

# **SIEMENS**

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# **SENTRON**

Protection devices
3VA molded case circuit breakers
with IEC certificate

Manual

## Legal information

#### Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

### **▲** DANGER

indicates that death or severe personal injury will result if proper precautions are not taken.

## **▲**WARNING

indicates that death or severe personal injury may result if proper precautions are not taken.

# **A**CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

#### NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

#### **Qualified Personnel**

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

### Proper use of Siemens products

Note the following:

## **MARNING**

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

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#### Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

### 1.1 About this documentation

### 3VA molded case circuit breakers with certification according to standard IEC 60947

The 3VA molded case circuit breakers from the portfolio of SENTRON protection, switching, measuring and monitoring devices ensure the reliable protection of people and property as integral components of efficient power distribution systems.

The product portfolio is designed for use in markets where low-voltage switchboards are installed according to IEC standards. The 3VA molded case circuit breakers are certified according to IEC 60947 and are suitable for the following applications:

- Incoming and outgoing circuit breakers in distribution systems
- Switching and protection devices for motors (motor protection in combination with a contactor and motor protection relay)
- Switch disconnectors

The 3VA molded case circuit breakers are available in the following versions:

- For line protection: The overload and short-circuit releases are designed for the protection of wiring and non-motor loads.
- For generator protection
- For the protection of three-phase squirrel-cage motors
- For the protection of starter combinations comprising molded case circuit breaker, contactor and overload relay: In this case, the 3VA molded case circuit breaker provides the short-circuit protection and the disconnector functionality.
- As a switch disconnector in compliance with IEC 60947-3: These molded case circuit breakers can be used as main switches for opening and closing or for disconnecting load switches. They are not equipped with overload and short-circuit protection.

# Scope of validity of this document

This manual has been specially compiled for the 3VA molded case circuit breakers certified to IEC 60947 and their accessory products. This manual serves as a reference manual for technical information regarding the configuration, commissioning and operation of 3VA molded case circuit breakers and their accessories.

Refer to the manual "3VA molded case circuit breakers with UL and IEC certification" (see chapter Reference documents (Page 10)) for 3VA UL molded case circuit breakers certified to UL 489.

# 1.2 Product-specific information

# 1.2.1 Target readers

### Target readers of this documentation

The information contained in this manual is provided for the benefit of:

- Users
- Cubicle manufacturers
- Switchgear manufacturers
- Maintenance personnel

# 1.2.2 Technical Support

You can find further support on the Internet at:

Technical Support (http://www.siemens.com/lowvoltage/technical-support)

# 1.2.3 Reference documents

#### **Further documents**

You will find further information in the following documents:

Table 1-1 Reference documents

| Title  |    | cle number         | Link   |  |  |  |  |
|--|----|--------------------|--|--|--|--|--|
| Catalog - chapter "Molded case circuit breakers" (chapter 2 of LV 10)      |    |                    | 3VA molded case circuit breaker catalog (https://support.industry.siemens.com/cs/ww/en/view/109750637) |  |  |  |  |
| Manual - 3VA27 molded case circuit breakers and 3WL10 air circuit breakers | DE | 3ZW1012-0WL10-0AB1 | 3VA27 molded case circuit breakers   |  |  |  |  |
|  | EN | 3ZW1012-0WL10-0AC1 | manual (https://support.industry.siemens.com/cs/ww/en/view/109753821)                                  |  |  |  |  |
| 3VA UL molded case circuit breakers  |    | 3ZW1012-0VA51-0AB1 | 3VA UL molded case circuit breakers  |  |  |  |  |
|  |    | 3ZW1012-0VA51-0AC1 | manual (https://support.industry.siemens.com/cs/ww/en/view/109758561)                                  |  |  |  |  |
| 3VA molded case circuit breaker operating instructions                     |    |                    | 3VA molded case circuit breaker documentation (http://www.siemens.com/3VA-Documentation)               |  |  |  |  |

| Title  | Artic                  | cle number                               | Link  |
|--|------------------------|--|---|
| System manual - Communication  |                        | 3ZW1012-0VA20-0BB0<br>3ZW1012-0VA20-0BC0 | 3VA molded case circuit breakers, communication system manual (https://support.industry.siemens.com/cs/ww/en/view/98746267) |
| 3VA molded case circuit breaker tables (updated daily)   |                        |  | 3VA molded case circuit breaker documentation (http://www.siemens.com/3VA-Documentation)                                    |
| SENTRON ATC5300 - Automatic transfer   | DE                     | A5E02469034-01                           | Automatic transfer control device   |
| switching equipment  |                        | A5E02469035-01                           | ATC5300<br>(http://support.automation.siemens.com/<br>WW/view/de/41909986/0/en)   |
| ATSE - Remote Control Software Manual  | DE<br>EN               | A5E02469028-01                           | ATSE - Remote Control Software Manual (http://support.automation.siemens.com/<br>WW/view/de/41909978)                       |
| ATSE - Modbus Communication Protocol   | DE<br>EN               | A5E02469001-01                           | ATSE - Modbus Communication Protocol (http://support.automation.siemens.com/WW/view/de/40761679)                            |
| Grundlagen der Niederspannungsschalt-<br>technik (Fundamentals of Low-Voltage<br>Switchgear and Controlgear),<br>Siemens AG © 2008   |                        |  |   |
| Hartmut Kiank, Wolfgang Fruth: Pla-<br>nungsleitfaden für Energieverteilungsan-<br>lagen (Planning Guide for Power<br>Distribution Plants),<br>Publicis Publishing                       | ISBN: A19100-L531-B115 |  |   |
| Schalten, Schützen, Verteilen in Nieder-<br>spannungsnetzen (Switching, Protection<br>and Distribution in Low-Voltage Net-<br>works), substantially extended and<br>revised edition 1997 | ISB                    | N 3-89578-041-3                          |   |
| Siemens: Residual Current Protective<br>Devices, Low-Voltage Circuit Protection<br>Technology Primer Siemens AG ©<br>04 / 2009   | E10                    | 003-E38-9T-B3011                         |   |

1.2 Product-specific information

Description

# 2.1 Overview - applications and portfolio

This chapter provides an overview of all molded case circuit breakers in the 3VA portfolio and describes the potential areas of application for different circuit breaker models.

The topics discussed in this chapter are listed below:

- Applications and possible uses
- Portfolio
- Possible configurations
- Detailed information about applications and possible uses
- Technical specifications
- Molded case circuit breakers and accessories in the system

# 2.1.1 Applications and possible uses

The two tables below show examples of possible uses and applications for 3VA molded case circuit breakers.

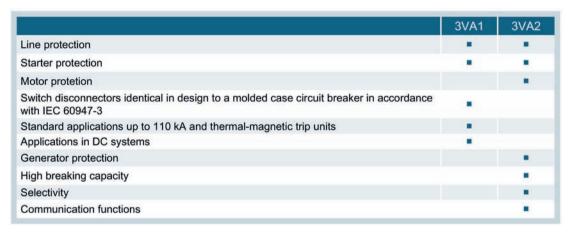
#### Possible uses

The 3VA molded case circuit breakers can be used in various areas where they perform different protection tasks. The following table (sorted according to breaking capacity) shows the areas in which 3VA molded case circuit breakers are used:

|                              |   | Buile   | dings  |   | Industry  |  |  |  |  |
|------------------------------|---|---|--|---|---|--|--|--|--|
| Molded case circuit breakers | 3VA1  | 3VA1<br>3VA2  | 3VA1<br>3VA2   | 3VA1<br>3VA2  | 3VA1<br>3VA2  | 3VA1<br>3VA2   |  |  |  |
| Breaking capacity            | Up to 25 kA   | Up to 55 kA   | Up to 85 kA  | Up to 150 kA  | Up to 110 kA  | Up to 150 kA   |  |  |  |
| Segments                     | Residential Commercial buildings buildings                                  |   | Infrastructure   | Industrial<br>buildings                               | Functional<br>shell   | Factory<br>automation/<br>process<br>automation                                    |  |  |  |
| Examples                     |   |   |  |   |   |  |  |  |  |
|                              | Single high-rise<br>building<br>in the<br>form of a<br>residential building | Office blocks,<br>banks, hotels,<br>bowling alleys,<br>cinemas,<br>shopping<br>malls, | Airports,<br>railway stations,<br>sports stadiums,<br>arenas,<br>port facilities | Industrial parks,<br>warehouses,<br>logistics centers | Paper industry,<br>computer centers,<br>oil & gas industry,<br>food and<br>beverages industry | Presses,<br>electroplating<br>plants,<br>rolling mills,<br>mills,<br>agitators and |  |  |  |
|                              | Building<br>complexes<br>Residential<br>buildings                           | hospitals,<br>universities and<br>schools   | Trade fairs and exhibitions  |   |   | blending plants<br>production lines  |  |  |  |

# Functions and applications

3VA molded case circuit breakers are used for various functions as shown in the table below:



Molded case circuit breakers are primarily designed for the following applications:

- Subdistribution systems
- Industrial distribution systems
- Final distribution systems
- On-site isolation
- Use in machines

### 2.1.2 Portfolio

The 3VA molded case circuit breakers set new standards in flexibility and the variety of modular accessories available. Standardized accessories suitable for use with several sizes of the 3VA molded case circuit breaker up to 1000 A together with quick and easy installation help to cut costs and save time.

### **Sizes**

The integrated 3VA portfolio consists of two different ranges of molded case circuit breakers in twelve frame sizes. The 1600 A frame size of the 3VA2 molded case circuit breaker and the 400 A and 630 A of the 3VA1 molded case circuit breaker are new.



The 3VA1 molded case circuit breakers are available in 1 to 4-pole versions (3VA1 160 A) or in 3 and 4-pole versions (3VA1 100 A to 630 A). The 3VA2 molded case circuit breakers are available in 3 and 4-pole versions.

The circuit breakers are suitable for rated operational currents ranging from 16 A to 1600 A and rated voltages up to 690 V AC, depending on the range and frame size.

#### Note

A separate manual is available for the 1600 A size of the 3VA27 molded case circuit breaker (see chapter Reference documents (Page 10)). The rest of this manual will deal with the properties and accessory components up to 1000 A in particular.

#### 3VA1 molded case circuit breakers



The 3VA1 molded case circuit breakers reliably perform all the tasks required for line protection.

#### **Features**

The key features of the 3VA1 range are:

- Compact design
- 1 and 2-pole versions in size 160 A; 3 and 4-pole versions in sizes 100 A, 160 A, 250 A, 400 A and 630 A
- Breaking capacity of 16 kA ... 70 kA at 415 V or 110 kA, (in sizes 400 A and 630 A), 3-pole or 4-pole breakers and 36 kA at 240 V, 1-pole breakers (dependent on size)
- Fixed-mounted, plug-in version
- Thermal-magnetic trip units
- AC/DC applications
- No derating up to +50 °C
- Modular and easy-to-fit internal accessories with diverse functions
- Uniform accessories platform across all 3VA molded case circuit breakers

#### Compact dimensions

Thanks to a mounting depth of 70 mm and a cover size of 45 mm, the 3VA1 molded case circuit breakers of sizes 100 A, 160 A and 250 A are optimized for installation in distribution boards, where they are used for protecting cables and lines. A wide range of accessories is also available for these applications, such as adapters for installation on DIN rails, as well as residual current devices (RCD310 and RCD510) and motor operators (MO310) that can be side mounted.

#### Thermal-magnetic trip units

The 3VA1 molded case circuit breakers have a thermal-magnetic trip unit with overload and short-circuit protection. This has been developed for implementing economical, cost-efficient installations up to 630 A. It is suitable for use in three-phase networks, AC networks, 400 Hz applications and with DC currents.

#### 3VA2 molded case circuit breakers





The 3VA2 molded case circuit breakers reliably perform all the tasks associated with line and generator protection.

This range is designed for applications with more exacting requirements:

- Increased breaking capacity
- Excellent selective protection
- Integrated metering function
- Connection to a fieldbus communication system

#### **Features**

The key features of the 3VA2 range are:

- Compact dimensions
- 3 and 4-pole versions
- Four breaking capacity classes from 55 kA ... 150 kA (at 415 V)
- Fixed-mounting, plug-in technology, draw-out technology
- Depending on size: Selective tripping at rated operational current difference 1: 2.5 or with ELISA 1 trip units: 1.6
- Electronic trip units
- Communication capability (ETUs 5-series and ETUs 8-series)
- Integrated metering function (ETUs 8-series)
- AC applications
- No derating up to +50 °C
- Modular and easy-to-fit internal accessories with diverse functions
- Uniform accessories platform across all 3VA molded case circuit breakers up to 1000 A
- Electronic Trip Units (ETU) with different setting values

#### Compact dimensions with expanded functionality

In addition to its expanded functionality, the 3VA2 molded case circuit breaker also comes with compact dimensions for fixed mounting, as a plug-in version and a draw-out version.

A cover size of 70 mm for the door cutout (up to 630 A) and a complete selection of breaking capacity classes from 55 kA to 150 kA at 415 V AC provide the necessary flexibility for planning.

Despite its compact size, the circuit breaker offers the following benefits:

- · Extremely high breaking capacity
- Extremely good selectivity
- Electronic trip units, versions with and without integrated metering function and optional fieldbus communication interface

#### Selective contact system

With its contact system, the 3VA2 molded case circuit breaker is designed for fast selectivity tripping. The selective contact system ensures the following:

- Dynamic instantaneous short-circuit range
- High breaking capacity
- Selective protection response of the molded case circuit breakers in relation to each other
- Selective protection response of the molded case circuit breakers in relation to other protection devices (e.g. downstream low-voltage fuses)

#### Electronic trip unit (ETU)

The current sensor of the 3VA2 molded case circuit breaker comprises an iron-cored transformer for the internal power supply and a Rogowski coil for precise current measurement. Each transformer can be optimized accordingly for its specific task. Thanks to the high accuracy of current measurement, the 3VA2 molded case circuit breaker is suitable for power/energy measurement. In addition, finer adjustment of ground-fault current monitoring is possible.

The electronic trip units (ETUs) provide the following protection functions:

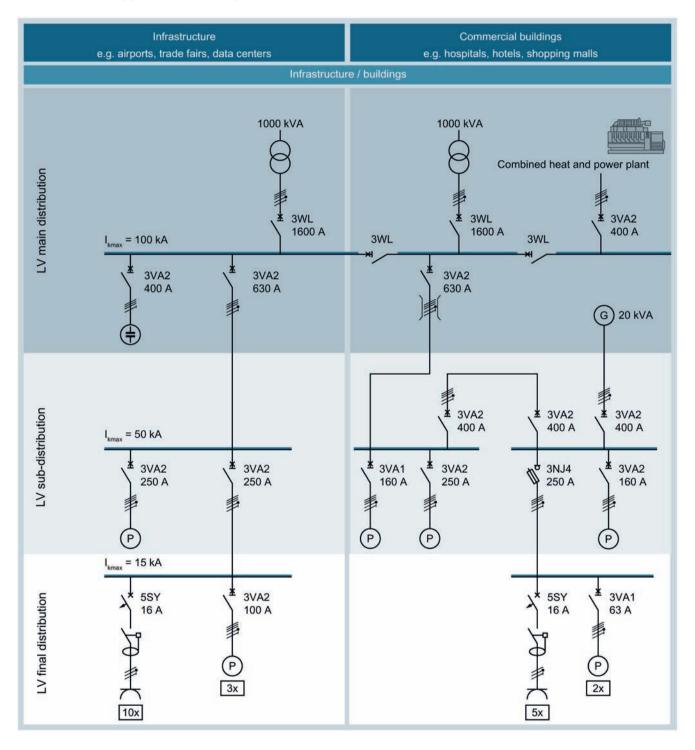
- Overload protection L ("L" = Long-time delay)
   Adjustable in steps from 40% to 100% of the rated operational current of the molded case circuit breaker.
- Short-time delayed short-circuit protection S ("S" = Short-time delay) for time-selective response in case of a short circuit
- Instantaneous short-circuit protection I ("I" = instantaneous):
- Protection of the neutral conductor against overload and short-circuit ("N" = neutral)
- Protection against residual currents to ground ("G" = Ground fault)

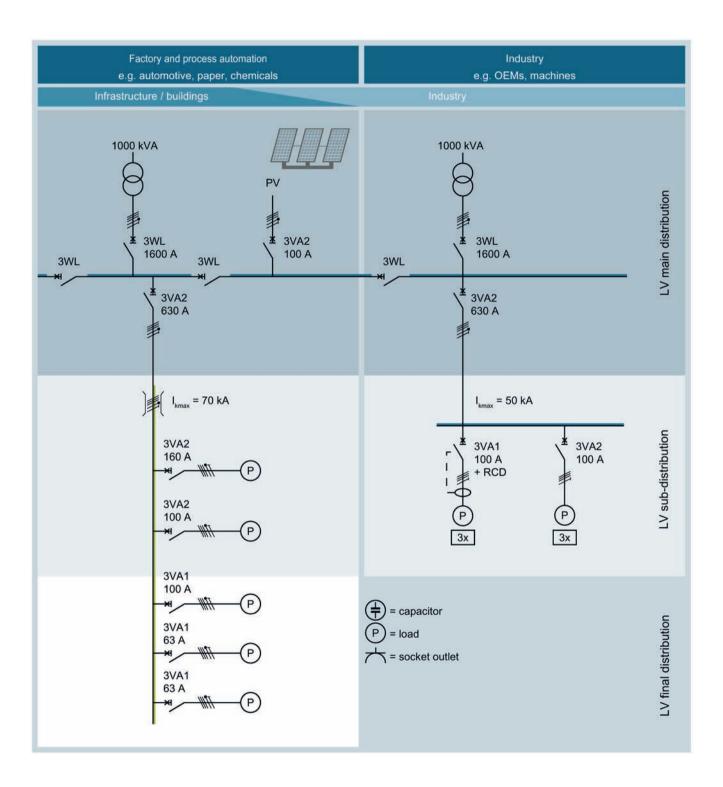
#### Energy management and communication

The electronic trip units (ETUs) provide the following energy management and communication functions:

- Metering functions
- Transfer of measured values and status information of the circuit breaker to a higher-level communication network
- Remote parameter assignment of tripping thresholds and circuit breaker parameters
- Flexible, local digital inputs and outputs via the EFB300 external function box
- Software commissioning support with the "powerconfig" software package
- Testing and archiving with the TD300 and TD500 test devices (with powerconfig)

# 2.1.3 Application examples





# 2.1.4 Detailed information about applications and possible uses

| Application  | 3VA1 | 3VA2 | Description  |
|--|------|------|--|
| Line protection  | •    | •    | The trip units for line protection are designed to protect the following against overload and short circuits:  - cables - lines - predominantly non-motorized loads  |
| Generator protection   |      |      | The trip units are set appropriately to provide protection for generators.   |
| Motor protection   |      |      | The overload and short-circuit releases are designed for optimized protection and direct-on-line starting of induction squirrel-cage motors. The molded case circuit breakers for motor protection have phase-failure sensitivity and a thermal image that protects the motor against overheating. The adjustable time lag class enables users to adjust the overload release to the startup conditions of the motor to be protected.  |
| Protection for<br>starter combinations<br>(starter protection) |      |      | Starter combinations consist of: Molded case circuit breaker + contactor + overload relay. The molded case circuit breaker handles short-circuit protection and the isolating function. The task of the contactor is the operational switching of the feeder. The overload relay handles overload protection that can be specially matched to the motor. The molded case circuit breaker for the starter combination is therefore equipped with an adjustable and instantaneous short-circuit release. |
| Residual current protection                                    |      | •    | Residual current devices afford fault protection (formerly referred to as: protection in case of indirect contact) and supplementary protection (formerly referred to as: protection in case of direct contact) in low-voltage systems in the event of failure of the basic insulation or contact with live parts. Their task is to prevent or reduce injury to personnel or livestock, or damage to property.   |
| Transfer switches  | ٠    |      | Transfer switches switch loads between two mutually independent supply systems.  The purpose of transfer switches is to ensure a continuous power supply to the installation following failure of the normal power supply.   |
| Switch disconnector  |      |      | Switch disconnectors are capable of switching equipment and parts of electrical installations when they are conducting their operational current under normal operating conditions. A switch disconnector isolates individual circuits or items of equipment so that maintenance or repair work can be carried out.  The switch disconnectors comply with IEC / EN 60947-3.  |

# See also

Applications (Page 109)

# 2.1.5 Technical specifications

| 3VA1 molded case circuit breakers for li                                      | ne protec           | ction                |    |     | 3VA10                          |    |    | 3VA11     |    |    | 3VA11     |    |                                | 3V.             | A11                            |     |  |  |
|---|---------------------|----------------------|----|-----|--------------------------------|----|----|-----------|----|----|-----------|----|--------------------------------|-----------------|--------------------------------|-----|--|--|
|   |                     |                      |    |     | The same of                    |    |    |           |    |    |           |    |                                | 1               |                                |     |  |  |
| Number of poles   |                     |                      |    |     | 3, 4                           |    |    | 1         |    |    | 211       |    |                                | 3               | 4                              |     |  |  |
| Rated operational current   | 1,                  | 50 °C                | Α  | - 3 | 6 10                           | 0  | 2  | 16 16     | 0  |    | 16 16     | 0  |                                | 16              | . 160                          |     |  |  |
| Rated operational voltage AC  | U.                  | AC (50/60 Hz)        | ٧  |     | 690                            |    |    | 415       |    |    | 415       |    |                                | 6               | 90                             |     |  |  |
| Utilization category according to IEC 60947-2                                 |                     |                      |    |     | Α                              |    |    | Α         |    |    | Α         |    |                                | - 1             | A                              |     |  |  |
|   |                     |                      |    | В   | N                              | S  | N  | S         | М  | N  | S         | M  | N                              | S               | М                              | Н   |  |  |
|   | l <sub>ou</sub>     | 220 240 V            | kA | 25  | 36                             | 55 | 25 | 36        | 55 | 36 | 55        | 85 | 36                             | 55              | 85                             | 10  |  |  |
|   | I <sub>ou</sub>     | 380 415 V            | kA | 16  | 25                             | 36 | 5  | 6         | 6  | 25 | 36        | 55 | 25                             | 36              | 55                             | 70  |  |  |
| Rated ultimate short-circuit breaking<br>capacity AC                          | I <sub>ou</sub>     | 440 V                | kA | 8   | 16                             | 25 |    |           |    |    |           |    | 16                             | 25              | 36                             | 55  |  |  |
| capacity Ac   | I <sub>ou</sub>     | 500 V                | kA | 5   | 5                              | 7  |    |           |    |    |           |    | 7                              | 7               | 10                             | 10  |  |  |
|   | I <sub>m</sub>      | 690 V                | kA | 5   | 5                              | 7  |    |           |    |    |           |    | 7                              | 7               | 10                             | 10  |  |  |
|   | I <sub>m</sub>      | 220 240 V            | kA | 25  | 36                             | 55 | 25 | 36        | 55 | 36 | 55        | 85 | 36                             | 55              | 85                             | 10  |  |  |
|   | I <sub>ss</sub>     | 380 415 V            | kA | 16  | 25                             | 36 | 5  | 6         | 6  | 25 | 36        | 55 | 25                             | 36              | 55                             | 70  |  |  |
| Rated service short-circuit breaking  | I <sub>cs</sub>     | 440 V                | kA | 8   | 16                             | 25 |    |           |    |    |           |    | 16                             | 25              | 36                             | 40  |  |  |
| capacity AC   | I <sub>cs</sub>     | 500 V                | kA | 5   | 5                              | 5  |    |           |    |    |           |    | 5                              | 5               | 5                              | 5   |  |  |
|   | l <sub>o</sub>      | 690 V                | kA | 5   | 5                              | 5  |    |           |    |    |           |    | 5                              | 5               | 5                              | 5   |  |  |
| IT system   |                     | Up to 690            |    |     | Up to 415                      |    |    | Up to 415 |    |    | Up to 690 |    |                                |                 |                                |     |  |  |
| Rated operational voltage DC  | U <sub>e</sub>      | DC                   | v  |     | 3-pole: 500 V<br>4-pole: 600 V |    |    | 125       |    |    | 250       |    |                                |                 | 3-pole: 500 V<br>4-pole: 600 V |     |  |  |
|   | I <sub>co</sub>     | 125 V (1 Schaltpol)  | kA |     |                                |    | 16 | 25        | 30 | 16 | 25        | 30 |                                |                 |                                |     |  |  |
| Rated ultimate short-circuit breaking   | I <sub>cu</sub>     | 250 V (2 Schaltpole) | kA | 25  | 36                             | 55 |    |           |    | 36 | 55        | 85 | 36                             | 55              | 85                             | 10  |  |  |
| capacity DC   | I <sub>ou</sub>     | 500 V (3 Schaltpole) | kA | 25  | 36                             | 55 |    |           |    |    |           |    | 36                             | 55              | 85                             | 10  |  |  |
|   | I.                  | 600 V (4 Schaltpole) | kA | 8   | 16                             | 25 |    |           |    |    |           |    | 16                             | 25              | 36                             | 55  |  |  |
|   | I <sub>cs</sub>     | 125 V (1 Schaltpol)  | kA |     |                                |    | 16 | 25        | 30 | 16 | 25        | 30 |                                |                 |                                |     |  |  |
| Rated service short-circuit breaking  | I <sub>cs</sub>     | 250 V (2 Schaltpole) | kA | 25  | 36                             | 55 |    |           |    | 36 | 55        | 85 | 36                             | 55              | 85                             | 10  |  |  |
| capacity DC   | l <sub>os</sub>     | 500 V (3 Schaltpole) | kA | 25  | 36                             | 55 |    |           |    |    |           |    | 36                             | 55              | 85                             | 10  |  |  |
|   | l <sub>m</sub>      | 600 V (4 Schaltpole) | kA | 8   | 16                             | 25 |    |           |    |    |           |    | 16                             | 25              | 36                             | 55  |  |  |
|   | FTFM                | TM210                |    |     |                                |    |    |           |    |    | *         |    |                                | i               |                                |     |  |  |
| Trip unit   | ATFM                | TM220                |    |     |                                |    |    |           |    |    |           |    |                                |                 |                                |     |  |  |
| **************************************  | ATAM                | TM240                |    |     |                                |    |    |           |    |    |           |    |                                | 1               |                                |     |  |  |
| Switch disconnectors  |                     |                      |    |     |                                |    |    |           |    |    |           |    |                                |                 |                                |     |  |  |
| Rated operational current   | 1,                  | 50 °C                | Α  |     |                                |    |    |           |    |    |           |    | 63                             | , 100,          | 125,                           | 160 |  |  |
|   | U.                  | AC (50/60 Hz)        | ٧  |     |                                |    |    |           |    |    |           |    |                                | 6               | 90                             |     |  |  |
| Rated operational voltage   | U <sub>e</sub> DC V |                      |    |     |                                |    |    |           |    |    |           |    | 3-pole: 500 V<br>4-pole: 600 V |                 |                                |     |  |  |
| Number of poles   |                     |                      |    |     |                                |    |    |           |    |    |           |    |                                | 3               | , 4                            |     |  |  |
| Rated conditional short-circuit current with<br>upstream 3VA1 circuit breaker | I <sub>q</sub>      |                      | kA |     |                                |    |    |           |    |    |           |    |                                | Up to<br>bei 41 |                                |     |  |  |
| Permissible rated short-time current  | I <sub>cw</sub>     |                      | kA |     |                                |    |    |           |    |    |           |    |                                | 3)              | 2                              |     |  |  |

A side plate must be installed (see chapter Insulating measures (Page 246)) if the installation conditions on the right-hand side are such that the device is not finger-safe.

 $I_n$  125 A, 160 A:  $I_{cu}/I_{cs}$  = 36 kA / 36 kA

| 3VA1 molded case circuit breakers for   |                 |  | 3VA12 |                                |      | 3V      | A13     | 3VA14 |       |         |       |       |       |      |
|---|-----------------|--|-------|--------------------------------|------|---------|---------|-------|-------|---------|-------|-------|-------|------|
|   |                 | dicito di la constanti di la c |       |                                |      |         | (A10.0) |       |       |         |       |       |       |      |
| Number of poles   |                 |  |       |                                | 3, 4 |         |         | 3     | , 4   | 3, 4    |       |       |       |      |
| Rated operational current   | 1,              | 50 °C  | Α     | 160 250                        |      | 320 400 |         |       |       | 500 630 |       |       |       |      |
| Rated operational voltage AC  | U.              | AC (50/60 Hz)  | V     | 690                            |      |         |         | 6     | 90    | 690     |       |       |       |      |
| Utilization category according to IEC 60947-2                                 |                 |  |       | A                              |      |         | A       |       |       |         |       | 9     | A     |      |
|   |                 |  |       | S                              | M    | н       | S       | M     | Н     | C       | S     | M     | Н     | C    |
|   | I <sub>ou</sub> | 220 240 V  | kA    | 55                             | 85   | 100     | 55      | 85    | 100   | 200     | 55    | 85    | 100   | 200  |
|   | I <sub>ou</sub> | 380 415 V  | kA    | 36                             | 55   | 70      | 36      | 55    | 70    | 110     | 36    | 55    | 70    | 110  |
| Rated ultimate short-circuit breaking<br>capacity AC                          | I <sub>ou</sub> | 440 V  | kA    | 25                             | 36   | 36      | a. A.   | a. A. | a. A. | a. A.   | a. A. | a. A. | a. A. | a. A |
| capacity AC   | I <sub>ou</sub> | 500 V  | kA    | 10                             | 15   | 15      | a. A.   | a. A. | a. A. | a. A.   | a. A. | a. A. | a. A. | a. A |
|   | I <sub>ou</sub> | 690 V  | kA    | 7                              | 10   | 10      | 7       | 7     | 10    | 10      | 7     | 7     | 10    | 10   |
| Rated service short-circuit breaking capacity AC                              | I <sub>os</sub> | 220 240 V  | kA    | 55                             | 85   | 100     | 55      | 85    | 100   | 200     | 55    | 85    | 100   | 200  |
|   | I <sub>cs</sub> | 380 415 V  | kA    | 36                             | 55   | 70      | 36      | 55    | 70    | 110     | 36    | 55    | 70    | 110  |
|   | I <sub>cs</sub> | 440 V  | kA    | 25                             | 36   | 36      | a. A.   | a. A. | a. A. | a. A.   | a. A. | a. A. | a. A. | a. A |
|   | I <sub>cs</sub> | 500 V  | kA    | 10                             | 10   | 10      | a. A.   | a. A. | a. A. | a. A.   | a. A. | a. A. | a. A. | a. A |
|   | l <sub>os</sub> | 690 V  | kA    | 5                              | 5    | 5       | 5       | 5     | 6     | 6       | 5     | 5     | 6     | 6    |
| IT system   | Ca              | V Up to 690  |       |                                |      |         |         |       |       |         |       |       |       |      |
|   | 1000            | 3-pole; 500 V  |       |                                |      |         |         |       |       |         |       |       |       |      |
| Rated operational voltage DC  | U.              | DC   | V     | 4-pole: 600 V                  |      |         |         |       |       |         |       |       |       |      |
| Rated ultimate short-circuit breaking capacity DC                             | I <sub>ou</sub> | 125 V (1 Schaltpol)  | kA    |                                |      |         |         |       |       |         |       |       |       |      |
|   | I <sub>ou</sub> | 250 V (2 Schaltpole)   | kA    | 55                             | 85   | 100     | 8       | 16    | 25    | 25      | 8     | 16    | 25    | 25   |
|   | I               | 500 V (3 Schaltpole)   | kA    | 55                             | 85   | 100     | 8       | 16    | 25    | 25      | 8     | 16    | 25    | 25   |
|   | I <sub>ou</sub> | 600 V (4 Schaltpole)   | kA    | 25                             | 36   | 55      | 8       | 16    | 25    | 25      | 8     | 16    | 25    | 25   |
|   | I <sub>cs</sub> | 125 V (1 Schaltpol)  | kA    |                                |      |         |         |       |       |         |       |       |       |      |
| Rated service short-circuit breaking  | I <sub>cs</sub> | 250 V (2 Schaltpole)   | kA    | 55                             | 85   | 100     | 8       | 16    | 25    | 25      | 8     | 16    | 25    | 25   |
| capacity DC   | I <sub>cs</sub> | 500 V (3 Schaltpole)   | kA    | 55                             | 85   | 100     | 8       | 16    | 25    | 25      | 8     | 16    | 25    | 25   |
|   | I <sub>cs</sub> | 600 V (4 Schaltpole)   | kA    | 25                             | 36   | 55      | 8       | 16    | 25    | 25      | 8     | 16    | 25    | 25   |
|   | FTFM            | TM210  |       |                                |      |         |         |       |       |         |       |       |       |      |
| Trip unit   | ATFM            | TM220  |       |                                |      |         |         |       |       |         |       |       |       |      |
| 5-0-7-0-3-3-2-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3-3                                 | ATAM            | TM240  | 40    |                                |      |         |         |       |       |         |       |       |       |      |
| Switch disconnectors  |                 | The Late Control of the Control of t |       |                                |      |         |         |       |       |         |       |       |       |      |
| Rated operational current   | 1,              | 50 °C  | Α     |                                | 250  |         |         | 4     | 00    |         |       |       |       |      |
| \$  | Ü,              | AC (50/60 Hz)  | ٧     |                                |      |         | 6       | 90    |       |         |       |       |       |      |
| Rated operational voltage   | U,              | DC   | V     | 3-pole: 500 V<br>4-pole: 600 V |      |         |         |       |       |         |       |       |       |      |
| Number of poles   |                 |  |       |                                | 3, 4 | i e d   |         | 3     | , 4   |         |       |       |       |      |
| Rated conditional short-circuit current with<br>upstream 3VA1 circuit breaker | I <sub>q</sub>  |  | kA    | Up to 70 kA<br>bei 415 V AC    |      |         |         |       |       |         |       |       |       |      |
| Permissible rated short-time current  | I <sub>cw</sub> |  | kA    |                                | 3    |         |         | 4     | .8    |         |       |       |       |      |

a. A. On request

| 3VA2 molded case circuit breakers for line protection |                 |                   |    |     |     | 420   |     | 3VA21 |       |       |     | 3VA22 |       |     |     |  |
|---|-----------------|-------------------|----|-----|-----|-------|-----|-------|-------|-------|-----|-------|-------|-----|-----|--|
|   |                 |                   |    |     |     |       |     |       |       |       |     |       |       |     |     |  |
| Number of poles                                       |                 |                   |    |     |     | 4     |     | 3, 4  |       |       |     | 3, 4  |       |     |     |  |
| Rated operational current                             | I <sub>n</sub>  | 50 °C             | Α  |     | 25  | . 100 |     |       | 25    | . 160 |     |       | 160 . | 250 |     |  |
| Rated operational voltage AC                          | U <sub>e</sub>  | AC (50/60 Hz)     | ٧  | 690 |     |       |     | 690   |       |       |     | 690   |       |     |     |  |
| Utilization category according to IEC 60947-2         |                 |                   |    | Α   |     |       | Α   |       |       |       | A   |       |       |     |     |  |
|   |                 |                   |    | M   | Н   | С     | L   | M     | н     | C     | L   | M     | Н     | C   | L   |  |
| Rated ultimate short-circuit breaking capacity AC     | I <sub>ou</sub> | 220 240 V / 50 Hz | kA | 85  | 110 | 150   | 200 | 85    | 110   | 150   | 200 | 85    | 110   | 150 | 200 |  |
|   | I <sub>ou</sub> | 380 415 V / 50 Hz | kA | 55  | 85  | 110   | 150 | 55    | 85    | 110   | 150 | 55    | 85    | 110 | 150 |  |
|   | l <sub>ou</sub> | 440 V / 50 Hz     | kA | 55  | 85  | 110   | 150 | 55    | 85    | 110   | 150 | 55    | 85    | 110 | 150 |  |
|   | l <sub>o</sub>  | 500 V / 50 Hz     | kA | 36  | 55  | 85    | 100 | 36    | 55    | 85    | 100 | 36    | 55    | 85  | 100 |  |
|   | l <sub>ou</sub> | 690 V / 50 Hz     | kA | 2   | 2   | 2     | 24  | 2.5   | 2.5   | 2.5   | 24  | 3     | 3     | 3   | 24  |  |
|   | Ics             | 220 240 V / 50 Hz | kA | 85  | 110 | 150   | 200 | 85    | 110   | 150   | 200 | 85    | 110   | 150 | 200 |  |
|   | l <sub>cs</sub> | 380 415 V / 50 Hz | kA | 55  | 85  | 110   | 150 | 55    | 85    | 110   | 150 | 55    | 85    | 110 | 150 |  |
| Rated service short-circuit breaking<br>capacity AC   | I <sub>cs</sub> | 440 V / 50 Hz     | kA | 55  | 85  | 110   | 150 | 55    | 85    | 110   | 150 | 55    | 85    | 110 | 150 |  |
|   | 1 <sub>cs</sub> | 500 V / 50 Hz     | kA | 36  | 55  | 85    | 100 | 36    | 55    | 85    | 100 | 36    | 55    | 85  | 100 |  |
|   | l <sub>os</sub> | 690 V / 50 Hz     | kA | 2   | 2   | 2     | 18  | 2.5   | 2.5   | 2.5   | 18  | 3     | 3     | 3   | 18  |  |
| IT system   |                 |                   | ٧  |     |     |       |     |       | Up to | 690   |     |       |       |     |     |  |
|   | LI              | ETU320            |    |     |     |       |     | •     |       |       |     |       | •     |     |     |  |
|   | LIG             | ETU330            |    |     |     |       |     |       |       |       |     |       |       |     |     |  |
| Trip unit   | LSI             | ETU350            |    |     |     |       |     | 1     |       |       |     |       |       |     |     |  |
|   | LSI             | ETU550/ETU850     |    |     |     |       |     |       |       |       |     |       |       |     |     |  |
|   | LSIG            | ETU560/ETU860     |    |     |     |       |     |       |       |       |     |       |       |     |     |  |

| 3VA2 molded case circuit breakers for line protection |                 |               |    |         | 3V   | A23 |         |    | 3V/             | A24  |          | 3VA25 |       |      |  |
|---|-----------------|---------------|----|---------|------|-----|---------|----|-----------------|------|----------|-------|-------|------|--|
|   |                 |               |    | olone . |      |     |         |    |                 |      |          |       |       |      |  |
| Number of poles                                       |                 |               |    |         | 3, 4 |     |         |    | 3, 4            |      |          |       | 3, 4  |      |  |
| Rated operational current                             | I,              | 50 °C         |    | 250 .   | 400  |     | 400 630 |    |                 |      | 630 1000 |       |       |      |  |
| Rated operational voltage AC                          | U <sub>e</sub>  | AC (50/60 Hz) | ٧  | 690     |      |     |         |    | 69              | 90   | 690      |       |       |      |  |
| Utilization category according to IEC 6094            |                 |               |    | Α       |      |     |         | Α/ | B <sup>1)</sup> |      | Α        |       |       |      |  |
|   |                 |               |    | М       | н    | С   | L       | М  | н               | С    | L        | М     | н     | С    |  |
| Rated ultimate short-circuit breaking capacity AC     | I <sub>ou</sub> | 220 240 V     | kA | 85      | 110  | 150 | a. A.   | 85 | 110             | 150  | a. A.    | 85    | 110   | 200  |  |
|   | l <sub>ou</sub> | 380 415 V     | kA | 55      | 85   | 110 | a. A.   | 55 | 85              | 110  | a. A.    | 55    | 85    | 110  |  |
|   | l <sub>o</sub>  | 440 V         | kA | 55      | 85   | 110 | a. A.   | 55 | 85              | 110  | a. A.    | a. A. | a. A. | a. A |  |
|   | l <sub>a</sub>  | 500 V         | kA | 36      | 55   | 85  | a. A.   | 36 | 55              | 85   | a. A.    | 36    | 55    | 85   |  |
|   | l <sub>ou</sub> | 690 V         | kA | 5       | 5    | 5   | a. A.   | 6  | 6               | 6    | a. A.    | 25    | 35    | 35   |  |
|   | I <sub>os</sub> | 220 240 V     | kA | 85      | 110  | 150 | a. A.   | 85 | 110             | 150  | a. A.    | 85    | 110   | 150  |  |
|   | l <sub>os</sub> | 380 415 V     | kA | 55      | 85   | 110 | a. A.   | 55 | 85              | 110  | a. A.    | 55    | 85    | 110  |  |
| Rated service short-circuit breaking<br>capacity AC   | I <sub>cs</sub> | 440 V         | kA | 55      | 85   | 110 | a. A.   | 55 | 85              | 110  | a. A.    | a. A. | a. A. | a. A |  |
| oupusity / to   | I <sub>cs</sub> | 500 V         | kA | 36      | 55   | 65  | a. A.   | 36 | 55              | 852) | a. A.    | 36    | 55    | 65   |  |
|   | l <sub>os</sub> | 690 V         | kA | 5       | 5    | 5   | a. A.   | 6  | 6               | 6    | a. A.    | 19    | 19    | 19   |  |
| IT system   |                 |               | ٧  |         |      |     |         |    | Up to           | 690  |          |       |       |      |  |
|   | LI              | ETU320        |    |         |      |     |         |    | 1               | •    |          |       |       |      |  |
| Trip unit   | LIG             | ETU330        |    |         |      |     |         |    |                 |      |          |       |       |      |  |
|   | LSI             | ETU350        |    |         |      |     |         |    | 1               |      |          |       |       |      |  |
|   | LSI             | ETU550/ETU850 |    |         |      |     |         |    |                 |      |          |       |       |      |  |
|   | LSIG            | ETU560/ETU860 |    |         |      |     |         |    |                 |      |          |       |       |      |  |

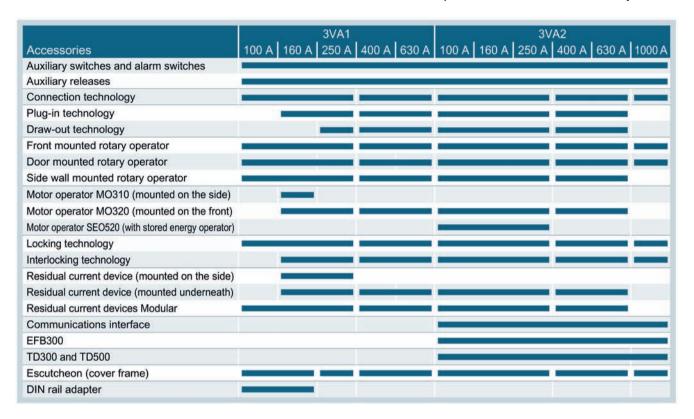
# a. A. On request

- Utilization category B only for 400 A and 500 A and ETUs 5-series 8-series
- $I_n$  400/500 A and  $I_n$  630 A:  $I_{cs}$  = 65 kA

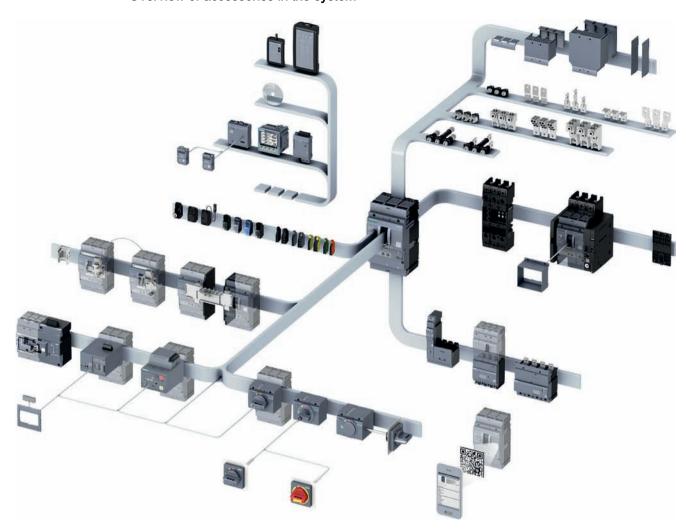
# 2.1.6 Molded case circuit breakers and accessories in the system

The 3VA molded case circuit breakers come with a large portfolio of internal and external accessories that can be installed flexibly in any size of circuit breaker (depending on the type of accessory).

The table below indicates which accessories are compatible with particular molded case circuit breakers, and which sizes of breakers are compatible with the same accessory:



# Overview of accessories in the system



# 2.2 Ergonomic design

This chapter provides an overview of the ergonomic design features of the 3VA molded case circuit breakers and explains what makes them so special.

The topics discussed in this chapter are listed below:

- Optional installation variants
- Color-coded indication of switching position in the draw-out unit
- Clear status indication
- Active illumination
- Ergonomic handle
- Color-coded control elements
- Broad range of accessories
- Connection options

### Integrated system

The 3VA molded case circuit breakers set new standards, not only in terms of their technical features and functional scope, but also in terms of their design.

The 3VA range provides an integrated system with regard to operation, functionality and installation. This principle is embodied in the basic units and in all internal and external accessories.

The internal and external accessories of the 3VA molded case circuit breakers offer the following benefits:

- Standardized methods of operation
- Standardized scope of functions
- Standardized installation procedures
- Uniform accessories from 16 A ... 1000 A (e.g. auxiliary switches, auxiliary releases, etc.)

# 2.2.1 The right circuit breaker for any installation conditions



The range of molded case circuit breakers can be equipped with additional components so that they can be installed as fully functional switches in any location, a feature of the product which affords maximum flexibility to system planners.

The following components can be installed to suit the installation location:

- · Front mounted rotary operator
- Door mounted rotary operator
- Side wall mounted rotary operator
- Motor operator



When the 3VA molded case circuit breaker is in the OFF position, it reliably disconnects all current paths of the circuit in accordance with IEC 60947-2 and IEC 60204-1 (VDE 0113). In the event of overvoltage between input and output, the reduced clearances prevent leakage currents at the surface and ensure that the dielectric strength is not degraded. The 3VA molded case circuit breaker therefore also meets the requirements for disconnector units according to IEC 60204-1.

The main switch or disconnector unit functionality is not diminished by installation of the following accessory components:

- · Plug-in and draw-out units
- Manual operator
- Motor operator
- Residual current device



# Optional installation variants

3VA molded case circuit breakers are available in the following installation variants:

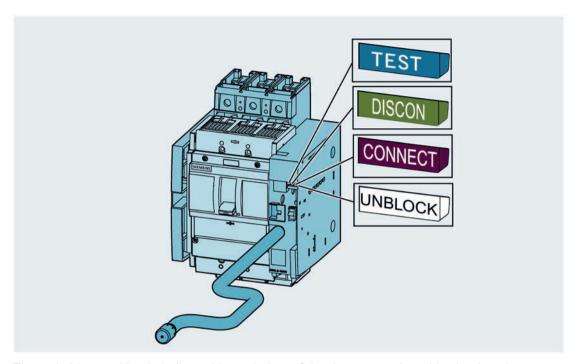


- Fixed mounted ①
- Plug-in technology ②
- Draw-out technology ③

All variants offer the full range of functions, e.g. they can be equipped with every kind of accessory. In addition, the last two variants are designed to allow speedy molded case circuit breaker replacement for maintenance purposes or visual indication of the electrical isolation in the main circuit.

### Indication of switching positions in the draw-out unit

The picture below illustrates the colors used to indicate the switching position in the draw-out unit:



The switching position is indicated in a window of the draw-out unit and is clearly color-coded, enabling immediate identification of the current switching position of the molded case circuit breaker.

The draw-out unit has three switching positions:

#### CONNECT:

The molded case circuit breaker is connected to the main circuit. The auxiliary circuits are also closed.

#### • TEST:

In the TEST position, the main contacts of the molded case circuit breaker are not connected to the main circuit, but only to the auxiliary circuit. This allows the functionality of the auxiliary circuit and all of its components (auxiliary switches, auxiliary releases, communication, etc.) to be tested when the main circuit is open.

#### DISCONNECT:

The molded case circuit breaker is not connected to the main circuit nor to the auxiliary circuit.

#### UNBLOCK:

The molded case circuit breaker is not in any of the positions defined above and can be moved by means of the crank handle.

### 2.2 Ergonomic design

### Motor operator for remote control

3VA molded case circuit breakers can also be controlled remotely. Whether the circuit breaker is controlled from "just" the other side of the closed panel door, or the breaker is switched on via a control room or operator panel, for example, is irrelevant.

Motor operators are available as accessories for remote control of the circuit breakers.

# 2.2.2 Ergonomic design of circuit breakers, handles and control elements

### **Ergonomic handle**



With its wide surface area, the ergonomic handle is designed to assist manual operation of the circuit breaker. The white strip around the edge of the handle makes it easy to identify in conditions of poor visibility. The additional rated operational current information stamped on the white strip also significantly eases identification of the circuit breaker when it is one of many breakers in a large switchboard installation.

### Clear status indication



The possible switching positions of manual rotary operators are listed below:

- ON red marking
- TRIP yellow marking
- OFF green marking

The handle clearly engages in one of these positions depending on the status of the molded case circuit breaker. The switching positions are color-coded so that you can identify the status of the circuit breaker at a glance.

## **Active illumination**



You can retrofit an active illumination kit for handling manual rotary operators. The illuminated indicator in the rotary handle signals the relevant switching position in the colors red, yellow and green. This provides clear visualization of the switching position on-site in conditions of poor visibility.

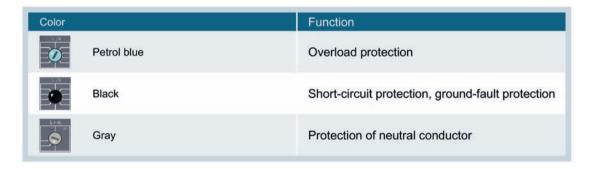
# 2.2 Ergonomic design

## Color-coded control elements

The control elements on the thermal-magnetic and electronic trip units are color-coded.

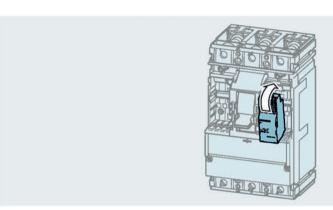


The color of each control element indicates that it performs a specific function, helping you to make the required settings quickly.



# 2.2.3 Wide range of accessories

The internal accessories (e.g. alarm and auxiliary switches, auxiliary releases, etc.) all belong to one family and can be installed on any size of circuit breaker up to 1000 A in the 3VA1 and 3VA2 ranges. The accessories are designed for quick and easy installation. The components are coded by color and design to ensure that they are always installed at the correct position in the circuit breaker.



# Color coding of accessories



## 2.2 Ergonomic design

A system of color coding has been used to clearly identify the specific functions of individual accessories:

| Color  | Auxiliary switches and alarm switches | Auxiliary releases                             |
|--------|---------------------------------------|--|
| Black  | Auxiliary switch AUX                  | Shunt trip left STL<br>Shunt trip flexible STF |
| Gray   | Leading changeover switch LCS         | Undervoltage release UVR                       |
| Yellow | Trip alarm switch TAS                 |  |
| Orange | Short circuit alarm switch SAS        |  |
| Green  | Electrical alarm switch EAS           |  |
| Blue   |                                       | Universal release UNI                          |

The cylinder lock and communication accessories included with the internal accessories in the picture above are explained in chapters Locking and interlocking (Page 360) and Communication and system integration (Page 484).

# Fast assembly of motor operators

The motor operators have been designed for quick and easy assembly and disassembly. The internal accessories are therefore easily accessible.

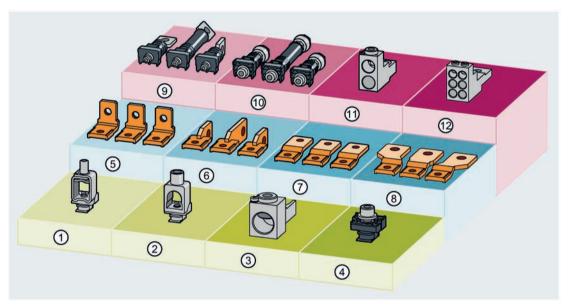


# 2.2.4 Connection technology

A large selection of connection technology is available for the 3VA range of molded case circuit breakers.

The supported cable cross-sections are based on the size of the molded case circuit breaker and the cable terminals used. The terminals are fitted either internally or externally to the molded case circuit breaker.

With it you can implement various front and rear main conductor connections for the molded case circuit breakers in all types of installation (fixed-mounted, plug-in and draw-out).

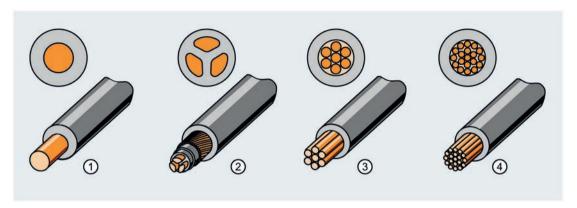


- ① Box terminal
- Wire connector
- 3 Wire connector, large
- 4 Nut keeper kit
- (5) Nut keeper kit, right-angled
- 6 Bus connectors edgewise

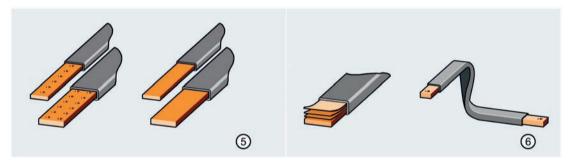
- (7) Front bus connectors extended
- 8 Front bus connectors offset
- (9) Rear connection stud flat
- Rear connection stud round
- 11) Wire connector for 2 cables
- Distribution wire connector for 6 cables

## Cables and busbars

The 3VA molded case circuit breakers are designed for different cables and busbars:



- Different cable types, e.g.
  - ① Circular conductor
  - ② Sector-shaped conductor
  - 3 Stranded
  - 4 Finely stranded



- ⑤ Busbars
  - Rigid
  - Laminated or flexible
- 6 Laminated copper bar
- Different materials
  - Copper cables
  - Aluminum cables

# 2.3 Technical details

A summary of the technical features of 3VA molded case circuit breakers can be found in this chapter.

The topics discussed in this chapter are listed below:

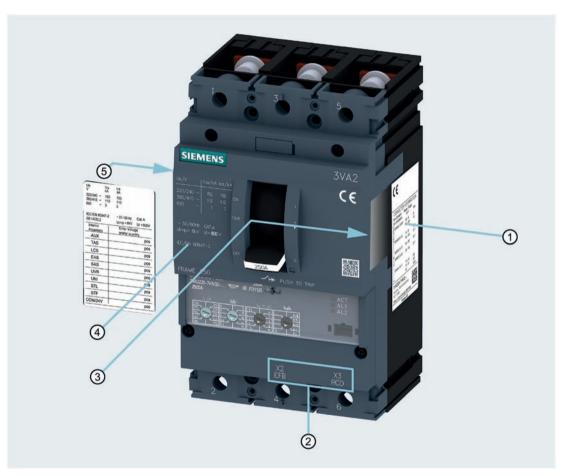
- Circuit breaker identification
- Operation
- Design and components 3VA1
- Design and components 3VA2
- Current limitation
- Breaking capacity

# 2.3.1 Circuit breaker identification

Each 3VA molded case circuit breaker can be clearly identified from various labels and plates attached to the unit.

# Circuit breaker labeling

Each 3VA molded case circuit breaker has labels displaying all the important technical information, enabling unique identification:



- ① Connection information label
- ② ETU connection designations
- 3 Adhesive label insert (in accessory compartment)
- 4 Key electrical data
- (5) Internal accessories label

## Front panel: Labeling

The following information is displayed on the front panel of the circuit breaker:



- ① Circuit breaker designation
- ② Approvals
- 3 Rated operational current
- 4 Knowledge Manager (see below)
- ⑤ Rated operational current
- 6 Date of manufacture

- Product version
- 8 Article number
- Trip unit type
- 10 Size and breaking capacity class
- 1 Key electrical data

### **Knowledge Manager**

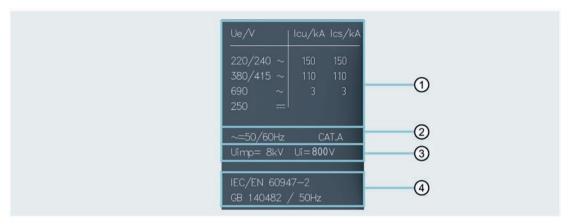
A QR code is attached in a clearly visible location to every 3VA molded case circuit breaker. This code can be scanned with a smartphone or a tablet PC. For the full range of QR code functions, use the "Industry Support" app supplied free of charge by Siemens.

It allows you to directly view or download all relevant product information.



### 2.3 Technical details

The key electrical data label ① contains the following information:

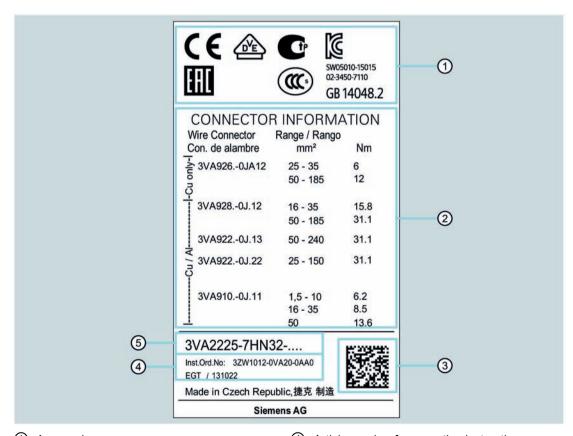


- ① IEC breaking capacity values at various voltages
- ② Frequency, utilization category

- ③ Insulation data
- Supported standards

# Connection information label

The connection information label displays the following information:

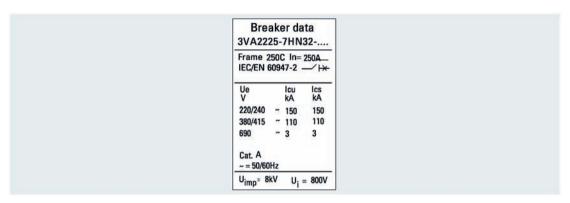


- Approvals
- 2 Information about cable connections
- 3 Code for production

- 4 Article number for operating instructions
- (5) Circuit breaker article number

#### Label insert

The label insert can be found in the right-hand accessory compartment. When an accessory (e.g. motor operator or manual operator) is installed on the circuit breaker, this label can be attached to the accessory.

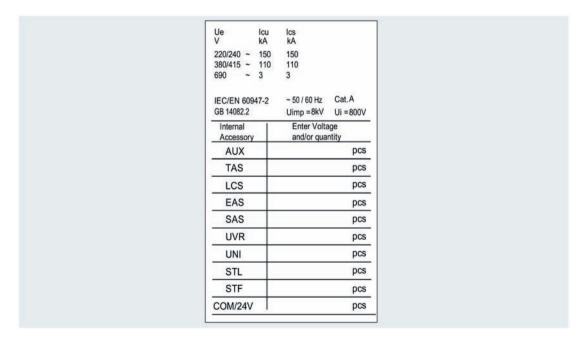


The label insert displays the following information:

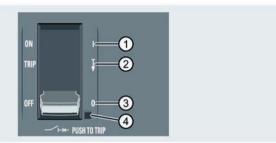
- Information about the molded case circuit breaker
- Article number
- Key electrical data

#### Internal accessories label

You can make a note of the number of installed accessories on the internal accessories label. This will enable you to ascertain which accessories are installed without removing the accessory cover and to use the information, for example, to reorder components.



#### 2.3.2 Operation



- ① ON: Main contacts closed
- ③ OFF: Main contacts open
- 2 TRIP: Switching position following a trip 4 PUSH TO TRIP: Initiates a mechanical trip

The main contacts of the molded case circuit breakers are opened and closed by means of a handle mounted on the front of the unit. All contacts open and close simultaneously on all 3VA molded case circuit breakers in response to the following events:

- The handle is moved from OFF to ON.
- The handle is moved from ON to OFF.
- The tripping mechanism is activated by a trip unit.
- The tripping mechanism is activated by auxiliary releases (e.g. shunt trips, trip units).

#### Reclosing the circuit breaker contacts from the TRIP position

Follow the steps below to reclose the circuit breaker contacts from the TRIP position:

- 1. Move the handle to the OFF position.
- 2. Move the handle to the ON position.
  - → The breaker contacts are now closed.

## Free tripping

All 3VA molded case circuit breakers have a free tripping capability. This function ensures that the breaker cannot be prevented from tripping even if the operator blocks or is held manually in the ON position or if the breaker is about to close.

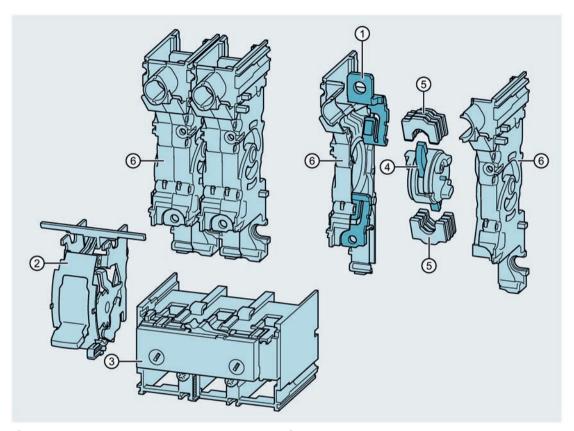
Follow the steps below to test the free tripping function in order to verify that the breaker's mechanical release system is working correctly:

- 1. Move the handle to the ON position.
- 2. Hold the handle in the ON position and press the button marked <PUSH TO TRIP>.
  - → The circuit breaker trips and opens the main contacts.
  - → The handle moves quickly into the TRIP position as soon as you release it.

Failure of the molded case circuit breaker to trip indicates that it is defective and must be replaced.

# 2.3.3 Design and components - 3VA1

The design of the 3VA1 molded case circuit breaker is illustrated in the diagram below:

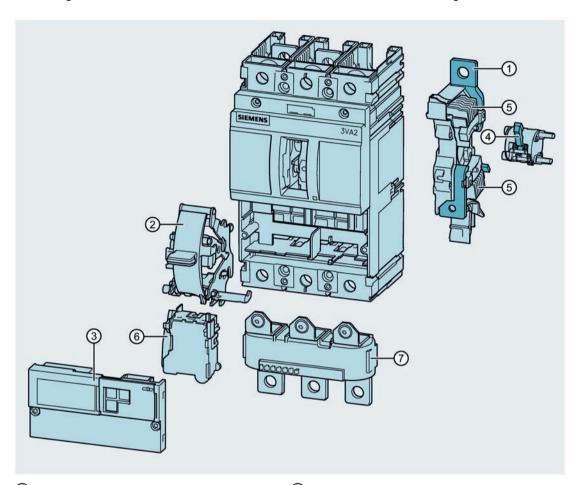


- 1 Main connections
- ② Breaker mechanism with handle
- 3 Trip unit: TMTU

- 4 Rotary contact system
- ⑤ Arc plates
- 6 Pole cassette enclosure

# 2.3.4 Design and components - 3VA2

The design of the 3VA2 molded case circuit breaker is illustrated in the diagram below:



- 1 Main connections
- ② Breaker mechanism with handle
- 3 Trip unit: ETU
- 4 Rotary contact system

- ⑤ Arc plates
- 6 Maglatch
- 7 Current sensor

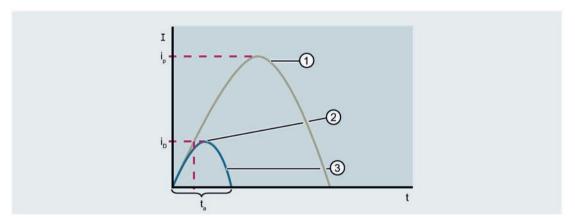
## 2.3.5 Current limitation

"Current limiting" means that the peak value of the prospective impulse short-circuit current ip is limited to a smaller let-through current ip.

The compact design of the breakers has been made possible by their excellent current limiting capabilities. In the event of a short-circuit, the molded case circuit breaker substantially reduces the magnitude of the let-through currents, i.e. reduces the load reaching downstream equipment (less thermal load, lower dynamic forces). The level of let-through energy is also reduced to a considerable extent.

3VA molded case circuit breakers are designed with a current-limiting capability. IEC EN 60947-2 (VDE 0660-101), section 2.3, page 12, defines current-limiting molded case circuit breakers as follows:

"Circuit breaker that, within a specified range of current, prevents the let-through current from reaching the prospective peak value and which limits the let-through energy (I2t) to a value less than the let-through energy of a half-cycle wave of the symmetrical prospective current."

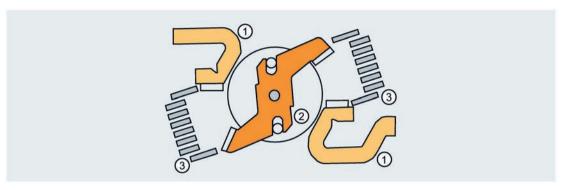


- 1 Unlimited current
- 2 Peak value of limited current
- 3 Limited current
- $i_D$  Let-through current
- ip Unlimited impulse short-circuit current
- ta Break time

#### 2.3 Technical details

# Double-rotary contact system

To achieve excellent current limiting, the 3VA molded case circuit breakers are equipped with a rotary double-contact system that opens dynamically - on its own - above the specified disengaging currents, on the principle of magnetic repulsion, before the expected peak value of the short-circuit current is reached. These limits have been coordinated and optimized to suit the overall device characteristics. This substantially reduces the thermal and mechanical loading on the molded case circuit breaker and the electrical installation.



- Fixed contacts
- 2 Rotary contact system
- 3 Arc splitter chute

The switching pole cassettes are optimized for high breaking capacity, and their rotary double-contact system design enables extremely good current limiting thanks to the build-up of peak arc voltage generated at both contacts in the event of a short-circuit. This results in significant limitation of the let-through energy I<sup>2</sup>t and the let-through current.

3VA molded case circuit breakers with a rated operational current  $I_n > 630$  A are equipped with a single contact in order to optimize the mounting depth.

# 2.3.6 Breaking capacity

The rated ultimate short-circuit breaking capacity I<sub>cu</sub> is the maximum value of the short-circuit current which the protective device is capable of disconnecting in accordance with regulations. Up to this value, the protective device is also allowed to be used in a network.

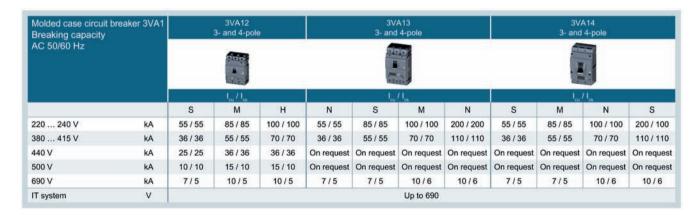
The 3VA molded case circuit breakers are available with identical external dimensions but various breaking capacity classes according to size and rated operational current range.

The tested tolerance range of the rated operational voltages is ±5%.

### Breaking capacity of the 3VA1 range



 $I_n$  125 A, 160 A:  $I_{cu}/I_{cs} = 36 \text{ kA}/36 \text{ kA}$ 



# Breaking capacity of the 3VA2 range

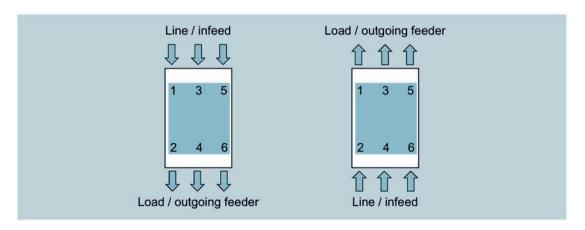
| Molded case circuit<br>Breaking capacity | breaker 3VA2 |         | 3V/<br>3- and   | A20<br>4-pole     |           |           | 3V/<br>3- and   |                   |           |         |                 | 422<br>4-pole     |           |
|--|--------------|---------|-----------------|-------------------|-----------|-----------|-----------------|-------------------|-----------|---------|-----------------|-------------------|-----------|
| AC 50/60 Hz                              |              |         |                 |                   |           |           |                 |                   |           |         |                 |                   |           |
|  |              |         | l <sub>cu</sub> | / I <sub>cs</sub> |           |           | l <sub>eu</sub> | / I <sub>cs</sub> |           |         | l <sub>cu</sub> | / I <sub>es</sub> |           |
|  |              | M       | Н               | С                 | L         | M         | н               | С                 | L         | M       | Н               | С                 | L         |
| 220 240 V                                | kA           | 85 / 85 | 110 / 110       | 150 / 150         | 200 / 200 | 85 / 85   | 110 / 110       | 150 / 150         | 200 / 200 | 85 / 85 | 110 / 110       | 150 / 150         | 200 / 200 |
| 380 415 V                                | kA           | 55 / 55 | 85 / 85         | 110 / 110         | 150 /150  | 55 / 55   | 85 / 85         | 110 / 110         | 150 /150  | 55 / 55 | 85 / 85         | 110 / 110         | 150 /150  |
| 440 V                                    | kA           | 55 / 55 | 85 / 85         | 110 / 110         | 150 /150  | 55 / 55   | 85 / 85         | 110 / 110         | 150 /150  | 55 / 55 | 85 / 85         | 110 / 110         | 150 /150  |
| 500 V                                    | kA           | 36 / 36 | 55 / 55         | 85 / 85           | 100 / 100 | 36 / 36   | 55 / 55         | 85 / 85           | 100 / 100 | 36 / 36 | 55 / 55         | 85 / 85           | 100 / 100 |
| 690 V                                    | kA           | 2/2     | 2/2             | 2/2               | 24 / 18   | 2.5 / 2.5 | 2.5 / 2.5       | 2.5 / 2.5         | 24 / 18   | 3/3     | 3/3             | 3/3               | 24 / 18   |
| IT system                                | V            |         |                 |                   |           |           | Up to           | 690               |           |         |                 |                   |           |

| Molded case circuit br<br>Breaking capacity | eaker 3VA2 |         | 3V/<br>3- and   | 423<br>4-pole    |            |         |                | A24<br>4-pole     |            |            | 3VA25<br>3- and 4-pole           | ,          |
|---|------------|---------|-----------------|------------------|------------|---------|----------------|-------------------|------------|------------|----------------------------------|------------|
| AC 50/60 Hz                                 |            |         |                 |                  |            |         |                |                   |            |            |                                  |            |
|   |            |         | l <sub>eu</sub> | /I <sub>cs</sub> |            |         | l <sub>o</sub> | / I <sub>cs</sub> |            |            | I <sub>cu</sub> /I <sub>cs</sub> |            |
|   |            | M       | Н               | С                | L          | M       | н              | С                 | L          | M          | н                                | С          |
| 220 240 V                                   | kA         | 85 / 85 | 110 / 110       | 150 / 150        | On request | 85 / 85 | 110 / 110      | 150 / 150         | On request | 85 / 85    | 110 / 110                        | 200/ 150   |
| 380 415 V                                   | kA         | 55 / 55 | 85 / 85         | 110 / 110        | On request | 55 / 55 | 85 / 85        | 110 / 110         | On request | 55 / 55    | 85 / 85                          | 110 / 110  |
| 440 V                                       | kA         | 55 / 55 | 85 / 85         | 110 / 110        | On request | 55 / 55 | 85 / 85        | 110 / 110         | On request | On request | On request                       | On request |
| 500 V                                       | kA         | 36 / 36 | 55 / 55         | 85 / 65          | On request | 36 / 36 | 55 / 55        | 85 / 851)         | On request | 36 / 36    | 55 / 55                          | 85 / 65    |
| 690 V                                       | kA         | 5/5     | 5/5             | 5/5              | On request | 6/6     | 6/6            | 6/6               | On request | 25 / 19    | 35 / 19                          | 35 / 19    |
| IT system                                   | V          |         |                 |                  |            |         | Up to 690      |                   |            |            |                                  |            |

 $I_n 400/500 \text{ A} \text{ and } I_n 630 \text{ A} : I_{cs} = 65 \text{ kA}$ 

# 2.3.7 Infeed

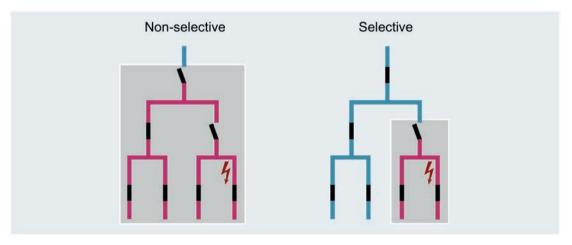
The 3VA molded case circuit breakers can be supplied with power from above and below.



# 2.4 Selectivity

Switching devices connected in series, e.g. molded case circuit breakers and fuses, work together to ensure graded tripping of these switching devices. The closest, upstream switching device before the location of the short-circuit must trip. The other switching devices on the same current run do not trip. The purpose of selectivity is to minimize the effects of a fault in terms of its duration and the area affected by the fault.

Selectivity is achieved when the circuit breakers are matched to each other by means of selection, configuring and trip settings in such a way that, in the event of a fault, only the breaker closest to the location of the fault trips.



4

Short-circuit location

### Selective behavior

The selective behavior of molded case circuit breakers is mainly influenced by the following factors:

- Tripping value settings of the trip unit
- Tripping and break times
- Let-through current values
- Modes of switching of the relevant circuit breakers
  - Zero-current interrupter
  - Current limiter

#### 2.4 Selectivity

The selective behavior of circuit breakers can be implemented technically by a variety of selectivity concepts:

### Current selectivity

The selectivity can be calculated in the overload range by comparing the time/current characteristics. In the short-circuit range, this comparison leads to values that are too low. The reason for this is that the trip unit behaves differently in the case of short-circuit currents compared with its long-term behavior, e.g. in the case of overload.

If the short-circuit currents differ sufficiently at the installation points of two molded case circuit breakers, the instantaneous short-circuit releases can normally be set such that if a short-circuit occurs behind the downstream circuit breaker, only this downstream breaker trips.

If the short-circuit currents are approximately the same at the installation points of the molded case circuit breakers, the grading of the tripping currents of the short-circuit releases only enables selectivity up to a specific short-circuit current.

This current is referred to as the ultimate selectivity value Is.

#### Time selectivity

Selectivity can be achieved by time selectivity up to the threshold values of the instantaneous short-circuit releases. To achieve this, the upstream circuit breaker requires delayed short-circuit releases, so that in the event of a fault, only the downstream circuit breaker will disconnect the part of the electrical installation affected by the fault from the supply.

Both the tripping delays and the tripping currents of the short-circuit releases are graded.

#### Zone selective interlocking - ZSI

Selective behavior is achieved by installing parallel control cables between the molded case circuit breakers. The electronic trip units then use a fast signal link to determine priorities in the tripping sequence.

Zone selective interlocking (ZSI) was developed by SIEMENS to prevent undesirably long tripping times when several molded case circuit breakers are connected in series.

ZSI enables the tripping delay to be reduced to 50 ms for the circuit breaker upstream from the location of the short circuit.

#### Dynamic selectivity

This method is based on evaluation of the arc power which is generated in the arc chute when the contacts open dynamically in response to a short circuit. During this process, a smaller sized downstream molded case circuit breaker converts more energy in the arc chute than the larger, upstream molded case circuit breaker. A selective trip unit evaluates the energy conversion in both molded case circuit breakers. The downstream molded case circuit breaker trips, while the contacts of the upstream circuit breaker close again. Since both molded case circuit breakers perform a current limiting function, the residual current limit imposed in practice is higher than the limiting action specified for the individual molded case circuit breakers.

### Full selectivity

There is an increasing demand for full selectivity in order to safeguard continuity of service by power distribution systems. A power system is said to be fully selective if only the protective device located upstream of the fault location when viewed in the direction of energy flow, i.e. from the infeed to the load, trips in the event of a fault.

Full selectivity always refers to the short-circuit current occurring at the installation point.

## Partial selectivity

A system is said to be partially selective when selective tripping in response to a system fault is not ensured up to the maximum ultimate short-circuit breaking capacity I<sub>cu</sub> of the switching devices. Selectivity is then ensured only up to a certain I<sub>s</sub> current value (ultimate selectivity value). If the calculated prospective short-circuit current at the installation point of the downstream protective device is lower than the ultimate selectivity value specified for the switchgear assembly, then it is still possible to describe the system as fully selective.

If the value determined by the short-circuit current calculation (e.g. according to IEC / EN 60909, DIN VDE 0102) at the installation point of the downstream circuit breaker is below the selectivity limit current listed in the respective table for the selected combination, selectivity is guaranteed for all possible short circuits at the installation point.

If the calculated short-circuit current at the installation point is higher than the ultimate selectivity value, selective tripping by the downstream circuit breaker is only assured up to the value listed in the table. A judgment must be made as to whether the value can be considered to be sufficient because the probability that the maximum short-circuit current will occur is low, for example. Otherwise, a circuit breaker combination should be chosen whose selectivity limit lies above the maximum short-circuit current.

#### Selectivity with 3VA2 molded case circuit breakers

The 3VA2 range is designed to deliver excellent selective tripping combined with optimum current limiting and outstanding breaking capacity.

3VA2 molded case circuit breakers have been specifically designed to meet the following requirements:

- System-wide, high selectivity with a rated operational current interval of 1: 2.5 up to the
  miniature circuit breaker (for molded case circuit breakers with ELISA trip units, even 1
  : 1.6 to each other or to LV HRC fuses)
- Selectivity in combination with high current limiting and high breaking capacity
- Cost-effective design / configuring of selective power distribution systems

These molded case circuit breaker requirements are achieved in engineering terms as follows:

- Rotary double-contact system for highly dynamic opening response
- Coordinated electronic trip units
- Dynamic selectivity

#### 2.4 Selectivity

Depending on the molded case circuit breakers used, with a size/rated operational current differential in a ratio of at least 1: 2.5 and selection of suitable breaking capacity classes, you can achieve selective tripping of the area of the installation directly affected by the fault up to the maximum ultimate short-circuit breaking capacity.

You can find information on selectivity values for 3VA2 molded case circuit breakers on the Internet under the link for 3VA documentation (<a href="http://www.siemens.com/3VA-Documentation">http://www.siemens.com/3VA-Documentation</a>).

#### Electronic trip units and fast trip units

As a protective device, the molded case circuit breaker is required to clear electrical faults in the system. For this purpose, 3VA2 circuit breakers are equipped with intelligent electronic trip units which can be combined with metering functions.

The tripping characteristic of the electronic trip units can be finely and flexibly adjusted. In the event of short circuits, a fast trip unit also responds according to the arc power from the arc chute. This selective trip unit ensures that major short circuits are cleared more quickly, while at the same time ensuring that medium short circuits are interrupted selectively.

# 2.5 Standards and guidelines

All the standards and guidelines with which 3VA molded case circuit breakers comply are summarized in this chapter.

The topics discussed in this chapter are listed below:

- Compliance with standards
- Electromagnetic compatibility
- Ambient conditions
- · Degrees of protection

# 2.5.1 Compliance with standards

The standards fulfilled by the 3VA molded case circuit breakers include:

- IEC / EN 60947-1
- IEC / EN 60947-2
- IEC / EN 60947-2, Annexes B, H and M
- IEC / EN 60947-3
- IEC / EN 60947-6-1

# 2.5.2 Electromagnetic compatibility

The 3VA molded case circuit breakers meet the requirements of the following standards:

- CISPR11, Class A and Class B
- IEC / EN 60947-1, Annex S
- IEC / EN 60947-2, Annexes B, F, J and N

The 3VA molded case circuit breakers are adequately resistant to the following factors:

- Electrostatic charge
- Electrostatic discharge
- Electromagnetic waves, e.g. from transmission systems, mobile phones, radio telephone sets and radar systems
- Overvoltage, e.g. caused by lightning
- Voltage surges

#### 2.5 Standards and guidelines

#### 2.5.3 Certificates

You can find information on the available certification (CE, UL, CSA, FM, marine approvals) on the Internet (http://support.automation.siemens.com/WW/view/en/54137334/134200).

In the Entry List you can use the certificate type (e.g. general product approval, explosion protection, test certificates, shipbuilding) as a filter criterion.

#### 2.5.4 Ambient conditions

## Pollution degree

Operation of the 3VA1 and 3VA2 molded case circuit breakers is approved in accordance with IEC / EN 60947-1 and IEC / EN 60664-1 for pollution degree 3.

### Ambient temperature

3VA molded case circuit breakers are used at ambient temperatures from -25 °C to +70 °C. Derating (reduction in rated operational current) is required at temperatures above +50 °C. You will find more information on the applicable derating factors in chapter Derating and temperature compensation (Page 628).

The permissible storage temperature in original Siemens packaging is between -40  $^{\circ}$ C and +80  $^{\circ}$ C.

### Special climatic requirements

3VA molded case circuit breakers can also be used under harsh conditions.

#### Harsh conditions of storage, transportation and stationary use

The molded case circuit breakers have been tested according to the relevant special test procedures defined in IEC / EN 60947-1, Annex Q for **Class E** applications.

This class covers the areas MC3 + CC2 + SC1:

- Ambient temperature
- Humidity
- Vibration environment
- Shock environment

These ambient conditions can be referred to as "Open deck, damp and cold atmosphere without salt spray" or "Difficult, non-marine conditions".

The following standards-related criteria are complied with:

IEC / EN 60068-2-2 "Bd" and IEC / EN 60068-2-1 "Ab":

Temperature range: -25 °C ... +70 °C

• IEC / EN 60068-2-30 "Db"

Humid heat up to +55 °C and air humidity up to 95 %

IEC / EN 60068-2-6 "Fc"

Vibration test

• IEC / EN 60068-2-27 "Ea"

Shock resistance test

Between the tests of compliance with the standards and at the end of the tests, the usability of the devices is assured with the "Verification of operation characteristics".

#### Vibration resistance and shock resistance

3VA molded case circuit breakers are insensitive to vibrations and meet the requirements relating to mechanical and electromechanical vibration strength according to IEC / EN 60068 and the specifications of the shipbuilding societies.

The circuit breakers resist impacts of up to 10 g and are tested to withstand without damage their operating conditions with shock impact according to IEC / EN 60068-2 27 "Ea" with  $150 \, \text{m/s}^2$  / 11 ms.

### Installation altitudes

When 3VA1 and 3VA2 molded case circuit breakers are used at up to 2000 m above sea level, the rated data will not change.

An installation altitude above 2000 m can lead to higher temperatures at the switching devices. The lower density of air can significantly reduce heat dissipation,

making it necessary to decrease rated operational voltage, the rated uninterrupted current and the short-circuit values.

Refer to the table below for the calculation factor for determining the key values:

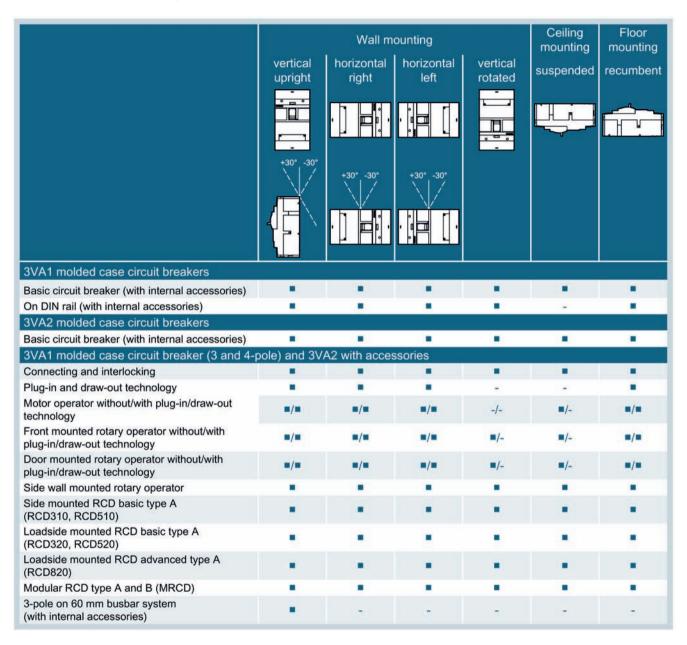
|  |                   |                   |                    | Altitude           |                    |                    |                    |
|--|-------------------|-------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|  | 2000 m<br>6562 ft | 3000 m<br>9843 ft | 4000 m<br>13123 ft | 5000 m<br>16404 ft | 6000 m<br>19685 ft | 7000 m<br>22966 ft | 8000 m<br>26247 ft |
| Breaking capacity I <sub>cu</sub> /I <sub>cs</sub> | 1.0               | 0.9               | 0.8                | 0.7                | 0.6                | 0.5                | 0.4                |
| Operating voltage U <sub>max</sub>                 | 1.0               | 0.9               | 0.8                | 0.7                | 0.6                | 0.5                | 0.4                |
| Operating current I <sub>max</sub> 1)              | 1.00              | 0.96              | 0.92               | 0.88               | 0.84               | 0.8                | 0.76               |
| Setting current I,2)                               | 1.00              | 1.02              | 1.04               | 1.06               | 1.08               | 1.10               | 1.12               |

<sup>1)</sup> At maximum ambient temperature +50 °C

<sup>2)</sup> Thermal-magnetic trip units only

# 2.5.5 Permissible mounting positions and mounting positions with accessories

The following table shows the possible variations on the mounting positions, as well as mounting positions with accessories:



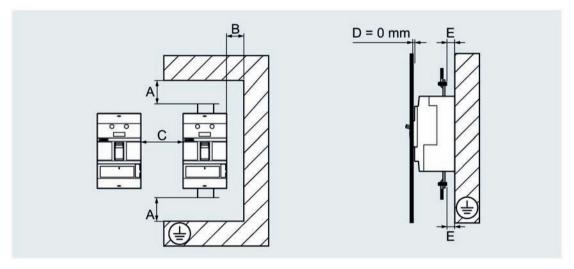
# 2.5.6 Safety clearances

During a short-circuit interruption, high temperatures, ionized gases and high pressures occur in and above the arcing chambers of the molded case circuit breaker. For this reason, defined minimum clearances must be adhered to during installation between the molded case circuit breakers and the mounting plates, conductor bars and other protection systems placed in the immediate vicinity. This safety area was successfully confirmed with the help of tests on test setups according to IEC 60947-2 (perforated grid cage).

Safety clearances are required to:

- allow pressure distribution
- prevent fire or damage caused by any diffused ionized gases
- · prevent a flashover to grounded parts
- prevent arcing or short-circuit currents to live sections.

The following safety clearances apply to 3VA molded case circuit breakers with accessories (e.g. phase barrier, long terminal cover, etc.):



- A Minimum clearance between molded case circuit breaker and current paths (uninsulated and grounded metal), see tables below
- B Minimum clearance between molded case circuit breaker and side walls left / right (uninsulated and grounded metal), see tables below
- C Minimum clearance between two horizontally installed molded case circuit breakers, see tables below; applicable to fixed-mounted and plug-in versions (see chapter Plug-in and draw-out technology (Page 272))
- D Minimum clearance between molded case circuit breaker and panel door
- E Minimum clearance between live parts of connection technology and grounded mounting plate:
  - 3VA10 and 3VA11: 11 mm
  - 3VA12, 3VA13 and 3VA14: 8 mm

# 2.5 Standards and guidelines

## Minimum clearance for 3VA1 molded case circuit breakers:

|  |  |                              |                            | Clea             | arances [r               | nm]                          |                 |            |                |
|--|--|------------------------------|----------------------------|------------------|--------------------------|------------------------------|-----------------|------------|----------------|
| 3VA10, 3VA11, 3VA12  | between  |                              | to ground                  | ded plate        |                          | t                            | o insulatin     | g materia  |                |
| Rated operational voltage  | devices  | 3VA10, 3VA11<br>100 A, 160 A |                            | 3VA12<br>250 A   |                          | 3VA10, 3VA11<br>100 A, 160 A |                 | 3V/<br>25  |                |
|  | С  | Α                            | В                          | А                | В                        | А                            | В               | Α          | В              |
| Molded case circuit breakers $3VA10/11/12$ will Clearances for $3VA10/11$ and $U \le 415$ V AC $I$ Clearances for $3VA11$ -ED1. and $U \le 240$ V Clearances for $3VA12$ and $U \le 415$ V AC DC | / U ≤ 250 V DC<br>AC / U ≤ 125 \                             | ;                            | ent device                 |                  |                          |                              |                 |            |                |
| without accessory or with short terminal cover   | 0  | 35                           | 10                         | 50               | 10                       | 35                           | 10              | 50         | 10             |
| with short phase barriers (1st third) 1)   | 0  | 0                            | 10                         | 35               | 10                       | 0                            | 10              | 35         | 10             |
| with long phase barriers 2)  | 0  | 0                            | 10                         | 0                | 10                       | 0                            | 10              | 0          | 10             |
| With terminal cover long   | 0  | 35                           | 10                         | 35               | 10                       | 35                           | 10              | 35         | 10             |
| Clearances for 3VA11ED1, and 240 V AC  |  |                              | 0 2 000                    | V DC / U         | > 415 V A                | C IT syste                   | ems or infe     | eed from I | pelow          |
| Clearances for 3VA12 and 415 V AC < U $\leq$ 69  | 00 V AC / 415 V  |                              |                            |                  | > 415 V A                | C IT syste                   | ems or infe     | eed from l | pelow          |
|  | 90 V AC / 415 V<br>Not<br>permitted                          | / DC < U                     |                            | С                | > 415 V A                | •                            | ems or infe     | Not pe     |                |
| Clearances for 3VA12 and 415 V AC < U $\leq$ 69 without accessory  | 90 V AC / 415 V<br>Not                                       | / DC < U<br>Not pe           | ≤ 750 V D                  | С                | rmitted                  | Not pe                       |                 |            | rmitte         |
| Clearances for 3VA12 and 415 V AC < U ≤ 69 without accessory or with short terminal cover  | 90 V AC / 415 N<br>Not<br>permitted<br>Not                   | / DC < U<br>Not pe           | ≤ 750 V D                  | OC<br>Not pe     | rmitted                  | Not pe                       | rmitted         | Not pe     | rmitted        |
| Clearances for 3VA12 and 415 V AC < U ≤ 69 without accessory or with short terminal cover with short phase barriers (1st third) 1) with short phase barriers (1st third) 1)                      | Not permitted  Not permitted                                 | V DC < U<br>Not pe<br>Not pe | ≤ 750 V D<br>rmitted       | Not pe           | rmitted<br>rmitted<br>10 | Not pe<br>Not pe             | rmitted         | Not pe     | rmitteormitteo |
| Clearances for 3VA12 and 415 V AC < U ≤ 69 without accessory or with short terminal cover with short phase barriers (1st third) 1) with short phase barriers (1st third) 1) + Insulating plate   | 90 V AC / 415 V<br>Not<br>permitted<br>Not<br>permitted<br>0 | V DC < U<br>Not pe<br>Not pe | ≤ 750 V Dermitted ermitted | Not pe Not pe 55 | rmitted<br>rmitted<br>10 | Not pe<br>Not pe             | rmitted rmitted | Not pe     | rmitteormitteo |

<sup>&</sup>lt;sup>1)</sup> Can be used for connection technology: box terminal, screw terminal, internal wire connector and rear terminals

<sup>&</sup>lt;sup>2)</sup> Can be used for connection technology: wire connector large, front bus connectors extended, and front bus connectors offset

| Molded case circuit breakers  |               |                        |          | Clea           | arances [n | nm]            |            |                |        |
|---|---------------|------------------------|----------|----------------|------------|----------------|------------|----------------|--------|
| 3VA13, 3VA14  | between       |                        | to groun | ded plate      | t          | o insulatir    | ng materia | ľ              |        |
| Rated operational voltage   | devices       | devices 3VA13<br>400 A |          | 3VA14<br>630 A |            | 3VA13<br>400 A |            | 3VA14<br>630 A |        |
|   | С             | Α                      | В        | А              | В          | Α              | В          | Α              | В      |
| Molded case circuit breakers 3VA13/14<br>Clearances for U ≤ 500 V AC:               | ii i          |                        |          | ):<br>         |            | 5              |            |                |        |
| without accessory or with short terminal cover                                      | 0             | 50                     | 10       | 50             | 20         | 40             | 5          | 40             | 5      |
| with short phase barriers 1)  | 0             | 0                      | 10       | 0              | 20         | 0              | 5          | 0              | 5      |
| with long phase barriers 2)   | 0             | 0                      | 10       | 0              | 20         | 0              | 5          | 0              | 5      |
| with terminal cover long  | 0             | 30                     | 5        | 30             | 5          | 25             | 5          | 25             | 5      |
| Molded case circuit breakers 3VA13/14<br>Clearances for 500 V AC < U ≤ 690 V AC and | U ≤ 600 V DC  | :                      |          |                |            |                |            |                |        |
| without accessory or with short terminal cover                                      | Not permitted | Not pe                 | rmitted  | Not pe         | rmitted    | Not pe         | rmitted    | Not pe         | mitted |
| with short phase barriers   | Not permitted | Not pe                 | rmitted  | Not pe         | rmitted    | Not pe         | rmitted    | Not pe         | mitted |
| with short phase barriers + insulating plate 1)                                     | 0             | 35                     | 20       | 35             | 20         | 20             | 5          | 20             | 5      |
| with long phase barriers 2)   | Not permitted | Not pe                 | rmitted  | Not pe         | rmitted    | Not pe         | rmitted    | Not pe         | mitted |
| with long phase barriers + insulating plate 1)                                      | 0             | 0                      | 20       | 0              | 20         | 0              | 5          | 0              | 5      |
|   |               |                        |          |                |            |                |            |                |        |

Can be used for connection technology: box terminal, screw terminal, internal wire connector and rear terminals

<sup>&</sup>lt;sup>2)</sup> Can be used for connection technology: wire connector large, front bus connectors extended, and front bus connectors offset

# 2.5 Standards and guidelines

### Minimum clearance for 3VA2 molded case circuit breakers:

| 3VA2 molded case circuit breakers   |             |                |               |         |                  | Dista   | inces [          | mm]     |        |          |                  |         |                 |
|---|-------------|----------------|---------------|---------|------------------|---------|------------------|---------|--------|----------|------------------|---------|-----------------|
| Rated operational voltage   | S           |                | to            | ground  | ded pla          | ite     |                  |         | to i   | nsulatin | g mat            | erial   |                 |
| and the man and the second  | devices     | 3V/            | A20           | 3VA     | 23 <sup>3)</sup> | 3VA     | 24 <sup>3)</sup> | 3VA     | 20     | 3VA      | 23 <sup>3)</sup> | 3VA     | 24 <sup>3</sup> |
|   | Jev         | 3V/            | 121           |         |                  |         |                  | 3VA     | 121    |          |                  |         |                 |
|   |             | 3V/            | 122           |         |                  |         |                  | 3V#     | 122    |          |                  |         |                 |
|   | Vec         | 10             | ) A           | 25      | ΑC               | 40      | ) A              | 100     | ) A    | 250      | ) A              | 400     | A               |
|   | between     | 16             | ) A           | 40      | ) A              | 63      | A C              | 160     | A      | 400      | ) A              | 630     | A               |
|   | ъ           | 25             | ) A           | ,       |                  |         |                  | 250     | ) A    |          |                  |         |                 |
|   | С           | Α              | В             | Α       | В                | Α       | В                | Α       | В      | Α        | В                | Α       | В               |
| without accessory or with short terminal cover  | 0           | 40             | 5             | 50      | 10               | 50      | 20               | 30      | 5      | 40       | 5                | 40      | 5               |
| with short phase barriers 1)  | 0           | 0              | 5             | 0       | 10               | 0       | 20               | 0       | 5      | 0        | 5                | 0       | 5               |
|   |             |                |               |         |                  |         |                  |         |        |          |                  |         | 0               |
| with long phase barriers 2)   | 0           | 0              | 5             | 0       | 10               | 0       | 20               | 0       | 5      | 0        | 5                | 0       | 5               |
| with long phase barriers <sup>2)</sup> with long terminal cover   | 0           | 0<br>25        | 5<br>5        | 0<br>30 | 10<br>5          | 0<br>30 | 20<br>5          | 0<br>25 | 5<br>5 | 0<br>25  | 5<br>5           | 0<br>25 | 5               |
|   | 0           | 25             | 5             | 30      |                  |         |                  |         |        | 0.50     |                  | T.      | 5               |
| with long terminal cover  3VA2 molded case circuit breaker with / without re                              | 0           | 25             | 5             | 30      |                  |         |                  |         |        | 0.50     |                  | T.      | 5               |
| with long terminal cover<br>3VA2 molded case circuit breaker with / without re<br>500 V AC < U ≤ 690 V AC | 0<br>esidua | 25<br>I currer | 5<br>it devic | 30<br>e | 5                | 30      | 5                | 25      | 5      | 25       | 5                | 25      | - 3             |

- 1) Can be used for connection technology: box terminal, screw terminal, internal wire connector and rear terminals
- <sup>2)</sup> Can be used for connection technology: wire connector large, front bus connectors extended, and front bus connectors offset
- 3) Does not apply to breaking capacity class L

| 3VA25 molded case circuit breakers          | Distances [mm]  |                             |           |  |  |  |
|---|-----------------|-----------------------------|-----------|--|--|--|
| Rated operational voltage                   | between devices | to ground                   | ded plate |  |  |  |
|   | 630             | 3VA25<br>O A, 800 A, 1000 A |           |  |  |  |
|   | С               | А                           | В         |  |  |  |
| 3VA25 molded case circuit breaker $U \le 4$ | 15 V            |                             |           |  |  |  |
| with short terminal cover                   | 0               | 50                          | 15        |  |  |  |
| 3VA25 molded case circuit breaker 415 V     | ⁄ < U ≤ 1000 V  |                             |           |  |  |  |
| with short terminal cover                   | 0               | 75                          | 15        |  |  |  |

#### Note

In addition to the clearances stated above, any insulation measures that might be required must also be considered, see chapter Insulating measures (Page 246).

If the molded case circuit breaker is installed in a system whose connection type and operational voltage does not correspond to the specified insulation measures, a type test is required.

It must be ensured that the cable or busbar connector does not reduce the air insulation clearance.

Accessory components can increase the width or height of the molded case circuit breaker. In this case the minimum clearances apply from the corresponding sides of the overall molded case circuit breaker/accessory combination.

#### NOTICE

#### Damage to the molded case circuit breaker and the system

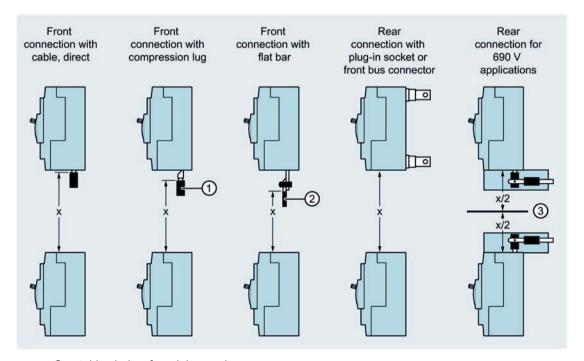
Depending on the application, larger minimum clearances may be necessary.

Please observe the specifications regarding air and creepage distances in the applicable overriding guidelines (e.g. IEC 61439).

### Safety clearances between molded case circuit breakers

No minimum clearance needs to be observed between the molded case circuit breakers on the longitudinal sides (see table above).

The following safety clearances apply to molded case circuit breakers installed directly on top of each other (for operation in the same network or at the same operational voltage):



- x See tables below for minimum clearance
- 1 Insulation of cable
- 2 Insulation of busbar
- 3 Insulation between the molded case circuit breakers

## 2.5 Standards and guidelines

Minimum clearance for 3VA1 molded case circuit breakers:

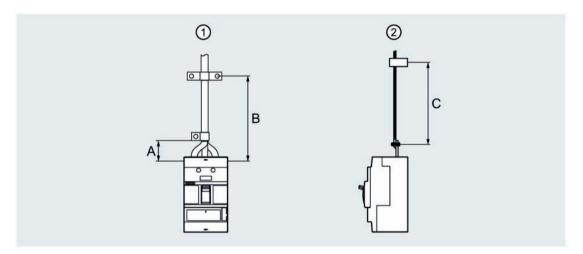
| 3VA1 molded case circuit breakers                    | 3VA10 / 3VA11 | 3VA12 | 3VA13 / 3VA14 |
|--|---------------|-------|---------------|
|  | 100 A / 160 A | 250 A | 400 A / 630 A |
| Rated operational voltage                            | x             | x     | x             |
|  | [mm]          | [mm]  | [mm]          |
| $U \le 690 \text{ V AC}$<br>$U \le 600 \text{ V DC}$ | 150           | 150   | 150           |

Minimum clearance for 3VA2 molded case circuit breakers:

| 3VA2 molded case circuit breakers | 3VA20 / 3VA21 / 3VA22 | 3VA23 | 3VA24 |
|-----------------------------------|-----------------------|-------|-------|
|                                   | 100 A / 160 A / 250 A | 400 A | 630 A |
|                                   | x                     | X     | X     |
| Rated operational voltage         | [mm]                  | [mm]  | [mm]  |
| $U \le 525 V$                     | 80                    | 100   | 100   |
| 525 V < U ≤ 690 V                 | 150                   | 200   | 100   |

## Maximum clearance to first fixing point of cable or busbar

The figure and table show the recommended maximum clearance between molded case circuit breakers and the first fixing point of the cable or busbar.



- 1 Fixing of cable
- ② Fixing of busbar

Recommended maximum clearance for 3VA1 molded case circuit breakers:

The values for the 3VA1 molded case circuit breakers are available from Siemens on request.

| 3VA2 molded case circuit                 | Maximum clearances to first                   | fixing point (recor | mmended)  |
|--|---|---------------------|-----------|
| breakers                                 | Cable   |                     | Busbar    |
| Conductor cross-section                  | A<br>[mm]                                     | B<br>[mm]           | C<br>[mm] |
| < 16 mm²                                 | 30 kA: 150<br>85 kA / 150 kA: 50 + cable duct | 250                 | 250       |
| 16 mm² < 70 mm²                          | 100   | 250                 | 250       |
| 70 mm <sup>2</sup> < 240 mm <sup>2</sup> | 150   | 250                 | 250       |

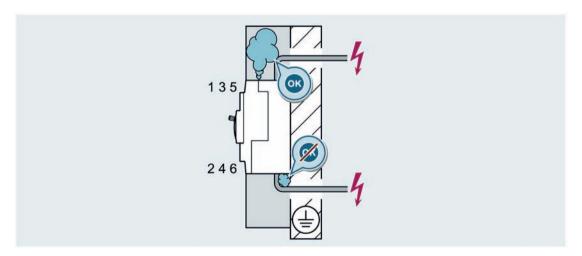
Recommended maximum clearance for 3VA2 molded case circuit breakers:

# 2.5.7 Arcing spaces

Adequate arcing spaces must be taken into account during planning and installation of the molded case circuit breakers.

In particular, the following must be observed:

- Ventilation openings must be kept free.
- Ionized gases must not be routed in the direction of connecting terminals or non-insulated busbars.
- Arcing spaces must not be blocked by busbars installed too close to one another or by other objects.



The 3VA molded case circuit breakers up to size 630 A have a rotary double-contact system and therefore blow out upwards and downwards. The upper blowout openings (at terminals 1, 3, 5) are located above the connections and the lower blowout openings (at terminals 2, 4, 6) are located below them.

The 3VA molded case circuit breakers in size 1000 A (3VA25) only blow upwards, i.e. in the direction of terminals 1, 3, 5, as they have a single-contact system.

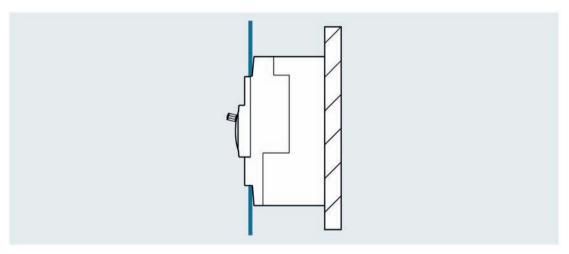
# 2.5.8 Degrees of protection

3VA molded case circuit breakers comply with the following degrees of protection as defined by IEC 60529 and IEC 60947-1, Annex C:



|  | Accessories | Accessories cover |         | Terminal cover |  |  |
|--|-------------|-------------------|---------|----------------|--|--|
|  | Without     | With              | Without | With           |  |  |
| Front panel without termination area ① | 1 <b>-</b>  | IP4x              | i '     |                |  |  |
| Front panel termination area ②         |             |                   | IP2x    | IP4x           |  |  |
| Infeed/load ends 3                     |             |                   | IP3x    | IP4x           |  |  |

Degree of protection IP30 is achieved when a 3VA molded case circuit breaker is installed in a switchboard with a door cutout including cover frame (see below).



Handle and trip unit are freely accessible, the panel door closes flush with the molded case circuit breaker.

The units can be upgraded to comply with higher degrees of protection up to IP65 by installation of the following components:

- Door mounted rotary operator
- Side wall mounted rotary operator

# 2.5.9 Environmental protection

The 3VA1 and 3VA2 molded case circuit breakers meet the specifications of the European Environment Guideline 2011 / 65 / EU RoHS directive (Restriction of the use of certain hazardous substances in electrical and electronic equipment). The development and production processes have been devised to have the lowest possible environmental impact.

# 2.6 Protection system

This chapter contains an overview of the protection system of 3VA molded case circuit breakers.

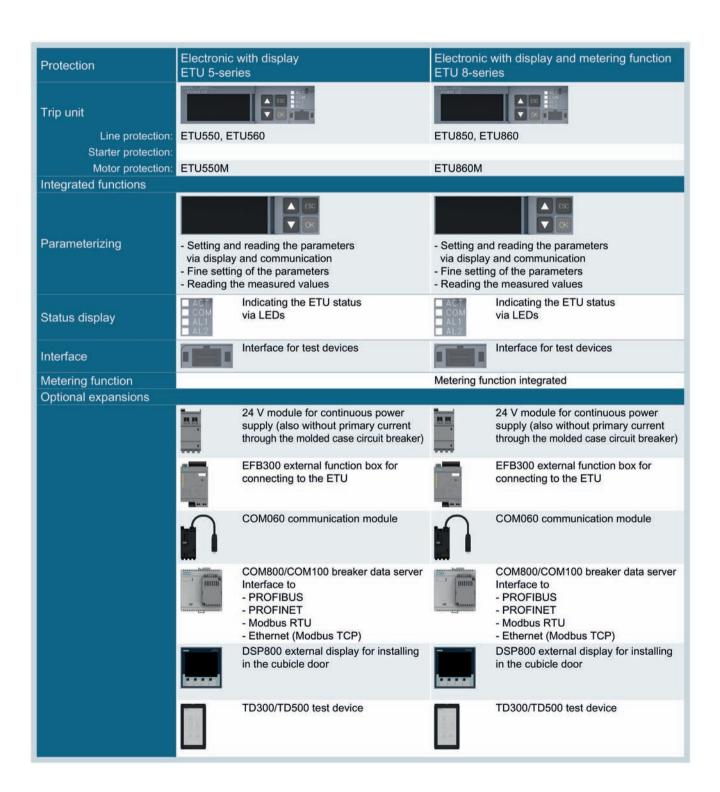
The topics discussed in this chapter are listed below:

- Description of functions
- Overload protection (L)
- Short-time delayed short-circuit protection (S)
- Instantaneous short-circuit protection (I)
- Ground-fault protection (G)
- Neutral conductor protection (N)
- ZSI Zone Selective Interlocking
- Guide to setting the tripping characteristic

# 2.6.1 Description of functions

The protection function performed by the molded case circuit breaker in the power distribution network is defined by the choice of trip unit. There are two different types of trip unit, i.e. thermal-magnetic (TMTU) and electronic (ETU):





### 2.6.2 Characteristic curves

To design a low-voltage switchboard in accordance with the valid rules, the system planner needs to dimension the protection settings of the molded case circuit breakers.

The settings selected for the trip unit of a molded case circuit breaker depend on the type of equipment to be protected, e.g. switchboard and applications.

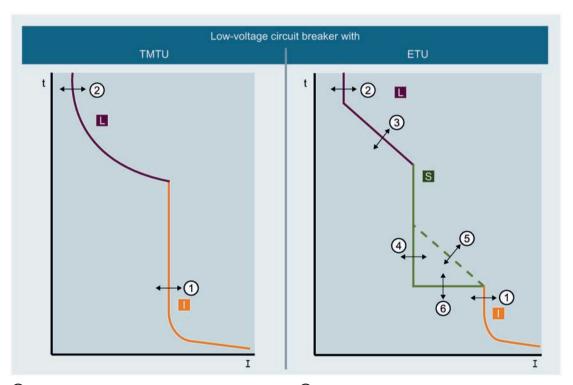
Tripping characteristics up to a tripping time of  $\geq 1$  ms are represented graphically. In order to ease the coordination of different protection devices, the current is specified as a multiple of the current setting value and the time is specified in seconds.

### Tripping characteristics for thermal-magnetic trip units

Characteristics are displayed graphically in the double-log coordinate system (cf. IEC 60947-2, paragraph 4.7.4 and IEC 60269-1). The ratio of current to time is 2: 1.

# Tripping characteristics for electronic trip units

Characteristics are displayed graphically in the double-log coordinate system (cf. IEC 60269-1). The ratio of current to time is 1: 1.



- Response threshold of the long-time delayed protection, thermal
- ② Response threshold of the long-time delayed protection
- 3 Delay of the long-time delayed protection
- Response threshold of the short-time delayed protection
- ⑤ I²t characteristic ON/OFF of the short-time delayed protection

- 6 Delay of the short-time delayed protection
- Response threshold of the instantaneous protection
- L Overload range
- S Short-time delayed short-circuit current range
- Instantaneous short-circuit current range

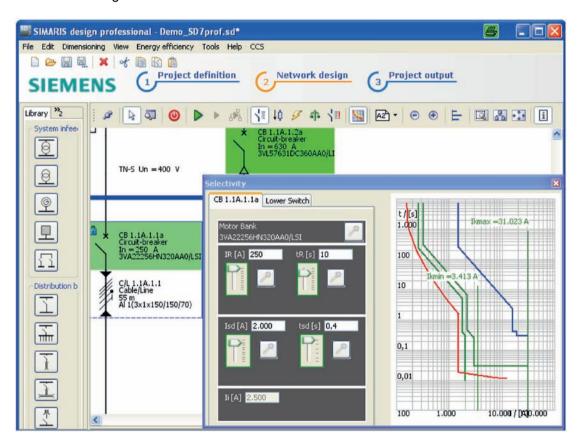
# 2.6.3 Guide to setting the tripping characteristic

### Supplementary conditions

The settings selected for the trip unit of a molded case circuit breaker depend on the technical environment (e.g. switchboard and applications) and the type of equipment to be protected. The task of calculating and dimensioning the protection settings in accordance with the valid rules is the responsibility of the system planner.

### SIMARIS design

The Siemens SIMARIS design software tool is a fast, simple and reliable tool for calculating and dimensioning networks in accordance with the valid rules:



For further information about SIMARIS design, please visit:

(http://www.siemens.com/simaris)

# Basic rules for setting different trip parameters

|    | 4 | Parameter                       | Buttons   | Effect on characteristic curve | Brief description  | Cause   | Example   |
|----|---|---------------------------------|---|--------------------------------|--|---|---|
| ١. | ñ | I <sub>c</sub>                  | I <sub>r</sub> /A  300 280 320 280 340 240 360 200 160 400  | Strom (i)                      | Operating current of overload protection:  ETU I <sub>r</sub> = 0.4 1 x I <sub>n</sub> TMTU I <sub>r</sub> = 0.7 1 x I <sub>n</sub> Absolute values in A | Optimization of the overload range by setting to the operational current of the circuit to be protected   | Overload range from 300 A   |
| ľ  | - | t,                              | t <sub>r</sub> /s   | Strom (l)                      | Delay time (or time-lag class) in the overload range. The set time is the tripping time at 6 x I,  | Improved selectivity in<br>the overload range in<br>switchboards with several<br>grade levels   | The tripping time t <sub>r</sub> = 10 s applies to 6 x I <sub>r</sub> , in this case 6 x 300 A = 1800 A                                     |
|    | , | sd                              | I <sub>sd</sub> =xI <sub>r</sub> /A  3.5  3.5  6  2.5  6  1.5   | Strom (i)                      | Operating current of the short-time delayed short-circuit protection   | Limitation of the short-circuit<br>range in which the current<br>has to be interrupted more<br>quickly but possibly with a<br>slight time delay | At I <sub>r</sub> = 300 A and I <sub>sd</sub><br>= 5: Tripping at 1500 A<br>following delay t <sub>sd</sub>                                 |
| 5  |   | t <sub>sd</sub>                 | t <sub>sd</sub> /s  | Strom (i)                      | Delay time of the short-<br>time delayed short-circuit<br>protection   | Improved selectivity in<br>the overload range in<br>switchboards with<br>several grade levels   | $t_{sd}$ = 0.15 s:<br>Tripping after 0.15 s for<br>current values between $l_{sd}$<br>and $l_i$   |
|    |   | Ĭ,                              | 1000 1250<br>750 1500<br>625 2250<br>375 2500   | Strom (I)                      | Operating current of the instantaneous short-circuit protection  | Limitation of the short-<br>circuit range in which the<br>impermissibly high current<br>has to be interrupted as<br>quickly as possible         | At I <sub>i</sub> = 2000 A:<br>instantaneous tripping at<br>currents > 2000 A   |
| _  | 1 | I <sub>N</sub>                  | I <sub>N</sub> =xI <sub>r</sub>   | Strom (I)                      | Operating current of<br>the neutral conductor<br>protection function   | Protection of the neutral conductor for overcurrent and short-circuit   | At $I_N$ = ON, $I_N$ = 0.5 x I, and I, = 300 A, overload from 150 A following characteristic curve with t, instantaneous tripping at 2000 A |
| G  | 6 | l <sub>g</sub> + t <sub>g</sub> | $\begin{array}{c c} t_g \!=\! 0,1 \text{ s} \\ t_g \!=\! 0,3 \text{ s} \\ \hline 250 & 100 \\ \hline 150 & 150 \\ \hline 100 & 250 \\ \hline \end{array}$ | Strom (I)                      | Operating current of the ground-fault protection function and delay time to tripping   | Line protection   | At ground-fault currents<br>from $I_g = 50 \text{ A}$ :<br>Tripping after time<br>$t_g = 0.1 \text{ s}$                                     |

# Setting the parameters for electronic trip units of the ETU 5-series and 8-series

ETUs 5-series and ETUs 8-series are equipped with an LCD.

Parameter settings can be adjusted via this LCD, values are input by means of buttons. The powerconfig software can also be used to input parameter settings. The TD500 test device and the COM800/COM100 breaker data server combined with the COM060 communication module can be used as the software interface.

# 2.6.4 Overload protection (L)

The ID letter for overload protection is L (stands for "Long-time delay").

The trip unit is inverse-time delayed and exhibits the following characteristics depending on the trip unit type:

- Bimetal characteristic with thermal-magnetic trip units
- I2t characteristic with electronic trip units

The letters I<sub>r</sub> refer to the current setting value, and t<sub>r</sub> to the associated time delay.

The time delay with the device-specific reference point defines the current-dependent curve shape of the setpoint characteristic. With 3VA molded case circuit breakers, this trip unit reference point corresponds to 6 times the current setting value I<sub>r</sub>. The following mathematical equation determines the remaining curve of the setpoint characteristic:

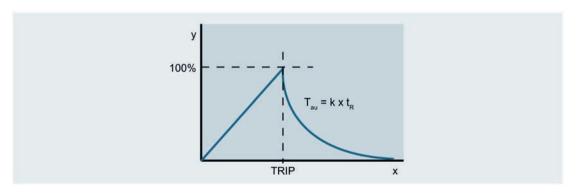
I2t = constant

### Thermal memory

The electronic trip units feature a thermal memory function that can be deactivated on some electronic overload releases.

### Thermal memory activated (ON)

If the thermal memory is activated, the previous thermal history is taken into account. After tripping, the thermal memories of the phases are set to a value corresponding to 85% of the thermal equivalent of the warmest phase. This setting allows reclosure of the contacts of the molded case circuit breaker. This is followed by a cool-down period according to an exponential function with a time constant  $T_{au}$  ( $\tau$ ).



#### Thermal memory deactivated (OFF)

It is the responsibility of the commissioning engineer/operator to provide additional thermal overload protection for the lower-level power distribution system while the thermal memory is deactivated.

# 2.6.5 Short-time delayed short-circuit protection (S)

The ID letter for short-time delayed short-circuit protection is "S" (stands for "Short-time delay"). The S function of the trip unit can be used to implement time-selective short-circuit tripping in low-voltage networks in which multiple molded case circuit breakers are installed in series.

The short-time delayed short-circuit protection function protects phases L1 to L3 and the neutral conductor. The protection function responds if the current in at least one phase exceeds the set tripping current  $I_{sd}$  for the set delay period  $t_{sd}$ .

The S release has a characteristic curve with current-dependent characteristic I²t, i.e. the delay time is dependent on the energy content of the short-circuit current present. The ETUs 5-series and ETUs 8-series can be optionally switched over to a current-independent tripping characteristic. In this case, a fixed delay time t<sub>sd</sub> applies.

# 2.6.6 Instantaneous short-circuit protection (I)

The ID letter for instantaneous short-circuit protection is "I" (stands for "Instantaneous").

This short-circuit protection function protects phases L1 to L3. The instantaneous short-circuit protection function responds if the instantaneous value equal to the rms of the current in at least one phase exceeds the instantaneous tripping current I<sub>i</sub>.

# 2.6.7 Ground-fault protection (G)

The ID letter for ground-fault protection is "G" (stands for "ground fault").

The G release detects residual currents between phases and grounded, electrically conductive parts. The ground-fault protection function responds if the ground fault current exceeds the set tripping current I<sub>g</sub> for the set delay period t<sub>g</sub>.

Ground-fault protection can be implemented either as a current-independent or a current-dependent function (I<sup>2</sup>t).

On 4-pole molded case circuit breakers and 3-pole molded case circuit breakers with external current transformer for the N conductor, the G release calculates the vector sum of the currents of the three phases and the neutral conductor. On 3-pole molded case circuit breakers, the vector sum is calculated without the neutral conductor. The G release trips the circuit breaker, or an alarm is issued via the communication system if the rms value of this vector sum exceeds the set response threshold  $I_{\alpha}$  for the set delay time  $t_{\alpha}$ .

### Ground-fault detection in balanced systems

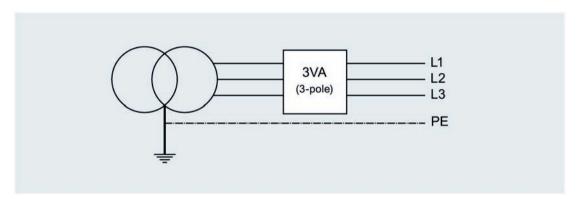
The three phase currents are evaluated using vectorial summation current.

### 3VA trip unit variants

ETUs 3-series: ETU330 (LIG)ETUs 5-series: ETU560 (LSIG)

• ETUs 8-series: ETU860 (LSIG)

3-pole molded case circuit breaker in balanced systems:

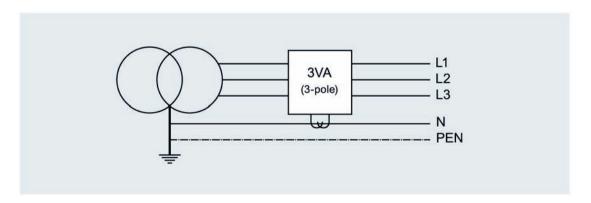


### Ground-fault detection in unbalanced systems

The neutral conductor current is measured directly and in the case of 3-pole molded case circuit breakers only for the ground-fault protection, but in the case of 4-pole circuit breakers the neutral conductor current is also evaluated for the neutral conductor protection.

The trip unit calculates the ground-fault current using the three phase currents and the neutral conductor current for the vectorial summation.

3-pole molded case circuit breaker in unbalanced systems, 3-pole 3VA with external N transformer:



# 3VA trip unit variants, 3-pole 3VA2 with external N transformer

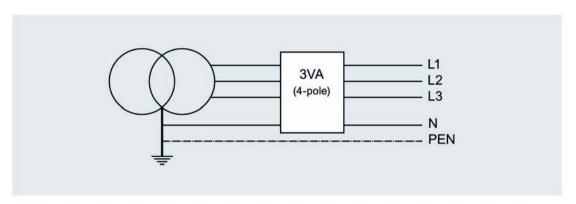
• ETUs 5-series: ETU560 (LSIG)

• ETUs 8-series: ETU860 (LSIG)

# 2.6 Protection system

For 4-pole molded case circuit breakers, the fourth current transformer is internally installed for the neutral conductor.

4-pole molded case circuit breaker in unbalanced systems:



# 3VA trip unit variants, 4-pole 3VA2

• ETUs 3-series: ETU330 (LIG)

• ETUs 5-series: ETU560 (LSIG)

• ETUs 8-series: ETU860 (LSIG)

# 2.6.8 Neutral conductor protection (N)

The ID letter for neutral conductor protection is "N".

The neutral conductor protection system protects the neutral conductor against overloads and short circuits.

The letters I<sub>N</sub> refer to the current setting value; the associated setting time is identical to t<sub>r</sub>.

#### Note

A neutral conductor with full cross sectional area (distributed neutral conductor of the same size as the phases) is normally protected by the phase protection system and does not require separate protection.

# **Neutral conductor protection**

Neutral conductor protection must be implemented in accordance with the standards valid in the country of installation. Possible reasons for implementing neutral conductor overload protection are:

- The neutral conductor has a smaller cross section than the phase conductors.
- Harmonic levels in the installation are expected to be higher than normal.
- A large number of loads, or predominantly single-phase loads, will be connected.

### Neutral conductor protection and 3VA1 molded case circuit breakers

The following 3VA1 molded case circuit breakers have neutral conductor protection:

All 4-pole versions of 3VA11, 3VA12, 3VA13, 3VA14 (TM210, TM220, TM240)

All of these molded case circuit breakers are available in versions without or with 100% neutral conductor protection. A version with 50% neutral conductor protection is available in addition for rated operational currents greater than 100 A.

| 3VA1  | Tein unit | Neutral conductor protect |      |       |
|-------|-----------|---------------------------|------|-------|
| Size  | Trip unit | 0 %                       | 50 % | 100 % |
| 3VA10 | TM210     |                           |      |       |
| 3VA11 | TM210     | •                         |      |       |
|       | TM220     |                           |      |       |
|       | TM240     |                           |      |       |
| 3VA12 | TM240     |                           |      |       |
| 3VA13 | TM240     |                           |      |       |
| 3VA14 | TM240     |                           |      |       |

#### 2.6 Protection system

### Neutral conductor protection and 3VA2 molded case circuit breakers

The following versions of 3VA2 molded case circuit breaker have neutral conductor protection:

- All 3-pole versions with external current transformer for N conductor
- All 4-pole versions

The tripping systems of the 5-series and 8-series ETUs enable overdimensioning of the neutral conductor protection up to 160% of I<sub>n</sub>. This might be necessary to provide protection against third-order harmonics and multiples thereof.

| 3VA2  | Options  | Neutral conductor protection  | ETU<br>3-series | ETU<br>5-series | ETU<br>8-series |
|---|--|---|-----------------|-----------------|-----------------|
| 3-pole molded case circuit breaker  | 3-pole,<br>3 phases monitored  | None  |                 |                 |                 |
| 2 note molded sees  | 3-pole,<br>3 phases monitored  | None  |                 | •               | •               |
| 3-pole molded case<br>circuit breaker with<br>external transformer<br>for neutral conductor | 3-pole, 3 phases monitored + N (20% $^{1)}$ 100% $I_n$ )                   | Protection for user-<br>defined cross section of<br>neutral conductor |                 |                 | •               |
| ioi riedirai conductoi  | 3-pole,<br>3 phases monitored + N (100% 160% I <sub>n</sub> )              | Oversized neutral conductor   |                 |                 |                 |
|   | 4-pole,<br>3 phases monitored  | None  |                 |                 |                 |
|   | 4-pole,<br>3 phases monitored + N (50% I <sub>r</sub> <sup>2)</sup> )      | Protection for half<br>cross section of neutral<br>conductor          |                 |                 |                 |
| 4-pole molded case circuit breaker  | 4-pole,<br>3 phases monitored + N (100% I <sub>r</sub> )                   | Protection for full cross<br>section of neutral<br>conductor          | •               |                 |                 |
|   | 4-pole,<br>3 phases monitored + N (20% <sup>1)</sup> 100% I <sub>n</sub> ) | Protection for user-<br>defined cross section of<br>neutral conductor |                 |                 |                 |
|   | 4-pole,<br>3 phases monitored + N (100% 160% I <sub>n</sub> )              | Oversized neutral conductor   |                 | <b>3</b> 3)     | <b>3</b> 3)     |

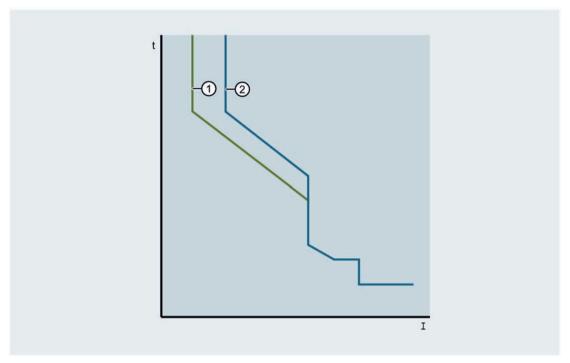
- N Neutral conductor protection
- 1) At rated operational currents  $I_n \le 63$  A:  $I_N = 40 \% \dots 100 \% I_n$
- Applies to  $I_n > 63 A$
- 3) Dependent on circuit breaker size and rated operational current

### Parameters of the neutral conductor protection function

- Tripping current I<sub>N</sub>:
   Adjustable as a proportion of the current setting (I<sub>r</sub>) for overload protection
- Tripping delay: Corresponds to the delay setting (t<sub>r</sub>) for overload protection
- Tripping current of the short-time delayed short-circuit protection: Corresponds to the short-time delayed short-circuit protection (I<sub>sd</sub>)
- Tripping delay: Corresponds to the delay setting for short-time delayed short-circuit protection (t<sub>sd</sub>)
- Instantaneous short-circuit protection:
   Corresponds to the tripping current (l<sub>i</sub>) for instantaneous short-circuit protection

You will find information about setting options in chapter Line protection applications of 3VA molded case circuit breakers (Page 110).

### Example of a neutral conductor protection characteristic



- ① Response threshold of the neutral conductor protection
- 2 Response threshold of the long-time delayed protection

# Adjustment of neutral conductor protection settings

The tripping current I<sub>N</sub> can be adjusted:

- for ETU 3-series via rotary selector switches
- for ETUs 5-series and 8-series
  - via the buttons on the ETU display
  - via a PC using powerconfig

### 2.6 Protection system

# 2.6.9 Zone selective interlocking (ZSI)

Microprocessor-controlled, zone selective interlocking (ZSI) has been developed in order to control the total breaking time in low-voltage networks with multiple molded case circuit breakers connected in series.

Regardless of the number of series-connected molded case circuit breakers, all short circuits in the network can be cleared within a maximum time period of 50 ms.

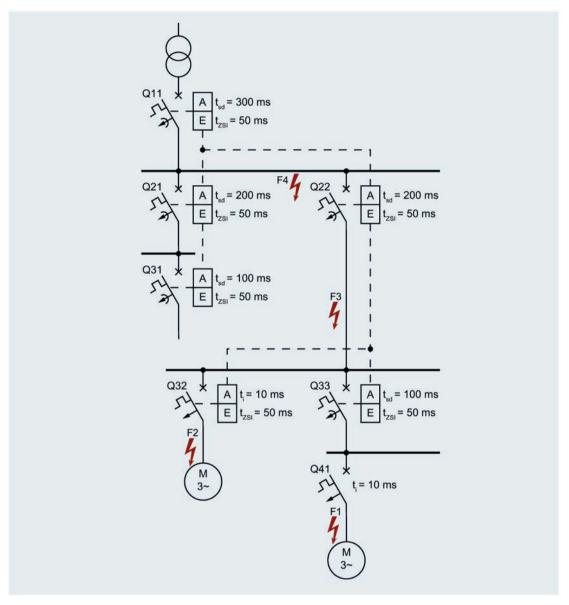
#### Note

### **Backward compatibility**

The ZSI function of the 3VA molded case circuit breakers is compatible with the ZSI function of the Siemens 3WL air circuit breakers.

# Operating principle

The diagram below illustrates the operating principle of zone selective interlocking:



--- Communication cable

A Output, transmits the blocking signal

E Input, receives the blocking signal

t<sub>i</sub> "Virtual" tripping time of I protection

t<sub>SD</sub> Delay time setting of S protection

t<sub>ZSI</sub> Delay time of all molded case circuit breakers which detect the short circuit but do not receive a blocking signal when ZSI is activated

The ZSI function acts on the S and G ranges of the tripping characteristic. Currents within the I range (instantaneous short circuit) continue to cause instantaneous tripping.

#### 2.6 Protection system

#### Fault 1

If the short-circuit current is sufficiently large, the trip units of molded case circuit breakers Q41, Q33, Q22 and Q11 are activated. Since Q41 clears the fault within t<sub>i</sub> = 10 ms, none of the other molded case circuit breakers trips even though Q41 has no ZSI and cannot therefore transmit a blocking signal to Q33.

#### Fault 2

If the short-circuit current is sufficiently large, the trip units of molded case circuit breakers Q32, Q22 and Q11 are activated. As a result of the ZSI function, Q32 temporarily blocks Q22 which in turn temporarily blocks Q11. Depending on the magnitude of the short-circuit current, the fault is cleared either within  $t_i$  = 10 ms or  $t_{zsi}$  = 50 ms.

#### Fault 3

Q22 signals short-circuit protection to Q11 with the result that only Q22 trips when delay time  $t_{zsi}$  = 50 ms expires. Without the ZSI function, the fault would not be cleared until  $t_{sd}$  = 200 ms had expired.

#### Fault 4

The short circuit is detected only by Q11. Since Q11 does not receive a blocking signal from the downstream molded case circuit breakers, it trips after  $t_{zsi}$  = 50 ms. Without the ZSI function, Q11 would not trip until  $t_{sd}$  = 300 ms had expired.

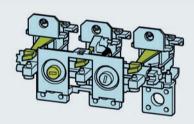
It is especially important to minimize breaking times when short circuits involving very high short-circuit currents occur.

# 2.7 Thermal-magnetic trip unit

A thermal-magnetic trip unit consists of a thermal trip unit for protecting against overload, and a magnetic trip unit for protecting against short circuits. Both trip units are seriesconnected.

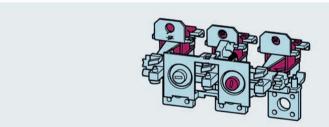
# 2.7.1 Thermal trip unit (L)

The thermal trip unit consists of a temperature-dependent bimetal that heats up as a result of the flow of current. This means the trip unit is current-dependent. The temperature rise in the bimetal strip depends not only on the current magnitude, but also on the ambient temperature of the molded case circuit breaker. All current values specified for thermal-magnetic trip units of 3VA circuit breakers refer to an ambient temperature of +50 °C.



# 2.7.2 Magnetic trip unit with short-circuit protection (I)

The magnetic trip unit with short-circuit protection comprises a yoke mounting through which a current path runs, and a flap armature that is kept at a distance from the yoke mounting by a tension spring.



If a short-circuit current flows along the current path, the magnetic field thus generated causes the flap armature to be moved towards the yoke mounting against the opposite force of the tension spring. The tripping time is almost current-independent and instantaneous. The flap armature releases the breaker mechanism and thus opens the switching contacts. Immediately after tripping, the flap armature is moved back to its starting position by the restoring force of the tension spring.

# 2.7.3 Application cases and trip unit types

The table below illustrates the applications for which different types of thermal-magnetic trip units can be used:

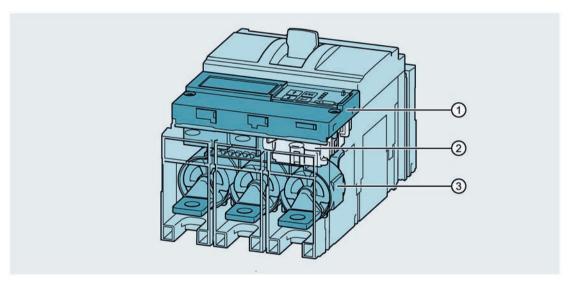
| Protection                      | TM210<br>FTFM | TM220<br>ATFM | TM240<br>ATAM |
|---------------------------------|---------------|---------------|---------------|
| Line protection                 |               |               |               |
| Version available with          |               |               |               |
| 1-pole and 2-pole breakers      |               |               |               |
| 3-pole breaker                  |               |               |               |
| 4-pole breaker                  |               |               |               |
| Available protection parameters |               |               |               |
| I <sub>r</sub> adjustable       |               |               |               |
| I <sub>i</sub> adjustable       |               |               |               |
| I <sub>r</sub> fixed            |               |               |               |
| I, fixed                        |               |               |               |
| I <sub>N</sub> <sup>1)</sup>    |               | •             |               |

 $<sup>^{1)}~</sup>$  For 4-pole molded case circuit breakers only, available without protection, 50% (  $\geq$  In 100 A) and 100%

# 2.8 Electronic trip unit

An electronic trip unit is based on the following concepts:

- Complete measurement of the current in the phases L1, L2 and L3, with N and currents to ground optional
- Rogowski coil
  - Very precise measurement of the current
  - Better ground-fault protection because the vectorial sum is more exact
- Evaluation of the current measurement values and constant comparison with the tripping limits
- Tripping by means of a maglatch



- ① Electronic trip unit (ETU)
- 2 Maglatch
- 3 Current sensor

### ETU protection against overtemperature

The ETUs are equipped with a temperature sensor for their own protection. This effectively protects the electronic components of the ETU against irreparable damage.

This protection takes effect in two stages:

- The first stage is an alarm which is indicated by LEDs directly on the ETU. This alarm is
  activated when the temperature reaches 90% of the maximum permissible temperature. It
  is automatically reset when the temperature falls below the activation limit.
  With 5-series and 8-series ETUs, this alarm can also be transmitted to a higher-level
  control system via the communication system.
- The second stage immediately opens the 3VA2 molded case circuit breaker when the
  maximum permissible temperature is exceeded in the ETU.
   The molded case circuit breaker cannot be switched back on until the temperature falls
  below approx. 95% of the maximum permissible temperature.

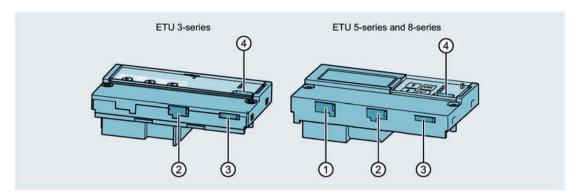
The temperature values of this temperature sensor do not allow any conclusions to be drawn about the temperature changes of other components within the circuit breaker, e.g. the circuits.

#### Note

The customer may perform insulation tests on the main circuits and the neutral conductor with test voltages up to 4 kV DC and surge voltages up to 14.5 kV.

# 2.8.1 Connections

The connections on the ETU are illustrated in the diagram below:



- ① Interface for an external current transformer for N conductor
- 2 Interface for connection of an EFB300 external function box
- 3 Interface for connection of an RCD820 residual current device
- 4 Connection for test devices TD300 and TD500

# 2.8.2 Protection functions

| Protection   | ETU320<br>LI | ETU330<br>LIG | ETU340<br>ELISA | ETU350<br>LSI |
|--|--------------|---------------|-----------------|---------------|
| Line protection  |              |               | LLIOA           |               |
| Generator protection   |              |               |                 |               |
| Version available with   |              |               |                 |               |
| 3-pole without external neutral conductor transformer                                  |              |               |                 |               |
| 3-pole with external neutral conductor transformer                                     |              |               |                 |               |
| 4-pole with protected neutral conductor  |              |               |                 | 1             |
| Available protection parameters  |              |               |                 |               |
| I,   | •            | -             |                 |               |
| t, at 6 x I,   |              |               |                 |               |
| Characteristic in L range: I <sup>2</sup> t <sub>r</sub>                               |              | •             |                 |               |
| Thermal image  |              |               |                 |               |
| Thermal image can be switched on/off   |              |               |                 |               |
| l <sub>sd</sub>  |              |               |                 |               |
| t <sub>sd</sub> at 8 x I <sub>r</sub>  |              |               |                 |               |
| Characteristic in S range: I2t <sub>sd</sub>   |              |               |                 |               |
| Characteristic in S range: selectable I <sup>2</sup> t <sub>sd</sub> / t <sub>sd</sub> |              |               |                 |               |
| l <sub>i</sub>   |              |               |                 |               |
| I <sub>N</sub> 1)  |              |               |                 |               |
| ا  |              |               |                 |               |
| t <sub>a</sub> at 2 x l <sub>a</sub>   |              | •             |                 |               |
| Characteristic in G range: I <sup>2</sup> t <sub>q</sub>                               |              |               |                 |               |
| Characteristic in G range: selectable I2tg / tg  |              |               |                 |               |
| Ground-fault alarm function  |              |               |                 |               |
| ZSI  |              |               |                 |               |
| Features and options   |              |               |                 |               |
| Setting by rotary switch   | ( (          |               |                 |               |
| Setting by ETU display   |              |               |                 |               |
| Data shown on ETU display  |              |               |                 |               |
| Metering function  |              |               |                 |               |
| Communication option   |              |               |                 |               |
| Front interface  | U.= 1        |               |                 |               |

Available in a version with external current transformer for N conductor or 4-pole breaker

| Protection   | ETU550 | ETU560   | ETU850 | ETU860 |
|--|--------|----------|--------|--------|
| ACCINICAL MODELLOS   | LSI    | LSIG     | LSI    | LSIG   |
| Line protection  |        |          | •      |        |
| Generator protection   |        |          |        | -      |
| Version available with   |        |          |        |        |
| 3-pole without external neutral conductor transformer                                  |        |          |        |        |
| 3-pole with external neutral conductor transformer                                     |        |          | •      |        |
| 4-pole with protected neutral conductor  |        |          |        | -      |
| Available protection parameters  |        |          |        |        |
| l <sub>r</sub>   | •      | •        |        | -      |
| t <sub>r</sub> at 6 x I <sub>r</sub>   |        |          | -      | -      |
| Characteristic in L range: I <sup>2</sup> t <sub>r</sub>                               |        | •        |        |        |
| Thermal image  |        |          |        |        |
| Thermal image can be switched on/off   |        |          |        |        |
| l <sub>sd</sub>  |        | •        |        |        |
| t <sub>sd</sub> at 8 x I <sub>r</sub>  |        | •        |        |        |
| Characteristic in S range: I <sup>2</sup> t <sub>sd</sub>                              |        | •        |        |        |
| Characteristic in S range: selectable I <sup>2</sup> t <sub>sd</sub> / t <sub>sd</sub> |        |          |        |        |
| I,   |        |          |        |        |
| I <sub>N</sub> 1)  |        |          |        | -      |
| l <sub>s</sub>   |        |          |        |        |
| t <sub>a</sub> at 2 x l <sub>a</sub>   |        |          |        |        |
| Characteristic in G range: I <sup>2</sup> t <sub>a</sub>                               |        |          |        |        |
| Characteristic in G range: selectable l²t d / t d                                      |        | -        |        |        |
| Ground-fault alarm function  |        |          |        |        |
| ZSI  |        | <b>.</b> |        |        |
| Features and options   |        |          |        |        |
| Setting by rotary switch   |        |          |        |        |
| Setting by ETU display   |        | -        |        |        |
| Data shown on ETU display  |        |          |        |        |
| Metering function  |        |          |        |        |
| Communication option   |        |          |        |        |
| Front interface  |        |          |        |        |

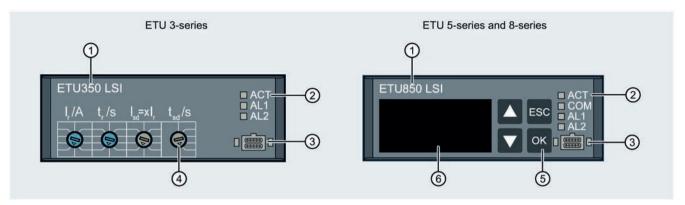
Available in a version with external current transformer for N conductor or 4-pole breaker

# 2.8 Electronic trip unit

| Protection   | ETU310M | ETU350M<br>LSI | ETU550M<br>LSI | ETU860M<br>LSIG |
|--|---------|----------------|----------------|-----------------|
| Starter protection   |         |                |                |                 |
| Motor protection   |         |                |                |                 |
| Version available with                                     |         |                |                |                 |
| 3-pole without external neutral conductor transformer      |         |                |                |                 |
| Available protection parameters                            | -       |                |                |                 |
| I <sub>e</sub>   |         |                |                |                 |
| $t_p$ at 7.2 x $I_r$                                       |         |                |                |                 |
| Trip class T <sub>c</sub>                                  |         |                |                |                 |
| Protection against phase unbalance                         |         |                |                | •               |
| Protection against phase unbalance: can be switched on/off |         |                |                |                 |
| Unbalance ratio adjustable 5 50%                           |         |                |                |                 |
| Thermal memory   |         | •              |                |                 |
| sd   |         |                |                |                 |
| $t_{sd}$ at 8 x I <sub>r</sub> (fixed $t_{sd}$ = 0.03 s)   |         |                |                |                 |
| Characteristic in S range: I <sup>2</sup> t <sub>sd</sub>  |         |                |                |                 |
| l <sub>i</sub>   |         |                |                | -               |
| I, adjustable  |         |                |                |                 |
| i,   |         |                |                |                 |
| t <sub>a</sub> at 2 x l <sub>a</sub>                       |         |                |                |                 |
| Characteristic in G range: I <sup>2</sup> t <sub>a</sub>   |         |                |                |                 |
| Characteristic in G range: selectable $I^2t_q$ / $t_q$     |         |                |                | •               |
| Idle running protection                                    |         |                |                |                 |
| Blocking protection  |         |                |                |                 |
| Ground-fault alarm function                                |         |                |                |                 |
| ZSI  |         |                |                |                 |
| Features and options                                       |         |                |                |                 |
| Setting by rotary switch                                   |         |                |                |                 |
| Setting by ETU display                                     |         |                |                |                 |
| Data shown on ETU display                                  |         |                |                |                 |
| Metering function  |         |                |                |                 |
| Communication option                                       |         |                |                |                 |
| Front interface  |         |                |                |                 |

# 2.8.3 Operator controls

The following figure shows the available ETU types of the 3VA2 molded case circuit breakers. You can decide which ETU to select according to the area of application.



- 1 Name of the ETU
- ② LED display

- 3 Front interface
- 4 Rotary selector switches
- ⑤ Pushbuttons
- 6 LCD

# LED displays

The following table explains what the LED displays mean:

| LED |     | Meaning  | Description  |
|-----|-----|----------|--|
|     | ACT | Off      | Current flow in the main circuit less than 20% $\rm I_{\rm n}$ , see activation limits.                    |
| *   | ACT | Flashing | ETUs 8-series:<br>Missing external 24 V DC supply voltage for metering function.                           |
| 崇   | ACT | On       | ETU ready for operation, current flow greater than 20% $\boldsymbol{I}_{\!_{n}}\!,$ see activation limits. |
|     | СОМ | Off      | No communication to a COM800 via COM060.   |
| *   | СОМ | Flashing | Communication interrupted. The LED flashes if communication has already been established once.             |
| 業   | СОМ | On       | Active communication to the COM800 breaker data server.  |
| 崇   | ACT | On       |  |
| 業   | AL1 | On       | Current flow between 90% and 105% $\rm I_r$ .  |
|     | AL2 | Off      |  |
| 崇   | ACT | On       |  |
| 業   | AL1 | On       | Current flow greater than 105% I <sub>r</sub> .  |
| 業   | AL2 | On       |  |
| 崇   | ACT | On       |  |
| **  | AL1 | Flashing | Overtemperature alarm (at 90% of maximum permissible ETU temperature) AL1 and AL2 flashing alternately.    |
| **  | AL2 | Flashing |  |
|     | ACT | Flashing |  |
|     | СОМ | Flashing | Internal fault in trip unit.   |
| **  | AL1 | Flashing | All LEDs flash simultaneously with same frequency.   |
|     | AL2 | Flashing |  |

### Activation limits for ETUs without an external supply

| Rated current I <sub>n</sub> [A] | Current in one of the three phases | Significance for ETU   |
|----------------------------------|------------------------------------|--|
|                                  | 0 60% I <sub>n</sub>               | The ETU is not active.   |
| 25                               | > 60% I <sub>n</sub>               | ETU protection is active. Display (ACT LED or display) is activated. |
|                                  | 0 40% I <sub>n</sub>               | The ETU is not active.   |
| 40                               | > 40% I <sub>n</sub>               | ETU protection is active. Display (ACT LED or display) is activated. |
|                                  | 0 30% I <sub>n</sub>               | The ETU is not active.   |
| 63                               | > 30% I <sub>n</sub>               | ETU protection is active. Display (ACT LED or display) is activated. |
|                                  | 0 20% I <sub>n</sub>               | The ETU is not active.   |
| > 63                             | > 20% I <sub>n</sub>               | ETU protection is active. Display (ACT LED or display) is activated. |

### ETUs of the 3-series

3-series electronic trip units are equipped with rotary selector switches. A description of the operating principle of the rotary selector switches and operating instructions can be found in chapter Guide to setting the tripping characteristic (Page 73).

### Displays on 5-series and 8-series electronic trip units

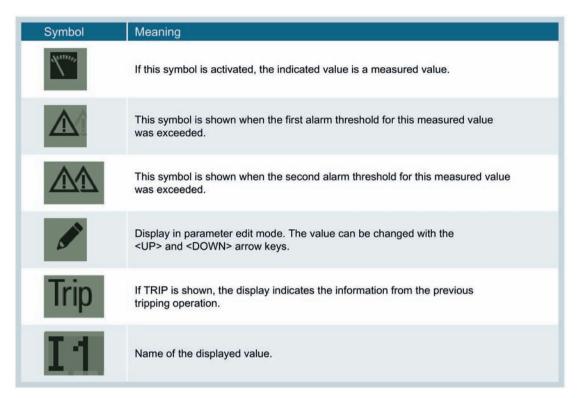
5-series and 8-series electronic trip units are equipped with an LCD. The displayed values are refreshed once per second.



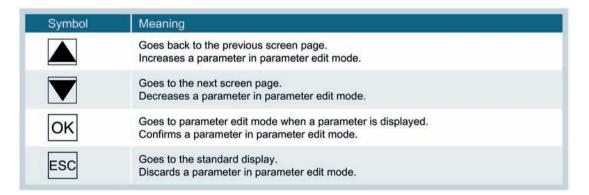
#### Note

The backlighting of the LCD is only active with an external voltage supply (e.g. COM060, EFB300, 24 V module).

The following table explains what the symbols in the display mean:



The following table explains what functions are performed by the buttons next to the display:

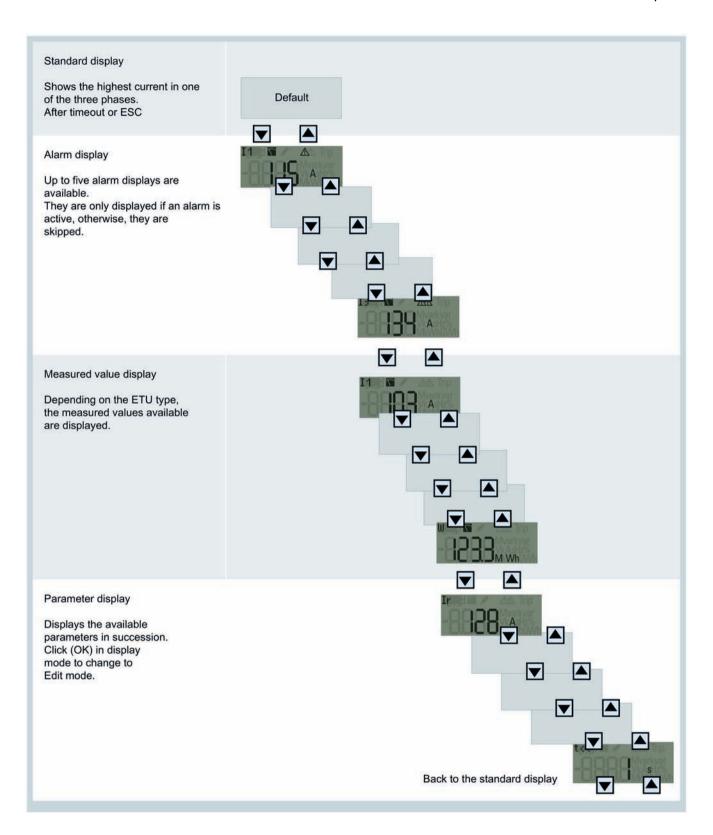


### Displays on 5-series and 8-series electronic trip units

The basic structure comprises the following displays:

- Standard display
- Alarm display
- Measured value display
- Parameter display

If no selection is made within an adjustable time period, the standard display will appear.



# 2.8 Electronic trip unit

# Standard display



# Alarm display

Active alarms are displayed consecutively in screens AV1 ... AV5. If no alarms are active, these screens are concealed.



# Measured value display

The table below explains the measured value display:

| Number | Screen               | Measured value  | Description  | ETU550 | ETU560 | ETU850 | ETU860 |
|--------|----------------------|-----------------|--|--------|--------|--------|--------|
| MV 1   | I1 8 A               | i,              | Instantaneous current I <sub>1</sub>                 | •      | •      | -      | •      |
| MV 2   | 12 <b>N</b>          | I <sub>2</sub>  | Instantaneous current I <sub>2</sub>                 |        | •      | •      | ٠      |
| MV 3   | -88 <b>9</b> 7 A     | l <sub>3</sub>  | Instantaneous current I <sub>3</sub>                 | •      | •      | •      | •      |
| MV 4   | IN N                 | I <sub>N</sub>  | Instantaneous<br>current in neutral<br>conductor     |        |        | •      |        |
| MV 5   | Ig N A               | l <sub>g</sub>  | Instantaneous residual current to ground             |        |        |        | •      |
| MV 6   | U12 <b>S</b>         | U <sub>12</sub> | Instantaneous voltage U <sub>1</sub> -U <sub>2</sub> |        |        | •      | ¥      |
| MV 7   | U23 <b>S</b>         | U <sub>23</sub> | Instantaneous voltage U <sub>2</sub> –U <sub>3</sub> |        |        | -      | •      |
| MV 8   | 031 <b>S</b><br>398v | U <sub>31</sub> | Instantaneous voltage U <sub>3</sub> -U <sub>1</sub> |        |        | •      | •      |
| MV 9   | 5000 Hz              | f               | Instantaneous frequency                              |        |        | -      | •      |
| MV 10  | 605.7 kw             | P               | Instantaneous<br>active power<br>(total)             |        |        |        |        |
| MV 11  | 188 I kvar           | Q               | Instantaneous<br>reactive power<br>(total)           |        |        | •      | •      |
| MV 12  | 0.95                 | PF              | Instantaneous power factor                           |        |        | •      | *      |
| MV 13  | 1233 <sub>M Wh</sub> | w               | Active energy  |        |        | -      | •      |

# Parameter display

The table below explains the parameter display:

| Number | Screen          | Para-<br>meter                 | Description  | ETU550 | ETU560          | ETU850 | ETU860 |
|--------|-----------------|--------------------------------|--|--------|-----------------|--------|--------|
| PV 1   | - 128 A         | I <sub>r</sub>                 | Overload protection current                                      | •      | •               | •      | •      |
| PV 2   | tr s            | t,                             | Overload protection delay time                                   | •      | •               | •      |        |
| PV 4   | -BREBWASSA      | ThM                            | Thermal image  |        | •               | •      | •      |
| PV 5   | 384 A           | I <sub>sd</sub>                | Short-time delayed short-circuit current                         | •      | •               | *      | *      |
| PV 6   | tsd<br>QQO s    | t <sub>sd</sub>                | Short-time delayed short-circuit current delay time              | •      | •               |        |        |
| PV 7   | OFF A           | l <sup>2</sup> t <sub>sd</sub> | Characteristic curve in S range                                  | •      | ¥               | *      |        |
| PV 8a  | OFF             | ZSI S                          | Zone Selective<br>Interlocking                                   | •      | •               | •      | •      |
| PV 8b  | SSIG AND THE    | ZSI G                          | Zone Selective<br>Interlocking in the<br>event of a ground fault |        |                 |        |        |
| PV9    | 1600 A          | l,                             | Instantaneous short-<br>circuit protection<br>current            |        |                 |        | *      |
| PV 10  | OFF A           | I <sub>N</sub>                 | Overload protection in the neutral conductor                     | 1)     | • <sub>1)</sub> | 1)     | 1)     |
| PV 11  | -88 <b>50</b> A | l <sub>g</sub>                 | Ground-fault protection current                                  |        |                 |        | •      |
| PV 12  | tg<br>080 s     | t <sub>g</sub>                 | Ground-fault protection delay time                               |        | •               |        | ٠      |
| PV 13  | OFFE MARKET     | l²t <sub>g</sub>               | Characteristic curve for ground-fault protection                 |        | •               |        | ٠      |
| PV 14  | 19 A            | I <sub>gA</sub>                | Ground fault alarm current                                       |        | ٠               |        | •      |

### Setting and changing parameters

- 1. Use the arrow keys to navigate to the correct display.
- 2. Press the <OK> button.
  - → Edit mode is active. Activation is confirmed by display of "pencil" symbol.



- 3. Use the arrow keys to adjust the parameter setting.
- 4. Confirm the setting with the <OK> button, or cancel the operation with <ESC>.
  - → The setting is accepted with <OK>. The parameter display now appears.

### "Tripped" display

After the ETU has initiated a trip, the "Tripped" display automatically appears:



This screen can be identified by the word "Trip" which is displayed in the top, right-hand corner. The displayed current value shows the current at the moment of tripping.

Press <ESC> to exit the display.

The additional information contained in the "Tripped" display is explained in the table below:

| Number | Display in the title | Meaning  | Unit  |
|--------|----------------------|--|-------|
| TV1    | LT                   | Tripped by overload protection                         | А     |
| TV2    | ST                   | Tripped by short-time delayed short-circuit protection | Α     |
| TV3    | Inst                 | Tripped by instantaneous short-circuit protection      | A, kA |
| TV4    | N                    | Tripped by overload in the neutral conductor           | Α     |
| TV5    | GF                   | Tripped by ground-fault protection                     | Α     |
| TV6    | Temp                 | Tripped by overheating                                 | %     |
| TV12   | RCD trip             | Tripped by residual current device RCD820              | А     |

### 2.8 Electronic trip unit

### Diagnostics display

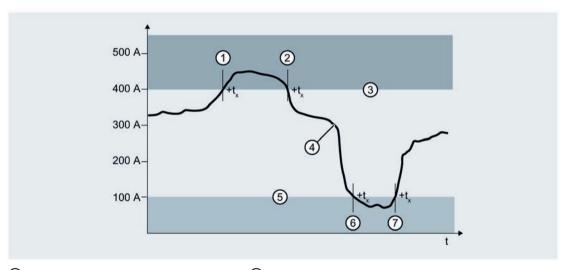
When a TD500 test device is connected, you can use it to initiate a test. The following screen appears when a TD500 is connected. The bar flashes at a frequency of 0.5 Hz.



The bar travels from left to right while testing is in progress. The test ends with a trip.

# 2.8.4 Load acceptance and load shedding - load management

3VA molded case circuit breakers equipped with an ETU 3-series or higher series provide two current thresholds for the purpose of implementing a local load management function. Load shedding is the upper threshold, and load acceptance the lower threshold.



- 1 Incoming alarm "load shedding"
- ② Outgoing alarm "load shedding"
- ③ Parameter load shedding 400 A
- 4 Current in one phase
- 5 Parameter load acceptance 100 A
- 6 Incoming alarm "load acceptance"
- Outgoing alarm "load acceptance"

### Note

#### No trip

Tripping is never initiated as a result of the current value crossing the upper or lower thresholds.

If the current in one phase exceeds the parameter setting for "load shedding" for longer than delay time t<sub>x</sub>, an incoming alarm "load shedding" is generated. Only when the current in all three phases drops below this threshold is an outgoing alarm "load shedding" generated.

The incoming and outgoing alarms can be output via an optional EFB module and transferred via the communication link.

The opposite applies for the load acceptance threshold. If the current in all three phases drops below the parameter setting, an incoming alarm "load acceptance" is generated. If only one of the three currents exceeds the parameter setting, an outgoing alarm "load acceptance" is generated.

To prevent these alarms being generated by brief current peaks and troughs, they can be delayed by the time  $t_x$  from 1 s to 15 s.

powerconfig is used for parameterization.

# 2.8.5 Measuring with a Rogowski coil

The Rogowski coil is a toroidal coil without a ferromagnetic core. It is used as a component in electronic measuring devices to measure alternating current.

Advantages of the current sensor:

- Each transformer can be optimized for its task and operating points
  - Transformers for power generation
  - Transformers for measurement
- Higher accuracy of current measurement and therefore higher accuracy for ground-fault currents

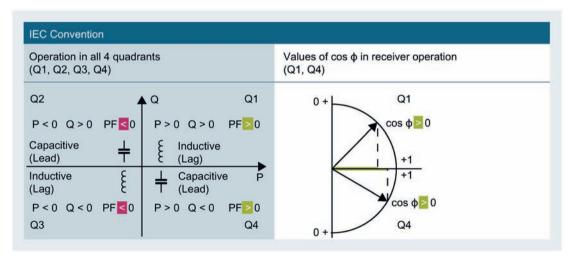
A power measurement is made possible by the more exact and more linear measurement of the current together with the integrated voltage tap in the molded case circuit breaker.

# Accuracy levels of the specified measured values of the 8-series ETU, including the integrated current sensors

| leasured value Additional condition |   | Accuracy in % of the read-off measured value |  |  |  |  |
|-------------------------------------|---|--|--|--|--|--|
| Current                             | 0.08 I <sub>b</sub> 2 I <sub>b</sub>  | ± 1%   |  |  |  |  |
| Voltage (L - N)                     | 80 V < U < 480 V  | ± 1%   |  |  |  |  |
| THD current                         | up to the 19th harmonic $0.08 I_b \dots 2 I_b$                                | ± 5%   |  |  |  |  |
| THD voltage                         | up to the 19th harmonic<br>80 V < U < 480 V                                   | ± 5%   |  |  |  |  |
| Power factor PF                     | 0.08 I <sub>b</sub> 2 I <sub>b</sub>  | ± 0.05 absolute                              |  |  |  |  |
| Active power                        | $I_b$ and $U_n$ as described below the table                                  | Class 2 acc. to IEC 61557-12                 |  |  |  |  |
| Active energy                       | ${\rm I_b}$ and ${\rm U_n}$ as described below the table                      | Class 2 acc. to IEC 61557-12                 |  |  |  |  |
| Reactive power<br>Apparent power    | $0.08 I_b \dots 2 I_b$<br>PF $\geq 0.6$ inductive<br>PF $\geq 0.8$ capacitive | ± 2%   |  |  |  |  |
| Reactive energy<br>Reactive power   | $0.08 I_b \dots 2 I_b$<br>PF $\geq 0.6$ inductive<br>PF $\geq 0.8$ capacitive | ± 2%   |  |  |  |  |
| Frequency                           | 80 V < U < 480 V  | ± 0.1%                                       |  |  |  |  |

 $I_b$  is the maximum current in the relevant size. Example:  $3VA21 \rightarrow I_b$  = 160 A  $U_n$  refers to the nominal voltage of the metering function, between phase and neutral All specified accuracies refer to an ambient temperature of 23 °C ± 2 °C

### Interpretation of measured values



PF Power factor

Measured current and voltage values are always positive.

The "normal" direction of energy flow of the 3VA molded case circuit breaker is top down (can also be adjusted using the powerconfig software), corresponding to operation in quadrants Q1 and Q4. If the molded case circuit breaker is supplied from below, it operates in quadrants Q2 and Q3.

The following table provides an overview of the setting values:

|  |                                 |                                |   | ETUs of the |          | Display           |          | Communication           |
|--|---------------------------------|--------------------------------|---|-------------|----------|-------------------|----------|-------------------------|
| Setting values <sup>1)</sup>                 |                                 |                                |   | 5-series    | 8-series | Display in<br>ETU | DSP800   | COM800<br>via<br>COM060 |
| Overload protection                          | Current                         | 1,                             | Α |             |          | 0/                | @        | <b>9</b>                |
|  | Delay time                      | t,                             | s |             |          | 0 /               | 0        | <b>*</b>                |
|  | Switch thermal image on/off     | ThM                            |   |             |          | 0 /               | <b>③</b> | 0 8                     |
| Short-time delayed short-circuit protection  | Current                         | l <sub>sd</sub>                | Α |             |          | 0 /               | <b>3</b> | <b>*</b>                |
|  | Delay time                      | t <sub>sd</sub>                | s |             |          | 0                 | (3)      | <b>*</b>                |
|  | Characteristic curve in S range | l <sup>2</sup> t <sub>sd</sub> |   |             |          | <b>O</b>          | <b>②</b> | 01                      |
|  | Zone selective interlocking     | ZSI                            |   |             |          | (a)               | •        | <b>*</b>                |
| Instantaneous short-circuit protection       | Current                         | l,                             | Α |             |          | 0/                | <b>3</b> | <b>O</b> /              |
| Overload protection in the neutral conductor | Current                         | I <sub>N</sub>                 | Α |             |          | 0/                | <b>②</b> | <b>*</b>                |
| Ground-fault protection                      | Current                         | ا                              | Α |             |          | 0/                | <b>3</b> | <b>O /</b>              |
|  | Delay time                      | t <sub>g</sub>                 | s |             |          | 0                 | <b>③</b> | <b>6</b>                |
|  | Characteristic curve            | l²t <sub>g</sub>               |   |             |          | 0 /               | •        | 0 8                     |
|  | Alarm current                   | l <sub>gA</sub>                | Α |             |          | 0 1               | •        | <b>O</b>                |

- 1) Depending on ETU version
- Value can be read
- Value can be edited

# 2.8 Electronic trip unit

|                                 |  |   |       | 5-series T<br>8-series 9 |   | Display              |          | Communication           |  |
|---------------------------------|--|---|-------|--------------------------|---|----------------------|----------|-------------------------|--|
| Metering function <sup>1)</sup> |  |   |       |                          |   | Display in<br>ETU    | DSP800   | COM800<br>via<br>COM060 |  |
| Current                         | Phase and neutral conductor currents     | I <sub>1</sub> , I <sub>2</sub> , I <sub>3</sub> , I <sub>N</sub>                                     | Α     | •                        |   | <b>③</b>             | <b>3</b> | •                       |  |
|                                 | Residual current to ground               | l <sub>g</sub>  | Α     |                          |   | <b>③</b>             | 9        | •                       |  |
|                                 | Phase with highest load                  |   | Α     | -                        | - | <b>③</b>             | <b>③</b> | <b>3</b>                |  |
|                                 | Mean value over the three phase currents | $I_{LAVG}(I_1 + I_2 + I_3)/3$   | Α     | •                        |   |                      | <b>③</b> | •                       |  |
|                                 | Asymmetry of the phase currents          | I <sub>nba</sub>  | %     |                          |   |                      | 0        | <b>③</b>                |  |
|                                 | THD of the 3 phases                      | THDI <sub>1</sub> , THDI <sub>2</sub> ,<br>THDI <sub>3</sub>  | %     |                          |   |                      | •        | •                       |  |
| Voltage                         | Phase voltages incl. mean value          | $\mathbf{U_1},\mathbf{U_2},\mathbf{U_3},\mathbf{U_{phavg}}$   | V     |                          |   | <b>③</b>             | 9        | <b>@</b>                |  |
|                                 | Voltages to N conductor incl. mean value | $\mathbf{U}_{\mathrm{1N}},\mathbf{U}_{\mathrm{2N}},\mathbf{U}_{\mathrm{3N}},\mathbf{U}_{\mathrm{NN}}$ | ٧     |                          |   |                      | <b>3</b> | •                       |  |
|                                 | Asymmetry of the voltages                |   | %     |                          |   |                      | 0        | <b>③</b>                |  |
|                                 | THD phase/phase and phase/N              | THDI <sub>1</sub> , THDI <sub>2</sub> ,<br>THDI <sub>3</sub>  | %     |                          |   |                      | <b>③</b> | •                       |  |
| Power                           | Active power, total and per phase        | P <sub>1</sub> , P <sub>2</sub> , P <sub>3</sub> , P <sub>tot</sub>                                   | kW    |                          |   | (P <sub>tot</sub> )  | 0        | <b>③</b>                |  |
|                                 | Apparent power, total and per phase      | S <sub>1</sub> , S <sub>2</sub> , S <sub>3</sub> , S <sub>tot</sub>                                   | kVA   |                          |   |                      | 0        | <b>③</b>                |  |
|                                 | Reactive power, total and per phase      | Q <sub>1</sub> , Q <sub>2</sub> , Q <sub>3</sub> , Q <sub>tot</sub>                                   | kVAr  |                          |   | (Q <sub>tot</sub> )  | 0        | <b>③</b>                |  |
|                                 | Fundamental power factor                 | PF <sub>1</sub> , PF <sub>2</sub> , PF <sub>3</sub> ,<br>PF <sub>avg</sub>                            |       |                          |   | (PF <sub>avg</sub> ) | <b>3</b> | •                       |  |
| Energy                          | Active energy, infeed and feedback       | E <sub>p</sub>  | kWh   |                          |   | <b>③</b>             | 0        | <b>③</b>                |  |
|                                 | Reactive energy, infeed and feedback     | Eq  | kVArh |                          | • |                      | •        | •                       |  |
|                                 | Apparent energy                          | E <sub>s</sub>  | kVAh  |                          | • |                      | <b>③</b> | <b>③</b>                |  |
| Frequency                       | Present frequency                        | f   | Hz    |                          |   | <b>3</b>             | <b>③</b> | •                       |  |
| Maximum pointer function        | Min/max current, voltage, power          | with time stamp   |       |                          |   |                      |          | <b>③</b>                |  |

<sup>1)</sup> Depending on ETU version

Value can be displayed/read

|   |   | ETL<br>th | ls of<br>ne | Dis               | olay       | Communication               |
|---|---|-----------|-------------|-------------------|------------|-----------------------------|
| Status, diagnostics and mainte                | nance <sup>1)</sup>   | 5-series  | 8-series    | Display in<br>ETU | DSP800     | COM100/800<br>via<br>COM060 |
| Breaker status                                | On, Off, TRIP   |           |             |                   | <b>(3)</b> | <b>(3)</b>                  |
| Currently pending alarm messages              |   | -         |             | •                 | <b>③</b>   | •                           |
| Reason for last trip                          |   | •         | •           | <b>3</b>          | <b>③</b>   | <b>②</b>                    |
| Event Log                                     | of the last 100 events  |           |             |                   |            | <b>3</b>                    |
|   | of the last 10 trips  |           |             |                   |            | <b>@</b>                    |
|   | of the last 100 switching operations  |           |             |                   |            | •                           |
| Maintenance information                       | Trip counter after LSIG trips   |           |             |                   | 9          | <b>3</b>                    |
|   | Operating hours counter   |           |             |                   | •          | <b>3</b>                    |
|   | Switching cycle counter   |           |             |                   | <b>③</b>   | <b>3</b>                    |
| Position in the draw-out unit                 |   |           | •           |                   |            | <b>@</b>                    |
| Identification                                |   |           |             |                   |            |                             |
| Identification data of the                    | Order No.   |           | •           |                   | •          | <b>3</b>                    |
| breaker                                       | Rated operational current, number of poles, I <sub>cu</sub>                     |           | •           |                   | <b>③</b>   | <b>3</b>                    |
| HW/FW version                                 |   |           |             |                   |            | <b>③</b>                    |
| Power management functions                    |   |           |             |                   |            |                             |
| Power demand values of the last demand period | Active, reactive and apparent power in fixed block or rolling block 5 to 60 min |           | •           |                   | •          | •                           |
| Energy pulse output                           | S0 signal at EFB output   |           |             |                   |            |                             |
| Load monitoring                               | Load shedding/load pick-up,<br>output via EFB                                   |           |             |                   | •          | •                           |
| Threshold value parameters                    | 10 freely adjustable monitoring parameters                                      |           | •           |                   | <b>③</b>   | <b>3</b>                    |

<sup>1)</sup> Depending on ETU version

Value can be displayed/read

2.8 Electronic trip unit

Applications

# 3.1 3VA IEC trip units

|           |                           |                      |            |                      |            |                 | δ.                             |                          |                   |           |                 |                        |               | Settir                  | g options                                      |                            |                                    |
|-----------|---------------------------|----------------------|------------|----------------------|------------|-----------------|--------------------------------|--------------------------|-------------------|-----------|-----------------|------------------------|---------------|-------------------------|--|----------------------------|------------------------------------|
|           |                           |                      |            |                      |            |                 | še                             | 200                      |                   |           |                 | L                      |               | S                       | 1  | G                          | N                                  |
| е         | Article No. supplement 1) |                      | protection | Generator protection | protection | protection      | Non-automatic circuit breakers | Communication capability | function          |           | of poles        | Overload<br>protection | Short-circuit | (short-time<br>delayed) | Short-circuit<br>protection<br>(instantaneous) | Ground-fault<br>protection | Neutral<br>conductor<br>protection |
| 3VA range | Article No                | Trip unit            | Line prote | Generato             | Motor pro  | Starter pr      | Non-auto                       | Commun                   | Metering function | Function  | Number of poles |                        | x = ps        | t <sub>sd</sub> [s]     |  | = x   u                    | c<br> -<br> -<br> -                |
|           | AA                        | SD100                | =          | 2                    | 2          | -               |                                | =                        | =                 | LBS       | 3, 4            | -                      | 20            | :=                      | 27   | -                          | ≅: ]                               |
|           | ED                        | TM210                |            |                      | -          | -               | -                              | -                        | -                 | LI (FTFM) | 1 4             | 1                      | -             | 3 <del>14</del>         | 10   | -                          | <del>-</del> 0                     |
|           | EE                        | TM220                |            | -                    | 77         | -               | 77                             | -                        | -                 | LI (ATFM) | 3               | 0.7 1                  |               | 1 <del></del>           | 10   | -                          | 52                                 |
|           | EC                        | TM240                |            | 2                    | 77.        | -               | 92                             | 1944                     | 22                | LI (ATAM) | 3               | 0.7 1                  | <u>187</u> 7  | 1522                    | 5 10   | 2                          |                                    |
| -         | FD                        | TM210                |            | -                    | -          | -               | -                              | -                        | -                 | LI (FTFM) | 4               | 1                      | <b>⇒</b> )    | ( <del>+</del>          | <del>-</del>                                   | -                          | - 1                                |
| 3VA1      | FE                        | TM220                |            | =                    | =          | -               | =                              | -                        | 12                | LI (ATFM) | 4               | 0.7 1                  | FE)           | 45                      | 10   | 170                        | 0.5                                |
| co        | FF                        | TM240                |            | -                    | 2          | 120             | _                              | _                        | 4                 | LI (ATAM) | 4               | 0.7 1                  | 4             | 82                      | 5 10   | _                          | 0.5                                |
|           | GD                        | TM210                |            | -                    | -          | ) <del></del> ) | -                              | -                        | -                 | LI (FTFM) | 4               | 1                      | -             | 8=                      | 10   | -                          | 1                                  |
|           | GE                        | TM220                |            | -                    | 77.        | -               | =                              | -                        | =                 | LI (ATFM) | 4               | 0.7 1                  |               | : <del></del>           | 10   | -                          | 1                                  |
|           | GF                        | TM240                |            | _                    | 2          | 121             | _                              | -                        | 4                 | LI (ATAM) | 4               | 0.7 1                  | <b>=</b> a    | 8=                      | 5 10   | 125                        | 1                                  |
|           | MH                        | TM120M <sup>2)</sup> | -          | -                    | =          |                 | -                              | -                        | -                 | 1         | 3               | -                      | -             | : <del>-</del>          | 5 12   | -                          | -                                  |
|           | 237                       | ETHORO               | 25,0       |                      |            |                 |                                |                          |                   | LI        | 3               | 0.4 1                  | =             | -                       | 1.5 12   | -                          | 8.                                 |
|           | HL                        | ETU320               |            | -                    | -          | -               | -                              | -                        | -                 | LIN       | 4               | 0.4 1                  | 40            | ( <del>)</del>          | 1.5 12   | 12                         | 0.5; 1; OFF                        |
|           |                           | ETHORO               |            |                      |            |                 |                                |                          |                   | LIG       | 3               | 0.4 1                  | <del> </del>  | × <del>-</del>          | 1.5 12   | 0.2 1                      | -                                  |
|           | НМ                        | ETU330               |            | -                    | -          | -               | -                              | -                        | -                 | LIGN      | 4               | 0.4 1                  |               | -                       | 1.5 12   | 0.2 1                      | 0.5; 1; OFF                        |
|           | 1112                      | ET11040              |            |                      | Control    | 755.55          |                                |                          |                   | ELISA     | 3               | 0.4 1                  |               | -                       | 15   | -                          | -                                  |
|           | HK                        | ETU340               |            | -                    | _          | _               | _                              | _                        | _                 | ELISA     | 4               | 0.4 1                  | -:            | -                       | 15   | -                          | 0.5; 1; OFF                        |
|           | LINE                      | ETHOEO               |            |                      |            |                 |                                |                          |                   | LSI       | 3               | 0.4 1                  | 1.5 10        | 0 0.4                   | 12   |                            | <u> </u>                           |
|           | HN                        | ETU350               |            |                      | 77         | -               | Ξ.                             | -                        | 100               | LSIN      | 4               | 0.4 1                  | 1.5 10        | 0 0.4                   | 12   | -                          | 0.5; 1; OFF                        |
|           | ID.                       | ETU550               | 10         | 900                  |            |                 |                                | 9:00                     |                   | LSI       | 3 + N           | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | -                          | 0.2 1.6; OFF                       |
| 3VA2      | JP                        | E10550               | •          | -                    | -          | -               | -                              | •                        | -                 | LSIN      | 4               | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | =                          | 0.2 1.6; OFF                       |
| 38        | 10                        | ETHECO               | _          |                      |            |                 |                                |                          |                   | LSIG      | 3 + N           | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | 0.2 1                      | 0.2 1.6; OFF                       |
|           | JQ                        | ETU560               |            | -                    | -          | -               | _                              |                          | -                 | LSING     | 4               | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | 0.2 1                      | 0.2 1.6; OFF                       |
|           | VD.                       | ETUGEO               | _          | _                    |            |                 |                                | _                        |                   | LSI       | 3 + N           | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | ( <u>12</u> )              | 0.2 1.6; OFF                       |
|           | KP                        | ETU850               |            |                      | 77         | -               | 7.5                            |                          |                   | LSIN      | 4               | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | -                          | 0.2 1.6; OFF                       |
|           | KQ                        | ETU860               |            |                      |            |                 |                                |                          |                   | LSIG      | 3 + N           | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | 0.2 1                      | 0.2 1.6; OFF                       |
|           | NQ.                       | E10000               |            | House,               | -          | 200             | 7.77                           | 0.0                      | -                 | LSING     | 4               | 0.4 1                  | 0.6 10        | 0.05 0.5                | 1.5 12   | 0.2 1                      | 0.2 1.6; OFF                       |
|           | MS                        | ETU310M              | =:         | -                    | -          |                 | 55                             | -                        | 17                | 1         | 3               | , j <del>.</del>       | -             | Q. <del>-</del>         | 3 15   | : <del></del> -            | =:                                 |
|           | MN                        | ETU350M              | 27         | _                    |            | 20              | _                              | P <u>144</u>             | _                 | LSI       | 3               | 0.4 1                  | 3 15          | 0.03                    | 15   | -                          |                                    |
|           | MP                        | ETU550M              | +0         | -                    |            | -               | -                              |                          | -                 | LSI       | 3               | 0.4 1                  | 3 15          | 0.03                    | 3 15   | -                          | -0                                 |
|           | MQ                        | ETU860M              | 表          | -                    |            | -               | -                              |                          |                   | LSIG      | 3               | 0.4 1                  | 3 15          | 0.03                    | 3 15   | 0.2 1                      | ₩.                                 |

1) In positions 9 and 10 of the Article No.

After a short circuit, tripping occurs at 140% of the set instantaneous short-circuit current with a 1-pole load.

FTFM T (thermal trip unit) and M (magnetic trip unit) fixed

ATFM T (thermal trip unit) adjustable, M (magnetic trip unit) fixed

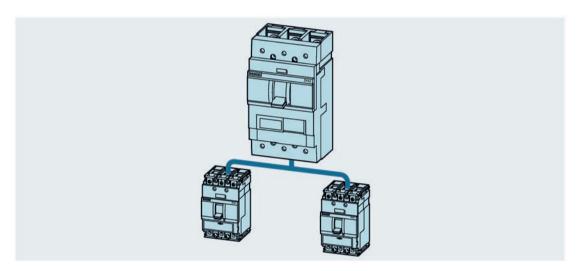
ATAM T (thermal trip unit) and M (magnetic trip unit) adjustable

The main applications of the circuit breakers as line protection components are:

- In main switchboards to provide protection for cables to subdistribution boards
- In subdistribution boards to provide protection for cables to small distribution boards
- Protection for mixed loads (e.g. machinery, lighting, heating)

The trip units for line protection are designed to provide overload and short-circuit protection for:

- Cables
- Conductors
- Non-motor loads



### Suitable 3VA molded case circuit breakers and trip units

3VA molded case circuit breakers equipped with the following trip units are suitable for use in line protection:

- 3VA1 breakers with thermal-magnetic trip units
  - TMs 2-series (Page 111)
- 3VA2 breakers with electronic trip units
  - ETUs 3-series (Page 115)
  - ETUs 5-series (Page 131)
  - ETUs 8-series (Page 131)

## 3.2.1 Variants

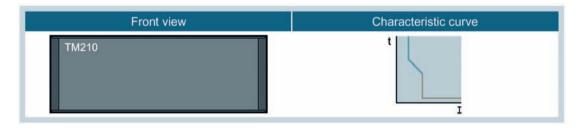
## 3.2.1.1 Thermal-magnetic trip units

## **Derating**

Thermal-magnetic trip units employ a temperature-dependent bimetal to provide overload protection. The setting values are calibrated at an ambient temperature of +50 °C. Compensation factors must be applied for ambient temperatures other than +50 °C.

You will find more information and derating factors in chapter Derating and temperature compensation (Page 628).

## Thermal-magnetic trip unit TM210 LI



## Line protection FTFM - function LI

The thermal-magnetic trip unit TM210 has:

- fixed parameter setting I<sub>r</sub> for overload protection (L)
- fixed parameter setting I<sub>i</sub> for instantaneous short-circuit protection (I)
- With 4-pole versions only: Neutral conductor (N) protection permanently set to 0%, 50% or 100% I<sub>r</sub> depending on version

### Parameter TM210:

| s    | ize   | I <sub>n</sub> [A] | l, [A] | I <sub>,</sub> [A] | I <sub>N</sub> [%] 1) |
|------|-------|--------------------|--------|--------------------|-----------------------|
|      |       | 16                 | 16     |                    | 100                   |
|      |       | 20                 | 20     | 200                |                       |
|      |       | 25                 | 25     | 320                |                       |
|      |       | 32                 | 32     |                    |                       |
|      | 100 A | 40                 | 40     | 400                | 0                     |
|      |       | 50                 | 50     | 500                |                       |
|      |       | 63                 | 63     | 630                |                       |
|      |       | 80                 | 80     | 800                |                       |
|      |       | 100                | 100    | 1000               |                       |
| 3VA1 |       | 16                 | 16     |                    |                       |
| 38   |       | 20                 | 20     | 320                |                       |
|      |       | 25                 | 25     | 320                |                       |
|      |       | 32                 | 32     |                    | 0 / 100               |
|      |       | 40                 | 40     | 400                | 07100                 |
|      | 160 A | 50                 | 50     | 500                |                       |
|      |       | 63                 | 63     | 630                |                       |
|      |       | 80                 | 80     | 800                |                       |
|      |       | 100                | 100    | 1000               |                       |
|      |       | 125                | 125    | 1250               | 0 / 50 / 100          |
|      |       | 160                | 160    | 1600               |                       |

1) With 4-pole versions only:

## Thermal-magnetic trip unit TM220 LI



## Line protection ATFM - function LI

The thermal-magnetic trip unit TM220 has:

- adjustable parameter setting I<sub>r</sub> for overload protection (L)
- fixed parameter setting I<sub>i</sub> for instantaneous short-circuit protection (I)
- With 4-pole versions only: Neutral conductor (N) protection permanently set to 0%, 50% or 100% I<sub>r</sub> depending on version

### Parameter TM220:

| Si   | ize   | I <sub>n</sub> [A] | I, [A]                | I, [A] | I <sub>N</sub> [%] 1) |
|------|-------|--------------------|-----------------------|--------|-----------------------|
|      | 1     | 16                 | 11 / 13 / 14 / 16     |        | AW                    |
|      |       | 20                 | 14 / 16 / 18 / 20     | 220    |                       |
|      |       | 25                 | 18 / 20 / 23 / 25     | 320    |                       |
|      |       | 32                 | 22 / 26 / 29 / 32     |        | 0./400                |
| _    |       | 40                 | 28 / 32 / 36 / 40     | 400    | 0 / 100               |
| 3VA1 | 160 A | 50                 | 35 / 40 / 45 / 50     | 500    |                       |
| m ·  |       | 63                 | 44 / 50 / 57 / 63     | 630    |                       |
|      |       | 80                 | 56 / 64 / 72 / 80     | 800    |                       |
|      |       | 100                | 70 / 80 / 90 / 100    | 1000   |                       |
|      |       | 125                | 88 / 100 / 113 / 125  | 1250   | 0 / 50 / 100          |
|      |       | 160                | 112 / 128 / 144 / 160 | 1600   |                       |

<sup>1)</sup> With 4-pole versions only:

## Thermal-magnetic trip unit TM240 LI



## Line protection ATAM - function LI

The thermal-magnetic trip unit TM240 has:

- adjustable parameter setting I<sub>r</sub> for overload protection (L)
- adjustable parameter setting l<sub>i</sub> for instantaneous short-circuit protection (I)
- With 4-pole versions only: Neutral conductor (N) protection permanently set to 0%, 50% or 100% I<sub>r</sub> depending on version

### Parameter TM240:

| Si   | ze    | I <sub>n</sub> [A] | I, [A]                | I, [A]                                  | I <sub>N</sub> [%] 1) |
|------|-------|--------------------|-----------------------|---|-----------------------|
|      |       | 16 A               | 11 / 13 / 14 / 16     |   |                       |
|      |       | 20 A               | 14 / 16 / 18 / 20     | 400 / 400 / 004 / 050 / 000 / 000       |                       |
|      |       | 25 A               | 18 / 20 / 23 / 25     | 160 / 192 / 224 / 256 / 288 / 320       |                       |
|      |       | 32 A               | 22 / 26 / 29 / 32     |   | 0./400                |
|      | 4     | 40 A               | 28 / 32 / 36 / 40     | 200 / 240 / 280 / 320 / 360 / 400       | 0 / 100               |
|      | 160 A | 50 A               | 35 / 40 / 45 / 50     | 250 / 300 / 350 / 400 / 450 / 500       |                       |
|      | ~     | 63 A               | 44 / 50 / 57 / 63     | 315 / 378 / 441 / 504 / 567 / 630       |                       |
|      |       | 80 A               | 56 / 64 / 72 / 80     | 400 / 480 / 560 / 640 / 720 / 800       |                       |
| A1   |       | 100 A              | 70 / 80 / 90 / 100    | 500 / 600 / 700 / 800 / 900 / 1000      |                       |
| 3VA1 |       | 125 A              | 88 / 100 / 113 / 125  | 625 / 750 / 875 / 1000 / 1125 / 1250    | 0 / 50 / 100          |
|      |       | 160 A              | 112 / 128 / 144 / 160 | 800 / 960 / 1120 / 1280 / 1440 / 1600   |                       |
|      | 4     | 160 A              | 112 / 128 / 144 / 160 | 800 / 960 / 1120 / 1280 / 1340 / 1600   |                       |
|      | 250 / | 200 A              | 140 / 160 / 180 / 200 | 1000 / 1200 / 1400 / 1600 / 1800 / 2000 | 0 / 50 / 100          |
|      | 2     | 250 A              | 175 / 200 / 225 / 250 | 1250 / 1500 / 1750 / 2000 / 2250 / 2500 |                       |
|      | A     | 320 A              | 220 / 260 / 290 / 320 | 1600 / 1920 / 2240 / 2560 / 2880 / 3200 | 0.150.1400            |
|      | 400 A | 400 A              | 280 / 320 / 360 / 400 | 2000 / 2400 / 2800 / 3200 / 3600 / 4000 | 0 / 50 / 100          |
|      | A     | 500 A              | 350 / 400 / 450 / 500 | 2500 / 3000 / 3500 / 4000 / 4500 / 5000 | 0./50./400            |
|      | 630 A | 630 A              | 440 / 500 / 570 / 630 | 2520 / 3150 / 3780 / 4410 / 5000 / -    | 0 / 50 / 100          |

1) With 4-pole versions only:

# 3.2.1.2 Electronic trip units

# ETUs for line protection applications

The following electronic trip units are suitable for use in line protection applications:

- ETU320 LI
- ETU330 LIG
- ETU340 ELISA; LI
- ETU350 LSI
- ETU550 LSI
- ETU560 LSIG
- ETU850 LSI
- ETU860 LSIG

## Electronic trip unit ETU320 LI

## ETU320 LI 3-pole:



## ETU320 LI 4-pole:

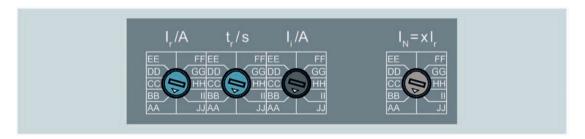


## Line protection - function LI

The ETU320 electronic trip unit has:

- Adjustable parameter settings I<sub>r</sub> and t<sub>r</sub> for overload protection (L)
- Adjustable parameter setting Ii for instantaneous short-circuit protection (I)
- With 4-pole versions only: Neutral conductor protection (N) which can be deactivated
- Permanently active thermal memory, cannot be deactivated

## ETU320 parameters:



# Overload protection L:

|         |        | I <sub>n</sub> |     |     |     |     | Setting | gs I <sub>r</sub> [A] |     |     |     |     |
|---------|--------|----------------|-----|-----|-----|-----|---------|-----------------------|-----|-----|-----|-----|
| 5       | Size   | [Ä]            | AA  | ВВ  | СС  | DD  | EE      | FF                    | GG  | нн  | II  | JJ  |
|         |        | 25             | 10  | 12  | 14  | 16  | 18      | 20                    | 22  | 23  | 24  | 25  |
|         | 400.4  | 40             | 16  | 20  | 24  | 28  | 30      | 32                    | 34  | 36  | 38  | 40  |
|         | 100 A  | 63             | 25  | 30  | 35  | 40  | 45      | 50                    | 54  | 57  | 60  | 63  |
| _1      |        | 100            | 40  | 50  | 63  | 70  | 75      | 80                    | 85  | 90  | 95  | 100 |
| M/H/C/L |        | 25             | 10  | 12  | 14  | 16  | 18      | 20                    | 22  | 23  | 24  | 25  |
| >       |        | 40             | 16  | 20  | 24  | 28  | 30      | 32                    | 34  | 36  | 38  | 40  |
| =       | 160 A  | 63             | 25  | 30  | 35  | 40  | 45      | 50                    | 54  | 57  | 60  | 63  |
| 2       |        | 100            | 40  | 50  | 63  | 70  | 75      | 80                    | 85  | 90  | 95  | 100 |
|         |        | 160            | 63  | 80  | 95  | 110 | 125     | 140                   | 145 | 150 | 155 | 160 |
|         | 050.4  | 160            | 63  | 80  | 95  | 110 | 125     | 140                   | 145 | 150 | 155 | 160 |
|         | 250 A  | 250            | 100 | 125 | 150 | 175 | 200     | 210                   | 220 | 230 | 240 | 250 |
|         | 400.4  | 250            | 100 | 125 | 150 | 175 | 200     | 210                   | 220 | 230 | 240 | 250 |
|         | 400 A  | 400            | 160 | 200 | 240 | 280 | 300     | 320                   | 340 | 360 | 380 | 400 |
| O       | 000 4  | 400            | 160 | 200 | 240 | 280 | 300     | 320                   | 340 | 360 | 380 | 400 |
| M/H/C   | 630 A  | 630            | 250 | 315 | 400 | 450 | 500     | 525                   | 550 | 575 | 600 | 630 |
| >       |        | 630            | 250 | 315 | 400 | 450 | 500     | 525                   | 550 | 575 | 600 | 630 |
|         | 1000 A | 800            | 320 | 400 | 500 | 550 | 600     | 630                   | 680 | 720 | 760 | 800 |
|         |        | 1000           | 400 | 500 | 630 | 700 | 750     | 800                   | 850 | 900 | 950 | 100 |

|         | 250 A<br>400 A | į,   |     |      |    |    | Setting | gs t <sub>r</sub> [s] |    |    |    |    |
|---------|----------------|------|-----|------|----|----|---------|-----------------------|----|----|----|----|
| 5       | oize           | [Å]  | AA  | ВВ   | CC | DD | EE      | FF                    | GG | НН | П  | IJ |
| П       |                | 25   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 100.4          | 40   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 100 A          | 63   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| _1      |                | 100  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| M/H/C/L |                | 25   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| 7       |                | 40   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| =       | 160 A          | 63   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| 2       |                | 100  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| !       |                | 160  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 050.4          | 160  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 250 A          | 250  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 15 |
|         | 100 4          | 250  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 400 A          | 400  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| O       | 000 4          | 400  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| I       | 630 A          | 630  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 11 | 12 |
| M/H/C   |                | 630  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         |                | 800  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         |                | 1000 | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |

# Instantaneous short-circuit protection I:

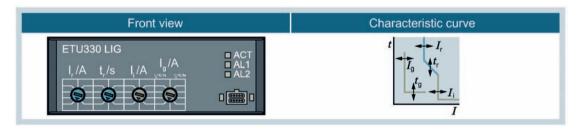
|         | in a   | I,   |      |      |      |      | Setting | gs I <sub>i</sub> [A] |      |      |      |      |
|---------|--------|------|------|------|------|------|---------|-----------------------|------|------|------|------|
| 3       | Size   | [Ä]  | AA   | ВВ   | СС   | DD   | EE      | FF                    | GG   | нн   | П    | JJ   |
| П       |        | 25   | 38   | 50   | 63   | 75   | 100     | 125                   | 150  | 200  | 250  | 300  |
|         | 100 4  | 40   | 60   | 80   | 100  | 120  | 160     | 200                   | 240  | 320  | 400  | 480  |
|         | 100 A  | 63   | 95   | 126  | 158  | 189  | 252     | 315                   | 378  | 504  | 360  | 756  |
| _1      |        | 100  | 150  | 200  | 250  | 300  | 400     | 500                   | 600  | 800  | 1000 | 1200 |
| M/H/C/L |        | 25   | 38   | 50   | 63   | 75   | 100     | 125                   | 150  | 200  | 250  | 300  |
| =       |        | 40   | 60   | 80   | 100  | 120  | 160     | 200                   | 240  | 320  | 400  | 480  |
| =       | 160 A  | 63   | 95   | 126  | 158  | 189  | 252     | 315                   | 378  | 504  | 360  | 756  |
| 2       |        | 100  | 150  | 200  | 250  | 300  | 400     | 500                   | 600  | 800  | 1000 | 1200 |
|         |        | 160  | 240  | 320  | 400  | 480  | 640     | 800                   | 960  | 1280 | 1440 | 1600 |
|         | 050 4  | 160  | 240  | 320  | 400  | 480  | 640     | 800                   | 960  | 1280 | 1600 | 1920 |
|         | 250 A  | 250  | 375  | 500  | 625  | 750  | 1000    | 1250                  | 1500 | 2000 | 2250 | 2500 |
|         | 400.4  | 250  | 375  | 500  | 625  | 750  | 1000    | 1250                  | 1500 | 2000 | 2500 | 3000 |
|         | 400 A  | 400  | 600  | 800  | 1000 | 1200 | 1600    | 2000                  | 2400 | 3200 | 3600 | 4000 |
| O       | 000 4  | 400  | 600  | 800  | 1000 | 1200 | 1600    | 2000                  | 2400 | 3200 | 4000 | 4800 |
| M/H/C   | 630 A  | 630  | 945  | 1260 | 1575 | 1890 | 2520    | 3150                  | 3780 | 4410 | 5040 | 5670 |
| E       |        | 630  | 945  | 1260 | 1575 | 1890 | 2520    | 3150                  | 3780 | 5040 | 6300 | 7560 |
|         | 1000 A | 800  | 1200 | 1600 | 2000 | 2400 | 3200    | 4000                  | 4800 | 6400 | 7200 | 8000 |
|         |        | 1000 | 1500 | 2000 | 2500 | 3000 | 4000    | 5000                  | 6000 | 8000 | 9000 | 1000 |

# Neutral conductor protection N:

|          | N:     | I,   |     |     |     |     | Settings | $SI_N = XI_r$ |     |     |      |     |
|----------|--------|------|-----|-----|-----|-----|----------|---------------|-----|-----|------|-----|
| 5        | Size   | [Ä]  | AA  | ВВ  | СС  | DD  | EE       | FF            | GG  | HH  | - II | JJ  |
|          |        | 25   | 1   | OFF | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
|          | 400.4  | 40   | 1   | OFF | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
|          | 100 A  | 63   | 1   | OFF | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| =1       |        | 100  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| M/H/C/L  |        | 25   | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| <u>~</u> |        | 40   | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| =        | 160 A  | 63   | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| 2        |        | 100  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| y.       |        | 160  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| 200      | 050 4  | 160  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
|          | 250 A  | 250  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
|          | 100 4  | 250  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
|          | 400 A  | 400  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| O        | 000 4  | 400  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| H/C      | 630 A  | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
| >        |        | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
|          | 1000 A | 800  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |
|          |        | 1000 | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF  | OFF |

# Electronic trip unit ETU330 LIG

ETU330 LIG 3-pole:



## ETU330 LIG 4-pole:



## Line protection - function LIG

The ETU330 electronic trip unit has:

- Adjustable parameter settings I<sub>r</sub> and t<sub>r</sub> for overload protection (L)
- Adjustable parameter setting Ii for instantaneous short-circuit protection (I)
- Adjustable parameter settings I<sub>g</sub> and t<sub>g</sub> for ground-fault protection (G)
- With 4-pole versions only: Neutral conductor protection (N) which can be deactivated
- Permanently active thermal memory, cannot be deactivated

## ETU330 parameters:



# Overload protection L:

|    | 100 A 100 A 250 A 400 A 1000 A | I,   |     |     |     |     | Setting | gs I <sub>r</sub> [A] |     |     |      |      |
|----|--------------------------------|------|-----|-----|-----|-----|---------|-----------------------|-----|-----|------|------|
| 3  | oize                           | [Ä]  | AA  | ВВ  | СС  | DD  | EE      | FF                    | GG  | HH  | II . | JJ   |
| П  |                                | 25   | 10  | 12  | 14  | 16  | 18      | 20                    | 22  | 23  | 24   | 25   |
|    | 100 4                          | 40   | 16  | 20  | 24  | 28  | 30      | 32                    | 34  | 36  | 38   | 40   |
|    | 100 A                          | 63   | 25  | 30  | 35  | 40  | 45      | 50                    | 54  | 57  | 60   | 63   |
| _1 |                                | 100  | 40  | 50  | 63  | 70  | 75      | 80                    | 85  | 90  | 95   | 100  |
| -  |                                | 25   | 10  | 12  | 14  | 16  | 18      | 20                    | 22  | 23  | 24   | 25   |
| =  |                                | 40   | 16  | 20  | 24  | 28  | 30      | 32                    | 34  | 36  | 38   | 40   |
| =  | 160 A                          | 63   | 25  | 30  | 35  | 40  | 45      | 50                    | 54  | 57  | 60   | 63   |
| 2  |                                | 100  | 40  | 50  | 63  | 70  | 75      | 80                    | 85  | 90  | 95   | 100  |
|    |                                | 160  | 63  | 80  | 95  | 110 | 125     | 140                   | 145 | 150 | 155  | 160  |
|    | 050 4                          | 160  | 63  | 80  | 95  | 110 | 125     | 140                   | 145 | 150 | 155  | 160  |
|    | 250 A                          | 250  | 100 | 125 | 150 | 175 | 200     | 210                   | 220 | 230 | 240  | 250  |
|    | 400.4                          | 250  | 100 | 125 | 150 | 175 | 200     | 210                   | 220 | 230 | 240  | 250  |
|    | 400 A                          | 400  | 160 | 200 | 240 | 280 | 300     | 320                   | 340 | 360 | 380  | 400  |
| O  | 000 4                          | 400  | 160 | 200 | 240 | 280 | 300     | 320                   | 340 | 360 | 380  | 400  |
| I  | 630 A                          | 630  | 250 | 315 | 400 | 450 | 500     | 525                   | 550 | 575 | 600  | 630  |
| Σ  |                                | 630  | 250 | 315 | 400 | 450 | 500     | 525                   | 550 | 575 | 600  | 630  |
|    | 1000 A                         | 800  | 320 | 400 | 500 | 550 | 600     | 630                   | 680 | 720 | 760  | 800  |
|    |                                | 1000 | 400 | 500 | 630 | 700 | 750     | 800                   | 850 | 900 | 950  | 1000 |

| •  | 100 A 1/O/H/W 160 A 250 A 400 A 0/H/W 1000 A | į,   |     |      |    |    | Setting | gs t <sub>r</sub> [s] |    |    |    |    |
|----|--|------|-----|------|----|----|---------|-----------------------|----|----|----|----|
| 5  | oize   | [Å]  | AA  | ВВ   | CC | DD | EE      | FF                    | GG | НН | ij | JJ |
|    |  | 25   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    | 400.4  | 40   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    | 100 A  | 63   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| _1 |  | 100  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| =  |  | 25   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| -  |  | 40   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    | 160 A  | 63   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| 2  |  | 100  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    |  | 160  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    | 050 4  | 160  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    | 250 A  | 250  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 15 |
|    | 400.4  | 250  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    | 400 A  | 400  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| O  | 000 4  | 400  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| I  | 630 A  | 630  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 11 | 12 |
| Σ  |  | 630  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    | 1000 A                                       | 800  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|    |  | 1000 | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |

# Instantaneous short-circuit protection I:

|    | 100 A 100 A 250 A 400 A 1000 A | l,   |      |      |      |      | Setting | gs I <sub>i</sub> [A] |      |      |      |      |
|----|--------------------------------|------|------|------|------|------|---------|-----------------------|------|------|------|------|
| 5  | size                           | [Å]  | AA   | ВВ   | СС   | DD   | EE      | FF                    | GG   | НН   | ll l | JJ   |
|    |                                | 25   | 38   | 50   | 63   | 75   | 100     | 125                   | 150  | 200  | 250  | 300  |
|    | 400.4                          | 40   | 60   | 80   | 100  | 120  | 160     | 200                   | 240  | 320  | 400  | 480  |
|    | 100 A                          | 63   | 95   | 126  | 158  | 189  | 252     | 315                   | 378  | 504  | 360  | 756  |
| _1 |                                | 100  | 150  | 200  | 250  | 300  | 400     | 500                   | 600  | 800  | 1000 | 1200 |
| -  |                                | 25   | 38   | 50   | 63   | 75   | 100     | 125                   | 150  | 200  | 250  | 300  |
| ×  |                                | 40   | 60   | 80   | 100  | 120  | 160     | 200                   | 240  | 320  | 400  | 480  |
| =  | 160 A                          | 63   | 95   | 126  | 158  | 189  | 252     | 315                   | 378  | 504  | 360  | 756  |
| 2  |                                | 100  | 150  | 200  | 250  | 300  | 400     | 500                   | 600  | 800  | 1000 | 1200 |
|    |                                | 160  | 240  | 320  | 400  | 480  | 640     | 800                   | 960  | 1280 | 1440 | 1600 |
|    | 050.4                          | 160  | 240  | 320  | 400  | 480  | 640     | 800                   | 960  | 1280 | 1600 | 1920 |
|    | 250 A                          | 250  | 375  | 500  | 625  | 750  | 1000    | 1250                  | 1500 | 2000 | 2250 | 2500 |
|    | 400.4                          | 250  | 375  | 500  | 625  | 750  | 1000    | 1250                  | 1500 | 2000 | 2500 | 3000 |
|    | 400 A                          | 400  | 600  | 800  | 1000 | 1200 | 1600    | 2000                  | 2400 | 3200 | 3600 | 4000 |
| O  | 000 4                          | 400  | 600  | 800  | 1000 | 1200 | 1600    | 2000                  | 2400 | 3200 | 4000 | 480  |
| I  | 630 A                          | 630  | 945  | 1260 | 1575 | 1890 | 2520    | 3150                  | 3780 | 4410 | 5040 | 5670 |
| E  |                                | 630  | 945  | 1260 | 1575 | 1890 | 2520    | 3150                  | 3780 | 5040 | 6300 | 7560 |
|    | 1000 A                         | 800  | 1200 | 1600 | 2000 | 2400 | 3200    | 4000                  | 4800 | 6400 | 7200 | 8000 |
|    |                                | 1000 | 1500 | 2000 | 2500 | 3000 | 4000    | 5000                  | 6000 | 8000 | 9000 | 1000 |

# Ground-fault protection G:

|         |        |      |     |     |                        |     | Setting | s I <sub>g</sub> [A] |     |                         |     |      |
|---------|--------|------|-----|-----|------------------------|-----|---------|----------------------|-----|-------------------------|-----|------|
| S       | Size   | [A]  |     |     | t <sub>g</sub> = 0.1 s |     |         | *                    | 7,  | $t_{g} = 0.3 \text{ s}$ |     |      |
|         |        | P 4  | AA  | ВВ  | СС                     | DD  | EE      | FF                   | GG  | НН                      | II  | JJ   |
|         |        | 25   | 15  | 18  | 20                     | 22  | 25      | 15                   | 18  | 20                      | 22  | 25   |
|         | 100 4  | 40   | 16  | 24  | 28                     | 32  | 40      | 16                   | 24  | 28                      | 32  | 40   |
|         | 100 A  | 63   | 16  | 25  | 38                     | 50  | 63      | 16                   | 25  | 38                      | 50  | 63   |
| -1      |        | 100  | 20  | 40  | 60                     | 80  | 100     | 20                   | 40  | 60                      | 80  | 100  |
| M/H/C/L |        | 25   | 15  | 18  | 20                     | 22  | 25      | 15                   | 18  | 20                      | 22  | 25   |
|         |        | 40   | 16  | 24  | 28                     | 32  | 40      | 16                   | 24  | 28                      | 32  | 40   |
| =       | 160 A  | 63   | 16  | 25  | 38                     | 50  | 63      | 16                   | 25  | 38                      | 50  | 63   |
| 2       |        | 100  | 20  | 40  | 60                     | 80  | 100     | 20                   | 40  | 60                      | 80  | 100  |
| !       |        | 160  | 32  | 64  | 96                     | 128 | 160     | 32                   | 64  | 96                      | 128 | 160  |
|         | 050.4  | 160  | 32  | 64  | 96                     | 128 | 160     | 32                   | 64  | 96                      | 128 | 160  |
|         | 250 A  | 250  | 50  | 100 | 150                    | 200 | 250     | 50                   | 100 | 150                     | 200 | 250  |
|         | 400.4  | 250  | 50  | 100 | 150                    | 200 | 250     | 50                   | 100 | 150                     | 200 | 250  |
|         | 400 A  | 400  | 80  | 160 | 240                    | 320 | 400     | 80                   | 160 | 240                     | 320 | 400  |
| O       | 000.4  | 400  | 80  | 160 | 240                    | 320 | 400     | 80                   | 160 | 240                     | 320 | 400  |
| I       | 630 A  | 630  | 126 | 252 | 378                    | 504 | 630     | 126                  | 252 | 378                     | 504 | 630  |
| M/H/C   |        | 630  | 126 | 252 | 378                    | 504 | 630     | 126                  | 252 | 378                     | 504 | 630  |
|         | 1000 A | 800  | 160 | 320 | 480                    | 640 | 800     | 160                  | 320 | 480                     | 640 | 800  |
|         |        | 1000 | 200 | 400 | 600                    | 800 | 1000    | 200                  | 400 | 600                     | 800 | 1000 |

The ground-fault protection cannot be deactivated.

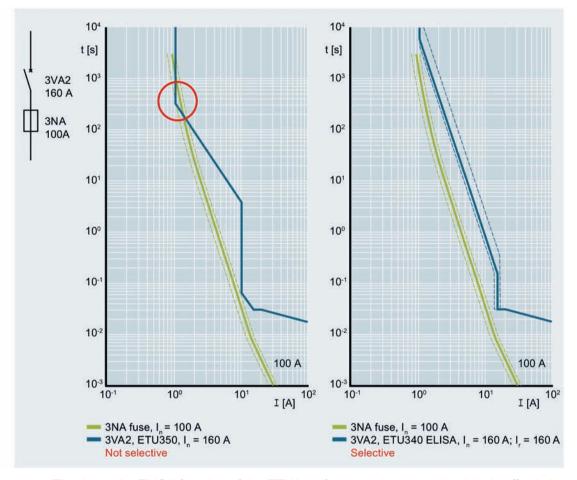
# Neutral conductor protection N:

|         |        | I,   |     |     |     |     | Settings | $s \mid_{N} = x \mid_{r}$ |     |     |     |     |
|---------|--------|------|-----|-----|-----|-----|----------|---------------------------|-----|-----|-----|-----|
| 5       | Size   | [Ä]  | AA  | ВВ  | CC  | DD  | EE       | FF                        | GG  | НН  | II. | JJ  |
| T       |        | 25   | 1   | OFF | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 100 4  | 40   | 1   | OFF | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 100 A  | 63   | 1   | OFF | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         |        | 100  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
| -       |        | 25   | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
| M/H/C/L |        | 40   | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 160 A  | 63   | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         |        | 100  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
| 1       |        | 160  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 050.4  | 160  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 250 A  | 250  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 400.4  | 250  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 400 A  | 400  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
| O       | 000 4  | 400  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
| H/C     | 630 A  | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
| È       |        | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         | 1000 A | 800  | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |
|         |        | 1000 | 0.5 | 1   | OFF | OFF | OFF      | OFF                       | OFF | OFF | OFF | OFF |

## Electronic trip unit ETU340 ELISA LI

The 3VA2 molded case circuit breaker with the ETU340 ELISA electronic trip unit has been specially developed for implementing selectivity with fuses in operational class gG. The tripping characteristic of the ETU340 ELISA of the 3VA2 molded case circuit breaker exhibits a similar characteristic to fuses of operational class gG, e.g. LV HRC fuses, across the entire overcurrent range.

From the selectivity perspective, this ETU340 ELISA is therefore especially suitable for combination with upstream and downstream fuses.



Thanks to the ELISA function of the ETU340, for example, total selectivity is afforded between an upstream 3VA2 molded case circuit breaker with a rated current In of just 160 A and a downstream 100 A LV HRC fuse. This advantageous feature allows users to choose cheaper circuit breakers and configure additional grading levels more easily in low-voltage networks.

#### Advantages of 3VA2 molded case circuit breaker with ETU340 ELISA over fuses

- The extensive internal and external accessories of the 3VA2 molded case circuit breaker can be used.
- When the EFB300 external function box is used, it is possible to output alarms from the ETU, e.g. reason for tripping overload warning (overload or short circuit).
- Adjustable operating current for the overload release, thereby making it possible to use smaller cable cross sections
- Selectivity to downstream fuses 1 : 1.6
- Can be closed again immediately after tripping and troubleshooting; no need to stock replacement fuses

#### Note

The minimum short-circuit current at the line side  $I^{"}_{kmin}$  must be at least 7 times the circuit breaker's rated current  $I_n$  to trip the molded case circuit breaker after 5 s in compliance with IEC 60364-4-43, DIN VDE 0100-430.

### ETU340 ELISA 3-pole:



### ETU340 ELISA 4-pole:



### Line protection - function ELISA LI

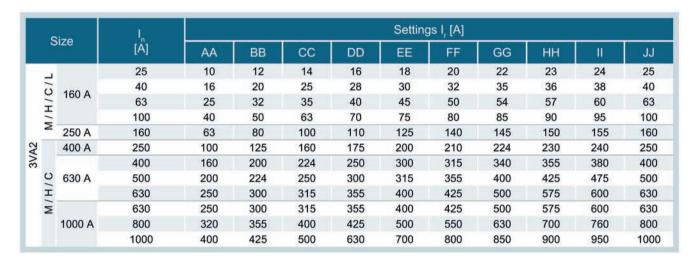
The ETU340 ELISA electronic trip unit has:

- Simulation of the tripping characteristic of a fuse in a circuit breaker
- Adjustable parameter setting I<sub>r</sub> for overload protection (L)
- Increased, fixed parameter setting I<sub>i</sub> for instantaneous short-circuit protection (I) –
   I<sub>i</sub> = 15 x I<sub>r</sub>
- With 4-pole versions only: Neutral conductor protection (N) which can be deactivated
- Permanently active thermal memory, cannot be deactivated

### ETU340 ELISA parameters



## Setting values Ir



# Setting values li

The instantaneous short-circuit protection is permanently set to the highest possible value.

| s        | ize    | ا _<br>[A] | Settings I <sub>i</sub> [A] (fixed) |  |
|----------|--------|------------|-------------------------------------|--|
|          |        | 25         | 375                                 |  |
| 0        | 400 A  | 40         | 600                                 |  |
| <u>~</u> | 160 A  | 945        | 945                                 |  |
| M/H/C/L  |        | 100        | 1500                                |  |
| 2        | 250 A  | 160        | 2400                                |  |
| Ž.       | 400 A  | 250        | 3750                                |  |
| SVAZ     |        | 400        | 6000                                |  |
| S        | 630 A  | 500        | 7000                                |  |
| I        |        | 630        | 5670                                |  |
| M/H/C    |        | 630        | 7560                                |  |
|          | 1000 A | 800        | 8000                                |  |
|          |        | 1000       | 10000                               |  |

# Setting values I<sub>N</sub>

|        | 'izo   | I,   |     |     |     |     | Settings | $s I_N = x I_r$ |     |     |     |     |
|--------|--------|------|-----|-----|-----|-----|----------|-----------------|-----|-----|-----|-----|
| 0      | Size   | [Ä]  | AA  | ВВ  | СС  | DD  | EE       | FF              | GG  | НН  | Ш   | JJ  |
|        |        | 25   | 1   | OFF | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
|        | 400.4  | 40   | 1   | OFF | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| ÷      | 160 A  | 63   | 1   | OFF | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| M/H/C/ |        | 100  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| 2      | 250 A  | 160  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| Ž.     | 400 A  | 250  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| 3VA2   |        | 400  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| 0      | 630 A  | 500  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| Ī      |        | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
| M/H    |        | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
|        | 1000 A | 800  | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |
|        |        | 1000 | 0.5 | 1   | OFF | OFF | OFF      | OFF             | OFF | OFF | OFF | OFF |

## Electronic trip unit ETU350 LSI

ETU350 LSI 3-pole:



# ETU350 LSI 4-pole:

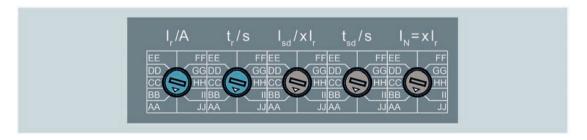


## Line protection - function LSI

The ETU350 electronic trip unit has:

- Adjustable parameter settings I<sub>r</sub> and t<sub>r</sub> for overload protection (L)
- Adjustable parameter settings I<sub>sd</sub> and t<sub>sd</sub> for short-time delayed short circuit protection (S)
- Fixed parameter setting I<sub>i</sub> for instantaneous short-circuit protection (I)
- With 4-pole versions only: Neutral conductor protection (N) which can be deactivated
- Permanently active thermal memory, cannot be deactivated

## ETU350 parameters:



# Overload protection L:

|         |        | I <sub>n</sub> |     |     |     |     | Setting | gs I <sub>r</sub> [A] |     |     |      |      |
|---------|--------|----------------|-----|-----|-----|-----|---------|-----------------------|-----|-----|------|------|
| 5       | Size   | [Ä]            | AA  | BB  | CC  | DD  | EE      | FF                    | GG  | НН  | - II | JJ   |
|         |        | 25             | 10  | 12  | 14  | 16  | 18      | 20                    | 22  | 23  | 24   | 25   |
|         | 100 4  | 40             | 16  | 20  | 24  | 28  | 30      | 32                    | 34  | 36  | 38   | 40   |
|         | 100 A  | 63             | 25  | 30  | 35  | 40  | 45      | 50                    | 54  | 57  | 60   | 63   |
| تـ      |        | 100            | 40  | 50  | 63  | 70  | 75      | 80                    | 85  | 90  | 95   | 100  |
| M/H/C/L |        | 25             | 10  | 12  | 14  | 16  | 18      | 20                    | 22  | 23  | 24   | 25   |
| ÷       |        | 40             | 16  | 20  | 24  | 28  | 30      | 32                    | 34  | 36  | 38   | 40   |
| =       | 160 A  | 63             | 25  | 30  | 35  | 40  | 45      | 50                    | 54  | 57  | 60   | 63   |
|         |        | 100            | 40  | 50  | 63  | 70  | 75      | 80                    | 85  | 90  | 95   | 100  |
|         |        | 160            | 63  | 80  | 95  | 110 | 125     | 140                   | 145 | 150 | 155  | 160  |
|         | 250 A  | 160            | 63  | 80  | 95  | 110 | 125     | 140                   | 145 | 150 | 155  | 160  |
|         | 250 A  | 250            | 100 | 125 | 150 | 175 | 200     | 210                   | 220 | 230 | 240  | 250  |
|         | 400 A  | 250            | 100 | 125 | 150 | 175 | 200     | 210                   | 220 | 230 | 240  | 250  |
|         | 400 A  | 400            | 160 | 200 | 240 | 280 | 300     | 320                   | 340 | 360 | 380  | 400  |
| 0       | C20 A  | 400            | 160 | 200 | 240 | 280 | 300     | 320                   | 340 | 360 | 380  | 400  |
| M/H/C   | 630 A  | 630            | 250 | 315 | 400 | 450 | 500     | 525                   | 550 | 575 | 600  | 630  |
| Ξ       |        | 630            | 250 | 315 | 400 | 450 | 500     | 525                   | 550 | 575 | 600  | 630  |
|         | 1000 A | 800            | 320 | 400 | 500 | 550 | 600     | 630                   | 680 | 720 | 760  | 800  |
|         |        | 1000           | 400 | 500 | 630 | 700 | 750     | 800                   | 850 | 900 | 950  | 1000 |

|         |        | į,   |     |      |    |    | Setting | gs t <sub>,</sub> [s] |    |    |    |    |
|---------|--------|------|-----|------|----|----|---------|-----------------------|----|----|----|----|
| 5       | Size   | [Å]  | AA  | ВВ   | CC | DD | EE      | FF                    | GG | НН | ij | JJ |
|         |        | 25   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 400.4  | 40   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 100 A  | 63   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| _1      |        | 100  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| -       |        | 25   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| 7       |        | 40   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| M/H/C/L | 160 A  | 63   | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         |        | 100  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         |        | 160  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 050 A  | 160  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 250 A  | 250  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 15 |
|         | 100.4  | 250  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 400 A  | 400  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| O       | 000 4  | 400  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
| I       | 630 A  | 630  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 11 | 12 |
| M/H/C   |        | 630  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         | 1000 A | 800  | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |
|         |        | 1000 | 0.5 | 0.75 | 1  | 2  | 3       | 5                     | 8  | 10 | 14 | 17 |

# Short-time delayed short-circuit protection S:

|        | ino.   | l,   |     |    |     |    | Settings | $I_{sd} = X I_r$ |    |    |      |    |
|--------|--------|------|-----|----|-----|----|----------|------------------|----|----|------|----|
| 3      | Size   | [Å]  | AA  | ВВ | СС  | DD | EE       | FF               | GG | НН | II . | JJ |
|        |        | 25   | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 100 4  | 40   | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 100 A  | 63   | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
| _      |        | 100  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        |        | 25   | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
| M/H/C/ |        | 40   | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 160 A  | 63   | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        |        | 100  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        |        | 160  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 250.4  | 160  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 250 A  | 250  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 400.4  | 250  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 400 A  | 400  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
| 0      | 000 4  | 400  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
| I      | 630 A  | 630  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 9  |
| M/H/C  |        | 630  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        | 1000 A | 800  | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |
|        |        | 1000 | 1.5 | 2  | 2.5 | 3  | 3.5      | 4                | 5  | 6  | 8    | 10 |

|         | Ni     | l,   |    |    |    |    | Setting | gs t <sub>sd</sub> [s] |      |      |       |     |
|---------|--------|------|----|----|----|----|---------|------------------------|------|------|-------|-----|
| 5       | Size   | [Ä]  | AA | ВВ | СС | DD | EE      | FF                     | GG   | НН   | ii ii | JJ  |
|         |        | 25   | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         | 100 4  | 40   | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         | 100 A  | 63   | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
| _1      |        | 100  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
| =       |        | 25   | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
| 7       |        | 40   | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
| M/H/C/L | 160 A  | 63   | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         |        | 100  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         |        | 160  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         | 250.4  | 160  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         | 250 A  | 250  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         | 400.4  | 250  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         | 400 A  | 400  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
| O       | 000 4  | 400  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
| I       | 630 A  | 630  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
| M/H/C   |        | 630  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         | 1000 A | 800  | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |
|         |        | 1000 | 0  | 0  | 0  | 0  | 0       | 0.08                   | 0.15 | 0.22 | 0.3   | 0.4 |

## Instantaneous short-circuit protection I:

The instantaneous short-circuit protection is permanently set to the highest possible value.

| s       | ize    | ا _<br>[A] | Settings I <sub>,</sub> [A]<br>(fixed) |  |
|---------|--------|------------|--|--|
|         |        | 25         | 300                                    |  |
|         | 100 4  | 40         | 480                                    |  |
|         | 100 A  | 63         | 756                                    |  |
| _       |        | 100        | 1200                                   |  |
| M/H/C/L |        | 25         | 300                                    |  |
| -       |        | 40         | 480                                    |  |
| =       | 160 A  | 63         | 756                                    |  |
| 2       |        | 100        | 1200                                   |  |
|         |        | 160        | 1600                                   |  |
| 1       | 050 4  | 160        | 1920                                   |  |
|         | 250 A  | 250        | 2500                                   |  |
|         | 400 A  | 250        | 3000                                   |  |
|         | 400 A  | 400        | 4000                                   |  |
| 0       | C20 A  | 400        | 4800                                   |  |
| M/H/C   | 630 A  | 630        | 5670                                   |  |
| Σ       |        | 630        | 7560                                   |  |
|         | 1000 A | 800        | 8000                                   |  |
|         |        | 1000       | 10000                                  |  |

# Neutral conductor protection N:

|         | ·i     | I.   |     |     |     |     | Settings | $SI_N = XI_r$ |     |     |     |     |
|---------|--------|------|-----|-----|-----|-----|----------|---------------|-----|-----|-----|-----|
| 5       | Size   | [Å]  | AA  | ВВ  | CC  | DD  | EE       | FF            | GG  | НН  | Ш   | JJ  |
|         |        | 25   | 1   | OFF | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         | 400.4  | 40   | 1   | OFF | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         | 100 A  | 63   | 1   | OFF | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| -1      |        | 100  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| M/H/C/L |        | 25   | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| 2       |        | 40   | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| =       | 160 A  | 63   | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| Σ       |        | 100  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         |        | 160  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         | 050.4  | 160  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         | 250 A  | 250  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         |        | 250  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         | 400 A  | 400  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| O       |        | 400  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| H       | 630 A  | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
| Σ       |        | 630  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         | 1000 A | 800  | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |
|         |        | 1000 | 0.5 | 1   | OFF | OFF | OFF      | OFF           | OFF | OFF | OFF | OFF |

### 5-series and 8-series electronic trip units

### Parameter input via display unit

With 5-series and 8-series electronic trip units, it is possible to set more parameters and to scale the selection of parameters more finely than on 3-series trip units.

Parameters are set via the display unit and its buttons. This functionality is available, however, only if a separate, dedicated power supply is connected to the molded case circuit breakers.

Potential alternatives for this power supply:

- 24 V supplied externally via:
  - EFB300 external function box
  - temporarily connected TD300 or TD500 test device
  - internal 24 V module
  - internal COM060 communication module
- Current flow > 20% In in one of the 3 phases

A description of the parameter display can be found in chapter "Operator controls (Page 93)".

#### Additional features of 8-series units

In addition to the features shared with 5-series trip units, 8-series units also offer:

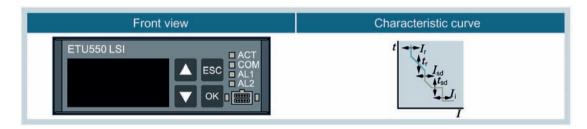
- With three-pole molded case circuit breakers, a voltage tap for each phase and the option
  of connecting the potential of the neutral conductor
  With four-pole molded case circuit breakers, four internal voltage taps are provided for
  measuring the conductor voltages
- Additional measurement of power values (only possible with an external 24 V supply)

#### Note

In order to avoid the display of small ghost currents (e.g. when the breaker is switched off), all currents below 5% of rated current are displayed as "0" as standard. This threshold can be changed using powerconfig.

## Electronic trip units ETU550 LSI and ETU850 LSI

ETU550 LSI 3-pole and 4-pole units:



### ETU850 LSI 3-pole and 4-pole units:



## Line protection - function LSI

The ETU550 and ETU850 electronic trip units have:

- Adjustable parameter settings I<sub>r</sub> and t<sub>r</sub> for overload protection (L)
- Adjustable parameter settings I<sub>sd</sub> and t<sub>sd</sub> for short-time delayed short circuit protection (S)
- Adjustable parameter setting l<sub>i</sub> for instantaneous short-circuit protection (I)
- With 4-pole versions: adjustable parameter setting I<sub>N</sub> for neutral conductor protection (N) (can be activated optionally with 3-pole versions when an external current transformer is used for the neutral conductor)

| 8      | Size   | I <sub>n</sub> [A] | l, [A]   | t, [s]  | I <sub>sd</sub> [A] | t <sub>sd</sub> [s] | I, [A]     | I <sub>N</sub> [A] 1) |
|--------|--------|--------------------|----------|---------|---------------------|---------------------|------------|-----------------------|
|        |        | 25                 | 10 25    |         | 15 250              |                     | 38 300     | 10 40 / OFF           |
|        | 100 4  | 40                 | 16 40    |         | 24 400              |                     | 60 480     | 16 63 / OFF           |
|        | 100 A  | 63                 | 25 63    |         | 38 630              |                     | 95 756     | 25 100 / OFF          |
| _      |        | 100                | 40 100   | 0.5 0.5 | 60 1000             |                     | 150 1200   | 20 160 / OFF          |
| -      |        | 25                 | 10 25    | 0.5 25  | 15 250              |                     | 38 300     | 10 40 / OFF           |
| M/H/C/ |        | 40                 | 16 40    |         | 24 400              |                     | 60 480     | 16 63 / OFF           |
| =      | 160 A  | 63                 | 25 63    |         | 38 630              | 0.05 0.5            | 95 756     | 25 100 / OFF          |
| 2      |        | 100                | 40 100   |         | 60 1000             |                     | 150 1200   | 20 160 / OFF          |
| v      |        | 160                | 63 160   | 0.5 20  | 96 1600             |                     | 240 1600   | 32 250 / OFF          |
| 3VA2   | 050 4  | 160                | 63 160   | 0.5 25  | 96 1600             |                     | 240 1920   | 32 250 / OFF          |
| 2      | 250 A  | 250                | 100 250  | 0.5 15  | 150 2500            |                     | 375 2500   | 50 400 / OFF          |
|        | 400 4  | 250                | 100 250  | 0.5 25  | 150 2500            |                     | 375 3000   | 50 400 / OFF          |
|        | 400 A  | 400                | 160 400  | 0.5 17  | 240 4000            |                     | 600 4000   | 80 630 / OFF          |
| O      |        | 400                | 160 400  | 0.5 25  | 240 4000            |                     | 600 6000   | 80 630 / OFF          |
| =      | 630 A  | 500                | 200 500  | 0.5 20  | 300 5000            |                     | 750 7000   | 100 800 / OFF         |
| M/H/M  |        | 630                | 250 630  | 0.5 12  | 378 5670            |                     | 945 5670   | 126 1000 / OF         |
| Σ      |        | 630                | 250 630  |         | 378 6300            |                     | 945 7560   | 126 1000 / OF         |
|        | 1000 A | 800                | 320 800  | 0.5 25  | 480 8000            |                     | 1200 8000  | 160 1280 / OF         |
|        |        | 1000               | 400 1000 |         | 600 10000           |                     | 1500 12000 | 200 1600 / OFF        |

<sup>1)</sup> only 3-pole version with external current transformer for N conductor

## ETU550 / ETU850 parameters (4-pole version):

| S                       | Size   | I <sub>n</sub> [A] | I <sub>,</sub> [A] | t, [s]           | I <sub>sd</sub> [A] | t <sub>sd</sub> [s] | I, [A]     | I <sub>N</sub> [A] |
|-------------------------|--------|--------------------|--------------------|------------------|---------------------|---------------------|------------|--------------------|
|                         |        | 25                 | 10 25              |                  | 15 250              |                     | 38 300     | 10 40 / OFF        |
|                         | 400 A  | 40                 | 16 40              | 0.5 25           | 24 400              |                     | 60 480     | 16 63 / OFF        |
|                         | 100 A  | 63                 | 25 63              |                  | 38 630              |                     | 95 756     | 25 100 / OFF       |
| -                       |        | 100                | 40 100             |                  | 60 1000             |                     | 150 1200   | 20 100 / OFF       |
| 0                       |        | 25                 | 10 25              |                  | 15 250              | 0.05 0.5            | 38 300     | 10 40 / OFF        |
|                         |        | 40                 | 16 40              |                  | 24 400              |                     | 60 480     | 16 63 / OFF        |
|                         | 160 A  | 63                 | 25 63              |                  | 38 630              |                     | 95 756     | 25 100 / OFF       |
|                         |        | 100                | 40 100             |                  | 60 1000             |                     | 150 1200   | 20 160 / OFF       |
| v                       |        | 160                | 63 160             | 0.5 20<br>0.5 25 | 96 1600             |                     | 240 1600   | 32 160 / OFF       |
| 7/D/H/W 25<br>40<br>063 | 050 4  | 160                | 63 160             |                  | 96 1600             |                     | 240 1920   | 32 250 / OFF       |
| 2                       | 250 A  | 250                | 100 250            | 0.5 15           | 150 2500            |                     | 375 2500   | 50 250 / OFF       |
|                         | 400.4  | 250                | 100 250            | 0.5 25           | 150 2500            |                     | 375 3000   | 50 400 / OFF       |
|                         | 400 A  | 400                | 160 400            | 0.5 17           | 240 4000            |                     | 600 4000   | 80 400 / OFF       |
| ()                      |        | 400                | 160 400            | 0.5 25           | 240 4000            |                     | 600 6000   | 80 500 / OFF       |
| <u>~</u>                | 630 A  | 500                | 200 500            | 0.5 20           | 300 5000            |                     | 750 7000   | 100 500 / OFF      |
| =                       |        | 630                | 250 630            | 0.5 12           | 378 5670            |                     | 945 5670   | 126 630 / OFF      |
| Σ                       |        | 630                | 250 630            |                  | 378 6300            |                     | 945 7560   | 126 630 / OFF      |
|                         | 1000 A | 800                | 320 800            | 0.5 25           | 480 8000            |                     | 1200 8000  | 160 800 / OFF      |
|                         |        | 1000               | 400 1000           |                  | 600 10000           |                     | 1500 12000 | 200 1000 / OF      |

## Overload protection L:

• I<sub>r</sub> Adjustable from 0.4 to 1.0 x I<sub>n</sub> in absolute current values I<sub>r</sub> < 50 A: in steps of 0.5 A
I<sub>r</sub>  $\geq$  50 A: in steps of 1 A

t<sub>r</sub> Adjustable from 0.5 to 12 / 15 / 17 / 20 / 25 s (dependent on rated operational current and frame size)
 with a reference point of 6 x I<sub>r</sub>.
 In steps of 0.1 s

The ETU550 LSI and ETU850 LSI units have a thermal memory; this can be deactivated.

### Short-time delayed short-circuit protection S:

•  $I_{sd}$  Adjustable from 0.6 to 9 / 10 x  $I_n$ 

 $I_{sd}$  < 50 A: in steps of 0.5 A

 $I_{sd} \ge 50 \text{ A}$ : in steps of 1 A

 t<sub>sd</sub> Adjustable from 0.05 to 0.5 s with a reference point of l<sub>sd</sub> = 8 x l<sub>r</sub> in steps of 0.01 s

The curve shape  $I^2t$  = constant can be deactivated.

#### Instantaneous short-circuit protection I:

 Ii Sizes 100 A to 400 A: adjustable from 1.5 to 10 / 12 x In Size 630 A: See tables above in steps of 1 A

### Neutral conductor protection N:

The neutral conductor protection function is available only for 3-pole molded case circuit breakers with external current transformer for N conductor for 4-pole molded case circuit breakers.

I<sub>N</sub> Adjustable in steps of 1 A

**3-pole** breakers with external current transformer for N conductor:

 $I_n$  < 63 A: 0.4 to 1.6 x  $I_n$  $I_n \ge$  63 A: 0.2 to 1.6 x  $I_n$ 

4-pole breakers:

 $I_n$  < 63 A: 0.4 to 1.6 x  $I_n$ 

 $I_n \ge 63 \text{ A}$ : 0.2 to 1.0 or 1.6 x  $I_n$ 

## Electronic trip units ETU560 LSIG and ETU860 LSIG

ETU560 LSIG 3-pole and 4-pole units:



### ETU860 LSIG 3-pole and 4-pole units:



### Line protection - function LSIG

The ETU560 and ETU860 electronic trip units have:

- Adjustable parameter settings I<sub>r</sub> and t<sub>r</sub> for overload protection (L)
- Adjustable parameter settings I<sub>sd</sub> and t<sub>sd</sub> for short-time delayed short circuit protection (S)
- Adjustable parameter setting l<sub>i</sub> for instantaneous short-circuit protection (I)
- Adjustable parameter settings I<sub>g</sub> and t<sub>g</sub> for ground-fault protection (G)
- With 4-pole versions: adjustable parameter setting I<sub>N</sub> for neutral conductor protection (N) optionally available for 3-pole versions

ETU560 / ETU860 parameters (3-pole version):

| 8              | Size                              | I <sub>n</sub> [A] | I, [A]   | t, [s] | I <sub>sd</sub> [A] | t <sub>sd</sub> [s] | I, [A]     | ا <sub>ه</sub> [A] | t, [s] | I <sub>N</sub> [A] 1) |
|----------------|-----------------------------------|--------------------|----------|--------|---------------------|---------------------|------------|--------------------|--------|-----------------------|
|                |                                   | 25                 | 10 25    |        | 15 250              |                     | 38 300     | 15 25              |        | 10 40 / OFF           |
|                | 400 4                             | 40                 | 16 40    |        | 24 400              |                     | 60 480     | 16 40              |        | 16 63 / OFF           |
|                | 100 A                             | 63                 | 25 63    |        | 38 630              |                     | 95 756     | 16 63              |        | 25 100 / OFF          |
|                | 100 A  160 A  250 A  400 A  630 A | 100                | 40 100   | 0.5 05 | 60 1000             |                     | 150 1200   | 20 100             |        | 20 160 / OFF          |
| 5              |                                   | 25                 | 1025     | 0.5 25 | 15 250              |                     | 38 300     | 15 25              |        | 10 40 / OFF           |
| =              |                                   | 40                 | 16 40    |        | 24 400              |                     | 60 480     | 16 40              |        | 16 63 / OFF           |
| 3VA2<br>M/H/C/ | 160 A                             | 63                 | 25 63    |        | 38 630              |                     | 95 756     | 16 63              |        | 25 100 / OFF          |
|                |                                   | 100                | 40 100   |        | 60 1000             |                     | 150 1200   | 20 100             |        | 20 160 / OFF          |
|                |                                   | 160                | 63 160   | 0.5 20 | 96 1600             |                     | 240 1600   | 32 160             |        | 32 250 / OFF          |
| <b>X</b>       | 050 4                             | 160                | 63 160   | 0.5 25 | 96 1600             | 0.05                | 240 1920   | 32 160             | 0.05   | 32 250 / OFF          |
| 3              | 250 A                             | 250                | 100 250  | 0.5 15 | 150 2500            | 0.5                 | 375 2500   | 50 250             | 0.8    | 50 400 / OFF          |
| 3V.A.          | 400 4                             | 250                | 100 250  | 0.5 25 | 150 2500            |                     | 375 3000   | 50 250             |        | 50 400 / OFF          |
|                | 400 A                             | 400                | 160 400  | 0.5 17 | 240 4000            |                     | 600 4000   | 80 400             |        | 80 630 / OFF          |
| ()             |                                   | 400                | 160 400  | 0.5 25 | 240 4000            |                     | 600 6000   | 80 400             |        | 80 630 / OFF          |
| =              | 630 A                             | 500                | 200 500  | 0.5 20 | 300 5000            |                     | 750 7000   | 100 500            |        | 100 800 / OFF         |
| M/H/M          |                                   | 630                | 250 630  | 0.5 12 | 378 5670            |                     | 945 5670   | 126 630            |        | 126 1000 / OFF        |
| Σ              |                                   | 630                | 250 630  |        | 378 6300            |                     | 945 7560   | 126 630            |        | 126 1000 / OFF        |
|                | 1000 A                            | 800                | 320 800  | 0.5 25 | 480 8000            |                     | 1200 8000  | 160 800            |        | 160 1280 / OFF        |
|                |                                   | 1000               | 400 1000 |        | 600 10000           |                     | 1500 12000 | 200 1000           |        | 200 1600 / OFF        |

only 3-pole version with external current transformer for N conductor

## ETU560 / ETU860 parameters (4-pole version):

| 5               | Size   | I <sub>n</sub> [A] | I, [A]   | t, [s]           | I <sub>sd</sub> [A] | t <sub>sd</sub> [s] | I, [A]     | ا <sub>ه</sub> [A] | t <sub>0</sub> [s] | I <sub>N</sub> [A] |
|-----------------|--------|--------------------|----------|------------------|---------------------|---------------------|------------|--------------------|--------------------|--------------------|
|                 |        | 25                 | 10 25    |                  | 15 250              |                     | 38 300     | 15 25              |                    | 10 40 / OFF        |
|                 | 100 A  | 40                 | 16 40    | 0.5 25           | 24 400              |                     | 60 480     | 16 40              |                    | 16 63 / OFF        |
|                 | 100 A  | 63                 | 25 63    |                  | 38 630              |                     | 95 756     | 16 63              |                    | 25 100 / OFF       |
| 3VA2<br>M/H/C/L |        | 100                | 40 100   |                  | 60 1000             |                     | 150 1200   | 20 100             |                    | 20 160 / OFF       |
|                 |        | 25                 | 1025     |                  | 15 250              |                     | 38 300     | 15 25              |                    | 10 40 / OFF        |
|                 |        | 40                 | 16 40    |                  | 24 400              |                     | 60 480     | 16 40              |                    | 16 63 / OFF        |
|                 | 160 A  | 63                 | 25 63    |                  | 38 630              |                     | 95 756     | 16 63              |                    | 25 100 / OFF       |
|                 |        | 100                | 40 100   |                  | 60 1000             |                     | 150 1200   | 20 100             | 0.05               | 20 160 / OFF       |
|                 |        | 160                | 63 160   | 0.5 20           | 96 1600             |                     | 240 1600   | 32 160             |                    | 32 250 / OFF       |
| ¥               | 050 4  | 160                | 63 160   | 0.5 25           | 96 1600             |                     | 240 1920   | 32 160             | 0.05<br>0.8        | 32 250 / OFF       |
| 2               | 250 A  | 250                | 100 250  | 0.5 15           | 150 2500            |                     | 375 2500   | 50 250             | 0.0                | 50 400 / OFF       |
|                 | 400 4  | 250                | 100 250  | 0.5 25<br>0.5 17 | 150 2500            |                     | 375 3000   | 50 250             |                    | 50 400 / OFF       |
|                 | 400 A  | 400                | 160 400  |                  | 240 4000            |                     | 600 4000   | 80 400             |                    | 80 630 / OFF       |
| O               |        | 400                | 160 400  | 0.5 25           | 240 4000            |                     | 600 6000   | 80 400             |                    | 80 630 / OFF       |
| ×               | 630 A  | 500                | 200 500  | 0.5 20           | 300 5000            |                     | 750 7000   | 100 500            |                    | 100 800 / OFF      |
| M/H/M           |        | 630                | 250 630  | 0.5 12           | 378 5670            |                     | 945 5670   | 126 630            |                    | 126 1000 / OFF     |
| Σ               |        | 630                | 250 630  |                  | 378 6300            |                     | 945 7560   | 126 630            |                    | 126 630 / OFF      |
|                 | 1000 A | 800                | 320 800  | 0.5 25           | 480 8000            |                     | 1200 8000  | 160 800            |                    | 160 800 / OFF      |
|                 |        | 1000               | 400 1000 |                  | 600 10000           |                     | 1500 12000 | 200 1000           |                    | 200 1000 / OFF     |

### Overload protection L:

• I<sub>r</sub> Adjustable from 0.4 to 1.0 x I<sub>n</sub> in absolute current values I<sub>r</sub> < 50 A: in steps of 0.5 A

 $I_r \ge 50 \text{ A}$ : in steps of 1 A

 $\begin{array}{ll} \bullet & t_r & \text{Adjustable from 0.5 to 12 / 15 / 17 / 20 / 25 s (dependent on rated operational current and frame size)} \\ & \text{with a reference point of 6 x I}_r. \\ & \text{In steps of 0.1 s} \end{array}$ 

The ETU560 LSIG and ETU860 LSIG units have a thermal memory which can be deactivated.

### Short-time delayed short-circuit protection S:

I<sub>sd</sub> Adjustable from 0.6 to 9 / 10 x I<sub>n</sub>

 $I_{sd}$  < 50 A: in steps of 0.5 A

 $I_{sd} \ge 50 \text{ A}$ : in steps of 1 A

 t<sub>sd</sub> Adjustable from 0.05 to 0.5 s with a reference point of l<sub>sd</sub> = 8 x l<sub>r</sub> in steps of 0.01 s

The curve shape  $I^2t$  = constant can be deactivated.

#### Instantaneous short-circuit protection I:

 Ii Sizes 100 A to 400 A: adjustable from 1.5 to 10 / 12 x In Size 630 A: See tables above in steps of 1 A

### Ground-fault protection G:

The detection of the ground-fault current is based on a vectorial summation of the phase currents and the neutral conductor current for 4-pole or 3-pole circuit breakers with an external current transformer for the neutral conductor.

I<sub>g</sub> Adjustable from 0.2 / 0.25 / 0.4 / 0.6 to 1.0 x I<sub>n</sub> in steps of 1 A

 t<sub>g</sub> Adjustable from 0.05 to 0.8 s with a reference point of 2 x I<sub>g</sub>
 In steps of 0.01 s

An alarm threshold I<sub>gA</sub> between 0.2 to 1 x I<sub>n</sub> can also be set. in steps of 1 A

The current-dependent curve shape  $I^2t$  = constant can be deactivated.

The ground-fault protection function G can be deactivated.

### Neutral conductor protection N:

The neutral conductor protection function is available only for 3-pole molded case circuit breakers with external current transformer for N conductor for 4-pole molded case circuit breakers.

I<sub>N</sub> Adjustable in steps of 1 A

**3-pole** breakers with external current transformer for N conductor:

 $I_n$  < 63 A: 0.4 to 1.6 x  $I_n$  $I_n \ge$  63 A: 0.2 to 1.6  $I_n$ 

4-pole breakers:

 $I_n$  < 63 A: 0.4 to 1.6 x  $I_n$ 

 $I_n \ge 63$  A: 0.2 to 1.0 or 1.6 x  $I_n$ 

# 3.2.2 Overview of 3VA molded case circuit breakers in line protection applications

|                          |   |                  | for line protection           |                 |         |                          |           |         | .3    | VA1 m | olded    | case c        | ircuit s | witchin | igs           |         |            |      |  |  |
|--------------------------|---|------------------|-------------------------------|-----------------|---------|--------------------------|-----------|---------|-------|-------|----------|---------------|----------|---------|---------------|---------|------------|------|--|--|
| Electrica                | al characteristi                        | cs according t   | o IEC 60947-2                 |                 |         |                          | 3VA10     |         |       | 3VA11 |          |               | 3VA11    |         |               |         | A11<br>0 A |      |  |  |
| Number o                 | of noles                                |                  |                               |                 |         |                          | 3, 4      | _       | 13    | 100 A |          |               | 2        | _       |               | 183     | . 4        |      |  |  |
|                          | erational current                       |                  |                               | 1               | [A]     | _                        | 16 10     | 0       |       | 16 16 | in.      |               | 160      |         | 16 160        |         |            |      |  |  |
| Rated op                 |   | AC 50 / 60 Hz    |                               | Ü,              | [V]     | 690                      |           |         |       | 415   |          |               | 415      |         | 690           |         |            |      |  |  |
| voltage, n               |   | DC               |                               | U.              | [V]     |                          | 600       |         |       | 125   |          |               | 250      |         | 600           |         |            |      |  |  |
|                          |   |                  |                               |                 | [V]     |                          | 800       |         |       | 500   |          |               | 500      |         | 800           |         |            |      |  |  |
|                          | pulse withstand                         | voltage          |                               | U               | [kV]    |                          | 8         | -       |       | 8     |          |               | 8        |         |               |         | 8          |      |  |  |
| Use in IT                |   | romago           |                               | imp             | [m]     |                          |           |         |       |       |          |               |          |         |               |         |            |      |  |  |
| Frequenc                 | 001 CHOY 14735 FEE                      |                  |                               |                 | [Hz]    | 0 400                    |           |         | 1 0   | 0 400 |          |               | 0 40     | 0       | 0 400         |         |            |      |  |  |
| Malladay da Jening dalah | 9                                       |                  |                               |                 | E- 1-3  | В                        | N         | S       | N     | S     | М        | N             | S        | М       | N             | S       | М          | Н    |  |  |
|                          |   |                  | 220 240 V                     | I <sub>cu</sub> | [kA]    | 25                       | 36        | 55      | 25    | 36    | 55       | 36            | 55       | 85      | 36            | 55      | 85         | 100  |  |  |
| Rated ulti               | mate                                    |                  | 380 415 V                     | l <sub>cu</sub> | [kA]    | 16                       | 25        | 36      | 5     | 6     | 6        | 25            | 36       | 55      | 25            | 36      | 55         | 70   |  |  |
| short-circ               |   | AC 50 / 60 Hz    | 440 V                         | I <sub>cu</sub> | [kA]    | 8                        | 16        | 25      |       |       |          |               |          |         | 16            | 25      | 36         | 55   |  |  |
|                          | capacity AC                             |                  | 500 V                         | I <sub>cu</sub> | [kA]    | 5                        | 5         | 7       |       |       |          |               |          |         | 7             | 7       | 10         | 10   |  |  |
|                          |   |                  | 690 V                         | I               | [kA]    | 5                        | 5         | 7       |       |       |          |               |          |         | 7             | 7       | 10         | 10   |  |  |
|                          |   |                  | 220 240 V                     | I <sub>cs</sub> | [kA]    | 25                       | 36        | 55      | 25    | 36    | 55       | 36            | 55       | 85      | 36            | 55      | 85         | 10   |  |  |
| Rated ser                | rvice                                   |                  | 380 415 V                     | I <sub>cs</sub> | [kA]    | 16                       | 25        | 36      | 5     | 6     | 6        | 25            | 36       | 55      | 25            | 36      | 55         | 70   |  |  |
| short-circ               | 100000000000000000000000000000000000000 | AC 50 / 60 Hz    | 440 V                         | I <sub>cs</sub> | [kA]    | 8                        | 16        | 25      |       |       |          |               |          |         | 16            | 25      | 36         | 40   |  |  |
| breaking i               | capacity AC                             |                  | 500 V                         | l <sub>cs</sub> | [kA]    | 5                        | 5         | 5       |       |       |          |               |          |         | 5             | 5       | 5          | 5    |  |  |
|                          |   |                  | 690 V                         | I <sub>cs</sub> | [kA]    | 5                        | 5         | 5       |       |       |          |               |          |         | 5             | 5       | 5          | 5    |  |  |
|                          |   |                  | 125 V (1 switching pole)      | I <sub>cu</sub> | [kA]    |                          |           |         | 16    | 25    | 30       | 16            | 25       | 30      |               |         |            |      |  |  |
| Rated ultimate           |   |                  | 250 V (2 switching poles      |                 | [kA]    | 25                       | 36        | 55      |       |       |          | 36            | 55       | 85      | 36            | 55      | 85         | 10   |  |  |
| short-circ               |   | DC               | 500 V (3 switching poles      | CU              | [kA]    | 25                       | 36        | 55      |       |       |          |               |          |         | 36            | 55      | 85         | 10   |  |  |
| breaking capacity DC     |   |                  | 600 V (4 switching poles      | CU              | [kA]    | 8                        | 16        | 25      |       |       |          |               |          |         | 16            | 25      | 36         | 55   |  |  |
|                          |   |                  | 125 V (1 switching pole)      | - Gu            | [kA]    |                          |           |         | 16    | 25    | 30       | 16            | 25       | 30      |               |         |            |      |  |  |
| Rated ser                | 13 (1) (100)                            |                  | 250 V (2 switching poles      | )               | [kA]    | 25                       | 36        | 55      |       |       |          | 36            | 55       | 85      | 36            | 55      | 85         | 10   |  |  |
| short-circ               |   | DC               | 500 V (3 switching poles      |                 | [kA]    | 25                       | 36        | 55      |       |       |          |               |          |         | 36            | 55      | 85         | 10   |  |  |
| breaking i               | capacity DC                             |                  | 600 V (4 switching poles      |                 | [kA]    | 8                        | 16        | 25      |       |       |          |               |          |         | 16            | 25      | 36         | 55   |  |  |
|                          | -                                       | T non-adjustab   |                               | 7. E.           |         |                          |           |         |       |       |          |               |          |         |               |         |            |      |  |  |
| Trip unit                | Thermal-<br>magnetic                    | T adjustable, M  | I non-adjustable T            | M220 A          | TFM     |                          |           |         |       |       |          |               |          |         |               |         |            |      |  |  |
|                          | magnetic                                | T adjustable, M  | 1 adjustable T                |                 |         |                          |           |         |       |       |          |               |          |         |               |         |            |      |  |  |
|                          | Mechanical <sup>2)</sup>                |                  |                               |                 |         | 20000                    |           |         | 20000 |       |          | 20000         |          |         | 20000         |         |            |      |  |  |
| Service                  |   |                  | 380 415 V S                   | witching        | cycles  | 8000                     |           |         | 8000  |       |          | 8000          |          |         | 8000          |         |            |      |  |  |
| life                     | Electrical                              | 50 / 60 Hz       | I <sub>n</sub> /2 380 415 V S | witching        | cycles  | 16000<br>8000            |           |         |       | 16000 |          | 16000<br>8000 |          |         | 16000<br>8000 |         |            |      |  |  |
|                          |   |                  | 690 V S                       | witching        | cycles  |                          |           |         |       | 8000  |          |               |          |         |               |         |            |      |  |  |
| Switching                | frequency                               |                  | Switchi                       | ng cycle        | es/hour |                          | 120       |         |       | 120   |          | 120 120       |          |         |               |         |            |      |  |  |
| Power los                | ss at max, rated                        | current per pole |                               |                 |         | see chapter "Power loss" |           |         |       |       |          |               |          |         |               |         |            |      |  |  |
| General                  | information                             |                  |                               |                 |         |                          |           |         |       |       |          |               |          |         |               |         |            |      |  |  |
| Standards                | s and specification                     | ons              |                               |                 |         |                          |           |         |       |       | IE       | C 6094        | 7-2      |         |               |         |            |      |  |  |
| Utilization              | category accord                         | ding to IEC 6094 | 7-2                           |                 |         |                          | Α         |         |       | Α     |          |               | Α        |         |               |         | A          |      |  |  |
| Overvolta                | ige category                            |                  |                               |                 |         |                          | IV        |         |       | IV    |          |               | IV       |         |               | - 1     | ٧          |      |  |  |
| Pollution                | degree accordin                         | g to IEC 60684-1 | E .                           |                 |         |                          | 3         |         |       | 3     |          |               | 3        |         |               |         | 3          |      |  |  |
| Power an                 | d infeed directio                       | n                |                               |                 |         |                          |           |         |       |       |          | Variabl       | е        |         |               |         |            |      |  |  |
| Standard                 | connection syst                         | em               |                               |                 |         |                          |           |         |       | Scre  | w-type t | ermina        | , box te | rminal  |               |         |            |      |  |  |
| Versions                 |   |                  |                               |                 |         |                          |           |         |       | Fixed |          |               |          |         |               |         | plug-ir    | 1    |  |  |
|                          | features accordin                       | -                |                               |                 |         |                          |           | 1       |       |       |          |               |          |         |               |         |            |      |  |  |
| Dimensio                 | ons and weight                          | S                |                               |                 |         |                          |           |         |       |       |          |               |          |         |               |         |            |      |  |  |
| Dimensi                  |   | Width [A]        |                               |                 | [mm]    | 76.2 (                   | 3p) / 101 | .6 (4p) |       | 25.4  |          |               | 50.8     |         | 76            | .2 (3p) | 101.6      | (4p) |  |  |
| Dimension<br>fixed-mou   |   | Height [B]       |                               |                 | [mm]    |                          | 130       |         |       | 130   |          |               | 130      |         |               | 1       | 30         |      |  |  |
|                          | connections                             | Depth [C], with  | out handle                    |                 | [mm]    |                          | 70        |         |       | 70    |          |               | 70       |         |               |         | 70         |      |  |  |
|                          |   | Depth [D], with  |                               | 85 85           |         |                          |           |         |       | 85    |          |               |          | 35      |               |         |            |      |  |  |
| Weight                   |   |                  |                               |                 | [kg]    |                          | 0.90 (3p  |         |       | 0.35  |          |               | 0.60     |         |               | 0.90    | (3p)       |      |  |  |
| reigni                   |   |                  |                               |                 | [49]    |                          | 1.15 (4p  | )       |       | 0.00  |          |               | 0.00     |         |               | 1.15    | 1.15 (4p)  |      |  |  |

 $I_n$  125 A, 160 A:  $I_{cu}$  /  $I_{cs}$  = 36 kA / 36 kA

<sup>&</sup>lt;sup>2)</sup> Operating cycles C - O

| 3VA mol                               | lded case circ   | uit switchings              | for line prot                               | ection                |                 |                      |                          |            |         | 3VA1         | molded  | case ci              | rcuit swi  | tchings |          |           |     |  |
|---------------------------------------|--|-----------------------------|---|-----------------------|-----------------|----------------------|--------------------------|------------|---------|--------------|---|----------------------|------------|---------|----------|-----------|-----|--|
|                                       |  | ics according t             |   |                       |                 |                      |                          | 3VA12      |         |              | 3V  | A13                  |            |         | 3V       | A14       |     |  |
|                                       |  |                             |   |                       |                 |                      |                          | 250 A      |         |              | No.   | 0 A                  |            | 630 A   |          |           |     |  |
| Number o                              |  |                             |   |                       |                 |                      |                          | 3, 4       |         |              |   | , 4                  |            | 3, 4    |          |           |     |  |
| Rated ope                             | erational current  |                             |   |                       | I <sub>n</sub>  | [A]                  |                          | 160 25     | 0       |              | -   | 400                  | 500 630    |         |          |           |     |  |
| Rated ope                             |  | AC 50 / 60 Hz               |   |                       | U.              | [V]                  |                          | 690        |         |              |   | 90                   |            | 690     |          |           |     |  |
| voltage, n                            | Andrew State of the Control of the C | DC                          |   |                       | U.              | [V]                  | ,                        | 600        |         |              |   | 00                   |            |         |          | 00        |     |  |
|                                       | ulation voltage  |                             |   |                       | U               | [V]<br>[kV]          |                          | 800        |         |              |   | 00                   |            |         |          | 00        |     |  |
|                                       | oulse withstand  | voltage                     | 8   |                       |                 |                      |                          | 8          |         |              |   | 8                    |            |         |          |           |     |  |
| Use in IT                             | NATIONAL PROPERTY AND THE REAL PROPERTY AND THE PERTY AND  |                             |   |                       | •               |                      |                          |            | •       |              |   |                      | •          |         |          |           |     |  |
| Frequenc                              | У  |                             |   |                       | [Hz]            | 0 400                |                          |            |         | - 5000       | . 400   | 1920                 |            | 1000    | . 400    |           |     |  |
|                                       |  |                             |   | 1997-                 | 70              |                      | S                        | М          | н       | S            | М   | Н                    | С          | S       | М        | Н         | C   |  |
|                                       |  |                             | 220 240                                     |                       | l <sub>ou</sub> | [kA]                 | 55                       | 85         | 100     | 55           | 85  | 100                  | 200        | 55      | 85       | 100       | 200 |  |
| Rated ulti                            |  |                             | 380 415                                     | V                     | lou             | [kA]                 | 36                       | 55         | 70      | 36           | 55  | 70                   | 110        | 36      | 55       | 70        | 110 |  |
| short-circ                            |  | AC 50 / 60 Hz               |   |                       | Icu             | [kA]                 | 25                       | 36         | 36      |              |   |                      |            |         |          |           |     |  |
| breaking (                            | capacity AC  |                             | 500 V                                       |                       | lou             | [kA]                 | 10                       | 15         | 15      | 25           | 36  | 55                   | 70         | 25      | 36       | 55        | 70  |  |
|                                       |  |                             | 690 V                                       |                       | l <sub>cu</sub> | [kA]                 | 7                        | 10         | 10      | 7            | 7   | 10                   | 10         | 7       | 7        | 10        | 10  |  |
|                                       |  |                             | 220 240                                     |                       | l <sub>cs</sub> | [kA]                 | 55                       | 85         | 100     | 55           | 85  | 100                  | 200        | 55      | 85       | 100       | 200 |  |
| Rated ser                             | vice   |                             | 380 415                                     | ٧                     | Ics             | [kA]                 | 36                       | 55         | 70      | 36           | 55  | 70                   | 110        | 36      | 55       | 70        | 110 |  |
| short-circu                           |  | AC 50 / 60 Hz               |   |                       | l <sub>os</sub> | [kA]                 | 25                       | 36         | 36      |              |   |                      |            |         |          |           |     |  |
| breaking capacity AC                  |  |                             | 500 V                                       |                       | CB              | [kA]                 | 10                       | 10         | 10      | 25           | 36  | 55                   | 70         | 25      | 36       | 55        | 70  |  |
|                                       |  |                             | 690 V                                       |                       | I <sub>cs</sub> | [kA]                 | 5                        | 5          | 5       | 5            | 5   | 6                    | 6          | 5       | 5        | 6         | 6   |  |
| Rated ultimate                        |  |                             | 125 V (1 sv                                 | vitching pole)        | lou             | [kA]                 |                          |            |         |              |   |                      |            |         |          |           |     |  |
| short-circuit<br>breaking capacity DC |  | DC                          | 250 V (2 sv                                 | vitching poles)       | l <sub>cu</sub> | [kA]                 | 55                       | 85         | 100     | 8            | 16  | 25                   | 25         | 8       | 16       | 25        | 25  |  |
|                                       |  | DC                          | 500 V (3 sv                                 | vitching poles)       | 1 <sub>cu</sub> | [kA]                 | 55                       | 85         | 100     | 8            | 16  | 25                   | 25         | 8       | 16       | 25        | 25  |  |
|                                       |  |                             | 600 V (4 sv                                 | vitching poles)       | I <sub>cu</sub> | [kA]                 | 25                       | 36         | 55      | 8            | 16  | 25                   | 25         | 8       | 16       | 25        | 25  |  |
|                                       | 0.000  |                             | 125 V (1 sv                                 | vitching pole)        | l <sub>cs</sub> | [kA]                 |                          |            |         |              |   |                      |            |         |          |           |     |  |
| Rated ser                             |  | DC                          | 250 V (2 sv                                 | vitching poles)       | 1,              | [kA]                 | 55                       | 85         | 100     | 8            | 16  | 25                   | 25         | 8       | 16       | 25        | 25  |  |
| short-circu                           | capacity DC  | DC                          | 500 V (3 sv                                 | vitching poles)       | I.              | [kA]                 | 55                       | 85         | 100     | 8            | 16  | 25                   | 25         | 8       | 16       | 25        | 25  |  |
| Dieaking (                            | capacity DC  |                             | 600 V (4 sv                                 | vitching poles)       | 1               | [kA]                 | 25                       | 36         | 55      | 8            | 16  | 25                   | 25         | 8       | 16       | 25        | 25  |  |
|                                       |  | T non-adjustat              | non-adjustable, M non-adjustable TM210 FTFM |                       |                 |                      |                          |            |         |              |   |                      |            |         |          |           |     |  |
| Trip unit                             | Thermal-<br>magnetic   | T adjustable, N             | M non-adjustable TM220 ATFM                 |                       |                 |                      |                          |            |         |              |   |                      |            |         |          |           |     |  |
|                                       | magnetic   | T adjustable, N             | A adjustable                                | TI                    | M240 /          | MATA                 |                          |            |         |              |   |                      |            |         |          |           |     |  |
|                                       | Mechanical <sup>2)</sup>   |                             |   |                       |                 |                      | 15000                    |            |         |              | 15  | 000                  | 15000      |         |          |           |     |  |
| Service                               |  |                             | 380   | 415 V S               | witchin         | g cycles             |                          | 8000       |         |              | 60  | 000                  | 4000       |         |          |           |     |  |
| life                                  | Electrical   | 50 / 60 Hz                  | 1,/2 380 415 V S                            |                       |                 |                      | 15000                    |            |         | 12000        |   |                      |            | 12000   |          |           |     |  |
|                                       |  |                             | 690   |                       |                 | g cycles             | 5000                     |            |         |              | 60  | 000                  | On request |         |          |           |     |  |
| Switching                             | frequency  |                             |   | Switching cycles/hour |                 |                      |                          | 120        |         |              | 1   | 20                   |            | 120     |          |           |     |  |
| NAME OF TAXABLE PARTY.                | The state of the s | current per pole            |   | 1,350,0135001         |                 |                      | see chapter "Power loss" |            |         |              |   |                      |            |         |          |           |     |  |
|                                       | information  | Victoria.                   |   |                       |                 |                      |                          |            |         |              |   |                      |            |         |          |           |     |  |
|                                       | s and specificati  | ons                         |   |                       |                 |                      |                          |            |         |              | 16  | EC 60947             | -2         |         |          |           |     |  |
|                                       | comprehensive for a principal of the latest and reserves   | ding to IEC 6094            | 7-2   |                       |                 |                      |                          | Α          |         |              |   | A                    |            |         |          | A         |     |  |
|                                       | ge category  |                             | (M) ( <del>T)</del> )                       |                       |                 |                      |                          | IV         |         |              |   | V                    |            |         |          | V         |     |  |
|                                       |  | g to IEC 60684-             | 1   |                       |                 |                      |                          | 3          |         |              |   | 3                    |            |         |          | 3         |     |  |
|                                       | d infeed direction   | T-                          |   |                       |                 |                      |                          |            |         |              |   | Variable             |            |         |          |           |     |  |
|                                       | connection syst  |                             |   |                       |                 |                      |                          |            |         | Sci          | rew-type  |                      | box term   | inal    |          |           |     |  |
| Versions                              |  |                             |   |                       |                 | -                    | -                        |            |         |              |   | plug-in /            |            | 111041  |          |           |     |  |
|                                       | solating features according to IEC 60947   |                             |   |                       |                 |                      |                          |            |         |              |   |                      |            |         |          |           |     |  |
|                                       | ons and weight   |                             |   |                       |                 |                      |                          |            |         |              |   |                      |            |         |          |           |     |  |
| ·                                     | Jano noigin  | Width [A]                   |   |                       |                 | [mm]                 | 105                      | (3p) / 140 | ) (4p)  |              | 138 (3n)  | / 184 (4p            | 1          |         | 138 (3n) | / 184 (4p | 0)  |  |
| Dimension                             |  | Height [B]                  |   |                       |                 | [mm]                 | ,00                      | 158        | - (417) |              | TO COMPANY OF THE PARTY OF THE | 48                   | ,          |         |          | 48        | 7   |  |
| fixed-mou                             |  | Depth [C], with             | out handle                                  |                       |                 | [mm]                 |                          | 70         |         |              |   | 10                   |            |         |          | 10        |     |  |
| standard (                            | connections  |                             |   |                       |                 | [mm]                 |                          | 93         |         |              |   | 7.5                  |            |         |          | 37.5      |     |  |
|                                       |  | Depth [D], with handle [mm] |   |                       |                 |                      |                          | 1.4 (3p)   | X.      |              |   | (3p)                 |            |         |          |           |     |  |
| Weight [kg]                           |  |                             |   |                       |                 | 1.4 (3p)<br>1.8 (4p) |                          |            |         | (3p)<br>(4p) |   | 4.9 (3p)<br>6.8 (4p) |            |         |          |           |     |  |

 $I_n$  125 A, 160 A:  $I_{cu}$  /  $I_{cs}$  = 36 kA / 36 kA

For the rated ultimate short-circuit breaking capacity and rated service short-circuit breaking capacity with direct current, see chapter DC network applications of 3VA molded case circuit breakers (Page 172) .

<sup>2)</sup> Operating cycles C - O

|  |                 |                  | for line prote                                      |        |                  |        |       |           |            | 3\   | A2 mo    | lded cas               |            | it break | ers            |        |      |    |  |  |
|--|-----------------|------------------|---|--------|------------------|--------|-------|-----------|------------|------|----------|------------------------|------------|----------|----------------|--------|------|----|--|--|
| Electrica  | al characteri   | stics accordin   | ig to IEC 6094                                      | 7-2    |                  |        |       |           | V20<br>0 A |      |          |                        | A21<br>0 A |          | 3VA22<br>250 A |        |      |    |  |  |
| Number o   | of poles        |                  |   |        |                  |        |       | 3         | . 4        |      |          | 3,                     | 4          | 3, 4     |                |        |      |    |  |  |
|  | erational curre | ent              |   |        | 1                | [A]    |       |           | . 100      |      |          |                        | . 160      | 160 250  |                |        |      |    |  |  |
| Rated ope  |                 | AC 50 / 60 Hz    |   |        | Ů,               | [V]    |       |           | 90         |      |          |                        | 90         |          |                | 6      | 90   |    |  |  |
| voltage, n   |                 | DC               |   |        | U.               | [V]    |       |           |            |      |          |                        |            |          |                |        |      |    |  |  |
| Rated ins  | ulation voltag  | е                |   |        | U                | [V]    |       | 8         | 00         |      |          | 8                      | 00         |          | 800            |        |      |    |  |  |
| Rated imp  | oulse withstan  | d voltage        |   |        | U <sub>imp</sub> | [kV]   |       |           | 8          |      |          |                        | В          |          |                |        | 8    |    |  |  |
| Use in IT  | systems         | 30               |   |        | 0.005.0          |        |       |           |            |      |          |                        |            |          |                |        |      |    |  |  |
| Frequenc   | у               |                  |   |        |                  | [Hz]   |       | 17,755717 | 60         |      |          |                        | 60         |          |                |        | 60   |    |  |  |
|  |                 |                  |   |        |                  |        | M     | Н         | С          | L    | М        | н                      | С          | L        | M              | н      | С    | L  |  |  |
|  |                 |                  | 220 240 V   |        | l <sub>ou</sub>  | [kA]   | 85    | 110       | 150        | 200  | 85       | 110                    | 150        | 200      | 85             | 110    | 150  | 20 |  |  |
| Rated ulti   |                 |                  | 380 415 V   |        | l <sub>cu</sub>  | [kA]   | 55    | 85        | 110        | 150  | 55       | 85                     | 110        | 150      | 55             | 85     | 110  | 15 |  |  |
| short-circ   |                 | AC 50/60 Hz      |   |        | l <sub>cu</sub>  | [kA]   | 55    | 85        | 110        | 150  | 55       | 85                     | 110        | 150      | 55             | 85     | 110  | 15 |  |  |
| breaking (   | capacity AC     |                  | 500 V   |        | 1,               | [kA]   | 36    | 55        | 85         | 100  | 36       | 55                     | 85         | 100      | 36             | 55     | 85   | 10 |  |  |
|  |                 |                  | 690 V   |        | l <sub>ou</sub>  | [kA]   | 2     | 2         | 2          | 24   | 2.5      | 2.5                    | 2.5        | 24       | 3              | 3      | 3    | 24 |  |  |
|  |                 |                  | 220 240 V   |        | l <sub>es</sub>  | [kA]   | 85    | 110       | 150        | 200  | 85       | 110                    | 150        | 200      | 85             | 110    | 150  | 20 |  |  |
| Rated service<br>short-circuit<br>breaking capacity AC |                 |                  | 380 415 V   |        | l <sub>cs</sub>  | [kA]   | 55    | 85        | 110        | 150  | 55       | 85                     | 110        | 150      | 55             | 85     | 110  | 15 |  |  |
|  |                 | AC 50/60 Hz      | 440 V   |        | l <sub>cs</sub>  | [kA]   | 55    | 85        | 110        | 150  | 55       | 85                     | 110        | 150      | 55             | 85     | 110  | 15 |  |  |
|  |                 |                  | 500 V   |        | l <sub>es</sub>  | [kA]   | 36    | 55        | 85         | 100  | 36       | 55                     | 85         | 100      | 36             | 55     | 85   | 10 |  |  |
|  |                 |                  | 690 V   |        | I <sub>cs</sub>  | [kA]   | 2     | 2         | 2          | 18   | 2.5      | 2.5                    | 2.5        | 18       | 3              | 3      | 3    | 18 |  |  |
| Trip unit  | Electronic      |                  | ETU320 LI, ET<br>ETU350 LSI                         | J330 I | LIG,             |        |       |           | •          |      |          |                        | •          |          |                |        | • () |    |  |  |
| Trip unit  |                 |                  | ETU550 LSI, ETU560 LSIG,<br>ETU850 LSI, ETU860 LSIG |        |                  |        |       |           | •          |      |          |                        | •          |          |                |        | •    |    |  |  |
|  | Mechanical      | 1                |   |        |                  |        |       |           | 000        |      |          |                        | 000        | 20000    |                |        |      |    |  |  |
| Service  |                 | 50 / 60 Hz       |   |        | Switching        |        |       |           | 000        |      | 12000    |                        |            |          | 10000          |        |      |    |  |  |
| life   | Electrical      |                  | 1,/2 380 4  |        | Color Charles    |        | 20000 |           |            |      | 30000    |                        |            |          | 15000          |        |      |    |  |  |
|  |                 |                  | 690 V   |        | Switching        |        |       |           | 000        |      |          |                        | 000        | 5000     |                |        |      |    |  |  |
|  | frequency       |                  |   | Switch | hing cycle       | s/hour |       | 120 120   |            |      |          |                        |            |          |                | 1.     | 20   |    |  |  |
|  |                 | ed current per p | ole   |        |                  |        |       |           |            |      | see      | chapter                | "Power I   | oss"     |                |        |      |    |  |  |
| STATE OF TAXABLE PARTY.                                | information     |                  |   |        |                  |        |       |           |            |      |          |                        | -          |          |                |        |      |    |  |  |
|  | s and specific  |                  |   |        |                  |        |       |           |            |      |          |                        | 0947-2     |          |                |        |      |    |  |  |
|  |                 | ording to IEC 6  | 0947-2  |        |                  |        |       |           | A          |      |          |                        | A          |          |                |        | A    |    |  |  |
|  | ge category     |                  | V. 1. 2.1   |        |                  |        |       |           | V          |      |          | - 10                   | ٧          |          |                |        | V    |    |  |  |
|  |                 | ding to IEC 6068 | 34-1  |        |                  |        |       |           | 3          |      |          |                        | 3          |          |                | ,      | 3    |    |  |  |
|  | d infeed direc  |                  |   |        |                  |        |       |           |            |      |          |                        | iable      |          |                |        |      |    |  |  |
|  | connection sy   | ystem            |   |        |                  |        |       |           |            |      |          | ype term               |            |          | <u></u>        |        |      |    |  |  |
| Versions   |                 |                  |   |        |                  |        |       |           |            |      | Fix      | ed / plug-             |            | -out     |                |        |      |    |  |  |
|  |                 | rding to IEC 609 | 147   |        |                  |        |       |           |            |      |          |                        |            |          |                |        | •    |    |  |  |
| Dimensio   | ons and weig    |                  |   |        |                  |        |       | 105 10    |            |      |          |                        |            |          |                | 105 10 |      |    |  |  |
| Dimension  | manalana        |                  |   |        | [mm]             |        |       | / 140 (4p | )          |      | 105 (3p) | Control of the Control | ))         |          | 105 (3p)       |        | 0)   |    |  |  |
| fixed-mou  |                 | Height [B]       | 200 V 200 200 200 200 200 200 200 200 20            |        |                  | [mm]   |       |           | 81         |      | 181      |                        |            |          |                |        | 81   |    |  |  |
| standard (   | connections     | Depth [C], with  |   |        |                  | [mm]   |       |           | 36         |      |          |                        | 6          |          |                |        | 36   |    |  |  |
|  |                 | Depth [D], with  | n handle  |        |                  | [mm]   |       |           | 07         |      |          |                        | 07         |          | 107            |        |      |    |  |  |
| Weight [kg]  |                 |                  |   |        |                  | 3.20   | (3p)  |           |            | 3.20 | (3p)     | 3.20 (3p)<br>4.20 (4p) |            |          |                |        |      |    |  |  |

## 3.2 Line protection applications of 3VA molded case circuit breakers

| 3VA mo                        | lded case ci   | ircuit breakers  | s for line protect                 | ion             |                  |                 |            |              | 3VA2       | 2 molded             | d case c  | rcuit bre | akers      |                          |          |    |
|-------------------------------|--|------------------|------------------------------------|-----------------|------------------|-----------------|------------|--------------|------------|----------------------|-----------|-----------|------------|--------------------------|----------|----|
| Electrica                     | al characteri  | stics accordir   | ng to IEC 60947                    | -2              |                  |                 |            | A23          |            |                      |           | A24       |            |                          | 3VA25    |    |
| NI.                           | faulas   |                  |                                    |                 |                  |                 |            | 0 A          |            |                      | 1000      | 0 A       |            |                          | 1000 A   |    |
| Number of                     |  | ant.             |                                    |                 | fA1              | 3, 4<br>250 400 |            |              |            |                      |           |           |            | 3, 4                     | 10       |    |
|                               | erational curre  | AC 50/60 Hz      |                                    | l U             | [A]              | 690             |            |              |            | 400 630              |           |           |            | 630 1000<br>690          |          |    |
| Rated ope<br>voltage, n       |  | DC               |                                    | U.              | [V]              |                 | 0:         | 90           |            | 690                  |           |           |            | 690                      |          |    |
| Th Chick Policy               | ulation voltag   | 17.07.0          |                                    | U               | [V]              |                 | 800        |              |            | 800                  |           |           |            | 800                      |          |    |
|                               | pulse withstan   | 95-5-1           |                                    | U_              | [kV]             |                 |            | В            | -          |                      |           | 8         | -          | 8                        |          |    |
| Use in IT                     |  |                  |                                    |                 |                  |                 |            |              |            |                      |           |           |            |                          |          |    |
| Frequenc                      | у  |                  |                                    |                 | [Hz]             |                 | 50 .       | 60           |            |                      | 50 .      | 60        |            |                          | 50 60    |    |
|                               |  |                  |                                    |                 |                  | M               | Н          | С            | L          | М                    | Н         | С         | L          | M                        | Н        | C  |
|                               |  |                  | 220 240 V                          | l <sub>ou</sub> | [kA]             | 85              | 110        | 150          | O.r.       | 85                   | 110       | 150       | O.r.       | 85                       | 110      | 20 |
| Rated ulti                    | mate   |                  | 380 415 V                          | I <sub>cu</sub> | [kA]             | 55              | 85         | 110          | O.r.       | 55                   | 85        | 110       | O.r.       | 55                       | 85       | 11 |
| short-circ                    |  | AC 50/60 Hz      | 440 V                              | l <sub>o</sub>  | [kA]             | 55              | 85         | 110          | 0.r.       | 55                   | 85        | 110       | O.r.       | O.r.                     | O.r.     | 0. |
| breaking                      | capacity AC  |                  | 500 V                              | I <sub>cu</sub> | [kA]             | 36              | 55         | 85           | O.r.       | 36                   | 55        | 85        | O.r.       | O.r.                     | O.r.     | 0. |
|                               |  |                  | 690 V                              | I <sub>ai</sub> | [kA]             | 5               | 5          | 5            | O.r.       | 6                    | 6         | 6         | O.r.       | 25                       | 35       | 35 |
|                               |  |                  | 220 240 V                          | l <sub>es</sub> | [kA]             | 85              | 110        | 150          | O.r.       | 85                   | 110       | 150       | O.r.       | 85                       | 110      | 15 |
| Rated ser                     | rvice  |                  | 380 415 V                          | 1               | [kA]             | 55              | 85         | 110          | O.r.       | 55                   | 85        | 110       | O.r.       | 55                       | 85       | 11 |
| short-circ                    |  | AC 50/60 Hz      | 440 V                              | ارم             | [kA]             | 55              | 85         | 110          | O.r.       | 55                   | 85        | 110       | O.r.       | O.r.                     | O.r.     | 0. |
| breaking capacity AC          |  |                  | 500 V                              | 1               | [kA]             | 36              | 55         | 65           | O.r.       | 36                   | 55        | 851)      | O.r.       | O.r.                     | O.r.     | 0. |
|                               |  |                  | 690 V                              | 1               | [kA]             | 5               | 5          | 5            | O.r.       | 6                    | 6         | 6         | O.r.       | 19                       | 19       | 19 |
| Trip unit                     | Electronic   |                  | ETU320 LI, ETU3<br>ETU350 LSI      | 30 LIG,         |                  |                 |            |              |            |                      |           | • .       |            |                          | •        |    |
| Trip unit                     | Electronic   |                  | ETU550 LSI, ETU<br>ETU850 LSI, ETU |                 |                  | •               |            |              |            |                      | 9         | •         |            |                          |          |    |
|                               | Mechanical   | N.               |                                    |                 |                  | 15000           |            |              |            | 15000                |           |           |            |                          | 10000    |    |
| Service                       |  |                  | 380 415                            | V Switchin      | Switching cycles |                 | 6000       |              |            | 4000                 |           |           |            | 5000                     |          |    |
| life                          | Electrical   | 50 / 60 Hz       | 1,/2 380 415                       | V Switchin      | ng cycles        |                 |            | 000          |            | 8000                 |           |           |            | -                        |          |    |
|                               |  |                  | 690 V                              |                 | ng cycles        |                 |            | 000          |            | 4000                 |           |           |            | 1000                     |          |    |
|                               | frequency  |                  | 7944                               | vitching cyc    | les/hour         | 120             |            |              |            |                      | 1         |           | 120        |                          |          |    |
|                               |  | ed current per p | ole                                |                 |                  |                 |            |              |            |                      |           |           |            |                          |          |    |
| ALC: USE OF PERSONS ASSESSED. | information  |                  |                                    |                 |                  |                 |            |              |            |                      |           |           |            |                          |          |    |
|                               | s and specific   |                  |                                    |                 |                  |                 |            |              |            |                      |           |           |            |                          |          |    |
| trickel brokenski von         |  | ording to IEC 6  | 0947-2                             |                 |                  |                 |            | Α            |            |                      |           | A         |            |                          | Α        |    |
|                               | ige category   |                  | Wild and a state of                |                 |                  |                 |            | ٧            |            |                      |           | V         |            |                          | IV       |    |
|                               |  | ding to IEC 606  | 84-1                               |                 |                  |                 |            | 3            | 1000       | (6)(6)               | į.        | 3         |            |                          | 3        |    |
|                               | d infeed direc   |                  |                                    |                 |                  |                 |            |              | Vari       |                      |           |           |            |                          | Variable |    |
|                               | connection sy  | ystem            |                                    |                 |                  |                 |            |              |            |                      | w-type te | rminal    |            |                          |          |    |
| Versions                      |  |                  |                                    |                 |                  |                 |            |              | ed / plug- | in / draw-           |           |           |            |                          | Fixed    |    |
|                               | A STATE OF THE STA | rding to IEC 609 | 947                                |                 |                  |                 |            | •            |            |                      |           | •         |            |                          |          |    |
| Dimensions and weights        |  |                  |                                    |                 |                  |                 |            |              |            |                      |           |           |            |                          |          |    |
| Dimensio                      | Width [A]  |                  | [mm]                               |                 |                  | / 184 (4p)      |            |              |            | / 184 (4p)           |           | 210       | (3p) / 280 | (4p)                     |          |    |
|                               | ins,<br>unted with   | Height [B]       |                                    |                 | [mm]             |                 | - 37       | 48           |            |                      |           | 48        |            |                          | 320      |    |
|                               | connections  | Depth [C], with  |                                    |                 | [mm]             |                 |            | 10           |            |                      |           | 10        |            |                          | 120      |    |
|                               | romania esta esta esta Es  | Depth [D], with  | h handle                           |                 | [mm]             |                 |            | 7.5          |            | 137.5                |           |           |            | 253                      |          |    |
| Weight                        |  |                  |                                    |                 | [kg]             |                 | 4.7<br>6.0 | (3p)<br>(4p) |            | 5.2 (3p)<br>6.7 (4p) |           |           |            | 11.35 (3p)<br>15.42 (4p) |          |    |

 $I_n$  400/500 A and  $I_n$  630 A:  $I_{cs}$  = 65 kA

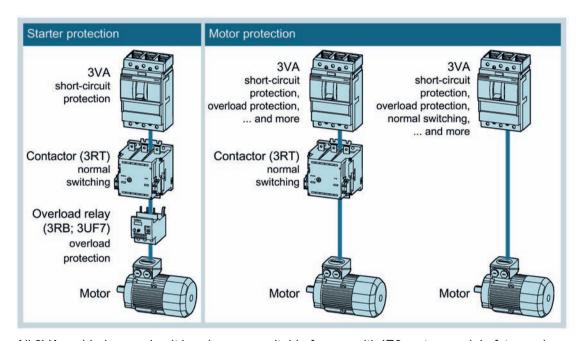
#### O. r. On request

## 3.3 Motor protection applications of 3VA molded case circuit breakers

The main applications for motor protection are:

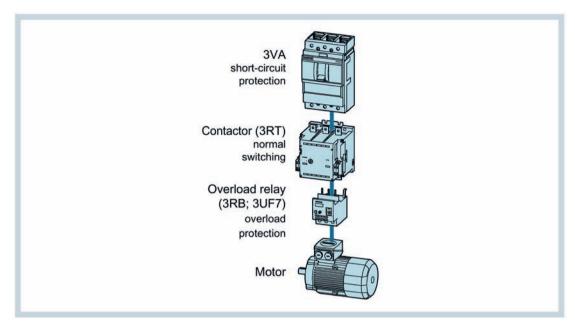
- The 3VA molded case circuit breaker as a starter protection circuit breaker
- The 3VA2 molded case circuit breaker as a motor protection breaker

Overview of possible uses of the 3VA molded case circuit breaker for motor protection:



All 3VA molded case circuit breakers are suitable for use with IE3 motors and, in future, also with IE4 motors.

#### 3.3.1 3VA molded case circuit breakers for starter protection



When the 3VA molded case circuit breaker is used as a starter protection circuit breaker, the 3VA only takes on the short-circuit protection function of the motor feeder. The overload protection of the motor feeder is provided by an overload relay, such as 3RB, or by a motor management device, such as SIMOCODE.

Functional switching is performed by the contactor.

#### Two different device ranges are available for starter protection applications:

- 3VA1 starter protection circuit breaker with a magnetic trip unit for standard motor feeders with a rated conditional short-circuit current I<sub>q</sub> up to 100 kA
- 3VA2 starter protection circuit breaker with electronic trip unit for high-end motor feeders with a rated conditional short-circuit current I<sub>q</sub> up to 150 kA

You will find the tested device combinations in the Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en/view/109483387).

The short-circuit release of the TM110M magnetic trip unit is not adjustable. In this case the short-circuit release is permanently set to 16 times the rated current  $I_n$ .

#### Setting values of the TM110M magnetic trip unit for the 3VA1 molded case circuit breaker:



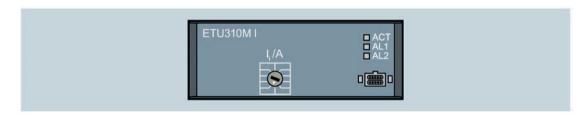
| 2    | Size  | ا<br>[A] | Fixed short-circuit release<br>l <sub>i</sub> [A] |  |
|------|-------|----------|---|--|
|      |       | 1        | 16  |  |
| _    |       | 2        | 32  |  |
| 3VA1 | 160 A | 4        | 64  |  |
| 'n   |       | 8        | 128   |  |
|      |       | 12.5     | 200   |  |

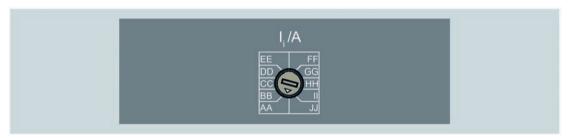
#### Setting values of the TM120M magnetic trip unit for the 3VA1 molded case circuit breaker:



| Size | I,  |                    |                    |                    |                    |                    | Settings            | $s \mid_{i} = x \mid_{n}$ |                     |                     |                     |                     |        |
|------|-----|--------------------|--------------------|--------------------|--------------------|--------------------|---------------------|---------------------------|---------------------|---------------------|---------------------|---------------------|--------|
| Size | [Å] | 5 x l <sub>n</sub> | 6 x I <sub>n</sub> | 7 x l <sub>n</sub> | 8 x I <sub>n</sub> | 9 x I <sub>n</sub> | 10 x I <sub>n</sub> | 11 x l <sub>n</sub>       | 12 x I <sub>n</sub> | 13 x I <sub>n</sub> | 14 x I <sub>n</sub> | 15 x I <sub>n</sub> | 16 x I |
|      | 20  |                    | 3 <del>7</del>     | 140                | 160                | 180                | 200                 | 220                       | 240                 | 260                 | 280                 | 300                 | 320    |
|      | 32  | _                  |                    | 220                | 256                | 288                | 320                 | 352                       | 384                 | 416                 | 448                 | 480                 | 510    |
|      | 40  | -                  | ( <del>-3)</del>   | 280                | 320                | 360                | 400                 | 440                       | 480                 | 520                 | 560                 | 600                 | 640    |
| 4004 | 50  | _                  | a <del></del>      | 350                | 400                | 450                | 500                 | 550                       | 600                 | 650                 | 700                 | 750                 | 800    |
| 160A | 63  | _                  |                    | 440                | 504                | 567                | 630                 | 693                       | 756                 | 819                 | 882                 | 945                 | 1010   |
|      | 80  | -                  | <del></del>        | 560                | 640                | 720                | 800                 | 880                       | 960                 | 1040                | 1120                | 1200                | 1280   |
| 4    | 100 | -                  | -                  | 700                | 800                | 900                | 1000                | 1100                      | 1200                | 1300                | 1400                | 1500                | 1600   |
| SVAT | 125 | -                  | <del></del>        | 875                | 1000               | 1125               | 1250                | 1375                      | 1500                | 1625                | 1750                | 1875                | 2000   |
| 0504 | 160 |                    | P.——2              | 1120               | 1280               | 1440               | 1600                | 1760                      | 1920                | 2080                | 2240                | 2400                | 2560   |
| 250A | 200 | ( <u></u>          | 1200               | 1400               | 1600               | 1800               | 2000                | 2200                      | 2400                | 2600                | 2800                | 2_3                 |        |
| 4004 | 250 | _                  | 12 <u></u>         | _                  | 2000               | 2250               | 2500                | 2750                      | 3000                | 3250                | 3500                | 3750                | 4000   |
| 400A | 320 | -                  | 9_0                | 2240               | 2560               | 2880               | 3200                | 3520                      | 3840                | 4160                | 4480                |                     | 1      |
| 0004 | 400 | -                  | 2400               | 2800               | 3200               | 3600               | 4000                | 4400                      | 4800                | _                   | -                   | _                   | -      |
| 630A | 500 | 2500               | 3000               | 3500               | 4000               | 4500               | 5000                | -                         | -                   | 3-31                | -                   | _                   | -      |

## Setting values of the ETU310M electronic trip unit for the 3VA2 molded case circuit breaker:





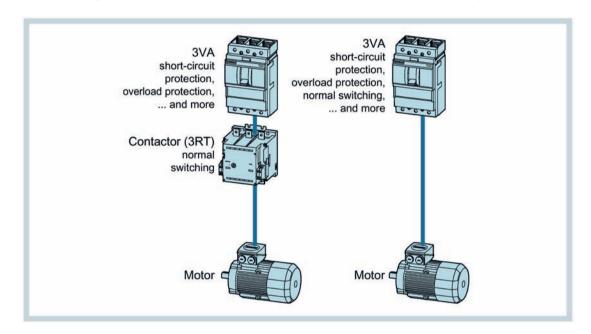
|       | ize   | l,  |      | Settings I <sub>i</sub> [A] |      |      |      |      |      |      |      |      |  |  |  |
|-------|-------|-----|------|-----------------------------|------|------|------|------|------|------|------|------|--|--|--|
| 0     | ize   | [Ä] | AA   | BB                          | СС   | DD   | EE   | FF   | GG   | НН   | ij   | JJ   |  |  |  |
|       |       | 25  | 75   | 100                         | 125  | 150  | 200  | 250  | 300  | 325  | 350  | 375  |  |  |  |
|       | 400 4 | 40  | 120  | 160                         | 200  | 240  | 320  | 400  | 480  | 520  | 560  | 600  |  |  |  |
|       | 160 A | 63  | 189  | 252                         | 315  | 378  | 504  | 630  | 756  | 819  | 882  | 945  |  |  |  |
| 01 () |       | 100 | 300  | 400                         | 500  | 600  | 800  | 1000 | 1200 | 1300 | 1400 | 1500 |  |  |  |
| 3VA2  | 050.4 | 160 | 480  | 640                         | 800  | 960  | 1280 | 1600 | 1920 | 2080 | 2240 | 2400 |  |  |  |
| რ ≥   | 250 A | 200 | 600  | 800                         | 1000 | 1200 | 1600 | 2000 | 2400 | 2600 | 2800 | 3000 |  |  |  |
|       | 400 A | 250 | 750  | 1000                        | 1250 | 1500 | 2000 | 2500 | 3000 | 3250 | 3500 | 3750 |  |  |  |
|       | COO A | 400 | 1200 | 1600                        | 2000 | 2400 | 3200 | 4000 | 4800 | 5200 | 5600 | 6000 |  |  |  |
|       | 630 A | 500 | 1500 | 2000                        | 2500 | 3000 | 4000 | 5000 | 6000 | 6500 | 7000 | 7500 |  |  |  |

## 3.3.2 3VA molded case circuit breakers for motor protection

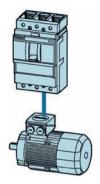
The 3VA2 molded case circuit breakers for motor protection are designed for optimal protection and direct-on-line starting of three-phase squirrel-cage motors.

#### Possible uses

- 3VA2 motor protection circuit breaker up to 500 A, tested according to IEC EN 60947-4-1
- 3VA2 motor protection circuit breaker as motor protection combination, 3VA2 with 3RT Overview of possible uses of the 3VA2 molded case circuit breaker for motor protection:



## 3.3.2.1 3VA2 motor protection circuit breaker up to 500 A, tested according to IEC EN 60947-4-1



As the 3VA2 molded case circuit breakers have been tested according to standard IEC EN 60947-4-1 (as motor starters), these devices can also be used as motor protection circuit breakers without an additional contactor. In this case the 3VA2 motor protection breaker takes on the short-circuit protection and overload protection functions in addition to functional switching (ON/OFF) of the motor.

However, as functional switching of the motor according to utilization category AC-3 reduces the electrical service life of the circuit breaker, this use is only suitable for applications with a low switching frequency. The maximum adjustable rated current of the circuit breaker is also restricted by the increased AC-3 requirements.

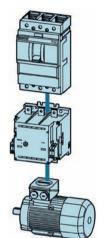
#### Dependence of motor protection circuit breaker on motor size and electrical service life

| Article No.  | Setting range<br>of overload<br>release | Standard three-phase<br>motor<br>4-pole at 400 V AC 1) |       | Elec. endurance of circuit breaker | setting o | current<br>of feeder<br>C3) | Rated conditional short-circuit current 2) |  |  |
|--------------|---|--|-------|------------------------------------|-----------|-----------------------------|--|--|--|
|              | [A]                                     | P [kW]   | I [A] | Operating cycles (AC3)             | IE2 [A]   | IE3 [A]                     | ا <sub>ه</sub> [kA]                        |  |  |
| 3VA2125M.3   | 10 25                                   | 11   | 22    |                                    | 23        | 23                          |  |  |  |
| 3VA2140M.3   | 16 40                                   | 18.5   | 35    | 10000                              | 37        | 37                          |  |  |  |
| 0)/40400 140 | 25 63                                   | 22   | 41    |                                    | 43        | 43                          |  |  |  |
| 3VA2163M.3   | 25 63                                   | 30   | 55    | 7500                               | 58        | 58                          |  |  |  |
|              |   | 37   | 66    |                                    | 69        | 69                          |  |  |  |
| 3VA2110M.3   | 40 100                                  | 45   | 80    | 5000                               | 84        | 84                          | 55.105                                     |  |  |
|              |   | 55   | 97    |                                    | 100       | 100                         | 55 / 85                                    |  |  |
| 3VA2216M.3   | 63 160                                  | 75   | 132   | 6500                               | 139       | 139                         |  |  |  |
| 0)/A000F M 0 | 100 050                                 | 90   | 160   | 4000                               | 005       | 205                         |  |  |  |
| 3VA2325M.3   | 100 250                                 | 110  | 195   | 4000                               | 205       | 205                         |  |  |  |
| 3VA2440M.3   | 160 400                                 | 160  | 280   | 3000                               | 295       | 295                         |  |  |  |
| 3VA2450M.3   | 200 500                                 | 200  | 350   | 2500                               | 368 368   |                             |  |  |  |

- Guide value for 4-pole standard motors at 400 V AC, 50 Hz. Selection depends on the specific startup and rated data of the protected motor
- 2) Rated conditional short-circuit current:
  - I<sub>q</sub> = 55 kA circuit breaker with medium breaking capacity M
  - I<sub>q</sub> = 85 kA circuit breaker with very high breaking capacity C

#### 3.3.2.2

#### 3VA2 motor protection breaker as tested motor protection combination, 3VA2 with 3RT



The 3VA2 motor protection circuit breakers with 3RT contactors and 3RW soft starters were tested as a motor protection combination for standard applications.

In this case, the 3VA2 molded case circuit breaker takes on the protection functions, short-circuit protection and overload protection, and the 3RT contactor or the soft starter is responsible for functional switching (ON/OFF) of the motor.

You will find the tested device combinations in the Siemens Industry Online Portal (https://support.industry.siemens.com/cs/ww/en/view/109483387).

#### 3.3.2.3 Protection functions of 3VA2 molded case circuit breakers for motor protection

Different trip unit variants are available for the 3VA2 molded case circuit breaker. These vary according to functionality and protection functions.

#### Overview of the ETU versions

| Protection                       |                     | ETU350M                      | ETU550M                                | ETU860M                                |
|----------------------------------|---------------------|------------------------------|--|--|
| Overload (L)                     |                     |                              |  |  |
| Short-time delayed short-(S)     | -circuit protection |                              |  |  |
| Instantaneous short-circu        | it protection (I)   | 15 x I <sub>n</sub>          | 3 15 x I <sub>n</sub>                  | 3 15 x I <sub>n</sub>                  |
| Ground-fault protection (        | G)                  | _                            |  |  |
| Additional functions             |                     |                              |  |  |
| Adjustable motor current         | I <sub>e</sub>      | via rotary selector switches | via buttons on display in steps of 1 A | via buttons on display in steps of 1 A |
| Thermal memory                   |                     |                              |  |  |
| Protection against phase         | unbalance           | 40% fixed                    | 5 50%<br>(default setting: 40%)        | 5 50%<br>(default setting: 40%)        |
| Tripping time on phase           | On startup          | 0.7 s fixed                  | 0.7 60 s<br>(default setting: 0.7 s)   | 0.7 60 s<br>(default setting: 0.7 s)   |
| unbalance 1)                     | In normal operation | 4 s fixed                    | 4 420 s<br>(default setting: 4 s)      | 4 420 s<br>(default setting: 4 s)      |
| Communication option             |                     | _                            | -                                      |  |
| Switching classes T <sub>c</sub> |                     | 10A, 10 / 10E<br>20 / 20E    | 10A, 10 / 10E<br>20 / 20E, 30 / 30E    | 10A, 10 / 10E<br>20 / 20E, 30 / 30E    |
| Integrated power measur          | ement               | -                            | -                                      |  |
| Blocking protection / idle       | running protection  | <u></u>                      | <u></u>                                |  |

Adjustable tripping times with phase unbalance in firmware version 4.3 and higher.

#### Thermal memory

All 3VA2 molded case circuit breakers for motor applications have a "thermal memory" which takes the pre-loading of the three-phase asynchronous motor into account. The tripping times of the inverse-time delayed overload releases are only valid for the unloaded (cold) state.

The pre-loading of the 3-phase motor must be taken into consideration in order to prevent damage to the motor, e.g. from being frequently switched on without sufficient cooling time.

#### Principle of operation

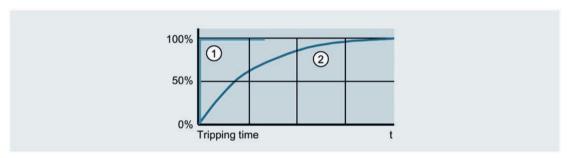
All 3VA2 molded case circuit breakers for motor protection have a thermal model of the motor integrated in the electronic trip unit. This reduces the response time of the molded case circuit breaker with a thermal memory such that further overloads cannot damage the motor windings. The motor is switched off within a time limit determined by the thermal preloading, see curve ② in the figure below (response time of the trip unit after overload trip).

An overload may also be the next inrush current of the motor.

After an overcurrent trip, the trip times are reduced according to the tripping characteristic.

A cooling time determined by the size of the motor is required before the motor can be switched on again. This prevents the motor from being thermally overloaded by a current after an overload trip.

Response time of the trip unit after overload trip:



- without thermal memory
- 2 with thermal memory

#### Protection against phase unbalance

All 3VA2 molded case circuit breakers for motor protection have protection against unbalanced current loading of the motor. This ensures that the motor is reliably protected against overheating if a phase failure or major fluctuation of a phase current occurs.

The phase unbalance ratio is calculated from the mean value of the three phases L1, L2 and L3 and the highest possible phase current deviating from this. If the phase unbalance ratio exceeds the set value, the circuit breaker trips according to tripping time t<sub>unbal</sub>. With ETU350M, the t<sub>unbal</sub> tripping times are permanently set to 0.7 s for startup and to 4 s for continuous operation. With ETU550M and ETU860M, the t<sub>unbal</sub> tripping times for startup can be set from 0.7 s to 60 s and for continuous operation from 4 s to 420 s. The lowest value is always set as a factory default.

The adjustable tripping time can be used for operation with soft starters, for 2-phase phaseangle control or DC braking with soft starters.

Calculation formulas:

$$I_{unbal} = \frac{(I_1 + I_2 + I_3)}{3}$$
Unbalance ratio = 
$$\frac{\underset{i=1}{\text{Max}} |I_i - I_{unbal}|}{I_{unbal}}$$

I<sub>MW</sub> Mean value of the three phase currents

l<sub>i</sub> One phase current

With the ETU350M trip unit version, the unbalance ratio is permanently set to 40%.

With the ETU550M and ETU860M trip unit versions, the unbalance ratio can be set freely between 5% and 50%. The default setting of 40% is set at the factory.

#### Trip classes Tc

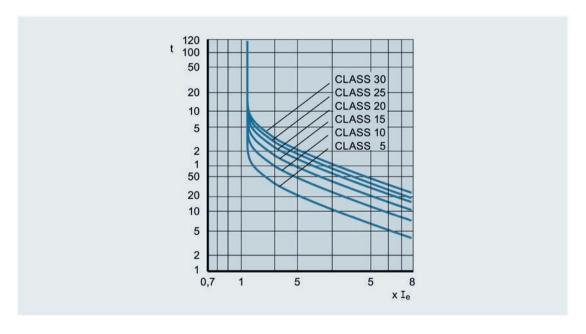
The trip class  $T_c$  specifies the tripping time  $T_p$  for balanced 3-pole loads, starting from the cold state, with 7.2 times the set current  $I_r$  according to IEC EN 60947 4-1. Combinations with class 10 are normally used.

The trip classes with "E" indicate a narrower tolerance band of tripping time T<sub>p</sub>. These trip classes can also be implemented with the precise electronic trip units of the 3VA2 motor protection circuit breakers.

| CLASS | Tripping time <sup>1)</sup>  |
|-------|------------------------------|
| 5     | 0,5 s < T <sub>p</sub> < 5 s |
| 10A   | 2 s < T <sub>p</sub> < 10 s  |
| 10    | 4 s < T <sub>p</sub> < 10 s  |
| 10E   | 5 s < T <sub>p</sub> < 10 s  |
| 20    | 6 s < T <sub>p</sub> < 20 s  |
| 20E   | 10 s < T <sub>p</sub> < 20 s |
| 30    | 9 s < T <sub>p</sub> < 30 s  |
| 30E   | 20 s < T <sub>p</sub> < 30 s |

<sup>1)</sup> The overload protection device must trip within these times.

Tripping characteristic for 3-pole symmetrical load:



3.3 Motor protection applications of 3VA molded case circuit breakers

#### **Blocking protection**

The 3VA2 molded case circuit breakers with the ETU860M motor protection trip unit now have blocking protection integrated in the circuit breaker for the first time.

If the motor is blocked (or if it falls short of the breakdown torque), a high motor current - almost as high as the starting current but still not as high as a short-circuit current - is generated. Without blocking protection, it can take up to 30 s or even longer (depending on the current and T<sub>P</sub> settings) for the molded case circuit breaker to trip. This results in unnecessary thermal stress.

Blocking protection is automatically deactivated during startup until the motor reaches operating speed  $(t_{\text{start}})$ .

t<sub>start</sub> is equal to t<sub>b</sub>.

Typical application examples for this include:

- Rock crushers (rock too large or too hard)
- Conveyor belts (transported goods jammed)

| Protection                              | ETU860M  |
|---|--|
| l <sub>b</sub> 1)                       | 1.2 10 x I <sub>n</sub> in A (default setting: 10) |
| Delay time t <sub>b</sub> <sup>2)</sup> | 1 10 s<br>(default setting: 1 s)                   |
| Blocking protection                     | ON / OFF<br>(default setting: ON)                  |

- 1) Adjustable I<sub>b</sub> over 0.4 in firmware version 4.3 and higher
- 2) Adjustable t<sub>b</sub> over 0.5 s in firmware version 4.3 and higher

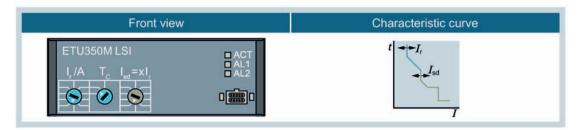
#### Idle running protection

The 3VA2 molded case circuit breakers with the ETU860M motor protection trip unit now have idle running protection integrated in the circuit breaker for the first time.

When the load on the motor is removed, e.g. when the drive chain or drive belt snaps, the current falls below the normal motor operational current. The integrated idle running protection detects this condition, trips and thus shuts down the application.

| Protection                       | ETU860M                                |
|----------------------------------|--|
| l <sub>ee</sub>                  | 0.3 0.9 x I,<br>(default setting: 0.9) |
| Delay time t <sub>&lt;&lt;</sub> | 1 200 s<br>(default setting: 1 s)      |
| Idle running protection          | ON / OFF<br>(default setting: OFF)     |

#### 3.3.3 ETU350M electronic trip unit

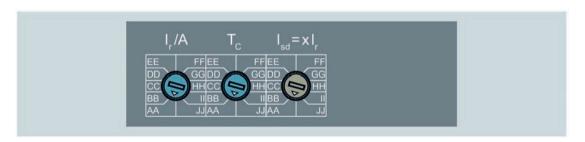


#### Motor protection - function LSI

The ETU350M electronic trip unit features:

- Adjustable parameter setting I<sub>r</sub> for overload protection (L)
- Adjustable parameter setting I<sub>sd</sub> for short-time delayed short circuit protection (S)
- Fixed parameter setting t<sub>sd</sub> for short-time delayed short circuit protection (S), t<sub>sd</sub> = 0.03 s
- Fixed parameter setting I<sub>i</sub> for short-circuit protection (I), I<sub>i</sub> = 15 x I<sub>r</sub>
- Adjustable parameter setting T<sub>c</sub> for the trip class
- Fixed parameter setting for phase unbalance of 40%
- Permanently active thermal memory, cannot be deactivated

#### ETU350M parameters



## Setting values for I<sub>r</sub>

|             | Nime.  | I,  |     | Settings I <sub>r</sub> [A] |     |     |     |     |     |     |      |     |  |  |
|-------------|--------|-----|-----|-----------------------------|-----|-----|-----|-----|-----|-----|------|-----|--|--|
| •           | Size   | [Ä] | AA  | BB                          | СС  | DD  | EE  | FF  | GG  | НН  | - 11 | JJ  |  |  |
|             |        | 25  | 10  | 12                          | 14  | 16  | 18  | 20  | 22  | 23  | 24   | 25  |  |  |
|             | 400.4  | 40  | 16  | 20                          | 24  | 28  | 30  | 32  | 34  | 36  | 38   | 40  |  |  |
|             | 160 A  | 63  | 25  | 30                          | 35  | 40  | 45  | 50  | 54  | 57  | 60   | 63  |  |  |
|             |        | 100 | 40  | 50                          | 63  | 70  | 75  | 80  | 85  | 90  | 95   | 100 |  |  |
| 0 0         | 250.4  | 160 | 63  | 80                          | 95  | 110 | 125 | 140 | 145 | 150 | 155  | 160 |  |  |
| 3VA2<br>M/C | 250 A  | 200 | 80  | 100                         | 120 | 140 | 150 | 160 | 170 | 180 | 190  | 200 |  |  |
| რ ≥         | 400 A  | 250 | 100 | 125                         | 150 | 175 | 200 | 210 | 220 | 230 | 240  | 250 |  |  |
|             | 000 4  | 400 | 160 | 200                         | 240 | 280 | 300 | 320 | 340 | 360 | 380  | 400 |  |  |
|             | 630 A  | 500 | 200 | 250                         | 300 | 350 | 375 | 400 | 425 | 450 | 475  | 500 |  |  |
|             | 4000 4 | 630 | 250 | 315                         | 400 | 450 | 500 | 525 | 550 | 575 | 600  | 630 |  |  |
|             | 1000 A | 800 | 320 | 400                         | 500 | 550 | 600 | 630 | 680 | 720 | 760  | 800 |  |  |

## Setting values for T<sub>c</sub>

|             | Nimo   | I <sub>n</sub> |     | Settings Trip class T <sub>c</sub> |     |     |     |     |     |     |     |     |  |  |
|-------------|--------|----------------|-----|------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|--|--|
| 3           | Size   | [Ä]            | AA  | ВВ                                 | СС  | DD  | EE  | FF  | GG  | НН  | Ш   | JJ  |  |  |
|             |        | 25             | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
|             | 160 A  | 40             | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
|             | 160 A  | 63             | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
|             |        | 100            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
| 0 0         | 250 4  | 160            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
| 3VA2<br>M/C | 250 A  | 200            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
| რ ≥         | 400 A  | 250            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
|             | C20 A  | 400            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
|             | 630 A  | 500            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
|             | 4000 A | 630            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |
|             | 1000 A | 800            | 10A | 10A                                | 10A | 10A | 10E | 10E | 20E | 20E | 20E | 20E |  |  |

## Setting values for Isd

|      | Cima   | l.  |    | Settings I <sub>sd</sub> = x I <sub>r</sub> |    |    |    |    |    |    |    |    |  |  |  |  |
|------|--------|-----|----|---|----|----|----|----|----|----|----|----|--|--|--|--|
|      | Size   | [Ä] | AA | ВВ  | СС | DD | EE | FF | GG | НН | Ш  | JJ |  |  |  |  |
| Т    |        | 25  | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
|      | 160 A  | 40  | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
|      | 160 A  | 63  | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
|      |        | 100 | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
| 01 ( | 050.4  | 160 | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
| 3VA2 |        | 200 | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
| € ≥  | 400 A  | 250 | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
|      | 000 4  | 400 | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
|      | 630 A  | 500 | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
|      | 4000 4 | 630 | 3  | 4   | 5  | 6  | 8  | 10 | 12 | 13 | 14 | 15 |  |  |  |  |
|      | 1000 A | 800 | 3  | 4   | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 |  |  |  |  |

#### Instantaneous short-circuit protection li

Short-circuit protection  $I_i$  is permanently set to the highest possible value.

| S           | Size   | ا _<br>[A] | Settings I <sub>i</sub> [A] (fixed) |  |
|-------------|--------|------------|-------------------------------------|--|
|             |        | 25         | 375                                 |  |
|             | 160 A  | 40         | 600                                 |  |
|             | 160 A  | 63         | 945                                 |  |
|             |        | 100        | 1500                                |  |
| 0 0         | 250.4  | 160        | 2400                                |  |
| 3VA2<br>M/C | 250 A  | 200        | 3000                                |  |
| რ ≥         | 400 A  | 250        | 3750                                |  |
|             | COO A  | 400        | 6000                                |  |
|             | 630 A  | 500        | 7500                                |  |
|             | 4000 A | 630        | 9450                                |  |
|             | 1000 A | 800        | 12000                               |  |

#### Phase unbalance / phase failure:

I<sub>unbal</sub> of current mean value permanently set to 40%
 I<sub>unbal</sub> tripping time during startup permanently set to 0.7 s
 I<sub>unbal</sub> tripping time during normal operation permanently set to 4 s

#### 3.3.4 5-series and 8-series electronic trip units

#### Parameter input via display unit

With 5-series and 8-series electronic trip units, it is possible to set more parameters and to scale the selection of parameters more finely than on 3-series electronic trip units.

Parameters are set via the display unit and its buttons. This functionality is available, however, only if a separate, dedicated power supply is connected to the molded case circuit breakers.

Potential alternatives for this power supply:

- 24 V power supply via:
  - EFB300 external function box
  - temporarily connected TD300 or TD500 test device
  - internal 24 V module
  - internal COM060 communication module
- Current flow > 20% In in one of the 3 phases

You will find further information on the parameter display in chapter Operator controls (Page 93).

#### Additional features of 8-series units

In addition to the features shared with 5-series trip units, 8-series units also offer:

- With three-pole molded case circuit breakers, a voltage tap for each phase and the option
  of connecting the potential of the neutral conductor
  With four-pole molded case circuit breakers, four internal voltage taps are provided for
  measuring the conductor voltages
- Additional measurement of power values (only possible with an external 24 V supply)

#### 3.3.4.1 ETU550M electronic trip unit



#### Motor protection - function LSI

The ETU550M electronic trip unit features:

- Adjustable parameter setting I<sub>r</sub> for overload protection (L)
- Adjustable parameter setting I<sub>sd</sub> for short-time delayed short circuit protection (S)
- Fixed parameter setting t<sub>sd</sub> for short-time delayed short circuit protection (S), t<sub>sd</sub> = 0.03 s
- Adjustable parameter setting I<sub>i</sub> for short-circuit protection (I)
- Adjustable parameter setting Tc for the trip class or tripping time Tp
- Adjustable parameter setting for phase unbalance from 5 to 50% / Off, tunbal

#### ETU550M setting parameters

| ,           | Size   | ا<br>[A] | ı,      | Ţ                               | T,   | l <sub>es</sub> | t <sub>err</sub> | I,        | Phase failure          | 1   |           | ip cla<br>s at 7 |    | ,]  |
|-------------|--------|----------|---------|---------------------------------|------|-----------------|------------------|-----------|------------------------|-----|-----------|------------------|----|-----|
| ·           | SIZE   |          | [Á]     | 16)                             | [s]  | [Å]             | [ms]             | [Å]       | (current<br>unbalance) | 10A | 10<br>10E | 20<br>20E        | 30 | 30E |
|             |        | 25       | 10 25   | 10A, 10/10E,<br>20/20E, 30/30E  | 3 30 | 30 375          |                  | 75 375    |                        | 4   | 8         | 17               | 24 | 24  |
|             | 160 A  | 40       | 16 40   | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30 | 48 600          |                  | 120 600   |                        | 4   | 8         | 17               | 24 | 24  |
|             | 100 A  | 63       | 25 63   | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30 | 76 945          |                  | 189 945   |                        | 4   | 8         | 17               | 24 | 24  |
|             |        | 100      | 40 100  | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 25 | 120 1500        |                  | 300 1500  |                        | 4   | 8         | 17               | 24 | 24  |
|             | 050.4  | 160      | 63 160  | 10A, 10/10E,<br>20/ 20E, 30     | 3 20 | 192 2400        |                  | 480 2400  |                        | 4   | 8         | 17               | 20 | -   |
| 3VA2<br>M/C | 250 A  | 200      | 80 200  | 10A, 10/10E,<br>20/ 20E         | 315  | 240 3000        | 30               | 600 3000  | 5 50% /<br>OFF         | 4   | 8         | 12               | 15 | -   |
|             | 400 A  | 250      | 100 250 | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30 | 300 3750        |                  | 750 3750  |                        | 4   | 8         | 17               | 24 | 24  |
|             | 000 4  | 400      | 160 400 | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 25 | 480 6000        |                  | 1200 6000 |                        | 4   | 8         | 17               | 24 | 24  |
|             | 630 A  | 500      | 200 500 | 10A, 10/10E,<br>20/ 20E         | 3 15 | 600 7500        |                  | 1500 7500 |                        | 4   | 8         | 12               | 15 | -   |
|             | 4000 4 | 630      | 250 630 | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30 | 756 9450        |                  | 1890 9450 |                        | 4   | 8         | 17               | 24 | 24  |
|             | 1000 A | 800      | 320 800 | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30 | 960 9600        |                  | 2400 9600 |                        | 4   | 8         | 17               | 24 | 24  |

#### Overload protection L:

I<sub>r</sub> Adjustable from 0.4 to 1.0 x I<sub>n</sub> in absolute current values

 $I_r$  < 50 A: in steps of 0.5 A  $I_r \ge$  50 A: in steps of 1 A

The ETU550M has a permanently activated thermal memory.

#### Short-time delayed short-circuit protection S:

I<sub>sd</sub> Adjustable from 1.2 to 12/15 x I<sub>n</sub> in absolute current values

 $I_r$  < 50 A: in steps of 0.5 A  $I_r \ge$  50 A: in steps of 1 A

t<sub>sd</sub> Permanently set to 0.03 s

#### Instantaneous short-circuit protection I:

I<sub>i</sub> Adjustable from 3 to 12/15 x I<sub>n</sub> in absolute current values

 $I_r$  < 50 A: in steps of 0.5 A

 $I_r \ge 50 \text{ A}$ : in steps of 1 A

#### Trip class T<sub>c</sub> or tripping time T<sub>p</sub>:

T<sub>c</sub> Adjustable 10 A / 10E / 20 / 20E / 30

 $\bullet$   $\,$   $\,$   $\,$   $\,$   $\,$  T\_p  $\,$   $\,$  Adjustable from 3 to 13 / 15 / 25 / 30 s (dependent on rated current)

in steps of 1 s

#### Phase unbalance Iunbal

I<sub>unbal</sub> Adjustable from 5 to 50% relative to the

mean value of the three phase currents

in steps of 1%

• t<sub>unbal</sub> tripping time<sup>1)</sup> during startup Adjustable from 0.7 to 60 s,

default setting 0.7 s

• t<sub>unbal</sub> tripping time<sup>1)</sup> during normal operation Adjustable from 4 to 420 s,

default setting 4 s

The phase unbalance function can be deactivated.

Adjustable tripping time with phase unbalance in firmware version 4.3 and higher.

#### 3.3.4.2 ETU860M electronic trip unit



#### Motor protection - function LSIG

The ETU860M electronic trip unit features:

- Adjustable parameter setting I<sub>r</sub> for overload protection (L)
- Adjustable parameter setting I<sub>sd</sub> for short-time delayed short circuit protection (S)
- Fixed parameter setting t<sub>sd</sub> for short-time delayed short circuit protection (S), t<sub>sd</sub> = 0.03 s
- Adjustable parameter setting l<sub>i</sub> for short-circuit protection (I)
- Adjustable parameter settings I<sub>g</sub> and t<sub>g</sub> for ground-fault protection (G)
- Adjustable parameter setting T<sub>c</sub> for the trip class or tripping time T<sub>p</sub>
- Adjustable parameter setting for phase unbalance from 5 to 50% / OFF, tunbal
- Adjustable parameter settings I<sub>b</sub> and t<sub>b</sub> for blocking protection
- Adjustable parameter settings I-- and t-- for idle running protection

## 3.3 Motor protection applications of 3VA molded case circuit breakers

## ETU860M setting parameters

| ٤           | Size   | ا<br>[A] | ļ.<br>[A]                          | T <sub>c</sub>                  | T <sub>p</sub> [s] | l <sub>sd</sub><br>[A] | t <sub>sd</sub><br>[ms] | ļ<br>[A]  | ا<br>[Å]      | t <sub>g</sub><br>[ms] |
|-------------|--------|----------|------------------------------------|---------------------------------|--------------------|------------------------|-------------------------|-----------|---------------|------------------------|
|             |        | 25       | 10 25                              | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30               | 30 375                 |                         | 75 375    | 5 25 / OFF    |                        |
|             | 160 A  | 40       | 16 40                              | 10A, 10/10E,<br>0/ 20E, 30/30E  | 3 30               | 48 600                 |                         | 120 600   | 8 40 / OFF    |                        |
|             | 100 A  | 63       | 25 63                              | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30               | 76 945                 |                         | 189 945   | 13 63 / OFF   |                        |
|             |        | 100      | 40 100                             | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 25               | 120 1500               |                         | 300 1500  | 20 100 / OFF  |                        |
|             | 250 A  | 160      | 63 160                             | 10A, 10/10E,<br>20/ 20E, 30     | 3 20               | 192 2400               |                         | 480 2400  | 32 160 / OFF  |                        |
| 3VAZ<br>M/C | 250 A  | 200      | 80 200 10A, 10/10E,<br>20/ 20E, 30 |                                 | 315                | 240 3000               | 30                      | 600 3000  | 40 200 / OFF  | 50 800                 |
|             | 400 A  | 250      | 100 250                            | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30               | 300 3750               |                         | 750 3750  | 50 250 / OFF  |                        |
|             | 630 A  | 400      | 160 400                            | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 25               | 480 6000               |                         | 1200 6000 | 80 400 / OFF  |                        |
|             | 030 A  | 500      | 200 500                            | 10A, 10/10E,<br>20/ 20E, 30     | 3 15               | 600 7500               |                         | 1500 7500 | 100 500 / OFF |                        |
|             | 1000 A | 630      | 250 630                            | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30               | 756 9450               |                         | 1890 9450 | 126 630 / OFF |                        |
|             | 1000 A | 800      | 320 800                            | 10A, 10/10E,<br>20/ 20E, 30/30E | 3 30               | 960 9600               |                         | 2400 9600 | 160 800 / OFF |                        |

|             | Size   | Phas<br>failur |                        | Blocking pr           | Idle running          | Idle running protection  |                           |     | Trip class [T <sub>p</sub> in s at 7.2 x I <sub>p</sub> ] |           |    |     |  |  |
|-------------|--------|----------------|------------------------|-----------------------|-----------------------|--------------------------|---------------------------|-----|---|-----------|----|-----|--|--|
|             | oize   | [Å]            | (current<br>unbalance) | ا <sub>ه</sub><br>[A] | t <sub>ջ</sub><br>[s] | 1 «                      | t <sub>&lt;&lt;</sub> [s] | 10A | 10<br>10E   | 20<br>20E | 30 | 30E |  |  |
|             |        | 25             |                        | 30 250; OFF           |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |
|             | 160 A  | 40             |                        | 48 400; OFF           |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |
|             | 160 A  | 63             |                        | 76 630; OFF           |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |
|             |        | 100            |                        | 120 1000; OFF         |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |
|             | 050 4  | 160            |                        | 162 1600; OFF         |                       |                          |                           | 4   | 8   | 17        | 20 |     |  |  |
| 3VA2<br>M/C | 250 A  | 200            | 00 5 50% /<br>OFF      | 240 2000; OFF         | 1 10                  | 0.3 0.9 x I <sub>r</sub> | 1 200                     | 4   | 8   | 12        | 15 | -   |  |  |
| e 2         | 400 A  | 250            | OH                     | 300 2500; OFF         |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |
|             | 000 4  | 400            |                        | 480 4000; OFF         |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |
|             | 630 A  | 500            |                        | 600 5000; OFF         |                       |                          |                           | 4   | 8   | 12        | 15 | -   |  |  |
|             | 4000   | 630            |                        | 756 6300, OFF         |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |
|             | 1000 A | 800            |                        | 960 8000; OFF         |                       |                          |                           | 4   | 8   | 17        | 24 | 24  |  |  |

#### Overload protection L:

I<sub>r</sub> Adjustable from 0.4 to 1.0 x I<sub>n</sub> in absolute current values

 $I_r$  < 50 A: in steps of 0.5 A

 $I_r \ge 50 \text{ A}$ : in steps of 1 A

The ETU860M has a permanently activated thermal memory.

#### Short-time delayed short-circuit protection S:

• I<sub>sd</sub> Adjustable from 1.2 to 12/15 x I<sub>n</sub> in absolute current values

 $I_r$  < 50 A: in steps of 0.5 A

 $I_r \geq$  50 A: in steps of 1 A

• t<sub>sd</sub> Permanently set to 0.03 s

#### Instantaneous short-circuit protection I:

• Ii Adjustable from 3 to 12/15 x In in absolute current values

 $I_r$  < 50 A: in steps of 0.5 A

 $I_r \ge 50 \text{ A}$ : in steps of 1 A

#### Ground-fault protection G:

The detection of the ground-fault current is based on the vectorial summation of the three phase currents.

I<sub>g</sub> Adjustable from 0.2 to 1 x I<sub>n</sub> in absolute current values

 $I_r$  < 50 A: in steps of 0.5 A

 $I_r \ge 50 \text{ A}$ : in steps of 1 A

t<sub>q</sub> Adjustable from 0.05 to 0.8 s

in steps of 0.01 s

An alarm threshold IgA between 0.2 to 1 x In can also be set; in steps of 1 A

The current-dependent curve shape  $l^2t_g$  = constant can be deactivated.

Ground-fault protection (G) can be deactivated.

#### Note

An external current transformer for the neutral conductor **cannot** be connected.

#### Trip class T<sub>c</sub> or tripping time T<sub>p</sub>:

- T<sub>c</sub> Adjustable 10 A / 10E / 20 / 20E / 30
- T<sub>p</sub> Adjustable from 3 to 13 / 15 / 25 / 30 s (dependent on rated current) in steps of 1 s

#### 3.3 Motor protection applications of 3VA molded case circuit breakers

#### Phase unbalance Iunbal

• I<sub>unbal</sub> Adjustable from 5 to 50% relative to the

mean value of the three phase currents

in steps of 1%

• t<sub>unbal</sub> tripping time<sup>1)</sup> during startup Adjustable from 0.7 to 60 s,

default setting 0.7 s

• t<sub>unbal</sub> tripping time<sup>1)</sup> during normal operation Adjustable from 4 to 420 s,

default setting 4 s

The phase unbalance function can be deactivated.

Adjustable tripping times with phase unbalance in firmware version 4.3 and higher.

#### Blocking protection:

- $\bullet \qquad I_b \ ^{1)} \qquad \text{Adjustable from 0.4 to 10 x } \ I_n \\ \text{in steps of 1 A}$
- t<sub>b</sub> <sup>2)</sup> Adjustable from 0.5 to 10 s in steps of 0.5 s

Blocking protection can be deactivated.

- 1) Adjustable I<sub>b</sub> over 0.4 in firmware version 4.3 and higher
- 2) Adjustable t<sub>b</sub> over 0.5 s in firmware version 4.3 and higher

#### Idle running protection:

- I<</li>
   Adjustable from 0.3 to 0.9 x I<sub>r</sub>
   in steps of 0.01 s
- t<</li>
   Adjustable from 1 to 200 s in steps of 1 s

Idle running protection can be deactivated.

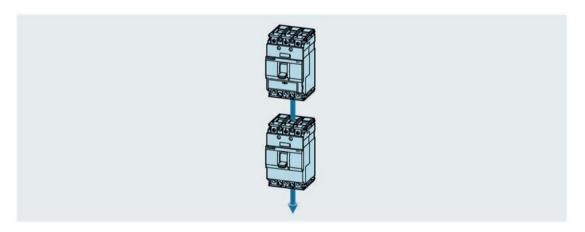
#### 3.4 Use of 3VA1 molded case circuit breakers as switch disconnectors

Switch disconnectors are deployed as:

- Disconnectors in subdistribution and final distribution boards
- Bus couplers
- Disconnectors for machine groups, e.g. as maintenance and repair breakers
- Operator control and disconnector element for cables, busbars and device groups
- Application as disconnector unit
- Application as main switches
- Isolation of small distribution systems in industrial/commercial buildings
- Disconnection of loads

Switch disconnectors are capable of switching equipment and parts of electrical installations when they are conducting their operational current under normal operating conditions.

Switch disconnectors do not have overload or short-circuit releases. For this reason, a molded case circuit breaker or a fuse must be installed upstream of every switch disconnector. Refer to chapter Upstream protection of switch disconnectors (Page 170).



#### Compatibility of 3VA switch disconnectors and accessories

3VA1 switch disconnectors have been developed from the 3VA1 molded case circuit breaker design. Both share the same attributes listed below:

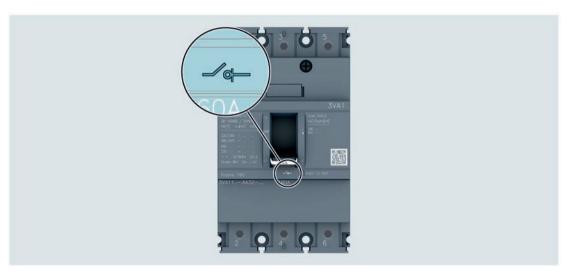
- Sizes
- Dimensions
- · Mounting options
- · Procedure for installing accessories

This means that a shunt trip can trip the switch disconnectors by remote control, or that the disconnector can be opened or closed by a side wall mounted rotary operator.

#### Isolating features

A switch disconnector isolates individual circuits or items of equipment so that maintenance or repair work can be carried out. This is a health and safety requirement.

In compliance with IEC 60947-3, the symbol below is clearly displayed on the front panel of switch disconnectors:



In accordance with the requirements of the standard regarding isolating function, the 3VA1 switch disconnector features:

- the switch disconnector symbol
- a correctly dimensioned isolating distance in the OFF position

When the switch disconnector handle is in the OFF position, the isolating distance between the main contacts is guaranteed to meet the requirements stipulated by standards pertaining to isolating features. This also applies when manual or motor operators installed on the disconnector are in the OFF position.

Only when the disconnector is in this safe position can it be locked by various methods (e.g. door mounted rotary operator, motor operator). The 3VA1 molded case circuit breaker therefore also meets the requirements for disconnector units according to IEC 60204-1 in the capacity of a switch disconnector.

#### Making capacity

Switch disconnectors have a predefined rated making and rated breaking capacity. As a result, loads are reliably switched on and off up to the specified breaking capacity.

#### **Features**

Switch disconnectors are primarily designed to conduct uninterrupted current up to the magnitude of the permissible rated uninterrupted current  $I_u$ .

Another important feature of these devices is their rated short-circuit making capacity l<sub>cm</sub>, as this defines the capability of the switch disconnector to withstand dynamic and thermal current loads. Current loads can reach very high values when the switch disconnector makes on a short circuit. Switch disconnectors are designed to withstand these short-circuit currents without sustaining damage up to the value of their rated short-circuit making capacity.

#### Utilization categories for switch disconnectors

Utilization categories are differentiated according to the following criteria:

- The relationship between operational current and rated operational current
- The relationship between operational voltage and rated operational voltage
- Power factor (p.f.)
- Time constant

The utilization category is also identified by a letter:

A - for frequent operation

B - for infrequent operation, e.g. disconnectors which are used only to isolate parts of electrical installations for maintenance purposes.

It is important to note, however, that the term "frequent operation" does not mean that the switch disconnector may be used to start up, accelerate or shut down individual motors in normal operation.

For example, a switch disconnector with a rated operational current  $I_e$  of 160 A and a rated operational voltage  $U_e$  of 400 V AC may be used for frequent switching of a mixture of resistive and inductive loads including moderate overload only if it can conduct a making current I of 480 A (3 x  $I_e$ ) and withstand a making voltage U of 420 V AC (1.05 x  $U_e$ ) with a power factor of 0.65. This capability corresponds to utilization category AC-22A.

#### 3.4 Use of 3VA1 molded case circuit breakers as switch disconnectors

| s of            | Utilizatior          | n category                              | 200  | Rated                       | Verification of rated making and breaking capacity |                  |       |                                 |         |       |  |  |  |
|-----------------|----------------------|---|--|-----------------------------|--|------------------|-------|---------------------------------|---------|-------|--|--|--|
| Type of current | А                    | В                                       | Typical applications   | operational current         | Switch on  |                  |       | Switch off                      |         |       |  |  |  |
| г о             | ^                    | В                                       |  | current                     | 1/1 <sub>e</sub>                                   | U/U <sub>e</sub> | cos φ | l <sub>c</sub> / l <sub>e</sub> | U, / U  | cos φ |  |  |  |
|                 | AC-21A               | AC-21B                                  | Switching of resistive loads including moderate overload                           | All values                  | 1.5  | 1.05             | 0.95  | 1.5                             | 1.05    | 0.95  |  |  |  |
| AC voltage      | AC-22A               | AC-22B                                  | Switching of mixed resistive<br>and inductive loads including<br>moderate overload | All values                  | 3  | 1.05             | 0.65  | 3                               | 1.05    | 0.65  |  |  |  |
| AC              | 40.004               | 10.000                                  | Switching of motors or other   | $0 < I_e \le 100 \text{ A}$ | 10   | 1.05             | 0.45  | 8                               | 1.05    | 0.45  |  |  |  |
|                 | AC-23A AC-23B        |   | high-inductance loads  | 100 A < I <sub>e</sub>      | 10   | 1.05             | 0.35  | 8                               | 1.05    | 0.35  |  |  |  |
| Type of current | Utilization category |   | Typical applications   | Rated operational           | 1/1  | ບ/ບູ             | L/R   | ا <sub>د</sub> / ا              | U, / U, | L/R   |  |  |  |
| Typ             | Α                    | В                                       | турісаі арріісацогіз   | current                     | 1 / le   | 0,0              | ms    | 'c ' 'e                         | O, / Oe | ms    |  |  |  |
| <u>o</u>        | DC-21A               | DC-21B                                  | Switching of resistive loads including moderate overload                           | All values                  | 1.5  | 1.05             | 1     | 1.5                             | 1.05    | 1     |  |  |  |
| Direct voltage  | DC-22A               | DC-22B                                  | Switching of mixed resistive<br>and inductive loads including<br>moderate overload | All values                  | 4  | 1.05             | 2.5   | 4                               | 1.05    | 2.5   |  |  |  |
| Ö               | DC-23A               | DC-23A DC-23B Switching of high-inducta |  | All values                  | 4  | 1.05             | 15    | 4                               | 1.05    | 15    |  |  |  |

- I Making current
- Ic Breaking current
- le Rated operational current
- U Applied voltage
- Ue Rated operational voltage
- U<sub>r</sub> Recovery voltage

## 3.4.1 Overview of 3VA1 as switch disconnectors

|  | 00 switch dis  |                                 |                              |                  |                    | 3VA                                | 1 switch disconnect               | ors       |
|--|--|---------------------------------|------------------------------|------------------|--------------------|------------------------------------|-----------------------------------|-----------|
| Electrical ch  | naracteristics   | according                       | to IEC 60947-                | 3                |                    | 3VA11                              | 3VA12                             | 3VA13     |
|  |  |                                 |                              |                  |                    | 1                                  | Garage<br>Barrer                  | O DO      |
| Rated uninterro  | upted current at   | 50 °C                           |                              | l <sub>u</sub>   | [A]                | 63, 100, 125, 160                  | 250                               | 400       |
| Number of pole   | es   |                                 |                              |                  |                    | 3, 4                               | 3, 4                              | 3, 4      |
|  |  | AC-21A                          |                              |                  | [A]                | 63, 100, 125, 160                  | 250                               | 400       |
|  |  | AC-22A                          |                              |                  | [A]                | 63, 100, 125, 160                  | 250                               | 400       |
| ruer e .   |  | AC-23A                          |                              |                  | [A]                | 63, 100, 125, 160                  | 250                               | 400       |
| Utilization cate   | gory   | DC-21A                          |                              |                  | [A]                | 63, 100, 125, 160                  | 250                               |           |
|  |  | DC-22A                          |                              |                  | [A]                | 63, 100, 125, 160                  | 250                               |           |
|  |  | DC-23A                          |                              |                  | [A]                | 63, 100, 125, 160                  | 250                               |           |
| Dated coast!   | nal  | AC (50 / 60 H                   | z)                           | U.               | [V]                | 690                                | 690                               | 690       |
| Rated operatio<br>voltage, max.  | iiai   | DC                              |                              | U.               | [V]                | 3-pole: 500<br>4-pole: 600         | 3-pole: 500<br>4-pole: 600        |           |
| Rated insulatio  | n voltage  |                                 |                              | U                | [V]                | 800                                | 800                               | 800       |
| Rated impulse  | withstand voltag   | je                              |                              | U <sub>imp</sub> | [kV]               | 8                                  | 8                                 | 8         |
| Rated condition<br>current   | nal short-circuit  | With additional circuit breake  | al upstream 3VA1<br>r (max.) | l <sub>q</sub>   | [kA]               | 70 kA at 415 V<br>3 kA at 690 V    | 70 kA at 415 V<br>10 kA at 690 V  |           |
| Rated short-cir  | ouit making  | Switch discor                   | nectors only                 | I <sub>cm</sub>  | [kA]               | 4.5                                | 4.5                               | 7.3       |
| capacity   | cult making  | With addition<br>circuit breake | al upstream 3VA1<br>r (max.) | I <sub>cm</sub>  | [kA]               | 154 kA at 415 V<br>4.5 kA at 690 V | 154 kA at 415 V<br>17 kA at 690 V |           |
| Rated short-circuit current<br>with LV HRC fuses (3NA,<br>3ND) (sizes 000, 00, 1 and 2,<br>type gl/gG) |  | 220 240 V                       |                              | I <sub>q</sub>   | [kA]               | 100                                | 100                               | 200       |
|  |  | 380 415 V                       |                              | l <sub>a</sub>   | [kA]               | 70                                 | 70                                | 110       |
|  |  | 690 V                           |                              | 1                | [kA]               | 3                                  | 10                                | 10        |
| ·) P = 9 · 9 = /   |  | 380 415 V                       |                              | l²t              | [A <sup>2</sup> s] | 475 000                            | 1 810 000                         | 1 515 000 |
| Max. permissib   | le let-through   | 500 V                           |                              | l²t              | [A <sup>2</sup> s] | 475 000                            | 1 660 000                         | 2 100 000 |
| energy   |  | 690 V                           |                              | I <sup>2</sup> t | [A <sup>2</sup> s] | 475 000                            | 1 140 000                         | 1 500 000 |
|  |  | 380 415 V                       |                              | I,               | [kA]               | 20                                 | 29                                | 40        |
| Max. permissib   | le let-through   | 500 V                           |                              | l <sub>c</sub>   | [kA]               | 3                                  | 18.7                              | 33        |
| current  |  | 690 V                           |                              | L                | [kA]               | 3                                  | 14.9                              | 21        |
| Rated short-tin  | ne withstand   | t = 1 s                         |                              | I <sub>cw</sub>  | [kA]               | 2                                  | 3                                 | 4.8       |
| 991497493  | Mechanical   |                                 |                              | Operating of     | cycles             | 20 000                             | 20 000                            | 10 000    |
|  | The state of the s | AC-21A                          | 380 415 V                    | Operating of     |                    | 8 000                              | 8 000                             | 6 000     |
|  |  | 50 / 60 Hz                      | 690 V                        | Operating of     | cycles             | 5 000                              | 5 000                             | 1 000     |
|  |  | AC-22A                          | 380 415 V                    | Operating of     |                    | 8 000                              | 8 000                             | 6 000     |
|  |  | 50 / 60 Hz                      | 690 V                        | Operating of     | cycles             | 5 000                              | 5 000                             | 1 000     |
|  |  | AC-23A                          | 380 415 V                    | Operating of     | cycles             | 8 000                              | 8 000                             | 6 000     |
|  |  | 50 / 60 Hz                      | 690 V                        | Operating of     | cycles             | 5 000                              | 5 000                             | 1 000     |
| Fadura   |  |                                 | 250 V                        | Operating of     |                    | 8 000                              | 8 000                             |           |
| Endurance  | Electrical   | DC21A                           | 500 V                        | Operating of     | cycles             | 8 000                              | 8 000                             |           |
|  |  |                                 | 600 V 4-pole                 | Operating of     | cycles             | 8 000                              | 8 000                             |           |
|  |  |                                 | 250 V                        | Operating of     | cycles             | 8 000                              | 8 000                             |           |
|  |  | DC22A                           | 500 V                        | Operating of     | cycles             | 8 000                              | 8 000                             |           |
|  |  |                                 | 600 V 4-pole                 | Operating of     | cycles             | 8 000                              | 8 000                             |           |
|  |  |                                 | 250 V                        | Operating of     | cycles             | 8 000                              | 8 000                             |           |
|  |  | DC23A                           | 500 V                        | Operating of     | cycles             | 8 000                              | 8 000                             |           |
|  |  |                                 | 600 V 4-pole                 | Operating of     | cycles             | 8 000                              | 8 000                             |           |

3.4 Use of 3VA1 molded case circuit breakers as switch disconnectors

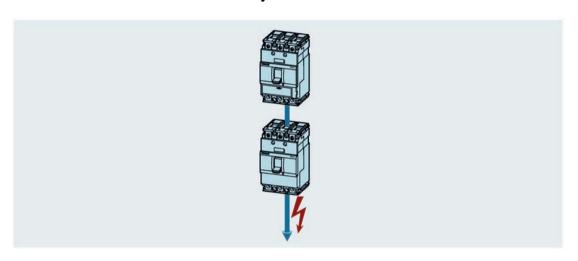
## 3.4.2 Upstream protection of switch disconnectors

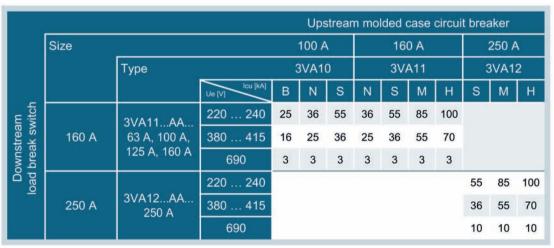
Switch disconnectors are not equipped with an integral overload or short-circuit release. For this reason, a molded case circuit breaker or a fuse must be installed upstream of every switch disconnector.

The coordination tables given below contain the following information:

- The correct assignment of molded case circuit breakers to the switch disconnectors which require protection
- The maximum permissible rms short-circuit current kA rms for each combination of molded case circuit breaker and switch disconnector

#### Protection of 3VA1 switch disconnectors at 50 / 60 Hz by a 3VA1 molded case circuit breaker





More combinations can be found on the Internet (<a href="http://www.siemens.com/3VA-Documentation">http://www.siemens.com/3VA-Documentation</a>).

3.4 Use of 3VA1 molded case circuit breakers as switch disconnectors

Combinations with other protective devices can be configured at any time by means of SIMARIS design or using the characteristics maximum let-through energy I<sup>2</sup>t<sub>max</sub> and maximum let-through current I<sub>c max</sub> of the 3VA1 switch disconnector. You will find these characteristics in the technical product data sheets and in the table in chapter Overview of 3VA1 as switch disconnectors (Page 169).

#### Note

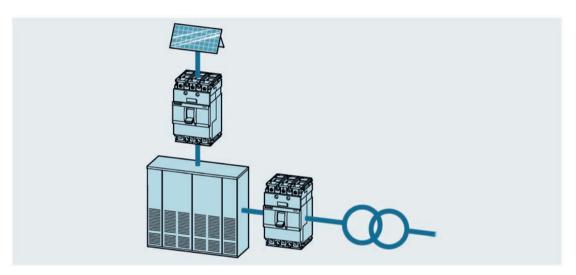
In the event of a fault, all switching devices in the affected branch must be function-tested (see Regular maintenance (Page 535)).

## 3.5 DC network applications of 3VA molded case circuit breakers

The main applications for 3VA circuit breakers in DC installations or networks are:

- Public transport systems, e.g. electric cars, underground rail networks and streetcars
- UPS systems
- Photovoltaic systems
- Wind power plants

3VA1 molded case circuit breakers as line protection devices with thermal overload releases and magnetic trip units with short-circuit protection are suitable for use in DC networks.



#### Features specific to direct current

Short-circuits are interrupted in DC networks by a method similar to the one applied to high alternating currents, i.e. by current limiting. A high arc voltage develops in molded case circuit breakers, which forces a current zero when the arc voltage exceeds the value of the recovery voltage. The current rise, however, is determined by the time constant and not the make time or power factor.

Overloads are interrupted by a completely different principle to the method applied in AC networks. With direct currents, there is no periodic zero crossing and thus also no period of time without magnetic energy in the circuit during which the conditions for extinguishing the arc are favorable. The arc is not extinguished until the arc voltage exceeds the line voltage and the current reduces to zero. In other words, a high arc voltage must be developed in order to interrupt the direct current.

The rated operational current values are generally the same for DC and AC applications.

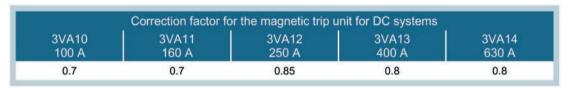
With DC applications, the breaking capacity depends only on:

- The arc extinction method used
- The line voltage

#### 3.5.1 Variants

The same thermal-magnetic trip units used as line protection devices in AC installations are also available for protecting DC installations.

However, a correction factor must be applied to the magnetic trip unit.



#### Example:

#### 3VA1 160 A, TM240 ATAM:

If the switching device is to trip instantaneously in response to an overcurrent of 1200 A, the parameter I<sub>i</sub> for instantaneous short-circuit protection (I) must be set to:

 $I_i = 1200 \text{ A} \times 0.7 = 840 \text{ A}.$ 

For further information on trip units and details about setting parameters, please refer to chapter "Line protection applications of 3VA molded case circuit breakers (Page 110)".

It is not possible to use electronic trip units for this application.

## 3.5.2 Breaking capacity with direct current

| 3VA molded<br>for DC appli<br>DC breaking | cations     |                         | ikei | 5    | 3V/<br>10 | A10<br>0 A | •       | 3V      | olded cas<br>A11<br>0 A | e circuit | 3V/       | A12<br>0 A | 3VA13 / 3VA14<br>400 A / 630 A |
|---|-------------|-------------------------|------|------|-----------|------------|---------|---------|-------------------------|-----------|-----------|------------|--------------------------------|
|   |             |                         |      |      | 3-pole    | 4-pole     | 1-pole  | 2-pole  | 3-pole                  | 4-pole    | 3-pole    | 4-pole     | 3-pole<br>4-pole               |
|   |             |                         | В    | [kA] |           |            |         |         |                         |           |           |            |                                |
|   | at          | -1                      | N    | [kA] |           |            | 16 / 16 | 16 / 16 |                         |           |           |            |                                |
|   | 125 V       | switching               | S    | [kA] |           |            | 25 / 25 | 25 / 25 |                         |           |           |            |                                |
|   | DC          | pole                    | М    | [kA] |           |            |         |         |                         |           |           |            |                                |
|   |             |                         | Н    | [kA] |           |            |         |         |                         |           |           |            |                                |
|   |             | 2<br>switching<br>poles | В    | [kA] | 25 / 25   | 25 / 25    |         |         |                         |           |           |            |                                |
| D-41                                      | at          |                         | N    | [kA] | 36 / 36   | 36 / 36    |         | 36 / 36 | 36 / 36                 | 36 / 36   |           |            |                                |
| Rated<br>ultimate                         | 250<br>V DC |                         | S    | [kA] | 55 / 55   | 55 / 55    |         | 55 / 55 | 55 / 55                 | 55 / 55   | 55 / 55   | 55 / 55    |                                |
| short-circuit                             |             |                         | M    | [kA] |           |            |         |         | 85 / 85                 | 85 / 85   | 85 / 85   | 85 / 85    |                                |
| breaking                                  |             |                         | Н    | [kA] |           |            |         |         | 100 / 100               | 100 / 100 | 100 / 100 | 100 / 100  |                                |
| capacity I /                              |             | 72                      | В    | [kA] | 25 / 25   | 25 / 25    |         |         |                         |           |           |            |                                |
| Rated                                     |             |                         | N    | [kA] | 36 / 36   | 36 / 36    |         |         | 36 / 36                 | 36 / 36   |           |            |                                |
| service                                   | at<br>500 V | 3<br>ovvitabing         | S    | [kA] | 55 / 55   | 55 / 55    |         |         | 55 / 55                 | 55 / 55   | 55 / 55   | 55 / 55    | 8/8                            |
| short-circuit<br>breaking                 | DC          | switching               | M    | [kA] |           |            |         |         | 85 / 85                 | 85 / 85   | 85 / 85   | 85 / 85    | 16 / 16                        |
| capacity I <sub>cs</sub>                  | 50          | poloo                   | Н    | [kA] |           |            |         |         | 100 / 100               | 100 / 100 | 100 / 100 | 100 / 100  | 25 / 25                        |
| oupuoity i <sub>cs</sub>                  |             |                         | С    | [kA] |           |            |         |         | 100 / 100               | 100 / 100 | 100 / 100 | 100 / 100  | 25 / 25                        |
|   |             |                         | В    | [kA] |           | 8/8        |         |         |                         |           |           |            |                                |
|   | Friday.     |                         | N    | [kA] |           | 16 / 16    |         |         |                         | 16 / 16   |           |            |                                |
|   | at<br>600 V | 4<br>cwitching          | S    | [kA] |           | 25 / 25    |         |         |                         | 25 / 25   |           | 25 / 25    | 8/8                            |
|   | DC          | switching               | M    | [kA] |           |            |         |         |                         | 36 / 36   |           | 36 / 36    | 16 / 16                        |
|   | 50          | poles                   | Н    | [kA] |           |            |         |         |                         | 55 / 55   |           | 55 / 55    | 25 / 25                        |
|   |             |                         | C    | [kA] |           |            |         |         |                         | 55 / 55   |           | 55 / 55    | 25 / 25                        |

## 3.5.3 Recommended circuit configurations for DC systems

| Max. permissi<br>voltage U <sub>e</sub> | ble direct        | DC 1-pole disconnection Grounded system | DC 2-pole (all-po<br>Grounded system | ole) disconnection  Non-grounded system |
|---|-------------------|---|--------------------------------------|---|
| 125 V DC                                | 1 switching pole  | Load                                    | Load                                 | Load                                    |
| 250 V DC                                | 2 switching poles | Load                                    | Load                                 | Load                                    |
| 500 V DC <sup>1)</sup>                  | 3 switching poles | Load                                    | Load                                 | Load                                    |
| 600 V DC <sup>1)</sup>                  | 4 switching poles | Load                                    |                                      |   |

#### GF Ground-fault monitoring

Ue > 250 V DC: DC insulating plate is mandatory for sizes 3VA10 and 3VA11 with a non-insulated mounting plate (see chapter Insulating measures (Page 246))

#### Note

#### DC 2-pole (all-pole disconnection), grounded system

The grounded pole must always be assigned to the individual conducting path, so that in the event of a ground fault there are always two conducting paths in series in a circuit with 3-pole molded case circuit breakers, and three conducting paths in series in a circuit with 4-pole molded case circuit breakers.

#### 3.5 DC network applications of 3VA molded case circuit breakers

#### Note

#### DC 2-pole (all-pole disconnection), non-grounded system

If there is no possibility of a double ground fault occurring, or if any ground fault that does occur is dealt with immediately (ground-fault monitoring), 500 V will be the maximum permissible direct voltage. In a non-grounded system, all poles must be disconnected.

Further circuits are available on request.

#### See also

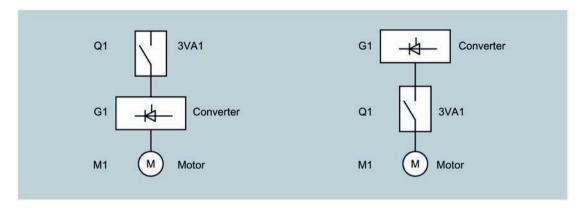
Insulating measures (Page 246)

# 3.6 Applications of the 3VA molded case circuit breaker with frequency converters

3VA molded case circuit breakers can be used as protective devices in systems using frequency converters.

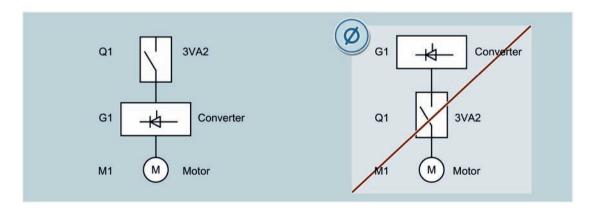
#### Applications of 3VA1 molded case circuit breakers with frequency converters

The 3VA1 thermal-magnetic molded case circuit breakers can be used on the primary or secondary side of the frequency converter in these applications.



#### Applications of 3VA2 molded case circuit breakers with frequency converters

The 3VA2 electronic molded case circuit breakers can only be used on the primary side of the frequency converter in the specified 50/60 Hz frequency range. Higher or lower frequencies result in major deviations in measured values with the result that the tripping characteristic cannot be adhered to.



3.6 Applications of the 3VA molded case circuit breaker with frequency converters

If the 3VA2 molded case circuit breaker with communication is used, it must be ensured that only one 24 V DC power supply unit is used in the system. If this power supply unit is installed on the primary side, the cable must have additional shielding and must be connected to ground. Interruptions in communication might otherwise occur.

#### Note

You can find tables of tested protective devices for SINAMICS PM240-2 Power Modules on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109486009).

# 3.7 400 Hz network applications of 3VA molded case circuit breakers

400 Hz networks are used for:

- Ground power supply systems for aircraft
- On-board electrical systems of marine craft and aircraft
- Other external stations of airports which are protected by uninterruptible power supplies,
   e.g. radar installations, data processing equipment, communication systems

It is important to supply the on-board electrical systems of aircraft with a very smooth DC voltage. This can be generated more easily by 400 Hz power supplies than by 50 Hz networks. Moreover, the power transmitters (transformers) are smaller and lighter by comparison with 50 Hz networks, two important arguments for using 400 Hz on-board electrical systems in aircraft and some marine craft.

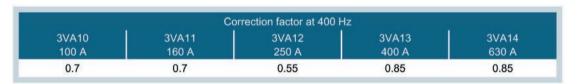
### Suitable 3VA molded case circuit breakers and trip units

3VA1 molded case circuit breakers equipped with thermal-magnetic trip units TM210, TM220 and TM240 are suitable for use in 400 Hz networks.

### Features specific to 400 Hz supplies

The thermal overload release of the 3VA1 molded case circuit breaker comprises a bimetal through which current flows, causing temperature rise. With currents at 400 Hz frequency, the temperature rise in the bimetal is higher than at 50 Hz. This is due to eddy-current losses and the reduction in the available conductor cross section as a result of the skin effect. The rated operational current must therefore be reduced by 10 % of the value used in 50/60 Hz applications.

Furthermore, a correction factor must be applied to the magnetic trip unit.



#### Example:

3VA1 160A, TM240 ATAM:

- Reduction by 10%:
   Maximum permissible rated operational current for 400 Hz applications = 160 A x 0.9 = 144 A
- Correction factor 0.7:
   If the switching device is to trip instantaneously in response to an overcurrent of 1200 A, the parameter I<sub>i</sub> for instantaneous short-circuit protection (I) must be set to I<sub>i</sub> = 1200 A x 0.7 = 840 A.

### 3.7 400 Hz network applications of 3VA molded case circuit breakers

For further information on trip units and details about the setting parameters, please refer to chapter Line protection applications of 3VA molded case circuit breakers (Page 110).

It is not possible to use electronic trip units for this application.

### See also

Temperature compensation for thermal-magnetic trip units TM210, TM220 and TM240 (Page 632)

# 3.8 IT system applications of 3VA molded case circuit breakers

The main advantage of IT systems is that they safeguard continuity of service by electrical installations and are therefore deployed predominantly in consumer installations where availability of electrical power is a priority. As a general rule, circuits are interrupted only if two insulation faults occur simultaneously.

Preferred applications for IT systems are therefore:

- · In buildings with rooms used for medical purposes
- · When mobile generators are in operation
- In certain industries, e.g.:
  - in the chemical industry
  - in the oil industry
  - in the steel industry
  - in mining

The IT system is a low-voltage power supply network with increased failure-safety in the event of ground faults. In an IT system, live phases are not connected to ground. A ground fault does not cause system shutdown. IEC 60364-4-41 (VDE 0100-410) therefore requires insulation monitoring to indicate a fault of this kind. In the unusual event that a fault on the load side coincides with a second fault on the line side, the full phase-to-phase voltage is connected across one contact of the breaker. Siemens 3VA molded case circuit breakers for line protection, whether they are equipped with a thermal-magnetic trip unit or an electronic trip unit, are suitable for use in IT systems.

Accordingly, the molded case circuit breakers meet the requirements of standard IEC / DIN EN 60947-2 Annex H up to a maximum voltage (Ue, max.) of 690 V AC.

### 3.8.1 Selection criteria for 3VA molded case circuit breakers

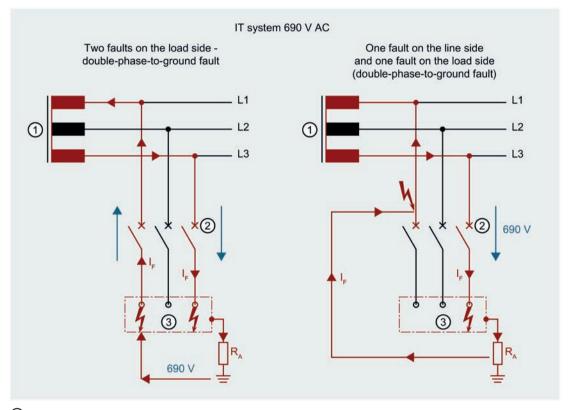
The circuit breakers are always dimensioned and selected irrespective of the system type in which they will be deployed.

The circuit breaker is always selected according to the maximum potential short-circuit current in the IT system. The device is selected in accordance with the relevant Icu values of the 3VA molded case circuit breaker.

If the system operator ensures that no double ground fault can occur on the input or output side of the molded case circuit breaker, the breaking capacity of  $I_{cu}$  / $I_{cs}$  remains unchanged in IT systems. If this cannot be ensured, the values in accordance with the standard IEC 60947-2 Annex H apply for single-pole short circuits.

### 3.8.2 Fault situation

The most critical fault for molded case circuit breakers in ungrounded IT systems is a double-phase-to-ground fault on the infeed and load ends of the molded case circuit breaker. If this fault occurs, the entire phase-to-phase voltage is applied across one pole of the molded case circuit breaker.



- Ungrounded transformer
- 2 Molded case circuit breaker
- 3 Exposed conductive part
- R<sub>A</sub> Contact resistance of exposed conductive part ground

Two faults on the load side - double-phase-to-ground fault

- A fault develops between two phases and an exposed conductive part or ground.
- A voltage of 690 V is applied at the main contacts. This voltage is disconnected by two breaker poles.
- The molded case circuit breaker is rated for Icu/Ics at 690 V.

One fault on the line side and one fault on the load side (double-phase-to-ground fault)

- Single-pole short circuit, the full phase-to-phase voltage of 690 V is applied to main contact L3.
- Selection of the molded case circuit breaker according to their suitability as defined in IEC 60947-2, Annex H.

# 3.9 Safety-related applications of 3VA molded case circuit breakers

The 3VA molded case circuit breakers can be used in safety-related applications (up to Category 2 and PL d according to ISO 13849-1 and SIL 2 according to IEC 62061).

As the molded case circuit breaker has no diagnostic capability, such as mirror contacts, it cannot be used as a second function channel in the safety function. Neither is is practical to trip the molded case circuit breaker every time a safety request occurs, as it has to be reset manually. However it is possible to use the molded case circuit breaker as a "test device output". When combined with a contactor, this corresponds to Category 2 according to ISO 13849-1 and can therefore achieve up to PL d. According to IEC 62061, a hardware fault tolerance (HFT) of 0 can be assumed and up to SILCL 2 can therefore be achieved.

Category 2 can be implemented if the contactor is monitored with the evaluation unit and a sufficiently prompt fault response (welding of main contacts) takes place in the event of contactor failure. The molded case circuit breaker is immediately tripped by an undervoltage release in the event of a fault. It is therefore a single-channel architecture with a specified fault reaction.

Moreover, the power contactor and the molded case circuit breaker constitute proven components according to ISO 13849-2.



#### Danger of death due to undetected fault cluster

Undetected fault clusters can result in life-threatening situations in the application.

In order to avoid an undetected fault cluster, the molded case circuit breaker must be tested after 6 to 12 months at the latest.

Documentary evidence of the tests performed must be kept by the user during the period of use.

The set delay time has an effect on the maximum response time.

# **A** DANGER

#### Danger of death due to excessively long delay time

The delay time set on the molded case circuit breaker has an effect on the maximum response time.

The user must ensure that this response time in the event of a fault is sufficiently short based on the risk assessment.

You can find details and calculation examples in the FAQs on the Internet (<a href="https://support.industry.siemens.com/cs/ww/en/view/40349715">https://support.industry.siemens.com/cs/ww/en/view/40349715</a>). The B10(d) values (<a href="https://support.industry.siemens.com/cs/ww/en/view/109738685">https://support.industry.siemens.com/cs/ww/en/view/109738685</a>) of the 3VA molded case circuit breakers are also listed there.

3.9 Safety-related applications of 3VA molded case circuit breakers

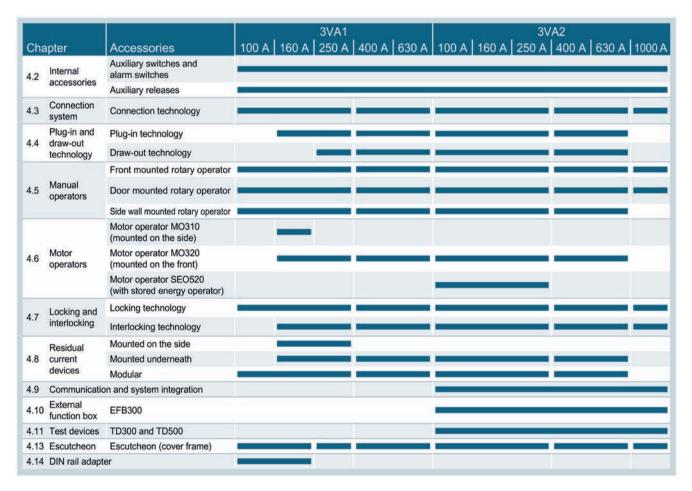
Accessories

### 4.1 Overview of accessories for 3VA molded case circuit breakers

# 4.1.1 Accessories groups

A comprehensive range of accessories is available to help you adapt 3VA molded case circuit breakers to the requirements of the specific application.

The table below indicates which accessories are compatible with particular 3VA molded case circuit breakers, and which sizes of breakers are compatible with the same accessory:



4.1 Overview of accessories for 3VA molded case circuit breakers

### 4.1.2 Possible combinations of of accessories

The tables below indicate the combinability of different accessories. The boxes to the right of the grey diagonal line indicate whether or not accessories can be combined.

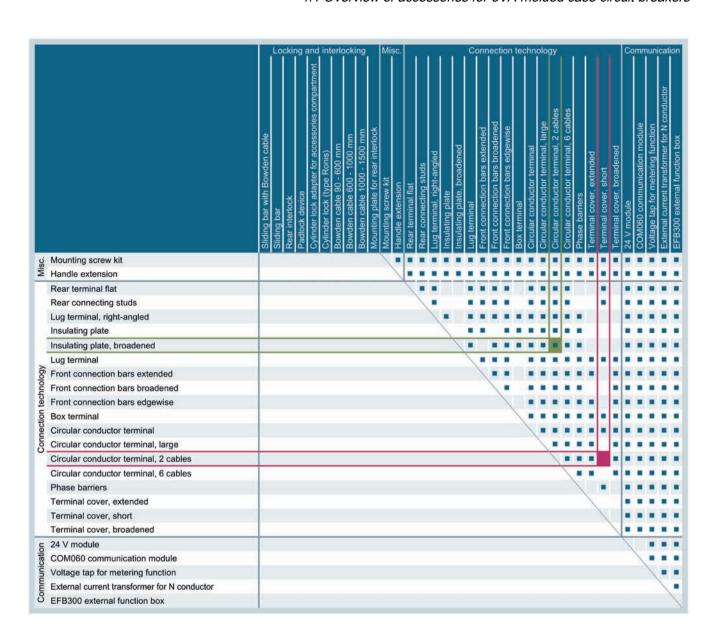
Examples:

Wire connector, 2 cables, and insulating plate offset (green lines in table below):

Common box: contains square sym- Accessories can be combined

bol

Wire connector, 2 cables, and terminal cover (red lines in table below):



### 4.1 Overview of accessories for 3VA molded case circuit breakers

|                                 |   | 7                             |                                   | _                            |                            |  |                 |                           |                                     |              |                        | _                               |   | -              |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
|---------------------------------|---|-------------------------------|-----------------------------------|------------------------------|----------------------------|--|-----------------|---------------------------|-------------------------------------|--------------|------------------------|---------------------------------|---|----------------|--------------------------------------|---------------------------------|----------------------------------|--------------------------------|---------------------------------|-------------------------------|------------------|--|--------------------------|---------------|---|----------------------------|
|                                 |   | н                             | ř                                 | ï                            | Ma                         | inu  | al c            | pe                        | rato                                | ors          | ٠,                     | ٠,                              | - 1   | M              | RC                                   | 미                               | 립                                | ug-                            | in a                            | and                           | dra              | w-c  | ut t                     | ech           | nol                                       | ogy                        |
|                                 |   | Front mounted rotary operator | Side wall mounted rotary operator | Door mounted rotary operator | Cylinder lock (type Ronis) | Cylinder lock adapter for manual operators | llumination kit | Cylinder lock (type Kaba) | Extended DIN rail for N/PE terminal | Shaft 600 mm | Variable depth adapter | Rotary operator with shaft stub | Supplementary handle for door mounted rotary operator | Motor operator | Side mounted residual current device | oadside residual current device | Conversion kit for draw-out unit | Complete Kit for draw-out unit | Conversion Kit for plug-in unit | Complete Kit for plug-in unit | DIN rail adapter | Auxiliary circuit connector for plug-in unit | osition signaling switch | · feedthrough | Sommunication interface for draw-out unit | Sylinder lock (type Ronis) |
|                                 |   | Fron                          | Side                              | Doo                          | Š                          | Š  | En III          | Š                         | Exte                                | Shaf         | Vari                   | Rota                            | Supp  | Moto           | Side                                 | Loac                            |                                  |                                | 5                               |                               |                  | Auxi   | Posi                     | Dool          | Com                                       | Š                          |
|                                 | Front mounted rotary operator                         | 1                             | -                                 |                              |                            | -  | -               |                           |                                     |              |                        |                                 |   |                | •                                    |                                 | -                                | -                              | 4                               |                               | 1                |  | •                        |               | -   | -                          |
|                                 | Side wall mounted rotary operator                     |                               | 1                                 | 1                            |                            | -  | 1               | -                         | •                                   | 1            |                        |                                 | -   |                |                                      |                                 |                                  |                                |                                 |                               |                  | AT PART                                      | -                        |               |   |                            |
|                                 | Door mounted rotary operator                          |                               |                                   | 1                            |                            |  |                 | -                         |                                     | u            | -1                     | -                               | -   |                | -                                    |                                 | -                                | ı                              |                                 | -1                            | 1                | -  | -                        |               | -1  | -1                         |
| Suc                             | Cylinder lock (type Ronis)                            | 1                             |                                   |                              |                            | •  | •               | •                         | ٠                                   | •            | •                      | ٠                               | •   | 4              | •                                    | •                               | 1                                | 4                              | 4                               | 4                             |                  |  | ۰                        | 8             | •   | -                          |
| ratc                            | Cylinder lock adapter for manual operators            | П                             |                                   |                              |                            | 1  | •               | -                         | •                                   | •            |                        | -                               | •   |                |                                      | -                               | -                                | ı                              | ł                               | J                             | I                | Н  | •                        | Н             | -   | -                          |
| Manual operators                | Illumination kit                                      | 1                             |                                   |                              |                            |  | 1               | •                         | •                                   | •            |                        | •                               | •   | 4              | •                                    | •                               |                                  |                                | 1                               | -                             |                  |  | -                        | •             | •   | • 1                        |
| nal                             | Cylinder lock (type Kaba)                             | н                             |                                   |                              |                            |  |                 | 1                         | •                                   |              |                        | -                               | -   |                |                                      | •                               |                                  | П                              | J                               | 4                             |                  | 1  | •                        |               |   | - 1                        |
| Man                             | Extended DIN rail for N/PE terminal                   | 1                             |                                   |                              |                            |  |                 |                           | 1                                   |              |                        |                                 | 4   | 4              |                                      | •                               |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| -                               | Shaft 600 mm  | П                             |                                   |                              |                            |  |                 |                           |                                     | 1            |                        | -                               | -   |                | •                                    | •                               |                                  | J                              | J                               | Я                             | I                | Н  |                          |               |   | - 1                        |
|                                 | Variable depth adapter                                |                               |                                   |                              |                            |  |                 |                           |                                     |              | 1                      | •                               | •   | 4              |                                      | •                               |                                  | •                              |                                 |                               |                  | -  | •                        |               | •   | -                          |
|                                 | Rotary operator with shaft stub                       | н                             |                                   |                              |                            |  |                 |                           |                                     |              |                        | /                               | •   | ٦              | •                                    | •                               |                                  | Т                              | 1                               | - 1                           | 1                |  |                          |               | •   |                            |
|                                 | Supplementary handle for door mounted rotary operator |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 | 1   | _              | •                                    | •                               |                                  | -                              | 7                               | -                             |                  |  | •                        |               | •   | •                          |
| Σ                               | Motor operator  |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 | 1 8   | V              |                                      | •                               | 1                                | 3                              | 3                               | 1                             | I                |  |                          |               | •   |                            |
| RCD                             | Side mounted residual current device                  |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                | 1                                    |                                 |                                  |                                |                                 | - 1                           |                  |  |                          |               |   |                            |
| œ                               | Loadside residual current device                      | 1                             |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                | 3                                    | V                               | Ш                                |                                |                                 |                               | 1                | Ш  |                          |               |   |                            |
|                                 | Conversion kit for draw-out unit                      | 1                             |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      | - 12                            | 1                                |                                |                                 |                               |                  |  |                          |               |   |                            |
| 3S                              | Complete kit for draw-out unit                        | П                             |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  | /                              |                                 |                               |                  |  | •                        |               |   | - 1                        |
| olo                             | Conversion kit for plug-in unit                       |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                | 1                               |                               |                  |  |                          |               |   |                            |
| chn                             | Complete kit for plug-in unit                         | н                             |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                | . 3                             | /                             |                  |  |                          |               |   |                            |
| ut te                           | DIN rail adapter                                      |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 | -                             | 1                |  |                          |               |   |                            |
| N-01                            | Auxiliary circuit connector for draw-out unit         |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| drav                            | Auxiliary circuit connector for plug-in unit          |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  | 1  |                          | •             |   | •                          |
| Pu                              | Position signaling switch                             |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  | 1                        |               |   | -                          |
| Plug-in and draw-out technology | Door feedthrough                                      |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          | 1             | •   | •                          |
| Ing                             | Communication interface for draw-out unit             |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               | 1   | •                          |
| ш                               | Cylinder lock (type Ronis)                            |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   | 1                          |
|                                 | Cylinder lock adapter for draw-out unit               |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   | )                          |
|                                 | Sliding bar with Bowden cable                         |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| D                               | Sliding bar   |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| Kin                             | Rear interlock  |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| Locking and interlocking        | Padlock device  |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| inte                            | Cylinder lock adapter for accessories compartment     |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| and                             | Cylinder lock (type Ronis)                            |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| ing                             | Bowden cable 90 - 600 mm                              |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| ock                             | Bowden cable 600 - 1000 mm                            |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
| _                               | Bowden cable 1000 - 1500 mm                           |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |
|                                 | Mounting plate for rear interlock                     |                               |                                   |                              |                            |  |                 |                           |                                     |              |                        |                                 |   |                |                                      |                                 |                                  |                                |                                 |                               |                  |  |                          |               |   |                            |

|                          |   |                               | Loc         | kir            | g a            | nd  | inte                | rloc              | king               |                                   | Mi                 | sc.              |                    |                       | 1                         |                 |                  | Co          | nne             | ecti                            | on 1                           | ect         | nol                         | ogy                                | ,                                  |                | -                       | ï       | C              | omr                  | nun               | icat   | tic |
|--------------------------|---|-------------------------------|-------------|----------------|----------------|---|---------------------|-------------------|--------------------|-----------------------------------|--------------------|------------------|--------------------|-----------------------|---------------------------|-----------------|------------------|-------------|-----------------|---------------------------------|--------------------------------|-------------|-----------------------------|------------------------------------|------------------------------------|----------------|-------------------------|---------|----------------|----------------------|-------------------|--|-----|
|                          |   | Ш                             |             |                |                | eut   | П                   | Т                 | П                  | П                                 |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 | П                              | П           | Т                           | Т                                  |                                    |                |                         |         |                |                      |                   |  | ı   |
|                          |   |                               |             |                |                | Cylinder lock adapter for accessories compartment | П                   | Т                 | П                  | П                                 |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 | П                              | П           | Т                           | Т                                  |                                    |                |                         |         |                |                      |                   | ţ  | ı   |
|                          |   |                               |             |                |                | ď   | П                   | Т                 | н                  | П                                 |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 | П                              | П           | Т                           | Т                                  |                                    |                |                         |         |                |                      |                   | duc  | I   |
|                          |   |                               |             |                |                | 8 00  | П                   | Т                 | н                  | П                                 |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 | П                              | П           | Т                           | 9                                  | S S                                |                |                         |         |                |                      |                   | cou  | I   |
|                          |   |                               |             |                |                | orie  | П                   | L                 | L                  | ×                                 |                    |                  |                    |                       |                           |                 |                  |             | اہ              | ed                              | e e                            | П           | 1                           | ge P                               | Cab<br>Cab                         |                |                         |         |                | 흑                    | 5                 | Z  | ı   |
|                          |   | aple                          |             |                |                | Sess  | П                   | _   [             |                    | Įĕ.                               |                    |                  |                    |                       |                           |                 | Д                |             | nde             | ge                              | ewis                           | ١.          | _   4                       | 0                                  | 9                                  |                |                         |         |                | Pour                 | ncti              | er fo  | ı   |
|                          |   | Sliding bar with Bowden cable |             |                |                | acc   | (SI                 | 1000 mm           | 1500 mm            | Mounting plate for rear interlock |                    |                  |                    |                       | eq                        |                 | broadened        |             | bars extended   | Front connection bars broadenec | Front connection bars edgewise |             | Circular conductor terminal | Circular conductor terminal, large | icular conductor terminal 6 cables |                | B                       |         | proadened      | communication module | metering function | External current transformer for N conductor |     |
|                          |   | vde                           |             |                |                | 일   | Ronis)              |                   | - 0                | rear                              |                    |                  |                    | spn                   | ang                       |                 | pad              |             | SIE             | Sug                             | ars                            | 1           |                             |                                    | lern tern                          |                | end                     | 딝       | ğ              | catic                | er.               | nsfe   | ı   |
|                          |   | B                             |             |                |                | apte  | a s                 | ۾ اچ              |                    | for                               | 호                  | E C              | at                 | gst                   | ght                       |                 | , bro            |             | ğ               | r P                             | ğ                              |             |                             | į                                  | į                                  |                | ĕ                       |         |                | Ē                    | met               | l fa   | ı   |
|                          |   | with                          |             | 충              | Padlock device | ad  | Cylinder lock (type | Bowden cable 90 - | Bowden cable 500 - | ate                               | Mounting screw kil | landle extension | Rear terminal flat | Rear connecting studs | ug terminal, right-angled | nsulating plate | nsulating plate, | _           | ront connection | sctic                           | Sctic                          | _ .         | ĕ,                          |                                    |                                    | ers            | erminal cover, extended | cover,  | erminal cover, | ,   ह                | ō                 | rren   | ı   |
|                          |   | par                           | bar         | Rear interlock | de             | 8   | 흰                   | S S               | 3 8                | d b                               | g S(               | exte             | 籄                  | nne                   | mine                      | g b             | g b              | ug terminal | u d             | Jun (                           | ă.                             | Box termina |                             | 3 8                                | 3 8                                | Phase barriers | 8                       | 8       | l erminal cov  | Ö                    | oltage tap        | 큥  |     |
|                          |   | g                             | Sliding bar | Ē              | Sc.            | ge  | اge.                | de                | ē E                | 튵                                 | 퉏                  | dle              | r<br>E             | 50                    | terr                      | latir           | latir            | terr        | i c             | ğ                               | ğ                              | e le        |                             | i la                               | 1 2                                | set            | ig                      | erminal | ĬĮ,            | OM060                | age               | rna  | ı   |
|                          |   | Sig                           | Slid        | Rea            | Pad            | 3   | ٥                   | No de             | Box                | Mor                               | Mor                | Han              | Rea                | Rea                   | Lug                       | Insu            | Insu             | Lug         | Fig             | Fro                             | Ē                              | ğ<br>B      |                             |                                    |                                    | Pha            | Terr                    |         | 24 E           |                      | Volt              | Exte   | ı   |
|                          | Front mounted rotary operator                         |                               |             |                |                |   |                     | t                 | Ť                  | П                                 |                    | П                | п                  | -                     | ī                         |                 |                  |             |                 |                                 |                                | 1           | Ť                           | t                                  | t                                  |                | -                       |         | 1              |                      | F                 | -  |     |
|                          | Side wall mounted rotary operator                     | 1                             |             |                |                |   |                     |                   |                    |                                   |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 |                                |             |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
|                          | Door mounted rotary operator                          |                               |             |                |                |   |                     |                   |                    |                                   |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 |                                |             |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| co                       | Cylinder lock (type Ronis)                            |                               |             |                |                |   |                     |                   |                    |                                   |                    |                  |                    | ī                     |                           |                 |                  |             |                 |                                 |                                |             |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| ator                     | Cylinder lock adapter for manual operators            |                               |             | •              |                |   | 1                   | į.                |                    |                                   | •                  | •                | •                  |                       |                           | •               |                  | •           |                 |                                 |                                |             |                             |                                    |                                    |                |                         | . 1     |                |                      |                   |  |     |
| per                      | Illumination kit                                      |                               |             | •              |                |   |                     |                   |                    |                                   |                    |                  | •                  |                       |                           | •               |                  |             |                 |                                 |                                |             |                             | T.                                 |                                    |                | •                       |         |                |                      |                   |  |     |
| alo                      | Cylinder lock (type Kaba)                             |                               |             | •              |                |   |                     |                   |                    |                                   |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 |                                |             | 1                           |                                    |                                    |                |                         | . 1     |                |                      |                   |  |     |
| Manual operators         | Extended DIN rail for N/PE terminal                   | Т                             |             |                |                |   |                     |                   |                    |                                   |                    |                  |                    | ۰                     |                           |                 |                  |             |                 |                                 |                                |             |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| Σ                        | Shaft 600 mm  |                               |             |                |                |   | -                   |                   |                    |                                   |                    |                  |                    |                       |                           |                 |                  |             |                 |                                 |                                |             |                             |                                    |                                    |                |                         | . 1     |                |                      |                   |  |     |
|                          | Variable depth adapter                                |                               |             |                |                |   |                     |                   |                    |                                   |                    |                  |                    |                       |                           | •               |                  |             |                 |                                 |                                |             |                             |                                    |                                    |                |                         | . 1     |                |                      |                   |  |     |
|                          | Rotary operator with shaft stub                       |                               |             |                |                |   |                     | T.                |                    |                                   |                    |                  |                    |                       |                           |                 |                  |             | ٠               |                                 |                                |             |                             |                                    |                                    |                |                         | - 1     |                |                      |                   |  |     |
|                          | Supplementary handle for door mounted rotary operator |                               |             | •              |                |   |                     |                   |                    |                                   |                    |                  |                    |                       |                           |                 |                  |             |                 | •                               | •                              | •           |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| Σ                        | Motor operator  |                               |             | •              |                |   |                     | T                 |                    |                                   |                    |                  |                    |                       | •                         | •               |                  | •           |                 |                                 | •                              | -           |                             | Ţ                                  | ij.                                |                |                         | - 1     |                |                      |                   |  | I   |
| RCD                      | Side mounted residual current device                  |                               |             |                |                |   |                     |                   |                    |                                   |                    |                  | •                  |                       |                           |                 | •                |             | •               | •                               |                                |             |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| ř                        | Loadside residual current device                      |                               |             |                |                | •   |                     |                   |                    |                                   |                    |                  |                    |                       |                           |                 |                  | •           | •               | •                               | •                              |             |                             | 1                                  | i c                                |                |                         | - 1     |                |                      |                   |  |     |
|                          | Conversion kit for draw-out unit                      |                               |             | •              | •              | •   | •                   |                   |                    |                                   |                    |                  | •                  |                       | •                         | •               | •                | •           | •               |                                 | •                              |             |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| <u>&gt;</u>              | Complete kit for draw-out unit                        |                               |             | •              |                |   |                     | T.                | 1                  |                                   | •                  |                  |                    |                       |                           | •               | •                | •           | •               | •                               | •                              |             |                             | Т                                  | į.                                 |                |                         | - 1     |                |                      | -                 |  |     |
| 200                      | Conversion kit for plug-in unit                       |                               | •           |                | •              |   |                     |                   |                    | •                                 | •                  |                  | •                  |                       |                           |                 |                  |             | •               | •                               |                                |             |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| 딩                        | Complete kit for plug-in unit                         |                               | •           | •              | •              | •   |                     |                   |                    |                                   |                    |                  |                    | •                     | •                         |                 | •                | •           |                 |                                 | •                              |             |                             |                                    |                                    |                | •                       |         |                |                      |                   |  |     |
| ir te                    | DIN rail adapter                                      | -                             | •           |                | •              | •   |                     |                   |                    |                                   |                    | •                | •                  |                       |                           |                 | •                | •           | •               | •                               |                                | •           |                             |                                    |                                    |                | •                       |         |                |                      |                   | -  |     |
| draw-out technology      | Auxiliary circuit connector for draw-out unit         |                               | •           | •              |                | •   | •                   |                   |                    |                                   |                    | •                |                    | •                     |                           |                 | •                | •           | •               |                                 | •                              |             |                             | Ţ.                                 |                                    |                | •                       |         |                |                      |                   | •  |     |
| dray                     | Auxiliary circuit connector for plug-in unit          | -                             |             |                | •              | •   | •                   |                   |                    | •                                 | •                  |                  |                    |                       |                           |                 | •                | •           | •               | •                               | •                              |             |                             | 1                                  | Ų.                                 | -              | •                       | - 1     |                |                      | -                 | •  |     |
| pue                      | Position signaling switch                             |                               |             | •              | •              | •   |                     | 1                 |                    |                                   |                    |                  |                    | •                     |                           |                 | •                | •           | •               | •                               | •                              |             | 1                           | 1                                  |                                    |                | •                       |         |                |                      |                   | •  |     |
| Plug-in and              | Door feedthrough                                      |                               |             | •              |                |   | _ !                 |                   |                    | •                                 |                    |                  | •                  | •                     | •                         | •               |                  | •           | •               | •                               | •                              | •           |                             |                                    |                                    |                |                         |         |                |                      |                   |  |     |
| Sing<br>Sing             | Communication interface for draw-out unit             |                               |             |                |                | •   |                     | T                 | 1                  |                                   |                    |                  |                    |                       |                           | •               |                  | •           | •               | •                               |                                |             | 1                           | I                                  |                                    |                | -                       |         |                | •                    |                   |  |     |
| _                        | Cylinder lock (type Ronis)                            |                               |             | •              | •              | •   | •                   |                   | 4                  |                                   | •                  |                  | •                  | •                     | •                         | •               | •                | •           | •               | •                               | •                              | -           |                             | 1                                  | ı.                                 |                | •                       | •       | 1              |                      |                   | •  |     |
|                          | Cylinder lock adapter for draw-out unit               |                               |             |                |                |   | 4                   | I                 | 1                  |                                   |                    |                  |                    |                       |                           |                 |                  |             | •               |                                 | •                              | 11          | 1                           | 1                                  | 3                                  |                | •                       |         |                |                      |                   |  | Ĺ   |
|                          | Sliding bar with Bowden cable                         | 1                             |             |                |                |   | _ !                 |                   |                    |                                   | •                  |                  |                    | •                     | •                         | •               | •                | •           | •               | •                               | •                              | •           |                             |                                    |                                    |                | •                       | •       |                |                      |                   | •  |     |
| D.                       | Sliding bar   |                               | 1           |                |                |   |                     |                   |                    |                                   |                    | -                |                    | •                     |                           |                 |                  |             | •               | •                               | -                              | -           | 1                           | 1                                  | -                                  |                |                         |         |                | •                    |                   | •  |     |
| CKI                      | Rear interlock  |                               |             | 1              | -              | •   | •                   |                   |                    |                                   | -                  |                  | -                  | •                     | -                         | •               | •                | •           | •               | •                               | •                              | 4           | 1                           | 4                                  |                                    | -              | •                       | - '     |                |                      | •                 | •  |     |
| eric                     | Padlock device  |                               |             |                | 1              |   |                     | I                 |                    | -                                 |                    |                  |                    | -                     |                           | •               | •                | •           | •               | •                               | •                              |             | 1                           | ı                                  | 1                                  | -              | •                       | -       |                | -                    |                   |  |     |
| E                        | Cylinder lock adapter for accessories compartment     |                               |             |                |                | 1   |                     |                   |                    | -                                 | -                  | -                | -                  | •                     | •                         | -               | •                |             | •               | •                               | •                              |             |                             |                                    | O Day                              |                | •                       | man in  | 1              |                      | -                 | •  |     |
| an                       | Cylinder lock (type Ronis)                            |                               |             |                |                |   | 1                   | 1                 | 1                  |                                   |                    |                  |                    | -                     |                           | •               | •                | -           | -               | -                               | -                              | -11         | 1                           | 1                                  |                                    |                | -                       |         | 1              |                      |                   | •  |     |
| Locking and interlocking | Bowden cable 90 - 600 mm                              |                               |             |                |                |   | - 1                 | 1                 |                    |                                   |                    | -                |                    | •                     | -                         | -               | •                |             |                 | •                               | •                              |             | 1                           | 1                                  | 4                                  | -              | •                       |         |                |                      | •                 | •  |     |
| 200                      | Bowden cable 600 - 1000 mm                            |                               |             |                |                |   |                     | -                 | 1                  |                                   |                    | H                |                    |                       |                           | -               | •                | •           |                 |                                 |                                |             | 1                           | i.                                 |                                    |                |                         |         |                |                      |                   | •  |     |
|                          | Bowden cable 1000 - 1500 mm                           |                               |             |                |                |   |                     |                   | 1                  | 1                                 |                    |                  |                    | -                     |                           |                 | -                |             |                 |                                 |                                |             |                             | 10                                 |                                    |                |                         |         |                |                      |                   |  |     |
|                          | Mounting plate for rear interlock                     |                               |             |                |                |   |                     |                   |                    | 1                                 |                    | ч                | ы                  | Ц                     | Н                         | ч               |                  |             | -               | -                               | •                              | -11         | 4                           | 4                                  | 4                                  |                |                         |         | 1              |                      |                   | -  |     |

### 4.1 Overview of accessories for 3VA molded case circuit breakers

|               |  | Locking and interlocking Misc. Connection technology Communication   |
|---------------|--|--|
|               |  | Sliding bar with Bowden cable Sliding bar with Bowden cable Padlock device Padlock device Cylinder lock adapter for accessories compartment Cylinder lock (type Ronis) Bowden cable 600 - 1000 mm Bowden cable 600 - 1000 mm Bowden cable 600 - 1000 mm Mounting plate for rear interlock Mounting screw kit Handle extension Rear terminal flat Rear connecting studs Lug terminal flat Insulating plate, broadened Insulating plate, broadened Front connection bars extended Front connection bars edgewise Box terminal Circular conductor terminal, 2 cables Circular conductor terminal, 2 cables Circular conductor terminal, 6 cables Colmologo communication module COMMO60 communication module COMMO60 communication module Voltage tap for metering function Externiar transformer for N conductor Externiar conductor box |
| Misc.         | Mounting screw kit                           |  |
| Σ             | Handle extension                             |  |
|               | Rear terminal flat                           |  |
|               | Rear connecting studs                        |  |
|               | Lug terminal, right-angled                   |  |
|               | Insulating plate                             |  |
|               | Insulating plate, broadened                  |  |
| >             | Lug terminal                                 | \*** ******  |
| technology    | Front connection bars extended               | \  |
| hhc           | Front connection bars broadened              | \  |
| tec           | Front connection bars edgewise               | \  |
| Connection    | Box terminal                                 |  |
| nne           | Circular conductor terminal                  |  |
| S             | Circular conductor terminal, large           | \****  |
|               | Circular conductor terminal, 2 cables        |  |
|               | Circular conductor terminal, 6 cables        |  |
|               | Phase barriers                               |  |
|               | Terminal cover, extended                     | \  |
|               | Terminal cover, short                        |  |
| _             | Terminal cover, broadened                    |  |
| noi           | 24 V module                                  |  |
| icat          | COM060 communication module                  | \•••   |
| unu           | Voltage tap for metering function            |  |
| Communication | External current transformer for N conductor |  |
| ŏ             | EFB300 external function box                 |  |

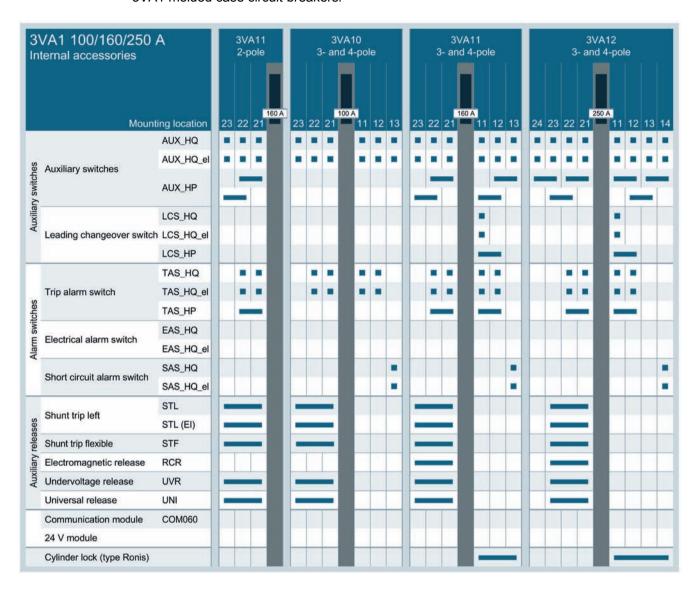
# 4.2.1 Mounting locations on 3VA molded case circuit breakers

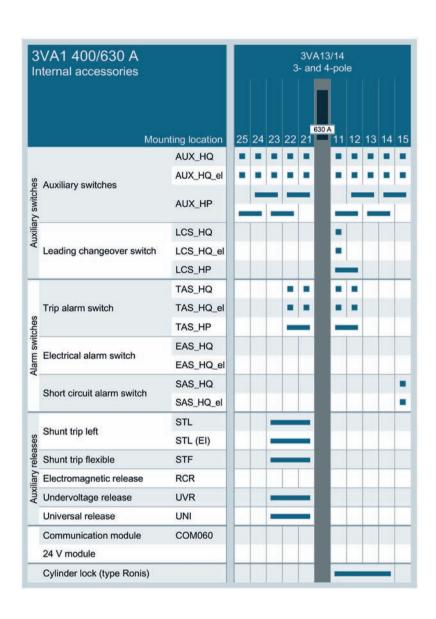
The portfolio of internal accessories includes:

- Auxiliary switches
- Alarm switches
- Auxiliary releases
- COM060 communication module
- 24 V module
- Cylinder lock (type Ronis)

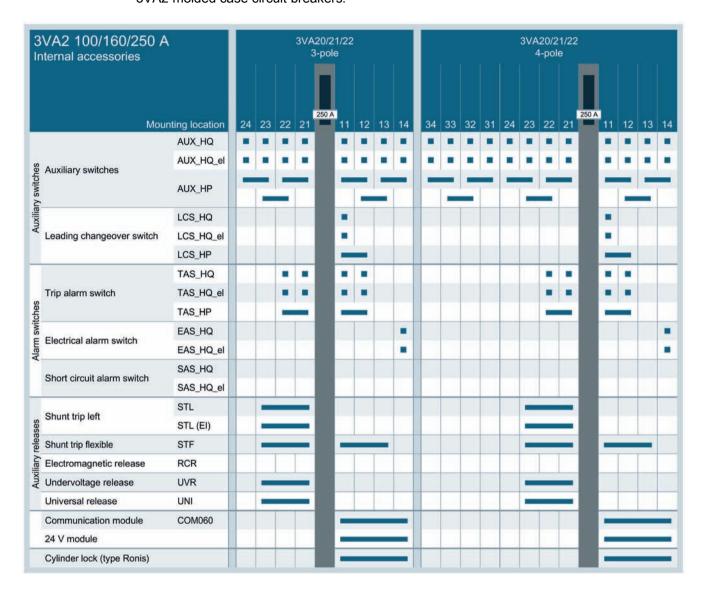
The following tables show the alternative mounting locations for internal accessories, which depend on the size and pole number of the circuit breaker.

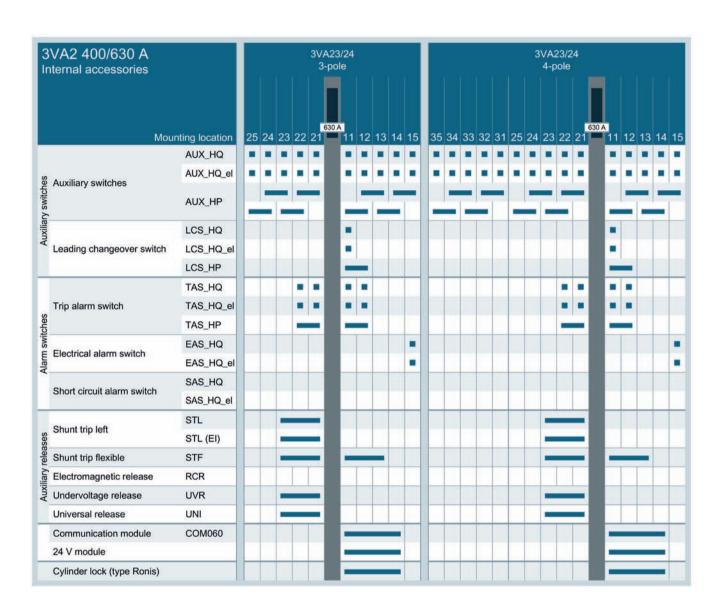
### 3VA1 molded case circuit breakers:

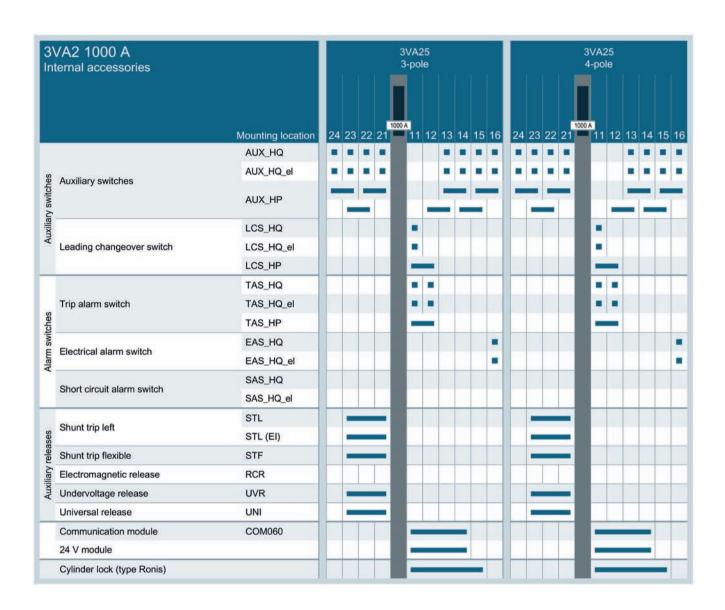




### 3VA2 molded case circuit breakers:







### See also

Cylinder locks for locking the 3VA molded case circuit breaker (Page 365)

### 4.2.2 Auxiliary and alarm switches

The auxiliary and alarm switches for 3VA molded case circuit breakers belong to an integrated range of accessories. They can be installed in all sizes of all circuit breakers up to 1000 A.

The auxiliary and alarm switches can be very simply snapped into place and connected up in accessory compartments provided on the front panel of the unit to the left and right of the handle.

All auxiliary and alarm switches are designed as changeover contacts and therefore provide a high degree of flexibility for planning and installation purposes.

#### **HQ** and **HP** switches

The switches are available in versions HQ and HP. HQ switches are 7 mm wide, and HP switches 14 mm wide.



Both switch versions can be combined extremely flexibly in a molded case circuit breaker. This level of compatibility means that two HQ switches can be optionally installed in place of one HP switch.

HQ and HP switches have the same functionality, but differ in terms of the following features:

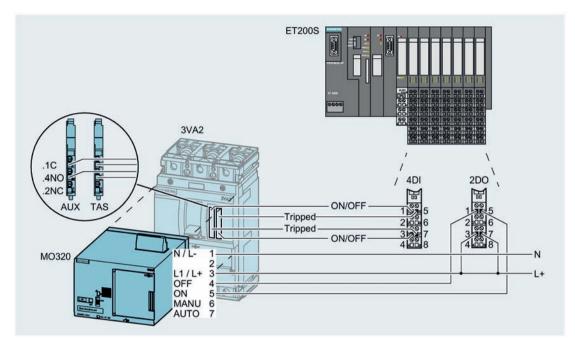
- Connection technology
  - HQ: One conductor per contact point
  - HP: Two conductors per contact point possible (loop-through)
- Key electrical data
  - HQ: max. 250 V; max. 6 A
  - HP: max. 600 V; max. 10 A

Individual key electrical data can be found at the end of this chapter.

All HQ switches are also available in an electronics-compatible version (HQ\_el).

The electronics-compatible auxiliary switches (HQ\_el) are specially optimized for switching small voltages and currents. They are therefore particularly useful for alarms in the vicinity of PLC controllers, for example.

The diagram below uses the example of an ET200S to illustrate the conventional method of connecting the electronics-compatible auxiliary switch AUX, the trip alarm switch TAS and the motor operator MO320 to a distributed I/O unit.



Further information about contact reliability can be found at the end of this chapter.

### **Auxiliary switches AUX**



The purpose of auxiliary switches is to signal the position of the main contacts of the molded case circuit breaker. The contacts of the auxiliary switch open and close simultaneously with the main contacts of the molded case circuit breaker.

### Leading changeover switches LCS



Leading changeover switches signal the opening of the main contacts with a lead time of 20 ms in advance of circuit breaker trips and can be used for load shedding, for example.

### Trip alarm switches TAS



Trip alarm switches signal all types of molded case circuit breaker trip, regardless of the cause of the trip. The trip alarm switches are actuated whenever the molded case circuit breaker switches to the TRIP position.

### Electrical alarm switches EAS



Electrical alarm switches are operated as soon as the main contacts of the molded case circuit breaker open in the event that the breaker is tripped by the ETU. They indicate the following conditions:

- Overload L and neutral conductor overload
- Short-circuit S. I.
- Ground-fault tripping G
- Residual current device RCD820

The electrical alarm switch is not operated:

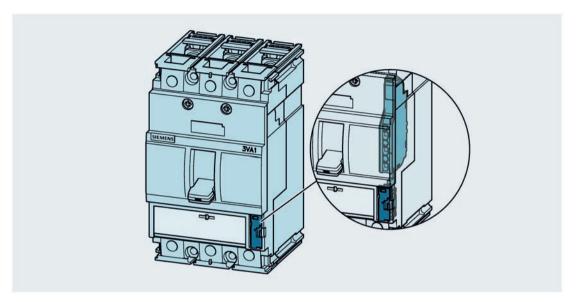
- When the breaker is tripped manually
  - PUSH TO TRIP
  - When the breaker is withdrawn from the plug-in/draw-out socket when the main contacts are closed
- When activated via an auxiliary release
  - Shunt trip STL, STL(EI), STF
  - Undervoltage release UVR
  - Universal release UNI

Electrical alarm switches are compatible only with 3VA2 molded case circuit breakers equipped with electronic trip units (ETU).

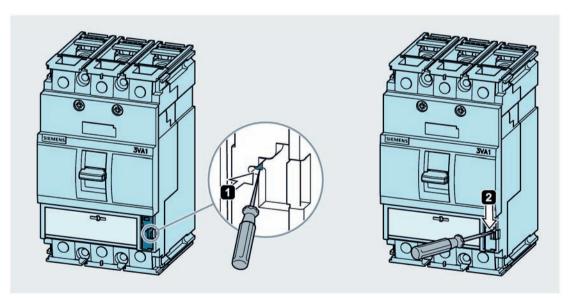
### Short circuit alarm switches SAS



Short circuit alarm switches signal trips only if they have been initiated by a short circuit. These events are also indicated on the molded case circuit breaker.

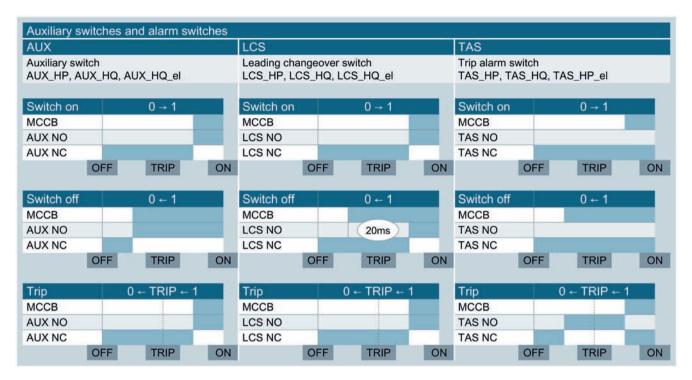


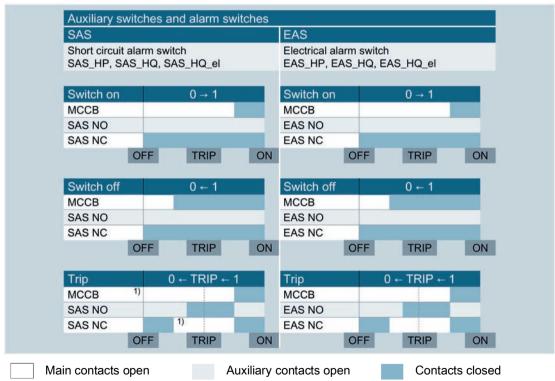
The trip must be reset by deliberate acknowledgement of the fault before the molded case circuit breaker is switched to ON again.



Short circuit alarm switches are only compatible with 3VA1 molded case circuit breakers. On breakers equipped with electronic trip units, the short circuit alarm function is performed by the electronic trip unit (ETU) and the EFB300 external function box.

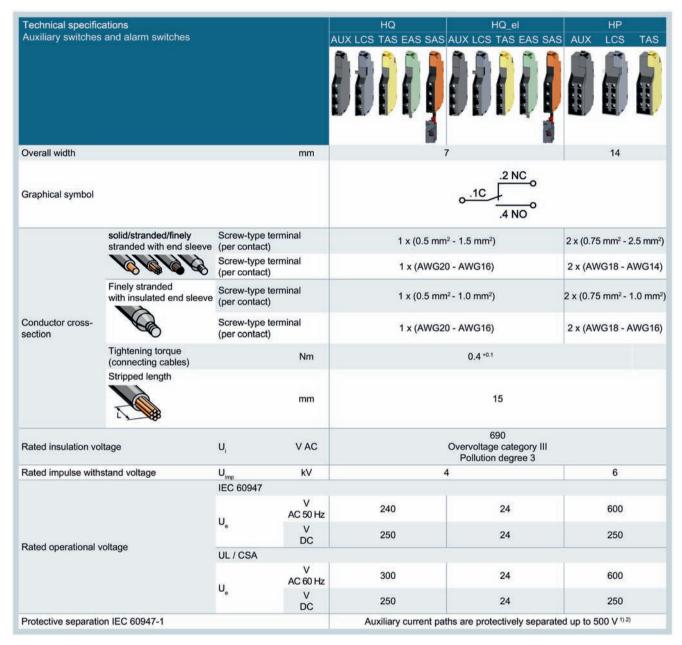
### 4.2.3 Contact sequence diagrams





Manual reset by tool necessary after tripping Automatic reset by motor operator MO320

# 4.2.4 Technical specifications of auxiliary and alarm switches



Safe separation in the case of side-by-side construction of auxiliary switches and auxiliary releases only up to 440 V and in systems up to an impulse voltage withstand level of 4 kV

<sup>&</sup>lt;sup>2)</sup> HP switches without adjacent switches; not in mounting locations 11 and 21 up to 690 V

| Technical specifica                 |                      |   |    | HQ                   | HQ_el                            | HP                 |
|-------------------------------------|----------------------|---|----|----------------------|----------------------------------|--------------------|
| Auxiliary switches a                | and alarm switches   |   |    | AUX LCS TAS EAS SAS  | AUX LCS TAS EAS SAS              | AUX LCS TAS        |
|                                     |                      |   |    |                      |                                  |                    |
| Conventional free-air               | thermal current      | I <sub>th</sub> = I <sub>e</sub>  | Α  | 6                    | 0.3                              | 10                 |
| Rated making capaci                 | ity                  |   | Α  | 6                    | 0.3                              | 10                 |
|                                     |                      | 12 V  | Α  | 6                    | 0.3                              | 10                 |
|                                     |                      | 24 V  | Α  | 6                    | 0.3                              | 10                 |
|                                     |                      | 48 V  | Α  | 6                    |                                  | 10                 |
|                                     | AC-12                | 125 V   | Α  | 6                    |                                  | 10                 |
|                                     |                      | 220/240 V   | Α  | 6                    |                                  | 10                 |
|                                     |                      | 280/440 V   | Α  |                      |                                  | 6                  |
|                                     |                      | 600 V   | Α  |                      |                                  | 2                  |
|                                     |                      | 12 V  | Α  | 3                    | 0.3                              | 6                  |
|                                     |                      | 24 V  | Α  | 3                    | 0.3                              | 6                  |
|                                     |                      | 48 V  | Α  | 3                    |                                  | 6                  |
|                                     | AC-15                | 125 V   | Α  | 3                    |                                  | 6                  |
| Rated operational                   |                      | 220/240 V   | Α  | 3                    |                                  | 6                  |
| current                             |                      | 280/440 V   | Α  |                      |                                  | 2                  |
|                                     |                      | 600 V   | Α  |                      |                                  | 0.6                |
|                                     |                      | 12 V  | Α  | 6                    | 0.1                              | 6                  |
|                                     |                      | 24 V  | Α  | 4                    | 0.1                              | 6                  |
|                                     | DC-12                | 48 V  | Α  | 2                    |                                  | 2                  |
|                                     |                      | 110 V   | Α  | 0.5                  |                                  | 0.6                |
|                                     |                      | 250 V   | Α  | 0.25                 |                                  | 0.3                |
|                                     |                      | 12 V  | Α  | 1                    | 0.07                             | 3                  |
|                                     |                      | 24 V  | Α  | 0.8                  | 0.07                             | 3                  |
|                                     | DC-13                | 48 V  | Α  | 0.4                  |                                  | 0.8                |
|                                     |                      | 110 V   | Α  | 0.2                  |                                  | 0.2                |
|                                     |                      | 250 V   | Α  | 0.1                  |                                  | 0.1                |
| Short-circuit                       | Fuses                | Type gG/gL  |    |                      | cifications relating to rated of |                    |
| protection<br>Lead time relative to |                      | akers Characteristic ty   |    | according to the spe | cifications relating to rated of | perational current |
| main contacts <sup>1)</sup>         | LCS                  |   | ms |                      | > 20                             |                    |
| Switching frequency                 |                      | 20 - 14 14 - 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  |    |                      | 240                              |                    |
| Degree of protection                | Accessories cover cl |   |    |                      | IP40                             |                    |
| 55 Å                                | Accessories cover of | CONTRACTOR OF THE PARTY OF THE |    |                      | IP20                             | 72HS2              |
| Minimum load                        |                      | At 24 V DC  | mA | 70                   | 0.5                              | 70                 |
|                                     |                      | At 5 V DC   | mA |                      | 1                                |                    |

<sup>1)</sup> In combination with manual switching operations, but not when motor operators are used

### 4.2.5 Auxiliary releases

Auxiliary releases allow remote electrical tripping of the circuit breaker. They can be used to monitor control or main circuits in order to implement a protective system against accidental restart following a power failure, for example.

Auxiliary releases therefore perform a main circuit monitoring function in addition to the main circuit monitoring performed by the trip unit.

Auxiliary releases are extremely easy to install. No tools are required because these 21 mm wide components are simply snapped into place in the accessory compartments to the left and right of the handle. The accessories are connected by screw terminals for auxiliary conductors with a cross-section of up to 1.5 mm<sup>2</sup>. The terminals are mounted on the front of the unit for easy access.

The shunt trips are suitable for use in electrical interlocks. An attempt to switch on a circuit breaker while the interlock voltage is applied to the shunt trip leads to a so-called "no-load switching operation", i.e. the basic breaker always returns to the TRIP position and the main contacts never close.

#### Note

All auxiliary releases are reverse-polarity-protected.

### Shunt trip left STL



Shunt trips of type STL can be fitted in the left-hand accessory compartment as an alternative to an undervoltage release. The units are available with five rated voltages in the following range:

- 24 to 600 V AC 50/60 Hz
- 12 to 250 V DC

They have a maximum power consumption of 58 VA which is significantly lower than the power consumption of the flexible shunt trip versions.

Switches (permanent signal) or momentary push-buttons (minimum signal duration 40 ms) may be used to control shunt trips.

### Shunt trip left STL (EI) for electrical interlocks



Shunt trips of the type STL (EI) can be used to implement electrical interlocks between two molded case circuit breakers. The interlocking auxiliary release prevents short-time contact between the main contacts during a switch-on attempt.

Shunt trip STL (EI) is available with a rated voltage of 24 V DC.

### Shunt trips flexible STF



Shunt trips of type STF can be fitted in the left-hand and the right-hand (3VA2 only) accessory compartment. They are therefore suitable for combining different auxiliary releases in one switch.

The units are available with six rated voltages in the following range:

24 to 600 V AC 50/60 Hz

Due to their design, their power consumption ranges up to maximum 750 VA and is therefore higher than the power consumption of STL versions.

### Undervoltage releases UVR



Undervoltage releases trip the molded case circuit breaker in the event that the rated voltage fails or drops to between 70% and 35% of its normal value (in compliance with the relevant standard).

The main contacts of the basic breaker cannot be reclosed until the voltage applied to the UVR reaches 85% of its rated value. The breaker main contacts cannot close until the UVR rated voltage reaches this level.

The units are available with rated voltages in the following range:

- 24 to 480 V AC 50/60 Hz
- 12 to 250 V DC

### Universal releases UNI



A universal release is a single, 21 mm wide component in which a shunt trip and an undervoltage release are combined. These are subject to the same tripping conditions as the individual devices. Both functions can therefore be performed at the same time with a minimal footprint.

The three available rated voltages are identical in each case for both the shunt trip and the undervoltage release. These rated voltages are:

- 12 V DC
- 24 V DC
- 48 V DC

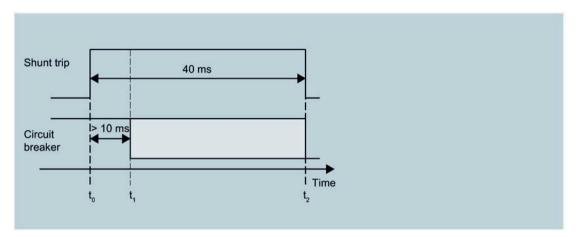
# Technical specifications of shunt trips and releases

| Technical specifica     | tions   |                                   |                 | STL       | STL (EI) | STF  | UVR                     | UNI                    |
|-------------------------|---|-----------------------------------|-----------------|-----------|----------|--|-------------------------|------------------------|
| Auxiliary releases      |   |                                   |                 | inna<br>H |          |  |                         |                        |
| Overall width           |   |                                   | mm              |           |          | 21   |                         | ,                      |
| Graphical symbol        |   |                                   |                 | C1<br>C2  | C1<br>C2 | C1<br>C2                                     | D1<br> -<br> U< <br> D2 | D1 C1<br>D2 L<br>D2 C2 |
|                         | solid/stranded/finely<br>stranded with end sleeve | Screw-type terminal (per contact) | Number<br>x mm² |           | 1 x      | (0.5 mm² - 1.5 m                             | ım²)                    |                        |
| 3                       | 4444  | Screw-type terminal (per contact) | Number<br>x AWG |           | 1 x      | (AWG20 - AWG                                 | 16)                     |                        |
| 3                       | Finely stranded with insulated end sleeve         | Screw-type terminal (per contact) | Number<br>x mm² |           | 1 x      | (0.5 mm² - 1.0 m                             | ım²)                    |                        |
| Conductor cross-section | <b>C</b>  | Screw-type terminal (per contact) | Number<br>x AWG |           | 1 x      | (AWG20 - AWG                                 | 16)                     |                        |
|                         | Tightening torque (conne                          | ecting cables)                    | Nm              |           |          | 0.4 +0.1                                     |                         |                        |
| ş                       | Stripped length                                   |                                   | mm              |           |          | 10   |                         |                        |
| Rated insulation volt   | age   | U                                 | V AC            |           |          | 690<br>ervoltage categor<br>Pollution degree |                         |                        |
|                         | 12  | V DC                              | W               | 30        |          |  | 8.                      |                        |
|                         | 24 - 30   | V DC                              | W               | 25 - 50   |          |  |                         |                        |
|                         | 48 - 60   | V DC                              | W               | 20 - 30   |          |  |                         |                        |
|                         | 110 - 127   | V DC                              | W               | 30 - 40   |          |  |                         |                        |
|                         | 220 - 250   | V DC                              | W               | 23 - 35   |          |  |                         |                        |
|                         | 24  | V AC 50/60 Hz                     | VA              | 30        |          |  |                         |                        |
|                         | 48 - 60   | V AC 50/60 Hz                     | VA              | 15 - 30   |          |  |                         |                        |
|                         | 110 - 127   | V AC 50/60 Hz                     | VA              | 30 - 40   |          |  |                         |                        |
| Power consumption       | 208 - 277   | V AC 50/60 Hz                     | VA              | 20 - 40   |          |  |                         |                        |
|                         | 380 - 600   | V AC 50/60 Hz                     | VA              | 15 - 40   | 7        |  |                         |                        |
|                         | 24  | V DC<br>V AC 50/60 Hz             | VA              |           | 1        | 340  |                         |                        |
|                         | 48 - 60   | V AC 50/60 Hz                     | VA              |           |          | 400 - 720                                    |                         |                        |
|                         | 110 127   | V AC 50/60 Hz                     | VA              | <u>-</u>  |          | 550 - 810                                    |                         |                        |
|                         | 208 - 277   | V AC 50/60 Hz                     | VA              |           | 10       | 380 - 720                                    |                         |                        |
|                         | 380 - 500   | V AC 50/60 Hz                     | VA              | _         |          | 350 - 720                                    |                         |                        |
|                         | 600   | V AC 50/60 Hz                     | VA              | =         |          | 300 - 650                                    |                         |                        |
|                         | 000   | V AC 50/60 HZ                     | VA              | 57        | L        | 300  |                         |                        |

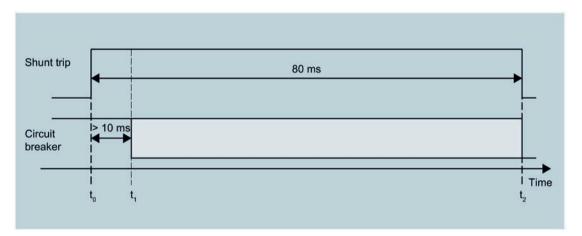
| Technical specifications   |  |                             |            | STL                | STL (EI)      | STF            | UVR          | UNI                   |
|--|--|-----------------------------|------------|--------------------|---------------|----------------|--------------|-----------------------|
| Auxiliary releases   |  |                             |            | Innas.             |               |                |              |                       |
|  | 12   | V DC                        | W          |                    | leconomic di  |                | < 2.5        |                       |
|  | 24   | V DC                        | W          |                    |               |                | < 2.5        |                       |
|  | 48   | V DC                        | W          |                    |               |                | < 2.5        |                       |
|  | 60   | V DC                        | W          |                    |               |                | < 2.5        |                       |
|  | 125 - 127                                  | V DC                        | W          |                    |               |                | < 2.5        |                       |
|  | 220-230                                    | V DC                        | w          |                    |               |                | < 2.5        |                       |
|  | 250  | V DC                        | W          |                    |               |                | < 2.5        |                       |
|  | 24   | V AC 50/60 Hz               | VA         |                    |               |                | < 2.0        |                       |
|  | 48   | V AC 50/60 Hz               | VA         |                    |               |                | < 2.0        |                       |
| 28 30  | 60   | V AC 50/60 Hz               | VA         |                    |               |                | < 2.0        |                       |
| Power consumption  | 110  | V AC 50/60 Hz               | VA         |                    |               |                | < 2.0        |                       |
|  | 120 - 127                                  | V AC 50/60 Hz               | VA         |                    |               |                | < 2.0        |                       |
|  | 208 - 230                                  | V AC 50/60 Hz               | VA         |                    |               |                | < 2.0        |                       |
|  | 380 - 400                                  | V AC 50/60 Hz               | VA         |                    |               |                | < 2.5        |                       |
|  | 440 - 480                                  | V AC 50/60 Hz               | VA         |                    |               |                | < 2.5        |                       |
|  | 12   | V DC (Cat II;<br>PELV/SELV) | w          |                    |               |                |              | UVR: < 2.5<br>SHT: 20 |
|  | 24   | V DC (Cat II;<br>PELV/SELV) | w          |                    |               |                |              | UVR: < 2.5<br>SHT: 20 |
|  | 48   | V DC (Cat II;<br>PELV/SELV) | w          |                    |               |                |              | UVR: < 2.5<br>SHT: 20 |
| Rated impulse withstand voltage                                    | Э  | U <sub>imp</sub>            | kV         | 6                  | 6             | 6              | 4            | 0.5                   |
| Making current   |  | I max                       | bei V      | 1.5 A / 24<br>V AC | 1 A / 24 V DC | 18 A / 24 V AC | 5 mA / 480 V | 1.5 A / 24 \          |
| Maximum tripping time  |  |                             | ms         |                    |               | < 10           |              |                       |
|  | Electrical tr                              | ips                         |            |                    |               | 8500           |              |                       |
| Service life   | Mechanica<br>breaker                       | I switching cycles of       | circuit    |                    |               | 25000          |              |                       |
| Priority with respect to other control signals                     |  |                             |            |                    |               | Given          |              |                       |
| Degree of protection   | Accessorie                                 | s cover closed              |            |                    |               | IP 40          |              |                       |
| N-100 € (CV-02 FC - N-10 FC CO C - CO FC CO C)                     | Accessorie                                 | s cover open                |            |                    |               | IP 20          |              |                       |
| Minimum signal duration  |  |                             | ms         | 40                 | 40            | 40             |              | 40                    |
| Response voltage of shunt trip:<br>Pick-up (circuit breaker trips) |  | Us/V                        | %          | 70 110             | 70 110        | 70 110         |              | 70 110                |
| Response voltage of undervoltage release:                          | Pick-up (cir<br>breaker car<br>switched or | n be Us/V<br>n)             | %          |                    |               |                | 85 .         | 110                   |
| and an analysis  | Release (ci<br>breaker trip                |                             | %          |                    |               |                | 35           | 70                    |
| Tripping frequency   |  | Tripping operations         | s per hour | 240                | 240           | 120            | Unli         | mited                 |
| Suitable for electrical interlocking                               | g of MCCBs                                 |                             |            | No                 | Yes           | No             | Y            | 'es                   |

# Tripping times of shunt trips

Cable length under 20 m at Ue:



Cable length 20 m to 200 m at Ue and max. conductor cross section:



### 4.2.6 Time-delay devices for undervoltage releases

Undervoltage releases can also be equipped with external, electronic time-delay control devices which prevent unintentional tripping in response to brief voltage dips during periods of disrupted operation.

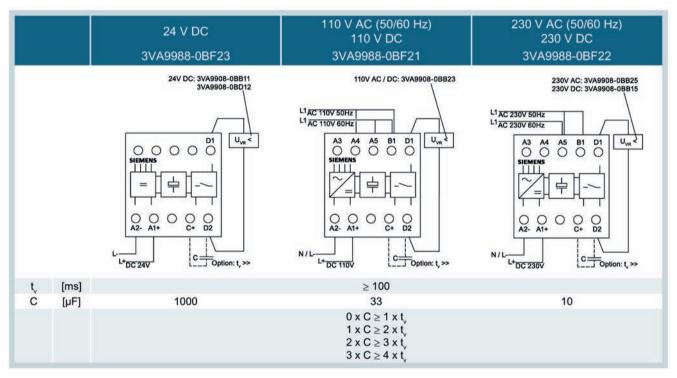
### Time-delay device for UVR with fixed delay setting



The simple time-delay device with fixed delay setting is available for the following voltages:

- 110 V AC and 230 V DC
- 24 V DC

The default delay time is >100 ms as supplied, but can be extended by the customer with the addition of supplementary capacitors:



The device can be screw-mounted or attached to a 35 mm DIN rail.

You can find a circuit diagram in chapter Circuit diagrams (Page 539) or in the operating instructions.

### 4.2.7 COM060 communication module

You can find information about the COM060 communication module in chapter Communication and system integration (Page 484).

### 4.2.8 24 V module



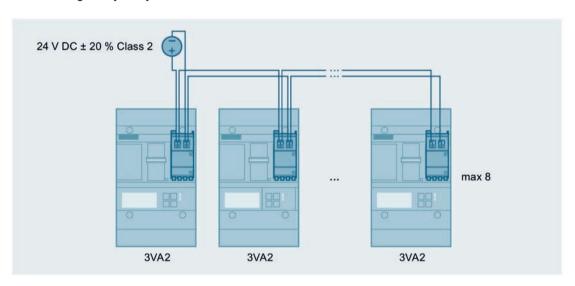
With the aid of the 24 volt module, the ETU electronic trip unit of the 3VA2 molded case circuit breaker can be permanently activated.

The module is installed in the right-hand accessory compartment and takes up four slots.

The following advantages arise from the use of the 24 V module:

- Activated display even when the circuit breaker is switched off or no current is flowing through the main circuit.
- · Backlighting permanently activated
- Through activation of the ETUs, it is possible to test and change setting parameters (5-series and 8-series ETUs)
- Faster tripping of the 3VA2 molded case circuit breaker on connecting to a short-circuit by an already active ETU

There are two connection points available for ground and 24 V DC, making looping through of the voltage very easy.



| Width                            | mm | 28.8 |  |
|----------------------------------|----|------|--|
| Height                           | mm | 64.1 |  |
| Depth                            | mm | 33.5 |  |
| Number of slots                  |    | 4    |  |
| Net weight                       | g  | 80   |  |
| General technical specifications |    |      |  |
| Pollution degree                 |    | 3    |  |
| Overvoltage category             |    | 1    |  |

# 4.3 Connection system

The chapter "Connection technology" contains useful information and provides a summarized description of the 3VA connection system. It provides a helpful guide to connecting cables or busbars to a molded case circuit breaker and so helps to ensure the safety of personnel and material assets. Mistakes which affect the operational safety of electrical installations can be avoided.

#### Contents

The chapter discusses the following topics:

- General information about cables and busbars
- Portfolio of connection components for 3VA molded case circuit breakers with
  - Front cable connection
  - Front busbar connection / cable lug connection
  - Rear busbar connection / cable lug connection
- Further connection accessories

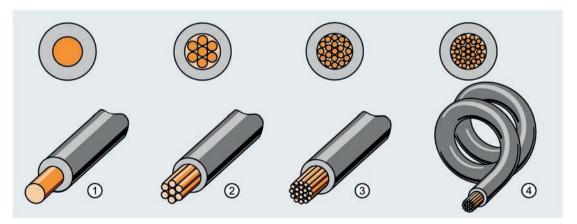
### 4.3.1 General information about cables and busbars

#### Cables and busbars: Cables

### Cable designation and cable classes

A key design feature of a cable is its flexibility. This is primarily determined by the number of cores inside the cable.

#### Cable classes as defined by IEC 60228:



- Class 1 cable with solid conductor
- 2 Class 2 cable with stranded conductors
- 3 Class 5 cable with finely stranded conductors
- 4 Class 6 cable with a large number of extra finely stranded conductors

#### 4.3 Connection system

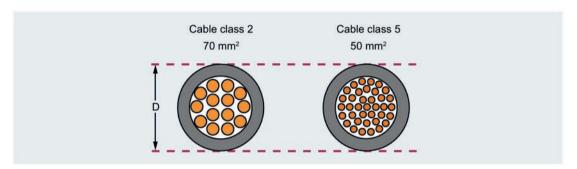
The conductors in class 1 and 2 cables are inflexible conductors, either solid or stranded. These are used predominantly in applications with low-curvature cable bending radii and in fixed or inflexible installations.

Flexible conductors of class 5 and class 6 permit greater cable bending radii.

The cable conductors used in low-voltage power distribution installations mainly belong to classes 1, 2, 5 and 6.

Cables with solid conductors in class 1 used for these applications normally have a cross section of 16 mm² or less.

Please note: Solid-conductor cables in classes 1 and 2 are smaller in diameter than cables in classes 5 and 6 even when their cross sectional area is the same. As a result, cables with the same diameter from different classes may have different connection cross sections.



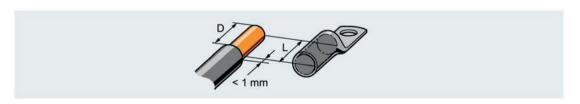
Solid and stranded sector-shaped conductors are also used.



### Compression lugs and wire-end ferrules

Cables are connected by means of compression lugs and wire-end ferrules to the molded case circuit breaker in order to provide stable, safe connections. These elements help to make solid connections at the breaker.

The cable is first stripped over the distance L before the compression lug or wire-end ferrule is attached to the cable.



The cable must be stripped carefully to ensure that the correct amount of insulating material is removed. If too much material is removed, it will not be possible to make a secure connection between the cable and compression lug or wire-end ferrule.

Cable lugs for compression connections compliant with DIN 46235 have ideal heat transfer characteristics for connecting busbar connectors. By contrast, "Terminal lugs with narrow palm for switching devices" (designation "SG" for example) must be used to make direct cable connections in the termination area of the molded case circuit breaker. These terminal lugs vary in design depending on make. All terminal lugs of this kind with the dimensions stipulated in standard IEC 60947-1, Annex P are basically suitable.

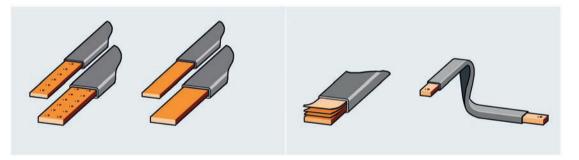
### Cables and busbars: Busbars

In addition to cables, the busbar is also widely used in electrical connections, especially in panels.

Some of the reasons for using busbars include:

- High-curvature bending radii which are unsuitable for cables of large cross section
- · Lack of space
- · Heat dissipation, air circulation
- ...

Rigid and in some cases flexible busbars are used in the examples of applications listed above.



Rigid busbars are made of copper or aluminum. Pre-punched aluminum busbars, some of which are threaded, are often used.

Flexible busbars are chosen for applications which demand a high degree of flexibility and high-curvature bending radii. These consist of bundles of copper or aluminum strips.

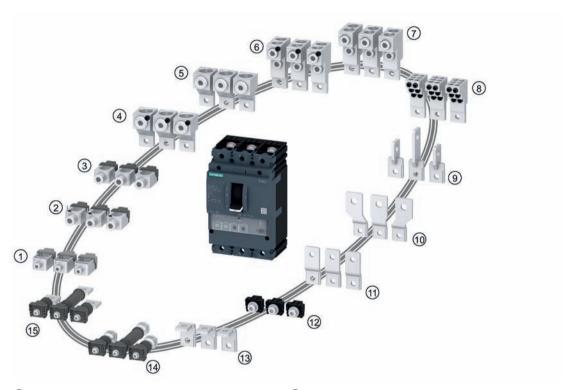
### 4.3 Connection system

### 4.3.2 Portfolio of connection components for 3VA molded case circuit breakers

### 4.3.2.1 General overview

3VA molded case circuit breakers employ connection technology which is designed to support uncomplicated and convenient commissioning of the breakers in such a way that all installation requirements are fulfilled.

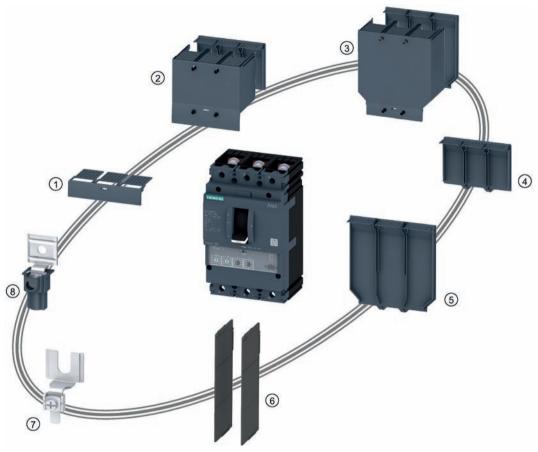
To meet this objective, an extensive portfolio of connection components is available.



- 1) Box terminal
- 2 Wire connector with control wire tap
- ③ Wire connector
- 4 Wire connector, large, with control wire tap
- Wire connector, large
- 6 Wire connector, 2 cables, with control wire tap
- Wire connector, 2 cables
- Wire connector, 6 cables

- 9 Bus connectors edgewise
- (10) Front bus connectors offset
- (1) Front bus connectors extended
- 12 Nut keeper kit
- Nut keeper kit, right-angled
- (4) Rear connection stud round
- (5) Rear connection stud flat

Furthermore, the connection accessories (see chapter Further connection accessories (Page 246)) can be optionally installed to insulate the termination area of the 3VA molded case circuit breaker and so provide protection against accidental contact. A control wire tap can be implemented quickly using accessory components which are available by special order.



- 1 Terminal cover
- 2 Terminal cover, extended
- 3 Terminal cover, offset
- 4 Insulating plate

- Sear insulating plate, offset
- 6 Phase barriers
- Ontrol wire tap for busbars
- 8 Control wire tap for box terminal

The table below lists all the main conductor connection systems available for 3VA molded case circuit breakers and also indicates which type of cables or busbars are compatible which each connection system. A basic distinction is made between front and rear connections.

The illustration in the table shows the 3-piece pack for the 3-pole molded case circuit breaker. All connection systems are also available in 4-piece packs for 4-pole molded case circuit breakers.

| Connection technology   |              |   | Cables a | nd busbars |    |
|---|--------------|---|----------|------------|----|
| Front connections   | Illustration | 5 |          |            |    |
| Box terminal  |              |   |          |            | •  |
| All versions of the wire connector                            | ٩٩٩          | • |          |            |    |
| Circular conductor terminal with auxiliary conductor terminal |              | • |          |            |    |
| Lug terminal  |              |   |          |            |    |
| Front connection bars extended                                |              |   |          |            |    |
| Front connection bars broadened                               | 333          |   |          |            |    |
| Front connection bars edgewise                                |              |   |          |            |    |
| Rear connections  |              |   |          |            | J. |
| Rear terminal flat  |              |   |          | •          |    |
| Rear connecting studs   |              |   |          |            |    |
| Lug terminal, right-angled 1)                                 |              |   | •        |            |    |

<sup>1)</sup> A box terminal can be installed at the right-angled nut keeper kit to allow a cable to be connected directly.

The connection technology for 3VA molded case circuit breakers can be used without modifications in the following applications:

- On all fixed-mounted versions of molded case circuit breaker
- On all molded case circuit breakers equipped with plug-in technology
- On all molded case circuit breakers equipped with draw-out technology

The connection components described above are identical for fixed-mounted breakers, for plug-in and for draw-out versions. If additional insulation measures are necessary, there may be differences between fixed-mounted and draw-out versions.

# Connection technology available from or installed at the factory

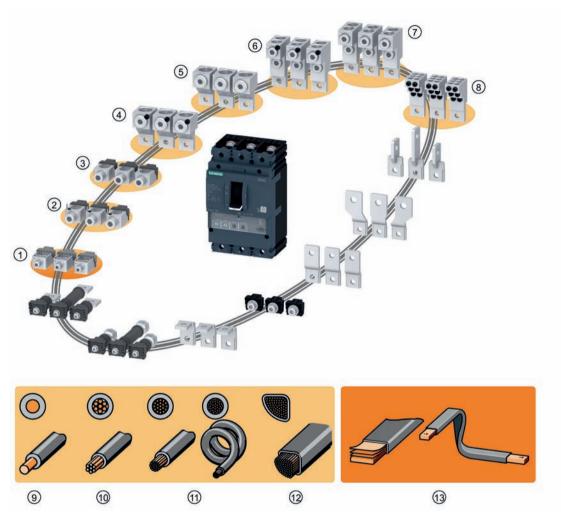
All 3VA molded case circuit breakers are available as standard with a nut keeper kit (clip-in nut and clamping screw) at the infeed and load ends.

For units up to size 160 A, a box terminal for direct cable connection can be optionally selected instead of the nut keeper kit. The box terminal is preassembled and installed at the factory.

| Connection technology   |              | 3VA1  |       |       |       | 3VA2  |       |       |       |       |       |        |
|-------------------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|
| from factory            | Illustration | 100 A | 160 A | 250 A | 400 A | 600 A | 100 A | 160 A | 250 A | 400 A | 630 A | 1000 A |
| Lug terminal            |              | ٠     |       | •     | •     | ٠     |       | •     | ٠     | •     | •     |        |
| Box terminal (optional) |              | ٠     |       |       |       |       | *     |       |       |       |       |        |

### 4.3.2.2 Front cable connection

The diagram below illustrates all the components available for implementing a direct cable connection at the molded case circuit breaker. The only exception is the box terminal as this can be used to connect busbars as well as cables.



### Connection technology

- 1) Box terminal
- ② Wire connector with control wire tap
- 3 Wire connector
- 4 Wire connector, large, with control wire tap
- Wire connector, large
- Wire connector, 2 cables, with control wire tap
- Wire connector, 2 cables
- 8 Wire connector, 6 cables

### Cables and busbars

- Solid conductor, class 1
- 10 Stranded conductor, class 2
- 1 Flexible conductors, classes 5 and 6
- Sector-shaped conductor
- Flexible busbars

### Box terminal



The box terminal as a factory-assembled connection can be optionally selected as an alternative to the nut keeper kit (see chapter Front busbar and cable lug connections (Page 232)) for all 3VA molded case circuit breakers up to size 160 A. The 3VA breaker is then shipped with preassembled box terminals.

An auxiliary connection can be implemented using a special control wire tap. For further information, please refer to chapter Auxiliary conductor terminal (Page 269).

In addition to directly connected cables, flexible busbars can also be connected to box terminals.

The tables below show all the types and sizes of cable and flexible busbar that can be connected to a box terminal.

# 3VA1 molded case circuit breakers:

|                    | Designation            |   |  |  | Box te                                       | rminal                                       |  |
|--------------------|------------------------|---|--|--|--|--|--|
| 2                  | Article No.            |   |  | 3VA9150JA11                              | 3VA9250JA11                                  | 3VA9250JA12                                  | 3VA9480JA13                                |
| technology         | Can be installed       | in 3VA1   |  | 3VA10<br>3VA11                           | 3VA12  | 3VA12  | 3VA13<br>3VA14                             |
| te                 |                        | Terminal marking                                      |  | TS1.1                                    | TS1.2  | TS1.3  | TS1.5 1)                                   |
|                    |                        | Cross-section specifica                               | tions in mm²                                   |  |  |  |  |
|                    |                        |   | Finely stranded<br>(Class 5/6)                 | 1 x 1.5 50 mm²                           | 1 x 10 95 mm²                                | 1 x 95 150 mm²                               | 1 x 35 240 mm²                             |
|                    |                        | Copper cable (number of cables x                      | Finely stranded<br>with ferrule<br>(Class 5/6) | 1 x 1.5 50 mm²                           | 1 x 6 95 mm²                                 | 1 x 50 150 mm²                               | 1 x 35 240 mm²                             |
|                    |                        | cross-section range)                                  | Stranded<br>(Class 2)                          | 1 x 1.5 70 mm²                           | 1 x 6 120 mm²                                | 1 x 50 185 mm²                               | 1 x 35 300 mm²                             |
|                    |                        |   | Solid<br>(Class 1)                             | 1 x 1.5 16 mm²                           | 1 x 6 16 mm²                                 | 120  | 14   |
|                    |                        | Aluminum cable  |  | ē  |  | ( <del> 0</del> 0)                           | 857  |
|                    |                        | Stripped length of cable                              | L  | 12 mm                                    | 19 mm  | 20 mm  | 26.5 mm                                    |
|                    | Cable connection       |   | Finely stranded<br>(Class 5/6)                 |  |  |  |  |
|                    |                        | Tightening torque                                     | Stranded<br>(Class 2)                          | ≤ 16 mm²: 5 Nm<br>≥ 25 mm²: 8 Nm         | ≤ 25 mm²: 6 Nm<br>≥ 35 mm²: 10 Nm            | ≤ 185 mm²: 14 Nm                             | ≤ 95 mm²: 16 Nm<br>≥ 120 mm²: 28 Nm        |
|                    |                        |   | Solid<br>(Class 1)                             |  |  |  |  |
| Ispa               |                        | Cross-section specifica                               | tions in AWG                                   |  |  |  |  |
| and bl             |                        | Copper cable (number of cables x cross-section range) | Stranded<br>(Class C)                          | 1 x 14 AWG 3/0 AWG                       | 1 x 10 AWG 3/0 AWG                           | 151  | 1 x 1/0 500 kcmil                          |
| capies and busbars |                        |   | Stranded<br>(Class B)                          | 1 x 14 AWG 3/0 AWG                       | 1 x 10 AWG 3/0 AWG                           |  | 1 x 1/0 500 kcmil                          |
|                    |                        |   | Solid<br>(Class A)                             | 1 x 14 AWG 10 AWG                        | 1 x 10 AWG                                   | H#M  | <b>拉拿</b>                                  |
|                    |                        | Aluminum cable  |  |  |  | 31   | 0.50                                       |
|                    |                        | Stripped length of cable                              | L  | 0.50 in                                  | 0.75 in                                      | 15 <del>4</del> 63                           | 1.05 in                                    |
|                    |                        |   | Stranded<br>(Class C)                          |  |  |  |  |
|                    |                        | Tightening torque                                     | Stranded<br>(Class B)                          | ≤ 6 AWG: 45 lb-in<br>≥ 4 AWG: 70 lb-in   | ≤ 4 AWG: 105 lb-in<br>≥ 3 AWG: 140 lb-in     | i <del>*</del> *:                            | ≤ 4/0: 140 lb-in<br>≥ 250 kcmil: 248 lb-ir |
|                    |                        |   | Solid<br>(Class A)                             |  |  |  |  |
|                    |                        |   | Minimum number:<br>Maximum number:             | 2 x 9 mm x 0.8 mm<br>9 x 9 mm x 0.8 mm   | 2 x 13 mm x 0.5 mm<br>6 x 13 mm x 0.5 mm     | 6 x 13 mm x 0.5 mm<br>6 x 13 mm x 0.5 mm     | 2 x 20 mm x 1 mm<br>10 x 20 mm x 1 mm      |
|                    | Flexible copper busbar | Specification of usual sizes [number x width x        | Minimum number:<br>Maximum number:             | 2 x 13 mm x 0.5 mm<br>6 x 13 mm x 0.5 mm | 2 x 15.5 mm x 0.8 mm<br>6 x 15.5 mm x 0.8 mm | 4 x 15.5 mm x 0.8 mm<br>6 x 15.5 mm x 0.8 mm | 2 x 24 mm x 1 mm<br>10 x 24 mm x 1 mm      |
|                    | DUSUAI                 | thickness]  | Minimum number:<br>Maximum number:             |  | 2 x 20 mm x 1 mm<br>6 x 20 mm x 1 mm         | 3 x 20 mm x 1 mm<br>6 x 20 mm x 1 mm         |  |
|                    |                        | Tightening torque                                     |  | 8 Nm                                     | 10 Nm  | 14 Nm  | 28 Nm                                      |

<sup>1)</sup> Cable connection: Maximum current carrying capacity 400 A

Flexible copper busbar: No restrictions

# 3VA2 molded case circuit breakers:

| Designation            |  |  |  | Box terminal                                 |  |  |
|------------------------|--|--|--|--|--|--|
| Article No.            |  |  | 3VA9160JA12                                  | 3VA9260JA12                                  | 3VA9480JA13                                |  |
| Can be installe        | d in 3VA2  |  | 3VA20<br>3VA21<br>3VA22                      | 3VA20<br>3VA21<br>3VA22                      | 3VA23<br>3VA24                             |  |
|                        | Terminal marking   |  | TS1.2  | TS1.4  | TS1.5 1)                                   |  |
|                        | Cross-section specifica  | itions in mm²                                  |  |  |  |  |
|                        |  | Finely stranded<br>(Class 5/6)                 | 1 x 10 95 mm²                                | 1 x 35 150 mm²                               | 1 x 35 240 mm²                             |  |
|                        | Copper cable (number of cables x                                   | Finely stranded<br>with ferrule<br>(Class 5/6) | 1 x 6 95 mm²                                 | 1 x 25 150 mm²                               | 1 x 35 240 mm²                             |  |
|                        | cross-section range)   | Stranded<br>(Class 2)                          | 1 x 6 120 mm²                                | 1 x 25 185 mm²                               | 1 x 35 300 mm²                             |  |
|                        |  | Solid<br>(Class 1)                             | 1 x 6 16 mm²                                 | *  | 1.07                                       |  |
|                        | Aluminum cable   |  |  | 5  | 953  |  |
|                        | Stripped length of cable   | e L  | 19 mm  | 20 mm  | 26.5 mm                                    |  |
| Cabla                  |  | Finely stranded<br>(Class 5/6)                 |  | Total Assistance                             |  |  |
| Cable connection       | Tightening torque  | Stranded<br>(Class 2)                          | ≤ 25 mm²: 6 Nm<br>≥ 35 mm²: 10 Nm            | ≤ 35 mm²: 6 Nm<br>≥ 50 mm²: 12 Nm            | ≤ 95 mm²: 16 Nm<br>≥ 120 mm²: 28 Nm        |  |
| 1                      |  | Solid<br>(Class 1)                             |  |  |  |  |
| 1                      | Cross-section specifica  | itions in AWG                                  |  |  |  |  |
|                        | Copper cable (number of cables x cross-section range)              | Stranded<br>(Class C)                          | 1 x 10 AWG 3/0 AWG                           | 1 x 4 AWG 350 kcmil                          | 1 x 1/0 500 kcmil                          |  |
|                        |  | Stranded<br>(Class B)                          | 1 x 10 AWG 3/0 AWG                           | 1 x 4 AWG 350 kcmil                          | 1 x 1/0 500 kcmil                          |  |
|                        |  | Solid<br>(Class A)                             | 1 x 10 AWG                                   | e  | H <del>≡</del> H                           |  |
|                        | Aluminum cable   |  |  | 8  | 183  |  |
|                        | Stripped length of cable   | e L  | 0.75 in                                      | 0.80 in                                      | 1.05 in                                    |  |
|                        |  | Stranded<br>(Class C)                          |  |  |  |  |
|                        | Tightening torque  | Stranded<br>(Class B)                          | ≤ 4 AWG: 105 lb-in<br>≥ 3 AWG: 140 lb-in     | ≤ 1 AWG: 70 lb-in<br>≥ 1/0: 140 lb-in        | ≤ 4/0: 140 lb-in<br>≥ 250 kcmil: 248 lb-in |  |
|                        |  | Solid<br>(Class A)                             |  |  |  |  |
|                        |  | Minimum number:<br>Maximum number:             | 2 x 13 mm x 0.5 mm<br>6 x 13 mm x 0.5 mm     | 4 x 15.5 mm x 0.8 mm<br>6 x 15.5 mm x 0.8 mm | 2 x 20 mm x 1 mm<br>10 x 20 mm x 1 mm      |  |
| Flexible copper busbar | Specification of usual<br>sizes<br>[number x width x<br>thickness] | Minimum number:<br>Maximum number:             | 2 x 15.5 mm x 0.8 mm<br>6 x 15.5 mm x 0.8 mm | 4 x 20 mm x 1 mm<br>6 x 20 mm x 1 mm         | 2 x 24 mm x 1 mm<br>10 x 24 mm x 1 mm      |  |
|                        |  | Minimum number:<br>Maximum number:             | 2 x 20 mm x 1 mm<br>6 x 20 mm x 1 mm         |  |  |  |
|                        | Tightening torque  |  | 10 Nm  | 12 Nm  | 28 Nm                                      |  |

Cable connection: Maximum current carrying capacity 400 A Flexible copper busbar: No restrictions

Box terminals can be ordered

- as a pack of 3
- as a pack of 4

# Wire connector with and without control wire tap



The wire connector is available under separate article numbers depending on whether it is ordered with or without a control wire tap. With the exception of the hole for the control wire tap, both wire connectors are technically identical, i.e. the same cable cross sections can be connected to both variants.

#### Note

All control wire taps offered in the 3VA molded case circuit breaker portfolio are permitted only up to a maximum current of 15 A.

Suitable cable cross-sections: Cables up to a maximum of 2.5 mm<sup>2</sup> can be connected.

The wire connector is an internal component, i.e. it is contained within the external contour of the molded case circuit breaker. As a result, the size of cable cross section which can be connected is limited by the geometry of the breaker's termination area.

The tables below show all the types and sizes of cable which can be connected to a wire connector.

# 3VA1 molded case circuit breakers:

| Designation                   |   |   | Aluminum circular condi   | uctor terminal without / with aux | iliary conductor terminal |  |
|-------------------------------|---|---|---|-----------------------------------|---------------------------|--|
| Autola Na                     | without auxiliary condu                                     | ctor terminal   | 3VA9110JB11   | 3VA9250JB12                       | 3VA9380JB13               |  |
| Article No.                   | with auxiliary conducto                                     | r terminal  | 3VA9110JG11   | 3VA9250JG12                       | 3VA9380JG13               |  |
| Article No.  Can be installed | d in 3VA1   |   | 3VA10<br>3VA11  | 3VA12                             | 3VA13<br>3VA14            |  |
|                               | Terminal marking  |   | TA1.1   | TA1.2                             | TS1.5 1)                  |  |
|                               | Cross-section specifica                                     | ations in mm²   | A 110 A 120 A |                                   |                           |  |
|                               |   | Finely stranded (Class 5/6)   | 1 x 1.535 mm²   | 1x 35 150 mm²                     | 1x 50 240 mm²             |  |
|                               | Copper cable (number of cables x                            | Finely stranded<br>with ferrule<br>(Class 5/6)                                | 1 x 1.535 mm²   | 1x 35 150 mm²                     | 1x 50 240 mm²             |  |
|                               | cross-section range)  | Stranded<br>(Class 2)   | 1 x 1.5 95 mm²  | 1x 35 185 mm²                     | 1x 50 300 mm²             |  |
|                               |   | Solid<br>(Class 1)  | 1 x 2.5 16 mm²  | *                                 | 8#33                      |  |
|                               | Aluminum cable (number of cables x                          | Stranded<br>(Class 2)   | 1 x 4 95 mm²  | 1x 35 185 mm²                     | 1x 50 300 mm²             |  |
|                               | cross-section range)  | Solid<br>(Class 1)  | 1 x 4 16 mm²  | €                                 | (87)                      |  |
|                               | Stripped length of cable                                    | e L   | 12.7 mm   | 20 mm                             | 28 mm                     |  |
| Cable connection              | Tightening torque   | Finely stranded<br>(Class 5/6)<br>Stranded<br>(Class 2)<br>Solid<br>(Class 1) | ≤ 2.5 mm²: 2.8 Nm<br>≤ 4 mm²: 4 Nm<br>≤ 10 mm²: 6.2 Nm<br>> 10 mm²: 11.3 Nm                                   | ≤ 185 mm²: 22.6 Nm                | 42.4 Nm                   |  |
| T TOWN                        | Cross-section specifica                                     |   |   |                                   |                           |  |
| 1 200                         | Oross section specifica                                     | Stranded<br>(Class C)   | 1 x 14 AWG 3/0 AWG  | 1x 2 AWG 350 kcmil                | 1x 1 AWG 600 kcmi         |  |
|                               | Copper cable<br>(number of cables x<br>cross-section range) | Stranded<br>(Class B)   | 1 x 14 AWG 3/0 AWG  | 1x 2 AWG 350 kcmil                | 1x 1 AWG 600 kcmi         |  |
|                               | cross-section range/  | Solid<br>(Class A)  | 1 x 14 AWG 10 AWG   | •                                 | 8#8                       |  |
|                               | Aluminum cable (number of cables x                          | Stranded<br>(Class B)   | 1 x 12 AWG 3/0 AWG  | 1x 2 AWG 350 kcmil                | 1x 1 AWG 600 kcmi         |  |
|                               | cross-section range)  | Solid<br>(Class A)  | 1 x 12 AWG 10 AWG   | ħ                                 | P <b>#</b> 23             |  |
|                               | Stripped length of cable                                    | e L   | 0.5 in  | 0.8 in                            | 1.1 in                    |  |
|                               |   | Stranded<br>(Class C)   | 14 AWG: 200 lb-in   |                                   |                           |  |
|                               | Tightening torque   | Stranded<br>(Class B)   | ≤ 12 AWG: 35 lb-in<br>≤ 8 AWG: 55 lb-in   | ≤ 350kcmil: 140 lb-in             | 375 lb-in                 |  |
|                               |   | Solid<br>(Class A)  | > 8 AWG: 100 lb-in  |                                   |                           |  |

Copper cable: Maximum current carrying capacity 400 A Aluminum cable: Maximum current carrying capacity 310 A

1)

### 3VA2 molded case circuit breakers:

|            | Designation        |   |  | Aluminum circular cond                  | uctor terminal without / with aux        | iliary conductor terminal |  |
|------------|--------------------|---|--|---|--|---------------------------|--|
|            | Article No.        | without auxiliary condu                                     | ctor terminal                                  | 3VA9100JB11                             | 3VA9260JB12                              | 3VA9380JB13               |  |
| g          | Article No.        | with auxiliary conducto                                     | r terminal                                     | 3VA9100JG11                             | 3VA9260JG12                              | 3VA9380JG13               |  |
| recunology | Can be installed i | in 3VA2   |  | 3VA20<br>3VA21<br>3VA22                 | 3VA20<br>3VA21<br>3VA22                  | 3VA23<br>3VA24            |  |
|            |                    | Terminal marking  |  | TA1.3                                   | TA1.4                                    | TS1.5 1)                  |  |
|            |                    | Cross-section specifica                                     | itions in mm²                                  |   |  |                           |  |
|            | ľ                  |   | Finely stranded<br>(Class 5/6)                 | 1 x 1.5 35 mm²                          | 1 x 25 150 mm²                           | 1 x 50 240 mm²            |  |
|            |                    | Copper cable (number of cables x                            | Finely stranded<br>with ferrule<br>(Class 5/6) | 1 x 1.5 35 mm²                          | 1 x 16 120 mm²                           | 1 x 50 240 mm²            |  |
|            |                    | cross-section range)  | Stranded<br>(Class 2)                          | 1 x 1.5 50 mm²                          | 1 x 16 185 mm²                           | 1 x 50 300 mm²            |  |
|            |                    |   | Solid<br>(Class 1)                             | 1 x 1.5 16 mm²                          | 1 x 16 mm²                               | UZ-U                      |  |
|            |                    | Aluminum cable (number of cables x                          | Stranded<br>(Class 2)                          | 1 x 1.5 50 mm²                          | 1 x 16 185 mm²                           | 1 x 50 300 mm²            |  |
|            |                    | cross-section range)  | Solid<br>(Class 1)                             | 1 x 1.5 16 mm²                          | 1 x 16 mm²                               | <u></u>                   |  |
|            |                    | Stripped length of cable                                    | e L  | 18 mm                                   | 20 mm                                    | 28 mm                     |  |
|            | Cable connection   | Tightening torque   | Stranded<br>(Class C)<br>Stranded<br>(Class B) | ≤ 10 mm²: 6.2 Nm<br>≤ 35 mm²: 8.5 Nm    | ≤ 35 mm²: 15.8 Nm<br>> 50 mm²: 31.1 Nm   | 42.4 Nm                   |  |
|            |                    |   | Solid<br>(Class 1)                             | > 35 mm²: 13.6 Nm                       |  |                           |  |
|            | 1                  | Cross-section specifica                                     | itions in AWG                                  |   |  |                           |  |
|            | - 200              |   | Stranded<br>(Class C)                          | 1 x 14 AWG 1/0 AWG                      | 1 x 6 AWG 350 kcmil                      | 1 x 1 AWG 600 kcmil       |  |
|            |                    | Copper cable<br>(number of cables x<br>cross-section range) | Stranded<br>(Class B)                          | 1 x 14 AWG 1/0 AWG                      | 1 x 6 AWG 350 kcmil                      | 1 x 1 AWG 600 kcmi        |  |
|            |                    | uroso occilor range,  | Solid<br>(Class A)                             | 1 x 14 AWG 10 AWG                       | £  | *                         |  |
|            |                    | Aluminum cable (number of cables x                          | Stranded<br>(Class B)                          | 1 x 12 AWG 1/0 AWG                      | 1 x 6 AWG 350 kcmil                      | 1 x 1 AWG 600 kcmi        |  |
|            |                    | cross-section range)  | Solid<br>(Class A)                             | 1 x 12 AWG10 AWG                        | ŧ.                                       | 3                         |  |
|            |                    | Stripped length of cable                                    | e L  | 0.7 in                                  | 0.8 in                                   | 1.1 in                    |  |
|            |                    |   | Stranded<br>(Class C)                          | ≤ 8 AWG; 55 lb-in                       | ######################################   |                           |  |
|            |                    | Tightening torque   | Stranded<br>(Class B)                          | ≤ 2 AWG: 75 lb-in<br>> 2 AWG: 120 lb-in | ≤ 2 AWG: 140 lb-in<br>> 2 AWG: 275 lb-in | 375 lb-in                 |  |
|            |                    |   | Solid<br>(Class A)                             |   |  |                           |  |

Copper cable: Maximum current carrying capacity 400 A
 Aluminum cable: Maximum current carrying capacity 310 A

Wire connector with and without control wire tap can be ordered:

- as a pack of 3
- as a pack of 4

# Wire connector, large, with and without control wire tap



The wire connector, large, is available under separate article numbers depending on whether it is ordered with or without a control wire tap. With the exception of the hole for the control wire tap, both wire connectors are technically identical, i.e. the same cable cross sections can be connected to both variants.

#### Note

All control wire taps offered in the 3VA molded case circuit breaker portfolio are permitted only up to a maximum current of 15 A.

Suitable cable cross-sections: Cables up to a maximum of 2.5 mm<sup>2</sup> can be connected.

The wire connector, large is an external terminal, i.e. it projects beyond the external contour of the breaker's termination area. This means that cables with a larger cross-section can be connected.

The terminal cover extended plus the required assembly materials are supplied as standard with all wire connectors, large. This is used for insulation and provides degree of protection IP4x at the front of the molded case circuit breaker and degree of protection IP2x at the infeed side and load side (see chapter Insulating measures (Page 246)).

The table below shows all the types and sizes of cable which can be connected to a wire connector, large.

|                    | Designation             |   |  | Aluminum circular conduct | or terminal, large without / with a | auxiliary conductor terminal |  |
|--------------------|-------------------------|---|--|---------------------------|-------------------------------------|------------------------------|--|
|                    | Article No.             | without auxiliary condu                                       | ctor terminal                                  | 3VA910JJ12                | 3VA920JJ13                          | 3VA92,,-0JJ13                |  |
| >                  | W. Companies Commission | with auxiliary conducto                                       | rterminal                                      | 3VA910JC12                | 3VA920JC13                          | 3VA920JC13                   |  |
| gol                |                         | 3VA1  |  | 3VA11                     | 3VA12                               | (8)                          |  |
| technology         | Can be installed in     | 3VA2  |  | •                         | ٠                                   | 3VA20<br>3VA21<br>3VA22      |  |
|                    |                         | Terminal marking  |  | TA2.1                     | TA2.2                               | TA2.2                        |  |
|                    |                         | Cross-section specifica                                       | tions in mm²                                   | 01/00/07/2                | 1000                                | 1,122.700                    |  |
|                    |                         |   | Finely stranded (Class 5/6)                    | 1 x 25 120 mm²            | 1 x 50 185 mm²                      | 1 x 50 185 mm²               |  |
|                    | Cable connection        | Copper cable (number of cables x                              | Finely stranded<br>with ferrule<br>(Class 5/6) | 1 x 25 95 mm²             | 1 x 50 185 mm²                      | 1 x 50 185 mm²               |  |
|                    |                         | cross-section range)  | Stranded<br>(Class 2)                          | 1 x 25 150 mm²            | 1 x 50 240 mm²                      | 1 x 50 240 mm²               |  |
|                    |                         |   | Solid<br>(Class 1)                             | ÷                         | •                                   | i <b>÷</b> :                 |  |
|                    |                         | Aluminum cable<br>(number of cables x<br>cross-section range) | Stranded<br>(Class 2)                          | 1 x 25 150 mm²            | 1 x 25 240 mm²                      | 1 x 25 240 mm²               |  |
| Cables and busbars |                         |   | Solid<br>(Class 1)                             | *                         | *                                   | ÷:                           |  |
| 2                  |                         | Stripped length of cable                                      | e L  | 30.5 mm                   | 30.5 mm                             | 30.5 mm                      |  |
| 0                  |                         | Tightening torque   |  | 28.5 Nm                   | 31.1 Nm                             | 31.1 Nm                      |  |
|                    | 1/4/18                  | Cross-section specifica                                       | tions in AWG                                   |                           |                                     |                              |  |
| 3                  |                         | 200000000000000000000000000000000000000                       | Stranded<br>(Class C)                          | 1x 4 AWG 300 kcmil        | 1 x 2 AWG 350 kcmil                 | 1 x 2 AWG 350 kcmil          |  |
|                    |                         | Copper cable<br>(number of cables x<br>cross-section range)   | Stranded<br>(Class B)                          | 1x 4 AWG 300 kcmil        | 1 x 2 AWG 350 kcmil                 | 1 x 2 AWG 350 kcmil          |  |
|                    |                         | oroso socion rango,   | Solid<br>(Class A)                             | 8                         | 2                                   | 14.7                         |  |
|                    |                         | Copper cable (number of cables x                              | Stranded<br>(Class B)                          | 1x 4 AWG 300 kcmil        | 1 x 2 AWG 350 kcmil                 | 1 x 2 AWG 350 kcmil          |  |
|                    |                         | cross-section range)  | Solid<br>(Class A)                             | *                         | -                                   | (#0                          |  |
|                    |                         | Stripped length of cable                                      | e L  | 1.2 in                    | 1.2 in                              | 1.2 in                       |  |
|                    |                         | Tightening torque   |  | 252 lb-in                 | 275 lb-in                           | 275 lb-in                    |  |

Wire connector, large with or without control wire tap can be ordered:

- as a pack of 3
- as a pack of 4

# Wire connector, 2 cables, with and without control wire tap



The wire connector, 2 cables, is available under separate article numbers depending on whether it is ordered with or without a control wire tap. With the exception of the hole for the control wire tap, both wire connectors are technically identical, i.e. the same cable cross sections can be connected to both variants.

#### Note

All control wire taps offered in the 3VA molded case circuit breaker portfolio are permitted only up to a maximum current of 15 A.

Suitable cable cross-sections: Cables up to a maximum of 2.5 mm<sup>2</sup> can be connected.

The wire connector, 2 cables is an external terminal, i.e. it projects beyond the external contour of the breaker's termination area. The 2-cable capacity of the terminal allows cables with large cross-sectional area to be connected.

The extended terminal cover plus the required assembly materials are supplied as standard with all wire connectors, 2 cables. This is used for insulation and provides degree of protection IP4x at the front of the molded case circuit breaker and degree of protection IP2x at the infeed side and load side (see chapter Insulating measures (Page 246)).

The table below shows all the types and sizes of cable which can be connected to a wire connector, 2 cables.

|            | Designation      |   |  | Aluminum circular conductor | terminal, 2 cables without / with | n auxiliary conductor termin |  |
|------------|------------------|---|--|-----------------------------|-----------------------------------|------------------------------|--|
|            | Article No.      | without auxiliary condu                                     | ctor terminal                                  | 3VA920JJ22                  | 3VA920JJ22                        | 3VA940JJ23                   |  |
| ≥          | Article No.      | with auxiliary conductor                                    | terminal                                       | 3VA920JC22                  | 3VA920JC22                        | 3VA940JC23                   |  |
| technology | Can be           | 3VA1  |  | 3VA12                       | É                                 | 3VA13<br>3VA14               |  |
| tecr       | installed in     | 3VA2  |  | -                           | 3VA21<br>3VA22                    | 3VA23<br>3VA24               |  |
|            |                  | Terminal marking  |  | TA2.3                       | TA2.3                             | TA2.4                        |  |
| 7          |                  | Cross-section specifica                                     | tions in mm²                                   |                             |                                   |                              |  |
|            |                  |   | Finely stranded (Class 5/6)                    | 2 x 25 150 mm²              | 2 x 25 150 mm²                    | 2 x 70 240 mm²               |  |
|            | Cable connection | Copper cable (number of cables x                            | Finely stranded<br>with ferrule<br>(Class 5/6) | 2 x 25 70 mm²               | 2 x 25 70 mm²                     | 2 x 70 185 mm²               |  |
|            |                  | cross-section range)  | Stranded<br>(Class 2)                          | 2 x 25 150 mm²              | 2 x 25 150 mm²                    | 2 x 70 300 mm²               |  |
|            |                  |   | Solid<br>(Class 1)                             |                             |                                   | ( <del>*</del> )             |  |
|            |                  | Aluminum cable (number of cables x cross-section range)     | Stranded<br>(Class 2)                          | 2 x 25 150 mm²              | 2 x 25 150 mm²                    | 2 x 70 300 mm²               |  |
|            |                  |   | Solid<br>(Class 1)                             | •                           | *                                 | *                            |  |
|            |                  | Stripped length of cable                                    | L  | 26 mm / 51 mm               | 26 mm / 51 mm                     | 31 mm / 58.5 mm              |  |
|            |                  | Tightening torque   |  | 31.1 Nm                     | 31.1 Nm                           | 50.8 Nm                      |  |
|            | 1/ 1/8           | Cross-section specifica                                     | tions in AWG                                   |                             |                                   |                              |  |
|            |                  |   | Stranded<br>(Class C)                          | 2 x 4 AWG 300 kcmil         | 2 x 4 AWG 300 kcmil               | 2 x 2/0 AWG 600 kcmi         |  |
|            |                  | Copper cable<br>(number of cables x<br>cross-section range) | Stranded<br>(Class B)                          | 2 x 4 AWG 300 kcmil         | 2 x 4 AWG 300 kcmil               | 2 x 2/0 AWG 600 kcmi         |  |
|            |                  | or odd oddion rungby  | Solid<br>(Class A)                             | 8                           |                                   | (4)                          |  |
|            |                  | Copper cable (number of cables x                            | Stranded<br>(Class B)                          | 2 x 4 AWG 300 kcmil         | 2 x 4 AWG 300 kcmil               | 2 x 2/0 AWG 600 kcmi         |  |
|            |                  | cross-section range)  | Solid<br>(Class A)                             | *                           | -                                 | (4)                          |  |
|            |                  | Stripped length of cable                                    | L  | 1.0 in / 2.0 in             | 1.2 in / 2.3 in                   | 1.2 in / 2.3 in              |  |
|            |                  | Tightening torque   |  | 275 lb-in                   | 275 lb-in                         | 450 lb-in                    |  |

Wire connector, 2 cables with or without control wire tap can be ordered:

- as a pack of 3
- as a pack of 4

# Wire connector, 6 cables



The distribution wire connector, 6 cables is an external terminal, i.e. it projects beyond the external contour of the breaker's termination area. It can hold up to 6 cables. One of the six holes in the terminal can be used to implement a control wire tap.

The terminal cover extended plus the required assembly materials are supplied as standard with all distribution wire connectors, 6 cables. This is used for insulation and provides degree of protection IP4x at the front of the molded case circuit breaker and degree of protection IP2x at the infeed side and load side (see chapter Auxiliary conductor terminal (Page 269)).

The table below shows all the types and sizes of cable which can be connected to a distribution wire connector, 6 cables.

3VA1 molded case circuit breakers:

| Designat               | ion   |  | Alumin   | um circular conductor terminal, f                     | cables  |
|------------------------|---|--|--|---|---|
| Article No.            |   |  | 3VA910JF60   | 3VA920JF60  | 3VA930JF60  |
| Article No. Can be ins | stalled in 3VA1   |  | 3VA10<br>3VA11                                       | 3VA12   | 3VA13<br>3VA14  |
|                        | Terminal marking  |  | TA2.5  | TA2.6   | TA2.7   |
|                        | Cross-section specifica                                     | itions in mm²                                  |  |   |   |
|                        |   | Finely stranded<br>(Class 5/6)                 | 6 x 1.5 25 mm²                                       | 6 x 1.5 25 mm²  | 6 x 1.5 25 mm²  |
|                        | Copper cable (number of cables x                            | Finely stranded<br>with ferrule<br>(Class 5/6) | 6 x 1.5 25 mm²                                       | 6 x 1.5 25 mm²  | 6 x 1.5 25 mm²  |
|                        | cross-section range)  | Stranded<br>(Class 2)                          | 6 x 1.5 35 mm²                                       | 6 x 1.5 35 mm²  | 6 x 1.5 35 mm²  |
|                        |   | Solid<br>(Class 1)                             | 6 x 1.5 16 mm²                                       | 6 x 1.5 16 mm²  | 6 x 1.5 16 mm²  |
| Cable                  | Aluminum cable (number of cables x                          | Stranded<br>(Class 2)                          | 6 x 4 35 mm²   | 6 x 4 35 mm²  | 6 x 4 35 mm²  |
|                        | cross-section range)  | Solid<br>(Class 1)                             | 6 x 4 16 mm²   | 6 x 4 16 mm²  | 6 x 4 16 mm²  |
| connection             | Stripped length of cable                                    | e L  | 13 / 25 / 39.5 mm                                    | 14.5 / 27 / 38.5 mm                                   | 19.5 / 35.5 mm  |
| V                      | Tightening torque   |  | 1.5mm²: 2.8 Nm<br>≤ 10 mm²: 6.2 Nm<br>> 10 mm²: 7 Nm | 1.5 mm²: 2.8 Nm<br>≤ 10 mm²: 6.2 Nm<br>> 10 mm²: 7 Nm | 1.5 mm²: 2.8 Nm<br>≤ 10 mm²: 6.2 Nm<br>> 10 mm²: 7 Nm |
| 1                      | Cross-section specifica                                     | itions in AWG                                  |  |   |   |
|                        | 2 750   | Stranded<br>(Class C)                          | 6 x 14 AWG 2 AWG                                     | 6 x 14 AWG 2 AWG                                      | 6 x 14 AWG 2 AWG                                      |
|                        | Copper cable<br>(number of cables x<br>cross-section range) | Stranded<br>(Class B)                          | 6 x 14 AWG 2 AWG                                     | 6 x 14 AWG 2 AWG                                      | 6 x 14 AWG2 AWG                                       |
|                        | areas section range,  | Solid<br>(Class A)                             | 6 x 14 AWG 10 AWG                                    | 6 x 14 AWG 10 AWG                                     | 6 x 14 AWG 10 AWG                                     |
|                        | Aluminum cable (number of cables x                          | Stranded<br>(Class B)                          | 6 x 12 AWG 2 AWG                                     | 6 x 12 AWG 2 AWG                                      | 6 x 12 AWG2 AWG                                       |
|                        | cross-section range)  | Solid<br>(Class A)                             | 6 x 12 AWG 10 AWG                                    | 6 x 12 AWG 10 AWG                                     | 6 x 12 AWG10 AWG                                      |
|                        | Stripped length of cable                                    | e L  | 0.5 / 0.9 / 1.5 in                                   | 0.6 / 1.0 / 1.5 in                                    | 0.8 in / 1.4 in                                       |
|                        | Tightening torque   |  | ≤ 8 AWG: 55 lb-in<br>> 8 AWG: 62 lb-in               | ≤ 8 AWG: 55 lb-in<br>> 8 AWG: 62 lb-in                | ≤ 8 AWG: 55 lb-in<br>> 8 AWG: 62 lb-in                |

# 3VA2 molded case circuit breakers:

| Designation      |   |  | Aluminum circular cond   | uctor terminal, 6 cables                              |
|------------------|---|--|--|---|
| Article No.      |   | 9.70   | 3VA920JF60   | 3VA930JF60  |
| Can be installed | ed in 3VA2  |  | 3VA20<br>3VA21<br>3VA22  | 3VA23<br>3VA24  |
|                  | Terminal marking  |  | TA2.6  | TA2.7   |
|                  | Cross-section specifica                                     | tions in mm²                                   |  |   |
|                  |   | Finely stranded<br>(Class 5/6)                 | 6 x 1.5 25 mm²   | 6 x 1.5 25 mm²  |
|                  | Copper cable (number of cables x                            | Finely stranded<br>with ferrule<br>(Class 5/6) | 6 x 1.5 25 mm²   | 6 x 1.5 25 mm²  |
|                  | cross-section range)  | Stranded<br>(Class 2)                          | 6 x 1.5 35 mm²   | 6 x 1.5 35 mm²  |
|                  |   | Solid<br>(Class 1)                             | 6 x 1.5 16 mm²   | 6 x 1.5 16 mm²  |
| Cable connection | Aluminum cable  | Stranded<br>(Class 2)                          | 6 x 4 35 mm²   | 6 x 4 35 mm²  |
|                  | (number of cables x cross-section range)                    | Solid<br>(Class 1)                             | 6 x 4 16 mm²   | 6 x 4 16 mm²  |
|                  | Stripped length of cable                                    | L  | 14.5 / 27 / 38.5 mm  | 19.5 / 35.5 mm  |
| Id               | Tightening torque   |  | 1.5 mm²: 2.8 Nm<br>≤ 10 mm²: 6.2 Nm<br>> 10 mm²: 7 Nm  | 1.5 mm²: 2.8 Nm<br>≤ 10 mm²: 6.2 Nm<br>> 10 mm²: 7 Nm |
| I.               | Cross-section specifica                                     | tions in AWG                                   | 21 M ( 2 M ( |   |
|                  | 2   | Stranded<br>(Class C)                          | 6 x 14 AWG 2 AWG   | 6 x 14 AWG 2 AWG                                      |
|                  | Copper cable<br>(number of cables x<br>cross-section range) | Stranded<br>(Class B)                          | 6 x 14 AWG 2 AWG   | 6 x 14 AWG2 AWG                                       |
|                  | cross section range,  | Solid<br>(Class A)                             | 6 x 14 AWG 10 AWG  | 6 x 14 AWG 10 AWG                                     |
|                  | Aluminum cable (number of cables x                          | Stranded<br>(Class B)                          | 6 x 12 AWG 2 AWG   | 6 x 12 AWG2 AWG                                       |
|                  | cross-section range)  | Solid<br>(Class A)                             | 6 x 12 AWG 10 AWG  | 6 x 12 AWG10 AWG                                      |
|                  | Stripped length of cable                                    | L  | 0.6 / 1.0 / 1.5 in   | 0.8 in / 1.4 in                                       |
|                  | Tightening torque   |  | ≤ 8 AWG: 55 lb-in<br>> 8 AWG: 62 lb-in   | ≤ 8 AWG: 55 lb-in<br>> 8 AWG: 62 lb-in                |

Distribution wire connectors, 6 cables can be ordered:

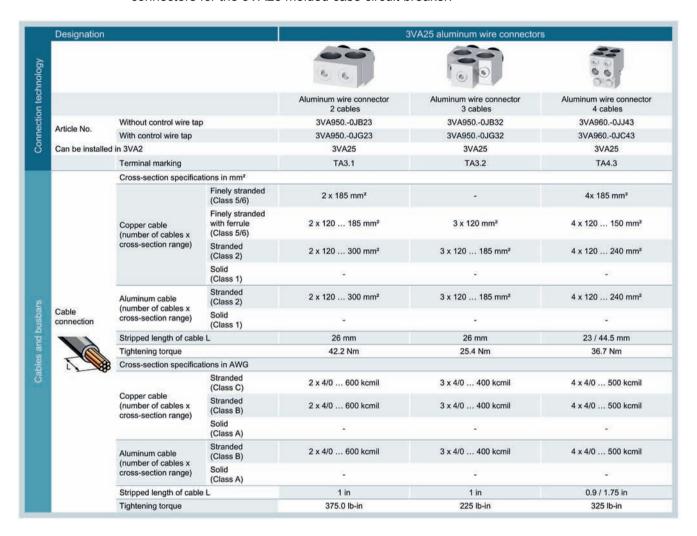
- as a pack of 3
- as a pack of 4

#### Wire connectors for 3VA25 molded case circuit breaker

The 3VA25 molded case circuit breaker is shipped with a preassembled nut keeper kit. Wire connectors are also available in 3-pole and 4-pole versions.

An auxiliary connection can be implemented using a special control wire tap. For further information, please refer to chapter Auxiliary conductor terminal (Page 269).

The table below shows all the types and sizes of cable which can be connected to wire connectors for the 3VA25 molded case circuit breaker.



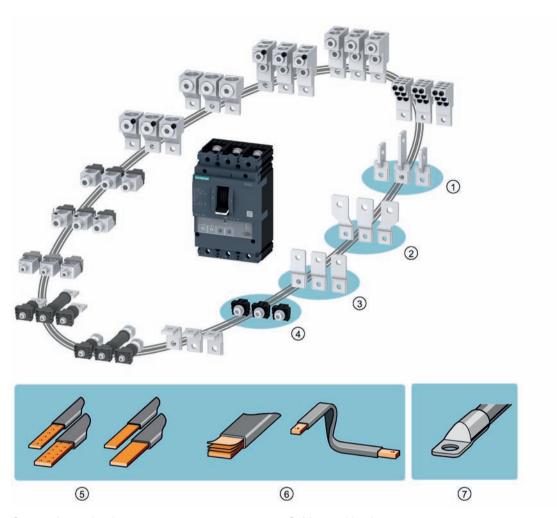
The wire connectors for the 3VA25 molded case circuit breaker can be ordered:

- as a pack of 3
- as a pack of 4

Assembly materials for wire connectors and the necessary insulation measure are included in the scope of supply.

# 4.3.2.3 Front busbar and cable lug connections

The diagram below illustrates all the components available for implementing a busbar or compression lug connection on the front panel of the 3VA molded case circuit breaker.



Connection technology

- 1 Bus connectors edgewise
- ② Front bus connectors offset
- 3 Front bus connectors extended
- 4 Nut keeper kit

Cables and busbars

- (5) Busbars
- 6 Flexible busbars
- ⑦ Compression lugs

# Nut keeper kit



With the nut keeper kit, it is possible to connect busbars and compression lugs directly to the terminal of the 3VA molded case circuit breaker.

An auxiliary connection can be implemented using a special control wire tap. For further information, please refer to chapter Auxiliary conductor terminal (Page 269).

The table below provides an overview of the minimum sizes of cables and busbars which can be installed using the nut keeper kit.

|                          | Designation                    |  |                  |         |                |             | Nut keeper kit          |                |  |
|--------------------------|--------------------------------|--|------------------|---------|----------------|-------------|-------------------------|----------------|--|
|                          | Article No.                    |  |                  |         | 3VA9110QA00    | 3VA9210QA00 | 3VA9200QA00             | 3VA9400QA00    | 3VA9600QA0   |
| Connection<br>technology |                                | 3VA1                                     |                  |         | 3VA10<br>3VA11 | 3VA12       | ê                       | 3VA13<br>3VA14 |  |
| Conn                     | Can be installed in            | 3VA2                                     |                  |         | S#85           | 8           | 3VA20<br>3VA21<br>3VA22 | 3VA23<br>3VA24 | 3VA25  |
|                          |                                | Maximum width                            | 107              | [mm]    | 17             | 25          | 25                      | 35             | 50   |
|                          |                                | Maximum widin                            | W <sub>max</sub> | [in]    | 0.66           | 0.98        | 0.98                    | 1.37           | 2.00   |
|                          | Front busbar connector         | Thisbass                                 | т                | [mm]    | ≤ 6.5          | ≤ 8         | ≤8                      | 1 10           | 4 29   |
|                          | (rigid & flexible)             | Thickness                                | 3                | [in]    | ≤ 0.25         | ≤ 0.31      | ≤ 0.31                  | 0.04 0.39      | 0.16 1.14  |
|                          |                                |  |                  | [mm]    | 8 10           | 10 12       | 10 12                   | 17 20          | Single hole:<br>16 21<br>Double hole:<br>13 18         |
|                          |                                | Length L                                 | L                | [in]    | 0.32 0.39      | 0.40 0.47   | 0.40 0.47               | 0.67 0.78      | Single hole:<br>0.63 0.82<br>Double hole:<br>0.51 0.71 |
|                          | 3VA25 only (rigid & flexible): | Transacti                                |                  | [mm]    | 8              | 10          | 10                      | 14.5           | 14.5 / 18  |
|                          | Ø Ø                            | Length H                                 | Н                | [in]    | 0.31           | 0.39        | 0.39                    | 0.57           | 0.57 / 0.71  |
|                          | ZII CH                         |  | Ø                | [mm]    | 6.5            | 8.5         | 8.5                     | 11             | 10.5   |
| bai                      |                                | Hole diameter                            | Ю                | [in]    | 1/4            | 5/16        | 5/16                    | 3/8            | 0.41   |
|                          |                                |  |                  | [Nm]    | 8              | 20          | 20                      | 40             | 31   |
|                          |                                | Tightening torque                        |                  | [lb-in] | 70             | 177         | 177                     | 354            | 275  |
| Cables and busbars       |                                | Tool: Hexagon socket wrench              |                  | [mm]    | 4              | 6           | 6                       | 8              | 8  |
| Cat                      |                                | ***************************************  |                  | [mm]    | 17             | 25          | 25                      | 35             | On request   |
|                          |                                | Maximum width                            | W <sub>max</sub> | [in]    | 0.66           | 0.98        | 0.98                    | 1.37           | On request   |
|                          |                                |  | 1200             | [mm]    | ≤ 6.5          | ≤ 8         | ≤8                      | 1 10           | On request   |
|                          | Cable connection               | Thickness                                | Т                | [in]    | ≤ 0.25         | ≤ 0.31      | ≤ 0.31                  | 0.04 0.39      | On request   |
|                          | with compression cable         | 7 8 E                                    | -                | [mm]    | 8              | 10          | 10                      | 15             | On request   |
|                          |                                | Length C <sub>min</sub>                  | C <sub>min</sub> | [in]    | 0.31           | 0.40        | 0.40                    | 0.59           | On request   |
|                          | Oa Oa                          | 1  |                  | [mm]    | 8              | 10          | 10                      | 14.5           | On request   |
|                          | OF OF                          | Length H                                 | Н                | [in]    | 0.31           | 0.39        | 0.39                    | 0.57           | On request   |
|                          | TOTAL FORM                     | C. C | -                | [mm]    | 6.5            | 8.5         | 8.5                     | 11             | On request   |
|                          | TIME TIME                      | Hole diameter                            | Ø                | [in]    | 1/4            | 5/16        | 5/16                    | 3/8            | On request   |
|                          |                                | 2227 20100200200000000000                |                  | [Nm]    | 8              | 20          | 20                      | 40             | On request   |
|                          |                                | Tightening torque                        |                  | [lb-in] | 70             | 177         | 177                     | 354            | On request   |
|                          |                                | Tool: Hexagon socket wrench              |                  | [mm]    | 4              | 6           | 6                       | 8              | On request   |

Nut keeper kits can be ordered:

- as a pack of 3
- as a pack of 4

### Front bus connectors extended

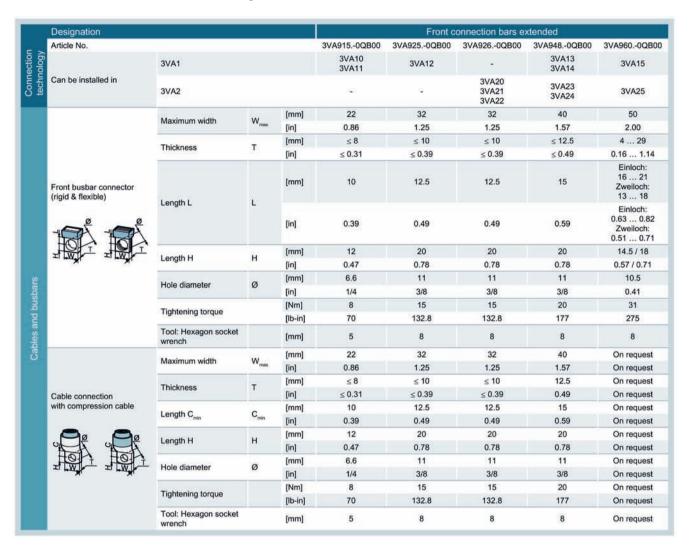


Bus connectors extended can be installed to connect larger busbars and compression lugs outside the termination area of a 3VA molded case circuit breaker. The front bus connectors therefore extend the terminal of the breaker.

All front bus connectors extended are supplied as standard with phase barriers to provide insulation between individual phases. For further information, please refer to chapter Insulating measures (Page 246).

An auxiliary connection can be implemented using a special control wire tap. For further information, please refer to chapter Auxiliary conductor terminal (Page 269).

The table below provides an overview of the minimum sizes of cables and busbars which can be installed using front bus connectors extended.



Front bus connectors extended can be ordered:

- as a pack of 3
- as a pack of 4

### Front bus connectors offset



Front bus connectors offset can be installed to connect very large busbars and compression lugs outside the termination area of a 3VA molded case circuit breaker. Front bus connectors offset increase the distance between pole centers of the terminals of the molded case circuit breaker.

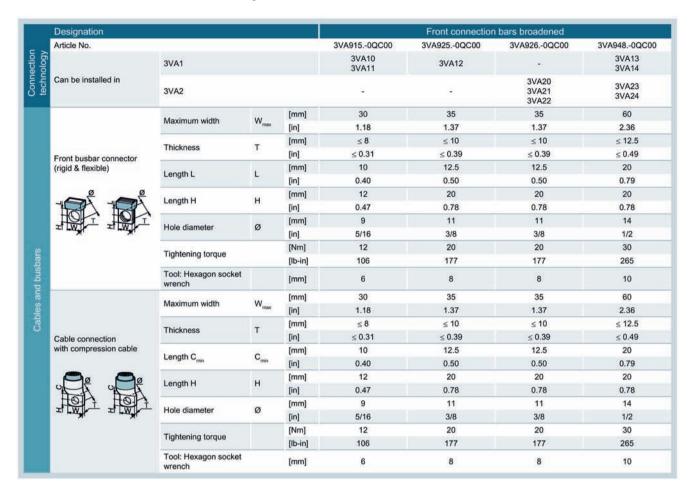
Distance between pole centers with front bus connectors offset:

- 3VA10 / 3VA11: 35 mm
- 3VA12 / 3VA20 / 3VA21 / 3VA22: 45 mm
- 3VA13 / 3VA14 / 3VA23 / 3VA24: 70 mm

All front bus connectors offset are supplied as standard with phase barriers to provide insulation between individual phases. For further information, please refer to chapter Insulating measures (Page 246).

An auxiliary connection can be implemented using a special control wire tap. For further information, please refer to chapter Auxiliary conductor terminal (Page 269).

The table below provides an overview of the minimum sizes of cables and busbars which can be installed using front bus connectors offset.



Front bus connectors offset can be ordered:

- as a pack of 3
- as a pack of 4

### Bus connectors edgewise



Bus connectors edgewise can be installed to connect large busbars and compression lugs outside the termination area of a 3VA molded case circuit breaker. The terminal of the breaker is turned by 90° when bus connectors edgewise are fitted.

All bus connectors edgewise are supplied as standard with phase barriers to provide insulation between individual phases. For further information, please refer to chapter Insulating measures (Page 246).

An auxiliary connection can be implemented using a special control wire tap. For further information, please refer to chapter Auxiliary conductor terminal (Page 269).

The table below provides an overview of the minimum sizes of cables and busbars which can be installed using bus connectors edgewise.

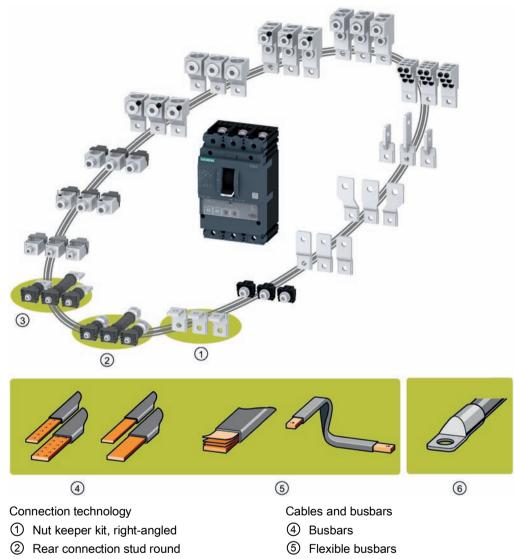
|                    | Designation                         |   |                  |         |                | Front connection | n bars edgewise         |                |
|--------------------|-------------------------------------|---|------------------|---------|----------------|------------------|-------------------------|----------------|
|                    | Article No.                         |   |                  |         | 3VA9150QD00    | 3VA9250QD00      | 3VA9260QD00             | 3VA9480QD00    |
| technology         |                                     | 3VA1                                    |                  |         | 3VA10<br>3VA11 | 3VA12            | *                       | 3VA13<br>3VA14 |
| techn              | Can be installed in                 | 3VA2                                    |                  |         | 2              | 3/               | 3VA20<br>3VA21<br>3VA22 | 3VA23<br>3VA24 |
|                    |                                     | Maximum width                           | 144              | [mm]    | 20             | 25               | 25                      | 40             |
|                    |                                     | Maximum width                           | W <sub>max</sub> | [in]    | 0.78           | 0.98             | 0.98                    | 1.57           |
|                    |                                     | Thistopera                              | -                | [mm]    | ≤ 6            | ≤ 7              | ≤7                      | ≤ 8            |
|                    | Front busbar connector              | Thickness                               | т                | [in]    | ≤ 0.23         | ≤ 0.27           | ≤ 0.27                  | ≤ 0.31         |
|                    | (rigid & flexible)                  | Locath I                                |                  | [mm]    | 10             | 12.5             | 12.5                    | 15             |
|                    | About the second of the second      | Length L                                | L                | [in]    | 0.40           | 0.50             | 0.50                    | 0.59           |
|                    | ~ \overline{\phi} ~ \overline{\phi} | Length H                                | н                | [mm]    | 12             | 15               | 15                      | 20             |
| Cables and busbars |                                     | Length H                                | ·m               | [in]    | 0.47           | 0.59             | 0.59                    | 0.78           |
|                    |                                     | Hole diameter                           | Ø                | [mm]    | 6.6            | 11               | 11                      | 11             |
|                    | TI PANTA                            | noie diameter                           | 6                | [in]    | 1/4            | 3/8              | 3/8                     | 3/8            |
|                    | T                                   | Tightening torque                       |                  | [Nm]    | 8              | 20               | 20                      | 30             |
|                    |                                     | rightening torque                       |                  | [lb-in] | 70             | 177              | 177                     | 265            |
|                    |                                     | Tool: Hexagon socket wrench             |                  | [mm]    | 6              | 8                | 8                       | 8              |
|                    |                                     | *************************************** | 10/              | [mm]    | 20             | 25               | 25                      | 40             |
|                    |                                     | Maximum width                           | W <sub>max</sub> | [in]    | 0.78           | 0.98             | 0.98                    | 1.57           |
|                    |                                     | Thickness                               | -                | [mm]    | ≤ 6            | ≤7               | ≤7                      | ≤ 8            |
|                    | Cable connection                    | Inickness                               | Т                | [in]    | ≤ 0.23         | ≤ 0.27           | ≤ 0.27                  | ≤ 0.31         |
|                    | with compression cable              | Learnin O                               | •                | [mm]    | 10             | 12.5             | 12.5                    | 15             |
|                    |                                     | Length C <sub>min</sub>                 | Cmin             | [in]    | 0.40           | 0.50             | 0.50                    | 0.59           |
|                    | Ag Ag                               | Length H                                | н                | [mm]    | 12             | 15               | 15                      | 20             |
|                    | The River                           | Length H                                |                  | [in]    | 0.47           | 0.59             | 0.59                    | 0.78           |
|                    | right treat                         | Hole diameter                           | Ø                | [mm]    | 6.6            | 11               | 11                      | 11             |
|                    | TI HAND TI HAND                     | noie diameter                           | Ø                | [in]    | 1/4            | 3/8              | 3/8                     | 3/8            |
|                    |                                     | T1.11.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1 |                  | [Nm]    | 8              | 20               | 20                      | 30             |
|                    |                                     | Tightening torque                       |                  | [lb-in] | 70             | 177              | 177                     | 265            |
|                    |                                     | Tool: Hexagon socket wrench             |                  | [mm]    | 6              | 8                | 8                       | 8              |

Bus connectors edgewise can be ordered:

- as a pack of 3
- as a pack of 4

# 4.3.2.4 Rear busbar and cable lug connections

The diagram below illustrates all the components available for implementing a busbar or compression lug connection on the rear panel of the 3VA molded case circuit breaker.



3 Rear connection stud flat

6 Compression lugs

### Nut keeper kit, right-angled

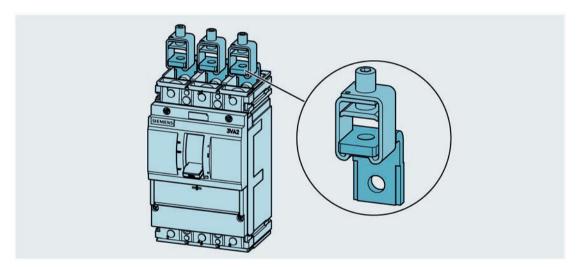


The right-angled nut keeper kit can be installed to connect busbars and compression lugs outside the termination area on the rear panel of a 3VA molded case circuit breaker. The terminal of the molded case circuit breaker is turned by 90° at right angles, allowing the busbar or compression lug to be connected at the rear.

#### Note

Right-angled nut keeper kits may only be connected to phases 1, 3 and 5 (top terminals) owing to the gases expelled by 3VA molded case circuit breakers.

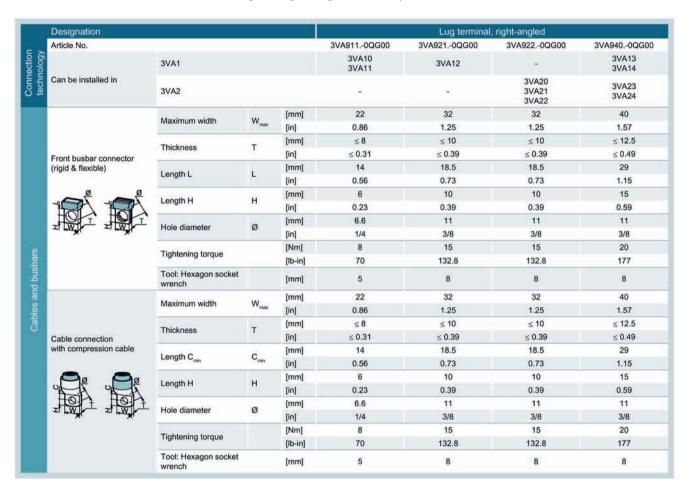
In addition, a box terminal can also be attached to the right-angled nut keeper kit allowing direct connection of a cable.



All right-angled nut keeper kits are supplied as standard with phase barriers to provide insulation between individual phases (see chapter Insulating measures (Page 246)).

An auxiliary connection can be implemented using a special control wire tap. For further information, please refer to chapter Auxiliary conductor terminal (Page 269).

The table below provides an overview of the minimum sizes of cables and busbars which can be installed using the right-angled nut keeper kit.



Right-angled nut keeper kits can be ordered:

- as a pack of 3
- as a pack of 4

### Rear connection stud round



The rear connection studs round can be installed to connect busbars and compression lugs to the rear panel of a 3VA molded case circuit breaker.

The dimensions of rear connection studs are given in the table below:

| Designation  |   |          |   | Rear connection stud round |                |             |                         |                |
|--|---|----------|---|----------------------------|----------------|-------------|-------------------------|----------------|
| Article No.  |   |          |   |                            | 3VA9110QF00    | 3VA9210QF00 | 3VA9200QF00             | 3VA9400QF0     |
| Can be installed in  | 3   | BVA1     |   |                            | 3VA10<br>3VA11 | 3VA12       | *                       | 3VA13<br>3VA14 |
| Can be installed in  | 3   | 3VA2     |   |                            | 626            | ¥           | 3VA20<br>3VA21<br>3VA22 | 3VA23<br>3VA24 |
| Dimension drawing  |   | G        |   | [mm]                       | 28             | 36          | 36                      | 45             |
| The state of the s | -1  | G        |   | [in]                       | 1.10           | 1.42        | 1.42                    | 1.77           |
|  |   | н        |   | [mm]                       | 66             | 59          | 59                      | 75             |
|  |   | 12       |   | [in]                       | 2.60           | 2.32        | 2.32                    | 2.95           |
| -  |   | j        |   | [mm]                       | 85             | 93          | 93                      | 105            |
|  |   | J        |   | [in]                       | 3.35           | 3.66        | 3.66                    | 4.13           |
|  |   | к        |   | [mm]                       | 123            | 116         | 116                     | 135            |
|  |   |          |   | [in]                       | 4.84           | 4.57        | 4.57                    | 5.31           |
|  |   |          | Hexagon nut                                 |                            | M8             | M10         | M10                     | M12            |
|  |   | L1       | Hexagon nut width<br>across flats           |                            | 17             | 16          | 16                      | 18             |
|  |   |          | Hexagon nut<br>tightening torque            | [Nm]                       | 12             | 10          | 10                      | 20             |
|  | L   | .2       | Round connection<br>stud width across flats |                            | 17 1)          | 14          | 14                      | 17             |
| Drilling pattern for fixed-me  | ounted circuit breaker  | Δ.       |   | [mm]                       | 114.50         | 123.50      | 146.00                  | 180.00         |
| Drilling pattern for fixed-ray 3VA1 - 100 / 160  | 3VA1 - 250<br>3VA2 - 400 / 630<br>3VA2 - 400 / 630<br>→ → → → → → → → → → → → → → → → → → → | •        |   | [in]                       | 4.51           | 4.86        | 5.75                    | 7.09           |
|  |   | 3        |   | [mm]                       | 107.80         | 134.00      | 157.00                  | 200.00         |
|  |   |          |   | [in]                       | 4.24           | 5.28        | 6.18                    | 7.87           |
|  |   | С        |   | [mm]                       | 3.50           | 5.25        | 5.50                    | 10.00          |
|  |   | <u> </u> |   | [in]                       | 0.14           | 0.21        | 0.22                    | 0.39           |
|  |   | 0        |   | [mm]                       | 12.70          | 17.50       | 17.50                   | 23.00          |
|  |   |          |   | [in]                       | 0.50           | 0.69        | 0.69                    | 0.91           |
|  |   |          |   | [mm]                       | 25.40          | 35.00       | 35.00                   | 46.00          |
|  |   | **       |   | [in]                       | 1.00           | 1.38        | 1.38                    | 1.81           |
|  |   | -        |   | [mm]                       | 4.00           | 4.50        | 4.50                    | 5.50           |
|  |   |          |   | [in]                       | 0.16           | 0.18        | 0.18                    | 0.22           |
|  |   | 3        |   | [mm]                       | 17.00          | 24.50       | 24.50                   | 34.00          |
| San Maria Maria Maria Maria  |   | - C      |   | [in]                       | 0.67           | 0.96        | 0.96                    | 1.34           |
| Drilling pattern for socket, plug-in/draw-out technology   |   | A        |   | [mm]                       | 160.50         | 185.50      | 209.00                  | 259.00         |
| 3VA1 - 100 / 160   |   | 411      |   | [in]                       | 6.32           | 7.30        | 8.23                    | 10.20          |
| 226  | 3VA1 - 250<br>3VA2 - 100 / 160 / 250<br>3VA2 - 400 / 630                                    | В        |   | [mm]                       | 153.80         | 196.00      | 220.00                  | 279.00         |
| <b>⊕•</b> •••••••••••••••••••••••••••••••••••  |   |          |   | [in]                       | 6.06           | 7.72        | 8.66                    | 10.98          |
|  | 1 4,4,4   | С        |   | [mm]                       | 3.50           | 5.25        | 5.50                    | 10.00          |
|  | 8   |          |   | [in]                       | 0.14           | 0.21        | 0.22                    | 0.39           |
|  |   | D        |   | [mm]                       | 12.70          | 17.50       | 17.50                   | 23.00          |
|  |   |          |   | [in]                       | 0.50           | 0.69        | 0.69                    | 0.91           |
|  |   | E        |   | [mm]                       | 25.40          | 35.00       | 35.00                   | 46.00          |
|  | 300000  | 8        |   | [in]                       | 1.00           | 1.38        | 1.38                    | 1.81           |
| 0 + 5+9  |   | F        |   | [mm]                       | 4.00           | 4.50        | 4.50                    | 5.50           |
| · ·  |   |          |   | [in]                       | 0.16           | 0.18        | 0.18                    | 0.22           |
|  | E   | G        |   | [mm]                       | 17.00          | 24.50       | 24.50                   | 34.00          |
| <u> </u>   |   | The same |   | [in]                       | 0.67           | 0.96        | 0.96                    | 1.34           |

<sup>1)</sup> Width across flats of the supplied lock nut

Rear connection studs round can be ordered:

- as a pack of 3 (2 short connection studs and 1 long connection stud)
- as a pack of 4 (2 short studs and 2 long studs)
- as a pack of 1 (1 short connection stud)
- as a pack of 1 (1 long connection stud)

#### Note

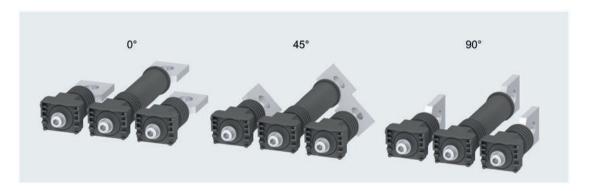
In order to achieve degree of protection IP40, terminal covers (flat version) must also be attached when a rear connection stud round is installed.

# Rear connection stud flat



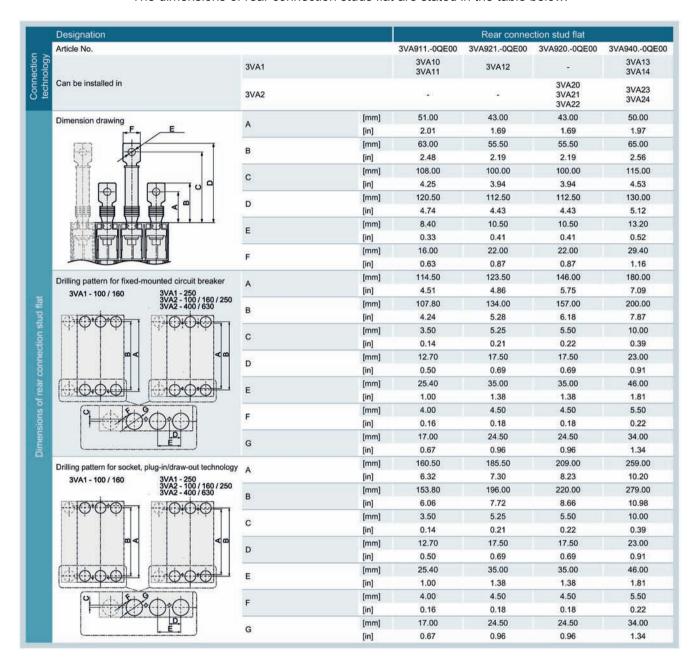
The rear connection stud flat can be installed to connect busbars and compression lugs to the rear panel of a 3VA molded case circuit breaker.

The rear connection stud flat can be rotated in steps of  $45^{\circ}$ , i.e. it can be installed at an angle of  $0^{\circ}$ ,  $45^{\circ}$  or  $90^{\circ}$ :



### Note

In order to achieve degree of protection IP40, terminal covers (flat version) must also be attached when a rear connection stud flat is installed.



#### The dimensions of rear connection studs flat are stated in the table below:

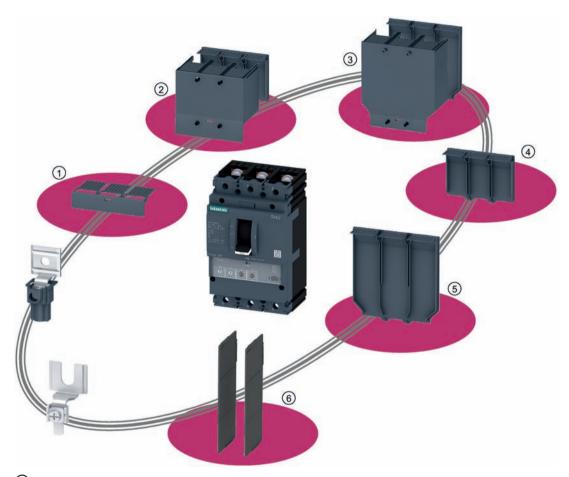
### Rear connection studs flat can be ordered:

- as a pack of 3 (2 short connection studs flat and 1 long connection stud flat)
- as a pack of 4 (2 short connection studs flat and 2 long connection studs flat)
- as a pack of 1 (1 short connection stud flat)
- as a pack of 1 (1 long connection stud flat)

# 4.3.3 Further connection accessories

# 4.3.3.1 Insulating measures

The portfolio of connection accessories includes a broad range of insulating measures. The diagram below provides an overview of insulation accessories available for 3VA molded case circuit breakers.



- 1 Terminal cover
- ② Terminal cover extended
- 3 Terminal cover offset
- 4 Insulating plate
- ⑤ Insulating plate offset:
- 6 Phase barriers

#### Phase barriers



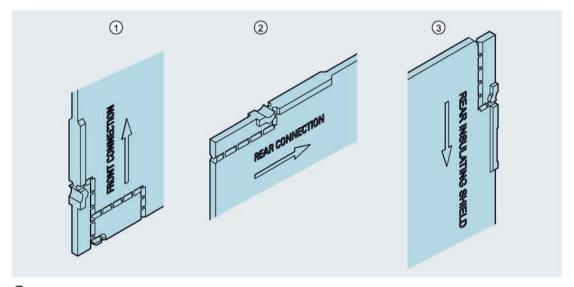
Phase barriers provide insulation between the individual phases of the molded case circuit breaker. They are simply snapped into place on the 3VA molded case circuit breaker.

Phase barriers can be used in combination with the insulating plate and the insulating plate offset. in order to provide additional insulation from the mounting plate.

Phase barriers are compatible with:

- Box terminal
- Wire connector
- Front bus connectors extended (included in scope of supply)
- Front bus connectors offset (included in scope of supply)
- Bus connectors edgewise (included in scope of supply)
- Nut keeper kit, right-angled (included in scope of supply)
- Other insulation accessories: Insulating plate or insulating plate, offset

Depending on the intended purpose of the phase barriers, they must be snapped into position in the direction indicated by the arrows below:



- 1 Front connection
- Rear connection for right-angled nut keeper kit
- 3 In combination with insulating plate

### Terminal cover, extended terminal cover, and offset terminal cover

All terminal covers afford degree of protection IP40 at the front of the breaker and degree of protection IP20 at the infeed and load ends provided that they are correctly installed (cutting of grille structure).

All terminal covers have a marking on the inside face which can be drilled through before the cover is installed. A voltage detector can be inserted through this hole to test for safe isolation.

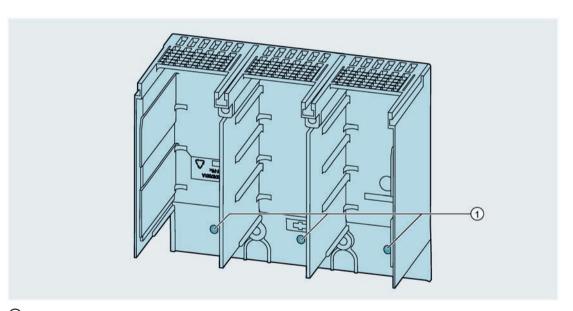


# WARNING

### Reduced degree of protection

If a hole is drilled through the terminal cover, degree of protection IP40 is no longer afforded.

Suitable precautions must be taken to safeguard against any hazards posed by this loss of protection.



# Marking for holes

Phase barriers can also be installed on all terminal covers in order to maintain the required clearances and creepage distances which might be reduced as a result of ionized gas following a short circuit.



#### Terminal cover

The terminal cover is compatible with:

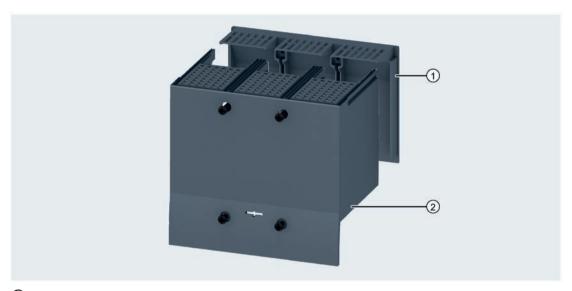
- Box terminals
- Wire connectors
- Nut keeper kits

The terminal cover is simply snapped into place on 3VA1 breakers, or is snapped into place and secured with two screws on 3VA2 breakers.



#### Terminal cover extended

The terminal cover extended always consists of two parts:



- 1 Rear insulating plate, provides insulation from the panel mounting plate
- ② Front half, pushed over the molded case circuit breaker from the front

The insulating plate is fitted to the rear panel of the molded case circuit breaker and then secured by two screws to the front half of the terminal cover. The terminal cover extended is also secured by two additional screws to the molded case circuit breaker itself.

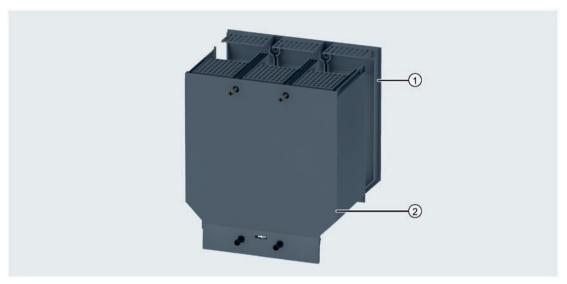
The terminal cover extended is compatible with:

- Wire connectors, large (terminal cover extended included in scope of supply)
- Wire connectors, 2 cables (terminal cover extended included in scope of supply)
- Wire connectors, 6 cables (terminal cover extended included in scope of supply)
- · Front bus connectors extended
- Bus connectors edgewise



#### Terminal cover offset

The terminal cover offset always consists of two parts:



- ① Rear insulating plate, provides insulation from the panel mounting plate
- 2 Front half, pushed over the molded case circuit breaker from the front

The insulating plate is fitted to the rear panel of the molded case circuit breaker and then secured by two screws to the front half of the terminal cover. The terminal cover offset is also secured by two additional screws to the molded case circuit breaker itself.

The terminal cover offset is compatible with:

Front bus connectors offset

# Insulating plate and insulating plate offset



In certain cases it may be necessary to provide insulation from the panel mounting plate, see section "Insulation measures" in chapter Insulating measures (Page 246). The insulating plates for the 3VA molded case circuit breakers are designed for this purpose.

The insulating plate is fitted to the rear panel of the molded case circuit breaker and can be installed in combination with phase barriers.

Potential applications:

- Insulating plate:
  - Bus connectors extended
  - Non-insulated, straight conductors / terminals
- Insulating plate, offset:
  - Bus connectors offset

### Side plate for 3VA1 2-pole

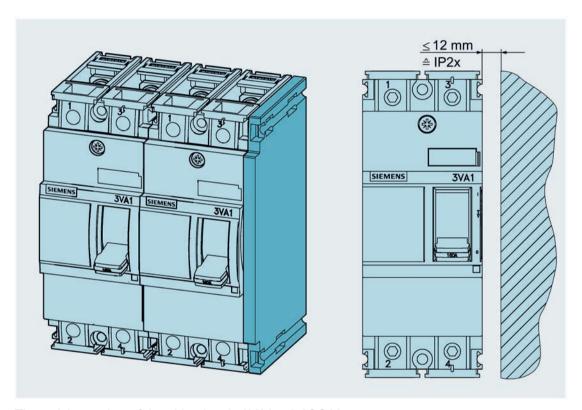




### Risk of injury

A side plate must be fitted if the side surface at the handle end of a 2-pole 3VA1 breaker with current rating  $I_0 > 100$  A is freely accessible.

For further information, please refer to Operating Instructions 3ZW1012-0VA10-2AA0.



The article number of the side plate is 3VA9112-0SG20.

### DC insulating plate



A DC insulating plate must be installed on 3-pole and 4-pole molded case circuit breakers for some applications:

- U<sub>e</sub> > 415 V AC: For IT system applications and for entry of incoming feeder cables through the bottom panel of the circuit breaker with non-insulated mounting plate
- U<sub>e</sub> > 250 V DC: with non-insulated mounting plate

For further information, please refer to Operating Instructions 3ZW1012-0VA10-0AA0

The article numbers for the DC insulating plates are 3VA9113-0SG10 (3-pole) and 3VA9114-0SG10 (4-pole)

# Insulating measures

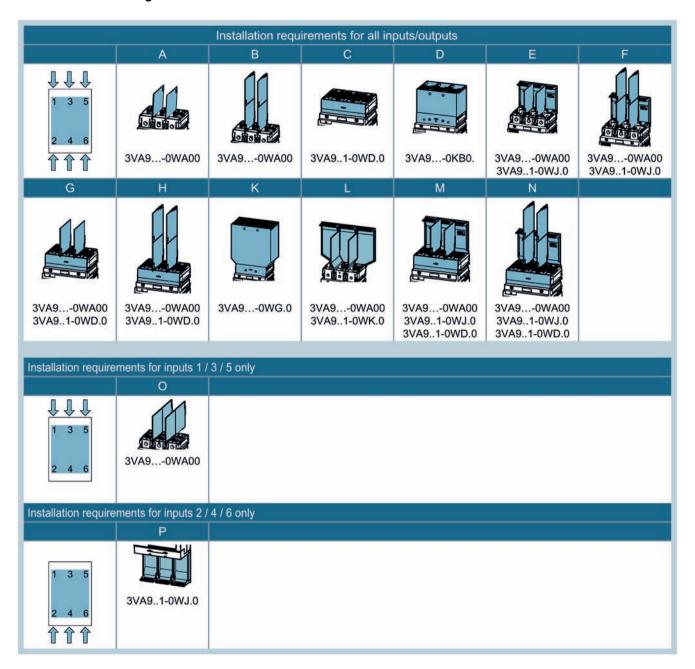
|      |               | Insulated cables and busbars e.g. insulated cable, insulated cable lug, insulated busbar, Flexibar, rear connecting studs, rear terminal flat                     | Non-insulated cables and busbars e.g. non-insulated cable, non-insulated cable lug, non-insulated busbar, connection bar extensions, external circular conductor terminals |
|------|---------------|---|--|
|      | Voltage level |   | 000 220 223<br>220 220 223   |
| 7    | ≤ 415 V       | If the cable or busbar is still insulated at the point at which it enters the terminal compartment, no additional insulating equipment is required. <sup>1)</sup> | Additional insulating equipment is required such as phase barriers, extended/broadened terminal cover  |
| 3VA1 | > 415 V       | <ol> <li>Phase to phase: Phase barriers or</li> </ol>   | ipment is always required:<br>r extended/broadened terminal covers<br>tes or extended/broadened terminal covers  |
| 42   | ≤ 525 V       | If the cable or busbar is still insulated at the point at which it enters the terminal compartment, no additional insulating equipment is required.               | Additional insulating equipment is required such as phase barriers, extended/broadened terminal cover  |
| 3VA2 | > 525 V       | 1. Phase to phase: Phase barriers or  | ipment is always required:<br>r extended/broadened terminal covers<br>tes or extended/broadened terminal covers  |

The 3VA12 molded case circuit breaker requires a rear insulating plate in the case of infeed from below.

### Insulation requirements for inputs/outputs of the molded case circuit breakers

The insulation requirements are represented by letters in the tables below. These letters stand for the following insulation accessories:

# Legend for insulation measures of molded case circuit breakers 3VA10 to 3VA24



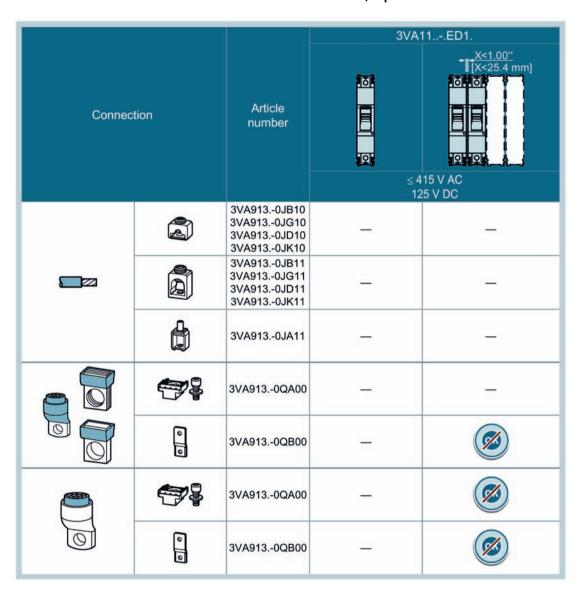
#### Note

All the insulation measures represent minimum requirements.

Covers can be replaced with higher-quality covers:

- Insulation measure A can be replaced with D and E
- · Insulation measure B can be replaced with D and F
- Insulation measure E can be replaced with D
- Insulation measure L can be replaced with K

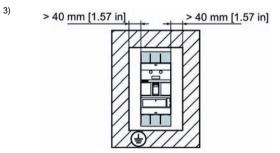
### Insulation measures for 3VA11 molded case circuit breaker, 1-pole



# Insulation measures for 3VA10 / 3VA 11 molded case circuit breakers, 2-pole, 3-pole, 4-pole

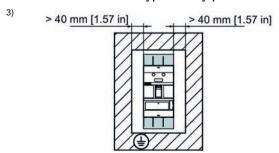
|            |     |  |                     |                                       | 3VA10      | / 3VA11                  |       |                                   |
|------------|-----|--|---------------------|---------------------------------------|------------|--------------------------|-------|-----------------------------------|
| Connection |     | Article<br>number  | ≤ 415 V AC          | , > 415 V AC<br>≤ 690 V AC            | ≤ 250 V DC | > 250 V DC<br>≤ 600 V DC |       | 1 3 5<br>2 4 6<br>Line<br>1 1 1 1 |
|            |     | 3VA9110JB10<br>3VA9110JD10<br>3VA9110JG10<br>3VA9110JK10 | _                   | D/E/F                                 | _          | D/E/F                    | D/E/F | D/E/F                             |
|            |     | 3VA9110JB11<br>3VA9110JD11<br>3VA9110JG11<br>3VA9110JK11 | -                   | D/E/F                                 | =          | D/E/F                    | D/E/F | D/E/F                             |
|            |     | 3VA9150JA11  | -                   | D/E/F                                 | -          | D/E/F                    | D/E/F | D/E/F                             |
|            |     | 3VA91120JJ12<br>3VA9110JF60                              | D                   | D                                     | D          | D                        | D     | D                                 |
|            |     | 3VA9110QA00  | _                   | D/E/F                                 | -          | D/E/F                    | D/E/F | D/E/F                             |
|            |     | 3VA9150QB00  | A/B                 | D / E <sup>3)</sup> / F <sup>3)</sup> | A/B        | D/E/F                    | D/E/F | D/E/F                             |
|            | 999 | 3VA9150QC00  | K / L <sup>3)</sup> | K / L <sup>3)</sup>                   | K/L        | K/L                      | K/L   | K/L                               |
|            |     | 3VA9150QD00  | D/E/F               | D / E <sup>3)</sup> / F <sup>3)</sup> | D/E/F      | D/E/F                    | D/E/F | D/E/F                             |
|            | 2)  | 3VA9150QD00  | 0                   | O <sup>3)</sup>                       | 0          | 0                        | 0     | 0                                 |

- <sup>1)</sup> Insulating plate 3VA911.-0SG10 must **always** be used with these systems.
- This connection type is only permissible for terminals 1 / 3 / 5.



|        |                            |                   |                     |                                       | 3VA10      | / 3VA11                  |            |                                   |
|--------|----------------------------|-------------------|---------------------|---------------------------------------|------------|--------------------------|------------|-----------------------------------|
| Connec | etion                      | Article<br>number | ≤ 415 V AC          | > 415 V AC<br>≤ 690 V AC              | ≤ 250 V DC | > 250 V DC<br>≤ 600 V DC | > 415 V AC | 1 3 5<br>2 4 6<br>Line<br>1 1 1 1 |
|        |                            | 3VA9110QA00       | A/B                 | D / E <sup>3)</sup> / F <sup>3)</sup> | A/B        | D/E/F                    | D/E/F      | D/E/F                             |
|        |                            | 3VA9150QB00       | В                   | D / F <sup>3)</sup>                   | D/F        | D/F                      | D/F        | D/F                               |
|        |                            | 3VA9150QC00       | K / L <sup>3)</sup> | K / L <sup>3)</sup>                   | K/L        | K/L                      | K/L        | K/L                               |
|        |                            | 3VA9150QD00       | D/F                 | D / F <sup>3)</sup>                   | D/F        | D/F                      | D/F        | D/F                               |
|        | 2)                         | 3VA9150QD00       | 0                   | O <sup>3)</sup>                       | 0          | O                        | 0          | 0                                 |
|        |                            | 3VA9150QE.0       | С                   | M/N                                   | С          |                          |            |                                   |
|        |                            | 3VA9110QF.0       | С                   | M/N                                   | С          |                          |            |                                   |
|        | <b>1 1 1 1 1 1 1 1 1 1</b> | 3VA9220QD00       | 0                   |                                       | 0          |                          |            |                                   |

- 1) Insulating plate 3VA911.-0SG10 must **always** be used with these systems.
- This connection type is only permissible for terminals 1/3/5.



# Insulation measures for 3VA12 molded case circuit breaker

| Connec  | etion | Article<br>number  | 1 3 5<br>2 4 6<br>Load<br>↓ ↓ ↓<br>≤ 415 V AC<br>≤ 415 V DC | ↑ ↑ ↑ 1 Load 1 3 5 2 4 6 Line ↑ ↑ ↑ ≤ 415 V AC ≤ 415 V DC | Line<br>1 3 5<br>2 4 6<br>Load<br>↓ ↓ ↓<br>≤ 690 V AC<br>≤ 750 V DC | ↑ ↑ ↑<br>1 3 5<br>2 4 6<br>↓ ↑ ↑<br>≤ 690 V AC<br>≤ 750 V DC |
|---|-------|--|---|---|---|--|
|   |       | 3VA9100JB11<br>3VA9260JB12<br>3VA9100JG11<br>3VA9260JG12 | -   | Р   | D/E/F   | D/E/F  |
|   |       | 3VA9160JA12<br>3VA9260JA12                               | _   | Р   | D/E/F   | D/E/F  |
|   | 191   | 3VA920JJ13<br>3VA920JC13<br>3VA920JJ22<br>3VA920JC22     | D   | D   | D   | D  |
|   |       | 3VA9200QA00  | -   | P   | D/E/F   | D/E/F  |
|   |       | 3VA9260QB00  | D/E/F   | D/E/F   | D/E/F   | D/E/F  |
|   | 999   | 3VA9260QB00  | K/L   | K/L   | K/L   | K/L  |
|   |       | 3VA9260QD00  | F   | F   | E   | F  |
|   | 1)    | 3VA9260QD00  | 0   | 0   |   |  |
|   |       | 3VA9200QA00  | A/B   | E/F   |   |  |
|   |       | 3VA9260QB00  | D/E/F   | D/E/F   |   |  |
| >8 mm<br>>90.3 in]<br>320 mm<br>(12.6 in]             |       | 3VA9260QC00  | K/L   | K/L   |   |  |
| 320 mm<br>[12.6 in]<br>[12.6 in]<br>8 mm<br>[>0.3 in] |       | 3VA9260QD00  | F   | F   |   |  |
|   | "     | 3VA9260QD00  | O   |   |   |  |

 $<sup>^{1)}</sup>$  This connection type is only permissible for terminals 1 / 3 / 5.

| Connec | tion         | Article<br>number | ↓ ↓ ↓<br>1 3 5<br>2 4 6<br>↓ ↓ ↓<br>≤ 415 V AC<br>≤ 415 V DC | 1 3 5<br>2 4 6<br>Line | ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ≤ 690 V AC ≤ 750 V DC | 1 3 5<br>2 4 6<br>Line<br>↑ ↑ ↑<br>≤ 690 V AC<br>≤ 750 V DC |
|--------|--------------|-------------------|--|------------------------|---------------------------------------|---|
|        |              | 3VA9200QA00       | A/B  | E/F                    | D/E/F                                 | D/E/F   |
|        |              | 3VA9260QB00       | D/E/F  | D/E/F                  | D/F                                   | D/F   |
|        | 999          | 3VA9260QC00       | K/L  | K/L                    | K/L                                   | K/L   |
|        |              | 3VA9260QD00       | F  | F                      | F                                     | F   |
|        | "            | 3VA9260QD00       | 0  |                        |                                       |   |
|        |              | 3VA9200QE.0       | С  | С                      | M/N                                   | M/N   |
|        |              | 3VA9200QF.0       | С  | С                      | M/N                                   | M/N   |
|        | <b>TTT</b> " | 3VA9220QD00       | 0  | O                      | 0                                     | o   |

<sup>1)</sup> This connection type is only permissible for terminals 1 / 3 / 5.

# Insulation measures for 3VA13 and 3VA14 molded case circuit breakers

| Connection   |     | Article number                         | ≤ 500 V AC | ≤ 690 V AC | ≤ 500 V DC | ≤ 600 V DC |
|--|-----|--|------------|------------|------------|------------|
|  |     | 3VA9380JB13<br>3VA9380JG13             | _          | D/E/F      | D          | D          |
|  |     | 3VA9480JA13                            | =-         | D/E/F      | D          | D          |
|  |     | 3VA930JF60<br>3VA940JJ23<br>3VA940JC23 | D          | D          | D          | D          |
|  |     | 3VA9400QA00                            | -          | D/E/F      | D          | D          |
|  |     | 3VA9280QB00                            | D/E/F      | D/E/F      | D          | D          |
|  |     | 3VA9480QC00                            | K/L        | к          | к          | к          |
|  |     | 3VA9480QD00                            | D/F        | D/F        | D          | D          |
|  |     | 3VA9480QD00                            | 0          | o          | o          |            |
|  |     | 3VA9400QA00                            | A/B        |            | D          |            |
|  |     | 3VA9480QB00                            | D/F        |            | D          |            |
| > 8 mm   [> 0.3 in]  | 999 | 3VA9480QC00                            | K/L        |            | к          |            |
| 450 mm<br>(17.7 in)<br>(17.7 in) |     | 3VA9480QD00                            | D/F        |            | D          |            |
|  | 1   | 3VA9480QD00                            | 0          |            |            |            |

These terminals are only permissible for connections 1 / 3 / 5.

| Connection |            | Article number | ≤ 500 V AC | ≤ 690 V AC | ≤ 500 V DC | ≤ 600 V DC |
|------------|------------|----------------|------------|------------|------------|------------|
|            |            | 3VA9400QA00    | A/B        | D/E/F      | D          | D          |
|            |            | 3VA9480QB00    | F          |            |            |            |
|            |            | 3VA9480QC00    | K/L        |            |            |            |
|            |            | 3VA9480QD00    | F          | F          |            |            |
|            | "          | 3VA9480QD00    | 0          | o          |            |            |
|            |            | 3VA9400QE.0    | С          | M/N        | M/N        | M/N        |
|            |            | 3VA9400QF.0    | С          | M/N        | M/N        | M/N        |
|            | <b>777</b> | 3VA9480QG.0    | 0          | 0          |            |            |

These terminals are only permissible for connections 1 / 3 / 5.

1)

# Insulation measures for 3VA20, 3VA21 and 3VA22 molded case circuit breakers

| Connection   |   | Article number   | ≤ 500 V AC | ≤ 690 V AC |
|--|---|--|------------|------------|
|  |   | 3VA9100JB11<br>3VA9260JB12<br>3VA9100JG11<br>3VA9260JG12           |            | D/E/F      |
|  |   | 3VA9160JA12<br>3VA9260JA12   | _          | D/E/F      |
|  |   | 3VA920JJ13<br>3VA920JC13<br>3VA920JJ22<br>3VA920JC22<br>3VA920JF60 | D          | D          |
|  |   | 3VA9200QA00  |            | D/E/F      |
|  |   | 3VA9260QB00  | A/B        | D/E/F      |
|  |   | 3VA9260QC00  | В/К        | K/L        |
|  |   | 3VA9260QD00  | D/F        | D/F        |
|  | " | 3VA9260QD00  | o          | o          |
|  |   | 3VA9200QA00  | A/B        |            |
|  |   | 3VA9260QA00  | A/B        |            |
| 2-58 mm [2-0.3 in] [2-0.3 in] [3-0.2 in] [3- |   | 3VA9260QC00  | B/K/L      |            |
| 320 mm<br>[12.6 in]<br>12.8 in]<br>8 mm<br>  >0.3 in]  |   | 3VA9260QD00  | D/F        |            |
|  | " | 3VA9260QD00  | o          |            |

 $<sup>^{1)}</sup>$  This connection type is only permissible for terminals 1 / 3 / 5.

| Connection |            | Article number | ≤ 500 V AC | ≤ 690 V AC |
|------------|------------|----------------|------------|------------|
|            |            | 3VA9200QA00    | -          | D/E/F      |
|            |            | 3VA9260QB00    | A/B        | D/E/F      |
|            |            | 3VA260QC00     | K/L        | K/L        |
|            |            | 3VA926-0QD00   | D/F        | D/F        |
|            | 1)         | 3VA926-0QD00   | o          | 0          |
|            |            | 3VA9200QA00    | A/B        | D/E/F      |
|            |            | 3VA9260QB00    | В          | D/F        |
|            | 000        | 3VA9260QC00    | K/L        | K/L        |
|            |            | 3VA9260QD00    | F          | F          |
|            | 1)         | 3VA9260QD00    | o          | 0          |
|            |            | 3VA9200QE.0    | С          | M/N        |
|            |            | 3VA9200QF.0    | С          | M/N        |
|            | <b>TTT</b> | 3VA9220QD00    | o          |            |

<sup>1)</sup> This connection type is only permissible for terminals 1 / 3 / 5.

# Insulation measures for 3VA23 and 3VA24 molded case circuit breakers

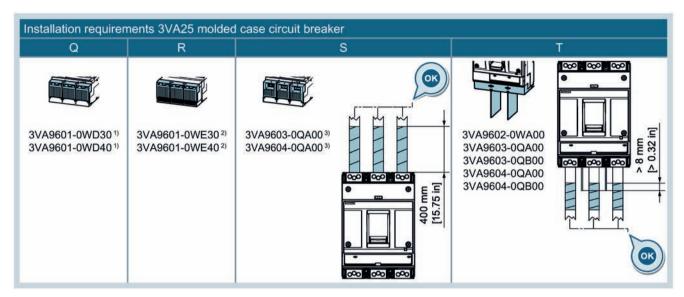
| Connection   |    | Article number                         | ≤ 500 V AC | ≤ 690 V AC |
|--|----|--|------------|------------|
|  |    | 3VA9380JB13<br>3VA9380JG13             | -          | D/E/F      |
|  |    | 3VA9480JA13                            | _          | D/E/F      |
|  |    | 3VA940JJ23<br>3VA940JC23<br>3VA930JF60 | D          | D          |
|  |    | 3VA9400QA00                            | <u>=</u>   | D/E/F      |
|  |    | 3VA9480QB00                            | A/B        | D/E/F      |
|  |    | 3VA9480QC00                            | В/К        | K/L        |
|  |    | 3VA9480QD00                            | D/F        | D/F        |
|  |    | 3VA9480QD00                            | o          | 0          |
|  |    | 3VA9400QA00                            | A/B        |            |
|  |    | 3VA9480QB00                            | A/B        |            |
| > 8 mm > 0.3 in]   0.0 in]   |    | 3VA9400QC00                            | B/K/L      |            |
| 450 mm<br>(1777 in)<br>(1777 in) |    | 3VA9480QD00                            | D/F        |            |
|  | 1) | 3VA9480QD00                            | O          |            |

 $<sup>^{1)}</sup>$  This connection type is only permissible for terminals 1 / 3 / 5.

| Connection |            | Article number | ≤ 500 V AC | ≤ 690 V AC |
|------------|------------|----------------|------------|------------|
|            |            | 3VA9400QA00    | -          | D/E/F      |
|            |            | 3VA9480QB00    | A/B        | D/E/F      |
|            |            | 3VA9480QC00    | K/L        | K/L        |
|            |            | 3VA9480QD00    | D/F        | D/F        |
|            | "          | 3VA9480QD00    | 0          | O          |
|            |            | 3VA9400QA00    | A/B        | D/E/F      |
|            |            | 3VA9480QB00    | В          | D/F        |
|            |            | 3VA9480QC00    | K/L        | K/L        |
|            |            | 3VA9480QD00    | F          | F          |
|            | "          | 3VA9480QD00    | 0          | 0          |
|            |            | 3VA9400QE.0    | С          | M/N        |
|            |            | 3VA9400QF.0    | С          | M/N        |
|            | <b>777</b> | 3VA9400QG.0    | 0          | O          |

 $<sup>^{1)}\,\,</sup>$  This connection type is only permissible for terminals 1 / 3 / 5.

### Legend for insulation measures of 3VA25 molded case circuit breaker



- Spare part, included in the scope of supply of the terminals below:
  - 3VA950.-0JB23
  - 3VA950.-0JG23
  - 3VA950.-0JB32
  - 3VA950.-0JG32
- Spare part, included in the scope of supply of the terminals below:
  - 3VA960.-0JJ43
  - 3VA960.-0JC43
- 3) Included in the scope of supply of the circuit breaker

# Insulation measures for 3VA25 molded case circuit breaker

| Connec | ction | Article number             | Position   | ≤ 690 V AC | ≤ 415 V AC | ≤ 750 V DC         | ≤ 1000 V DC        |
|--------|-------|----------------------------|--|------------|------------|--------------------|--------------------|
|        | 00    | 3VA9500JB23<br>3VA9500JG23 | $ \begin{array}{cccc}                                  $ | Q          | Q          | n/a                | n/a                |
|        |       | 3VA9500JB32<br>3VA9500JG32 |  | Q          | Q          | n/a                | n/a                |
|        |       | 3VA9600JJ43<br>3VA9600JC43 | 2 4 6<br>1 1 1   | On request | On request | On request         | On request         |
|        |       | 3VA9600QA00                | 1 3 5  | S          | S          | R<br>3VA9601-0WE30 | R<br>3VA9601-0WE40 |
|        | 0     | 3VA9600QB00                | 2 4 6  | S          | S          | n/a                | n/a                |
|        |       | 3VA9600QA00                | 1 3 5  | S          | S          | R                  | R                  |
|        | 0     | 3VA9600QB00                | 2 4 6  | т          | т          | т                  | т                  |

### **Touch protection**

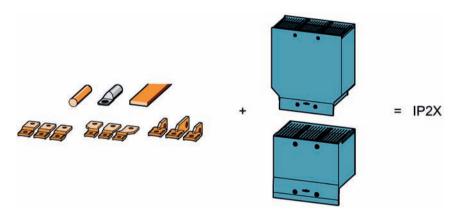
#### Insulated cables and busbars

With insulated cables and busbars that have insulation that reaches inside the termination area of the 3VA molded case circuit breaker, the unit is classed as finger-safe (IP2X) if it is also equipped with a terminal cover. This protection is guaranteed only if the unit is installed and wired correctly.



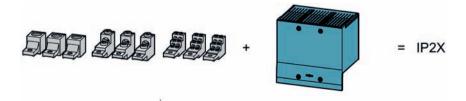
#### Non-insulated cables and busbars

With non-insulated cables and busbars, and bus connectors extended or bus connectors offset, the unit is classed as finger-safe (IP2X) if it is also equipped with an extended or offset terminal cover. This protection is guaranteed only if the unit is installed and wired correctly.



#### **External wire connectors**

External wire connectors are supplied as standard with a terminal cover extended. The external wire connectors are classed as finger-safe (IP2X) on condition that the extended terminal cover is correctly installed.



# 4.3.3.2 Auxiliary conductor terminal

A control wire tap can be implemented easily using components from the 3VA molded case circuit breaker equipment portfolio.

|                       | Designatio | n   |                              |             |  | Control wire tap                                |   |
|-----------------------|------------|---|------------------------------|-------------|--|---|---|
| Connection technology | Variant    |   |                              |             |  |   |   |
| nection t             |            | Use   |                              |             | Control wire tap at wire connector 1)        | Control wire tap for box terminal 1)            | Control wire tap for front busbar connectors 1) |
| Con                   |            | Suitable cables   | and busbars                  |             | Ring terminal<br>Plug-in connection          | Ring terminal Plug-in connection Bare conductor | Ring terminal Plug-in connection Bare conductor |
| Cables and busbars    |            | Cross-section specifications in mm²                             |                              |             |  |   |   |
|                       |            | Copper cable<br>(number of<br>cables x cross-<br>section range) | Finely stranded              | (Class 5/6) | 2 x 0.75 mm <sup>2</sup> 2.5 mm <sup>2</sup> | 2 x 0.75 mm² 2.5 mm²                            | 2 x 0.75 mm² 2.5 mm²                            |
|                       |            |   | Finely stranded with ferrule | (Class 5/6) | 2 x 0.75 mm <sup>2</sup> 2.5 mm <sup>2</sup> | 2 x 0.75 mm <sup>2</sup> 2.5 mm <sup>2</sup>    | 2 x 0.75 mm² 2.5 mm                             |
|                       |            |   | Stranded                     | (Class 2)   | *  | (( <del>=</del> )                               | (1 <del>4</del> ))                              |
|                       |            |   | Solid                        | (Class 1)   | 2 x 0.75 mm <sup>2</sup> 2.5 mm <sup>2</sup> | 2 x 0.75 mm <sup>2</sup> 2.5 mm <sup>2</sup>    | 2 x 0.75 mm <sup>2</sup> 2.5 mm <sup>2</sup>    |
|                       |            | Stripped length of cable L                                      |                              | 5 8 mm      | 5 8 mm                                       | 5 8 mm  |   |
|                       |            | Tightening torque   | Finely stranded              | (Class 5/6) | 0.5 Nm                                       | 2 Nm  | 2 Nm  |
|                       |            |   | Stranded                     | (Class 2)   |  |   |   |
|                       |            |   | Solid                        | (Class 1)   |  |   |   |
|                       |            | Cross-section sp  | pecifications in AV          | VG          |  |   |   |
|                       |            | Copper cable<br>(number of<br>cables x cross-<br>section range) | Stranded                     | (Class C)   | 2 x 18 AWG 14 AWG                            | 2 x 18 AWG 14 AWG                               | 2 x 18 AWG 14 AWG                               |
|                       |            |   | Stranded                     | (Class B)   | 2 x 18 AWG 14 AWG                            | 2 x 18 AWG 14 AWG                               | 2 x 18 AWG 14 AWG                               |
|                       |            |   | Solid                        | (Class A)   | 2 x 18 AWG 14 AWG                            | 2 x 18 AWG 14 AWG                               | 2 x 18 AWG 14 AWG                               |
|                       |            | Stripped length of cable L                                      |                              | 0.2 0.3 in  | 0.2 0.3 in                                   | 0.2 0.3 in                                      |   |
|                       |            | Tightening torque   | Stranded                     | (Class C)   | 4.4 lb-in                                    | 17.7 lb-in                                      | 17.7 lb-in                                      |
|                       |            |   | Stranded                     | (Class B)   |  |   |   |
|                       |            |   | Solid                        | (Class A)   |  |   |   |

<sup>1)</sup> Maximum current carrying capacity 15 A

### Note

A maximum current limit of 15 A applies to all control wire taps for 3VA molded case circuit breakers and must not be exceeded.

The control wire tap must be taken into account when configuring the molded case circuit breaker. Suitable cable cross-sections: Cables up to a maximum of 2.5 mm² can be connected.

All wire connectors can be ordered with control wire tap under a separate article number. The wire connector is then supplied with a hole for the control wire tap. A ring terminal can be installed in this hole. The screw required is supplied.

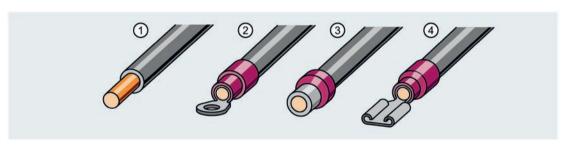


# Control wire tap for box terminal



This control wire tap is inserted in the box terminal with the cable.

The following connections can be selected for the control wire tap:



- ① Bare conductor
- 2 Ring terminal

- 3 Wire-end ferrule
- 4 Cable lug (connector)

# Control wire tap for busbar connector

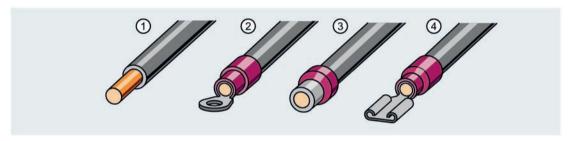


This control wire tap is installed at the 3VA molded case circuit breaker with the busbar.

It can also be installed using:

- Front bus connectors extended
- Front bus connectors offset
- Bus connectors edgewise
- Nut keeper kits, right-angled

The following connections can be selected for the control wire tap:



- 1 Bare conductor
- ② Ring terminal

- 3 Wire-end ferrule
- 4 Cable lug (connector)

# 4.4.1 Introduction

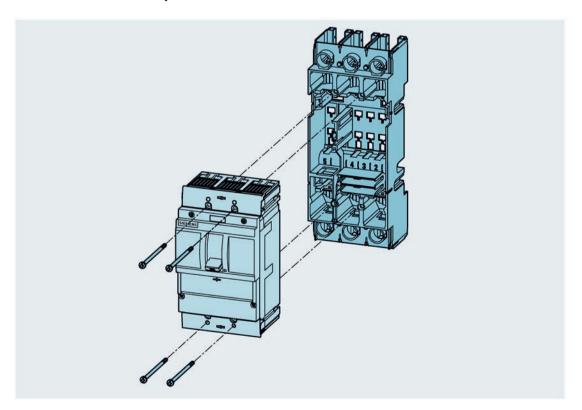
With most applications, 3VA molded case circuit breakers are installed in a fixed position in switchboards or distribution boards. The breaker is normally secured by mounting screws directly to the mounting plate or other suitable supporting stays of the panel. The cables or busbars of the main circuits are connected directly to the 3VA molded case circuit breaker by various terminals or connectors. A rigid, permanent connection is thus created between the 3VA molded case circuit breaker and the panel.

For certain applications, e.g. cyclic inspections or service, it must be possible to replace the 3VA molded case circuit breakers quickly. To meet this requirement, 3VA molded case circuit breakers can be converted to plug-in and draw-out units.

The main differences between plug-in units and draw-out units are convenience of operation and the potential for functional expansion.

### Plug-in technology

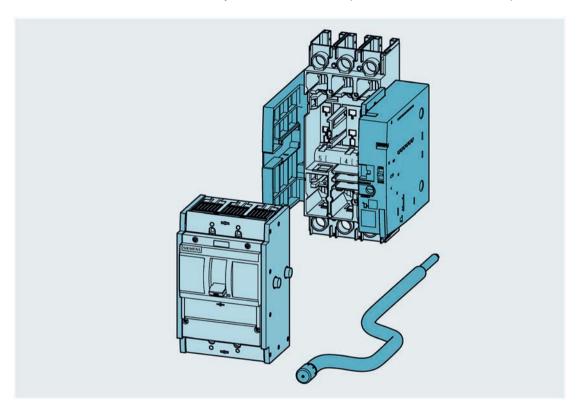
Plug-in technology is the less expensive and more space-saving of the two solutions. The 3VA molded case circuit breaker is inserted in the appropriate plug-in socket and fitted with plug-in contacts which make a keyed, friction-locked connection with the corresponding mating contacts (tulip-type contacts) in the plug-in socket. In this case, the device is plugged in and withdrawn manually.



### **Draw-out technology**

Like the plug-in versions, draw-out versions of 3VA molded case circuit breakers are equipped with plug-in contacts at the main current paths. In addition, side walls including guide and support bolts are bolted to the sides of the 3VA molded case circuit breakers.

In this case, the mating contacts are in the draw-out socket. This is also equipped with a guide mechanism via which the molded case circuit breaker is moved into the draw-out socket by means of a crank handle in order to connect the breaker to the main circuits. The operator can clearly read from a position indicator whether the breaker is properly connected to the main circuits or is 100% safely isolated from them (so that it can be withdrawn).



#### Cable connection

With plug-in and draw-out circuit breakers, the cables or busbars are connected to the plug-in socket or the draw-out socket. Here, the termination areas are implemented in the same way as for the molded case circuit breaker. That is, all the connection technology available for the 3VA molded case circuit breaker is also available in a similar way for the plug-in and draw-out sockets.

### 3VA plug-in and draw-out units

Plug-in and draw-out technology as it is implemented in 3VA molded case circuit breakers is described below. But 3VA switch disconnectors in MCCB design can also be converted to plug-in or draw-out technology. The information given below therefore applies analogously to 3VA switch disconnectors.

# **A**WARNING

# Formation of arcs between contacts and irreparable damage to circuit breakers and installation

When the 3VA molded case circuit breaker is moved into or out of the socket when the main contacts are closed (breaker position ON), arcs can form between contacts and result in irreparable damage to the circuit breaker or the electrical installation, and possibly cause physical injury to personnel.

Do not move the 3VA molded case circuit breaker into or out of the plug-in socket or the socket of the draw-out unit unless the main contacts are open, i.e. unless the breaker is in the OFF position.

Before moving the molded case circuit breaker into or out of the socket, use the handle to switch it to the OFF position. In order to prevent operating errors, 3VA molded case circuit breakers are equipped with an autotrip plunger when they are converted to plug-in or draw-out units. This plunger automatically trips the circuit breaker (breaker position TRIP) and thus opens the main contacts whenever an attempt is made to move a unit into or out of the socket when the breaker contacts are closed.

# 4.4.2 Overview of variants / products

### Installation overview

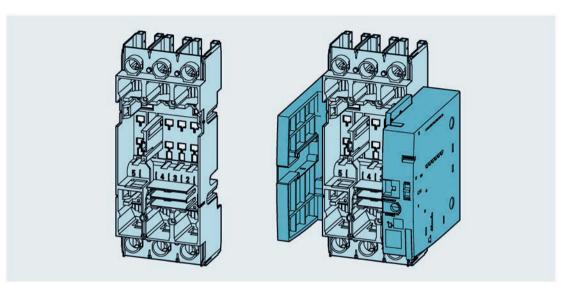
3-pole and 4-pole 3VA molded case circuit breakers are available in a version for fixed mounting, as a plug-in version and a draw-out version, as shown in the table below:

|          | Size           | Fixed-mounted | Plug-in | Draw-out |
|----------|----------------|---------------|---------|----------|
|          | 100 A, 3-pole  | •             |         |          |
|          | 100 A, 4-pole  |               |         |          |
|          | 160 A, 1-pole  |               |         |          |
|          | 160 A, 2-pole  |               |         |          |
|          | 160 A, 3-pole  | •             |         |          |
| BVA1     | 160 A, 4-pole  |               |         |          |
| 3VA1     | 250 A, 3-pole  | •             |         |          |
|          | 250 A, 4-pole  | •             |         |          |
|          | 400 A, 3-pole  |               |         |          |
|          | 400 A, 4-pole  |               |         |          |
|          | 630 A, 3-pole  |               |         |          |
|          | 630 A, 4-pole  |               |         |          |
|          | 160 A, 3-pole  |               |         |          |
|          | 160 A, 4-pole  |               |         |          |
|          | 250 A, 3-pole  |               |         |          |
| 2) ( 4 0 | 250 A, 4-pole  |               |         |          |
|          | 400 A, 3-pole  |               | •       | •        |
| VA2      | 400 A, 4-pole  |               |         |          |
|          | 630 A, 3-pole  |               | •       | •        |
|          | 630 A, 4-pole  |               |         |          |
|          | 1000 A, 3-pole |               |         |          |
|          | 1000 A, 4-pole |               |         |          |

Apart from the complete kit for plug-in or draw-out technology, a plug-in or draw-out "conversion kit" for the 3VA molded case circuit breaker can be ordered as a separate item. These conversion kits are used to prepare 3VA molded case circuit breakers in advance so that ready-assembled units are available at short notice in the event that a defective breaker needs to be replaced.

### 4.4.3 General information

With plug-in and draw-out circuit breakers, the cables or busbars are connected to the plugin socket or the draw-out socket. The same socket unit is used for the same sizes of both variants



The incoming and outgoing feeder ends of the socket unit termination area is designed to match the relevant 3VA molded case circuit breaker. The major benefit of this design feature is that all terminal and connection variants of the 3VA molded case circuit breaker are fully compatible with the corresponding plug-in or draw-out unit. To facilitate the ordering process, the components used in combination with plug-in and draw-out units have been given separate article numbers. Furthermore, an optional terminal cover for the molded case circuit breaker can also be installed as a terminal cover over the plug-in socket or draw-out socket.

The connection systems available for a 3VA rated current version and the sizes of cable or busbar cross section which are compatible with various connection types are described in detail in chapter Connection system (Page 211).

# 4.4.4 Information about installation, built-on and built-in components

# Securing plug-in and draw-out units to the mounting plate

### Bolts supplied with complete kit

Supplied with each complete kit for plug-in or draw-out technology:

• 4 fastening bolts, metric thread, Phillips pan head

The fastening bolts are used to attach the relevant socket unit to a mounting plate or supporting stay. Sets of fastening bolts can also be ordered separately as spare parts. Fastening bolts with an inch thread are also available.

# Mounting positions

The permissible mounting positions are described in Chapter Permissible mounting positions and mounting positions with accessories (Page 60).

#### See also

Connection system (Page 211)

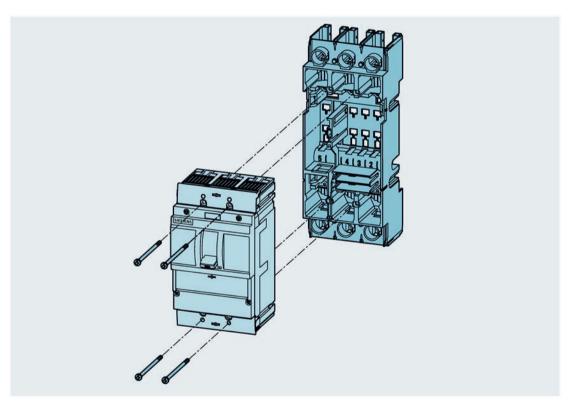
# 4.4.5 Plug-in technology

### 4.4.5.1 Product description

### **Applications**

The plug-in versions of 3VA molded case circuit breakers are designed for use in complex applications for which speedy replacement of molded case circuit breakers is a basic requirement. Plug-in technology can be used, for example, when clear visual evidence of safe electrical isolation of circuits is essential, e.g. when overhaul work is in progress.

### **Description**



With a plug-in system, the molded case circuit breaker is moved into and out of the plug-in socket manually.



# Risk of large magnetic forces in the event of short circuits

Accident hazard posed by short circuit events. The molded case circuit breaker can be ejected from its socket by the resulting magnetic forces.

The 3VA molded case circuit breaker must be bolted securely in position in the socket. The complete kit for plug-in technology contains assembly bolts for this purpose.

A complete kit for plug-in technology contains all the components required to convert the fixed mounting version of a 3VA molded case circuit breaker or 3VA switch disconnector to a plug-in version.

A complete kit for plug-in technology contains:

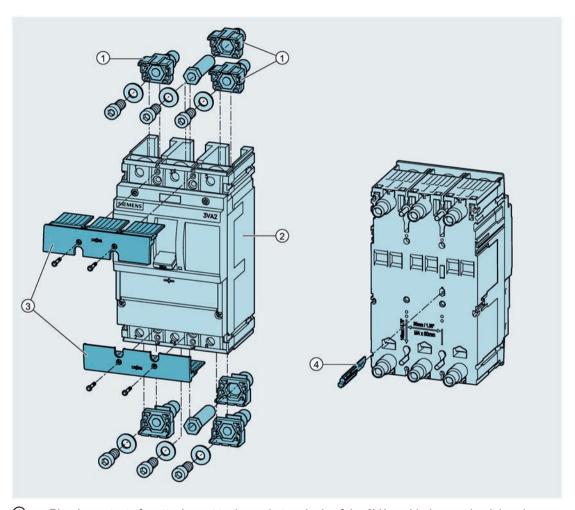
- Plug-in socket
- 4 mounting screws for installing the socket in the panel
- Mounting screws for fixing the molded case circuit breaker in the plug-in socket
  - 3-pole version:
    - 2 mounting screws from the scope of supply of the plug-in unit and
    - 2 mounting screws from the scope of supply of the molded case circuit breaker
  - 4-pole version:
    - No additional mounting screws in the scope of supply of the plug-in unit 4 mounting screws from the scope of supply of the molded case circuit breaker
- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 plug-in contacts
- Autotrip plunger, labeled "Plug-in"
- 2 screw-mounted terminal covers for the molded case circuit breaker
- Cable cages (see chapter Cable cage (Page 306))

A conversion kit for plug-in technology contains:

- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 plug-in contacts
- Autotrip plunger, labeled "Plug-in"
- 2 screw-mounted terminal covers for the molded case circuit breaker
- Cable cages (see chapter Cable cage (Page 306))

Scope of supply of the 3VA molded case circuit breaker and the 3VA switch disconnector in molded case circuit breaker design:

- For 3-pole version up to 250 A: 2 assembly bolts
- For 3-pole version up to 630 A: 4 assembly bolts
- For 4-pole version up to 630 A: 4 assembly bolts



- ① Plug-in contacts for attachment to the main terminals of the 3VA molded case circuit breaker
- 3VA molded case circuit breaker
- 3 Screw-mounted terminal cover for the molded case circuit breaker
- 4 Autotrip plunger

#### **Terminal covers**

As described above, two screw-mounted terminal covers are included in the plug-in socket complete kit and the plug-in socket conversion kit. These feature molded grips to ease withdrawal of the molded case circuit breaker from its socket. Since it requires significant force to remove a molded case circuit breaker from its socket, the plug-in terminal covers are bolted to the contact unit.

If the termination area of the plug-in socket needs to be protected by terminal covers, a variety of models of terminal cover are available to order as options for this purpose.

### Autotrip plunger

An autotrip plunger is supplied as standard with every complete kit and every conversion kit for converting a 3VA molded case circuit breaker to plug-in technology. The plunger performs safety functions in operation.

When a 3VA molded case circuit breaker is converted to a 3VA plug-in unit, this plunger is installed from the rear of the device and latched. The plunger performs safety functions in operation. It prevents the molded case circuit breaker from being switched to the ON position if the breaker is not correctly bolted to the socket. For further information, see also section "Signal 'Plug-in unit - MCCB correctly bolted to plug-in socket'" in chapter Position signaling switches (Page 295).



### Make sure that the autotrip plunger is correctly installed

The molded case circuit breaker cannot be safely moved into or out of the socket without an autotrip plunger. Insertion and removal in switched-on state (circuit breaker position ON) can lead to formation of arcs between contacts and can result in irreparable damage to the breaker and electrical installation as well as physical injuries.

Once installed, the autotrip plunger cannot be dismantled again!

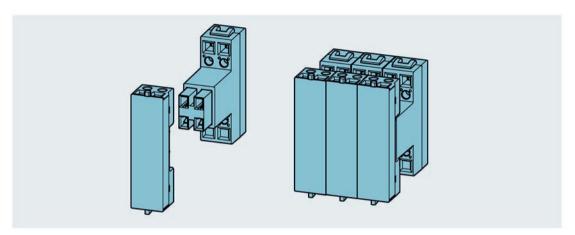
Note the color coding and labels for the autotrip plunger:

- Plug-in technology: Black, labeled "Plug-in"
- Draw-out technology: Grey, labeled "Draw-out"

# Auxiliary circuit connectors

Molded case circuit breakers or switch disconnectors in molded case circuit breaker design are frequently equipped with internal accessories, e.g. with an auxiliary switch and auxiliary release. A broad range of internal accessory components is also available for the 3VA molded case circuit breaker. For further information, please refer to chapter Internal accessories (Page 191).

To ensure that the electrical connections required by plug-in units can be quickly and safely disconnected, auxiliary circuit connectors can be installed.



The part of the auxiliary circuit connectors on the circuit breaker side is mounted on the underside of the molded case circuit breaker using the cable cages and is electrically connected to the internal accessories. Appropriate openings and cable ducts are provided in the molded case circuit breaker for routing stranded wires. The plug-in socket half of the auxiliary circuit connector is inserted in the socket and electrically connected to the customer's installation.

When the molded case circuit breaker is inserted into the plug-in socket, the internal accessories in the breaker are quickly connected to the customer's installation without the use of tools.

### Note

Plug-in and draw-out units use different versions of the auxiliary circuit connector. The draw-out version has a longer, movable telescopic rail because the distance to be bridged in the draw-out socket is longer.

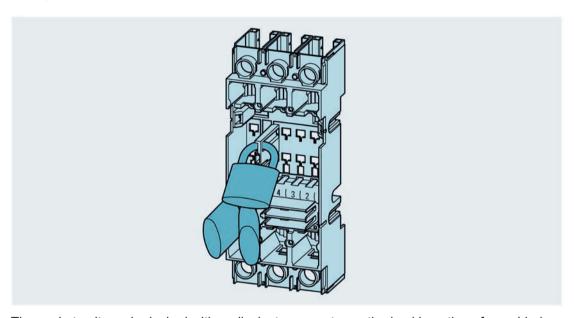
Further details about auxiliary circuit connectors can be found in chapter Auxiliary circuit connector (Page 301).

### Position signaling in the plug-in socket

Several position signaling switches (number depends on socket size) can be fitted in the plug-in socket. Auxiliary switches are capable of signaling "Plug-in unit - MCCB correctly bolted to plug-in socket" via electrical connections.

For further information, please refer to chapter Position signaling switches (Page 295).

### Padlocks for preventing insertion of a molded case circuit breaker



The socket unit can be locked with padlocks to prevent unauthorized insertion of a molded case circuit breaker during service calls and inspections. Using these locks to prevent insertion and operation of a molded case circuit breaker helps to protect personnel and the installation itself. The socket unit of the plug-in socket is equipped with three openings for padlocks.

Openings for padlocks:

- Up to three padlocks
- Shackle diameter 6 mm to 8 mm / 0.25" to 0.31"

### Benefits of plug-in technology

- · Defective molded case circuit breakers can be replaced quickly and easily
- · Clear visual evidence of safe electrical isolation of main circuits
- Remote signaling of molded case circuit breaker positions:
  - "INSERTED": The 3VA molded case circuit breaker is properly inserted and bolted to the socket
  - "WITHDRAWN": The bolts have been removed and the 3VA molded case circuit breaker removed
- Plug-in socket can be locked by padlocks to prevent insertion of a molded case circuit breaker
- Degree of protection IP20 at all termination points
- No grounding required

### See also

Locking and interlocking (Page 360)

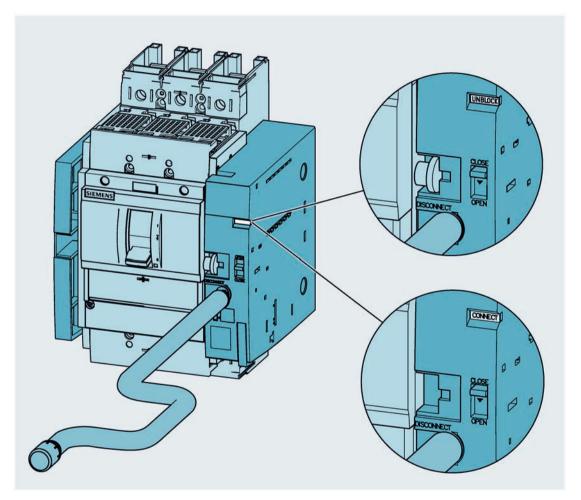
# 4.4.5.2 Combination with other accessories

| Accessories group            | Component   |  |  |
|------------------------------|---|--|--|
| Manuel                       | Front mounted rotary operator                               |  |  |
| Manual operators             | Door mounted rotary operator                                |  |  |
| Describe controlled consists | MO320 motor operator  |  |  |
| Remote-controlled operator   | Synchronizable motor operator SEO520                        |  |  |
|                              | Rear interlocking module                                    |  |  |
| Interlocks                   | Bowden cable interlock for handle                           |  |  |
|                              | Bowden cable interlock (for front mounted rotary operators) |  |  |

# 4.4.6 Draw-out technology

### 4.4.6.1 Product description

Typical applications for draw-out versions of 3VA molded case circuit breakers are installations in which inspections and overhauls need to be carried out at regular intervals and, for reasons of safety, clear visual evidence of safe electrical isolation of plant sections must be provided at short notice so that work can commence. Draw-out versions of 3VA molded case circuit breakers are also suitable for applications which require that molded case circuit breakers or switch disconnectors can be replaced very rapidly when necessary.



In the draw-out version, the 3VA molded case circuit breaker is supported by the side walls of the draw-out unit and can be moved into three defined positions by rotation of a crank handle. The current breaker position is indicated by the breaker status indicator.

### **Defined positions**

- CONNECT position: The molded case circuit breaker is connected to the main circuits.
   The auxiliary circuits are also electrically connected to the installation via the auxiliary circuit connectors.
  - This is the normal operating position of the molded case circuit breaker.
- TEST position: The main circuits are not connected to the installation. The auxiliary circuits are connected to the installation via auxiliary circuit connectors.
   The auxiliary circuits can be function-tested with the breaker in the TEST position even when the installation itself is not live.
- DISCON position: Neither the main circuits nor the auxiliary circuits are connected to the installation.
  - The molded case circuit breaker is electrically isolated.

If the molded case circuit breaker is not in any of these defined positions, the breaker status indicator displays the word UNBLOCK on a white background. When the breaker is in this position, its main contacts cannot be closed if the autotrip plunger is correctly installed (see below).

### Move the molded case circuit breaker into a defined position

### NOTICE

#### Gear damage

The following operations will lead to irreparable damage of the draw-out socket gear:

- Molded case circuit breaker is in DISCONNECT position: Insertion of the crank handle (position indicator changes to UNBLOCK) and counterclockwise turning of the crank handle toward DISCONNECT.
- Molded case circuit breaker is in CONNECT position: Insertion of the crank handle (position indicator changes to UNBLOCK) and clockwise turning of the crank handle toward CONNECT.

In the situations described above, pay attention not to turn the crank handle in the indicated direction.

#### Note

If the breaker status indication is CONNECT, TEST or DISCON, the sliding clutch of the crank gear is engaged and rotation of the crank handle has no effect.

By removing and reinserting the crank handle, it is possible to disengage the gear. The breaker status indicator will then show UNBLOCK. The molded case circuit breaker can now be moved to a new position.

- 1. If the crank handle is inserted in the crankcase, pull it out.
- 2. Insert the crank handle into the crankcase again.

  By removing and reinserting the crank handle, it is possible to disengage the gear.
- 3. Turn the crank handle until the breaker status indication shows the required position.

#### Remove the molded case circuit breaker

### NOTICE

### Gear damage

The following operations will lead to irreparable damage of the draw-out socket gear:

- Molded case circuit breaker is in DISCONNECT position: Insertion of the crank handle (position indicator changes to UNBLOCK) and counterclockwise turning of the crank handle toward DISCONNECT.
- Molded case circuit breaker is in CONNECT position: Insertion of the crank handle (position indicator changes to UNBLOCK) and clockwise turning of the crank handle toward CONNECT.

In the situations described above, pay attention not to turn the crank handle in the indicated direction.

- 1. Move the molded case circuit breaker into the DISCON position. The molded case circuit breaker is electrically isolated.
- 2. To disengage the lock, press the safety lock slide underneath the breaker status indication downwards as indicated by the arrow.
- 3. Remove the molded case circuit breaker.

### Components of a complete kit for draw-out technology

A complete kit for draw-out technology contains all the components required to convert the fixed mounting version of a molded case circuit breaker or switch disconnector to a draw-out version.

- Draw-out socket including side walls with the mechanical components required to guide the molded case circuit breaker into and out of the socket under the control of a crank handle
- 4 mounting screws for installing the socket in the panel
- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 connectors
- · Side walls with guide bolts for mounting on the molded case circuit breaker
- Autotrip plunger, labeled "Draw-out"
- 2 screw-mounted terminal covers for the molded case circuit breaker
- Cable cage (see chapter Cable cage (Page 306))

## Note

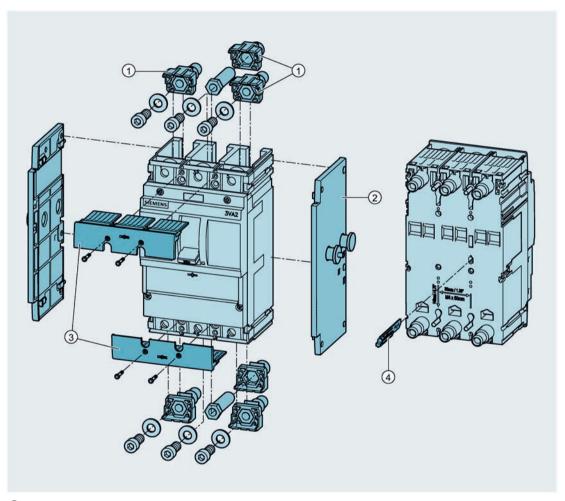
#### Information about the crank handle

The crank handle is not supplied as part of the complete kit and must be ordered separately.

# 4.4 Plug-in and draw-out technology

# Components of a conversion kit for draw-out technology

- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 plug-in contacts
- · Side walls with guide bolts for mounting on the molded case circuit breaker
- Autotrip plunger, labeled "Draw-out"
- 2 screw-mounted terminal covers for the molded case circuit breaker



- ① Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
- ② Side walls with guide bolts for mounting on the molded case circuit breaker
- 3 Screw-mounted terminal cover for the molded case circuit breaker
- 4 Autotrip plunger

#### Installation instructions

The draw-out socket is permanently mounted in the panel by means of the mounting screws included in the complete kit for draw-out technology.

The molded case circuit breaker / switch disconnector in molded case circuit breaker design is supplied with two assembly bolts (3-pole version) or four assembly bolts (4-pole version). These bolts are not required if the device is to be converted to a draw-out unit.

#### Terminal cover

Two terminal covers are included in the scope of supply of the complete kit for draw-out technology and the conversion kit for draw-out technology for the molded case circuit breaker. These two terminal covers are intended for installation over the molded case circuit breaker. If terminal covers are to be attached to the busbars of the draw-out socket, they must be ordered separately, see chapter Insulating measures (Page 246).

### Autotrip plunger

An autotrip plunger is supplied as standard with every complete kit and every conversion kit for converting a molded case circuit breaker to draw-out technology.



### Make sure that the autotrip plunger is correctly installed

The molded case circuit breaker cannot be safely moved into or out of the socket without an autotrip plunger. Moving it into or out of the socket when the main contacts are closed (breaker position ON) can cause arcs to form between contacts and result in irreparable damage to the circuit breaker or the electrical installation, and possibly cause physical injury to personnel.

Once installed, the autotrip plunger cannot be dismantled again!

Note the color coding and labels for the autotrip plunger:

- Plug-in technology: Black, labeled "Plug-in"
- Draw-out technology: Grey, labeled "Draw-out"

When a molded case circuit breaker is converted to a molded case circuit breaker for drawout technology, the autotrip plunger is installed from the rear of the device and latched.

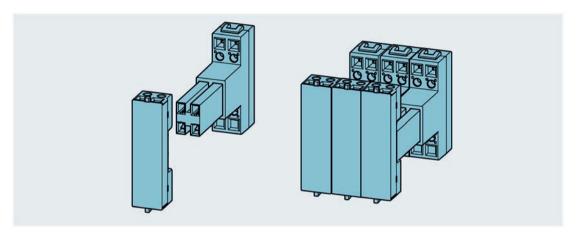
The plunger performs various safety functions in operation:

- It prevents closure of the main contacts of the molded case circuit breaker when the breaker is inserted in the draw-out socket and in an undefined position (breaker status indication is UNBLOCK).
- It allows the breaker to be closed in the defined positions TEST and CONNECT.
- It trips the molded case circuit breaker (TRIP) when the breaker's main contacts are closed (switching position ON) and an attempt is made to move the breaker out of one of the three defined positions CONNECT, TEST or DISCON using the crank handle.

## **Auxiliary circuit connectors**

3VA molded case circuit breakers or 3VA switch disconnectors are frequently equipped with internal accessories, e.g. auxiliary switches and auxiliary releases. A broad range of internal accessory components is also available for the 3VA molded case circuit breaker. For further information, please refer to chapter Internal accessories (Page 191).

To ensure that the electrical connections required by draw-out units can be quickly and safely disconnected, auxiliary circuit connectors can be installed.



The part of the auxiliary circuit connectors on the circuit breaker side is mounted on the underside of the molded case circuit breaker using the cable cages and is electrically connected to the internal accessories. Appropriate openings and cable ducts are provided in the 3VA molded case circuit breaker for routing stranded wires. The socket-end half of the auxiliary circuit connector with the movable telescopic rail is inserted in the socket and electrically connected to the customer's installation.

When the molded case circuit breaker is inserted into the draw-out unit, an electrical connection between the internal accessories in the breaker and the customer's installation is quickly established.

#### Note

Plug-in and draw-out units use different versions of the auxiliary circuit connector.

The draw-out version has a longer, movable telescopic rail because the distance to be bridged in the draw-out socket is longer.

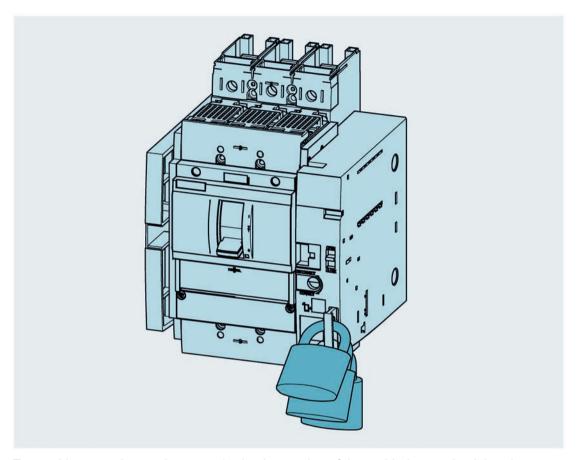
Further details about auxiliary circuit connectors can be found in chapter Auxiliary circuit connector (Page 301).

## Position signaling in the draw-out socket

Several position signaling switches (number depends on socket size) can be installed in the right-hand side wall of the draw-out socket. These auxiliary switches are capable of signaling breaker positions DISCON, TEST and CONNECT. The auxiliary switches also output a position indication signal if the molded case circuit breaker in the draw-out socket is not in one of the positions specified above. For information, please refer to chapter Position signaling switches (Page 295).

## Protection against unauthorized operation of molded case circuit breaker

# Padlocks for protection against unauthorized operation



To provide protection against unauthorized operation of the molded case circuit breaker, padlocks can be inserted through the plastic frame opening of the padlock locking unit on the right side wall of the draw-out socket. The plastic frame is simple to pull out. The crank handle opening is mechanically sealed when the plastic frame is in the OUT position.

Openings for padlocks in plastic frame:

- Up to three padlocks
- Shackle diameter 6 mm to 8 mm / 0.25" to 0.31"

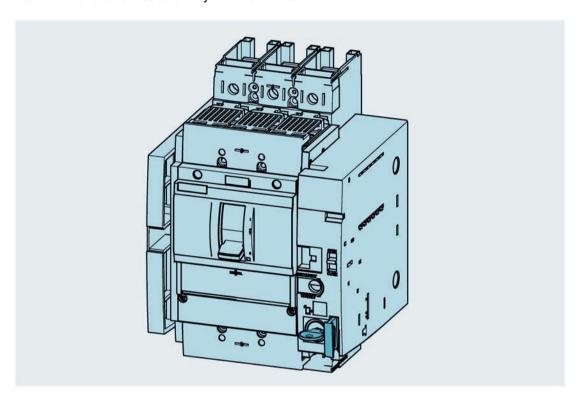
## Attach padlocks

- 1. Move the molded case circuit breaker into the CONNECT, TEST or DISCON position.

  The breaker must be in one of these positions before the plastic frame can be pulled out.
- 2. Pull out the plastic frame.
  The crank handle opening is sealed off.
- 3. Insert padlock shackles through the plastic frame and lock padlocks as illustrated above.

### Cylinder lock for protection against unauthorized operation

A cylinder lock can be retrofitted in the right-hand side wall of the draw-out socket. Like the plastic frame and padlocks, this cylinder lock is capable of locking a molded case circuit breaker in either the CONNECT, TEST or DISCON position. The cylinder lock utilizes the locking mechanism of the plastic frame. This is evident from the way the plastic frame moves into or out of the socket as the cylinder lock is turned.



## Signaling of locked/unlocked status

The locked or unlocked status of a draw-out unit can be signaled electrically. This requires the installation of a position signaling switch (3VA9987-0KB00) in the right-hand side wall of the draw-out socket. This switch signals whether the plastic frame described above is in the "IN" or "OUT" position. For further details, refer to chapter Position signaling switches (Page 295).

## Integration of molded case circuit breaker position signal into a communication network

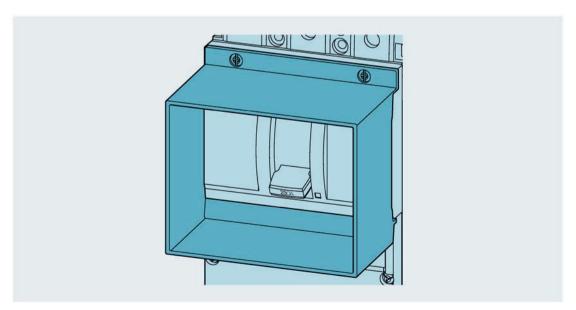
By means of the COM100 and COM800 breaker data servers, various statuses of multiple molded case circuit breakers can be queried and passed on by bus systems. This includes messages such as "Breaker tripped", "Breaker on", "Breaker off", reason for tripping. Depending on the version of the 3VA molded case circuit breaker, actual current and voltage measurements can also be passed on. To provide this communications capability, the molded case circuit breaker itself is equipped with a COM060 communication module which functions as the breaker's actual communications interface.

In addition to the status information listed above, the position of the molded case circuit breaker in the draw-out unit can also be transferred. For this purpose, the molded case circuit breaker and the draw-out socket must be equipped with the communications interface for the draw-out unit. This kit allows the position of the molded case circuit breaker in the draw-out unit to be picked up and transferred to the COM060 communication module and from there to the higher-level communication network. For further information about the communication kit for draw-out units, please refer to chapter Communications interface for draw-out unit (Page 300).

## Operation through the panel door

The molded case circuit breaker can be optionally installed in the panel in such a way that the breaker can be operated even when the panel door is closed. Draw-out versions of molded case circuit breakers can then be switched on or off when the panel door is not open. This is made possible by a cutout in the panel door which allows access to the main control elements, i.e the handle and the <PUSH TO TRIP> button of the molded case circuit breaker, but prohibits access to other live components inside the panel. This solution is referred to as a "door feedthrough".

Door feedthroughs are mounted on the front of the molded case circuit breaker and securely attached to the breaker by means of two bolts and a latch.



### 4.4 Plug-in and draw-out technology

The door cutout must be positioned such that it is flush with the door feedthrough. It must also be positioned in such a way as to minimize the size of the gap between the feedthrough walls and the cutout. A cover frame can be fitted as well in order to obtain an optimum finish.

An opening in the panel through which the crank handle can be inserted must be provided in addition to the cutout for the door feedthrough.

With its straight sides, the door feedthrough is designed to allow the molded case circuit breaker to be moved through positions DISCON, TEST and CONNECT, while at the same time providing a permanently tight seal around the feedthrough area (degree of protection IP30) and preventing access to live components inside the panel.

Markings are visible on the door feedthrough to help the user identify the current position of the molded case circuit breaker as it is moved into or out of the panel. Since mounting dimensions may vary slightly, however, these markings should be regarded as a rough guide only. The crank handle mechanism provides the user with feedback information about the molded case circuit breaker position, e.g. whether it has been correctly inserted.

## Benefits of draw-out technology

- Defective molded case circuit breakers can be replaced quickly and easily
- Clear visual evidence of safe electrical isolation of main circuits
- Molded case circuit breaker and accessories can be function-tested in the TEST position
- Remote signaling of molded case circuit breaker positions CONNECT, TEST and DISCON
- Padlocks and / or cylinder locks can be used to lock draw-out unit so that the molded case circuit breaker cannot be inserted or removed by unauthorized persons
- Molded case circuit breaker can be operated through the panel door
- Degree of protection IP20 at all termination points
- No grounding required

### See also

Locking and interlocking (Page 360)

## 4.4.6.2 Combination with other accessories

| Accessories group          | Component   |  |
|----------------------------|---|--|
| Manual operators           | Front mounted rotary operator                               |  |
|                            | Door mounted rotary operator                                |  |
|                            | MO320 motor operator  |  |
| Remote-controlled operator | Synchronizable motor operator SEO520                        |  |
|                            | Rear interlocking module                                    |  |
| Interlocks                 | Bowden cable interlock for handle                           |  |
|                            | Bowden cable interlock (for front mounted rotary operators) |  |

### See also

Locking and interlocking (Page 360)

# 4.4.7 Accessories for plug-in and draw-out units

# 4.4.7.1 Description of individual product variants

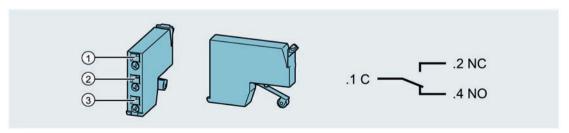
# Position signaling switches

These auxiliary switches are capable of signaling a variety of states via electrical connections. The position signaling switch is available in only one version.

### Applications:

- Signal "Position of breaker in the draw-out unit"
- Signal "Draw-out unit locked / open"
- Signal "Plug-in unit MCCB correctly bolted to plug-in socket"

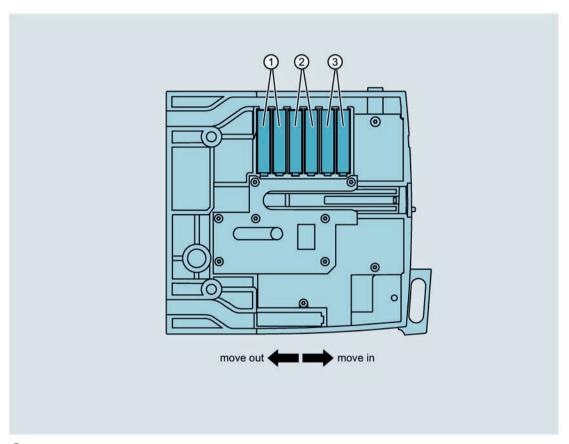
The position signaling switches are changeover switches, i.e. they have three connections:



- 1 NO contact
- 2 NC contact
- 3 Common potential contact

### Signal "Position of molded case circuit breaker in the draw-out unit"

Up to three position signaling switches can be integrated in the draw-out unit in order to transmit breaker position information to monitoring and control systems. They are installed in the right-hand side wall of the unit at the positions indicated in the diagram below:



- 1 41a or 41b: Detects position CONNECT
- 2 42a or 42b: Detects position TEST
- 3 43a or 43b: Detects position DISCON

### Signal "Position of molded case circuit breaker in the draw-out unit"

It is irrelevant whether the position signaling switch is inserted in slot a or b. Only one position signaling switch per position is usually installed. The remaining free slots can be used for the signaling switches of the communication link kit or for an additional position signaling switch.

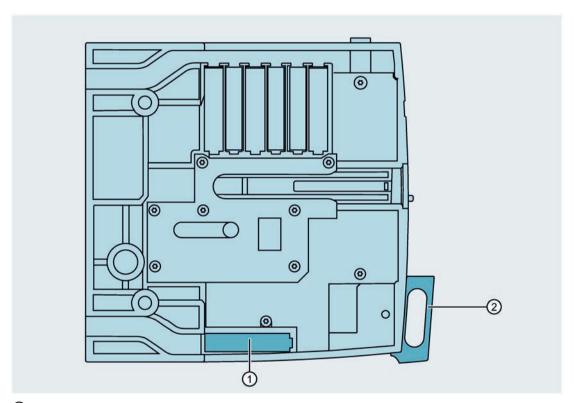
If the molded case circuit breaker in the draw-out unit is moved into a defined position with the crank handle, the corresponding position signaling switch outputs a signal that can be further used electrically, e.g. for visual or acoustic alarm indications.

If the molded case circuit breaker is not in any of the defined positions, the breaker status indicator displays the word UNBLOCK on a white background. In this position, the molded case circuit breaker is either off (position OFF, contacts open) or tripped (position TRIP, contacts open). The breaker main contacts cannot be closed with the breaker in the UNBLOCK state.

Depending on the position of the molded case circuit breaker in the draw-out unit, the outputs of the position signaling switches assume one of the following states:

| Desition signaling | owitch |        | Position of circuit breaker |         |         |  |  |
|--------------------|--------|--------|-----------------------------|---------|---------|--|--|
| Position signaling | SWITCH | DISCON | TEST                        | CONNECT | UNBLOCK |  |  |
| DISCON             | NC     | Open   | Closed                      | Closed  | Closed  |  |  |
| DISCON             | NO     | Closed | Open                        | Open    | Open    |  |  |
| TEOT               | NC     | Closed | Open                        | Closed  | Closed  |  |  |
| TEST               | NO     | Open   | Closed                      | Open    | Open    |  |  |
| CONNECT            | NC     | Closed | Closed                      | Open    | Closed  |  |  |
| CONNECT            | NO     | Open   | Open                        | Closed  | Open    |  |  |

Signal "Draw-out unit locked / open"



- ① Slot for position signaling switch for signal "Draw-out unit locked / open"
- 2 Plastic frame for padlock locking unit

# 4.4 Plug-in and draw-out technology

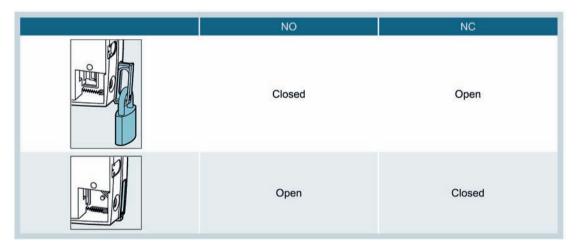
### Signal "Draw-out unit locked / open"

A position signaling switch to transmit this signal is installed in position 44 of the right-hand side wall of the draw-out unit.

A position signaling switch in position 44 outputs a signal which indicates whether the padlock locking unit is in the OUT position, thereby locking the draw-out unit.

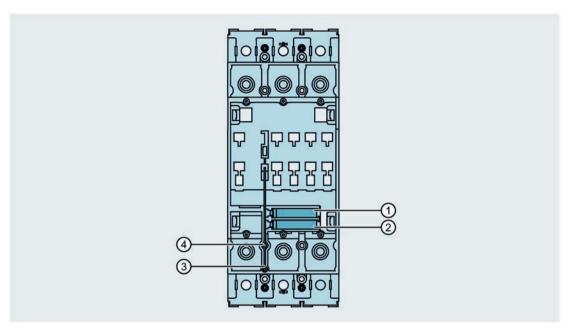
The draw-out unit can be locked in the defined breaker positions CONNECT, TEST and DISCON by padlocks or a cylinder lock (available as retrofit component). The position of the molded case circuit breaker cannot be changed when the draw-out is locked. In the locked state, the opening for the crank handle is mechanically sealed and the handle cannot be inserted.

To lock the unit using padlocks, the padlock locking unit on the draw-out unit must be pulled out manually so that the shackles of the padlocks can be inserted through the opening. When the draw-out unit is locked by the cylinder lock, the padlock locking unit moves out automatically as the cylinder lock is turned because it is mechanically coupled with the cylinder lock in the draw-out unit. The position of the padlock locking unit ultimately determines the position of the contacts of the position signaling switch.

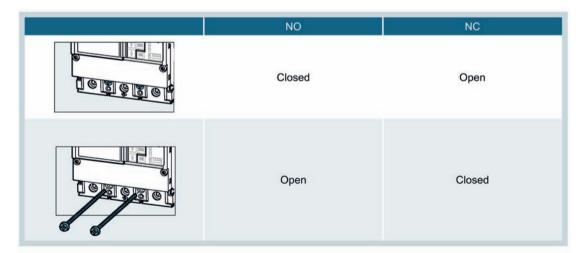


# Signal "Plug-in unit - MCCB correctly bolted to plug-in socket"

This option is provided for plug-in units only. Depending on the socket size, up to two position signaling switches can be installed in slot No. 46.



- ① Slot 46 for position signaling switch of the plug-in socket
- 2 Slot 46 for position signaling switch of the plug-in socket
- Mechanical system for actuation of position signaling switches when the bolt is tightened
- 4 Bolt hole which determines the signal output by the position signaling switches



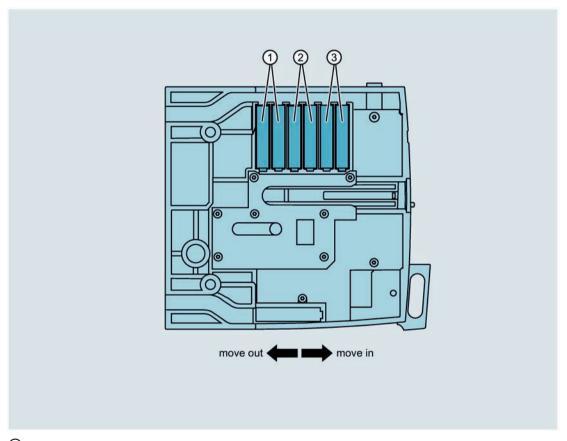
With this application, the position signaling switches indicate whether the molded case circuit breaker is inserted in the plug-in socket and secured by at least one bolt. The reason for this application is that the molded case circuit breaker needs to be secured in position by mounting screws in the plug-in socket. The four mounting screws supplied with the complete kit for plug-in technology must be used for this purpose.

#### Communications interface for draw-out unit

The pre-assembled cable set which functions as the communications interface for the drawout unit consists of a pre-assembled cable with a mini USB port at one end and three special position signaling switches at the other. It is also supplied with another cable with mini USB connector and tab connector.

### Attaching the cable set

 Insert the three position signaling switches of the cable set in the right-hand side wall according to the color coding of the cables, see diagram below.
 It is irrelevant whether the switches are inserted in slots a or b.



CONNECT: Position signaling switch with green cables
 TEST: Position signaling switch with blue cables
 DISCON: Position signaling switch with red cables

The remaining slots are normally used to install standard position signaling switches.

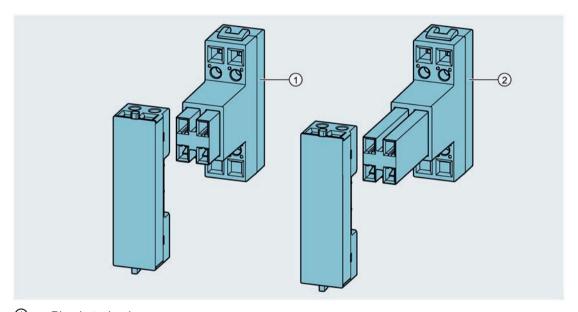
- 2. Remove the seal over the opening for the micro USB port on the right-hand side wall.
- 3. Insert the USB connector attached to the cable set into the micro USB port in the right-hand side wall.
- 4. Store the cable in the space available behind the side wall.
- 5. Connect the position signaling switches and the COM060 communication module to the USB connector and tab connector of the second cable.

The cable with pre-assembled USB and tab connectors can also be ordered as an individual item for installation on molded case circuit breakers prepared for use as draw-out units.

For detailed instructions on how to install the communications interface for the draw-out unit, please refer to the relevant Operating Instructions (http://support.automation.siemens.com/WW/view/en/80597324).

For instructions on how to read out data via remote data transfer, refer to the operating instructions for the COM100/COM800 breaker data server.

# Auxiliary circuit connector



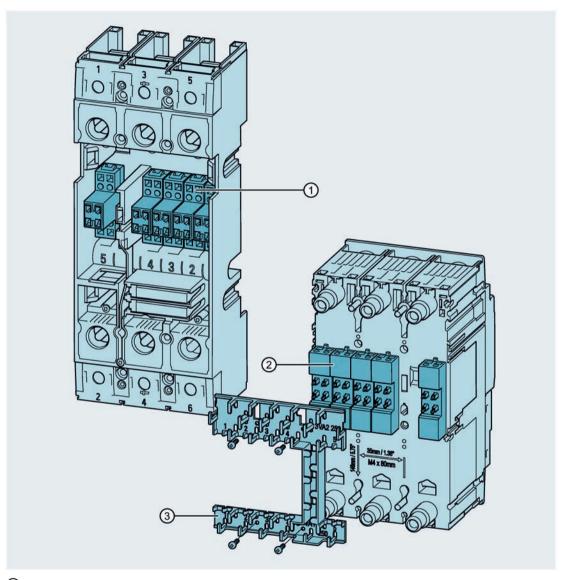
- Plug-in technology
- ② Draw-out technology

Auxiliary circuit connectors are required only if the molded case circuit breaker to be converted to plug-in or draw-out technology is equipped with internal accessories. Plug-in units use a different design of auxiliary circuit connector than draw-out units.

The number of auxiliary circuit connectors required depends on the accessories to be installed in the molded case circuit breaker and ultimately on the number of electrical connections which need to be brought out of the molded case circuit breaker. Each auxiliary circuit connector can be used to connect up to four cables. Accordingly, the breaker-end and socket-end halves of the auxiliary circuit connectors have four screw-type terminals which are labeled ".1" to ".4".

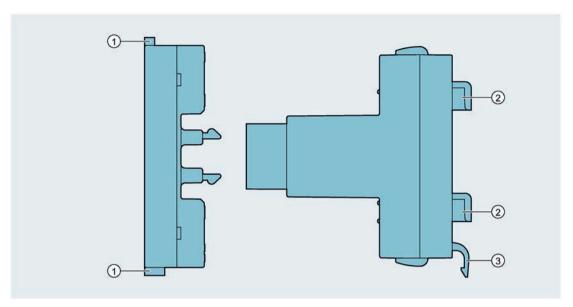
## 4.4 Plug-in and draw-out technology

A total of nine auxiliary circuit connectors can be installed depending on the size of the molded case circuit breaker and the size of the plug-in or draw-out socket. The slots for auxiliary circuit connectors are labeled from right to left in the socket, starting at 1.



- Socket-end auxiliary circuit connector
- ② Breaker-end auxiliary circuit connector
- 3 Cable cage

Cable cages are used to attach the breaker-end half of the auxiliary circuit connector to the underside of the molded case circuit breaker. Slot numbers are also printed on the cable cages. The design of the cable cages for the top and bottom halves of the molded case circuit breaker is different so that the cages cannot be mixed up or installed in the wrong position. The fixing tongues of the breaker-end half of the auxiliary circuit connectors latch into small recesses in the cable cages which are screw-mounted to the rear panel of the circuit breaker. The auxiliary circuit connectors are securely fixed once the cable cages have been installed.



- ① Fixing tongue (breaker end)
- ② Fixing hook (socket end)
- 3 Latching element (socket end)

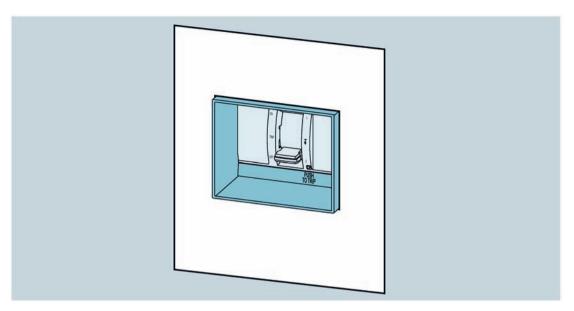
The socket-end half of the auxiliary circuit connectors is simply snapped into the socket.

Various cable routing openings and ducts are provided in the socket and the molded case circuit breaker. For further details, please refer to the operating instructions for the complete kits for plug-in or draw-out technology.

# See also

Cable cage (Page 306)

# Door feedthrough

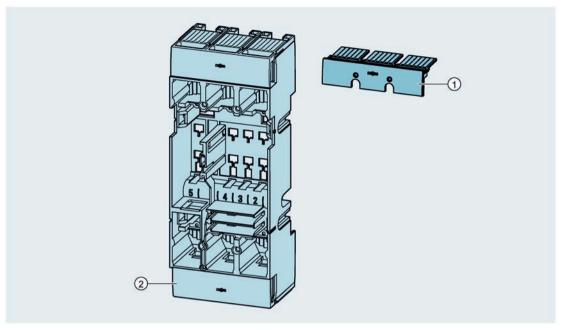


Door feedthroughs must be installed for applications which require

- direct operation of a molded case circuit breaker even when the panel door is closed,
- the draw-out version of a molded case circuit breaker to be electrically isolated from or connected to the installation while the panel door is closed,
- prevention of access to live components inside the panel.

Door feedthroughs are mounted over the front of the molded case circuit breaker and securely attached to the breaker by means of two bolts and a latch.

# Terminal cover for a molded case circuit breaker converted to plug-in or draw-out technology



- 1 Terminal cover with molded grips, can be screwed to contact unit
- 2 Terminal cover for covering the termination area

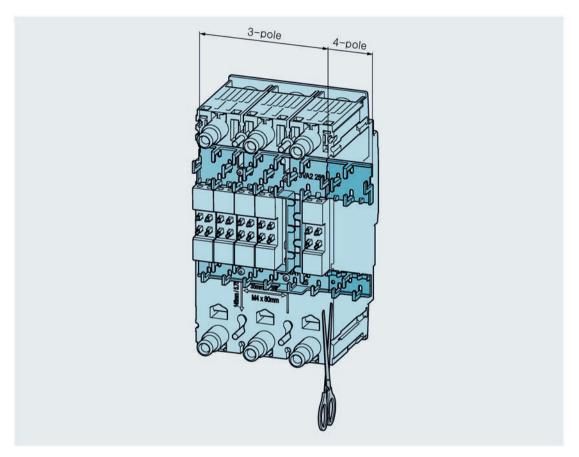
Two screw-mounted terminal covers ① are included in the scope of supply of the complete kits and the conversion kits for plug-in and draw-out technology. These feature molded grips to ease withdrawal of the molded case circuit breaker from its socket. Since it requires significant force to remove a molded case circuit breaker from its socket, the plug-in terminal covers are bolted to the contact unit.

These terminal covers can be ordered separately as spare parts.

The additionally available terminal covers ② are used for the plug-in technology as well as the draw-out technology for covering the terminal area.

# Cable cage

Cable cages are used to attach the breaker-end half of auxiliary circuit connectors to the molded case circuit breaker. They are also designed to act as cable ducts for installing wires from internal accessories to the auxiliary circuit connector. For further information about cable cages, please refer to chapter Auxiliary circuit connector (Page 301).



Cable cages consist of a top half and a bottom half. These parts are designed such that they cannot be mounted in the wrong position at the rear of the molded case circuit breaker.

Cable cages are included in the scope of supply of the conversion kits and complete kits for converting molded case circuit breakers to plug-in or draw-out units and are therefore also supplied with complete kits. They are available as standard only in the broadened version for 4-pole units. For use on 3-pole units, part of the cable cage need only be cut away (at the required breaking point).

# 4.4.7.2 Overview of technical specifications

Technical specifications of the accessories for internal components of molded case circuit breakers in plug-in and draw-out technology:

| Article No.   | 3VA9987-0KB00     |            |                 |         |
|---|-------------------|------------|-----------------|---------|
| Dated angusting valleng III                             |                   |            |                 | 400 AC  |
| Rated operating voltage U <sub>e</sub>                  |                   |            | V               | 250 DC  |
| Rated insulation voltage U <sub>i</sub>                 | V                 | 500 AC     |                 |         |
| Rated frequency f <sub>n</sub>                          |                   |            | Hz              | 50 / 60 |
| Rated operating current I <sub>e</sub> / U <sub>e</sub> | AC-13             | 12 V       | Α               | 6       |
|   |                   | 24 V       | Α               | 6       |
|   |                   | 48 V       | Α               | 6       |
|   |                   | 110 V      | Α               | 6       |
|   |                   | 230 V      | Α               | 6       |
|   | DC-15             | 12 V       | Α               | 6       |
|   |                   | 24 V       | Α               | 3       |
|   |                   | 48 V       | Α               | 1       |
|   |                   | 110 V      | Α               | 0.5     |
|   |                   | 230 V      | Α               | 0.25    |
| Thermal current I <sub>th</sub> A                       |                   |            |                 | 6       |
| Contact switching                                       |                   |            |                 | 001     |
| Conductor cross section S mm²                           |                   |            | mm <sup>2</sup> | 0.5 1.5 |
| Degree of protection of terminals (v                    | vhen breaker is o | connected) |                 | IP20    |

| Article No.   |       | 3VA9977-0KP80               |
|---|-------|-----------------------------|
| Article No.   |       | 3VA9977-0KD80               |
| Dated energing voltage II                                     | ٧     | AC 250                      |
| Rated operating voltage U <sub>e</sub>                        | V     | DC 250                      |
| Rated insulation voltage U <sub>i</sub>                       | V     | AC 500                      |
| Rated frequency f   | Hz    | 50 / 60                     |
| Detect  | AC-13 | 3 A / 400 V                 |
| Rated operating current I <sub>e</sub> / U <sub>e</sub>       | DC-15 | 0.15 A / 250 V; 3 A / 125 V |
| Thermal current I <sub>th</sub>                               | Α     | 10                          |
| Conductor cross section S                                     | mm²   | 0.5 1.5                     |
| Degree of protection of terminals (when breaker is connected) |       | IP20                        |

### 4.4.7.3 Combination with other accessories

### Information about combination with other accessories

The communications interface for the draw-out unit and the switches for signaling the
position of the molded case circuit breaker in the draw-out unit are mutually compatible.
For further information, please refer to the following chapters:
Position signaling switches (Page 295)

Communications interface for draw-out unit (Page 300)

 The switches for signaling whether or not the molded case circuit breaker is locked have no influence on other accessories described in chapter Position signaling switches (Page 295)

#### Note

## No transfer of "locked / not locked" signals

The information "locked / not locked" cannot be transferred via the COM060 communication module.

- A molded case circuit breaker which requires a communications interface to transfer signals must be equipped with a COM060 communication module.
- When internal accessories are integrated in a molded case circuit breaker, auxiliary circuit connectors and cable cages for plug-in and draw-out technology must also be installed.
- Door feedthroughs are required only if the molded case circuit breaker needs to be operated when the cubicle door is closed. The door feedthrough is compatible with position signaling switches, communications interface and auxiliary circuit connectors with cable cages.
- The terminal cover for plug-in technology can be installed in combination with any other internal accessories. It does not have any effect on other accessories.
- A variable depth adapter (see section Door mounted rotary operator (Page 316)) can be
  used in conjunction with the door mounted rotary operator in order to compensate the
  racking distance and so allow the molded case circuit breaker to be moved out when the
  cubicle door is closed.

# 4.5 Manual operators

The manual operators for 3VA molded case circuit breakers are described in this chapter.

# Overview of manual operators



The manual operators available for 3VA molded case circuit breaker are listed below:

- Front mounted rotary operator (optionally with door interlock)
- Door mounted rotary operator
  - Fixing bracket for long shafts
  - Variable depth adapter for draw-out units
  - Supplementary handle for door mounted rotary operator
- Side wall mounted rotary operator (optionally with mounting plate)



The following accessories are available for all manual operators:

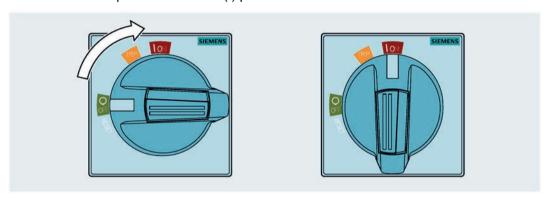
- Illumination kit
- Cylinder locks for locking, blocking and interlocking



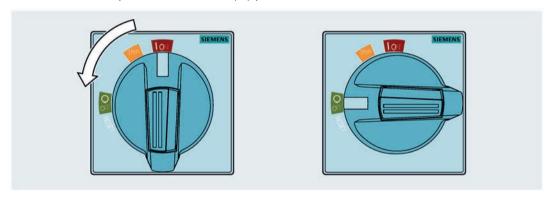
# 4.5.1 Opening, closing and resetting the 3VA molded case circuit breaker

# Opening and closing

• To close the 3VA molded case circuit breaker: Turn the manual operator to the ON (I) position.

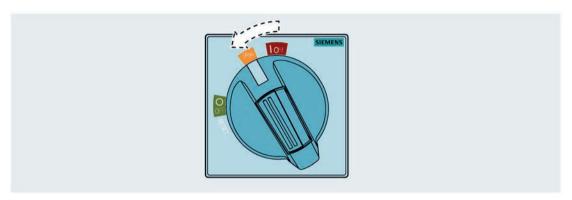


To open the 3VA molded case circuit breaker:
 Turn the manual operator to the OFF (O) position.



# Resetting the manual operator after the molded case circuit breaker has tripped

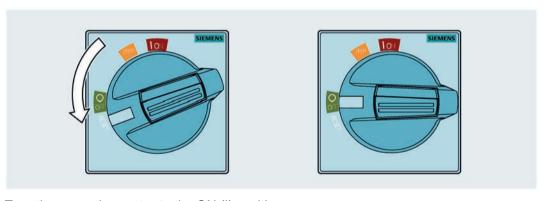
When the molded case circuit breaker trips, the manual operator moves automatically from the ON (I) to the TRIP position.



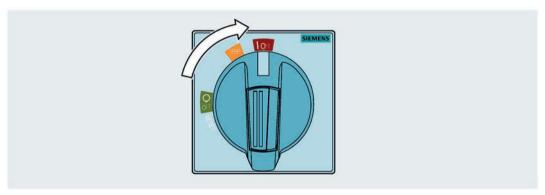
The molded case circuit breaker remains in the tripped state until the manual operator is reset:

- 1. Clear the fault which has caused the molded case circuit breaker to trip.
- 2. Turn the manual operator counter-clockwise to the limit stop (RESET position, at or just past OFF (O)).

The manual operator remains in the OFF (O) position.



3. Turn the manual operator to the ON (I) position.



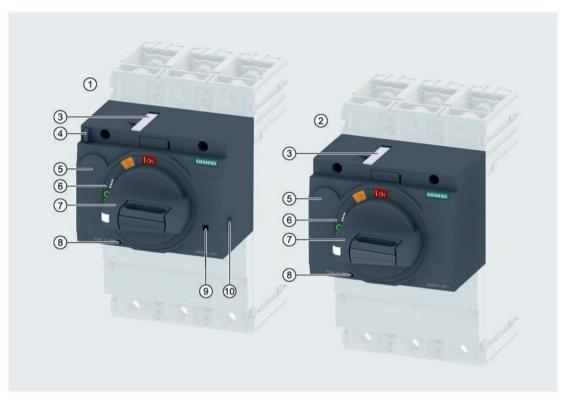
The molded case circuit breaker is closed again.

# 4.5 Manual operators

# 4.5.2 Front mounted rotary operator

The front mounted rotary operator is available in two versions:

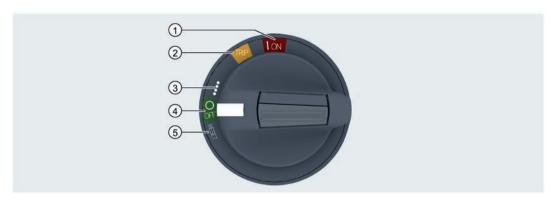
- With door interlock
- Without door interlock



- Front mounted rotary operator with door interlock
- ② Front mounted rotary operator without door interlock
- 3 Device for up to 3 padlocks
- Door contact (door interlock element)
- ⑤ Cylinder lock device

- Indication of the breaker status (on, off, trip) (see below)
- Thandle with mechanism for up to 3 padlocks
- Trip unit button <PUSH TO TRIP>
- 9 Defeat function (door interlock element)
- 10 Door interlock

# Indication of the breaker status on front mounted rotary operator



- ① ON: Breaker closed
- ② TRIP: Breaker tripped
- 3 Mounting position

- 4 OFF: Breaker open
- ⑤ RESET: Reset following a trip

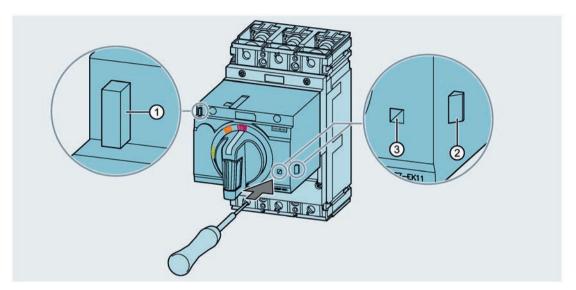
### 4.5 Manual operators

# Front mounted rotary operator with door interlock

The front mounted rotary operator with door interlock projects through the panel door. This arrangement ensures that the molded case circuit breaker can be switched on only when the panel door is closed. The door is locked automatically when the front mounted rotary operator is turned to position ON (I).

# Overriding the door interlock

The door interlock can be overridden by a deliberate action. This means that the door can be opened with the operator in position ON (I), e.g. so that maintenance can be carried out.



- ① Door position switch
- 2 Door interlock
- ③ Defeat function

#### **Procedure**

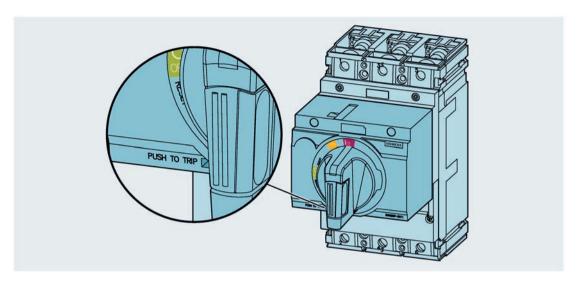
- 1. Press the door interlocking pin with a sharp object.
- 2. Hold the pin down while the door is opened.

### Switch on the circuit breaker with the panel door open

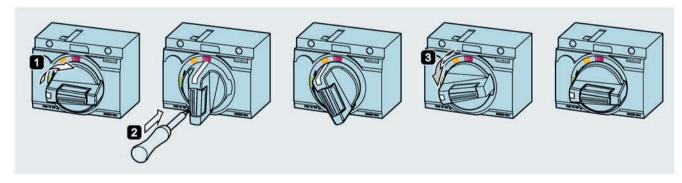
The door contact must be operated manually in order to switch on the molded case circuit breaker with the panel door open. The handle can then be moved to the ON (I) position.

# Testing the tripping mechanism

The button <PUSH TO TRIP> can be pressed to perform a function test on the tripping mechanism.



### **Procedure**

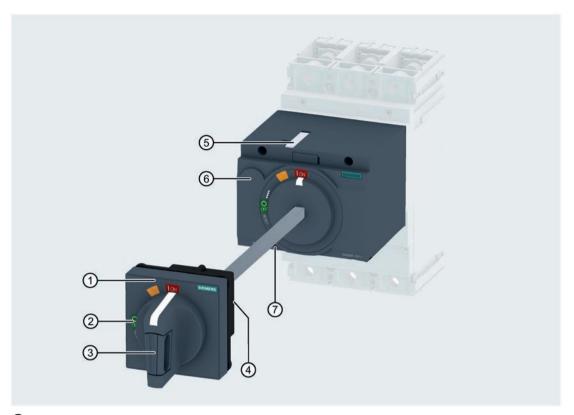


- 1. Turn the front mounted rotary operator to position ON (I) in order to close the molded case circuit breaker.
- Press the button <PUSH TO TRIP> with a tool such as a screwdriver.
   The front mounted rotary operator moves from position ON (I) to position TRIP. The molded case circuit breaker is now in the tripped state.
- 3. Turn the front mounted rotary operator counter-clockwise to the limit stop (RESET position, at or just past OFF (O)).

  The front mounted rotary operator remains in the OFF (O) position and the molded case circuit breaker can now be closed again.

# 4.5.3 Door mounted rotary operator

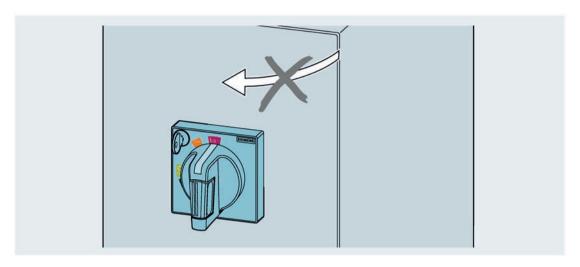
With the door mounted rotary operator installed, it is possible to operate the molded case circuit breaker through the panel door without opening the door.



- ① Door mounted rotary operator
- 2 Indication of the breaker status ON, TRIP, mounting position, OFF, RESET For mounting position, see chapter Front mounted rotary operator (Page 312)
- 3 Handle with device for up to 3 padlocks
- 4 Tolerance compensation
- (5) Device for up to 3 padlocks
- 6 Cylinder lock device (type Ronis)
- Trip unit button <PUSH TO TRIP>

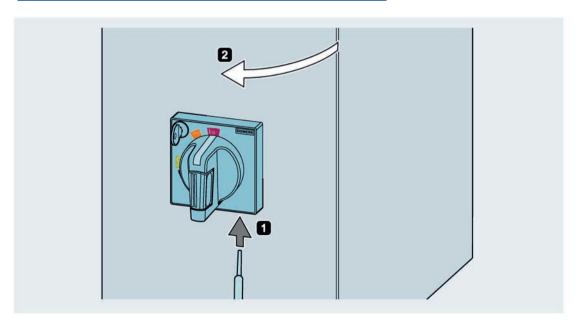
# Door interlock with door mounted rotary operator

The door interlock of the door mounted rotary operator locks the door as soon as the door mounted rotary operator is turned to position ON (I).



## Overriding the door interlock

The door interlock can be overridden by a deliberate action. This means that the door can be opened with the operator in position ON (I), e.g. so that maintenance can be carried out. The door interlock can also be completely deactivated by a small modification on the inside of the handle. The panel door can then also be opened at any time without additional measures if the circuit breaker is switched on (position ON). For details, see the Operating Instructions (https://support.industry.siemens.com/cs/ww/en/view/80600132).



# 4.5 Manual operators

### **Procedure**

- 1. Press the door interlocking pin with a sharp object.
- 2. Hold the pin down while the door is opened.

## See also

(https://support.industry.siemens.com/cs/ww/en/view/80600132)

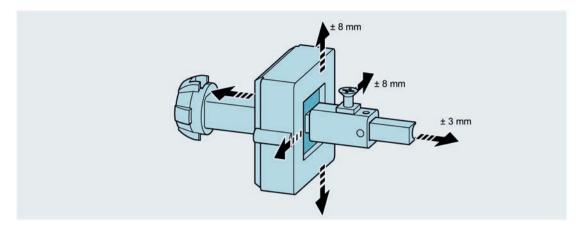
# Tolerance compensator

Door mounted rotary operators are supplied as standard with a tolerance compensator. This device compensates any potential minor offset between the rotary switch of the cubicle doors and the shaft of the door mounted rotary operator.



1 Tolerance compensator

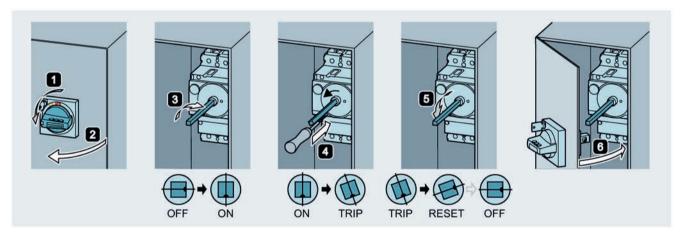
# Offset compensator



# Testing the tripping mechanism

The button <PUSH TO TRIP> can be pressed to perform a function test on the tripping mechanism.

## **Procedure**



- 1. Turn the door mounted rotary operator to the OFF (O) position.
- 2. Open the panel door.
- 3. Use a tool to turn the shaft to the ON (I) position in order to close the molded case circuit breaker.
  - Alternatively, the supplementary handle for the door mounted rotary operator can also be used to close the breaker.
- 4. Press the button <PUSH TO TRIP> with a tool such as a screwdriver. The door mounted rotary operator moves from position ON (I) to position TRIP. The molded case circuit breaker is now in the tripped state.

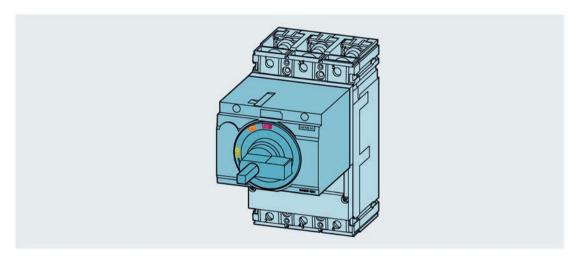
## 4.5 Manual operators

- Turn the door mounted rotary operator counter-clockwise to the limit stop (RESET position, just beyond OFF (O)).
  - The manual operator remains in the OFF (O) position.
- 6. Close the panel door.

The molded case circuit breaker can now be closed again.

# Supplementary handle for door mounted rotary operator

The supplementary handle can be used to operate the molded case circuit breaker when the cubicle door is open.



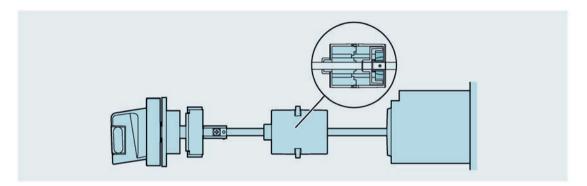
# Use the supplementary handle to close the molded case circuit breaker:

A deliberate action is required to turn the molded case circuit breaker to the ON (I) position:

- 1. Push in the supplementary handle.
- 2. Turn the supplementary handle to the ON (I) position in order to close the molded case circuit breaker.

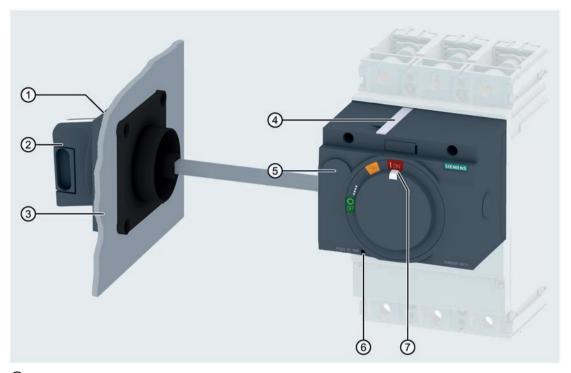
# Variable depth adapter

The variable depth adapter enables adjustment of the travel distance Connect - Test - Disconnect when using draw-out technology. As a result, the panel door does not have to be opened in the Connect, Test and Disconnect positions. See also chapter Draw-out technology (Page 285)



# 4.5.4 Side wall mounted rotary operator

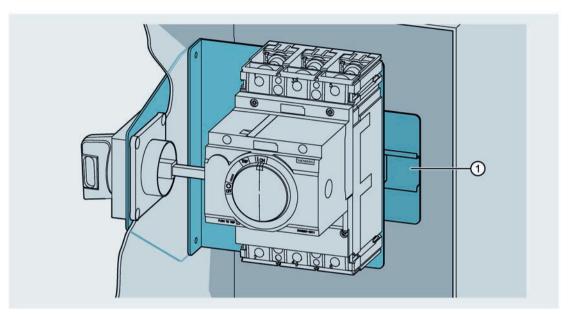
The side wall mounted rotary operator allows the molded case circuit breaker to be operated through the right-hand or left-hand side wall of the cubicle.



- Side wall mounted rotary operator
- ② Handle with device for up to 3 padlocks
- 3 Side wall of cubicle
- Device for up to 3 padlocks
- 5 Device for cylinder lock
- 6 Trip unit button <PUSH TO TRIP>
- Switching position indicator ON, TRIP, mounting position, OFF, RESET For mounting position, see chapter Front mounted rotary operator (Page 312)

## Side wall mounted rotary operator with mounting plate

The side wall mounted rotary operator is available in a version with mounting plate for molded case circuit breakers up to 250 A. The mounting plate can be installed on the right-hand or left-hand side panel. The space on the mounting plate can be used to install other components.



If there is insufficient space available on the mounting plate to install terminals, a terminal plate  $\bigcirc$  can be bolted to the cubicle.

## 4.5 Manual operators

## 4.5.5 Locking and interlocking for manual operators

The following accessories for locking, blocking and interlocking are used:

- · Locking at the handle
- Locking, blocking and interlocking at the rotary operator

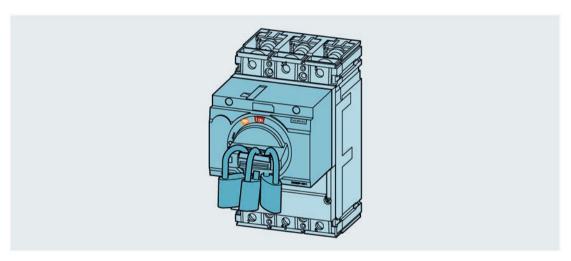
## 4.5.5.1 Locking by the handle

The following manual operators can be locked by the handle:

- Front mounted rotary operator
- Door mounted rotary operator
- Side wall mounted rotary operator

Up to three padlocks with a shackle diameter of between 5 and 8 mm can be used to lock the rotary operators. Padlocks are not included in the scope of supply.

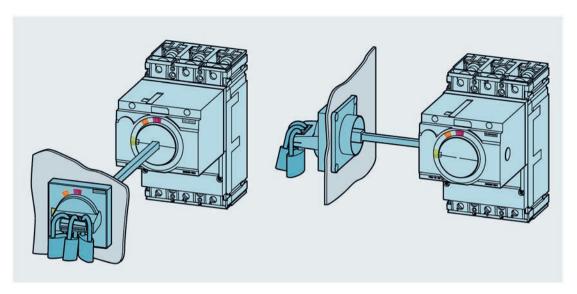
#### Front mounted rotary operator



Lockable switching positions:

- Position OFF (O)
- Position ON (I)
   Possible only if the front mounted rotary operator has been modified accordingly during installation.





#### Lockable switching positions:

- Position OFF (O)
   When the door mounted rotary operator or the side wall mounted rotary operator is locked in the OFF (O) position, the molded case circuit breaker cannot be closed, nor can the cubicle door be opened. The door interlock cannot be overridden.
- Position ON (I)
   Possible only if the door mounted rotary operator or the side wall mounted rotary operator has been modified accordingly during installation.

#### Note

### No impairment of protection functions

Locking the rotary operators in the ON (I) position does not impair the protective functionality of the molded case circuit breakers. In the event of a fault, the molded case circuit breaker trips in the normal way.

When the rotary operator is unlocked, the switching position changes to TRIP.

#### 4.5 Manual operators

## 4.5.5.2 Locking and interlocking by the rotary operator

The following manual operators can be locked and interlocked by the rotary operator:

- Front mounted rotary operator
- Rotary operator with shaft stub
- Door mounted rotary operator
- Side wall mounted rotary operator

The manual operators can be locked by up to three padlocks with a shackle diameter of between 5 and 8 mm or by means of cylinder locks (type Ronis). Manual operators can be interlocked only by means of cylinder locks (type Ronis).

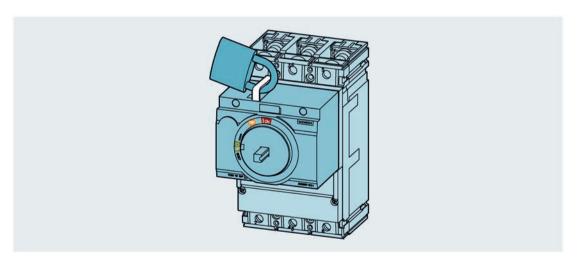
In addition, the door mounted rotary operator and side wall mounted rotary operator at the masking plate in the panel door or side panel can also be locked using cylinder locks (type Kaba).

Padlocks and cylinder locks are not included in the scope of supply of manual rotary operators.

## Locking with padlocks

All rotary operators are equipped with a padlock locking unit. This locking unit is simply pulled out of the rotary operator.

Example of rotary operator with shaft stub:



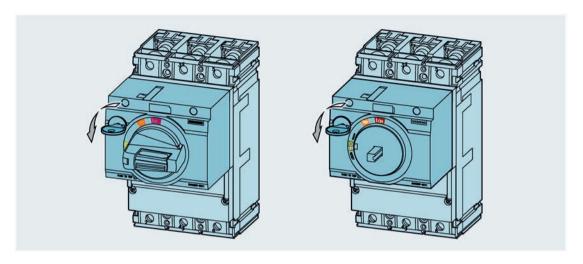
Lockable switching positions:

Position OFF (O)

### Locking or interlocking using a cylinder lock (type Ronis)

Rotary operators can be locked or interlocked (depending on how the lock holder is installed) by means of the cylinder lock (type Ronis).

Example of a front mounted rotary operator and a rotary operator with shaft stub:



## Locking with cylinder lock (type Ronis):

The cylinder lock (type Ronis) locks the rotary operators in the OFF (O) position.

#### Mutual interlocking with cylinder lock (type Ronis):

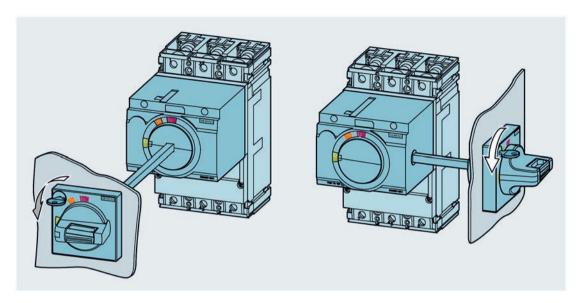
By using the cylinder lock insert for interlocking, it is possible to establish a mutual interlock between an unlimited number of rotary operators. This requires that the keys of all molded case circuit breakers locked in the open position are removed from the lock and stored in a safe place. Only the key of the rotary operator which is in the ON (I) position is left in the cylinder lock. This key cannot be removed while the rotary operator is in the ON (I) position. The key can be removed only after the rotary operator has been turned to the OFF (0) position, the cylinder lock turned to the "locked" position so that the molded case circuit breaker is interlocked. See also chapter Cylinder locks for implementing interlocks between multiple 3VA molded case circuit breakers (Page 369).

## 4.5 Manual operators

## Locking with cylinder lock (Kaba)

The door mounted rotary operator and the side wall mounted rotary operator can be locked by means of a cylinder lock (type Kaba) fitted in the panel door or side panel.

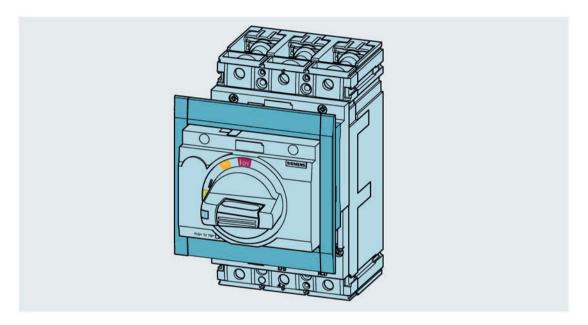
The cylinder lock (type Kaba) is not included in the scope of supply.



## 4.5.6 Degree of protection

| Operator  | IP degree of protection |
|---|-------------------------|
| Front mounted rotary operator   | IP30                    |
| Front mounted rotary operator in control cubicle door with escutcheon | IP30                    |
| Door mounted rotary operator  | IP65                    |
| Side wall mounted rotary operator                                     | IP65                    |

When fitted with an escutcheon (see illustration below), a front mounted rotary operator installed in the cubicle door has degree of protection IP30.



#### Note

To ensure that the control cabinet door can still be opened, the front mounted rotary operator must not project over the cover frame by more than 5 mm when the door is closed.

## 4.5.7 Accessories

#### Illumination kit



With this kit installed, the front edge of the handle of the front mounted operator of the door mounted rotary operator or side wall mounted rotary operator lights up to indicate the switching position of the circuit breaker. The illumination kit can be ordered with the operator as a pre-assembled accessory, or individually as a retrofit component.

The illumination kit operates on a 24 V DC supply.

Its power consumption is 0.16 W.

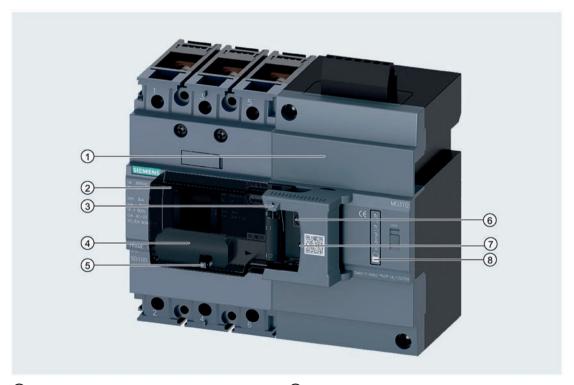
## 4.6.1 MO310 side mounted motor operator



The MO310 side mounted motor operator makes it possible to implement remote control of the 3VA1 molded case circuit breaker without having to attach anything to the front of the circuit breaker. Its compact design (cover size of 45 mm) and the DIN rail mounting option make this MO310 side mounted motor operator especially suitable for:

- Building distribution boards
- Distribution boards

MO310 side mounted motor operators are also used in conjunction with automatic transfer control devices.



- 1 MO310 motor operator
- ② Plastic cover
- 3 Seal
- 4 Handle for manual operation
- ⑤ <PUSH TO TRIP> button
- 6 Reset mode setting
- 7 LED "Active"
- 8 Mechanism for padlocks

## Description

The switchstick on the front panel clearly shows the switching position of the molded case circuit breaker. The MO310 side mounted motor operator meets the requirements pertaining to isolating features stipulated by IEC / EN 60947-1.

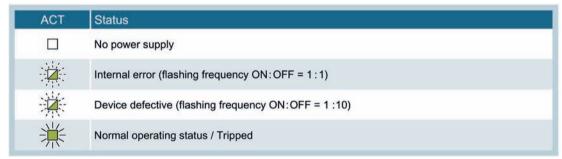
## Switchstick on the front panel



| Switchstick position | Switching position | Description  |
|----------------------|--------------------|--|
|                      | ON                 | The main contacts of the molded case circuit breaker are closed.   |
|                      | OFF                | The main contacts of the molded case circuit breaker are open.   |
| Ţ                    | TRIP               | The molded case circuit breaker is in the TRIP position. It is not absolutely clear that all main contacts are open. |

## LED status displays





See also chapter Faults, causes of faults and rectification of faults (Page 338).

## 4.6.1.1 MANUAL, AUTO and LOCK modes

The MO310 side mounted motor operator is switched to MANUAL or AUTO mode when the plastic cover is opened (MANUAL) or closed (AUTO).



#### MANUAL:

When the plastic cover is open, the MO310 side mounted motor operator is in MANUAL mode. The switchstick on the front panel can be operated to move the molded case circuit breaker to the ON (I) or OFF (O) position.

#### **AUTO:**

If the plastic cover is closed, the MO310 side mounted motor operator is operated via control cables, e.g. via pushbuttons or a PLC.

## LOCK:

The MO310 side mounted motor operator can be interlocked to prevent reclosing by operating the locking bar in the OFF (O) position. The locking device can be locked with up to three padlocks (shackle diameter 5.0 mm to 8.0 mm). Padlocks are not included in the scope of supply.



## 4.6.1.2 Closing, opening and resetting the 3VA molded case circuit breaker

#### Closing and opening in MANUAL mode

The plastic cover is open. The MO310 side mounted motor operator is in MANUAL mode.

• Close the molded case circuit breaker:

Push the switchstick to the ON (I) position.

The molded case circuit breaker is closed ON (I). The contacts are closed.

• Open the molded case circuit breaker:

Push the switchstick to the OFF (O) position.

The molded case circuit breaker is open OFF (O). The contacts are open.

### Closing and opening in AUTO mode

The plastic cover is closed. The MO310 side mounted motor operator is in AUTO mode. The 3VA molded case circuit breaker can only be closed or opened by means of electrical signals.

 Close the 3VA molded case circuit breaker by means of an electrical ON signal at the terminal block:

The molded case circuit breaker is ON (I). The contacts are closed. The switchstick is in the ON (I) position.

 Open the 3VA molded case circuit breaker by means of an electrical OFF signal at the terminal block:

The molded case circuit breaker is OFF (O). The main contacts are separated. The switchstick is in the OFF (O) position.

## Resetting the molded case circuit breaker

The method by which the molded case circuit breaker is reset by the MO310 side mounted motor operator depends on the selected reset mode.

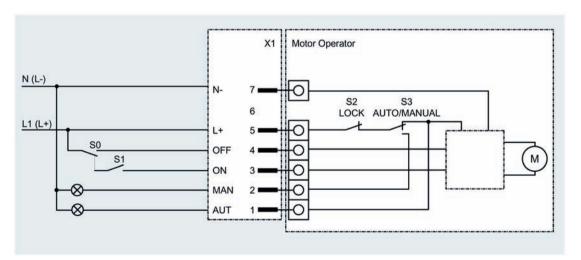
#### Selectable reset mode

The reset mode can be set. After the molded case circuit breaker has tripped, the selected reset mode determines the response of the motor operator in the TRIP position.

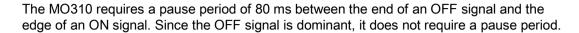
Response of MO310 side mounted motor operator to tripping of the molded case circuit breaker, depending on the selected reset mode:

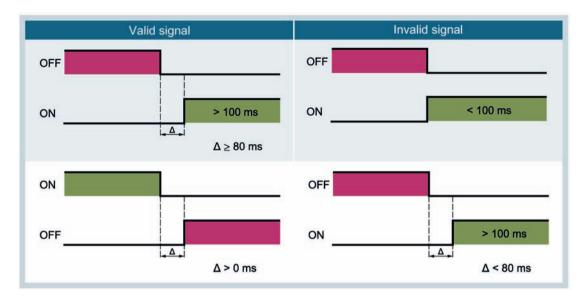
| Reset mode   | Requirements   | Operating mode   | Setting<br>Rotary button | Description   |
|--|--|------------------|--------------------------|---|
| Operating mode 1:<br>Automatic reset                               | Plastic window<br>closed,<br>motor operator is in<br>AUTO position.                          | AUTO             |                          | If the molded case circuit breaker has tripped, the motor operator moves it automatically from position TRIP to position OFF.   |
| Operating mode 2:<br>Manual reset or<br>reset by remote<br>control | Plastic window open<br>or closed,<br>motor operator is<br>in the MANUAL or<br>AUTO position. | MANUAL /<br>AUTO |                          | MANUAL operating mode: The motor operator must be reset locally by means of the handle (switching position OFF (O)).  AUTO operating mode: The motor operator must be reset with an OFF signal transferred via control cables (e.g. pushbutton, PLC). |

## Connection diagram for control of the MO310 motor operator



The MO310 motor operator is edge-controlled, i.e. it reacts only to the positive edge of an ON or OFF command at the relevant terminals 3 and 4. In this case, the OFF signal is dominant, i.e. the motor operator will be switched off in response to an OFF edge even if an ON signal is applied.





### 4.6.1.3 Faults, causes of faults and rectification of faults



#### Device defective and internal fault:

- "Device defective" refers to a fault or defect in the motor operator which cannot be rectified. The device must be replaced. This can be caused by a defective microswitch, for example.
- "Internal error" refers to faults which can be rectified (e.g. an undefined switching position, fault during automatic RESET, excessively long switching times). If the motor operator fault condition cannot be rectified by switching it ON/OFF again, the switching position must be corrected manually.

#### Note

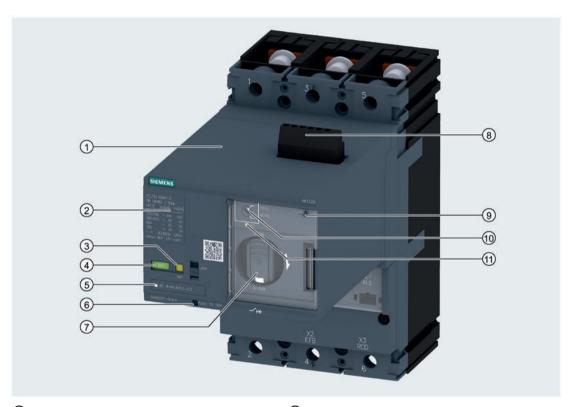
You must first ensure that the rotary switch for RESET mode is in a defined state.

## 4.6.2 Motor operator MO320



The motor operator MO320 transmits commands via electrical control cables to open and close the molded case circuit breaker. The source of commands transmitted via electrical control cables can be a pushbutton or a PLC, for example.

Motor operators must also used in conjunction with automatic transfer control devices.



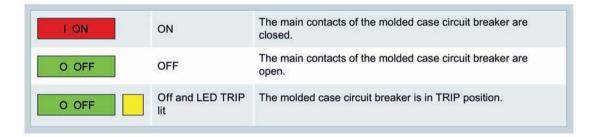
- 1 MO320 motor operator
- ② Characteristic data of the molded case circuit breaker
- 3 LED "TRIP"
- 4 Indication of the breaker status ON/OFF
- Mechanism for padlocks
- 6 Button for trip unit <PUSH TO TRIP>

- 7 Handle for manual operation
- 8 Connecting terminals for power supply (AC/DC depending on version)
- 9 Seal
- ® Reset mode setting
- ① LED "Active"

## Description of front panel

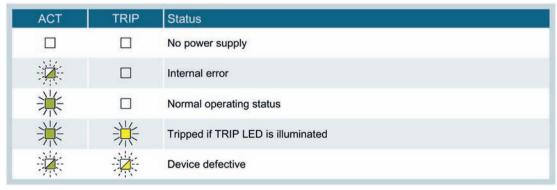
The front panel of the motor operator MO320 features an indication of the breaker status and an LED labeled "TRIP". The indication directly reflects the status of the actuating shaft. With its clear breaker status indication, the motor operator MO320 meets the requirements pertaining to isolating features stipulated by IEC / EN 60947-1.

#### Indication of the breaker status on the front panel



## LED status displays





See also chapter Faults, causes of faults and rectification of faults (Page 346).

## 4.6.2.1 MANUAL, AUTO and LOCK modes

The motor operator MO320 is switched to MANUAL or AUTO mode when the plastic window is opened (MANUAL) or closed (AUTO).



## MANUAL:

When the plastic window is open, the motor operator MO320 is in MANUAL mode. The motor operator is moved to position ON (I) or OFF (O) by manual operation of the handle.

#### **AUTO:**

When the plastic window is closed, the motor operator MO320 is in AUTO mode. The motor operator can be operated via control cables, e.g. in response to signals issued by a pushbutton or by control commands output by a PLC.

#### LOCK:

The motor operator can be locked in the OFF (O) position to prevent reclosure of the breaker. The padlock locking device snaps out if the slide above it is moved to the "LOCK" position.

Up to three padlocks with a shackle diameter of between 5 and 8 mm can be inserted through the openings in the padlock locking unit. Padlocks are not included in the scope of supply.



## 4.6.2.2 Opening, closing and resetting the 3VA molded case circuit breaker

## Closing and opening in MANUAL mode

The plastic window is open, the motor operator is in MANUAL mode. The supply to the LEDs is also disconnected, but the motor operator remains fully operational.

Close the 3VA molded case circuit breaker:
 Turn the handle clockwise until the breaker status indicator displays ON (I).
 The molded case circuit breaker is now ON (I). The contacts are closed.



Open the 3VA molded case circuit breaker:
 Turn the handle clockwise until the breaker status indication indicates OFF (O).
 The molded case circuit breaker is now OFF (O). The contacts are open.



## Closing and opening in AUTO mode

The plastic window is closed, the motor operator is in AUTO mode. The 3VA molded case circuit breaker can only be closed or opened by means of electrical signals.



- Close the 3VA molded case circuit breaker by means of an electrical ON signal at the terminal block:
  - The molded case circuit breaker is ON (I). The contacts are closed. The switching position indicator on the front panel of the motor operator displays ON (I).
- Open the 3VA molded case circuit breaker by means of an electrical OFF signal at the terminal block:
  - The molded case circuit breaker is OFF (O). The main contacts are separated. The switching position indicator on the front panel of the motor operator displays OFF (O).

## Resetting the molded case circuit breaker

If the 3VA molded case circuit breaker has tripped, the LED labeled "TRIP" lights up



## Reset mode setting

The method by which the 3VA molded case circuit breaker is reset by the motor operator depends on the selected reset mode.

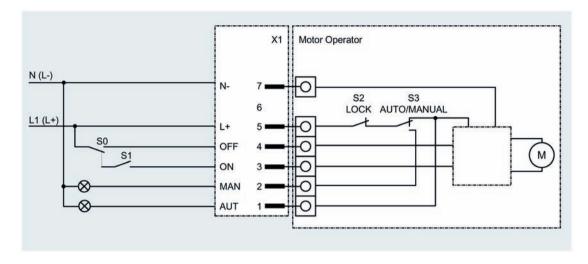
#### Reset modes

The reset mode can be set. After the molded case circuit breaker has tripped, the selected reset mode determines the response of the motor operator in the TRIP position.

Motor operator response to tripping of the 3VA molded case circuit breaker depending on the reset mode selection:

| Reset mode   | Requirements   | Operating mode   | Setting<br>Rotary button | Description   |
|--|--|------------------|--------------------------|---|
| Operating mode 1:<br>Automatic reset                               | Plastic window<br>closed,<br>motor operator is in<br>AUTO position.                          | AUTO             |                          | If the molded case circuit breaker has tripped, the motor operator moves it automatically from position TRIP to position OFF.   |
| Operating mode 2:<br>Manual reset or<br>reset by remote<br>control | Plastic window open<br>or closed,<br>motor operator is<br>in the MANUAL or<br>AUTO position. | MANUAL /<br>AUTO |                          | MANUAL operating mode: The motor operator must be reset locally by means of the handle (switching position OFF (O)).  AUTO operating mode: The motor operator must be reset with an OFF signal transferred via control cables (e.g. pushbutton, PLC). |

## Connection diagram for control of the motor operator MO320



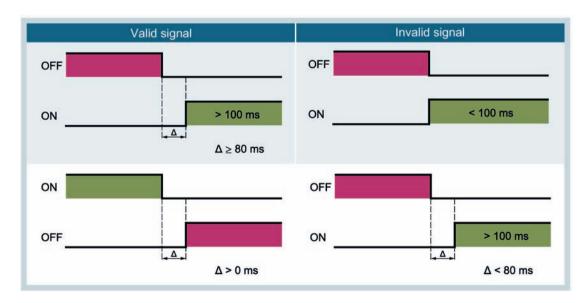
#### Note

An EMERGENCY-OFF circuit is implemented by means of undervoltage releases (Page 191).

For further circuit diagrams, see chapter "Circuit diagrams" (Page 539).

The MO320 motor operator is edge-controlled, i.e. it reacts only to the positive edge of an ON or OFF command at the relevant terminals 3 and 4. In this case, the OFF signal is dominant, i.e. the motor operator will be switched off in response to an OFF edge even if an ON signal is applied.

The MO320 requires a pause period of 80 ms between the end of an OFF signal and the edge of an ON signal. Since the OFF signal is dominant, it does not require a pause period.



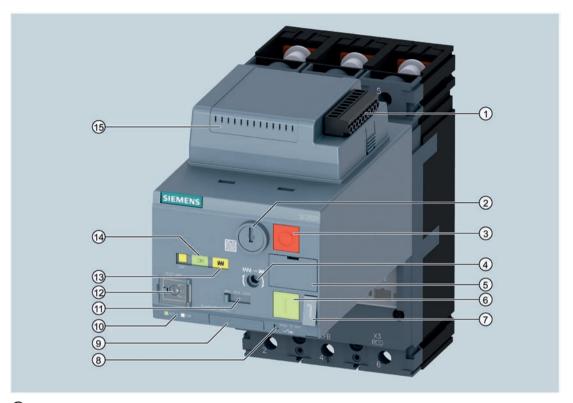
## 4.6.2.3 Faults, causes of faults and rectification of faults

| Causes of faults   | LED      | display  | Remedy  |
|--|----------|----------|---|
|  | ACT      | TRIP     |   |
| Defects  |          |          |   |
| Unit is defective<br>(e.g. defective microswitch)                              | ***      | <u> </u> | Cannot be repaired, replace the unit  |
| Faults   |          |          |   |
| Excessively long switching time (e.g. blocked motor)                           | <u> </u> |          | Reset fault by 2 x OFF signal (< 1 s)   |
| Incorrect switching position after command (e.g. OFF position after ON signal) |          |          | Reset fault by 2 x OFF signal (< 1 s) or manual correction of switching position        |
| Undefined switching position   | 溢        |          | Reset fault by 2 x OFF signal (< 1 s) or manual correction of switching position        |
| Fault during automatic reset   |          |          | Reset fault by 2 x OFF signal (< 1 s)   |
| Undefined reset mode (e.g. rotary button not in position 1 or 2)               | ***      |          | Set the reset mode correctly, reset fault by 2 x OFF signal (< 1 s) or manual actuation |

## 4.6.3 SEO520 motor operator with stored energy operator



The front motor operator with SEO520 stored energy operator is primarily designed for network synchronization applications on account of its fast switching times. It also offers the option of a communication link which allows the 3VA2 molded case circuit breaker to be remotely controlled in fieldbus systems associated with the 3VA range.

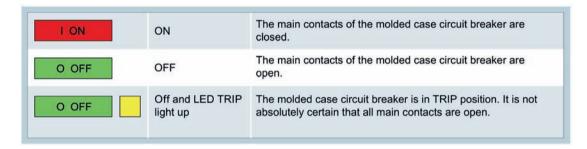


- ① Connecting terminals
- 2 Cylinder lock installation option (type Ronis) for mode interlocking
- ③ OFF button
- 4 Tool insertion slot for manually winding up the stored energy operator
- 5 Installation option for mechanical operating cycles counter
- 6 ON button
- Slot for storing tool for manual wind-up
- 8 <PUSH TO TRIP> test button
- 9 Locking device for padlocks
- Active and Communication LEDs
- 11) Mode slide switch
- 12 Reset mode selector switch
- (3) Indication of status of stored energy operator
- (Indication of the breaker status (ON/OFF)
- (5) Power supply top unit (24 V DC, 42 60 V AC/DC, 110 230 V AC/DC)

### Description of front panel

The front panel of the motor operator with SEO520 stored energy operator features an indication of the breaker status and an LED labeled "TRIP". The clear breaker status indication allows the SEO520 motor operator to meet the requirement pertaining to isolating features stipulated by IEC / EN 60947-1.

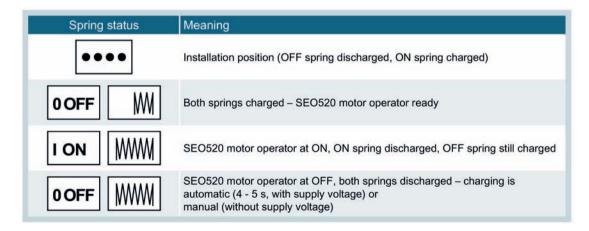
#### Indication of the breaker status on the front panel



### LED status displays



#### Stored energy operator status display



## 4.6.3.1 MANUAL, AUTO and LOCK modes

The SEO520 motor operator with stored energy operator features the operating modes

- MANUAL (manual mode)
- AUTO (remote control mode)
- LOCK (locked)

These are selected using a slide switch on the front of the SEO.



## **MANUAL**

In MANUAL mode (slide switch on the left), the SEO520 motor operator can only be operated using the buttons on the front panel of the SEO520 motor operator.

#### **AUTO**

In AUTO mode (slide switch in the middle), the SEO520 motor operator is operated via control cables, e.g. via pushbuttons or a PLC, or via the optional communication function.

#### **LOCK**

In LOCK mode (slide switch on the right, only possible in the OFF (O) position), the SEO520 motor operator can be interlocked to prevent reclosing. The locking device can be locked with up to three padlocks (shackle diameter 5.0 mm to 8.0 mm).

Padlocks are not included in the scope of supply.



## 4.6.3.2 Closing, opening and resetting the 3VA molded case circuit breaker

#### Closing and opening

#### In MANUAL mode

In MANUAL mode, the molded case circuit breaker is operated using the buttons on the front panel of the SEO520 motor operator. Remote control is not possible.

Operating the ON (I) button causes the contacts of the molded case circuit breaker to close. Operating the OFF (O) button causes the contacts to open. This is not performed by means of a TRIP. It is an actual switch-off operation.

#### In AUTO mode

In AUTO mode, the molded case circuit breaker can be closed and opened by means of electrical signals at the terminal block.

Versions with the communication module can be closed and opened via the connection to the COM060 communication module in the molded case circuit breaker. This takes place via the communication environment selected for the 3VA2 molded case circuit breaker, e.g. PROFIBUS, PROFINET, Ethernet (Modbus TCP). ON/OFF commands can also be issued via the powerconfig commissioning and parameterization software. Here too, an actual switch-off operation is performed and not a TRIP.

In AUTO mode, the OFF (O) button on the SEO520 operator can be used. The ON (I) button cannot be operated.

## Resetting the molded case circuit breaker

The method by which the molded case circuit breaker is reset by the SEO520 motor operator depends on the selected reset mode.

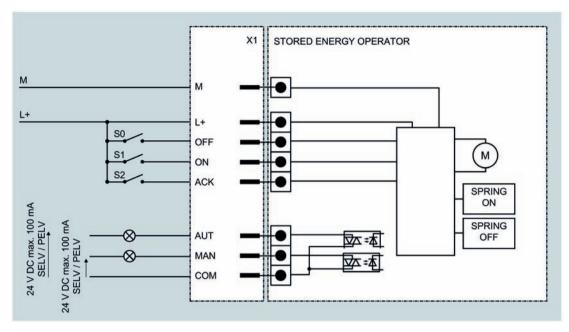
#### Selectable reset mode

The reset mode can be set. After the molded case circuit breaker has tripped, the selected reset mode determines the response of the motor operator in the TRIP position.

Response of SEO520 motor operator to tripping of the molded case circuit breaker, depending on the selected reset mode:

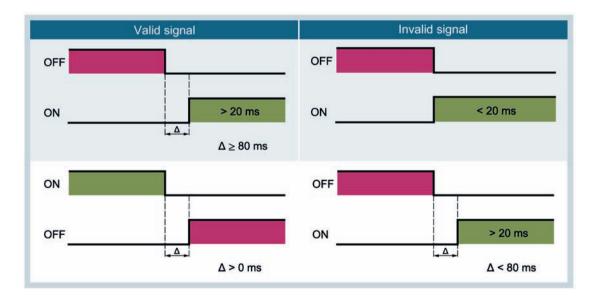
| Reset mode  | Requirement   | Operating mode   | Position of rotary knob                 | Description   |
|---|---|------------------|---|---|
| Mode 1:<br>Automatic reset                                    | Slide switch at AUTO,<br>the SEO520 motor<br>operator is in the AUTO<br>position                      | AUTO             | <b>1</b> 2 3                            | If the molded case circuit breaker trips, the SEO520 motor operator automatically moves it from the TRIP position to the OFF position.  |
| Mode 2:<br>Reset via manual<br>operation or<br>remote control | Slide switch at AUTO<br>or MANU, the SEO520<br>motor operator is in<br>the MANUAL or AUTO<br>position | MANUAL /<br>AUTO | (L) 2 3                                 | MANUAL mode: The motor operator must be reset locally using the pushbuttons (OFF (O)). It may be necessary to charge the spring assembly manually beforehand.  AUTO mode: The motor operator must be reset via control cables (e.g. pushbutton, PLC) or communication with an OFF signal. |
| Mode 3:<br>Reset after<br>additional<br>acknowled-<br>gement  | Slide switch at AUTO,<br>the SEO520 motor<br>operator is in the AUTO<br>position                      | AUTO             | 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | If the molded case circuit breakers trips, the SEO520 motor operator requires an acknowledgement (via electrical signal at terminal block (ACK) or via communication) before it can be reset by an OFF signal.  |

## Connection diagram for control of the SEO520 motor operator



The SEO520 motor operator is edge-controlled, i.e. it reacts only to the positive edge of an ON or OFF command at the relevant terminals 3 and 4. In this case, the OFF signal is dominant, i.e. the motor operator will be switched off in response to an OFF edge even if an ON signal is applied.

The SEO520 requires a pause period of 80 ms between the end of an OFF signal and the edge of an ON signal. Since the OFF signal is dominant, it does not require a pause period.



## 4.6.3.3 Faults, causes of faults and rectification of faults

"Device defective" refers to a fault or defect in the motor operator which cannot be rectified. The device must be replaced. This can be caused by a defective microswitch, for example.

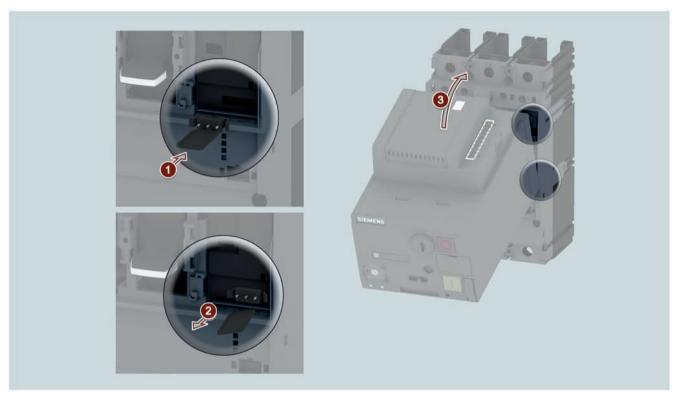
"Internal error" refers to faults which can be rectified (e.g. an undefined switching position, fault on automatic RESET, excessively long switching times). If the motor operator fault condition cannot be rectified by (remotely) switching it ON/OFF again, the following actions are necessary:

- Ensure that the rotary switch for RESET mode is in a defined state (1, 2 or 3)
- Correct the switching position manually (manually charge the stored energy and operate the ON/OFF button).



#### 4.6.3.4 Communication

A communication-capable version of the SEO520 motor operator can be ordered as an option. This integrates it in the 3VA communication environment and makes it possible to remotely control the molded case circuit breaker. The signal transmission takes place via an SEO-COM adapter to the COM060 communication module in the right-hand accessory compartment of the molded case circuit breaker.



- 1. Insert the COM060 communication module and the SEO-COM adapter in the molded case circuit breaker.
- 2. Break off the assembly support of the SEO-COM adapter.
- Fit the SEO520 in the mounting position.
   The communication connection is established automatically when the COM060 is connected to COM800/100, thereby contacting the 24 V DC.

## 4.6.3.5 Accessories

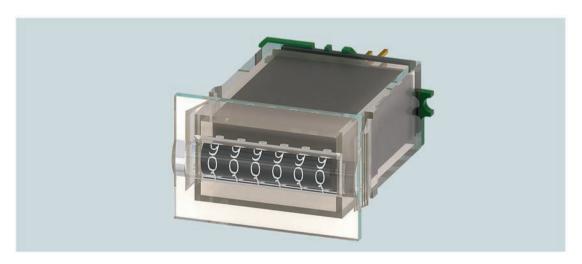
## Cylinder lock (type Ronis)

The SEO520 motor operator can be fitted with a cylinder lock (type Ronis) at the front. The lock kit comprises a cylinder lock with four possible key versions and the SEO-specific lock insert. The cylinder lock interlocks the selected operating mode (MANUAL, AUTO, LOCK) to prevent any unauthorized change of operating mode.



## Operating cycles counter

The mechanical operating cycle counter can be installed at the front. It counts the number of ON/OFF cycles from the time it is installed.



### Compatibility with other accessories



#### Irreparable damage to the molded case circuit breaker

If the SEO520 motor operator is equipped with a communication option, the use of auxiliary (AUX) switches is **not** permitted in the HP version (3VA9988-0AA11) due to requirements pertaining to air and creepage distances in the right-hand accessory compartment of the molded case circuit breaker.

This warning notice is relevant for cases where an SEO520 motor operator with a communication option is used in an application without communication. If the SEO520 motor operator is connected to a communication system, the COM060 communication module occupies the mounting location of the auxiliary (AUX) switch in the HP version in the right-hand accessory compartment.

# 4.6.4 Technical specifications

## MO310 motor operator

|   |                     |      | MO310 motor operator                         |  |  |
|---|---------------------|------|--|--|--|
|   |                     |      | 3VA1   |  |  |
|   |                     |      | 160 A  |  |  |
| Ambient temperature (operation)         |                     | °C   | –25 +70                                      |  |  |
| Ambient temperatur                      | e (storage)         | °C   | -40 +80                                      |  |  |
| Rated control supply voltage (operating |                     |      | 24 60 V DC / 4260 V AC (0.85 1.1)            |  |  |
| range of control sup                    | ply voltage)        |      | 110 230 V AC / 110 250 V DC (0.85 1.1)       |  |  |
| Rating                                  |                     | W/VA | 250, max. 500 (60 ms)                        |  |  |
| Danakian analiki                        | 24 60 V DC          | Α    | 0.5  |  |  |
| Breaking capacity (outputs)             | 110 230 V AC        | Α    | 1  |  |  |
| (outputs)                               | 110 250 V DC        | Α    | 0.04   |  |  |
|   | 24 60 V DC          | kΩ   | 10 25  |  |  |
| Input impedance                         | 110 230 V AC        | kΩ   | 100 140                                      |  |  |
|   | 110 250 V DC        | kΩ   | 100 160                                      |  |  |
| Make time, typically                    |                     | ms   | < 300  |  |  |
| Break time, typically                   |                     | ms   | < 300  |  |  |
| Pulse duration, mini                    | mum                 | ms   | 100  |  |  |
| Maximum switching                       | frequency           | 1/h  | 120  |  |  |
| Degree of protection                    | 1                   |      | IP20, with cover frame IP30                  |  |  |
| Connectable conduc                      | ctor cross-sections | mm²  | 1.5 2.5                                      |  |  |
| Tightening torque                       |                     | Nm   | 0.4  |  |  |
| Stripped length                         |                     | mm   | 7  |  |  |
|   |                     | Α    | 4  |  |  |
| DIAZED fuse                             |                     |      | Operational class gG<br>Characteristic: slow |  |  |
| Miniature circuit brea                  | aker                |      | C characteristic according to DIN VDE 0641   |  |  |
| Endurance                               |                     |      | Same as basic circuit breaker                |  |  |

## MO320 motor operator

|  |                     |  | MO320 motor operator                         |             |                  |        |  |  |
|--|---------------------|--|--|-------------|------------------|--------|--|--|
|  |                     |  | 3VA1 3VA2                                    |             |                  |        |  |  |
|  |                     |  | 160 A  | 250 A       | 250 A            | 630 A  |  |  |
| Ambient temperature  | e (operation)       | °C   | ,  | -25         | . +70            |        |  |  |
| Ambient temperature  | e (storage)         | °C   | -40 +80                                      |             |                  |        |  |  |
| Rated control supply voltage (operating range of control supply voltage) |                     | 24 60 V DC (0.85 1.26)<br>110 230 V AC / 110 250 V DC (0.85 1.1) |  |             |                  |        |  |  |
| Rating   |                     | W/VA   |  | 250, max. 5 | 500 (60 ms)      | 7      |  |  |
| Breaking capacity (outputs)  | 24 60 V DC          | Α  |  | 0.          | HATELEON CONTROL |        |  |  |
|  | 110 230 V AC        | Α  | 1  |             |                  |        |  |  |
|  | 110 250 V DC        | Α  | 0.04   |             |                  |        |  |  |
| Input impedance  | 24 60 V DC          | kΩ   | 10 25  |             |                  |        |  |  |
|  | 110 230 V AC        | kΩ   | 100 140                                      |             |                  |        |  |  |
|  | 110 250 V DC        | kΩ   | 100 160                                      |             |                  |        |  |  |
| Make time, typically m   |                     | ms   | < 800  | < 900       | < 1000           | < 1700 |  |  |
| Break time, typically ms   |                     | ms   | < 800  | < 900       | < 1000           | < 1400 |  |  |
| Pulse duration, mini   | mum                 | ms   | 100  |             |                  |        |  |  |
| Maximum switching frequency 1/h  |                     | 120  |  |             |                  |        |  |  |
| Degree of protection   |                     |  | IP20, with cover frame IP30                  |             |                  |        |  |  |
| Connectable conduc   | ctor cross-sections | mm²  | 1.5 2.5                                      |             |                  |        |  |  |
| Tightening torque  |                     | Nm   | 0.4  |             |                  |        |  |  |
| Stripped length  |                     | mm   | 7  |             |                  |        |  |  |
|  |                     | Α  | 4  |             |                  |        |  |  |
| DIAZED fuse  |                     |  | Operational class gG<br>Characteristic: slow |             |                  |        |  |  |
| Miniature circuit brea   | aker                |  | C characteristic according to DIN VDE 0641   |             |                  |        |  |  |
| Endurance  |                     |  | Same as basic circuit breaker                |             |                  |        |  |  |

# SEO520 motor operator with stored energy operator

|  |      | SEO520 motor operator with stored energy operator 3VA2 250 A   |
|--|------|--|
| Ambient temperature (operation)  | °C   | -25 +70  |
| Ambient temperature (storage)  | °C   | -40 +80  |
|  |      | 24 V DC (0.85 1.26)  |
| Rated control supply voltage (operating range of control supply voltage) |      | 42 60 V DC / 42 60 V AC (0.85 1.26)                            |
| control supply voltage)  |      | 110 230 V AC / 110 250 V DC (0.85 1.1)                         |
| Rating   | W/VA | 300, max. 500 (60 ms)  |
| Outputs  |      | 2 x relay outputs (250 V rated voltage), see below for details |
| Make time, typically   | ms   | < 80   |
| Break time, typically  | ms   | < 80   |
| Pulse duration, minimum  | ms   | 20   |
| Maximum switching frequency  | 1/h  | 120  |
| Degree of protection   |      | IP20, with cover frame IP30                                    |
| Connectable conductor cross-sections                                     | mm²  | 1.5 2.5  |
| Tightening torque  | Nm   | 0.4  |
| Stripped length  | mm   | 7  |
|  | A    | 4  |
| DIAZED fuse  |      | Operational class gG Characteristic: slow                      |
| Miniature circuit breaker  |      | On request   |
| Spring charging time   | s    | 3.5 4.5  |

# Details of breaking capacity of inputs/outputs

| Control voltage | AC-15 | AC-12 | DC-13  | DC-12  |
|-----------------|-------|-------|--------|--------|
| 24 V            | 3 A   |       | 0.8 A  | 4 A    |
| 42 V            |       |       | 0.4 A  | 2 A    |
| 60 V            |       | 6.4   | 0.25 A | 0.8 A  |
| 110 V           |       | 6 A   | 0.2 A  | 0.5 A  |
| 230 V           |       |       | 0.1.0  | 0.05.4 |
| 250 V           |       |       | 0.1 A  | 0.25 A |

## 4.7.1 General information

With all types of 3VA molded case circuit breaker, a basic distinction is made between:

- Locking of molded case circuit breakers
- Interlocking of molded case circuit breakers

## 4.7.1.1 Locking

Padlock devices can be used to lock 3VA molded case circuit breakers in the OFF (O) or ON (I) position. A molded case circuit breaker cannot be operated when it is locked.

## Locking a molded case circuit breaker in the OFF (O) position



In order to prevent closure of a 3VA molded case circuit breaker, it can be locked in the OFF (O) position by a padlock. Once it is locked, the 3VA molded case circuit breaker is safely locked in the OFF (O) position. It can be unlocked again only by an authorized person.

The padlock devices for locking the 3VA molded case circuit breaker in the OFF (O) position ensure safe separation of the main contacts as defined by IEC 60947-2.



## Locking a molded case circuit breaker in the ON (I) position

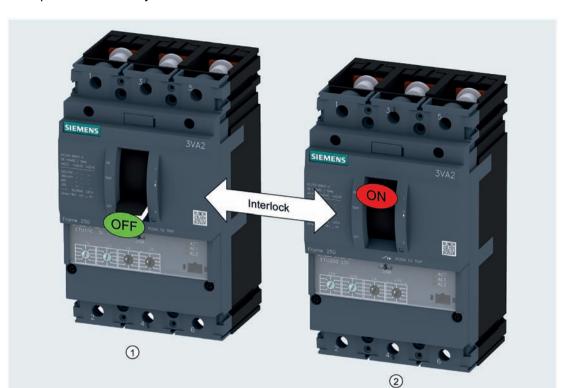
It is also possible to safely lock a 3VA molded case circuit breaker in the ON (I) position using a padlock device. The breaker contacts cannot be opened when it is locked in this position. A 3VA molded case circuit breaker can be released from its ON position again only by an authorized person.

The TRIP function, i.e. the protective functionality of the 3VA molded case circuit breaker, is not affected by locking the breaker in the ON (I) position. In the event of a fault, the 3VA molded case circuit breaker trips in the normal way.

## 4.7.1.2 Interlocking

The available interlocking devices can be used to implement a mutual interlock between at least two 3VA molded case circuit breakers.

The interlocking device only ever releases one 3VA molded case circuit breaker at a time, thereby ensuring that only the released circuit breaker can be operated. All other 3VA molded case circuit breakers remain in the safe OFF (O) position and are blocked by the interlock.



Principle of two mutually interlocked 3VA molded case circuit breakers:

- ① Molded case circuit breaker blocked/locked in the safe switching state OFF (O)
- 2 Molded case circuit breaker released for operation

The following interlocking systems are available for 3VA molded case circuit breakers:

- Front interlock
- Rear interlock

#### Front interlock

All front interlocks are installed on the front panel of the 3VA molded case circuit breaker. Front interlocks make it impossible to install some other external accessories, e.g. motor operator, rotary operators. They also partially restrict access to internal accessory compartments.

## Rear interlock

The rear interlock does not affect the front panel of the 3VA molded case circuit breaker. All components of the interlocking system are concealed behind the molded case circuit breaker or the mounting plate.

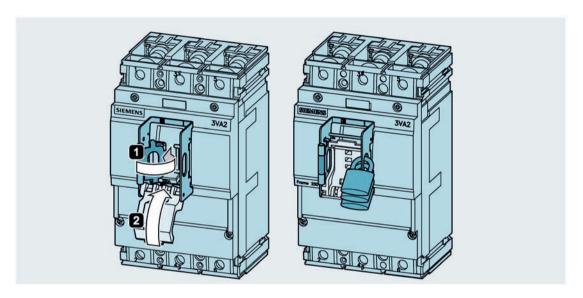
# 4.7.2 Locking

The following locking devices are available for 3VA molded case circuit breakers:

- Padlock device for the handle
- · Cylinder locks for locking the 3VA molded case circuit breaker

## 4.7.2.1 Padlock device for the handle

The padlock device for the handle is directly attached to the handle of the 3VA molded case circuit breaker and latched in place.

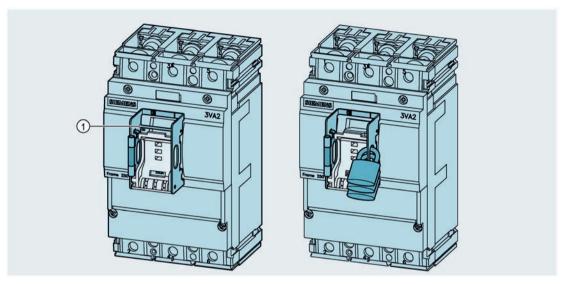


## Note

For installation instructions, please refer to operating instructions "Padlock device for the handle".

When the padlock device for the handle is installed, the 3VA molded case circuit breaker can be locked in the OFF (O) position by up to three padlocks (shackle diameter 4.5 to 8.5 mm).

If the application requires the 3VA molded case circuit breaker to be locked in the ON (I) position as well, the metal pin ① must be removed by pliers from the handle, see illustration below. This deliberate action is a safety precaution and prevents accidental locking of the breaker in the ON position.



1 Metal pin

#### Padlock devices in INSTA distribution boards

Installed padlock devices for the handle of 3VA1 molded case circuit breakers in rated current versions 100 A, 160 A and 250 A have a cover size of 45 mm. They are therefore suitable for installation in INSTA distribution boards.

#### Installation of other accessories

When the padlock device for the handle is fitted, some other accessories cannot be installed, see chapter Possible combinations of of accessories (Page 186).

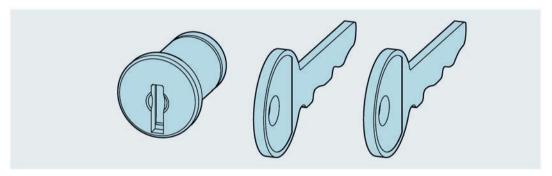
## 4.7.2.2 Cylinder locks for locking the 3VA molded case circuit breaker

The 3VA molded case circuit breaker can also be locked in the OFF (O) or ON (I) position by means of a cylinder lock (type Ronis). The 3VA molded case circuit breaker is protected against further operation once it has been locked.

Cylinder locks (type Ronis) can be fitted to all types of 3VA molded case circuit breaker. The cylinder lock is installed in an accessory compartment of the 3VA molded case circuit breaker.

To provide a cylinder lock, the following two components need to be ordered:

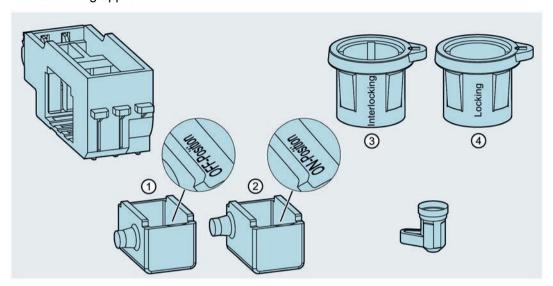
One cylinder lock (type Ronis)
 One lock and two keys are always included in the order.



Selection of the lock number is highly flexible, i.e. it can be selected from a choice of three different lock numbers. If different cylinder lock numbers are required for multiple locks, they can be selected from the predefined article numbers stated in the catalog.

## • One adapter kit

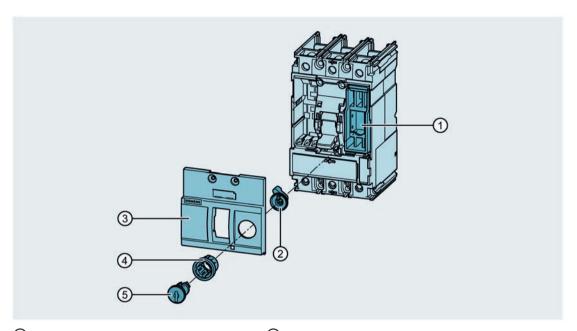
The adapter kit transfers the motion of the lock to the switching mechanism. The article number includes the adapter kit and two cylinder lock housings. One cylinder lock housing (locking) is used for locking applications and the other housing (interlocking) for interlocking applications.



- ① Slide for locking in the OFF position
- ② Slide for locking in the ON position
- 3 Cylinder lock housing for locking
- 4 Cylinder lock housing for interlocking

## Locking in the OFF (O) position

The cylinder lock (type Ronis) is installed with the adapter kit and the cylinder lock housing for locking in the right-hand accessory compartment of the 3VA molded case circuit breaker so that the breaker can be locked in the OFF (O) position. The slide for locking in the OFF position is fitted for this purpose.



- Adapter kit with OFF position slide
- 4 Cylinder lock housing for locking

2 Actuating lever

5 Cylinder lock (type Ronis)

- 3 Accessory cover
- 1. Remove the accessory cover ③ from the 3VA molded case circuit breaker.
- 2. Drill a hole through the accessory cover at the position marked on the rear face and smooth down the drilled surface with a file.
- 3. Insert a cylinder lock (type Ronis) ⑤ and the locking version of the cylinder lock housing ④ in the drilled hole and connect it securely to the accessory cover ② via the actuating lever.
- 4. Install the adapter kit ① in the right-hand accessory compartment of the 3VA molded case circuit breaker.
- 5. Reattach the accessory cover to the 3VA molded case circuit breaker.

To lock the 3VA molded case circuit breaker in the OFF (O) position, the key must be turned to the vertical "locked" position.



## Locking in the ON (I) position

For safety reasons, a deliberate action is required to lock the breaker in the ON (I) position. The slide for locking in the ON position must be used for this purpose. Further information can be found in the relevant operating instructions.

#### Use of cylinder locks (type Ronis) for other applications

Cylinder locks (type Ronis) can also be used in the following applications:

- For locking the racking distance in draw-out units, see chapter Draw-out technology (Page 285)
- For locking in the manual operators of the 3VA molded case circuit breaker, see chapter Manual operators (Page 309)

#### Installation of other accessories

The installation of the cylinder lock in the accessory compartment of the molded case circuit breaker partly excludes the installation of other accessory components, e.g. front mounted accessories such as manual and motor operators as well as front interlocks. Likewise the cylinder lock blocks slots for internal accessories (for overview see chapter Mounting locations on 3VA molded case circuit breakers (Page 191)).

## 4.7.3 Front interlocking

Front interlocks are installed on the front panel of the 3VA molded case circuit breaker.

The following interlocking devices are available for 3VA molded case circuit breakers:

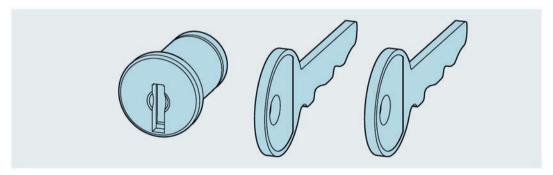
- Cylinder locks for implementing interlocks between an unlimited number of molded case circuit breakers
- Sliding bar with Bowden cable
- Sliding bar

# 4.7.3.1 Cylinder locks for implementing interlocks between multiple 3VA molded case circuit breakers

Cylinder locks (type Ronis) can be installed in the accessory compartments not only to lock molded case circuit breakers, see chapter Cylinder locks for locking the 3VA molded case circuit breaker (Page 365), but also to implement mutual interlocks between an unlimited number of 3VA molded case circuit breakers. The purpose of this system is to ensure that only one single 3VA molded case circuit breaker included in the interlock application can be in the ON (I) position at any given time.

In order to implement a mutual interlock between multiple 3VA molded case circuit breakers, the following two components must be ordered for each circuit breaker to be included in the interlock arrangement:

One cylinder lock (type Ronis)
 One lock and two keys are always included in the order.

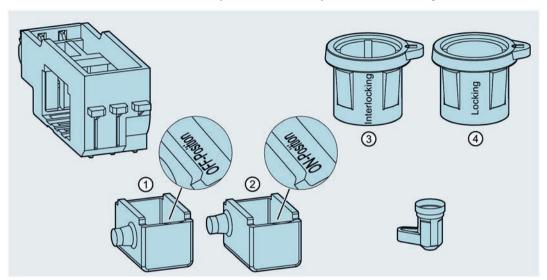


#### Note

It is important to order the same lock number for all circuit breakers to be included in the interlock arrangement!

## • One adapter kit

The adapter kit transfers the motion of the lock to the switching mechanism. The article number includes the adapter kit and two cylinder lock housings.

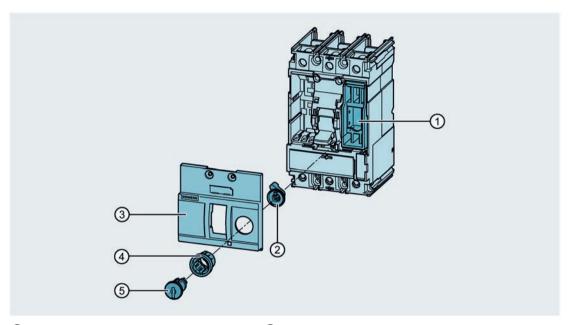


- 1 Slide for locking in the OFF position
- 2 Slide for locking in the ON position
- 3 Locking version of cylinder lock housing
- 4 Interlocking version of cylinder lock housing

If, for example, three 3VA molded case circuit breakers are to be interlocked, three cylinder locks (type Ronis) with the same lock number and 3 adapter kits suitable for the particular 3VA molded case circuit breaker must be ordered.

#### Installing the cylinder lock in the accessory compartment

The cylinder lock (type Ronis) is installed together with the adapter kit and the interlocking version of the cylinder lock housing in the right-hand accessory compartment of the molded case circuit breaker.



- 1 Adapter kit
- 2 Actuating lever
- 3 Accessory cover

- 4 Cylinder lock housing for interlocking
- ⑤ Cylinder lock (type Ronis)
- 1. Remove the accessory cover ③ from the 3VA molded case circuit breaker.
- 2. Drill a hole through the accessory cover at the position marked on the rear face and smooth down the drilled surface with a file.
- 3. Insert a cylinder lock (type Ronis) ⑤ and the interlocking version of the cylinder lock housing ④ in the drilled hole and connect it securely to the accessory cover ② via the actuating lever.
- 4. Install the adapter kit ① in the right-hand accessory compartment of the 3VA molded case circuit breaker.
- 5. Reattach the accessory cover to the 3VA molded case circuit breaker.

A cylinder lock (type Ronis) is installed at each 3VA molded case circuit breaker to be interlocked.

## Interlocking of molded case circuit breakers



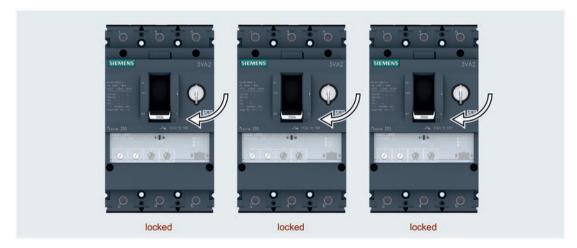
Use of more than one key poses safety hazard and/or risk of damage to property

Only leave one key in the entire interlock arrangement.

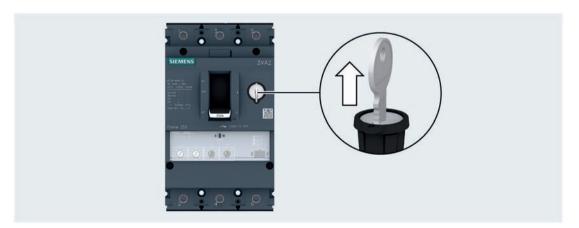
Store all other keys in a safe place or lock them away.

In order to ensure reliable functioning of the interlock, only one must remain in the entire interlock arrangement. This one key serves as the release instrument for only one molded case circuit breaker at a time.

1. Move all 3VA molded case circuit breakers in the interlock arrangement to the OFF position and lock them (turn the cylinder lock to the horizontal "locked" position).



2. Remove all keys.

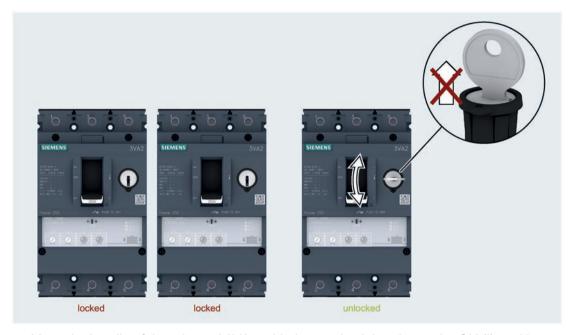


All 3VA molded case circuit breakers in the interlock arrangement are now safely locked in the OFF (O) position and cannot be operated.

3. Insert **one single** key in one circuit breaker included in the interlock; store or lock away **all other** keys.

4. Use the single key to turn the cylinder lock of the 3VA molded case circuit breaker to be released to the "unlocked" position.

Once the key is in the "unlocked" position, it must not be removed.



5. Move the handle of the released 3VA molded case circuit breaker to the ON (I) position.

## Releasing a different molded case circuit breaker

- 1. Move the handle of the currently released molded case circuit breaker to the OFF (O) position.
- Turn the cylinder lock to the vertical "locked" position and remove the key.
   This 3VA molded case circuit breaker is now safely locked in the OFF (O) position and cannot be operated.
- 3. Use the same key to turn the cylinder lock of the 3VA molded case circuit breaker to be released to the horizontal "unlocked" position.
- 4. Move the handle of the released 3VA molded case circuit breaker to the ON (I) position.

#### Interlock combinations

The following interlock combinations can be implemented with cylinder locks:

- All 3VA1 and 3VA2 molded case circuit breakers can be mutually interlocked.
- Interlocks can be implemented between all sizes of breakers.
- Mutual interlocks can be implemented between all 2-pole, 3-pole and 4-pole molded case circuit breakers.

## Installation of other accessories

When the cylinder lock is fitted in the accessory compartment of the circuit breaker, some other accessories cannot be installed, see chapter Possible combinations of of accessories (Page 186).

#### See also

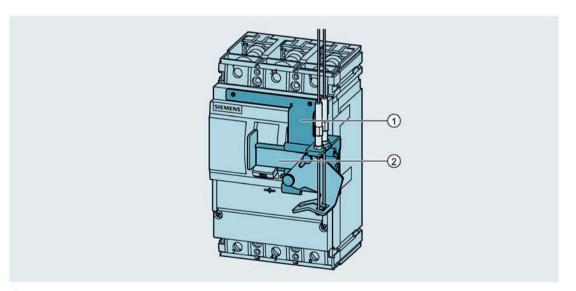
Manual operators (Page 309)

Draw-out technology (Page 285)

## 4.7.3.2 Sliding bar with Bowden cable: Modules for sliding bar with Bowden cable

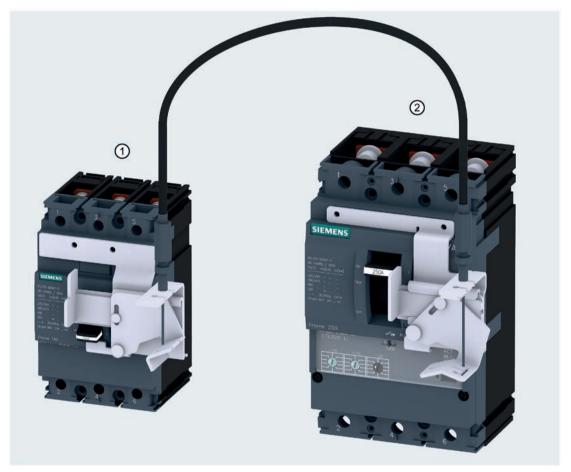
A mutual interlock between up to three molded case circuit breakers can be implemented by means of the front Bowden cable interlock module. This interlock functions according to the blocking principle: If one of the circuit breakers included in the interlock is unlocked, the Bowden cables move in such a way as to ensure that the other molded case circuit breakers are locked in the OFF (O) position.

In order to implement a front Bowden cable interlock, sliding bar modules must be mounted on the 3VA molded case circuit breakers to be included in the interlock arrangement. These modules are equipped with a handle blocking device to block or release operation of the handle.



- Sliding bar module
- Slide

A Bowden cable must be installed in addition to the sliding bar modules. This cable prevents the slides from releasing more than one molded case circuit breaker at any one time. As a result, only one 3VA molded case circuit breaker at a time can be operated and only **one** molded case circuit breaker can be in the ON (I) position.



- 1 3VA1 160 molded case circuit breaker, blocked by slide
- 2 3VA2 250 molded case circuit breaker, released by slide

#### Note

For installation instructions, please refer to operating instructions "Sliding bar modules".

## Bowden cable lengths

The following lengths of Bowden cable can be ordered:

- 0.5 m
- 1.0 m
- 1.5 m

## Interlock combinations

Interlocks can be implemented between the following 3VA molded case circuit breakers:

|  | 3VA11                |                  | 3VA13 /<br>3VA14 | 3VA20 /<br>3VA21 /<br>3VA22 | 3VA23 /<br>3VA24 | 3VA25            |
|--|----------------------|------------------|------------------|-----------------------------|------------------|------------------|
|  | 2-, 3- and<br>4-pole | 3- and<br>4-pole | 3- and<br>4-pole | 3- and<br>4-pole            | 3- and<br>4-pole | 3- and<br>4-pole |
| 3VA11<br>2-, 3- and 4-pole             |                      |                  | •                | •                           | •                |                  |
| 3VA12<br>3- and 4-pole                 |                      | 0.               | *                | •                           |                  |                  |
| 3VA13 / 3VA14<br>3- and 4-pole         |                      |                  |                  |                             | •                |                  |
| 3VA20 / 3VA21 / 3VA22<br>3- and 4-pole | •                    | *                | •                | •                           | •                |                  |
| 3VA23 / 3VA24<br>3- and 4-pole         |                      |                  |                  |                             |                  |                  |
| 3VA25<br>3- and 4-pole                 |                      |                  |                  |                             |                  | •                |

## Possible combinations of handle positions

When a cable interlock module using a Bowden cable is installed to interlock **two** 3VA molded case circuit breakers, the following combinations of handle position are possible:

| Molded case circuit breaker 1 | Molded case circuit breaker 2 |
|-------------------------------|-------------------------------|
| ON / TRIP                     | OFF                           |
| OFF                           | ON / TRIP                     |
| OFF                           | OFF                           |

When a cable interlock module using a Bowden cable is installed to interlock **three** 3VA molded case circuit breakers, the following combinations of handle position are possible:

| Molded case circuit breaker 1 | Molded case circuit breaker 2 | Molded case circuit breaker |  |  |  |  |
|-------------------------------|-------------------------------|-----------------------------|--|--|--|--|
| ON / TRIP                     | OFF                           | OFF                         |  |  |  |  |
| OFF                           | ON / TRIP                     | OFF                         |  |  |  |  |
| OFF                           | OFF                           | ON / TRIP                   |  |  |  |  |
| OFF                           | OFF                           | OFF                         |  |  |  |  |

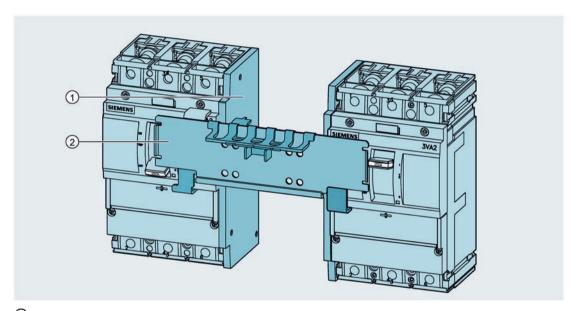
#### Installation of other accessories

When the front Bowden cable interlock module is fitted, some other accessories cannot be installed, see chapter Possible combinations of of accessories (Page 186).

## 4.7.3.3 Sliding bar

The sliding bar can be used to implement an interlock between three 3VA molded case circuit breakers of the same size. Up to three padlocks (shackle diameter of between 4.5 and 8 mm) can be attached in order to lock the bar in position.

#### Installing the sliding bar



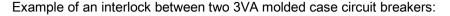
- 1 Side plate
- 2 Locking slide
- 1. Attach two side plates (1) to the sides of the 3VA molded case circuit breakers.
- 2. Attach the locking slide 2 securely to the two side plates.

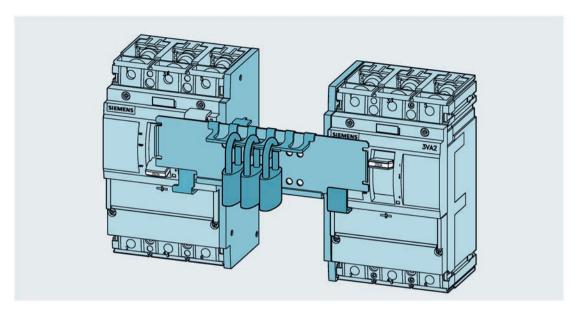
#### Locking the handle

The handle of the 3VA molded case circuit breaker to be locked is blocked when the locking slide is moved into position.

Up to three commercially available padlocks (shackle diameter 4.5 to 8 mm) can be fitted to lock the slide in position and prevent operation of the blocked handle. The blocked 3VA molded case circuit breaker is thus always locked in the safe OFF (O) position, while the released circuit breaker can still be operated.

If the locking slide is in the midway position and locked there by padlocks, both or all three of the molded case circuit breakers can be blocked or held securely in the OFF (O) position.





## Scope of supply

One article number always includes:

- 2 side plates
- 1 locking slide

## Interlock combinations

The following interlock combinations can be implemented with the sliding bar:

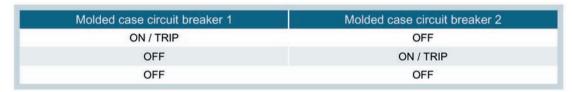
- Interlocks can be implemented between the same rated current versions of molded case circuit breakers:
  - 3VA11 with 3VA11
  - 3VA12 with 3VA12
  - 3VA13 / 3VA14 / 3VA23 / 3VA24 with 3VA13 / 3VA14 / 3VA23 / 3VA24
  - 3VA20 / 3VA21 / 3VA22 with 3VA20 / 3VA21 / 3VA22
  - Not available for 3VA25
- All 2-pole (see note below), 3-pole and 4-pole molded case circuit breakers of the same size can be interlocked.

#### Note

The 2-pole molded case circuit breaker must always be mounted on the right-hand side in the sliding bar module.

#### Possible combinations of handle positions

When a sliding bar interlock between **two** 3VA molded case circuit breakers is locked by padlocks, the following combinations of sliding bar position are possible:



When a sliding bar interlock between **three** 3VA molded case circuit breakers is locked by padlocks, the following combinations of handle position are possible:

| Molded case circuit breaker 1 | Molded case circuit breaker 2 | Molded case circuit breaker |  |  |  |  |  |
|-------------------------------|-------------------------------|-----------------------------|--|--|--|--|--|
| ON / TRIP                     | OFF                           | OFF                         |  |  |  |  |  |
| OFF                           | ON / TRIP                     | OFF                         |  |  |  |  |  |
| OFF                           | OFF                           | ON / TRIP                   |  |  |  |  |  |
| OFF                           | OFF                           | OFF                         |  |  |  |  |  |

#### Installation of other accessories

When the front handle blocking device is fitted, some other accessories cannot be installed, see chapter Possible combinations of of accessories (Page 186).

## 4.7.4 Rear interlock

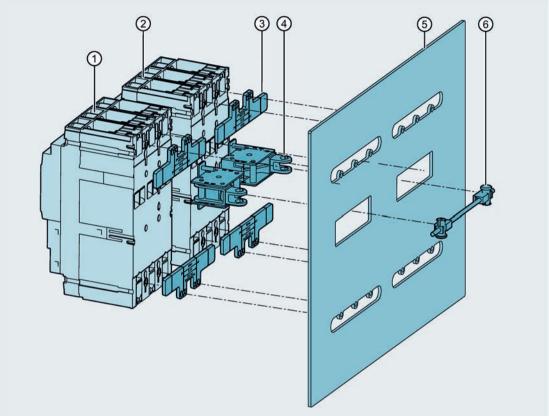
## Rear interlock

The rear interlock system is capable of creating an interlock between two 3VA molded case circuit breakers and does not restrict the number of accessories which can be assembled on the front panel of the molded case circuit breaker.

The rear interlock operates according to the following principle: When one molded case circuit breaker is closed, the other circuit breaker is prevented from closing by a tappet which engages in the breaker mechanism directly from the rear panel of the molded case circuit breaker.

The rear interlock is provided by two interlocking modules which are attached at the rear of the molded case circuit breakers and behind the mounting plate. The two interlocking modules are interconnected by means of the interlocking rod.

Machining work to the panel mounting plate is required.



- Molded case circuit breaker 1
- 2 Molded case circuit breaker 2
- 3 Mounting accessories

- 4 Interlocking modules
- ⑤ Panel mounting plate
- 6 Interlocking rod

## Note

The mounting frame for the rear interlocking rod can only be used with fixed-mounted molded case circuit breakers.

For installation instructions, please refer to the operating instructions for the rear interlock.

## Scope of supply

One article number always includes:

- Two interlocking modules
- Mounting accessories
- Interlocking rod

## Interlock combinations

The following interlock combinations are possible:

- All molded case circuit breakers 3VA11 / 3VA12 / 3VA13 / 3VA14 and 3VA20 / 3VA21 / 3VA22 / 3VA23 / 3VA24 can be independently interlocked.
- Mutual interlocks can be implemented between all 2-pole, 3-pole and 4-pole molded case circuit breakers.

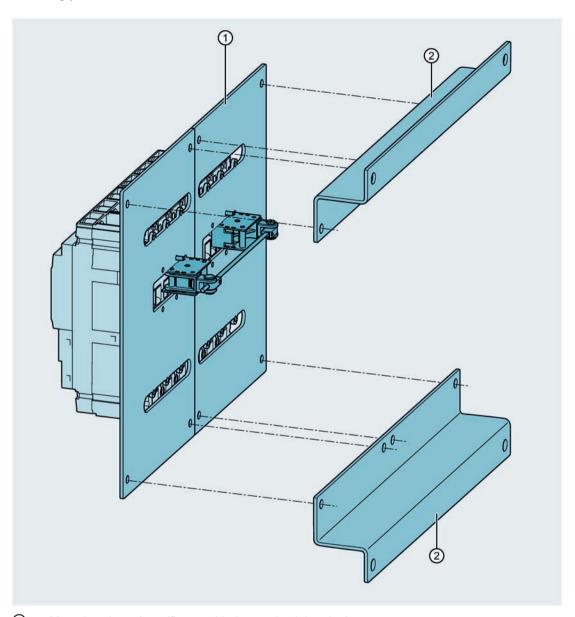
## Handle positions

When a rear interlock is installed between two 3VA molded case circuit breakers, the following combinations of handle position are possible:

| Molded case circuit breaker 1 | Molded case circuit breaker 2 |
|-------------------------------|-------------------------------|
| ON / TRIP                     | OFF                           |
| OFF                           | ON / TRIP                     |
| OFF                           | OFF                           |

## Aid to facilitate installation of rear interlock

An installation aid is available for all 3VA molded case circuit breakers. It facilitates installation of the rear interlock and reduces the amount of work required to the panel mounting plate.



- ① Mounting plates (specific to molded case circuit breaker)
- ② DIN rail

- 1. Assemble installation frame:
  - Place mounting plates ① on the molded case circuit breaker.
  - Install rear interlock.
  - Bolt the DIN rails ② to the adapter plates.
- 2. Bolt the assembled installation frame to the panel mounting plate.

No further work to the panel mounting plate is required.

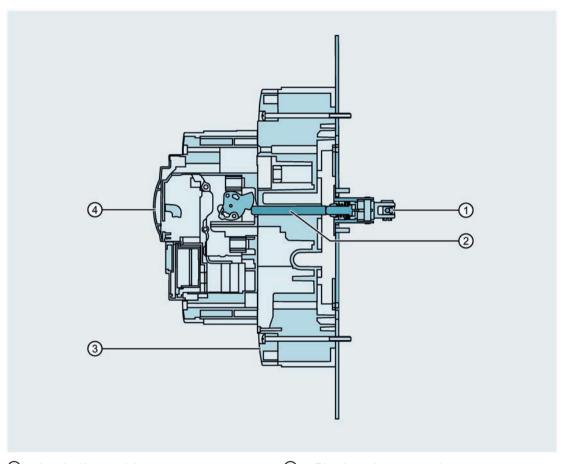
The same rear interlock combinations can be implemented regardless of whether or not the installation aid is used.

#### Note

For installation instructions, please refer to the operating instructions for the rear interlock.

## Rear interlock for plug-in and draw-out units

In order to use a rear interlock for plug-in or draw-out versions of the molded case circuit breakers, the tappet needs to be lengthened. The tappet extension transfers the interlocking motion of the modules through the plug-in socket or the draw-out socket.



- 1 Interlocking module

  - Tappet extension

2

- ③ Plug-in or draw-out socket
- 4 Molded case circuit breaker

The rear interlock for plug-in or draw-out units is available as a complete kit containing all the required components:

- Two interlocking modules
- Mounting accessories
- Interlocking rod
- All the required tappet extensions

An installation aid must be ordered separately if it is required.

## Interlock combinations

The same rear interlock combinations can be implemented for plug-in and draw-out versions as for fixed-mounted versions.

#### Note

Plug-in and draw-out technology cannot be used in conjunction with mounting plates and profile rails.

## 4.8 Residual current devices

Residual current devices afford fault protection (formerly referred to as: protection in case of indirect contact) and supplementary protection (formerly referred to as: protection in case of direct contact) in low-voltage systems. In the event of a basic insulation failure or direct contact with live components, they provide some degree of protection to persons, material assets and livestock against harm.

## Operating principle of a residual current device

In fault-free electrical installation, the vector sum of the load currents of all connected conductors equals zero. A residual current occurring in the protected circuit as the result of an insulation fault, for example, induces a voltage in the secondary winding of a summation current transformer. The evaluation electronics system monitors the induced voltage and transmits a trip command to the RCD trip unit if the trip criterion is fulfilled. The molded case circuit breaker with residual current protection combination is designed to ensure that the molded case circuit breaker contacts open if the residual current exceeds a preset value.

## 4.8.1 Portfolio

The new portfolio of residual current devices includes different RCD designs so that an optimum solution is available for every conceivable type of application. The types can be distinguished as follows:

- Designs:
  - Side mounted
  - Loadside
  - Modular

Because a wide variety of residual current waveforms (e.g. sinusoidal AC residual currents or smooth DC residual currents) can occur in different applications (depending on the electronic switch in the circuit), the following types of residual current devices are available:

- Type A
- Type B
- Type B+

Since all residual current devices can be set to between 0.03 A and maximum 5 A or 30 A, they are suitable for use in the following applications:

• Personnel protection:  $I_{\Delta n} = 30$  mA with instantaneous tripping

#### Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

- Fire protection:  $I_{\Delta n} \le 300 \text{ mA}$
- Protection in the case of indirect contact
- Ground-fault protection

While residual current devices attached to the circuit breakers are supplied with voltage from all connected phases of the system to be monitored, the modular residual current device (MRCD) is supplied from a 1-phase auxiliary voltage source (internal or external). The modular residual current device utilizes an undervoltage release (UVR) or a shunt trip.

The recommended applications for different RCD designs are thus as follows:

|   | Mounted residual current device (RCD) | Modular residual cu<br>with shunt trip | rrent device (MRCD) with undervoltage release |  |  |  |  |
|---|---------------------------------------|--|---|--|--|--|--|
| Protection in case of direct contact    | ++                                    | _                                      | ++  |  |  |  |  |
| Operational safety                      | ++                                    | +                                      | 21  |  |  |  |  |
| Integration into existing installations |                                       |  | ++  |  |  |  |  |
| Flexibility                             | +                                     |  | ++  |  |  |  |  |
| Assembly/wiring overhead                | +                                     |  | -   |  |  |  |  |

- Suitable
- Less suitable

#### 4.8 Residual current devices

#### **Sizes**



Special "BASIC" residual current devices have been developed for use with 3VA1 molded case circuit breakers.

#### Basic RCD310 and Basic RCD510



Side-mounted residual current devices are available for 3VA1 molded case circuit breakers and 3VA1 switch disconnectors with box terminals up to 250 A. These residual current devices are optimally designed for installation in distribution boards.

#### **Features**



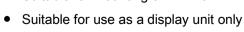
The key features of the RCD310 and RCD510 series are:

Type A





- Compact, L-shaped design
- Cover size 45 mm
- 3 and 4-pole versions
- LEDs to signal "ready" state and pre-alarms
- Tripped signal at device and via electrical contacts
- Signal must be acknowledged via the RESET button on the residual current device
- Through-hole technology allows connection of cables to circuit breaker's box terminals
- Electromagnetic release (RCR) with dual functionality
- Suitable for mounting on DIN rail



#### Special characteristics

There are two different functional types of side mounted residual current device, i.e. the RCD310 and the RCD510. The differences in functionality between these two types are explained by the list of features below.

- Time delay:
  - RCD310 without time delay (instantaneous)
  - RCD510 with an adjustable delay time Δt from 0 to 3000 ms
- · Number of poles:
  - RCD310 is available only in a 4-pole version
  - RCD510 is available in 3-pole and 4-pole versions
- Rated operating current:
  - RCD310 available only up to 160 A (3VA11)
  - RCD510 available up to 250 A
- Supplied connection technology:
  - RCD510 (3VA12 molded case circuit breaker) is supplied with the necessary connection components (1 set of box terminals).

#### **Advantages**

- Slimline, side mounted design (30 mm) leaves space for other components in the distribution board.
- The residual current devices, the 3VA1 molded case circuit breakers and the 3VA1 switch disconnectors all have a cover size of 45 mm, so that they are easy to install, for example, adjacent to miniature circuit breakers in a distribution board.
- With the DIN rail adapter accessory installed, RCD310 and RCD510 units up to 160 A can be mounted easily on a DIN rail.
  - The side mounted residual current devices also feature a screw mounting option so that they can be attached directly to a mounting plate.

#### 4.8 Residual current devices

#### Basic RCD320 and Basic RCD520



## **Features**

The key features of the RCD320 and RCD520 series are:

- Type A
- Response current I∆n adjustable in eight steps from 0.03 A to 5 A
- Compact design
- Cover size 45 mm
- 3 and 4-pole versions
- LEDs to signal "ready" state and pre-alarms
- Tripped signal at device and via electrical contacts
- Signal must be acknowledged via the RESET button on the residual current device
- Suitable for use in 1-phase and 3-phase systems

## Special characteristics

The differences between the two RCD320 and RCD520 residual current devices designed for loadside mounting are explained below:

- Time delay:
  - RCD320 without time delay (instantaneous)
  - RCD520 with an adjustable delay time Δt from 0 to 3000 ms
- Number of poles:
  - RCD320 is available only in a 4-pole version
  - RCD520 is available in 3-pole and 4-pole versions
- Rated operating current:
  - RCD320 available only up to 160 A (3VA11)
  - RCD520 available up to 250 A



#### Basic RCD520B



Residual current devices types B and B+ for loadside mounting are supplied for 3VA11 molded case circuit breakers up to 160 A.

Type B is also described as universal current sensitive. Unlike residual current devices RCD320 or RCD520, devices of the type RCD520B detect smooth DC residual currents in addition to pure sinusoidal AC residual currents and pulsating DC residual currents.

#### **Features**

The key features of the RCD520B series are:

- Types B and B+ (selectable)
- Type B+ meets the requirements for advanced preventative protection against fire according to VDE 0664-400
- Use as residual current device or residual current display unit (selectable)
- Response current I<sub>∆n</sub> adjustable in Type B: 8 steps from 0.03 A to 5 A Type B+: 4 steps from 0.03 A to 0.3 A
- Delay time Δt adjustable in 10 steps from 0 to 10000 ms
- Compact design
- Cover size 45 mm
- 3 and 4-pole versions
- LEDs to signal "ready" state, pre-alarm and MONITORING mode
- Integrated auxiliary contacts for tripped signals and pre-alarms
- Signal must be acknowledged via the RESET button on the residual current device
- Tripping by means of plunger
- Periodic self-test functions

#### Special characteristics

- Selection between type B/type B+:
  - Selection of tripping characteristic (B or B+) possible
- Selection between RCD mode and MONITORING mode:
  - RCD520B functions as a protection device in "RCD mode"
  - RCD520B functions purely as a display unit in "MONITORING mode"
- Number of poles:
  - The 3-pole version of RCD520B is installed in a 4-pole enclosure
- Rated current:
  - RCD520B available for 3VA11 (160 A) molded case circuit breaker

#### 4.8 Residual current devices

A special "ADVANCED" residual current device has been developed for use with 3VA2 molded case circuit breakers.

## **Advanced RCD820**



The RCD820 series is suitable for use in applications with exacting technical requirements:

- High residual current response values
- Long delay time settings for selective grading
- Onboard interface to a fieldbus communication system
- Graded alarm system

#### **Features**

The key features of the RCD820 series are:

- Residual current devices available with ratings up to 630 A
- Type A
- Response current I<sub>∆n</sub> adjustable in ten steps from 0.03 A to 30 A
- Delay time Δt adjustable in ten steps from 0 to 10000 ms
- 3 and 4-pole versions
- LEDs to signal "ready" state, pre-alarms and communication status
- Auxiliary contacts for tripped signals and pre-alarms
- With remote acknowledgement and remote commissioning capability
- Remote tripping possible via communication link or auxiliary contact
- Suitable for use in 1-phase and 3-phase systems
- Suitable for use as a display unit only

#### Modular residual current device







The modular residual current device (MRCD) is ideal for applications which require a high degree of flexibility. It can be retrofitted easily in an existing installation, for example, in order to provide residual current protection without the need for any major modifications to the existing application.

Thanks to its modular design, it is compatible with all breaker designs and can therefore be combined with 3VA1 molded case circuit breakers and with circuit breakers from the 3VA2 range.

#### Note

For possible combinations, please refer to Chapter Modular residual current device (Page 478). Further tested combinations available on request.

The key features of the MRCD are:

- Digital modular residual current device type A (compliant with IEC 60947-2 Annex M)
- Response current I<sub>∆n</sub> adjustable in seven steps from 0.03 A to 3 A
- Delay time Δt adjustable in twelve steps from 0 to 10 s
- Compact design
- Cover size 45 mm
- Suitable for 2-pole, 3-pole or 4-pole circuit breakers
- Summation current transformer with a diameter ranging from 35 mm to 210 mm
- Operated by means of 6 buttons
- Output of status and current measured value on color display screen
- Fault cause is displayed in the event of faults
- Two relay contacts, one for alarm (warning of continuous rise in residual current) and one for trip, which can be programmed independently of one another
- Voltage of monitored circuit up to max. 690 V AC
- For installation on 35 mm DIN rail

## 4.8 Residual current devices

## 4.8.1.1 Possible combinations of residual current devices and 3VA circuit breakers

| Overview of possil combinations of re                          |                 |    | 1          |       |                 | 3\              | /A1             |            |           |    |            |      |     |           |            | 3V  | 'A2        |      |            |      |            |
|--|-----------------|----|------------|-------|-----------------|-----------------|-----------------|------------|-----------|----|------------|------|-----|-----------|------------|-----|------------|------|------------|------|------------|
| combinations of re<br>current devices an<br>3VA circuit breake | nd              |    | j          |       |                 |                 |                 |            |           |    |            |      |     |           |            |     |            | T.   |            | 100  |            |
|  |                 |    | A10<br>0 A | 3V/   |                 |                 | A12<br>0 A      | 3V/<br>400 |           |    | A14<br>0 A | 3V/  |     | 3V/<br>16 | A21<br>0 A |     | A22<br>0 A |      | A23<br>0 A |      | A24<br>0 A |
| Residual current device  | Installation    | 3р | 4р         | 3р    | 4p              | Зр              | 4р              | 3р         | 4p        | Зр | 4p         | Зр   | 4р  | 3р        | 4р         | 3р  | 4р         | 3р   | 4р         | Зр   | <b>4</b> p |
| Basic<br>RCD310  | Side<br>mounted |    |            |       | F               |                 |                 |            |           |    |            |      |     |           |            |     |            |      |            |      |            |
| Basic<br>RCD510  | Side<br>mounted |    |            | F     | F               | F               | F               |            |           |    |            |      |     |           |            |     |            |      |            |      |            |
| Basic<br>RCD320  | Loadside        |    |            |       | F1)             |                 |                 |            |           |    |            |      |     |           |            |     |            |      |            |      |            |
| Basic<br>RCD520  | Loadside        |    |            | F1)   | F <sup>1)</sup> | F <sup>1)</sup> | F <sup>1)</sup> |            |           |    |            |      |     |           |            |     |            |      |            |      |            |
| Basic<br>RCD520B   | Loadside        |    |            | F1)2) | F1)             |                 |                 |            |           |    |            |      |     |           |            |     |            |      |            |      |            |
| Advanced<br>RCD820   | Loadside        |    |            |       |                 |                 |                 |            |           |    |            | F    | F   | F         | F          | F   | F          | F    | F          | F    | F          |
| MRCD<br>Type A   | Flexible        | F  | F          | F-    | PI              | F-P             | I-DO            | Crequ      | n<br>uest |    | On<br>uest | F-PI | -DO | F-PI      | -DO        | F-P | I-DO       | F-PI | I-DO       | F-PI | -DC        |
| MRCD<br>Type B   | Flexible        | F  | F          | F-    | PI              | 44 T P L TO 1   | On<br>uest      | 355 557    | n<br>uest |    | On<br>uest | F-PI | -DO | F-PI      | -DO        | F-P | I-DO       | F-PI | I-DO       | F-PI | l-DC       |

3p 3-pole

4p 4-pole

F Fixed-mounted circuit breaker

PI Plug-in circuit breaker
DO Draw-out circuit breaker

1) Cannot be combined with switch disconnector

<sup>2)</sup> 3-pole version in 4-pole enclosure

# 4.8.2 Residual current devices for mounting on circuit breakers

The RCD310, RCD510, RCD320, RCD520, RCD520B and RCD820 residual current devices are available as accessories for mounting on specific 3VA molded case circuit breakers up to the largest circuit breaker size/current rating.

# Combination with circuit breakers

After a residual current device has been mounted on a molded case circuit breaker or switch disconnector, the specifications of the breaker or disconnector remain unchanged with respect to the following characteristics:

- Standards
- Conductor cross-sections
- Use of connection accessories
- Isolating features
- Selective behavior

When a basic type residual current device is mounted on a 3VA1 molded case circuit breaker or a 3VA1 switch disconnector, the electrical rating of the equipment combination is automatically downgraded to the lower electrical rating of the residual current device.

Example:

U<sub>e</sub>: 3VA1  $\leq 690 \text{ V AC}$  3VA1 and Basic residual current device  $\leq 480 \text{ V AC}$ 

For more information, refer to chapter Technical specifications (Page 472).

#### Residual current devices

#### **Standards**

The combination of molded case circuit breaker and residual current device conforms to IEC 60947-2 Annex B.

#### Power supply

The residual current devices do not require an external power supply, but tap a supply from the main current paths of the molded case circuit breaker or switch disconnector.

# Guaranteed to function properly

Proper functioning of the residual current device is guaranteed even with only one phase and N (applies to RCD320, RCD520, RCD520B and RCD820) or two phases (alternating current or pulsating direct voltage).

#### Direction of incoming supply

The direction of incoming supply to the combination of circuit breaker and residual current device is optional, i.e. it can be connected at the top or bottom. The performance of the residual current devices is not impaired by regenerative feedback from motors.

#### Device type

Residual current devices without an additional letter at the end of the short code (e.g. RCD520) meet the requirements for device type A, i.e. they are capable of detecting all sinusoidal AC residual currents and pulsating DC residual currents.

The letter B at the end of the short code (e.g. RCD520B) indicates that it is a universal current-sensitive residual current device (type B or B+).

#### Combination with external accessories

#### **DIN** rail adapters

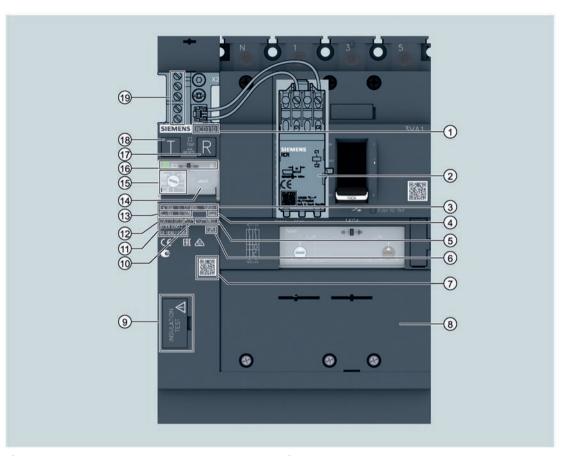
DIN rail adapters are available as accessories for side-mounted residual current devices RCD310 and RCD510 up to 160 A. These permit fast and easy installation of residual current devices on 35 mm DIN rails compliant with IEC / EN 60715 TH35-7.5 and TH35-15.

You can find more information in chapter DIN rail adapter (Page 531).

# 4.8.2.1 Side mounted residual current devices Basic RCD310 and Basic RCD510

# Front view of Basic RCD310 and Basic RCD510

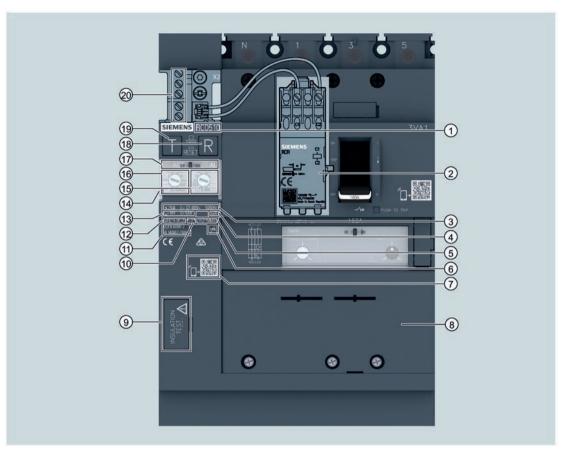
#### **RCD310**



- 1 Type designation
- ② Electromagnetic release (RCR = Residual Current Release)
- Maximum rated operational current, rated operational voltage and frequency
- 4 Device type
- 5 Location and date of manufacture
- 6 Only suitable for use in 3-phase systems
- 7 Knowledge Manager
- Contact hazard protective cover over main current paths with sealing option
- Oircuit breaker
- ① Product version

- 1 Standard
- 2 Article number
- Rated insulation voltage and rated impulse strength
- (4) Transparent protective cover over setting buttons
- (5) Setting button for response current
- (6) LED: ACTIVE and pre-alarm
- RESET button / tripped display
- 18 Test button (test device)
- ① Auxiliary contacts

#### **RCD510**



- 1 Type designation
- ② Electromagnetic release (RCR = Residual Current Release)
- 3 Maximum rated operational current, rated operational voltage and frequency
- 4 Device type
- (5) Location and date of manufacture
- 6 Only suitable for use in 3-phase systems
- 7 Knowledge Manager
- (8) Contact hazard protective cover over main current paths with sealing option
- Oircuit breaker
- Product version

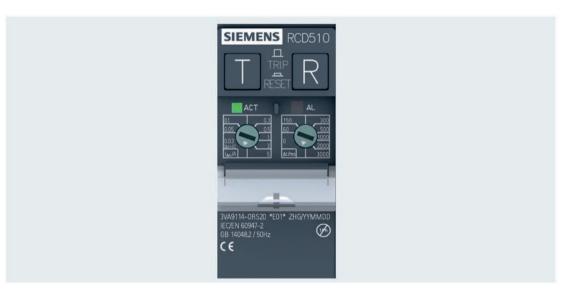
- 11) Standard
- (2) Article number
- Rated insulation voltage and rated impulse strength
- Transparent protective cover over setting buttons
- 15 Setting button for delay time
- 16 Setting button for response current
- 17 LED: ACTIVE and pre-alarm
- 18 RESET button / tripped display
- Test button (test device)
- ② Auxiliary contacts

# Description of front panel view

# Display elements

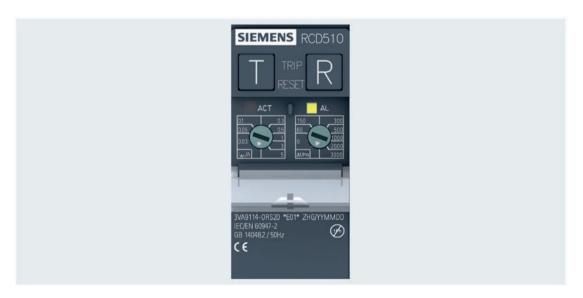
# "Ready" signals and alarms

"Ready" signal of the residual current device:
 The LED labeled "ACT" stands for ACTIVE and lights up when the residual current device is ready.



# • Pre-alarm:

Both the Basic RCD310 and the Basic RCD510 feature an alarm LED labeled "AL" (prealarm) which lights up promptly to indicate potential shutdown of the installation due to residual current.



# LED displays

| ED    | Status               | Description   |  |  |
|-------|----------------------|---|--|--|
| ☐ ACT | Off                  | Residual current device is not in operation   |  |  |
| ACT   | Flashing             | Residual current device is malfunctioning   |  |  |
| ACT   | On                   | Residual current device is operating normally   |  |  |
| ACT   | On<br>On             | The residual current $\rm I_{\Delta}$ is higher than 30 % of the set response current (I_{\Delta n} value)  |  |  |
| ACT   | Flashing<br>Flashing | Possible causes: - The residual current device is defective - The white setting arrow of the I <sub>Δn</sub> or Δt setting button is resting between two setting ranges |  |  |

# Tripped display

The <RESET> button is not only used to reset the residual current device, but also as a mechanical indication that the unit has "tripped". If a residual current is detected or the button <TEST> is pressed, the button <RESET> is automatically released and so signals that the residual current device has tripped. Even when the residual current device is at zero potential, the <RESET> remains in the "TRIP" position.

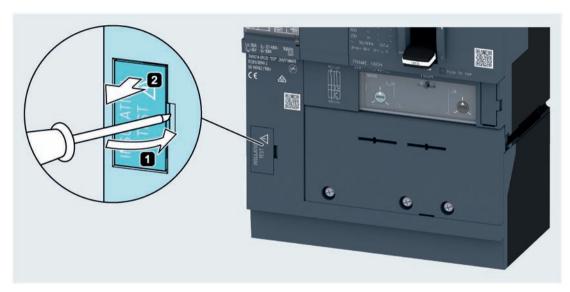


- Residual current device is operating normally and has not tripped
- ② Residual current device has tripped

# Operator controls

#### Insulation tests

It is absolutely essential to isolate the evaluation electronics circuit while insulation tests are in progress in order to protect the circuit against potential damage on the one hand and to prevent detection of insulation faults due to the power pack on the other. This is done simply by withdrawing (15 to 17 mm) the circuit breaker which is anchored in the enclosure.



Disconnection of the main conductor connections is thus unnecessary. On completion of the tests, the circuit breaker must be pushed back into position before the residual current device is commissioned.

#### Testing and resetting the residual current device

#### **Testing**

Depending on operating conditions, the test button on the front panel of the residual current device should be pressed in order to function-test the device. The test button is labeled with the letter "T". If the test button is pressed, the device is tested immediately irrespective of the current delay time setting.

If the test button is pressed, a residual current is simulated on a test winding attached to the summation current transformer. If the residual current device is functioning properly, it must trip the molded case circuit breaker/switch disconnector.

The test button must be held down for at least two seconds. The design of the test button prevents unintentional actuation.

# Note

The residual current device can be successfully tested only if it is connected to a voltage equal to at least 85% of the minimum rated operational voltage.

#### Resetting

If the residual current device trips the molded case circuit breaker/switch disconnector due to a high residual current or actuation of the test button, the <RESET> button on the RCD is released. At the same time, the trip alarm switch which is mechanically coupled with the <RESET> button also signals that a trip has occurred.

The <RESET> button is labeled with the letter "R".

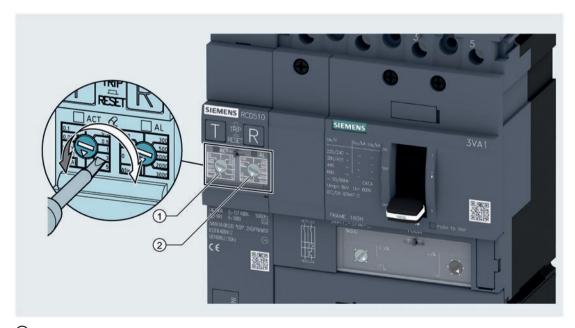
The following actions must be taken in order to reset the residual current device and reclose the main contacts of the molded case circuit breaker:

- Press the <RESET> button on the residual current device.
   The "tripped" signal at the signaling contacts is canceled, the residual current device is now reset.
- 2. Reset and switch on the molded case circuit breaker or switch disconnector.

#### Note

If the main contacts of the molded case circuit breaker/switch disconnector are closed before the residual current device has been reset, the molded case circuit breaker/switch disconnector will be tripped again immediately (approx. 0.8 s) by the residual current device. This also applies if the fault which leads to the trip has already been rectified.

#### Parameterization of the residual current device



- Setting button for response current I<sub>∆n</sub>
- ② Setting button for delay time Δt (RCD510 only)

#### Button for setting the response current IAn

The response current can be set in eight steps, ranging from 0.03 A to maximum 5 A. Each response current has a dedicated setting range. The corresponding response current is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device is automatically set to 0.03 A for safety reasons.

If the response current is set to 0.03 A, the delay time setting  $\Delta t$  is deactivated and the breaker is tripped instantaneously. in order to afford personal protection in the case of direct contact.

#### Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

The factory setting for the response current is 0.03 A.

# Button for setting the delay time Δt (RCD510 only)

The delay time on RCD510 units can be set in eight steps, ranging from 0 (instantaneous) to a maximum value of 3000 ms.

Each delay time has a dedicated setting range. The corresponding delay time is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device trips instantaneously in response to residual currents.

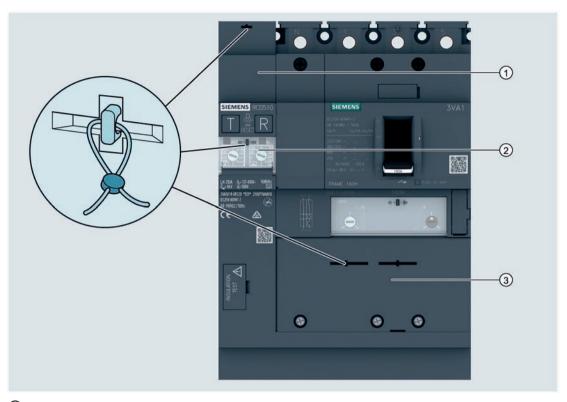
The factory setting for the delay time is 0 ms.

The delay time is not adjustable on the RCD310. The RCD310 always trips instantaneously.

#### Possible procedure for setting the response current and the delay time

- 1. Switch off the molded case circuit breaker/switch disconnector.
- 2. Open the transparent protective cover over the setting buttons.
- 3. Adjust the setting values for response current and delay time on the residual current device to the maximum value in each case.
- Switch on the molded case circuit breaker/switch disconnector.
   The LED labeled "ACT" on the residual current device now lights up, the residual current device is ready.
- 5. Reduce the setting for the response current until the LED labeled "AL" lights up. The residual current is now 30% higher than the response current setting.
- 6. By turning the setting button clockwise, set the next higher response current. The LED "AL" goes out, the correct response current is now set.
- 7. Set the required delay time.
- 8. Close the transparent protective cover over the setting buttons. The device is now fully parameterized.

# Sealable protective covers of the residual current device



- ① Contact hazard protective cover over auxiliary contacts
- 2 Transparent protective cover over setting buttons
- 3 Contact hazard protective cover over main current paths

# Transparent protective cover over setting buttons

In order to prevent unauthorized access to the setting buttons for  $I_{\Delta n}$  and  $\Delta t$ , the transparent cover over the settings buttons can be optionally sealed.

# Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

#### Contact hazard protective cover over main current paths including sealing option

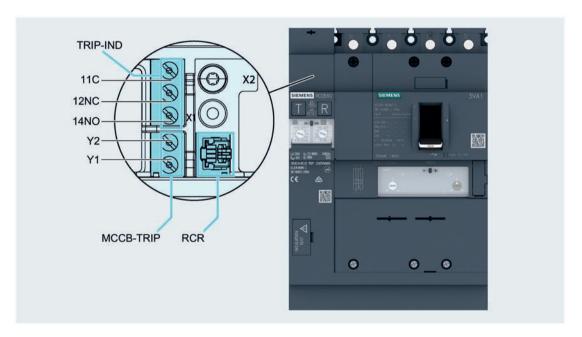
After the residual current device RCD310 or RCD510 has been mounted on the 3VA1 molded case circuit breaker or 3VA1 switch disconnector, a contact hazard protective cover is installed over the main current paths to protect against direct contact. This cover can be sealed optionally in order to block any attempt to dismantle the residual current device from the molded case circuit breaker/switch disconnector.

#### **Terminals**

#### Note

Cables for the following terminals must be routed separately from the main circuits. Their maximum cable length is 300 m.

A number of auxiliary contacts which perform different functions are located underneath a contact hazard protective cover:



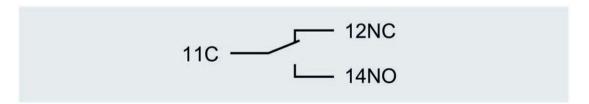
# Alarm switches

TRIP-IND (TRIP INDICATOR)

A tripped signal can be output via the floating contact for display via a warning lamp, for example. This trip alarm switch operates as soon as the residual current exceeds the response current setting value and has therefore caused the residual current device to trip.

The standard trip alarm switch has changeover contacts and screw-type connections.

The terminal designations of the relevant contact are shown in the diagram below.



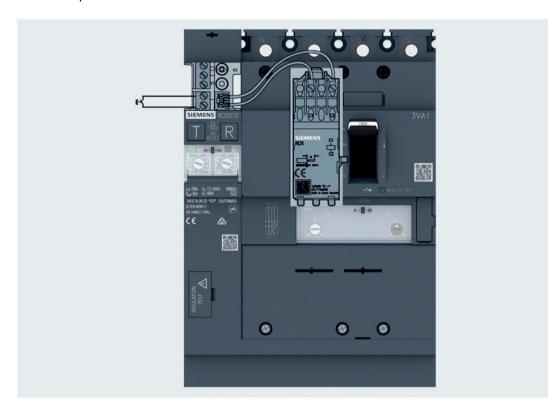
#### External control of the residual current release (RCR)

#### MCCB-TRIP

Although the RCR is utilized by the residual current device, it can also be accessed externally via a floating contact by means of the auxiliary contact MCCB-TRIP. The floating contact must be capable of switching a 5 mA current with a voltage supply of 24 V DC.

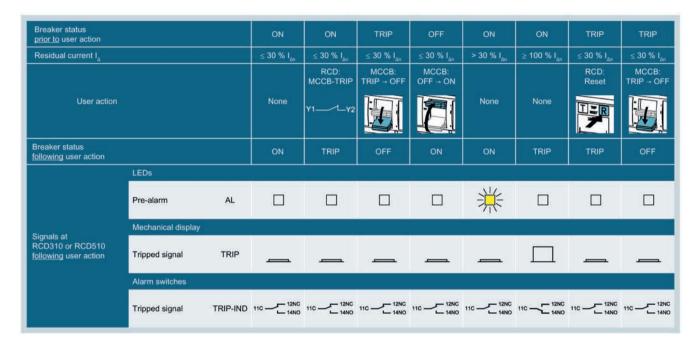
The RCR functions as a shunt trip, allowing the circuit breaker to be tripped by remote control. External tripping of the molded case circuit breaker or switch disconnector via the RCR does not affect the residual current device. In other words, neither the "tripped" display on the residual current device nor the auxiliary contacts for the "tripped" signal are activated in the event of an external trip.

It is not possible, however, to connect the contacts named above of several residual current devices in parallel.



# Status indicators

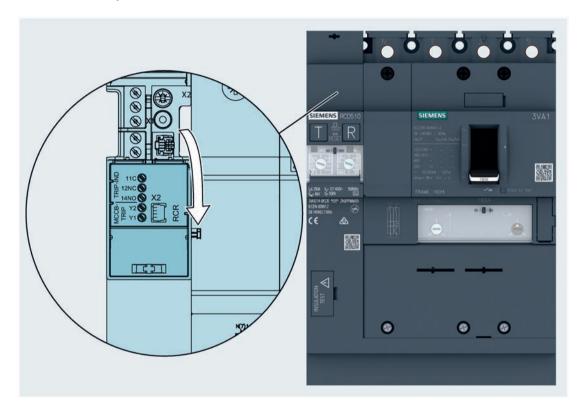
The table below illustrates the behavior of pre-alarm and tripped signals on RCD310 and RCD510 devices in response to various user actions and residual currents.



# Terminal labeling and cable installation

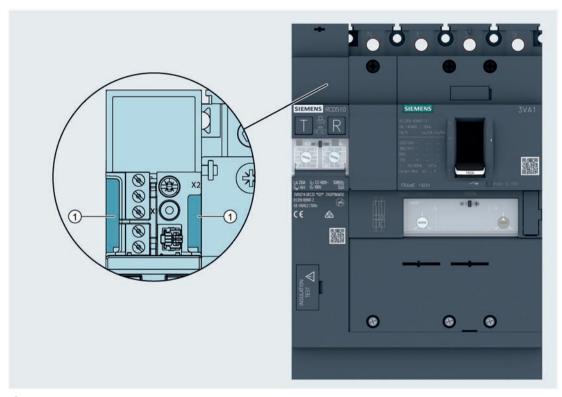
# Labeling of terminals

The labels for individual terminals are printed on the rear of the contact hazard protection cover for auxiliary contacts.



#### Cable installation

Cable ducts for bringing out cables are provided to the left and right on the residual current device.



1 Cable duct

# Other labels on front panel

# **Approvals**

The residual current device bears the CE mark. For an overview of all approvals, please refer to Appendix (Page 647).

For all queries relating to approvals, please contact Technical Support (Page 10).

# **Technical specifications**

In  $\leq \dots$ A: Specifies the highest permissible rated operational current of the molded case circuit breaker/switch disconnector with which the residual current device may be combined.

 $\begin{array}{ll} \mbox{Ue} \sim ... \mbox{V:} & \mbox{Specifies the operating voltage range of the residual current device.} \\ \mbox{... \mbox{Hz:}} & \mbox{Specifies the operating frequency range of the residual current device.} \\ \end{array}$ 

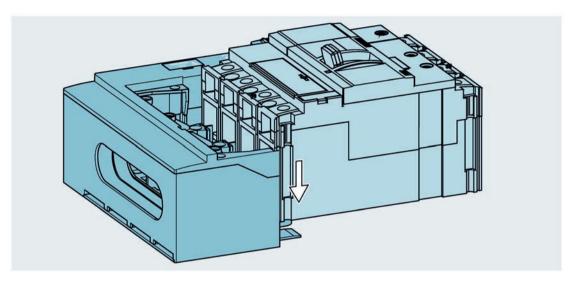


Denotes the response behavior to residual currents.

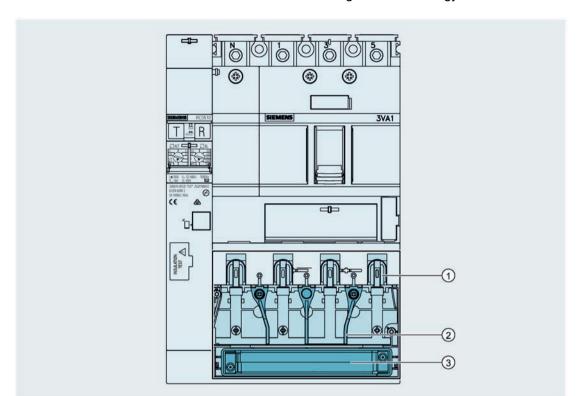
# Installation

The side mounted residual current device is attached to the left-hand side of the molded case circuit breaker or switch disconnector. No tools are required:

- 1. Push the molded case circuit breaker/switch disconnector onto the residual current device along the guides at the top.
- 2. Push the molded case circuit breaker/switch disconnector backwards until its rear panel is flush with the rear panel of the residual current device.



- 3. Place the contact hazard protective cover over the circuit breaker/RCD assembly.
- 4. Attach the assembly to a mounting plate using the mounting screws or mount it on a DIN rail adapter.



The side mounted residual current devices feature through-hole technology.

- 1 Box terminals of the molded case circuit breaker
- 2 Phase barriers
- 3 Summation current transformer

With this technology, the cables are simply guided through the summation current transformer 3 and connected directly to the box terminals 1 of the molded case circuit breaker or switch disconnector.

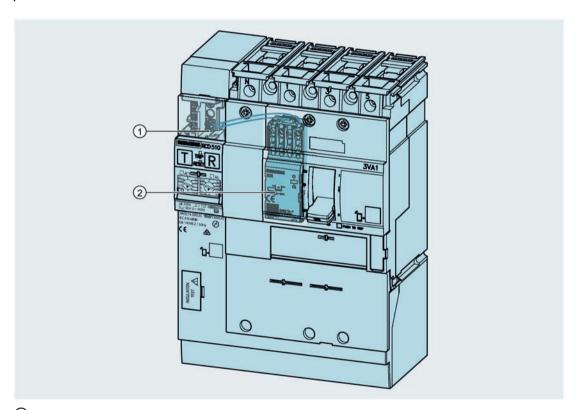
The phase barriers ② not only ensure safe operation, but also serve as a guide for correct routing of cables.

# **Tripping**

In the event of a fault, the side mounted residual current device employs a residual current release (RCR) to trip the molded case circuit breaker or switch disconnector. This release is installed in the accessory compartment to the left of the handle.

The RCR and the connecting cable are included in the scope of supply of the side mounted residual current device.

The release is connected to the "RCR" contacts on the residual current device via a plug-in connection and receives a trip command if the residual current reaches or exceeds the preset value.



- 1 Plug-in connection for RCR
- ② RCR

# Use of the residual current device as a pure display unit

The RCD310 and RCD510 residual current devices can also operate as pure display units without a tripping function, i.e. they detect and signal residual currents, but do not trip the molded case circuit breaker or switch disconnector and therefore do not interrupt the circuit.

To operate the RCD310 or RCD510 purely as a display unit, the residual current release (RCR) and its connecting cable are not installed. The residual current device can perform all its normal functions, e.g. status signaling, in "display mode."

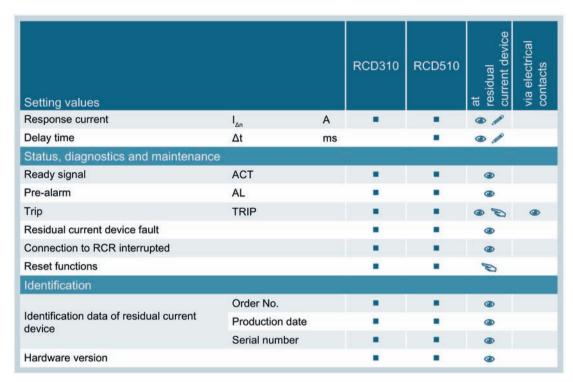


#### Note

Because the RCR and its connecting cable have not been installed, the LED "ACT" flashes continuously.

# **Function overview**

The table below provides an overview of all the functions and data which are available in the residual current device environment:



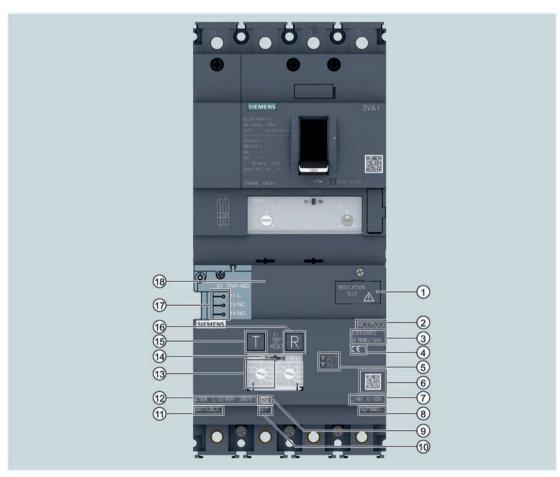
- Value can be read
- Value can be edited
- Commands

# 4.8.2.2 Loadside residual current devices Basic RCD320 and Basic RCD520

Loadside residual current devices are also available to order for 3VA1 molded case circuit breakers.

# Front view of Basic RCD320 and Basic RCD520

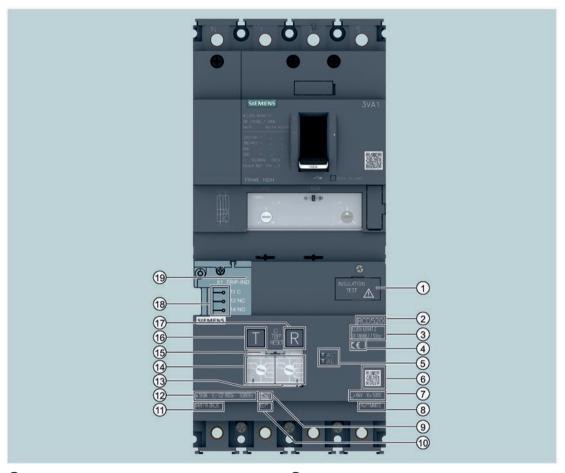
# RCD320



- 1 Circuit breaker
- ② Type designation
- 3 Standard
- 4 Approvals
- ⑤ LED: ACTIVE and pre-alarm
- 6 Knowledge Manager
- Rated insulation voltage and rated impulse strength
- 8 Location and date of manufacture
- 9 Device type
- ① Product version

- 1 Article number
- Maximum rated operational current, rated operational voltage and frequency
- (3) Setting button for response current
- Transparent protective cover over setting buttons
- 15 Test button (test device)
- 16 RESET button / tripped display
- Auxiliary contacts
- ® Contact hazard protective cover over main current paths with sealing option

#### **RCD520**



- ① Circuit breaker
- 2 Type designation
- 3 Standard
- 4 Approval
- (5) LED: ACTIVE and pre-alarm
- 6 Knowledge Manager
- Rated insulation voltage and rated impulse strength
- 8 Location and date of manufacture
- 9 Device type
- 10 Product version

- 1 Article number
- Maximum rated operational current, rated operational voltage and frequency
- Setting button for delay time
- (4) Setting button for response current
- (5) Transparent protective cover over setting buttons
- 16 Test button (test device)
- TRESET button / tripped display
- Auxiliary contacts
- Contact hazard protective cover over main current paths with sealing option

# Description of front panel view

# Display elements

# "Ready" signals and alarms

"Ready" signal of the residual current device:
 The LED labeled "ACT" stands for ACTIVE and lights up when the residual current device is ready.



#### Pre-alarm:

Both the Basic RCD320 and the Basic RCD520 feature an alarm LED labeled "AL" (prealarm) which lights up promptly to indicate potential shutdown of the installation due to residual current.



# LED displays

| LED |           | Status               | Description  |  |  |
|-----|-----------|----------------------|--|--|--|
|     | ACT       | Off                  | Residual current device is not in operation  |  |  |
|     | ACT       | Flashing             | Residual current device is malfunctioning  |  |  |
| 祟   | ACT       | On                   | Residual current device is operating normally  |  |  |
| 崇   | ACT<br>AL | On<br>On             | The residual current $\rm I_\Delta$ is higher than 30 % of the set response current ( $\rm I_{\Delta n}$ value)  |  |  |
|     | ACT<br>AL | Flashing<br>Flashing | Possible causes: - The residual current device is defective - The white setting arrow of the $I_{\Delta n}$ or $\Delta t$ setting button is resting between two setting ranges |  |  |

# Tripped display

The <RESET> button is not only used to reset the residual current device, but also as a mechanical indication that the unit has "tripped". If a residual current is detected or the button <TEST> is pressed, the button <RESET> is automatically released and so signals that the residual current device has tripped. Even when the residual current device is at zero potential, the <RESET> remains in the "TRIP" position.

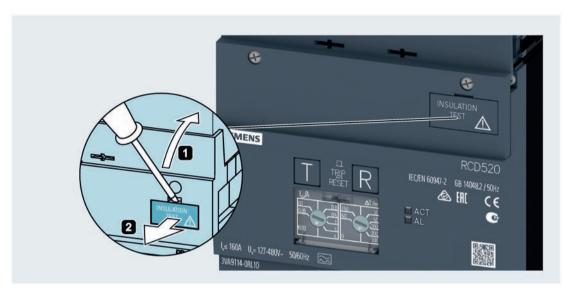


- Residual current device is operating normally and has not tripped
- ② Residual current device has tripped

# Operator controls

#### Insulation tests

It is absolutely essential to isolate the evaluation electronics circuit while insulation tests are in progress in order to protect the circuit against potential damage on the one hand and to prevent detection of insulation faults due to the power pack on the other. This is done simply by withdrawing (15 - 17 mm) the circuit breaker which is anchored in the enclosure.



Disconnection of the main conductor connections is thus unnecessary. On completion of the tests, the circuit breaker must be pushed back into position before the residual current device is commissioned.

#### Testing and resetting the residual current device

# **Testing**

Depending on operating conditions, the test button on the front panel of the residual current device should be pressed in order to function-test the device. The test button is labeled with the letter "T". If the test button is pressed, the device is tested immediately irrespective of the current delay time setting.

If the test button is pressed, a residual current is simulated on a test winding attached to the summation current transformer. If the residual current device is functioning properly, it must trip the molded case circuit breaker.

The test button must be held down for at least 2 seconds. The design of the test button prevents unintentional actuation.

#### Note

The residual current device can be successfully tested only if it is connected to a voltage equal to at least 85% of the minimum rated operational voltage.

#### Resetting

If the residual current device trips the molded case circuit breaker due to a high residual current or actuation of the test button, the <RESET> button on the RCD is released ("RCD" mode must be selected). At the same time, the trip alarm switch which is mechanically coupled with the <RESET> button also signals that a trip has occurred.

The <RESET> button is labeled with the letter "R".

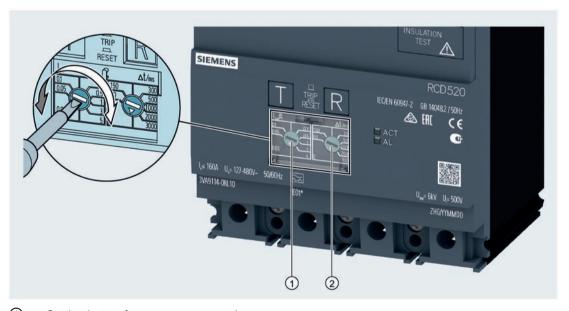
The following actions must be taken in order to reset the residual current device and reclose the main contacts of the molded case circuit breaker:

- Press the <RESET> button on the residual current device.
   The "tripped" signal at the signaling contacts is canceled, the residual current device is now reset.
- 2. Reset and switch on the molded case circuit breaker.

#### Note

The molded case circuit breaker cannot be switched on before the <RESET> button on the residual current device has been actuated and a residual current is no longer present  $(I_{\Delta n} > I_{\Delta})$ .

#### Parameterization of the residual current device



- ① Setting button for response current  $I_{\Delta n}$
- ② Setting button for delay time Δt (RCD520 only)

#### Button for setting the response current IAn

The response current can be set in eight steps, ranging from 0.03 A to maximum 5 A. Each response current has a dedicated setting range. The corresponding response current is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device is automatically set to 0.03 A for safety reasons.

If the response current is set to 0.03 A, the delay time setting is deactivated and the breaker is tripped instantaneously in order to afford personal protection in the case of direct contact.

#### Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

The factory setting for the response current is 0.03 A.

#### Button for setting the delay time Δt (RCD520 only)

The delay time on the RCD520 residual current device can be set in eight steps, ranging from 0 (instantaneous) to a maximum value of 3000 ms.

Each delay time has a dedicated setting range. The corresponding delay time is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device trips instantaneously in response to residual currents.

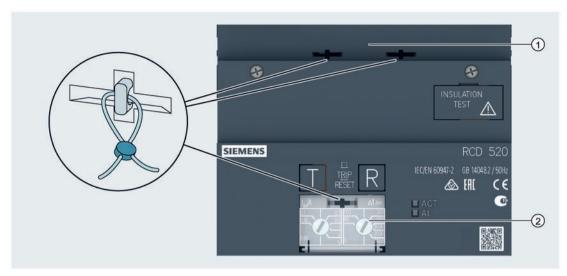
The factory setting for the tripping delay is 0 ms.

The delay time is not adjustable on the RCD320. The RCD320 always trips instantaneously.

#### Possible procedure for setting the response current and the delay time

- 1. Switch off the molded case circuit breaker.
- 2. Open the transparent protective cover over the setting buttons.
- 3. Adjust the setting values for response current and delay time on the residual current device to the maximum value in each case.
- Switch on the molded case circuit breaker.
   The LED labeled "ACT" on the residual current device now lights up, the residual current device is ready.
- 5. Reduce the setting for the response current until the LED labeled "AL" lights up. The residual current is now 30% higher than the response current setting.
- 6. By turning the setting button clockwise, set the next higher response current. The LED "AL" goes out, the correct response current is now set.
- 7. Set the required delay time.
- 8. Close the transparent protective cover over the setting buttons. The device is now fully parameterized.

# Sealable protective covers of the residual current device



- ① Contact hazard protective cover over main current paths and auxiliary contacts
- 2 Transparent protective cover over setting buttons

#### Transparent protective cover over setting buttons

In order to prevent unauthorized access to the setting buttons for  $I_{\Delta n}$  and  $\Delta t$ , the transparent cover over the settings buttons can be optionally sealed.

#### Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

# Contact hazard protective cover over main current paths and auxiliary contacts including sealing option

After the residual current device RCD320 or RCD520 has been mounted on the 3VA1 molded case circuit breaker, a contact hazard protective cover is installed over the main current paths to protect against direct contact. This cover can be sealed optionally in order to block any attempt to dismantle the residual current device from the molded case circuit breaker.

#### **Terminals**

#### Note

Cables for the following terminals must be routed separately from the main circuits. Their maximum cable length is 300 m.

A number of auxiliary contacts which perform different functions are located underneath the contact hazard protective cover:



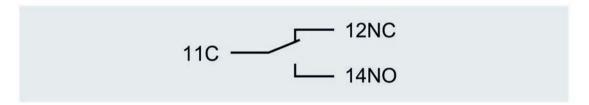
# Alarm switch

TRIP-IND (TRIP INDICATOR)

A tripped signal can be output via the floating contact for display via a warning lamp, for example. This trip alarm switch operates as soon as the residual current exceeds the response current setting value and has therefore caused the residual current device to trip.

The standard trip alarm switch has changeover contacts and screw-type connections.

The terminal designations of the relevant contact are shown in the diagram below.



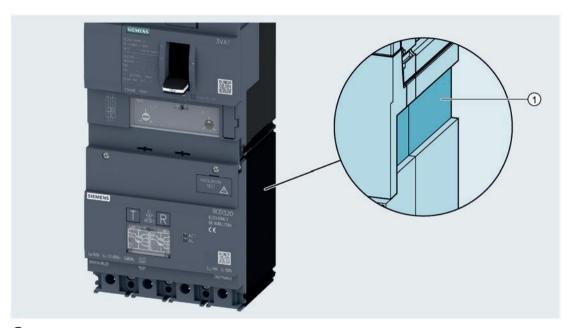
# Status indicators

The table below illustrates the behavior of pre-alarm and tripped signals on RCD320 and RCD520 devices in response to various user actions and residual currents.



#### Cable installation

Cable ducts for bringing out cables are provided to the left and right on the residual current device.



1 Cable duct

# Other labels on front panel

# **Approvals**

The residual current device bears the CE mark. For an overview of all approvals, please refer to Appendix (Page 647).

For all queries relating to approvals, please contact Technical Support (Page 10).

# **Technical specifications**

In  $\leq$  ...A: Specifies the highest permissible rated operational current of the molded case circuit breaker with which the residual current device may be combined.

Ue ~ ...V: Specifies the operating voltage range of the residual current device.

...Hz: Specifies the operating frequency range of the residual current device.

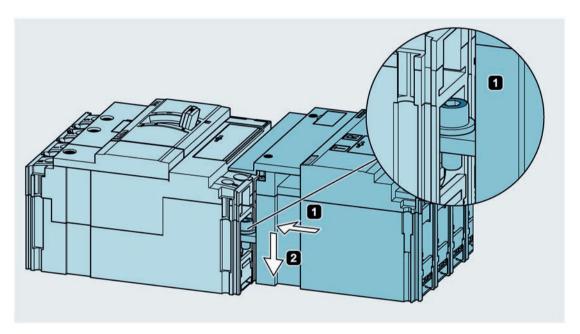
Denotes the response behavior to residual currents.

#### Installation

#### Installation

Regardless of the type of connection technology installed on the 3VA1 molded case circuit breaker, the residual current devices RCD320 and RCD520 are mounted on the load side (i.e. beneath the thermal-magnetic trip unit) of the breaker:

- 1. Dismantle the loadside connection components of the molded case circuit breaker and install the supplied connection components for the residual current device.
- 2. Insert the residual current device into the T slots of the molded case circuit breaker.



- 3. Push the residual current device backwards until its rear panel is flush with the rear panel of the molded case circuit breaker.
- 4. Screw the molded case circuit breaker to the residual current device. Special connecting screws are provided on the line side of the residual current device for this purpose.
- 5. Place a contact hazard protective cover over the circuit breaker/RCD assembly.
- 6. Reinstall the loadside connection components of the molded case circuit breaker at the outgoing feeder end of the residual current device.
- 7. Attach the assembly to a mounting plate using the mounting screws.

#### Note

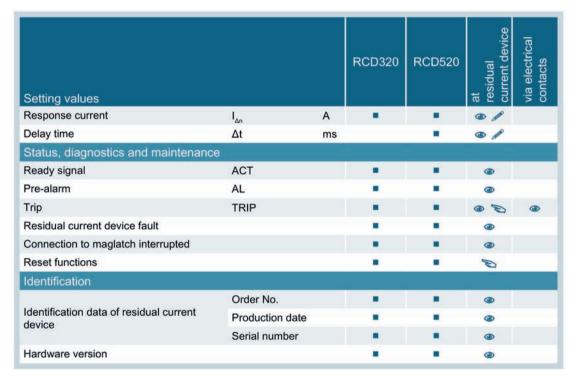
Since the outgoing feeder end of the residual current device has exactly the same connection contours as the 3VA1 molded case circuit breaker, all connection accessories, e.g. phase barrier, terminal cover, can also be mounted on the residual current device.

# **Tripping**

The molded case circuit breaker is tripped by means of a direct-acting tappet which engages in the breaker mechanism from the residual current device. The electromagnetic trip unit is integrated in the residual current device.

# **Function overview**

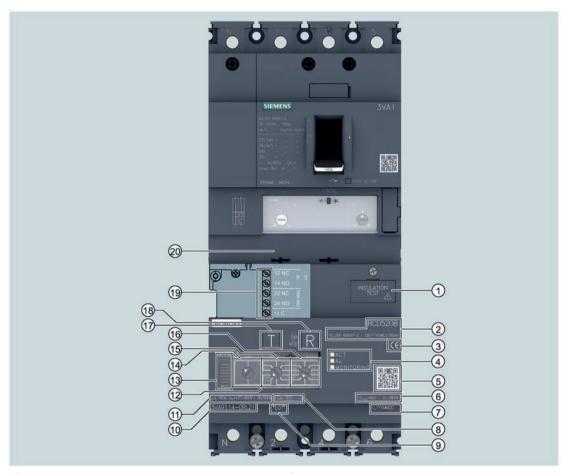
The table below provides an overview of all the functions and data which are available in the residual current device environment:



- Value can be read
- Value can be edited
- Commands

# 4.8.2.3 Loadside residual current device Basic RCD520B

# Front view of the Basic RCD520B



- Circuit breaker
- 2 Type designation and standard
- 3 Approvals
- 4 LED: ACTIVE, pre-alarm and MONITORING
- (5) Knowledge Manager
- 6 Rated insulation voltage and rated impulse strength
- O Location and date of manufacture
- 8 Device type
- 9 Product version
- ① Article number

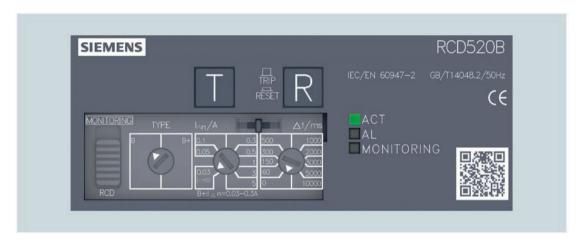
- Maximum rated operational current, rated operational voltage and frequency
- Transparent protective cover over setting buttons
- ③ Selection slide switch for MONITORING / RCD mode
- Button for setting tripping characteristic type B / type B+
- (5) Setting button for response current
- 16 Setting button for delay time
- Test button (test device)
- ® RESET button / tripped display
- Auxiliary contacts
- ② Contact hazard protective cover over main current paths with sealing option

# Description of front panel view

# Display elements

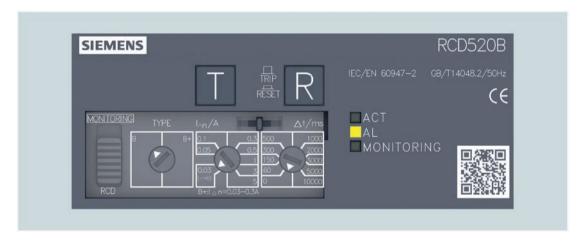
# "Ready" signal, alarms and monitoring

"Ready" signal of the residual current device:
 The LED labeled "ACT" stands for ACTIVE and lights up when the residual current device is ready to operate.



Pre-alarm:

The Basic RCD520B features an alarm LED labeled "AL" which lights up promptly to indicate potential shutdown of the installation due to residual current.



# • Monitoring:

The "MONITORING" LED indicates the operating mode of the RCD520B.

When the selection slide switch is set to "MONITORING", the "MONITORING" LED is lit and the "ACT" LED flashes. RCD520B Basic functions purely as a display unit without a tripping function.



# LED displays

| LED         | Status      | Description  |
|-------------|-------------|--|
| ☐ ACT       | Off         | Residual current device not in operation   |
| ACT         | Flashing    | Fault in residual current device   |
| ¥ ACT       | On          | Residual current device is in normal operation (protection mode)   |
| ☐ AL        | Off         | Residual current $I_{\Delta}$ is less than or equal to 30% of the set response current $(I_{\Delta n} \text{ value})$            |
| ₩ AL        | On          | Residual current $I_{\Delta}$ is greater than or equal to 30% of the set response current ( $I_{\Delta n}$ value)                |
| ACT ACT     | Flashing    | Residual current device is operating purely as display unit (monitoring  |
| MONITORIN   | NG On       | mode)  |
| ¥ ACT       | On          | Residual current device is operating in protection mode  |
| ☐ MONITORIN | NG Off      | (RCD functionality)  |
| ACT ACT     | Flashing    | Possible causes:   |
| AL AL       | Flashing    | <ul><li>Residual current device is defective</li><li>The white arrow of a setting button is between two setting ranges</li></ul> |
| MONITORIN   | NG Flashing |  |

## Tripped display

In RCD mode, the <RESET> button is used not only to reset the residual current device, but also as a mechanical indication that the unit has "tripped". If a residual current is detected or the button <TEST> is pressed, the button <RESET> is automatically released and so signals that the residual current device has tripped. Even when the residual current device is at zero potential, the <RESET> remains in the "TRIP" position.

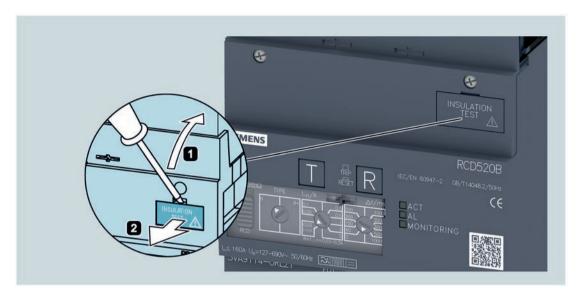


- ① Residual current device is operating normally and has not tripped
- Residual current device has tripped

## Operator controls

#### Insulation tests

It is absolutely essential to isolate the evaluation electronics circuit while insulation tests are in progress in order to protect the circuit against potential damage on the one hand and to prevent detection of insulation faults due to the power pack on the other. This is done simply by withdrawing (15 to 17 mm) the circuit breaker which is anchored in the enclosure.



Disconnection of the main conductor connections is thus unnecessary. On completion of the tests, the circuit breaker must be pushed back into position before the residual current device is commissioned.

## Testing and resetting the residual current device

## **Testing**

Depending on operating conditions, the test button on the front panel of the residual current device should be pressed in order to function-test the device. The test button is labeled with the letter "T". If the test button is pressed, the device is tested immediately irrespective of the current delay time setting.

If the test button is pressed, a residual current is simulated on a test winding attached to the summation current transformer. If the residual current device is functioning properly, it must trip the molded case circuit breaker (in "RCD" mode).

The test button must be held down for at least two seconds. The design of the test button prevents unintentional actuation.

When the residual current device is in "MONITORING" mode, it behaves in the same way as in RCD mode (e.g. when the tripped auxiliary switch operates), the only difference being that the molded case circuit breaker is not tripped and the <RESET> button is not released.

#### Note

The residual current device can be successfully tested only if it is connected to a voltage equal to at least 85% of the minimum rated operational voltage.

## Resetting

If the residual current device trips the molded case circuit breaker due to a high residual current or actuation of the test button, the <RESET> button on the RCD is released ("RCD" mode must be selected). At the same time, the trip alarm switch which is mechanically coupled with the <RESET> button also signals that a trip has occurred.

The <RESET> button is labeled with the letter "R".

The following actions must be taken in order to reset the residual current device and reclose the main contacts of the molded case circuit breaker:

- Press the <RESET> button on the residual current device.
   The "tripped" signal at the signaling contacts is canceled, the residual current device is now reset.
- 2. Reset and switch on the molded case circuit breaker.

#### Note

The molded case circuit breaker cannot be switched on before the <RESET> button on the residual current device has been actuated and a residual current is no longer present  $(I_{\Delta n} > I_{\Delta})$ .

## Parameterization of the residual current device

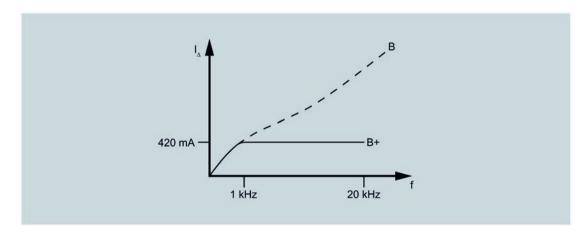


- ① Button for setting tripping characteristic type B / type B+
- ② Setting button for response current I<sub>Δn</sub>
- $\bigcirc$  Setting button for delay time  $\triangle$ t

## Button for setting the tripping characteristic

This rotary switch can be used to change the tripping characteristic of the RCD520B between type B (according to IEC 62423 and IEC 60947-2) and type B+ (according to DIN VDE 0664-400 for  $I_{\Delta n}$  = 30 to 300 mA and for frequencies over 1 kHz).

The same conditions apply for type B+ as for type B, i.e. the tripping characteristics of type B and type B+ are identical up to 1 kHz. With device type B+ however, the frequency range for the detection of residual currents extends up to 20 kHz. Tripping takes place below 420 mA within this frequency range to provide increased fire protection. With type B, the tripping threshold increases above 1 kHz to prevent spurious tripping due to discharge currents, particularly in conjunction with frequency converters.



## Button for setting the response current IAn

The response current can be set in 8 steps, ranging from 0.03 A to 0.3 A for type B+ and 0.03 A to maximum 5 A for type B (for detailed information, see "Overview of selection settings in conjunction with  $I_{\Delta n}$ "). Each response current has a dedicated setting range. The corresponding response current is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device is automatically set to 0.03 A for safety reasons.

If the response current is set to 0.03 A, the delay time setting is deactivated and the breaker is tripped instantaneously. in order to afford personal protection in the case of direct contact.

#### Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

The factory setting for the response current is 0.03 A.

## Button for setting the delay time $\Delta t$

The delay time on the RCD520B residual current device can be set in 10 steps, ranging from 0 (instantaneous) to a maximum value of 10000 ms.

Each delay time has a dedicated setting range. The corresponding delay time is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device trips instantaneously in response to residual currents.

The factory setting for the delay time is 0 ms.

## Possible procedure for setting the response current and the delay time

- 1. Switch off the molded case circuit breaker.
- 2. Open the transparent protective cover over the setting buttons.
- 3. Adjust the setting values for response current and delay time on the residual current device to the maximum value in each case.
- 4. Switch on the molded case circuit breaker. The LED labeled "ACT" now lights up (RCD mode) on the residual current device or the "ACT" LED flashes and the "MONITORING" LED lights up (monitoring mode); the residual current device is ready.
- 5. Reduce the setting for the response current until the LED labeled "AL" lights up. The residual current is now 30% higher than the response current setting.
- 6. By turning the setting button clockwise, set the next higher response current. The LED "AL" goes out, the correct response current is now set.
- 7. Set the required delay time.
- 8. Close the transparent protective cover over the setting buttons. The device is now fully parameterized.

## Selecting the operating mode



1 Selection switch for RCD / MONITORING mode

Two different operating modes can be selected using the selection switch on the RCD520B:

• RCD mode



The device functions as a residual current device in RCD mode. When  $I_{\Delta} > I_{\Delta n}$ , the residual current device trips the molded case circuit breaker by means of a plunger.

Die <RESET> button on the residual current device releases, thus signaling that the residual current device has tripped. At the same time, the trip alarm switch (TRIP-IND) operates so that the tripped status can be transmitted to an indicator light in the panel door, for example (see also Table "Scenario A" in chapter "Connecting terminals", section "Status indicators").

The molded case circuit cannot be switched back on until the fault has been rectified and the <RESET> button has been pressed.

The residual current device is set to RCD mode as supplied.

#### MONITORING mode



In MONITORING mode, the device functions purely as a display unit. In this mode, the "ACT" LED flashes and the "MONITORING" LED is lit.

If the residual current exceeds the response current set on the RCD520B, this does **not** result in tripping of the molded case circuit breaker. The <RESET> button also remains in the depressed position and is **not** released. The trip alarm switch (TRIP-IND) operates however. As soon as the residual current falls below the threshold again, the trip alarm switch resets immediately (see also table "Scenario C" in chapter "Connecting terminals", section "Status indicators").

It is possible to switch between the two operating modes at all times, irrespective of whether the RCD520B residual current device is operating in a running application. Proper functioning of the selection switch is continuously monitored. In the event of a malfunction, the device automatically switches to RCD mode internally, thereby excluding the possibility of a safety-related risk.

Overview of selection settings in conjunction with  $I_{\Delta n}$ :

| Position of selection slide<br>switch RCD / MONITORING<br>mode | Position of setting button<br>type B / B+ | Position of setting button fault response current I <sub>Δn</sub> | Comment   |
|--|---|---|---|
|  | В   | 0.031) 5  | Residual current device<br>operating as selected on the<br>device |
|  | B+  | 0.031) 0.3  | Residual current device<br>operating as selected on the<br>device |
| Any position   | B+  | 0.5 5   | I <sub>Δn</sub> is automatically set to 300 mA internally         |
|  | Any position                              | Position undefined  | I <sub>Δn</sub> is automatically set to 30 mA internally          |
|  | Position undefined                        | Any position  | Type B / B+ is automatically set to type B internally             |
| Position undefined or selection slide switch defective         | Any position                              | Any position  | Residual current device is<br>operating in RCD mode               |

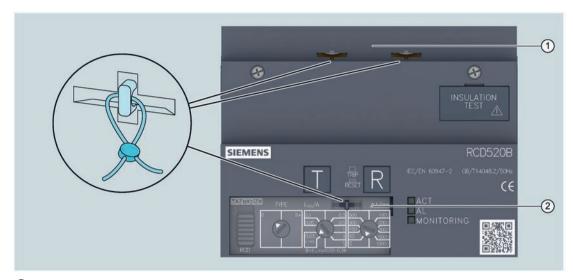
Note: If  $I_{\Delta n} = 0.03$  A, the circuit breaker trips instantaneously irrespective of the setting of  $\Delta t$ .

#### Note

Observe the operating instructions.

Functional testing must be performed before the residual current device is put into operation.

## Sealable protective covers of the residual current device



- ① Contact hazard protective cover over main current paths and auxiliary contacts
- 2 Transparent protective cover over setting buttons

## Transparent protective cover over setting buttons

In order to prevent unauthorized access to the settings for  $I_{\Delta n}$ ,  $\Delta t$ , type B/B+ and RCD/MONITORING mode, the transparent cover over the settings buttons can be optionally sealed.

#### Note

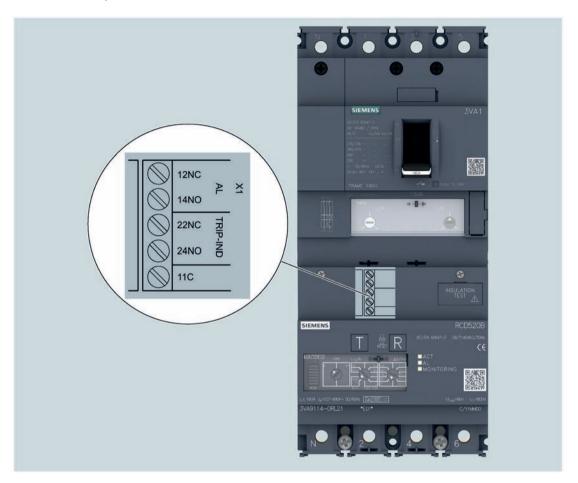
In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

# Contact hazard protective cover over main current paths and auxiliary contacts including sealing option

After the residual current device RCD520B has been mounted on the 3VA11 molded case circuit breaker, a contact hazard protective cover is installed over the main current paths to protect against direct contact. This cover can be sealed optionally in order to block any attempt to dismantle the residual current device from the molded case circuit breaker.

#### **Terminals**

A number of auxiliary contacts which perform different functions are located underneath the contact hazard protective cover:



## Alarm switch

Floating auxiliary contacts for 2 different alarms are provided:

• TRIP-IND (TRIP INDICATOR)

A tripped signal can be output via this auxiliary switch, e.g. for connection to a warning lamp. This trip alarm switch operates as soon as the residual current exceeds the set response current, irrespective of whether the residual current device is in RCD or MONITORING mode.

Since the relay for the tripped signal (TRIP-IND) is a bistable relay, the relay contact states remain "stored" even in the event of a power outage. When the power supply recovers, the indicated relay contact states are those which existed before the power outage.

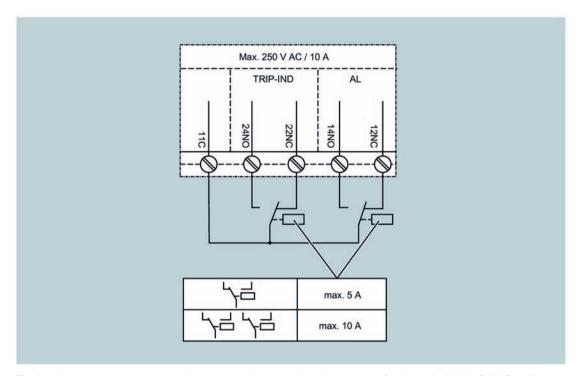
#### AL

Signaling switch for pre-alarm. This auxiliary switch operates as soon as the residual current exceeds 30% of the operating current setting value. The relay for the pre-alarm signal (AL) drops out again as soon as the residual current reaches or falls below the pre-alarm threshold of 30%.

Since the relay for the pre-alarm signal (AL) is a monostable relay, the relay switches back to the original state in the event of a power outage.

The standard auxiliary switches for pre-alarms and tripped signals have changeover contacts and screw-type connections.

The terminal designations of the relevant contact, the maximum rated voltage and the current carrying capacity are shown in the diagram below.



Each relay contact has a maximum rated operational current of 5 A at 250 V AC (AC-13). The common terminal (11C = Common) is designed such that the maximum permissible current of 5 A can be applied to both relay contacts (TRIP-IND and AL) simultaneously.

## Note

Cables for the following terminals must be routed separately from the main circuits. Their maximum cable length is 300 m.

| Use of signaling switches | in SELV | and PELV | circuits: |
|---------------------------|---------|----------|-----------|
|---------------------------|---------|----------|-----------|

| Rated<br>operational<br>voltage U <sub>e</sub> | Overvoltage category | Rated impulse withstand<br>voltage U <sub>imp</sub> between main<br>circuit and main circuit | Insulation<br>of auxiliary<br>switches | Rated impulse withstand<br>voltage U <sub>imp</sub> between auxiliar<br>circuits and main circuit |  |
|--|----------------------|--|--|---|--|
| 480 V AC                                       | CAT III              | 4 kV   | Double insulation                      | 6 kV  |  |
| 480 V AC                                       | CAT IV               | 6 kV   | Basic insulation                       | 6 kV  |  |
| 690 V AC                                       | CAT III              | 6 kV   | Basic insulation                       | 6 kV  |  |

The signaling switches TRIP-IND and AL meet the requirements for safety isolation (including double insulation between the auxiliary current paths and the main circuit).

## Requirement:

- 1. Molded case circuit breakers equipped with a residual current device are operated with a rated operational voltage of 480 V AC.
- 2. The combination is installed at the distribution system level (overvoltage category III according to DIN EN-60947-1 Annex H).

If these two requirements are met, the signaling switches are suitable for SELV and PELV circuits.

## Status indicators

The table below illustrates the behavior of pre-alarm and tripped signals on RCD520B devices in response to various user actions and residual currents.

Scenario A: Residual current device is in RCD mode, infeed at the top

| Breaker status<br>prior to user action      |                                       |                     | ON                     | ON                     | ON                      | TRIP                    | TRIP                   | TRIP                   | OFF                    |
|---|---------------------------------------|---------------------|------------------------|------------------------|-------------------------|-------------------------|------------------------|------------------------|------------------------|
| Residual current I <sub>Δ</sub>             |                                       |                     | ≤ 30 % I <sub>Δn</sub> | > 30 % I <sub>Δn</sub> | ≥ 100 % I <sub>Δn</sub> | < 100 % I <sub>Δn</sub> | ≤ 30 % I <sub>Δn</sub> | ≤ 30 % I <sub>∆n</sub> | ≤ 30 % I <sub>Δn</sub> |
| User action                                 |                                       | None                | None                   | None                   | None                    | RCD:<br>Reset           | MCCB:<br>TRIP -+ OFF   | MCCB:<br>OFF → ON      |                        |
| Breaker status<br>following user action     |                                       |                     | ON                     | ON                     | TRIP                    | TRIP                    | TRIP                   | OFF                    | ON                     |
|   | LEDs                                  |                     |                        |                        |                         |                         |                        |                        |                        |
|   | Readiness for operation               | ACT                 | *                      | 業                      |                         |                         |                        |                        | 業                      |
|   | Pre-alarm                             | AL                  |                        | 禁                      |                         |                         |                        |                        |                        |
|   | Monitoring                            | MONITORING          |                        |                        |                         |                         |                        |                        |                        |
|   | Mechanical display                    |                     |                        |                        |                         |                         |                        |                        |                        |
| Signals at RCD520B<br>following user action | Tripped signal                        | TRIP                | _                      |                        |                         | П                       |                        | _                      | _                      |
|   | Operating mode selection slide switch | Monitoring<br>/ RCD |                        |                        |                         |                         |                        |                        |                        |
|   | Alarm switches                        |                     |                        |                        |                         |                         |                        |                        |                        |
|   | Pre-alarm                             | AL                  | 11C 12NC<br>14NO       | 11C - 12NC             | 11C 12NC<br>14NO        | 11C 12NC<br>14NO        | 11C 12NC<br>14NO       | 11C 12NC<br>14NO       | 11C —— 127             |
|   | Tripped signal                        | TRIP-IND            | 11C - 22NC             | 11C 22NC               | 11C 22NC                | 11C 22NC                | 11C 22NC               | 11C 22NC               | 110 - 22               |

Scenario B: Residual current device is in RCD mode, infeed at the bottom

| Breaker status prior to user action      |                                       |                     | ON                    | ON                    | ON                     | TRIP                  | TRIP                  | TRIP                  | OFF                   |
|--|---------------------------------------|---------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Residual current I <sub>A</sub>          |                                       |                     | ≤ 30% I <sub>Δn</sub> | > 30% I <sub>An</sub> | ≥ 100% I <sub>Δn</sub> | ≤ 30% I <sub>ān</sub> | ≤ 30% I <sub>∆n</sub> | ≤ 30% I <sub>Δn</sub> | ≤ 30% I <sub>Δn</sub> |
| User action                              |                                       |                     | None                  | None                  | None                   | None                  | RCD:<br>Reset         | MCCB:<br>TRIP → OFF   | MCCB:<br>OFF → ON     |
| Breaker status<br>following user action  |                                       |                     | ON                    | ON                    | TRIP                   | TRIP                  | TRIP                  | OFF                   | ON                    |
|  | LEDs                                  |                     |                       |                       |                        |                       |                       |                       |                       |
|  | Readiness for operation               | ACT                 | 業                     | 崇                     | 業                      | 業                     | 業                     | 業                     | 業                     |
|  | Pre-alarm                             | AL                  |                       | 禁                     |                        |                       |                       |                       |                       |
|  | Monitoring                            | MONITORING          |                       |                       |                        |                       |                       |                       |                       |
|  | Mechanical display                    |                     |                       |                       |                        |                       |                       |                       |                       |
| Signals at RCD520B following user action | Tripped signal                        | TRIP                | _                     |                       |                        |                       | -                     | _                     | _                     |
|  | Operating mode selection slide switch | Monitoring<br>/ RCD |                       |                       |                        |                       |                       |                       |                       |
|  | Alarm switches                        |                     |                       |                       |                        |                       |                       |                       |                       |
|  | Pre-alarm                             | AL                  | 11C 12NC<br>14NO      | 11C 12NC<br>14NO      | 11C 12NC<br>14NO       | 11C 12NC<br>14NO      | 11C 12NC<br>14NO      | 11C 12NC<br>14NO      | 11C 12NC<br>14NO      |
|  | Tripped signal                        | TRIP-IND            | 11C 22NC<br>24NO      | 11C 22NC<br>24NO      | 11C — 22NC<br>24NO     | 11C 22NC<br>24NO      | 11C 22NC<br>24NO      | 11C 22NC<br>24NO      | 11C - 22NC<br>24NO    |

Scenario C: Residual current device is in MONITORING mode, infeed at the top

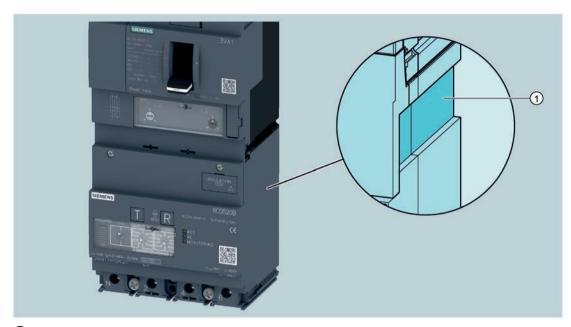
| Breaker status<br>prior to user action      |                                       |                     | ON                     | ON                     | ON                      | ON                      | OFF                    | OFF                    |      |                 |
|---|---------------------------------------|---------------------|------------------------|------------------------|-------------------------|-------------------------|------------------------|------------------------|------|-----------------|
| Residual current I <sub>Δ</sub>             |                                       |                     | ≤ 30 % I <sub>Δn</sub> | > 30 % I <sub>An</sub> | ≥ 100 % I <sub>Δn</sub> | ≥ 100 % I <sub>Δn</sub> | ≤ 30 % I <sub>Δn</sub> | ≤ 30 % I <sub>Δn</sub> |      |                 |
| User action                                 |                                       | User action         |                        |                        | None                    | None                    | None                   | MCCB:<br>ON → OFF      | None | MCCB:<br>OFF ON |
| Breaker status<br>following user action     |                                       |                     | ON                     | ON                     | ON                      | OFF                     | OFF                    | ON                     |      |                 |
|   | LEDs                                  |                     |                        |                        |                         |                         |                        |                        |      |                 |
|   | Readiness for operation               | ACT                 |                        | ***                    |                         |                         |                        |                        |      |                 |
|   | Pre-alarm                             | AL                  |                        | 禁                      | 禁                       |                         |                        |                        |      |                 |
|   | Monitoring                            | MONITORING          | **                     | 業                      | *                       |                         |                        | **                     |      |                 |
|   | Mechanical display                    |                     |                        |                        |                         |                         |                        |                        |      |                 |
| Signals at RCD520B<br>following user action | Tripped signal                        | TRIP                | _                      | _                      | _                       | _                       | _                      | _                      |      |                 |
|   | Operating mode selection slide switch | Monitoring<br>/ RCD |                        |                        |                         |                         |                        |                        |      |                 |
|   | Alarm switches                        |                     |                        |                        |                         |                         |                        |                        |      |                 |
|   | Pre-alarm                             | AL                  | 11C - 12NC<br>14NO     | 11C - 12NC             | 11C - 12NC              | 11C - 12NC<br>14NO      | 11C - 12NC<br>14NO     | 11C - 12NC             |      |                 |
|   | Tripped signal                        | TRIP-IND            | 11C 22NC               | 11C 22NC               | 11C 22NC                | 11C - 22NC              | 11C 22NC               | 110 22NO               |      |                 |

Scenario D: Residual current device is in MONITORING mode, infeed at the bottom

| Breaker status prior to user action      |                                       |                     | ON                     | ON                     | ON                      | ON                      | OFF                    | OFF                    |
|--|---------------------------------------|---------------------|------------------------|------------------------|-------------------------|-------------------------|------------------------|------------------------|
| Residual current I <sub>Δ</sub>          |                                       |                     | ≤ 30 % I <sub>Δn</sub> | > 30 % I <sub>An</sub> | ≥ 100 % I <sub>Δn</sub> | ≥ 100 % I <sub>Δn</sub> | ≤ 30 % I <sub>Δn</sub> | ≤ 30 % I <sub>Δn</sub> |
| User action                              |                                       |                     | None                   | None                   | None                    | MCCB:<br>ON → OFF       | None                   | MCCB:<br>OFF → ON      |
| Breaker status following user action     |                                       |                     | ON                     | ON                     | ON                      | OFF                     | OFF                    | ON                     |
|  | LEDs                                  |                     |                        |                        |                         |                         |                        |                        |
|  | Readiness for operation               | ACT                 |                        |                        |                         |                         |                        |                        |
|  | Pre-alarm                             | AL                  |                        | 禁                      | 業                       |                         |                        |                        |
|  | Monitoring                            | MONITORING          | **                     | 業                      | *                       | **                      | *                      | **                     |
|  | Mechanical display                    |                     |                        |                        |                         |                         | 24.                    |                        |
| Signals at RCD520B following user action | Tripped signal                        | TRIP                | _                      | _                      | _                       |                         | _                      | _                      |
|  | Operating mode selection slide switch | Monitoring<br>/ RCD |                        |                        |                         |                         |                        |                        |
|  | Alarm switches                        |                     |                        |                        |                         |                         |                        |                        |
|  | Pre-alarm                             | AL                  | 11C 12NC<br>14NO       | 11C - 12NC<br>14NO     | 11C - 12NC<br>14NO      | 11C - 12NC<br>14NO      | 11C - 12NC<br>14NO     | 11C 12NC               |
|  | Tripped signal                        | TRIP-IND            | 11C 22NC<br>24NO       | 11C —— 22NC<br>24NO    | 11C 22NC<br>24NO        | 11C - 22NC<br>24NO      | 11C - 22NC<br>24NO     | 11C 22NC<br>24NO       |

## Cable installation

Cable ducts for bringing out cables are provided to the left and right on the residual current device.



1 Cable duct

## Other labels on front panel

## **Approvals**

The residual current device bears the CE mark. For an overview of all approvals, please refer to Appendix.

For all queries relating to approvals, please contact Technical Support (Page 10).

## **Technical specifications**

In  $\leq$  ...A: Specifies the highest permissible rated operational current of the mold-

ed case circuit breaker with which the residual current device may be

combined.

Ue ~ ...V: Specifies the operating voltage range of the residual current device.

...Hz: Specifies the operating frequency range of the residual current device.

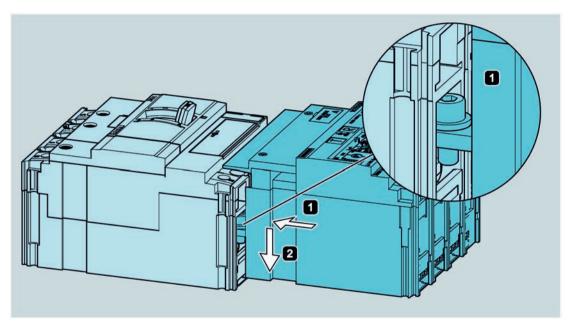
Denotes the response behavior to residual currents.

#### Installation

#### Installation

Regardless of the type of connection technology installed on the 3VA1 molded case circuit breaker, the RCD520B residual current device is mounted on the load side (i.e. beneath the thermal-magnetic trip unit) of the breaker:

- 1. Dismantle the loadside connection components of the molded case circuit breaker and install the supplied connection components for the residual current device.
- 2. Insert the residual current device into the T slots of the molded case circuit breaker.



- 3. Push the residual current device backwards until its rear panel is flush with the rear panel of the molded case circuit breaker.
- 4. Screw the molded case circuit breaker to the residual current device. Special connecting screws are provided on the line side of the residual current device for this purpose.
- 5. Place a contact hazard protective cover over the circuit breaker/RCD assembly.
- 6. Reinstall the loadside connection components of the molded case circuit breaker at the outgoing feeder end of the residual current device.
- 7. Attach the assembly to a mounting plate using the mounting screws.

## Note

Since the outgoing feeder end of the residual current device has exactly the same connection contours as the 3VA11 molded case circuit breaker, all connection accessories, e.g. phase barrier, terminal cover, can also be mounted on the residual current device.

## **Tripping**

The molded case circuit breaker is tripped by means of a direct-acting tappet which engages in the breaker mechanism from the residual current device.

## Periodic self-test

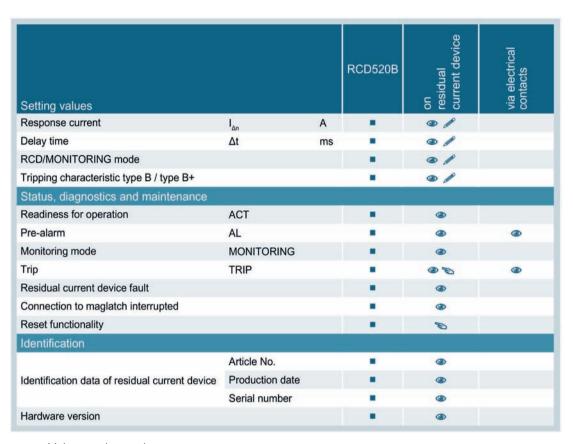
In addition to manually checking the proper functioning of the residual current device by pressing the test button, cyclic self-tests are performed inside the residual current device.

Checks are performed periodically, for example, to ensure that:

- the microcontroller is functioning properly
- the physical connection between the printed-circuit board and the maglatch is interrupted
- the current transformers and the detection electronics are functioning properly

## **Function overview**

The table below provides an overview of all the functions and data which are available in the residual current device environment:

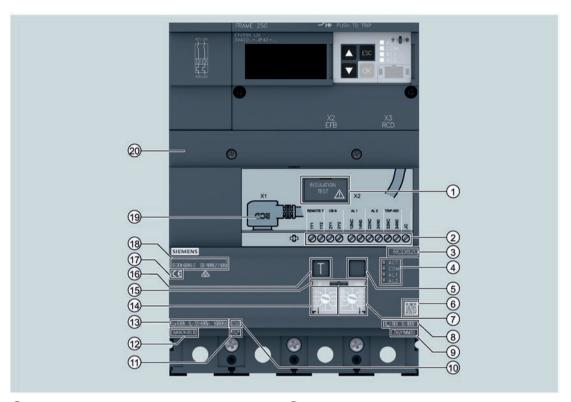


- Value can be read
- Value can be edited
- Commands

## 4.8.2.4 Loadside residual current device Advanced RCD820

The "Advanced" residual current devices of type RCD820 are available as an accessory for 3VA2 molded case circuit breakers.

## Front view of Advanced RCD820



- 1 Circuit breaker
- ② Auxiliary contacts
- 3 Type designation
- 4 LED: ACTIVE, communication, pre-alarm
- 5 Tripped display
- 6 Knowledge Manager
- Setting button for delay time
- 8 Rated insulation voltage and rated impulse strength
- 10 Device type

- (1) Product version
- (2) Article number
- Maximum rated operational current, rated operational voltage and frequency
- (4) Setting button for response current
- Transparent protective cover over setting buttons
- (6) Test button (test device)
- ① Approval
- ® Standard
- 19 RCD-to-ETU connecting cable
- ② Contact hazard protective cover over main current paths with sealing option

## Description of front panel view

## Display elements

## "Ready" signals, communication status and alarms



- "Ready" signal of the residual current device:
   The LED labeled "ACT" ① stands for ACTIVE and lights up when the device is ready to operate.
- Communication status:
   The LED labeled "COM" ② stands for COMMUNICATION and indicates the communication status of the residual current device.
- Pre-alarms:

The Advanced RCD820 has two LEDs labeled "AL1" (ALARM 1) ③ and "AL2" (ALARM 2) ③ which light up successively or simultaneously to promptly indicate potential shutdown of the installation due to residual current.

## LED displays

| LED |     | Status   | Description   |
|-----|-----|----------|---|
|     | ACT | Off      | Residual current device is not in operation   |
| **  | ACT | Flashing | <ul> <li>Residual current device is malfunctioning</li> <li>Residual current device is not functioning as a trip unit (no cable is connected between the ETU and RCD)</li> <li>Residual current device is integrated into communication system only Residual current device is not connected to a supply voltage</li> <li>Break in connecting cable between RCD and ETU</li> </ul>  |
| 祟   | ACT | On       | Residual current device is operating normally.  |
|     | сом | Off      | Communication function of the residual current device is inoperative.  This can happen, for example, if  a 3VA2 molded case circuit breaker is equipped with an ETU 5-series or 8-series, but not with a communication module.  a 3VA2 molded case circuit breaker is equipped with an ETU 3-series, but the ETU is not equipped with a communication interface.  Residual current device is not functioning as a trip unit (no cable is connected between the RCD and ETU) |
| **  | СОМ | Flashing | Fault in communication system of the residual current device.  Possible causes:  - Break in connecting cable between RCD and ETU  |
| *   | СОМ | On       | The communication system of the residual current device is active. Even when the molded case circuit breaker is switched off, communication remains active on condition that  - the communication system is working properly,  - the ETU is connected to an external power supply through the COM060 communication module.  |
| 祟   | ACT | On       |   |
| **  | AL1 | On       | The residual current ${\bf I}_{_\Delta}$ is higher than 30 % of the set response current ( ${\bf I}_{_{\Delta n}}$ value).  |
|     | AL2 | Off      |   |
| 祟   | ACT | On       |   |
| *   | AL1 | On       | The residual current $I_\Delta$ is higher than 60 % of the set response current (I_{\Delta n} value).   |
| 祟   | AL2 | On       |   |
|     | ACT | Flashing |   |
|     | СОМ | Flashing | Possible causes:  - The residual current device is defective.  The white setting arrow of the At certifier button is recting between two  |
|     | AL1 | Flashing | - The white setting arrow of the $\Delta t$ setting button is resting between two setting ranges.   |
| Ä   | AL2 | Flashing |   |

## Tripped display

If the residual current device is tripped by a residual current, a remote trip command or actuation of the test button, the trip is signaled mechanically on the RCD, i.e. by a rotating disk.



- Residual current device is operating normally and has not tripped
- 2 Residual current device has tripped

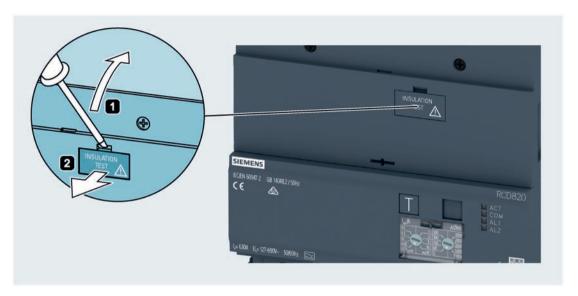
## Note

In the case of infeed from below, an auxiliary switch must be connected by means of auxiliary contacts CB-S to ensure correct functioning of the tripped display (for description, see auxiliary contacts CB-S).

## Operator controls

#### Insulation tests

It is absolutely essential to isolate the evaluation electronics circuit while insulation tests are in progress in order to protect the circuit against potential damage on the one hand and to prevent detection of insulation faults due to the power pack on the other. This is done simply by withdrawing (15 to 17 mm) the circuit breaker which is anchored in the enclosure.



Disconnection of the main conductor connections is thus unnecessary. On completion of the tests, the circuit breaker must be pushed back into position before the residual current device is commissioned.

## Testing and resetting the residual current device

## **Testing**

Depending on operating conditions, the test button on the front panel of the residual current device should be pressed in order to function-test the device. The test button is labeled with the letter "T". If the test button is pressed, the device is tested immediately irrespective of the current delay time setting.

If the test button is pressed, a residual current is simulated on a test winding attached to the summation current transformer. If the residual current device is functioning properly, it must trip the molded case circuit breaker.

The test button must be held down for at least 2 seconds. The design of the test button prevents unintentional actuation.

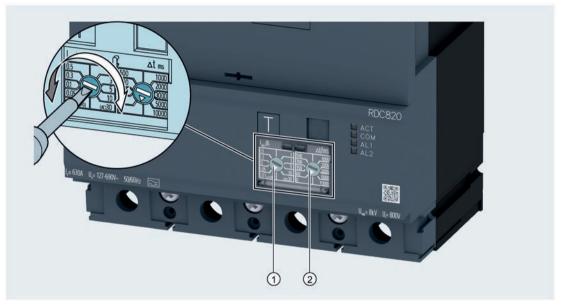
## Note

The residual current device can be successfully tested only if it is connected to a voltage equal to at least 85% of the minimum rated operational voltage.

#### Resetting

The residual current device and the "tripped" display are reset by means of the handle of the molded case circuit breaker, or the handle of the manual operator or by means of the motor operator.

#### Parameterization of the residual current device



- ① Setting button for response current  $I_{\Delta n}$
- Setting button for delay time Δt

## Button for setting the response current Ian

The response current can be set in ten steps, ranging from 0.03 A to maximum 30 A. A residual current of type A is detected within the 0.03 A to 10 A range. If the response current is set to 30 A, the device detects only residual currents of type AC (i.e. purely sinusoidal currents).

Each response current has a dedicated setting range. The corresponding response current is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device is automatically set to 0.03 A for safety reasons.

If the response current is set to 0.03 A, the delay time setting is deactivated and the breaker is tripped instantaneously. in order to afford personal protection in the case of direct contact.

#### Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

The factory setting for the response current is 0.03 A.

## Button for setting the delay time $\Delta t$

The delay time can be set in ten steps, ranging from 0 (instantaneous) to a maximum value of 10000 ms.

Each delay time has a dedicated setting range. The corresponding delay time is set as soon as the button is latched in the setting range.

If the white setting arrow is resting between two setting ranges, the residual current device trips instantaneously in response to residual currents.

The factory setting for the delay time is 0 ms.

## Possible procedure for setting the response current and the delay time

- 1. Switch off the molded case circuit breaker.
- 2. Open the transparent protective cover over the setting buttons.
- 3. Adjust the setting values for response current and delay time on the residual current device to the maximum value in each case.
- Switch on the molded case circuit breaker.
   The LED labeled "ACT" on the residual current device now lights up, the residual current device is ready.
- 5. Reduce the setting for the response current until the LED labeled "AL1" lights up. The residual current is now 30% higher than the response current setting.
- 6. By turning the setting button clockwise, set the next higher response current. The LED "AL1" goes out, the correct response current is now set.
- 7. Set the required delay time.
- 8. Close the transparent protective cover over the setting buttons. The device is now fully parameterized.

## Sealable protective covers of the residual current device



- ① Contact hazard protective cover over main current paths and auxiliary contacts
- 2 Transparent protective cover over setting buttons

#### Transparent protective cover over setting buttons

In order to prevent unauthorized access to the setting buttons for  $I_{\Delta n}$  and  $\Delta t$ , the transparent cover over the settings buttons can be optionally sealed.

#### Note

In order to protect personnel, it is necessary to seal the transparent protective cover so that the 30 mA setting range cannot be changed.

# Contact hazard protective cover over main current paths and auxiliary contacts including sealing option

After the residual current device RCD820 has been mounted on the 3VA2 molded case circuit breaker, a contact hazard protective cover is installed over the main current paths to protect against direct contact. This cover can be sealed optionally in order to block any attempt to dismantle the residual current device from the molded case circuit breaker.

## **Terminals**

#### Note

Cables for the following terminals must be routed separately from the main circuits. Their maximum cable length is 300 m.

A number of auxiliary contacts which perform a broad range of functions are located underneath the contact hazard protective cover.

#### Alarm switch

Floating auxiliary contacts for 3 different alarms are provided:

- AL1
  - Signaling switch for pre-alarm threshold 1. This auxiliary switch operates as soon as the residual current exceeds 30 % of the operating current setting value.
- AL2

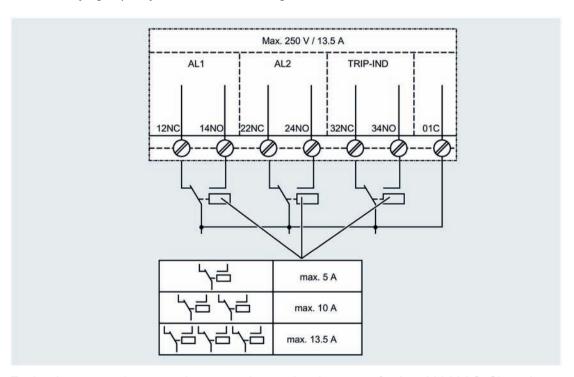
Signaling switch for pre-alarm threshold 2. This auxiliary switch operates as soon as the residual current exceeds 60 % of the operating current setting value.

TRIP-IND (TRIP INDICATOR)

A tripped signal can be output via this auxiliary switch for connection to a warning lamp, for example. The switch operates as soon as the residual current reaches or exceeds the response current setting value and has therefore caused the residual current device to trip.

Switches with changeover contacts and screw-type connections are used as standard as auxiliary switches for pre-alarms and tripped signals.

The terminal designations of the relevant contact, the maximum rated voltage and the current carrying capacity are shown in the diagram below.



Each relay contact has a maximum rated operational current of 5 A at 230 V AC. Since the terminals have a maximum current carrying capacity of 13.5 A, the current flow across the common terminal (01C = Common) must be limited to 13.5 A when all three signaling switches are used.

The relays for the pre-alarm signals (AL1 and AL2) drop out again as soon as the residual current reaches or exceeds the relevant pre-alarm thresholds.

The relay for the tripped signal (TRIP-IND) drops out again as soon as the residual current device is reset again by means of the molded case circuit breaker handle, or the handle of the manual or motor operator.

Since the relay for the tripped signal (TRIP-IND) is a bistable relay, the relay contact states remain "stored" even in the event of a power outage. When the power supply recovers, the indicated relay contact states are those which existed before the power outage.

## Other auxiliary inputs

Two further auxiliary inputs in the form of screw terminals are also provided:

#### **REMOTE-T**

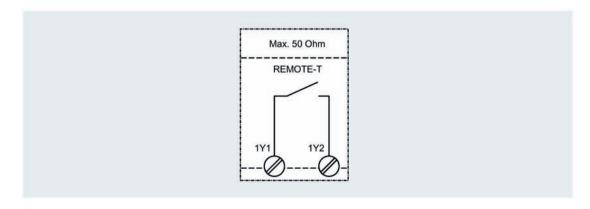
The residual current device can be remotely tripped via this auxiliary input for test purposes ("Remote test button"), for example.

To utilize this function, the customer must connect, for example, a pushbutton (NO contact) to terminals 1Y1 and 1Y2 by means of a two-core, twisted cable which must not be more than 300 m in length. The switching contact should have a minimum breaking capacity of 5 V / 1 mA. The residual current device trips if the pushbutton is actuated for at least 2 seconds. The terminals 1Y1 and 1Y2 are galvanically isolated from the mains supply (functional extra low voltage, FELV).

In special cases, such as cable installation outdoors, the amplitude of overvoltages (e.g. overvoltages due to thunderstorms) between the conductor and ground must be limited to 2.5 kV by suitable routing of the cable or other protection measures.

Each residual current device requires a separate NO contact and cable for remote tripping. It is not possible to use one cable and connect two or more residual current devices in parallel.

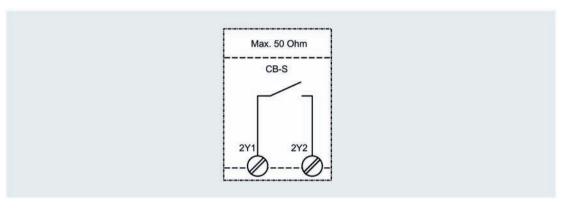
It is necessary to use an unshielded cable or a shielded, twisted-pair cable with a maximum capacitance of 36 nF as well as a maximum resistance of 50 ohms (total length out and back).



## **CB-S (Circuit Breaker Switch)**

If the molded case circuit breaker / RCD820 assembly has an infeed from below (reverse feed), it is absolutely essential to install an auxiliary switch (internal accessory, circuit breaker with article number 3VA9988-0AA13) for interrogation of the circuit breaker status to allow resetting of the tripped signal. In this case, the "normally closed contact", i.e. cable at .1C and .2NC, of the changeover contact must be connected.

This switch is installed in the accessory compartment of the molded case circuit breaker. The auxiliary switch is then connected to terminals 2Y1 and 2Y2 of the floating contact CB-S. It is necessary to use an unshielded or shielded twisted-pair cable, no more than 1 m in length, with a maximum capacitance of 36 nF as well as a maximum resistance of 50 ohms (total length out and back).

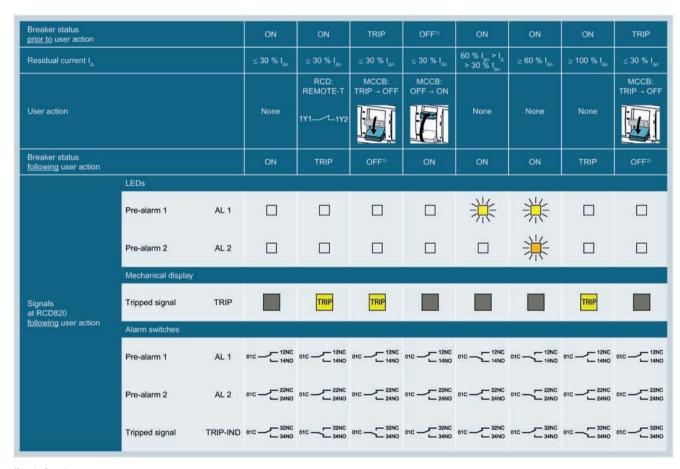


When the molded case circuit breaker is reset and then switched on again, the contacts .1C and .2NC of the auxiliary switch are closed and the tripped display on the residual current device is reset.

The auxiliary switch is not included in the scope of supply and must be ordered separately. The method for connecting the auxiliary switch to auxiliary contact CB-S is described in the Operating Instructions for the RCD820 residual current device.

## Status indicators

The table below illustrates the behavior of pre-alarm and tripped signals on RCD820 devices in response to various user actions and residual currents.

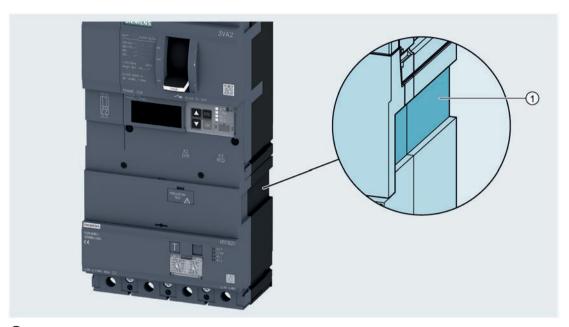


<sup>1)</sup> Infeed at top

<sup>2)</sup> Infeed at bottom

## Cable installation

Cable ducts for bringing out cables are provided to the left and right on the residual current device.



1 Cable duct

## Other labels on front panel

## **Approvals**

The residual current device bears the CE mark. For an overview of all approvals, please refer to Appendix (Page 647).

For all queries relating to approvals, please contact Technical Support (Page 10).

## **Technical specifications**

In  $\leq$  ...A: Specifies the highest permissible rated operational current of the molded case circuit breaker with which the residual current device may be combined.

Ue ~ ...V: Specifies the operating voltage range of the residual current device.

...Hz: Specifies the operating frequency range of the residual current device.

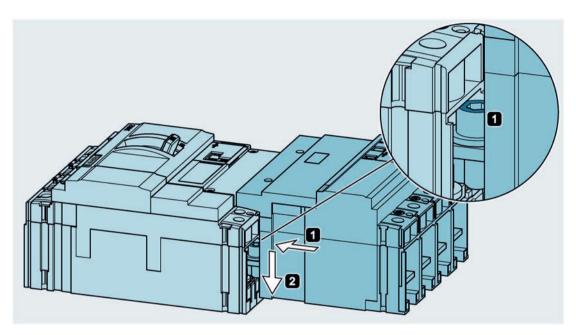
Denotes the response behavior to residual currents.

#### Installation

#### Installation

Regardless of the type of connection technology installed on the 3VA2 molded case circuit breaker, the RCD820 is mounted underneath the electronic trip unit of the circuit breaker.

- 1. Dismantle the loadside connection components of the molded case circuit breaker and install the supplied connection components for the residual current device.
- 2. Insert the residual current device into the T slots of the molded case circuit breaker.



- 3. Push the residual current device backwards until its rear panel is flush with the rear panel of the molded case circuit breaker.
- 4. Screw the molded case circuit breaker to the residual current device. Special connecting screws are provided on the line side of the residual current device for this purpose.
- 5. Place a contact hazard protective cover over the circuit breaker/RCD assembly.
- 6. Reinstall the loadside connection components of the molded case circuit breaker at the outgoing feeder end of the residual current device.
- 7. Attach the assembly to a mounting plate using the mounting screws.

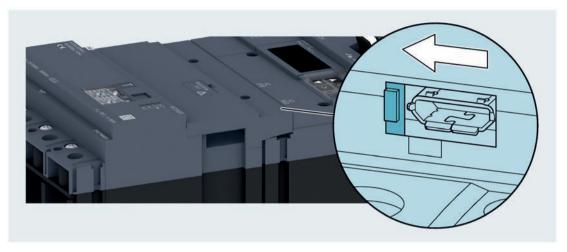
## Note

Since the outgoing feeder end of the residual current device has exactly the same connection contours as the 3VA2 molded case circuit breaker, all connection accessories, such as phase barriers and terminal covers, can also be mounted on the residual current device.

## Installation of the RCD-ETU connecting cable

- 1. Remove the contact hazard protective cover.
- 2. Open the slide over the interface <X3 RCD>.

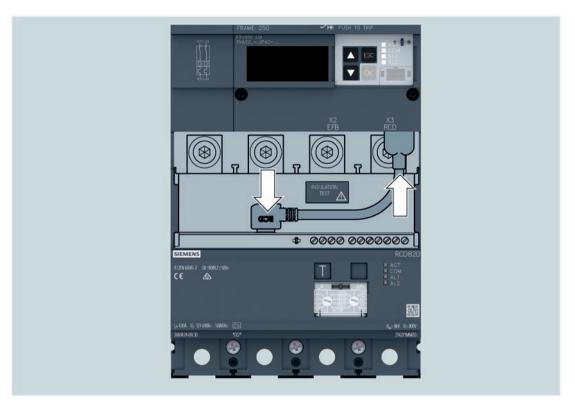
  The slide is fitted as a protective guard (e.g. to protect the interface against soiling).



3. Insert one end of the connecting cable into the interface on the residual current device. The interfaces and the connecting cable are labeled to ensure that the cable ends are inserted in the right interfaces.

## Note

Plug in or remove the RCD-ETU cable only when the residual current device is deenergized.



4. Insert the other end of the connecting cable into the interface <X3 RCD> on the ETU.

The RCD-to-ETU connecting cable is free of silicone and halogen and is electrically isolated from the main circuits.

The connecting cable is included in the scope of supply.

# **Tripping**

The residual current device utilizes the maglatch of the electronic trip unit (ETU) in order to trip the molded case circuit breaker. It therefore needs to be connected to the ETU of the molded case circuit breaker. This connection is made by means of the RCD-ETU connecting cable.

# Use of the residual current device as a pure display unit

The RCD820 residual current device can also operate as a pure display unit without a tripping function, i.e. it detects and signals residual currents, but does not trip the molded case circuit breaker or interrupt the circuit.

If the RCD820 device is to operate as a pure display unit, the connecting cable between the residual current device and the ETU of the molded case circuit breaker can be omitted. With the exception of its communications interface functionality, the residual current device can perform all its normal functions (e.g. status signaling via LEDs or alarm switches) in "display mode". Since there is no connection between the RCD and the ETU, the LED "ACT" flashes continuously and the LED "COM" is not illuminated even if a 5-series or 8-series ETU is installed.



#### Communications interface

The RCD-ETU connecting cable not only carries the trip command, but also acts as the communications interface between the residual current device and the 3VA communication system.

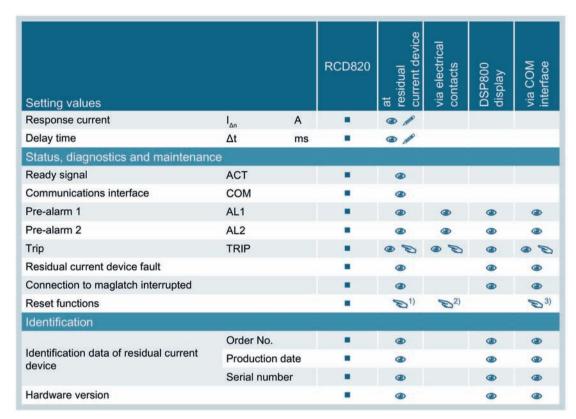
Precondition for interface functionality:

- The 3VA2 molded case circuit breaker is equipped with a communication-capable, electronic trip unit (ETU 5-series or 8-series).
- The molded case circuit breaker is linked to the communication system via a COM060 communication module.

If the residual current device is linked to the communication system, the link can be used not only to interrogate the device for important status, diagnostic, maintenance and identification data, but also to transmit commands.

The residual current device is normally supplied with power by the main current paths. When the molded case circuit breaker is switched off, the power supply will be interrupted if the feed is at the top. In order to maintain the link to the communication system when the power supply from the main current paths is disconnected, the residual current device is supplied with the necessary power by the COM060 communication module.

The table below provides an overview of all the functions and data which are available in the residual current device environment:



- Value can be read
- Value can be edited
- Commands
- Reset by means of the molded case circuit breaker handle, or the handle of the manual or motor operator
- 2) Reset in combination with motor operators
- 3) On request

# 4.8.2.5 Special operating modes of residual current devices

Residual current devices also function in 1 and 2-phase operation. They are unrestricted in functionality, including the test circuit, if at least 2 conductors are connected (2-pole operation).

The phases can be selected freely.

Please note the following:

- 1. Adhere to the permissible rated operational voltage.
- 2. If a connection to the N pole (N) is made in a 4-pole MCCB-RCD assembly, the current setting of the N pole determines the maximum current carrying capacity of the circuit.

If the N pole is protected, the 100% setting (protection) is recommended with the corresponding cable cross-section in the N pole. According to IEC 60947, the neutral conductor must be connected to the designated terminal in the case of a 4-pole breaker. Connecting a line conductor to the switching pole labeled N is not permitted.

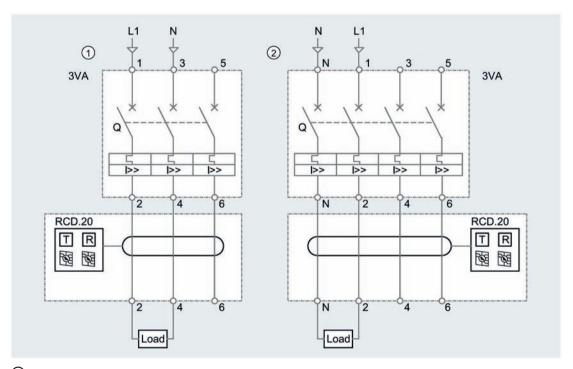
3. The same conditions apply in 1 or 2-phase operation as in 3-phase operation with respect to the parameter settings of the residual current device (I<sub>Δn</sub> or Δt) or the trip unit of the molded case circuit breaker (e.g. I<sub>r</sub>, I<sub>i</sub>).

#### Connection of residual current device for 1-phase operation

The following 3 and 4-pole molded case circuit breakers equipped with a residual current device can be operated in a single phase (L to N) with 2-pole switching:

- Loadside residual current devices for 3VA1: RCD320 and RCD520 Permissible rated operational voltage: 100 – 277 VAC 50/60 Hz
- Loadside residual current devices for 3VA2: RCD820
   Permissible rated operational voltage: 100 400 VAC 50/60 Hz

# Wiring example for 1-phase operation, 2-pole switching (3 and 4-pole molded case circuit breakers)



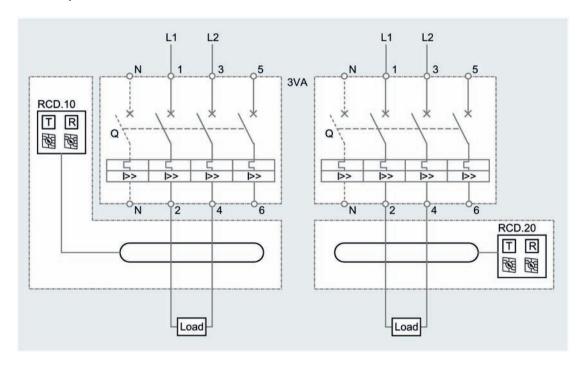
- ① 3-pole
- 2 4-pole

#### Connection of residual current device for 2-phase operation

The following 3 and 4-pole molded case circuit breakers equipped with a residual current device can be operated in two phases (L to L) with 2-pole switching:

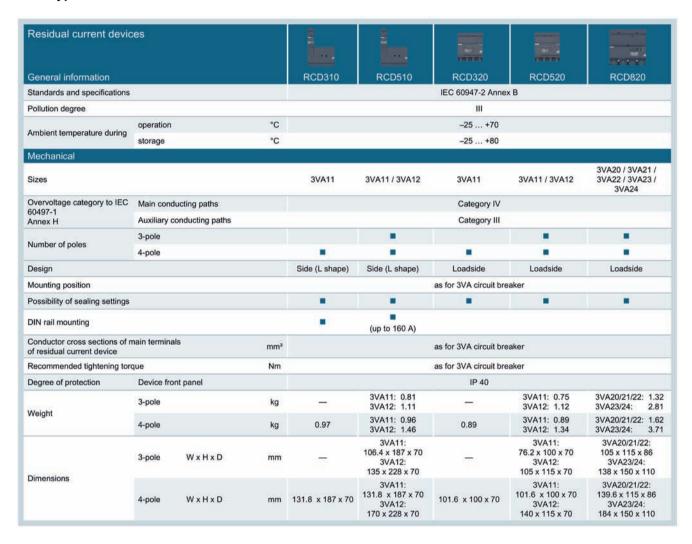
- Loadside residual current devices for 3VA1: RCD320 and RCD520 Permissible rated operational voltage: 127 – 480 VAC 50/60 Hz
- Side mounted residual current devices for 3VA1: RCD310 and RCD510 Permissible rated operational voltage: 127 – 480 VAC 50/60 Hz
- Loadside residual current devices for 3VA2: RCD820
   Permissible rated operational voltage: 127 690 VAC 50/60 Hz

# Wiring example for 2-phase operation, 2-pole switching (3 and 4-pole molded case circuit breakers)



# 4.8.2.6 Technical specifications

## RCD type A

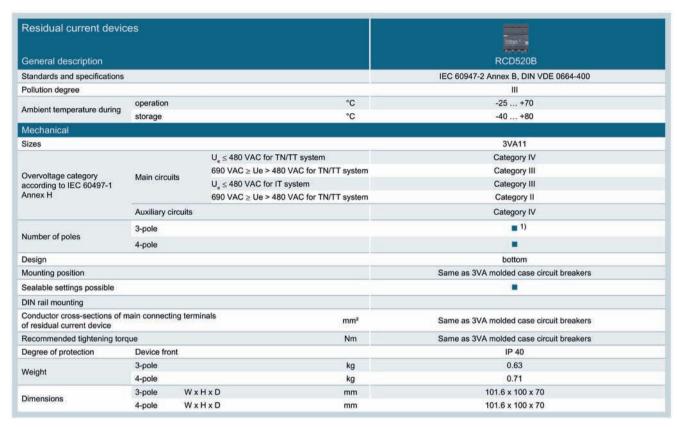


| Residual   | current devic  | es   |   |               | <u>.</u>  | ħ.   |   | 100  |  |
|--|--|--|---|---------------|---|--|---|--|--|
| Electrical   |  |  |   |               |   | RCD510   | RCD320  | RCD520   | RCD820   |
| Rated opera  | And the second s |  |   | Α             | up to 160   | up to 250  | up to 160   | up to 250  | up to 630  |
| Rated operational frequency f  |  | Hz   | 50/60                                   | 50/60         | 50/60   | 50/60  | 50/60   |  |  |
| Sensitivity Type A (pulse current sensitive)   |  | )  |   |               |   |  |   |  |  |
| Rated opera  | ational  | 3 AC   | U.                                      | V AC          | 127-480   | 127-480  | 127-480   | 127-480  | 127-690  |
| voltage  |  | 1 AC   | U.                                      | V AC          |   |  | 100-277   | 100-277  | 100-400  |
| Rated respo  | onse current   |  | I <sub>Δn</sub>                         | Α             | 0.03 / 0.05 / 0.1 /<br>0.3 / 0.5 / 1.00 /<br>3.00 / 5.00              | 0.03 / 0.05 / 0.1 /<br>0.3 / 0.5 / 1.00 /<br>3.00 / 5.00 | 0.03 / 0.05 / 0.1 /<br>0.3 / 0.5 / 1.00 /<br>3.00 / 5.00              | 0.03 / 0.05 / 0.1 /<br>0.3 / 0.5 / 1.00 /<br>3.00 / 5.00                             | 0.03 / 0.05 / 0.1 / 0.3<br>0.5 / 1.00 / 3.00 /<br>5.00 / 10.00 / 30.00 |
| Delay time $\Delta t$  |  |  | s                                       | Instantaneous | Instantaneous<br>/ 0.06 / 0.15 /<br>0.3 / 0.5 / 1.00 /<br>2.00 / 3.00 | Instantaneous  | Instantaneous /<br>0.06 / 0.15<br>/ 0.3 / 0.5 / 1.00 /<br>2.00 / 3.00 | Instantaneous /<br>0.06 / 0.15 / 0.3 /<br>0.5 / 1.00 / 2.00 /<br>3.00 / 5.00 / 10.00 |  |
| Residual cu  | rrent frequency m  | easurement range   | f                                       | Hz            | 50/60   | 50/60  | 50/60   | 50/60  | 50/60  |
| The state of the s |  |  | V AC                                    | 108 480       | 108 480   | 108 4801)  | 108 4801)   | 108 6901)  |  |
| Suitable for use   |  |  |   |               | in 3-phase systems  | in 1- and 3-phase<br>systems                             | in 1- and 3-phase<br>systems  | in 1- and 3-phase<br>systems   |  |
| Rated isolat   |  | NAME OF THE PROPERTY OF THE PR | U                                       | V AC          | 500   | 500  | 500   | 500  | 800  |
|  |  |  | U <sub>imp</sub>                        | kV            | 6   | 6  | 6   | 6  | 8  |
| Self-supply  | 8  |  |   |               |   |  |   |  |  |
|  | on the device  | Test key   |   |               |   |  |   |  |  |
| Test<br>functions  | Remote tripping  |  | er contacts                             |               |   |  |   |  |  |
|  |  | Via comm<br>interface  | unication                               |               |   |  |   |  |  |
|  | on the device  |  |   |               |   |  |   |  |  |
| Reset<br>functions   |  |  | Electrically via<br>changeover contacts |               |   |  |   |  | 3)   |
|  |  | interface  | Via communication interface             |               |   |  |   |  | 33   |
|  |  | mech. Indi<br>tripped sig  | nals                                    |               |   | •  | •   | •  |  |
|  |  | LED - ACT  | TIVE                                    |               |   |  |   | -  |  |
|  | on the device  | LED - COI<br>(communi<br>interface)  |   |               |   |  |   |  | <b>4</b> )   |
| Visual   |  | LED - Pre-<br>signal 1 (fi   | -alarm<br>rom 30% I <sub>M</sub> )      |               | •   |  | •   | •  |  |
| displays   |  | LED - Pre-<br>signal 2 (fi   | -alarm<br>rom 60% I <sub>M</sub> )      |               |   |  |   |  | •  |
|  |  | Tripped si   | gnal                                    |               |   | •  |   |  |  |
|  | Electrical<br>(changeover<br>contacts)   | Pre-alarm<br>(from 30%   | l <sub>an</sub> )                       |               |   |  |   |  |  |
|  |  | Pre-alarm<br>(from 60%   |   |               |   |  |   |  |  |
|  | Communication  | n  |   |               |   |  |   |  | 4)   |
| Infeed from  | top/bottom   |  |   |               |   |  | ( ·   |  |  |
| Vibration an   | d shock resistance   | e  |   |               |   | IEC 60068-2  | -6 / IEC 60068-2-27   | IEC 60068-2-47   |  |

- 1) 85 V AC minimum voltage (with phase to neutral conductor) for operation of the test function
- 2) Reset by means of the circuit breaker handle
- 3) Via MO or SEO
- <sup>4)</sup> Requirement: The 3VA2 molded case circuit breaker is equipped with an ETU 5-series or 8-series

| Auxiliary switches and<br>current device | l alarm sv                      | witches o | n residua                        | al      | Ī.,                         | i.,                         | 200                         | 200                         | -                           |
|--|---------------------------------|-----------|----------------------------------|---------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| General information                      |                                 |           |                                  | RCD310  | RCD510                      | RCD320                      | RCD520                      | RCD820                      |                             |
| Standards and specifications             |                                 |           |                                  |         |                             |                             | IEC 60947-5                 |                             |                             |
| Mechanical                               |                                 |           |                                  |         |                             |                             |                             |                             |                             |
|  | Solid                           |           |                                  | mm²     | 1 x 0.5 1.5<br>2 x 0.5 0.75 | 1 x 0.51.5<br>2 x 0.5 0.75  | 1 x 0.51.5<br>2 x 0.5 0.75  | 1 x 0.51.5<br>2 x 0.5 0.75  | 1 x 0.51.5<br>2 x 0.5 0.75  |
| Conductor cross sections                 | Stranded                        |           |                                  | mm²     | 1 x 0.5 1.5<br>2 x 0.5 0.75 | 1 x 0.51.5<br>2 x 0.5 0.75  |
| Conductor cross sections                 | Finely stranded                 |           |                                  | mm²     | 1 x 0.5 1.5<br>2 x 0.5 0.75 | 1 x 0.5 1.5<br>2 x 0.5 0.75 | 1 x 0.5 1.5<br>2 x 0.5 0.75 | 1 x 0.51.5<br>2 x 0.5 0.75  | 1 x 0.5 1.5<br>2 x 0.5 0.75 |
|  | Finely stranded with end sleeve |           |                                  | mm²     | 1 x 0.5 1.5<br>2 x 0.5      |
| Recommended tightening tor               | que                             |           |                                  | Nm      | 0.5 0.6                     | 0.5 0.6                     | 0.5 0.6                     | 0.5 0.6                     | 0.5 0.6                     |
| Electrical                               |                                 |           |                                  |         |                             |                             |                             |                             |                             |
| Conventional free-air therma             | current                         |           | 1 <sub>et</sub> = 1 <sub>e</sub> | Α       | 10                          | 10                          | 10                          | 10                          | 5                           |
|  |                                 | 24 V      | 1,                               | Α       | 10                          | 10                          | 10                          | 10                          | 5                           |
|  |                                 | 48 V      | I,                               | Α       | 10                          | 10                          | 10                          | 10                          | 5                           |
|  | AC-12                           | 110 V     | I,                               | Α       | 10                          | 10                          | 10                          | 10                          | 5                           |
|  | A0-12                           | 125 V     | l <sub>e</sub>                   | Α       | 10                          | 10                          | 10                          | 10                          | 5                           |
| Rated operational current                |                                 | 230 V     | I.                               | Α       | 10                          | 10                          | 10                          | 10                          | 5                           |
| rated operational current                |                                 | 250 V     | 1,                               | Α       | 10                          | 10                          | 10                          | 10                          | 5                           |
|  |                                 | 24 V      | I.                               | Α       | 4                           | 4                           | 4                           | 4                           | 4                           |
|  | DC-12                           | 30 V      | I,                               | Α       | 4                           | 4                           | 4                           | 4                           | 4                           |
|  | 00-12                           | 125 V     | I.                               | Α       | 0.4                         | 0.4                         | 0.4                         | 0.4                         | 0.5                         |
|  |                                 | 250 V     | 1,                               | Α       | 0.2                         | 0.2                         | 0.2                         | 0.2                         | 0.2                         |
| Short-circuit protection: max.           | fuse, quick-                    | response  |                                  | A gG/gL | 10                          | 10                          | 10                          | 10                          | 5                           |

# RCD type B



The 3-pole version of RCD520B is installed in a 4-pole enclosure

| Residual current                 | devices  |  |  |                  |      | Total Control of the |
|----------------------------------|--|--|--|------------------|------|---|
|                                  |  |  |  |                  |      | REPORT.   |
| Electrical                       |  |  |  |                  |      | RCD520B   |
| Rated operational cur            | rent   |  | Up to 160  |                  |      |   |
| Rated operational free           | Rated operational frequency f Hz   |  |  |                  |      | 50/60   |
| Sensitivity                      |  | Type B   |  |                  |      |   |
| Constituting                     |  | Type B+  |  |                  |      | •   |
| Rated operational voltage        |  | Type B   | L-L  | U,               | V AC | 127 690   |
|                                  |  | Type 6   | L-N  |                  |      | 100 400   |
| realed operational voi           | tage   | Type B+  | L-L  | U.               | V AC | 50 690  |
|                                  |  | туре в .   | L-N  |                  |      | 85 400  |
| Rated response current           |  | Туре В   |  | I <sub>de</sub>  | Α    | 0.03 / 0.05 / 0.1 / 0.3 / 0.5 / 1.00 / 3.00 / 5.00  |
|                                  |  | Type B+  |  | I <sub>dn</sub>  | Α    | 0.03/0.05/0.1/0.3   |
| Delay time                       |  |  |  | Δt               | s    | instantaneous 0.06 / 0.15 / 0.3 / 0.5 / 1.00 / 2.00 / 3.00 / 5.00 / 10.00   |
| Measuring range of re            | esidual current frequency  | Type B / Type  | 9 B+   | f                | kHz  | 0 100   |
|                                  |  | Type B   | L-L  | U,               | V AC | 108   |
| Operating range of test function |  | Type D   | L-N  | U,               | V AC | 85  |
|                                  |  | Type B+  | L-L  | U,               | V AC | 50  |
|                                  |  |  | L-N  | U,               | V AC | 85  |
| Suitable for use                 | WARES.   |  |  | 111878           |      | in 1-phase and 3-phase systems  |
| Rated insulation volta           |  |  |  | U                | V AC | 800   |
| Rated impulse withsta            | and voltage  |  |  | U <sub>imp</sub> | kV   | 6   |
| Self-powered                     | ON THE CONTRACT OF THE CONTRAC | Maria Maria Maria  |  |                  |      |   |
|                                  | On the device  | Test key   |  |                  |      |   |
| Test functionality               | Remote tripping  |  | changeover c   | ontacts          |      |   |
|                                  |  | Via communi  | cation link  |                  |      |   |
|                                  | On the device  |  |  |                  |      | •   |
| Reset functionality              | Remotely   | Electrical via<br>Via communi  | changeover c<br>cation link  | ontacts          |      |   |
|                                  |  | Mech. indicat  | or for tripped   | signals          |      | •   |
|                                  |  | LED ACTIVE   |  |                  |      |   |
|                                  | On the device  |  | ommunication   | link)            |      |   |
|                                  |  |  | ARM (from 30   |                  |      |   |
| Optical indicators               |  | LED MONITO   | DELOCATED TO THE PARTY OF THE P | im.              |      | •   |
| 92                               | -  | Tripped signa  |  |                  |      |   |
|                                  | Electrical   | Constitution of the Consti |  |                  |      | -   |
| (changeover contact              |  | Pre-alarm 1 (  | and the same of th |                  |      |   |
|                                  | Communication  | Pre-alarm 2 (  | irom 60% I <sub>an</sub> )   |                  |      |   |
| Incoming supply from             | AND THE PROPERTY OF THE PROPER |  |  |                  |      |   |
| modifing supply from             | and shock resistance   |  |  |                  |      | IEC 60068-2-6 / IEC60068-2-27 / IEC600068-2-47  |

| Auxiliary and alarm switches on       | residual current | device      |                                  |     | 100 T                       |  |  |
|---------------------------------------|------------------|-------------|----------------------------------|-----|-----------------------------|--|--|
| General description                   |                  |             | RCD520B                          |     |                             |  |  |
| Standards and specifications          |                  |             | IEC 60947-5                      |     |                             |  |  |
| Mechanical                            |                  |             |                                  |     |                             |  |  |
|                                       | Solid            |             |                                  | mm² | 1 x 0.5 1.5<br>2 x 0.5 1.0  |  |  |
| Conductor cross-sections              | Stranded         |             |                                  | mm² | 1 x 0.5 1.5<br>2 x 0.5 0.75 |  |  |
|                                       | Finely stra      | nded        |                                  | mm² | 1 x 0.5 1.5<br>2 x 0.5 0.75 |  |  |
|                                       | Finely stra      | nded with f | errule                           | mm² | 1 x 0.5 1.0                 |  |  |
| Recommended tightening torque         |                  |             |                                  | Nm  | 0.5 0.6                     |  |  |
| Electrical                            |                  |             |                                  |     |                             |  |  |
| Rated impulse withstand voltage       |                  |             | U <sub>imp</sub>                 | kV  | 4                           |  |  |
| Conventional free-air thermal current |                  |             | 1 <sub>e1</sub> = 1 <sub>e</sub> | A   | 5                           |  |  |
| Rated operational voltage             |                  |             | U <sub>p</sub>                   |     | 250                         |  |  |
|                                       |                  | 24 V        | l <sub>e</sub>                   | Α   | 5                           |  |  |
|                                       |                  | 48 V        | l.                               | Α   | 5                           |  |  |
|                                       | AC-12            | 110 V       | I.                               | A   | 5                           |  |  |
|                                       | A0-12            | 125 V       | l <sub>e</sub>                   | Α   | 5                           |  |  |
|                                       |                  | 230 V       | 1.                               | Α   | 5                           |  |  |
|                                       |                  | 250 V       | 1,                               | Α   | 5                           |  |  |
|                                       |                  | 24 V        | I.                               | Α   | 1                           |  |  |
|                                       |                  | 48 V        | 1,                               | A   | 1                           |  |  |
|                                       | AC-15            | 110 V       | 1,                               | A   | 1                           |  |  |
| Dated assertional assert              | AC-15            | 125 V       | I,                               | A   | 1                           |  |  |
| Rated operational current             |                  | 230 V       | 1,                               | Α   | 1                           |  |  |
|                                       |                  | 250 V       | I,                               | A   | 1                           |  |  |
|                                       |                  | 24 V        | I.                               | Α   | 4                           |  |  |
|                                       | DC-12            | 48 V        | l <sub>e</sub>                   | A   | 4                           |  |  |
|                                       | DC-12            | 125 V       | I,                               | Α   | 0.2                         |  |  |
|                                       |                  | 250 V       | I,                               | Α   | 0.1                         |  |  |
|                                       |                  | 24 V        | I,                               | Α   | 1                           |  |  |
|                                       | DO 42            | 48 V        | I,                               | Α   | On request                  |  |  |
|                                       | DC-13            | 125 V       | 1,                               | Α   | On request                  |  |  |
|                                       |                  | 250 V       | I.                               | A   | On request                  |  |  |

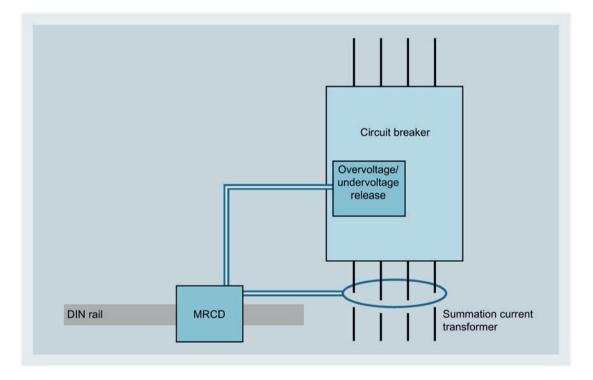
#### 4.8.3 Modular residual current device

Thanks to their design, the modular residual current devices (MRCD) type A 5SV8101-6KK and type B (5SV8101-4KK, 5SV8111-4KK / 0 to 2000 Hz) are compatible with all molded case circuit breaker designs and can therefore be combined with 3VA1 molded case circuit breakers/switch disconnectors and with molded case circuit breakers from the 3VA2 range.

The MRCD is installed on a DIN rail (35 mm) as close as possible to the molded case circuit breaker/switch disconnector.

### Operating principle

The MRCD is connected to a summation current transformer through which all live conductors (including neutral conductor where applicable) must be routed. The residual current is detected in the summation current transformer and transferred to the MRCD. If this current exceeds the limit value for the set rated residual current  $I_{\Delta n}$ , the residual current device trips the molded case circuit breaker/switch disconnector by means of a shunt trip or undervoltage release.



## Front view



# Parameterization of the MRCD

For a description of MRCD parameterization procedures and other operating options, please refer to the operating instructions for the unit.

## Summation current transformer



#### Suitable summation current transformers

Depending on the rated operational current or maximum current of the circuit to be monitored, the following summation current transformers can be used:

# MRCD type A:

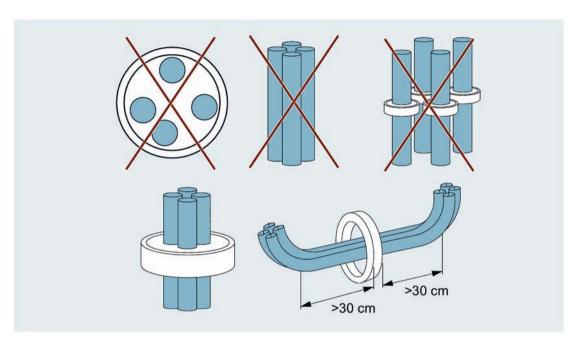
| Туре        | Rated operational current | Max. current |
|-------------|---------------------------|--------------|
| 5SV8702-0KK | 80 A                      | 480 A        |
| 5SV8703-0KK | 200 A                     | 1200 A       |
| 5SV8704-0KK | 250 A                     | 1500 A       |
| 5SV8705-0KK | 500 A                     | 3000 A       |
| 5SV8706-0KK | 600 A                     | 3600 A       |

# MRCD type B (5SV8101-4KK, 5SV8111-4KK / 0 ... 2000 Hz):

| Туре        | Rated operational current | Max. current |  |  |  |
|-------------|---------------------------|--------------|--|--|--|
| 5SV8701-2KK | 20.4                      | 500 A        |  |  |  |
| 5SV8701-2KP | 80 A                      | 500 A        |  |  |  |
| 5SV8702-2KK | 100 A                     | 1000 A       |  |  |  |
| 5SV8702-2KP | 160 A                     | 1000 A       |  |  |  |
| 5SV8703-2KK | 330 A                     | 2000 A       |  |  |  |
| 5SV8704-2KK | 630 A                     | 3800 A       |  |  |  |

## Alignment of conductors in the summation current transformer

In order to prevent measurement errors or spurious tripping, it is absolutely essential to ensure that the conductors are properly aligned or arranged in the summation current transformer.



#### Note

With MRCD type A, the summation current transformer used for the application must have an inside diameter which is at least 1.5 times larger than the outside diameter of the conductors which pass through it. With MRCD type B, the inside diameter must be at least 2 times larger.

If the combination MRCD, summation current transformer, trip unit and molded case circuit breaker/switch disconnector is to be installed, the minimum clearances must be observed. For more information, refer to the operating instructions.

# Combinations of molded case circuit breaker, MRCD and shunt trip/undervoltage release

Modular residual current devices, molded case circuit breakers, and shunt trips or undervoltage releases UVR can be combined as indicated in the tables below:

# MRCD type A:

| Molded case circuit breaker                                 | Shunt trip    | Volta         | ge      |
|---|---------------|---------------|---------|
| Wolded case circuit breaker                                 | Shunt trip    | V AC 50/60 Hz | V DC    |
| 3VA10 (16 100 A)<br>3VA11 (16 160 A)<br>3VA12 (160 250 A)   | 3VA9988-0BL30 | 24            | 12 30   |
| 3VA20 (25 100 A)<br>3VA21 (25 160 A)                        | 3VA9988-0BL32 | 110 127       | 110 127 |
| 3VA22 (160 250 A)<br>3VA23 (250 400 A)<br>3VA24 (400 630 A) | 3VA9988-0BL33 | 208 277       | 220 250 |

| Maldad area size it becales          | Hadamakana valansa (HV/D)  | Voltag          | Voltage     |  |  |  |  |
|--------------------------------------|----------------------------|-----------------|-------------|--|--|--|--|
| Molded case circuit breaker          | Undervoltage release (UVR) | V AC 50/60 Hz   | V DC        |  |  |  |  |
| 3VA10 (16 100 A)                     | 3VA9908-0BB11              | 8 <del>.7</del> | 24          |  |  |  |  |
| 3VA11 (16 160 A)                     | 3VA9908-0BB20              | 24              | 8 <u>22</u> |  |  |  |  |
| 3VA20 (25 100 A)<br>3VA21 (25 160 A) | 3VA9908-0BB24              | 120 127         | .=          |  |  |  |  |
| 3VA22 (160 250 A)                    | 3VA9908-0BB25              | 208 230         |             |  |  |  |  |
| 3VA12 (160 250 A)                    | 3VA9908-0BB11              | ( <del>57</del> | 24          |  |  |  |  |
| 3VA23 (250 400 A)                    | 3VA9908-0BB20              | 24              |             |  |  |  |  |
| 3VA24 (400 630 A)                    | 3VA9908-0BB24              | 120 127         | _           |  |  |  |  |

# MRCS type B:

| Molded case circuit breaker                                 | Chunt trin    | Volta         | ge      |
|---|---------------|---------------|---------|
| Moided case circuit breaker                                 | Shunt trip    | 50/60 Hz V AC | V DC    |
| 3VA10 (16 100 A)<br>3VA11 (16 160 A)                        | 3VA9988-0BL30 | 24            | 12 30   |
| 3VA20 (25 100 A)<br>3VA21 (25 160 A)                        | 3VA9988-0BL32 | 110 127       | 110 127 |
| 3VA22 (160 250 A)<br>3VA23 (250 400 A)<br>3VA24 (400 630 A) | 3VA9988-0BL33 | 208 277       | 220 250 |

| Molded case circuit breaker                                 | Undervoltage release (UND)  | Voltage         |      |  |  |  |  |
|---|-----------------------------|-----------------|------|--|--|--|--|
| violded case circuit breaker                                | Undervoltage release (UVR)  | V AC 50/60 Hz   | V DC |  |  |  |  |
| 3VA10 (16 100 A)<br>3VA11 (16 160 A)                        | 3VA9908-0BB11               | 8 <del>17</del> | 24   |  |  |  |  |
| 3VA20 (25 100 A)<br>3VA21 (25 160 A)                        | 3VA9908-0BB24 <sup>1)</sup> | 120 127         | 7-   |  |  |  |  |
| 3VA22 (160 250 A)<br>3VA23 (250 400 A)<br>3VA24 (400 630 A) | 3VA9908-0BB25               | 208 230         | -    |  |  |  |  |

<sup>1)</sup> Cannot be combined with 3VA23 and 3VA24 molded case circuit breakers

# 4.9 Communication and system integration

# 4.9.1 System description

Communication-capable 3VA molded case circuit breakers are presented in this chapter. You will find out about the components that 3VA molded case circuit breakers require in order to communicate, how these components are interconnected and what properties they have.

The advantages of optimum integration of 3VA molded case circuit breakers into a software or communication system are as follows:

- · Acquisition of breaker status
- Remote control
- Remote parameterization
- Monitoring of capacity utilization
- Acquisition of consumption and performance data
- · Local signaling via the EFB300 external function box
- Local visualization of 3VA molded case circuit breakers

A 3VA molded case circuit breaker can utilize all these functions only if a COM060 communication module is installed in the 3VA breaker and connected to a COM800 breaker data server for up to eight 3VA molded case circuit breakers, or a COM100 breaker data server for one breaker.

You can find detailed information on the communication module and breaker data server and the communication link of the molded case circuit breaker in the 3VA Communication System Manual.

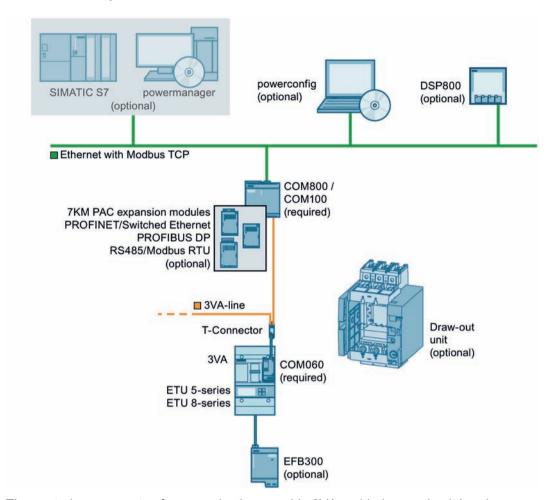
# 4.9.2 Communication system of the 3VA molded case circuit breaker

The following components combine with the 3VA molded case circuit breaker to create a communication system:

- Electronic trip unit (ETU)
- COM800 / COM100 breaker data server
- Optional expansion modules for three other communication networks
- COM060 communication module
- Draw-out unit with communication link
- Synchronizable motor operator SEO520
- EFB300 external function box (EFB)
- DSP800 display
- Commissioning and service software: powerconfig

The diagram below presents the components which render a 3VA molded case circuit breaker capable of communication.

Communication system architecture for 3VA



The central components of communication-capable 3VA molded case circuit breakers are the ETUs 5-series or 8-series.

You can find additional information in the 3VA Communication System Manual. There the components are regarded only as suppliers of information or receivers of commands. Typical communication partners are:

- SIMATIC S7
- powermanager

While reference is frequently made to these systems, they are not an integral part of the 3VA communication system.

#### 4.9.3 COM800 / COM100 breaker data server

The COM800/COM100 breaker data servers can be used to integrate communication-capable 3VA molded case circuit breakers with ETUs 5-series and 8-series into communication networks of various types.

- The COM800 breaker data server supports a maximum of eight 3VA molded case circuit breakers
- The COM100 breaker data server supports one 3VA molded case circuit breaker

3VA molded case circuit breakers can be connected to higher-level communication networks by the following methods:

- Direct Ethernet connection to Modbus TCP
- 7KM PAC PROFIBUS DP expansion module to PROFIBUS DPV1 / V2
- 7KM PAC Switched Ethernet PROFINET expansion module to PROFINET IO and PROFIenergy, as well as Modbus TCP
- 7KM PAC RS 485 expansion module for Modbus RTU

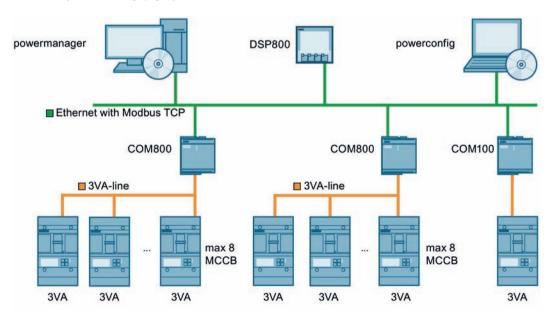
3VA molded case circuit breakers are typically linked to the power monitoring software powermanager or the automation concept TIA (Totally Integrated Automation) via a communication network.

3VA molded case circuit breakers can also be connected to the commissioning and service software powerconfig.

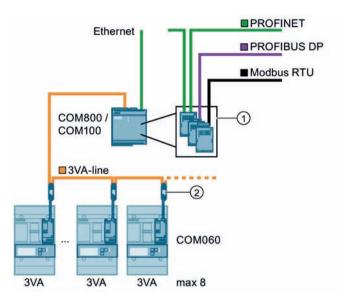
The 3VA molded case circuit breakers can also be linked to many non-Siemens systems through such communication networks.

Furthermore, local visualization on the DSP800 display can be implemented with the COM800/COM100 breaker data server.

Example: Configuration of the COM800/COM100 breaker data server with a 3VA-line of three 3VA molded case circuit breakers and with connection to the power monitoring software powermanager (left), to the DSP800 (center) and to the commissioning and service software powerconfig (right).



To establish a communication link, the COM800 or COM100 breaker data server is connected via the 3VA-line to the COM060 communication module of the relevant circuit breaker.



- 1 PAC expansion modules
- 2 T-connector

From a 24 V DC supply, the COM800/COM100 breaker data server supplies power to all the connected 3VA molded case circuit breakers and the following components:

- COM060 communication module
- ETUs 5-series and 8-series
- Position signaling switch for draw-out socket
- 7KM PAC PROFIBUS DP expansion module
- 7KM PAC Switched Ethernet PROFINET expansion module
- 7KM PAC RS 485 expansion module

## 4.9.3.1 Area of application

The COM800/COM100 breaker data server can be used to link 3VA molded case circuit breakers to:

- Power monitoring software powermanager
- Industrial automation systems
- Building automation systems
- Parameterization and breaker condition evaluation via communication link
- Maintenance systems
- MindSphere

#### 4.9 Communication and system integration

#### 4.9.3.2 Features

Working in conjunction with the connected 3VA molded case circuit breakers with ETUs 5-series and 8-series, the COM800/COM100 breaker data server supplies the following information about the power distribution system:

- Condition of the 3VA molded case circuit breaker
- Tripping history with time stamp, cause of trip and number of trip events for breakers with ETUs 5-series and 8-series
- · Minimum and maximum values of measured variables
- Limit-value monitoring for measured variables in the 3VA molded case circuit breakers
- Load curves with power demands, e.g. 15-minute demands
- Energy values such as active energy (kWh) and reactive energy (kvarh)
- Power supply to connected 3VA molded case circuit breakers
- Three simultaneous communication connections via the integrated Ethernet interface (e.g. DSP800, powermanager and, temporarily, powerconfig)

#### 4.9.4 Communication with ETUs

Electronic trip units allow detailed setting of protection parameters from a central location. They record measured variables and maintenance information in order to support power and installation monitoring.

The electronic trip units (ETUs) provide the following protection functions:

- Overload protection L ("L" = Long time)
- Short-time delayed short-circuit release S ("S" = Short time) for time-selective response in case of a short-circuit
- Instantaneous short-circuit release I ("I" = Instantaneous)
- Protection of the neutral conductor against overload and short-circuit ("N" = neutral)
- Protection against residual currents to ground G ("G" = Ground fault)

## 4.9.4.1 Area of application

Communication-capable ETUs are deployed for any application which requires the following functions:

- Diverse protection functions
- Finer setting options for protection functions
- Metering functions
- For 50 and 60 Hz networks (45 to 65 Hz)
- The communication option provides a wide range of information about the status of the molded case circuit breaker, as well as the actual measured values.

# 4.9.5 DSP800 display

The DSP800 display is designed for mounting in the panel door and can be optionally connected to the Ethernet (Modbus TCP) interface integrated in the COM800 / COM100 breaker data server. The DSP800 display shows the data of the breaker data server and thus the data of up to eight connected 3VA molded case circuit breakers.

The start page of the DSP800 displays the status and maximum current of all 3VAs. All the detailed information about individual molded case circuit breakers can be selected via the efficiently structured menu. This includes

- Measured values of ETU 5-series and 8-series
- ETU setting parameters
- Status
- Diagnostics

With firmware version 2.07, up to three 3WL10 / 3VA27 circuit breakers can also be shown on the DSP800 display. It must be noted that a maximum of 8 breakers can be displayed.

Templates for 1, 2, 4 and 8 breakers are available as default screens. These can either be selected and arranged automatically or they can be manually assigned. In addition, the measured values to be displayed can be selected in the overview.



# 4.9.6 Commissioning and testing of electronic trip units using powerconfig

#### powerconfig

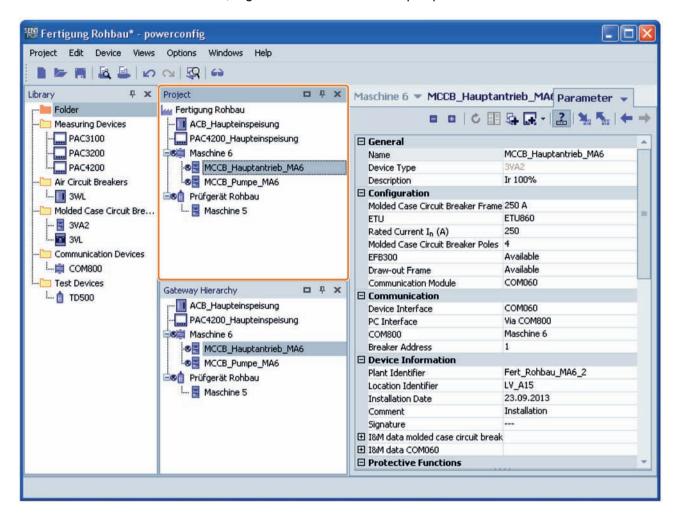
powerconfig performs the following functions for 3VA molded case circuit breakers:

- · Parameterization of 3VA ETUs and other 3VA components
- Testing of 3VA
- Commissioning of 3VA
- Statistical analysis of 3VA
- Readout of measured variables such as energy, current, voltage and power from 3VA molded case circuit breakers
- Readout of minimum and maximum values from 3VA molded case circuit breakers
- Diagnostics of 3VA

The PC on which powerconfig is installed is connected to the 3VA molded case circuit breaker by means of the COM800 / COM100 breaker data server (optionally with modules) or the TD500 test device.

The TD500 test device is required in order to perform function tests. You can find more detailed information on the TD500 test device in chapter TD500 test device (Page 513).

3VA molded case circuit breakers and, in some cases, other devices supported by powerconfig are combined in powerconfig to form a project if they are related to one another from a technical, organizational or some other perspective.



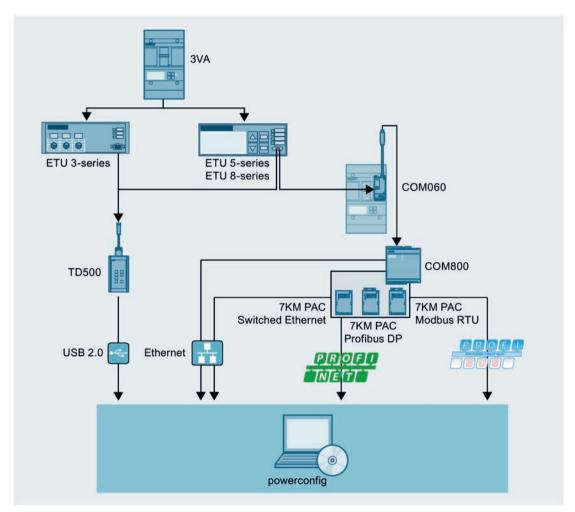
Electronic trip units (ETU), the EFB300 external function box and the communication structure can be commissioned easily by means of the powerconfig software. On completion of the commissioning process, the ETU settings can be stored as a project on the PC and printed out.

powerconfig can also be used to perform ETU trip tests. A test report is generated automatically and stored in the project every time a test is carried out.

#### 4.9 Communication and system integration

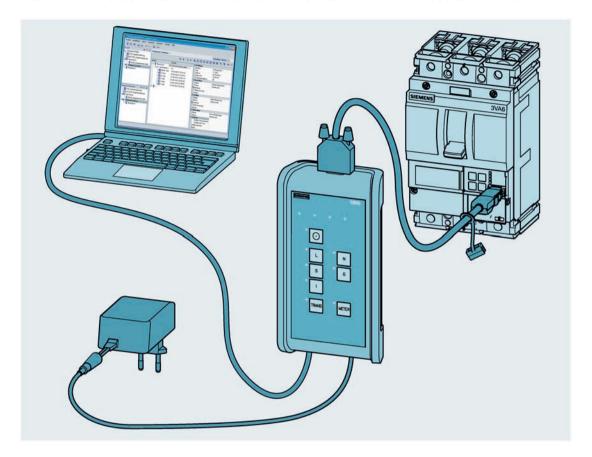
powerconfig supports a variety of different device communication links depending on the SENTRON device used:

- USB
- Ethernet (Modbus TCP)
- PROFINET
- PROFIBUS
- MODBUS RTU



The possible means of connection of the COM800 / COM100 breaker data server are described in detail in the 3VA Communication system manual (see Reference documents (Page 10)).

With 3VA molded case circuit breakers and 3-series ETUs, powerconfig is linked to the ETU interface via the USB interface on the PC and the interface on the TD500 test device.



# 4.9.7 Power management with powermanager

For power and plant monitoring, Siemens offers the powermanager software. Together with SENTRON protection devices such as 3VA, 3WL and PAC measuring devices as well as non-Siemens devices, powermanager provides a power monitoring system for reducing energy costs and increasing energy availability.

powermanager acquires the measured variables that are needed to optimize power consumption and so reduce costs. These variables not only include energy and power values, but also electrical parameters such as current, voltage, or power factor. Not only is this system able to display values, but also to monitor and archive them for later analysis. In addition, the load monitoring function is capable of monitoring a specified setpoint and making recommendations as to which loads should be connected and disconnected.

## Identifying savings potential

The power monitoring software has been tested by the TÜV Rheinland for its suitability to support an energy management system in accordance with ISO 50001.

#### Functionality and user-friendliness

The salient features and functions of the power monitoring software are as follows:

- · Good scalability
- Enhanced report templates
- Response plans
- Mass parameterization
- Virtual measuring points for computing customer-specific parameters
- Load monitoring function for monitoring specified power limits for freely definable time periods
- Switching recommendations in the event of limit violations
- · Remote control of circuit breakers

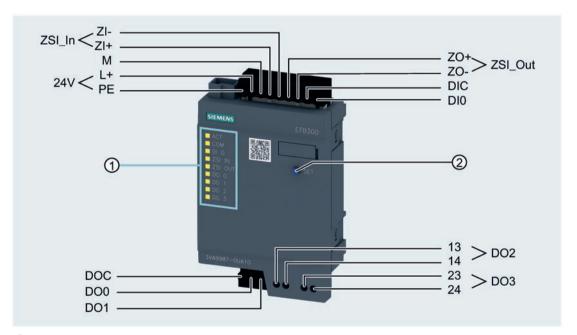
# 4.10 EFB300 external function box

#### 4.10.1 General information

3VA molded case circuit breakers equipped with the electronic trip unit systems ETU 3-series, ETU 5-series and ETU 8-series can be optionally upgraded with an EFB300 external function box.

The EFB300 external function box receives information from the ETU via a cable connection. This information can be used to output active trip alarms and tripping reasons (configurable using powerconfig) via four digital outputs.

Zone selective interlocking ZSI (see chapter Zone selective interlocking (ZSI) (Page 82)) can also be implemented via the EFB300. The EFB300 also supplies the ETU with power which means that the ETU can be parameterized via the display even when a 3VA molded case circuit breaker is in the de-energized state.



- ① LED display
- ② <SET> button
- ZSI Zone selective interlocking
- DI Digital input
  DO 0 ... 3 Digital output

# 4.10.2 Power supply

The EFB300 external function box must be operated on a 24 V DC power supply unit. It acts as a power supply for the connected ETU. This allows the ETU to remain operational even when a 3VA molded case circuit breaker has tripped.

# 4.10.3 Functions of the digital input and digital outputs

#### Functions of the digital input

Two different functions can be implemented using the digital input:

- Tripped signals in the ETU can be reset (this also removes the reason for the tripped signal from the ETU display and the default screen is displayed again).
- Information from a digital input can be made available via the communication interface of the COM800/COM100 breaker data server, e.g. the status of a door contact transmitter.

## Functions of the digital outputs

With the powerconfig software application, it is possible to selectively assign signals transmitted by the connected ETU to the four digital outputs of the EFB300. powerconfig can be accessed via the TD500 test device or by means of the COM800 or COM100 breaker data server through the interface to the communication system.

The following signals (dependent on the ETU) can be assigned:

#### • All the trip causes of the ETU

- Overload L
- Overload L in the neutral conductor
- Short-time delayed short circuit S
- Instantaneous short circuit I
- Ground-fault protection G
- Overtemperature
- Blocking protection (with motor protection)
- Idle running protection (with motor protection)
- Phase failure protection (with motor protection)
- RCD trip
- Group signal for trip due to short circuit (i.e. S or I)
   This makes it possible to differentiate between overload and short circuit. This is an important criterion for the question "May I reconnect?".
- Group alarm for trip by ETU

#### Warnings

- Alarm level AL1 (90% I<sub>r</sub>)
- Alarm level AL2 (105% I<sub>r</sub>)
- Temperature alarm
- Load shedding or load pick up

By means of the load shedding and load pick up signals, a load can be switched off or connected automatically depending on the capacity utilization of the 3VA molded case circuit breaker.

- Ground-fault alarm
- Internal ETU fault
- Group signal for all warnings
- Pre-trip for overload
   This warning appears 200 ms before an overload trip. This allows the user to bring frequency converters into a safe state, for example.

#### Remote control

- The four digital outputs can be controlled directly from the fieldbus/Ethernet.

Possible application: Control of an MO320 motor operator without communication capability

#### • Limit values (4)

The 8-series ETUs offer a total of four limit value settings. Almost all measured values are available for monitoring. These can be assigned a hysteresis and an additional time delay. In the event of upward or downward violation of the set measured value, a limit value violation is generated which can be output via the EFB300 outputs and also transmitted via the communication system.

One possible example is to signal the measured frequency in a combined heat and power plant.

#### • Energy pulse (with ETU 8-series only)

An energy pulse (S0 signal pulse) contains information pertaining to the consumption of a specific quantity of energy. The data are transmitted by weighted pulses, i.e. a specific number of pulses are transferred to represent one kWh unit.

Settings for the energy pulse, see table on next page.

Example of energy pulse:

Energy meter source: Active energy kWh

Pulses per unit: 5

Unit: 20 kWh Pulse length: 30 ms

Output of 140 kWh: Output of 35 pulses, each 30 ms in length

# 4.10 EFB300 external function box

## Overview of functions available with EFB300 external function box

| Version ava  | ilable with  |     | J320<br>J |       | J330<br>IG |      | J340<br>ISA |      | J350<br>SI |    | J550<br>SI | ETL  | ETU |   |    | J86<br>SIG |
|--|--|-----|-----------|-------|------------|------|-------------|------|------------|----|------------|------|-----|---|----|------------|
| 3-pole breake  | er   | 120 | -'        | 2000) |            |      | IOA         | 7050 |            |    | 01         |      |     |   |    |            |
|  | nal neutral conductor transformer                              | •   |           | •     |            | •    |             |      |            |    |            |      |     |   |    |            |
| 3-pole breaker with external neutral conductor transformer   |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| 4-pole breaker   |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| TANK THE PARTY OF  | d neutral conductor transformer trip alarms and output signals |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Trip reason o  |  |     |           |       |            |      |             | 10-1 |            |    |            |      |     |   |    |            |
| Charles a grant of the charles and the charles and the charles and the charles are cha | hort-time delayed short-circuit                                |     |           | _     |            |      |             |      |            |    |            |      |     |   |    |            |
| STATE OF THE PARTY | nstantaneous short circuit                                     |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| THE RESERVE OF THE PERSON NAMED IN   | verload at neutral conductor                                   | _   |           | _     |            |      |             | _    |            | _  |            |      | -   |   | _  |            |
| Assessment of the same   | round fault protection   |     |           |       |            |      |             |      |            |    |            |      |     | - |    |            |
| The second secon | vertemperature   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | RCD (residual current)   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Alarm level 1  |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Alarm level 2  |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | n for overload   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Temperature  |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| 0.5  | d-fault protection   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | cate internal ETU fault  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | g of threshold for load reconnection                           |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | of threshold for load shedding                                 |     |           |       |            |      |             | -    |            |    |            |      |     |   |    |            |
| Phase failure  |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Blocking prot  |  |     |           |       |            |      |             | 2)   |            | 3) |            |      |     |   |    |            |
| Idle running p   |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Ground-fault   |  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Remote conti   | rol (from bus system)  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | trip reason short-circuit                                      |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Group alarm,   | alarm  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Group alarm,   | trip   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Limit value  | e violation 1 in ETU   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Limit value  | e violation 2 in ETU   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Limit value  | e violation 3 in ETU   |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Limit value  | e violation 4 in ETU   |     |           |       |            |      |             |      |            |    |            |      |     |   |    | -          |
| Energy pulse   | F  |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | Apparent energy (kVAh)   |     |           |       |            |      |             |      |            |    |            |      |     |   |    | 1          |
|  | Active energy (kWh) import                                     |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Energy   | Active energy (kWh) export                                     |     |           |       |            |      |             |      |            |    |            |      |     |   |    | -51        |
| source   | Reactive energy (kvarh) inductive                              |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
|  | Reactive energy (kvarh) capacitive                             |     |           |       |            |      |             |      |            |    |            |      |     |   |    | 1          |
| Weighted pulse   | 1 1000 (in steps of 1 in kWh or kVArh)                         |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Pulse<br>width   | 30 500 ms<br>(in steps of 10 ms)                               |     |           |       |            |      |             |      |            |    |            |      |     |   |    | •          |
|  | d zone selective interlocking ZSI                              |     |           |       |            |      |             |      |            |    |            |      |     |   |    |            |
| Load monitoring  |  |     | 100       | 1 125 | 527        | 1723 | (80         |      |            |    |            | 2.50 | 120 |   | 12 | 1750       |

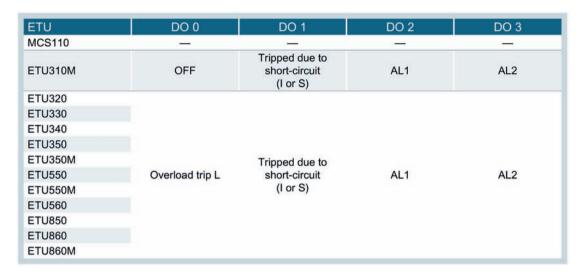
<sup>1)</sup> ETU860M (starter protection and motor protection)

<sup>2)</sup> ETU350M (motor protection)

<sup>3)</sup> ETU550M (motor protection)

#### Default output assignments

The four outputs of the EFB300 are automatically assigned factory defaults in ETUs with firmware version 4.2 and higher.



# 4.10.4 Zone selective interlocking (ZSI)

## **Description**

Microprocessor-controlled, zone selective interlocking (ZSI) has been developed in order to control the total breaking time in low-voltage networks with multiple molded case circuit breakers connected in series.

#### Advantage of ZSI:

Regardless of the number of series-connected molded case circuit breakers, all short circuits in the network can be cleared within a maximum time period of 50 ms. Short-circuit clearance times should be minimized, particularly in the case of system short circuits of very large magnitude.

#### Note

#### **Backward compatibility**

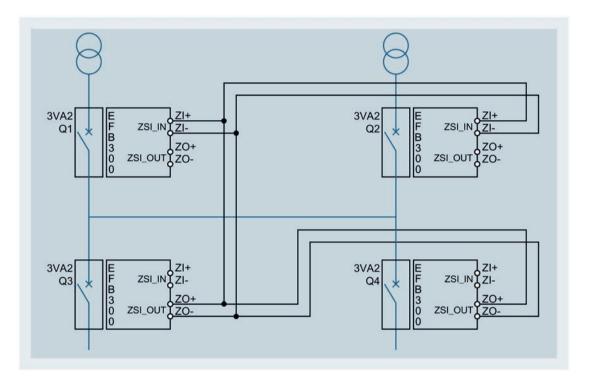
The ZSI function is backward-compatible with the ZSI function of the 3WL molded case circuit breakers.

#### 4.10 EFB300 external function box

#### Connection

Use of the ZSI function is conditional upon the connection of a dedicated EFB300 external function box to each 3VA2 molded case circuit breaker. The EFB300 allows molded case circuit breakers to communicate with one another, a capability which is a basic requirement for the ZSI function.

To permit utilization of the ZSI function, EFB300 external function boxes must be interconnected as illustrated below:



## See also

Zone selective interlocking (ZSI) (Page 82)

## 4.10.5 <SET> button

The <SET> button performs the following functions depending on mode:

- Operating mode: Acknowledgment of signals
- Test mode: Execution of a test function

# Operating mode

The EFB300 external function box is in operating mode during operation. Operation of the EFB300 is indicated by steady illumination of the LED labeled "ACT".

If a tripped signal is present at an output (output is activated), the user can acknowledge the signal or reset the output. This can be done by various methods:

- By application of a signal to the digital input of the EFB300
- By brief actuation of the <SET> button on the EFB300
- By actuation of the <ESC> button on the ETU

# LED states in operating mode

| LED |         | Meaning         | Description                              |
|-----|---------|-----------------|--|
|     | ACT     | Off             | EFB300 not active                        |
| 崇   | ACT     | On              | EFB300 ready                             |
|     | СОМ     | Off             | No communication link with ETU           |
|     | COM     | Flashing (2 Hz) | Establishing communication link with ETU |
| 崇   | СОМ     | On              | Communication link with ETU established  |
|     | DI 0    | Off             | Input not activated                      |
| 崇   | DI 0    | On              | Input activated                          |
|     | ZSI IN  | Off             | ZSI function not activated               |
| 崇   | ZSI IN  | On              | ZSI function activated                   |
|     | ZSI OUT | Off             | No ZSI Out signal transmitted            |
| 崇   | ZSI OUT | On              | ZSI Out signal transmitted               |
|     | DO 0    | Off             | No valid reason for trip signal          |
| 崇   | DO 0    | On              | Active trip signal                       |
|     | DO 1    | Off             | No valid reason for trip signal          |
| 崇   | DO 1    | On              | Active trip signal                       |
|     | DO 2    | Off             | No valid reason for trip signal          |
| 崇   | DO 2    | On              | Active trip signal                       |
|     | DO 3    | Off             | No valid reason for trip signal          |
| 崇   | DO 3    | On              | Active trip signal                       |

Steady illumination

Flashing

□ Off

Simultaneous flashing of all LEDs indicates that the EFB300 is defective.



Flashing

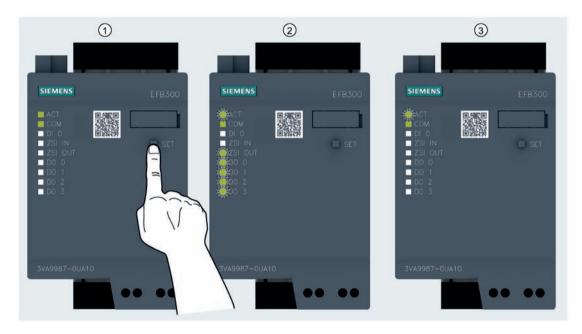
#### Test mode

All inputs and outputs can be activated or deactivated manually in test mode. This can be done to determine whether the digital outputs and the ZSI bus are functioning properly and wired correctly.

The LED labeled "ACT" flashes to indicate that test mode is active. The powerconfig software can also be used to test outputs.

#### Activating test mode and performing tests

1. In order to activate test mode, press the <SET> button for at least 2 seconds ① until all the LEDs for the outputs light up briefly ②. Test mode is activated when the LED labeled "ACT" starts to flash ③.



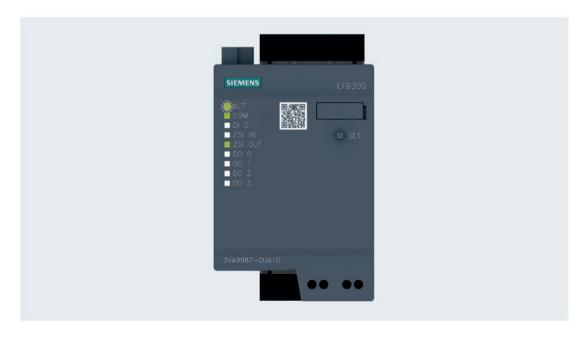
#### 4.10 EFB300 external function box

2. Press the <SET> button briefly. LED "ZSI\_OUT" flashes, the ZSI output is selected.



3. In order to activate the selected output, press the <SET> button for longer than 2 seconds.

The LED of the selected output changes from flashing to steady illumination to indicate activation of the selected output.

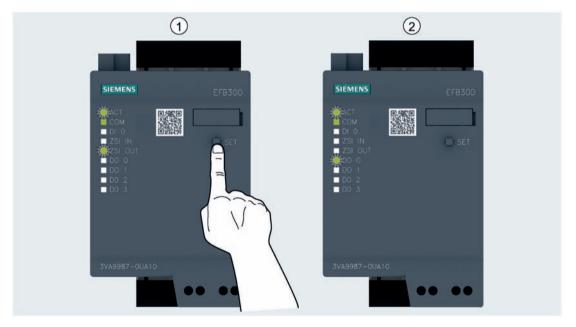


4. In order to deactivate the output again, press the <SET> button again for longer than 2 seconds.

The LED of the activated output will change from steady illumination to flashing. The output is deactivated, but still selected.



5. In order to select the next output, press the <SET> button briefly ①. The LED of the next output starts to flash ②, the output is selected.



6. Repeat steps 3 to 5 in order to check the wiring of all digital outputs in succession.

#### 4.10 EFB300 external function box

#### Terminating test mode

If the <SET> button is not pressed for a period of three minutes after selection of an output, test mode is terminated automatically and the EFB300 reverts to operating mode.

Alternative method: After working through the entire menu structure (only the LED labeled "ACT" flashes), press the <SET> button for longer than 2 seconds.

#### LED states in test mode

| LED       |         | Meaning         | Description                              |
|-----------|---------|-----------------|--|
|           | ACT     | Off             | EFB300 not active                        |
|           | ACT     | Flashing (2 Hz) | Test mode active                         |
|           | СОМ     | Off             | No communication link with ETU           |
|           | СОМ     | Flashing (2 Hz) | Establishing communication link with ETU |
| 祟         | COM     | On              | Communication link with ETU established  |
|           | DI 0    | Off             | Input not activated                      |
| 業         | DI 0    | On              | Input activated                          |
|           | ZSI IN  | Off             | ZSI function not activated               |
| 祟         | ZSI IN  | On              | ZSI function activated                   |
|           | ZSI OUT | Off             | No ZSI Out signal transmitted            |
| 業         | ZSI OUT | On              | ZSI Out signal transmitted               |
|           | DO 0    | Off             | Output not selected                      |
| <b>**</b> | DO 0    | Flashing (2 Hz) | Output selected                          |
| 業         | DO 0    | On              | Output selected and activated            |
|           | DO 1    | Off             | Output not selected                      |
|           | DO 1    | Flashing (2 Hz) | Output selected                          |
| 祟         | DO 1    | On              | Output selected and activated            |
|           | DO 2    | Off             | Output not selected                      |
| **        | DO 2    | Flashing (2 Hz) | Output selected                          |
| 崇         | DO 2    | On              | Output selected and activated            |
|           | DO 3    | Off             | Output not selected                      |
|           | DO 3    | Flashing (2 Hz) | Output selected                          |
| 業         | DO 3    | On              | Output selected and activated            |

Steady illumination

Flashing

Off

## 4.10.6 Technical specifications

| Suitability for application                          |                  | Installation in fixed switchboard inside enclosed   |
|--|------------------|---|
|  |                  | rooms   |
| Type of mounting                                     |                  |   |
| DIN rail (35 mm)                                     |                  | Yes   |
| Flat mounting  |                  | Yes   |
| Mounting position                                    |                  | Vertical  |
| Width  | mm               | 70  |
| Height   | mm               | 115   |
| Depth  | mm               | 34  |
| Weight (net)   | g                | 145   |
| Functions  |                  |   |
| ETU power supply                                     |                  | Yes   |
| Data exchange with ETU                               |                  | Yes   |
| Digital input and output module                      |                  | Yes   |
| Supply   |                  |   |
| Rated power dissipation P <sub>v</sub>               | VA               | 4   |
| Rated control supply voltage U <sub>c</sub>          | V DC             | 24  |
| Operating range                                      | x U <sub>c</sub> | ± 20 %  |
| Power consumption                                    | Α                | ≤ 0.16  |
| Communication with molded case circuit breaker       | s                |   |
| Number of 3VA-line interfaces                        |                  | 1   |
| Length of cable                                      | m                | 1.5   |
| ZSI  |                  |   |
| Number of breakers which can be connected to ZSI IN  |                  | ≤ 20  |
| Number of breakers which can be connected to ZSI OUT |                  | ≤ 8   |
| Cable for ZSI  |                  | Flexible, shielded (min. 85 % coverage), twisted cable, max. capacitance: 200 nF/km (cable/shield), 160 nF/km (cable/cable), inductance 0.65 H/km, total cable resistance: max. 28 ohms |
| Cable length for ZSI                                 |                  | < 600 m / 0.75 mm <sup>2</sup> (AWG 18)<br>< 1200 m / 1.5 mm <sup>2</sup> (AWG 16)<br>< 2000 m / 2.5 mm <sup>2</sup> (AWG 14)   |

| Digital input   |  |                 | 1  |
|---|--|-----------------|--|
| Number of digital inputs  |  | V DC            |  |
| Rated operational voltage   |  | V DC            |  |
| Working range   |  |                 | + 20 %<br>IEC: SELV/PELV                                       |
| Voltage value for reliable detection of a "1" signal                              |  |                 | 15   |
| Voltage value for reliable detection of a "0" signal                              |  | ٧               | ≤ 5  |
| Digital outputs   |  |                 |  |
| Number of relays  |  |                 | 2  |
| Voltage   |  |                 | IEC: ≤ 250 V AC/DC   |
| Rated uninterrupted current   |  |                 | 6 A  |
| Rated switching capacity  | AC-12 / 250 V<br>AC-15 / 250 V<br>DC-12 / 250 V<br>DC-13 / 250 V | A<br>A<br>A     | 6<br>3<br>0.2<br>0.1   |
| Output current for signal <1>   |  | mA              | 10 27  |
| Output current for signal <0>   |  | mA              | ≤ 0.2  |
| Design of fuse link for short-circuit p contacts of output relay                  | rotection of auxiliary   | Α               | 6  |
| Specified fuse for auxiliary contacts   |  |                 | Fuse links, operating class gL/gG 6A                           |
| Overvoltage category  |  |                 | III (relays) I (all others)                                    |
| Number of semiconductor outputs   |  |                 | 2  |
| Rated voltage   |  |                 | 24 V DC ± 20 %<br>IEC: SELV/PELV                               |
| Rated operational current   |  | mA              | 100  |
| Connection elements and termin  | nals   |                 |  |
| Design of electrical connection   |  |                 |  |
| - inputs for supply voltage   |  |                 | removable / plug-in  |
| - at inputs for supply voltage  |  |                 | Screw-type terminal  |
| Type of connectable conductor cros  | s-sections   |                 |  |
| - solid   |  | mm <sup>2</sup> | 0.5 2.5  |
| - finely stranded / with end sle  | eve  | mm <sup>2</sup> | 0.5 2.5  |
| - with AWG cables / solid   |  |                 | 1 x 21 14; 2 x 21 16   |
| Tightening torque   |  | Nm              | 0.4 0.5  |
| Electromagnetic compatibility   |  |                 |  |
| Conducted or radiated emissions   |  |                 | EN 61000-6-3 / FCC Class A and marine engineering requirements |
| Immunity in industrial environments   |  |                 | EN 61000-6-2 and marine engineering requirements               |
| Ambient conditions  |  |                 |  |
| Ambient temperature   |  |                 |  |
| - during operation  |  | °C              | -25 +60  |
| <ul> <li>during operation with derating operational current of digital</li> </ul> |  | °C              | -25 +70  |
| - during storage and transport  |  | °C              | -25 +70  |
| Pollution degree  |  |                 | 3  |
|   | tion class   |                 |  |
| Degree of protection and protec   | tion oldoo   |                 |  |

Test devices are required in order to perform local tests on 3VA2 molded case circuit breakers equipped with electronic trip units (ETUs).

Two versions of the test devices are available:

- TD300 activation and trip box
- TD500 test device

#### Functional scope of test devices

|                                       | TD300 activation and trip box |          |          | TD500 test device |          |          |
|---------------------------------------|-------------------------------|----------|----------|-------------------|----------|----------|
| ETU                                   | 3-series                      | 5-series | 8-series | 3-series          | 5-series | 8-series |
| Activation of ETUs                    |                               | •        |          |                   |          | •        |
| Mechanical trip tests                 |                               |          |          |                   |          |          |
| Testing of trip functions             |                               |          |          |                   | >        |          |
| Testing of metering function          |                               |          |          |                   |          |          |
| Testing of transformers <sup>1)</sup> |                               |          |          |                   |          |          |
| Connection to a PC with powerconfig   |                               |          |          |                   |          |          |
| ETU parameterization                  |                               |          |          |                   | 2)       | 2)       |
| Saving test results                   |                               |          |          |                   |          |          |

<sup>1)</sup> One energy transformer, one Rogowski coil

### 4.11.1 TD300 activation and trip box

The TD300 activation and trip box is a mobile, battery-operated local test device. Its purpose is:

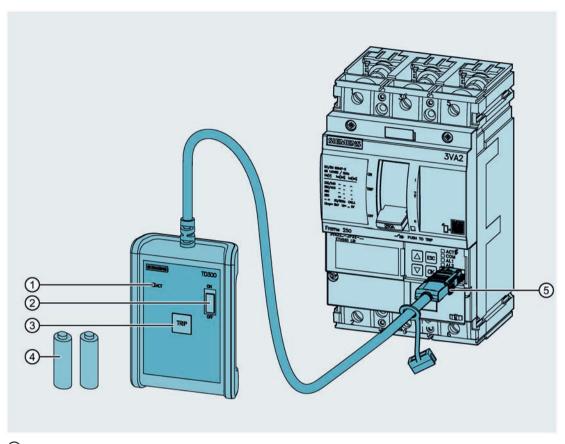
- To supply the ETU with power so that the ETU can be parameterized when the molded case circuit breaker is switched off and de-energized.
- To test and service the electronic trip unit (ETU).

The power supply is provided by two AA batteries included in the scope of supply.

The TD300 activation and trip box is designed for ease of handling with dimensions of  $76 \times 107 \times 25 \text{ mm}$  (W x H x D).

<sup>2)</sup> Via powerconfig

#### Description of the TD300 activation and trip box



- 1 LED "ACT" for indicating the battery status
- (2) Slide switch ON/OFF
- 3 <TRIP> pushbutton for testing the molded case circuit breaker
- 4 2 1.5 V AA batteries
- (5) Plug-in connector for insertion in the test socket on the ETU

#### 4.11.1.1 Operation and execution of the TD300 tripping function



Personal injury, spurious tripping and irreparable damage to the TD300 activation and trip box

Use of the TD300 when the molded case circuit breaker is not de-energized can result in personal injury, spurious tripping of the circuit breaker and irreparable damage to the TD300.

Disconnect the molded case circuit breaker from the power supply before using the TD300 activation and trip box.

#### TD300: Connect, switch on and off, disconnect

#### Connect the TD300 to the 3VA2 molded case circuit breaker

- 1. Disconnect the molded case circuit breaker from the power supply.
- 2. Insert the connecting cable in the test socket of the ETU.

#### Switch the TD300 on and off

- 1. Check whether the molded case circuit breaker is disconnected from the power supply. If it is not, disconnect it.
- 2. Push the slide switch to ON.

The LED labeled "ACT" on the TD300 lights up and the ETU display is activated. The TD300 is ready.

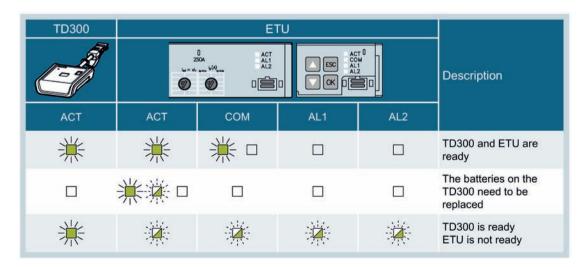
If the "ACT" LED does not light up:

- Push the slide switch to OFF.
- Detach the connecting cable from the molded case circuit breaker.
- Replace the batteries.
- Follow the correct sequence of steps to connect the unit to the molded case circuit breaker again.
- Push the slide switch to ON.
- Push the slide switch to OFF.The LED labeled "ACT" on the TD300 goes out to indicate that the unit is switched off.

#### Disconnect the TD300 from the 3VA2 molded case circuit breaker

- 1. Switch off the molded case circuit breaker (OFF position).
- 2. Detach the connecting cable from the molded case circuit breaker.

#### LED states when the TD300 and the molded case circuit breaker are switched on



#### Test the molded case circuit breaker (mechanical trip test)

- 1. Connect the TD300 to the molded case circuit breaker in the correct sequence and switch on.
- 2. Switch on the molded case circuit breaker (ON position).
- 3. Press the pushbutton labeled <TRIP> on the TD300.

#### The molded case circuit breaker trips:

The molded case circuit breaker is functioning correctly.

#### The molded case circuit breaker does not trip:

- Switch off the TD300.
- Switch off the molded case circuit breaker (OFF position).
- Detach the connecting cable from the molded case circuit breaker.
- Connect the TD300 correctly to the molded case circuit breaker again and switch on.
- Repeat the trip test (by pressing the pushbutton labeled <TRIP> on the TD300).
- If the molded case circuit breaker fails to trip again, contact Technical Support (Page 10).

#### 4.11.1.2 Technical specifications of TD300

| Height   | mm | 107                 |
|--|----|---------------------|
| Width  | mm | 76                  |
| Depth  | mm | 25                  |
| IP degree of protection  |    | IP30                |
| Ambient temperature  |    |                     |
| - in operation   | °C | -10 +40             |
| - in storage   | °C | -40 +50             |
| <ul> <li>with installed battery</li> <li>in storage</li> </ul> | °C | 0 +25               |
| Mounting position  |    | Any                 |
| Interface to circuit breaker                                   |    |                     |
| Number of circuit breakers / directly connectable              |    | 1                   |
| Length / of connecting cable                                   | m  | 1                   |
| Power supply   |    |                     |
| Type of batteries  |    | AA, alkaline, 1.5 V |
| Approvals / certificates:                                      |    |                     |
| Declaration of conformity                                      |    |                     |
| C E  |    |                     |

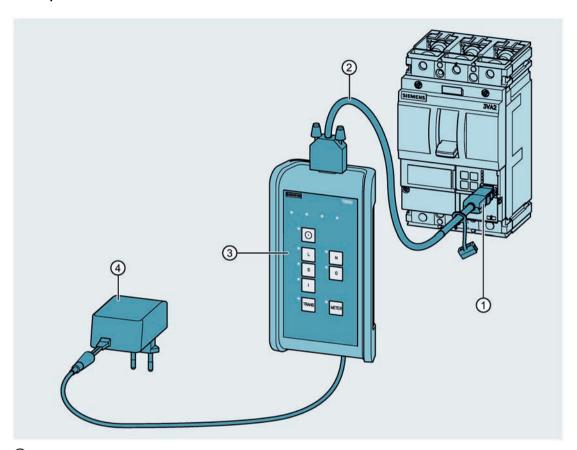
#### 4.11.2 TD500 test device

The TD500 mobile test device can be used to test the different causes of ETU trips. It is therefore useful for checking the proper functioning and correct wiring of all connected system components before the 3VA2 molded case circuit breaker is commissioned. The system behaves as it would in the case of a real trip event. The molded case circuit breaker trips when the set delay times expire and signals all alarms and tripped signals from connected components.

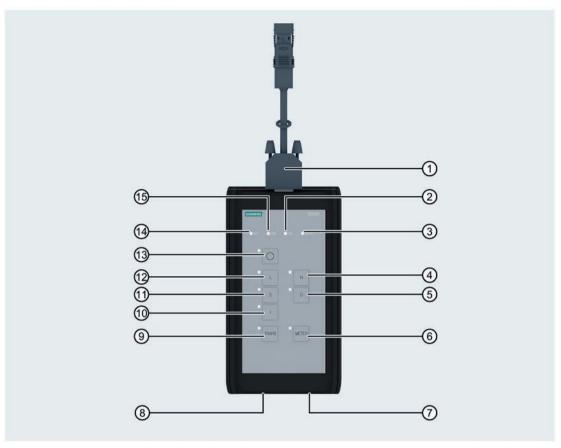
#### Benefits of the TD500 test device

- A TD500 test device via powerconfig can be used to successively parameterize all 3VA2 molded case circuit breakers directly in situ.
- The device can store up to 100 test results.
- Using the TD500 test device and the powerconfig software, it is possible to read out all diagnostic data of the 3VA2 molded case circuit breaker either digitally or as a hardcopy.
- In addition, test functions can be performed directly on the PC with the powerconfig software.

### Description of the TD500



- ① Plug-in connector for insertion in the test socket on the ETU
- ② TD500-to-ETU connecting cable
- ③ TD500 test device
- 4 Power supply unit



- ① Connecting cable for ETU
- ② LED "LOG" (available memory status)
- ③ LED "RESULT"
- 4 Pushbutton for neutral trip test N
- ⑤ Pushbutton for ground fault trip test G
- Pushbutton for meter test (current measurement display)
- 7 PC connection
- 8 Mains cable connection

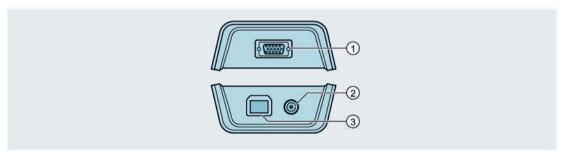
- Pushbutton for transformer test
- Pushbutton for instantaneous short-circuit trip test I
- ① Pushbutton for short-time delayed short-circuit test S
- Pushbutton for overload trip test L
- Pushbutton for ETU Power ON/OFF
- 4 LED "ACT" (status)
- (5) LED "COM" (communication status)

#### LED display

| LED |        | Meaning                | Description  |
|-----|--------|------------------------|--|
|     | ACT    | Off                    | TD500 switched off   |
| 業   | ACT    | On                     | TD500 ready  |
|     | СОМ    | Off                    | No communication link with ETU   |
| **  | СОМ    | Flashing<br>(2 Hz)     | - Establishing communication link with ETU - Communications error - TD500 not ready  |
| 祟   | СОМ    | On                     | Communication link established with ETU  |
|     | LOG    | Off                    | No free memory space The TD500 device can continue to be used, but the results of the trip tests will no longer be stored on the TD500. The device is still capable of executing all test functions.   |
| *   | LOG    | Flashing<br>(2 Hz)     | Available memory space < 25 % The TD500 device can continue to be used without restriction, but there is only enough memory space available to store a few test results. In order to ensure safe storage of test results, save the existing results to a PC and delete the contents of the TD500 memory using powerconfig. |
| 崇   | LOG    | On                     | Free memory space $\geq$ 25 % The TD500 device can continue to be used without restriction.  |
|     | RESULT | Off                    | No test has been carried out and no test result has been recorded.   |
| **  | RESULT | Flashing red<br>(2 Hz) | It has not been possible to establish whether or not the molded case circuit breaker is functioning correctly.   |
| 崇   | RESULT | On                     | No faults have been detected.  |

#### Interfaces of the TD500 test device

The diagram below shows the physical interfaces of the TD500 test device.



① Top of unit: Connection to 3VA2 molded case circuit breaker

② Bottom of unit on right: 24 V DC supply③ Bottom of unit on left: Connection to PC

#### Compatibility with molded case circuit breakers

The TD500 test device can be connected to all 3VA2 molded case circuit breakers equipped with ETU 3-series, 5-series and 8-series. The connecting cable from the test device is inserted in the test socket of the ETU.

#### Data stored in the TD500

The following data are stored in the TD500:

- Article number
- ETU parameter settings
- Causes of ETU trips

#### Note

#### Readout of data and clearing of the internal memory of the TD500

Using a PC and the powerconfig software, you can read these data out of the TD500 and clear its internal memory.

#### Test functions of the TD500

The relevant pushbutton must be pressed in order to start a specific test. The molded case circuit breaker is tripped electronically when the pushbutton is actuated. This is essential to allow effectual testing of the electronic and mechanical control elements of the circuit breaker.

| Test       | Description   |
|------------|---|
| L test     | Overload function test The circuit breaker trips when the time setting $\mathbf{t}_{_{\!f}}$ elapses  |
| S test     | Function test on the short-time delayed short-circuit protection system. The circuit breaker trips when the time $\mathbf{t}_{\mathrm{sd}}$ set on the ETU elapses                          |
| I test     | Function test on the instantaneous short-circuit protection system<br>The circuit breaker trips instantaneously   |
| N test     | Function test on neutral conductor protection system The circuit breaker trips when the time t, set on the ETU elapses  |
| G test     | Function test on ground fault protection system The circuit breaker trips when the time $\mathbf{t}_{\mathbf{q}}$ set on the ETU elapses  |
| TRANS test | Function test on transformers (energy and Rogowski transformers)  One energy transformer and one Rogowski transformer is tested  The circuit breaker trips after a delay of several seconds |
| METER test | Function test on the measured value display In order to test the displayed current measurement The circuit breaker does <b>not</b> trip during this test                                    |

### 4.11.2.1 Operation and execution of test functions

#### Connecting and disconnecting the TD500



#### Personal injury, malfunctions and false test results

Failure to connect the TD500 test device to the molded case circuit breaker according to the sequence of steps specified below can result in personal injury, malfunctions and false test results.

Disconnect the molded case circuit breaker from the power supply before connecting the TD500.

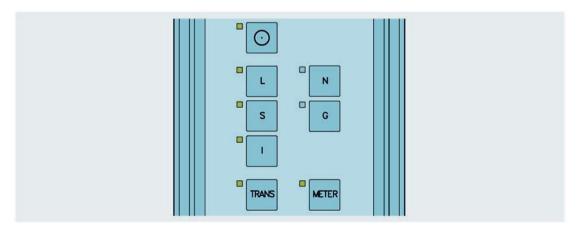
Strictly adhere to the sequence of steps described below for connecting the two devices.

#### Connecting the TD500 to the 3VA2 molded case circuit breaker

- 1. Disconnect the molded case circuit breaker from the power supply.
- 2. Insert the connecting cable in the socket on top of the TD500 test device.
- 3. Insert the connecting cable in the test socket of the ETU.
- 4. Insert the cable of the power supply unit in the socket on the bottom of the TD500 test device.
- Connect the power supply unit to a socket.The TD500 test device is now switched on and ready.
- 6. Press the pushbutton labeled <ETU Power ON/OFF> on the TD500 test device. The ETU is now powered via the TD500 and activated. Successful communication between the TD500 and ETU is indicated by illumination of the LED labeled "COM" on the TD500.

All test functions available for the connected ETU are indicated by illumination of the appropriately labeled LEDs.

Example: The L, S and I releases, the transformers (TRANS) and the current meter (METER) can be tested on the ETU:

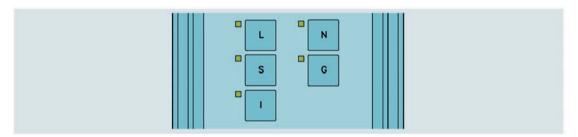


#### Disconnecting the TD500 from the 3VA2 molded case circuit breaker

- 1. Switch off the 3VA2 molded case circuit breaker.
- 2. Press the pushbutton labeled <ETU Power ON/OFF> on the TD500 test device. The LED labeled "COM" on the TD500 goes out. The ETU is now no longer powered via the TD500 and is deactivated.
- 3. Disconnect the power supply unit from the socket.
- 4. Detach the power supply unit cable from the TD500.
- 5. Detach the connecting cable between the TD500 and the ETU.

#### Test tripping functions L, S, I, N and G

- 1. Connect the TD500 to the 3VA2 molded case circuit breaker as described above.
- 2. Switch on the 3VA2 molded case circuit breaker.
- 3. To test the tripping function, press one of the pushbuttons <L>, <S>, <I>, <N> or<G on the TD500 test device.



- When a pushbutton is pressed, its LED flashes while the test is in progress.
- The ETU trips when the set trip times expire and the molded case circuit breaker switches from "ON" to "TRIP".
- On completion of the test, the LED of the selected pushbutton changes from flashing to steady illumination.
- 4. Wait for the test to end and evaluate the test result by the status of the LED labeled "RESULT":

#### Test was successful:

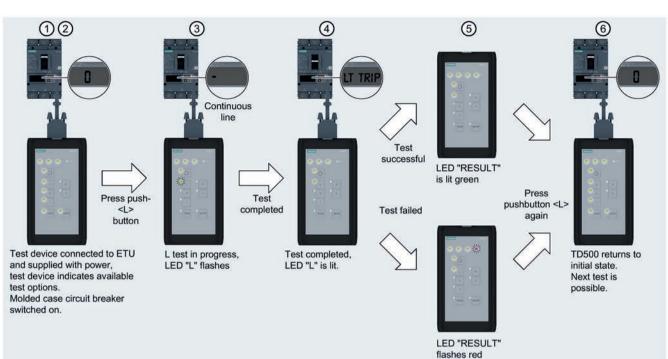
The LED "RESULT" lights up green.

#### Test was unsuccessful:

The LED "RESULT" flashes red.

Repeat the test. If the test fails again, contact Technical Support (Page 10) .

- 5. Press the pushbutton for the same tripping function again in order to confirm the test result and restore the TD500 to its initial state.
- Switch on the molded case circuit breaker again (ON position) in order to carry out further tripping function tests.



### Example: Testing the tripping function L on an ETU550 LSI

- 1. Connect the TD500 test device to the 3VA2 molded case circuit breaker.
- 2. Switch on the 3VA2 molded case circuit breaker.
- Press pushbutton <L> on the TD500 test device. The LED in the pushbutton <L> starts to flash.
- 4. Wait until the LED in the pushbutton <L> changes from flashing to steady illumination. The test is completed.
- 5. Evaluate the test result by the status of the LED labeled "RESULT":
  - LED "RESULT" is illuminated steadily in green: The test was successful.
  - LED "RESULT" flashes **red: The test was unsuccessful** and must be repeated. If the test fails again, contact Technical Support (Page 10).
- 6. Press the pushbutton <L> again in order to confirm the test result and restore the TD500 to its initial state.

#### Carry out a meter test

The purpose of the meter test is to determine whether the ETU is measuring and displaying current correctly. A test current of  $0.4 \times I_n$  is fed into the ETU. The current value measured by the ETU is then checked to confirm that it matches the test current.

#### Note

The molded case circuit breaker does **not** need to be switched to position "ON" for this test.

#### **Execute the test**

- 1. Connect the TD500 test device to the 3VA2 molded case circuit breaker.
- 2. Press the pushbutton labeled <METER> ①.



The LED in the <METER> pushbutton begins to flash. The test takes approximately 30 seconds.

- Wait until the LED in the pushbutton <METER> changes from flashing to steady illumination.
  - The test is completed.
- 4. Evaluate the test result by the status of the LED labeled "RESULT":
  - LED "RESULT" is illuminated steadily in green: The test was successful.
  - LED "RESULT" flashes **red: The test was unsuccessful** and must be repeated. If the test fails again, contact Technical Support (Page 10).
- Press the pushbutton <METER> again in order to confirm the test result and restore the TD500 to its initial state.

#### **Test transformers**

This procedure tests the transformers (energy transformer or Rogowski coil) to determine the following:

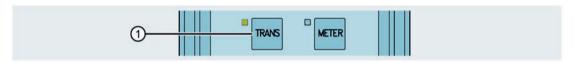
- Are transformers installed in the ETU?
- Are transformers correctly installed in the ETU?
- Are the installed transformers functioning correctly?

#### Note

In order to carry out this test, it is absolutely essential to disconnect all external power supplies (e.g. EFB300, COM800, COM100, 24 V module) to the electronics.

#### **Execute the test**

- 1. Disconnect all external power supplies to the electronics.
- 2. Connect the TD500 test device to the 3VA2 molded case circuit breaker.
- 3. Switch on the 3VA2 molded case circuit breaker.
- 4. Press the pushbutton labeled <TRANS> ①.



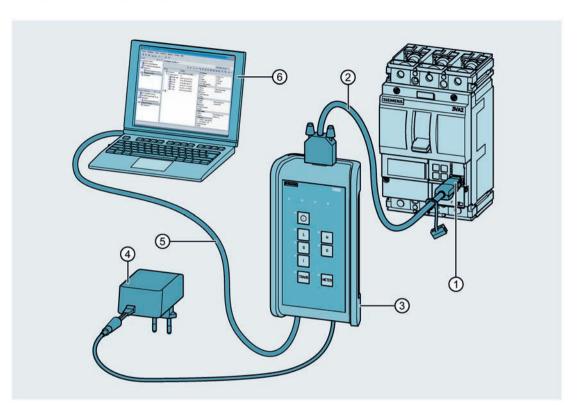
The LED in the <TRANS> pushbutton begins to flash. The test takes several seconds.

- 5. Wait until the LED in the pushbutton <TRANS> changes from flashing to steady illumination.
  - The test is completed.
- 6. Evaluate the test result by the status of the LED labeled "RESULT":
  - LED "RESULT" is illuminated steadily in green: The test was successful.
  - LED "RESULT" flashes **red: The test was unsuccessful** and must be repeated. If the test fails again, contact Technical Support (Page 10).
- 7. Press the pushbutton <TRANS> again in order to confirm the test result and restore the TD500 to its initial state.

### 4.11.2.2 Executing the test functions using a PC and powerconfig

In addition to its capabilities as a stand-alone test device, the TD500 can also act as a PC interface to the ETU.

If the TD500 test device is connected both to the ETU and a PC, the protective functions can be triggered from a PC on which the powerconfig software is installed. A test log for the molded case circuit breaker is generated and stored in the powerconfig project. The test log can be printed out.



#### Connections between ETU - TD500 - PC

- ① Plug-in connector for insertion in the test socket on the ETU
- ② TD500-to-ETU connecting cable
- 3 TD500 test device

- 4 Power supply unit
- ⑤ USB connecting cable
- 6 PC with powerconfig installed

### 4.11.2.3 Parameterizing using the powerconfig software

In addition to test functions, the powerconfig software package also provides tools for assigning parameters to ETU 5-series and 8-series.

These tools allow you to:

- assign parameters to ETU 5-series and 8-series
- store parameter settings for ETU 5-series and 8-series in the powerconfig project and print them out

## 4.11.2.4 Technical specifications of TD500

| Dimensions  |      |         |  |
|---|------|---------|--|
| Length  | mm   | 190     |  |
| Width   | mm   | 105     |  |
| Depth   | mm   | 42      |  |
| Degree of protection  |      | IP30    |  |
| Ambient conditions  |      |         |  |
| Ambient operating temperature                               | °C   | -10 +40 |  |
| Storage temperature   | °C   | -40 +80 |  |
| Normal position of use                                      |      | Any     |  |
| Interface to molded case circuit breakers                   |      |         |  |
| Number of directly connectable molded case circuit breakers |      | 1       |  |
| Length of cable   | m    | 1.5     |  |
| Power supply  |      |         |  |
| Number of electrical connections / for external network     |      | 1       |  |
| External power supply unit                                  |      |         |  |
| Input voltage   | V AC | 100 240 |  |
| Output voltage  | V DC | 12      |  |
| Interface to PC   |      |         |  |
| Number of interfaces / acc. to USB                          |      | 1       |  |

### 4.12 External current transformer for N conductor

The external current transformer for the N conductor is a current transformer for 3-pole 3VA2 molded case circuit breakers with 5-series and 8-series ETUs.

This transformer can be used to provide protection for the N conductor against overload as well as for ground-fault protection.

### 4.12.1 Parameterization of the external N transformer

#### N conductor protection against overload

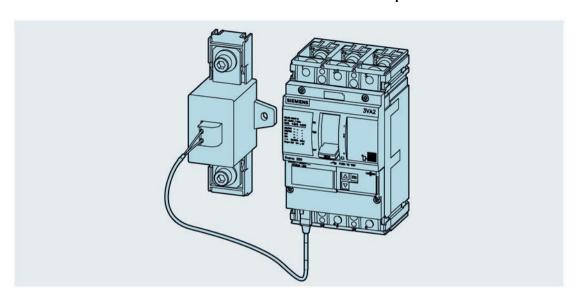
The function "N conductor protection  $I_N$ " is deactivated ("OFF") as standard (factory setting) in 5-series and 8-series ETUs.

If an external N transformer is connected to 5-series or 8-series ETUs, the "N conductor protection  $I_N$ " must be manually activated on the ETU and adjusted according to system requirements.

#### **Ground-fault protection**

If the external N conductor is used with 5-series or 8-series ETU variants with ground-fault protection, ETU560 and ETU860, no parameterization is required at the user end. As soon as the external N transformer is connected to the ETU, the N conductor is also automatically monitored for ground-fault protection.

## 4.12.2 External current transformer for front busbar connector up to 630 A

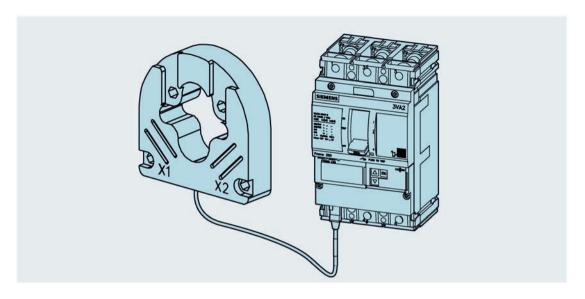


| Rated current I <sub>n</sub><br>3VA2 circuit breakers | Article number<br>External current transformer | Rated current I <sub>n</sub><br>External current transformer | Measuring range          |
|---|--|--|--------------------------|
| 25 / 40 / 63 / 100 A                                  | 3VA9007 - 0NA10                                | 25 150 A   |                          |
| 160 / 250 A   | 3VA9107 - 0NA10                                | 160 350 A  | 0.05 15 x I <sub>n</sub> |
| 400 / 500 / 630 A                                     | 3VA9307 - 0NA10                                | 400 630 A  |                          |

### **Technical specifications**

|  | Rated current I <sub>n</sub>        |  |  |  |  |
|--|-------------------------------------|--|--|--|--|
|  | 25 150 A 160 250 A 400 630 A        |  |  |  |  |
| Rated frequency                          | 50/60 Hz                            |  |  |  |  |
| Rated operational voltage U <sub>e</sub> | Max. 690 V                          |  |  |  |  |
| Rated impulse strength U <sub>imp</sub>  | 8 kV                                |  |  |  |  |
| Rated insulation voltage U <sub>i</sub>  | 0.8 kV                              |  |  |  |  |
| IP degree of protection                  | IP00                                |  |  |  |  |
| Ambient temperature                      | −25 °C 50 °C                        |  |  |  |  |
| > 50 °C: Derating                        | 7.5 % / 10 K                        |  |  |  |  |
| Max. bar temperature                     | 115 °C at 50 °C ambient temperature |  |  |  |  |

## 4.12.3 External current transformer as straight-through transformer up to 1250 A



| Rated current I <sub>n</sub><br>3VA2 circuit<br>breakers | Article number<br>External current<br>transformer | Rated current I <sub>n</sub><br>External current<br>transformer | Measuring range          | For cable cross-sections                 | For busbar<br>cross-sections      |
|--|---|---|--------------------------|--|-----------------------------------|
| 25 / 40 / 63 / 100 A                                     | 3VA9007 - 0NA10                                   | 25 150 A  |                          | 2 x 300 mm <sup>2</sup><br>2 x 600 kcmil | 1 x 50 x 10 mm                    |
| 160 / 250 A  | 3VA9107 - 0NA10                                   | 160 350 A   |                          |  | 2 x 40 x 10 mm                    |
| 400 / 500 / 630 A  | 3VA9307 - 0NA10                                   | 400 630 A   | 0.05 15 x I <sub>n</sub> |  | 0.5 x 3 in                        |
| 630 / 800 / 1000 A                                       | 3VA9677 - 0NA10                                   | 600 1250 A  |                          | <del>5</del> 4                           | 2 x 100 x 10 mm<br>1.25 in x 4 in |

### **Technical specifications**

|  | Rated current I <sub>n</sub>        |            |           |            |  |  |
|--|-------------------------------------|------------|-----------|------------|--|--|
|  | 25 150 A                            | 160 250 A  | 400 630 A | 600 1250 A |  |  |
| Rated frequency                          |                                     | 50/6       | 0 Hz      |            |  |  |
| Rated operational voltage U <sub>e</sub> |                                     | Max. 690 V |           |            |  |  |
| Rated impulse strength U <sub>imp</sub>  | 8 kV                                |            |           |            |  |  |
| Rated insulation voltage U <sub>i</sub>  | 0.8 kV                              |            |           |            |  |  |
| IP degree of protection                  | IP30                                |            |           |            |  |  |
| Ambient temperature                      | −25 °C 70 °C                        |            |           |            |  |  |
| Max. bar temperature                     | 115 °C at 50 °C ambient temperature |            |           |            |  |  |

### 4.13 Escutcheon

Molded case circuit breakers or supplementary motor operators or front mounted rotary operators for molded case circuit breakers are often installed in panels or distribution boards in such a way that only the operating device is directly accessible. Busbars, cables and the termination area of the molded case circuit breaker are covered by metal or plastic plates in order to prevent direct contact with live components. The panel door itself is often designed as a protective cover.

Cutouts must be made in these covers

- in order to allow access to control elements.
- · which are designed to prevent direct contact with cables, and
- which are large enough in size that the cover can be closed easily.

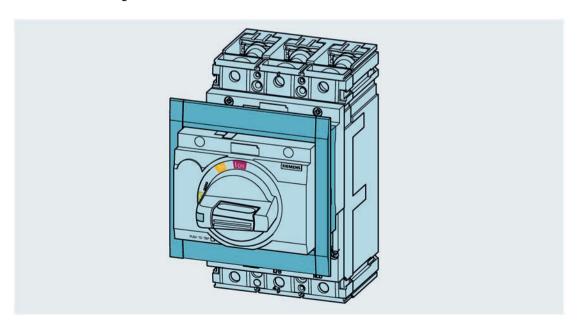
All these requirements necessitate gap dimensions of a few millimeters between the cutout and the unit.

Cover frames are installed in cases where the gap size needs to be minimized and the gaps covered. The use of cover frames makes for a clean-lined, attractive panel front face and provides a higher degree of protection (IP30).

### 4.13.1 Product description

Cover frames are available for the following items of equipment from the 3VA product range:

- 3VA1 / 3VA2 molded case circuit breakers, 3-pole or 4-pole: Handle area only
- 3VA1 / 3VA2 molded case circuit breakers, 3-pole or 4-pole: Area around handle and trip unit
- Front mounted rotary operator
- Motor operators
- Loadside residual current devices, 3-pole or 4-pole
- Door feedthroughs



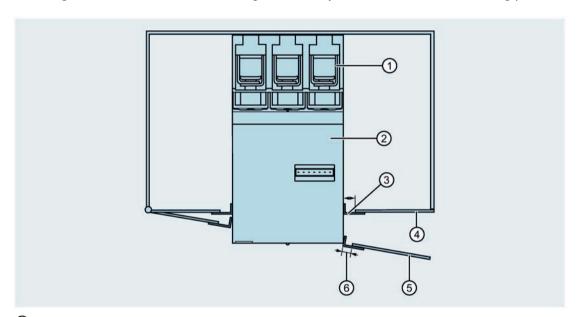
#### Installation

- Cut out an opening in the cover plate.
   Refer to the operating instructions for the correct cutout dimensions.
- 2. Insert the cover frame into the cutout from the front and fasten by means of small spring steel sheets at the rear of the cover plate.

The fastening system is designed such that the the cover frame can move in the cutout. In other words, the cover frame is "float-mounted". Tolerance compensation in the range  $\pm$  3 mm /  $\pm$  0.12" is thus possible in the horizontal direction and in the range  $\pm$  6 mm /  $\pm$  0.24" in the vertical direction. On the one hand, this tolerance compensation is required to achieve the small gap dimension of max.  $\pm$  0.5 mm /  $\pm$  0.19" between the cover frame and device. On the other hand, it is needed to compensate for tolerances, e.g. in the panel, which are always present due to the construction.

Typical tolerance compensation examples are:

- Tolerance compensation of the door angle with right-hinged or left-hinged doors
- Tilting of devices under their own weight when they are fastened to thin mounting plates



- Molded case circuit breaker
- 2 Motor operator
- 3 Cover frame
- Panel door (closed)
- ⑤ Panel door (open)
- 6 Tolerance compensation

#### Note

To ensure that the panel door can still be opened, a mounted accessory component must not project beyond the cover frame by more than 5 mm / 0.19" when the door is closed.

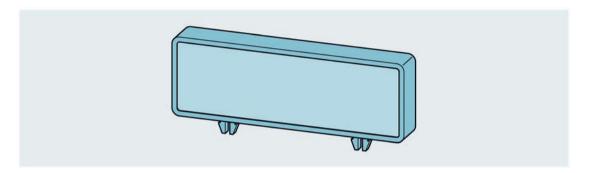
#### 4.13 Escutcheon

### 4.13.2 Labeling plate

A supplementary labeling plate (3VA9087-0SX10) is available for the cover frame.

It can be latched in position in the center of any of the four sides of the cover frame. Paper or plastic labels displaying plant-specific information are attached by adhesive to the labeling plate.

The scope of supply includes ten labeling plates and ten aluminum-colored labels.



### 4.14 DIN rail adapter

#### 4.14.1 Introduction

### Description of application and basic function

The DIN rail adapter is used to mount molded case circuit breakers on 35 mm DIN rails of meter or distribution cubicles, for example. DIN rail adapters are available exclusively for 3VA1 molded case circuit breakers in sizes 100 A and 160 A since, on the one hand, DIN rails are not designed to support heavy weights and, on the other, only molded case circuit breakers with thermal-magnetic trip units and rated operational currents up to maximum 160 A are normally installed in distribution boards.

The DIN rail adapters are snapped onto the rear panel of the molded case circuit breaker or fastened by screws. With an adapter installed, the circuit breaker is simple to attach to a DIN rail. This is done by placing the circuit breaker with attached DIN rail adapter from above onto the DIN rail and then pressing the bottom half of the circuit breaker lightly against the rail until the adapter engages.

### Overview of variants and products

| 3VA9181-0SH10 | DIN rail adapter for MCCB 3VA1 160 A, 1-pole                               |
|---------------|--|
| 3VA9182-0SH10 | DIN rail adapter for MCCB 3VA1 160 A, 2-pole                               |
| 3VA9187-0SH10 | DIN rail adapter for MCCB 3VA1 100 A and 160 A, 3-pole / 4-pole            |
| 3VA9187-0SH20 | DIN rail adapter for MCCB 3VA1 160 A, 3-pole / 4-pole and side mounted RCD |

### 4.14.2 Information about installation, assembly and attachment

#### 3VA1 160 1-pole and 2-pole molded case circuit breakers



#### 3VA1 160 1-pole molded case circuit breakers

To attach these to a DIN rail, a 3VA9181-0SH10 DIN rail adapter is required. This DIN rail adapter is not attached by screws to the molded case circuit breaker, but simply snapped into place on the rear panel.

#### 3VA1 160 2-pole molded case circuit breakers

To attach 2-pole molded case circuit breakers to 35 mm DIN rails, a 3VA9182-0SH10 DIN rail adapter is required. This adapter is fitted with threaded nuts. The molded case circuit breakers are screwed onto the adapter by means of the mounting screws supplied with the circuit breakers. The nuts supplied with the circuit breakers are not required.

### 3VA1 100 and 3VA1 160 3-pole and 4-pole molded case circuit breakers





To attach 3-pole and 4-pole molded case circuit breakers to 35 mm DIN rails, a 3VA9187-0SH10 DIN rail adapter is required. This adapter is fitted with threaded nuts. The molded case circuit breakers are screwed onto the adapter by means of the mounting screws supplied with the circuit breakers. The nuts supplied with the circuit breakers are not required.

# 3VA1 100 and 3VA1 160 3-pole and 4-pole molded case circuit breakers with side mounted residual current device





The 3VA9187-0SH20 DIN rail adapter has been specially developed for use with molded case circuit breakers combined with side mounted residual current device. This DIN rail adapter is also fitted with threaded nuts so that the molded case circuit breaker/residual current device assembly can be fastened to it by means of the screws included in the scope of supply of both devices.

#### Assembly instructions

The molded case circuit breaker must first be attached to the DIN rail adapter. 3-pole molded case circuit breakers must be attached such that their right-hand edge (when viewed from above) is flush with the DIN rail adapter. With 4-pole molded case circuit breakers, the N pole is situated opposite on the left-hand side (when viewed from above). The screws are inserted in the fastening holes between phases 1 and 2, and between phases 2 and 3, in the molded case circuit breaker.

After the molded case circuit breaker has been attached to the DIN rail adapter, the residual current device must also be mounted on the adapter. After the residual current device has been secured in position on the DIN rail adapter, the main current paths of the residual current device and the molded case circuit breaker must be checked to ensure that they are properly aligned and connected.

#### Information about combination with other accessories

DIN rail adapters are normally used to install molded case circuit breakers (possibly with side mounted residual current device) in distribution boards. The standard cover is then fitted over the circuit breakers. The front panel (45 mm high) is the only part of the device which protrudes through the cover. With this arrangement, it is not possible to use front mounted accessories.

When molded case circuit breakers including DIN rail adapter are installed on rails in an open system panel without a cover, it is possible to use front mounted accessories such as motor operator, rotary operator with shaft stub, front mounted rotary operator and the front mounted Bowden cable interlock module.

The following accessories are compatible with molded case circuit breakers and DIN rail adapters:

| Manual operators        | Front mounted rotary operator                               |  |
|-------------------------|---|--|
| Motor operators         | erators Side mounted motor operator MO310                   |  |
| Interlocks              | Sliding bar unit (2 or 3 breakers)                          |  |
|                         | Bowden cable interlock (for front mounted rotary operators) |  |
| Residual current device | Side mounted residual current device                        |  |
|                         | Modular residual current device                             |  |

4.14 DIN rail adapter

Service and maintenance

#### 5.1 Notes

### **Qualified personnel**

It is essential to refer to this documentation when setting up and operating a device/system described here. The device/system must only ever be serviced and maintained by qualified personnel. For the purpose of the safety information in these operating instructions, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

### Maintenance category

| Maintenance category   | Maintenance interval  |  |
|------------------------|---|--|
| Inspection             | Annually  |  |
| Maintenance            | As required; 10 years after delivery at the latest                                |  |
| Corrective maintenance | As required; 20 years after delivery or after 1000 switching cycles at the latest |  |

## 5.2 Regular maintenance

#### Recommended maintenance/inspection intervals

Following initial commissioning, the equipment/system must be inspected at least once per year.

In addition, an inspection should be carried out after 1000 trips at rated operational current.

If the molded case circuit breaker or switch disconnector is operated in an atmosphere that is dust-laden or in which corrosive vapors, gases, or salt spray is present, it is advisable to adjust the inspection intervals accordingly, e.g. to twice per year.

### 5.2 Regular maintenance

### Inspection procedure recommended for 3VA molded case circuit breakers / switch disconnectors

| Schedule of inspections/tests   | Inspection/test procedures   |  |
|---|--|--|
| 3VA molded case circuit breakers / sw   | itch disconnectors   |  |
| Check that connections are tight  | <ul> <li>Check the tightening torque of the connecting screws (80% of the tightening torque is recommended)</li> <li>Visually inspect the incoming and outgoing cables</li> <li>Visually inspect the connection accessories</li> <li>Replace any damaged connection accessories after cleaning the termination area</li> </ul> |  |
| Inspect the exterior surfaces of the molded case circuit breaker / switch disconnector                | <ul> <li>Examine all visible surfaces for oxidation,</li> <li>residues or other adverse effects</li> <li>Remove residues with a lint-free, dry</li> <li>and clean cloth. Never use chemical cleaning agents or water!</li> </ul>   |  |
| Check the protection parameters   | Check that the trip unit is correctly set for the prevailing conditions in the installation and adjust the settings if necessary.  |  |
| Test the electrical and mechanical functions of the molded case circuit breaker / switch disconnector | Move the handle from OFF to ON, and from ON to OFF, in order to check the mechanical function of the molded case circuit breaker contacts  |  |
| Test the tripping function with the<br><push to="" trip=""> button</push>                             | Press the <push to="" trip=""> button.  The molded case circuit breaker / switch disconnector must trip and move to the "TRIP" position.</push>  |  |
| Residual current device   |  |  |
| Test the tripping function with the<br><push to="" trip=""> button</push>                             | Press the <push to="" trip=""> button.  The molded case circuit breaker must trip and you must be able to switch it on again afterward.</push>   |  |
| Undervoltage release  |  |  |
| Test the tripping function  | <ol> <li>Open the molded case circuit breaker.</li> <li>Set the operational voltage (terminals D1 and D2) to 0 V.</li> <li>Close the molded case circuit breaker (move handle to ON).</li> <li>The molded case circuit breaker must trip and move to the "TRIP" position.</li> </ol>   |  |

### Optional inspection procedure for the ETU of the 3VA2 molded case circuit breaker

| What needs to be tested/inspected?                                 | What is the correct test/inspection procedure?   |
|--|--|
| The various protective trip functions of the ETU need to be tested | Test the individual protective functions LSING in the ETU using the TD500 test device.  The circuit breaker must trip at the end of each test.  The current transformer and the metering function can also be tested for proper functioning.  Refer to section "Test devices". |

## 5.3 Maintenance following tripping of a molded case circuit breaker

If a 3VA molded case circuit breaker trips on overcurrent (overload, short circuit) or residual current (ground fault or via residual current device), the cause of the trip must be identified and rectified before the molded case circuit breaker is switched on again.

In the case of 3VA1 molded case circuit breakers with thermal-magnetic trip units, the cause of tripping can be determined by means of the SAS short circuit alarm switch. With 3VA2 molded case circuit breakers, the cause of tripping can be output via the EFB300 external function box. With electronic trip units 5-series and 8-series ETUs, the cause of tripping can be indicated on the LCD and optionally transferred via communication modules.

An inspection as described in chapter Regular maintenance (Page 535) should be carried out every time the molded case circuit breaker is tripped by the trip unit. In addition, all black residues on the molded case circuit breaker must be removed as they might contain conductive particles. The molded case circuit breaker should then be switched on and off without load at least five times.

## 5.4 Fault diagnostics

| Description of problem                                 | Possible fault cause  | Remedial action   |
|--|---|---|
| Repeated tripping                                      | The protection settings of the ETU are not correct  | Check whether the current setting of the ETU matches the rated current of the supply system.  |
|  | Fluctuations in the voltage of the undervoltage release   | Check the voltage at the undervoltage release. The connection of other high-consumption loads (such as motor operators) to the same power source may cause the voltage to dip briefly in some cases.  |
|  | Ambient temperature too high  | The protection settings are specified for a particular reference point. Erroneous tripping can occur if the ambient temperature is higher than the specified reference or if othe ambient conditions have not been given due consideration (e.g. derating for draw-out technology when installation location is above 2000 m).  Pay due attention to ambient conditions and appropriate derating. |
|  | Shunt trip is activated   | The trip is initiated by the shunt trip STL or STF. Check the causes of unintentional shunt trip activation.  |
|  | Tripping by residual current device   | Check the insulation in the low-voltage network and at the loads.   |
|  | Tripping by ground fault  | Check the insulation in the low-voltage network and at the loads.   |
| Molded case circuit                                    | No voltage supply to the undervoltage release   | Check the voltage supply UVR to the undervoltage release.   |
| breaker cannot be                                      | Shunt trip STL or STF is connected to voltage   | Check the voltage.  |
| switched on by the<br>handle or manual<br>operators    | Molded case circuit breaker is locked, e.g.<br>by sliding bar or cylinder locks in the manual<br>operators  | Unlock the circuit breaker.   |
|  | Molded case circuit breaker is interlocked, e.g. by a front interlock   | Release the circuit breaker.  |
| Molded case circuit                                    | No voltage supply to the undervoltage release   | Check the voltage supply UVR to the undervoltage release.   |
| breaker cannot be<br>switched on via motor<br>operator | Shunt trip STL or STF is connected to voltage   | Check the voltage.  |
|  | Molded case circuit breaker is locked, e.g. by cylinder lock in the motor operator  | Unlock the circuit breaker.   |
|  | Molded case circuit breaker cannot be switched on or off via the communication interface if the write protection slide switch on the COM800 is set to OFF | Check the position of the write protection slide switch on the COM800.  |

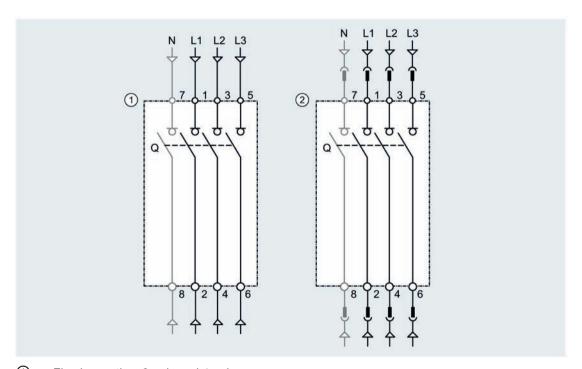
### See also

Technical Support (Page 10)

# 6.1.1 3VA1 molded case circuit breakers

### 6.1.1.1 Basic units

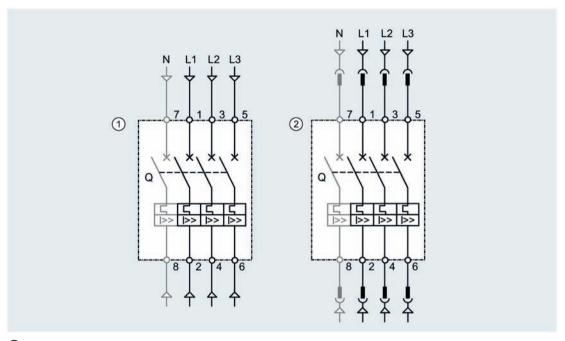
### **Switch disconnectors**



- ① Fixed mounting, 3-pole and 4-pole
- 2 Plug-in/draw-out units, 3-pole and 4-pole

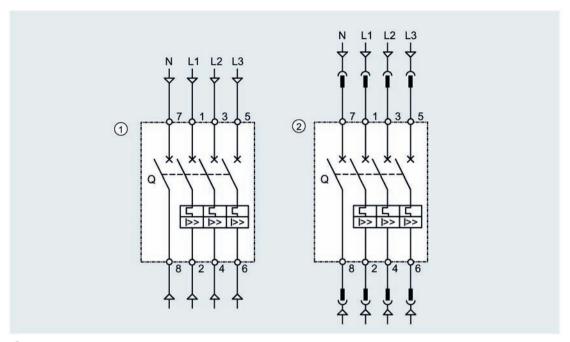
# 3VA1 molded case circuit breakers with thermal-magnetic trip unit

### Fixed mounting and plug-in/draw-out units, 3-pole and 4-pole



- ① Fixed mounting, 3-pole and 4-pole
- 2 Plug-in/draw-out units, 3-pole and 4-pole

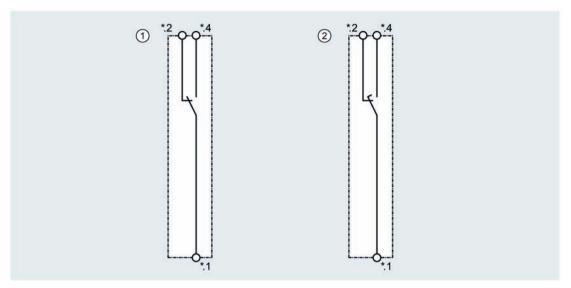
#### Fixed mounting and plug-in/draw-out units, 4-pole, unprotected N conductor



- 1 Fixed mounting, 4-pole, unprotected N conductor
- 2 Plug-in and draw-out units, 4-pole, unprotected N conductor

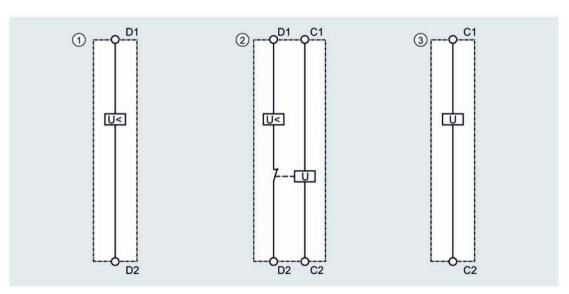
#### 6.1.1.2 Accessories

### Auxiliary switches, alarm switches and position signaling contacts



- ① Changeover contacts for auxiliary switches AUX, trip alarm switches TAS and electrical alarm switches EAS, position signaling switches for plug-in and draw-out units
- 2 Leading changeover contacts for leading changeover switch LCS

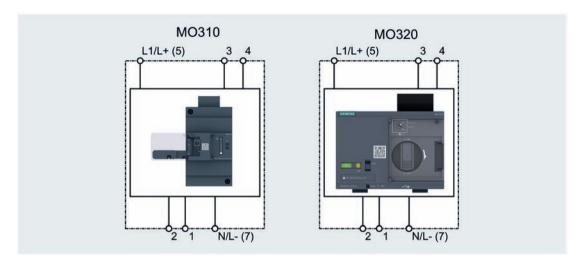
### **Auxiliary releases**



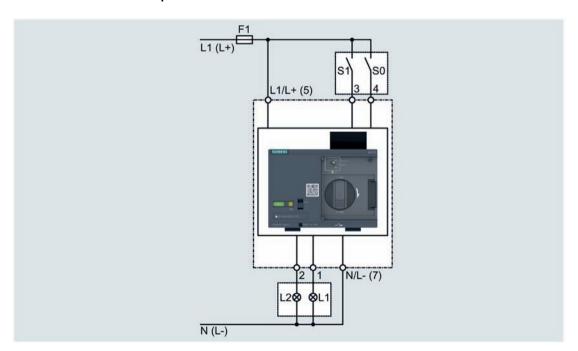
- ① Undervoltage release UVR
- ② Universal release UNI
- 3 Shunt trip

### **Motor operators**

#### MO310 side mounted motor operator and MO320 front mounted motor operator



MO310 / MO320 motor operator actuation controlled via control cable



- S0 OFF (to be provided by customer)
- S1 ON (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

F1
L1 (L+)
S01
S1
S0
L1/L+ (5)
3
4
L1/L+ (7)

MO310 / MO320 motor operator actuation controlled via control cable and undervoltage release

S0 OFF (to be provided by customer)

N (L-)

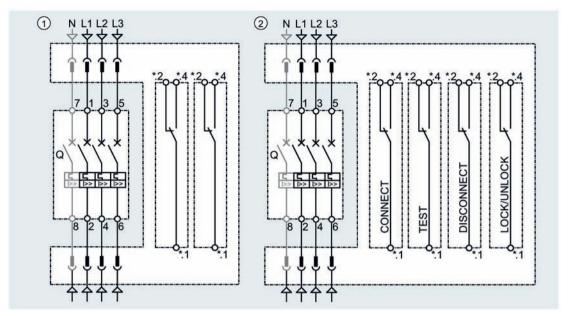
- S1 ON (to be provided by customer)
- S01 Remote command (to be provided by customer)
- K1 Contactor relay (to be provided by customer)
- U< Undervoltage release (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

This circuit is deployed in order to prevent no-load operation of the molded case circuit breaker. The contact of auxiliary contactor K1 prevents no-load operation when the undervoltage release "U<" is de-energized.

No-load operations subject the molded case circuit breaker to high stresses. If the undervoltage release is de-energized, auxiliary contactor K1 has not picked up. The contact in the ON circuit (control circuit) of the motor operator is thus not closed, i.e. the molded case circuit breaker cannot be switched.

This auxiliary contactor is not necessary when the undervoltage release is supplied uninterrupted (e.g. pushbutton S01) from the same source as the motor operator itself (e.g. contact 3).

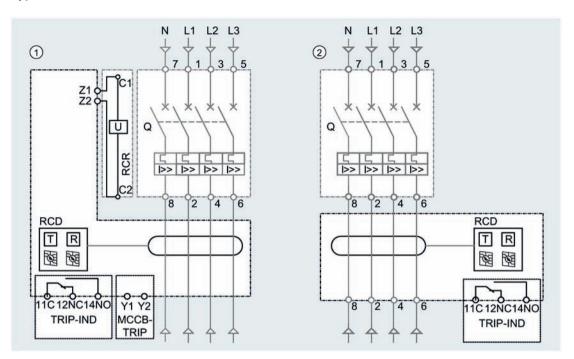
### Plug-in and draw-out units



- ① Plug-in units, 3-pole and 4-pole, with two optionally integrated position signaling switches for signaling "Plug-in unit MCCB correctly bolted to plug-in socket".
- ② Draw-out units, 3-pole and 4-pole, with an optional switch for signaling the condition "Draw-out unit locked / open" and six optionally integrated position signaling switches for signaling "Position of breaker in the draw-out unit".

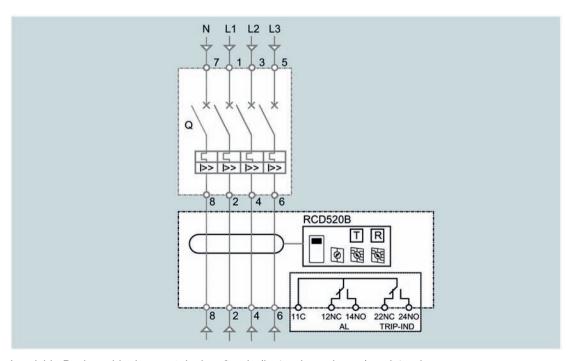
#### **RCD Basic**

Type A



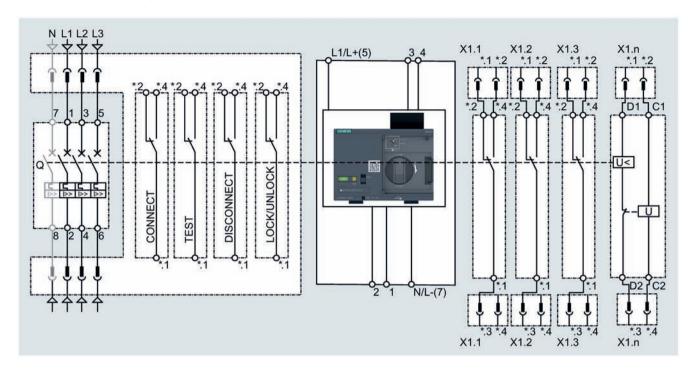
- ① Side mounted RCD Basic, 3-pole and 4-pole
- 2 Loadside RCD Basic, 3-pole and 4-pole

Type B



Loadside Basic residual current device, 3-pole (in 4-pole enclosure) and 4-pole

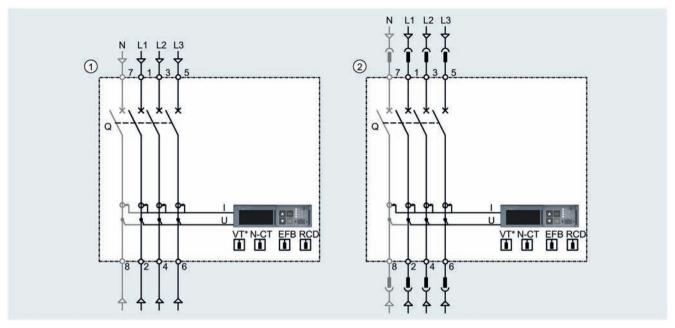
# 6.1.1.3 Example: 3VA1 molded case circuit breaker with built-on/built-in accessories



# 6.1.2 3VA2 molded case circuit breakers

### 6.1.2.1 Basic units

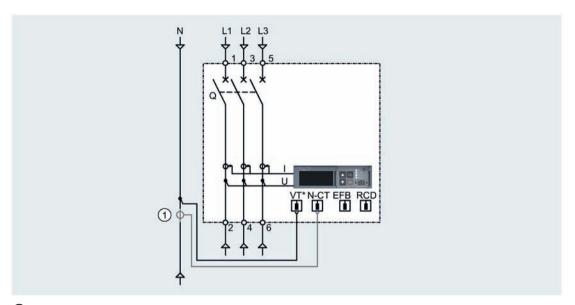
Fixed mounting and plug-in/draw-out units, 3-pole and 4-pole



- ① Fixed mounting, 3-pole and 4-pole
- Voltage tap

② Plug-in/draw-out units, 3-pole and 4-pole

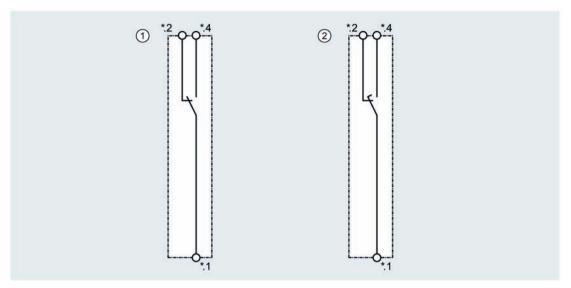
# Fixed mounting, 3-pole 3VA2 molded case circuit breaker in 5-wire system



- ① Optional external current transformer for N conductor (gray line)
- Voltage tap

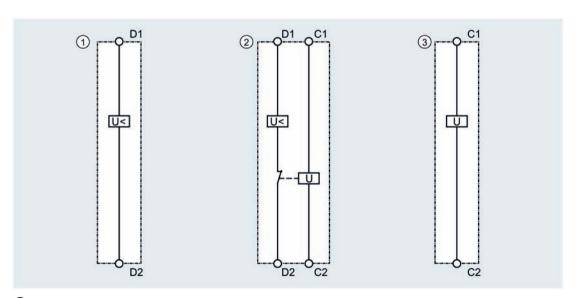
#### 6.1.2.2 Accessories

### Auxiliary switches, alarm switches and position signaling contacts



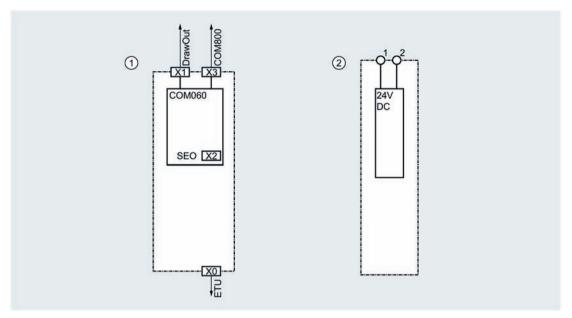
- ① Changeover contacts for auxiliary switches AUX, trip alarm switches TAS and electrical alarm switches EAS, position signaling switches for plug-in and draw-out units
- 2 Leading changeover contacts for leading changeover switch LCS

### **Auxiliary releases**



- ① Undervoltage release UVR
- ② Universal release UNI
- 3 Shunt trip

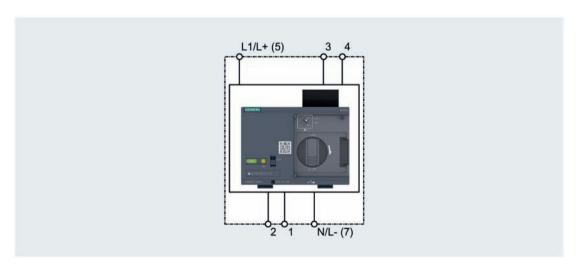
### Other internal accessories



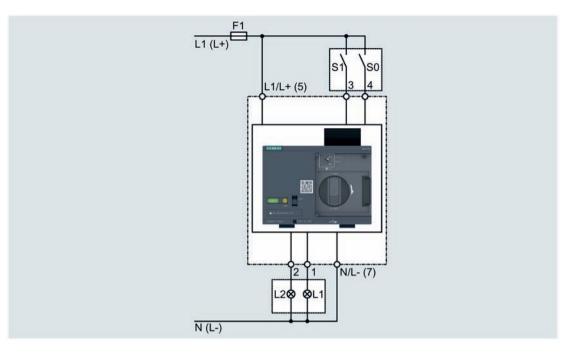
- ① COM060 communication module
- 2 24 V module

# Motor operators

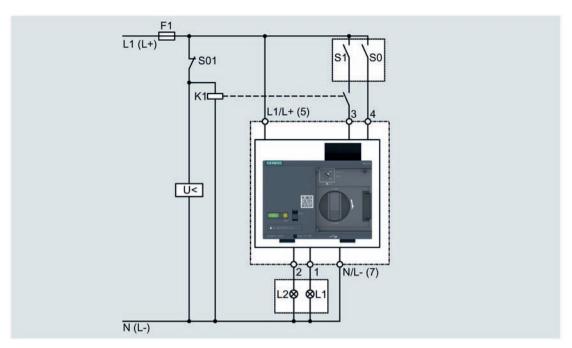
## MO320 front mounted motor operator



### MO320 motor operator actuation controlled via control cable



- S0 OFF (to be provided by customer)
- S1 ON (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)



#### MO320 motor operator actuation controlled via control cable and undervoltage release

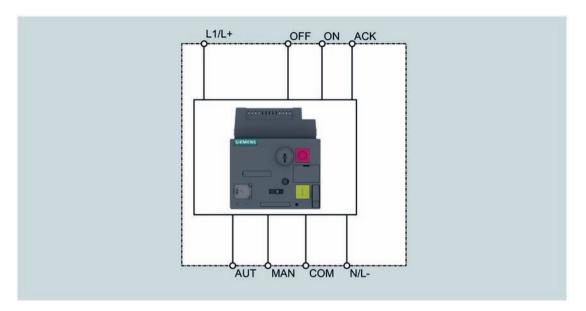
- S0 OFF (to be provided by customer)
- S1 ON (to be provided by customer)
- S01 Remote command (to be provided by customer)
- K1 Contactor relay (to be provided by customer)
- U< Undervoltage release (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

This circuit is deployed in order to prevent no-load operation of the molded case circuit breaker. The contact of auxiliary contactor K1 prevents no-load operation when the undervoltage release "U<" is de-energized.

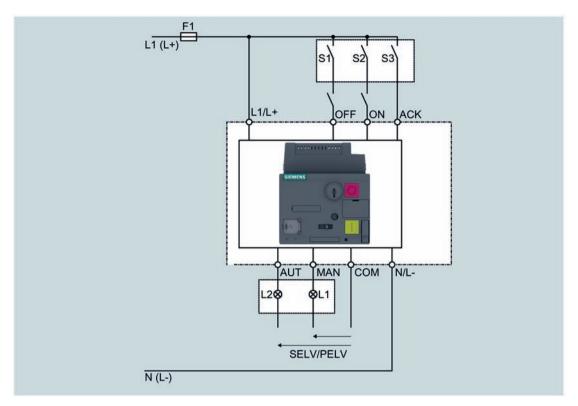
No-load operations subject the molded case circuit breaker to high stresses. If the undervoltage release is de-energized, auxiliary contactor K1 has not picked up. The contact in the ON circuit (control circuit) of the motor operator is thus not closed, i.e. the molded case circuit breaker cannot be switched.

This auxiliary contactor is not necessary when the undervoltage release is supplied uninterrupted (e.g. pushbutton S01) from the same source as the motor operator itself (e.g. contact 3).

# SEO520 motor operator with stored energy operator

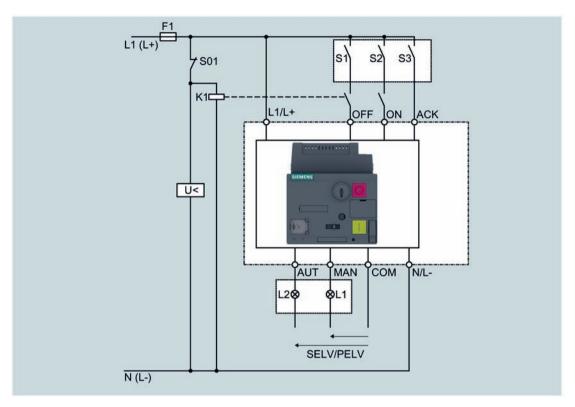


#### Actuation of SEO520 motor operator with stored energy operator controlled via control cable



- S1 OFF (to be provided by customer)
- S2 ON (to be provided by customer)
- S3 Reset signal for operating mode 3 (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

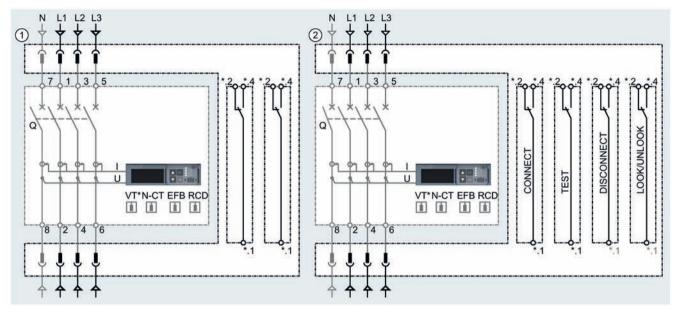
# Actuation of SEO520 motor operator with stored energy operator controlled via control cable and undervoltage release



- S1 OFF (to be provided by customer)
- S2 ON (to be provided by customer)
- S3 Reset signal for operating mode 3 (to be provided by customer)
- S01 Remote command (to be provided by customer)
- K1 Contactor relay (to be provided by customer)
- U< Undervoltage release (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

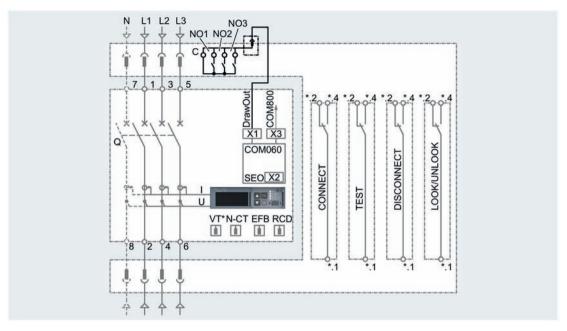
### Plug-in and draw-out units

#### Plug-in and draw-out units



- ① Plug-in units, 3-pole and 4-pole, with two optionally integrated position signaling switches for signaling "Plug-in unit MCCB correctly bolted to plug-in socket".
- ② Draw-out units, 3-pole and 4-pole, with an optional switch for signaling the condition "Draw-out unit locked / open" and six optionally integrated position signaling switches for signaling "Position of breaker in the draw-out unit".
- \* Voltage tap

#### Draw-out units with communication interface

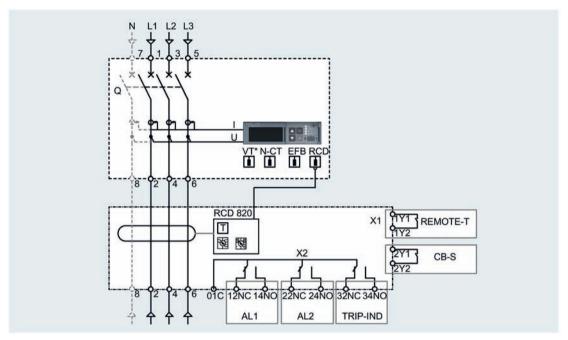


#### Voltage tap

Draw-out units, 3-pole and 4-pole, with an optional switch for signaling the condition "Draw-out unit locked / open" and three optionally integrated position signaling switches for signaling "Position of breaker in the draw-out unit".

### **RCD Advanced**

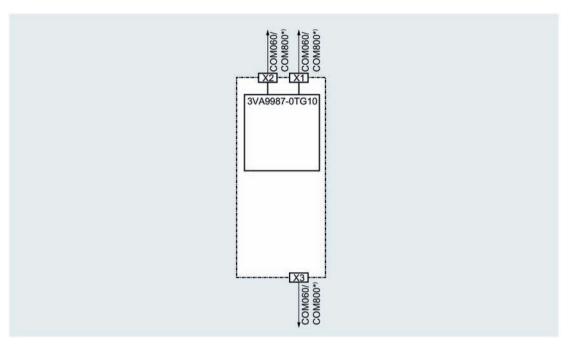
# Loadside RCD, 3-pole and 4-pole type A



Voltage tap

#### Other external accessories

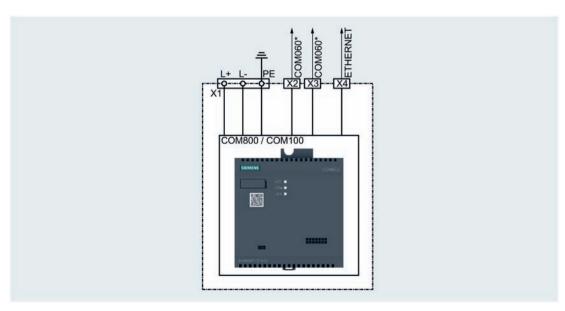
#### T-connector



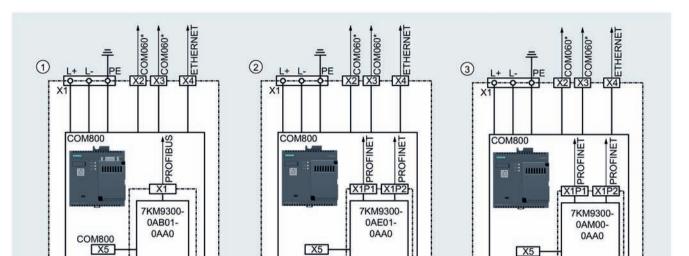
\* A connection can also be optionally equipped with a bus terminating resistor.

The T-Connector is included in the scope of supply of the COM060 communication module.

#### COM800 / COM100 breaker data server



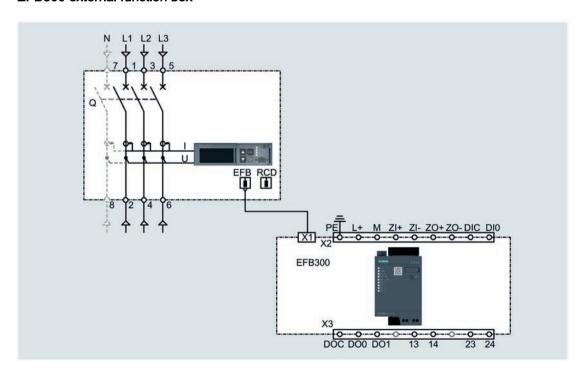
\* A connection can also be optionally equipped with a bus terminating resistor.



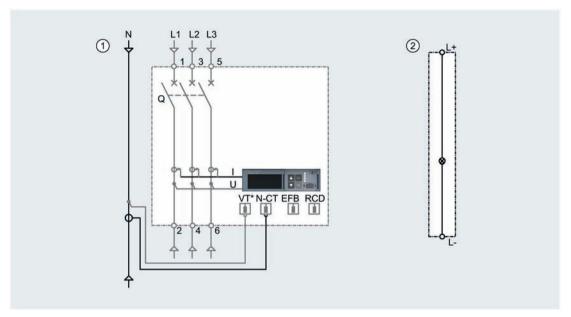
#### COM800 / COM100 breaker data server with expansion modules

- ① COM800 / COM100 breaker data server with 7KM PAC PROFIBUS DP expansion module
- 2 COM800 / COM100 breaker data server with 7KM PAC Switched Ethernet PROFINET expansion module
- 3 COM800 / COM100 breaker data server with 7KM PAC RS485 Modbus RTU expansion module
- \* A connection can also be optionally equipped with a bus terminating resistor.

#### EFB300 external function box

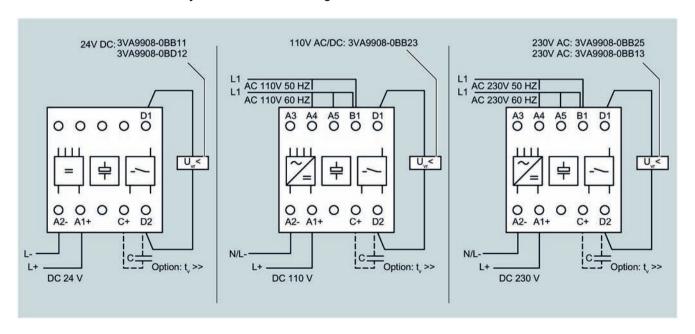


# External current transformer for N conductor and illumination kit (24 V DC) for manual handle

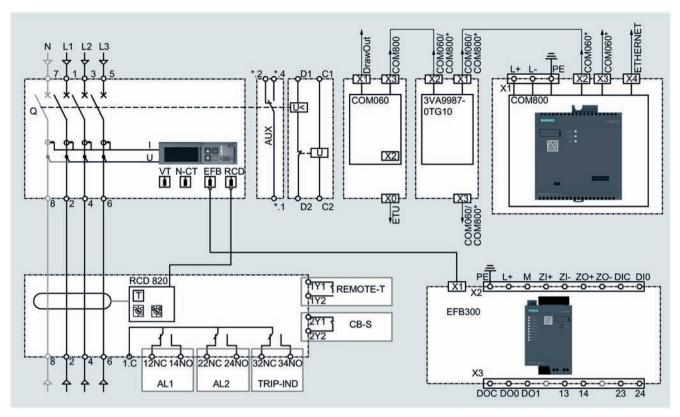


- ① Connection for external current transformer for N conductor
- ② Illumination kit (24 V DC) for manual handle
- Voltage tap

#### Time-delay device for undervoltage releases



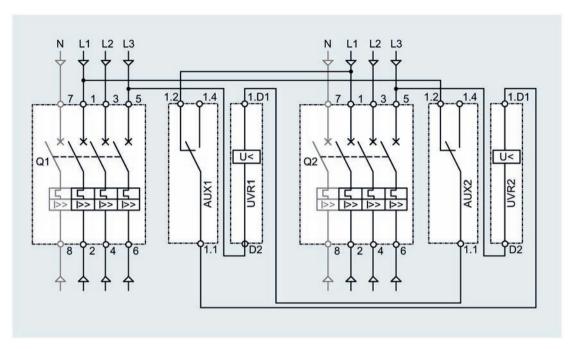
## 6.1.2.3 Example: 3VA2 molded case circuit breaker with built-on/built-in accessories



<sup>\*</sup> A connection can also be optionally equipped with a bus terminating resistor.

## 6.1.3 Application example

Electrical interlocking of two 3VA molded case circuit breakers with undervoltage releases



Q 1 Molded case circuit breaker 1

UVR1 Undervoltage release in molded case circuit breaker 1

AUX1 Auxiliary switch in molded case circuit breaker 1

Q2 Molded case circuit breaker 2

UVR2 Undervoltage release in molded case circuit breaker 2

AUX2 Auxiliary switch in molded case circuit breaker 2

#### Note

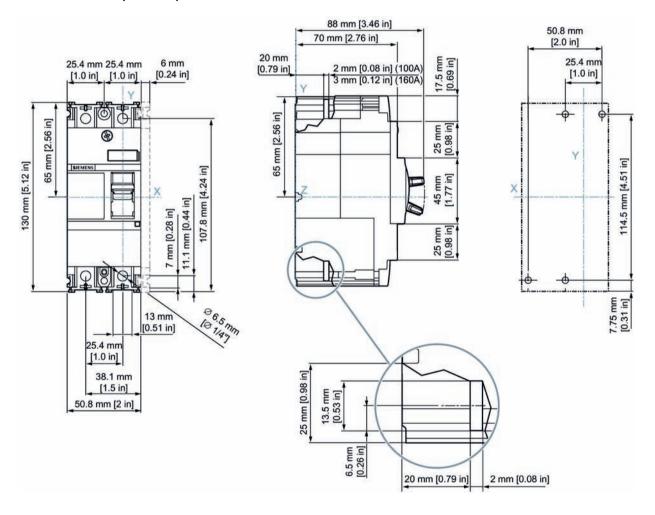
The undervoltage release UVR must not be connected to phases L1 and L3 for 690 V AC applications. In this case, it is connected to phase L1 and the N conductor or to a control voltage supply up to maximum 480 V AC.

# 6.2 Dimensional drawings

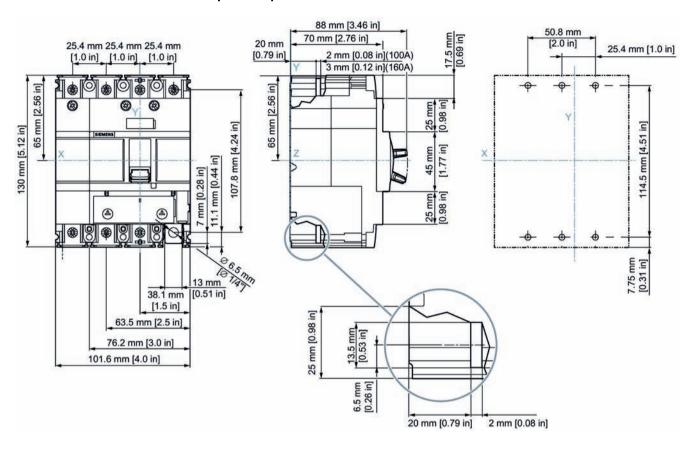
#### 6.2.1 Dimensions of basic units

#### 6.2.1.1 3VA10 and 3VA11

### 3VA11 160 A 1-pole / 2-pole

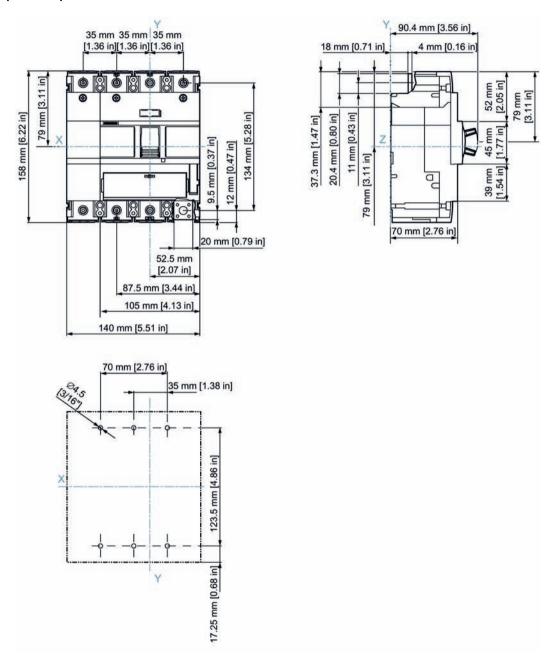


### 3VA10 100 A / 3VA11 160 A 3-pole / 4-pole

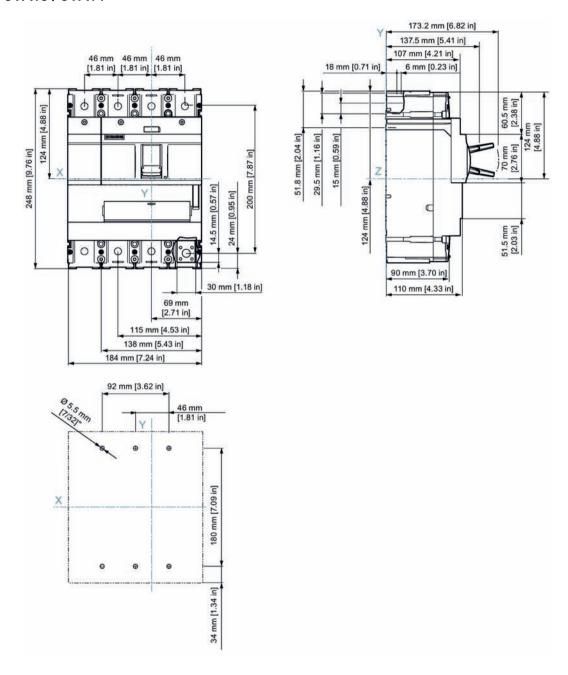


### 6.2.1.2 3VA12

## 3VA12 250 A 3-pole / 4-pole

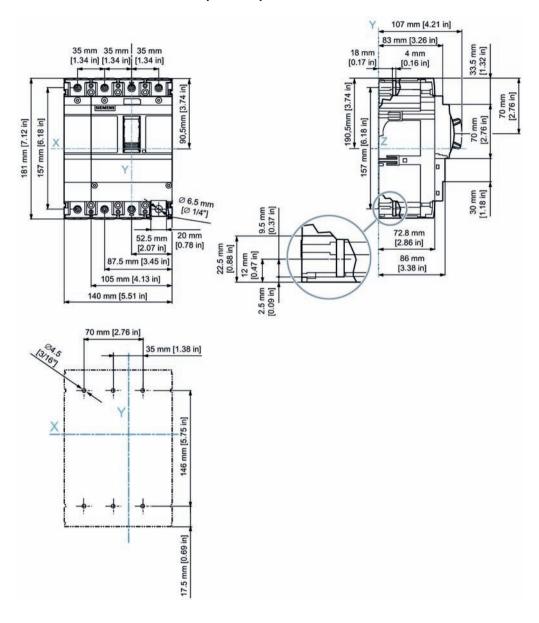


### 6.2.1.3 3VA13 / 3VA14



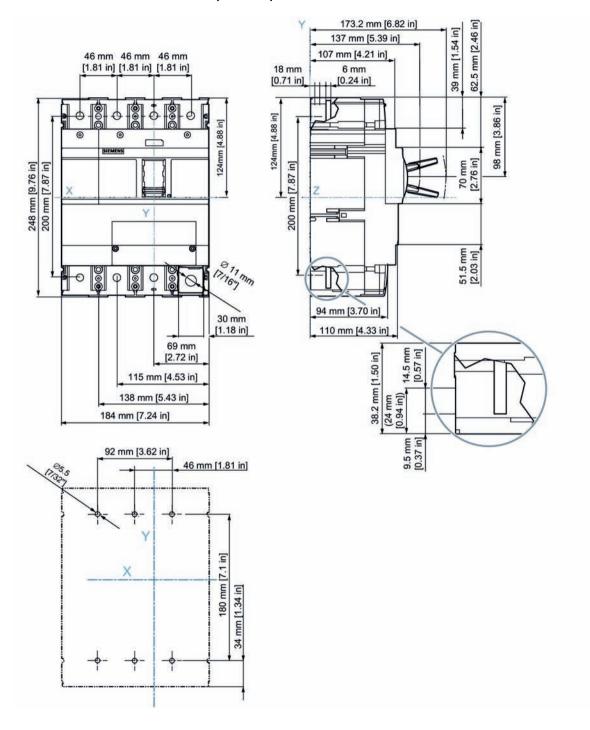
#### 6.2.1.4 3VA20 / 3VA21 / 3VA22

## 3VA20 100 A / 3VA21 160 A / 3VA22 250 A 3-pole / 4-pole



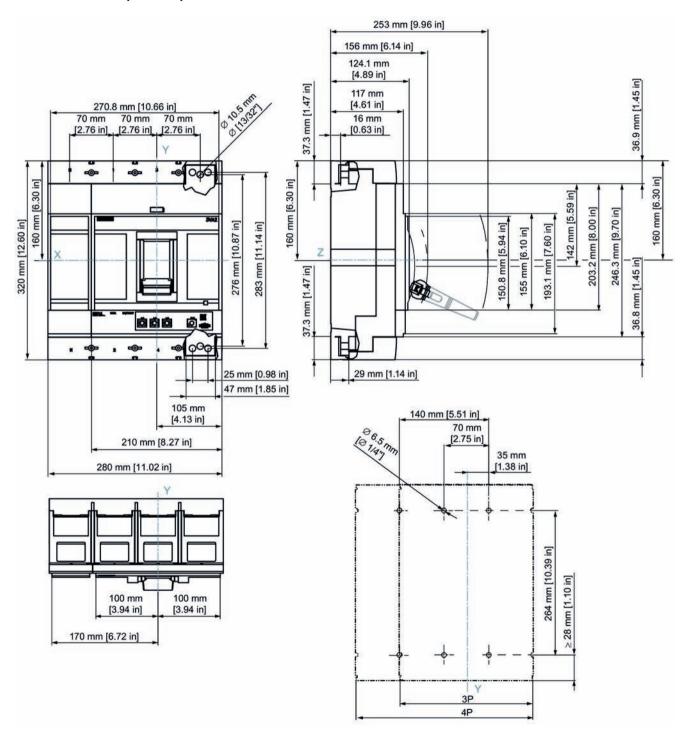
#### 6.2.1.5 3VA23 / 3VA24

### 3VA23 400 A / 3VA24 630 A 3-pole / 4-pole



#### 6.2.1.6 3VA25

### 3VA25 1000 A 3-pole / 4-pole

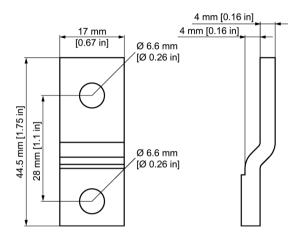


### 6.2.2 Dimensions of accessories

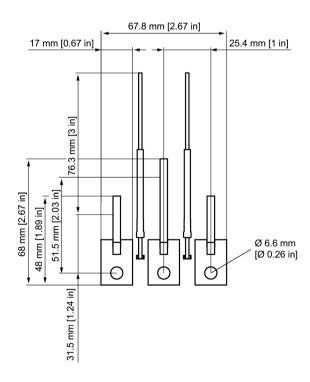
# 6.2.2.1 Connection technology

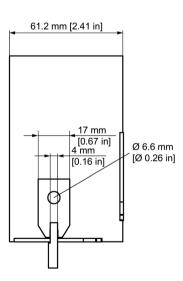
## Bus connectors extended or offset for 3VA up to 630 A

#### **Extension**

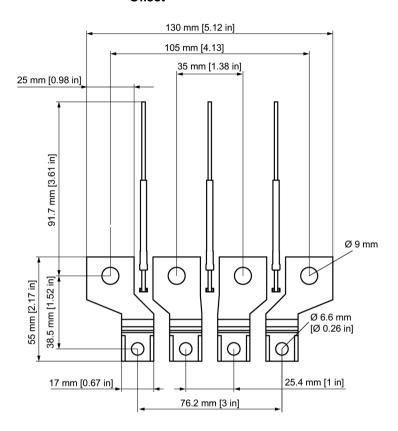


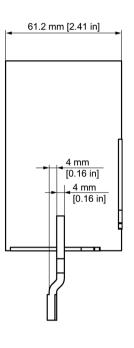
#### Rotated extension



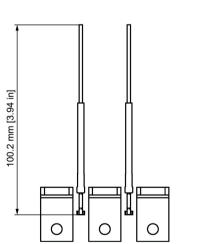


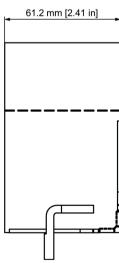
### Offset



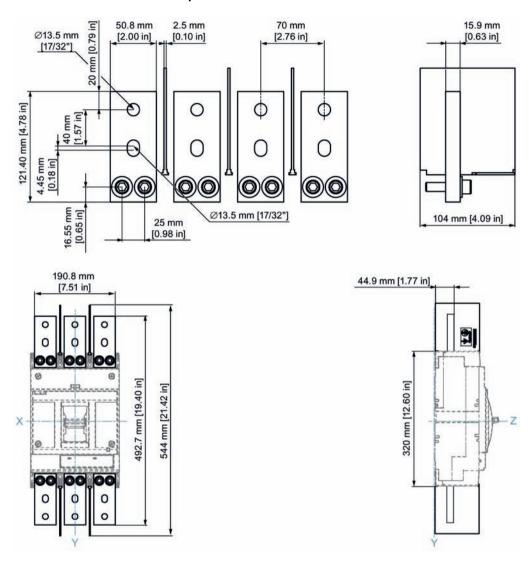


### Right-angled extension



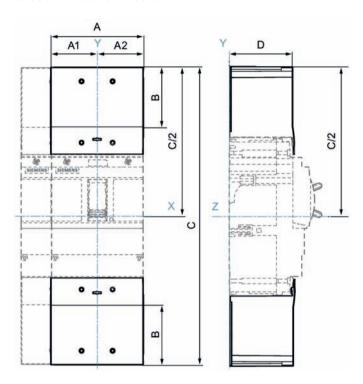


# Bus connectors extended or offset for 3VA up to 1000 A



#### Wire connectors large / for 2 cables / for 6 cables up to 630 A

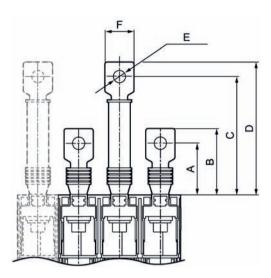
The dimensions of the terminal cover for wire connectors large / for 2 cables / for 6 cables up to 630 A are shown below.



|     |                     |                      | 3V                   | 'A1                  |                      | 3VA2                 |                      |                      |                      |                      |
|-----|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
|     | 100 / 160           |                      | 2                    | 50                   | 400 / 630            |                      | 100 / 16             | 60 / 250             | 400 / 630            |                      |
|     | 3-pole              | 4-pole               | 3-pole               | 4-pole               | 3-pole               | 4-pole               | 3-pole               | 4-pole               | 3-pole               | 4-pole               |
| Α   | 76.2 mm<br>[3 in]   | 101.6 mm<br>[3.9 in] | 105 mm<br>[4.13 in]  | 140 mm<br>[5.51 in]  | 138 mm<br>[5.4 in]   | 184 mm<br>[7.2 in]   | 105 mm<br>[4.1 in]   | 140 mm<br>[5.5 in]   | 138 mm<br>[5.4 in]   | 184 mm<br>[7.2 in]   |
| A1  | 38.1 mm<br>[1.5 in] | 63.5 mm<br>[2.5 in]  | 52.5 mm<br>[2.06 in] | 87.5 mm<br>[3.44 in] | 69.0 mm<br>[2.71 in] | 87.5 mm<br>[3.44 in] | 52.5 mm<br>[2.06 in] | 87.5 mm<br>[3.44 in] | 69.0 mm<br>[2.71 in] | 87.5 mm<br>[3.44 in] |
| A2  | 38.1 mm<br>[1.5 in] | 38.1 mm<br>[1.5 in]  | 52.5 mm<br>[2.06 in] | 52.5 mm<br>[2.06 in] | 69.0 mm<br>[2.71 in] | 69.0 mm<br>[2.71 in] | 52.5 mm<br>[2.06 in] | 52.5 mm<br>[2.06 in] | 69.0 mm<br>[2.71 in] | 69.0 mm<br>[2.71 in] |
| В   | 50 mm               | [1.9 in]             | 66.6 mn              | n [2.6 in]           | 64.9 mn              | n [2.6 in]           | 67.4 mm              | [2.65 in]            | 64.9 mn              | n [2.6 in]           |
| C   | 230 mm              | n [9.1 in]           | 291.2 mn             | n [11.5 in]          | 377.8 mn             | n [14.9 in]          | 315.8 mn             | n [12.4 in]          | 377.8 mn             | n [14.9 in]          |
| C/2 | 115 mm              | [4.55 in]            | 145.6 mn             | n [5.75 in]          | 188.9 mn             | n [7.45 in]          | 157.9 mi             | m [6.2 in]           | 188.9 mn             | n [7.45 in]          |
| D   | 67 mm               | [2.64 in]            | 61.4 mn              | n [2.4 in]           | 91.5 mm              | n [3.6 in]           | 71 mm                | [2.8 in]             | 91.5 mn              | n [3.6 in]           |

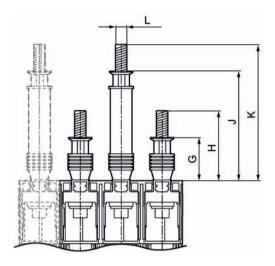
## 6.2 Dimensional drawings

#### Rear connection stud flat



|   |                    | 3VA1               | 3V.               | 3VA2               |                   |  |
|---|--------------------|--------------------|-------------------|--------------------|-------------------|--|
|   | 100 / 160          | 250                | 400 / 630         | 100 / 160 / 250    | 400 / 630         |  |
| Α | 51 mm [2.01 in]    | 43 mm [1.69 in]    | 50 mm [1.97 in]   | 43 mm [1.69 in]    | 50 mm [1.97 in]   |  |
| В | 63 mm [2.48 in]    | 55.5 mm [2.19 in]  | 65 mm [2.56 in]   | 55.5 mm [2.19 in]  | 65 mm [2.56 in]   |  |
| С | 108 mm [4.25 in]   | 100 mm [3.94 in]   | 115 mm [4.53 in]  | 100 mm [3.94 in]   | 115 mm [4.53 in]  |  |
| D | 120.5 mm [4.74 in] | 112.5 mm [4.43 in] | 130 mm [5.12 in]  | 112.5 mm [4.43 in] | 130 mm [5.12 in]  |  |
| E | 8.4 mm [0.33 in]   | 10.5 mm [0.41 in]  | 13.2 mm [0.52 in] | 10.5 mm [0.41 in]  | 13.2 mm [0.52 in] |  |
| F | 16 mm [0.63 in]    | 22 mm [0.87 in]    | 29.4 mm [1.16 in] | 22 mm [0.87 in]    | 29.4 mm [1.16 in] |  |

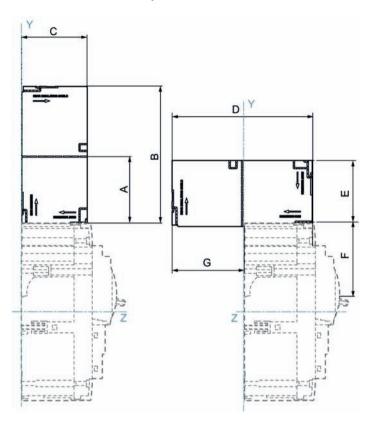
## Rear connection stud round



|   |                  | 3VA1             | 3V               | 3VA2             |                  |  |
|---|------------------|------------------|------------------|------------------|------------------|--|
|   | 100 / 160        | 250              | 400 / 630        | 100 / 160 / 250  | 400 / 630        |  |
| G | 28 mm [1.10 in]  | 36 mm [1.42 in]  | 45 mm [1.77 in]  | 36 mm [1.42 in]  | 45 mm [1.77 in]  |  |
| Н | 66 mm [2.60 in]  | 59 mm [2.32 in]  | 75 mm [2.95 in]  | 59 mm [2.32 in]  | 75 mm [2.95 in]  |  |
| J | 85 mm [3.35 in]  | 93 mm [3.66 in]  | 105 mm [4.13 in] | 93 mm [3.66 in]  | 105 mm [4.13 in] |  |
| K | 123 mm [4.84 in] | 116 mm [4.57 in] | 135 mm [5.31 in] | 116 mm [4.57 in] | 135 mm [5.31 in] |  |
| L | M8               | M10              | M12              | M10              | M12              |  |

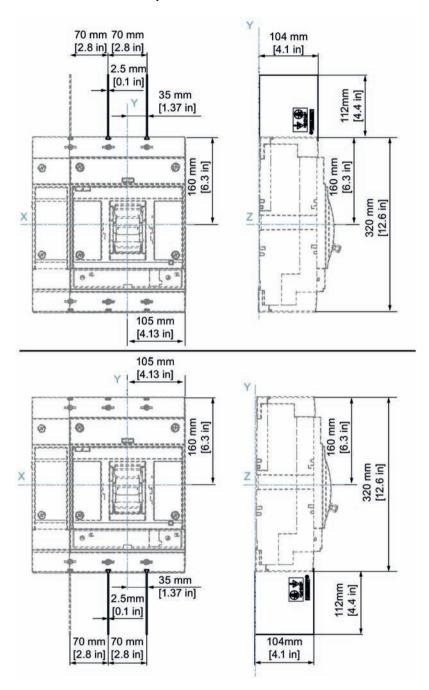
#### Phase barrier

#### Phase barrier for 3VA up to 630 A

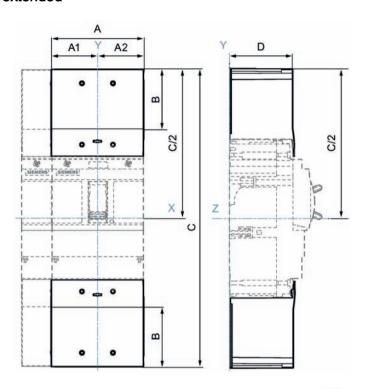


|   |                         | 3VA1                    | 3VA2             |                    |                  |
|---|-------------------------|-------------------------|------------------|--------------------|------------------|
|   | 100 / 160               | 250                     | 400 / 630        | 100 / 160 / 250    | 400 / 630        |
| Α | 35/65 mm [1.38/2.56 in] | 40/93 mm [1.59/3.66 in] | 80 mm [3.15 in]  | 68 mm [2.68 in]    | 80 mm [3.15 in]  |
| В | 97 mm [3.82 in]         | 138.5 mm [5.45 in]      | 167 mm [6.58 in] | 141 mm [5.55 in]   | 167 mm [6.58 in] |
| С | 61.5 mm [2.42 in]       | 64 mm [2.52 in]         | 88 mm [3.47 in]  | 69 mm [2.72 in]    | 88 mm [3.47 in]  |
| D | 100.5 mm [3.96 in]      | 143.5 mm [5.65 in]      | 175 mm [6.89 in] | 146.5 mm [5.77 in] | 175 mm [6.89 in] |
| E | 59 mm [2.33 in]         | 59 mm [2.33 in]         | 80 mm [3.15 in]  | 63.4 mm [2.50 in]  | 80 mm [3.15 in]  |
| F | 65 mm [2.56 in]         | 79 mm [3.11 in]         | 124 mm [4.89 in] | 90.5 mm [3.57 in]  | 124 mm [4.89 in] |
| G | 42 mm [1.66 in]         | 81 mm [3.19 in]         | 88 mm [3.47 in]  | 79 mm [3.11 in]    | 88 mm [3.47 in]  |

#### Phase barrier for 3VA up to 1000 A

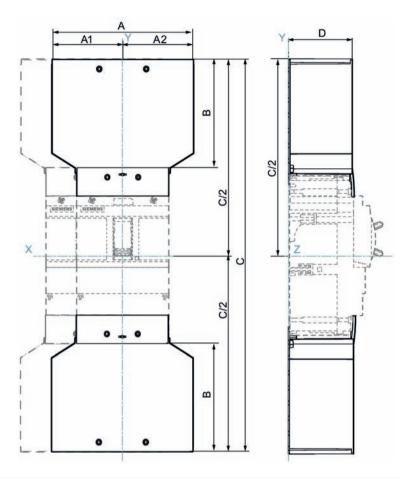


#### Terminal cover extended



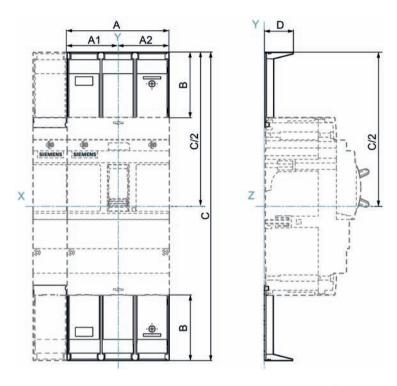
|     |                     |                     |                     | 3\                   | /A1                  |                      |                       |                      | 3V                   | A2                   |                       |  |
|-----|---------------------|---------------------|---------------------|----------------------|----------------------|----------------------|-----------------------|----------------------|----------------------|----------------------|-----------------------|--|
|     |                     | 100 / 160           |                     |                      | 50                   | 400                  | / 630                 | 100 / 16             | 60 / 250             | 50 400 / 630         |                       |  |
|     | 2-pole              | 3-pole              | 4-pole              | 3-pole               | 4-pole               | 3-pole               | 4-pole                | 3-pole               | 4-pole               | 3-pole               | 4-pole                |  |
| Α   | 50.8 mm<br>[2 in]   | 76.2 mm<br>[3 in]   | 101.6 mm<br>[4 in]  | 105 mm<br>[4.13 in]  | 140 mm<br>[5.51 in]  | 138 mm<br>[5.43 in]  | 182.2 mm<br>[7.17 in] | 105 mm<br>[4.13 in]  | 140 mm<br>[5.51 in]  | 138 mm<br>[5.43 in]  | 182.2 mm<br>[7.17 in] |  |
| A1  | 38.1 mm<br>[1.5 in] | 38.1 mm<br>[1.5 in] | 63.5 mm<br>[2.5 in] | 52.5 mm<br>[2.06 in] | 87.5 mm<br>[3.44 in] | 69.0 mm<br>[2.71 in] | 87.5 mm<br>[3.44 in]  | 52.5 mm<br>[2.06 in] | 87.5 mm<br>[3.44 in] | 69.0 mm<br>[2.71 in] | 87.5 mm<br>[3.44 in]  |  |
| A2  | 12.7 mm<br>[0.5 in] | 38.1 mm<br>[1.5 in] | 38.1 mm<br>[1.5 in] | 52.5 mm<br>[2.06 in] | 52.5 mm<br>[2.06 in] | 69.0 mm<br>[2.71 in] | 69.0 mm<br>[2.71 in]  | 52.5 mm<br>[2.06 in] | 52.5 mm<br>[2.06 in] | 69.0 mm<br>[2.71 in] | 69.0 mm<br>[2.71 in]  |  |
| В   | 5                   | 2 mm [2.05          | in]                 | 67.4 mm              | [2.65 in]            | 64.9 mm              | [2.56 in]             | 67.4 mm              | [2.65 in]            | 64.9 mm              | [2.56 in]             |  |
| C   | 23                  | 4 mm [9.21          | in]                 | 292.8 mm             | [11.53 in]           | 377.8 mm             | [14.87 in]            | 315.8 mm             | [12.43 in]           | 377.8 mm             | [14.87 in]            |  |
| C/2 | 11                  | 7 mm [4.61          | in]                 | 146.4 mn             | [5.76 in]            | 188.9 mr             | n [7.44 in]           | 157.9 mn             | n [6.22 in]          | 188.9 mn             | n [7.44 in]           |  |
| D   | 6                   | 7 mm [2.64          | in]                 | 61.4 mn              | n [2.4 in]           | 91.5 mr              | n [3.6 in]            | 71 mm                | [2.8 in]             | 91.5 mm              | n [3.6 in]            |  |

#### Terminal cover offset



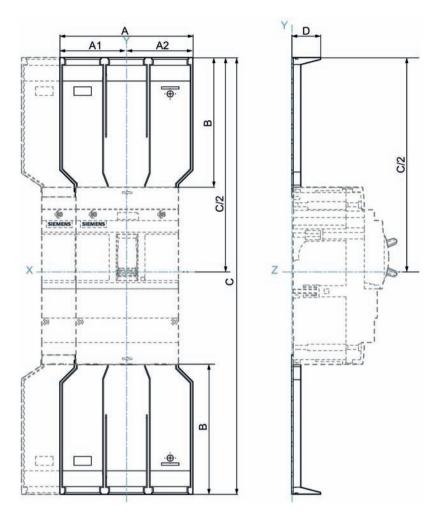
|     |                       |                       | 3V                    | A1                    |                       |                       | 3VA2                  |                       |                       |                       |  |
|-----|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--|
|     | 100 / 160             |                       | 25                    | 50                    | 400 / 630 100 / 16    |                       | 160 / 250 400 /       |                       | 630                   |                       |  |
|     | 3-pole                | 4-pole                |  |
| A   | 106.5 mm<br>[4.19 in] | 141.5 mm<br>[5.57 in] | 136.8 mm<br>[5.39 in] | 181.8 mm<br>[7.16 in] | 212 mm<br>[8.35 in]   | 282 mm<br>[11.1 in]   | 136.8 mm<br>[5.39 in] | 181.8 mm<br>[7.16 in] | 212 mm<br>[8.35 in]   | 282 mm<br>[11.1 in]   |  |
| A1  | 53.3 mm<br>[2.1 in]   | 88.4 mm<br>[3.48 in]  | 68.4 mm<br>[2.69 in]  | 113.6 mm<br>[4.47 in] | 106.0 mm<br>[4.17 in] | 176.3 mm<br>[6.94 in] | 68.4 mm<br>[2.69 in]  | 113.6 mm<br>[4.47 in] | 106.0 mm<br>[4.17 in] | 176.3 mm<br>[6.94 in] |  |
| A2  | 53.3 mm<br>[2.1 in]   | 53.1 mm<br>[2.09 in]  | 68.4 mm<br>[2.69 in]  | 68.2 mm<br>[2.69 in]  | 106.0 mm<br>[4.17 in] | 105.8 mm<br>[4.17 in] | 68.4 mm<br>[2.69 in]  | 68.2 mm<br>[2.69 in]  | 106.0 mm<br>[4.17 in] | 105.8 mm<br>[4.17 in] |  |
| В   | 96.5 mm               | n [3.8 in]            | 133.7 mn              | n [5.26 in]           | 147.5 mn              | n [5.81 in]           | 133.7 mn              | n [5.26 in]           | 147.5 mn              | n [5.81 in]           |  |
| C   | 323 mm                | [12.72 in]            | 425.4 mm              | [16.75 in]            | 543 mm                | [21.38 in]            | 448.4 mm              | [17.65 in]            | 543 mm                | [21.38 in]            |  |
| C/2 | 161.5 mm              | n [6.36 in]           | 212.7 mn              | n [8.37 in]           | 271.5 mm              | [10.69 in]            | 224.2 mn              | n [8.83 in]           | 271.5 mm              | [10.69 in]            |  |
| D   | 67 mm                 | [2.64 in]             | 61.4 mn               | n [2.4 in]            | 91.5 mn               | n [3.6 in]            | 71 mm                 | [2.8 in]              | 91.5 mn               | n [3.6 in]            |  |

# Insulating plate



|     |                     |                     |                     | 3\                   | /A1                  |                               |                       | 3VA2                 |                      |                      |                       |
|-----|---------------------|---------------------|---------------------|----------------------|----------------------|-------------------------------|-----------------------|----------------------|----------------------|----------------------|-----------------------|
|     |                     | 100 / 160           |                     | 2                    | 50                   | 400 / 630 100 / 160 / 250 400 |                       |                      | 400                  | 00 / 630             |                       |
|     | 2-pole              | 3-pole              | 4-pole              | 3-pole               | 4-pole               | 3-pole                        | 4-pole                | 3-pole               | 4-pole               | 3-pole               | 4-pole                |
| Α   | 50.8 mm<br>[2 in]   | 76.2 mm<br>[3 in]   | 101.6 mm<br>[4 in]  | 105 mm<br>[4.13 in]  | 140 mm<br>[5.51 in]  | 138 mm<br>[5.43 in]           | 182.2 mm<br>[7.17 in] | 105 mm<br>[4.13 in]  | 140 mm<br>[5.51 in]  | 138 mm<br>[5.43 in]  | 182.2 mm<br>[7.17 in] |
| A1  | 38.1 mm<br>[1.5 in] | 38.1 mm<br>[1.5 in] | 63.5 mm<br>[2.5 in] | 52.5 mm<br>[2.06 in] | 87.5 mm<br>[3.44 in] | 69.0 mm<br>[2.71 in]          | 87.5 mm<br>[3.44 in]  | 52.5 mm<br>[2.06 in] | 87.5 mm<br>[3.44 in] | 69.0 mm<br>[2.71 in] | 87.5 mm<br>[3.44 in]  |
| A2  | 12.7 mm<br>[0.5 in] | 38.1 mm<br>[15 in]  | 38.1 mm<br>[1.5 in] | 52.5 mm<br>[2.06 in] | 52.5 mm<br>[2.06 in] | 69.0 mm<br>[2.71 in]          | 69.0 mm<br>[2.71 in]  | 52.5 mm<br>[2.06 in] | 52.5 mm<br>[2.06 in] | 69.0 mm<br>[2.71 in] | 69.0 mm<br>[2.71 in]  |
| В   | 52                  | 2 mm [2.05]         | in]                 | 67.4 mm              | [2.65 in]            | 64.9 mm                       | [2.56 in]             | 67.4 mm              | [2.65 in]            | 64.9 mm              | [2.56 in]             |
| С   | 23                  | 4 mm [9.21          | in]                 | 292.8 mm             | [11,53 in]           | 377.8 mm                      | [14.87 in]            | 315.8 mm             | [12.43 in]           | 377.8 mm             | [14.87 in]            |
| C/2 | 11                  | 7 mm [4.61          | in]                 | 146.4 mn             | n [5.76 in]          | 188.9 mm                      | n [7.44 in]           | 157,9 mn             | n [6.22 in]          | 188.9 mn             | n [7.44 in]           |
| D   | 7                   | mm [0.28 ii         | n]                  | 29.2 mm              | [1.15 in]            | 33.2 mm                       | [1.31 in]             | 29.2 mm              | [1.15 in]            | 33.2 mm              | [1.31 in]             |

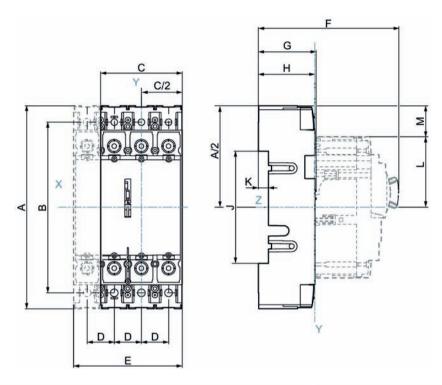
# Insulating plate offset:



|     |                       | V.                    | 3V                    | A1                    |                       |                           |                       | 3V                    | 'A2                   |                       |
|-----|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|---------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
|     | 100 / 160             |                       | 25                    | 50                    | 400                   | 400 / 630 100 / 160 / 250 |                       | 400                   | 400 / 630             |                       |
|     | 3-pole                | 4-pole                | 3-pole                | 4-pole                | 3-pole                | 4-pole                    | 3-pole                | 4-pole                | 3-pole                | 4-pole                |
| Α   | 106.5 mm<br>[4.19 in] | 141.5 mm<br>[5.57 in] | 136.8 mm<br>[5.39 in] | 181.8 mm<br>[7.16 in] | 212 mm<br>[8.35 in]   | 282 mm<br>[11.1 in]       | 136.8 mm<br>[5.39 in] | 181.8 mm<br>[7.16 in] | 212 mm<br>[8.35 in]   | 282 mm<br>[11.1 in]   |
| A1  | 53.3 mm<br>[2.1 in]   | 88.4 mm<br>[3.48 in]  | 68.4 mm<br>[2.69 in]  | 113.6 mm<br>[4.47 in] | 106.0 mm<br>[4.17 in] | 176.3 mm<br>[6.94 in]     | 68.4 mm<br>[2.69 in]  | 113.6 mm<br>[4.47 in] | 106.0 mm<br>[4.17 in] | 176.3 mm<br>[6.94 in] |
| A2  | 53.3 mm<br>[2.1 in]   | 53.1 mm<br>[2.09 in]  | 68.4 mm<br>[2.69 in]  | 68.2 mm<br>[2.69 in]  | 106.0 mm<br>[4.17 in] | 105.8 mm<br>[4.17 in]     | 68.4 mm<br>[2.69 in]  | 68.2 mm<br>[2.69 in]  | 106.0 mm<br>[4.17 in] | 105.8 mm<br>[4.17 in] |
| В   | 96.5 mn               | n [3.8 in]            | 133.7 mn              | n [5.26 in]           | 147.5 mn              | n [5.81 in]               | 133.7 mn              | n [5.26 in]           | 147.5 mn              | n [5.81 in]           |
| С   | 323 mm                | [12.72 in]            | 425.4 mm              | [16.75 in]            | 543 mm                | [21.38 in]                | 448.4 mm              | [17.65 in]            | 543 mm                | [21.38 in]            |
| C/2 | 161.5 mm              | n [6.36 in]           | 212.7 mn              | n [8.37 in]           | 271.5 mm              | [10.69 in]                | 224.2 mn              | n [8.83 in]           | 271.5 mm              | [10.69 in]            |
| D   | 26.8 mm               | [1.06 in]             | 29.5 mm               | [1.16 in]             | 37.3 mm               | [1.47 in]                 | 29.5 mm               | [1.16 in]             | 37.3 mm               | [1.47 in]             |

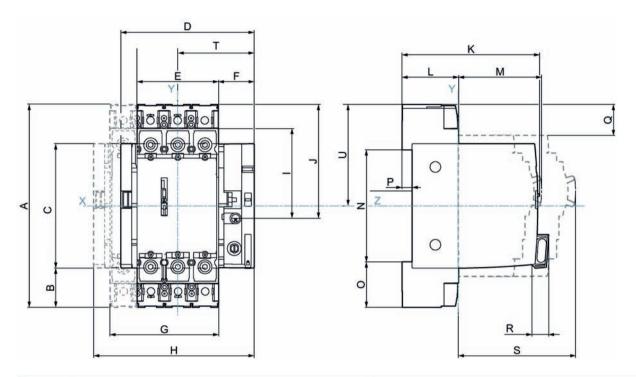
## 6.2.2.2 Plug-in and draw-out units

# Plug-in socket



|     |                   | 3VA1              |                   | 3V                | A2                |
|-----|-------------------|-------------------|-------------------|-------------------|-------------------|
|     | 100 / 160         | 250               | 400 / 630         | 100 / 160 / 250   | 400 / 630         |
| Α   | 186.1 mm [7.3 in] | 237 mm [9.3 in]   | 327 mm [12.9 in]  | 261 mm [10.3 in]  | 327 mm [12.9 in]  |
| A/2 | 93.1 mm [3.7 in]  | 118.5 mm [4.7 in] | 163.5 mm [6.5 in] | 130.5 mm [5.2 in] | 163.5 mm [6.5 in] |
| В   | 153.8 mm [6.1 in] | 196 mm [7.7 in]   | 279 mm [11 in]    | 220 mm [8.7 in]   | 279 mm [11 in]    |
| С   | 76.2 mm [3 in]    | 105 mm [4.1in]    | 138 mm [5.4 in]   | 105 mm [4.1 in]   | 138 mm [5.4 in]   |
| C/2 | 38.1 mm [1.5 in]  | 52.5 mm [2.1 in]  | 69 mm [2.7 in]    | 52.5 mm [2.1 in]  | 69 mm [2.7 in]    |
| D   | 25.4 mm [1 in]    | 35 mm [1.4 in]    | 46 mm [1.8 in]    | 35 mm [1.4 in]    | 46 mm [1.8 in]    |
| E   | 101.6 mm [4 in]   | 140 mm [5.5 in]   | 184 mm [7.2 in]   | 140 mm [5.5 in]   | 184 mm [7.2 in]   |
| F   | 153 mm [6 in]     | 155.4 mm [6.1 in] | 232 mm [9.1 in]   | 180 mm [7.1 in]   | 232 mm [9.1 in]   |
| G   | 66.5 mn           | n [2.6 in]        | 95.5 mm [3.8 in]  | 74.5 mm [2.9 in]  | 95.5 mm [3.8 in]  |
| Н   | 65 mm             | [2.6 in]          | 94 mm [3.7 in]    | 73 mm [2.9 in]    | 94 mm [3.7 in]    |
| J   | 122.3 mm [4.8 in] | 149.5 mm [5.9 in] | 192 mm [7.6 in]   | 144 mm [5.7 in]   | 192 mm [7.6 in]   |
| K   | 5 mm              | [0.2 in]          | 34 mm [1.3 in]    | 13 mm [0.5 in]    | 34 mm [1.3 in]    |
| L   | 60 mm [2.4 in]    | 79 mm [3.1 in]    | 98 mm [3.9 in]    | 70 mm [2.8 in]    | 98 mm [3.9 in]    |
| М   | 28 mm [1.1 in]    | 39.5 mm [1.6 in]  | 39.5 mm [1.6 in]  | 40 mm [1.6 in]    | 39.5 mm [1.6 in]  |

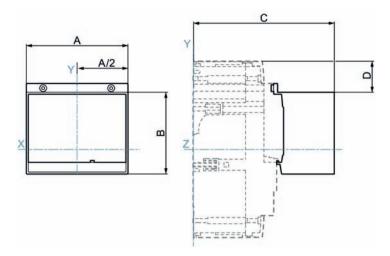
## Draw-out unit



|   | 3V                | 'A1               | 3V                | A2                |
|---|-------------------|-------------------|-------------------|-------------------|
|   | 250               | 400 / 630         | 100 / 160 / 250   | 400 / 630         |
| A | 237 mm [10.7 in]  | 327 mm [12.9 in]  | 261 mm [10.3 in]  | 327 mm [12.9 in]  |
| В | 38.5 mm [1.5 in]  | 83.5 mm [3.3 in]  | 50.5 mm [2 in]    | 83.5 mm [3.3 in]  |
| С |                   | 160 mn            | n [6.3 in]        |                   |
| D | 172 mm [6.8 in]   | 205 mm [8.1 in]   | 172 mm [6.8 in]   | 205 mm [8.1 in]   |
| E | 105 mm [4.1 in]   | 138 mm [5.4 in]   | 105 mm [4.1 in]   | 138 mm [5.4 in]   |
| F |                   | 46 mm             | [1.8 in]          |                   |
| G | 140 mm [5.5 in]   | 184 mm [7.2 in]   | 140 mm [5.5 in]   | 184 mm [7.2 in]   |
| Н | 207 mm [8.1 in]   | 251 mm [9.9 in]   | 207 mm [8.1 in]   | 251 mm [9.9 in]   |
| 1 | 104 mm [4.1 in]   | 140.5 mm [5.5 in] | 115.6 mm [4.6 in] | 140.5 mm [5.5 in] |
| J | 134.5 mm [5.3 in] | 179.5 mm [7.1 in] | 146.5 mm [5.8 in] | 179.5 mm [7.1 in] |
| K | 169.5 mm [6.7 in] | 199 mm [7.8 in]   | 178 mm [0.9 in]   | 199 mm [7.8 in]   |
| L | 65 mm [2.6 in]    | 94 mm [3.7 in]    | 73 mm [2.9 in]    | 94 mm [3.7 in]    |
| М | 90.4 mm [3.6 in]  |                   | 107 mm [4.2 in]   |                   |
| N | 149.5 mm [5.9 in] | 192 mm [7.6 in]   | 144 mm [5.7 in]   | 192 mm [7.6 in]   |
| С | 43.8 mm [1.7 in]  | 67.5 mm [2.7 in]  | 58.5 mm [2.1 in]  | 67.5 mm [2.7 in]  |
| P | 5 mm [0.2 in]     | 34 mm [1.3 in]    | 13 mm [0.5 in]    | 34 mm [1.3 in]    |
| Q | 39.5 mm [1.6 in]  |                   | 40 mm [1.6 in]    |                   |
| R |                   | 12.5 mr           | n [0.5 in]        |                   |
| S | 132.4 mm [5.2 in] |                   | 149 mm [5.9 in]   |                   |
| T | 98.5 mm [3.8 in]  | 148.5 mm [5.9 in] | 98.5 mm [3.8 in]  | 148.5 mm [5.9 in] |
| U | 118.5.mm [5.6 in] | 163.5 mm [6.6 in] | 130.5 mm [5.2 mm] | 163.5 mm [6.6 in] |

## 6.2 Dimensional drawings

# Door feedthrough

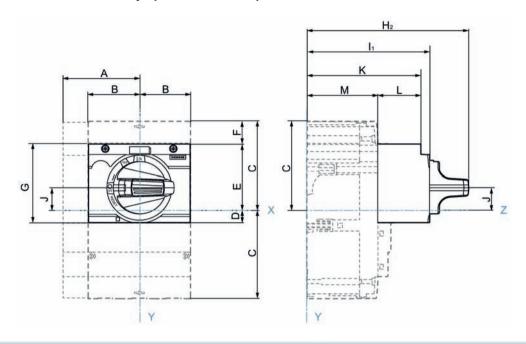


|    | 3V                | 'A1                | 3V                | A2                |
|----|-------------------|--------------------|-------------------|-------------------|
|    | 250               | 400 / 630          | 100 / 160 / 250   | 400 / 630         |
| A  | 104.6 mm [4.1 in] | 137.6 mm [5.4 in]  | 104.6 mm [4.1 in] | 137.6 mm [5.4 in] |
| V2 | 52.3 mm [2.1 in]  | 68.8 mm [2.7 in]   | 52.3 mm [2.1 in]  | 68.8 mm [2.7 in]  |
| В  | 84 mm [3.3 in]    | 108.5 mm [4.27 in] | 84 mm [3.3 in]    | 108.5 mm [4.3in]  |
| С  | 129.3 mm [5.1 in] | 172.0 mm [6,77 in] | 145.3 mm [5.7 in] | 172 mm [6.8 in]   |
| D  | 34 mm [1.3 in]    | 51.0 mm [2,01 in]  | 31.5 mm [1.2 in]  | 51 mm [2 in]      |

## 6.2.2.3 Manual operators

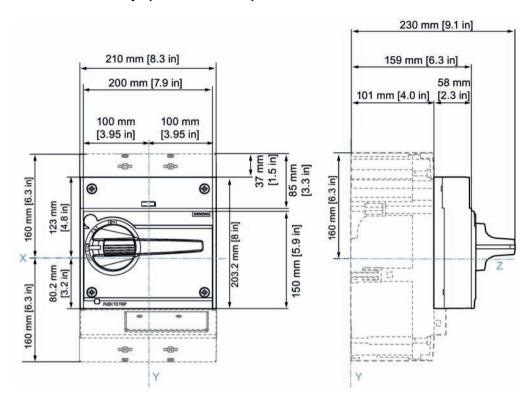
#### Front mounted rotary operator

#### Front mounted rotary operator for 3VA up to 630 A



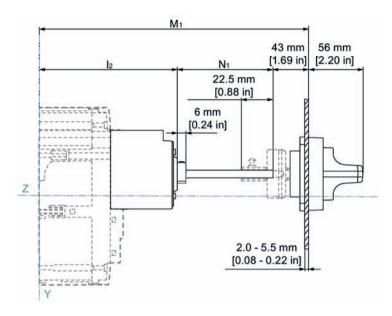
|    |                    | 3VA1               |                   | 3V.                | A2                |
|----|--------------------|--------------------|-------------------|--------------------|-------------------|
|    | 100 / 160          | 250                | 400 / 630         | 100 / 160 / 250    | 400 / 630         |
| Α  | 63.5 mm [2.50 in]  | 87.5 mm [3.44 in]  | 115 mm [4.53 in]  | 87.5 mm [3.44 in]  | 115 mm [4.53 in]  |
| В  | 38.1 mm [1.50 in]  | 52.5 mm [2.07 in]  | 69 mm [2.72 in]   | 52.5 mm [2.07 in]  | 69 mm [2.72 in]   |
| С  | 65 mm [2.56 in]    | 79 mm [3.11 in]    | 124 mm [4.88 in]  | 90.5 mm [3.56 in]  | 124 mm [4.88 in]  |
| D  | 22.6 mm [0.89 in]  | 18 mm [0.71 in]    | 8.5 mm [0.33 in]  | 13.1 mm [0.52 in]  | 8.5 mm [0.33 in]  |
| E  | 47.4 mm [1.87 in]  | 57 mm [2.24 in]    | 84.9 mm [3.34 in] | 67.9 mm [2.67 in]  | 84.9 mm [3.34 in] |
| F  | 17.6 mm [0.69 in]  | 22 mm [0.87 in]    | 39 mm [1.54 in]   | 22.6 mm [0.89 in]  | 39 mm [1.54 in]   |
| G  | 45 mm              | [1.77 in]          |                   | 70 mm [2.76 in]    |                   |
| Η, | 159 mm [6.26 in]   | 158 mm [6.22 in]   | 200 mm [7.87 in]  | 181 mm [7.13 in]   | 200 mm [7.87 in]  |
| 1, | 116.6 mm [4.59 in] | 114.5 mm [4.51 in] | 160 mm [6.30 in]  | 136.1 mm [5.36 in] | 160 mm [6.30 in]  |
| J  | 0 mm [0 in]        | 4.6 mm [0.18 in]   | 27.5 mm [1.08 in] | 22.9 mm [0.90 in]  | 27.5 mm [1.08 in] |
| K  | 111 mm [4.37 in]   | 109 mm [4.29 in]   | 151 mm [5.94 in]  | 127 mm [5.00 in]   | 151 mm [5.94 in]  |
| L  | 46 mm              | [1.81 in]          | 57 mm [2.24 in]   | 54 mm [2.13 in]    | 57 mm [2.24 in]   |
| М  | 65 mm [2.56 in]    | 63 mm [2.48 in]    | 94 mm [3.70 in]   | 73 mm [2.87 in]    | 94 mm [3.70 in]   |

#### Front mounted rotary operator for 3VA up to 1000 A



#### Door mounted rotary operator

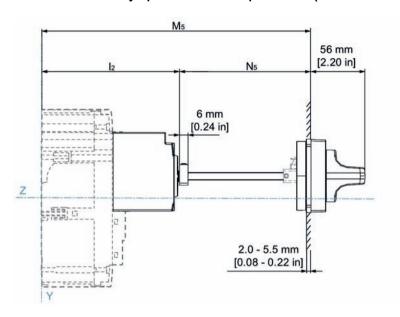
#### Door mounted rotary operator for 3VA up to 630 A (3VA9..7 - 0FK2.)



|                   | 3VA1               |                   |                           | 3V                 | A2                |
|-------------------|--------------------|-------------------|---------------------------|--------------------|-------------------|
|                   | 100 / 160          | 250               | 400 / 630                 | 100 / 160 / 250    | 400 / 630         |
| l <sub>2</sub>    | 119.1 mm [4.69 in] | 117 mm [4.61 in]  | 165 mm [6.50 in]          | 141.1 mm [5.56 in] | 165 mm [6.50 in]  |
| M <sub>1min</sub> | 191.1 mm [7.52 in] | 189 mm [7.44 in]  | 237 mm [9.33 in]          | 213.1 mm [8.39 in] | 237 mm [9.33 in]  |
| M <sub>1max</sub> | 440 mm [17.32 in]  | 438 mm [17.24 in] | 483 mm [19.02 in]         | 460 mm [18.11 in]  | 483 mm [19.02 in] |
| N,                |                    |                   | M, - I, - 43 mm [1.69 in] |                    |                   |

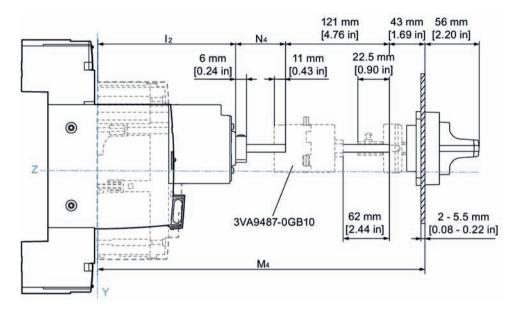
#### 6.2 Dimensional drawings

#### Door mounted rotary operator for 3VA up to 630 A (3VA9..7 - 0FK61)



|                   | 3VA1               |                   |   | 3V                 | A2                |
|-------------------|--------------------|-------------------|---|--------------------|-------------------|
|                   | 100 / 160          | 250               | 400 / 630                                     | 100 / 160 / 250    | 400 / 630         |
| l <sub>2</sub>    | 119.1 mm [4.69 in] | 117 mm [4.61 in]  | 165 mm [6.50 in]                              | 141.1 mm [5.56 in] | 165 mm [6.50 in]  |
| M <sub>5min</sub> | 149 mm [5.87 in]   | 147 mm [5.79 in]  | 195 mm [7.68 in]                              | 171 mm [6.73 in]   | 195 mm [7.68 in]  |
| M <sub>5max</sub> | 398 mm [15.28 in]  | 396 mm [15.20 in] | 441 mm [17.36 in]                             | 418 mm [16.45 in]  | 441 mm [17.36 in] |
| N <sub>5</sub>    |                    |                   | $M_5 - I_2 - 5 \text{ mm } [0.20 \text{ in}]$ |                    |                   |

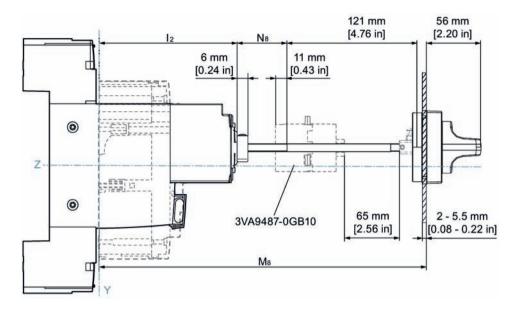
# Door mounted rotary operator with variable depth adapter (3VA9487-0GB10, 3VA9..7 - 0FK2.)



|                | 3VA1                | 3V.   | A2                |
|----------------|---------------------|---|-------------------|
|                | 100 / 160           | 100 / 160 / 250                                 | 400 / 630         |
| l <sub>2</sub> | 119.1 mm [4.69 in]  | 141.1 mm [5.56 in]                              | 165 mm [6.50 in]  |
| 4min           | 312.1 mm [12.29 in] | 334.1 mm [13.15 in]                             | 358 mm [14.09 in] |
| 4max           | 563.1 mm [22.17 in] | 583 mm [22.95 in]                               | 605 mm [23.82 in] |
| N <sub>4</sub> |                     | $M_4 - I_2 - 164 \text{ mm } [6.46 \text{ in}]$ |                   |

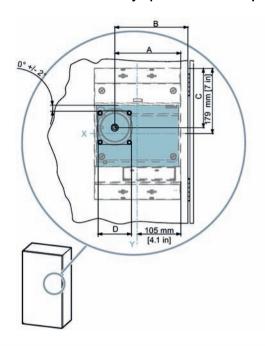
#### 6.2 Dimensional drawings

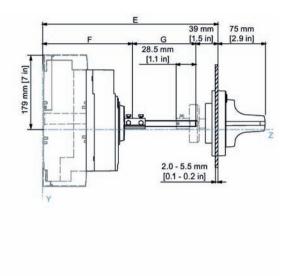
#### Door mounted rotary operator with variable depth adapter (3VA9..7 - 0FK61)



|                   | 3VA1               | 3V  | A2                |
|-------------------|--------------------|---|-------------------|
|                   | 100 / 160          | 100 / 160 / 250                                 | 400 / 630         |
| 2                 | 119.1 mm [4.69 in] | 141.1 mm [5.56 in]                              | 165 mm [6.50 in]  |
| 8min              | 270 mm [10.63 in]  | 292 mm [11.50 in]                               | 316 mm [12.44 in] |
| A <sub>8max</sub> | 521 mm [20.51 in]  | 541 mm [21.30 in]                               | 563 mm [22.17 in] |
| N <sub>8</sub>    |                    | $M_8 - I_2 - 126 \text{ mm } [4.96 \text{ in}]$ |                   |

#### Door mounted rotary operator for 3VA up to 1000 A

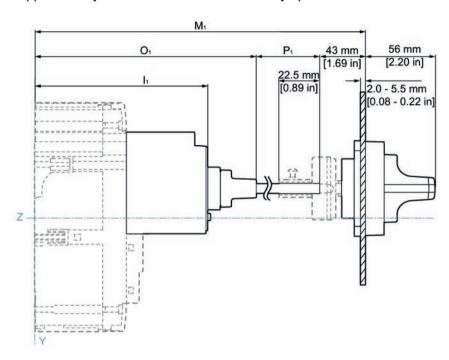




|                  | 3VA2                |  |
|------------------|---------------------|--|
|                  | 1000 A              |  |
| A                | 160 mm [6.3 in]     |  |
| В                | ≥ 80 mm [7.9 in]    |  |
| С                | 145 mm [5.7 in]     |  |
| D                | 100 mm [3.9 in]     |  |
| E <sub>min</sub> | 290 mm [11.4 in]    |  |
| E <sub>max</sub> | 555 mm [21.9 in]    |  |
| F                | 198 mm [7.8 in]     |  |
| G                | E – 237 mm [9.3 in] |  |

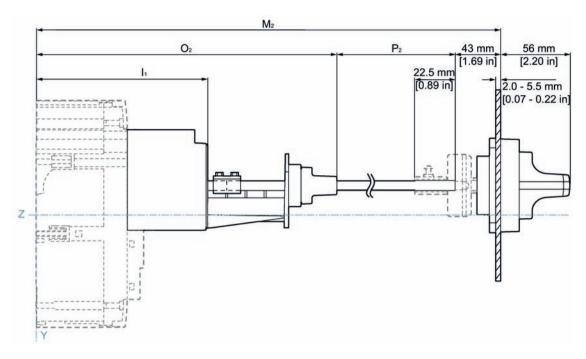
#### Supplementary handle for door mounted rotary operator

Supplementary handle for door mounted rotary operator 3VA9.87 - 0GC..



|                   | 3VA1               |                    | 3V                | A2                 |                   |
|-------------------|--------------------|--------------------|-------------------|--------------------|-------------------|
|                   | 100 / 160          | 250                | 400 / 630         | 100 / 160 / 250    | 400 / 630         |
| I,                | 116.6 mm [4.59 in] | 114.5 mm [4.51 in] | 160 mm [6.30 in]  | 136.1 mm [5.36 in] | 160 mm [6.30 in]  |
| M <sub>1min</sub> | 191.1 mm [7.52 in] | 189.1 mm [7.44 in] | 237 mm [9.33 in]  | 213.1 mm [8.39 in] | 237 mm [9.33 in]  |
| M <sub>1max</sub> | 440 mm [17.32 in]  | 438 mm [17.24 in]  | 483 mm [19.02 in] | 460 mm [18.11 in]  | 483 mm [19.02 in] |
| 0,                | 158 mm [6.22 in]   | 156 mm [6.14 in]   | 201 mm [7.91 in]  | 177 mm [6.97 in]   | 201 mm [7.91 in]  |
| P <sub>1min</sub> |                    |                    | 23 mm [0.91 in]   |                    |                   |
| P <sub>1max</sub> |                    |                    | 237 mm [9.33 in]  |                    |                   |

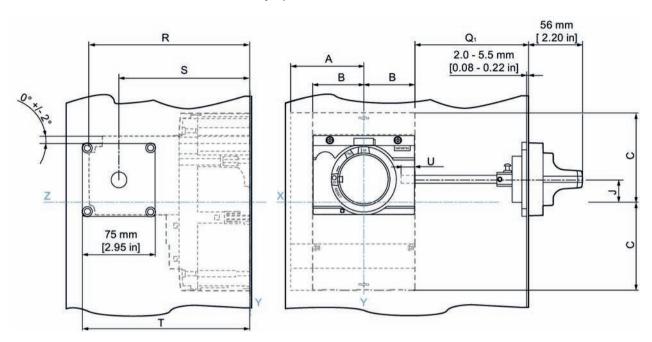
#### Supplementary handle for door mounted rotary operator 3VA9.87 - 0GA80



|                   | 3VA1               |                    |                   | 3V                 | A2                |
|-------------------|--------------------|--------------------|-------------------|--------------------|-------------------|
|                   | 100 / 160          | 250                | 400 / 630         | 100 / 160 / 250    | 400 / 630         |
| I,                | 116.6 mm [4.59 in] | 114.5 mm [4.51 in] | 160 mm [6.30 in]  | 136.1 mm [5.36 in] | 160 mm [6.30 in]  |
| M <sub>2min</sub> | 294 mm [11.57 in]  | 292 mm [11.50 in]  | 337 mm [13.27 in] | 313 mm [12.32 in]  | 337 mm [13.27 in  |
| M <sub>2max</sub> | 784 mm [30.87 in]  | 782 mm [30.79 in]  | 828 mm [32.60 in] | 803 mm [31.61 in]  | 828 mm [32.60 in  |
| 0,                | 225 mm [8.86 in]   | 223 mm [8.78 in]   | 268 mm [10.55 in] | 244 mm [9.61 in]   | 268 mm [10.55 in] |
| P <sub>2min</sub> |                    |                    | 23 mm [0.91 in]   |                    |                   |
| P <sub>2max</sub> |                    |                    | 516 mm [20.31 in] |                    |                   |

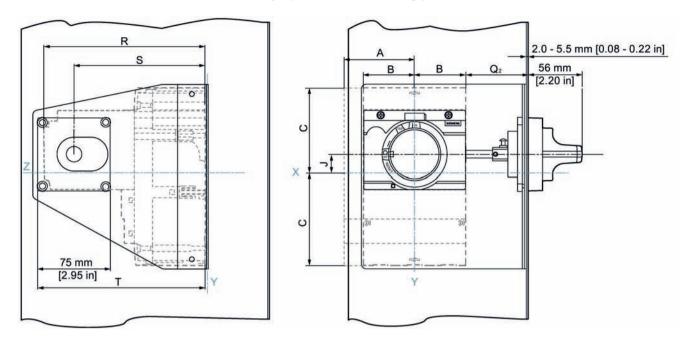
## Side wall mounted rotary operator

#### Side wall mounted rotary operator



|                   |                   | 3VA1              | 3VA2              |                   | A2                |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
|                   | 100 / 160         | 250               | 400 / 630         | 100 / 160 / 250   | 400 / 630         |
| Α                 | 63.5 mm [2.50 in] | 87.5 mm [3.44 in] | 115 mm [4.53 in]  | 87.5 mm [3.44 in] | 115 mm [4.53 in]  |
| В                 | 38.1 mm [1.50 in] | 52.5 mm [2.07 in] | 69 mm [2.72 in]   | 52.5 mm [2.07 in] | 69 mm [2.72 in]   |
| С                 | 65 mm [2.56 in]   | 79 mm [3.11 in]   | 124 mm [4.88 in]  | 90.5 mm [3.56 in] | 124 mm [4.88 in]  |
| J                 | 0 mm [0.00 in]    | 4.6 mm [0.18 in]  | 27.5 mm [1.08 in] | 22.9 mm [0.90 in] | 27.5 mm [1.08 in] |
| Q <sub>1min</sub> |                   |                   | 28 mm [1.10 in]   |                   |                   |
| Q <sub>1max</sub> | 286 mm[11.26 in ] | 273 mm [10.75 in] | 257 mm [10.12 in] | 273 mm [10.75 in] | 257 mm [10.12 in] |
| R                 | 147 mm [5.79 in]  | 145 mm [5.71 in]  | 185 mm [7.28 in]  | 167 mm [6.57 in]  | 185 mm [7.28 in]  |
| S                 | 119 mm [4.69 in]  | 117 mm [4.61 in]  | 159 mm [6.26 in]  | 135 mm [5.31 in]  | 159 mm [6.26 in]  |
| Т                 | 157 mm [6.18 in]  | 155 mm [6.10 in]  | 197 mm [7.76 in]  | 173 mm [6.81 in]  | 197 mm [7.76 in]  |
| U                 | 15 mm [0.59 in]   | 29.5 mm [1.16 in] | 45 mm [1.77 in]   | 29.5 mm [1.16 in] | 45 mm [1.77 in]   |

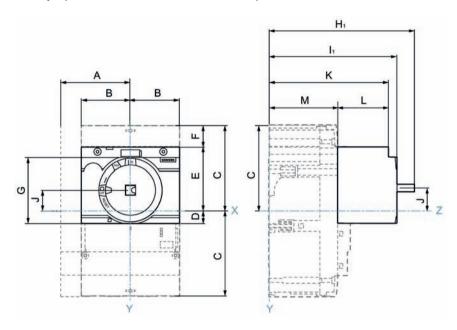
#### Side wall mounted rotary operator with mounting plate



|       | 3VA1              |                   | 3VA2              |
|-------|-------------------|-------------------|-------------------|
|       | 100 / 160         | 250               | 100 / 160 / 250   |
| A     | 63.5 mm [2.50 in] | 87.5 mm [3.44 in] | 68                |
| В     | 38.1 mm [1.50 in] | 52.5 mm [2.07 in] | 167               |
| С     | 65 mm [2.56 in]   | 79 mm [3.11 in]   | 90.5 mm [3.56 in] |
| J     | 0 mm [0.00 in]    | 4.6 mm [0.18 in]  | 22.9 mm [0.90 in] |
| $Q_2$ | 42 mm             | [1.65 in]         | 45 mm [1.77 in]   |
| R     | 147 mm[5.79 in ]  | 145 mm [5.71 in]  | 167 mm [6.57 in]  |
| S     | 119 mm [4.69 in]  | 117 mm [4.61 in]  | 135 mm [5.31 in]  |
| Т     | 157 mm [6.18 in]  | 155 mm [6.10 in]  | 173 mm [6.81 in]  |

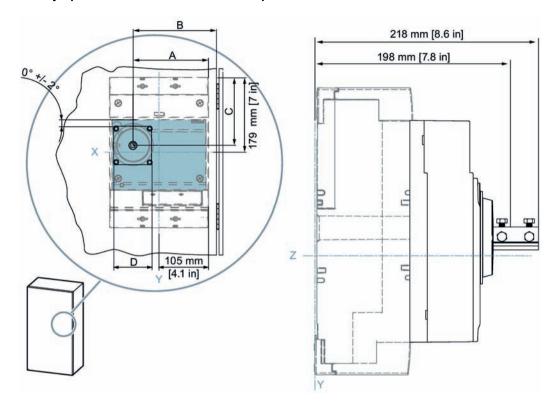
# Rotary operator with shaft stub

#### Rotary operator with shaft stub for 3VA up to 630 A



|    |                    | 3VA1               |                   | 3V.                | A2                |
|----|--------------------|--------------------|-------------------|--------------------|-------------------|
|    | 100 / 160          | 250                | 400 / 630         | 100 / 160 / 250    | 400 / 630         |
| Α  | 63.5 mm [2.50 in]  | 87.5 mm [3.44 in]  | 115 mm [4.53 in]  | 87.5 mm [3.44 in]  | 115 mm [4.53 in]  |
| В  | 38.1 mm [1.50 in]  | 52.5 mm [2.07 in]  | 69 mm [2.72 in]   | 52.5 mm [2.07 in]  | 69 mm [2.72 in]   |
| С  | 65 mm [2.56 in]    | 79 mm [3.11 in]    | 124 mm [4.88 in]  | 90.5 mm [3.56 in]  | 124 mm [4.88 in]  |
| D  | 22.6 mm [0.89 in]  | 18 mm [0.71 in]    | 8.5 mm [0.33 in]  | 13.1 mm [0.52 in]  | 8.5 mm [0.33 in]  |
| E  | 47.4 mm [1.87 in]  | 57 mm [2.24 in]    | 84.9 mm [3.34in]  | 67.9 mm [2.67 in]  | 84.9 mm [3.34in]  |
| F  | 17.6 mm [0.69 in]  | 22 mm [0.87]       | 39 mm [1.54 in]   | 22.6 mm [0.89 in]  | 39 mm [1.54 in]   |
| G  | 45 mm              | [1.77 in]          |                   | 70 mm [2.76 in]    |                   |
| Η, | 141 mm [5.55 in]   | 138 mm [5.43 in]   | 185 mm [7.28 in]  | 160 mm [6.30 in]   | 185 mm [7.28 in]  |
| ١, | 116.6 mm [4.59 in] | 114.5 mm [4.51 in] | 160 mm [6.30 in]  | 136.1 mm [5.36 in] | 160 mm [6.30 in]  |
| j  | 0 mm [0.00 in]     | 4.6 mm [0.18 in]   | 27.5 mm [1.08 in] | 22.9 mm [0.90 in]  | 27.5 mm [1.08 in] |
| K  | 111 mm [ 4.37 in]  | 109 mm [4.29 in]   | 151 mm [5.94 in]  | 127 mm [5.00 in]   | 151 mm [5.94 in]  |
| L  | 46 mm              | [1.81 in]          | 57 mm [2.24 in]   | 54 mm [2.13 in]    | 57 mm [2.24 in]   |
| М  | 65 mm [2.56 in]    | 63 mm [2.48 in]    | 94 mm [3.70 in]   | 73 mm [2.87 in]    | 94 mm [3.70 in]   |

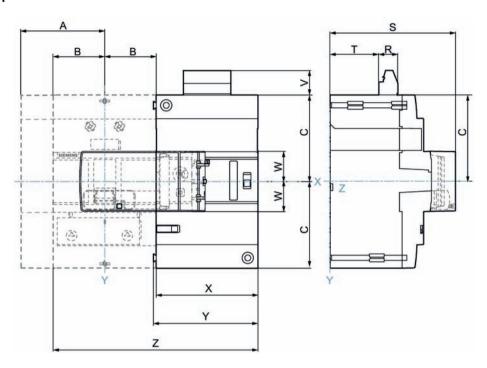
#### Rotary operator with shaft stub for 3VA up to 1000 A



|   | 3VA2<br>1000 A   |  |
|---|------------------|--|
| A | 160 mm [6.3 in]  |  |
| В | ≥ 80 mm [7.9 in] |  |
| С | 145 mm [5.7 in]  |  |
| D | 100 mm [3.9 in]  |  |

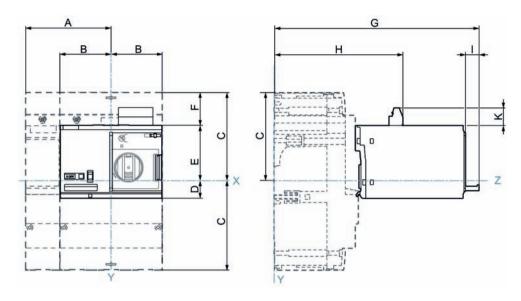
## 6.2.2.4 Motor operators

## MO310 motor operator



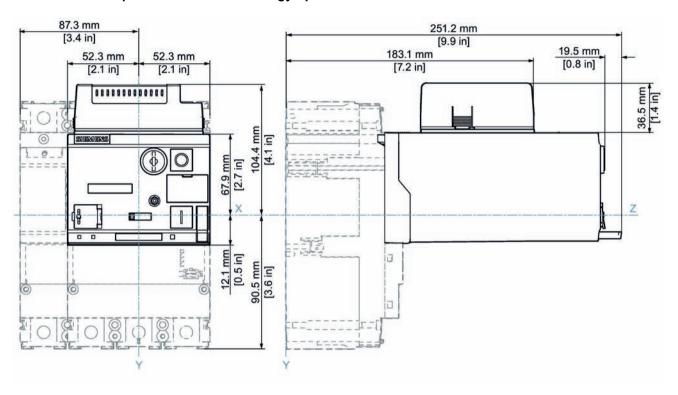
|        | 3VA1               |  |
|--------|--------------------|--|
|        | 100 / 160          |  |
| A      | 101.6 mm [4.00 in] |  |
| В      | 76.2 mm [3.00 in]  |  |
| С      | 65 mm [2.56 in]    |  |
| M      | 114.5 mm [4.51 in] |  |
| N      | 64 mm [2.52 in]    |  |
| R      | 14.1 mm [0.56 in]  |  |
| R<br>s | 93.8 mm [3.69 in]  |  |
| Т      | 37.9 mm [1.49 in]  |  |
| V      | 19 mm [0.75 in]    |  |
| W      | 22.5 mm [0.89 in]  |  |
| X      | 76.2 mm [3.00 in]  |  |
| Υ      | 78.3 mm [3.08 in]  |  |
| Z      | 152.4 mm [6.00 in] |  |

# MO320 motor operator



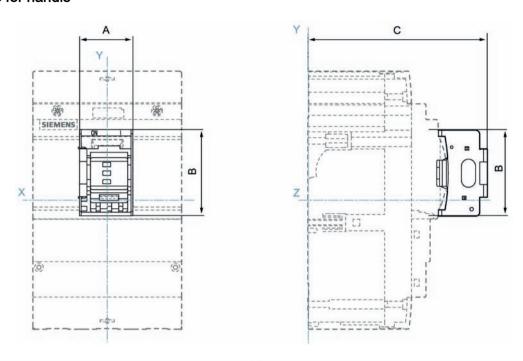
|   | 3VA1              |                   |                   | 3VA2              |                   |  |
|---|-------------------|-------------------|-------------------|-------------------|-------------------|--|
|   | 100 / 160         | 250               | 400 / 630         | 100 / 160 / 250   | 400 / 630         |  |
| A | 63.5 mm [2.5 in]  | 87.6 mm [3.4 in]  | 115.0 mm [4.5 in] | 87.6 mm [3.4 in]  | 115.0 mm [4.5 in] |  |
| В | 38.1 mm [1.5 in]  | 52.5 mm [2.1 in]  | 69.0 mm [2.7 in]  | 52.5 mm [2.1 in]  | 69.0 mm [2.7 in]  |  |
| С | 65.0 mm [2.6 in]  | 79 mm [3.1 in]    | 124.0 mm [4.9 in] | 90.5 mm [3.6 in]  | 124.0 mm [4.9 in] |  |
| D | 22.6 mm [0.9 in]  | 18.3 mm [0.7 in]  | 8.5 mm [0.3 in]   | 7.1 mm [0.3 in]   | 8.5 mm [0.3 in]   |  |
| E | 47.4 mm [1.9 in]  | 56.7 mm [2.2 in]  | 83.5 mm [3.3 in]  | 67.9 mm [2.7 in]  | 83.5 mm [3.3 in]  |  |
| F | 17.6 mm [0.7 in]  | 22.3 mm [0.9 in]  | 40.5 mm [1.6 in]  | 22.6 mm [0.9 in]  | 40.5 mm [1.6 in]  |  |
| G | 181 mm [7.1 in]   | 201.4 mm [7.9 in] | 241.0 mm [9.5 in] | 217.9 mm [8.6 in] | 241.0 mm [9.5 in] |  |
| Н | 121.1 mm [4.8 in] | 126.6 mm [5.0 in] | 170.2 mm [6.7 in] | 143.1 mm [5.6 in] | 170.2 mm [6.7 in] |  |
| 1 |                   |                   | 15.0 mm [0.6 in]  |                   |                   |  |
| K |                   |                   | 17.2 mm [0.7 in]  |                   |                   |  |

#### SEO520 motor operator with stored energy operator



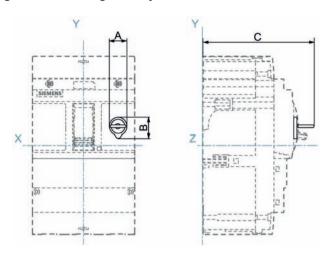
# 6.2.2.5 Accessories for locking, blocking and interlocking

#### Padlock device for handle



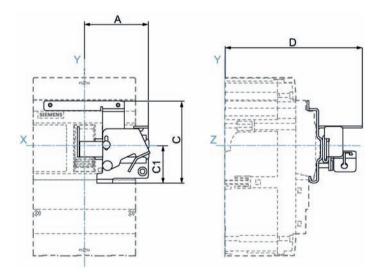
|   | 3V.             | A1              | 3V              | A2              |
|---|-----------------|-----------------|-----------------|-----------------|
|   | 100 / 160 / 250 | 400 / 630       | 100 / 160 / 250 | 400 / 630       |
| Α | 29 mm [1.1 in]  | 39 mm [1.5 in]  | 39 mm           | [1.5 in]        |
| В | 45 mm [1.7 in]  | 61 mm [2.4 in]  | 61 mm [2.4 in]  |                 |
| С | 108 mm [4.3 in] | 151 mm [5.9 in] | 127 mm [5 in]   | 151 mm [5.9 in] |

## Locking, blocking or interlocking with cylinder lock



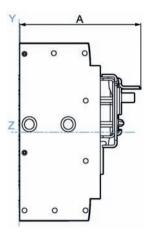
|   | 3V                | A1              | 3V              | A2              |  |  |
|---|-------------------|-----------------|-----------------|-----------------|--|--|
|   | 100 / 160 / 250   | 400 / 630       | 100 / 160 / 250 | 400 / 630       |  |  |
| 4 | 20 mm [0.8 in]    |                 |                 |                 |  |  |
| 3 | 23 mm [0.9 in]    |                 |                 |                 |  |  |
| С | 104.8 mm [4.1 in] | 146 mm [5.7 in] | 122 mm [4.8 in] | 146 mm [5.7 in] |  |  |

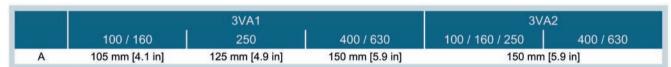
## Cable interlock module using a Bowden cable



|    | 3VA1              |                   |                    | 3VA2               |                   |
|----|-------------------|-------------------|--------------------|--------------------|-------------------|
|    | 100 / 160         | 250               | 400 / 630          | 100 / 160 / 250    | 400 / 630         |
| Α  | 59.7 mm [2.40 in] | 63.5 mm [2.50 in] | 69.7 mm [2.70 in]  | 66.7 mm [2.60 in]  | 69.7 mm [2.70 in] |
| C  | 73.5 mm [2.90 in] | 80 mm [3.20 in]   | 97.5 mm [3.80 in]  | 85 mm [3.30 in]    | 97.5 mm [3.80 in] |
| 21 | 26 mm [1.00 in]   | 21 mm [0.80 in]   | 12.9 mm [0.50 in]  | 17 mm [0.70 in]    | 12.9 mm [0.50 in] |
| D  | 114 mm            | [4.50 in]         | 164.5 mm [6.50 in] | 140.5 mm [5.50 in] | 164.5 mm [6.50 in |

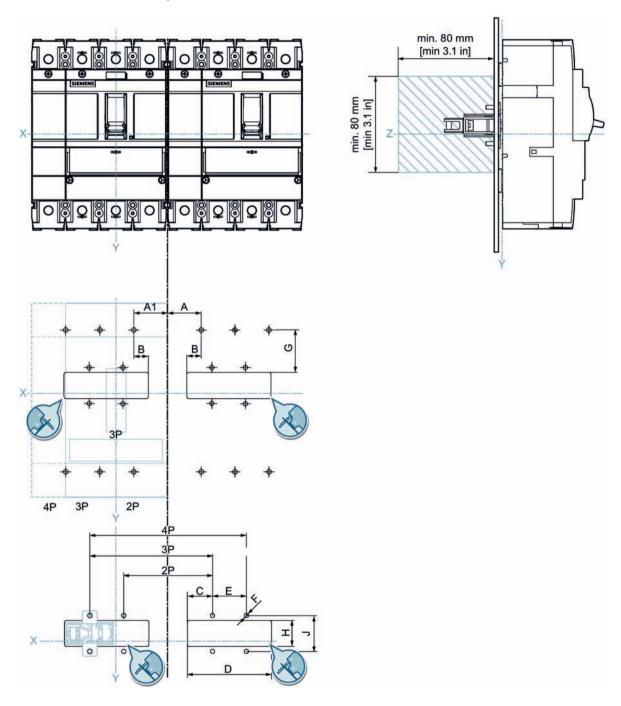
# Handle blocking device





#### Rear interlock: Mounting on rear wall of panel, fixed-mounted

#### 3VA up to 630 A

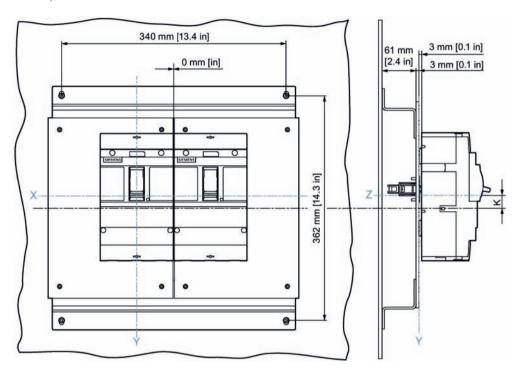


|                     | 3VA1             |                  | 3\                   |                     | 'A2                 |
|---------------------|------------------|------------------|----------------------|---------------------|---------------------|
|                     | 160              | 250              | 400 / 630            | 100 / 160 / 250     | 400 / 630           |
| A/A1 <sub>min</sub> | 25.4 mm [1.0 in] | 34.8 mm [1.4 in] | 45.8 mm [1.8 in]     | 34.8 mm [1.4 in]    | 45.8 mm [1.8 in]    |
| VA1 <sub>max</sub>  | 98 mm [3.9 in]   | 99.8 mm [3.9 in] |                      | 97.8 mm [3.9 in]    |                     |
| В                   | 15 mm [0.6 in]   | 14 mm [0.6 in]   |                      | 15 mm [0.6 in]      |                     |
| С                   | 26 mm [1.0 in]   | 25.4 mm [1.0 in] |                      | 26 mm [1.0 in]      |                     |
| D                   | 77.4 mm [3.0 in] | 85 mm [3.3 in]   | 98 mm [3.9 in]       | 87 mm [3.4 in]      | 98 mm [3.9 in]      |
| E                   | 25.4 mm [1.0 in] | 35 mm [1.4 in]   | 46 mm [1.8 in]       | 35 mm [1.4 in]      | 46 mm [1.8 in]      |
| F                   |                  |                  | Ø 4.5 mm [Ø 3/16 in] |                     |                     |
| G                   | 37.3 mn          | n [1.5 in]       | 57.4 mm<br>[2.3 in]  | 43.5 mm<br>[1.7 in] | 57.4 mm<br>[2.3 in] |
| н                   |                  |                  | 27 mm [1.1 in]       |                     |                     |
| J                   |                  |                  | 37 mm [1.5 in]       |                     |                     |

#### 6.2 Dimensional drawings

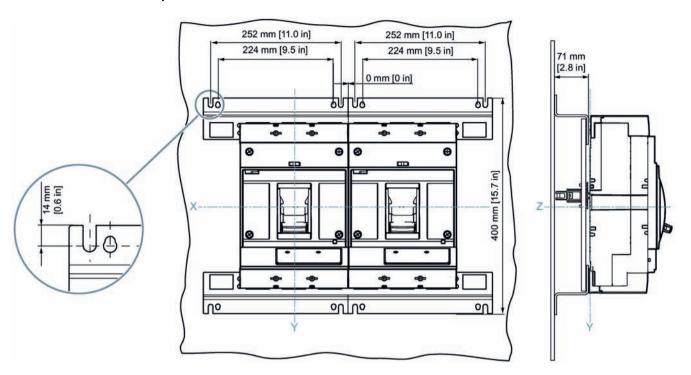
## Rear interlock: Mounting with mounting plate and profile rail

#### 3VA up to 630 A

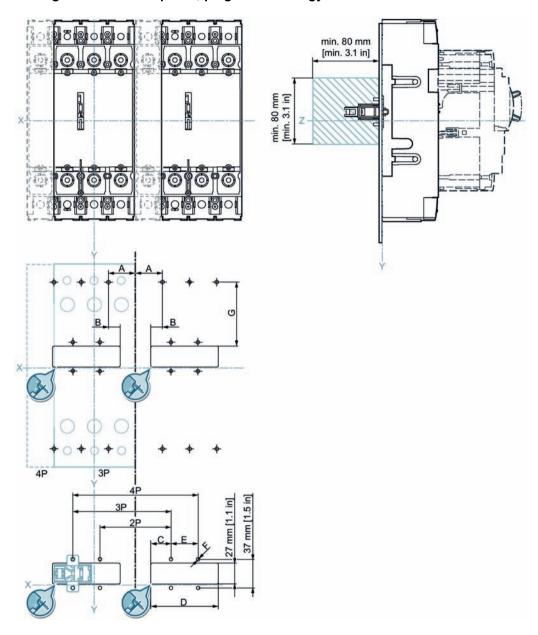


|   |              | 3VA1         | 3V               | A2              |                  |
|---|--------------|--------------|------------------|-----------------|------------------|
|   | 160          | 250          | 400 / 630        | 100 / 160 / 250 | 400 / 630        |
| K | 25 mm [1 in] | 25 mm [1 in] | 1.5 mm [0.06 in] | 3 mm [0.1 in]   | 1.5 mm [0.06 in] |

## 3VA up to 1000 A

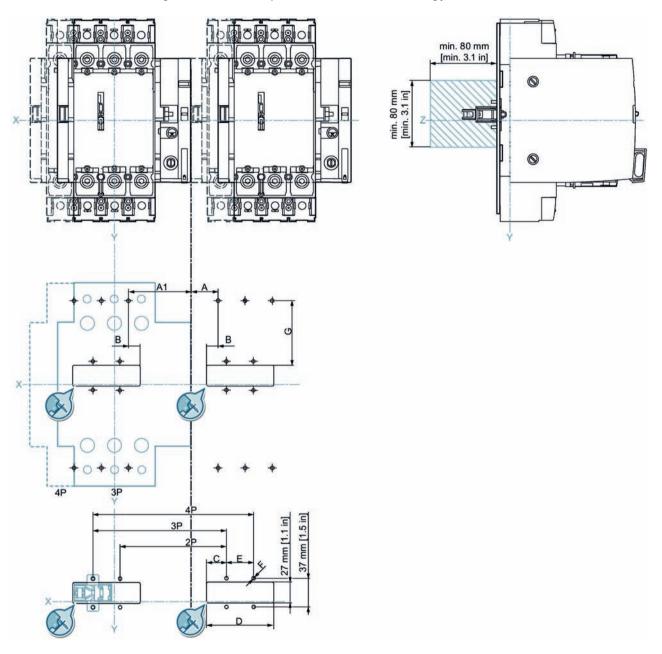


# Rear interlock: Mounting on rear wall of panel, plug-in technology



|                  |                  | 3VA1             |                   | 3V                 | A2               |                       |         |
|------------------|------------------|------------------|-------------------|--------------------|------------------|-----------------------|---------|
|                  | 160              | 250              | 400 / 630         | 100 / 160 /<br>250 | 400 / 630        |                       |         |
| A <sub>min</sub> | 25.4 mm [1.0 in] | 34.8 mm [1.4 in] | 45.8 mm [1.8 in]  | 34.8 mm [1.4 in]   | 45.8 mm [1.8 in] | Plug IN 3VA9<br>0KP00 | 000000  |
| A <sub>max</sub> | 98 mm [3.9 in]   | 99.8 mm [3.9 in] |                   | 97.8 mm [3.9 in]   |                  | Plug IN 3VA9<br>0KP00 | 000 000 |
| В                | 15 mm [0.6 in]   | 14 mm [0.6 in]   |                   | 15 mm [0.6 in]     |                  |                       |         |
| С                | 26 mm [1.0 in]   | 25.4 mm [0.1 in] |                   | 26 mm              | [1.0 in]         |                       |         |
| D                |                  |                  | 98 mm [3.9 in]    |                    |                  |                       |         |
| E                | 25.4 mm [1.0 in] | 35 mm [1.4 in]   | 46 mm [1.8 in]    | 35 mm [1.4 in]     | 46 mm [1.8 in]   |                       |         |
| F                |                  | Ø                | 4.5 mm [Ø 3/16 in | ո]                 |                  |                       |         |
| G                | 60.3 mm [2.4 in] | 68.3 mm [2.7 in] | 96.9 mm [3.8 in]  | 75 mm [3.0 in]     | 96.9 mm [3.8 in] |                       |         |

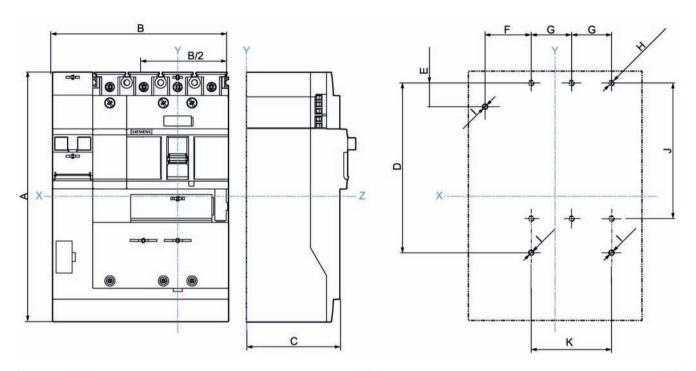
# Rear interlock: Mounting on rear wall of panel, draw-out technology



|                   |                  | 3VA1             |                  | 3V                 | 'A2              |               |         |
|-------------------|------------------|------------------|------------------|--------------------|------------------|---------------|---------|
|                   | 160              | 250              | 400 / 630        | 100 / 160 /<br>250 | 400 / 630        |               |         |
| A <sub>min</sub>  | 46.4 mm [1.8 in] | 55.8 mm [2.2 in] | 66.8 mm [2.6 in] | 55.8 mm [2.2 in]   | 66.8 mm [2.6 in] | Draw OUT      | 000000  |
| A1 <sub>min</sub> | 71.4 mm [2.8 in] | 80.8 mm [3.2 in] | 91.8 mm [3.6 in] | 80.8 mm [3.2 in]   | 91.8 mm [3.6 in] |               | 000000  |
| A <sub>max</sub>  | 77 mm [3.0 in]   | 78.8 mm [3.1 in] |                  | 76.8 mm [3.0 in]   |                  | Draw OUT      | 000 000 |
| A1 <sub>max</sub> | 52 mm [2.0 in]   | 53.8 mm [2.1 in] |                  | 51.8 mm [2.0 in]   |                  | 3VA9<br>0KD00 | 000 000 |
| В                 | 15 mm [0.6 in]   | 14 mm [0.6 in]   |                  | 15 mm [0.6 in]     |                  |               |         |
| С                 | 26 mm [1.0 in]   | 25.4 mm [0.1 in] |                  | 26 mm              | [1.0 in]         |               |         |
| D                 |                  |                  | 98 mm [3.9 in]   |                    |                  |               |         |
| E                 | 25.4 mm [1.0 in] | 35 mm [1.4 in]   | 46 mm [1.8 in]   | 35 mm [1.4 in]     | 46 mm [1.8 in]   |               |         |
| F                 |                  | Q                | 4.5 mm [Ø 3/16 i | n]                 |                  |               |         |
| G                 | 60.3 mm [2.4 in] | 68.3 mm [2.7 in] | 96.9 mm [3.8 in] | 75 mm [3.0 in]     | 96.9 mm [3.8 in] |               |         |

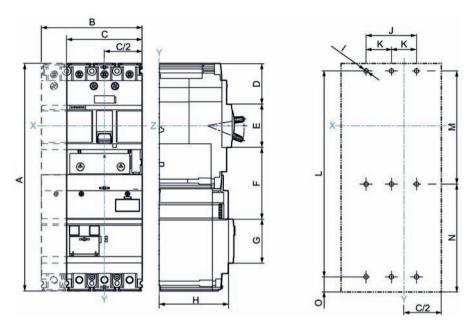
# 6.2.2.6 Residual current devices

# Side-mounted residual current devices Basic RCD310 and Basic RCD510



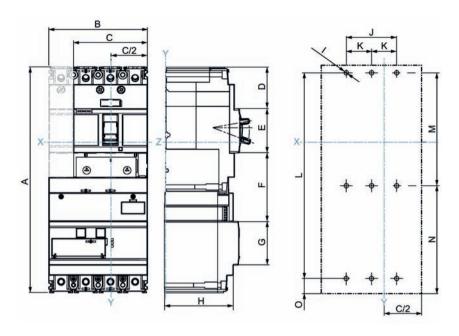
|   | 3VA1 160; R                            | CD 310 / 510                           | 3VA1 250;                              | RCD 510                               |  |  |  |
|---|--|--|--|---------------------------------------|--|--|--|
|   | 3-polig                                | 4-polig                                | 3-polig                                | 4-polig                               |  |  |  |
| Α | 187 mm                                 | [7.36 in]                              | 228 mm [8.98 in]                       |                                       |  |  |  |
| В | 106.4 mm [4.19 in]                     | 131.8 mm [5.19 in]                     | 135 mm [5.31 in]                       | 170 mm [6.69 in]                      |  |  |  |
| С |  | 70 mm                                  | nm [2.76 in]                           |                                       |  |  |  |
| D | 129.2 mn                               | n [5.09 in]                            | 147.75 mm [5.82 in]                    |                                       |  |  |  |
| E | 20.7 mm                                | [0.81 in]                              | 20.75 mm                               | n [0.82 in]                           |  |  |  |
| F | 35.6 mm                                | [1.40 in]                              | 45 mm [1.77 in]                        |                                       |  |  |  |
| G | 25.4 mn                                | n [1.0 in]                             | 35 mm [1.38 in]                        |                                       |  |  |  |
| н | 4 X Ø 4.5 mm [4 X Ø 3/16 in]<br>(MCCB) | 6 X Ø 4.5 mm [6 X Ø 3/16 in]<br>(MCCB) | 4 X Ø 4.5 mm [4 X Ø 3/16 in]<br>(MCCB) | 6 X Ø 4.5 mm [6 X Ø 3/16 ir<br>(MCCB) |  |  |  |
| 1 |  | Ø 3.5 mm                               | [Ø 9/64"]                              |                                       |  |  |  |
| J | 114.5 mn                               | n [4.51 in]                            | 123.5 mm [4.86 in]                     |                                       |  |  |  |
| K |  | 50.8 mm [2.0 in]                       |  | 70 mm [2.76 in]                       |  |  |  |

# Loadside residual current devices Basic RCD320 and Basic RCD520



|     | 3VA1 160; RC      | D320 / 520        | 3VA1 25             | 0; RCD520       |  |  |  |
|-----|-------------------|-------------------|---------------------|-----------------|--|--|--|
|     | 3-pole            | 4-pole            | 3-pole              | 4-pole          |  |  |  |
| A   | 230.1 mm [        | 9.05 in]          | 273.2 mi            | m [10.76 in]    |  |  |  |
| В   |                   | 101.6 mm [4.0 in] | 140 mm [5.51        |                 |  |  |  |
| С   | 76.2 mm [3.0 in]  |                   | 105 mm [4.13 in]    |                 |  |  |  |
| 2/2 | 38.25 mm [1,5 in] |                   | 52.5 mm [2.07 in]   |                 |  |  |  |
| D   | 42.5 mm [         | 1.67 in]          | 52 mm               | [2.05 in]       |  |  |  |
| E   |                   | 45 mm [           | 1.77 in]            |                 |  |  |  |
| F   | 69.5 mm [2        | 2.74 in]          | 104 mr              | n [4.09 in]     |  |  |  |
| G   |                   | 45 mm [           | 1.77 in]            |                 |  |  |  |
| Н   |                   | 70 mm [           | 2.76 in]            |                 |  |  |  |
| 1   |                   | Ø 4.5 mm          | Ø 3/16 in]          |                 |  |  |  |
| J   |                   | 50.8 mm [2.0 in]  |                     | 70 mm [2.76 in] |  |  |  |
| K   | 25.4 mm [         | 1.0 in]           | 35 mm [1.38 in]     |                 |  |  |  |
| L   | 214.6 mm [        | 8.45 in]          | 238.7 mm [9.4 in]   |                 |  |  |  |
| М   | 114.5 mm [        | 4.51 in]          | 123.5 mm [4.86 in]  |                 |  |  |  |
| N   | 107.85 mm         | [4.25 in]         | 132.45 mm [5.21 in] |                 |  |  |  |
| 0   | 7.75 mm [0        | 0.31 inl          | 17.25 mm [0.68 in]  |                 |  |  |  |

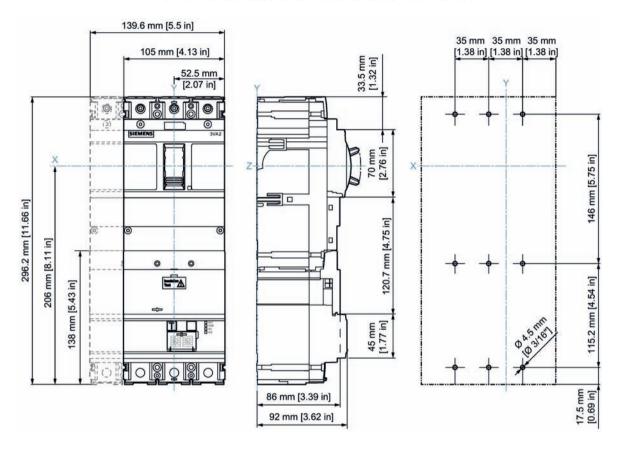
# Loadside residual current device Basic RCD520B

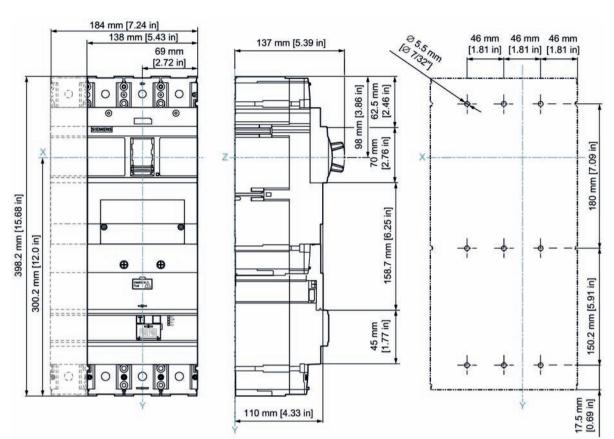


|        | 3VA1 160; RCD520B    |  |
|--------|----------------------|--|
| A      | 230.1 mm [9.05 in]   |  |
| В      | 101.6 mm [4.0 in]    |  |
| С      | 76.2 mm [3.0 in]     |  |
| C/2    | 38.25 mm [1.51 in]   |  |
| D      | 42.5 mm [1.67 in]    |  |
| E      | 45 mm [1.77 in]      |  |
| E<br>F | 69.5 mm [2.74 in]    |  |
| G      | 45 mm [1.77 in]      |  |
| Н      | 70 mm [2.76 in]      |  |
| 1      | Ø 4.5 mm [Ø 3/16 in] |  |
| J      | 50.8 mm [2.0 in]     |  |
| K      | 25.4 mm [1.0 in]     |  |
| L      | 214.6 mm [8.45 in]   |  |
| М      | 114.5 mm [4.51 in]   |  |
| N      | 107.85 mm [4.25 in]  |  |
| 0      | 7.75 mm [0.31 in]    |  |

## Loadside residual current device Advanced RCD820

## With 3VA2 molded case circuit breaker sizes 100 A to 250 A

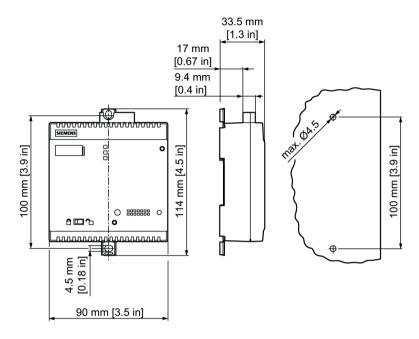




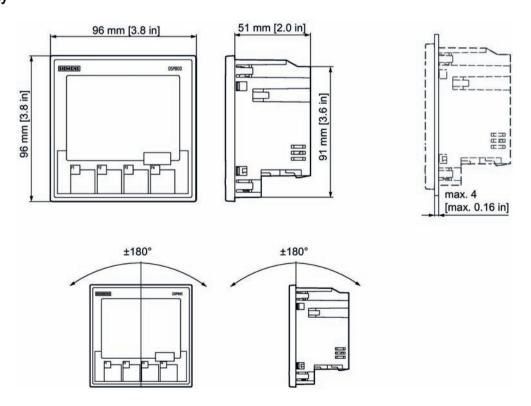
With 3VA2 molded case circuit breaker sizes 400 A to 630 A

# 6.2.2.7 Communication and system integration

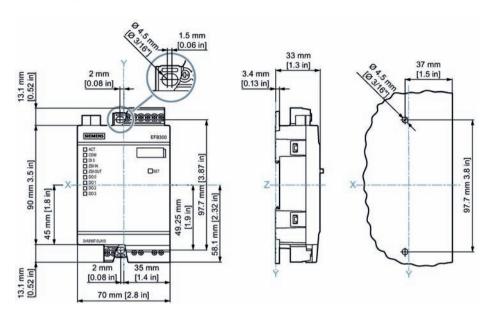
# COM800 and COM100 breaker data server



# DSP800 display



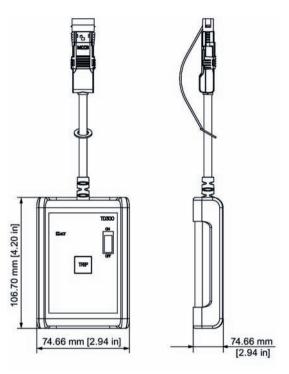
# 6.2.2.8 EFB300 external function box



## 6.2.2.9 Test devices

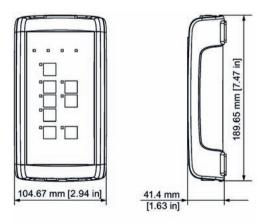
# TD300 activation and trip box

You can find more information in chapter Technical specifications of TD300 (Page 512).



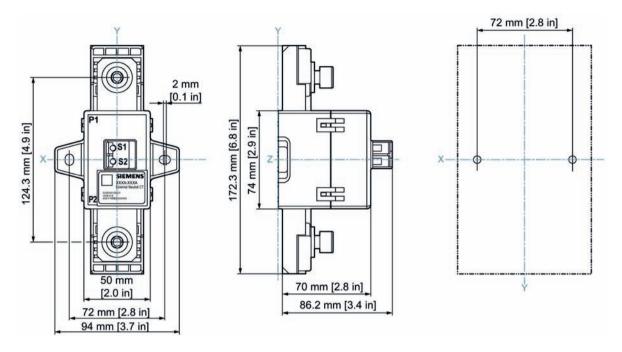
# TD500 test device

You can find more information in chapter Technical specifications of TD500 (Page 524).



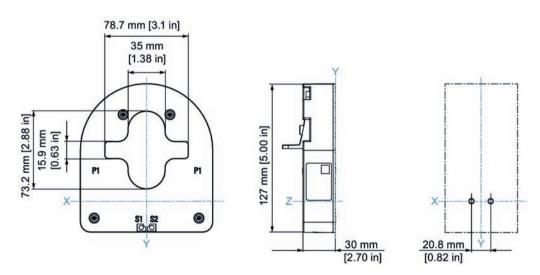
## 6.2.2.10 External current transformer for N conductor

# Dimensions of external current transformer for front busbar connector up to 630 A

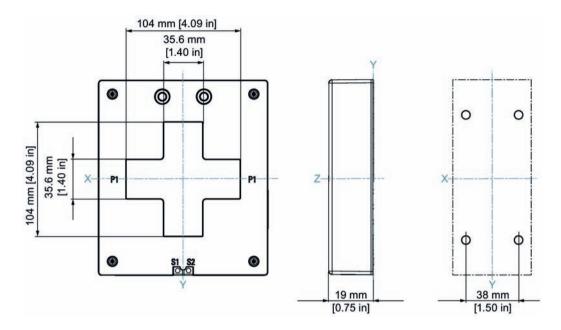


# Dimensions of external current transformer as straight-through transformer up to 1250 A

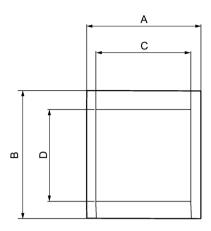
Dimensions 25 ... 630 A



# Dimensions 600 A ... 1250 A



# 6.2.2.11 Escutcheon



|                 | A                  | В                 | С                  | D                 |
|-----------------|--------------------|-------------------|--------------------|-------------------|
| 3VA9053 - 0SB10 | 98.2 mm [3.9 in]   | 85.65 mm [3.4 in] | 76.2 mm [3 in]     | 45.65 mm [1.8 in] |
| 3VA9053 - 0SB20 | 98.2 mm [3.9 in]   | 110.7 mm [4.4 in] | 76.2 mm [3 in]     | 70.7 mm [2.8 in]  |
| 3VA9054 - 0SB10 | 123.6 mm [4.9 in]  | 85.65 mm [3.4 in] | 101.6 mm [4 in]    | 45.65 mm [1.8 in] |
| 3VA9054 - 0SB20 | 123.6 mm [4.9 in]  | 110.7 mm [4.4 in] | 101.6 mm [4 in]    | 70.7 mm [2.8 in]  |
| 3VA9163 - 0SB10 | 126.6 mm [5 in]    | 110.7 mm [4.4 in] | 104.6 mm [4.1 in]  | 70.7 mm [2.8 in]  |
| 3VA9163 - 0SB20 | 126.6 mm [5 in]    | 140.8 mm [5.5 in] | 104.6 mm [4.1 in]  | 100.8 mm [4 in]   |
| 3VA9164 - 0SB10 | 161.6 mm [6.4 in]  | 110.7 mm [4.4 in] | 139.6 mm [5.5 in]  | 70.7 mm [2.8 in]  |
| 3VA9164 - 0SB20 | 161.6 mm [6.4 in]  | 140.8 mm [5.5 in] | 139.6 mm [5.5 in]  | 100.8 mm [4 in]   |
| 3VA9167 - 0SB30 | 126.6 mm [5 in]    | 120.8 mm [4.8 in] | 104.6 mm [4.1 in]  | 80.8 mm [3.2 in]  |
| 3VA9253 - 0SB10 | 126.6 mm [5 in]    | 85.65 mm [3.4 in] | 104.6 mm [4.1 in]  | 45.65 mm [1.8 in] |
| 3VA9253 - 0SB20 | 126.6 mm [5 in]    | 124.7 mm [4.9 in] | 104.6 mm [4.1 in]  | 84.7 mm [3.3 in]  |
| 3VA9254 - 0SB10 | 161.6 mm [6.4 in]  | 85.65 mm [3.4 in] | 139.6 mm [5.5 in]  | 45.65 mm [1.8 in] |
| 3VA9254 - 0SB20 | 161.6 mm [6.4 in]  | 124.7 mm [4.9 in] | 139.6 mm [5.5 in]  | 84.7 mm [3.3 in]  |
| 3VA9257 - 0SB30 | 126.6 mm [5 in]    | 115.8 mm [4.6 in] | 104.6 mm [4.1 in]  | 75.8 mm [3 in]    |
| 3VA9303 - 0SB40 | 159.6 mm [6.3 in]  | 85.65 mm [3.4 in] | 137.6 mm [5.4 in]  | 45.65 mm [1.8 in] |
| 3VA9304 - 0SB40 | 205.6 mm [8.1 in]  | 85.65 mm [3.4 in] | 183.6 mm [7.2 in]  | 45.65 mm [1.8 in] |
| 3VA9353 - 0SB20 | 159.6 mm [6.3 in]  | 149.3 mm [5.9 in] | 137.6 mm [5.4 in]  | 109.3 mm [4.3 in] |
| 3VA9354 - 0SB20 | 205.6 mm [8.1 in]  | 149.3 mm [5.9 in] | 183.6 mm [7.2 in]  | 109.3 mm [4.3 in] |
| 3VA9363 - 0SB20 | 159.6 mm [6.3 in]  | 162.3 mm [6.4 in] | 137.6 mm [5.4 in]  | 122.3 mm [4.8 in] |
| 3VA9364 - 0SB20 | 205.6 mm [8.1 in]  | 162.3 mm [6.4 in] | 183.6 mm [7.2 in]  | 122.3 mm [4.8 in] |
| 3VA9383 - 0SB10 | 159.6 mm [6.3 in]  | 110.7 mm [4.4 in] | 137.6 mm [5.4 in]  | 70.7 mm [2.8 in]  |
| 3VA9384 - 0SB10 | 205.6 mm [8.1 in]  | 110.7 mm [4.4 in] | 183.6 mm [7.2 in]  | 70.7 mm [2.8 in]  |
| 3VA9387 - 0SB30 | 159.6 mm [6.3 in]  | 132.8 mm [5.2 in] | 137.6 mm [5.4 in]  | 92.8 mm [3.7 in]  |
| 3VA9503 - 0SB10 | 222.3 mm [8.8 in]  | 190.8 mm [7.5 in] | 200.3 mm [7.9 in]  | 150.8 mm [5.9 in] |
| 3VA9503 - 0SB20 | 222.3 mm [8.8 in]  | 233.8 mm [9.2 in] | 200.3 mm [7.9 in]  | 193.8 mm [7.6 in] |
| 3VA9503 - 0SB50 | 222.3 mm [8.8 in]  | 240.8 mm [9.5 in] | 200.8 mm [7.9 in]  | 200.8 mm [7.9 in] |
| 3VA9504 - 0SB10 | 292.3 mm [11.5 in] | 190.8 mm [7.5 in] | 270.3 mm [10.6 in] | 150.8 mm [5.9 in] |
| 3VA9504 - 0SB20 | 292.3 mm [11.5 in] | 233.8 mm [9.2 in] | 270.3 mm [10.6 in] | 193.8 mm [7.6 in] |

# 6.3 Power losses

# 6.3.1 Power losses of 3VA1 molded case circuit breakers

|       |     | 9               | 3VA1 Breake  | er          | 3VA1               | Breaker     |             | 3VA1 F             | Breaker      |                  |
|-------|-----|-----------------|--------------|-------------|--------------------|-------------|-------------|--------------------|--------------|------------------|
|       |     |                 | J. T. Brount |             |                    | UVR         |             |                    | ccessories   |                  |
|       |     | P               | Power loss P | V           |                    | loss PV     | - 3         |                    | ower loss P\ | /                |
|       |     |                 |              |             |                    |             | 1           | Plug-In /          | RCD          | RCD              |
|       |     |                 |              |             |                    |             | Rear        | Draw-Out           | Type A       | Type B           |
|       |     |                 |              |             |                    |             | terminals   | unit               | (load side)  | (load side)      |
|       | I,  | 1-pole          | 2-pole       | 3- / 4-pole | 2-pole             | 3- / 4-pole | 3- / 4-pole | 3- / 4-pole        | 3- / 4-pole  | 3- / 4-pole      |
|       | [A] | [W]             | [W]          | [W]         | [W]                | [W]         | [W]         | [W]                | [W]          | [W]              |
|       | 16  | -               | =            | 10.6        | 1 <del></del>      | 13.1        | 0.1         | 0.1                | -            | ı <del> -</del>  |
|       | 20  | -               | 100          | 12.0        | 5 <del>.0</del> )  | 14.5        | 0.1         | 0.2                | <i>⊞</i>     | 25               |
|       | 25  | 9.575           | -            | 8.5         | 100                | 11.0        | 0.2         | 0.3                | TT 1         | 25 <del>77</del> |
| 0     | 32  | S=              | -            | 10.6        | -                  | 13.1        | 0.3         | 0.4                | =            | \ <del>-</del>   |
| 3VA10 | 40  | =               | -            | 10.8        | -                  | 13.3        | 0.4         | 0.7                | =            | -                |
| 3     | 50  | -               | -            | 14.6        | -                  | 17.1        | 0.6         | 1.1                | #            | -                |
|       | 63  | -               | -            | 17.3        | -                  | 19.8        | 1.0         | 1.7                | -            | -                |
|       | 80  | -               | -            | 19.2        | -                  | 21.7        | 1.6         | 2.7                | =            | ₹                |
|       | 100 | _               | =            | 25.0        |                    | 27.5        | 2.5         | 4.2                | <u> </u>     | 77 <u>-1</u>     |
|       | 16  | 3.5             | 7.1          | 10.6        | 9.6                | 13.1        | 0.1         | 0.1                | 0.1          | 1.6              |
|       | 20  | 4.0             | 8.0          | 12.0        | 10.5               | 14.5        | 0.1         | 0.2                | 0.1          | 1.6              |
|       | 25  | 2.8             | 5.7          | 8.5         | 8.2                | 11.0        | 0.2         | 0.3                | 0.1          | 1.6              |
|       | 32  | 3.5             | 7.1          | 10.6        | 9.6                | 13.1        | 0.3         | 0.4                | 0.2          | 1.7              |
| Ξ     | 40  | 3.6             | 7.2          | 10.8        | 9.7                | 13.3        | 0.4         | 0.7                | 0.4          | 1.9              |
| 3VA11 | 50  | 4.9             | 9.7          | 14.6        | 12.2               | 17.1        | 0.6         | 1.1                | 0.6          | 2.1              |
| 3     | 63  | 5.8             | 11.5         | 17.3        | 14.0               | 19.8        | 1.0         | 1.7                | 0.9          | 2.4              |
|       | 80  | 6.4             | 12.8         | 19.2        | 15.3               | 21.7        | 1.6         | 2.7                | 1.5          | 3.0              |
|       | 100 | 8.3             | 16.7         | 25.0        | 19.2               | 27.5        | 2.5         | 4.2                | 2.4          | 3.9              |
|       | 125 | 9.4             | 18.7         | 28.1        | 21.2               | 30.6        | 3.8         | 6.6                | 3.7          | 5.2              |
|       | 160 | 12.7            | 25.3         | 38.0        | 27.8               | 40.5        | 6.3         | 10.8               | 6.1          | 7.6              |
| 12    | 160 | -               | -            | 33.0        | ( <u></u>          | 35.5        | 4.4         | 6.1                | 13.9         | : <del>(-</del>  |
| 3VA12 | 200 | ( <del>Le</del> | -            | 42.0        | ( <del>111</del> ) | 44.5        | 6.9         | 9.6                | 17.0         |                  |
|       | 250 | :=              | -            | 57.0        | -                  | 59.5        | 10.8        | 15.0               | 21.0         | 0.00             |
| 3VA13 | 320 | A.T.            | -            | 80.1        | 1570               | 82.6        | 19.0        | 30.21)             | 5,754        | 200              |
|       | 400 | -               | -            | 92.1        |                    | 94.6        | 29.8        | 36.3 <sup>1)</sup> | -            | -                |
| 3VA14 | 500 | -               | -            | 122.7       | i <del></del>      | 125.2       | 46.5        | 49.6 ¹)            | -            | e <del>s</del>   |
| 37,4  | 630 | -               | -            | 192.9       | -                  | 195.4       | 73.8        | 78.2 1)            | -            | 5 <del></del>    |

The following values for additional power losses result based on the derating factor of 0.9 (< 500 A) or 0.8 ( $\geq$  500 A) for plug-in and draw-out units

320 A: 24.5 W

400 A: 29.4 W

500 A: 31.7 W

630 A: 50.0 W

## 6.3 Power losses

#### Note

The specified power loss applies to 3-pole and 4-pole devices in the case of 3-phase, symmetrical loading.

# Power losses of 3VA1 molded case circuit breakers - starter protection circuit breakers

|        |            | Power loss PV |  |
|--------|------------|---------------|--|
|        | L.         | 3-pole        |  |
|        | ا _<br>[A] | įw]           |  |
|        | 32         | 10.6          |  |
|        | 40         | 10.8          |  |
|        | 50         | 14.6          |  |
| 3VA11  | 63         | 17.3          |  |
|        | 80         | 19.2          |  |
|        | 100        | 25.0          |  |
|        | 125        | 28.1          |  |
| 3VA12  | 160        | 33.0          |  |
| SVAIZ  | 200        | 42.0          |  |
| 21/442 | 250        | 80.1          |  |
| 3VA13  | 320        | 92.1          |  |
| 2)///4 | 400        | 122.7         |  |
| 3VA14  | 500        | 192.9         |  |

## Power losses of 3VA1 molded case circuit breakers - switch disconnectors

|        |            | Power loss PV |  |  |  |
|--------|------------|---------------|--|--|--|
|        | ا _<br>[A] | 3-pole<br>[W] |  |  |  |
|        | 32         | 2.6           |  |  |  |
|        | 40         | 3.6           |  |  |  |
|        | 50         | 5.6           |  |  |  |
| 3VA11  | 63         | 8.9           |  |  |  |
|        | 80         | 14.4          |  |  |  |
|        | 100        | 22.5          |  |  |  |
|        | 125        | 28.1          |  |  |  |
| 3VA12  | 160        | 33            |  |  |  |
| SVAIZ  | 200        | 42            |  |  |  |
| 3VA13  | 250        | 30            |  |  |  |
| SVAIS  | 320        | 49.2          |  |  |  |
| 21/444 | 400        | 76.8          |  |  |  |
| 3VA14  | 500        | 120           |  |  |  |

# 6.3.2 Power losses of 3VA2 molded case circuit breakers

|       |     | 3VA2 B  | reaker                                      | 3VA2 E<br>with                                    |   | ex                 | 3VA2 Breaker<br>ternal accessori | es                 |  |  |  |
|-------|-----|---|---|---|---|--------------------|----------------------------------|--------------------|--|--|--|
|       |     | Power I   | oss PV                                      | Power   | oss PV                                      | Addi               | Additional Power loss PV         |                    |  |  |  |
|       |     | l <sub>cu</sub> /l <sub>cs</sub><br>M, H, C-class | l <sub>cu</sub> /l <sub>cs</sub><br>L-class | I <sub>cu</sub> /I <sub>cs</sub><br>M, H, C-class | ا <sub>دی</sub> /ا <sub>دs</sub><br>L-class | Rear terminals     | Draw-Out unit                    | RCD<br>(load side) |  |  |  |
|       | [A] | 3- / 4-pole<br>[W]                                | 3- / 4-pole<br>[W]                          | 3- / 4-pole<br>[W]                                | 3- / 4-pole<br>[W]                          | 3- / 4-pole<br>[W] | 3- / 4-pole<br>[W]               | 3- / 4-pole<br>[W] |  |  |  |
|       | 25  | 0.84  | 0.50  | 3.34  | 3.00  | 0.1                | 0.1                              | 0.2                |  |  |  |
| 3VA20 | 40  | 2.2   | 1.2   | 4.7   | 3.7   | 0.3                | 0.3                              | 0.6                |  |  |  |
| 37/   | 63  | 5.4   | 3.0   | 7.9   | 5.5   | 0.7                | 0.8                              | 1.5                |  |  |  |
|       | 100 | 13.5  | 7.7   | 16.0  | 10.2  | 1.7                | 2.0                              | 3.9                |  |  |  |
|       | 25  | 0.6   | 0.5   | 3.1   | 3.0   | 0.1                | 0.1                              | 0.2                |  |  |  |
| _     | 40  | 1.6   | 1.2   | 4.1   | 3.7   | 0.3                | 0.3                              | 0.6                |  |  |  |
| 3VA21 | 63  | 4.0   | 3.1   | 6.5   | 5.6   | 0.7                | 0.8                              | 1.5                |  |  |  |
| 'n    | 100 | 10.0  | 7.7   | 12.5  | 10.2  | 1.7                | 2.0                              | 3.9                |  |  |  |
|       | 160 | 25.5  | 19.7  | 28.0  | 22.2  | 4.4                | 5.0                              | 10                 |  |  |  |
| 3VA22 | 160 | 19.7  | 19.7  | 22.2  | 22.2  | 4.4                | 5.0                              | 10                 |  |  |  |
| 3//   | 250 | 48.0  | 48.0  | 50.5  | 50.5  | 10.8               | 12.3                             | 24.3               |  |  |  |
| 3VA23 | 250 | 37.5  |   | 40.0  | 9   | 3.3                | 4.7                              | 29.3               |  |  |  |
| 30/   | 400 | 96.0  | _   | 98.5  | -   | 8.5                | 12.0                             | 75.0               |  |  |  |
| 4     | 400 | 63.5  | #   | 66.0  | _   | 8.5                | 5.8                              | 17.3               |  |  |  |
| 3VA24 | 500 | 99.0  | -   | 101.5   | -   | 13.2               | 9.0                              | 27.0               |  |  |  |
| (2)   | 630 | 162.0   | -   | 164.5   | S <del></del>                               | 7.0                | 72.0                             | 66.0               |  |  |  |

## Note

The specified power loss applies to 3-pole and 4-pole devices in the case of 3-phase, symmetrical loading.

# 6.4.1 Derating of 3VA1 molded case circuit breakers

The temperature inside the molded case circuit breaker is influenced by the ambient temperature and the current-dependent power loss generated inside the unit. To prevent overloading of 3VA1 molded case circuit breakers under difficult thermal conditions, the maximum rated continuous operational current must be limited as a function of the ambient temperature.

#### Note

The values were calculated for molded case circuit breakers without accessories. They do not apply to all installation situations of the molded case circuit breaker and may deviate depending upon factors such as cables and busbars, packing density, ventilation, etc.

Please observe the applicable overriding guidelines (e.g. IEC 61439).

|               |              |                    | Rated operational      |       | Max. r | ated conti | nuous op | erational o | current |       |
|---------------|--------------|--------------------|------------------------|-------|--------|------------|----------|-------------|---------|-------|
|               |              |                    | current I <sub>n</sub> | 40 °C | 45 °C  | 50 °C      | 55 °C    | 60 °C       | 65 °C   | 70 °C |
|               |              |                    | [A]                    | [A]   | [A]    | [A]        | [A]      | [A]         | [A]     | [A]   |
|               |              |                    | 16                     |       |        |            |          | 15          | 15      | 15    |
|               |              |                    | 20                     |       |        |            |          | 19          | 19      | 19    |
|               |              |                    | 25                     |       |        |            | 24       | 24          | 23      | 23    |
|               | Ξ            | əlc                | 32                     |       |        |            | 31       | 31          | 30      | 30    |
|               | Ä            | 4-p                | 40                     |       |        |            | 39       | 39          | 38      | 37    |
|               | , 3          | 3-,                | 50                     |       |        |            | 49       | 48          | 46      | 45    |
|               | 3VA10, 3VA11 | 2-,                | 63                     |       |        |            | 62       | 61          | 60      | 58    |
|               | 37,          | 1-, 2-, 3-, 4-pole | 80                     |       |        |            | 78       | 77          | 75      | 74    |
| ted           |              |                    | 100                    |       |        |            | 98       | 96          | 94      | 91    |
| onu           |              |                    | 125                    |       |        |            | 122      | 120         | 117     | 114   |
| Fixed-mounted |              |                    | 160                    |       |        |            | 158      | 155         | 153     | 150   |
| xec           | 2            | e e                | 160                    |       |        |            | 156      | 151         | 147     | 142   |
| _             | 3VA12        | 3-, 4-pole         | 200                    |       |        |            | 194      | 188         | 182     | 176   |
|               | 3            | 45                 | 250                    |       |        |            | 243      | 237         | 230     | 223   |
|               | 3            | e                  | 250 ¹)                 |       |        |            | 245      | 239         | 234     | 228   |
|               | 3VA13        | 3-, 4-pole         | 320                    |       |        |            | 313      | 306         | 299     | 292   |
|               | 3/           | 3.                 | 400                    |       |        |            | 392      | 384         | 376     | 367   |
|               | 3VA14        | 3-, 4-pole         | 500                    |       |        |            | 488      | 476         | 464     | 452   |
|               | 3//          | 3-, 4              | 630                    |       |        |            | 618      | 607         | 595     | 583   |

For TM120M only (starter protection circuit breaker)

No derating up to the rated operational current  $I_{\text{n}}$  of the molded case circuit breaker

# Derating in combination with accessories

None of the accessories from the extensive range available for 3VA1 molded case circuit breakers has an influence on the thermal response thresholds of the switching devices except for two accessories that require additional correction factors. These are:

|                              |        |         | Rated operational      |       |       | j     | Max. rat | ed contir | nuous op | erationa | al curren | t     |       |       |
|------------------------------|--------|---------|------------------------|-------|-------|-------|----------|-----------|----------|----------|-----------|-------|-------|-------|
|                              |        |         | current I <sub>n</sub> | 20 °C | 25 °C | 30 °C | 35 °C    | 40 °C     | 45 °C    | 50 °C    | 55 °C     | 60 °C | 65 °C | 70 °C |
|                              |        |         | [A]                    | [A]   | [A]   | [A]   | [A]      | [A]       | [A]      | [A]      | [A]       | [A]   | [A]   | [A]   |
|                              |        |         | 16                     |       |       |       |          | 8         |          |          | 15        | 14    | 14    | 14    |
|                              |        |         | 20                     |       |       |       |          |           | 19       | 18       | 18        | 17    | 17    | 17    |
|                              |        |         | 25                     |       |       |       |          | 24        | 23       | 23       | 22        | 22    | 21    | 21    |
|                              | _      |         | 32                     |       |       |       |          | 30        | 29       | 29       | 28        | 28    | 27    | 27    |
|                              | 3VA11  | olig    | 40                     |       |       |       |          | 37        | 36       | 36       | 35        | 35    | 34    | 33    |
| _                            |        | 4-polig | 50                     |       |       |       |          | 47        | 46       | 45       | 44        | 43    | 41    | 41    |
| Sior                         | 3VA10, | 3-, 4   | 63                     |       |       |       |          | 59        | 58       | 57       | 56        | 55    | 54    | 52    |
| Vers                         | 38     | .,      | 80                     |       |       |       |          | 74        | 73       | 72       | 70        | 69    | 68    | 67    |
| ğ                            |        |         | 100                    |       |       |       |          | 95        | 92       | 90       | 88        | 86    | 85    | 82    |
| Š                            |        | L       | 125                    |       |       |       |          | 118       | 115      | 113      | 110       | 108   | 105   | 103   |
| Plug-in and draw-out version |        |         | 160                    |       |       |       |          | 150       | 148      | 144      | 142       | 140   | 138   | 135   |
| and<br>a                     | 2      | olig    | 160                    |       |       |       |          | 150       | 145      | 141      | 137       | 133   | 129   | 125   |
| ⊑<br>□                       | 3VA12  | 4-polig | 200                    |       |       |       |          | 187       | 181      | 176      | 171       | 165   | 160   | 155   |
| ģ                            | 3      | 3-,     | 250                    |       |       |       |          | 231       | 225      | 220      | 214       | 209   | 202   | 196   |
| ı                            | က      |         | 250 1)                 |       |       | 245   | 240      | 235       | 230      | 225      | 220       | 215   | 210   | 205   |
|                              | 3VA13  | 4-polig | 320                    |       |       | 313   | 307      | 301       | 294      | 288      | 282       | 275   | 269   | 263   |
|                              | 3      | 3-,4    | 400                    |       | 397   | 390   | 282      | 375       | 367      | 360      | 353       | 345   | 338   | 330   |
|                              | 3VA14  | 4-polig | 500                    | 458   | 449   | 439   | 429      | 419       | 410      | 400      | 390       | 381   | 371   | 361   |
|                              | 37/    | 3-, 4-  | 630                    | 561   | 551   | 542   | 532      | 523       | 513      | 504      | 495       | 485   | 476   | 466   |

<sup>&</sup>lt;sup>1)</sup> For TM120M only (starter protection circuit breaker)

No derating up to the rated operational current  $I_{\text{n}}$  of the molded case circuit breaker

|                             |       |        | Rated operational      |       | Max. ra | ited conti | nuous op | erational | current |       |
|-----------------------------|-------|--------|------------------------|-------|---------|------------|----------|-----------|---------|-------|
|                             |       |        | current I <sub>n</sub> | 40 °C | 45 °C   | 50 °C      | 55 °C    | 60 °C     | 65 °C   | 70 °C |
|                             |       |        | [A]                    | [A]   | [A]     | [A]        | [A]      | [A]       | [A]     | [A]   |
|                             |       |        | 16                     |       |         |            | 15       | 15        | 15      | 15    |
|                             |       |        | 20                     |       |         |            | 18       | 18        | 18      | 18    |
| 10                          |       |        | 25                     |       | 24      | 24         | 23       | 23        | 22      | 22    |
| D5                          |       |        | 32                     |       | 31      | 31         | 30       | 30        | 29      | 29    |
| S S                         | _     | ole    | 40                     |       | 39      | 39         | 38       | 38        | 37      | 36    |
| ent devices<br>Basic RCD510 | 3VA11 | 4-pole | 50                     |       | 49      | 49         | 48       | 47        | 45      | 44    |
| 10 / Bas                    | 3     | ÷,     | 63                     |       | 62      | 61         | 60       | 59        | 58      | 56    |
| 10/                         |       |        | 80                     |       | 79      | 78         | 76       | 75        | 73      | 72    |
|                             |       |        | 100                    |       | 99      | 97         | 95       | 93        | 91      | 88    |
| RC                          |       |        | 125                    |       | 123     | 121        | 118      | 116       | 113     | 111   |
| Basic RCD3                  |       |        | 160                    |       | 158     | 155        | 153      | 150       | 148     | 146   |
| Ba                          | 2     | ole    | 160                    |       | 157     | 152        | 148      | 143       | 140     | 135   |
|                             | 3VA12 | 4-pole | 200                    |       | 196     | 190        | 184      | 179       | 173     | 167   |
|                             | 3     | 6,     | 250                    | 249   | 243     | 238        | 231      | 225       | 219     | 212   |

No derating up to the rated operational current In of the molded case circuit breaker

|       |          | Rated operational      |       | Max. ra | ated conti | nuous op | erational | current |       |
|-------|----------|------------------------|-------|---------|------------|----------|-----------|---------|-------|
|       |          | current I <sub>n</sub> | 40 °C | 45 °C   | 50 °C      | 55 °C    | 60 °C     | 65 °C   | 70 °C |
|       |          | [A]                    | [A]   | [A]     | [A]        | [A]      | [A]       | [A]     | [A]   |
|       |          | 16                     |       |         |            | 15       | 14        | 14      | 14    |
|       |          | 20                     |       | 19      | 18         | 18       | 17        | 17      | 17    |
|       |          | 25                     | 24    | 23      | 23         | 22       | 22        | 21      | 21    |
|       |          | 32                     | 30    | 29      | 29         | 28       | 28        | 27      | 27    |
| _     | e        | 40                     | 37    | 36      | 36         | 35       | 35        | 34      | 33    |
| 3VA11 | 4-pole   | 50                     | 47    | 46      | 45         | 44       | 43        | 41      | 41    |
| 3     | ج.<br>ب. | 63                     | 59    | 58      | 57         | 56       | 55        | 54      | 52    |
| Г     |          | 80                     | 74    | 73      | 72         | 70       | 69        | 68      | 67    |
|       |          | 100                    | 95    | 92      | 90         | 88       | 86        | 85      | 82    |
|       |          | 125                    | 118   | 115     | 113        | 110      | 108       | 105     | 103   |
|       |          | 160                    | 150   | 148     | 144        | 142      | 140       | 138     | 135   |
| 2     | ole      | 160                    | 156   | 152     | 147        | 144      | 139       | 135     | 131   |
| 3VA12 | 4-pole   | 200                    | 195   | 190     | 184        | 178      | 173       | 167     | 162   |
| 3     | 3-,      | 250                    | 241   | 236     | 230        | 224      | 218       | 212     | 205   |

No derating up to the rated operational current In of the molded case circuit breaker

|  |       |        | Rated operational                   |       | Max. ra | ated conti | nuous op | erational | current |       |
|--|-------|--------|-------------------------------------|-------|---------|------------|----------|-----------|---------|-------|
|  |       |        | current I <sub>n</sub> [A] 16 20 25 | 40 °C | 45 °C   | 50 °C      | 55 °C    | 60 °C     | 65 °C   | 70 °C |
|  |       |        | [A]                                 | [A]   | [A]     | [A]        | [A]      | [A]       | [A]     | [A]   |
|  |       |        | 16                                  |       |         |            | 15       | 14        | 14      | 14    |
|  |       |        | 20                                  |       | 19      | 18         | 18       | 17        | 17      | 17    |
|  |       |        | 25                                  | 24    | 23      | 23         | 22       | 22        | 21      | 21    |
| e residual current device<br>Basic RCD520B |       | 4-pole | 32                                  | 30    | 29      | 29         | 28       | 28        | 27      | 27    |
|  | _     |        | 40                                  | 37    | 36      | 36         | 35       | 35        | 34      | 33    |
|  | 3VA11 |        | 50                                  | 47    | 46      | 45         | 44       | 43        | 41      | 41    |
| ic   | 3     | 3-,    | 63                                  | 59    | 58      | 57         | 56       | 55        | 54      | 52    |
| Bas  |       |        | 80                                  | 74    | 73      | 72         | 70       | 69        | 68      | 67    |
|  |       |        | 100                                 | 95    | 92      | 90         | 88       | 86        | 85      | 82    |
| В  |       |        | 125                                 | 118   | 115     | 113        | 110      | 108       | 105     | 103   |
|  |       |        | 160                                 | 150   | 147     | 142        | 139      | 136       | 132     | 128   |

No derating up to the rated operational current I<sub>n</sub> of the molded case circuit breaker

# 6.4.2 Temperature compensation for thermal-magnetic trip units TM210, TM220 and TM240

The trip units for 3VA1 molded case circuit breakers are factory-calibrated to a temperature of 50 °C. The thermal response threshold of the trip unit changes when the circuit breaker is operated in a higher or lower ambient temperature. To obtain the characteristic tripping times at a specific ambient temperature, it is necessary to apply correction factors when setting the thermal trip units.

Correction factor TK is applied to compensate for the ambient temperature.

The first step in calculating the correction factor TK is to determine the setting factor at 50 °C:

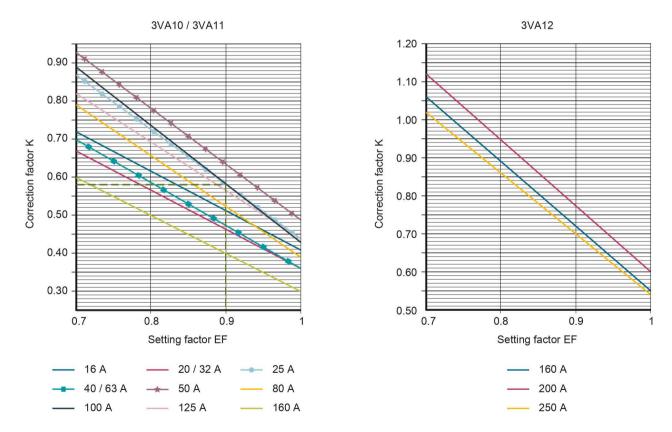
$$EF(50 °C) = \frac{I}{I_n}$$

EF(50 °C) Setting factor at 50 °C

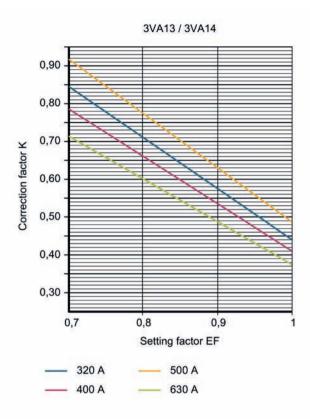
I System current

Rated operational current of the molded case circuit breaker

Using the setting factor calculated at 50  $^{\circ}$ C, it is possible to read the correction factor K off the following charts:



--- No derating up to the rated operational current In of the molded case circuit breaker



Using the two calculated values, it is possible to determine the temperature compensation TK and finally the setting value for the trip unit  $I_{r(TU)}$ :

$$TK(T_U) = \left(\frac{K \cdot (T_U - 50 \text{ °C})}{100} + 1\right)$$

 $\mathsf{TK}(\mathsf{T}_\mathsf{U})$  Temperature compensation for molded case circuit breaker with service temperature  $\mathsf{T}_\mathsf{U}$ 

K Correction factor

T<sub>u</sub> Service temperature of molded case circuit breaker

Trip unit setting value:

 $I_{r(TU)} = I_n \cdot EF(50 \, ^{\circ}C) \cdot TK$ 

 $I_{r(TU)}$  Trip unit setting value with service temperature  $T_u$ 

The operational current must never exceed the maximum rated operational current  $I_n$  of the molded case circuit breaker. If the current calculated for the operating conditions is higher than the rated operational current of the unit, a molded case circuit breaker with the appropriate rated operational current must be deployed.

#### Example 1: Correction of setting values as a function of ambient temperature

## Starting point:

On a 3VA1 100 A molded case circuit breaker with a TM240 100 A trip unit, the real tripping threshold for various different service temperatures must be set to a required system current of I = 90 A.

#### Ambient temperature 60 °C:

Setting factor EF(50 °C) = (90 / 100) = 0.9

Correction factor K = 0.58 (see chart above)

Temperature compensation TK(60 °C) =  $(0.58 \cdot (60 \text{ °C to } 50 \text{ °C}) / 100) + 1 = 1.058$ 

Setting value  $I_{r(60~^{\circ}C)}$  = 100 A  $\cdot$  0.9  $\cdot$  1.058 = **95 A** 

#### Ambient temperature 40 °C:

Setting factor EF(50  $^{\circ}$ C) = (90 / 100) = 0.9

Correction factor K = 0.58

Temperature compensation TK(40 °C) = (0.58 · (40 °C ... 50 °C) / 100) + 1 = 0.942

Setting value  $I_{r(40 \, ^{\circ}\text{C})} = 100 \, \text{A} \cdot 0.9 \cdot 0.942 = 85 \, \text{A}$ 

If the setting value calculated for the thermal trip unit  $I_{r(TU)}$  is outside the possible setting range, an appropriate molded case circuit breaker with a higher or lower rated operational current must be selected and the compensation calculation then performed again.

#### Note

These values do not apply to all installation situations of the molded case circuit breaker and may deviate depending upon factors such as cables and busbars, packing density, ventilation, etc.

Please observe the applicable overriding guidelines (e.g. IEC 61439).

#### Example 2: Calculation of the tripping time

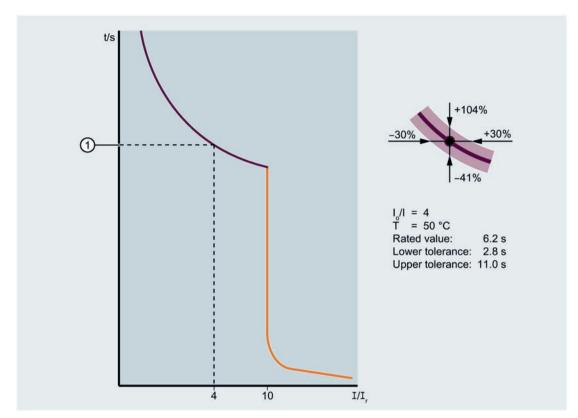
Starting point:

Based on the example above, the tripping time for an overcurrent  $I_0$  = 360 A will now be calculated.

To compensate for the ambient temperature of 60 °C, rather than 50 °C, the thermal trip unit has been set  $I_{r(60 \text{ °C})}$  = 95 A for a system current I = 90 A.

The first step is to calculate the ratio between the overcurrent and the system current:

 $I_0/I = 360 \text{ A} / 90 \text{ A} = 4$ 



Using this value, it is now possible to read the tripping time from the characteristics chart:

1 Tripping time (schematic representation)

### Inclusion of accessories

None of the accessories from the extensive range available for 3VA1 molded case circuit breakers has an influence on the thermal response thresholds of the switching devices except for two accessories that require additional correction factors. These are:

- Plug-in version / draw-out version
- · Residual current devices

None of the other accessories has an influence on the thermal response thresholds of trip units.

The table below shows the correction factors of setting value I<sub>r</sub> for the trip units of 3VA1 molded case circuit breakers in plug-in / draw-out technology and for 3VA1 molded case circuit breakers combined with residual current devices:

| 3VA1 molded case circuit breakers with accessories                           | Correction factor (calibration temperature 50 °C) |       |       |                              |  |  |  |  |  |
|--|---|-------|-------|------------------------------|--|--|--|--|--|
|  | 3VA10   | 3VA11 | 3VA12 | 3VA13 / 3VA14                |  |  |  |  |  |
| 3VA1 fixed-mounted   | 1.00  | 1.00  | 1.00  | 1.00                         |  |  |  |  |  |
| 3VA1 plug-in version, draw-out version                                       |   | 0.90  | 0.88  | < 500 A: 0.9<br>≥ 500 A: 0.8 |  |  |  |  |  |
| 3VA1 with side mounted residual current device (Basic RCD310 / Basic RCD510) |   | 0.97  | 0.95  |                              |  |  |  |  |  |
| 3VA1 with loadside residual current device<br>(Basic RCD320 / Basic RCD520)  |   | 0.91  | 0.92  |                              |  |  |  |  |  |
| 3VA1 with loadside residual current device (Basic RCD520B)                   |   | 0.91  |       |                              |  |  |  |  |  |

#### **Example**

#### Starting point:

The current loading of a 3VA1 molded case circuit breaker is calculated to be 90 A and the ambient temperature 65 °C for a given application. The plug-in version of the molded case circuit breaker will be used.

The appropriate size of molded case circuit breaker is determined first on the basis of the correction factor for 3VA1 plug-in technology (see table above): Design of assembly at 50 °C:  $I_r = (90 \text{ A} / 0.9) = 100 \text{ A}$ 

It is therefore necessary to select a molded case circuit breaker that allows a setting value of 100 A on the thermal overload release at a calibration temperature of 50  $^{\circ}$ C. A 3VA1 molded case circuit breaker 160 A with  $I_{0}$  = 125 A is therefore used for the application.

The temperature compensation is then calculated according to the method described above:

#### Ambient temperature 65 °C:

Setting factor EF(50 °C) = (100 / 125) = 0.8

Correction factor K = 0.69 (from chart)

Switching device temperature compensation TK(65 °C) =  $(0.69 \cdot (65 \text{ °C} \dots 50 \text{ °C}) / 100) + 1 = 1.1$ 

Setting value  $I_{r(65 °C)} = 125 \text{ A} \cdot 0.9 \cdot 1.1 = 124 \text{ A}$ 

#### Note

These values do not apply to all installation situations of the molded case circuit breaker and may deviate depending upon factors such as cables and busbars, packing density, ventilation, etc.

Please observe the applicable overriding guidelines (e.g. IEC 61439).

# 6.4.3 Additional correction factors with frequencies other than 50/60 Hz for 3VA1 molded case circuit breakers

The temperature rise in the bimetal is greater at frequencies above 50/60 Hz. This is due to eddy-current losses and the reduction in the available conductor cross section as a result of the skin effect.

The rated operational current must therefore be reduced from the value used in 50/60 Hz applications.

| 3VA10 / 3VA11 | Correction factor         |
|---------------|---------------------------|
| Frequencies   | for the thermal trip unit |
| < 150 Hz      | 1.0                       |
| 150 Hz 400 Hz | 0.9                       |

| 3VA12         | Correction factor         |
|---------------|---------------------------|
| Frequencies   | for the thermal trip unit |
| < 100 Hz      | 1.0                       |
| 100 Hz 250 Hz | 0.95                      |
| 250 Hz 400 Hz | 0.90                      |

| 3VA13 / 3VA14 | Correction factor         |
|---------------|---------------------------|
| Frequencies   | for the thermal trip unit |
| ≤ 100 Hz      | 1.0                       |
| 100 Hz 150 Hz | 0.95                      |
| 200 Hz        | 0.90                      |
| 300 Hz 400 Hz | 0.85                      |

In an application with 400 Hz, this means the following for the example from chapter Derating of 3VA1 molded case circuit breakers (Page 628) with a 3VA1 molded case circuit breaker when current  $I_r$  = 90 A is required:

Setting value I<sub>r(400 Hz)</sub> = 90 A · 0.9 = 81 A

Where ambient temperatures differ from the calibration temperature, temperature compensation as described in chapter Derating of 3VA1 molded case circuit breakers (Page 628) must be performed.

In addition, a correction factor for setting the magnetic trip unit as a function of frequency must be applied.

|                | DC   |      | Corre | ction fac | tor for th | ne magn | etic trip | unit at fr | equency | f [Hz] |      |
|----------------|------|------|-------|-----------|------------|---------|-----------|------------|---------|--------|------|
|                | DC   | 20   | 50    | 60        | 100        | 150     | 200       | 250        | 300     | 350    | 400  |
| 3VA10<br>3VA11 | 0.7  | 1.05 | 1     | 1         | 1          | 0.95    | 0.9       | 0.85       | 0.80    | 0.75   | 0.70 |
| 3VA12          | 0.85 | 1    | 1     | 1         | 0.8        | 0.75    | 0.7       | 0.65       | 0.6     | 0.57   | 0.55 |
| 3VA13<br>3VA14 | 0.8  | 1    | 1     | 0.95      | 0.91       | 0.83    | 0.8       | 0.75       | 0.7     | 0.65   | 0.6  |

#### **Example**

Starting point:

A 3VA1 molded case circuit breaker 100 A with a TM240 trip unit is used for a 400 Hz application. The molded case circuit breaker is required to trip instantaneously in response to an overcurrent of 900 A.

The maximum permissible rated continuous operational current is calculated first:

The setting value for instantaneous short-circuit protection (I<sub>i</sub>) is then determined on the basis of the correction factor from the table above:

$$I_i = 900 A \cdot 0.7 = 630 A$$

# 6.4.4 Correction factors with direct current for the thermal-magnetic trip units of 3VA1 molded case circuit breakers

With DC systems, a correction factor must be applied to the magnetic trip unit.

|                | Correction factor for | or the magnetic trip u | nit for DC systems |                |
|----------------|-----------------------|------------------------|--------------------|----------------|
| 3VA10<br>100 A | 3VA11<br>160 A        | 3VA12<br>250 A         | 3VA13<br>400 A     | 3VA14<br>630 A |
| 0.7            | 0.7                   | 0.85                   | 0.8                | 0.8            |

Where ambient temperatures differ from the calibration temperature, temperature compensation as described in chapter Derating of 3VA1 molded case circuit breakers (Page 628) must be performed.

#### Example:

Starting point:

A 3VA1 molded case circuit breaker 160 A with a TM240 trip unit is used in a DC system. The molded case circuit breaker is required to trip instantaneously in response to an overcurrent of 1200 A.

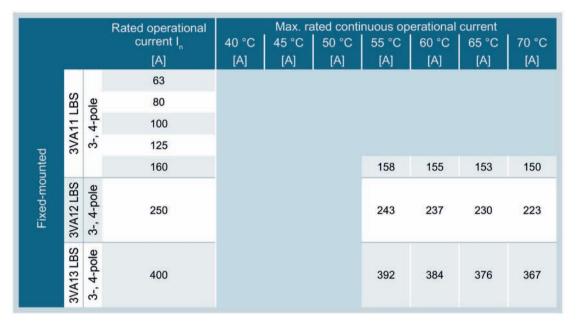
The setting value for the instantaneous short-circuit protection (I<sub>i</sub>) is:

$$I_i = 1200 A \cdot 0.7 = 840 A$$

# 6.4.5 Derating for the 3VA1 switch disconnector

The 3VA1 SD switch disconnectors do not have a trip unit. The temperature inside the switch disconnector is however influenced by the ambient temperature and the current-dependent power loss generated inside the unit. Nonetheless, 3VA1 switch disconnectors up to 125 A do not require derating up to 70 °C.

To prevent overloading of switch disconnectors over 125 A under difficult thermal conditions, the maximum rated continuous operational current must be limited as a function of the ambient temperature:



No derating up to the rated operational current In of the switch disconnector

## Limitation of the rated continuous operational current in combination with accessories

The table below shows the maximum rated continuous operational current for the plug-in version of switch disconnectors in sizes 160 A, 250 A and 400 A and for switch disconnectors combined with residual current devices:

|                              |           |            | Rated operational |       |       | N   | lax. rate | d contir | nuous o | peration | al curre | nt  |     |     |
|------------------------------|-----------|------------|-------------------|-------|-------|-----|-----------|----------|---------|----------|----------|-----|-----|-----|
|                              |           |            | current I         | 20 °C | 25 °C |     |           |          |         | 50 °C    |          |     |     |     |
|                              | _         |            | [A]               | [A]   | [A]   | [A] | [A]       | [A]      | [A]     | [A]      | [A]      | [A] | [A] | [A] |
|                              |           |            | 63                |       |       |     |           |          |         |          |          |     |     |     |
|                              | LBS       | əle        | 80                |       |       |     |           |          |         |          |          |     |     |     |
| sion                         | 11        | 3-, 4-pole | 100               |       |       |     |           |          |         |          |          |     |     |     |
| t ver                        | 3VA11     | က်         | 125               |       |       |     |           |          |         |          |          |     |     |     |
| no-/                         |           |            | 160               |       |       |     |           | 150      | 148     | 144      | 142      | 140 | 138 | 135 |
| Plug-in and draw-out version | 3VA12 LBS | 3-, 4-pole | 250               |       |       |     |           | 231      | 225     | 220      | 214      | 209 | 202 | 196 |
| Plug                         | 3VA13 LBS | 3-, 4-pole | 400               |       | 397   | 390 | 382       | 375      | 367     | 360      | 353      | 345 | 338 | 330 |

No derating up to the rated operational current In of the molded case circuit breaker

|                                    |           |            | Rated operational      |       |       | ated conti |       |       |       |       |
|------------------------------------|-----------|------------|------------------------|-------|-------|------------|-------|-------|-------|-------|
|                                    |           |            | current I <sub>n</sub> | 40 °C | 45 °C | 50 °C      | 55 °C | 60 °C | 65 °C | 70 °C |
|                                    |           |            | [A]                    | [A]   | [A]   | [A]        | [A]   | [A]   | [A]   | [A]   |
| s<br>D510                          |           |            | 63                     |       |       |            |       |       |       |       |
| ices                               | LBS       | ole        | 80                     |       |       |            |       |       |       |       |
| ted<br>dev<br>sic F                |           | 4-pole     | 100                    |       |       |            |       |       |       |       |
| mounter<br>urrent de<br>0 / Basic  | 3VA11     | က်         | 125                    |       |       |            |       |       |       |       |
|                                    |           |            | 160                    |       | 158   | 155        | 153   | 150   | 148   | 146   |
| Side<br>residual or<br>Basic RCD31 | 3VA12 LBS | 3-, 4-pole | 250                    |       | 243   | 238        | 231   | 225   | 219   | 212   |

No derating up to the rated operational current In of the molded case circuit breaker

None of the other available accessories require derating of the 3VA1 switch disconnector.

# 6.4.6 Derating for the electronic trip units of 3VA2 molded case circuit breakers

The current measuring circuits of the electronic trip units of 3VA2 molded case circuit breakers are not affected by the ambient temperature. The Rogowski coils integrated in the trip unit measure the current and compare it to the set tripping threshold. Higher or lower ambient temperatures do not influence the tripping threshold, which means that it is not necessary to apply correction factors.

## Limitation of the rated operational current

The temperature inside the molded case circuit breaker is nonetheless influenced by the ambient temperature and the current-dependent power loss generated inside the unit. To prevent overloading of molded case circuit breakers under difficult thermal conditions, the maximum rated continuous operational current must therefore be limited as a function of the ambient temperature in some cases:

The tables below specify the maximum rated uninterrupted operational current as a function of the accessories to be taken into account and the ambient temperature. The operational current must never exceed the maximum rated operational current of the molded case circuit breaker.

#### Note

These values do not apply to all installation situations of the molded case circuit breaker and may deviate depending upon factors such as cables and busbars, packing density, ventilation, etc.

Please observe the applicable overriding guidelines (e.g. IEC 61439).

# 3VA2 molded case circuit breakers, fixed-mounted versions

| Internal accessories1) | Electronic trip<br>unit ETU | Size   | Rated operational          | Max. rate<br>30 °C 35 °C 40 ° |     |     |     |     |     | 70° |
|------------------------|-----------------------------|--------|----------------------------|-------------------------------|-----|-----|-----|-----|-----|-----|
| 40003301103            | unit E10                    |        | current I <sub>n</sub> [A] | [A] [A] [A]                   | [A] | [A] | [A] | [A] | [A] | [A] |
|                        |                             | 100 A  | 25 100                     |                               |     |     |     |     |     |     |
|                        |                             | 160 A  | 25 160                     |                               |     |     |     |     |     |     |
|                        |                             | 250 A  | 160                        |                               |     |     |     |     |     |     |
|                        |                             | 200 A  | 250                        |                               |     |     | 241 | 232 | 222 | 21  |
|                        |                             | 400 A  | 250                        |                               |     |     |     |     |     |     |
|                        | 3-series                    | 400 A  | 400                        |                               |     |     | 385 | 370 | 355 | 34  |
|                        | 5-361163                    |        | 400                        |                               |     |     |     |     |     |     |
|                        |                             | 630 A  | 500                        |                               |     |     | 495 | 490 | 485 | 48  |
|                        |                             |        | 630                        |                               | 612 | 593 | 575 | 557 | 538 | 52  |
|                        |                             |        | 630                        |                               |     |     |     |     |     |     |
|                        |                             | 1000 A | 800                        |                               |     |     |     |     | 767 | 70  |
| Basic circuit          |                             |        | 1000                       |                               |     |     |     | 955 | 885 | 81  |
| breaker                |                             | 100 A  | 24 160                     |                               |     |     |     |     |     |     |
|                        |                             | 160 A  | 25 160                     |                               |     |     |     |     |     |     |
|                        |                             | 250 A  | 160                        |                               |     |     |     |     |     |     |
|                        |                             | 230 A  | 250                        |                               |     |     | 238 | 225 | 213 | 20  |
|                        |                             | 400 A  | 250                        |                               |     |     |     |     |     |     |
|                        | 5 and 8 sories              | 400 A  | 400                        |                               |     |     | 375 | 350 | 325 | 30  |
|                        | 5- and 8-series             |        | 400                        |                               |     |     |     |     |     |     |
|                        |                             | 630 A  | 500                        |                               |     |     | 477 | 455 | 432 | 41  |
|                        |                             |        | 630                        |                               | 600 | 570 | 540 | 510 | 480 | 45  |
|                        |                             |        | 630                        |                               |     |     |     |     |     |     |
|                        |                             | 1000 A | 800                        |                               |     |     |     |     | 767 | 70  |
|                        |                             |        | 1000                       |                               |     |     |     | 955 | 885 | 81  |
|                        |                             | 100 A  | 25 100                     |                               |     |     |     |     |     |     |
|                        |                             | 160 A  | 25125                      |                               |     |     |     |     |     |     |
|                        |                             | 100 A  | 160                        |                               |     |     |     |     |     |     |
|                        |                             | 250 A  | 160                        |                               |     |     |     |     |     |     |
| with COM060            | 5- and 8-series             | 200 A  | 250                        |                               |     |     | 232 | 215 | 198 | 18  |
| WILLI COMOO            | J- and o-series             | 400 A  | 250                        |                               |     |     |     |     |     |     |
| With COMU60            |                             | 400 A  | 400                        |                               |     |     | 368 | 335 | 303 | 27  |
|                        |                             |        | 400                        |                               |     |     |     |     | 387 | 35  |
|                        |                             | 630 A  | 500                        |                               |     |     | 463 | 425 | 387 | 35  |
|                        |                             |        | 630                        |                               | 588 | 548 | 507 | 467 | 426 | 38  |

Only the COM060 communication module has an effect on derating. Other internal accessories can be used without restriction.

COM060 COM060 communication module

No derating up to the rated operational current In of the molded case circuit breaker

# 3VA2 molded case circuit breakers, plug-in and draw-out versions

| Internal accessories1)   | Electronic trip<br>unit ETU | Size  | Rated                                  | 20.00 | Max. rated continuous operational current °C 35 °C 40 °C 45 °C 50 °C 55 °C 60 °C 65 °C 70 °C |     |     |     |     |     |     |          |  |
|--------------------------|-----------------------------|-------|--|-------|--|-----|-----|-----|-----|-----|-----|----------|--|
|                          |                             |       | operational current I <sub>n</sub> [A] | [A]   | [A]  | [A] | [A] | [A] | [A] | [A] | [A] | /0<br>[A |  |
| Basic circuit<br>breaker | 3-series                    | 100 A | 25 100                                 | -     |  |     |     |     |     |     |     |          |  |
|                          |                             | 160 A | 25 160                                 |       |  |     |     |     |     |     |     |          |  |
|                          |                             | 250 A | 160                                    |       |  |     |     |     |     |     |     |          |  |
|                          |                             |       | 250                                    |       |  |     | 238 | 230 | 220 | 210 | 203 | 19       |  |
|                          |                             | 400 A | 250                                    |       |  |     |     |     |     |     |     |          |  |
|                          |                             |       | 400                                    |       |  |     |     | 390 | 375 | 360 | 345 | 33       |  |
|                          |                             | 630 A | 400                                    |       |  |     |     |     |     |     | 388 | 37       |  |
|                          |                             |       | 500                                    |       | 481  | 466 | 444 | 425 | 412 | 400 | 388 | 3        |  |
|                          |                             |       | 630                                    | 585   | 562  | 540 | 525 | 510 | 495 | 480 | 465 | 45       |  |
|                          | 5- and 8-series             | 100 A | 25 100                                 |       |  |     |     |     |     |     |     |          |  |
|                          |                             | 160 A | 25 160                                 |       |  |     |     |     |     |     |     |          |  |
|                          |                             | 250 A | 160                                    |       |  |     |     |     |     |     |     |          |  |
|                          |                             |       | 250                                    |       |  | 238 | 227 | 215 | 204 | 193 | 181 | 17       |  |
|                          |                             | 400 A | 250                                    |       |  |     |     |     |     |     |     |          |  |
|                          |                             |       | 400                                    |       |  |     |     | 380 | 360 | 340 | 320 | 30       |  |
|                          |                             | 630 A | 400                                    |       |  |     |     |     |     | 388 | 365 | 3        |  |
|                          |                             |       | 500                                    |       | 481  | 466 | 444 | 425 | 410 | 388 | 365 | 3        |  |
|                          |                             |       | 630                                    | 585   | 562  | 540 | 517 | 493 | 470 | 447 | 423 | 40       |  |
| with COM060              | 5- and 8-series             | 100 A | 25 100                                 |       |  |     |     |     |     |     |     |          |  |
|                          |                             | 160 A | 25 125                                 |       |  |     |     |     |     |     |     |          |  |
|                          |                             |       | 160                                    |       |  |     |     |     |     |     |     |          |  |
|                          |                             | 250 A | 160                                    |       |  |     |     |     |     |     |     |          |  |
|                          |                             |       | 250                                    |       |  | 238 | 226 | 214 | 201 | 189 | 177 | 16       |  |
|                          |                             | 400 A | 250                                    |       |  |     |     |     |     |     |     |          |  |
|                          |                             |       | 400                                    |       |  |     |     | 380 | 355 | 320 | 285 | 25       |  |
|                          |                             | 630 A | 400                                    |       |  |     |     |     |     | 367 | 339 | 3        |  |
|                          |                             |       | 500                                    |       | 481  | 466 | 444 | 425 | 400 | 367 | 339 | 3        |  |
|                          |                             |       | 630                                    | 585   | 562  | 540 | 514 | 487 | 460 | 434 | 407 | 38       |  |

Only the COM060 communication module has an effect on derating. Other internal accessories can be used without restriction.

COM060 COM060 communication module

No derating up to the rated operational current In of the molded case circuit breaker

## 3VA2 molded case circuit breakers with RCD820 residual current device

| Internal accessories <sup>1)</sup> | Electronic trip<br>unit ETU | Size  | Rated Max. rated continuous operational current operational 30 °C 35 °C 40 °C 45 °C 50 °C 55 °C 60 °C 65 |     |     |     |     |     |     |     |     |     |
|------------------------------------|-----------------------------|-------|--|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                                    |                             |       | current I <sub>n</sub> [A]   | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [A] | [A] |
| Basic circuit<br>breaker           | 3-series                    | 100 A | 25 100   |     |     |     |     |     |     |     |     |     |
|                                    |                             | 160 A | 25 160   |     |     |     |     |     |     |     |     |     |
|                                    |                             | 250 A | 160  |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 250  |     |     | 240 | 230 | 220 | 210 | 200 | 190 | 18  |
|                                    |                             | 400 A | 250  |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 400  |     |     |     | 383 | 367 | 350 | 333 | 317 | 30  |
|                                    |                             | 630 A | 400  |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 500  |     |     |     |     |     | 482 | 463 | 443 | 42  |
|                                    |                             |       | 630  | 585 | 562 | 540 | 525 | 510 | 495 | 480 | 465 | 45  |
|                                    | 5- and 8-series             | 100 A | 25 100   |     |     |     |     |     |     |     |     |     |
|                                    |                             | 160 A | 25 160   |     |     |     |     |     |     |     |     |     |
|                                    |                             | 250 A | 160  |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 250  |     |     | 240 | 230 | 220 | 210 | 200 | 190 | 18  |
|                                    |                             | 400 A | 250  |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 400  |     |     |     | 375 | 350 | 325 | 300 | 275 | 25  |
|                                    |                             | 630 A | 400  |     |     |     |     |     |     |     |     | 37  |
|                                    |                             |       | 500  |     |     |     |     |     | 468 | 437 | 407 | 37  |
|                                    |                             |       | 630  | 600 | 568 | 537 | 505 | 474 | 443 | 412 | 381 | 35  |
| with COM060                        | 5- and 8-series             | 100 A | 25 100   |     |     |     |     |     |     |     |     |     |
|                                    |                             | 160 A | 25 125   |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 160  |     |     |     |     |     |     |     |     |     |
|                                    |                             | 250 A | 160  |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 250  |     |     | 240 | 230 | 220 | 210 | 200 | 190 | 18  |
|                                    |                             | 400 A | 250  |     |     |     |     |     |     |     |     |     |
|                                    |                             |       | 400  |     |     |     |     | 370 | 340 | 310 | 280 | 25  |
|                                    |                             | 630 A | 400  |     |     |     |     |     |     |     | 388 | 35  |
|                                    |                             |       | 500  |     |     |     |     |     | 463 | 425 | 388 | 35  |
|                                    |                             |       | 630  | 600 | 565 | 533 | 500 | 467 | 437 | 404 | 372 | 34  |

Only the COM060 communication module has an effect on derating. Other internal accessories can be used without restriction.

COM060 COM060 communication module

No derating up to the rated operational current  $I_{\text{n}}$  of the molded case circuit breaker

# **Examples**

## Example 1

Starting point:

A plug-in version of a 3VA2 molded case circuit breaker 160 A with an ETU350 LSI trip unit is to be operated at 70 °C:

 $I_{r(max 70^{\circ} C)} = 160 A$ 

No derating is required.

## Example 2

Starting point:

A plug-in version of a 3VA2 molded case circuit breaker 250 A with an ETU850 LSI trip unit is to be operated at 60 °C with the COM060 communication module:

 $I_{r(max 60 °C)} = 189 A$ 

# 6.4.7 Use of terminals with auxiliary conductor connection

When connecting terminals with control wire tap are used, the total current from the main circuit and control wire must not exceed the maximum rated operational current of the 3VA1 and 3VA2 molded case circuit breakers.

# Appendix



## A.1 Standards and approvals

## Description

Table A- 1 3VA1 and 3VA2 molded case circuit breakers conform to the following international standards

| Standard   |            | Title  |  |
|--|------------|--|--|
| CISPR11 Class A  |            | Limits and methods of measurement of radio interference suppression of equipment in industrial environments. |  |
|  | Class B    | Limits and methods of measurement of radio interference suppression of equipment in domestic environments.   |  |
| IEC 60664-   | ·1         | Insulation coordination for equipment within low-voltage systems.  |  |
| IEC 60068-   | -2-1 "Ab"  | Environmental testing - Part 2-1: Tests - Test A: Cold   |  |
| IEC 60068-   | -2-2 "Bd"  | Environmental testing - Part 2-2: Tests - Test B: Dry heat   |  |
| IEC 60068-   | -2-27 "Ea" | Environmental testing - Part 2-27: Tests - Test Ea and guidance Shock  |  |
| IEC 60068-   | -2-30 "Db" | Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 + 12 hours)                        |  |
| IEC 60068-   | -2-52      | Environmental testing - Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)                |  |
| IEC 60068-   | -2-6 "Fc"  | Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)                                    |  |
| IEC 60228  | Class 1    | Solid conductors   |  |
| IEC 60228  | Class 2    | Stranded conductors  |  |
| IEC 60228  | Class 5    | Flexible conductors  |  |
| IEC 60228  | Class 6    | Very flexible conductors (more flexibility than Class 5)   |  |
| IEC 60364-   | 4-41       | Electrical installations of buildings - Part 4-41: Protection for safety - Protection against electric shock |  |
| VDE 0100-<br>(IEC 60364                                | · · ·      | Protection for safety - Protection against electric shock  |  |
| IEC 60529  |            | Degrees of protection provided by enclosures (IP code)   |  |
| IEC 60947-1 /<br>DIN EN 60947-1<br>(VDE 0600-100)      |            | Low-voltage switchgear and controlgear – General rules   |  |
| IEC / EN 60947-1                                       |            | Low-voltage switchgear and controlgear – General rules   |  |
| IEC / EN 60947-1, Annex S                              |            | Digital inputs and/or digital outputs contained in switchgear and control-<br>gear                           |  |
| IEC / EN 60947-2 Edi-<br>tion 4.1, 05.2009 Low-voltage |            | Low-voltage switchgear and controlgear - Part 2: Circuit-Breakers  |  |
| IEC / EN 60947-2,<br>Annex B                           |            | Circuit-breakers incorporating residual current protection   |  |

#### A.1 Standards and approvals

| Standard   | Title  |  |
|--|--|--|
| IEC / EN 60947-2, An-                                  | "Test sequence for circuit-breakers for IT systems"  |  |
| nex H  | "Circuit-breakers for IT systems"  |  |
| IEC / EN 60947-3 /<br>DIN EN 60947-3<br>(VDE 0660-107) | Low-voltage switchgear and controlgear – Switches, disconnectors, switch-disconnectors and fuse-combination units  |  |
| IEC 60947-4-1 /<br>DIN EN 60947-4-1<br>(VDE 0660-102)  | Contactors and motor-starters – Electromechanical contactors and motor-starters  |  |
| IEC / EN 61000-4-2                                     | Electrostatic discharge immunity test  |  |
| IEC / EN 61000-4-3                                     | Radiated, radio-frequency, electromagnetic field immunity test   |  |
| IEC / EN 61000-4-4                                     | Electrical fast transient/burst immunity test  |  |
| IEC / EN 61000-4-5                                     | Surge immunity test  |  |
| IEC / EN 61000-4-6                                     | Immunity to conducted disturbances, induced by radio-frequency fields  |  |
| IEC 61557-12   | Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c Equipment for testing, measuring or monitoring of protective measures - Part 12: Performance measuring and monitoring devices (PMD) |  |
| UL489 Annex SE   | "Firmware analysis for safety-relevant applications in electronic trip units"  |  |
|  | RoHS Directive 2002/95/EC (Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment)   |  |

## 3VA molded case circuit breakers conform to the following national standards

Please go to (<a href="http://www.siemens.com/3VA-Documentation">http://www.siemens.com/3VA-Documentation</a>) for a list of national standards to which 3VA molded case circuit breakers conform.

## Certification by marine classification societies

You can find a list of certifications by marine classification societies for 3VA molded case circuit breakers at (http://www.siemens.com/3VA-Documentation).

## Disposal of waste electronic equipment



Waste electronic equipment must not be disposed of as unsorted municipal waste, e.g. household waste. When disposing of waste electronic equipment, the current local national/international regulations must be observed.

ESD guidelines

## B.1 Electrostatic sensitive devices (ESD)

ESD components are destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged. ESD components which have been subject to such voltage are usually not recognized immediately as being defective, because the malfunction does not occur until after a longer period of operation.

#### **ESD Guidelines**

#### NOTICE

#### Electrostatic sensitive devices

Electronic modules contain components that can be destroyed by electrostatic discharge. These modules can be easily destroyed or damaged by improper handling.

- You must discharge your body electrostatically immediately before touching an
  electronic component. To do this, touch a conductive, grounded object, e.g., a bare
  metal part of a switch cabinet or the water pipe.
- Always hold the component by the plastic enclosure.
- Electronic modules should not be brought into contact with electrically insulating
  materials such as plastic film, plastic parts, insulating table supports or clothing made of
  synthetic fibers.
- Always place electrostatic sensitive devices on conductive bases.
- Always store and transport electronic modules or components in ESD-safe conductive packaging, e.g. metallized plastic or metal containers. Leave the component in its packaging until installation.

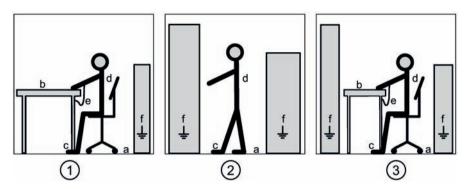
#### NOTICE

#### Storage and transport

If you have to store or transport the component in non-conductive packaging, you must first pack the component in ESD-safe, conductive material, e.g., conductive foam rubber, ESD bag.

## B.1 Electrostatic sensitive devices (ESD)

The diagrams below illustrate the required ESD protective measures for electrostatic sensitive devices.



- (1) ESD seat
- (2) ESD standing position
- (3) ESD seat and ESD standing position

#### Protective measures

- a Conductive floor
- b ESD table
- c ESD footwear
- d ESD smock
- e ESD bracelet
- f Cubicle ground connection

Figure B-1 ESD work center

## C.1 List of abbreviations

## Overview

Table C- 1 Meaning of abbreviations used in this document

| Abbreviation                 | Meaning   |  |
|------------------------------|---|--|
| AC                           | Alternating voltage   |  |
| ACT                          | ACTIVE (ready signal)   |  |
| AL                           | ALARM (pre-alarm)   |  |
| ASCII<br>[Modbus interface]  | American Standard Code for Information Interchange  |  |
| ATAM                         | Adjustable Thermal Adjustable Magnetic Trip Unit (adjustable thermal overload release, adjustable magnetic trip unit with short-circuit protection) |  |
| ATFM                         | Adjustable Thermal Fixed Magnetic Trip Unit (adjustable thermal overload release, permanently set magnetic trip unit with short-circuit protection) |  |
| ATSE                         | Automatic Transfer Switching Equipment  |  |
| AUX                          | Auxiliary switch  |  |
| С                            | Common  |  |
| CB-S                         | Circuit Breaker Switch (standard auxiliary switch (NO contact))   |  |
| CD                           | Compact Disk  |  |
| COM-DO                       | COM-Draw-out-Kit  |  |
| DC                           | Direct voltage  |  |
| DIN                          | Deutsches Institut für Normierung e. V. (German Institute for Standardization)  |  |
| DISCON                       | DISCONNECT  |  |
| DO                           | Draw out  |  |
| EFB                          | External Function Box   |  |
| ESD                          | Electrostatic sensitive devices   |  |
| EMC                          | Electromagnetic compatibility   |  |
| EN                           | European standard   |  |
| ETU                          | Electronic trip unit  |  |
| FTAM                         | Fixed thermal adjustable magnetic trip unit (permanently set thermal overload release, adjustable magnetic trip unit with short-circuit protection) |  |
| FTFM                         | Fixed thermal fixed magnetic trip unit (permanently set thermal overload release, permanently set magnetic trip unit with short-circuit protection) |  |
| G                            | Ground fault (protection)   |  |
| GF [tripping characteristic] | Ground fault  |  |
| HH-fuse                      | High-voltage fuses  |  |

| Abbreviation                   | Meaning   |  |  |
|--------------------------------|---|--|--|
| 1                              | Instantaneous (short-circuit protection)  |  |  |
| 1                              | Isolated  |  |  |
| 1/0                            | Input / Output  |  |  |
| IEC                            | International Electrotechnical Commission   |  |  |
| INST [tripping characteristic] | INST [tripping characteristic]  |  |  |
| INSTA                          | Final distribution area   |  |  |
| IP                             | International Protection  |  |  |
| IT                             | Injection Tester  |  |  |
| IT                             | Isolated ground, French: "Isolé Terre"  |  |  |
| L                              | Long-time delay (overload protection)   |  |  |
| L                              | Overload release  |  |  |
| LBS                            | Load Break Switch (switch disconnector)   |  |  |
| LCS                            | Leading changeover switch   |  |  |
| LI                             | Overload protection (L) and instantaneous short-circuit protection (I)  |  |  |
| LIG                            | Overload protection (L), instantaneous short-circuit protection (I) and ground-fault protection (G)   |  |  |
| LIN                            | Overload protection (L), instantaneous short-circuit protection (I) and neutral-conductor protection (N)  |  |  |
| LSI                            | Overload protection (L), short-time delayed short-circuit protection (S) and instantaneous short-circuit protection (I)                                   |  |  |
| LSIN                           | Overload protection (L), short-time delayed short-circuit protection (S), instantaneous short-circuit protection (I) and neutral-conductor protection (N) |  |  |
| LSING                          | Overload protection (L), short-time delayed short-circuit protection (S), instantaneous short-circuit protection (I) and ground-fault protection (N)      |  |  |
| LT [tripping characteristic]   | Partial overload range of the characteristic curve of a switching device  |  |  |
| MCCB                           | Molded case circuit breaker   |  |  |
| МО                             | Motor operator  |  |  |
| MRCD                           | Modular residual current device [without integrated trip device]  |  |  |
| N                              | Neutral conductor   |  |  |
| NC                             | Normally closed contact   |  |  |
| NEMA                           | National Electrical Manufacturers Association   |  |  |
| NFPA                           | National Fire Protection Association  |  |  |
| NO                             | Normally open contact   |  |  |
| LV                             | Low voltage   |  |  |
| LV fuse                        | Low-voltage fuse  |  |  |
| PAC                            | Power Analysis & Control  |  |  |
| PI                             | Plug-in (unit)  |  |  |
| RCD                            | Residual Current Device   |  |  |
| R                              | RESET   |  |  |
| RCR                            | Residual Current Release  |  |  |
| REC                            | Reclose (automatic reset)   |  |  |
| RJ [connector]                 | Registered Jack   |  |  |

| Abbreviation              | Meaning   |  |
|---------------------------|---|--|
| RMS                       | Root Mean Square  |  |
| RS [interface]            | Formerly: Radio Selector; now usually: Recommended Standard   |  |
| RTU<br>[Modbus interface] | Remote Terminal Unit  |  |
| SAS                       | Short circuit alarm switch  |  |
| PLC                       | Programmable logic controller   |  |
| ST                        | Shunt trip  |  |
| STF                       | Shunt trip flexible   |  |
| STL                       | Shunt trip left   |  |
| T                         | Test  |  |
| T [IT systems]            | French: Terre (ground)  |  |
| TC                        | Test device for molded case circuit breaker or MRCD, suitable for systems with grounded phase               |  |
| TCP                       | Transmission Control Protocol   |  |
| TD                        | Test Device   |  |
| TM                        | Thermal Magnetic  |  |
| TMTU                      | Thermal Magnetic Trip Unit  |  |
| TRIP-IND                  | TRIP INDICATOR (trip alarm switch)  |  |
| TRUE RMS                  | TRUE root-mean-square   |  |
| TU                        | Trip Unit   |  |
| UAR                       | Universal release   |  |
| UL                        | Underwriters Laboratories Inc.  |  |
| UR                        | Undervoltage release  |  |
| USB                       | Universal Serial Bus  |  |
| UPS                       | Uninterruptible power supply  |  |
| UVR                       | Undervoltage release  |  |
| VDE                       | Verband der Elektrotechnik Elektronik Informationstechnik e.V. (Association of German Electrical Engineers) |  |
| VDI                       | Verein Deutscher Ingenieure (Association of German Engineers)   |  |
| ZSI                       | Zone selective interlocking   |  |

Table C- 2 Meanings of symbols and abbreviations

| Sym-                   | Meaning   |
|------------------------|---|
| bol/abbreviation       | i wearing   |
| Δt                     | Delay time  |
| ∕∆n                    | Residual current; rated residual current; response current  |
| <i>I</i> <sub>1</sub>  | Inrush current  |
| <b>/</b> 'kG           | Initial balanced short-circuit current  |
| <i>P</i> t             | Let-through energy  |
| <b>/</b> B             | Take-over current   |
| Ь                      | Pickup value blocking protection  |
| <b>/</b> cm            | Making capacity; rated short-circuit making capacity  |
| <b>/</b> cn            | Rated breaking capacity; rated short-circuit breaking capacity  |
| <i>I</i> <sub>CS</sub> | Maximum short-circuit breaking capacity (partial selectivity); rated service short-circuit breaking capacity  |
| <i>I</i> <sub>cu</sub> | Maximum short-circuit breaking capacity (full selectivity); rated ultimate short-circuit breaking capacity  |
| / <sub>cw</sub>        | Rated short-time withstand current; rated short-time current  |
| <b>/</b> d             | Prospective current; residual current; response residual current  |
| Ь                      | Let-through current   |
| <b>/</b> g             | Ground-fault protection; ground-fault release; ground-fault current setting value   |
| <i>I</i> <sub>1</sub>  | Instantaneous tripping current; instantaneous short-circuit protection; instantaneous magnetic protection; rated tripping current of instantaneous trip   |
| <b>k</b>               | Short-circuit current   |
| ∕kD                    | Uninterrupted short-circuit current   |
| ∕k MAX                 | Maximum short-circuit current   |
| /kmaxline              | Uninterrupted short-circuit current of system   |
| <b>I</b> n             | Rated operational current   |
| <b>/</b> nG            | Rated operational current (generator)   |
| <b>/</b> P             | Rated peak withstand current, impulse short-circuit current   |
| $I_{ m q}$             | Rated conditional short-circuit current that a switching device (e.g. power contactor,) protected by a short-circuit protective device (e.g. motor protection breaker) can carry for the duration of the tripping delay of the protective device. |
| l <sub>r</sub>         | Thermal protection; setting current; response value; current setting value of adjustable overload protection (pickup value overload protection)   |
| ls .                   | Limit current with selectivity; maximum short-circuit current for selectivity limit   |
| /sc                    | Prospective current   |
| <b>I</b> sd            | Short-time delayed tripping current; response current of S protection; short-time delayed short-circuit release; short-time delayed short-circuit protection; delay time of S protection  |
| <b>/</b> th            | Conventional free-air thermal current   |
| ſυ                     | Rated uninterrupted current   |
| <i>R</i> A             | Contact resistance of exposed conductive part ground  |
| <i>t</i> <sub>1</sub>  | Time of inrush current  |
| <i>t</i> <sub>2</sub>  | Ramp up time  |
| <i>t</i> A             | Safety clearance  |

| Sym-<br>bol/abbreviation | Meaning   |
|--------------------------|---|
| <i>t</i> b               | Delay time (delay of blocking time)   |
| <i>t</i> d               | Response time   |
| <i>t</i> <sub>g</sub>    | Delay time associated with the adjustable response current; trip time associated with ground-fault current setting value                  |
| <i>t</i> i               | "Virtual" trip time of I protection; highest trip time associated with rated tripping current of instantaneous trip                       |
| $\mathcal{T}_p$          | Trip time; delay time; time-lag class   |
| <i>t</i> r               | Trip time associated with current setting value of adjustable overload protection   |
| <i>t</i> sd              | Trip time associated with short-time delayed tripping current; delay time of S protection   |
| <i>t</i> s               | Fuse pre-arcing time  |
| <i>t</i> zsı             | Delay time of all molded case circuit breakers which detect the short circuit but do not receive a blocking signal when ZSI is activated. |
| U                        | Voltage across main contacts of the molded case circuit breaker   |
| <i>U</i> e               | Maximum voltage; rated operational voltage  |
| $U_{Nn}$                 | Nominal system voltage  |

Conversion tables

The U.S. units can be converted to the corresponding European/metric units using the conversion tables listed.

#### Note

### No liability assumed for completeness or accuracy

No liability can be assumed for the completeness or accuracy of the values listed in this section of the manual.

#### Conversion of North American cross section dimensions into metric cross section dimensions

Metric cross-sections in accordance with VDE (Verband Deutscher Elektroingenieure (Association of German Electrical Engineers)) (mm²) ↔ conductor cross-sections in accordance with AWG (American Wire Gauge) or kcmil (Thousand Circular Mils)

AWG ↔ mm<sup>2</sup> conversion table

|     | AWG / kcmil | Diameter<br>d/mm    | mm²  | Metric equivalent [mm²] |
|-----|-------------|---------------------|------|-------------------------|
|     | 20          | 0.81 1)             | 0.52 | 0.75                    |
|     | 18          | 1.02 1)             | 0.82 | 1                       |
|     | 16          | 1.29 <sup>1)</sup>  | 1.3  | 1.5                     |
|     | 14          | 1.63 <sup>1)</sup>  | 2.08 | 2.5                     |
|     | 12          | 2.05 <sup>1)</sup>  | 3.31 | 4                       |
|     | 10          | 2.59 <sup>1)</sup>  | 5.26 | 6                       |
|     | 8           | 3.26 1)             | 8.4  | 10                      |
|     | 6           | 4.12 <sup>1)</sup>  | 13.3 | 16                      |
|     | 4           | 5.19 <sup>1)</sup>  | 21.2 | 25                      |
|     | 2           | 6.54 <sup>1)</sup>  | 33.6 | 35                      |
|     | 1           | 7.34 1)             | 42.4 | 50                      |
| AWG | 1 / 0       | 8.25 <sup>1)</sup>  | 53.5 | _                       |
|     | 2/0         | 9.27 <sup>1)</sup>  | 67.4 | 70                      |
|     | 3 / 0       | 10.4 1)             | 85.0 | 95                      |
|     | 4/0         | 11.68 <sup>1)</sup> | 107  | 120                     |

<sup>1)</sup> Diameters over Solid Conductors and Cross-Sectional Area for All Solid and Stranded Conductors Source: Standard UL 83

## kcmil ↔ mm<sub>2</sub> conversion table

|       | AWG / kcmil | Diameter<br>d/mm    | mm²  |
|-------|-------------|---------------------|------|
|       | 250         | 14.6 <sup>1)</sup>  | 126  |
|       | 300         | 16 <sup>1)</sup>    | 152  |
|       | 350         | 17.3 <sup>1)</sup>  | 177  |
|       | 400         | 18.49 <sup>1)</sup> | 203  |
|       | 500         | 20.65 1)            | 253  |
|       | 600         | 22.68 1)            | 304  |
|       | 800         | 26.16 <sup>1)</sup> | 405  |
| kcmil | 1000        | 29.26 <sup>1)</sup> | 507  |
|       | 1500        | 35.86 <sup>1)</sup> | 760  |
|       | 2000        | 41.45 <sup>1)</sup> | 1010 |

<sup>1)</sup> Diameter over Round Concentric-Lay-Stranded Conductors for Classes B, C and D Source: Standard UL83

## Other conversions

## Conversion factors for units of length

| Length       | Conversion factor     |
|--------------|-----------------------|
| 1 inch (")   | 25.4 millimeters (mm) |
| 1 centimeter | 0.3937 inches (")     |

## Conversion factors for units of weight

| Weight          | Conversion factor    |
|-----------------|----------------------|
| 1 ounce (Oz.)   | 28.35 grams (g)      |
| 1 pound (lb.)   | 0.454 kilograms (kg) |
| 1 kilogram (kg) | 2.205 pounds (lb.)   |

Pound (lb.)

Ounce (Oz.)

## Conversion for units of temperature

| Temperature                 |                             |
|-----------------------------|-----------------------------|
| 100 degrees Centigrade (°C) | 212 degrees Fahrenheit (°C) |
| 80 °C                       | 176 °F                      |
| 60 °C                       | 140 °F                      |
| 40 °C                       | 104 °F                      |
| 20 °C                       | 68 °F                       |
| 0 °C                        | 32 °F                       |

| Temperature |         |
|-------------|---------|
| - 5 °C      | 23 °F   |
| - 10 °C     | 14 °F   |
| - 15 °C     | 5 °F    |
| - 20 °C     | - 4 °F  |
| - 25 °C     | - 13 °F |
| - 30 °C     | - 22 °F |

## Conversion factors for tightening torques

| Tightening torque       | Conversion factor                           |
|-------------------------|---|
| 1 Newton meter (Nm)     | 8.85 lbFin, 8.85 lb-in (inch-pound)         |
| 1.36 Newton meter (Nm)  | 1 lbFft, 1 lb-ft (food-pound)               |
| 0.113 Newton meter (Nm) | 1 lbFin, 1 lb-in (inch-pound); 1 / 12 lb-ft |

## Glossary

## **AUTO**

Method of remote operation of the motor operators via control cables, e.g. PLC.

## **Breaking capacity**

The breaking capacity is the rms value of the current at a specific  $\cos \phi$  (power factor) and a specific voltage which can be safely interrupted by a switching device or fuse under prescribed conditions. The rms value of the symmetrical component applies in the case of alternating current.

#### I2t characteristic

The Pt characteristic is a curve which represents the minimum or maximum values of Pt in relation to break times as a function of the prospective current under defined operating conditions.

#### I2t value

The Pt value is the thermal value of a prospective or a limited short-circuit current (let-through current).

## Let-through current

The let-through current h is the maximum instantaneous current value during the breaking time of a switching device or fuse. Limited short-circuit currents occur if the switching device reduces the amplitude of the short-circuit current due to, for example, resistance, switching delay and peak arc voltage. The let-through current of a device such as a current-limiting fuse or a current-limiting molded case circuit breaker determines the thermal load (Pt value) imposed on equipment connected downstream of the device (current limiting).

#### **LOCK**

Operating mode of motor operators; the operating mechanism is locked and cannot be operated.

### Making capacity

The making capacity is the value of the prospective making current which the switching device can safely conduct at the instant of closing under prescribed conditions for a specific circuit.

For molded case circuit breakers, the making capacity is expressed as the maximum possible instantaneous value of the potential prospective current at the input terminals for the specified voltage.

## **MANUAL**

Local, manual operating mode of motor operators.

#### Protective characteristic

The protective characteristic is determined by the rated operational current and the setting and tripping values of the circuit breaker.

## Rated breaking capacity

The rated breaking capacity is the maximum current that can be interrupted by a switching device under certain conditions.

## Rated frequency

Design frequency for a switching device and reference value for other characteristics of the device.

## Rated making capacity

The rated making capacity is the maximum current that a switching device can conduct at the instant of closing in accordance with the utilization category at the relevant rated operational voltage.

## Rated operational current

The rated operational current  $l_n$  for molded case circuit breakers is equivalent to the rated uninterrupted current  $l_n$  and to the conventional free-air thermal current  $l_n$ .

#### Rated operational voltage

The rated operational voltage  $U_e$  of a switching device, e.g. a molded case circuit breaker, is the voltage which serves as a reference to state other characteristics of the device. The maximum rated operational voltage must never be higher than the rated insulation voltage.

With multi-phase circuits, the specified voltage is generally the phase-to-phase voltage.

#### Rated peak withstand current, impulse short-circuit current

Maximum permissible instantaneous (peak) value of the prospective short-circuit current in the current path under the highest load. It characterizes the dynamic short-circuit strength of a switching device.

#### Rated residual current

The rated residual current  $I_{\Delta n}$  is the fault (residual) current for which residual current-operated circuit breakers are designed. The residual current rating is declared on the rating plate of the device.

## Rated service short-circuit breaking capacity

The rated service short-circuit breaking capacity  $k_{\rm S}$  is the short-circuit current determined by the operational voltage that a molded case circuit breaker is capable of interrupting repeatedly (test sequence 0 - C0 - CO, formerly P - 2). After a molded case circuit breaker has interrupted a short circuit, it can continue to carry the rated operational current despite increased self-heating and will trip again in the event of a short circuit.

## Rated short-circuit breaking capacity

The rated short-circuit breaking capacity  $I_{cn}$  of a molded case circuit breaker is the maximum current that the circuit breaker can safely interrupt at a specific rated operational voltage and rated frequency. It is specified as an rms value.

With AC molded case circuit breakers, the rated short-circuit breaking capacity must be independent of the magnitude of the DC component. The rated short-circuit breaking capacity also ensures that the molded case circuit breaker can interrupt every current up to the rated short-circuit breaking capacity in the event of a line-frequency recovery voltage with 110% of the rated operational voltage.

This applies:

- To alternating current at every value of the power factor, but not lower than the value defined in the relevant test specification.
- To direct current (unless otherwise specified by the manufacturer) with every time constant, but not greater than the value defined in the relevant test specification.

The short-circuit breaking capacity does not apply in the event of a recovery voltage at line frequency above 110% of the rated operational voltage.

#### Rated short-circuit making capacity

The rated short-circuit making capacity  $k_m$  of a molded case circuit breaker is the maximum current that the circuit breaker can safely interrupt at a specific rated operational voltage and rated frequency. Unlike other characteristic data, this is specified as a peak value.

With AC molded case circuit breakers, the rated short-circuit making capacity must be at least equal to the rated short-circuit breaking capacity multiplied by a factor n.

The rated short-circuit making capacity is calculated to allow the molded case circuit breaker to conduct the current during closing at a voltage of up to 110% inclusive of the rated operational voltage.

#### Rated short-time current

Permissible rms value of the AC component of the prospective short-circuit current which the switching device is capable of conducting for a specific time period, e.g. from 0.05 s to 1 s (thermal short-circuit strength).

#### Rated short-time withstand current

The rated short-time withstand current  $l_{cw}$  is specified as an rms value of the short-circuit current and characterizes the thermal strength of a circuit of a switchgear assembly under brief load conditions. The rated short-time withstand current calculation normally refers to a period of 1 s. The reference time must be specified if it deviates from the above. The rated short-time withstand current is specified for the distribution and/or main busbars of a switchgear assembly.

### Rated ultimate short-circuit breaking capacity

The rated ultimate short-circuit breaking capacity  $k_u$  is the maximum short-circuit current that a molded case circuit breaker is capable of interrupting (test sequence 0 - C0, formerly P - 1). After the molded case circuit breaker has cleared the short circuit, it is capable of tripping with increased tolerances under overload conditions.

Limit value of rated ultimate short-circuit breaking capacity Lu.

## Rated uninterrupted current

The rated uninterrupted current h of a switching device, e.g. a molded case circuit breaker, is a current that the device can conduct in uninterrupted operation (for weeks, months or years). This current is specified by the manufacturer.

#### Rating

The rating is the power that a switching device is capable of switching at the associated rated operational voltage in accordance with the utilization category, e.g. power contactor utilization category AC-3:37 kW at 400 V.

#### Remote control

Or AUTO; method of remote operation of the motor operators via control cables, e.g. PLC.

#### Short circuit

Connection with a negligibly low impedance between two points of different potential in an electric circuit. The short-circuit current is a multiple of the rated operating current. Short circuits can cause thermal or mechanical damage to switching devices and other parts of an electrical installation.

### Short-circuit strength

This is the resistivity of a switching device in the closed state, along with its components (e.g. releases), or a complete switchboard, to the electrodynamic and thermal stresses which arise in the event of a short circuit.

The characteristic for the dynamic stress is the rated peak withstand current, which is the maximum instantaneous value of the short-circuit current.

The characteristic for the thermal stress of the short-circuit current is the root-mean-square value of the short-circuit current throughout its duration.

### Tripping current of overload release

The current value at which a trip unit trips within a specified time.

## Tripping current, ground fault

When the ground-fault current reaches or exceeds this limit value, the ground-fault protection, for example, of a molded case circuit breaker, is tripped.

## Tripping current, instantaneous

When this current limit is exceeded, the circuit breaker trips instantaneously.

## Tripping current, overload

When this uninterrupted current limit is exceeded within a predefined time period, the circuit breaker trips (inverse-time delayed tripping!).

#### Tripping current, short-time delayed

When this current limit is exceeded, the circuit breaker trips after a predefined time delay.

#### Tripping time

Period of time from the instant of commencement of trip command output to the moment at which the command becomes irrevocable (timing concept for the tripping of circuit breakers).

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## **Further Information**

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