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**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.

<table>
<thead>
<tr>
<th><strong>DANGER</strong></th>
<th>indicates that death or severe personal injury will result if proper precautions are not taken.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WARNING</strong></td>
<td>indicates that death or severe personal injury may result if proper precautions are not taken.</td>
</tr>
<tr>
<td><strong>CAUTION</strong></td>
<td>indicates that minor personal injury can result if proper precautions are not taken.</td>
</tr>
</tbody>
</table>

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.

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Note the following:

| **WARNING** | 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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1.1 Introduction

Purpose of this manual

This manual is intended for reference purposes. The information in this manual enables you to configure and operate the SENTRON 3VL system.

Audience

This manual is aimed at people with the required qualifications to commission and operate the SENTRON 3VL system.

1.2 Technical Support

You can find further support on the Internet at:

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

Validity

This manual applies to SENTRON molded case circuit breakers with the following designations:

- VL160X
- VL160
- VL250
- VL400
- VL630
- VL800
- VL1250
- VL1600

Standards and certifications

The 3VL molded case circuit breakers comply with the following regulations:

- IEC 60947-2 / DIN EN 60947-2
- IEC 60947-1 / DIN EN 60947-1
- Isolating features in accordance with IEC 60947-2 / DIN EN 60947-2
- As a network disconnecting device (main control switches) according to EN 60204 and DIN VDE 0113, and additionally also with the requirements for "disconnecting units with features for stopping and switching off in an emergency" (EMERGENCY-STOP switches) in conjunction with lockable rotary operating mechanisms (red-yellow) and terminal covers. Not in conjunction with motorized operating mechanisms.

Operating conditions

Suitable enclosures must be provided for operation in areas with severe ambient conditions (such as dust, caustic vapors, hazardous gases).
Disclaimer of liability

The products described here were developed to perform safety-oriented functions as part of an overall installation or machine. A complete safety-oriented system generally features sensors, evaluation units, signaling units, and reliable shutdown concepts. It is the responsibility of the manufacturer to ensure that a system or machine is functioning properly as a whole. Siemens AG, its regional offices, and associated companies (hereinafter referred to as "Siemens") cannot guarantee all the properties of a whole plant or machine that has not been designed by Siemens.

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See also

Standards and specifications (Page 308)
2.2 Ordering data

Order number scheme

The table below describes the order number scheme according to which all circuit breakers can be located and combined to suit the individual application:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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<th>14</th>
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<th>16</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>V</td>
<td>L</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>A</td>
<td>N</td>
<td>N</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
</tr>
</tbody>
</table>

- **Size**
- **Version (ANSI/UL - IEC)**
- **Rated current**
- **Breaking capacity**
- **Overcurrent release**
- **Number of poles**
- **Installation method and connections**
- **Shunt release and under-voltage release**
- **Auxiliary current and alarm switches**

(N = numeric, A = alphanumeric value)

Figure 2-1 Overview of the order number system
3.1 Overview 3VL

3VL molded case circuit breakers are climate-proof. They are designed for operation in enclosed areas. Suitable enclosures must be provided for operation in areas with severe ambient conditions (such as dust, caustic vapors, hazardous gases).

SENTRON VL types

The type designations of all available molded case circuit breakers are oriented around the rated current.

<table>
<thead>
<tr>
<th>Type designation</th>
<th>Maximum rated current (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X / 3VL1</td>
<td>160</td>
</tr>
<tr>
<td>VL160 / 3VL2</td>
<td>160</td>
</tr>
<tr>
<td>VL250 / 3VL3</td>
<td>250</td>
</tr>
<tr>
<td>VL400 / 3VL4</td>
<td>400</td>
</tr>
<tr>
<td>VL630 / 3VL5</td>
<td>630</td>
</tr>
<tr>
<td>VL800 / 3VL6</td>
<td>800</td>
</tr>
<tr>
<td>VL1250 / 3VL7</td>
<td>1250</td>
</tr>
<tr>
<td>VL1600 / 3VL8</td>
<td>1600</td>
</tr>
</tbody>
</table>
Rating plate and ID number

The figure shows all the operator elements, setting options and names corresponding to the precise specified use of the molded case circuit breaker.

Figure 3-1  3VL molded case circuit breakers - labeling and operator controls
SENTRON VL accessories

(1) Withdrawable/plug-in base
(2) Side panels of withdrawable unit
(3) Phase barriers
(4) Front connecting bars for increased pole spacing
(5) Straight connecting bars
(6) Circular conductor terminal for Al / Cu
(7) Box terminal for Cu
(8) Extended terminal cover
(9) Standard terminal cover
(10) Masking/cover frame for door cutout
(11) Motorized operating mechanism with stored energy mechanism (SEO)
(12) Motorized operating mechanism (MO)
(13) Front-operated rotary operating mechanism
(14) Door-coupling rotary operating mechanism
(15) 3VL molded case circuit breaker
(16) Internal accessories
(17) Electronic trip unit LCD ETU
(18) Electronic trip unit with communication function
(19) Thermal/magnetic overcurrent release
(20) RCD module
(21) Rear terminals - flat and round
(22) COM20 / 21 communication module to the PROFIBUS DP / MODBUS RTU
(23) Battery power supply with test function for electronic trip units (ETUs)

Figure 3-2  SENTRON VL accessories
### 3.2 Application overview

The following overview shows the most frequently occurring applications.

#### Application overview

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<th>Description</th>
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</thead>
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<td>3- and 4-pole molded case circuit breakers</td>
<td>VL160X, VL160, VL250, VL400, VL630, VL800, VL125, VL1600</td>
<td><strong>System protection</strong>&lt;br&gt;The releases for system protection are designed to protect cables and non-motorized loads against overload and short-circuit.</td>
</tr>
<tr>
<td>3- and 4-pole molded case circuit breakers</td>
<td>VL160, VL250, VL400, VL630, VL800, VL125, VL1600</td>
<td><strong>Generator protection</strong>&lt;br&gt;The overload and short-circuit releases can be used for optimized protection of generators.</td>
</tr>
<tr>
<td>3-pole molded case circuit breakers</td>
<td>VL160, VL250, VL400, VL630</td>
<td><strong>Motor protection</strong>&lt;br&gt;The overload and short-circuit releases are designed for optimal protection and direct starting of three-phase AC 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.</td>
</tr>
</tbody>
</table>
### 3.2 Application overview

#### 3-pole molded case circuit breakers

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<th>Type</th>
<th>Description</th>
</tr>
</thead>
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<tr>
<td>VL160</td>
<td>Starter combination: molded case circuit breaker + contactor + overload relay. The molded case circuit breaker handles short-circuit protection and the isolating function. The contactor has the task of switching the load feeder normally. The overload relay handles overload protection that can be specially matched to the motor. The molded case circuit breaker for starter combination is therefore equipped with an adjustable and instantaneous short-circuit release.</td>
</tr>
<tr>
<td>VL250</td>
<td></td>
</tr>
<tr>
<td>VL400</td>
<td></td>
</tr>
<tr>
<td>VL630</td>
<td></td>
</tr>
</tbody>
</table>

#### 3- and 4-pole molded case circuit breakers

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X</td>
<td>Non-automatic air circuit breakers: These molded case circuit breakers are used as incoming circuit breakers, main switches or isolating switches without overload protection. They have fixed short-circuit releases so that back-up fuses are not necessary.</td>
</tr>
<tr>
<td>VL160</td>
<td></td>
</tr>
<tr>
<td>VL250</td>
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3.3 Configuration

3.3.1 Functional principle

Mechanical design

All 3VL molded case circuit breakers have a trip-free mechanism that ensures the trip process is not prevented even if the operating mechanism is blocked or manually held in the "ON" position.

The contacts are opened and closed by a toggle lever positioned in the center. This is attached to the front side on all molded case circuit breakers.

All 3VL molded case circuit breakers are "joint trip units". This means all contacts open or close simultaneously when the molded case circuit breaker toggle lever is moved from "OFF" to "ON" or from "ON" to "OFF", or when the tripping mechanism is activated by an overcurrent or with the help of the auxiliary trips (shunt release or undervoltage release).

Current limiting

The 3VL molded case circuit breakers are designed on the principle of magnetic repulsion of the contacts. The contacts open before the expected peak-value of the short-circuit current is reached. Magnetic repulsion of the contacts very considerably reduces the thermal load $I^2t$ as well as the mechanical load resulting from the impulse short-circuit current $I_p$ of the system components that occur during a short-circuit.

You can find more information in the chapter Use in motor protection (Page 64).

3.3.2 Subdivision according to power ranges

VL160X molded case circuit breakers

The most important components of the VL160X molded case circuit breakers are the three current paths with the incoming and outgoing terminals. The fixed and movable contacts are arranged in such a way as to guarantee magnetic repulsion of the contacts. In conjunction with the arcing chambers, a dynamic impedance is generated that causes current limitation. This reduces the damaging effects of excessively high values $I^2t$ and $I_p$.

The overcurrent release is a factory-installed thermal-magnetic device. It is equipped with fixed or adjustable overload releases and a fixed short-circuit release in each pole.

To the right and left of the centrally positioned toggle lever of every SENTRON VL molded case circuit breaker is a double-insulated accessory compartment for installing auxiliary switches or alarm switches as well as shunt releases and undervoltage releases.
3.3 Configuration

3VL IEC molded case circuit breakers

The arrangement of current paths, contact configuration and switch mechanism of the VL160 to VL630 molded case circuit breakers corresponds to that of the VL160X molded case circuit breaker. The designs diverge with regard to the overcurrent release.

- The overcurrent releases are available in a thermal-magnetic version and in an electronic version.
- Thermal-magnetic overcurrent releases are available with adjustable overload releases and short-circuit releases.

VL800 to VL1600 molded case circuit breakers

The arrangement of the current paths and switch mechanisms is identical to that of the VL160X to VL630 molded case circuit breakers.

However, the VL800 to VL1600 molded case circuit breakers are only available in the version with electronic trip unit. As with all electronic trip units for the SENTRON VL molded case circuit breakers from Siemens, the current transformers (one per phase) are accommodated within the overcurrent release enclosure.

All 3VL molded case circuit breakers with electronic trip units measure the actual RMS current. This method is the most accurate way of measuring currents in electrical distribution systems with extremely high harmonics.

3.3.3 Thermal-magnetic overcurrent trip units

A thermal-magnetic overcurrent release consists of two components - a thermal release for protecting against overload, and a magnetic release for protecting against short-circuit. Both release components are series-connected.

Thermal release

The thermal release consists of a temperature-dependent bimetal that heats up as a result of the flow of current. This means the release is current-dependent. The heating of the bimetal strip depends on the ambient temperature of the molded case circuit breaker. All current values specified for 3VL for thermal-magnetic releases refer to an ambient temperature of 40 °C. Where ambient temperatures deviate from this, the values in the tables in the chapter Use at altitudes above 2000 meters (Page 142) are to be used.
Magnetic release

The magnetic release 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 now 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 release time is almost current-independent and instantaneous. The flap armature releases the switching lock and thus opens the switching contacts before the short-circuit current can reach its maximum; a current limiting effect is thus achieved. Immediately after release, the flap armature is moved back to its starting position by the opposite force of the tension spring.

3.3.4 Electronic overcurrent trip unit (ETU)

Electronic trip units (ETUs)

In contrast to thermal-magnetic releases/trip units (TMTUs) where the overcurrent trip is caused by a bimetal strip or magnetic release, electronic trip units (ETUs) use electronics with current transformers. The ETU captures the actual currents and compares them with the default specifications.

All 3VL molded case circuit breakers with electronic overcurrent trips measure the actual RMS current (true RMS). This is the most accurate method of measuring.

ETUs are available from the VL160 molded case circuit breaker up to and including the VL1600. The VL800, VL1250 and VL1600 molded case circuit breakers are only available in the version with electronic trip unit.

Configuration

The electronic overcurrent tripping system consists of:

- 3 to 4 (3-pole or 4-pole) current transformers that also provide their own power supply. This means an external auxiliary voltage is not required.
- Evaluation electronics with microprocessor
- Tripping solenoid

In all versions with electronic trip units for the 3VL molded case circuit breakers, the current transformers are located in the same enclosure as the trip unit. At the output of the electronic overcurrent tripping module, there is a tripping solenoid that trips the molded case circuit breaker in the event of an overload or short-circuit. In all electronic trip units, the tripping solenoid is located within the trip unit, except in the shipbuilding ETUs of sizes VL160 and VL250. In these ETUs, the tripping solenoid is located in the left accessories compartment.

Power supply

The protection functions of the electronic trip unit are guaranteed without additional auxiliary voltage. The overcurrent releases are supplied with energy via internal current transformers. The protection function is set via rotary encoding switches on the ETU or via an LCD display.
In the case of an LCD display, the electronic trip unit must be activated. This requires a 3-phase (3-pole) load current of at least 20% or, in the case of a single-phase (single-pole) load, 30% of the relevant rated current of the molded case circuit breaker. If this load current is not available, the necessary auxiliary energy can be supplied via a battery power supply (order no. 3VL9000-8AP01). With communication-capable, molded case circuit breakers, the trip unit is powered by means of the COM20 or COM21 module.

Battery supply device

The handheld tester for electronic trip units is used as a local test device for the 3VL molded case circuit breakers with electronic trip unit, and it can be used as an external voltage supply for the electronic trip units (ETU and LCD-ETU). The portable battery power supply is fed by two standard 9 V block batteries.

Test function:

- Test tripping

![Battery supply device](image)

Figure 3-3  Battery supply device

4-pole molded case circuit breakers

The four-pole molded case circuit breakers for system protection can be supplied in all 4 poles with or without current transformers. The trip units in the 4th pole (N) can be set to 50% or 100% of the current in the 3 main current paths dependent on the size, so that safe protection of the neutral conductor can be guaranteed even with a reduced cross-section. In the case of LCD-ETUs, the neutral conductor protection can be adjusted in steps from 50% to 100% or switched off.
3.4 Mechanical operating mechanisms

3.4.1 Toggle lever operating mechanism

In the basic version, the 3VL molded case circuit breakers have a toggle lever as actuator, which is also an indicator of the switching position. The "Tripped" position is also displayed in addition to the "ON" and "OFF" positions.

The toggle lever goes to the "tripped" position when the internal trip mechanism is activated by an overcurrent situation, e.g. overload or short-circuit, or if the Test key is operated.

Activation by an undervoltage release or shunt release will also cause the toggle lever to move to the "Tripped" position.

The toggle lever must be returned to the "OFF/RESET" position before the molded case circuit breaker can be activated again. This enables the internal release mechanism to be reset. 3VL molded case circuit breakers with toggle lever operation comply with the "Network disconnecting device" condition (5.3.2 Section c) and 5.3.3) according to DIN EN 60204-1 (VDE 0113-1) in conjunction with a locking device.

Toggle lever positions

<table>
<thead>
<tr>
<th>OFF</th>
<th>RESET</th>
</tr>
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<tbody>
<tr>
<td>Tripped</td>
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</table>

Toggle lever positions
3.4 Mechanical operating mechanisms

Toggle lever extension

Toggle lever extensions enable user-friendly operation of the molded case circuit breaker toggle lever.

- VL160X to VL250: toggle lever extension not necessary / not available
- VL400 to VL800: possible as option
- VL1250 to VL1600: included in the scope of supply / optional installation

3.4.2 Rotary mechanism on front (optional)

The front-operated rotary operating mechanism converts the vertical movement of the toggle lever into rotary motion. The molded case circuit breaker is switched on/off or tripped with the help of the front-operated rotary operating mechanism. The rotary motion on the switching knob is converted to vertical motion on the toggle lever.

The front-operated rotary operating mechanism is mounted directly on the molded case circuit breaker. 3VL molded case circuit breakers with rotary mechanism comply with the "Network disconnecting device" condition of DIN EN 60204-1 (DIN VDE 0113-1).
Product description

3.4 Mechanical operating mechanisms

Degree of protection

The front-operated rotary operating mechanism has degree of protection IP30.

Interlocking

Lockable in the "OFF" position with up to 3 padlocks.
A safety lock can also be used.

Application

Standard application:

- Black knob
- Gray indicator plate

Network disconnecting device with features for stopping and shutting down in an emergency:

- Red knob
- Yellow indicator plate

Accessories

Optionally, up to 4 changeover contacts can be used. Two contacts can be used as leading NO contacts and two contacts as leading NC contacts. These are equipped with 1.5 m long connection cables.
3.4.3 Door-coupling rotary operating mechanism (optional)

The door-coupling rotary operating mechanism is available for installation in control cabinets and distribution boards.

3VL molded case circuit breakers with door-coupling rotary mechanism comply with the "Network disconnecting device" condition of DIN EN 60204-1 (DIN VDE 0113-1)

![Diagram of door-coupling rotary operating mechanism]

Door-coupling rotary operating mechanism

The door-coupling rotary operating mechanism is designed as follows:

- Rotary mechanism on the front with shaft stub (without knob)
- Shaft coupling
- 300 mm extension shaft (600 mm optional, retaining bracket required)
- Actuator

Degree of protection

This mechanism offers degree of protection IP65.

Interlocking

Lockable in the "OFF" position with up to 3 padlocks. A safety lock can also be used.

Application

Standard application:

- Black knob
- Gray indicator plate

Network disconnecting device with features for stopping and shutting down in an emergency:

- Red knob
- Yellow indicator plate
Accessories

Leading auxiliary switches when switching ON and OFF

The leading auxiliary switches (changeover switches) are available as accessories for front-operated rotary operating mechanisms and door-coupling rotary operating mechanisms. The following applications are possible:

- Leading auxiliary switch for switching from "ON" to "OFF"
- Leading auxiliary switch for switching from "OFF" to "ON"

Each version, leading auxiliary switch for switching on and off, can be equipped with one or two changeover switches. The connecting cables of the auxiliary switches are 1.5 m long.

Figure 3-4  Rotary operating mechanism with leading auxiliary switches

3.4.4 Side panel rotary operating mechanism (optional)

The side panel rotary operating mechanism is available for installation in control cabinets and distribution boards.
Interlocking

Lockable in the "OFF" position with up to 3 padlocks.

Figure 3-5  Side panel rotary operating mechanism

The side panel rotary operating mechanism is structured as follows:

- Rotary mechanism on the front with shaft stub (without knob)
- Bowden wire operation on the switch
- 2 Bowden wires
- Bowden wire operation for panel-mounting (side panel of the distribution board)
- Actuator
Product description

3.5 Motorized operating mechanisms (optional)

Application

Standard application:
- Black knob
- Gray indicator plate

Network disconnecting device with features for stopping and shutting down in an emergency:
- Red knob
- Yellow indicator plate

Accessories

Leading auxiliary switches when switching ON and OFF

The leading auxiliary switches (changeover switches) are available as accessories for side panel rotary operating mechanisms.

The following applications are possible:
- Leading auxiliary switch for switching from "ON" to "OFF"
- Leading auxiliary switch for switching from "OFF" to "ON"

Each version, leading auxiliary switch for switching on and off, can be equipped with one or two changeover switches. The connecting cables of the auxiliary switches are 1.5 m long.

3.5 Motorized operating mechanisms (optional)

Motorized operating mechanisms enable the molded case circuit breaker to be switched on/off locally or by remote control. For electrical and mechanical locking of the operating mechanism, they are equipped as standard with a locking device for padlocks.

The motorized operating mechanism with stored energy mechanism (SEO) can be optionally equipped with a cylinder lock for locking in the OFF position.

Motorized operating mechanisms can also be actuated manually. Two types of mechanisms are offered.

Note

molded case circuit breakers with motorized operating mechanisms cannot be used as network disconnecting devices in accordance with DIN EN 60204-1 (VDE 0113-1).
3.5.1 Motorized operating mechanism with stored energy mechanism (SEO)

SEO for VL160X-VL800

- The motorized operating mechanism with stored energy mechanism (SEO) is suitable for synchronization tasks.
- The motor charges a motorized operating mechanism with stored energy mechanism and moves the SENTRON VL toggle lever to the "OFF/RESET" position.
- The motorized operating mechanism with stored energy operate discharges when actuated, quickly switching the SENTRON VL toggle lever to the "ON" position.
- A mode switch allows local (Manual) or remote (Auto) operation to be selected.
- The manual actuator handle is located on the front of the operating mechanism cover.

![Image of motorized operating mechanism with stored energy mechanism](image.png)

Figure 3-6 Motorized operating mechanism with stored energy mechanism
3.5 Motorized operating mechanisms (optional)

3.5.2 Motorized operating mechanism (MO)

Motorized operating mechanism for VL160x-VL1600

The motorized operating mechanism (MO) is required for remote switching of molded case circuit breakers. Thanks to its fast break time, it is perfectly suited to transfer control systems.

The integrated switch position indicator of the motorized operating mechanism (MO) indicates the ON, OFF and TRIP states.

The LOCAL, MANUAL or AUTO modes can be selected with the mode switch:

- **LOCAL**: Operation using pushbuttons on-site
- **MANUAL**: Manual operation with the help of an Allen key on the front of the motorized operating mechanism (MO)
- **AUTO**: Remote control via control wire

Note

The Allen key for manual operation is located on the front of the device.
Functions

4.1 Protection functions

4.1.1 Overcurrent release

The 3VL molded case circuit breakers are designed on the principle of magnetic repulsion of the contacts. The contacts open before the expected peak-value of the short-circuit current is reached. Magnetic repulsion of the contacts very considerably reduces the thermal load $I^2t$ as well as the mechanical load resulting from the impulse short-circuit current $I_p$ of the system components that occur during a short-circuit.

![Diagram of MCCB interior view](image)

(1) Main connections  
(2) Breaker mechanism  
(3) Overcurrent release  
(4) Movable contact arm  
(5) Arc chute  
(6) Enclosure

Figure 4-1 Interior view MCCB
### Functions

#### 4.1 Protection functions

4.1.2 Function overview of the overcurrent release

**VL160 to VL1600**

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<th>System protection</th>
<th>System / generator protection</th>
<th>Motor protection</th>
<th>Starter protection</th>
<th>Non-automatic circuit breakers</th>
<th>Function Release type</th>
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## Functions

### 4.1 Protection functions

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1) Size dependent  
2) TM to $I_n = 630$ A  
3) Motor protection to $I_n = 500$ A  

L: Long time delay  
S: Short time delay  
I: Instantaneous  
N: Neutral protection  
G: Ground fault
### 4.1.3 Setting options of the overcurrent release

**VL160 to VL1600**

In view of the large number of setting options of the individual overcurrent releases, an overview in table form is useful for calculating the optimal operating point.

#### Table 4-3 Overcurrent tripping method - setting options

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3VL IEC molded case circuit breakers

System Manual, 11/2013, 110 0110 - 02 DS 03
### Functions

#### 4.1 Protection functions

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1) Size dependent

2) TM to $I_n = 630$ A

3) Motor protection to $I_n = 500$ A

4) Fixed

5) With single-pole load, tripping occurs at 130% of the set instantaneous short-circuit current.

---

3VL IEC molded case circuit breakers
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### 4.1 Protection functions

#### 4.1.4 General technical data of the overcurrent release

**VL160 to VL1600**

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## Functions

### 4.1 Protection functions

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1) Size dependent
2) TM to Iₐ = 630 A
3) Motor protection to Iₐ = 500 A
4) With COM20/COM21

---

3VL IEC molded case circuit breakers
System Manual, 11/2013, 110 0110 - 02 DS 03

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Functions

4.1 Protection functions

Further information on ①, ② and ③

Further information for ①, ② and ③ can be found in chapter:

Ground-fault protection (Page 49)

Table 4- 5  Image references for ①, ② and ③

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Table 4- 6  General data II

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## 4.1 Protection functions

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2) TM to I<sub>n</sub> = 630 A
3) Motor protection to I<sub>n</sub> = 500 A
4.1.5 Differential current protection with RCD module

The molded case circuit breaker with differential current protection is very often used to implement a double function:

- Protection of systems against overload and short-circuit currents.
- Protection of cables and electrical equipment against damage from ground faults.

The SENTRON VL RCD modules are offered as accessories for the VL160X, VL160, VL250 and VL400 molded case circuit breakers with thermal-magnetic overcurrent releases. This combination is called molded case circuit breaker with differential current protection of type A. Type A means tripping is guaranteed both in the case of faults in sinusoidal alternating currents and in the case of faults in pulsating direct currents. These units have an adjustable trip time delay $\Delta t$. The values for the rated fault current $I_{\Delta n}$ can also be adjusted.

In a fault-free system, the sum of the currents in the summation current transformer of the RCD module is zero. A ground fault current occurring in the circuit as the result of an insulation fault produces a differential current that induces a voltage in the secondary winding of the current transformer. The evaluation electronics monitors the induced voltage and transmit a trip command to the RCD trip unit if the trip criterion is met. The molded case circuit breaker with differential current protection combination is designed to open the molded case circuit breaker contacts if the differential current reaches a specific value.

Note

The RCD module can only be combined with 3VL molded case circuit breakers with thermal-magnetic overcurrent release. It cannot be combined with a molded case circuit breaker with ETU.
Standard features

- **Mechanical trip display:**
  The Reset button on the RCD pops out when the RCD module trips the molded case circuit breaker.

- **Reset button:**
  This must be manually reset after the molded case circuit breaker has been tripped by the RCD module. The molded case circuit breaker can only be reset and switched on again after the RCD module has been reset.

- **Cover:**
  Modifiable settings for \( \Delta t \) and \( I_{\text{fan}} \).
  A sealable transparent cover is available for preventing modification.

- **The RCD module has three LEDs:**
  - Green LED flashes: "Active" -> indicates that the RCD module is functional
  - Yellow LED flashes: The fault current is between 25% < \( I_{\Delta} < 50\% \) of the set \( I_{\text{fan}} \) value
  - Red LED flashes: The fault current \( I_{\Delta} \) is greater than 50% of the set \( I_{\text{fan}} \) value

- **Test button:**
  The functionality of the RCD module is checked with the test button. If the test button is pressed, differential current is simulated on a test winding attached to the summation current transformer. When functioning correctly, the RCD module must trip the molded case circuit breaker.

  The test button must be pressed for at least the set delay time \( \Delta t \).

- **A line disconnector:**
  - makes it possible to disconnect the evaluation electronics of the RCD module from the circuit without removing the primary cable or the busbars (e.g. before insulation tests).
  - Limitation of the maximum RMS withstand voltage to an RMS value of 3500 V AC for this feature, i.e. the RMS value of the voltage for max. 60 seconds for one insulation test must not exceed 3500 V.

- **Protection function from 50 V AC between phase and neutral conductor**

- **The RCD module has a surge current withstand capability of** \( I_{\text{peak}} = 2000 \) A. The standard surge wave is defined as 8 / 20-µs waveform.

- **The RCD module does not trip in the case of making currents.**

  \[ \Delta t \geq 0 \ I_{\text{rms}} = 3000 \text{ A} \]
  \[ \Delta t \geq 60\text{ms} \ I_{\text{peak}} = 20 \times I_n \times \sqrt{2} \]

- **The molded case circuit breaker with differential current protection combination can be supplied from both sides.**

- **Matching molded case circuit breaker standard accessories – covers, phase barriers, wire connectors.**
4.1 Protection functions

Special features of the VL160X

- The molded case circuit breaker is tripped via an electromagnetic trip relay installed in the breaker accessories compartment to the left of the toggle lever. The trip unit in the molded case circuit breaker is connected to the RCD module and receives a trip command when the preset fault currents are reached.

- Internal accessories can still be installed to the right of the toggle lever.

- The Reset button functions in exactly the same way as on the RCD modules VL160 to 400 and is accessible via the molded case circuit breaker accessories cover supplied with this module.

Note
Motorized operating mechanism with stored energy mechanisms and rotary operating mechanisms cannot be installed with this product.

Special features of VL160, VL250, VL400

- The molded case circuit breaker is tripped by means of a direct-acting tappet from the RCD module to the system protection switch. The electromagnetic trip unit is integrated in the RCD module.

- The Reset button pops out beyond the surface of the RCD module cover to indicate that the RCD module has tripped the system protection switch. This unit prevents the system protection switch contacts from closing before the Reset button of the RCD module has been manually reset.

- This has the same design as the system protection switch accessories including the accessories for external operating mechanisms as well as for fixed-mounted assembly, plug-in assembly and withdrawable assembly.

- An auxiliary switch (changeover contact) is available. The contacts change status when the RCD module trips the system protection switch.

- Remote tripping is supported. The customer connects a switch (NO contact) to terminals X13.1 and X13.3 via a twisted-pair cable. The switching contact must have a minimum switching capacity of 5 V/1 mA (e.g. SIEMENS 3SB3). If the NO contact is actuated, the RCD module trips. The connection terminals X13.1 and X13.3 are galvanically isolated from the system by means of a transformer (functional extra low voltage, FELV). The maximum trip time of the molded case circuit breaker with differential current protection is 50 ms regardless of the set trip time delay Δt. In special cases, such as routing of the cable outside, ensure by means of suitable cable routing or protection measures that the amplitude of overvoltages (e.g. overvoltages due to thunderstorms) between the conductor and ground is limited to 2.5 kV.
Special requirements

- Every RCD module requires a separate cable for remote tripping. It is not possible to use one cable and connect two or more RCD modules in parallel. It is possible to use two or more switches in parallel for remote tripping of an RCD module.
- Use an unshielded or 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).
- With a shielded cable, the shield must not be applied to the PE conductor of the system.
- A separate conductor must connect terminal X13.2 with the ground busbar (E or PE). This connection is recommended for the prevention of electrostatic charge on the remote tripping cable. This applies in particular when long cables (> 10 m) are used. If this is not the case, the remote tripping cable is isolated.

Design of the RCD module

![RCD module for VL160](image)

Figure 4-2  RCD module for VL160
4.1 Protection functions

4.1.6 Single-pole operation with RCD module

Connection of the RCD module for single-pole operation

All 3-pole or 4-pole molded case circuit breakers with RCD module can be operated with 2 poles (L to N), since the power supply of the RCD module is supplied from all three external conductors, and on 4-pole devices additionally from the N conductor.

Apart from the test current circuit, the RCD module is unrestricted in functionality if at least 2 conductors are connected.

When connecting the RCD module, you only have to ensure that the test current circuit connected to current path 1-2 and 3-4 (marking) is functioning or is supplied with power.

The following connections are possible in 2-pole operation:

2-pole operation with a 3-pole molded case circuit breaker

- Connection of the network to current path 1-2 and 3-4 (any incoming supply side)

![Figure 4-3 3-pole RCD](image)

Note

Single-pole load

Series connection of the current paths is not necessary in the case of single-pole load.
2-pole operation with 4-pole molded case circuit breakers

- Connection of the network to current path 1-2 and 3-4 (any incoming supply side) or
- Connection of the network to current path 1-2 and N; however, a jumper is required here from N to current path 3-4 (on the input or output side)

Figure 4-4 4-pole RCD

4.1.7 Ground-fault protection

Ground fault trip “G” (ground fault overcurrent protection) captures fault currents flowing to ground that can cause fires in the plant.

Several molded case circuit breakers connected in series can be assigned time-graded discrimination by means of the adjustable delay time. The delays can be reduced to 100 ms by using a ZSI system.

Measurement method 1: Vectorial summation current formation

Ground fault detection in balanced systems

The three phase currents are evaluated using vectorial summation current formation.

Figure 4-5 molded case circuit breaker in balanced system
**Ground fault detection in unbalanced systems**

The neutral conductor current is measured directly. Only the ground-fault current is measured for the 3-pole circuit breakers. In the case of the 4-pole circuit breakers, the neutral conductor overload protection is also measured.

The overcurrent release calculates the ground-fault current using the vectorial summation of the three phase currents and the neutral conductor current.

The 4th current transformer of the neutral conductor is installed internally in the case of 4-pole molded case circuit breakers.

![Figure 4-6 3-pole molded case circuit breaker, current transformer in neutral conductor current](image)

![Figure 4-7 4-pole molded case circuit breaker, current transformer installed internally](image)

**Measurement method 2: Direct detection of the ground-fault current via a current transformer in the grounded neutral point of the transformer**

The current transformer is installed direct in the grounded neutral point of the transformer.

![Figure 4-8 3-pole molded case circuit breaker, current transformer in the grounded neutral point of the transformer](image)
4.2 Internal accessories

4.2.1 Possible complements for the insulated accessory compartments

3-pole molded case circuit breaker with communication preparation

When using a communication-capable ETU, the accessory compartment X1 is fitted with an auxiliary switch and an alarm switch.

4-pole molded case circuit breaker with communication preparation

When using a communication-capable ETU, the accessory compartment X2 is fitted with an auxiliary switch and an alarm switch.

Figure 4-9 Possible complements for the insulated accessory compartments
4.2 Internal accessories

Note
ETU with communication 3-pole (3VL_7__-M*) or 4-pole (3VL_7__-N*)
If a communication-capable ETU is used, the left-hand accessory compartment X2 contains an auxiliary switch and an alarm switch.

Note
Max. no. of contact blocks
Maximum 6 contact blocks (HS) per molded case circuit breaker VL160X to VL400
Maximum 8 contact blocks (HS) per molded case circuit breaker VL630 to VL1600

4.2.2 Undervoltage release

Molded case circuit breaker with undervoltage release
If there is no voltage present, closing of the molded case circuit breaker is not possible. If voltage is not applied to the releases, operation of the circuit breaker will result in no-load switching.

The undervoltage release trips the molded case circuit breaker when the voltage fails. Tripping can occur within a voltage range of 0.7 to 0.35 x Us. Tripping occurs under 0.35 x Us. Re-closure of the molded case circuit breaker contacts is only possible once the voltage has reached a value of 0.85 to 1.1 x Us. Undervoltage releases can be installed for electronic locking.

Undervoltage release
Undervoltage releases are installed in the right accessory compartment of the 3VL molded case circuit breakers.
4.2.3 Shunt release

Molded case circuit breaker with shunt release

The molded case circuit breaker with shunt release is used for remote protection. The shunt release is used for remote tripping of the molded case circuit breaker. The molded case circuit breaker is tripped by applying the operating voltage at the shunt release.

It is designed for short-time operation and is therefore equipped with an interrupt contact for self-protection. Shunt releases are installed in the right accessory compartment of the 3VL molded case circuit breakers.
4.2 Internal accessories

4.2.4 Auxiliary switches and alarm switches

Auxiliary switches and alarm switches are used to indicate the switching status of the molded case circuit breaker.

Auxiliary switches show the position of the main contacts ("ON" or "OFF").

Alarm switches transmit a signal when the molded case circuit breaker trips due to a short-circuit or overcurrent, or when the shunt release, undervoltage release, test button, or RCD module trips.

### Leading auxiliary switches when switching ON and OFF

The leading auxiliary switches (changeover switches) are available as accessories for front-operated rotary operating mechanisms and door-coupling rotary operating mechanisms.

The following applications are possible:
- Leading auxiliary switch for switching from "ON" to "OFF"
- Leading auxiliary switch for switching from "OFF" to "ON"

Each version, leading auxiliary switch for switching on and off, can be equipped with one or two changeover switches. The connecting cables of the auxiliary switches are 1.5 m long.

#### Leading auxiliary switch when switching from "OFF" to "ON" (leading NO contact)

<table>
<thead>
<tr>
<th>L1, L2, L3</th>
<th>Switch ON</th>
<th>Leading auxiliary switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>ON, &quot;S4&quot; with front operating mechanism</td>
</tr>
</tbody>
</table>

![Diagram of auxiliary switch](image)
Application example:

If the molded case circuit breaker is equipped with an undervoltage release, and the leading auxiliary switch is installed in the rotary operating mechanism, the leading NO contacts make it possible to supply the undervoltage release with power before the main contacts can be closed.

**Leading auxiliary switch for switching off (leading NC contact)**

![Diagram showing the state of the switch](Diagram)

Switch OFF
- Closed
- Open

Leading auxiliary switch OFF, "S4" with front operating mechanism

Application example:

In applications with thyristors, it is necessary to reset the power electronics of the converter before the main circuit is switched off.

Molded case circuit breakers with leading auxiliary switches create a leading signal that enables selective deceleration of the thyristor.
5.1 Use with frequency converters

Combination of frequency converter and 3VL molded case circuit breaker

3VL molded case circuit breakers can be used as protection devices on the primary side in systems in which frequency converters, variable-speed drives, and electronic motor control devices are used. The thermal-magnetic and electronic trip units of the 3VL molded case circuit breakers can be used in these applications. On account of RMS measurement, the SENTRON VL trip units are not influenced by harmonics.

![Diagram](image)

Figure 5-1 Frequency converters

Note

Alternative circuit breakers

SIRIUS 3RV circuit breakers can also be used for applications up to approximately 45 kW.

SIRIUS soft starters and 3VL molded case circuit breakers

For more detailed information, please refer to the soft starter catalogs and the selection guides.

Visit our site on the Internet at:

Soft starter ([http://www.siemens.de/sanftstarter](http://www.siemens.de/sanftstarter))

Frequency converters / variable-speed drives and 3VL molded case circuit breakers

Please refer to the relevant catalogs for information on the new SINAMICS series, MICROMASTER 4, and SIMOVERT MASTERDRIVES.
5.2 Use of capacitor banks

Capacitor banks are used, for example, for reactive power compensation. In reactive power compensation, also called power factor correction, the undesired reactive power of loads in AC systems is reduced. Reactive power compensation is usually performed by compensating inductive reactive power with capacitive load.

A combination of fixed and central compensations are used depending on the design of the low-voltage system and the loads involved.

Molded case circuit breaker for protecting and switching capacitor banks

According to the relevant standards DIN VDE 0560 Part 41 / EN 60831-1 / IEC 70, capacitors must operate under normal operating conditions with the current's RMS value being up to 1.3 times the rated current of the capacitor. In addition, a further tolerance of up to 15% of the real value of the power must be taken into consideration.

The maximum current with which the selected molded case circuit breaker can be constantly loaded, and which it must also be able to switch, is calculated as follows:

\[ I_{N,\text{max}} = I_N \times 1.5 \] (RMS value, RMS current)

Important values for selecting the molded case circuit breaker

More detailed information in the technical data: Capacitor banks (Page 152)

<table>
<thead>
<tr>
<th>Abbr.</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( Q_n )</td>
<td>Capacitor bank rated power in kVA</td>
</tr>
<tr>
<td>( U_N )</td>
<td>Rated voltage of the capacitor</td>
</tr>
<tr>
<td>( I_N )</td>
<td>Rated current of the capacitor bank</td>
</tr>
<tr>
<td>( I_{N,\text{max}} )</td>
<td>Maximum expected rated current</td>
</tr>
<tr>
<td>( I_i )</td>
<td>Value for setting the instantaneous short-circuit release</td>
</tr>
<tr>
<td>( I_R )</td>
<td>Value for setting the inverse-time delayed overload release</td>
</tr>
</tbody>
</table>

The following applies:

\[ I_N = \frac{Q_N}{\sqrt{3} \times U_N} \]
\[ I_R = I_{N,\text{max}} = I_N \times 1.5 \]
\[ I_i > 9 \times I_R \] (minimum)
5.3 Transformer protection on the primary side

The molded case circuit breaker as transformer protection on the primary side

When switching on low-voltage AC transformers, the extremely high inrush current peaks place special demands on the trip unit or on the making capacity of the molded case circuit breakers if these are also used to switch the transformer.

For most applications, an inrush current of 20 to 30 times the rated operating current is expected in practice and must be taken into account when selecting the molded case circuit breakers.

The maximum short-circuit current \( I_k \) of the 3VL molded case circuit breakers is \( 11 \times I_n \) (rated current). A molded case circuit breaker in the lower setting range must therefore be used for transformer protection on the primary side.

Example: A transformer with 500 A rated current; 20 times the inrush current

Selected: ETU with \( I_n = 1000 \text{ A} \); setting range 0.4 - 1 \times I_n = 400 \text{ A} to 1000 \text{ A} 

\[ 50\% \text{ of } I_n = 500 \text{ A}; I_i = 11 \times I_n = 1000 \text{ A} \times 11 = 11000 \text{ A} = 22 \times \text{current setting} \]

### Note

**Disconnection of molded case circuit breaker**

It is imperative to ensure that the minimum short-circuit current \( I_{k_{min}} \) in accordance with VDE 0100 can be disconnected using a protection facility (e.g. molded case circuit breaker).

The 3VL molded case circuit breaker can be disconnected using the short-time-delayed short-circuit release (S), e.g. a 3VL with an ETU20, where it is possible to set the delay time to up to 500 ms depending on the duration of the inrush current.

The short delay "bridges" the inrush current peak and the short-circuit protection can then respond at low current values after a delay.

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Molded case circuit breaker with phase failure protection</strong></td>
</tr>
</tbody>
</table>

Molded case circuit breakers with phase failure protection must not be used. Their trip units have protection against unbalanced network load which cannot be deactivated and can lead to unintentional trips.
5.4 Use in DC systems

The 3VL molded case circuit breakers 160X to VL630 with thermal overload and magnetic short-circuit trip units (TMTU) are suitable for use in DC systems.

The 3VL 160 to VL1600 molded case circuit breakers with electronic trip units (ETUs) are not suitable for switching DC.

Selection criteria for molded case circuit breakers

The following are the most important criteria for selecting the optimal molded case circuit breaker for protecting a DC system:

- The rated current determines the size of the molded case circuit breaker.
- The rated voltage determines the number of series-connected poles required for breaking - 3 or 4 poles.
- The maximum short-circuit current at the connection point determines the breaking capacity.
- The type of supply determines the circuit design.

Ampacity of current path

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

Switching DC currents

In AC circuits, arc quenching is facilitated because the current flows through zero. These preconditions do not apply for DC.

For this reason, a high arc voltage must be developed to interrupt the direct current.

Therefore, the breaking capacity depends on the arc quenching method and the line voltage. Several switching contacts can be connected in series in order to achieve a higher arc voltage.

Furthermore, the effects to be expected in the event of a ground fault or double ground fault must also be considered.

Setting of the trip values

- Thermal overload release ("L" release):
  Same settings as in 50 / 60 Hz systems.
- Instantaneous short-circuit release ("I" release):
  The threshold values of the instantaneous short-circuit release ("I" release) increase by 30 to 40%. See also Chap. 9
Example:

4000 A + 30% = 5200 A
There is also a tolerance of ± 20%.

At the Ii = 4000 A setting, the instantaneous short-circuit release responds at approx. 5200 A ± 20%.

As the current has to flow through all of the conducting paths, the following connections are recommended in order to satisfy the thermal tripping characteristics.

### Recommended connections for DC systems

#### Table 5-1  Recommended connections / maximum permitted DC voltage $U_e$

<table>
<thead>
<tr>
<th>Circuit with 3-pole molded case circuit breakers</th>
<th>Circuit with 4-pole molded case circuit breakers</th>
<th>2-pole switching (ungrounded system)</th>
</tr>
</thead>
<tbody>
<tr>
<td>![3-pole circuit breaker diagram]</td>
<td>![4-pole circuit breaker diagram]</td>
<td>If there is no possibility of a ground fault, or if every ground fault is rectified immediately (ground-fault monitoring), then the maximum permitted DC voltage is 600 V for both circuits. On an ungrounded system, all poles must be switched off.</td>
</tr>
<tr>
<td>≤ 250 V DC</td>
<td>≤ 500 V DC</td>
<td>2-pole switching (grounded system)</td>
</tr>
<tr>
<td>Switching capacity N</td>
<td>Switching capacity H</td>
<td>The grounded pole is always assigned to the individual conducting path, so that there are always 2 conducting paths in series in a circuit with 3-pole circuit breakers in the event of a ground fault and 3 conducting paths in a circuit with 4-pole circuit breakers in the event of a ground fault.</td>
</tr>
<tr>
<td>![3-pole circuit breaker diagram]</td>
<td>![4-pole circuit breaker diagram]</td>
<td>1-pole switching (grounded system)</td>
</tr>
<tr>
<td>≤ 500 V DC</td>
<td>≤ 600 V DC</td>
<td>1) With 4 conducting paths in series, either the 4th pole must be equipped with a 100% release, or the 4th pole (N) must be equipped with neither an overload release nor a short-circuit release.</td>
</tr>
<tr>
<td>Switching capacity H</td>
<td>Switching capacity L</td>
<td></td>
</tr>
</tbody>
</table>

1) With 4 conducting paths in series, either the 4th pole must be equipped with a 100% release, or the 4th pole (N) must be equipped with neither an overload release nor a short-circuit release.

### Recommended connections for DC systems with voltages of more than 600 V DC (e.g. photovoltaic plants)

5.5 Use in IT systems

Use of the 3VL molded case circuit breakers in IT systems

The 3VL molded case circuit breakers up to size VL1250 have been tested in accordance with IEC / EN 60947-2, Annex H (testing sequence for molded case circuit breakers for IT systems) up to a maximum voltage (U_{i max.}) of 690 V AC. The 3VL8 and 3VL7 (1250 A) cannot be used in an IT system.

The 3VL molded case circuit breakers for system protection from SIEMENS, optionally available with thermal overload and electromagnetic short-circuit releases, or electronic trip units, are suitable for use in IT systems. The molded case circuit breakers also meet the requirements of IEC 60947-2 Annex H (EN 60947-2, Annex H). The respective options are required here, and the necessary safety clearances (ventilation clearances) must be observed.

Selection criteria for molded case circuit breakers

The devices are always dimensioned and selected independently of the relevant system type. The circuit breaker is always selected in accordance with the maximum short-circuit current in the IT system. The device is selected in accordance with the relevant I_{cu} values of the 3VL molded case circuit breaker. The neutral conductor is not grounded by definition in the IT system.

The system operator ensures that no double ground fault can occur on the input or output side of the molded case circuit breaker. In this case, the switching capacity of the IT systems remains unchanged.

If this is not guaranteed, the values in accordance with the standard IEC 60947-2 Annex H apply for single-pole short-circuits.
Fault situation

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

Figure 5-2  Double ground fault (ground fault and short-circuit to frame)

Explanation of the illustration

- Faults ① and ② simultaneously:
  - Double ground fault on the load and infeed side
  - Single-pole short-circuit, the full phase-to-phase voltage of 690 V is applied to main contact L1
  - Selection of the molded case circuit breaker according to their suitability as defined in IEC 60947-2, Annex H

- Fault ③
  - 2 or 3-pole short-circuit
  - Multi-pole short-circuit, a voltage of \( 690 \text{ V} / \sqrt{3} = 400 \text{ V} \) is applied at the main contacts
  - The design of the molded case circuit breaker is in accordance with \( I_{cu}/I_{cs} \)

See also

Standards and specifications (Page 308)
5.6 Use in motor protection

The overload and short-circuit releases are designed for optimal protection and direct starting of three-phase AC squirrel-cage motors. The molded case circuit breakers for motor protection are sensitive for phase failures and have an adjustable trip class.

The ETUs operate with a microprocessor.

Note

The 3VL circuit breakers with motor protection function are suitable for use in IE2 motors. You can obtain detailed information for the use of the 3VL molded case circuit breaker with IE3 motors on request.

Operating principle of the overcurrent releases

The tripping characteristic curves of the inverse-time delayed overload releases are specially designed for overload protection of 3-phase AC motors.

With the inverse-time delayed overload release "L", the value IR can be set to be 0.4 to 1.0 times the rated current In of the molded case circuit breaker. This occurs in 0.01 increments (e.g. 0.40 / 0.41 / 0.42 ... 0.99 / 1.0 x In), so that the molded case circuit breaker exactly matches the rated current of the motor to provide optimal protection.

The current transformers in the 3VL molded case circuit breaker not only measure the load current, they also supply power to the electronic trip unit. No external auxiliary power supply is required.

This independence from an external energy supply guarantees a high standard of safety.

Area of application

Machine tools, manufacturing systems, presses, fans, air-conditioning units and packaging machines all require motors that must be protected. This is the main area of application of the 3VL molded case circuit breakers for motor protection.

Trip class

The 3VL molded case circuit breakers offer the option of selecting from various trip units with fixed or adjustable trip classes that are suitable for differing motor applications.

**ETU 10 M**

This version is equipped with a thermal image, phase failure sensitivity and the fixed trip class 10.

**ETU 30 M**

This version is equipped with an adjustable trip class 10 to class 30 in addition to the thermal image and phase failure sensitivity.
ETU 40 M

This version enables the parameters and the trip class 5 to class 30 to be configured step by step using a menu on the LCD display that is built into the trip unit.

Trip classes

Trip class 5 is used for motors that have very simple start-up characteristics (those with a short start-up time and a small mass moment of inertia). The class 30 releases are used to protect motors that have to withstand difficult start-up characteristics (long start-up time and large mass moment of inertia). The motor must be suitable for heavy-duty starting.

The trip class must be selected so that it corresponds to the overload factor of the motor under operating conditions. You can find further information at the end of this chapter in the figure "Current-time curve before and after overload, with thermal image".

Definition of the trip class

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

Applications that require a longer start-up time, such as fans with large blade diameters, require a higher trip class.

![Figure 5-3 ETU with trip classes 5, 10, 15, 20, 30](image)

Tripping characteristic curve for molded case circuit breakers with electronic trip unit.
Thermal image

All 3VL molded case circuit breakers with electronic trip unit have a "thermal image" which takes the pre-loading of the AC motor into consideration. The tripping times of the current-dependent delayed overload releases are only valid for the unloaded (cold) state.

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

Siemens offers the 3VL molded case circuit breakers with fixed thermal image to provide maximum protection for the motor.

Functional principle of the thermal image

During operation, a thermal model of the motor is simulated in the ETU. This reduces the response time of the molded case circuit breaker with thermal image such that further overloads cannot damage the motor windings. The motor is switched off within a time limit that is specified by the pre-loading.

An overload may also be the switch-on current of the motor.

After an overcurrent tripping, the tripping times are reduced in accordance with the tripping characteristic curves.

A cooling time defined by the size of the motor is required before the motor can be switched on again. This prevents the motor from being excessively thermally loaded by a current immediately after an overload release occurs.

Phase failure sensitivity

The "phase failure sensitivity" function is also integrated into the 3VL molded case circuit breaker for motor protection. This ensures that the motor is reliably protected against overheating if a phase interruption or a large fluctuation occurs.

The specified operational current $I_{R}$ is automatically reduced to 80% of the set value if the RMS values of the operational currents in the three phases differ by 5 to 50% (depending on release type).

Deviations of more than 50% mean the value of the current in the least loaded phase drops to a level below 50% of the maximum loaded phase.
5.7 Use in unusual environments:

If the 3VL molded case circuit breakers are to be used outside closed control cabinets or in difficult operating conditions, the following information must be taken into account at the planning stage:

Reduction factors under unusual operating conditions

- Altitude in excess of 2000 meters
- Temperature above 50 °C
- Frequencies outside the 50 / 60 Hz range
- Humidity
- etc.

You can find further details in DIN ISO 2533 "Standard Atmosphere".

Use at altitudes above 2,000 meters

The lower air density at altitudes above 2,000 meters affects the key electrical data of molded case circuit breakers. The table in the Technical data (Page 142) shows the derating factors that have to be taken into account when using the molded case circuit breakers at altitudes above 2,000 m.

Use at different ambient temperatures

A reduction (derating) of the rated operational current of the 3VL molded case circuit breakers is necessary if the ambient temperature around the molded case circuit breaker exceeds 50 °C. The reference temperature is 40 °C for molded case circuit breakers with RCD modules or for plug-in / withdrawable versions.

The permissible load for various ambient temperatures with reference to the rated operational current of the molded case circuit breaker are shown in the technical data. Furthermore, the following points must be taken into consideration, because each one of these factors can influence the rated operational current and permissible load.

- Type of molded case circuit breaker (fixed-mounted, plug-in or withdrawable version)
- Type of main connection (vertical/horizontal busbar, cable)
- Ambient temperature around the molded case circuit breaker
- Altitude derating factors
- Temperature derating factors based on different trip units and connections
- Increased degree of protection
5.7 Use in unusual environments:

Thermal-magnetic overcurrent releases

Thermal-magnetic overcurrent releases are calibrated to 50 °C. As a result, the tripping times of the thermal overcurrent releases increase for a constant current at low temperatures.

To correct the tripping times, the thermal overcurrent release settings must be changed by the factor from the table "Derating factors for thermal-magnetic overcurrent releases" in the technical data (lower settings).

Use in systems with other frequencies

If low-voltage switching devices designed for 50 / 60 Hz are to be used at other line frequencies, the following points must be taken into consideration:

- Thermal effects on the system components
- Switching capacity
- Service life of the contact system
- Tripping characteristics of the overcurrent releases
- Behavior of the accessories

Thermal rating of the system components and conductors depending on the line frequency

Molded case circuit breakers designed for alternating current of 50 / 60 Hz can be used at lower frequencies for at least the same rated currents. However, the permissible operating current must be reduced at frequencies higher than 100 Hz to ensure the specified temperature rise limits are not exceeded.

Influence of temperature and humidity on overcurrent releases

The relevant reduction in the rated operating current (derating) of the 3VL molded case circuit breakers is also necessary if the operating temperature of 50 °C or 70 °C is exceeded at a relative humidity level (non-condensing) of 95%.

Thermal-magnetic TM releases

![Figure 5-5 Thermal-magnetic TM](image)

Figure 5-5  Thermal-magnetic TM
0 °C to +70 °C, ☂ 95%

The SENTRON VL thermal-magnetic releases are designed for use in ambient temperatures up to 70 °C and a relative humidity level (non-condensing) up to 95%. The appropriate correction factors must be applied for ambient temperatures above 50 °C. You can find more information in Chapter 11.4 "Reduction factors"
5.8 Use in series connection

The 3VL electronic trip units are designed for use in ambient temperatures up to 70 °C and a relative humidity (non-condensing) up to 95%.

The high-quality electronic trip units LCD ETUs are designed for use in ambient temperatures up to 70 °C and a relative humidity (non-condensing) up to 95%. The appropriate correction factors must be applied for ambient temperatures above 50 °C.

5.8 Use in series connection

In the case of molded case circuit breakers connected in series, the overload and short-circuit protection is described as "selective" when, from the point of view of the direction of energy flow, only the circuit breaker immediately upstream of the fault trips.

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 to its long-term behavior, e.g. in the case of overloads.

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 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 selectivity limit.

If the values 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 are below the selectivity limit 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 mounting point is higher than the selectivity limit, selective tripping by the downstream circuit breaker is only ensured up to the value listed in the table. The engineer must judge whether the value can be considered to be sufficient because the probability of, for example, the maximum short-circuit occurring is low. Otherwise, a circuit breaker combination should be chosen whose selectivity limit lies above the maximum short-circuit current.

**Time selectivity**

Selectivity can be achieved by time selectivity up to the threshold values of the instantaneous short-circuit release. 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 faulted system component from the supply.

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

**Zone-selective interlocking - ZSI**

Zone-selective interlocking (ZSI) has been developed by SIEMENS for the 3VL molded case circuit breakers to prevent long, undesired release 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.

When selecting, ensure that the molded case circuit breaker can handle the initial balanced short-circuit current $I_k$ at the installation point.

The following are required for the ZSI function:

- A COM20 or COM21 communication module
- A communication-capable ETU

You can find further details in the following manuals:

- "SENTRON WL and SENTRON VL circuit breakers with communication capability - PROFIBUS" (Order No. A5E01051347)
- "SENTRON WL and SENTRON VL circuit breakers with communication capability - Modbus" (Order No. A5E02126886)
5.9 Use in transfer control system

The 3KC ATC5300 transfer control device (automatic transfer control device) together with two 3VL molded case circuit breakers with motorized operating mechanism (MO), forms the transfer control system that can be used to switch automatically or manually between two low-voltage power distribution systems.

Overview of the 3KC ATC5300 transfer control device

The ATC5300 controls the transfer between two power supplies fully automatically, while taking account of set limit values and delay times. It detects fluctuations occurring in the main power supply quickly and switches to the standby power supply. The control device only switches to the standby power supply after it has ensured that the standby supply is providing the required quality. The devices switch back to the main power supply, taking into consideration the set parameters, once the required quality has been restored. If the standby power supply and/or the main power supply is fed by a generator, the control device also offers a wide range of settings, such as a generator lead time, generator delay time, and generator start test at specified times.

The ATC5300 can be used for the following applications:

- Supply of UPS (uninterruptible power supply) systems
- Emergency supply of public buildings, hotels and airports
- Supply of data centers and communication systems
- Supply of industrial processes requiring a high level of operational continuity

Note

You can find more detailed information on the 3KC ATC5300 transfer control device in the Industry Mall (www.siemens.com/industrymall).
Structure of the transfer control system

- Infeeds line 1 (main system) and line 2 (standby system) are connected to the ATC5300.
- In case of system disturbances, the ATC5300 activates the 3VL molded case circuit breakers Q1 and Q2 accordingly.
- The 3VL molded case circuit breakers must be equipped with the following accessories:
  - One motorized operating mechanism per molded case circuit breaker
  - One alarm switch per molded case circuit breaker
  - Two auxiliary switches 1NO/1NC per molded case circuit breaker
3KC ATC5300 transfer control device in a Modbus RTU network

The ATC5300 supports the Modbus communication protocol (RTU or ASCII) via the RS485 interface.

Easy system integration through integrated Modbus interface, for integrating into a power management system, for example
5.10 Use in communication environment

The 3VL molded case circuit breakers with communication-capable ETUs can be integrated into PROFIBUS or MODBUS RTU networks via the COM20 / COM21 communication modules.

Network topology

![Network Topology Diagram]

**Note**
When using communication-capable ETUs, the left-hand accessory compartment X2 contains an auxiliary switch and an alarm switch.
More information

- System manual - SENTRON 3WL / 3VL circuit breakers with communication capability - Modbus
- System manual - SENTRON 3WL / 3VL circuit breakers with communication capability - PROFIBUS
6.1 Installation methods

Installation overview

The 3VL molded case circuit breakers are available in **fixed-mounted, plug-in** or **withdrawable** versions, **3-pole** or **4-pole**.

<table>
<thead>
<tr>
<th>Molded case circuit breaker type</th>
<th>Fixed</th>
<th>Plug-in</th>
<th>Withdrawable part</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X</td>
<td>x</td>
<td>x</td>
<td>-</td>
</tr>
<tr>
<td>VL160</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>VL250</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>VL400</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>VL630</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>VL800</td>
<td>x</td>
<td>-</td>
<td>x</td>
</tr>
<tr>
<td>VL1250</td>
<td>x</td>
<td>-</td>
<td>x</td>
</tr>
<tr>
<td>VL1600</td>
<td>x</td>
<td>-</td>
<td>x</td>
</tr>
</tbody>
</table>

Fixed mounting

*Mounting on mounting plate*

The 3VL molded case circuit breakers can be mounted direct onto the mounting plate. If busbars or terminals are used to connect the circuit breaker on the back of the mounting plate, the appropriate safety clearances must be observed.

Technical overview (Page 132)

*Mounting on 8US busbar adapter system*

The 3VL to 630A molded case circuit breakers can be mounted on device adapters for busbar systems.

You can find further information on this subject in the system manual for busbar systems.
**Busbar connections**

Busbars or cables can be connected direct to the front of busbar extensions or to bolts for connections on the back. If straight busbar extensions are used, terminal covers or phase barriers are recommended.

**Plug-in version**

*Mounting plate*

Plug-in bases with flat terminals on the front or rear are available for direct connection of cables or busbars. The plug-in base is attached direct to the mounting plate supplied by the customer.

The appropriate safety clearances must be observed. Terminal covers or phase barriers are available for the front connecting bars. Molded case circuit breakers cannot be removed from the plug-in base in the "ON" position. The molded case circuit breaker will go to the "tripped" position if attempts are made to remove it while in the "ON" position.
Withdrawable version

The 3VL molded case circuit breakers can be used as withdrawable devices. They can be connected on either the front or the back. Terminal covers are provided and are required for final installation.

In the connected position, the molded case circuit breaker is completely engaged, and all contacts - supply, outgoing and auxiliary contacts - are connected to the guide frame. The molded case circuit breaker is ready for operation.

Note
Safety interlock

A safety interlock prevents the molded case circuit breaker from being removed when it is switched on. The safety interlock causes the molded case circuit breaker to switch off so that the arc which occurs inside the circuit breaker when current flows can be extinguished.

The molded case circuit breaker can be installed in and removed from the guide frame when it is in the removable position.
6.2 Mounting and safety clearances

Permissible mounting positions

All 3VL molded case circuit breakers can be mounted in the positions shown:

Unlimited:

There is a separate mounting assembly for VL800 to VL1600 molded case circuit breakers with guide frame in lateral installation position.

Limited:

- Use of the internal accessories possible
- Permissible current load factor 0.9
- Not allowed: motorized operating mechanisms, rotary operating mechanisms, plug-in assembly / withdrawable assembly

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.

Safety clearances are required to:

- allow pressure distribution
- prevent fire or damage caused by any diffused ionized gases
- prevent a short circuit to grounded parts
- prevent arcing or short-circuit currents to live sections
Table 6-2 Permissible safety clearances in accordance with IEC 60947

<table>
<thead>
<tr>
<th>Molded case circuit breaker type</th>
<th>Switching capacity</th>
<th>Minimum footprint m³</th>
<th>A ≤ 415 V</th>
<th>A &gt; 415-690 V</th>
<th>B ≤ 690 V</th>
<th>C ≤ 690 V</th>
<th>D ≤ 690 V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Without or without covers</td>
<td>Without covers</td>
<td>With covers</td>
<td>Without covers</td>
<td>With covers</td>
</tr>
<tr>
<td>VL160X</td>
<td>N, H</td>
<td>0,011</td>
<td>35 mm</td>
<td>70 mm</td>
<td>35 mm</td>
<td>25 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>VL160</td>
<td>N, H, L</td>
<td>0,011</td>
<td>50 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>25 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>VL250</td>
<td>N, H, L</td>
<td>0,015</td>
<td>50 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>25 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>VL400</td>
<td>N, H, L</td>
<td>0,036</td>
<td>50 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>25 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>VL630</td>
<td>N, H, L</td>
<td>0,18</td>
<td>50 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>25 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>VL800</td>
<td>N, H, L</td>
<td>0,22</td>
<td>50 mm</td>
<td>100 mm</td>
<td>50 mm</td>
<td>25 mm</td>
<td>25 mm</td>
</tr>
<tr>
<td>VL1250</td>
<td>N, H, L</td>
<td>0,22</td>
<td>70 mm</td>
<td>100 mm</td>
<td>70 mm</td>
<td>30 mm</td>
<td>30 mm</td>
</tr>
<tr>
<td>VL1600</td>
<td>N, H, L</td>
<td>0,264</td>
<td>100 mm</td>
<td>100 mm</td>
<td>100 mm</td>
<td>30 mm</td>
<td>30 mm</td>
</tr>
</tbody>
</table>

N: Standard  
H: High  
L: Very high

Figure 6-1 Safety clearances

Figure 6-2 No minimum clearance between two horizontally or vertically installed molded case circuit breakers

Table 6-3 Definition of the permissible safety clearances in [mm] between

| A: | Molded case circuit breakers and busbars ( uninsulated and grounded metal); terminal cover required above 600 V AC, 500 V DC |
| B: | Molded case circuit breaker terminal and lower panel |
| C: | Sides of the molded case circuit breaker and side panels left / right ( uninsulated and grounded metal) |
| D: | Molded case circuit breaker and non-conductive parts with at least 3 mm thick insulation ( insulator, insulated bar, painted plate) |
If uninsulated conductors are connected to terminals 1, 3, 5, they must be insulated from each other independently of the direction of the mains supply. This can be achieved using phase barriers or terminal covers.

Terminal covers must be used for the main terminals at voltages of > 600 V AC or > 500 V DC.

**Note**

We recommend you also insulate connections 2, 4 and 6 from each other for additional safety.

---

**Minimum clearance between two horizontally or vertically installed molded case circuit breakers**

Ensure the busbar or cable connection does not reduce the air insulation clearance. The permissible clearance between two molded case circuit breakers applies for both fixed-mounted and plug-in versions. Some accessories may increase the width of the circuit breaker.

![Diagram showing minimum clearance](image)

**Figure 6-3** Minimum clearance between the molded case circuit breaker and metal

The clearance between the terminal and the grounded metal must be \( G \geq 12 \text{ mm} \).

If the clearance to ground \( G \) is < 12 mm, live parts must be insulated or a suitable barrier must be installed.

**NOTICE**

Depending on the application, appropriate air and creepage distances must be observed that are described in standards IEC 61439-1 and 61439-2.
Safety clearances between molded case circuit breakers

Minimum clearance to be maintained between two molded case circuit breakers installed immediately above one another with different connection methods.

A  Font connection with cable, direct
B  Front connection with cable lug
C  Front connection with flat connecting bar
D  Rear connection with plug-in base or busbar terminals
①  Insulation
②  Insulation of busbar

Figure 6-4  Table of different connection types

<table>
<thead>
<tr>
<th>Molded case circuit breaker type</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>x ≤ 690 V</td>
<td>160 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6.3 Locking devices

6.3.1 Locking devices for a padlock

The locking device for the toggle lever is designed to be easily attached to the molded case circuit breaker escutcheon. This device allows the lever to be locked in the "OFF" position. The locking device for the toggle lever can be installed in 3-pole and 4-pole molded case circuit breakers. Up to 3 padlocks with diameters from 5 to 8 mm may be used. (Not for the VL160X with RCD module)

![Locking device for the toggle lever](image1)

Figure 6-5  Locking device for the toggle lever

![Locking device for front-operated rotary operating mechanism](image2)

Figure 6-6  Locking device for front-operated rotary operating mechanism
6.3 Locking devices

Locking device for motorized operating mechanism (MO)

Figure 6-7 Locking motorized operating mechanism

Locking mechanism for motorized operating mechanism with stored energy mechanism (SEO)

Figure 6-8 Locking device for motorized operating mechanisms with stored energy mechanism
6.3.2 Locking device with a safety lock

Safety lock for the rotary operating mechanism and the motorized operating mechanism

A safety lock can be used for both rotary operating mechanisms and motorized operating mechanisms with stored energy mechanism (SEO).

The safety lock is used to lock the molded case circuit breaker in the "OFF" position. The key can only be removed when the molded case circuit breaker is in the "OFF" position. The key cannot be removed when the rotary operating mechanism or the motorized operating mechanism is in the "ON" position.

6.3.3 Mutual interlocking of two molded case circuit breakers

Mutual interlocking of two molded case circuit breakers (Bowden wire) in the fixed-mounted, plug-in and withdrawable versions

Possible interlocking

Two 3VL molded case circuit breakers can be mutually mechanically interlocked using a Bowden wire and the locking modules.
Use of this accessory kit means only one of the molded case circuit breakers is in the "ON" position at any time.

Fixed-mounted and plug-in molded case circuit breakers use different interlocking modules. However, these are compatible with each other. This enables both to be used in interlock circuits.

Two molded case circuit breakers can be mounted side by side or one above the other. The distance between the two molded case circuit breakers depends on the length of the Bowden wire and its minimum bending radius. The cable comes in lengths of 0.5, 1.0 and 1.5 m. The minimum bending radius for each cable is 60 mm. The length of the Bowden wire must not be altered by the customer. The Bowden wire has a mechanical endurance of 10,000 operations. Each Bowden wire must be ordered separately.

The combination options of the molded case circuit breakers with Bowden wire interlocking is described in Table 12-1 of Chapter 12.6.

**Note**

Not possible in combination with the motorized operating mechanism.

Mutual interlocking (rear interlocking module) of two molded case circuit breakers in the fixed-mounted, plug-in and withdrawable versions

Fixed-mounted version
(lock at rear)

Plug-in version
(lock at rear)

Fixed-mounted version
(lock at front)

Plug-in version
(lock at front)

The rear interlocking module enables mutual mechanical interlocking of two 3VL molded case circuit breakers of the same size. The rear interlocking module is attached behind the molded case circuit breakers to the mounting plate supplied by the customer.
A tappet on each end of the rocker mechanically accesses each of the breakers through an opening in the mounting plate and the base of the molded case circuit breakers. The rear interlocking module prevents both molded case circuit breakers from being in the "ON" position at the same time.

The rear interlocking module can be used with fixed-mounted, plug-in and withdrawable molded case circuit breakers.

Cross wiring of internal accessories via the rear of the molded case circuit breakers is not prevented.

This locking version is possible with all operating mechanism types (toggle lever, rotary operating mechanism, and motorized operating mechanism).
7.1 Cables and busbars

The 3VL molded case circuit breaker can be connected using cables, flexible copper bars or busbars.

Thermal and electrodynamic stresses affect these conductors in the event of a short-circuit. To avoid dangerous effects, it is necessary to assess them correctly and to take appropriate measures to suppress them.

The diagrams and tables below show the recommended maximum clearance between the molded case circuit breaker and the first point.

Overview of cable and busbar mounting methods

<table>
<thead>
<tr>
<th></th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>A cable mm</td>
<td>100</td>
<td>100</td>
<td>130</td>
<td>150</td>
<td>300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B cable mm</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>400</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C bar mm</td>
<td></td>
<td></td>
<td>250</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This table applies for all switching capacities.
Rated operating voltage: $U_e \leq 600 \text{ V AC} / 500 \text{ V DC}$

Table 7-2  Connection methods ($U_e \leq 600 \text{ V AC} / 500 \text{ V DC}$)

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible switching capacity class for $U_e \leq 600 \text{ V AC} / 500 \text{ V DC}$</td>
<td>N H L</td>
<td>N H L</td>
<td>N H L</td>
<td>N H L</td>
<td>N H L</td>
<td>N H L</td>
<td>N H L</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

- Cable installed directly, e.g. via box terminal or multiple feed-in terminal
- Insulated up to the circuit breaker
- **Accessories:**
  - None

- Cable with cable lug
- Clearance between non-insulated conductor and the end of the phase barrier at least 8 mm
- **Accessories:**
  - Phase barriers
  - Cable lug
  - Terminals with screw connection

- Not applicable
### 7.1 Cables and busbars

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible switching capacity class for ( U_e \leq 600 \text{ V AC} / 500 \text{ V DC} )</td>
<td>N</td>
<td>H</td>
<td>N</td>
<td>H</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

- **Cable with cable lug**
- **Front connecting bars, standard**
- **Insulation 8 mm above phase barrier**

**Accessories:**
- **Phase barriers**
- **Terminals with screw connection**
- **Front connecting bars, standard**

- **Cable with cable lug**
- **Front connecting bars, for increased pole spacing**
- **Insulation 8 mm above phase barrier**

**Accessories:**
- **Phase barriers**
- **Terminals with screw connection**
- **Front connecting bars for increased pole spacing**
### Connecting

#### 7.1 Cables and busbars

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible switching capacity class for $U_e \leq 600$ V AC / 500 V DC</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

- Connecting bar, directly installed
- Without insulation

**Accessories:**
- Phase barriers
- Terminals with screw connection

- Connecting bar, directly installed
- With extended terminal cover
- Without insulation

**Accessories:**
- Extended terminal cover
- Terminals with screw connection
### 7.1 Cables and busbars

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible switching capacity class for $U_e \leq 600,\text{V AC} / 500,\text{V DC}$</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
</tbody>
</table>

**REVERSE FEED**

- Connecting bar, directly installed
- Incoming supply from overcurrent release side (REVERSE FEED)
- Without insulation

**Accessories:**
- Phase barriers
- Terminals with screw connection

---

- Connecting bar, directly installed
- Insulation 250 mm from the circuit breaker

**Accessories:**
- Terminals with screw connection

---

![Image](image.png)
## 7.1 Cables and busbars

### Circuit breaker dimensions

<table>
<thead>
<tr>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

**Permissible switching capacity class for \( U_e \leq 600 \) V AC / 500 V DC**

- Connecting bar, directly installed
- Insulation 8 mm above phase barrier and 250 mm from circuit breaker

**Accessories:**
- Phase barriers
- Terminals with screw connection

- Connecting bar
- Front connecting bars, standard
- Insulation 8 mm above phase barrier and 250 mm from circuit breaker

**Accessories:**
- Phase barriers
- Terminals with screw connection
- Front connecting bars, standard

N  H  L  N  H  L  N  H  L  N  N  N  N
Connecting 7.1 Cables and busbars

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Permissible switching capacity class for $U_e \leq 600$ V AC / 500 V DC</th>
<th>N</th>
<th>N</th>
<th>N</th>
<th>N</th>
<th>N</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectors</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Connecting bar</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

- Connecting bar
- Front connecting bars, standard
- Insulation 250 mm from the circuit breaker

**Accessories:**
- Terminals with screw connection
- Front connecting bars, standard

3VL IEC molded case circuit breakers
System Manual, 11/2013, 110 0110 - 02 DS 03
Connecting

7.1 Cables and busbars

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL180X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connecting dimensions</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td>Connecting bar</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td>Front connecting bars, standard</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

**Accessories:**
- Extended terminal cover
- Terminals with screw connection
- Front connecting bars, standard

Circuit breaker dimensions

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL180X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible switching capacity class for $U_e \leq 690$ V AC / 600 V DC</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
<td>N</td>
</tr>
<tr>
<td></td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
<td>H</td>
</tr>
<tr>
<td></td>
<td>L</td>
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<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

**Rated operating voltage:** $U_e \leq 690$ V AC / 600 V DC

Table 7-3 Connection methods ($U_e \leq 690$ V AC / 600 V DC)

- Cable installed directly, e.g., via box terminal or multiple feed-in terminal
- Insulated up to the circuit breaker

**Accessories:**
- Standard terminal cover

N: Low
H: High
L: Very high
### 7.1 Cables and busbars

<table>
<thead>
<tr>
<th>Circuit breaker dimensions</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permissible switching capacity class for $U_e \leq 690$ V AC / 600 V DC</td>
<td>N H</td>
<td>N H</td>
<td>N H</td>
<td>N H</td>
<td>N H</td>
<td>N H</td>
<td>N H</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

- Cable with cable lug
- Front connecting bars, standard
- Insulated up to the circuit breaker

**Accessories:**
- Standard terminal cover
- Terminals with screw connection
- Front connecting bars, standard

<table>
<thead>
<tr>
<th></th>
<th>N</th>
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</tbody>
</table>

- Cable with cable lug
- With extended connection cover

**Accessories:**
- Extended terminal cover
- Terminals with screw connection

<table>
<thead>
<tr>
<th></th>
<th>N</th>
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<th>N</th>
<th>N</th>
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</tbody>
</table>

- Connecting bar, directly installed
- Insulation 250 mm from the circuit breaker

**Accessories:**
- Standard terminal cover
- Terminals with screw connection

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>N</th>
<th>N</th>
<th>N</th>
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<td>L</td>
</tr>
</tbody>
</table>
### 7.1 Cables and busbars

#### Circuit breaker dimensions

<table>
<thead>
<tr>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N</td>
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</tr>
</tbody>
</table>

### Permissible switching capacity class for \( U_e \leq 690 \text{ V AC} / 600 \text{ V DC} \)

- Connecting bar
- Front connecting bars, standard
- Insulation 250 mm from the circuit breaker

**Accessories:**
- Standard terminal cover
- Terminals with screw connection
- Front connecting bars, standard

### REVERSE FEED

- Connecting bar, directly installed
- Incoming supply from overcurrent release side (REVERSE FEED)
- Without insulation

**Accessories:**
- Phase barriers
- Terminals with screw connection

---

N: Low  
H: High  
L: Very high

---

3VL IEC molded case circuit breakers  
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7.2 Main connection types for fixed mounting

Main conductor connection for SENTRON 3VL fixed-mounted version

There are various methods of connecting the molded case circuit breaker main conductors for fixed mounting.

Network connection

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

Multiple feed-in terminal for circular conductors (copper/aluminum)

The multiple feed-in terminals for incoming supply and outgoing feeders consist of an aluminum body with tin coating to prevent oxidation. Both aluminum and copper cables may be used. Only one conductor is permitted per terminal. The multiple feed-in terminals are available for the VL400 to VL1250 molded case circuit breakers.

For additional information, refer to the technical data in the chapter Configuration of main connections (Page 136).
Connecting

7.2 Main connection types for fixed mounting

**Box terminals (copper cables or bars)**

The VL160X to VL250 can be supplied optionally with box terminal or with screw-type connection. The terminal is designed to connect either a conductor or a solid/flexible copper bar.

For additional information, refer to the technical data in the chapter Configuration of main connections (Page 136).

**Front connecting bars**

Connecting bars are used to connect the circuit breakers to busbars or cables in electrical systems. Front connecting bars are supplied with the SENTRON VL1600 as standard. Phase barriers are also included. Extended terminal covers can be fitted if necessary.

For additional information, refer to the technical data in the chapter Configuration of main connections (Page 136).
7.2 Main connection types for fixed mounting

Front connecting bars for increased pole spacing

Front connecting bars for increased pole spacing are used to establish busbar connections in switchboards or other electrical equipment. Normal use enables adjustment to the next largest molded case circuit breaker. Phase barriers are also included.

Note

Front connecting bars for increased pole spacing cannot be combined with extended terminal covers!

Rear terminals

Rear terminals are used to adapt the 3VL molded case circuit breakers to switchboards or other applications that require rear connection. They are bolted direct to a standard 3VL molded case circuit breaker without requiring any modification. Molded case circuit breakers mounted in switchboards or other electrical equipment may be removed from the front by removing the fixing screw that connects the molded case circuit breaker to the terminal.

Round terminals

For additional information, refer to the technical data in the chapter Configuration of main connections (Page 136).
Rear flat busbar terminals

Rear flat busbar terminals are used to adapt VL630 to VL1600 molded case circuit breakers to switchboards or other applications that require rear connection. The rear busbars are bolted direct to a standard 3VL molded case circuit breaker without requiring any modification. A vertical or horizontal connection is established, depending on the way the busbar terminals are mounted to the rear of the circuit breaker. Molded case circuit breakers mounted in switchboards or other electrical equipment with the help of rear flat busbar terminals may be removed from the front by removing the fixing screw that connects the molded case circuit breaker to the terminal.

For additional information, refer to the technical data in the chapter Configuration of main connections (Page 136).
**Terminals with screw connection**

The screw-type terminal with metric thread slides onto the incoming and outgoing terminal of the 3VL molded case circuit breaker and acts as a threaded adapter for connecting busbars or cable lugs. The customer is responsible for providing screws and washers for the terminals and busbars if the size specified below is exceeded. Screw-type terminals are supplied for use with the SENTRON VL400 to VL1250 as standard.

For additional information, refer to the technical data in the chapter Configuration of main connections (Page 136).

**Connection with cable lugs**

Cable lugs (ring cable lugs) are used to connect the cables to the terminals of the molded case circuit breaker. Cable lugs in accordance with DIN 46220 with a narrow flange are recommended (VL1 to VL4).
7.2 Main connection types for fixed mounting

**Connection terminal for circular conductors (copper/aluminum)**

Circular conductor terminals for the incoming supply and outgoing feeders consist of an aluminum body with tin plating to prevent oxidation. Both aluminum and copper cables may be used. Only one conductor is permitted per terminal.

The circular conductor terminals are available for the VL160X to VL400 molded case circuit breakers.

For additional information, refer to the chapter Configuration of main connections (Page 136).

**Auxiliary conductor terminal**

The 3VL offers two versions of auxiliary conductors for voltage tap.

**A) Connection with lug to circular conductor terminal (voltage tap)**

The 3VL1-3VL7 circular conductor terminals are provided with an M3 hole. Using the screw with contact washer provided, cable lugs up to 2.5 mm² can be connected.

The maximum load of the auxiliary conductor connection $I_{\text{max}} = 500$ mA must not be exceeded.
B) Connection with auxiliary conductor terminal in box or circular conductor terminal

The auxiliary connection terminal is an additional component that is inserted into a circular conductor terminal or steel box terminal additionally to the main conductor.

1. Main conductor
2. Auxiliary conductor terminal
3. Circular conductor terminal

The maximum load of the auxiliary conductor connection $I_{\text{max}} = 6\, \text{A}$ must not be exceeded.
Several auxiliary conductors can be connected to the auxiliary connection terminal:

- 1 x stranded with core end sleeve max. 4 mm² + 1 x stranded with AMP connector 6.3
- 1 x stranded with core end sleeve max. 4 mm² + 1 x stranded with core end sleeve max. 2.5 mm²

### Main connection methods for plug-in and withdrawable version

There are different methods of connecting the molded case circuit breaker main conductors for the plug-in and withdrawable version.
Plug-in base: Connection on the front with busbar connection pieces

Plug-in bases simplify installation and removal of the 3VL molded case circuit breakers. The molded case circuit breaker has been developed together with the plug-in base in such a way as to prevent disconnection in the "ON" position. Busbars or cables can be connected on the front. A connection cover is supplied and is to be used both for the incoming and the outgoing side. An additional phase barrier for insulation between the connections is possible (see Connection covers/barriers and phase barriers). If the molded case circuit breaker is in the connected position, the primary voltage is supplied via multiple terminal contacts in the guide frame.

![Plug-in base (front)](image1)

Plug-in base with busbar connection (busbar covers are not shown)

Plug-in base (rear)

Plug-in base with rear flat busbar terminals

Plug-in base: Connection on the back with flat busbar terminals

Busbars and cables can be connected on the back. Vertical and horizontal connections are possible depending on the configuration of the connecting bars.
7.3 Main connection methods for plug-in and withdrawable version

Withdrawable version: Connection on the front with busbar connection pieces

The withdrawable version enables the insertion and removal of the 3VL molded case circuit breaker without requiring the disconnection of incoming or outgoing cables or busbars. A special operating mechanism, attached to the stationary assembly, is used to insert or remove the molded case circuit breaker. A mechanical interlock prevents the circuit breaker from being moved from the connected position to the disconnected position when it is switched on. The molded case circuit breaker will trip before the multiple clamping contacts between the molded case circuit breaker and the guide frame open. A locking device with padlock is provided on the stationary arm of the withdrawable unit. The customer can lock the circuit breaker in either the disconnected or connected position.

Withdrawable version with front busbar connections and terminal covers

Withdrawable version with front busbar connections

Withdrawable version: Connection on the back with flat busbar terminals

It is possible to configure the busbars for horizontal connection when the withdrawable assembly with rear flat busbar terminals is used. A separate kit is available for vertical connection of molded case circuit breakers up to and including VL250.
8.1 Overcurrent trip unit without LCD display

The different setting options of the individual overcurrent releases without LCD display are explained using the examples listed:

**Magnetic overcurrent releases M VL160-VL630**

<table>
<thead>
<tr>
<th>Characteristic curve</th>
<th>Application</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Starter protection M, I function</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection, adjustable ( I_i = 7 ) to ( 15 \times I_{\text{N}} ), for VL160 to VL630 (size dependent)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;DK&quot; version</td>
<td></td>
</tr>
</tbody>
</table>

**Thermal-magnetic overcurrent releases TM VL160X**

<table>
<thead>
<tr>
<th>Characteristic curve</th>
<th>Application</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>System protection TM, LI / LIN function</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overload protection fixed, short-circuit protection fixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;DA&quot;, &quot;EH&quot; and &quot;EA/EL&quot; versions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;DD&quot; version</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Characteristic curve</th>
<th>Application</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>System protection TM, LI / LIN function</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overload protection adjustable ( I_R = 0.8 ) to ( 1 \times I_{\text{N}} )</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection fixed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;DD&quot; version</td>
<td></td>
</tr>
</tbody>
</table>
Displays and operator controls

8.1 Overcurrent trip unit without LCD display

### Thermal-magnetic overcurrent releases TM VL160-VL630

<table>
<thead>
<tr>
<th>Characteristic curve</th>
<th>Application</th>
<th>View</th>
</tr>
</thead>
</table>
| ![Characteristics](image) | **System protection TM, LI / LIN function**  
Overload protection adjustable $I_R = 0.8$ to $1 \times I_n$  
Short-circuit protection adjustable $I_i = 5$ to $10 \times I_n$ for VL160 to VL630  
"DC", "EJ", "EM" and "EC" versions | ![View](image) |

### Electronic trip units ETU VL160-VL1600

The electronic trip units include the following operating features:

- No auxiliary voltage is necessary for the tripping system. The tripping system draws its supply from the main connecting cables. Reliable tripping is thus ensured.
- All ETUs have a thermal image
- A flashing green LED indicates correct operation of the microprocessor
- Overload status ($I > 1.05 \times I_R$) is indicated by a permanent yellow LED (alarm)
- Integrated self-test function
- Plug-in socket for tester
- Communication connection to PROFIBUS DP or Modbus RTU for ETUs with communication preparation

#### Note

**Signal output to the COM20 / COM21**

Communication preparation (1 auxiliary switch and 1 alarm switch) is already integrated into the left accessory compartment for all ETUs with communication preparation and wired to the ETU. The cable to the COM20 / COM21 is included in the scope of supply.
### Displays and operator controls

#### 8.1 Overcurrent trip unit without LCD display

**LED display**

LED display of the ETU VL160 – VL1600 electronic trip units

- **Active LED**

<table>
<thead>
<tr>
<th>Color</th>
<th>LED OFF</th>
<th>LED flashes</th>
<th>LED ON (continuous light)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>ETU not activated</td>
<td>Normal status, the flashing green LED signals that the microprocessor is functioning properly.</td>
<td>The LED is in continuous light mode when the current flow of the processor is below the activation limit, in other words, when the load current flow is too low.</td>
</tr>
</tbody>
</table>

- **Alarm LED**

<table>
<thead>
<tr>
<th>Color</th>
<th>LED OFF</th>
<th>LED flashes</th>
<th>LED ON (continuous light)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow/orange</td>
<td>No overload</td>
<td>--</td>
<td>Signals overload, ( I &gt; 1.05 \times I_R )</td>
</tr>
</tbody>
</table>
### Displays and operator controls

#### 8.1 Overcurrent trip unit without LCD display

<table>
<thead>
<tr>
<th>Characteristic curve</th>
<th>Application</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image]</td>
<td><strong>ETU10 for system protection, LI/LIN function</strong></td>
<td>![Image]</td>
</tr>
<tr>
<td></td>
<td>Overload protection $I_R = 0.4$; $0.45$; $0.5$ to $0.95$; $1 \times I_n$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>time-lag class $t_R = 2.5$ to $30$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection (instantaneous) $I_i = 1.25$ to $11 \times I_n$ (size dependent)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot;SB&quot;, &quot;MB&quot;, &quot;LB&quot;, &quot;TB&quot; and &quot;NB&quot; versions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Neutral conductor protection $I_n = 50% / 100% \times I_n$, &quot;TA&quot;, &quot;LA&quot; and &quot;NA&quot; versions</td>
<td></td>
</tr>
</tbody>
</table>

| ![Image]            | **ETU20 for system and generator protection, LSI / LSIN function**         | ![Image] |
|                     | Overload protection $I_R = 0.4$; $0.45$; $0.5$ to $0.95$; $1 \times I_n$ |      |
|                     | Short-circuit protection (short-time delay) $I_{sd} = 1.5$ to $10 \times I_R$, $t_{sd} = 0$ to $0.5$ s |      |
|                     | $I^2t$ selectable on / off                                                  |      |
|                     | Short-circuit protection (instantaneous) $I_i = 11 \times I_n$ (fixed setting, size dependent) |      |
|                     | "SE", "ME", "LE", "TE" and "NE" versions                                   |      |
|                     | Neutral conductor protection $I_n = 50\% / 100\% \times I_n$, "TF", "LF" and "NF" versions |      |

<p>| ![Image]            | <strong>ETU12 for system protection, LIG / LING function</strong>                      | ![Image] |
|                     | Overload protection $I_R = 0.4$; $0.45$; $0.5$ to $0.95$; $1 \times I_n$ |      |
|                     | time-lag class $t_R = 2.5$ to $30$                                          |      |
|                     | Short-circuit protection (instantaneous) $I_i = 1.25$ to $11 \times I_n$ (size dependent) |      |
|                     | On 4-pole molded case circuit breakers:                                   |      |
|                     | neutral conductor                                                        |      |
|                     | protection $50% / 100% \times I_R$, &quot;TN&quot; and &quot;NN&quot; versions             |      |
|                     | Ground-fault protection:                                                  |      |
|                     | $I_g = 0.6 / 1.0 I_n$, $t_g = 0.1 / 0.3$ s                                |      |
|                     | measuring method No. 1: $(G\vec{r})$ vectorial summation current formation in the three phases and neutral conductor (4-conductor systems); $I_{\Delta n} = I_n$, versions &quot;SL&quot;, &quot;SF&quot;, &quot;ML&quot;, &quot;MF&quot;, &quot;TN&quot;, and &quot;NN&quot; |      |</p>
<table>
<thead>
<tr>
<th>Characteristic curve</th>
<th>Application</th>
<th>View</th>
</tr>
</thead>
</table>
| ETU22 for system and generator protection, LSIG / LSING function | Overload protection $I_n = 0.4; 0.45; 0.5$ to $0.95; 1 \times I_n$  
Short-circuit protection (short-time delayed) $I_{sc} = 1.5$ to $10 \times I_n$, $t_{sd} = 0$ to $0.5$ s  
$I^t$ selectable on / off  
Short-circuit protection (instantaneous) $I_i = 11 \times I_n$, (fixed setting, size dependent)  
On 4-pole molded case circuit breakers: neutral conductor protection $50\% / 100\% \times I_n$  
"TH" and "NH" versions  
Ground-fault protection: $I_g = 0.6 / 1.0 \times I_n$, $I_g = 0.1 / 0.3$ s  
Measuring method No. 1: $(G_{12})$ vectorial summation current formation in the three phases and neutral conductor (4-wire systems); $I_{10} = I_n$, versions "SG", "MG", "SH", "MH", "TH", "NH"  | ![Image 1](image1.png) |
| ETU10M for motor and generator protection, LI function | Finely adjustable overload protection $I_n = 0.41; 0.42$ to $0.98; 0.99; 1 \times I_n$, Trip class $t_C = 10$ (fixed setting)  
Thermal image  
Short-circuit protection (instantaneous) $I_i = 1.25$ to $11 \times I_n$ (size dependent) with phase failure sensitivity (40\% $I_n$ fixed setting)  
"SP" and "MP" versions  | ![Image 2](image2.png) |
| ETU30M for motor and generator protection, LI function | Finely adjustable overload protection $I_n = 0.41; 0.42$ to $0.98; 0.99; 1 \times I_n$, Trip class $t_C = 10, 20, 30$  
Thermal image  
Short-circuit protection (instantaneous) $I_i = 6$ to $11 \times I_n$ with phase failure sensitivity (40\% $I_n$ fixed setting)  
"SS", "MS" and "LS" versions  | ![Image 3](image3.png) |
8.2 Overcurrent trip unit with LCD display

The electronic trip units with LCD display have the following operating features:

- No auxiliary voltage is necessary for the tripping system.
- Current display
- Correct microprocessor operation is displayed.
- Overload status ($I > 1.05 \times I_R$) is indicated by "overload" on the LCD display
- Direct, user-friendly, menu-driven setting of the absolute values of the protection parameters in absolute ampere values via buttons
- Integrated self-test function
- Plug-in socket for tester
- Communication link to PROFIBUS DP and MODBUS RTU possible

Note

Signal output to the COM20 / COM21

Communication preparation (1 auxiliary switch and 1 alarm switch) is already integrated into the left accessory compartment for all LCD-ETUs and wired to the LCD-ETU. The COM20 / COM21 cable is included in the scope of supply.
**Electronic trip unit LCD ETU**

<table>
<thead>
<tr>
<th>Characteristic curve</th>
<th>Application</th>
<th>View</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Characteristic curve" /></td>
<td>ETU40 for system protection, LI / LSI / LSIN function, ETU40M motor / generator protection, LI function</td>
<td><img src="image2" alt="View image" /></td>
</tr>
<tr>
<td></td>
<td>Overload protection $I_{r} = 0.4$ to $1 \times I_{n}$, Trip class $t_{C} = 5$ to $30$ at ETU40M Time-lag class $t_{R} = 2.5$ to $30$ at ETU40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermal image selectable on / off, with phase failure sensitivity with ETU40M (5 ... 50% $I_{R}$ adjustable) “UP” version</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection (short-time delayed) on ETU40 $I_{sd} = 1.5$ to $10 \times I_{n}, t_{sd}^{(1)} = 0$ to $0.5$ s $I^{2}t$ selectable on / off on ETU40 “UH” and “UJ” versions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection (instantaneous) $I_{i} = 1.25$ to $11 \times I_{n}$ (size dependent)</td>
<td></td>
</tr>
<tr>
<td><img src="image3" alt="Characteristic curve" /></td>
<td>ETU42 for system protection, LSI/LSIG/LSING function</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overload protection $I_{r} = 0.4$ to $1 \times I_{n}$ Time-lag class $t_{R} = 2.5$ to $30$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thermal image selectable on/off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection (short-time delayed) $I_{sd} = 1.5$ to $10 \times I_{n}, t_{sd}^{(1)} = 0$ to $0.5$ s $I^{2}t$ selectable on / off</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Short-circuit protection (instantaneous) $I_{i} = 1.25$ to $11 \times I_{n}$ (size dependent)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ground-fault protection: Measuring method No. 1: ($G_{R}$) vectorial summation current formation in the three phases and neutral conductor (4-conductor systems); $I_{\Delta n} = 0.4$ to $1 \times I_{n}$, “UL”, “UM” and “UN” versions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Measuring method No. 2: ($G_{GND}$) direct measurement of the ground-fault current using a current transformer, $I_{g} = 0.4$ to $1 \times I_{n}, t_{g} = 0.1$ to $0.5$ s; “UM” version</td>
<td></td>
</tr>
<tr>
<td></td>
<td>On 4-pole molded case circuit breakers: neutral conductor protection N: 50 to 100% $I_{R}$ selectable or adjustable.</td>
<td></td>
</tr>
</tbody>
</table>

1) For $t_{sd} = 0$, the ST function must be set to the value “disabled”.

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**Displays and operator controls**

8.2 Overcurrent trip unit with LCD display

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3VL IEC molded case circuit breakers

System Manual, 11/2013, 110 0110 - 02 DS 03
Displays and operator controls

8.2 Overcurrent trip unit with LCD display

**MENU on the LCD display of the overcurrent release**

The following languages are available:

- English (default)
- German, French, Italian, Spanish
Displays and operator controls

8.2 Overcurrent trip unit with LCD display

![Figure 8-1 MENU on the LCD display of the overcurrent release](image)

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System Manual, 11/2013, 110 0110 - 02 DS 03
Displays and operator controls

8.2 Overcurrent trip unit with LCD display

Commissioning

The overcurrent release must be activated before it can be parameterized. A minimum load current of approximately 20% of the relevant rated current $I_n$ of the molded case circuit breaker is required.

**Note**

The factory-set "LCD-ETU" with the maximum settings for the overload release and the short-circuit release must be adapted during commissioning.

Changing the parameters for the overload and short-circuit releases during operation to a value below the current operating value causes instantaneous tripping.

If this minimum load current is not available, the required auxiliary power can be supplied using the 3VL9000-8AP01 hand-held tester. In molded case circuit breakers with communication capability, the trip unit is supplied with power by the COM20/21 Release 2.
9.1 Setting the parameters

Settings on the ETU

Note

Adjusting settings

The overcurrent release is preset with the maximum settings for the overload release and the short-circuit release. You must adjust these settings to the requirements of the system when installing the molded case circuit breakers.

Changing the setting values for the overload and short-circuit releases during operation to a value below the present operating value causes instantaneous tripping.

The protection parameters to be set on the electronic trip unit of the molded case circuit breaker depend on the technical environment (switchgear, cables), the network configuration, and the type of equipment to be protected. There are no fixed protection settings. The protection parameters can be determined by the relevant electrical planning engineer.

The Siemens software tool SIMARIS Design offers a simple, quick and safe solution for dimensioning switching and protective devices.

Internet link to SIMARIS (www.siemens.com/simaris)

Tripping characteristic curve and settings parameters

The time/current characteristic of a trip unit offers the best method for calculating the tripping characteristics of a trip unit. The tripping characteristic reflects the response of the circuit breaker in the event of a fault, e.g. overload or short-circuit. The time required to trip is defined at a specific current. The tripping characteristic is split into different sections. Each section reflects the tripping response of the circuit breaker at a specific current level.

Depending on the type of tripping, the trip units can be supplied with or without the S, N, or G functions (L, S, I, N, G designations in accordance with IEC 60947-2, Annex K).

- L long time delay = overload protection with current-dependent long time delay and current-dependent tripping curve ($I^2t =$ constant)
- S short time delay (short-circuit protection with short-time delay) = short-circuit protection with current-dependent or current-independent short time delay and current-dependent tripping curve ($I^2tsd =$ constant)
- I Instantaneous = short-circuit protection with instantaneous adjustable tripping.
- N Neutral protection = protection of the neutral conductor with adjustable, current-dependent tripping curve.
- G Ground fault = ground-fault protection with current-independent short-time delay.
### 9.1 Setting the parameters

#### Parameter assignment / addressing

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting buttons</th>
<th>Effect on characteristic curve</th>
<th>Brief description</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L</strong></td>
<td>$I_R$</td>
<td><img src="image1.png" alt="Image" /></td>
<td>Tripping current of the overload protection $I_R = 0.4$ to $1 \times I_n$</td>
<td>Setting to the operating current of the circuit to be protected</td>
</tr>
<tr>
<td>$t_R$</td>
<td>$t_{sd}$</td>
<td><img src="image2.png" alt="Image" /></td>
<td>Delay (or time-lag class) in the overload range. The set time is the tripping time at $6 \times I_R$. $t_R = 2.5$ to $30 \text{ s}$</td>
<td>Improved selectivity in the overload range in switchgear with several grade levels when the rated currents differ only slightly</td>
</tr>
<tr>
<td><strong>S</strong></td>
<td>$I_{sd}$</td>
<td><img src="image3.png" alt="Image" /></td>
<td>Tripping current of the short-time delayed short-circuit protection $I_{sd} = 1.5$ to $10 \times I_R$</td>
<td>Short-circuit release with time delay. In this way, time selectivity can be achieved with downstream switching devices.</td>
</tr>
<tr>
<td>$t_{sd}$</td>
<td>$t_{sd}$</td>
<td><img src="image4.png" alt="Image" /></td>
<td>Delay time of the short-circuit protection. Please note: The selection between $t_{sd} = \text{constant and } t^2$ characteristic $t_{sd} = 0$ to $0.5 \text{ s}$ with the position of the rotary encoding switch</td>
<td>Improved selectivity of the short-circuit protection in switchgear with several grade levels</td>
</tr>
<tr>
<td><strong>I</strong></td>
<td>$I_i$</td>
<td><img src="image5.png" alt="Image" /></td>
<td>Tripping current of the instantaneous short-circuit release $I_i = 1.25$ to $11 \times I_n$</td>
<td>Instantaneous short-circuit tripping for immediate shutdown of the molded case circuit breaker when the permissible short-circuit current is exceeded</td>
</tr>
<tr>
<td><strong>N</strong></td>
<td>$I_N$</td>
<td><img src="image6.png" alt="Image" /></td>
<td>Tripping current of the neutral conductor protection $I_N = 0.5$ or $1 \times I_R$</td>
<td>Overload protection of a neutral conductor or protection of a conductor with reduced cross-section</td>
</tr>
</tbody>
</table>

**3VL IEC molded case circuit breakers**

System Manual, 11/2013, 110 0110 - 02 DS 03
9.1 Setting the parameters

### Parameter assignment / addressing

#### Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Setting buttons</th>
<th>Effect on characteristic curve</th>
<th>Brief description</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>Ig/tg</td>
<td><img src="image" alt="Effect on Characteristic Curve" /></td>
<td>Tripping current and time delay of the ground-fault protection $I_g = \text{Off}, 1 \text{ or } 0.6 \times I_n$ $tg = \text{Off}, 0.1 \text{ s or } 0.3 \text{ s}$</td>
<td>Protection from short-circuit to ground and thus prevention of arcs. Ground-fault protection is part of the fire protection.</td>
</tr>
</tbody>
</table>

1) For LCD ETUs, the ST function must be set to the value “disabled” for $t_{sd} = 0$.

### Setting of the protection parameter for line and generator protection

The settings are variable depending on the trip unit (ETU10, ETU12, ETU20, ETU22, LCD-ETU40 and LCD-ETU42). The following parameters can be set depending on the version:

**L overload release $I_R$**:  
The overload release $I_R$ is set to the operating current $I_B$ of the circuit to be protected. This takes place with the help of the left rotary encoding switch $I_R$ that is set to the factor $I_B/I_n$ (example: $I_B = 250 \text{ A, } I_n = 315 \text{ A} \Rightarrow$ setting factor $250 \div 315 = 0.79$ corresponds to 0.8 on the rotary encoding switch).

**Delay time $t$**:  
The delay time (or time-lag class) $t$ can be set using another rotary encoding switch. The set time is the tripping time at $6 \times I_c$. In this way, selectivity to other molded case circuit breakers can be achieved in the overload range, for example, when the rated current range does not differ much.

**S short-time delayed short-circuit protection $I_{sd}$**:  
The short-time delay short-circuit protection can be set with regard to the tripping value of the current $I_{sd}$ and the delay time $t_{sd}$. $I_{sd}$ refers to the tripping value of the overload release $I_R$ and can be set between 1.5 to $10 \times I_c$ (depending on the molded case circuit breaker).

**Delay time $t_{sd}$**:  
Depending on the requirements and on the trip unit, selectivity to the other molded case circuit breakers can be achieved with appropriate selection of the delay time $t_{sd}$. If the rotary encoding switch is in the “ON” range, this means the delay time is current-dependent. The $I^2t$ value is constant. For example, the higher the current, the faster the circuit breaker will trip (equivalent to the overload release $I_R$). In contrast, the delay time in the “OFF” position is current-independent, that is, constant. If the current reaches the set value $I_{sd}$, the circuit breaker trips after the set time $t_{sd}$. The degree to which the current exceeds the value $I_{sd}$ is not important. The set time is the tripping time at $8 \times I_c$. 

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9.1 Setting the parameters

$I^2t$ waveform:

A $I^2t$ waveform of the characteristic curve can be switched in (depending on the ETU), the delay time $t_{sd}$ is based on the reference point $8 \times I_R$. Two different procedures are used to form the characteristic curve. As well as a fixed time delay for all currents in the characteristic curve section, the $I^2t$ characteristic can also be used. The tripping time falls continuously as the current increases, and the product of squared current and time remains constant.

![I^2t waveform](image)

**Figure 9-1 $I^2t$**

**$I$ instantaneous short-circuit protection $I_i$:**

On some trip units, the instantaneous short-circuit release $I_i$ can also be set. This refers to the rated current $I_n$ of the molded case circuit breaker. It must always be noted that either the instantaneous short-circuit release ($I_i$) or the delayed short-circuit release ($I_{sd}$) handles personnel protection. The tripping current of the short-circuit release of the molded case circuit breaker is set to a value that is at least 20% (tolerance of the trip unit) lower than the lowest short-circuit current at the installation location and simultaneously higher than the maximum operating current +20%. This guarantees that the circuit breaker will trip within the required time even with the smallest short-circuit current, and that correct currents will not result in unwanted trips.

**$G$ ground-fault protection $I_g$:**

The tripping value of the ground-fault release $I_g$ is fixed to the rated breaker current on the ETU12 and ETU22. The tripping current of the ground-fault release can be set to between 0.6 and $1 \times I_n$, and the delay time $t_g$ can be set between 0.3 s and 0.6 s. The measuring methods for the ground-fault protection are specified on the representation of the trip unit. On the ETU42, the tripping current of the ground-fault release can be set to between 0.4 and $1 \times I_n$, and the delay time can be set between 0.1 s and 0.5 s.

**Note**

**Ground-fault protection**

It must be noted that the ground-fault protection is not a residual-current operated circuit breaker (FI or RCD in the building installation). Fault currents to ground therefore cannot be detected, only ground "short"-circuits.
9.2 Setting the protection parameters for motor protection (ETU10M, ETU30M and LCD-ETU 40M)

The selection of the molded case circuit breaker is oriented around the rated operating current of the motor; the releases are specially designed for overload protection of 3-phase motors.

Overload release $I_R$:

The overload release $I_R$ is set to the rated current of the motor, in the same way as protection parameters for line and generator protection. The overload protection is finely adjustable with the left rotary encoding switch (first decimal place) and the center rotary encoding switch (second decimal place) in the range between $I_R = 0.41; 0.42$ to $0.98; 0.99; 1 \times I_n$ ($I_n$ = rated breaker current).

Example

Adjusting to the motor current $360 \ A$ is carried out for the rotary encoding switch left and center (ETU10M and ETU30M) (rated breaker current $I_n = 500 \ A$) as follows:

1. Setting the rotary encoding switch left factor 0.7
2. Setting the rotary encoding switch center factor 0.02

Short-circuit release $I_i$

Furthermore, instantaneous short-circuit release $I_i$ can also be set depending on the trip unit. This setting value refers to the rated current $I_n$ of the molded case circuit breaker. As with line and generator protection, the minimum short-circuit must be taken into account when selecting the setting.

With the ETU30M version, you must note that the setting of the short-circuit release is selected in combination with the time-lag class. The rotary encoding switch is divided into three areas here, corresponding to the values 6, 8 or $11 \times I_n$. The desired time-lag class can be selected within these ranges.
Setting the time-lag class/trip class

The 3VL molded case circuit breaker offers the option of selecting from various time-lag classes or trip classes for different motor applications.

One version (ETU10M) contains a thermal image and phase failure sensitivity based on a fixed trip class 10.

With the ETU30M, both the time-lag class TC and the tripping current of the short-circuit release are set in combination with the right rotary encoding switch.

The other version (ETU40M) with an LCD trip unit permits step by step setting from class 5 to 30. The setting in accordance with CLASS 5 is only used on motors with an extremely low overload capacity. In CLASS 30, by contrast, the motor must be suitable for starting under a heavy load. That is, the trip class must be adapted to the start-up time of the motor.

Definition of the trip class

The trip class specifies the start-up times during the motor start in accordance with IEC 60947-4-1. The trip class is defined by the tripping time at 7.2-times the set current level (in the cold state). Combinations with CLASS 10 are generally used.

The tripping times are as follows:

- CLASS 5 between 0.5 and 5 secs,
- CLASS 10 between 4 and 10 secs,
- CLASS 20 between 6 and 20 secs,
- CLASS 30 between 9 and 30 secs.

Applications such as fans, require longer start-up times.

Phase failure sensitivity

The “phase failure sensitivity” function is also integrated into the trip units for motor protection ETU10M, ETU30M and ETU40M. This ensures that the motor is reliably protected against overheating if a phase interruption or a large fluctuation occurs. The phase failure sensitivity protects 3-phase AC motors against overheating while only 2 phases are active. The specified operating current $I_R$ is automatically reduced to 80% of the set value if the RMS values of the operating currents in the three phases in the case of the ETU10M and ETU30M trip units differ by more than 40%. If an adjustable phase unbalance of 5 to 50% is set on the ETU40M trip unit, the set operating current $I_R$ is automatically reduced to 87% of the set value.

Thermal image

All releases with overload protection function have a “thermal image” which takes the pre-loading of the AC motor into consideration. The function of the fixed thermal image cannot be switched off (except on the ETU40M). Following an overload trip of the molded case circuit breaker, the tripping time is reduced by the thermal pre-loading of the molded case circuit breaker in such a way that further overloads cannot harm the motor windings.

After an overload trip, the tripping times are reduced in accordance with the tripping characteristic curves so that the inrush current can already cause a trip. A cooling time dependent on the size of the motor is required before the motor can be switched on again.
10.1 Preventive measures

Maintenance

**DANGER**

Qualified personnel
Functionality tests and maintenance tasks must only be carried out by qualified personnel due to the dangers associated with electrical equipment.

The following inspection intervals must be defined by the operator (qualified skilled personnel) depending on the conditions of use of the relevant 3VL molded case circuit breaker:

- At least 1 x per year
- After severe high-energy shutdowns
- After trips caused by the electronic overcurrent release
- After shutdowns caused by the thermal overcurrent release
- After shutdowns caused by the magnetic instantaneous overcurrent release
- Additional testing of downstream molded case circuit breakers.
Service and maintenance

10.1 Preventive measures

Inspection

The following checks must be carried out within the scope of the inspection(s) and/or after 1,000 rated current shutdowns. Please proceed as follows:

- **External circuit breaker housing**
  - Examine all visible surfaces for oxidation, residues or other adverse effects.
  - Remove residues with a lint-free, dry and clean cloth. (Never use chemical cleaners or water)

  **NOTICE**

  **Damage to the molded case circuit breaker**

  Never carry out repairs to the plastic casing or the interior of the circuit breaker! Molded case circuit breakers contain only maintenance-free components.

- **Electrical and mechanical functions of the circuit breaker**
  - Test the operating lever to check the mechanical functioning of the molded case circuit breaker contacts

- **Function of the mechanical on and off switch**
  - Operate the trip button, if available. Return the molded case circuit breaker to the starting position after each operation.

- **Main circuits and control circuits, function.**

- **Check connections are tight**
  - Check the tightening torque of the connecting screws (80% of the tightening torque recommended)
  - Visual inspection of the incoming and outgoing cables
  - Visual inspection of the connection accessories
  - Replace damaged terminal accessories after cleaning the terminal area

- **Check and, if necessary, correct the settings of the overcurrent release in accordance with the system conditions**
  - Electronic molded case circuit breaker releases must only be tested with a device especially supplied for this purpose (MLFB: 3VL9000-8AP01).

The operator (customer) must arrange for the disposal of the molded case circuit breaker or the replaced parts at the end of their service life in accordance with the currently applicable legal requirements and guidelines.
### 10.2 Troubleshooting

#### Notes on troubleshooting

<table>
<thead>
<tr>
<th>Circuit breaker status</th>
<th>Causes of faults</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload causes circuit breaker to trip:</td>
<td>Excessive current</td>
<td>The circuit breaker is functioning correctly and switches off an overload that occurs. Check to see if the operating current has exceeded the thermal tripping limit.</td>
</tr>
<tr>
<td></td>
<td>Connecting cable not correctly connected to the circuit breaker</td>
<td>Carry out a visual inspection of the terminals for discoloration. Cables can become loose during service due to various reasons such as vibration (machine tool applications) and cold flow (for aluminum cables).</td>
</tr>
<tr>
<td></td>
<td>Ambient temperature too high</td>
<td>This can be a problem on hot summer days or in areas subject to extreme heat. Although all 3VL molded case circuit breakers are calibrated for use at an ambient temperature of 50 °C, the temperatures in the enclosures can exceed this level. It may be necessary to consider derating the In or Ir values. See the Chapters Use in unusual environments, and Derating factors.</td>
</tr>
<tr>
<td></td>
<td>Overcurrent release not correctly connected to the circuit breaker.</td>
<td>If none of the above suggestions apply, the overcurrent release must be removed from the molded case circuit breaker and inspected for discoloration. The tightening torque values are listed in the operating manual supplied with every circuit breaker.</td>
</tr>
<tr>
<td>Short-circuit causes circuit breaker to trip:</td>
<td>Excessive making current, e.g. motor</td>
<td>Adjust the magnetic trip rating to the next highest setting or until the circuit breaker does not trip when the motor is started.</td>
</tr>
<tr>
<td></td>
<td>High current peaks, e.g. when changing from star to delta in star-delta starters.</td>
<td>A current peak of up to 20 times the rated current of the motor can occur when changing from star to delta. In this case, the short-circuit release &quot;I&quot; must be set to a higher value. However, this may result in the loss of the desired higher motor protection function.</td>
</tr>
</tbody>
</table>
### 10.2 Troubleshooting

<table>
<thead>
<tr>
<th>Circuit breaker status</th>
<th>Causes of faults</th>
<th>Corrective action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical and electrical functions:</td>
<td>High humidity</td>
<td>The molded case circuit breakers must not be used in environments with high humidity since this can cause dielectric and insulation problems. In such environments, appropriate measures need to be taken, such as placing the circuit breaker in an enclosure.</td>
</tr>
<tr>
<td></td>
<td>Corrosion</td>
<td>The molded case circuit breakers are not designed to be used in aggressive environments. In such environments, the circuit breaker should be installed in a housing.</td>
</tr>
<tr>
<td></td>
<td>Function of the internal accessories</td>
<td>Determine what type of internal accessories are installed. Remove the molded case circuit breaker cover and determine the type of accessories using the circuit breaker order number. Then check for correct functioning.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Undervoltage release: Ensure the correct voltage is connected to the undervoltage release since otherwise, the circuit breaker cannot be tripped.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Shunt release: Ensure the voltage is not applied to the shunt release since this can also prevent the circuit breaker from tripping.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Auxiliary and alarm switches: The auxiliary and alarm switches do not have any effect on the protection function of the molded case circuit breaker.</td>
</tr>
</tbody>
</table>
## Technical data

### 11.1 General data - 3VL molded case circuit breakers

<table>
<thead>
<tr>
<th>Type</th>
<th>VL160X 3VL1</th>
<th>VL160 3VL2</th>
<th>VL250 3VL3</th>
<th>VL400 3VL4</th>
<th>VL630 3VL5</th>
<th>VL800 3VL6</th>
<th>VL1250 3VL7</th>
<th>VL1600 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. rated current I&lt;sub&gt;n&lt;/sub&gt; [A]</strong></td>
<td>160</td>
<td>160</td>
<td>250</td>
<td>400</td>
<td>630</td>
<td>800</td>
<td>1250</td>
<td>1600</td>
</tr>
<tr>
<td><strong>N pole [A]</strong></td>
<td>160</td>
<td>160</td>
<td>250</td>
<td>400</td>
<td>630</td>
<td>800</td>
<td>1250</td>
<td>1600</td>
</tr>
</tbody>
</table>

#### Rated insulation voltage U<sub>i</sub> in accordance with IEC 60947-2

<table>
<thead>
<tr>
<th></th>
<th>VL160X 3VL1</th>
<th>VL160 3VL2</th>
<th>VL250 3VL3</th>
<th>VL400 3VL4</th>
<th>VL630 3VL5</th>
<th>VL800 3VL6</th>
<th>VL1250 3VL7</th>
<th>VL1600 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main current paths [V AC]</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
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</tr>
<tr>
<td>Auxiliary circuits [V AC]</td>
<td>690</td>
<td>690</td>
<td>690</td>
<td>690</td>
<td>690</td>
<td>690</td>
<td>690</td>
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</tr>
</tbody>
</table>

#### Rated impulse withstand voltage U<sub>imp</sub>

<table>
<thead>
<tr>
<th></th>
<th>VL160X 3VL1</th>
<th>VL160 3VL2</th>
<th>VL250 3VL3</th>
<th>VL400 3VL4</th>
<th>VL630 3VL5</th>
<th>VL800 3VL6</th>
<th>VL1250 3VL7</th>
<th>VL1600 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main current paths [kV]</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
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</tr>
<tr>
<td>Auxiliary circuits [kV]</td>
<td>4</td>
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<td>4</td>
<td>4</td>
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</table>

#### Rated operating voltage U<sub>e</sub>

<table>
<thead>
<tr>
<th></th>
<th>VL160X 3VL1</th>
<th>VL160 3VL2</th>
<th>VL250 3VL3</th>
<th>VL400 3VL4</th>
<th>VL630 3VL5</th>
<th>VL800 3VL6</th>
<th>VL1250 3VL7</th>
<th>VL1600 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 50 / 60 Hz [V AC]</td>
<td>690&lt;sup&gt;4)&lt;/sup&gt;</td>
<td>690</td>
<td>690</td>
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</tr>
<tr>
<td>IEC DC&lt;sup&gt;3)&lt;/sup&gt;</td>
<td>500</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>600&lt;sup&gt;1)&lt;/sup&gt;</td>
<td>600&lt;sup&gt;1)&lt;/sup&gt;</td>
</tr>
<tr>
<td>NEMA 60 Hz [V AC]</td>
<td>600</td>
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</tr>
</tbody>
</table>

#### Utilization category (IEC 60947-2)

|                     | A           | A           | A           | A           | A           | A           | A           | A           |

#### Permissible ambient temperature

<table>
<thead>
<tr>
<th></th>
<th>0 to +70</th>
<th>-25 to +70</th>
<th>-25 to +70</th>
<th>-25 to +70</th>
<th>-25 to +70</th>
<th>-25 to +70</th>
<th>-25 to +70</th>
<th>-25 to +70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation [°C]&lt;sup&gt;2)&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage [°C]</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
<td>-40 to +80</td>
</tr>
</tbody>
</table>

1) Breaker cannot be used for direct current.
2) Exception: 3VL molded case circuit breaker with TMTU: 0 °C ... 70 °C
3) The values apply for at least 3 current paths in series and extremely high breaking capacity L. For switching direct current, the maximum permissible direct voltage per current path must be observed.
4) VL160X in the 16 A and 20 A version cannot be used at 690 V.

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Note

For more information, see the following chapter:

Use in DC systems (Page 60) under "Suggested circuits for DC networks"
11.1 General data - 3VL molded case circuit breakers

<table>
<thead>
<tr>
<th>Type</th>
<th>VL160X 3VL1</th>
<th>VL160 3VL2</th>
<th>VL250 3VL3</th>
<th>VL400 3VL4</th>
<th>VL630 3VL5</th>
<th>VL800 3VL6</th>
<th>VL1250 3VL7</th>
<th>VL1600 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X 3VL1</td>
<td>100 / 100</td>
<td>93 / 100</td>
<td>100 / 95</td>
<td>100 / 95</td>
<td>100 / 95</td>
<td>100 / 95</td>
<td>100 / 95</td>
<td>100 / 95</td>
</tr>
<tr>
<td>VL160 3VL2</td>
<td>86 / 80</td>
<td>86 / 80</td>
<td>86 / 80</td>
<td>86 / 80</td>
<td>86 / 80</td>
<td>86 / 80</td>
<td>86 / 80</td>
<td>86 / 80</td>
</tr>
</tbody>
</table>

### Permissible load at different ambient temperatures

- **Molded case circuit breaker for system protection / generator protection**
  - TM/ETU up to 50 °C [%]
    - ETU at 50 °C [%]: 100emen / 100
    - ETU at 60 °C [%]: 93 / 95
    - ETU at 70 °C [%]: 86 / 80
  - TM/ETU up to 60 °C [%]
    - ETU at 50 °C [%]: 93 / 95
    - ETU at 60 °C [%]: 93 / 95
    - ETU at 70 °C [%]: 86 / 80
  - TM/ETU up to 70 °C [%]
    - ETU at 50 °C [%]: 93 / 95
    - ETU at 60 °C [%]: 93 / 95
    - ETU at 70 °C [%]: 86 / 80

- **Molded case circuit breaker for motor protection**
  - TM to 50 °C [%]: 100
  - TM at 60 °C [%]: 93
  - TM at 70 °C [%]: 86

### Weights of 3-pole molded case circuit breakers [kg]

- **Basic breaker without overcurrent release**
  - VL160X 3VL1: 1.5
  - VL160 3VL2: 1.6
  - VL250 3VL3: 4.2
  - VL400 3VL4: 7.8
  - VL630 3VL5: 14.2
  - VL800 3VL6: 21
  - VL1250 3VL7: 27.5
  - VL1600 3VL8: 34.8

- **Thermal-magnetic overcurrent release**
  - VL160X 3VL1: 0.7
  - VL160 3VL2: 0.7
  - VL250 3VL3: 1.5
  - VL400 3VL4: 1.2
  - VL630 3VL5: -
  - VL800 3VL6: -
  - VL1250 3VL7: -
  - VL1600 3VL8: -

- **Electronic trip unit**
  - VL160X 3VL1: 0.9
  - VL160 3VL2: 0.9
  - VL250 3VL3: 1.7
  - VL400 3VL4: 1.5
  - VL630 3VL5: 1.8
  - VL800 3VL6: 4.0
  - VL1250 3VL7: 4.0
  - VL1600 3VL8: -

### Weights of 4-pole molded case circuit breakers [kg]

- **Basic breaker without overcurrent release**
  - VL160X 3VL1: 2.0
  - VL160 3VL2: 2.2
  - VL250 3VL3: 5.5
  - VL400 3VL4: 9.7
  - VL630 3VL5: 18.2
  - VL800 3VL6: 27.5
  - VL1250 3VL7: 34.8
  - VL1600 3VL8: 6.0

- **Thermal-magnetic overcurrent release**
  - VL160X 3VL1: 1.0
  - VL160 3VL2: 1.0
  - VL250 3VL3: 1.9
  - VL400 3VL4: 1.5
  - VL630 3VL5: -
  - VL800 3VL6: -
  - VL1250 3VL7: -
  - VL1600 3VL8: -

- **Electronic trip unit**
  - VL160X 3VL1: 1.1
  - VL160 3VL2: 1.1
  - VL250 3VL3: 2.1
  - VL400 3VL4: 2.0
  - VL630 3VL5: 2.3
  - VL800 3VL6: 6.0
  - VL1250 3VL7: 6.0
  - VL1600 3VL8: -

- **Basic breaker with thermal-magnetic overcurrent release**
  - VL160X 3VL1: 2.5
  - VL160 3VL2: 3.0
  - VL250 3VL3: 3.2
  - VL400 3VL4: 7.4
  - VL630 3VL5: 11.2
  - VL800 3VL6: -
  - VL1250 3VL7: -
  - VL1600 3VL8: -

- **Basic breaker with electronic trip unit**
  - VL160X 3VL1: 3.1
  - VL160 3VL2: 3.3
  - VL250 3VL3: 7.6
  - VL400 3VL4: 11.7
  - VL630 3VL5: 20.5
  - VL800 3VL6: 33.5
  - VL1250 3VL7: 40.8
  - VL1600 3VL8: 40.8
## 11.1 General data - 3VL molded case circuit breakers

### Rated short-circuit breaking capacity in accordance with IEC 60947-2

<table>
<thead>
<tr>
<th></th>
<th>20000</th>
<th>20000</th>
<th>20000</th>
<th>20000</th>
<th>10000</th>
<th>10000</th>
<th>3000</th>
<th>3000</th>
</tr>
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<tbody>
<tr>
<td><strong>Service life make-break operations</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Service life electrical make-break operations</strong></td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
<td>10000</td>
<td>5000</td>
<td>3000</td>
<td>1500</td>
<td>1500</td>
</tr>
<tr>
<td><strong>Max. switching frequency [1/h]</strong></td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>120</td>
<td>60</td>
<td>60</td>
<td>30</td>
<td>30</td>
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<tr>
<td><strong>Connection types</strong></td>
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<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

See the chapter Technical overview (Page 132)

See the chapter Connecting (Page 89)
11.2 Technical overview

The technical overview lists all the operating data and dimensions as well as the possible overcurrent tripping methods and the switching capacities of the 3VL molded case circuit breakers. The RCD blocks overview contains the relevant operating data.

### VL160X, VL160 to VL400

**Table 11-1 Technical overview VL160X, VL160 to VL400**

<table>
<thead>
<tr>
<th></th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current $I_n$ at 50 °C ambient temperature</td>
<td>16 to 160 A</td>
<td>50 to 160 A</td>
<td>200 to 250 A</td>
<td>200 to 400 A</td>
</tr>
<tr>
<td>Number of poles</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>mm A</td>
<td>105</td>
<td>139</td>
<td>105</td>
<td>139</td>
</tr>
<tr>
<td>mm B</td>
<td>157</td>
<td>157</td>
<td>175</td>
<td>175</td>
</tr>
<tr>
<td>mm C</td>
<td>81</td>
<td>81</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td>mm D</td>
<td>107</td>
<td>107</td>
<td>107</td>
<td>107</td>
</tr>
<tr>
<td>Overcurrent release</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Electronic trip unit ETU</td>
<td>--</td>
<td>--</td>
<td>X</td>
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</table>

### VL630 to VL1600

**Table 11-2 Technical overview VL630 to VL1600**

<table>
<thead>
<tr>
<th></th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated current $I_n$ at 50 °C ambient temperature</td>
<td>315 to 630 A</td>
<td>800 A</td>
<td>1000 to 1250 A</td>
<td>1600 A</td>
</tr>
<tr>
<td>Number of poles</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>mm A</td>
<td>190</td>
<td>253</td>
<td>190</td>
<td>253</td>
</tr>
<tr>
<td>mm B</td>
<td>279</td>
<td>279</td>
<td>406</td>
<td>406</td>
</tr>
<tr>
<td>mm C</td>
<td>102</td>
<td>102</td>
<td>114</td>
<td>114</td>
</tr>
<tr>
<td>mm D</td>
<td>138</td>
<td>138</td>
<td>151</td>
<td>151</td>
</tr>
<tr>
<td>Overcurrent release</td>
<td>X</td>
<td>X</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Electronic trip unit ETU</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Standard breaking capacity VL160X, VL160 to VL400

Table 11- 3  SENTRON VL - N rated breaking current (kA) symmetrical (standard breaking capacity)

<table>
<thead>
<tr>
<th>Type</th>
<th>SENTRON</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Icu/Ics</td>
<td></td>
<td>Icu/Ics</td>
<td></td>
</tr>
<tr>
<td>IEC 60947-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 240 V AC</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
<td>65/65</td>
</tr>
<tr>
<td>Up to 415 V AC</td>
<td>55/55</td>
<td>55/55</td>
<td>55/55</td>
<td>55/55</td>
<td>55/55</td>
</tr>
<tr>
<td>Up to 440 V AC</td>
<td>25/20</td>
<td>25/20</td>
<td>25/20</td>
<td>25/20</td>
<td>35/26</td>
</tr>
<tr>
<td>Up to 500/525 V AC</td>
<td>18/14</td>
<td>25/20</td>
<td>25/20</td>
<td>25/20</td>
<td>25/20</td>
</tr>
<tr>
<td>Up to 690 V AC</td>
<td>8/4 1)</td>
<td>12/6</td>
<td>12/6</td>
<td>15/8</td>
<td></td>
</tr>
<tr>
<td>Up to 250 V DC</td>
<td>30/30</td>
<td>32/32</td>
<td>32/32</td>
<td>32/32</td>
<td>32/32</td>
</tr>
<tr>
<td>Up to 500 V DC</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Up to 600 V DC</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

1) For rated currents from 25 A. VL160X in the 16 A and 20 A version cannot be used at 690 V.

Standard breaking capacity VL630 to VL1600

Table 11- 4  SENTRON VL - N rated breaking current (kA) symmetrical (standard breaking capacity)

<table>
<thead>
<tr>
<th>Type</th>
<th>SENTRON</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Icu/Ics</td>
<td></td>
<td>Icu/Ics</td>
<td></td>
</tr>
<tr>
<td>IEC 60947-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 240 V AC</td>
<td>65/65</td>
<td>65/65</td>
<td>65/35</td>
<td>65/35</td>
<td>65/35</td>
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<tr>
<td>Up to 415 V AC</td>
<td>55/55</td>
<td>55/55</td>
<td>55/28</td>
<td>55/28</td>
<td>55/28</td>
</tr>
<tr>
<td>Up to 440 V AC</td>
<td>35/26</td>
<td>35/26</td>
<td>35/26</td>
<td>35/26</td>
<td>35/26</td>
</tr>
<tr>
<td>Up to 500/525 V AC</td>
<td>25/20</td>
<td>25/20</td>
<td>25/20</td>
<td>25/20</td>
<td>25/20</td>
</tr>
<tr>
<td>Up to 690 V AC</td>
<td>20/10</td>
<td>20/10</td>
<td>20/10</td>
<td>20/10</td>
<td>20/10</td>
</tr>
<tr>
<td>Up to 250 V DC</td>
<td>30/30</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Up to 500 V DC</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Up to 600 V DC</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
### 11.2 Technical overview

**High breaking capacity VL160X, VL160 to VL400**

Table 11-5  SENTRON VL - H rated breaking current (kA) symmetrical (high breaking capacity)

<table>
<thead>
<tr>
<th>Type</th>
<th>SENTRON</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60947-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 240 V AC</td>
<td>100/75</td>
<td>100/75</td>
<td>100/75</td>
<td>100/75</td>
<td></td>
</tr>
<tr>
<td>Up to 415 V AC</td>
<td>70/70</td>
<td>70/70</td>
<td>70/70</td>
<td>70/70</td>
<td></td>
</tr>
<tr>
<td>Up to 440 V AC</td>
<td>42/32</td>
<td>50/38</td>
<td>50/38</td>
<td>50/38</td>
<td></td>
</tr>
<tr>
<td>Up to 500/525 V AC</td>
<td>30/23</td>
<td>40/30</td>
<td>40/30</td>
<td>40/30</td>
<td></td>
</tr>
<tr>
<td>Up to 690 V AC</td>
<td>12/6 1)</td>
<td>12/6</td>
<td>12/6</td>
<td></td>
<td>15/8</td>
</tr>
<tr>
<td>Up to 250 V DC</td>
<td>30/30</td>
<td>32/32</td>
<td>32/32</td>
<td>32/32</td>
<td></td>
</tr>
<tr>
<td>Up to 500 V DC</td>
<td>30/30</td>
<td>32/32</td>
<td>32/32</td>
<td>32/32</td>
<td></td>
</tr>
<tr>
<td>Up to 600 V DC</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

1) For rated currents from 25 A. VL160X in the 16 A and 20 A version cannot be used at 690 V.

**High breaking capacity VL630 to VL1600**

Table 11-6  SENTRON VL - H rated breaking current (kA) symmetrical (high breaking capacity)

<table>
<thead>
<tr>
<th>Type</th>
<th>SENTRON</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEC 60947-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 240 V AC</td>
<td>100/75</td>
<td>100/75</td>
<td>100/50</td>
<td>100/50</td>
<td></td>
</tr>
<tr>
<td>Up to 415 V AC</td>
<td>70/70</td>
<td>70/70</td>
<td>70/35</td>
<td>70/35</td>
<td></td>
</tr>
<tr>
<td>Up to 440 V AC</td>
<td>50/38</td>
<td>50/38</td>
<td>50/38</td>
<td>50/38</td>
<td></td>
</tr>
<tr>
<td>Up to 500/525 V AC</td>
<td>40/30</td>
<td>40/30</td>
<td>40/30</td>
<td>40/30</td>
<td></td>
</tr>
<tr>
<td>Up to 690 V AC</td>
<td>20/10</td>
<td>20/10</td>
<td>30/15</td>
<td>30/15</td>
<td></td>
</tr>
<tr>
<td>Up to 250 V DC</td>
<td>30/30</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Up to 500 V DC</td>
<td>30/30</td>
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<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Up to 600 V DC</td>
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<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
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</tbody>
</table>
Very high breaking capacity VL160X, VL160 to VL400

Table 11-7  SENTRON VL - L rated breaking current (kA) balanced (very high breaking capacity)

<table>
<thead>
<tr>
<th>Type</th>
<th>SENTRON</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 240 V AC</td>
<td>--</td>
<td>200/150</td>
<td>200/150</td>
<td>200/150</td>
<td>200/150</td>
</tr>
<tr>
<td>Up to 415 V AC</td>
<td>--</td>
<td>100/75</td>
<td>100/75</td>
<td>100/75</td>
<td>100/75</td>
</tr>
<tr>
<td>Up to 440 V AC</td>
<td>--</td>
<td>75/50</td>
<td>75/50</td>
<td>75/50</td>
<td>75/50</td>
</tr>
<tr>
<td>Up to 500/525 V AC</td>
<td>--</td>
<td>50/38</td>
<td>50/38</td>
<td>50/38</td>
<td>50/38</td>
</tr>
<tr>
<td>Up to 690 V AC</td>
<td>--</td>
<td>12/6</td>
<td>12/6</td>
<td>12/6</td>
<td>12/6</td>
</tr>
<tr>
<td>Up to 250 V DC</td>
<td>--</td>
<td>32/32</td>
<td>32/32</td>
<td>32/32</td>
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<td>32/32</td>
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<td>32/32</td>
<td>32/32</td>
<td>32/32</td>
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</table>

Very high breaking capacity VL630 to VL1600

Table 11-8  SENTRON VL - L rated breaking current (kA) balanced (very high breaking capacity)

<table>
<thead>
<tr>
<th>Type</th>
<th>SENTRON</th>
<th>VL630</th>
<th>VL800</th>
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<th>VL1600</th>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 240 V AC</td>
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<td>200/150</td>
<td>200/100</td>
<td>200/100</td>
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<tr>
<td>Up to 415 V AC</td>
<td></td>
<td>100/75</td>
<td>100/75</td>
<td>100/50</td>
<td>100/50</td>
</tr>
<tr>
<td>Up to 440 V AC</td>
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<td>75/50</td>
<td>75/50</td>
<td>75/50</td>
<td>75/50</td>
</tr>
<tr>
<td>Up to 500/525 V AC</td>
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<td>50/38</td>
<td>50/38</td>
<td>50/38</td>
<td>50/38</td>
</tr>
<tr>
<td>Up to 690 V AC</td>
<td></td>
<td>20/10</td>
<td>20/10</td>
<td>35/17</td>
<td>35/17</td>
</tr>
<tr>
<td>Up to 250 V DC</td>
<td></td>
<td>30/30</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Up to 500 V DC</td>
<td></td>
<td>30/30</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Up to 600 V DC</td>
<td></td>
<td>30/30</td>
<td>--</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>

Further information

For more information, see the following chapter:
Use in DC systems (Page 60)
Section "Suggested circuits for DC networks"
11.3 Configuration of main connections

Main connections

<table>
<thead>
<tr>
<th>Molded case circuit breakers</th>
<th>Connection overview and further options</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Box terminals</td>
</tr>
<tr>
<td>VL160X</td>
<td>□</td>
</tr>
<tr>
<td>VL160</td>
<td>□</td>
</tr>
<tr>
<td>VL250</td>
<td>□</td>
</tr>
<tr>
<td>VL400</td>
<td>x</td>
</tr>
<tr>
<td>VL630</td>
<td>x&lt;sup&gt;1)&lt;/sup&gt;</td>
</tr>
<tr>
<td>VL800</td>
<td>--</td>
</tr>
<tr>
<td>VL1250</td>
<td>--</td>
</tr>
<tr>
<td>VL1600</td>
<td>--</td>
</tr>
</tbody>
</table>

○ Scope of supply
□ Optional scope of supply
x Available
-- Not available
1) Connecting terminal plate for flexible busbar; not for 690 V AC / 600 V DC.
2) Multiple feed-in terminal
3) Circular conductor terminal also available.

Conductor cross-sections

<table>
<thead>
<tr>
<th>Type</th>
<th>VL160X 3VL1</th>
<th>VL160 3VL2</th>
<th>VL250 3VL3</th>
<th>VL400 3VL4</th>
<th>VL630 3VL5</th>
<th>VL800 3VL6</th>
<th>VL1250 3VL7</th>
<th>VL1600 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Box terminal&lt;sup&gt;2)&lt;/sup&gt;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1) Connecting terminal plate for flexible busbar&lt;sup&gt;3)&lt;/sup&gt; [mm]</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2 units 10 × 32</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Circular conductor terminal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2) Solid or stranded cable; Cu or Al [mm²]</td>
<td>16 to 70</td>
<td>16 to 70</td>
<td>25 to 185</td>
<td>50 to 300</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>3) Finely stranded with end sleeve [mm²]</td>
<td>2.5 to 50</td>
<td>2.5 to 50</td>
<td>25 to 120</td>
<td>50 to 240</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>4) Flexible busbar [mm]</td>
<td>12 x 10</td>
<td>12 x 10</td>
<td>17 x 10</td>
<td>25 x 10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers

System Manual, 11/2013, 110 0110 - 02 DS 03
### 11.3 Configuration of main connections

#### Technical data

**11.3 Configuration of main connections**

<table>
<thead>
<tr>
<th>Type</th>
<th>VL160X 3VL1</th>
<th>VL160 3VL2</th>
<th>VL250 3VL3</th>
<th>VL400 3VL4</th>
<th>VL630 3VL5</th>
<th>VL800 3VL6</th>
<th>VL1250 3VL7</th>
<th>VL1600 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Finely stranded with end sleeve [mm²]</td>
<td>10 to 50</td>
<td>10 to 50</td>
<td>25 to 120</td>
<td>50 to 240</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Circular conductor terminal with auxiliary conductor connection**

| • Solid or stranded cable; Cu or Al [mm²] | 16 to 150 | 16 to 150 | 120 to 240 | - | - | - | - |
| • Finely stranded with end sleeve [mm²] | 16 to 120 | 16 to 120 | 120 to 185 | - | - | - | - |

**Multiple feed-in terminal**

| • Solid or stranded cable; Cu or Al [mm²] | - | - | - | 2 units 50 to 120 | 2 units 50 to 240 | 3 units 50 to 240 | 4 units 50 to 240 | - |
| • With terminal cover; Cu or Al [mm²] | - | - | - | 2 units 70 to 300 | - | - | - | - |
| • Finely stranded with end sleeve | - | - | - | 2 units 50 to 95 | 2 units 50 to 185 | 3 units 50 to 185 | 4 units 50 to 185 | - |

**Direct connection**

| • Direct connection of busbars; Cu or Al [mm] | 17 x 7 | 22 x 7 | 24 x 7 | 32 x 10 | 40 x 10 | 2 x 40 x 10 | 2 x 50 x 10 | 3 x 60 x 10 |
| • Screw for terminals with screw connection | M6 | M6 | M8 | M8 | M6 | M8 | M8 | - |

1) Not for 690 V AC / 600 V DC  
2) Cross-sections in accordance with IEC 6099

---

### Conductor cross-sections for internal accessories for terminals with screw connection

**Table 11-9** Conductor cross-sections for internal accessories for terminals with screw connection: UVR, shunt, auxiliary switches, alarm switches

| • Solid [mm²] | 0.75 to 1.5 |
| • Finely stranded with end sleeve [mm²] | 0.75 to 1.0 |

See installation instructions for details.
## Technical data

### 11.3 Configuration of main connections

#### Tightening torques for cables and leads

<table>
<thead>
<tr>
<th>Molded case circuit breakers</th>
<th>Connection type</th>
<th>Conductor</th>
<th>Conductor cross-section mm²</th>
<th>Tightening torque</th>
<th>Tool Allen key</th>
<th>Connection screw</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>7 x 17 (busbar)</td>
<td>6 Nm</td>
<td>5 mm</td>
<td>M6</td>
</tr>
<tr>
<td></td>
<td>Box terminal</td>
<td>Cu</td>
<td>2.5 – 10 16 – 95</td>
<td>4 Nm</td>
<td>4 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexible copper busbar</td>
<td>12 x 10</td>
<td>8 Nm</td>
<td>4 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Circular conductor connection</td>
<td>Al / Cu</td>
<td>16 – 70</td>
<td>14 Nm</td>
<td>4 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Circular conductor connection with terminal cover</td>
<td>Al / Cu</td>
<td>16 – 35 50 – 150</td>
<td>31 Nm</td>
<td>5 mm</td>
<td>--</td>
</tr>
<tr>
<td>VL160</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>7 x 22 (busbar)</td>
<td>6 Nm</td>
<td>5 mm</td>
<td>M6</td>
</tr>
<tr>
<td></td>
<td>Box terminal</td>
<td>Cu</td>
<td>2.5 – 10 16 – 95</td>
<td>4 Nm</td>
<td>4 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexible copper busbar</td>
<td>12 x 10</td>
<td>8 Nm</td>
<td>4 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Circular conductor connection</td>
<td>Al / Cu</td>
<td>16 – 70</td>
<td>14 Nm</td>
<td>4 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Circular conductor connection with terminal cover</td>
<td>Al / Cu</td>
<td>16 – 35 50 – 150</td>
<td>31 Nm</td>
<td>5 mm</td>
<td>--</td>
</tr>
<tr>
<td>VL250</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>7 x 24 (busbar)</td>
<td>10 Nm</td>
<td>6 mm</td>
<td>M8</td>
</tr>
<tr>
<td></td>
<td>Box terminal</td>
<td>Cu</td>
<td>25 – 185</td>
<td>12 Nm</td>
<td>5 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexible copper busbar</td>
<td>17 x 10</td>
<td>12 Nm</td>
<td>5 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Circular conductor connection</td>
<td>Al / Cu</td>
<td>25 – 35 50 – 185</td>
<td>14 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>285 – 240</td>
<td>31 Nm</td>
<td>8 mm</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Circular conductor connection with terminal cover</td>
<td>Al / Cu</td>
<td>120 – 150 50 – 185</td>
<td>25 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 Nm</td>
<td>31 Nm</td>
<td>8 mm</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>VL400</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>10 x 32 (busbar)</td>
<td>15 Nm</td>
<td>6 mm</td>
<td>M8</td>
</tr>
<tr>
<td></td>
<td>Box terminal</td>
<td>Cu</td>
<td>50 – 300</td>
<td>25 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexible copper busbar</td>
<td>25 x 10</td>
<td>25 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Circular conductor connection</td>
<td>Al / Cu</td>
<td>95 – 120 150 – 300</td>
<td>31 Nm</td>
<td>12 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>56 Nm</td>
<td>31 Nm</td>
<td>8 mm</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Multiple feed-in terminal (2 cables)</td>
<td>Al / Cu</td>
<td>50 – 120</td>
<td>31 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Multiple feed-in terminal with terminal cover</td>
<td>Al / Cu</td>
<td>70 – 300</td>
<td>42 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
</tbody>
</table>
### Technical data

#### 11.3 Configuration of main connections

<table>
<thead>
<tr>
<th>Molded case circuit breakers</th>
<th>Connection type</th>
<th>Conductor</th>
<th>Conductor cross-section mm²</th>
<th>Tightening torque</th>
<th>Tool Allen key</th>
<th>Connection screw</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL630</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>1x 40 x 10 (busbar)</td>
<td>15 Nm</td>
<td>5 mm</td>
<td>M6</td>
</tr>
<tr>
<td></td>
<td>Multiple feed-in terminal (2 cables)</td>
<td>Al / Cu</td>
<td>50 – 240</td>
<td>34 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td>Connecting terminal plate for flexible copper busbars</td>
<td>Cu</td>
<td>10 x 32 (busbar)</td>
<td>15 Nm</td>
<td>5 mm</td>
<td>M6</td>
</tr>
<tr>
<td>VL800</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>2x 40 x 10 (busbar)</td>
<td>24 Nm</td>
<td>6 Nm</td>
<td>M8</td>
</tr>
<tr>
<td></td>
<td>Multiple feed-in terminal (3 cables)</td>
<td>Al / Cu</td>
<td>50 – 240</td>
<td>42 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td>VL1250</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>2x 50 x 10 (busbar)</td>
<td>24 Nm</td>
<td>6 mm</td>
<td>M8</td>
</tr>
<tr>
<td></td>
<td>Multiple feed-in terminal (4 cables)</td>
<td>Al / Cu</td>
<td>50 – 240</td>
<td>42 Nm</td>
<td>8 mm</td>
<td>--</td>
</tr>
<tr>
<td>VL1600</td>
<td>Terminals with screw connection with metric thread for flat connection</td>
<td>Al / Cu</td>
<td>3x 60 x 10 (busbar)</td>
<td>24 Nm</td>
<td>6 mm</td>
<td>--</td>
</tr>
</tbody>
</table>

### Front connecting bars

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>VL160X/ VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250 / VL160</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (W)</td>
<td>20</td>
<td>22</td>
<td>30,5</td>
<td>42</td>
<td>51</td>
<td>60</td>
</tr>
<tr>
<td>Length (L)</td>
<td>44,5</td>
<td>44,5</td>
<td>81,75</td>
<td>69,75</td>
<td>91,5</td>
<td>102,25</td>
</tr>
<tr>
<td>Clearance (D)</td>
<td>10</td>
<td>13</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>20</td>
</tr>
<tr>
<td>Thickness (T)</td>
<td>6,5</td>
<td>6,5</td>
<td>9,5</td>
<td>9,5</td>
<td>9,5</td>
<td>16</td>
</tr>
<tr>
<td>inside (Ø)</td>
<td>7</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers
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11.3 Configuration of main connections

Front connecting bars for increased pole spacing

Table 11-11  Front connecting bars for increased pole spacing

<table>
<thead>
<tr>
<th>Dimensions (mm)</th>
<th>VL160X / VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pole clearance (P)</td>
<td>44,5</td>
<td>44,5</td>
<td>63,5</td>
<td>76</td>
<td>76</td>
</tr>
</tbody>
</table>

Rear terminals

Table 11-12  Rear terminals

<table>
<thead>
<tr>
<th>Thread round terminal</th>
<th>VL160X / VL160</th>
<th>VL250</th>
<th>VL400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short length (Ls) mm</td>
<td>66</td>
<td>66</td>
<td>73</td>
</tr>
<tr>
<td>Long length (Ll) mm</td>
<td>123</td>
<td>123</td>
<td>131</td>
</tr>
<tr>
<td>Thread</td>
<td>M12</td>
<td>M12</td>
<td>M12</td>
</tr>
<tr>
<td>Flat terminal</td>
<td>VL160X / VL160</td>
<td>VL250</td>
<td>VL400</td>
</tr>
<tr>
<td>Short length (Ls) mm</td>
<td>51,5</td>
<td>51,5</td>
<td>98</td>
</tr>
<tr>
<td>Long length (Ll) mm</td>
<td>108,5</td>
<td>108,5</td>
<td>157</td>
</tr>
<tr>
<td>Bore hole Ø</td>
<td>11</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>W / W / T</td>
<td>25 / 25 / 4</td>
<td>25 / 25 / 4</td>
<td>28 / 28 / 8</td>
</tr>
</tbody>
</table>
Technical data

11.3 Configuration of main connections

Rear flat busbar terminals

Table 11- 13 Rear flat busbar terminals

<table>
<thead>
<tr>
<th>mm</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width (W)</td>
<td>32</td>
<td>50</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td>Length (L)</td>
<td>66,5</td>
<td>142</td>
<td>142</td>
<td>178</td>
</tr>
<tr>
<td>inside (Ø D)</td>
<td>11</td>
<td>13 (2x)</td>
<td>13 (2x)</td>
<td>13 (2x)</td>
</tr>
<tr>
<td>Allen key/hex \n wrench opening</td>
<td>6 / -</td>
<td>6 / -</td>
<td>6 / -</td>
<td>- / 18</td>
</tr>
<tr>
<td>Tightening torque \n for fixing screw</td>
<td>15 Nm</td>
<td>15 Nm</td>
<td>15 Nm</td>
<td>30 Nm</td>
</tr>
</tbody>
</table>

Terminals with screw connection

Table 11- 14 Terminals with screw connection

<table>
<thead>
<tr>
<th>Molded case \n circuit breaker</th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
<th>VL630</th>
<th>VL800</th>
<th>VL1250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw</td>
<td>M6 x 20</td>
<td>M6 x 20</td>
<td>M8 x 20</td>
<td>M8 x 25</td>
<td>M6 x 40</td>
<td>M8 x 50</td>
<td>M8 x 50</td>
</tr>
<tr>
<td>Busbar thickness T</td>
<td>1 - 7</td>
<td>1 - 7</td>
<td>1 - 7</td>
<td>3 - 10</td>
<td>5 - 10</td>
<td>10 - 20</td>
<td>20 - 30</td>
</tr>
<tr>
<td>Max. torque Nm</td>
<td>6</td>
<td>6</td>
<td>10</td>
<td>15</td>
<td>15</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Busbar dmax Wmax mm</td>
<td>6</td>
<td>9</td>
<td>9</td>
<td>10</td>
<td>10</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>24</td>
<td>24</td>
<td>32</td>
<td>42</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>
11.4 Derating factors

The tables for derating factors apply for 3VL molded case circuit breakers used under difficult operating conditions in the following areas:

11.4.1 Use at altitudes above 2000 meters

Table 11-15 Derating factors for high altitudes

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>Characteristic values</th>
<th>Altitude (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>2000</td>
</tr>
<tr>
<td>All</td>
<td>Breaking capacity $I_{cu}/I_{CS}$</td>
<td>1,0</td>
</tr>
<tr>
<td></td>
<td>Operating voltage $U_{max}$</td>
<td>1,0</td>
</tr>
<tr>
<td></td>
<td>Operating current $I_{max}$</td>
<td>1,00</td>
</tr>
<tr>
<td></td>
<td>Set current $I_{r}$</td>
<td>1,00</td>
</tr>
</tbody>
</table>

1) At max. ambient temperature 50 °C
2) Thermal-magnetic releases only

See also

Use in unusual environments: (Page 67)
11.4.2 Use under diverse ambient temperatures

Thermal-magnetic overcurrent releases

Fixed mounting:

Table 11-16 Derating factors of thermal-magnetic overcurrent release

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>In at 50 °C [A]</th>
<th>Cross-section Cu [mm²] min.</th>
<th>Cross-section Al [mm²] min.</th>
<th>Max. rated uninterrupted current according to the ambient temperature x In</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In</td>
<td></td>
<td></td>
<td>40 °C</td>
</tr>
<tr>
<td>VL160X</td>
<td></td>
<td></td>
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</table>
### Plug-in or withdrawable version:

Table 11- 17 Derating factors thermal-magnetic overcurrent releases (plug-in or withdrawable version)

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>Thermal-magnetic TM</th>
<th>Coefficient at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Release</td>
<td>40 °C</td>
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<tr>
<td>VL160X</td>
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<td>VL160 &amp; VL160X</td>
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<tr>
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<td>630</td>
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</tbody>
</table>

Example for VL250:

- $I_n = 200 \text{ A at } 50 \degree \text{C}$
- Ambient temperature = 60 °C

1. Fixed-mounted version:
   $I_n = 200 \times 0.93^{1)} \times 0.92^{2)} = 186 \text{ A}$
   - Set $I_R$ to the next lowest value -> $I_R = 0.9 = 180 \text{ A}$

2. Plug-in or withdrawable version:
   $I_n = 200 \times 0.93^{1)} \times 0.92^{2)} = 167 \text{ A}$
   - Calculation of overall derating = $0.93 \times 0.9 = 0.837$
   - Set $I_R$ to the next lowest value -> $I_R = 0.8 = 160 \text{ A}$

1) Derating factor from the table "Derating factors of thermal-magnetic overcurrent releases"

2) Coefficient for plug-in or withdrawable version from the table "Derating factors for thermal-magnetic overcurrent releases (plug-in or withdrawable version)"
### Thermal-magnetic overcurrent release + RCD module

#### Fixed mounting:

**Table 11-18 Derating factors for thermal-magnetic overcurrent release + RCD module (fixed mounting)**

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>( I_n ) At 50 °C [A]</th>
<th>Cross-section Cu [mm²] min.</th>
<th>Cross-section Al [mm²] min.</th>
<th>Max. rated uninterrupted current according to the ambient temperature ( x \ I_n )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40 °C</td>
<td>50 °C</td>
<td>60 °C</td>
<td>70 °C</td>
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<td>VL250</td>
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</table>

3VL IEC molded case circuit breakers

System Manual, 11/2013, 110 0110 - 02 DS 03
Plug-in or withdrawable version:

Table 11-19  Derating factors for thermal-magnetic overcurrent release + RCD module (plug-in or withdrawable version)

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>Release</th>
<th>Coefficient at 40 °C</th>
<th>50 °C</th>
<th>60 °C</th>
<th>70 °C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Thermal-magnetic TM From [A]</td>
<td>To [A]</td>
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<td></td>
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<tr>
<td>VL160X</td>
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<td>1</td>
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Electronic trip unit

Fixed mounting:

Table 11-20  Derating factors for electronic trip unit (fixed mounting)

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>I_{n} At 50 °C [A]</th>
<th>Cross-section Cu [mm²] min.</th>
<th>Cross-section Al [mm²] min.</th>
<th>Max. rated uninterrupted current according to the ambient temperature x I_{n}</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td>40 °C</td>
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<td></td>
<td>250</td>
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<td>185</td>
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</tr>
<tr>
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<td>VL1600</td>
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</tbody>
</table>

Note
The electronic trip units with order No. supplement (9th and 10th position) Sx, Mx, Lx, Tx, Nx and Ux have a thermal self-protection feature that trips the breaker if the electronics components reach 100 °C.
Plug-in or withdrawable version:

Table 11-21 Derating factors for electronic trip units (plug-in or withdrawable version)

<table>
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<tr>
<th>Molded case circuit breaker</th>
<th>Release ETU</th>
<th>Coefficient at</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From [A]</td>
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<tr>
<td>VL630</td>
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<tr>
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<td>1250</td>
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<td>1600</td>
</tr>
</tbody>
</table>

Example for VL250:

- \( I_n = 250 \text{ A at } 50 \degree C \)
- Ambient temperature = 60 \degree C

1. Fixed-mounted version:
   \( I_n = 250 \times 0.95^{1)} \times 0.9^{2)} = 237 \text{ A} \)
   
   Set \( I_R \) to the next lowest value -> \( I_R = 0.95 = 237 \text{ A} \)

2. Plug-in or withdrawable version:
   \( I_n = 250 \times 0.95^{1)} \times 0.9^{2)} = 213 \text{ A} \)
   
   Calculation of overall derating = 0.95 x 0.9 = 0.885
   
   Set \( I_R \) to the next lowest value -> \( I_R = 0.8 = 200 \text{ A} \)

1) Derating factor from the table "Derating factors of electronic trip units (fixed mounting)"

2) Coefficient for plug-in or withdrawable version from the table "Derating factors for electronic trip units (plug-in or withdrawable version)"
Response values for minimum and maximum settings on the thermal release

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<th>Size</th>
<th>In [A]</th>
<th>0 °C</th>
<th>10 °C</th>
<th>20 °C</th>
<th>30 °C</th>
<th>35 °C</th>
</tr>
</thead>
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<td></td>
<td>315</td>
<td>338</td>
<td>378</td>
<td>320</td>
<td>365</td>
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</tr>
<tr>
<td></td>
<td>400</td>
<td>432</td>
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<td>410</td>
<td>464</td>
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</tr>
<tr>
<td></td>
<td>500</td>
<td>540</td>
<td>600</td>
<td>512</td>
<td>580</td>
<td>484</td>
</tr>
<tr>
<td></td>
<td>630</td>
<td>675</td>
<td>756</td>
<td>640</td>
<td>731</td>
<td>605</td>
</tr>
<tr>
<td>VL630</td>
<td>315</td>
<td>338</td>
<td>378</td>
<td>320</td>
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<td>303</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>432</td>
<td>480</td>
<td>410</td>
<td>464</td>
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<tr>
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<td>500</td>
<td>540</td>
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<td>512</td>
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<td></td>
<td>630</td>
<td>675</td>
<td>756</td>
<td>640</td>
<td>731</td>
<td>605</td>
</tr>
</tbody>
</table>

* For TMTUs with fixed setting, the value for "max" applies.

**Example for VL160:**

The Iᵣ of a VL 160X with adjustable TMTU and In = 63 A refers to 50 °C and can be adjusted there in the range 50 A … 63 A. At an ambient temperature of 30 °C, these values change so that the adjustable range for Iᵣ is 57 A … 68 A.
Table 11-23  Setting values I<sub>r</sub> dependent on the ambient temperature (40 °C … 70 °C)

<table>
<thead>
<tr>
<th>Size</th>
<th>In [A]</th>
<th>40 °C</th>
<th>50 °C</th>
<th>60 °C **</th>
<th>70 °C **</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>min</td>
<td>max*</td>
<td>min</td>
<td>max*</td>
</tr>
<tr>
<td>VL160X</td>
<td>16</td>
<td>-</td>
<td>17</td>
<td>-</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>17</td>
<td>21</td>
<td>16</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>-</td>
<td>26</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>27</td>
<td>33</td>
<td>25</td>
<td>32</td>
</tr>
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<td>43</td>
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<td>50</td>
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<td>63</td>
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<td>83</td>
<td>63</td>
<td>80</td>
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<td>86</td>
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<tr>
<td></td>
<td>125</td>
<td>107</td>
<td>130</td>
<td>100</td>
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<td>134</td>
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<td>40</td>
<td>50</td>
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<td></td>
<td>63</td>
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<td>63</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>67</td>
<td>84</td>
<td>63</td>
<td>80</td>
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<tr>
<td></td>
<td>100</td>
<td>86</td>
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<td></td>
<td>160</td>
<td>134</td>
<td>168</td>
<td>125</td>
<td>160</td>
</tr>
<tr>
<td>VL250</td>
<td>200</td>
<td>171</td>
<td>210</td>
<td>160</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>214</td>
<td>263</td>
<td>200</td>
<td>250</td>
</tr>
<tr>
<td>VL400</td>
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<td>200</td>
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<td></td>
<td>250</td>
<td>214</td>
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<td>250</td>
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<td>315</td>
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<td></td>
<td>400</td>
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<td>320</td>
<td>400</td>
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<td>VL630</td>
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<td></td>
<td>630</td>
<td>535</td>
<td>655</td>
<td>500</td>
<td>630</td>
</tr>
</tbody>
</table>

* For TMTUs with fixed setting, the value for "max" applies.

** For temperatures in excess of 50 °C, the derating factors also have to be observed. (see Auto-Hotspot)
11.5 Power loss

Power loss for fixed-mounted molded case circuit breakers

Thermal-magnetic overcurrent releases (TM)

The table below shows the power loss and the current path resistance for thermal-magnetic overcurrent releases (TM). The power loss applies for $I_n$, with 3-phase balanced load. The specified power loss is the sum of all current paths. The current path resistance is only a guide value and can fluctuate.

Table 11-24 Power loss for thermal-magnetic overcurrent releases (TM)

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated current [A]</th>
<th>Power loss [W]</th>
<th>Path resistance [mΩ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X</td>
<td>16</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>7</td>
<td>3,7</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>11</td>
<td>3,6</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>16</td>
<td>3,3</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>15</td>
<td>2,0</td>
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<tr>
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<td>63</td>
<td>18</td>
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<tr>
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<td>80</td>
<td>24</td>
<td>1,3</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>22</td>
<td>0,73</td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>31</td>
<td>0,66</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>41</td>
<td>0,53</td>
</tr>
<tr>
<td>VL160</td>
<td>50</td>
<td>16</td>
<td>2,1</td>
</tr>
<tr>
<td></td>
<td>63</td>
<td>21</td>
<td>1,8</td>
</tr>
<tr>
<td></td>
<td>80</td>
<td>27</td>
<td>1,4</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>27</td>
<td>0,90</td>
</tr>
<tr>
<td></td>
<td>125</td>
<td>36</td>
<td>0,77</td>
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<td></td>
<td>160</td>
<td>55</td>
<td>0,63</td>
</tr>
<tr>
<td>VL250</td>
<td>200</td>
<td>60</td>
<td>0,47</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>71</td>
<td>0,38</td>
</tr>
<tr>
<td>VL400</td>
<td>200</td>
<td>60</td>
<td>0,50</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>84</td>
<td>0,45</td>
</tr>
<tr>
<td></td>
<td>315</td>
<td>120</td>
<td>0,40</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>175</td>
<td>0,36</td>
</tr>
<tr>
<td>VL630</td>
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<td>85</td>
<td>0,29</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>120</td>
<td>0,25</td>
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<tr>
<td></td>
<td>500</td>
<td>170</td>
<td>0,23</td>
</tr>
<tr>
<td></td>
<td>630</td>
<td>230</td>
<td>0,19</td>
</tr>
</tbody>
</table>
Electronic trip units (ETU / LCD-ETU)

The table below shows the power loss for electronic trip units (ETU / LCD-ETU). The power loss applies for $I_n$ with 3-phase balanced load. The specified power loss is the sum of all current paths.

The current path resistance is only a guide value and can fluctuate.

Table 11-25 Power loss for electronic overload releases (ETU / LCD-ETU)

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated current [A]</th>
<th>Power loss [W]</th>
<th>Path resistance [mΩ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160</td>
<td>63</td>
<td>7</td>
<td>0,59</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>16</td>
<td>0,53</td>
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<td></td>
<td>160</td>
<td>40</td>
<td>0,52</td>
</tr>
<tr>
<td>VL250</td>
<td>200</td>
<td>42</td>
<td>0,35</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>60</td>
<td>0,32</td>
</tr>
<tr>
<td>VL400</td>
<td>315</td>
<td>60</td>
<td>0,2</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>90</td>
<td>0,19</td>
</tr>
<tr>
<td>VL630</td>
<td>630</td>
<td>160</td>
<td>0,13</td>
</tr>
<tr>
<td>VL800</td>
<td>800</td>
<td>250</td>
<td>0,13</td>
</tr>
<tr>
<td>VL1250</td>
<td>1000</td>
<td>135</td>
<td>0,045</td>
</tr>
<tr>
<td></td>
<td>1250</td>
<td>210</td>
<td>0,045</td>
</tr>
<tr>
<td>VL1600</td>
<td>1600</td>
<td>260</td>
<td>0,034</td>
</tr>
</tbody>
</table>

Starter combinations

The table below shows the power loss and the current path resistance for starter combinations. The power loss applies for $I_n$ with 3-phase balanced load. The specified power loss is the sum of all current paths. The current path resistance is only a guide value and can fluctuate.

Table 11-26 Power loss for starter combinations

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated current [A]</th>
<th>Power loss [W]</th>
<th>Path resistance [mΩ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160</td>
<td>63</td>
<td>7</td>
<td>0,59</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>16</td>
<td>0,53</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>40</td>
<td>0,52</td>
</tr>
<tr>
<td>VL250</td>
<td>250</td>
<td>60</td>
<td>0,32</td>
</tr>
<tr>
<td>VL400</td>
<td>315</td>
<td>60</td>
<td>0,2</td>
</tr>
<tr>
<td></td>
<td>400</td>
<td>90</td>
<td>0,19</td>
</tr>
<tr>
<td>VL630</td>
<td>630</td>
<td>160</td>
<td>0,13</td>
</tr>
<tr>
<td>VL800</td>
<td>800</td>
<td>250</td>
<td>0,13</td>
</tr>
<tr>
<td>VL1250</td>
<td>1000</td>
<td>135</td>
<td>0,045</td>
</tr>
<tr>
<td></td>
<td>1250</td>
<td>210</td>
<td>0,045</td>
</tr>
<tr>
<td>VL1600</td>
<td>1600</td>
<td>260</td>
<td>0,034</td>
</tr>
</tbody>
</table>
Technical data

11.6 Capacitor banks

Molded case non-automatic circuit breakers

The table below shows the power loss and the current path resistance for molded case non-automatic circuit breakers. The power loss applies for \( I_n \) with 3-phase balanced load. The specified power loss is the sum of all current paths. The current path resistance is only a guide value and can fluctuate.

Table 11-27  Power loss for molded case circuit breakers

<table>
<thead>
<tr>
<th>Type</th>
<th>Rated current [A]</th>
<th>Power loss [W]</th>
<th>Path resistance [mΩ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X</td>
<td>100</td>
<td>13</td>
<td>0,43</td>
</tr>
<tr>
<td></td>
<td>160</td>
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<td>0,44</td>
</tr>
<tr>
<td>VL160</td>
<td>100</td>
<td>16</td>
<td>0,53</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>40</td>
<td>0,52</td>
</tr>
<tr>
<td>VL250</td>
<td>250</td>
<td>60</td>
<td>0,32</td>
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<tr>
<td>VL400</td>
<td>400</td>
<td>90</td>
<td>0,19</td>
</tr>
<tr>
<td>VL630</td>
<td>630</td>
<td>160</td>
<td>0,13</td>
</tr>
<tr>
<td>VL800</td>
<td>800</td>
<td>250</td>
<td>0,13</td>
</tr>
<tr>
<td>VL1250</td>
<td>1250</td>
<td>210</td>
<td>0,045</td>
</tr>
<tr>
<td>VL1600</td>
<td>1600</td>
<td>260</td>
<td>0,034</td>
</tr>
</tbody>
</table>

11.6 Capacitor banks

Selection of the molded case circuit breaker for protecting and switching capacitors

This table takes account of only a few typical applications and combinations. The appropriate selection must be made for all other applications.

Table 11-28  Selection examples for capacitor protection circuits

<table>
<thead>
<tr>
<th>Rated voltage [50 Hz]</th>
<th>( Q_c ) capacitor bank power [kvar]</th>
<th>Capacitor rated current ( x 1.5 = I_R ) of the SENTRON VL [A]</th>
<th>Upstream 3VL molded case circuit breaker</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type</td>
</tr>
<tr>
<td>230 V</td>
<td>15</td>
<td>56</td>
<td>VL160</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>113</td>
<td>VL160</td>
</tr>
<tr>
<td>400 V</td>
<td>25</td>
<td>54</td>
<td>VL160</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>108</td>
<td>VL160</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>216</td>
<td>VL250</td>
</tr>
<tr>
<td>415 V</td>
<td>20</td>
<td>42</td>
<td>VL160</td>
</tr>
<tr>
<td></td>
<td>40</td>
<td>84</td>
<td>VL160</td>
</tr>
<tr>
<td>525 V</td>
<td>25</td>
<td>42</td>
<td>VL160</td>
</tr>
<tr>
<td></td>
<td>50</td>
<td>84</td>
<td>VL160</td>
</tr>
</tbody>
</table>
11.7 Motor Protection

The following characteristic values in the relevant tables apply for the 3VL molded case circuit breakers in motor protection with different trip classes:

- Trip class ETU10M fixed
- Trip class ETU30M adjustable
- Trip class ETU40M adjustable

Molded case circuit breakers for motor protection with fixed trip class ETU10M

These molded case circuit breakers possess an adjustable overload and short-circuit release and a fixed trip class. They are current-limiting and have a phase failure sensitivity feature. Communication via PROFIBUS DP and Modbus RTU is possible.

Table 11-29 Molded case circuit breakers for motor protection with fixed trip class ETU10M

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>Rated current ( I_n ) [A]</th>
<th>Max. rated power of the motor at 50 Hz AC [kW]</th>
<th>Adjustable range of the overload protection ( I_R ) [A]</th>
<th>Adjustable range of the short-circuit protection ( I_n ) [A]</th>
<th>Trip class TC [s]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160</td>
<td>63</td>
<td>30-37</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.25-11 ( I_n )</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>37-75</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.25-11 ( I_n )</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>55-75</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.25-11 ( I_n )</td>
<td>10</td>
</tr>
<tr>
<td>VL250</td>
<td>200</td>
<td>90-110</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.25-11 ( I_n )</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>110-132</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.25-11 ( I_n )</td>
<td>10</td>
</tr>
<tr>
<td>VL400</td>
<td>315</td>
<td>160-200</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.25-11 ( I_n )</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>315</td>
<td>200-250</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.25-11 ( I_n )</td>
<td>10</td>
</tr>
<tr>
<td>VL630</td>
<td>500</td>
<td>250-355</td>
<td>0.41-1.0 ( I_n )</td>
<td>1.5-12.5 ( I_n )</td>
<td>10</td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers
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11.7 Motor Protection

Molded case circuit breakers for motor protection with adjustable trip class ETU30M

These molded case circuit breakers possess an adjustable overload and short-circuit release and an adjustable trip class. They are current-limiting and have a phase failure sensitivity feature. Communication via PROFIBUS DP and Modbus RTU is possible.

Molded case circuit breaker characteristic curve for motor protection with adjustable trip class ETU30M

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>Rated current $I_n$</th>
<th>Max. rated power of the motor at 50 Hz AC</th>
<th>Adjustable range of the overload protection $I_R$</th>
<th>Adjustable range of the short-circuit protection $I_s$</th>
<th>Trip class TC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>[A]</td>
<td>[kW]</td>
<td>$[A]$</td>
<td>$[A]$</td>
<td>[s]</td>
</tr>
<tr>
<td>380 / 415 V</td>
<td>500 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VL160</td>
<td>63</td>
<td>30</td>
<td>37</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/11 x $I_n$</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>37, 45</td>
<td>55</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/11 x $I_n$</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>55, 75, 75</td>
<td>75, 90</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/11 x $I_n$</td>
</tr>
<tr>
<td>VL250</td>
<td>200</td>
<td>90, 110</td>
<td>110, 132</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/11 x $I_n$</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>132</td>
<td>160</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/11 x $I_n$</td>
</tr>
<tr>
<td>VL400</td>
<td>315</td>
<td>160</td>
<td>200</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/11 x $I_n$</td>
</tr>
<tr>
<td></td>
<td>315</td>
<td>200</td>
<td>250</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/11 x $I_n$</td>
</tr>
<tr>
<td>VL630</td>
<td>500</td>
<td>250</td>
<td>355</td>
<td>0.41-1.0 x $I_n$</td>
<td>6/8/12.5 x $I_n$</td>
</tr>
</tbody>
</table>
Molded case circuit breakers for motor protection with adjustable trip class ETU40M

These molded case circuit breakers possess an adjustable overload and short-circuit release and an adjustable trip class. They are current-limiting and have a phase failure sensitivity feature. They are also equipped with an LCD display for indicating the current and for parameterization.

Communication via PROFIBUS and Modbus RTU is possible.

Table 11-31 Molded case circuit breakers for motor protection with adjustable trip class ETU40M

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>Rated current Iₘ</th>
<th>Max. rated power of the motor at 50 Hz AC</th>
<th>Adjustable range of the overload protection Iₚ</th>
<th>Adjustable range of the short-circuit protection Iₚ</th>
<th>Trip class TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160</td>
<td>63</td>
<td>30</td>
<td>37</td>
<td>25-63</td>
<td>1.25-11 x Iₘ</td>
</tr>
<tr>
<td></td>
<td>100</td>
<td>37, 45</td>
<td>55</td>
<td>40-100</td>
<td>1.25-11 x Iₘ</td>
</tr>
<tr>
<td></td>
<td>160</td>
<td>55, 75</td>
<td>75, 90</td>
<td>63-160</td>
<td>1.25-11 x Iₘ</td>
</tr>
<tr>
<td>VL250</td>
<td>200</td>
<td>90, 110</td>
<td>110, 132</td>
<td>80-200</td>
<td>1.25-11 x Iₘ</td>
</tr>
<tr>
<td></td>
<td>250</td>
<td>132</td>
<td>160</td>
<td>100-250</td>
<td>1.25-11 x Iₘ</td>
</tr>
<tr>
<td>VL400</td>
<td>315</td>
<td>160</td>
<td>200</td>
<td>126-315</td>
<td>1.25-11 x Iₘ</td>
</tr>
<tr>
<td></td>
<td>315</td>
<td>200</td>
<td>250</td>
<td>126-315</td>
<td>1.25-11 x Iₘ</td>
</tr>
<tr>
<td>VL630</td>
<td>500</td>
<td>250</td>
<td>355</td>
<td>200-500</td>
<td>1.25-12.5 x Iₘ</td>
</tr>
</tbody>
</table>
11.8 Motorized operating mechanisms

### Table 11-32 Overview of motorized operating mechanisms

<table>
<thead>
<tr>
<th>Type</th>
<th>3VL1</th>
<th>3VL2</th>
<th>3VL3</th>
<th>3VL4</th>
<th>3VL5</th>
<th>3VL6</th>
<th>3VL7</th>
<th>3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorized operating mechanism (MO)</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Motorized operating mechanism with stored energy mechanism (SEO) for network synchronization</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

x: Available

### Table 11-33 Motorized operating mechanism with stored energy mechanism (SEO)

<table>
<thead>
<tr>
<th>Type of molded case circuit breaker</th>
<th>3VL1 / 3VL2 / 3VL3</th>
<th>3VL4</th>
<th>3VL5 / 3VL6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of motorized operating mechanism with stored energy mechanism (SEO)</td>
<td>3VL9300-3M_00</td>
<td>3VL9400-3M_00</td>
<td>3VL9600-3M_00</td>
</tr>
<tr>
<td>Power consumption [VA / W]</td>
<td>&lt; 100</td>
<td>&lt; 200</td>
<td>&lt; 250</td>
</tr>
<tr>
<td>Rated control supply voltage U_s</td>
<td>50 / 60 Hz [V AC]</td>
<td>42 ... 48 / 60 / 110 ... 127 / 220 ... 250</td>
<td></td>
</tr>
<tr>
<td>DC [V]</td>
<td>24 / 42 ... 48 / 60 / 110 ... 127 / 220 ... 250</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NEOZED fuse (performance class gG, characteristic slow)</td>
<td>24 V</td>
<td>9 A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>42 / 60 V</td>
<td>4 A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>110 / 250 V</td>
<td>2 A</td>
<td></td>
</tr>
<tr>
<td>Miniature circuit breaker (C characteristic in accordance with DIN VDE 0641)</td>
<td>24 V</td>
<td>6 A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>42 / 60 V</td>
<td>4 A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>110 / 250 V</td>
<td>2 A</td>
<td></td>
</tr>
<tr>
<td>Operating range [V]</td>
<td>0.85 ... 1.1 x U_s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. command duration at U_s [ms]</td>
<td>50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. command duration, connection-dependent 1)</td>
<td>Jog or continuous command</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total closing time [ms]</td>
<td>&lt; 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF time [s]</td>
<td>&lt; 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interval between the commands OFF and ON [s]</td>
<td>&gt; 5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interval between the commands ON and OFF [s]</td>
<td>&gt; 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. permissible switching frequency [1/h]</td>
<td>120</td>
<td>60</td>
<td></td>
</tr>
</tbody>
</table>

1) Note the idle times between ON and OFF.
## Motorized operating mechanism (MO)

### Table 11-34 Motorized operating mechanism (MO)

<table>
<thead>
<tr>
<th>Type of molded case circuit breaker</th>
<th>3VL1</th>
<th>3VL2 / 3VL3</th>
<th>3VL4</th>
<th>3VL5 / 3VL6</th>
<th>3VL7 / 3VL8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of motorized operating mechanism (MO)</td>
<td>3VL9100-3M_10</td>
<td>3VL9300-3M_10</td>
<td>3VL9400-3M_10</td>
<td>3VL9600-3M_10</td>
<td>3VL9800-3M_10</td>
</tr>
<tr>
<td>Power consumption [VA / W]</td>
<td>24 V</td>
<td>42 … 60 V</td>
<td>110 V</td>
<td>220 V</td>
<td>50 / 60 Hz [V AC]</td>
</tr>
<tr>
<td>Rated control supply voltage $U_n$</td>
<td>6 A</td>
<td>6 A</td>
<td>4 A</td>
<td>2 A</td>
<td></td>
</tr>
<tr>
<td>NEOZED fuse (performance class $g_L / g_G$)</td>
<td>24 V</td>
<td>24 V</td>
<td>110 V</td>
<td>220 V</td>
<td>NE0ZED fuse (performance class $g_L / g_G$)</td>
</tr>
<tr>
<td>Miniature circuit breaker (C characteristic in accordance with DIN VDE 0641)</td>
<td>C 6 A</td>
<td>C 6 A</td>
<td>C 4 A</td>
<td>C 2 A</td>
<td></td>
</tr>
<tr>
<td>Operating range [V]</td>
<td>0.85 … 1.1 x $U_s$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Min. command duration at $U_n$ [ms]</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. command duration, connection-dependent 1)</td>
<td>—</td>
<td>Jog or continuous command</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total closing time [s]</td>
<td></td>
<td>&lt; 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF time [s]</td>
<td></td>
<td></td>
<td></td>
<td>&lt; 1</td>
<td></td>
</tr>
<tr>
<td>Interval between the commands OFF and ON [s]</td>
<td></td>
<td></td>
<td></td>
<td>≥ 10</td>
<td></td>
</tr>
<tr>
<td>Interval between the commands ON and OFF [s]</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. permissible switching frequency [1 / h]</td>
<td></td>
<td>120</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Switching capacity of the floating contact (switch position of the mode selector)</td>
<td></td>
<td>16 A / 250 V AC; 0.4 A / 125 V DC; 0.2 A / 250 V DC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) Note the idle times between ON and OFF.
11.9 RCD modules

The RCD modules have the following technical data for their system protection function:

<table>
<thead>
<tr>
<th>RCD module, molded case circuit breaker for system protection 3- and 4-pole</th>
<th>Rated current $I_n$ [A]</th>
<th>Differential currents $I_{\Delta n}$ Adjustable</th>
<th>Delay time $t_d$ Adjustable</th>
<th>Rated operational voltage $U_e$ [V AC]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X</td>
<td>160</td>
<td>0,03</td>
<td>Instantaneous</td>
<td>127-480</td>
</tr>
<tr>
<td>VL160</td>
<td>160</td>
<td>0,10, 0,30, 0,50, 1,00, 3,00</td>
<td>0,06, 0,10, 0,25, 0,50, 1,00</td>
<td>127-480, 230-690</td>
</tr>
<tr>
<td>VL250</td>
<td>250</td>
<td></td>
<td></td>
<td>127-480, 230-690</td>
</tr>
<tr>
<td>VL400</td>
<td>400</td>
<td></td>
<td></td>
<td>127-480, 230-690</td>
</tr>
</tbody>
</table>

Table 11-36 Tripped signaling switch in the RCD module ¹)

<table>
<thead>
<tr>
<th>Rated operating voltage [V AC]</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal rated current $I_n$, [A]</td>
<td>2</td>
</tr>
<tr>
<td>Rated making capacity [A]</td>
<td>2</td>
</tr>
<tr>
<td>Rated operating current [A]</td>
<td>2</td>
</tr>
<tr>
<td>Rated breaking capacity, inductive, $\cos \phi = 0.7$ [A]</td>
<td>0.5</td>
</tr>
<tr>
<td>Rated breaking capacity, resistive [A]</td>
<td>2</td>
</tr>
<tr>
<td>Quick-response backup fuse [A]</td>
<td>2</td>
</tr>
</tbody>
</table>

¹) DC rated operating voltage max. 125 V, minimum load 50 mA at 5 V DC.
11.10 Undervoltage release

Technical data of the undervoltage releases of the 3VL molded case circuit breakers:

Table 11-37 Undervoltage releases for VL160X, VL160 to VL400

<table>
<thead>
<tr>
<th></th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release (circuit breaker trips)</td>
<td>0.35-0.70 $U_s$</td>
<td>0.35-0.70 $U_s$</td>
<td>0.35-0.70 $U_s$</td>
<td>0.35-0.70 $U_s$</td>
</tr>
<tr>
<td>Pick-up (circuit breaker can be switched on)</td>
<td>0.85-1.10 $U_s$</td>
<td>0.85-1.10 $U_s$</td>
<td>0.85-1.10 $U_s$</td>
<td>0.85-1.10 $U_s$</td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 50 / 60 Hz [VA] 110-127 V</td>
<td>1,5</td>
<td>1,5</td>
<td>1,5</td>
<td>1,5</td>
</tr>
<tr>
<td>220-250 V</td>
<td>1,5</td>
<td>1,5</td>
<td>1,5</td>
<td>1,5</td>
</tr>
<tr>
<td>208 V</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>277 V</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>380-415 V</td>
<td>1.6</td>
<td>1.6</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>440-480 V</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
<td>1.8</td>
</tr>
<tr>
<td>500-525 V</td>
<td>2,05</td>
<td>2,05</td>
<td>2,05</td>
<td>2,05</td>
</tr>
<tr>
<td>600 V</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
</tr>
<tr>
<td>DC [W]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 V</td>
<td>0.75</td>
<td>0.75</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>24 V</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>48 V</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>60 V</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>110-127 V</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>220-250 V</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Max. opening time [ms]</td>
<td>50</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>
11.11 Time-delay device for undervoltage releases

The time-delay device for undervoltage releases has the following technical data:

### Table 11-39 Time-delay device for undervoltage releases, 3TX4701-0A

<table>
<thead>
<tr>
<th></th>
<th>VL160X ... VL400</th>
<th>VL630 ... VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated control supply voltage $U_s$ [V AC / DC]</td>
<td>220 ... 250</td>
<td>220 ... 250</td>
</tr>
<tr>
<td>Control voltage for undervoltage release [V DC]</td>
<td>220 ... 250</td>
<td>220 ... 250</td>
</tr>
</tbody>
</table>

#### Conductor cross-sections

- Finely stranded with core end sleeve [mm²]
  - 2 x (0.5 ... 1.5)
- Solid conductor [mm²]
  - 2 x (0.5 ... 1.5)

For delay time / protective circuit, refer to the chapter "Circuit diagrams (Page 293)".
## 11.12 Shunt release

Technical data of the shunt releases of the 3VL molded case circuit breakers

### Table 11-40 Shunt releases for VL160X, VL160 to VL400

<table>
<thead>
<tr>
<th></th>
<th>VL160X</th>
<th>VL160</th>
<th>VL250</th>
<th>VL400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Response voltage: Pick-up (circuit breaker trips) [V]</td>
<td>0.7-1.10 U_{S}</td>
<td>0.7-1.10 U_{S}</td>
<td>0.7-1.10 U_{S}</td>
<td>0.7-1.10 U_{S}</td>
</tr>
<tr>
<td>Power consumption AC 50 / 60 Hz [VA]</td>
<td>24</td>
<td>480</td>
<td>480</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>48-60 V</td>
<td>401 - 501</td>
<td>401 - 501</td>
<td>401 - 501</td>
</tr>
<tr>
<td></td>
<td>110-127 V</td>
<td>424 - 480</td>
<td>424 - 480</td>
<td>424 - 480</td>
</tr>
<tr>
<td></td>
<td>208-277 V</td>
<td>533 - 736</td>
<td>533 - 736</td>
<td>533 - 736</td>
</tr>
<tr>
<td></td>
<td>380-600 V</td>
<td>408 - 645</td>
<td>408 - 645</td>
<td>408 - 645</td>
</tr>
<tr>
<td>DC [W]</td>
<td>24 V</td>
<td>594</td>
<td>594</td>
<td>594</td>
</tr>
<tr>
<td></td>
<td>48 - 60 V</td>
<td>740 - 925</td>
<td>740 - 925</td>
<td>740 - 925</td>
</tr>
<tr>
<td></td>
<td>110 - 127 V</td>
<td>559 - 648</td>
<td>559 - 648</td>
<td>559 - 648</td>
</tr>
<tr>
<td>Max. in-service period [s]</td>
<td>Interrupts automatically</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. opening time [ms]</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Fuse (slow) [A]</td>
<td>4 (AC 24, 48-60, 110-127 V, 208-277 V)</td>
<td>2 (all others)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Molded case circuit breaker, [A] C characteristic</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 11- 41  Shunt release for VL630 to VL1600

<table>
<thead>
<tr>
<th></th>
<th>VL630</th>
<th>VL800</th>
<th>VL1200</th>
<th>VL1600</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Response voltage:</strong> Pick-up (circuit breaker trips) [V]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VL630</td>
<td>0.7-1.10 Us</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VL800</td>
<td>0.7-1.10 Us</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VL1200</td>
<td>0.7-1.10 Us</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VL1600</td>
<td>0.7-1.10 Us</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power consumption</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AC 50 / 60 Hz [VA]</td>
<td>24</td>
<td>480</td>
<td>480</td>
<td>480</td>
</tr>
<tr>
<td></td>
<td>48-60 V</td>
<td>401-501</td>
<td>401-501</td>
<td>401-501</td>
</tr>
<tr>
<td></td>
<td>110-127 V</td>
<td>424-489</td>
<td>424-489</td>
<td>424-489</td>
</tr>
<tr>
<td></td>
<td>208-277 V</td>
<td>533-736</td>
<td>533-736</td>
<td>533-736</td>
</tr>
<tr>
<td></td>
<td>380-600 V</td>
<td>408-645</td>
<td>408-645</td>
<td>408-645</td>
</tr>
<tr>
<td>DC [W]</td>
<td>24 V</td>
<td>594</td>
<td>594</td>
<td>594</td>
</tr>
<tr>
<td></td>
<td>48-60 V</td>
<td>740-925</td>
<td>740-925</td>
<td>740-925</td>
</tr>
<tr>
<td></td>
<td>110-127 V</td>
<td>559-648</td>
<td>559-648</td>
<td>559-648</td>
</tr>
<tr>
<td></td>
<td>220-250 V</td>
<td>722-820</td>
<td>722-820</td>
<td>722-820</td>
</tr>
<tr>
<td><strong>Max. in-service period [s]</strong></td>
<td>Interupts automatically</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Max. opening time [ms]</strong></td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>Fuse (slow) [A]</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C characteristic</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(AC 24, 48-60, 110-127 V, 208-277 V)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(all others)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note**

The power consumption of the shunt releases for approx. 20 ms should be taken into account when selecting the power supply for the control circuit, for example by means of a corresponding short-time overload capability of the power supply used.
## 11.13 Auxiliary switches and alarm switches

Technical data of the auxiliary and alarm switches of the 3VL molded case circuit breakers:

<table>
<thead>
<tr>
<th>Technical data</th>
<th>Rated insulation voltage $U_i$ with degree of pollution in accordance with IEC 60947-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated impulse withstand voltage $U_{imp}$</td>
<td>6 kV</td>
</tr>
<tr>
<td>Conventional thermal current $I_{th}$</td>
<td>10 A</td>
</tr>
<tr>
<td>Rated operating current $I_e$</td>
<td></td>
</tr>
<tr>
<td>Rated operating voltage $U_e$</td>
<td></td>
</tr>
<tr>
<td>Alternating current 50 / 60 Hz, AC-12</td>
<td></td>
</tr>
<tr>
<td>$U_e$</td>
<td>24 V</td>
</tr>
<tr>
<td>$I_e$</td>
<td>10 A</td>
</tr>
<tr>
<td>$U_e$</td>
<td>48 V</td>
</tr>
<tr>
<td>$I_e$</td>
<td>10 A</td>
</tr>
<tr>
<td>$U_e$</td>
<td>110 V</td>
</tr>
<tr>
<td>$I_e$</td>
<td>10 A</td>
</tr>
<tr>
<td>$U_e$</td>
<td>230 V</td>
</tr>
<tr>
<td>$I_e$</td>
<td>10 A</td>
</tr>
<tr>
<td>$U_e$</td>
<td>400 V</td>
</tr>
<tr>
<td>$I_e$</td>
<td>10 A</td>
</tr>
<tr>
<td>$U_e$</td>
<td>600 V</td>
</tr>
<tr>
<td>$I_e$</td>
<td>10 A</td>
</tr>
</tbody>
</table>

| Alternating current 50 / 60 Hz, AC-15       |                                                                                            |
| $U_e$                                       | 24 V                                                                                     |
| $I_e$                                       | 6 A                                                                                      |
| $U_e$                                       | 48 V                                                                                     |
| $I_e$                                       | 6 A                                                                                      |
| $U_e$                                       | 110 V                                                                                    |
| $I_e$                                       | 3 A                                                                                      |
| $U_e$                                       | 230 V                                                                                    |
| $I_e$                                       | 6 A                                                                                      |
| $U_e$                                       | 400 V                                                                                    |
| $I_e$                                       | 6 A                                                                                      |
| $U_e$                                       | 600 V                                                                                    |
| $I_e$                                       | 3 A                                                                                      |

| Direct current, DC-12                       |                                                                                            |
| $U_e$                                       | 24 V                                                                                     |
| $I_e$                                       | 10 A                                                                                     |
| $U_e$                                       | 48 V                                                                                     |
| $I_e$                                       | 5 A                                                                                      |
| $U_e$                                       | 110 V                                                                                    |
| $I_e$                                       | 2.5 A                                                                                     |
| $U_e$                                       | 230 V                                                                                    |
| $I_e$                                       | 1 A                                                                                      |

| Direct current, DC-13                       |                                                                                            |
| $U_e$                                       | 24 V                                                                                     |
| $I_e$                                       | 3 A                                                                                      |
| $U_e$                                       | 48 V                                                                                     |
| $I_e$                                       | 1.5 A                                                                                    |
| $U_e$                                       | 110 V                                                                                    |
| $I_e$                                       | 0.7 A                                                                                    |
| $U_e$                                       | 230 V                                                                                    |
| $I_e$                                       | 0.3 A                                                                                    |

<table>
<thead>
<tr>
<th>Contact reliability</th>
<th>Test voltage/test current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test voltage / test current</td>
<td>5 V/1 mA</td>
</tr>
</tbody>
</table>
### Technical data

<table>
<thead>
<tr>
<th>Short-circuit protection</th>
<th>10 A TDz, 16 A D 10 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEOZED fuse links, utilization category gL / gG</td>
<td></td>
</tr>
<tr>
<td>Miniature circuit breaker with C characteristic in accordance with IEC 60898 (VDE 0641)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conductor cross-sections</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stranded, with end sleeves in accordance with DIN 46228</td>
<td>2 × (0.5 ... 1.5) mm²</td>
</tr>
<tr>
<td>Solid or stranded (metric)</td>
<td>2 × (1 ... 2.5) mm²</td>
</tr>
<tr>
<td>Solid or stranded (AWG)</td>
<td>2 × AWG 18 ... 14</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tightening torques</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection screws</td>
<td>0.8 Nm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching devices</td>
<td>300 V AC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Continuous current</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10 A</td>
<td></td>
</tr>
</tbody>
</table>

### 11.14 Position signaling switch

**Position signaling switch**

When a molded case circuit breaker is mounted in a withdrawable or plug-in assembly, the position signaling switch, which is equipped with a changeover contact, is used to indicate whether the molded case circuit breaker is in the connected or withdrawn position. Two position signaling switches can be mounted in each withdrawable or plug-in base.

![Position signaling switch](image-url)
Technical data of the position signaling switches of the 3VL molded case circuit breakers:

<table>
<thead>
<tr>
<th>Technical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conductor cross-sections</td>
</tr>
<tr>
<td>Screw-type terminal</td>
</tr>
<tr>
<td>Tightening torques</td>
</tr>
<tr>
<td>Screws for cable connection</td>
</tr>
<tr>
<td>Rated operating temperature</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data in accordance with IEC/EN 61058</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating current Ie with rated operating voltage Ue</td>
</tr>
<tr>
<td>Standard operation</td>
</tr>
<tr>
<td>At Ue 250 V AC / 400 V AC</td>
</tr>
<tr>
<td>Ie</td>
</tr>
<tr>
<td>16 A / 10 A</td>
</tr>
<tr>
<td>Rated making capacity</td>
</tr>
<tr>
<td>At 250 V AC</td>
</tr>
<tr>
<td>16 A</td>
</tr>
<tr>
<td>At 400 V AC</td>
</tr>
<tr>
<td>10 A</td>
</tr>
<tr>
<td>Rated thermal current Ith</td>
</tr>
<tr>
<td>16 A</td>
</tr>
<tr>
<td>Rated operating voltage</td>
</tr>
<tr>
<td>250 V AC</td>
</tr>
<tr>
<td>400 V AC</td>
</tr>
<tr>
<td>Rated breaking capacity</td>
</tr>
<tr>
<td>cosφ = 1 (resistive)</td>
</tr>
<tr>
<td>At 250 V AC</td>
</tr>
<tr>
<td>16 A</td>
</tr>
<tr>
<td>At 400 V AC</td>
</tr>
<tr>
<td>10 A</td>
</tr>
<tr>
<td>cosφ = 0.7 (inductive)</td>
</tr>
<tr>
<td>4 A</td>
</tr>
<tr>
<td>Short-circuit fuse (quick-response)</td>
</tr>
<tr>
<td>At 250 V AC</td>
</tr>
<tr>
<td>16 A</td>
</tr>
<tr>
<td>At 400 V AC</td>
</tr>
<tr>
<td>10 A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data according to UL 1054</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated operating current Ie with rated operating voltage Ue</td>
</tr>
<tr>
<td>Alternating current</td>
</tr>
<tr>
<td>With Ue, power, [horsepower]</td>
</tr>
<tr>
<td>125 / 250 V AC, 1 HP</td>
</tr>
<tr>
<td>Ie</td>
</tr>
<tr>
<td>16 A</td>
</tr>
</tbody>
</table>

| Flammability class                   |
| UL94V-0                              |
11.15 Leading auxiliary switches in front-operated rotary operating mechanism

Technical data of the leading auxiliary switches in front-operated rotary operating mechanism:

Table 11-44 Leading auxiliary switches in front-operated rotary operating mechanism

<table>
<thead>
<tr>
<th>Rated operating voltage [V] AC</th>
<th>230</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal rated current $I_{th}$ [A]</td>
<td>2</td>
</tr>
<tr>
<td>Rated making/breaking capacity</td>
<td></td>
</tr>
<tr>
<td>Resistive [A]</td>
<td>2</td>
</tr>
<tr>
<td>Inductive [A] $\cos \varphi = 0.7$</td>
<td>0.5</td>
</tr>
<tr>
<td>Rated operating voltage [V] AC</td>
<td>230</td>
</tr>
<tr>
<td>Rated operating current [A]</td>
<td>2</td>
</tr>
<tr>
<td>Quick-response backup fuse [A]</td>
<td>2</td>
</tr>
</tbody>
</table>

11.16 Ground-fault detection

The individual overcurrent releases have different ground-fault detection:

Table 11-45 Overview of ground-fault protection classes

<table>
<thead>
<tr>
<th>Release</th>
<th>Ordering data</th>
<th>Ground-fault detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETU22</td>
<td>SG, MG</td>
<td>Vectorial summation current formation (3-conductor system)</td>
</tr>
<tr>
<td>ETU22</td>
<td>SH, NH</td>
<td>Vectorial summation current formation (4-conductor system)</td>
</tr>
<tr>
<td>ETU22</td>
<td>TH, NH</td>
<td>Vectorial summation current formation (4-conductor system)</td>
</tr>
<tr>
<td>LCD-ETU42</td>
<td>UL</td>
<td>Vectorial summation current formation (3-conductor system)</td>
</tr>
<tr>
<td>LCD-ETU42</td>
<td>UM</td>
<td>Vectorial summation current formation (3-conductor system)/direct recording of the ground-fault current in the neutral point of the transformer</td>
</tr>
<tr>
<td>LCD-ETU42</td>
<td>UN</td>
<td>Vectorial summation current formation (4-conductor system)</td>
</tr>
</tbody>
</table>
11.17 IP degrees of protection

All 3VL molded case circuit breakers are constructed with degree of protection IP20 regardless of size and version.

For 3VL6 in withdrawable version, degree of protection IP20 cannot be achieved. The IP degree of protection is less than IP20.

A wide range of additional accessories is available for the basic version of the 3VL molded case circuit breaker in IP20.

The accessories listed below are designed to provide a higher degree of protection:
Technical data

11.17 IP degrees of protection

The degree of protection in accordance with IEC 60529 is listed in the table below:

<table>
<thead>
<tr>
<th>Molded case circuit breaker</th>
<th>Protection</th>
<th>Degree of protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker</td>
<td>Finger-proof Protected against solid foreign bodies with a diameter of 12.5 mm or larger.</td>
<td>IP20</td>
</tr>
<tr>
<td>Molded case circuit breaker with terminal cover</td>
<td>Protected against access to live parts with a tool. Protected against solid foreign bodies with a diameter of 2.5 mm or larger.</td>
<td>IP30</td>
</tr>
<tr>
<td>Plug-in molded case circuit breaker</td>
<td>Finger-proof protection against solid foreign bodies with a diameter of 12.5 mm or larger.</td>
<td>IP20 IP30 (1)</td>
</tr>
<tr>
<td>Molded case circuit breaker with masking frame and motorized operating mechanism</td>
<td>Protected against access to live parts with a wire. Protected against solid foreign bodies with a diameter of 1.0 mm or larger.</td>
<td>IP40 (2)</td>
</tr>
<tr>
<td>Molded case circuit breaker with masking frame for door cutout</td>
<td>Protected against access to live parts with a wire. Protected against solid foreign bodies with a diameter of 1.0 mm or larger.</td>
<td>IP40 (2)</td>
</tr>
<tr>
<td>Molded case circuit breaker with door coupling rotary operating mechanism</td>
<td>Protected against ingress of dust and water jets from any direction.</td>
<td>IP65 (2)</td>
</tr>
</tbody>
</table>

1) If the molded case circuit breaker is installed and the supplied covers are mounted.
2) Depending on the degree of protection of the enclosure
12 Dimensional drawings

All dimensions are in mm.

12.1 VL160X (3VL1), VL160 (3VL2), and VL250 (3VL3), 3- and 4-pole, to 250 A

12.1.1 Molded case circuit breakers

VL160X (3VL1) molded case circuit breakers
12.1 VL 160X (3VL1), VL 160 (3VL2), and VL 250 (3VL3), 3- and 4-pole, to 250 A

<table>
<thead>
<tr>
<th>Molded case circuit breakers</th>
<th>Molded case circuit breakers</th>
<th>Molded case circuit breakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160 / VL250 (3VL2 / 3VL3)</td>
<td>VL160 (3VL2)</td>
<td>VL250 (3VL3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VL160 and VL250 (3VL2 and 3VL3)</td>
</tr>
</tbody>
</table>

Note

The 5.5 mm extension at each end of the VL250 (3VL3) molded case circuit breaker is only to be observed when using box terminals or circular conductor terminals (8).
12.1.2 Operating mechanisms

Motorized operating mechanism with stored energy mechanism (SEO)

VL160X (3VL1), VL160 (3VL2), and VL250 (3VL3)

1. Safety locks
2. Masking frame for door cutout (for circuit breakers with operating mechanism)
3. Grading for cover
4. External surface of cabinet door
5. Motorized operating mechanism with stored energy mechanism

Motorized operating mechanism (MO)

VL160X (3VL1)
12.1 VL 160X (3VL1), VL 160 (3VL2), and VL 250 (3VL3), 3- and 4-pole, to 250 A

Front-operated rotary operating mechanism

1. Safety locks
2. Front-operated rotary operating mechanism
3. Padlock barrier
4. Masking frame for door cutout
5. Grading for cover
6. External surface of cabinet door

Molded case circuit breaker with door-coupling rotary operating mechanism

2. Door-coupling rotary operating mechanism
5. Terminal covers
6. External surface of cabinet door
7. Mounting level
10. Supporting bracket
11. Extension
12. Center line of operating mechanism shaft
Dimensional drawings

12.1 VL160X (3VL1), VL160 (3VL2), and VL250 (3VL3), 3- and 4-pole, to 250 A

Molded case circuit breaker with side panel rotary operating mechanism
12.1.3 Connections and phase barriers

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X (3VL1)</td>
<td>242</td>
<td>126</td>
<td>116</td>
<td>222</td>
<td>266.5</td>
<td>138.5</td>
<td>222</td>
<td>116</td>
<td>20</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>VL160 (3VL2)</td>
<td>258</td>
<td>130</td>
<td>120</td>
<td>238</td>
<td>283.5</td>
<td>143</td>
<td>238</td>
<td>120</td>
<td>20</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>VL250 (3VL3)</td>
<td>263.5</td>
<td>133</td>
<td>120</td>
<td>238</td>
<td>283.5</td>
<td>143</td>
<td>238</td>
<td>120</td>
<td>22</td>
<td>11</td>
<td>29</td>
</tr>
</tbody>
</table>

(1) Interphase barrier
(2) Front connecting bars
(6) External surface of cabinet door
(7) Mounting level
(10) Front connecting bars for increased pole spacing
Molded case circuit breaker with rear connections – long and short

(3) Terminal covers (standard)
(4) Rear connection threaded bolt (long)
(5) Rear connection threaded bolt (short)
(7) Mounting level
(8) Rear flat terminals (long)
(9) Rear flat terminals (short)

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X (3VL1)</td>
<td>71,5</td>
<td>133</td>
<td>96</td>
<td>182</td>
</tr>
<tr>
<td>VL160 (3VL2)</td>
<td>75,5</td>
<td>149</td>
<td>101</td>
<td>199</td>
</tr>
<tr>
<td>VL250 (3VL3)</td>
<td>75,5</td>
<td>149</td>
<td>101</td>
<td>199</td>
</tr>
</tbody>
</table>
12.1.4 Terminal covers

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL160X (3VL1)</td>
<td>96</td>
<td>182</td>
<td>326,5</td>
<td>168,5</td>
</tr>
<tr>
<td>VL160 (3VL2)</td>
<td>101</td>
<td>199</td>
<td>343</td>
<td>173</td>
</tr>
<tr>
<td>VL250 (3VL3)</td>
<td>101</td>
<td>199</td>
<td>343</td>
<td>173</td>
</tr>
</tbody>
</table>
12.1.5 Locking device for the toggle lever

12.1.6 Rear interlocking module

Rear interlocking module for plug-in / withdrawable molded case circuit breakers, with front connection, with/without RCD module (withdrawable module only without RCD module)

For other detailed dimension drawings, please refer to the mounting instructions for the rear interlocking module.

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without RCD module</td>
<td>194</td>
</tr>
<tr>
<td>VL160X (3VL1), VL160 (3VL2), VL250 (3VL3)</td>
<td></td>
</tr>
<tr>
<td>With RCD module – &quot;plug-in version&quot; only</td>
<td>315</td>
</tr>
<tr>
<td>VL160X (3VL1), VL160 (3VL2), VL250 (3VL3)</td>
<td></td>
</tr>
</tbody>
</table>
12.1.7 Accessories

Molded case circuit breaker with door-coupling rotary operating mechanism

<table>
<thead>
<tr>
<th>Masking frame for door cutout for molded case circuit breakers with toggle lever</th>
<th>Masking frame for door cutout for molded case circuit breakers with operating mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram 1" /></td>
<td><img src="image2.png" alt="Diagram 2" /></td>
</tr>
</tbody>
</table>

(3) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)

(4) Masking frame for door cutout (for molded case circuit breakers with toggle lever)

(6) External surface of cabinet door
12.1.8 Door cutouts

<table>
<thead>
<tr>
<th>Door cutout</th>
<th>Door cutout</th>
<th>Door cutout</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toggle lever (without masking frame)</td>
<td>Front-operated rotary operating mechanism and motorized operating mechanism with stored energy mechanism (without masking frame)</td>
<td>Door coupling rotary operating mechanism</td>
</tr>
</tbody>
</table>

| Door cutout toggle lever (with masking frame) | Door cutout front-operated rotary operating mechanism, motorized operating mechanism with stored energy mechanism and extended escutcheon (with masking frame) | Drilling template and cutout for plug-in base with connecting bars on rear |

### Note
Door cutouts require a minimum clearance between reference point Y and the door hinge.
Dimensional drawings

12.1 VL 160X (3VL1), VL 160 (3VL2), and VL 250 (3VL3), 3- and 4-pole, to 250 A

<table>
<thead>
<tr>
<th>Combination</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker only</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + door-coupling rotary operating mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + motorized operating mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + front-operated rotary operating mechanism</td>
<td>200</td>
</tr>
<tr>
<td>Molded case circuit breaker + withdrawable version</td>
<td>200</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL 160X (3VL1)</td>
<td>114,5</td>
<td>65</td>
<td>71,5</td>
<td>133</td>
</tr>
<tr>
<td>VL 160 (3VL2)</td>
<td>131,5</td>
<td>65</td>
<td>75,5</td>
<td>149</td>
</tr>
<tr>
<td>VL 250 (3VL3)</td>
<td>131,5</td>
<td>65</td>
<td>75,5</td>
<td>149</td>
</tr>
</tbody>
</table>

Drilling template and cutout for rear connection

![Drilling Template Diagram]

Door hinge point (see arrow)

![Door Hinge Diagram]
12.1.9 Plug-in base and accessories

Plug-in base with front connecting bars and drilling template for plug-in base with front connecting bars

(4) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
(8) Plug-in base with front connecting bars
(9) Plug-in base with terminal covers on the front
(10) Phase barriers
12.1 VL 160X (3VL1), VL 160 (3VL2), and VL 250 (3VL3), 3- and 4-pole, to 250 A

Plug-in base with flat rear terminals

(1) Plug-in base with rear terminal covers
(2) Plug-in base
(3) Plug-in base with flat rear terminals
(5) Terminal covers (standard)
(7) Mounting level

Dimensional drawings
12.1.10 VL160X (3VL1), 3- and 4-pole, up to 160 A

12.1.10.1 Plug-in base and accessories

<table>
<thead>
<tr>
<th>VL160X (3VL1) molded case circuit breaker with motorized operating mechanism with stored energy mechanism, mounted on plug-in base</th>
<th>VL160X (3VL1) molded case circuit breaker with front-operated rotary operating mechanism mounted on plug-in base</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Plug-in base with terminal covers</td>
<td>(6) External surface of cabinet door</td>
</tr>
<tr>
<td>(2) Plug-in base</td>
<td>(7) Mounting level</td>
</tr>
<tr>
<td>(3) Molded case circuit breakers</td>
<td>(8) Motorized operating mechanism with stored energy mechanism</td>
</tr>
<tr>
<td>(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
<td>(9) Front-operated rotary operating mechanism</td>
</tr>
<tr>
<td>(5) Terminal covers (standard)</td>
<td></td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers
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Dimensional drawings

12.1 VL 160X (3VL 1), VL 160 (3VL 2), and VL 250 (3VL 3), 3- and 4-pole, to 250 A

Connection adapter 90° angle
12.1.11 VL160 (3VL) and VL250 (3VL3), 3- and 4-pole, up to 250 A

12.1.11.1 Withdrawable version and accessories

<table>
<thead>
<tr>
<th>VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with motorized operating mechanism with stored energy mechanism (connected position)</th>
<th>VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with motorized operating mechanism with stored energy mechanism (disconnected position)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Plug-in base with terminal covers</td>
<td>(1) Plug-in base with terminal covers</td>
</tr>
<tr>
<td>(2) Plug-in base</td>
<td>(2) Plug-in base</td>
</tr>
<tr>
<td>(3) Molded case circuit breaker</td>
<td>(3) Molded case circuit breaker</td>
</tr>
<tr>
<td>(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
<td>(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
</tr>
<tr>
<td>(5) Terminal covers (standard)</td>
<td>(5) Terminal covers (standard)</td>
</tr>
<tr>
<td>(6) External surface of cabinet door</td>
<td>(6) External surface of cabinet door</td>
</tr>
<tr>
<td>(7) Mounting level</td>
<td>(7) Mounting level</td>
</tr>
<tr>
<td>(8) Motorized operating mechanism with stored energy mechanism</td>
<td>(8) Motorized operating mechanism with stored energy mechanism</td>
</tr>
<tr>
<td>(10) Locking device for the racking mechanism</td>
<td>(10) Locking device for the racking mechanism</td>
</tr>
<tr>
<td>(11) Racking mechanism</td>
<td>(11) Racking mechanism</td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers
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Dimensional drawings

12.1 VL160X (3VL1), VL160 (3VL2), and VL250 (3VL3), 3- and 4-pole, to 250 A

<table>
<thead>
<tr>
<th><strong>VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with front-operated rotary operating mechanism (connected position)</strong></th>
<th><strong>VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with front-operated rotary operating mechanism (disconnected position)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Plug-in base with terminal covers</td>
</tr>
<tr>
<td>(2)</td>
<td>Plug-in base</td>
</tr>
<tr>
<td>(3)</td>
<td>Molded case circuit breaker</td>
</tr>
<tr>
<td>(4)</td>
<td>Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
</tr>
<tr>
<td>(5)</td>
<td>Terminal covers (standard)</td>
</tr>
<tr>
<td>(6)</td>
<td>External surface of cabinet door</td>
</tr>
<tr>
<td>(7)</td>
<td>Mounting level</td>
</tr>
<tr>
<td>(8)</td>
<td>Front-operated rotary operating mechanism</td>
</tr>
<tr>
<td>(9)</td>
<td>Locking device for the racking mechanism</td>
</tr>
<tr>
<td>(10)</td>
<td>Racking mechanism</td>
</tr>
</tbody>
</table>
VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with extended escutcheon (connected position)

- (1) Plug-in base with terminal covers
- (2) Plug-in base
- (3) Molded case circuit breaker
- (4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
- (5) Terminal covers (standard)
- (6) External surface of cabinet door
- (7) Mounting level
- (8) Extended escutcheon
- (10) Locking device for the racking mechanism
- (11) Racking mechanism

VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with extended escutcheon (disconnected position)
12.1 VL 160X (3VL1), VL 160 (3VL2), and VL 250 (3VL3), 3- and 4-pole, to 250 A

<table>
<thead>
<tr>
<th>Extended escutcheon installation dimensions</th>
<th>Withdrawable version installation dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
<td>(4)</td>
</tr>
<tr>
<td>(8) Extended escutcheon</td>
<td>(10) + (2)</td>
</tr>
<tr>
<td>(11) Racking mechanism</td>
<td>(16)</td>
</tr>
<tr>
<td></td>
<td>152.5 (3P)</td>
</tr>
<tr>
<td></td>
<td>187 (4P)</td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers
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12.2 VL400 (3VL4), 3- and 4-pole, up to 400 A

12.2.1 Molded case circuit breakers

VL400 (3VL4) molded case circuit breaker

(9) Toggle lever extension
12.2.2 Operating mechanisms

Motorized operating mechanism with stored energy mechanism (SEO)

(1) Safety lock
(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(7) Motorized operating mechanism with stored energy mechanism
(8) Mounting level

Motorized operating mechanism (MO)

Figure 12-1 Front view and side view of the MO 3VL4 motorized operating mechanism
12.2 VL400 (3VL4), 3- and 4-pole, up to 400 A

Dimensional drawings

Front-operated rotary operating mechanism

(1) Safety lock
(2) Front-operated rotary operating mechanism
(3) Padlock barrier
(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(6) External surface of cabinet door
(8) Mounting level
Dimensional drawings

12.2 VL400 (3VL4), 3- and 4-pole, up to 400 A

Molded case circuit breaker with door-coupling rotary operating mechanism

(3) Molded case circuit breaker
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
(9) Door-coupling rotary operating mechanism
(11) Supporting bracket
(12) Center line of operating mechanism shaft
Molded case circuit breaker with side panel rotary operating mechanism
12.2.3 Connections and phase barriers

(1) Interphase barrier
(2) Front connecting bars
(7) Mounting level
(10) Front connecting bars for increased pole spacing

(3) Terminal covers (standard)
(4) Rear connection (long)
(5) Rear connection (short)
(6) Rear flat terminals (long)
(8) Rear flat terminals (short)
12.2.4 Terminal covers

Table 12-1

<table>
<thead>
<tr>
<th>Molded case circuit breaker installation note</th>
<th>Front connecting bars</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

- (2) Front connecting bars
- (3) Terminal covers (standard)
- (4) Terminal covers (extended)
- (6) External surface of cabinet door
- (7) Mounting level
- (8) Cutout
12.2.5 Rear interlocking module

Table 12- 2

<table>
<thead>
<tr>
<th>Rear interlocking module for plug-in/withdrawable circuit breakers for front connection, with/without RCD module</th>
<th>Rear interlocking module</th>
</tr>
</thead>
<tbody>
<tr>
<td>For other detailed dimension drawings, please refer to the mounting instructions for the rear interlocking module.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without RCD module VL400 (3VL4)</td>
<td>289</td>
</tr>
<tr>
<td>With RCD module VL400 (3VL4)</td>
<td>449</td>
</tr>
</tbody>
</table>

12.2.6 Locking devices, locking device for toggle lever and accessories

Table 12- 3

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>3VL9 4</td>
<td>20,3</td>
<td>80,3</td>
<td>57,4</td>
<td>52,8</td>
<td>49,3</td>
<td>49,8</td>
<td>6,35</td>
<td>6,3</td>
<td>11,2</td>
<td>58,5</td>
</tr>
<tr>
<td>3VL9 6</td>
<td>21,6</td>
<td>79,8</td>
<td>71,1</td>
<td>62,0</td>
<td>50,4</td>
<td>46,5</td>
<td>12,9</td>
<td>8,9</td>
<td>8,6</td>
<td>72,2</td>
</tr>
<tr>
<td>3VL9 8</td>
<td>21,6</td>
<td>110,5</td>
<td>88,9</td>
<td>96,5</td>
<td>77,2</td>
<td>69,1</td>
<td>11,7</td>
<td>5,1</td>
<td>24,8</td>
<td>90,0</td>
</tr>
</tbody>
</table>
Masking frame for door cutout for molded case circuit breakers with toggle lever

(6) External surface of cabinet door
(7) Mounting level
(10) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
12.2.7 Door cutouts

| Dimensional drawings | 12.2 VL400 (3VL4), 3- and 4-pole, up to 400 A |

<table>
<thead>
<tr>
<th>Door cutout toggle lever operating mechanism (without masking frame)</th>
<th>Door cutout front-operated rotary operating mechanism and motorized operating mechanism with stored energy mechanism (without masking frame)</th>
<th>Door cutout Door coupling rotary operating mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram of door cutout toggle lever operating mechanism" /></td>
<td><img src="image2" alt="Diagram of door cutout front-operated rotary operating mechanism and motorized operating mechanism with stored energy mechanism" /></td>
<td><img src="image3" alt="Diagram of door cutout front-operated rotary operating mechanism and motorized operating mechanism with stored energy mechanism" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Door cutout toggle lever operating mechanism (with masking frame)</th>
<th>Door cutout front-operated rotary operating mechanism, motorized operating mechanism with stored energy mechanism and extended escutcheon (with masking frame)</th>
<th>Drilling template and cutout for plug-in base with flat connecting bars on rear</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image4" alt="Diagram of door cutout toggle lever operating mechanism with masking frame" /></td>
<td><img src="image5" alt="Diagram of door cutout front-operated rotary operating mechanism with stored energy mechanism and extended escutcheon" /></td>
<td><img src="image6" alt="Diagram of drilling template and cutout for plug-in base with flat connecting bars on rear" /></td>
</tr>
</tbody>
</table>
Drilling template and cutout for rear connection

Door hinge point (see arrow)

### Note
Door cutouts require a minimum clearance between reference point Y and the door hinge.

<table>
<thead>
<tr>
<th>Combination</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker only</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + door-coupling rotary operating mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + motorized operating mechanism with stored energy mechanism</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + front-operated rotary operating mechanism</td>
<td>200</td>
</tr>
<tr>
<td>Molded case circuit breaker + withdrawable version</td>
<td>200</td>
</tr>
</tbody>
</table>
12.2.8 Plug-in base and accessories

Plug-in base and drilling template; plug-in base with front connecting bars

(2) Plug-in base
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
(8) Plug-in base with front connecting bars
(9) Plug-in base with terminal covers on the front
(10) Interphase barrier
(1) Plug-in base with rear terminal covers
(2) Plug-in base
(3) Plug-in base with rear flat connecting bars
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
Dimensional drawings

12.2 VL400 (3VL4), 3- and 4-pole, up to 400 A

Table 12- 5

<table>
<thead>
<tr>
<th>Description</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>3VL4 circuit breaker in the withdrawable unit (connected position)</td>
<td><img src="image1" alt="Diagram" /></td>
</tr>
<tr>
<td>3VL4 circuit breaker in the withdrawable unit (disconnected position)</td>
<td><img src="image2" alt="Diagram" /></td>
</tr>
<tr>
<td>Withdrawable module motorized operating mechanism with stored energy mechanism (connected position)</td>
<td><img src="image3" alt="Diagram" /></td>
</tr>
<tr>
<td>Withdrawable module motorized operating mechanism with stored energy mechanism (disconnected position)</td>
<td><img src="image4" alt="Diagram" /></td>
</tr>
</tbody>
</table>
Dimensional drawings

12.2 VL400 (3VL4), 3- and 4-pole, up to 400 A

Withdrawable module motorized operating mechanism
(connected position)

Withdrawable module motorized operating mechanism
(disconnected position)

(1) Plug-in base with terminal covers
(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
(8) Motorized operating mechanism with stored energy mechanism
(10) Locking device for the racking mechanism
(11) Racking mechanism
Table 12- 6

<table>
<thead>
<tr>
<th>Withdrawable module extended escutcheon (connected position)</th>
<th>Withdrawable module extended escutcheon (disconnected position)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Plug-in base with terminal covers</td>
<td>(1) Plug-in base with terminal covers</td>
</tr>
<tr>
<td>(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
<td>(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
</tr>
<tr>
<td>(5) Terminal covers (standard)</td>
<td>(5) Terminal covers (standard)</td>
</tr>
<tr>
<td>(6) External surface of cabinet door</td>
<td>(6) External surface of cabinet door</td>
</tr>
<tr>
<td>(7) Mounting level</td>
<td>(7) Mounting level</td>
</tr>
<tr>
<td>(8) Extended escutcheon</td>
<td>(8) Extended escutcheon</td>
</tr>
<tr>
<td>(9) Front-operated rotary operating mechanism</td>
<td>(9) Front-operated rotary operating mechanism</td>
</tr>
<tr>
<td>(10) Locking device for the racking mechanism</td>
<td>(10) Locking device for the racking mechanism</td>
</tr>
<tr>
<td>(11) Racking mechanism</td>
<td>(11) Racking mechanism</td>
</tr>
</tbody>
</table>
Extended escutcheon mounted on guide rail

- (4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
- (10) Locking device for the racking mechanism
- (11) Racking mechanism
12.3 VL630 (3VL5), 3- and 4-pole, up to 630 A

12.3.1 Molded case circuit breakers

VL630 (3VL5) molded case circuit breaker

![Dimensional drawing of VL630 (3VL5) molded case circuit breaker](image)
12.3.2 Operating mechanisms

Motorized operating mechanism with stored energy mechanism (SEO)

VL630 (3VL5)

(1) Safety lock
(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(6) External surface of cabinet door
(7) Motorized operating mechanism with stored energy mechanism
(8) Mounting level
Motorized operating mechanism (MO)

VL630 (3VL5) and VL800 (3VL6)

Figure 12-2  New front view and side view of the 3VL5 and 3VL6 motorized operating mechanisms (MO)

Front-operated rotary mechanism

1. Safety lock
2. Front-operated rotary operating mechanism
3. Padlock barrier
4. Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
5. Grading for cover
6. External surface of cabinet door
7. Mounting level

3VL IEC molded case circuit breakers

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Molded case circuit breaker with door-coupling rotary operating mechanism

(3) Molded case circuit breaker  
(5) Terminal covers (standard)  
(6) External surface of cabinet door  
(7) Mounting level  
(9) Door-coupling rotary operating mechanism  
(12) Supporting bracket
Dimensional drawings

12.3 VL630 (3VL5), 3- and 4-pole, up to 630 A

Molded case circuit breaker with side panel rotary operating mechanism

12.3.3 Connections and phase barriers

(1) Interphase barrier

(2) Front connecting bars

(7) Mounting level

(8) Front connecting bars for increased pole spacing
Dimensional drawings

12.3 VL630 (3VL5), 3- and 4-pole, up to 630 A

12.3.4 Terminal covers

(2) Front connecting bars
(3) Terminal covers (standard)
(4) Terminal covers (extended)
(7) Mounting level
12.3.5 Rear interlocking module

Rear interlocking module for plug-in/withdrawable molded case circuit breakers for front connection

Rear interlocking module for plug-in/withdrawable molded case circuit breakers for front connection.

(1) For withdrawable module
12.3.6 Locking and locking device for toggle lever

![Diagram of locking device]

Table 12-7

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>3VL9 4</td>
<td>20.3</td>
<td>80.3</td>
<td>57.4</td>
<td>52.8</td>
<td>49.3</td>
<td>49.8</td>
<td>6.35</td>
<td>6.3</td>
<td>11.2</td>
<td>58.5</td>
</tr>
<tr>
<td>3VL9 6</td>
<td>21.6</td>
<td>79.8</td>
<td>71.1</td>
<td>62.0</td>
<td>50.4</td>
<td>46.5</td>
<td>12.9</td>
<td>8.9</td>
<td>8.6</td>
<td>72.2</td>
</tr>
<tr>
<td>3VL9 8</td>
<td>21.6</td>
<td>110.5</td>
<td>88.9</td>
<td>96.5</td>
<td>77.2</td>
<td>69.1</td>
<td>11.7</td>
<td>5.1</td>
<td>24.8</td>
<td>90.0</td>
</tr>
</tbody>
</table>

12.3.7 Accessories

Masking frames for door cutouts

| (6)  | External surface of cabinet door |
| (7)  | Mounting level |
| (10) | Masking frame for door cutout (for molded case circuit breakers with toggle lever) |
| (11) | Masking frame for door cutout (for molded case circuit breakers with operating mechanism) |
Dimensional drawings

12.3 VL630 (3VL5), 3- and 4-pole, up to 630 A

Toggle lever extension

12.3.8 Door cutouts

<table>
<thead>
<tr>
<th>Door cutout door coupling rotary operating mechanism</th>
<th>Door cutout toggle lever operating mechanism (without masking frame)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Door cutout front-operated rotary operating mechanism, motorized operating mechanism with stored energy mechanism and extended escutcheon (without masking frame)</th>
<th>Door cutout toggle lever operating mechanism (with masking frame)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image3.png" alt="Diagram" /></td>
<td><img src="image4.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Note

Door cutouts require a minimum clearance between reference point Y and the door hinge.
Dimensional drawings

12.3 VL630 (3VL5), 3- and 4-pole, up to 630 A

Door cutout front-operated rotary operating mechanism, motorized operating mechanism with stored energy mechanism and extended escutcheon (with masking frame)

<table>
<thead>
<tr>
<th>Combination</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker only</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + door-coupling rotary operating mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + motorized operating mechanism with stored energy mechanism</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + front-operated rotary operating mechanism</td>
<td>200</td>
</tr>
<tr>
<td>Molded case circuit breaker + withdrawable version</td>
<td>200</td>
</tr>
</tbody>
</table>

Drilling template and cutout for plug-in base (with flat connecting bars on rear)

Drilling template and cutout for molded case circuit breakers (with flat connecting bars on rear)

3VL IEC molded case circuit breakers
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12.3.9 Plug-in base and accessories

Plug-in base with terminal covers on the front and drilling template for plug-in base with front connecting bars

(2) Plug-in base
(4) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
(8) Plug-in base with front connecting bars
(9) Plug-in base with terminal covers on the front
(10) Interphase barrier
(11) Connection surface
Plug-in base, with terminal covers, rear flat connecting bars on plug-in base

(1) Plug-in base with rear terminal covers
(2) Plug-in base
(3) Plug-in base with rear flat connecting bars
(4) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
### 12.3.10 Withdrawable version and accessories

<table>
<thead>
<tr>
<th>VL630 (3VL5) molded case circuit breaker with rotary operating mechanism in withdrawable design (connected position)</th>
<th>VL630 (3VL5) molded case circuit breaker with rotary operating mechanism in withdrawable design (disconnected position)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

**Dimensional drawings**

12.3 VL630 (3VL5), 3- and 4-pole, up to 630 A

**3VL IEC molded case circuit breakers**

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### VL630 (3VL5) molded case circuit breaker with motorized operating mechanism in withdrawable design (connected position)

![Diagram of VL630 (3VL5) molded case circuit breaker with motorized operating mechanism in connected position](image)

1. Plug-in base with terminal covers
2. Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
3. Terminal covers (standard)
4. External surface of cabinet door
5. Mounting level
6. Motorized operating mechanism with stored energy mechanism
7. Front-operated rotary operating mechanism
8. Locking device for the racking mechanism
9. Racking mechanism

### VL630 (3VL5) molded case circuit breaker with motorized operating mechanism in withdrawable design (disconnected position)

![Diagram of VL630 (3VL5) molded case circuit breaker with motorized operating mechanism in disconnected position](image)

1. Plug-in base with terminal covers
2. Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
3. Terminal covers (standard)
4. External surface of cabinet door
5. Mounting level
6. Motorized operating mechanism with stored energy mechanism
7. Front-operated rotary operating mechanism
8. Locking device for the racking mechanism
9. Racking mechanism
Dimensional drawings

12.3 VL630 (3VL5), 3- and 4-pole, up to 630 A

Table 12-9

<table>
<thead>
<tr>
<th>Part</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Plug-in base with terminal covers</td>
</tr>
<tr>
<td>(2)</td>
<td>Plug-in base</td>
</tr>
<tr>
<td>(4)</td>
<td>Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
</tr>
<tr>
<td>(5)</td>
<td>Terminal covers (standard)</td>
</tr>
<tr>
<td>(6)</td>
<td>External surface of cabinet door</td>
</tr>
<tr>
<td>(7)</td>
<td>Mounting level</td>
</tr>
<tr>
<td>(8)</td>
<td>Extended escutcheon</td>
</tr>
<tr>
<td>(10)</td>
<td>Locking device for the racking mechanism</td>
</tr>
<tr>
<td>(11)</td>
<td>Racking mechanism</td>
</tr>
</tbody>
</table>
VL630 (3VL5) molded case circuit breaker with extended escutcheon in withdrawable design

(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(8) Extended escutcheon
(10) Locking device for the racking mechanism
(11) Racking mechanism
12.4 VL800 (3VL6), 3- and 4-pole, up to 800 A

12.4.1 Molded case circuit breakers

VL800 (3VL6) molded case circuit breaker
12.4.2 Operating mechanisms

Motorized operating mechanism with stored energy mechanism (SEO)

VL800 (3VL6)

(1) Safety lock
(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(5) Grading for cover
(6) External surface of cabinet door
(7) Motorized operating mechanism with stored energy mechanism
(8) Mounting level

Motorized operating mechanism (MO)

VL800 (3VL6)
Dimensional drawings

12.4 VL800 (3VL6), 3- and 4-pole, up to 800 A

Front-operated rotary operating mechanism

(1) Safety lock
(2) Front-operated rotary operating mechanism
(3) Padlock barrier
(4) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(6) External surface of cabinet door
(8) Mounting level

Molded case circuit breaker with door-coupling rotary operating mechanism

(3) Molded case circuit breaker
(5) Terminal covers (standard)
(6) External surface of cabinet door
(7) Mounting level
(9) Door-coupling rotary operating mechanism
(12) Supporting bracket
(13) Center line of operating mechanism shaft

3VL IEC molded case circuit breakers
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12.4.3 Withdrawable version

Withdrawable version with front-operated rotary operating mechanism, insert position and remove position

(1) Connected position
(2) Masking frame for door cutout
(3) External surface of cabinet door
(4) Mounting level
(5) Disconnected position
Withdrawable version with motorized operating mechanism, insert position and remove position

(1) Connected position
(2) Masking frame for door cutout
(3) External surface of cabinet door
(4) Mounting level
(5) Disconnected position
Dimensional drawings

12.4 VL800 (3VL6), 3- and 4-pole, up to 800 A

Withdrawable version with motorized operating mechanism with stored energy mechanism, insert position and remove position

(1) Connected position
(2) Masking frame for door cutout
(3) External surface of cabinet door
(4) Mounting level
(5) Disconnected position
Withdrawable version with extended escutcheon (without masking frame), insert position and remove position

(1) Connected position   (4) Mounting level
(2) Masking frame for door cutout   (5) Disconnected position
(3) External surface of cabinet door
Dimensional drawings

12.4 VL800 (3VL6), 3- and 4-pole, up to 800 A

<table>
<thead>
<tr>
<th>Withdrawable version</th>
<th>Drilling template and cutout for withdrawable modules with flat connecting bars on rear</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Dimensional drawing for Withdrawable version" /></td>
<td><img src="image2.png" alt="Dimensional drawing for Drilling template and cutout" /></td>
</tr>
</tbody>
</table>

Drilling template and cutout for withdrawable modules with flat connecting bars on rear

3VL IEC molded case circuit breakers
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12.4.4 Connections and phase barriers

(1) Interphase barrier
(2) Front connecting bars
(7) Mounting level
(8) Front connecting bars for increased pole spacing
12.4.5 Terminal covers

- Front connecting bars (2)
- Mounting level (7)
- Terminal covers (extended) (4)
Dimensional drawings

12.4 VL800 (3VL6), 3- and 4-pole, up to 800 A

Table 12- 10

(3) Terminal covers (standard)  (8) Rear connection (horizontal mounting)
(7) Mounting level  (9) Rear connection (vertical mounting)

12.4.6 Locking and locking device for toggle lever

Table 12- 11

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td>3VL9 4</td>
<td>20,3</td>
<td>80,3</td>
<td>57,4</td>
<td>52,8</td>
<td>49,3</td>
<td>49,8</td>
<td>6,35</td>
<td>6,3</td>
<td>11,2</td>
<td>58,5</td>
</tr>
<tr>
<td>3VL9 6</td>
<td>21,6</td>
<td>79,8</td>
<td>71,1</td>
<td>62,0</td>
<td>50,4</td>
<td>46,5</td>
<td>12,9</td>
<td>8,9</td>
<td>8,6</td>
<td>72,2</td>
</tr>
<tr>
<td>3VL9 8</td>
<td>21,6</td>
<td>110,5</td>
<td>88,9</td>
<td>96,5</td>
<td>77,2</td>
<td>69,1</td>
<td>11,7</td>
<td>5,1</td>
<td>24,8</td>
<td>90,0</td>
</tr>
</tbody>
</table>
12.4.7 Rear interlocking module

Rear interlocking module 3-pole molded case circuit breaker

For other detailed dimension drawings, please refer to the mounting instructions for the rear interlocking module.

Rear interlocking module 4-pole molded case circuit breaker

(1) For withdrawable module
12.4.8 Accessories

Masking frame for door cutout

<table>
<thead>
<tr>
<th>Masking frame for door cutout for molded case circuit breakers with toggle lever</th>
<th>Masking frame for door cutout for molded case circuit breakers with operating mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Masking frame for door cutout for molded case circuit breakers with toggle lever" /></td>
<td><img src="image2" alt="Masking frame for door cutout for molded case circuit breakers with operating mechanism" /></td>
</tr>
</tbody>
</table>

(6) External surface of cabinet door  
(7) Mounting level  
(10) Masking frame for door cutout (for molded case circuit breakers with toggle lever)  
(11) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)

Toggle lever extension

<table>
<thead>
<tr>
<th><img src="image3" alt="Toggle lever extension" /></th>
</tr>
</thead>
</table>
| (4) Toggle lever extension  
(7) Mounting level |
### 12.4.9 Door cutouts

<table>
<thead>
<tr>
<th>Door cutout</th>
<th>Door cutout toggle lever</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Door coupling rotary operating mechanism</strong></td>
<td><strong>(without masking frame)</strong></td>
</tr>
<tr>
<td><img src="image1.png" alt="Door cutout diagram" /></td>
<td><img src="image2.png" alt="Door cutout toggle lever diagram" /></td>
</tr>
</tbody>
</table>

**Door cutout front-operated rotary operating mechanism, motorized operating mechanism with stored energy mechanism and extended escutcheon (without masking frame)**

**Door cutout toggle lever (with masking frame)**

![Door cutout diagram with masking frame](image3.png)

---

**Note**

Door cutouts require a minimum clearance between reference point Y and the door hinge.
Dimensional drawings
12.4 VL800 (3VL6), 3- and 4-pole, up to 800 A

<table>
<thead>
<tr>
<th>Combination</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker only</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + door-coupling rotary operating mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + motorized operating mechanism with stored energy mechanism</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + front-operated rotary operating mechanism</td>
<td>200</td>
</tr>
<tr>
<td>Molded case circuit breaker + withdrawable version</td>
<td>200</td>
</tr>
</tbody>
</table>

(1) Withdrawable version only
12.5 VL1250 (3VL7) and VL1600 (3VL8), 3- and 4-pole, up to 1600 A

12.5.1 Molded case circuit breakers

VL1250 (3VL7) molded case circuit breaker

(1) Toggle lever extension
12.5.2 Operating mechanisms

Motorized operating mechanism (MO)
Dimensional drawings

12.5 VL1250 (3VL7) and VL1600 (3VL8), 3- and 4-pole, up to 1600 A

Front-operated rotary operating mechanism

(1) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)

(2) Motorized operating mechanism

(3) Front-operated rotary operating mechanism

(4) External surface of cabinet door

(5) Mounting level

(6) Safety lock

Molded case circuit breaker with door-coupling rotary operating mechanism

(2) Door-coupling rotary operating mechanism

(3) External surface of cabinet door

(4) Supporting bracket

(5) Mounting level
12.5.3 Withdrawable version

Withdrawable version with front-operated rotary operating mechanism, insert position and remove position

(1) Connected position
(2) Masking frame for door cutout
(3) External surface of cabinet door
(4) Mounting level
(5)Disconnected position
Dimensional drawings

12.5 VL1250 (3VL7) and VL1600 (3VL8), 3- and 4-pole, up to 1600 A

Withdrawable version motorized operating mechanism, insert position and remove position

(1) Connected position
(2) Masking frame for door cutout
(3) External surface of cabinet door
(4) Mounting level
(5) Disconnected position
Dimensional drawings

12.5 VL 1250 (3VL7) and VL 1600 (3VL8), 3- and 4-pole, up to 1600 A

Withdrawable version with extended escutcheon (without masking frame), insert position and remove position

(1) Connected position
(2) Masking frame for door cutout
(3) External surface of cabinet door
(4) Mounting level
(5) Disconnected position
Table 12-12

<table>
<thead>
<tr>
<th>Withdrawable version</th>
<th>Drilling template and cutout for withdrawable modules with flat connecting bars on rear</th>
</tr>
</thead>
</table>

Dimensional drawings

12.5 VL1250 (3VL7) and VL1600 (3VL8), 3- and 4-pole, up to 1600 A
12.5.4 Connections and phase barriers

(1) Interphase barrier
(2) Front connecting bars
(3) Mounting level
12.5.5 Terminal covers

(1) Front connecting bars
(3) Terminal covers (extended)
(4) Mounting level
Dimensional drawings

12.5 VL 1250 (3VL7) and VL 1600 (3VL8), 3- and 4-pole, up to 1600 A

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### VL1250 (3VL7) molded case circuit breakers only

- **(2)** Terminal covers (short) – for VL1250 (3VL7) molded case circuit breakers only
- **(4)** Mounting level
- **(5)** Rear connection (horizontal mounting)
- **(6)** Rear connection (vertical mounting)
12.5 VL1250 (3VL7) and VL1600 (3VL8), 3- and 4-pole, up to 1600 A

**Dimensional drawings**

**3VL IEC molded case circuit breakers**

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---

### VL1600 (3VL8) molded case circuit breakers only

1. Front connecting bars
2. Terminal covers (short) – for VL1250 (3VL7) molded case circuit breakers only
3. Terminal covers (extended)
4. Mounting level
5. Rear connection (horizontal mounting)
6. Rear connection (vertical mounting)
7. Phase barriers

---

**Front connecting bars**

**Terminal covers (short)** – for VL1250 (3VL7) molded case circuit breakers only

**Terminal covers (extended)**

**Mounting level**

**Rear connection (horizontal mounting)**

**Rear connection (vertical mounting)**

**Phase barriers**
12.5.6 Rear interlocking module

For other detailed dimension drawings, please refer to the mounting instructions for the rear interlocking module.

3-pole version

4-pole version
12.5.7 Locking and locking device for toggle lever

![Diagram of locking and locking device for toggle lever]

Table 12-13

<table>
<thead>
<tr>
<th>Type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>K</th>
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</thead>
<tbody>
<tr>
<td>3VL9 4</td>
<td>20,3</td>
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<td>49,3</td>
<td>49,8</td>
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<td>6,3</td>
<td>11,2</td>
<td>58,5</td>
</tr>
<tr>
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<td>21,6</td>
<td>79,8</td>
<td>71,1</td>
<td>62,0</td>
<td>50,4</td>
<td>46,5</td>
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<td>8,9</td>
<td>8,6</td>
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</tr>
<tr>
<td>3VL9 8</td>
<td>21,6</td>
<td>110,5</td>
<td>88,9</td>
<td>96,5</td>
<td>77,2</td>
<td>69,1</td>
<td>11,7</td>
<td>5,1</td>
<td>24,8</td>
<td>90,0</td>
</tr>
</tbody>
</table>

12.5.8 Accessories

Masking frame for door cutout for molded case circuit breakers with toggle lever

![Diagram of accessories]

(1) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
(3) External surface of cabinet door
(5) Mounting level
### 12.5.9 Door cutouts

Table 12-14

<table>
<thead>
<tr>
<th>Door cutout toggle lever (without masking frame)</th>
<th>Door cutout front-operated rotary operating mechanism (without masking frame)</th>
<th>Door cutout coupling rotary operating mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Door cutout toggle lever (without masking frame)" /></td>
<td><img src="image" alt="Door cutout front-operated rotary operating mechanism (without masking frame)" /></td>
<td><img src="image" alt="Door cutout coupling rotary operating mechanism" /></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Door cutout toggle lever (with masking frame)</th>
<th>Door cutout front-operated rotary operating mechanism, motorized operating mechanism and extended escutcheon (with masking frame)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Door cutout toggle lever (with masking frame)" /></td>
<td><img src="image" alt="Door cutout front-operated rotary operating mechanism, motorized operating mechanism and extended escutcheon (with masking frame)" /></td>
</tr>
</tbody>
</table>
12.5.10  Current transformer

Table 12-15

<table>
<thead>
<tr>
<th>Current transformer for neutral conductor for ground-fault protection in 4-conductor three-phase systems for VL160 (3VL2)/VL250 (3VL3) molded case circuit breakers</th>
<th>Current transformer for neutral conductor for ground-fault protection in 4-conductor three-phase systems for VL630 (3VL5)/VL800 (3VL6) molded case circuit breakers</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Diagram of current transformer for neutral conductor for ground-fault protection in 4-conductor three-phase systems for VL160 (3VL2)/VL250 (3VL3) molded case circuit breakers]</td>
<td>![Diagram of current transformer for neutral conductor for ground-fault protection in 4-conductor three-phase systems for VL630 (3VL5)/VL800 (3VL6) molded case circuit breakers]</td>
</tr>
</tbody>
</table>

For other dimension drawings (for current transformers for 3VL4, 3VL7, 3VL8), please refer to the mounting instructions for current transformers.
12.6 Interlocks for VL160X (3VL1) to VL800 (3VL6), 3- and 4-pole, up to 800 A

12.6.1 Locking with bowden wire

Table 12-16

<table>
<thead>
<tr>
<th>Combination options</th>
<th>3VL93008LA00</th>
<th>3VL94008LA00</th>
<th>3VL96008LA00</th>
<th>3VL98008LA00</th>
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<tr>
<td>3VL98008LA00</td>
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<td>-</td>
<td>OK</td>
<td>OK</td>
</tr>
</tbody>
</table>
12.7 VL160X (3VL1) with RCD block, 3- and 4-pole, up to 160 A

12.7.1 Molded case circuit breakers

VL160X (3VL1) molded case circuit breakers with RCD module
12.7.2 Connections and phase barriers

1. Interphase barrier
2. Front connecting bars
3. External surface of cabinet door
4. Mounting level
5. Front connecting bars for increased pole spacing
6. Masking frame for door cutout (for molded case circuit breakers with RCD module)
(3) Terminal covers (standard)
(4) Rear connection threaded bolt (long)
(5) Rear connection threaded bolt (short)
(6) External surface of cabinet door
(7) Mounting level
(8) Rear connection, long flat terminals
(9) Rear connection, short flat terminals
(11) Masking frame for door cutout (for molded case circuit breakers with RCD module)
12.7.3 Terminal covers

12.7 VL 160X (3VL1) with RCD block, 3- and 4-pole, up to 160 A

(2) Front connecting bars
(4) Terminal covers (extended)
(5) Masking frame for door cutout
       (for molded case circuit breakers with RCD module)
(6) External surface of cabinet door
(7) Mounting level
12.7.4 Door cutouts

Table 12-17

<table>
<thead>
<tr>
<th>Drilling template for rear connection</th>
<th>Door cutout toggle lever (with masking frame)</th>
<th>Door cutout toggle lever (without masking frame)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><img src="image" alt="Drilling template" /></td>
<td><img src="image" alt="Door cutout toggle lever with masking frame" /></td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Door cutout toggle lever without masking frame" /></td>
<td></td>
</tr>
</tbody>
</table>
Dimensional drawings

12.7 VL 160X (3VL 1) with RCD block, 3- and 4-pole, up to 160 A

Door hinge point (see arrow)

D > A from table + (P × 5)

Note

Door cutouts require a minimum clearance between reference point Y and the door hinge.

<table>
<thead>
<tr>
<th>Combination</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker only</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + motorized operating mechanism with stored energy mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + front-operated rotary operating mechanism</td>
<td>200</td>
</tr>
</tbody>
</table>
Molded case circuit breaker with RCD module mounted on side

(1) External surface of cabinet door
(2) Fastening bracket
(3) Mounting level
(4) Mounting rail TH 75 in accordance with DIN EN 60715 (to be provided by the customer)
12.7.5 Plug-in base and accessories

(1) Plug-in base with rear terminal covers
(2) Plug-in base for molded case circuit breaker with RCD module
(3) Plug-in base with flat rear terminals
(5) Terminal cover (standard)
(7) Mounting level
(2) Plug-in base for molded case circuit breaker with RCD module
(4) Masking frame for door cutout (for molded case circuit breakers with RCD module)
(5) Terminal cover (standard)
(7) Mounting level
(8) Plug-in base with front connecting bars
(9) Plug-in base with terminal covers on the front
(10) Interphase barrier
12.8 VL160 (3VL2) and VL250 (3VL3) with RCD module, 3- and 4-pole, to 250 A

12.8.1 Molded case circuit breakers

VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with RCD module

---

**Note**

VL250 (3VL3) molded case circuit breakers:
The 5-mm extension (total height 307 mm) at each end is only significant when box terminals and circular conductor terminals are used.
12.8.2 Connections and phase barriers

(1) Interphase barrier
(2) Front connecting bars
(6) External surface of cabinet door
(7) Mounting level
(10) Front connecting bars for increased pole spacing
(11) Masking frame for door cutout (for molded case circuit breakers with RCD module)
(12) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
Dimensional drawings

12.8 VL 160 (3VL2) and VL 250 (3VL3) with RCD module, 3- and 4-pole, to 250 A

(1) Interphase barrier
(2) Front connecting bars
(3) Terminal covers (standard)
(4) Rear connections (long)
(5) Rear connections (short)
(6) External surface of cabinet door
(7) Mounting level
(8) Rear flat terminals (long)
(9) Rear flat terminals (short)
(10) Front connecting bars for increased pole spacing
(11) Masking frame for door cutout (for molded case circuit breakers with RCD module)
(12) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
12.8.3 Terminal covers

Dimensions of lower cover frame "VL160X (3VL1) with RCD block, 3- and 4-pole, up to 160 A", Terminal covers (Page 256).

(1) Masking frame for door cutout (for molded case circuit breakers with RCD module)
(3) Terminal covers (standard)
(5) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
(6) External surface of cabinet door
(7) Mounting level
Dimensional drawings

12.8 VL 160 (3VL2) and VL 250 (3VL3) with RCD module, 3- and 4-pole, to 250 A

(1) Masking frame for door cutout (for molded case circuit breakers with RCD module)
(2) Front connecting bars
(4) Terminal covers (extended)
(5) Masking frame for door cutout (for molded case circuit breakers with toggle lever)
(6) External surface of cabinet door
12.8.4 Door cutouts

Table 12-18

<table>
<thead>
<tr>
<th>Door cutout</th>
<th>Door cutout</th>
<th>Door cutout</th>
</tr>
</thead>
<tbody>
<tr>
<td>toggle lever (without masking frame)</td>
<td>toggle lever (with masking frame)</td>
<td>coupling rotary operating mechanism</td>
</tr>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
<td><img src="image3.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Door cutout front-operated rotary operating mechanism and motorized operating mechanism with stored energy mechanism (with masking frame)

| ![Diagram](image4.png) |

Door cutout front-operated rotary operating mechanism (without masking frame)

| ![Diagram](image5.png) |

Drilling template for cutout rear connection bolts

| ![Diagram](image6.png) |
Dimensional drawings

12.8 VL 160 (3VL2) and VL 250 (3VL3) with RCD module, 3- and 4-pole, to 250 A

Door hinge point (see arrow)

D > A from table + (P × 5)

Note

Door cutouts require a minimum clearance between reference point Y and the door hinge.

<table>
<thead>
<tr>
<th>Combination</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker only</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + door-coupling rotary operating mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + motorized operating mechanism with stored energy mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + front-operated rotary operating mechanism</td>
<td>200</td>
</tr>
<tr>
<td>Molded case circuit breaker + withdrawable version</td>
<td>200</td>
</tr>
</tbody>
</table>
12.8.5 Plug-in base and accessories

Plug-in base and accessories with drilling template and cutout for plug-in base with flat connecting bars on rear

(1) Plug-in base with rear terminal covers
(2) Plug-in base for molded case circuit breaker with RCD module
(3) Plug-in base with flat rear terminals
(5) Terminal cover (standard)
(7) Mounting level
Drilling template and cutout for plug-in base with flat connecting bars on rear with plug-in base and accessories

(2) Plug-in base for molded case circuit breaker with RCD module
(4) Masking frame for door cutout (for molded case circuit breakers with RCD module)
(5) Terminal cover (standard)
(7) Mounting level
(8) Plug-in base with front connecting bars
(9) Plug-in base with terminal covers on the front
(10) Interphase barrier
12.8 VL160 (3VL2) and VL250 (3VL3) with RCD module, 3- and 4-pole, to 250 A

**Dimensional drawings**

**VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with RCD module and motorized operating mechanism with stored energy mechanism (connected position)**

**VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with RCD module and motorized operating mechanism with stored energy mechanism (disconnected position)**

---

(1) Safety lock  
(4) Motorized operating mechanism with stored energy mechanism  
(5) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)  
(6) External surface of cabinet door

---

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12.8 VL160 (3VL2) and VL250 (3VL3) with RCD module, 3- and 4-pole, to 250 A

(7) Mounting level
(8) Masking frame for door cutout
   (for molded case circuit breakers with RCD module)
(10) RCD extended escutcheon
(11) Locking device for the racking mechanism
(12) Racking mechanism

| (2) | Front-operated rotary operating mechanism |
| (3) | Padlock barrier |
| (5) | Masking frame for door cutout (for molded case circuit breakers with operating mechanism) |
| (7) | Mounting level |
| (9) | Masking frame for door cutout
   (for molded case circuit breakers with RCD module, toggle lever/rotary operating mechanism) |
| (10) | RCD extended escutcheon |
| (11) | Locking device for the racking mechanism |
| (12) | Racking mechanism |

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|   | VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with RCD module and extended escutcheon (connected position) | VL160 (3VL2) and VL250 (3VL3) molded case circuit breakers with RCD module and extended escutcheon (disconnected position) |
|---|---|
| (3) | Molded case circuit breaker extended escutcheon |
| (5) | Masking frame for door cutout (for molded case circuit breakers with operating mechanism) |
| (6) | External surface of cabinet door |
| (7) | Mounting level |
| (9) | Masking frame for door cutout (for molded case circuit breakers with RCD module, toggle lever/rotary operating mechanism) |
| (10) | RCD extended escutcheon |
| (11) | Locking device for the racking mechanism |
| (12) | Racking mechanism |
**Dimensional drawings**

12.8 VL 160 (3VL2) and VL250 (3VL3) with RCD module, 3- and 4-pole, to 250 A

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<table>
<thead>
<tr>
<th>Withdrawable version</th>
<th>Withdrawable version</th>
<th>Withdrawable version</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2)</td>
<td>Front-operated rotary operating mechanism</td>
<td></td>
</tr>
<tr>
<td>(3)</td>
<td>Molded case circuit breaker extended escutcheon</td>
<td></td>
</tr>
<tr>
<td>(4)</td>
<td>Motorized operating mechanism with stored energy mechanism</td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td>Masking frame for door cutout (for molded case circuit breakers with operating mechanism)</td>
<td></td>
</tr>
<tr>
<td>(8)</td>
<td>Masking frame for door cutout (for molded case circuit breakers with RCD module)</td>
<td></td>
</tr>
<tr>
<td>(9)</td>
<td>Masking frame for door cutout (for molded case circuit breakers with RCD module, toggle lever/rotary operating mechanism)</td>
<td></td>
</tr>
<tr>
<td>(10)</td>
<td>RCD extended escutcheon</td>
<td></td>
</tr>
<tr>
<td>(11)</td>
<td>Locking device for the racking mechanism</td>
<td></td>
</tr>
<tr>
<td>(12)</td>
<td>Racking mechanism</td>
<td></td>
</tr>
</tbody>
</table>
12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A

12.9.1 Molded case circuit breakers

VL400 (3VL4) molded case circuit breaker with RCD module
Dimensional drawings

12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A

(1) Masking frame for door cutout (for molded case circuit breakers with RCD module)

(5) Masking frame for door cutout (for molded case circuit breakers with toggle lever)

(6) External surface of cabinet door

(7) Mounting level
12.9.2 VL400 (3VL4) molded case circuit breaker with RCD front connection bar (connections and interphase barriers)

(1) Interphase barrier
(2) Front connecting bars
(7) Mounting level
(10) Front connecting bars for increased pole spacing
Dimensional drawings

**12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A**

(3) Terminal covers (standard)
(4) Rear connections (long)
(5) Rear connections (short)
(7) Mounting level
(8) Rear flat terminals (long)
(9) Rear flat terminals (short)
12.9.3 Terminal covers

- (3) Terminal covers (standard)
- (7) Mounting level
- (8) Cutout
Dimensional drawings

12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A

(2) Front connecting bars
(4) Terminal covers (extended)
(7) Mounting level
(8) Cutout
12.9.4 Door cutouts

Table 12-20

<table>
<thead>
<tr>
<th>Door cutout toggle lever (with masking frame)</th>
<th>Door cutout front-operated rotary operating mechanism (without masking frame)</th>
<th>Door cutout Door coupling rotary operating mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram 1" /></td>
<td><img src="image2" alt="Diagram 2" /></td>
<td><img src="image3" alt="Diagram 3" /></td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers
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Dimensional drawings

12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A

Door hinge point (see arrow)

D > A from table + (P \times 5)

Note

Door cutouts require a minimum clearance between reference point Y and the door hinge.

<table>
<thead>
<tr>
<th>Combination</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molded case circuit breaker only</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + door-coupling rotary operating mechanism</td>
<td>100</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + motorized operating mechanism with stored energy mechanism</td>
<td>150</td>
</tr>
<tr>
<td>Molded case circuit breaker + plug-in base + front-operated rotary operating mechanism</td>
<td>200</td>
</tr>
<tr>
<td>Molded case circuit breaker + withdrawable version</td>
<td>200</td>
</tr>
</tbody>
</table>
12.9.5 Plug-in base and accessories

Table 12-21

(1) Plug-in base with terminal covers
(2) Plug-in base
(3) Plug-in base with flat rear terminals
(5) Terminal covers (standard)
(7) Mounting level

Drilling template and cutout for plug-in base for rear flat busbar connection
Dimensional drawings

12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A

(5) Terminal covers (standard)
(7) Mounting level
(8) Plug-in base with front connecting bars
(9) Plug-in base with terminal covers on the front
(10) Interphase barrier
Table 12-22

<table>
<thead>
<tr>
<th>Dimensional drawings</th>
<th>Dimensional drawings</th>
</tr>
</thead>
<tbody>
<tr>
<td>VL400 (3VL4) molded case circuit breaker with RCD module, withdrawable module, with motorized operating mechanism with stored energy mechanism (connected position)</td>
<td>VL400 (3VL4) molded case circuit breaker with RCD module, withdrawable module, with motorized operating mechanism with stored energy mechanism (disconnected position)</td>
</tr>
<tr>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Diagram" /></td>
</tr>
</tbody>
</table>

3VL IEC molded case circuit breakers
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Dimensional drawings

12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A

(1) Safety lock
(4) Motorized operating mechanism with stored energy mechanism
(5) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(6) External surface of cabinet door
(7) Mounting level
(8) Masking frame for door cutout (for molded case circuit breakers with RCD module)
(10) RCD extended escutcheon
(11) Locking device for the racking mechanism
(12) Racking mechanism

VL400 (3VL4) molded case circuit breaker with RCD module, plug-in, with front-operated rotary operating mechanism (connected position)

VL400 (3VL4) molded case circuit breaker with RCD module, plug-in, with front-operated rotary operating mechanism (disconnected position)

(2) Front-operated rotary operating mechanism
(3) Padlock barrier
(5) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)
(6) External surface of cabinet door
(7) Mounting level
(9) Masking frame for door cutout (for molded case circuit breakers with RCD module, toggle lever/rotary operating mechanism)
(10) RCD extended escutcheon
(11) Locking device for the racking mechanism
(12) Racking mechanism
12.9 VL400 (3VL4) with RCD module, 3- and 4-pole, up to 400 A

**Dimensional drawings**

<table>
<thead>
<tr>
<th>VL400 (3VL4) molded case circuit breaker with RCD module, withdrawable module, with extended escutcheon (connected position)</th>
<th>VL400 (3VL4) molded case circuit breaker with RCD module, withdrawable module, with extended escutcheon (disconnected position)</th>
</tr>
</thead>
</table>

(2) Front-operated rotary operating mechanism  
(3) Molded case circuit breaker extended escutcheon  
(5) Masking frame for door cutout (for molded case circuit breakers with operating mechanism)  
(6) External surface of cabinet door
12.10 Door-coupling rotary operating mechanisms 8UC

Door-coupling rotary operating mechanisms 8UC71 and 8UC72, sizes 1 and 2

Table 12- 23

<table>
<thead>
<tr>
<th>with extension shaft</th>
<th>without extension shaft</th>
<th>Door cutout with fixing holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Knob</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Coupling driver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Cover frame</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Seal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Door</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(6) Fastening screws, Qty. 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(7) Extension shaft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(8) Spacer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9) Actuating shaft of the circuit breaker</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Door-coupling rotary operating mechanisms 8UC73, size 3

<table>
<thead>
<tr>
<th>with extension shaft</th>
<th>without extension shaft</th>
<th>Door cutout with fixing holes</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Diagram" /></td>
<td><img src="image2" alt="Diagram" /></td>
<td><img src="image3" alt="Diagram" /></td>
</tr>
</tbody>
</table>

1) Adjust the length of the extension shaft by reducing the installation depth. Extension shaft also available in 600 mm length.

(1) Handle or double handle
(2) Coupling driver
(3) Cover frame
(4) Seal
(5) Door
(6) Fastening screws, Qty. 4
(7) Extension shaft
(8) Spacer
(9) Actuating shaft of the circuit breaker
**Coupling driver 8UC60/8UC70**

<table>
<thead>
<tr>
<th>Coupling driver</th>
<th>a</th>
<th>b</th>
<th>Wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>with tolerance compensation</td>
<td>+ 5</td>
<td>±5</td>
<td>x</td>
</tr>
<tr>
<td>without tolerance compensation</td>
<td>+ 1,5</td>
<td>±2,5</td>
<td>x+23.5</td>
</tr>
</tbody>
</table>

Handles with cover frame, sizes 1 to 3

1) Lock holder of the handle when extended.
12.11 4NC current transformers for measuring purposes

Table 12-24

<table>
<thead>
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<th>4NC51</th>
<th>4NC52</th>
<th>4NC53</th>
<th>4NC54</th>
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<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>transformers for</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>measuring purposes</td>
<td></td>
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**Window openings**

<table>
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<th>2</th>
<th>1</th>
<th>2</th>
<th>1</th>
<th>2</th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>12 × 5</td>
<td>20 × 5</td>
<td>20 × 5</td>
<td>25 × 5</td>
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<td>25 × 5</td>
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<td>30 × 10</td>
<td>30 × 10</td>
<td>40 × 10</td>
<td>50 × 10</td>
<td>60 × 10</td>
</tr>
</tbody>
</table>

**For busbars**

max. mm: 17.5 ∅, 28 ∅, 36 ∅, 45 ∅
12.12 COM20/COM21 (communication module for SENTRON 3VL)
The circuit diagram examples below show the most frequent uses of the 3VL molded case circuit breaker:

It is not possible to show combinations here. For versions that differ from those shown, the diagrams must be modified appropriately.

Circuit diagrams are only provided where they are required for improved understanding of the operation of the device.

Figure 13-1 Connection diagram for 3- and 4-pole VL160X-VL630 molded case circuit breakers for system protection with thermal-magnetic overcurrent releases
Terminal assignments for rotary operating mechanism, leading auxiliary switch

- **Q1**: Main contacts
- **F1**: Tripping solenoid for A1
- **F3**: Shunt release
- **AS**: Alarm switches
- **EBS**: Leading auxiliary switch OFF (integrated into the rotary operating mechanism)
- **EMS**: Leading auxiliary switch ON (integrated into the rotary operating mechanism)
- **T1 ... T4**: Current transformer
- **F2**: Undervoltage release
- **HS**: Auxiliary switches

**Figure 13-2** Internal circuit diagram for 3- and 4-pole molded case circuit breakers for system and motor protection with electronic trip units

Circuit diagrams VL1 ... 8 motorized operating mechanism (MO)

You can see the circuit diagrams for the motorized operating mechanism (MO) without stored energy mechanism below.

The functions of the motorized operating mechanisms are described in the following chapter: Motorized operating mechanisms (optional) (Page 32)

The isolated contact S3 (terminals 6, 7, 8) is used for scanning the contact position of the mode selector (switching capacity in accordance with UL 1054: 16 A / 250 V AC; 0.4 A / 125 V DC; 0.2 A / 250 V DC).

With this changeover contact S3, two states of the mode selector can be scanned:

1. Local operation -> "MANUAL" or "LOCAL" position
2. Remote operation -> "AUTO" position
Manual operation with Allen key

Figure 13-3  Motorized operating mechanism (MO) without stored energy mechanism for VL160X to VL1600.

Manual operation with pushbutton on motorized operating mechanism
Control via control cable

L1 (L+) F1
S0 E
S1 E
S3
N (L-) F2

AUTO

Control vi
Control with undervoltage release

Figure 13-4  Motorized operating mechanism without stored energy mechanism for VL160X to VL1600 with undervoltage release

Note

Switching the circuit breaker off automatically

A separate alarm switch contact (7-8) can be connected for switching off the circuit breaker automatically. Automatic switching on of the molded case circuit breaker must be prevented, otherwise after a tripping event it may automatically switch to short-circuit.
The contact of auxiliary contactor K1 prevents no-load operation of the molded case circuit breaker when the undervoltage release "U<" is without power. No-load operations represent a high level of stress for the molded case circuit breaker. If the undervoltage release is without power, auxiliary contactor K1 has not picked up. The contact in the ON circuit (control circuit) of the motorized operating mechanism is thus not closed, that is, the molded case circuit breaker cannot be switched.

This auxiliary contactor is not necessary in principle when the undervoltage release is supplied uninterruptedly (e.g. pushbutton S01) from the same source as the motorized operating mechanism itself (e.g. contact 1).

Circuit diagrams VL1 ... 6, motorized operating mechanism with stored energy mechanism, with or without undervoltage release

Below are the circuit diagrams for the motorized operating mechanism with stored energy mechanism for the circuit breakers VL160X, VL160, VL250, VL400, VL630 and VL800. The functions of the motorized operating mechanisms are described in the following chapter: Motorized operating mechanisms (optional) (Page 32)

Figure 13-5 Motorized operating mechanism with stored energy mechanism for VL160X, VL160, VL250, VL400, VL630 and VL800, without undervoltage release
Note

Automatic charging/close

A separate alarm switch contact (7-8) can be connected for automatic charging after tripping. Automatic switching on of the molded case circuit breaker must be prevented, otherwise after a tripping event it may automatically switch to short-circuit.

The contact of auxiliary contactor K1 or K3 prevents no-load operation of the molded case circuit breaker when the undervoltage release “U<” is without power. No-load operations represent a high level of stress for the molded case circuit breaker. If the undervoltage release is without power, auxiliary contactor K1 or K3 has not picked up. The contact in the ON circuit (control circuit) of the motorized operating mechanism is thus not closed, that is, the molded case circuit breaker cannot be switched.

This auxiliary contactor is not necessary in principle when the undervoltage release is supplied uninterrupted (e.g. pushbutton S01) from the same source as the motorized operating mechanism itself (e.g. contact 4).
Circuit diagrams, undervoltage release and shunt release

Undervoltage release and shunt release for VL160X to VL1600

![Circuit diagram]

- **S01** Delayed release
- **S02** Instantaneous release for EMERGENCY-OFF loop (if required)
- **S03** Leading auxiliary contact, e.g. 3VL9300-3AS10 "OFF to ON" in the front-operated rotary operating mechanism of the molded case circuit breaker (if required)
- **K1** Auxiliary contactor 3RH11 (if required)

Figure 13-7  Time-delay device (3TX4701-0A) for undervoltage release for VL160X to VL1600

<table>
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<tr>
<th>Protective circuit with UVR (220 V to 250 V DC)</th>
<th>Tripping time UVR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y2 only</td>
<td>Approx. 3 seconds</td>
</tr>
<tr>
<td>Y2 and Y1 bridged</td>
<td>Approx. 6 seconds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protective circuit with UVR and contactor</th>
<th>Tripping time UVR</th>
<th>Drop-out time contactor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y2 only</td>
<td>0.8 s</td>
<td>Approx. 2 s</td>
</tr>
<tr>
<td>Y2 and Y1 bridged</td>
<td>1.2 s</td>
<td>Approx. 4 s</td>
</tr>
</tbody>
</table>
Circuit diagrams 3VL plus RCD module

Figure 13-8 4-pole 3VL1 with RCD module (3-pole version corresponds, but without N pole)
Q₀  Molded case circuit breakers
A  Evaluation electronics
F₀  Closing solenoid with local trip indication and reset
TEST  Test button
S₀  Remote trip (to be provided by customer)

Figure 13-9  4-pole molded case circuit breaker for 3VL2, 3VL3 and 3VL4 molded case circuit breakers with remote trip unit and RCD alarm switch (3-pole version corresponds, but without N pole)
14.1 Installation

The following safety accessory parts are available for installing in the 3VL molded case circuit breaker:

- Masking frames for door cutouts
- Terminal covers / phase barriers
- Phase barriers
- Toggle lever extension
Masking frames for door cutouts:

Masking frames for door cutouts are used to increase the IP degree of protection of the molded case circuit breakers and to better adapt them to the control cabinets. Masking frames for door cutouts are available for fixed-mounted, plug-in and withdrawable molded case circuit breakers with rotary operating mechanisms, motorized operating mechanisms and RCD modules. The masking frames for door cutouts are attached to the door with 4 fixing elements.

![Masking frames for door cutouts](image)

3VL9300-8BC00 (front)

3VL9300-8BG00

3VL9300-8BJ00 / 3VL9300-8BD00
**Terminal covers/phase barriers:**  
Sealable terminal covers can be installed on the input and output side of the 3VL molded case circuit breakers. They offer degree of protection IP30 for fixed-mounted or withdrawal molded case circuit breakers in the connected position. In addition, extended terminal covers provide separation between the phases if uninsulated busbars or cables are used.

![Extended terminal cover](image1.png)  
![Standard terminal cover](image2.png)

**Phase barriers**  
Phase barriers provide insulation on the input and output side of the molded case circuit breakers. They can be mounted in the specially formed slots on the input and output sides of the molded case circuit breakers. They can be used in conjunction with other connection accessories (except terminal covers). The phase barriers can be used with fixed-mounted, plug-in and withdrawable molded case circuit breakers. Terminal covers must be used if the molded case circuit breakers are mounted immediately next to each other (see the section Mounting and safety clearances).

![Phase barriers](image3.png)

![Use of phase barriers](image4.png)
Spare parts/accessories

14.1 Installation
## A.1 Table of abbreviations

Explanation of the abbreviations

<table>
<thead>
<tr>
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<th>Explanation</th>
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<tbody>
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<td>line</td>
<td>for line protection</td>
</tr>
<tr>
<td>motor</td>
<td>for motor protection</td>
</tr>
<tr>
<td>starter</td>
<td>for starter combinations</td>
</tr>
<tr>
<td>insulation circuit breaker</td>
<td>Switch disconnectors</td>
</tr>
<tr>
<td>$I_R$</td>
<td>Current value of the overload release</td>
</tr>
<tr>
<td>$I_{sd}$</td>
<td>Current value of the short-time delayed short-circuit release</td>
</tr>
<tr>
<td>$t_{sd}$</td>
<td>Delay time of the short-time delayed short-circuit release</td>
</tr>
<tr>
<td>$I_i$</td>
<td>Current value of the instantaneous short-circuit release</td>
</tr>
<tr>
<td>$I_{cn}$</td>
<td>Rated short-circuit breaking capacity</td>
</tr>
<tr>
<td>TM</td>
<td>Thermal-magnetic release</td>
</tr>
<tr>
<td>ETU</td>
<td>Electronic trip unit</td>
</tr>
</tbody>
</table>

Settings of the LI and LSI releases of the upstream and downstream protective devices for calculating the selectivity limits:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_R$</td>
<td>$1 \times I_r$</td>
</tr>
<tr>
<td>$I_{sd}$</td>
<td>max.</td>
</tr>
<tr>
<td>$t_{sd}$</td>
<td>100 ms</td>
</tr>
<tr>
<td>$I_i$</td>
<td>max.</td>
</tr>
</tbody>
</table>
Appendix

A.2 Standards and specifications

3VL molded case circuit breakers comply with:

- IEC 60947-2 / DIN EN 60947-2 (VDE 0660-101)
- IEC 60947-1 / DIN EN 60947-1 (VDE 0660-100)

Disconnector properties in accordance with:

- IEC 60947-2 / DIN EN 60947-2 (VDE 0660-101)

Please contact SIEMENS for additional standards.

The overcurrent releases of the circuit breakers for motor protection additionally fulfill:

- IEC 60947-4-1 / DIN EN 60947-4-1 (VDE 0660-102)

Network disconnecting device (used to be called "main switch" in accordance with:

- IEC 60204-1 / DIN EN 60204-1 (VDE 0113-1)

Network disconnecting device for stopping and shutting down in an emergency (previously called "EMERGENCY-OFF switch")

Table A-1 The following certificates are available on request

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<td>CE certificate of conformity</td>
</tr>
<tr>
<td></td>
<td>Type examination certificate IEC 60947</td>
</tr>
<tr>
<td></td>
<td>Type examination certificate CCC (China)</td>
</tr>
<tr>
<td></td>
<td>Gost</td>
</tr>
<tr>
<td></td>
<td>Valid from July 2014</td>
</tr>
<tr>
<td></td>
<td>C-Tick certification for Australia</td>
</tr>
<tr>
<td></td>
<td>Shipbuilding approvals (GL, LRS, DNV, ABS, BV)</td>
</tr>
<tr>
<td></td>
<td>KTL certificate</td>
</tr>
<tr>
<td></td>
<td>Fire Safety certificate</td>
</tr>
<tr>
<td></td>
<td>Certificate of origin</td>
</tr>
<tr>
<td></td>
<td>Halogen-free</td>
</tr>
<tr>
<td></td>
<td>PVC-free</td>
</tr>
</tbody>
</table>
VL160X–VL400 molded case circuit breakers that are equipped with a SENTRON VL RCD module correspond to IEC 60947-2 Annex B.

The RCD module SENTRON VL corresponds to IEC 61000-4-2 to 61000-4-6, IEC 61000-4-11 and EN 55011, Class B (tested in accordance with CISPR 11) with regard to electromagnetic compatibility.

The reference temperature for the RCD modules and the 3VL molded case circuit breakers is 40 °C. The suitability of the SENTRON VL RCD module for mounting on the 3VL molded case circuit breakers has no effect on the characteristic key data of the molded case circuit breaker, such as:

- Rated voltage (50 / 60 Hz), switching capacity
- Electrical and mechanical service life
- Connections
- Operating mechanisms (VL160, VL250, VL400)
- Auxiliary switches and trip units

Rated current, see "Use in unusual environments".

In accordance with DIN 40713, the graphical symbols that the internal circuit diagrams contain only provide information on the type, connection and mode of operation of devices, but not on their type of construction.

**Shock resistance**

All 3VL molded case circuit breakers have shock resistance in accordance with the test procedures defined in IEC 68 Part 2.
Appendix

A.3 Comprehensive support from A to Z

For more information, please see the following links:

Useful links

Table A- 2  Product information

<table>
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<th>Website</th>
<th>The website provides rapid and targeted information on our pioneering products and systems.</th>
<th>Link (<a href="http://www.siemens.com/lowvoltage">http://www.siemens.com/lowvoltage</a>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newsletter</td>
<td>Constantly updated information on the subject of low-voltage power distribution.</td>
<td>Link (<a href="http://www.siemens.com/lowvoltage/newsletter">http://www.siemens.com/lowvoltage/newsletter</a>)</td>
</tr>
</tbody>
</table>

Table A- 3  Product information / product and system selection

<table>
<thead>
<tr>
<th>Information and Download Center</th>
<th>Current catalogs</th>
<th>Customer magazines</th>
<th>Brochures</th>
<th>Demonstration software</th>
<th>Promotion packages</th>
<th>Link (<a href="http://www.siemens.com/lowvoltage/infomaterial">http://www.siemens.com/lowvoltage/infomaterial</a>)</th>
</tr>
</thead>
</table>

Table A- 4  Product and system selection

<table>
<thead>
<tr>
<th>Industry Mall</th>
<th>Platform for e-business and product information. 24/7 access to a comprehensive information and ordering platform for our complete low-voltage controls and distribution portfolio, including:</th>
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<td></td>
<td>• Availability check</td>
</tr>
<tr>
<td></td>
<td>• Order tracking</td>
</tr>
<tr>
<td></td>
<td>Link (<a href="http://www.siemens.com/lowvoltage/mall">http://www.siemens.com/lowvoltage/mall</a>)</td>
</tr>
</tbody>
</table>
## A.3 Comprehensive support from A to Z

### Table A-5  Product documentation

| Service & Support Portal | Comprehensive technical information from the planning phase through configuration to operation. Around the clock. 365 days a year.  
  |  |  
  |  | • Product data sheets  
  |  | • Manuals / operating instructions  
  |  | • Certificates  
  |  | • Characteristic curves  
  |  | • Downloads  
  |  | • FAQs  
  |  | Link (http://www.siemens.com/lowvoltage/support)  

| CAx DVD | Configuration-relevant CAx data on SENTRON is available on DVD:  
  |  | • Commercial and technical product master data  
  |  | • 2D dimension drawings  
  |  | • Isometric illustrations  
  |  | • 3D models  
  |  | • Product data sheets  
  |  | • Tender specifications  
  |  | Link (http://www.siemens.com/lowvoltage/mall)  
  |  | Order number: E86060-D1000-A207-A6-6300  

| Image Database | Free downloads in several different versions are available from the image database:  
  |  | • All current product photos  
  |  | • 2D dimension drawings  
  |  | • Isometric illustrations  
  |  | • 3D models  
  |  | • Device circuit diagrams  
  |  | • Symbols  
  |  | Link (http://www.siemens.com/lowvoltage/picturedb)  

### Table A-6  Product training

| SITRAIN Portal | Comprehensive training program to expand your knowledge about our products, systems, and engineering tools  
  |  | Link (http://www.siemens.com/lowvoltage/training)  

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