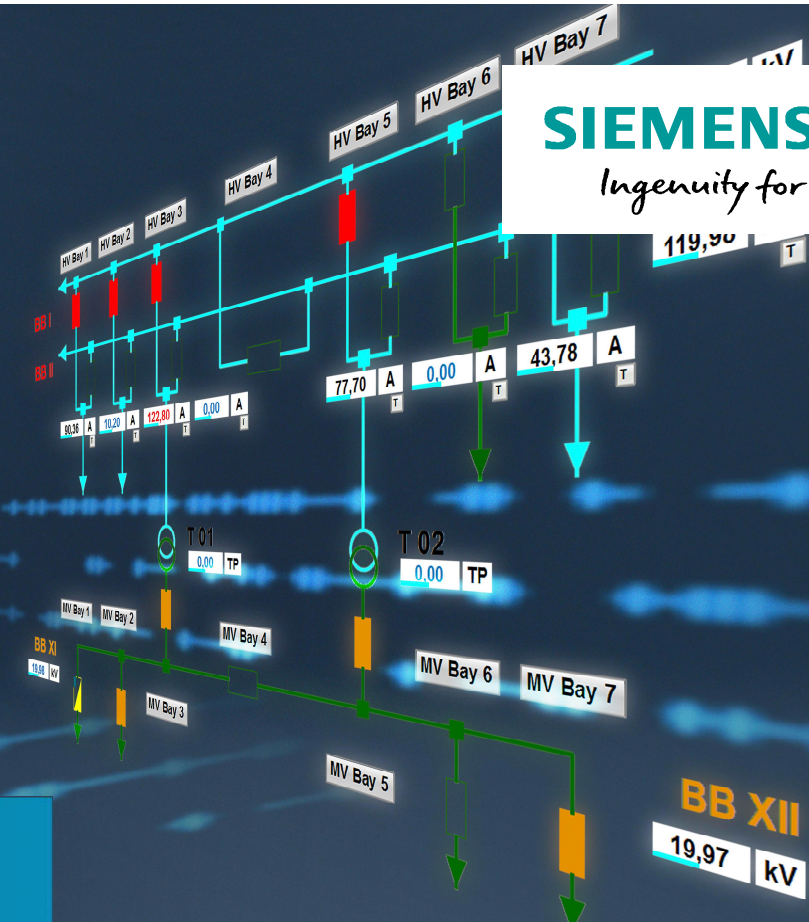


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*Ingenuity for life*



# SIPROTEC 5

New solutions for energy automation systems



Unrestricted © Siemens 2020

[siemens.com/energy-automation](http://siemens.com/energy-automation)

# Foundation for Our Innovations



And across several generations.



## Perfectly tailored fit Flexible Configuration of the Device Hardware

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With the SIPROTEC 5 modular system you get exactly the device that you need.



## Perfectly tailored fit Flexible Configuration of the Device Hardware

The simple SIPROTEC 5 equation:

Base module with basic functionality

- + Optional expansion modules
- + Operation panels for base and expansion modules
- + Optional plug-in modules

---

= Your **individual** SIPROTEC 5 device

Supplied completely assembled by Siemens!





## Hardware Overview

### Basic Modules and Expansion Module

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- Basic modules with  
1/3-width of a 19" rack
- Expansion modules with  
1/6-width of a 19" rack  
up to 4 modules (19")



# Hardware Overview

## Basic Modules and Expansion Module

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- From 2014 on, also a second row of expansion modules is possible:  
= max. 9 expansion modules



## Hardware Overview Various Operation Panels

### Basic modules

- With LEDs
- With LEDs, keyboard and standard display
- With LEDs, keyboard and large display

### Expansion modules

- Without operator elements or control elements
- With LEDs
- With LEDs and key switch



# Hardware Overview

## Optimized Current Terminals for Protection and Measurement

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- Protection input transformer or measurement input transformer
- When configuring the SIPROTEC 5 device, select the appropriate transformer
- When exchanging, pull current terminal and plug-on
- SIPROTEC 5 device automatically recognizes the integrated transformer type





# Hardware Overview

## Many Plug-in Modules for all SIPROTEC 5 Devices

### Plug-in modules for ...

- Communication
- Measured value acquisition

### Handling

- Easy installation and removal
- SIPROTEC 5 device doesn't have to be opened

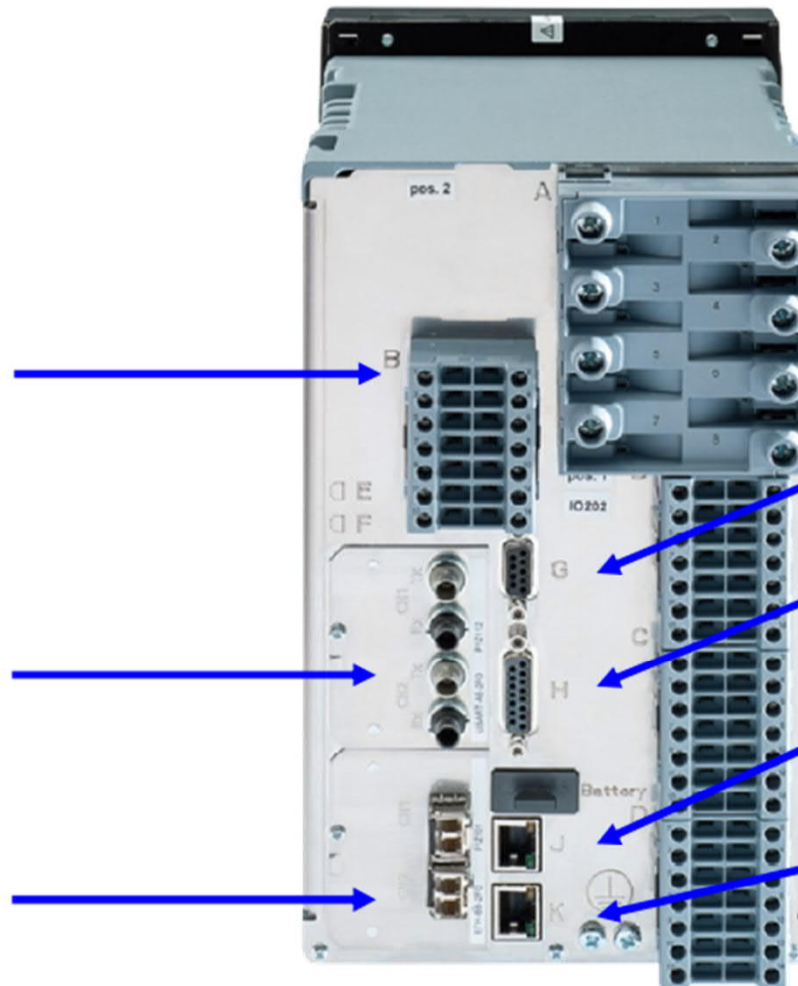


## Basic module: Interfaces

Aux voltage

Port E  
for plugin module

Port F  
for plugin module



Time synchronisation

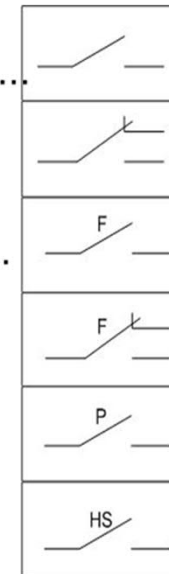
Detached display

Port J  
for DIGSI / IEC61850  
reporting

Connection to CB  
202

## I/O Modules: Components

- Relay Standard < 10 ms (Make contact, normally open).....
  - Relay Standard (Change over contact).....
  - Relay **F**ast < 5 ms (Make contact, normally open).....
  - Relay **F**ast (Change over contact).....
  - **P**ower-Relay.....
  - **H**igh-**S**peed Relay 0.2 ms (semi-conductor speed-up).....
- 
- Binary Inputs (with and without common potentials)
  - Current Transformer Input (Protection or Measurement)
  - Voltage Transformer Input
  - Measurement Transducer Input (20mA)
  - Plug-In-Modules (Communication, 20mA Input,...)



## I/O Modules: Components

### Binary outputs

#### Standard Relay (Type S)

Switching capacity	On: 1000 W/VA Off: 30 VA; 40 W ohmic; 30 W/VA at L/R ≤ 40 ms
AC and DC contact voltage	250 V
Permissible current per contact (continuous)	5 A
Permissible current per contact (switching on and holding)	30 A for 1 s (make contact)
Short-time current across closed contact	250 A for 30 ms
Total permissible current for contacts connected to common potential	5 A
Switching time OOT (Output Operating Time) Additional delay of the output medium used	Make time: typical: 8 ms; maximum: 10 ms Break time: typical: 2 ms; maximum: 5 ms

#### Fast Relay (Type F)

Switching capacity	On: 1000 W/VA Off: 30 VA; 40 W ohmic; 30 W/VA at L/R ≤ 40 ms
AC and DC contact voltage	250 V
Permissible current per contact (continuous)	5 A
Permissible current per contact (switching on and holding)	30 A for 1 s (make contact)
Short-time current across closed contact	250 A for 30 ms
Total permissible current for contacts connected to common potential	5 A
Switching time OOT (Output Operating Time) Additional delay of the output medium used	Make time: typical: 4 ms; maximum: 5 ms Break time: typical: 2 ms; maximum: 5 ms



## I/O Modules: Components

### Binary outputs

#### High-Speed Relay with Semiconductor Acceleration (Type HS)

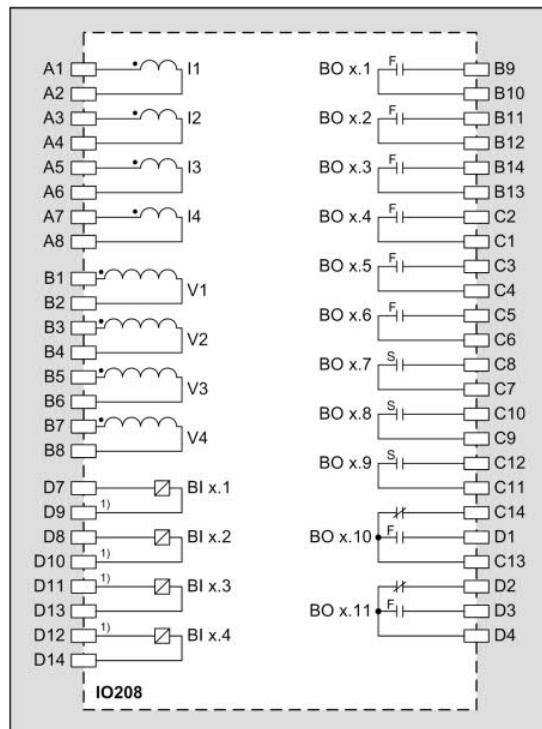
Switching capacity	On/Off: 1000 W/VA
Contact voltage	AC 200 V, DC 250 V
Permissible current per contact (continuous)	5 A
Permissible current per contact (switching on and holding)	30 A for 1 s (make contact)
Short-time current across closed contact	250 A for 30 ms
Total permissible current for contacts connected to common potential	5 A
Switching time OOT (Output Operating Time)	Make time, typical: 0.2 ms; maximum: 0.2 ms
Additional delay of the output medium used	Break time, typical: 9 ms; maximum: 9 ms

#### Power Relay (for Direct Control of Motor Switches)

Switching capacity for permanent and periodic operation		
250 V/4.0 A	1000 W	In order to prevent any damage, the external protection circuit must switch off the motor in case the rotor is blocked.
220 V/4.5 A	1000 W	
110 V/5.0 A	550 W	
60 V/5.0 A	300 W	
48 V/5.0 A	240 W	
24 V/5.0 A	120 W	

# I/O Modules: Components Binary inputs

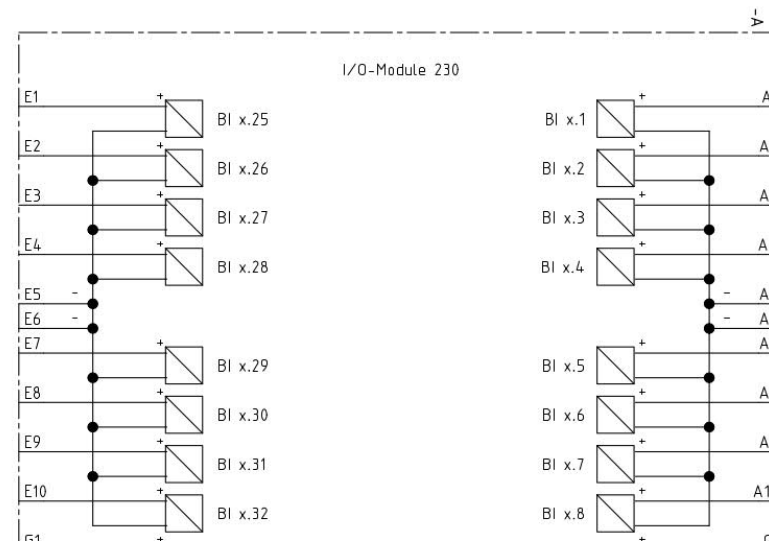
## Rated voltage range



<sup>1)</sup> Use these terminals to root the binary inputs.

## DC 24 V to 250 V

The binary inputs of SIPROTEC 5 are bipolar with the exception of the binary inputs on the IO230, the IO231, and the IO233.



## Voltage terminals Connections

### The following connections are possible

- Solid conductors
- Stranded conductors with ferrules
- Stranded conductors without ferrules

Max number of cables per connection: 2

Both cables must have the same diameter

Combination of cross connectors and  
conductors possible

### Conductors

<b>Cable cross section</b>	<b>0.5 mm<sup>2</sup> to 2.5 mm<sup>2</sup></b>
<b>Ferrule with plastic shroud</b>	<b>L = 10 mm or L = 12 mm</b>
<b>Stripped length without ferrule</b>	<b>12 mm, only copper leads</b>

## 3 types of current transformer terminals

### Modular devices:

- 4 protection CTs:  
C73334-A1-A87-1
- 3 protection-, 1 measurement CT:  
C73334-A1-A88-1
- 4 measurement CTs:  
C73334-A1-A89-1

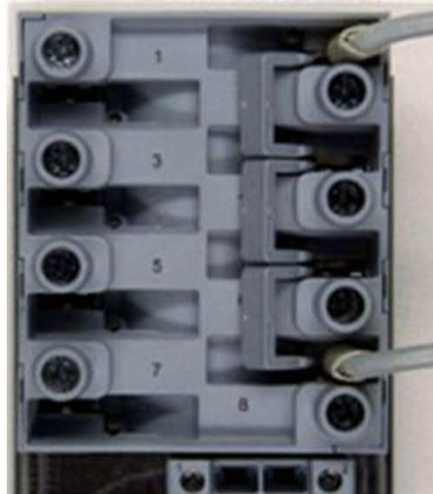
### Non modular devices (7xx82):

- 4 protection CTs:  
C73334A 1A \*5 1
- 3 protection-, 1 measurement CT:  
C73334A 1A \*6 1



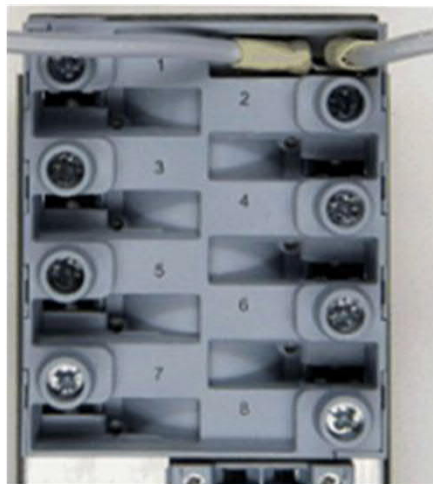


## Current terminals Connection of ring-type lugs



- single cables with ring type lug
- cross connectors

When using cross connectors, ring-type lugs are compulsory



- 2 single cables with ring type lug

## Current terminals Connections

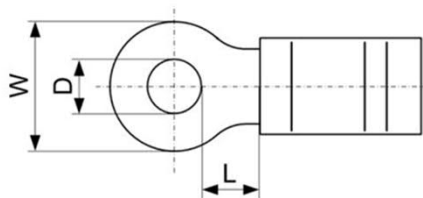
### The following connections are possible

- Ring-type lugs
- Solid conductors
- Stranded conductors with ferrules

Max number of lugs / cables per connection: 2

For cables: both must have the same diameter

### Ring-type lugs



<b>D</b>	<b>5.0 mm</b>
<b>W</b>	<b>9.5 mm</b>
<b>L</b>	<b>7.1 to 7.7 mm</b>

### Conductors

<b>Cable cross section</b>	<b>2.0 mm<sup>2</sup> to 4.0 mm<sup>2</sup></b>
<b>Ferrule with plastic shroud</b>	<b>L = 10 mm or L = 12 mm</b>
<b>Without ferrule</b>	<b>Only solid copper cables</b>

# Current Transformer Inputs

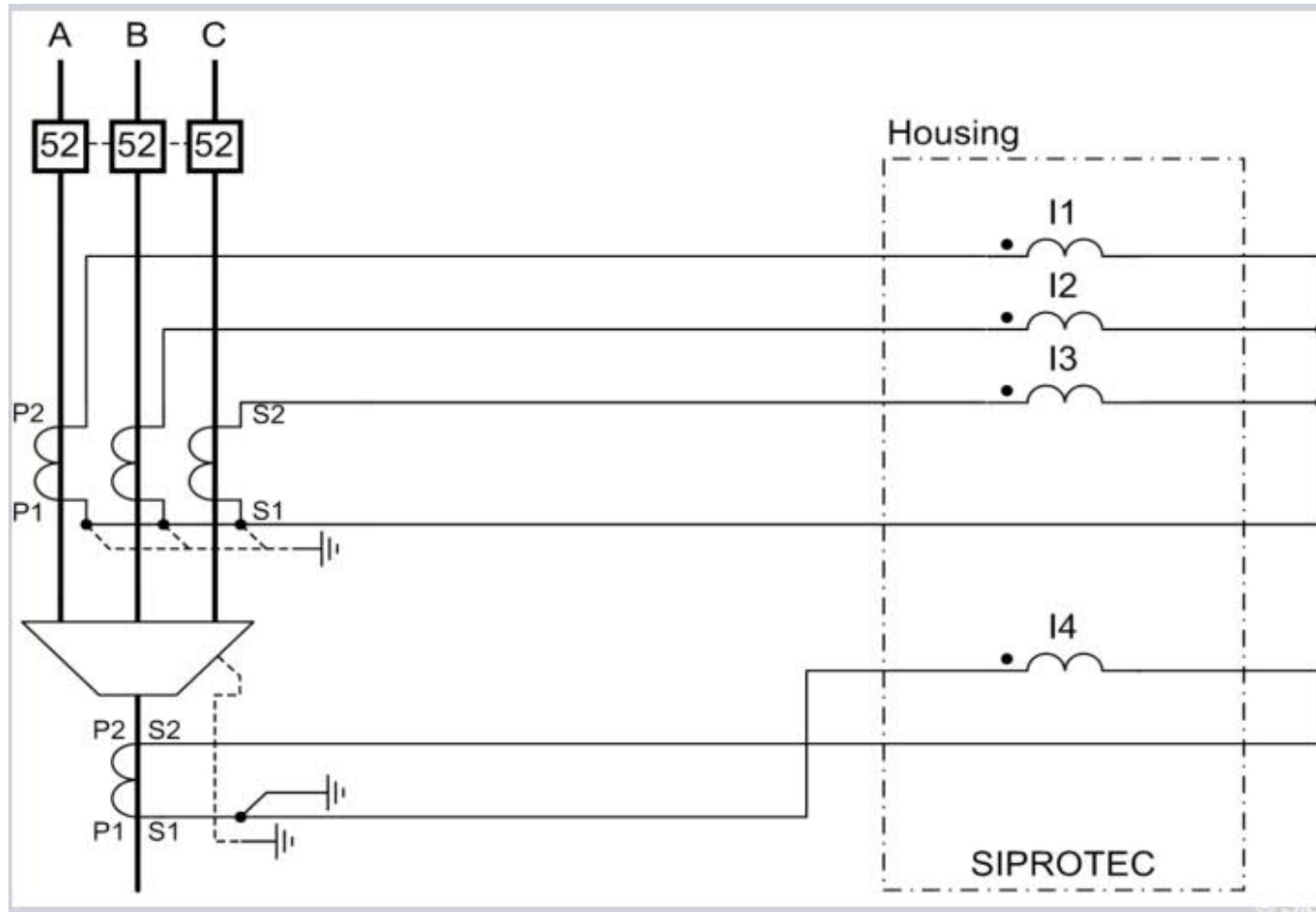


# Current Transformer Inputs





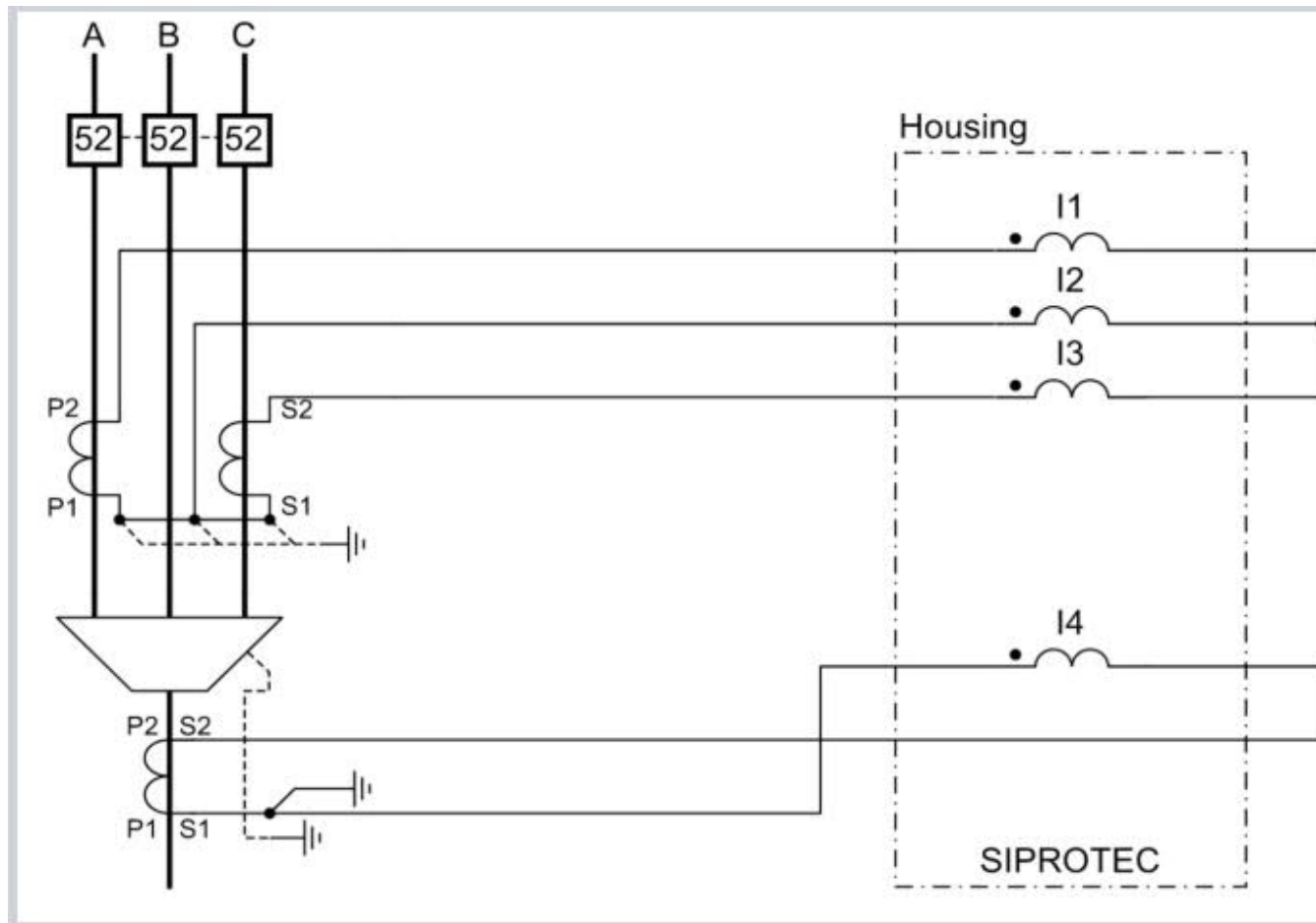
# Current Transformer Inputs



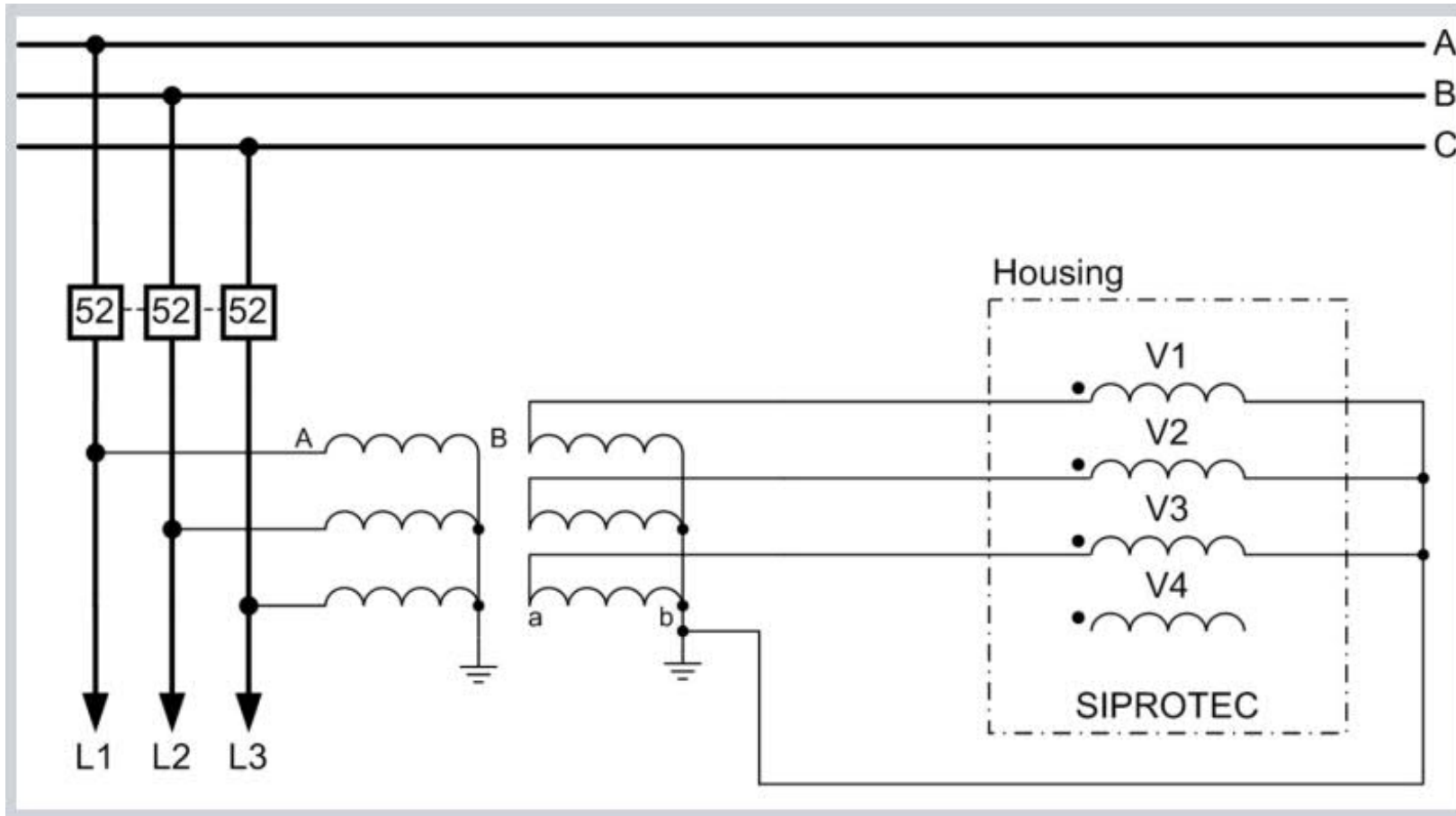
# Current Transformer Inputs



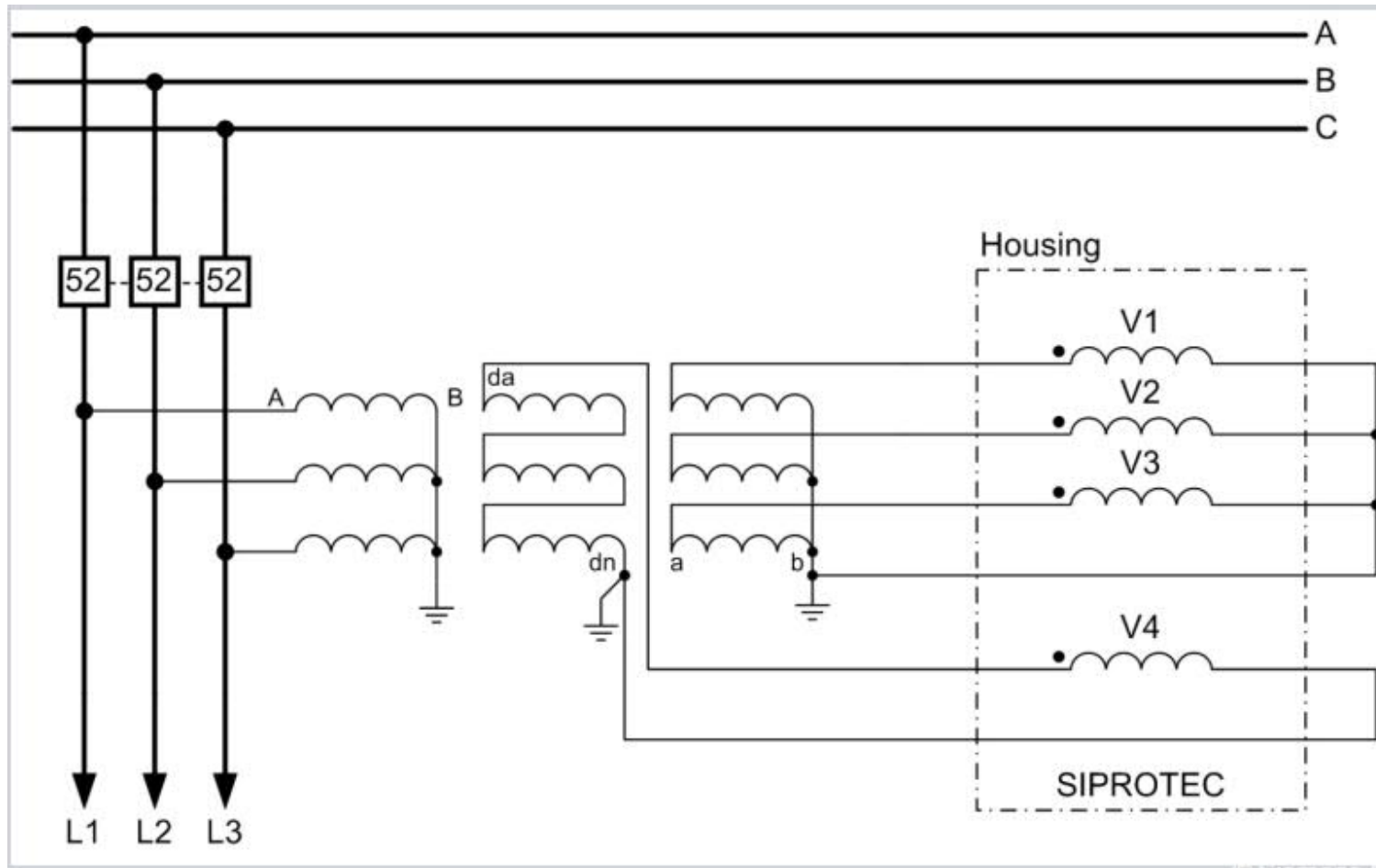
# Current Transformer Inputs



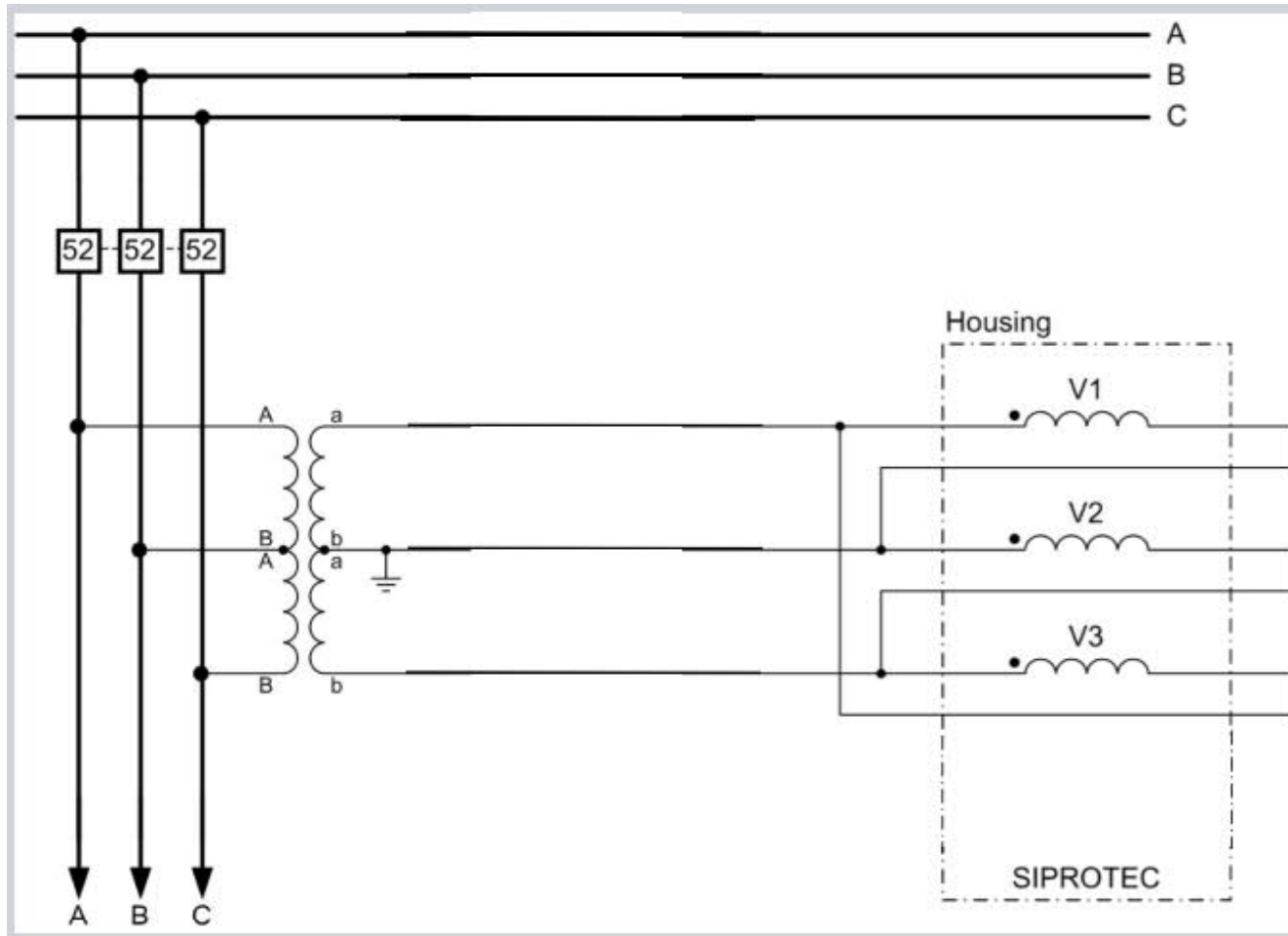
# Voltage Transformer Inputs



# Voltage Transformer Inputs

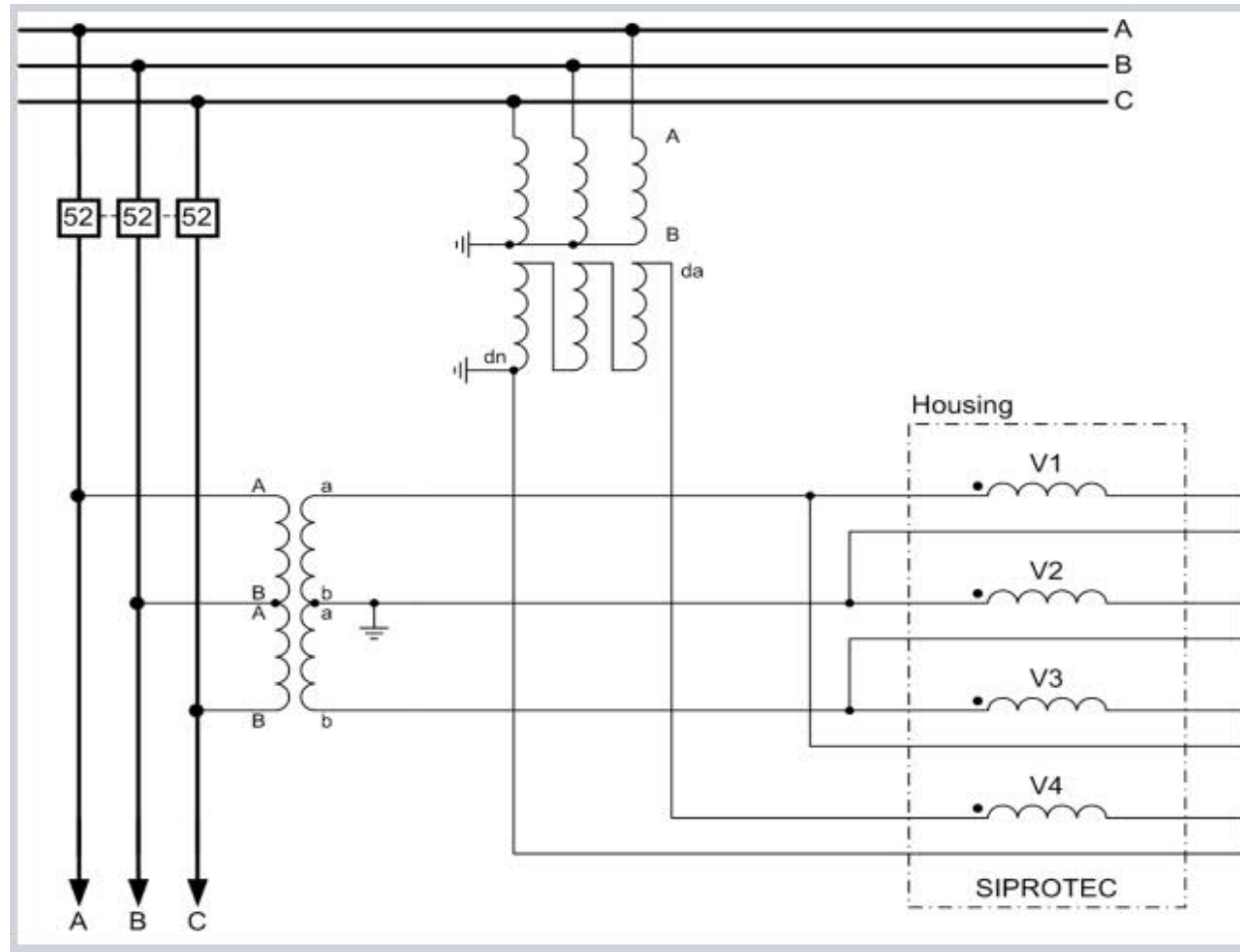


# Voltage Transformer Inputs

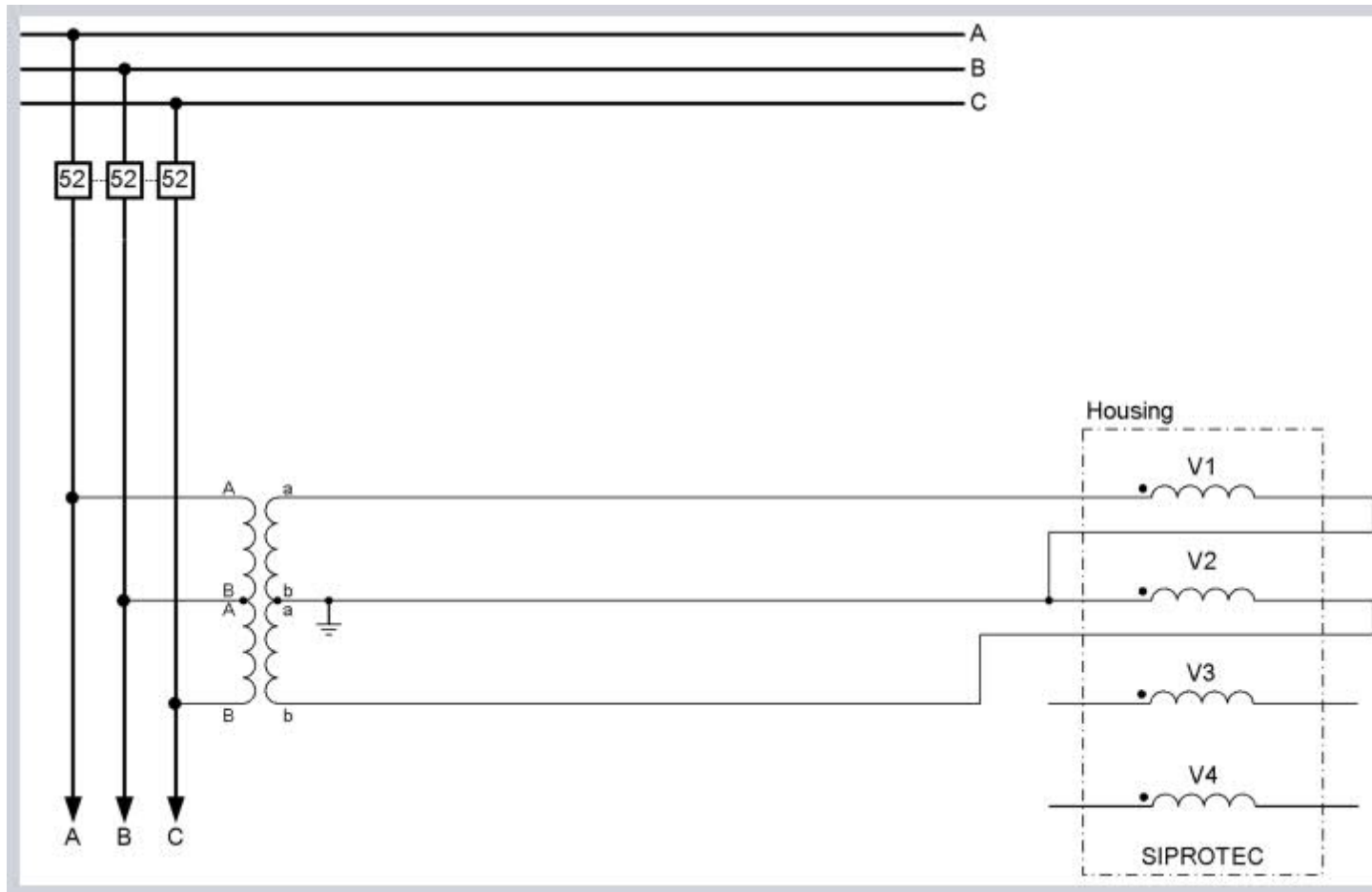




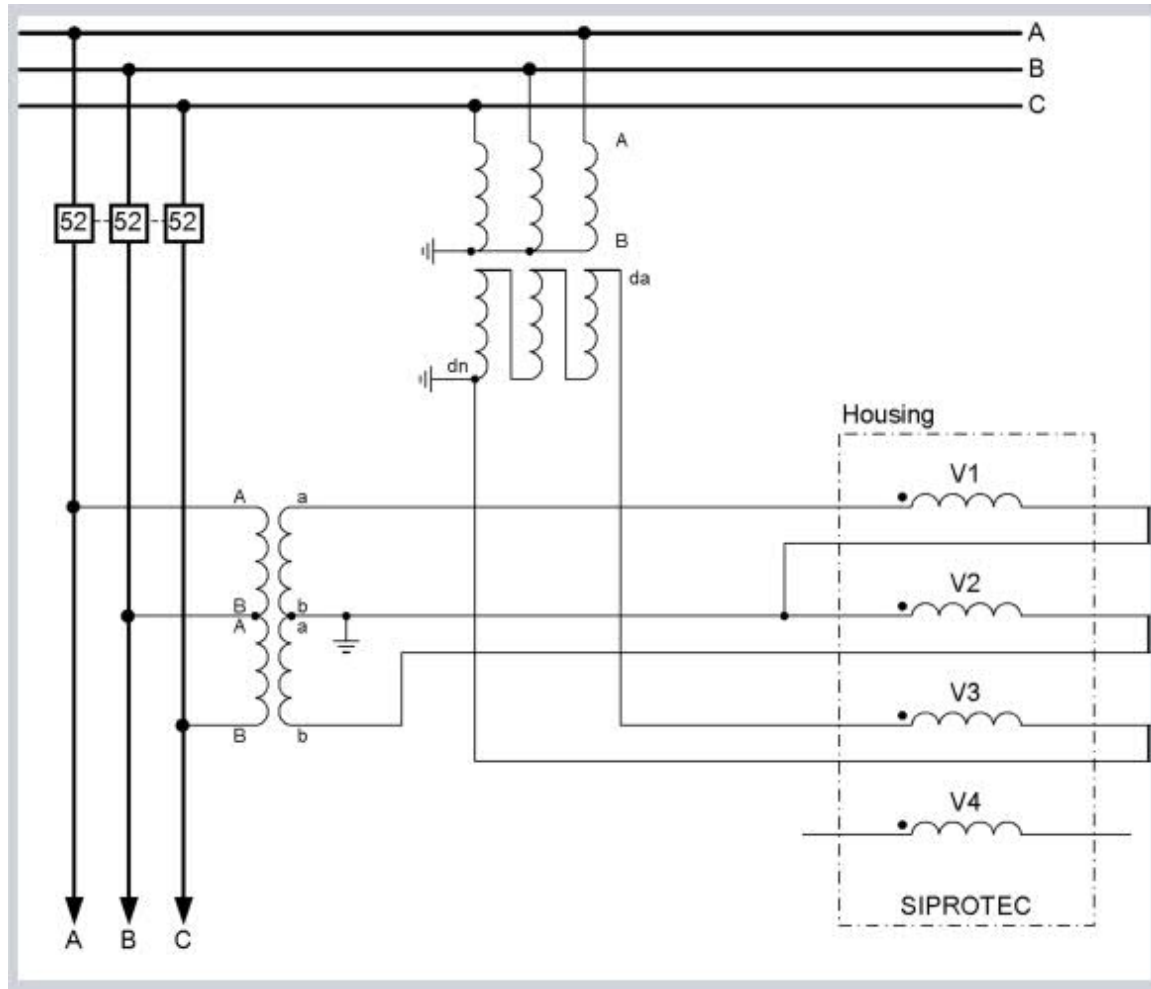
# Voltage Transformer Inputs



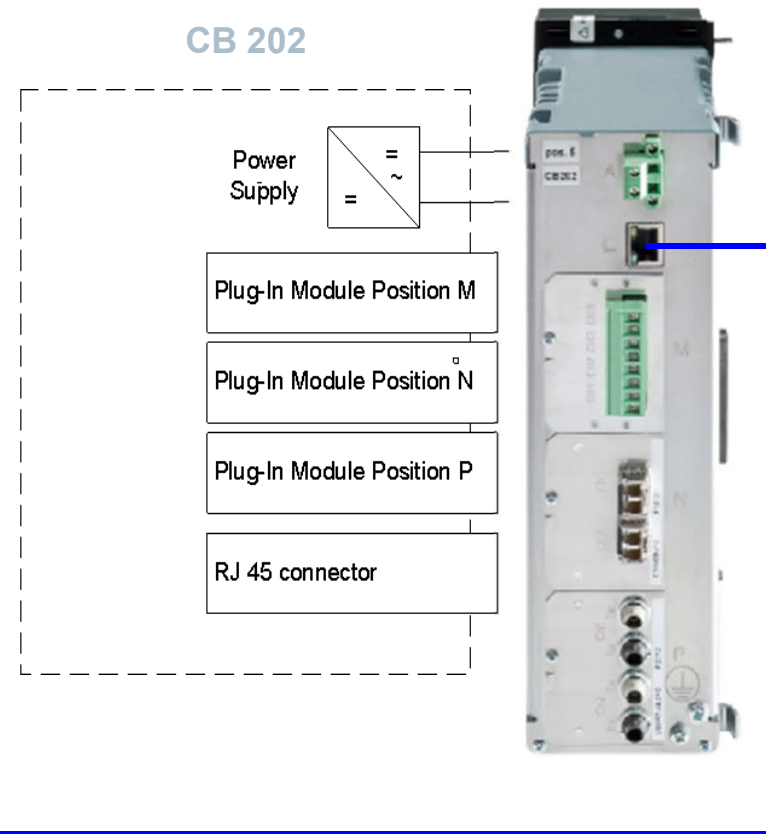
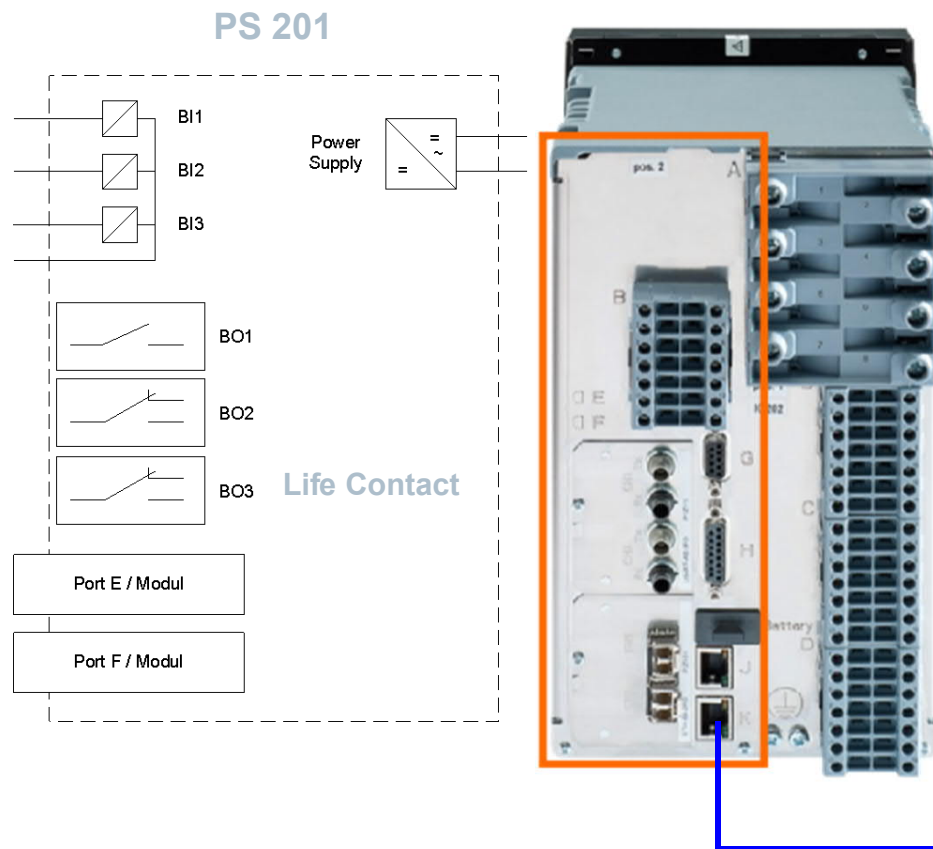
# Voltage Transformer Inputs



# Voltage Transformer Inputs



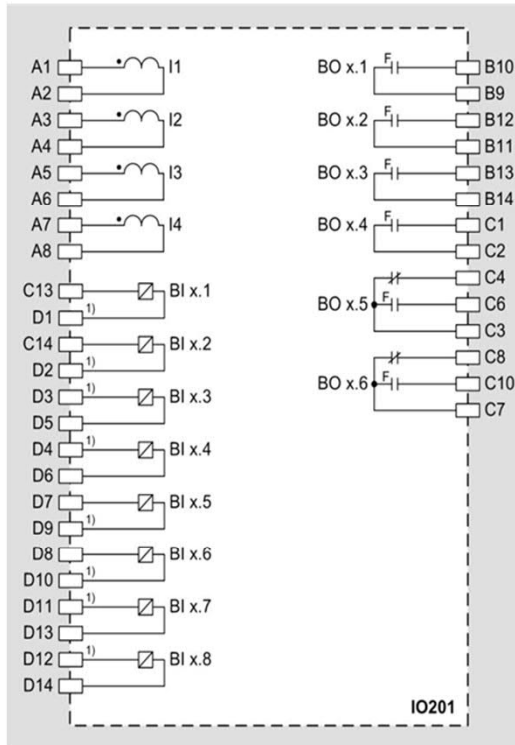
# I/O Modules: Power Supply - Communication Board



# I/O Modules: 4CT - 8 CT

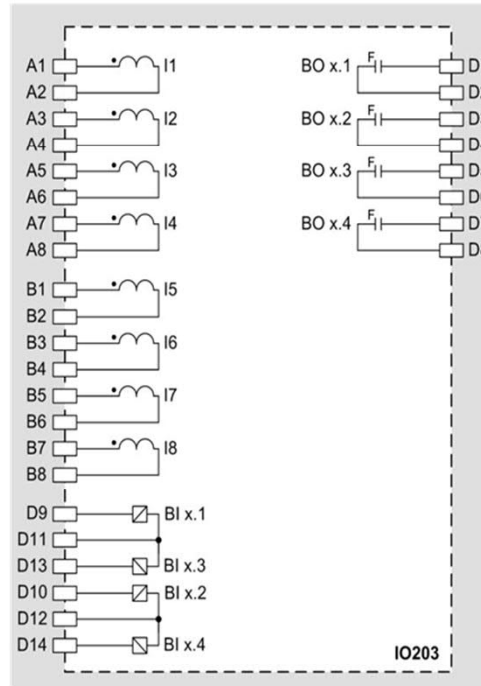


**IO201**



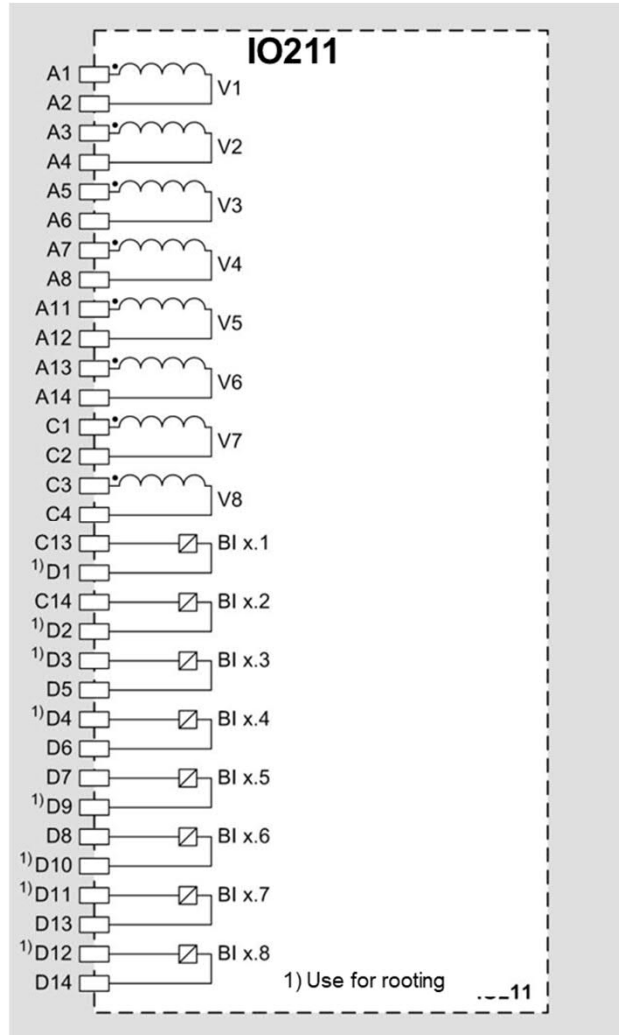
**4CT, 0VT, 8 BI,  
6 BO: 4 N/O (F), 2 C/O (F)**

**IO203**



**8CT, 0VT, 4 BI  
4 BO: 4 N/O (F)**

## I/O Modules: 8 VTs



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**IO211**

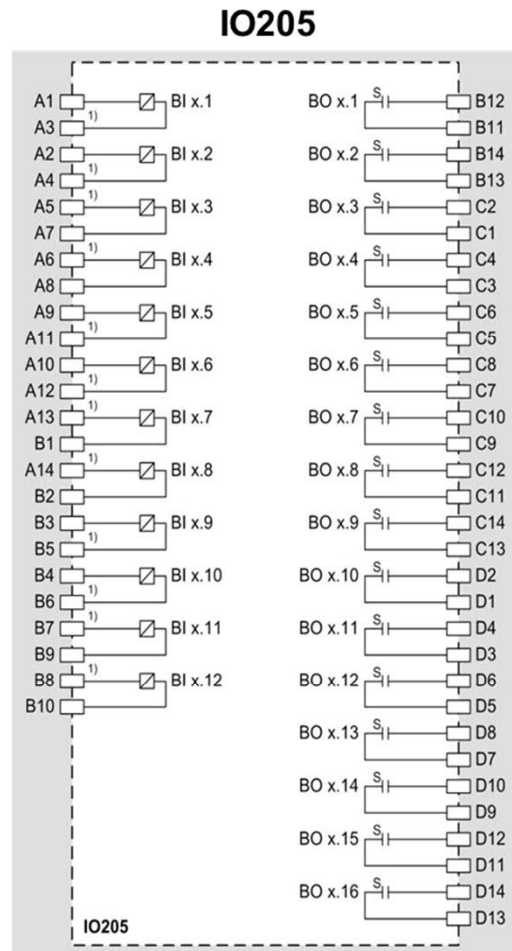
**8 VT**

**8 BI**

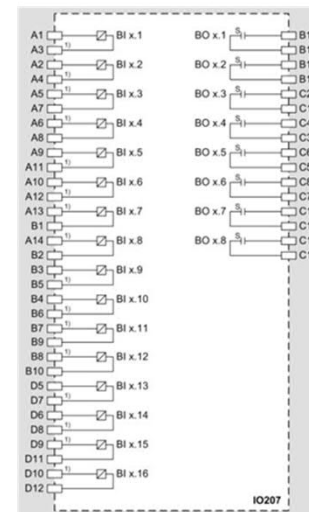


# I/O Modules: BI / BO only

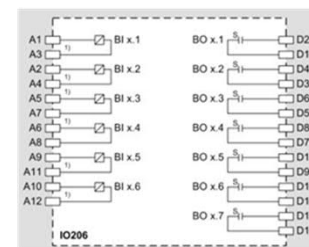
**SIEMENS**  
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**IO205**  
12 BI,  
BO:  
16 N/O



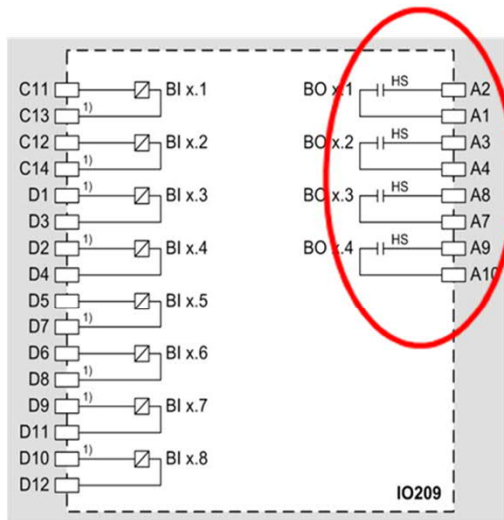
**IO207**  
16 BI  
BO: 8 N/O



**IO206**  
6 BI  
BO: 7 N/O

# I/O Modules: BI / BO (HS)

## IO209



### IO209

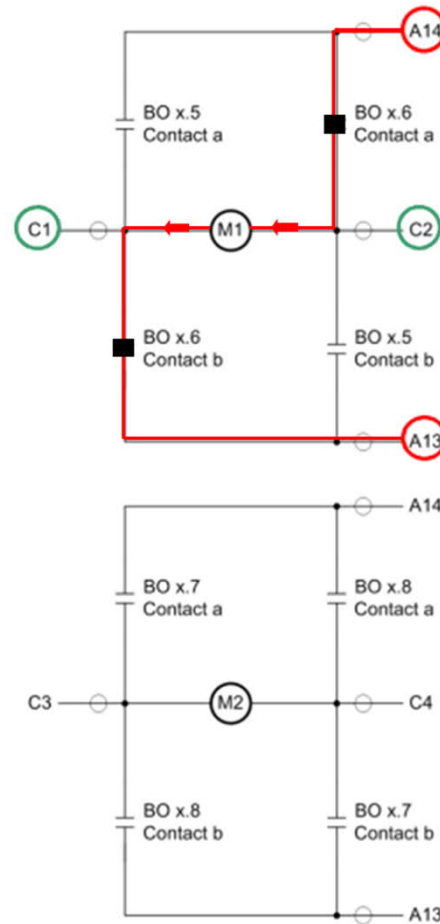
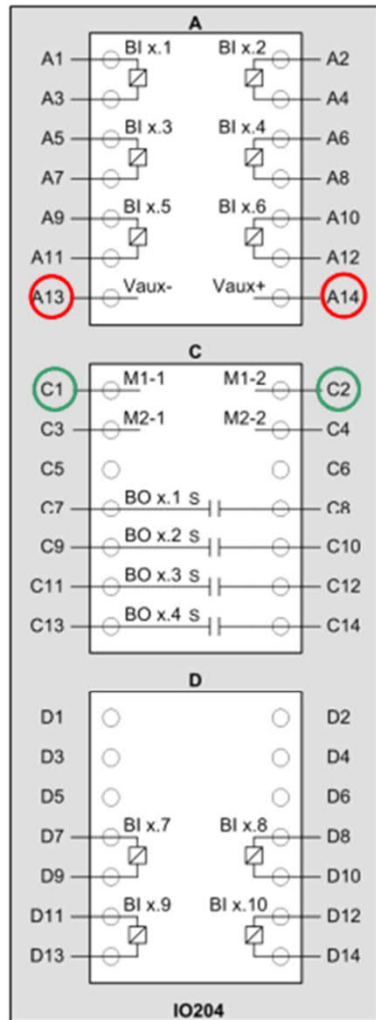
**8 BI**  
**BO: 4 N/O (HS)**

**Accelerated tripping contacts via transistors**

**Closing time 0.2 ms**

**Make / Break: 1000W / VA**

# I/O Modules: Motor Control

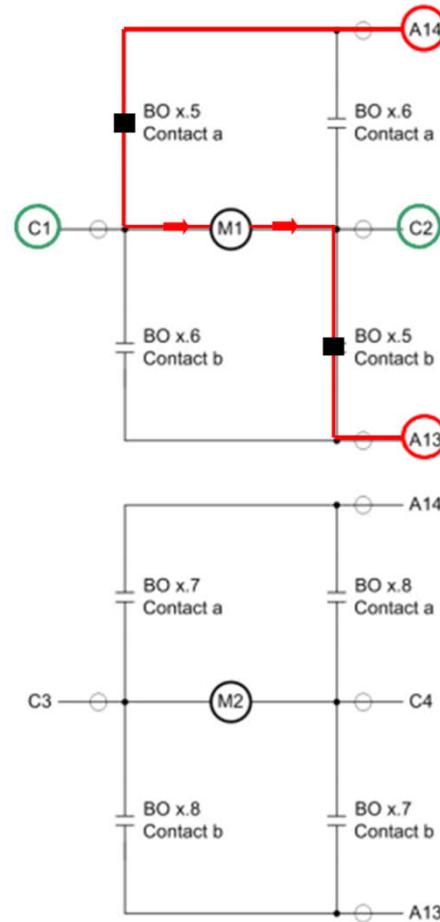
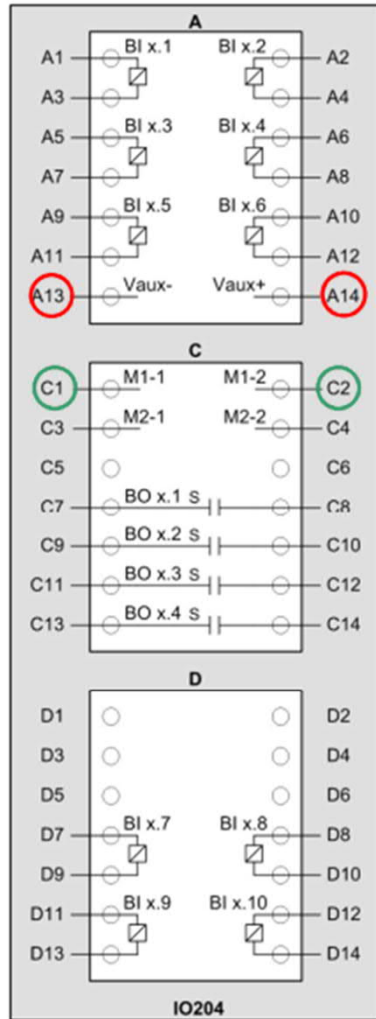


## IO204

- 10 BI
- 4 BO (N/O)
- 2 BO (Motor control)

- crosswise interlocked
- control of motors for disconnectors
- 2 directions

# I/O Modules: Motor Control



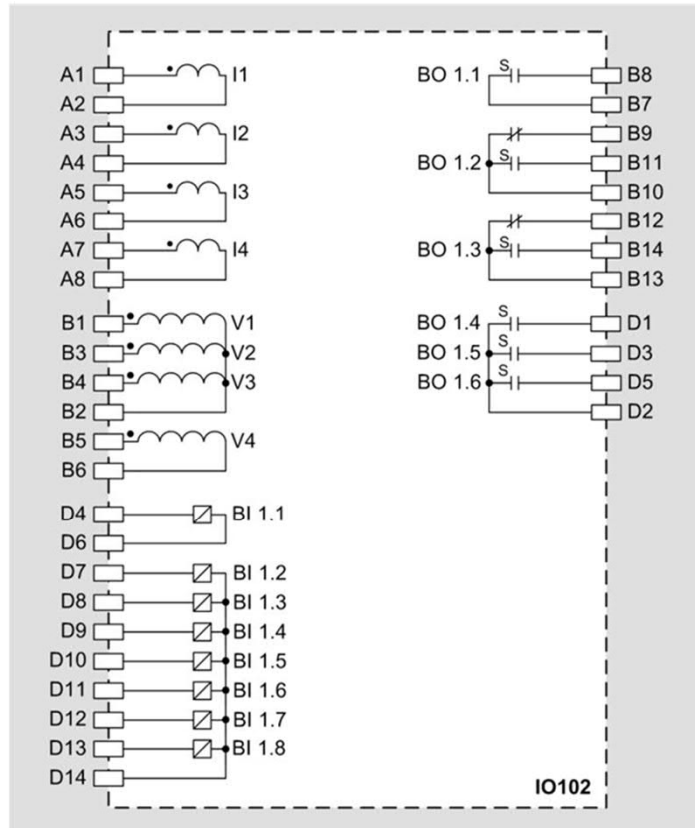
## IO204

**10 BI**  
**4 BO (N/O)**  
**2 BO (Motor control)**

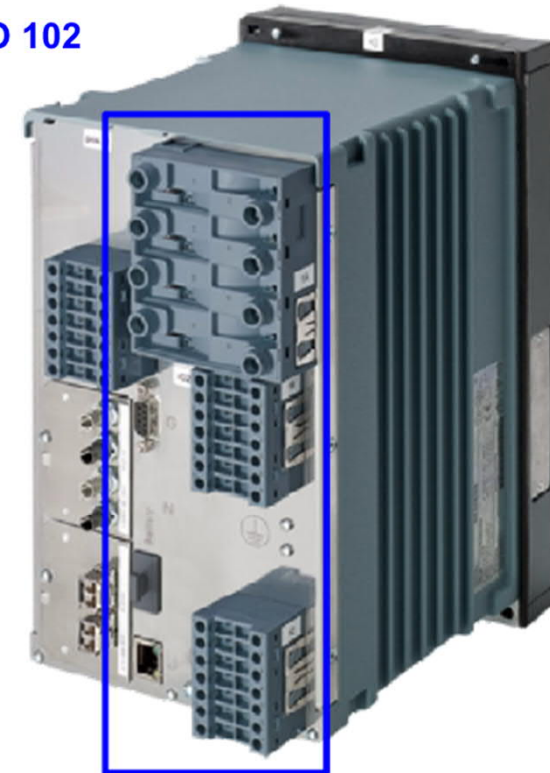
- crosswise interlocked
- control of motors for disconnectors
- 2 directions

# I/O Modules: Non expandable Devices 7x82

## IO 102



## IO 102



### IO102

**4CT, 4VT**

**8 BI**

**6 BO:**  
- 4 N/O (S)  
- 2 C/O (S)

## Plug In Module Measuring transducer interface

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ANAI-CA-4EL

### Measuring transducer module

- 4 input channels
- DC -24 mA to +24 mA



You want to be prepared against arc flashes?

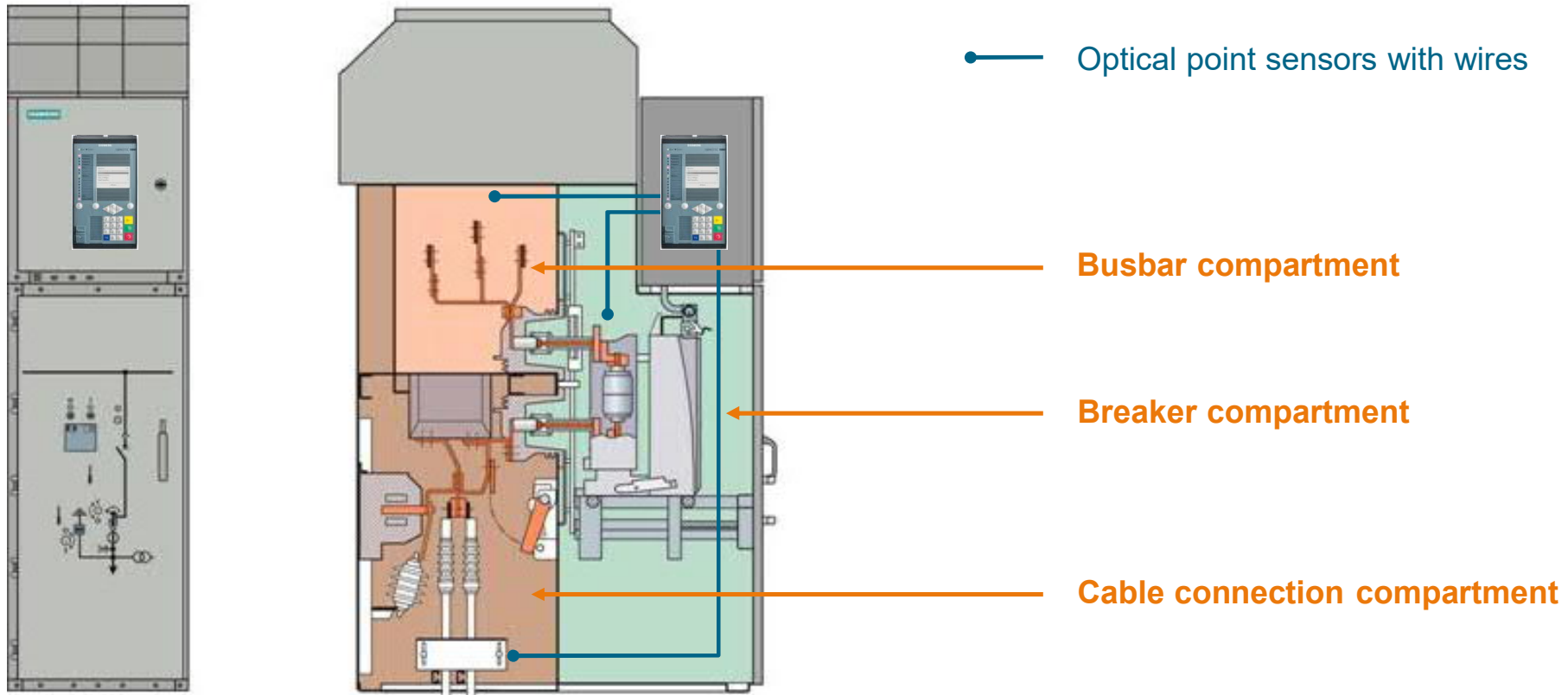
**SIEMENS**  
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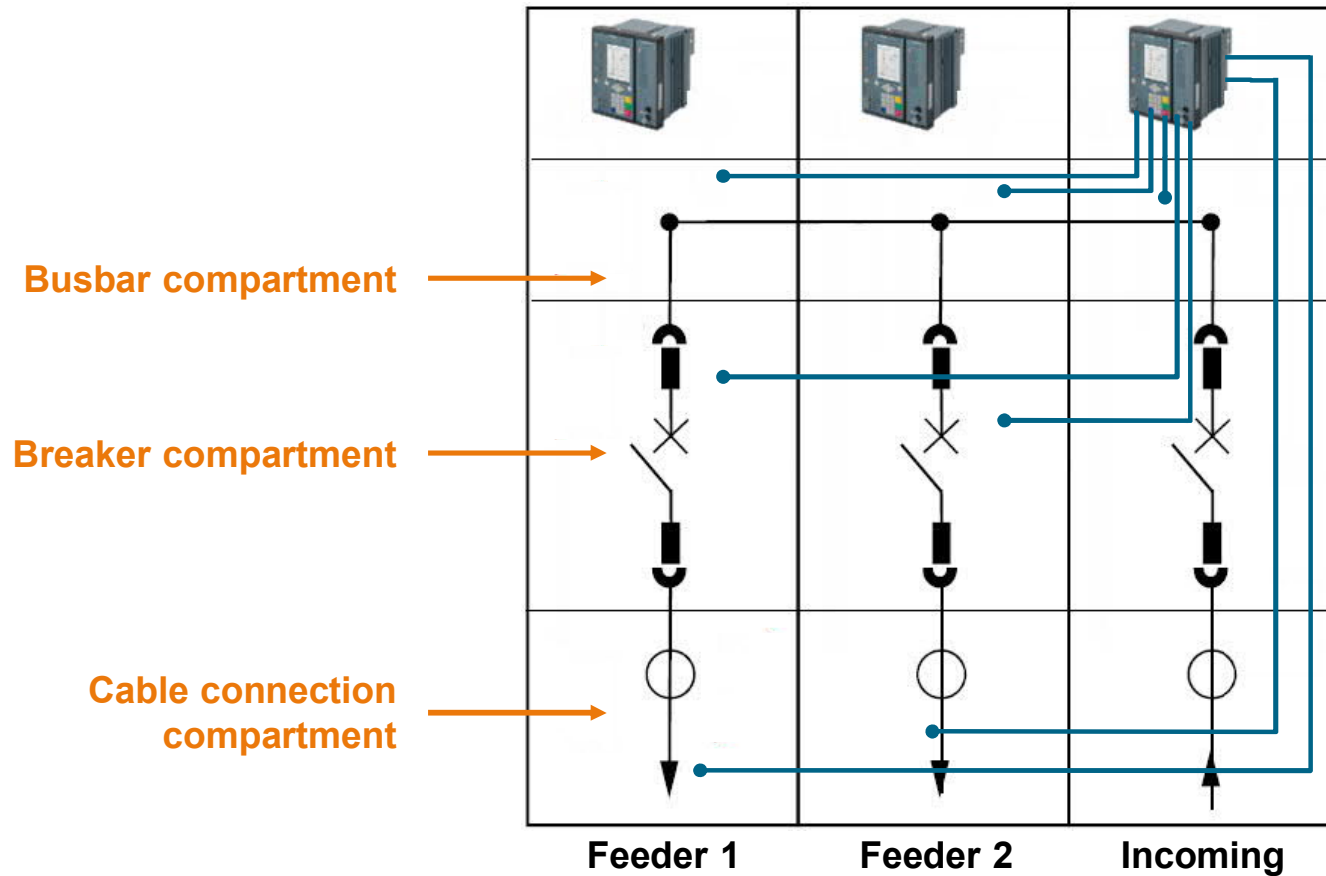
Then you should be interested in  
**SIPROTEC 5 Arc Protection!**

# Arc protection – Example: MV switchgear (NXAIR)

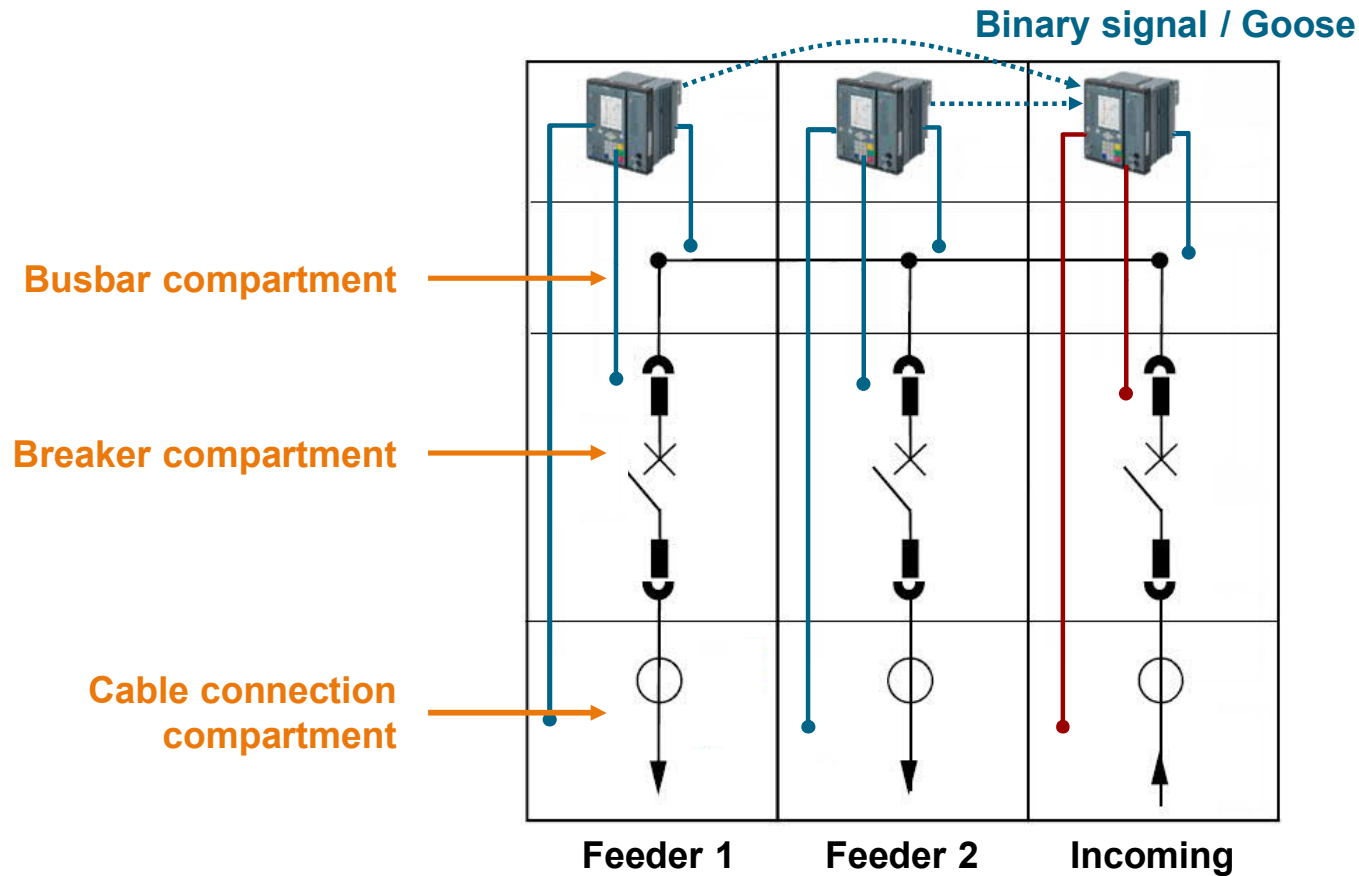
## Front and side view



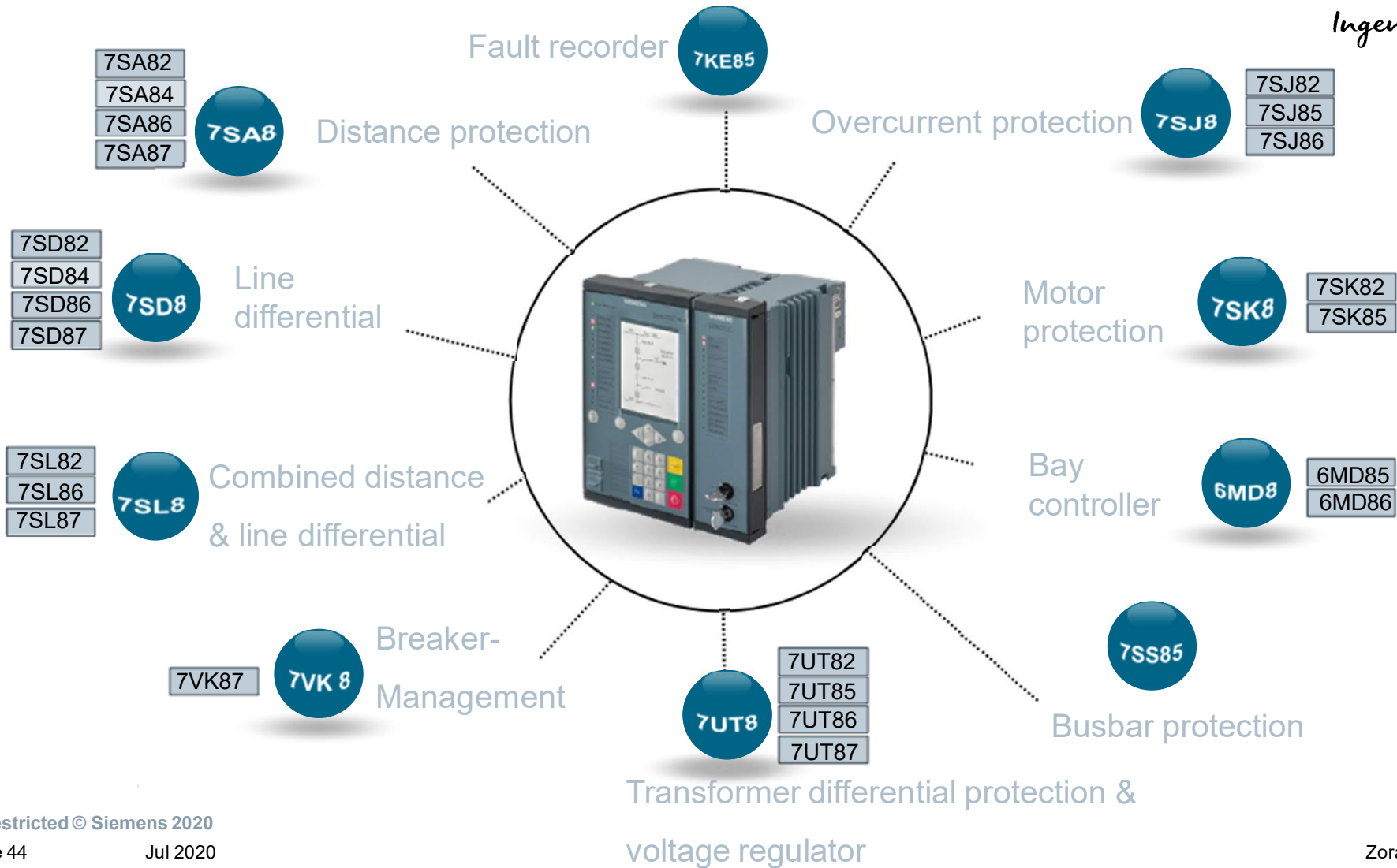
# Application I – Light and Current



# Application II – Light and Current (with communication)



# SIPROTEC 5 portfolio



# SIPROTEC 5 Overcurrent protection

**OC protection**  
(modular IO)

**OC protection**  
(non-modular IO)

**OC protection,  
as line protection backup**  
(modular IO)

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**7SJ85**



**7SJ82**



**7SJ86**





## SIPROTEC 5 Distance protection

Distance protection for 3-pole tripping  
(modular IO)

Distance protection for 3-pole tripping  
(non-modular IO)

Distance protection for 1-/3-pole trip  
(modular IO)

**SIEMENS**  
*Ingenuity for life*

**7SA82**



**7SA86**

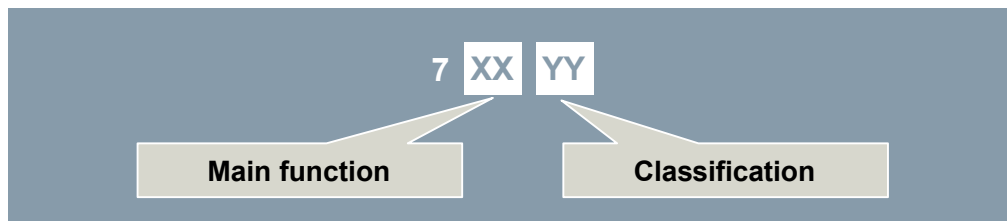


**7SA86**



# SIPROTEC 5

## Line Protection devices



7	XX	82	<ul style="list-style-type: none"> <li>• Exclusively 3-pole tripping</li> <li>• I/O quantity not expandable</li> </ul>
7	XX	86	<ul style="list-style-type: none"> <li>• Exclusively 3-pole tripping</li> <li>• I/Os completely flexible</li> </ul>
7	XX	87	<ul style="list-style-type: none"> <li>• 1- and 3-pole tripping</li> <li>• I/Os completely flexible</li> </ul>

	7SA82	7SD82	7SA86	7SD86	7SL86	7SJ86	7SA87	7SD87	7SL87	7VK87
3-pole tripping	■	■	■	■	■	■				
1-/3-pole tripping							■	■	■	■
Flexible and configurable HW			■	■	■	■	■	■	■	■
Distance Protection	■		■				■			
Line Differential Protection		■		■				■		
O/C protection for O/H lines	■	■	■	■	■	■	■	■	■	
Line Differential and Distance Prot.					■				■	
Circuit-breaker Management										■

# SIPROTEC 5

## Transformer differential protection – 7UT82

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### Applications

- Two winding differential protection
- 1 differential protection for standard and auto transformers
- 2 restricted earth fault protections
- Number of measuring points (MP)
  - only 2 three phase current MPs
  - only 2 single phase current MPs
- 1/3 Device with IO103
  
- 8 I, 7 BI, 7 BO (not expandable)



not expandable

### Suitable device 7UT82

### Device functions

- **Differential protection** with restraint characteristic and fast trip stage
- Flexible vector group adaptation
- Inrush and over excitation detection
- CT saturation detection
- **Restricted earth fault protection**
  
- Temperature monitoring
- Modular software
- IEC 61850 (Edition 1 and 2)
- Multiple communication
- SIPROTEC 5 standard functions for protection, control and monitoring



# SIPROTEC 5

## Transformer differential protection devices

**SIEMENS**  
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**Two winding transformers**  
(3 sides, 5 measuring points)

**7UT85**



**Three winding transformers**  
(4 sides, 6 measuring points)

**7UT86**



**Multiple winding transformers**  
(5 sides, 9 measuring points)

**7UT87**



## SIPROTEC 5

# Generator protection devices 7UM85 – Flexible hardware configuration



Small units

**Basic hardware**  
(4 I and 4 V)

7UM85



Small and medium sized units

**Standard hardware**  
(e.g. 8I and 8 V)

7UM85



Larger units

**Large hardware**  
(e.g. 16 I and 8V)

7UM85



# Busbar protection 7SS85 – Profile

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*Ingenuity for life*

## Application range

- Single busbar
- Double busbar / single breaker
- Triple busbar
- Double busbar with combined bus
- Double busbar with transfer bus
- 1 ½ circuit-breaker arrangement
- Double busbar / double breaker (1 or 2 CT)
- H- and T-circuits arrangements
- Ring bus, meshed corner



# Busbar protection 7SS85 – Profile 1

**SIEMENS**  
*Ingenuity for life*

## Protection functions

- 87B Phase-selective differential protection
- 50BF Breaker fail protection 1/3pole or 3pole
- 50EF End fault protection for feeders and couplers
- 62BF Breaker fail protection with no current monitoring
- 50/87B Sensitive operate curve
- 50/74 Current transformer supervision
- 74TC Trip circuit supervision
- 50BF<sub>inh.</sub> Inherent breaker fail protection 3pole for busbar faults
- 27/59 Under- / Overvoltage protection
- 81>< Frequency protection
- 50/51(N) Overcurrent protection 3 phase (ground) per bay





## Busbar protection 7SS85 – Profile 2

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*Ingenuity for life*

### Protection functions

- Cross stabilization
- Bus coupler differential protection
- 21T Impedance protection
- 67/67N Directional overcurrent protection phase/ground



# Busbar protection 7SS85 – Profile

**SIEMENS**  
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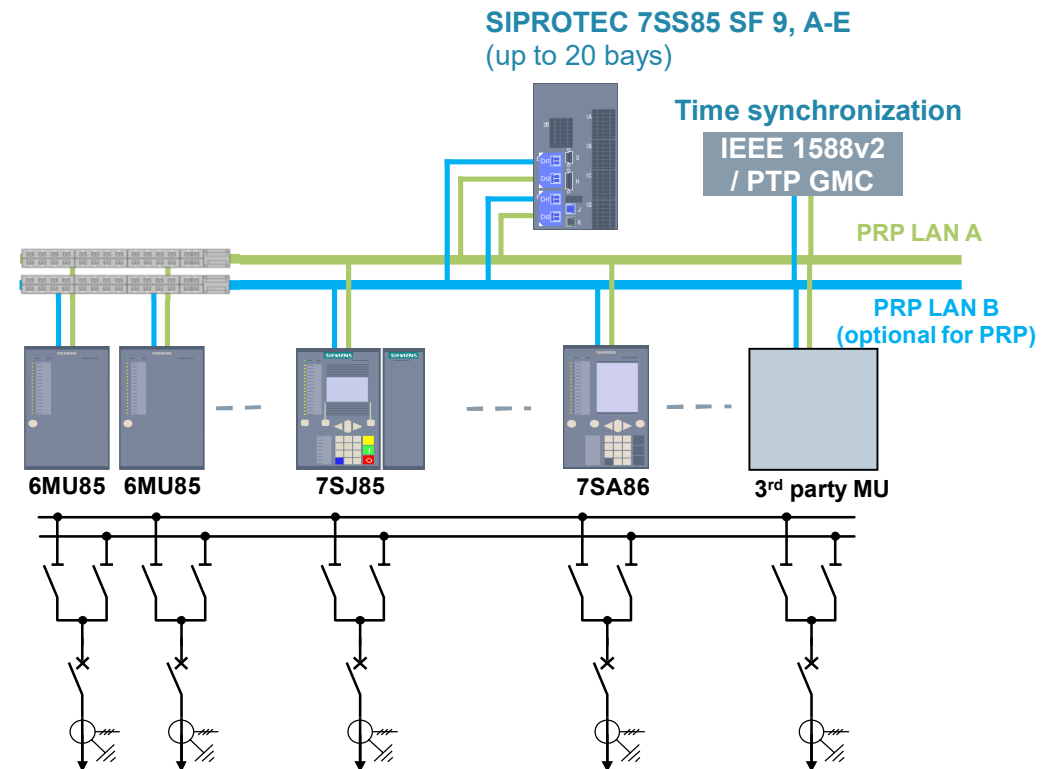
## System features

- 20 current measuring points (3-ph CT sets)
- 26 bays (feeder, coupler, sectionalizer)
- 6 (4 until V7.5x) bus zones
- 4 coupler
- 4 voltage measuring points (3-ph VT sets)
- Very short tripping time (<10ms)
- Integrated check zone as additional trip criterion
- High stability for external faults (CT saturation-free time 2ms)
- Graphical engineering, configuration, and operation with DIGSI5
- Comprehensive supervision and control functions
- Online substation monitoring (Single-line based) via display or DIGSI5
- One 3-phase device for processing and HMI



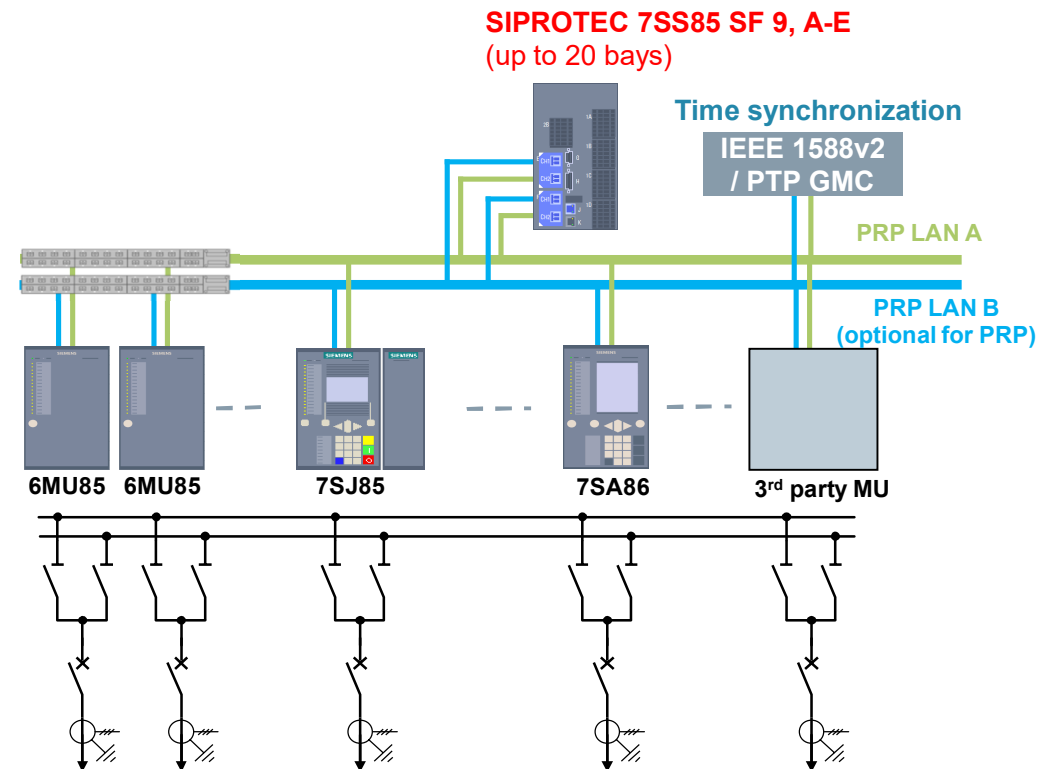
# Distributed Busbar Protection (max. 20 bays) 7SS85 + Merging Units: Basics

- 7SS85 SF9, A-E  
Central Unit for distributed busbar protection (same as centralized busbar protection)
- Time synchronization via IEEE1588v2/ PTP
- Distributed process data acquisition:
  - Merging Unit 6MU85
  - Every modular SIPROTEC 5 device
  - Third party Merging Unit
- Interoperable IEC 61850 busbar protection solution
- Open engineering through standard IEC 61850 configuration tools and DIGSI 5



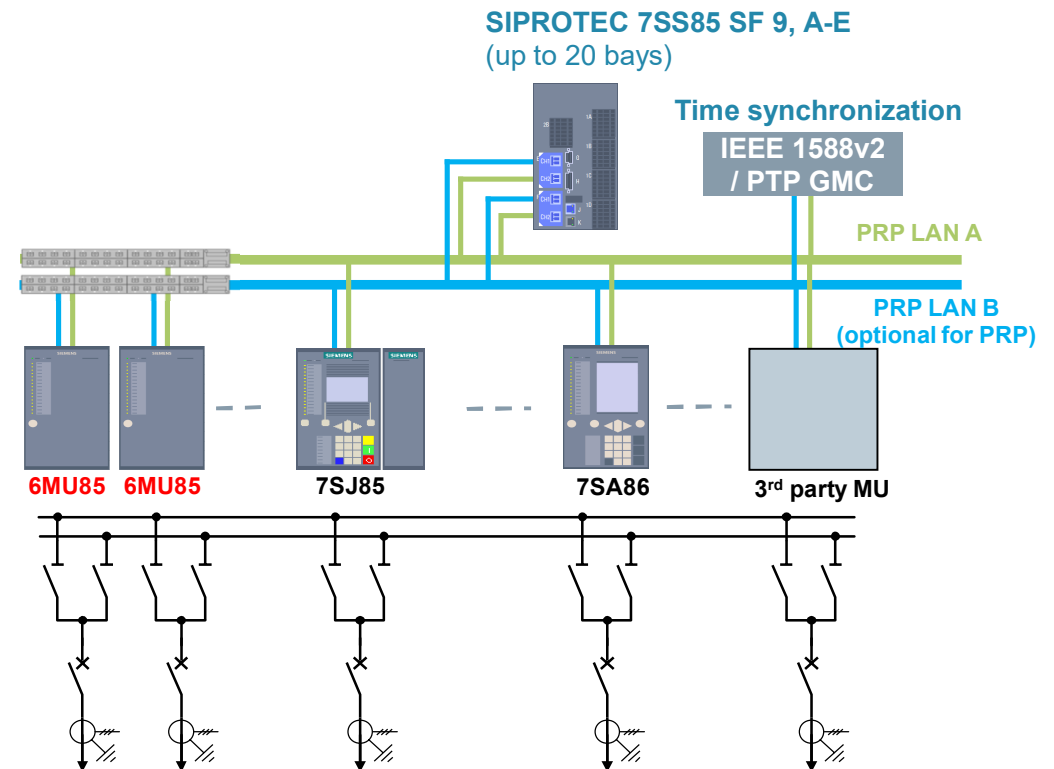
# Distributed Busbar Protection (max. 20 bays) 7SS85 + Merging Units: 7SS85 Selection

- Existing central 7SS85 variants as Central Unit
- New hardware variant V4 as preferred variant for application as CU: IO207 in base module, 1 BD-Module
- Up to 14 current measuring points per BD-Module possible
- Selection according disconnector image, number bus zones, functions points as before (FPs for bays necessary)
- Process bus client functionality needs no additional function points.
- PRP is optional (but recommended)
- Don't forget to calculate and order the switch(es)



# Distributed Busbar Protection (max. 20 bays) 7SS85 + Merging Units: MU Selection

- If a dedicated MU is requested, the 6MU85 is applied.
- 6MU85 Standard Variant AJ1 (IO201 base module):  
1/3, 11BI, 9BO, 4CT, 1 BD-module, 1 Dataset  
~ 7SS525
- 6MU85 Standard Variant AJ1  
+ IO205 + small Display:  
1/2, 23BI, 25BO, 4CT, 1 BD-module, 1 Dataset  
~ 7SS523



# SIPROTEC 5 Bay Controller devices



**Bay Controller for Distribution  
and Transmission systems**

**6MD85**



**Bay Controller for  
Transmission systems**

**6MD86**



## SIPROTEC 5 Bay Controller devices

Functionality	6MD85	6MD86
Breaker Failure Protection	-	Optional
Autoreclosure	-	Optional
FB Switching sequences	Optional	☑
CFC Arithmetic	Optional	☑
CFC Measurement Processing	Optional	☑
Number of Switching Devices >4	Optional	☑
Synchrocheck	Optional	☑

A lot more functions are available – table shows only the features which are different between 6MD85 and 6MD86



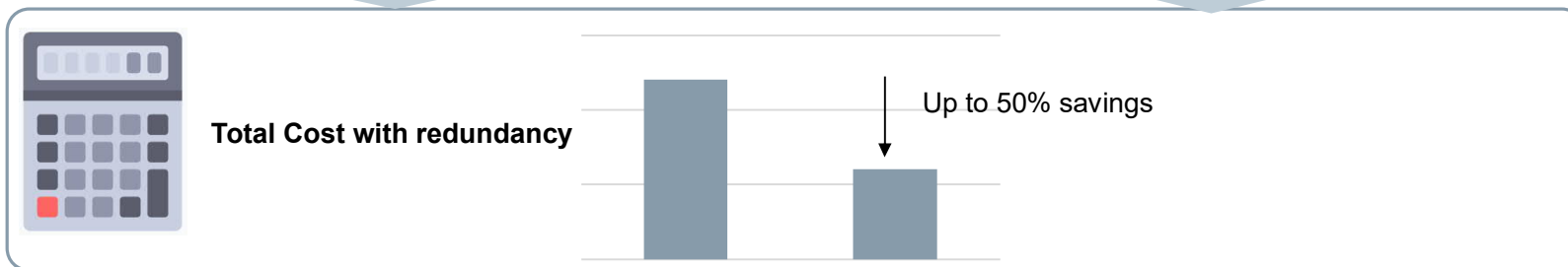
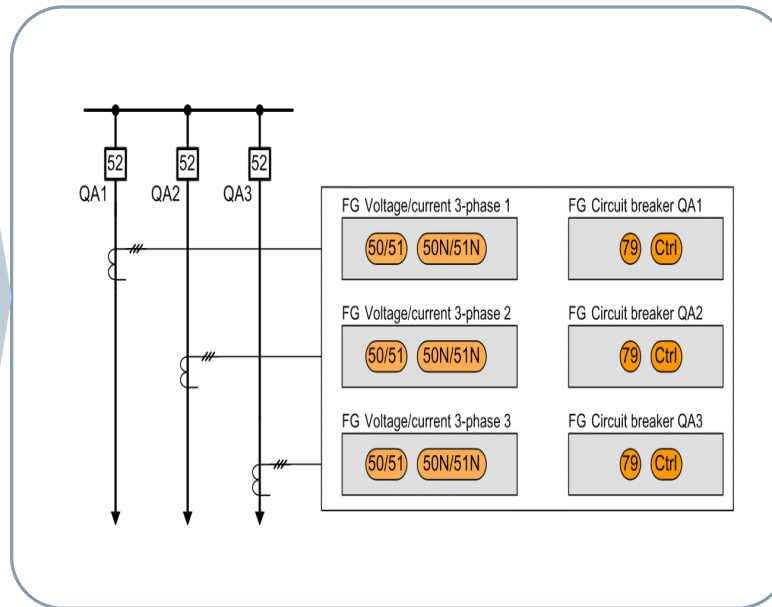
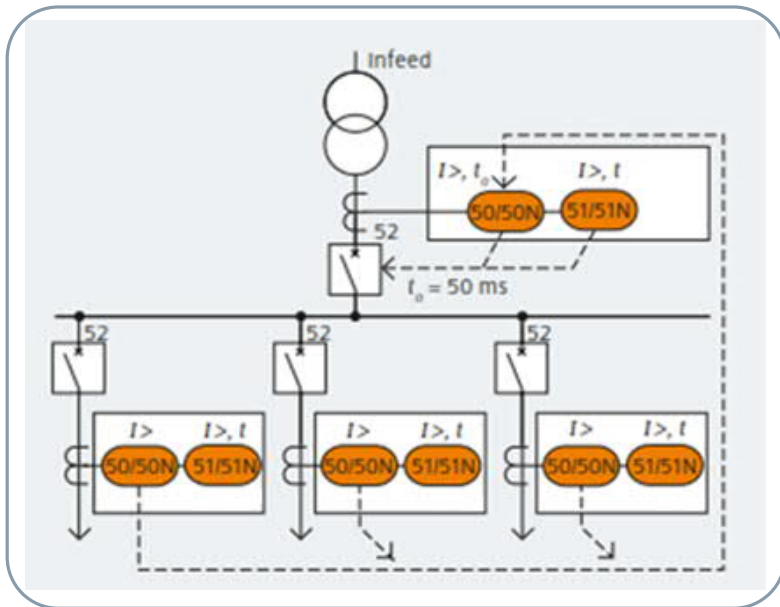
Savings of SIPROTEC 5  
solution in comparison to  
traditional solution – some  
examples

# Medium Voltage Protection and control of multiple feeders, one device



Traditional

SIPROTEC 5

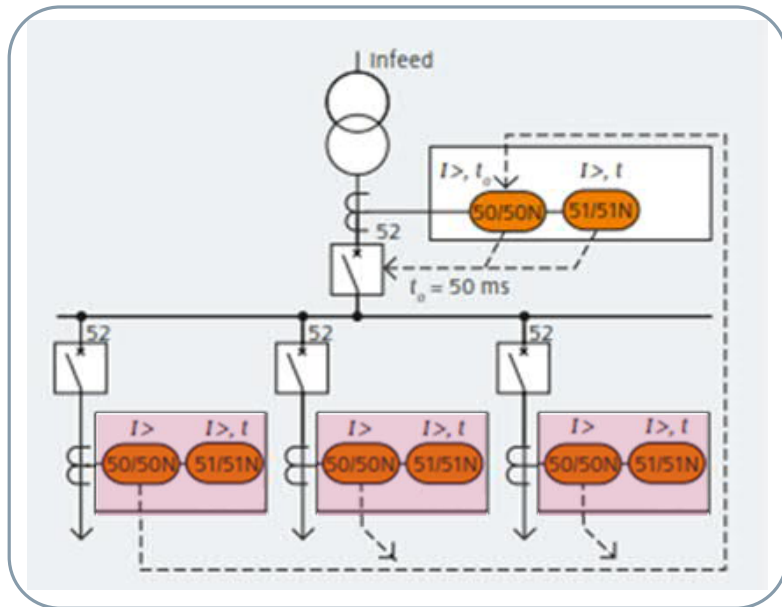


- ### Benefits
- Reduced investment (50%) → Just 1 device for multiple feeders
  - Up to 9 feeders in just one device!!
  - Simple parameterization → Parameters will be loaded just one time!!
  - Redundancy affordable

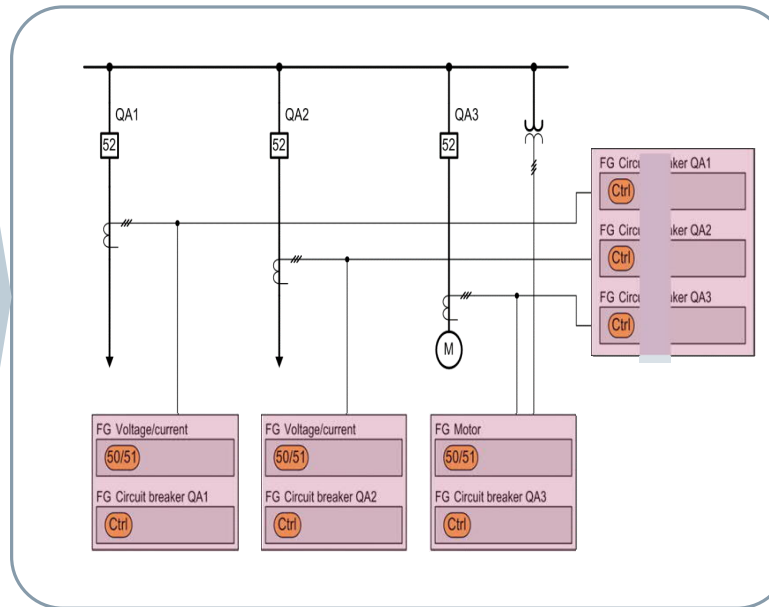
# Medium Voltage Central control of multiple feeders, dedicated protection



Traditional



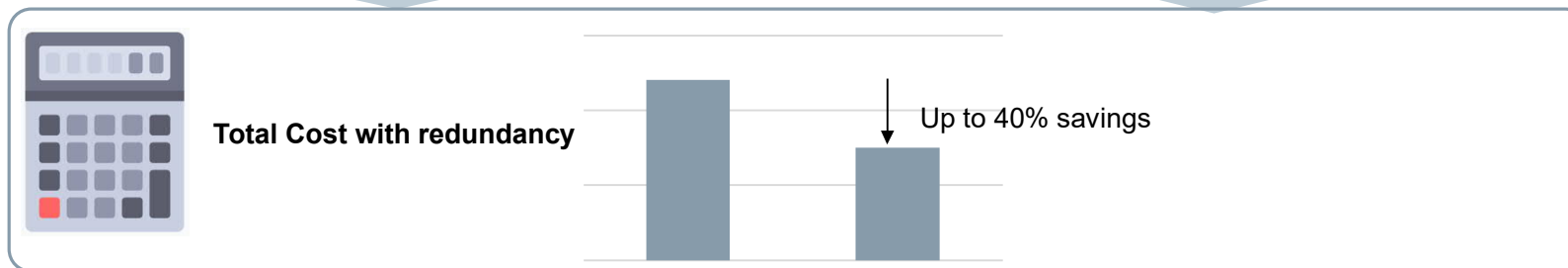
SIPROTEC 5



## Benefits

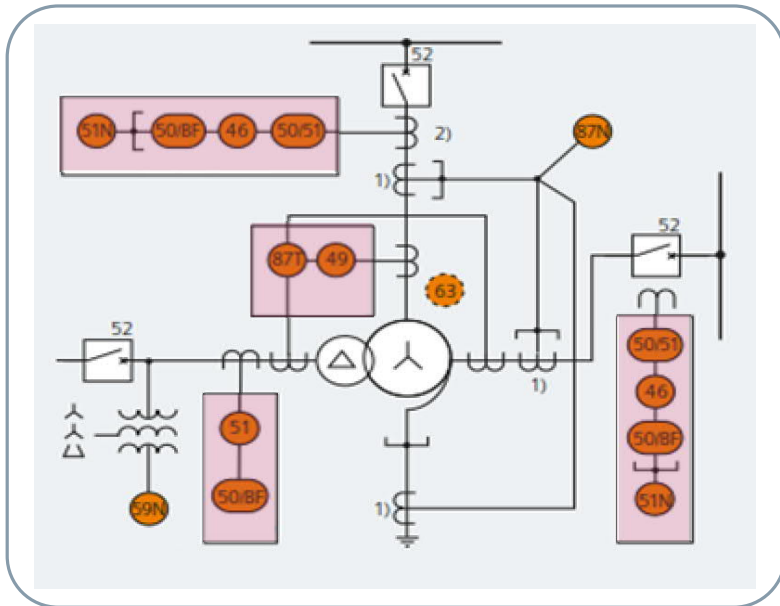


- High availability because backup protection functions can be activated in the controllers
- Simple parameterization
- Reduced investment having full redundancy

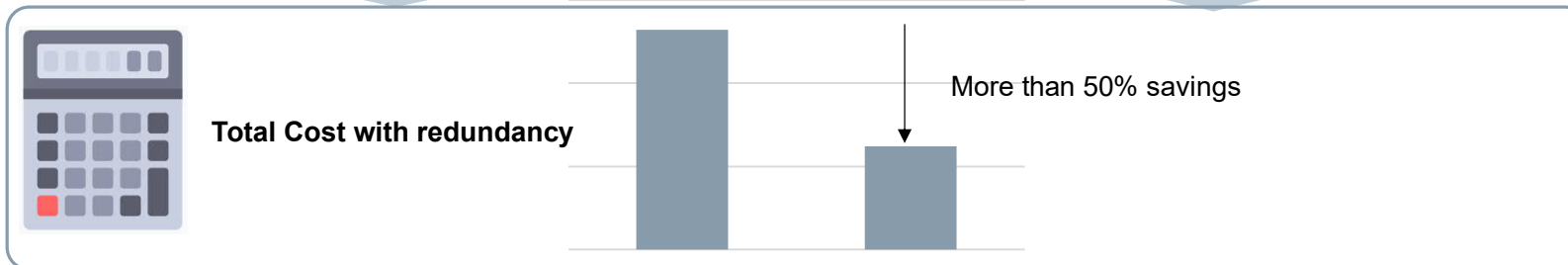
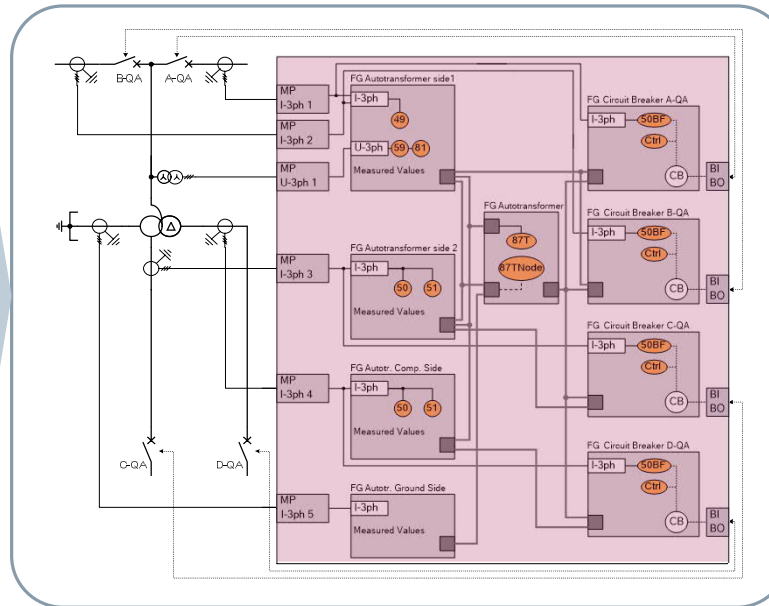


# Medium Voltage Transformer Protection

Traditional



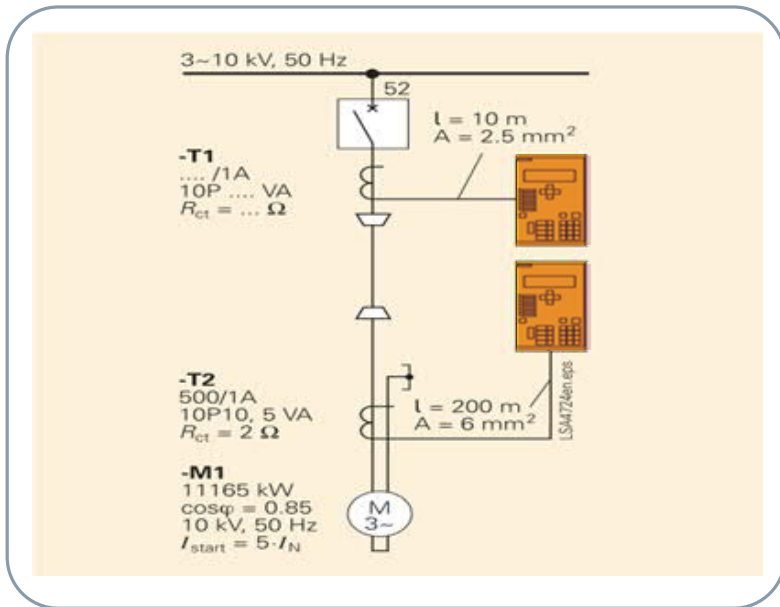
SIPROTEC 5



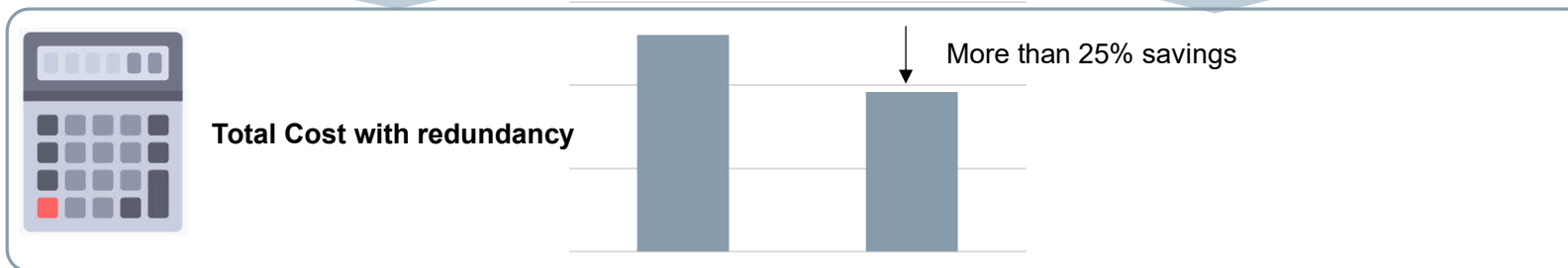
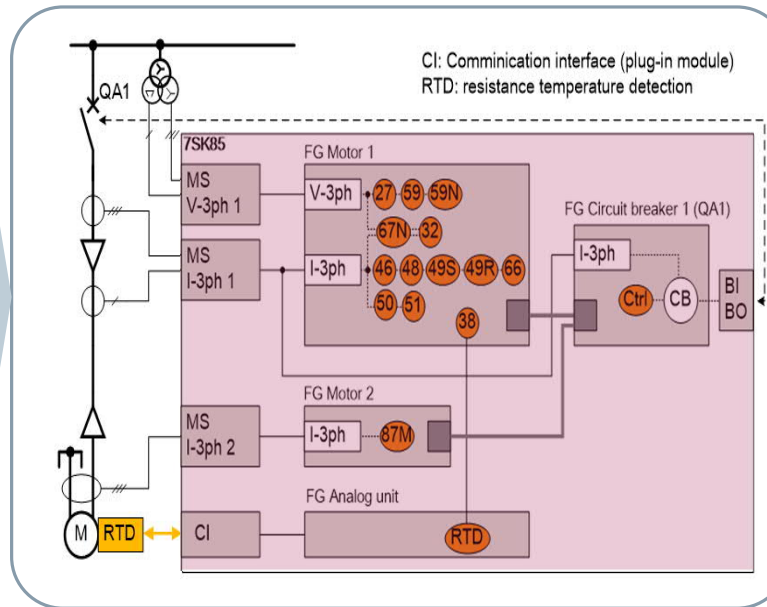
- Benefits**
- Reduced investment  
→ all necessary functions integrated within 1 protection relay
  - Simple parameterization
  - Faster commissioning
  - Possibility to afford **REDUNDANCY** with just 2 devices !

# Medium Voltage Motor Protection

## Traditional



## SIPROTEC 5



## Benefits

- Reduced investment (just 1 protection relay or two in case of full redundancy). More than 25% savings!
- Simple parameterization
- Faster commissioning

## Kontakt

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*Ingenuity for life*



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