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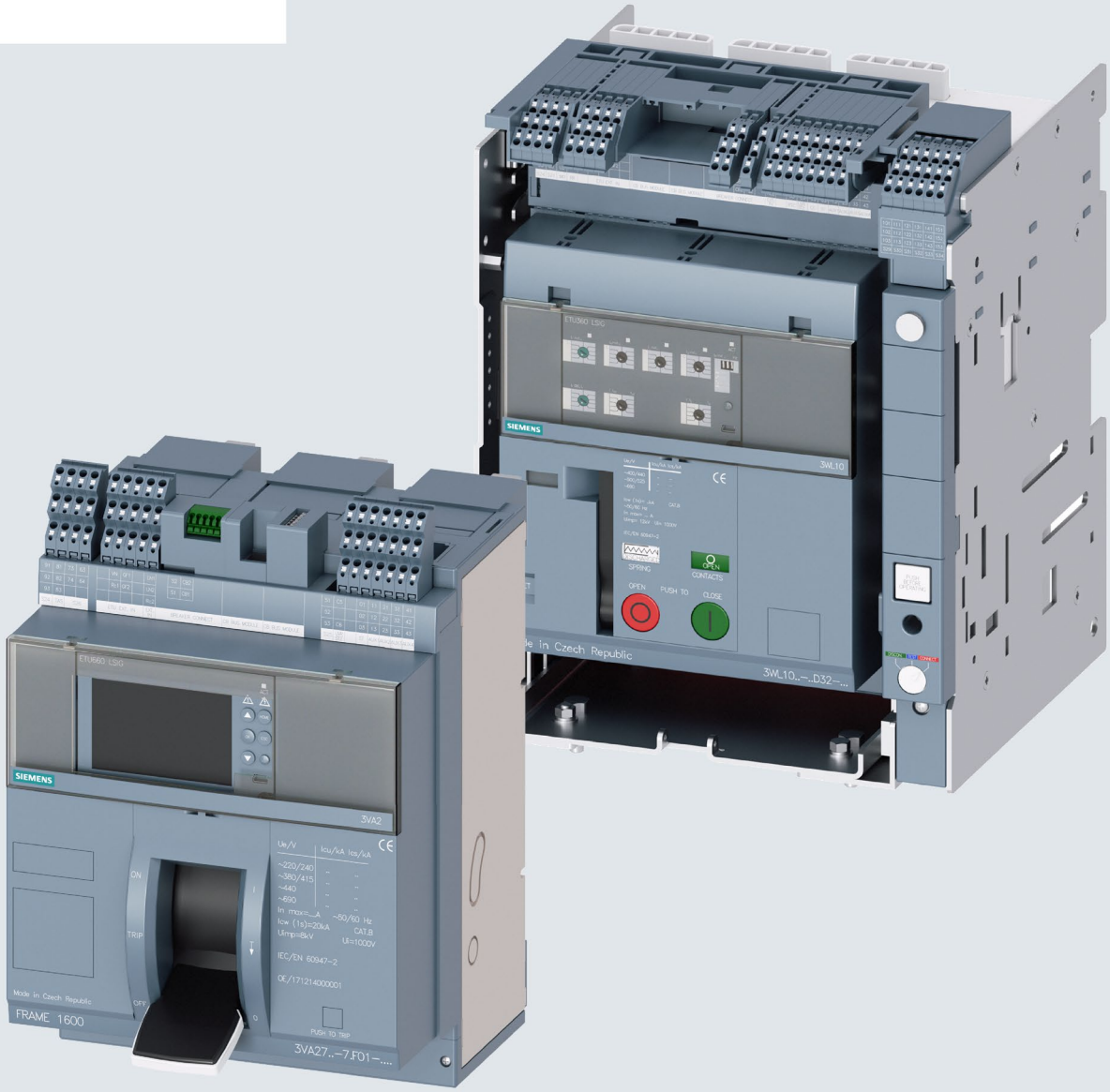

Manual

SENTRON

Air Circuit Breaker 3WL10 & Molded Case Circuit Breaker 3VA27

Edition 10/2018

siemens.de/3WL siemens.de/3VA

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Protection devices
3VA27 molded case circuit breakers & 3WL10 air circuit breakers

Manual

10/2018

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Legal information

Warning notice system

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

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

⚠ 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.

Trademarks

All names identified by ® are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

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

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Introduction 1

1.1 About this documentation

Circuit breaker

The circuit breaker is an integral part of an economically efficient, safe and reliable power distribution system that is designed to protect personnel and material assets. The platform device that is described below is available as a variant of the 3WL10 air circuit breaker (ACB) and the 3VA27 molded case circuit breaker (MCCB).

Scope of validity of this document

This manual is a reference manual for technical information that users will need to configure, connect, and operate the 3WL10 / 3VA27 circuit breaker and its accessories 3VW8/9.

1.2 Product-specific information

Target readers of this documentation

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

- Users
- Control cabinet manufacturers
- Switchgear manufacturers
- Maintenance personnel

Siemens Technical Support

You can find further support on the Internet at:
Technical Support (http://www.siemens.com/lowvoltage/technical-support)

1.3 Reference documents

Further documents

You can find further details in the following documents:

Table 1- 1 Reference documents

Title	
Catalog LV 10 - Low-Voltage Power Distribution and Electrical Installation Technology	@ (https://support.industry.siemens.com/cs/ww/en/view/109482234)
Catalog - 3VA27 Molded Case Circuit Breakers	@ (https://support.industry.siemens.com/cs/ww/en/view/109755686)
Communication Manual - 3VA27 Molded Case Circuit Breakers & 3WL10 Air Circuit Breakers	@ (https://support.industry.siemens.com/cs/ww/en/view/109760220)
Configuration Manual - Selectivity for 3VA Molded Case Circuit Breakers	@ (https://support.industry.siemens.com/cs/ww/en/view/109743975)
Selectivity Tables - Low-Voltage Protection Devices	@ (https://support.industry.siemens.com/cs/ww/en/view/109748621)
System Manual - 3VA Molded Case Circuit Breaker Communication	@ (https://support.industry.siemens.com/cs/ww/en/view/98746267)
Operating Instructions - 3WL10 Air Circuit Breakers, Fixed-Mounted	@ (https://support.industry.siemens.com/cs/ww/en/view/109748199)
Operating Instructions - 3WL10 Air Circuit Breakers, Withdrawable	@ (https://support.industry.siemens.com/cs/ww/com/view/109748198)
Operating Instructions - 3VA27 Circuit Breakers, Fixed-Mounted	@ (https://support.industry.siemens.com/cs/ww/en/view/109748313)
Operating Instructions - 3VA27 Circuit Breakers, Withdrawable	@ (https://support.industry.siemens.com/cs/ww/en/view/109748314)
Hartmut Kiank, Wolfgang Fruth: Planning Guide for Power Distribution Plants, Publicis Publishing	ISBN: A19100-L531-B115
Switching, Protection and Distribution in Low-Voltage Networks, substantially extended and revised edition 1997	ISBN 3-89578-041-3
Siemens: Residual Current Protective Devices, Low-Voltage Circuit Protection Technology Primer Siemens AG © 04 / 2009	E10003-E38-9T-B3011

1.4 Advanced training courses

Find out about training courses on offer on the following link.

Training for Industry (https://www.siemens.com/sitrain-lowvoltage)

This is where you can choose from

- Web-based training courses (online, informative, free)
- Classroom training courses (course attendance, comprehensive, subject to fee)

.

You also have the possibility of compiling your own training portfolio via **Learning paths**.

1.5 Safety instructions

DANGER

Hazardous voltage

Results in death, serious injury or irreparable damage to material / property.

Only qualified personnel who have been instructed in the warnings and safety instructions and the maintenance rules must ever work on the device.

Successful and safe functioning of this device depends on proper installation, operation, handling, and maintenance.

WARNING

Improper installation, commissioning, and maintenance

Safe operation of the circuit breaker can only be ensured if it is installed, commissioned, and maintained properly by qualified personnel, observing the warnings provided in these operating instructions.

In particular, both the general installation and safety instructions for work on power-current installations (e.g. DIN VDE) and the rules prescribing proper use of lifting equipment and tools and use of personal protective equipment (goggles etc.) must be followed.

If these are not observed, this can result in death, severe injury, or substantial material damage.

Qualified personnel

A qualified person for the purpose of this documentation is a person who is familiar with assembling, installing, commissioning, and operating the product and who has the relevant qualifications, such as:

- Training or instruction/authorization to close and open, ground, and tag circuits and devices and systems according to the safety standards.
- Training / instruction in the proper care and use of protective equipment in accordance with established safety procedures.
- Training in first aid.

Ambient conditions

The circuit breakers are designed to be operated in enclosed rooms in which the operating conditions are not affected by dust or corrosive vapors/gases. Suitable enclosures must be used in dusty or damp conditions. You will find further ambient conditions in Chapter Application planning (Page 137).

Standards

The circuit breaker complies with the standards:

- IE 60947-2
- IEC 60947-3
- EN 60947-2
- EN 60947-3

Safety instructions

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. Such systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial security measures that may be implemented, please visit http://www.siemens.com/industrialsecurity (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they are available and that the latest product versions are used. Use of product versions that are no longer supported, and failure to apply the latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at http://www.siemens.com/industrialsecurity (http://www.siemens.com/industrialsecurity).

Open Source Software

This product also includes open-source software developed by third parties. You can find the open-source software included in this product, and the corresponding open-source software license conditions, in the Readme_OSS.

The open-source software programs are protected by copyright. You are authorized to use the open-source software in accordance with the relevant open-source software license conditions. In the case of contradictions between the open-source software license conditions and the Siemens license conditions valid for the product, the open-source software license conditions take precedence with regard to the open-source software.

The open-source software is provided free of charge. Insofar as the relevant open-source software license conditions allow it, you can request the source text of the software from the following address, on payment of the postage:

Siemens AG
Energy Management, Low Voltage & Products
Siemensstrasse 10
93055 Regensburg
Germany

Internet: (www.siemens.com/lowvoltage/support-request)

Keyword: Open Source Request (please specify product name and version, if applicable)

at least up to 3 years after purchasing the product:

We accept liability for the product, including the open-source software it contains, in accordance with the license conditions valid for the product. We accept no liability for use of

the open-source software beyond the program sequence envisaged by us for the product, and we accept no liability for faults caused by changes to the open-source software. We will not provide any technical support for the product if this has been changed.

Transport

Unpack the circuit breaker or the guide frame when it is delivered and examine it for damage in transit. Notify the carrier immediately if any damage in transit is found.

If the circuit breaker or the guide frame will not be installed until later, store it in its original packaging. Always use the original packaging for onward shipping.

If the circuit breaker is delivered in seaworthy packaging, check the color of the moisture label:

- Blue: Moisture-tight packaging is effective
- Pink: Moisture-tight packaging is ineffective.
  Inspect the circuit breaker for corrosion damage and report the damage to the carrier. Replace or dry the desiccants and weld the plastic film. Inspect the packaging at regular intervals.

Handling

NOTICE
Damage due to incorrect setting down
The circuit breaker and the guide frame must not be set down on their rear side nor on the terminals of their main circuit connection after removal from the packaging, unless the suitably shaped wooden board provided has first been placed underneath.
After unpacking, stand the circuit breaker vertically on its underside or lay it horizontally on its side.

The circuit breaker and the guide frame are shipped together in one packing unit. The circuit breaker and guide frame are next to each other in the packaging. The circuit breaker can be removed from the packaging and transported by one person, as can the guide frame. Equipment, such as a crane, etc. is not required.

Description

2

2.1 Current-carrying 3WL10 circuit breakers

Air circuit breakers of the 3WL range are designed as current-carrying circuit breakers. Their place in the power distribution is upstream of molded case circuit breakers and they must have time-selective current-carrying characteristics. They are equipped with ST releases for short-time-delayed short-circuit protection. The INST release for instantaneous short-circuit protection can be disabled in certain circumstances.

The air circuit breakers can carry the full short-circuit current for a certain duration without the contacts lifting and limiting the short-circuit current. This gives lower-level devices enough time to disconnect the outgoing feeder with the fault. These are the positive characteristics of a protection device that is most frequently used near to the incoming feeder and that, like the 3WL10 air circuit breaker, is time-selective and current-carrying in the event of a fault.

2.2 Current-limiting 3VA27 molded case circuit breakers

"Current limiting" means that the peak value of the prospective impulse short-circuit current i_p is limited to a smaller let-through current i_D. Effective current limitation means that the circuit breakers and busbar trunking systems can be constructed more compactly. In the event of a short-circuit, the molded case circuit breaker substantially reduces the magnitude of the let-through currents, i.e. reduces the load reaching downstream equipment (less thermal load, lower dynamic forces). The let-through energy is also significantly reduced. 3VA molded case circuit breakers are designed to be current limiting. IEC EN 60947-2 (VDE 0660-101), section 2.3, page 12, defines current-limiting molded case circuit breakers in the following way:

"Circuit breaker that, within a specified range of current, prevents the let-through current from reaching the prospective peak value and which limits the let-through energy (I_2t) to a value less than the let-through energy of a half-cycle wave of the symmetrical prospective current."

These are the positive characteristics of a protection device that is most frequently used on the outgoing side and that, like the 3VA27 molded case circuit breaker, is dynamically selective and current limiting in the event of a fault.

2.3 Advantages of the platform approach

This product platform (ACB/MCCB) provides users with a selection of product variants depending on their requirements whereas the accessories, electronic trip units, electronics, connections, and outer dimensions are mainly the same.

This is made possible by the modular design of the contact system inside the product.

The user or plant constructor does still have to perform integration tests, but the physical design and the system of accessories remain largely intact.

2.4 Overview - applications and portfolio

This chapter provides an overview of the circuit breakers and describes the potential areas of application for different circuit breaker models.

The topics discussed in this chapter are listed below:

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

2.5 Basic properties of the circuit breaker (3WL10 / 3VA27)

- Choice between two ranges of electronic trip units with a number of equipment versions:
  - Electronic trip units (ETUs) of the 3-series with rotary coding switches
  - Electronic trip units (ETUs) of the 6-series with LC display for additional settings and functions for enhanced requirements (communication and metering function)
- Variable and versatile connections with identical dimensions (3WL10 / 3VA27)
- Options for integration into switchboards complying with IEC 61439-2
- Optional expansion with a wide range of internal and external accessories
- Integrated communication concept together with the other 3VA molded case circuit breakers, the 3WL, and the 7KM PAC measuring devices. Option of direct integration into the Siemens communication environment via optional accessories (with ETUs of the 6-series):
  - Communication modules (Plug & Play) for PROFIBUS DP, PROFINET IO, Modbus TCP, and Modbus RTU
  - I/O modules
  - Modules with expanded metering functions for efficient energy management
- Integration of the circuit breaker into the Totally Integrated Power (TIP) solutions is possible
- Integration into the SENTRON software environment, including powerconfig and powermanager

Support by CAx files and Siemens tools simplifies planning and integration of the circuit breaker into the overall installation.

3WL10 air circuit breaker

The 3WL10 air circuit breaker is a current-carrying circuit breaker with IEC certification (3WL1) and is an addition to the existing 3WL1 IEC portfolio. It has the following characteristics:

- Frame size 0 (FS 0) with a rated current I_n of 630 A to 1250 A
- Optionally available either as a fixed-mounted version or as a withdrawable version
- An especially high I_{cw} value (up to 50kA 1s) and an I_{cu} value (up to 66kA @440V)

3VA27 molded case circuit breaker

The 3VA27 molded case circuit breaker is a current-limiting circuit breaker with IEC certification and is an addition to the existing 3VA IEC portfolio. It has the following characteristics:

- Frame size 1600 A with a rated current I_n of 800 A to 1600 A
- Choice of two designs:
  - as a toggle operating mechanism, e.g. as an additional manual operating mechanism
  - as a stored energy spring mechanism for integration of internal spring charging motors (external dimensions are not affected by this)
- Optionally available either as a fixed-mounted version or as a withdrawable version
- An especially high I_{cu} value (up to 110kA @415V) and an I_{cw} value (up to 20kA 1s)

Features

The circuit breakers meet the following requirements:

- High breaking capacity
- Selective protective response
- Optional integrated metering function with internal voltage tap and expansion module metering function Basic / metering function Advanced (with electronic trip units of the 6-series)
- Connection to a fieldbus communication system or Ethernet-based IP communication (with electronic trip units of the 6-series)

The most important features of the circuit breaker are:

Feature	Air circuit breaker 3WL10	Molded case circuit breaker 3VA27
Compact dimensions	✓	✓
Rated current I_n	630 / 800 / 1000 / 1250 A	800 / 1000 / 1250 / 1600 A
Breaking capacity classes	42 kA, 55 kA, and 66 kA (I_{cu} at 440 V)	55 kA, 85 kA, and 110 kA (I_{cu} at 415 V)
Fixed-mounted	✓	✓
Withdrawable	✓	✓
Toggle operating mechanism	—	✓
Stored energy operating mechanism	✓	✓
Electronic trip units	3-series / 6-series	3-series / 6-series
Direct communication link to the device without an intermediate gateway. Various bus systems are available (optionally for electronic trip units of the 6-series)	✓	✓
Use in AC applications	✓	✓
Direct communication link to various bus systems of the device (optionally for electronic trip units of the 6-series)	✓	✓
No derating of the circuit breaker up to +70 °C in accordance with IEC 60947-2	✓	—
Modular and easy-to-fit accessories	✓	✓
Connections that can be retrofitted by the user. Its orientation is modular or rotatable for subsequent modification.	✓	✓

Benefits

The circuit breaker provides many different advantages:

- Low space requirements

  The 3WL10 circuit breakers are extremely compact. 3-pole and 4-pole devices of size 0 fit into a 400 mm wide switchboard panel. Two 3-pole 3WL10 circuit breakers can also be installed side by side in a 600 mm wide switchboard panel.

  The flexibly mountable connections and installation options of the device enable a considerable amount of space to be saved in the switchboard. For example, due to the possibility of mounting the bar flat terminals directly on the front and the positioning the device on the rear in wall-mounted configuration, which is unusual for an air circuit breaker.

  The 3VA27 molded case circuit breakers provide a compact solution up to 1600 A. A spring charging motor and/or a metering function can optionally be integrated in the device.

- Highly modular design

  Components such as auxiliary releases, spring charging motors, electronic trip units, external current sensors, auxiliary circuit signaling switches, automatic reset devices, and interlocks can all be exchanged or retrofitted at a later stage, thus allowing the circuit breaker to be adapted to new, changing requirements.

- Retrofittable functions for electronic trip units (ETUs)

  Upgrading the electronic trip units is possible at any time. This is done simply by replacing the ETU. For example, the residual current protection (Rc) can be added by replacing the rating plug in the ETU660.

  Rating plugs, the metering function, and communication modules for the electronic trip units are available for fast and easy retrofitting and adaptation to changing requirements.

  Subsequent upgrading of the ETUs of the 3-series to the ETUs of the 6-series is possible.

- Flexible communication / metering function

  The use of modern communication-capable circuit breakers opens up completely new possibilities in terms of start-up, parameterization, diagnostics, plant transparency, maintenance and operation. This allows many different ways of reducing costs and improving productivity in industrial plants, buildings and infrastructure projects to be achieved:

  – Simultaneous use of up to two different bus systems, such as PROFIBUS, PROFINET, Modbus TCP, or Modbus RTU
  – Fast and reliable parameterization
  – Timely information and response can prevent plant stoppages
  – Effective diagnostics management
  – Measured values are the basis for efficient load management, for drawing up power demand profiles, and for allocating energy to cost centers
  – Preventive maintenance reduces the risk of expensive plant downtimes
  – Metering function with a wide range of measured values, such as current, voltage, energy, power
  – The metering function picked off inside the circuit breaker enables a small space requirement, reduced wiring work, savings on external voltage transformers, and therefore an additional cost reduction.

Applications

- As incoming feeder, distribution, coupling and outgoing feeder circuit breakers in electrical installations
- For switching and protecting motors, capacitors, generators, transformers, busbars, and cables.
- When connected to an electronic I&C system, the circuit breaker offers a wide range of options for monitoring network events.

2.6 Possible uses and portfolio

Possible uses

The circuit breaker performs the different protection tasks and can be used in the following areas:

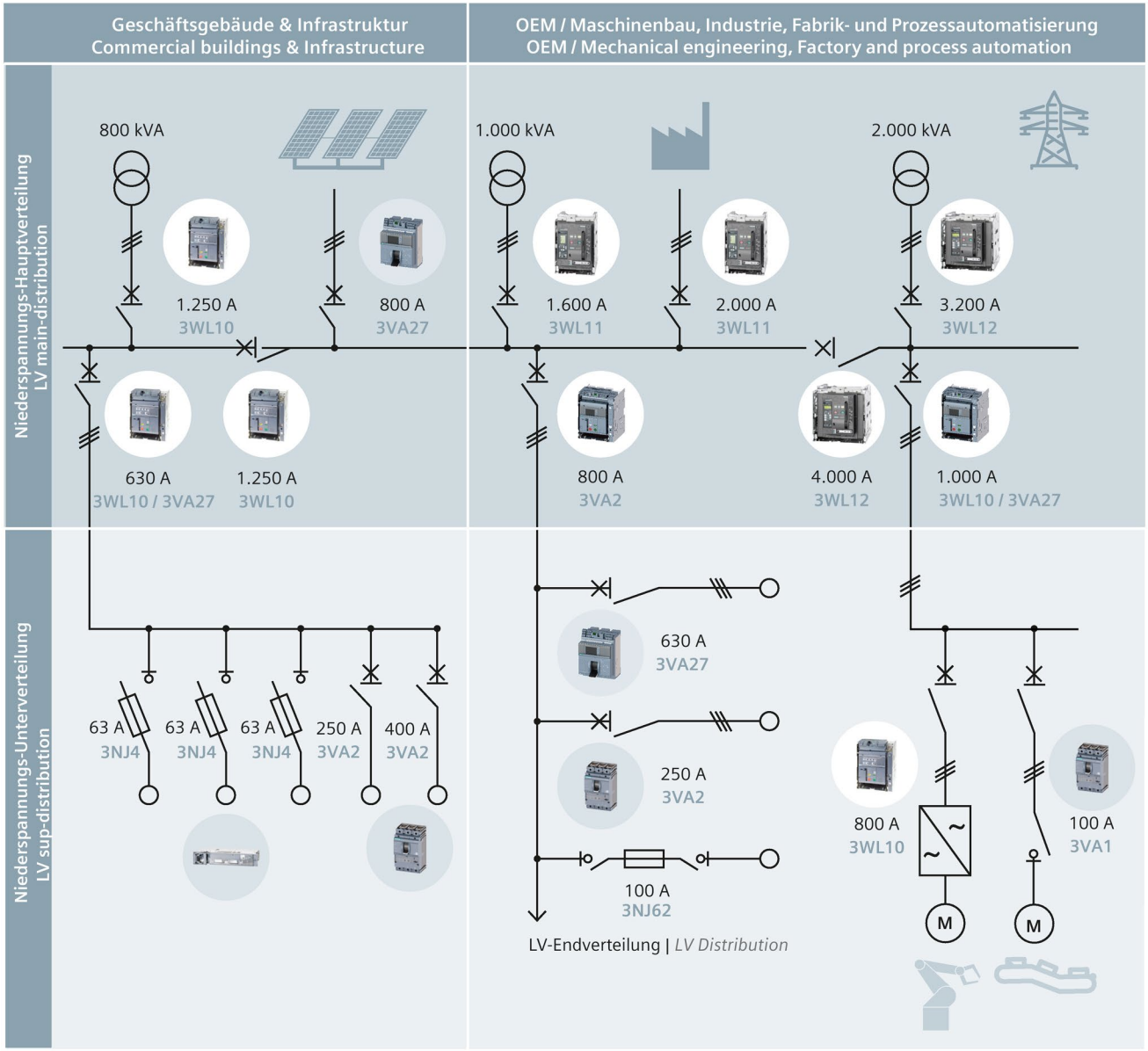
Field of application	**Building**			**Industry**	
Breaking capacity 3WL10: 42 to 66 kA / 3VA27: 55 to 110 kA					
Segments	Commercial buildings	Infrastructure	Industrial buildings	Functional enclosure	Production/ process automation
Examples	Office buildings, banks, hotels, cinemas, shopping malls, hospitals, universities, schools	Airports, train stations, sports stadiums, ports, exhibition sites	Industrial parks, warehouses, logistics centers	Paper industry, computer centers, oil & gas industry, foodstuffs industry	Presses, galvanizing lines, rolling mills, grinding mills, agitators and mixers, production lines

The circuit breaker is used for the following functions:

- Line protection
- Generator protection
- Motor protection
- High breaking capacity
  - 3WL10 air circuit breakers: Up to 66 kA
  - 3VA27 molded case circuit breakers: Up to 110 kA
- Selectivity, in particular, for high coordination requirements based on time, current, and energy discrimination.
- Communication
- As a version of a non-automatic air circuit breaker in accordance with IEC 60947-3

For this purpose, the focus is on the following applications of the circuit breaker:

- Main distribution board
- Industrial distribution systems
- Distribution for infrastructure applications (e.g. secondary substations)
- Applications in machine construction



2.6.1 Portfolio of 3WL10 air circuit breakers

The 3WL10 air circuit breaker is part of the Siemens 3WL range, which covers all breaking capacity classes between B and C and extends to 630 to 6300 A in the basic versions.

Class	I_{cu}(440V) [kA]				630	800	1000	1250	1600	2000	2500	3200	4000	5000	6300
	BG0	BG1	BG2	BG3	[A]										
C	-	-	130	150 3p										BG3	
H	-	85	100	100							BG2				
S	66	66	80	-					BG1						
N	55	55	66	-		BG0									
B	42	-	-	-											

FS Frame size

Frame size and breaking capacity classes

The 3WL10 air circuit breaker has size 0 and is suitable for:

- Rated currents between 630 A and 1250 A
- Rated voltages up to 690 V
- Breaking capacity I_{cu} of 42 kA, 55 kA, and 66 kA at 440 V AC

Selective response

With its contact system, the 3WL10 air circuit breaker is designed for time-selective time-delayed tripping.

- A short-circuit-induced trip can be delayed for up to 400 ms (short-time-delayed short-circuit protection ST).
- Between these, you have extensive possibilities for fine adjustment of the values, in respect of current response thresholds, delay times and for switching between characteristics, such as fixed delay time and inverse-time I^2t characteristic
- For maximum requirements, the instantaneous short-circuit protection (INST) can additionally be disabled to temporarily deactivate or increase the current response threshold of the short-circuit protection ST up to the I_{cw} value of the device. After this utilizable time and current limit has been exceeded, the circuit breaker instantaneously trips within 10 ms and interrupts the overcurrent within 30 ms.

These settings give downstream devices time to clear the fault in the feeder affected (time-selective response, thus ensuring maximum availability in the outgoing feeders).

On the other hand, a system can be protected specifically by optimization of the circuit breaker for fast response. In this case, it clears a lower-level fault within 30 ms, irrespective of any selective response.

2.6.2 Portfolio of 3VA27 molded case circuit breakers

The 3VA27 molded case circuit breaker is part of the Siemens 3VA portfolio that covers all applications from 16 A to 1600 A.

Selective response

Series 3VA2 circuit breakers are designed for selective tripping combined with optimum current limiting and a high breaking capacity.

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

- System-wide, high selectivity with a rated current differential of 1 : 2.5 up to the miniature circuit breaker
- Selectivity combined with effective current limiting and high breaking capacity
- Cost-effective design / configuring of selective power distribution systems

Technically these requirements of the molded case circuit breakers are met as follows:

- Dynamically opening contact system
- Coordinated electronic trip units

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

2.6.3 Electronic trip unit (ETU)

The circuit breaker provides two series of electronic trip units (ETUs): ETUs of the 3-series and ETUs of the 6-series.

To ensure the protection function of the device during operation at any time, all ETUs are powered via transformers in each of the main circuits.

The current sensor of the circuit breaker comprises an iron-core transformer for powering the ETU and a Rogowski coil for sensing the current to be able to detect operating states and fault conditions precisely in the operational current and overcurrent range. Each transformer can be optimized accordingly for its specific task. Thanks to the high accuracy of current measurement, the circuit breaker is suitable for power/energy measurement. In addition, fine adjustment of ground fault current monitoring is possible.

Depending on the type, the electronic trip units provide the following protection functions:

- Overload protection LT (Long Time)

  Adjustable in steps of 40% to 100% of the rated current I_n of the circuit breaker.
- Short-time-delayed short-circuit protection ST (Short Time)

  For time-selective response in case of a short-circuit
- Instantaneous short-circuit protection INST
- Protection against residual currents to ground GF (ground fault).

The electronic trip units of the 6-series also provide enhanced protection functions that can protect against directional power flows and power system anomalies affecting the voltage and frequency, and can provide additional information for energy management and communication functions:

- Metering functions
- Directional and enhanced protection functions (differentiation of power flow direction and detection of directional faults, e.g. in ring or meshed systems)
- Communication
- Flexible, local digital inputs and outputs, and an external function box
- Software commissioning support with powerconfig
- Testing and archiving with the TD410 or TD420 test devices and the powerconfig / powerservice software

2.6.4 3VA27 / 3WL10 for motor protection applications

Both the current-carrying 3WL10 and the current-limiting 3VA27 are suitable and can be used for motor protection.

First of all, the usability of both device classes is verified by checking the maximum short-circuit power of the transformer / generator.

The following must be considered: In the 3VA27, the molded case circuit breaker reduces the let-through currents above approx. 32 kA in case of a short-circuit, i.e. the load reaching downstream equipment, e.g. contactor and motor, is lowered (less thermal load, lower dynamic forces).

However, the 3VA27 also trips instantaneously above the max. I_i ($15xI_n$).

The 3WL10, however, is designed to prevent automatic lifting of the contacts above the max. I_i to avoid unwanted tripping of the device.

That makes it more robust against high inrush currents and false tripping on motor starting.

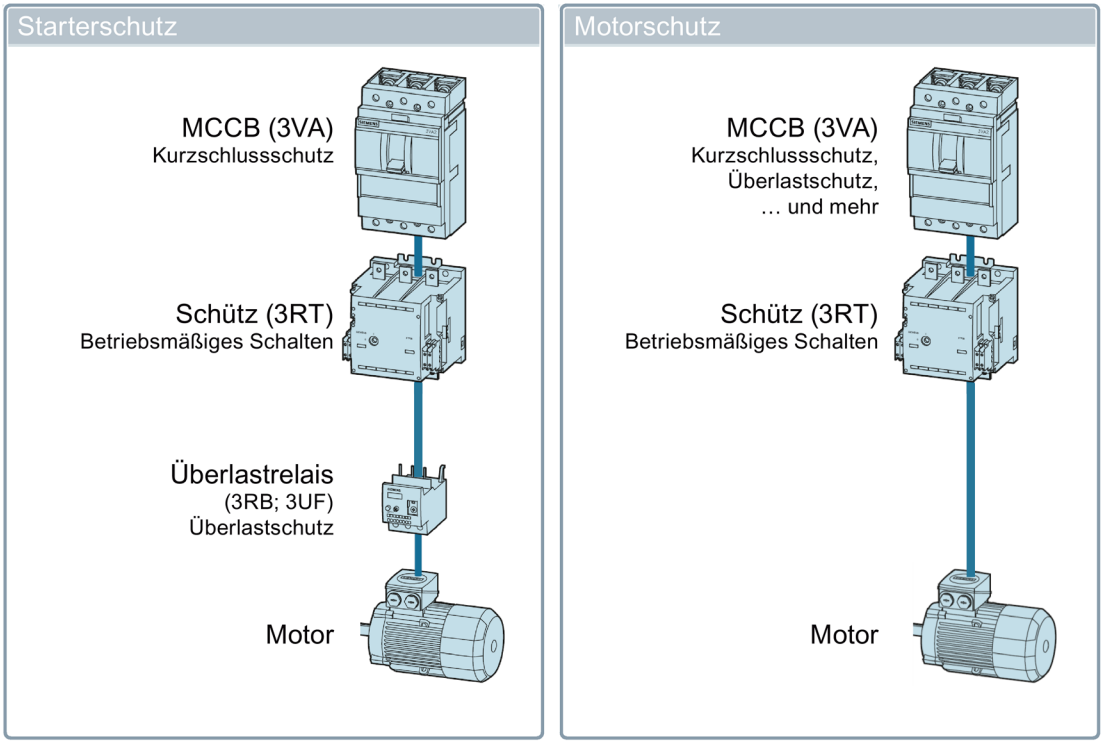
The starting function suspends the parameters set within the limits of the electronic trip unit ($<I_i$ max = $15xI_n$) equally on both devices to withstand certain starting characteristics (inrush / heavy starting) without unwanted tripping.

After the set active starting time during starting, the parameters are automatically set to the set values again.

The setting options on the electronic trip units (ETUs) are identical on 3VA27 molded case circuit breakers and 3WL10 air circuit breakers.

The main applications for motor protection are:

- The 3VA27 molded case circuit breaker or 3WL10 air circuit breaker as an MSP for starter combinations, also combined with soft starters or frequency converters
- The 3VA2 molded case circuit breaker or 3WL10 air circuit breaker as a motor starter protector



All 3VA27 molded case circuit breakers and 3WL10 air circuit breakers are suitable for use with IE3 motors and, in future, also with IE4 motors.

The 3VA27 molded case circuit breaker or 3WL10 air circuit breaker as an MSP for starter combinations

MSP for starter combinations with ETU320

- Use of the rating plug "L OFF" is not possible.

  The overload protection "L" is set to the maximum slow setting.

- The instantaneous short circuit protection is max. 15x I_n:

  This cannot be increased during the switch-on phase.

It is therefore suitable for combining with 3RW soft starters or frequency converters because they strongly limit the high inrush currents.

MSP for starter combinations with ETUs of the 6-series

- With use of the rating plug "L OFF".

  The overload protection is deactivated:

- Deactivation of the instantaneous short-circuit protection "S"

Short-time-delayed short-circuit protection		ETU650 LSI	ETU660 LSIG
S	Protection function can be enabled/disabled	•	

- Selection and parameterization of the setting options (current and time) for instantaneous short-circuit protection for the switch-on phase (inrush adaptation) according to the application.

Instantaneous short-circuit protection INST		ETU650 LSI	ETU660 LSIG
INST	Switchover to alternative operating values with instantaneous short-circuit current during the switch-on phase (inrush adaptation, start-up function)	• Default value: OFF Switch over to ON	
	Setting range for duration t during the switch-on phase	0.10 to 30 s (in steps of 0.01) Default value: 0.1	
	Setting range $I_i = I_n$ x … during the switch-on phase	1.5 to 15 (in steps of 0.1) Default value: 1.5	

Suitable for all motor starter combinations

The 3VA27 molded case circuit breaker or 3WL10 air circuit breaker as a motor starter protector

The ETUs of the 6-series can also be used for motor protection applications. For this purpose, these ETUs provide the following setting parameters for protecting motors:

- Deactivation of the instantaneous short-circuit protection "S"

Short-time-delayed short-circuit protection		ETU650 LSI	ETU660 LSIG
S	Protection function can be enabled/disabled	• Default value: OFF	

The short-time-delayed short-circuit protection is not required for motor protection applications because no discrimination is required for coordination with downstream circuit breakers.

- Selection and parameterization of the setting options (current and time) for instantaneous short-circuit protection for the switch-on phase (inrush adaptation) according to the application.

Instantaneous short-circuit protection INST		ETU650 LSI	ETU660 LSIG
INST	Switchover to alternative operating values with instantaneous short-circuit current during the switch-on phase (inrush adaptation, start-up function)	• Default value: OFF Switch over to ON	
	Setting range for duration t during the switch-on phase	0.10 to 30 s (in steps of 0.01) Default value: 0.1	
	Setting range $I_i = I_n$ x … during the switch-on phase	1.5 to 15 (in steps of 0.1) Default value: 1.5	

- Setting option phase unbalance I_{nba}

Phase unbalance		ETU650 LSI	ETU660 LSIG
I_{nba}	Protection function can be enabled/disabled	• Default value: OFF Switch over to ON	
	Setting range I_{nba} Phase current unbalance	2 to 90% (in steps of 1%) Default value: 50%	
	Setting range of the delay time t_{nba} for phase current unbalance	0.50 to 60 s (in steps of 0.5) Default value: 10 s	
	Enabling/disabling of tripping on phase current unbalance On "OFF", a message is output on the display or via the communication interface, but no tripping.	• Default value: OFF Switch over to ON	

- Setting the trip class T_c or the tripping time T_p

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

The trip classes with "E" stand for a narrower tolerance band of the tripping time T_p. These trip classes can also be implemented with the precise electronic trip units of the 3VA27 / 3WL10 motor starter protectors.

The trip class T_c itself cannot be set directly on the ETU. This can be calculated by conversion of the delay time t_r for the I^2t characteristic to the tripping time T_p.

Delay time to be set t_r:	**Corresponds to tripping time T_p**	**CLASS T_c**	**Range**
11.5 s	8 s	10A	2 s < T_p < 10 s
		10	4 s < T_p < 10 s
		10E	5 s < T_p < 10 s
24.5 s	17 s	20	6 s < T_p < 20 s
		20E	10 s < T_p < 20 s
36 s	25 s	30	9 s < T_p < 30 s
		30E	20 s < T_p < 30 s

The tripping time T_p for motor protection has its reference point at 7.2 x Ir while the delay time t_r for plant protection has the reference point at 6 x I_r. For this reason, the delay time t_r and tripping time T_p are not identical.

2.7 Basic unit

2.7.1 Product and mounting versions

Product versions of 3WL10 air circuit breakers

- Air circuit breaker with a stored energy operating mechanism
- Switch disconnector with a stored energy operating mechanism

Product versions of 3VA27 molded case circuit breakers

- Molded case circuit breaker acc. to IEC60947-2
- Non-automatic air circuit breaker acc. to IEC60947-3 and IEC60947-2 Annex L, CBI-Y

Operator versions of 3VA27 molded case circuit breakers:

- Toggle operating mechanism

  Conventional front operation of the circuit breaker via toggle, optionally expandable with manual operators (direct operators and door mounted rotary operators)

- Stored energy operating mechanism

  Front operation via a pushbutton with an integrated spring energy store, as for the air circuit breakers, for optional integration of spring charging motors that charge the spring energy store

Mounting versions of 3WL10 and 3VA27 circuit breakers

The following two mounting versions are available:

- Fixed-mounted

  In the case of fixed-mounted breakers, the circuit breaker is permanently installed in the switchboard panel.

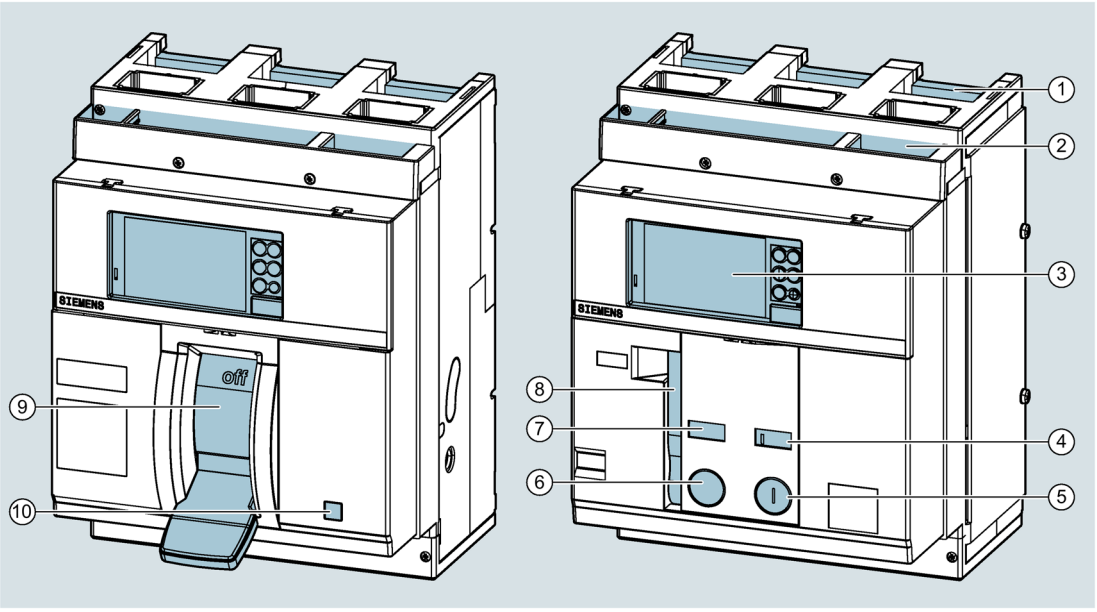
- Withdrawable

  The withdrawable breaker comprises a fixed part (guide frame) and a movable part (circuit breaker). This permits fast disconnection of the circuit breaker from the power system for quick replacement or for maintenance without disassembly work and thus ensures high availability of the installation.

2.7.2 Design of the circuit breaker

The circuit breaker contains the contacts (3 or 4 poles), the switching mechanism, and the internal accessories, comprising an operator and contact system and the internal accessories. Each of the poles is contained in a separate plastic enclosure and consists of the interrupting contact system and a current transformer.

Main components of the 3VA27 & 3WL10 circuit breakers

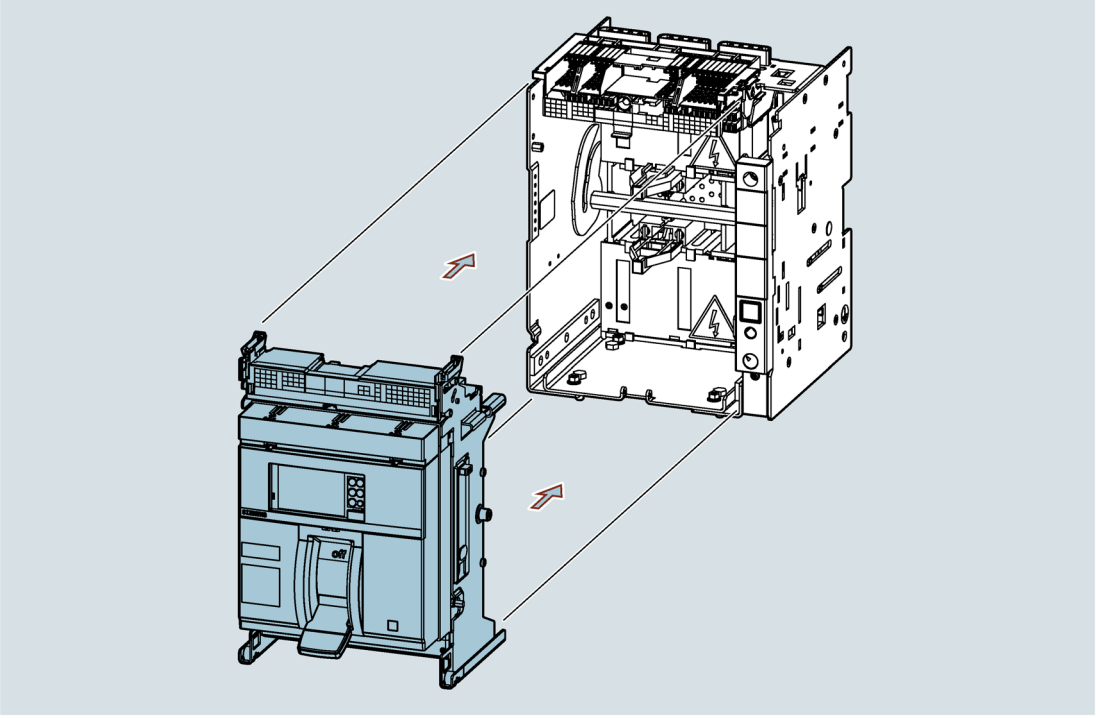


① Area with front / rear connections
② Auxiliary conductor terminal system
③ Electronic trip unit (ETU)
④ Switch position indicator contacts OPEN / CLOSED
⑤ "Mechanical ON" pushbutton
⑥ "Mechanical OFF" pushbutton
⑦ Status indicator of spring energy store CHARGED / DISCHARGED
⑧ Manual lever for charging the spring energy store
⑨ Toggle operating mechanism
⑩ PUSH TO TRIP: initiates a mechanical trip

2.7.3 Withdrawable breaker

The withdrawable version of the circuit breaker is not permanently mounted in the control panel. Instead a guide frame holding the circuit breaker is mounted in the control panel. The busbars and cables are connected to this guide frame. When the circuit breaker is inserted into the guide frame, the main circuit connection is established. In the retracted position, built-in shutters ensure safe touch protection of the main circuit connections.

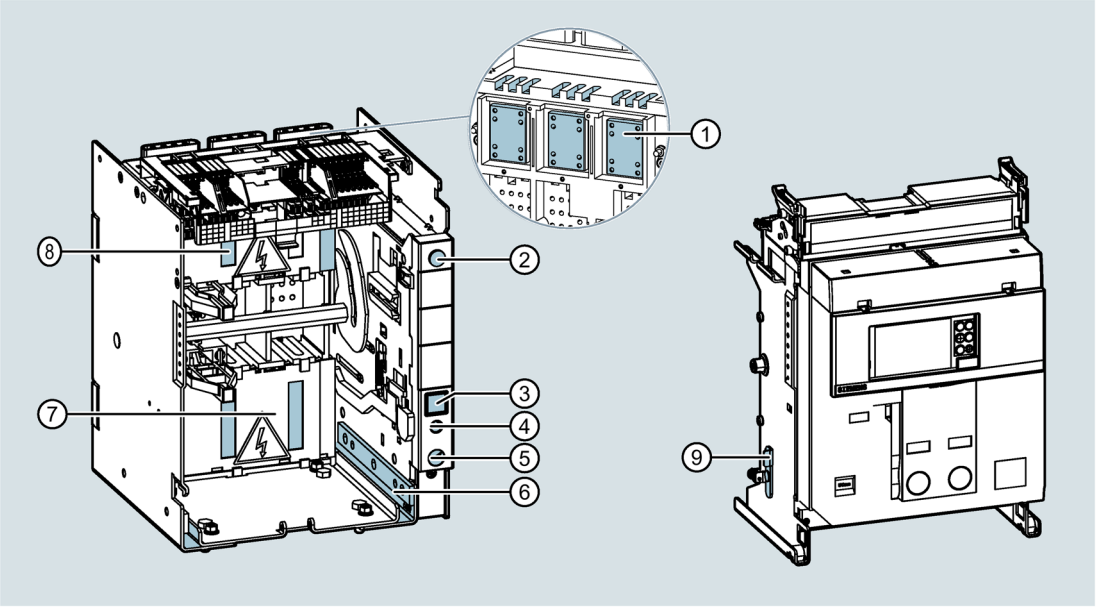
In this way, the circuit breaker can be removed from the guide frame without disassembly work and removed from the control panel if required.



The withdrawable breaker has the following advantages:

- Fast replacement of the circuit breaker for maintenance and service
- Simple establishment of visible galvanic disconnection in the main circuit
- Testing of the auxiliary circuits while the main circuit is open

Main components of the guide frame



① Mounting location of connection technology
② Racking handle
③ Pushbutton for unlocking racking (Push before Operating, to rack the circuit breaker positions using the racking handle)
④ Hole for inserting the racking handle
⑤ Circuit breaker position indicator
⑥ Racking rail
⑦ Lower shutter
⑧ Upper shutter
⑨ Locking lever

Circuit breaker positions in the guide frame

Using the racking handle, the circuit breaker can be put in three different positions in the guide frame:

- CONNECT:

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

- TEST:

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

- DISCON:

  The circuit breaker is not connected to the main circuit nor to the auxiliary circuit. In the DISCON (DISCONNECT) position, it can be removed from the guide frame.

The circuit breaker position is indicated below the hole for inserting the racking handle.

When the circuit breaker arrives at one of the positions during racking, it engages in this position. Further racking is then only possible once the pushbutton for unlocking racking (Push before Operating) has been pressed.

2.7.4 Technical overview

3WL10 circuit breakers

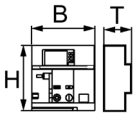
Number of poles				3, 4		
Rated operational current	I_n	40 °C	A	630, 800, 1000, 1250		
Rated operational voltage	U_e	AC (50/60 Hz)	V	Up to 690		
Rated insulation voltage	U_i	AC (50/60 Hz)	V	1000		
Rated impulse withstand voltage	U_{imp}		kV	12		
Current-carrying capacity of the neutral pole for 4-pole circuit breakers			% I_n	100		
Breaking capacity				B	N	S
Rated ultimate short-circuit breaking capacity AC	I_{cu}	415 / 440 V AC	kA	42	55	66
	I_{cu}	500 / 525 V AC	kA	42	50	50
	I_{cu}	690 V AC	kA	—	42	50
Rated service short-circuit breaking capacity AC	I_{cs}	415 / 440 V AC	kA	42	50	50
	I_{cs}	500 / 525 V AC	kA	42	50	50
	I_{cs}	690 V AC	kA	—	42	50
Rated short-circuit making capacity AC	I_{cm}	415 / 440 V AC	kA	88	121	145
	I_{cm}	500 / 525 V AC	kA	88	105	105
	I_{cm}	690 V AC	kA	—	88	105
Rated short-time withstand current	I_{cw}	1 s	kA	42	42	50
	I_{cw}	3 s	kA	24	24	36
Break time on opening		$I < I_{cw}$	ms	40		
		$I > I_{cw}$	ms	25		
Rated conditional short-circuit current of the non-automatic air circuit breakers	I_{cc}	500 / 690 V AC	kA	—	42	50
Utilization category		IEC 60947-2		B		
Disconnector feature				✓		
Reference standard				IEC 60947-2		
Trip unit (ETU)		3-series	LI	✓		
			LSI	✓		
			LSIG	✓		
		6-series	LSI	✓		
			LSIG	✓		

The use and installation of accessories does not adversely affect the life of the device.

Mechanical and electrical endurance with regular maintenance in accordance with the manufacturer's instructions:

Mechanical endurance		I_u	≤ 1000	1250
		Operating cycles x 1000	20	20
	Fre-quency	Operating cycles/h	60	60
Electrical endurance	440 V	Operating cycles x 1000	8	8
	690 V	Operating cycles x 1000	8	6.5
		Operating cycles/h	30	30

Dimensions and weight:

Dimensions 	Fixed-mounted breaker	H - with COM		mm	291
		H - without terminal cover, without COM		mm	268
		D		mm	183
		W	3-pole	mm	214[1)]
			4-pole	mm	284[1)]
	Withdrawable breaker	H		mm	363.5
		D		mm	271
		W	3-pole	mm	278
			4-pole	mm	348
Weight (with ETU and current sensor)	Fixed-mounted breaker		3-pole	kg	14
			4-pole	kg	16
	Withdrawable breaker		3-pole	kg	38
			4-pole	kg	43

[1)] including both side plates

3VA27 molded case circuit breakers

Poles				3, 4
Rated operational current			A	800, 1000, 1250, 1600
Rated operational voltage	U_e	AC (50—60 Hz)	V	690
Rated insulation voltage	U_i		V	1000
Rated impulse withstand voltage	U_{imp}		kV	8

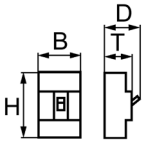
Breaking capacity

Breaking capacity class				M	H	C
Rated ultimate short-circuit breaking capacity	I_{cu}	220/230 V	kA	100	150	200
		380/400/415 V	kA	55	85	110
		440 V	kA	55	85	100
		500 V	kA	36	55	85
		690 V	kA	25	36	50
Rated service short-circuit breaking capacity	I_{cs}	220/230 V	kA	100	150	200
		380/400/415 V	kA	55	85	110
		440 V	kA	55	85	100
		500 V	kA	36	55	63
		690 V	kA	25	36	37
Rated short-circuit making capacity	I_{cm}	220/230 V	kA	220	330	440
		380/400/415 V	kA	121	187	242
		440 V	kA	121	187	220
		500 V	kA	75.6	121	187
		690 V	kA	52.5	75.6	105
Rated short-time withstand current	I_{cw}	1 s	kA	20		
Utilization category		IEC 60947-2		B		
Disconnector feature				●		
Reference standard				IEC 60947-2		
Trip unit (ETU)		3-series	LI	●		
			LSI	●		
			LSIG	●		
		6-series	LSI	●		
			LSIG	●		
Interchangeability of the ETUs				●		
Version				fixed, withdrawable		

Endurance

Mechanical endurance		No. of operating cycles	10,000
		Operating cycles/h	60
Electrical endurance	415V AC	No. of operating cycles	2,000
		Operating cycles/h	60
	690 V	No. of operating cycles	500

Dimensions

Dimensions of fixed-mounted version 	H - with COM		mm	291
	H - without terminal cover, without COM		mm	268
	D	Toggle operating mechanism	mm	171
		Stored energy spring mechanism	mm	183
	W	3-pole	mm	210
		4-pole	mm	280
	D		mm	225
Dimensions of withdrawable version	H		mm	363.5
	D	Toggle operating mechanism	mm	271
		Stored energy spring mechanism	mm	271
	W	3-pole	mm	278
		4-pole	mm	348
	D		mm	325

Weights

Weight	Fixed	3P manual	kg	9.7
		4P manual	kg	12.5
	Withdrawable	3P manual	kg	29.7
		4P manual	kg	39.6
	Fixed	3P motorizable	kg	11
		4P motorizable	kg	14
	Withdrawable	3P motorizable	kg	32
		4P motorizable	kg	42.6

Switch disconnectors

Switch disconnectors are devices that meet the insulation requirements of the standard IEC 60947-3 and IEC 60947-2 CBI-Y Annex L.

The switch disconnector has an identical design to the circuit breaker and has the same dimensions, weights, and optional accessories. However, it differs from the circuit breaker in that it does not have any protection functions and therefore no electronic trip unit (ETU) and no internal electronics or current transformer.

The disconnector ensures an insulation clearance between its main contacts in the open state that isolates all downstream parts of the installation.

If used with an external protection relay with a maximum delay time of 500 ms, the switch disconnector has a breaking capacity at the maximum rated operational voltage (U_e) that corresponds to the value of the one-second rated short-time current (I_{cw}). The "non-automatic air circuit breaker" is sometimes also called a load interrupter switch because it can switch overcurrents.

3WL10 non-automatic air circuit breakers

3WL10 non-automatic air circuit breakers are only available in classes N and S.

Number of poles				3, 4	
Rated operational voltage	U_e	AC (50/60 Hz)	V	690	
Rated insulation voltage	U_i	AC (50/60 Hz)	V	1000	
Rated impulse withstand voltage	U_{imp}		kV	12	
Isolating features				IEC 60947-3	
Current-carrying capacity of the neutral pole for 4-pole non-automatic circuit breakers			% I_n	100	
Breaking capacity				N	S
Rated uninterrupted current (at 40 °C)	I_u	AC (50/60 Hz)	A	630	630
	I_u	AC (50/60 Hz)	A	800	800
	I_u	AC (50/60 Hz)	A	1000	1000
	I_u	AC (50/60 Hz)	A	1250	1250
Rated short-circuit making capacity up to 690 V	I_{cm}	disconnector only	kA	88	105
		with upstream ACB air circuit breaker	kA	145	145
Rated short-time withstand current	I_{cw}	1 s	kA	42	50
	I_{cw}	3 s	kA	24	36
Utilization category (according to IEC 60947-3)				AC-23A	AC-23A
Rated conditional short-circuit current up to 690 V	I_{cc}		kA	42	50

3VA27 non-automatic air circuit breakers

The 3VA27 non-automatic air circuit breaker is offered in class M.

Number of poles				3, 4			
Conventional thermal current	I_{th}		A	800	1000	1250	1600
Rated operational current	AC22	I_e	A	800	1000	1250	1600
	AC23	I_e	A	800	1000	1250	1250
Rated operational voltage	U_e	AC (50-60 Hz)	V	690			
		DC	V	750			
Rated insulation voltage	U_i		V	1000			
Rated impulse withstand voltage	U_{imp}		kV	8			
Rated short-circuit making capacity	I_{cm}	disconnector only	kA	40			
		with up-stream circuit breaker	kA	440			
Rated short-time current	I_{cw}	1 sec	kA	20			
Reference standard				IEC 60947-3			

Endurance

Mechanical endurance		No. of operating cycles	10,000
		Operating cycles/h	60
Electrical endurance	415 V AC	No. of operating cycles	2000
	690 V AC	Operating cycles/h	500

Dimensions and weights

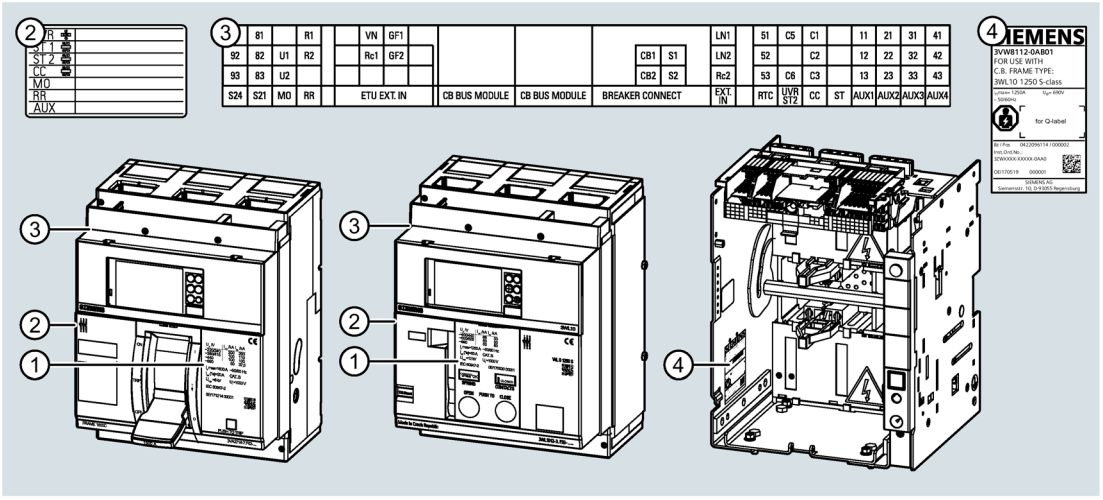
Dimensions of fixed-mounted breaker		3-pole	W	mm	210
		4-pole	W	mm	280
			T (toggle operating mechanism)	mm	225
			T (stored energy operating mechanism)	mm	183
			H	mm	296
Weight	Toggle operating mechanism	Fixed-mounted breaker	3P	kg	9.7
			4P	kg	12.5
		Withdrawable breaker	3P	kg	29.7
			4P	kg	39.6
	Stored energy operating mechanism	Fixed-mounted breaker	3P	kg	11
			4P	kg	14
		Withdrawable breaker	3P	kg	32
			4P	kg	42.6

2.7.5 Circuit breaker identification

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

Circuit breaker labeling

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

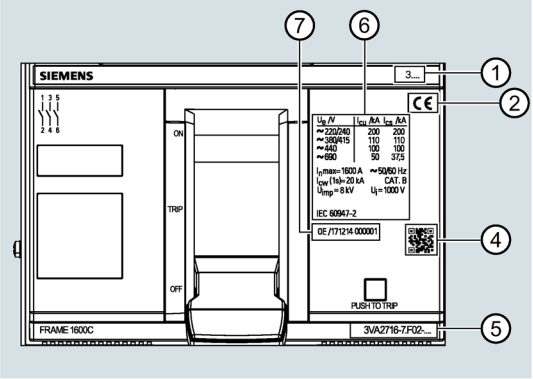


① Key electrical data
② Label for installed internal accessories
③ Label of circuit breaker data
④ Label for guide frame

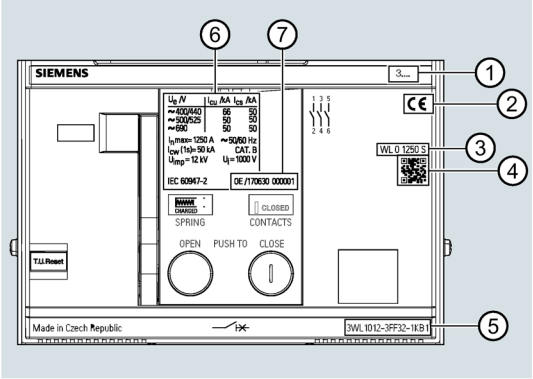
Front panel: Inscription

The following data are stated on the front of the circuit breaker:

Breaker with toggle operating mechanism



Breaker with stored energy operating mechanism



① Designation of the circuit breaker
② Approvals
③ Size and breaking capacity class
④ Knowledge Manager (see below)
⑤ Article number
⑥ Key electrical data (see below)
⑦ ID number

Knowledge Manager

A QR code is attached in a clearly visible location to every circuit breaker. This code can be scanned with a smartphone or a tablet PC. A data sheet of the product is provided in this way. This does not include the accessories. The accessories are stated on the label on the side of the circuit breaker. For the full range of QR code functions, use the "Industry Support" app supplied free of charge by Siemens.

App Store (https://itunes.apple.com/de/app/siemens-industry-online-support/id478868966?mt=8)

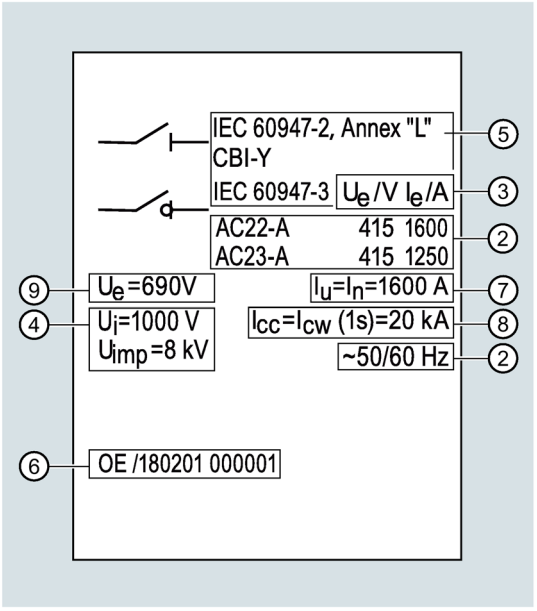
Google Play (https://play.google.com/store/apps/details?id=com.siemens.industry.onlinesupport&hl=en)

Windows Phone Store (http://www.windowsphone.com/en-en/store/app/online-support/014eed14-ce40-451e-9da9-680ecab46523)

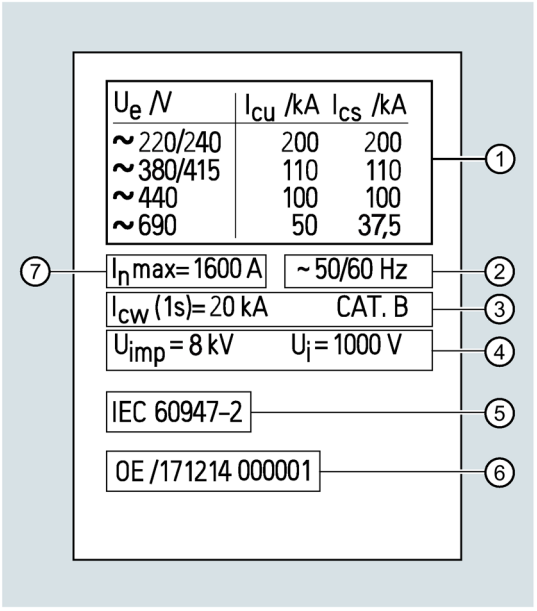
Key electrical data

The key electrical data label on the circuit breaker displays the following information:

Non-automatic air circuit breaker



Circuit breaker



① IEC breaking capacity values at various voltages
② Frequency
③ Utilization category
④ Insulation data
⑤ Supported standards
⑥ Production site / identification number
⑦ Maximum rated operational current
⑧ I_{cw}: Rated short-time withstand current
I_{cc}: Rated conditional short-circuit current
⑨ Rated operational voltage

Label for installed internal accessories

You can make a note of the number of installed accessories on the internal accessories label. Accessories that have been pre-installed in the factory are already listed here.

This tells you which accessories are installed without the need to open the circuit breaker. You can use this information, for example, to reorder components.

The presence of a metering function can also be seen here by the side of the main contacts on which the voltage tap is located. (above/below or on the incoming/outgoing side)

Label of circuit breaker data

A label is affixed to the left-hand side of the circuit breaker that provides an overview of the most important data of the circuit breaker.

Label for guide frame

A label is affixed to the left-hand inside of the guide frame that provides an overview again of the most important data of the guide frame.

The article number of the guide frame is stated separately on its label even if it is part of the withdrawable breaker version.

2.8 Electronic trip unit ETU

As a protection device, the circuit breaker has the task of protecting installations and clearing electrical faults occurring in the system. A trip unit detects whether a fault occurs by comparing the protection parameters set in it with the measured values. The circuit breaker has microprocessor-controlled trip units.

The tripping characteristic can be adjusted to the required values with numerous possible settings.

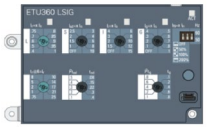
Selective tripping and instantaneous release

On short-circuits in the medium current range, selective tripping (ST) is ensured. On short-circuits with a larger current and high arc energy in the arc chute, an instantaneous release (INST) responds and interrupts the overcurrent immediately (< 30 ms).

One ETU for two versions of the current-limiting (3VA27) and current-carrying (3WL10) contact system

The kinematic behavior of the two contact systems (ACB/MCCB) of this platform device only diverges above the maximum settable operating value of the instantaneous short-circuit release (INST). For this reason, it is possible to use the identical ETU (ETU of the 3-series and ETU of the 6-series) for both versions.

2.8.1 Description of functions

Protection	Electronic ETUs of the 3-series	Electronic with display ETUs of the 6-series
Trip units	 ETU320, ETU350, ETU360 Line / generator protection	 ETU650, ETU660 Line / generator / motor protection
Parameter assignment	Setting parameters with rotary coding switch	• Setting the parameters with push-buttons and reading them off the display and communication • Fine adjustment of the parameters • Reading off the measured values
Enhanced protection function	—	• 2nd parameter set (set A/B) • Making current release (MCR) • DAS - Arc-fault-mitigation • Ground fault protection in the star point • Phase unbalance • Further functions in conjunction with metering function Advanced, which include the voltage, the directions of power flow in the protection architecture or can detect residual currents more precisely
Communication	—	Optional
Metering function	—	Optional

Two individual series of electronic trip units

ETU, 3-series

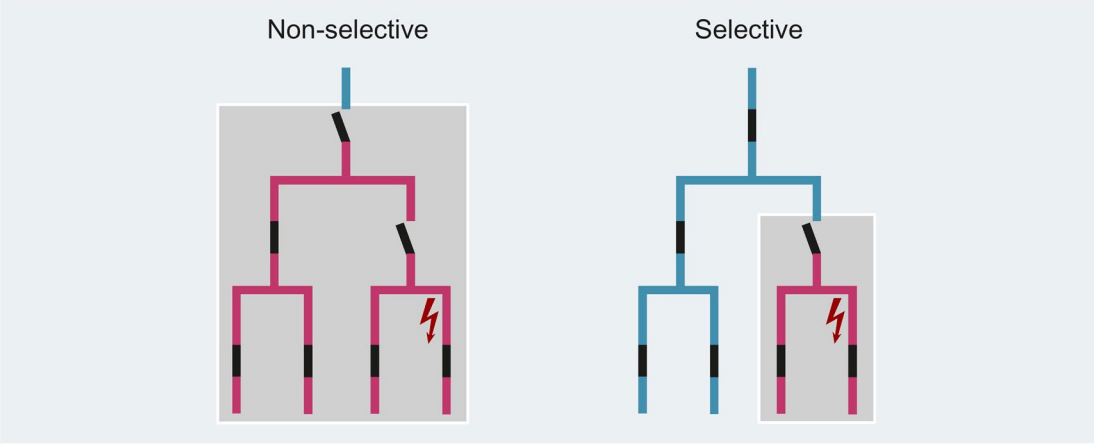
- LI, LSI, LSIG protection function
- Adjustable neutral protection
- Rotary coding switch in 3VA design
- Tripping characteristics with selective design for the 3WL and 3VA family
- Operation in the temperature range from -25 °C to +70 °C

ETU, 6-series

- LI, LSI, LSIG protection function
- Adjustable neutral protection
- Display and modularly expandable functionality
- Fine adjustment for increased selectivity requirements
- Communication-capable
- Metering function (Basic & Advanced)
- Enhanced protection functions for tailored applications & specific network requirements
- Residual current protection
- Ground fault protection in the star point
- Interactive I/O functionalities
- Operation in the temperature range from -25 °C to +70 °C

2.8.2 Selectivity

Switching devices connected in series, e.g. circuit breakers and fuses, can work together in a selective or discriminating manner to ensure graded tripping in the event of a fault. The upstream switching device closest to the fault must trip in the event of a short-circuit. The other switching devices in the circuit remain closed. This minimizes the effects of a fault in terms of its duration (selectivity) and the area affected.



Short-circuit location

Selectivity tables for the 3WL10 are available on the Internet for simple implementation of selective trip combinations (see Selectivity tables (https://support.industry.siemens.com/cs/ww/en/view/109748621)).

The parameters relevant to selectivity are:

- Tripping value settings of the trip unit
- Tripping and break times
- Let-through current values
- Modes of switching of the relevant circuit breakers
  - Zero-current interrupter (3WL10)
  - Current limiter (3VA27)

Selectivity with 3WL10 air circuit breakers

The 3WL10 circuit breaker is designed for selective (discriminating) tripping behavior in conjunction with both high breaking capacity and high current-carrying capacity.

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

- Current selectivity

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

  If the short-circuit currents differ sufficiently at the points where two circuit breakers are mounted, the instantaneous short-circuit releases can normally be set such that if a short-circuit occurs behind one of the circuit breakers as seen from the other circuit breaker, only the circuit breaker nearest to the fault will trip.

  If the short-circuit currents are approximately the same at the points where the circuit breakers are mounted, the time grading of the operating currents of the short-circuit releases only enables selectivity up to a specific short-circuit current.

- Time selectivity (strong characteristic of the 3WL10 air circuit breaker)

  Up to the operating values of the instantaneous short-circuit releases, selectivity can be achieved by time selectivity. To achieve this, the upstream circuit breaker requires a time delay provided by a time-delayed short-circuit release so that, in the event of a fault, only the circuit breaker closest to the fault location has time to disconnect the part of the installation with the fault from the power system.

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

You will find more information in the manual on selectivity (see Reference documents (Page 10)).

Selectivity with 3VA27 molded case circuit breakers

The 3VA27 circuit breaker is designed for selective (discriminating) tripping behavior in conjunction with both high breaking capacity and high current limitation.

Energy selectivity and dynamic selectivity

For energy selectivity and dynamic selectivity, the tested devices are graded toward the end load as follows:

The arising short-circuit energy and the current rise in case of a fault ensure that the contact of the switching device directly upstream of the fault location open fastest, already within the first half cycle, limiting and finally quenching the current. The other upstream protection devices in the chain with the fault are set to a much slower response by the contact system. For this reason, these devices, which may also be current-limiting, do not trip.

Summary: It is possible and quite common to combine these selectivity principles.

For protection requirements that apply more to the higher level and parts of the circuit near to a transformer, devices must be selected that are better capable of time selectivity on a short-circuit - i.e. use of a 3WL10.

For protection requirements applying to the outgoing side and parts of the circuit near to the final load, devices are selected that are better at energy selectivity - i.e. use of a 3VA27.

In addition to short-circuit considerations, complete coordination of the current selectivity throughout the chain is an important part of the configuration, especially in the overload range.

This makes the power distribution system totally selective. Siemens protection devices are designed for optimum coordination in order to achieve just that.

As an interface between characteristics of a molded case circuit breaker and an air circuit breaker, the 3WL10 and 3VA27 platform product was designed.

For optimum configuration, the Simaris software tools Simaris curves, powerconfig and selectivity tables (see Chapter Reference documents (Page 10)) can be used.

You will find more information in the manual on selectivity, see Chapter Reference documents (Page 10).

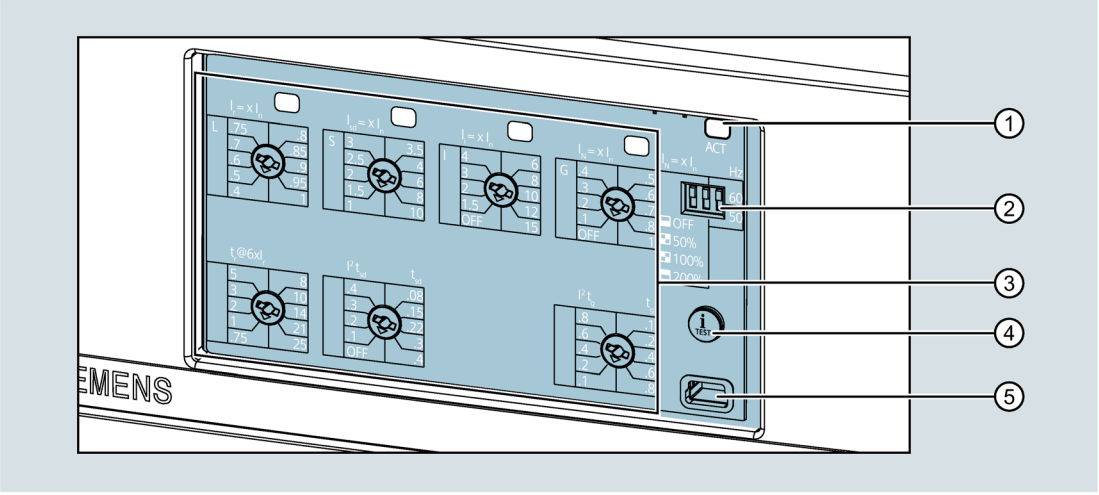
See also

Characteristic curves (Page 66)

2.8.3 Design of the electronic trip units

2.8.3.1 Electronic trip units of the 3-series

The following figure shows the maximum possible equipment of an ETU of the 3-series. Depending on the ETU used, the number of rotary coding switches and LEDs can vary.



① Active LED ACT
② DIP switch
③ Rotary coding switch with LED
④ Test and info button
⑤ Connection socket for test devices TD310, TD410, and TD420

See also

Entering parameters (Page 197)

Alarms (Page 203)

Display elements (ETUs of the 3-series)

ETU readiness can be indicated via the LED ACT.

Alarms and trips are indicated via the LEDs in the area of the rotary coding switches.

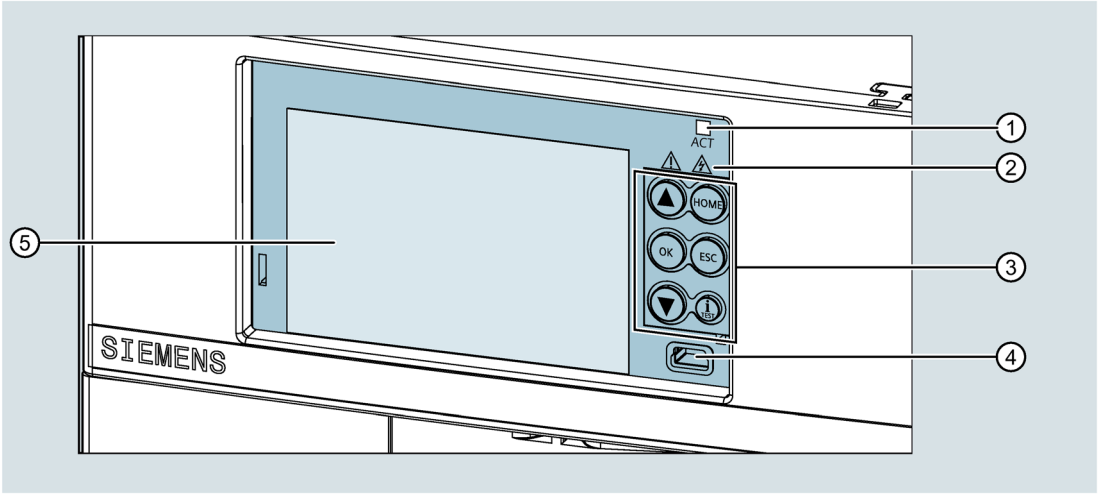
You will find the precise description and meaning of the LED states in Chapter Alarms (Page 203).

Operating elements (ETUs of the 3-series)

The electronic trip units of the 3-series are equipped with rotary coding and DIP switches.

- DIP switches: Setting the neutral protection and the line frequency
- Rotary coding switch: Parameterizing the protection functions
- Test and info button: Enables test tripping in conjunction with a test device or with another power source. Also display of the last reason for tripping after a fault by lighting up the LED for this purpose.
  This is enabled by a button cell inside the ETU without any external power supply.

2.8.3.2 Electronic trip units of the 6-series



① Active LED ACT
② Warning displays
③ Operating keys, including test and info button
④ Connection socket for test devices TD310, TD410, and TD420
⑤ Display (LCD)

Operation of the menu functions is described in Chapter Entering parameters (Page 197).

See also

Menu structure of the ETUs of the 6-series (Page 272)

Alarms (Page 203)

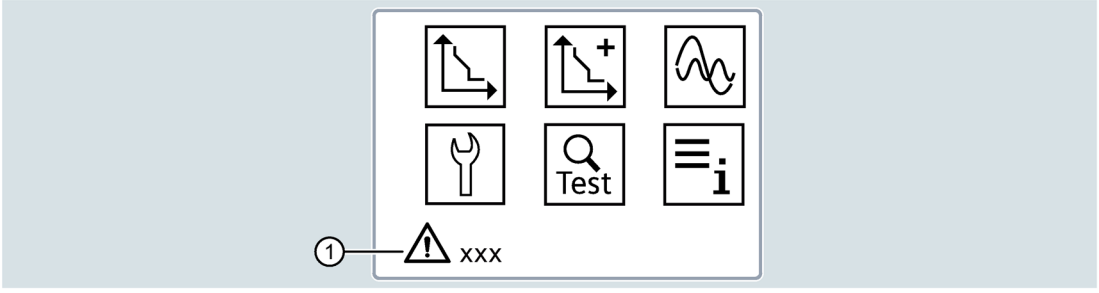
Display elements (ETUs of the 6-series)

The central visualization element of the ETU of the 6-series is the display. Alongside this, an LED and warning displays are used:

- LED ACT: ETU ready indicator
- Warning displays: See Chapter Alarms (Page 203)
- Test and info button: Enables test tripping in conjunction with a test device or with another power source and indication of the last reason for tripping after a fault by short activation of the display. This is enabled by a button cell inside the ETU without any external power supply.

Menus and menu structure (ETUs of the 6-series)

The display shows the main menu on the start screen:



① Display of information, faults, and warnings

The symbols stand for the following areas:

Symbol	Menu	Symbol	Menu	Symbol	Menu
	Protection functions		Enhanced protection functions		Metering functions
	Settings		Test functions		Information

Some menu areas contain multiple levels.

You will find the entire menu structure in the Annex, Chapter Menu structure of the ETUs of the 6-series (Page 272).

Operating elements (ETUs of the 6-series)

Navigation in the menus and input of protection parameters, settings, etc. are performed with the control keys:

Control key	Meaning
	Switches between the main menu symbols. Goes back to the previous screen page. Increases a parameter in parameter edit mode.
	Goes to the selected menu level. Confirms a parameter in parameter edit mode.
	Switches between the main menu symbols. Goes to the next screen. Decreases a parameter in parameter display mode.
	Returns to the start screen.
	Cancels the operation. Jumps one menu level up.
	Shows the cause of a trip. Tests the readiness of the ETU and can perform test tripping as a function test.

2.8.4 Characteristics of the ETU

The electronic trip units are suitable for all common distribution board systems, protect any power distribution system from overcurrents, and have settable overload and short-circuit releases. Depending on the type, the ETU can monitor the energy consumption and signal anomalies via alarms.
The modular expandable functions of the ETUs of the 6-series can replace external devices, such as voltage transformers and measuring devices for efficient load management and power monitoring in one compact device and therefore reduce costs and engineering work.

The electronic trip units of the 6-series can be replaced with a metering module and sense anomalies such as transient interruptions and voltage spikes, and run network analyses. The protection functions can be specifically adapted to the circumstances of the installation with these expanded options and therefore ensure optimum protection. Directional quantities that depend on the direction of power flow can also be included in measurement and protection. With the electronic trip units of the 6-series, the circuit breaker can also be integrated into communication networks.

Protection functions

Protection functions of the electronic trip units		ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
		Rotary coding switch			Display (LCD)	
Protection functions						
	Overload protection (LT)	●	●	●	●	●
	Short-time-delayed short-circuit protection (ST)	—	●	●	●	●
	Instantaneous short-circuit protection (INST)	●	●	●	●	●
	Neutral protection (N)	●	●	●	●	●
	Ground-fault protection (GF)	—	—	●	—	●
Enhanced protection functions						
	Making current release (MCR)[1]	—	—	—	●	●
	Current unbalance protection (I-NBA)	—	—	—	●	●
	DAS protection - arc fault mitigation mode	—	—	—	●	●
	Ground fault return (G_{ret})[1]	—	—	—	—	●
	2nd parameter set (set A/B)	—	—	—	●	●
					With metering function MF Advanced	
	Residual current protection (Rc)	—	—	—	—	●[2]
	Direct short-time protection (DST)	—	—	—	●	●
	Voltage unbalance protection (V-NBA)	—	—	—	●	●
	Undervoltage protection (V_u)	—	—	—	●	●
	Overvoltage protection (V_o)	—	—	—	●	●
	Underfrequency protection (f_u)	—	—	—	●	●
	Overfrequency protection (f_o)	—	—	—	●	●
	Reverse active power protection (RP)	—	—	—	●	●
	Phase sequence check L1-L3	—	—	—	●	●
	COS PHI protection (alarm/trip)	—	—	—	●	●

1) Breaker Connect module required for auxiliary power supply
2) Summation current transformer (Rc CT) and rating plug (Rc) required to permit the protection function

Metering functions - acc. to IEC 61557-12		ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
		Rotary coding switch			Display (LCD)	
					With metering function MF Advanced	
	Voltage L-L and L-N	—	—	—	●	●
	Power: active, reactive, apparent	—	—	—	●	●
	Energy counter: Active, reactive, apparent energy	—	—	—	●	●
	Frequency	—	—	—	●	●
	Power factor (p.f.)	—	—	—	●	●
	Peak factor	—	—	—	●	●

Communication, input and output modules		ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
		Rotary coding switch			Display (LCD)	
					With Breaker Connect module	
	COM040 (PROFIBUS)	—	—	—	●	●
	COM041 (PROFINET)	—	—	—	●	●
	COM042 (Modbus RTU)	—	—	—	●	●
	COM043 (Modbus TCP)	—	—	—	●	●
	IOM040 configurable, digital I/O module	—	—	—	●	●
	IOM300 configurable, digital I/O module	●	●	●	●	●
	Enabled functionalities					
	Energy monitoring and management	—	—	—	with COM + MF	with COM + MF
	Remote parameterization	—	—	—	with COM	with COM
	Remote switching and control (synchronization)	—	—	—	with COM[3)]	with COM[3)]
	Possible connections of internal and external input and output modules for interaction with the control panel environment	with IOM300	with IOM300	with IOM300	with IOM	with IOM

[3)] Actuator module COM ACT forwards the command to the closing coil (CC) or shunt release (ST)

Additional functions		ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
		Rotary coding switch			Display (LCD)	
Test	Display of alarms and trip log memory in OFF status of the circuit breaker and the ETU	With LED signal			On the display (LCD)	
	With test device TD420 on ETU front interface					
	Data log with internal high resolution memory	—	—	—	●	●
	Enhanced testing and analysis of protection functions	●	●	●	●	●
	With gateway device TD410/TD420 on ETU front interface					
	Read/write maintenance info, contact wear, history, time	●	●	●	● (&LCD &COM)	● (&LCD &COM)
	Record of a measuring interval memory and min/max registers (in ETU)	●	●	●	● (&LCD &COM)	● (&LCD &COM)
	Diagnostic report	●	●	●	●	●
	Enhanced settings	TD410 / TD420			TD410 / TD420 or LCD	
	Watchdog: steady electronics or maglatch or CT failure surveillance: trip enable	●	●	●	●	●
	Overtemperature: trip enable	●	●	●	●	●
	Thermal memory disable	—	—	—	●	●
	LT protection disable	—	—	—	●[4)]	●[4)]
	Pre-alarm threshold PAL - function trigger on x I_n/I_r	—	—	—	●	●
	Software-guided parameterization (powerconfig)	—	—	—	●	●
	I^4t overload characteristic & INST = OFF setting for highly selective applications	—	—	—	●	●

[4)] L = OFF type of rating plug required to be able to switch off the protection function LT

Description of the protection functions

Overload protection (LT)

The overload protection of the ETUs of the 3 and 6-series is inverse-time long-time-delayed and has an I^2t characteristic by default. On electronic trip units of the 6-series, the characteristics can be adapted to characteristics acc. to IEC 60255 to meet increased or special requirements, for example, to produce a I^4t characteristic. In this way, improved discrimination with respect to fuses or upstream protection devices, such as medium-voltage protection devices, can be achieved.

I_r denotes the overcurrent setting value and t_r the associated time delay. The time delay for the overcurrent trip is defined as 6 times the value of the current setting I_r at the reference point in the same way as the other size devices of the 3WL portfolio. The minimum tripping time is limited to 500 ms.

A pre-alarm is also output when 90% of the set current setting I_r is reached. This pre-alarm can be modified on all trip units.

Short-time-delayed short-circuit protection (ST)

The ST function of the trip unit can be used to implement time-selective, short-time-delay, short-circuit tripping in low-voltage systems in which a number of circuit breakers are installed in series.

The short-time-delayed short-circuit protection responds when a short-circuit current in at least one of the conductors to be protected exceeds the set tripping current I_{sd} for the duration of the set delay time t_{sd}.

The ST release provides characteristics with inverse-time curve I^2t or a time delay with a definite-time tripping characteristic (t_{sd} = const.). It can also be disabled.

Instantaneous short-circuit protection (INST)

The instantaneous short-circuit protection (INST) is a protection function that opens the circuit breaker on a short-circuit immediately, without a time delay. It responds when a short-circuit current in at least one of the conductors to be protected exceeds the set tripping current I_i.

It can optionally be disabled in each trip unit to meet increased requirements for discrimination. Due to this, the short-time-delayed short-circuit protection remains active with its set delay time up to the I_{cw} value of the circuit breaker. The MCR function is an alternative to this setting that disables the instantaneous short-circuit protection automatically a certain time after the circuit breaker has been closed.

Neutral protection (N)

Neutral protection is included in all types of ETU as standard and protects the neutral conductor from overloads and short-circuits. As the trip condition, it uses the same setting values as the protection functions LT, ST, INST of the three phases, but its sensitivity can be scaled from 50% to 200% depending on the design of the conductor. In every 4-pole circuit breaker, the neutral conductor is protected via the current transformer on the fourth pole that is always incorporated or, in 3-pole circuit breakers, via an externally connected neutral conductor CT.

It is also possible to disable neutral protection.

Ground-fault protection (GF)

The GF release detects residual currents between the conductors and grounded, electrically conductive parts of the installation. The ground-fault protection function responds if the ground fault current exceeds the set tripping current I_g for the set delay time t_g.

Ground-fault protection can be implemented as a definite-time (t_g = constant) and as an inverse-time function (I^2t).

On 4-pole and 3-pole circuit breakers with an external current transformer for the neutral conductor, the GF release calculates the vector sum of the currents of the three phases and the neutral conductor. The difference between this sum and zero describes the ground fault and tripping occurs, defined by the setting current I_g and the delay time t_g. The possible responses are to disable the protection or just to output alarms.

Ground fault residual current protection (Rc)

Residual currents from 3 A to 30 A can be measured directly with an external summation current transformer and evaluated by the ETU660 (LSIG), which is additionally equipped with a rating plug Rc for residual current protection and the metering function MF Advanced. Direct measurement of ground faults with a summation current transformer is an alternative to the calculated ground-fault protection method of the GF protection function.

Ground fault return (G_{ret})

Currents in the grounding conductor of the transformer star point can be directly measured with high accuracy using an external toroidal-core transformer and evaluated with the ETU660 (LSIG). Direct measurement of ground faults with a toroidal-core transformer is an alternative to the vector sum calculation of the GF protection function. The ETU requires an external power supply for the function (e.g. Breaker Connect module or MF Advanced metering module)

Monitoring of the switch-on phase (start-up inrush adaptation)

Using this function it is possible to individually adapt the operating value of the protection functions ST, INST, and GF toward higher thresholds over a certain time and thus to make them less sensitive. During the switch-on and starting phase, for example, of motors with high inrush currents or during heavy starting, and also for transformers or lamps, this can prevent undesired false tripping of the circuit breaker.

The duration in which this monitoring and the alternative, individually set values for ST, INST, and GF are active can vary between 100 ms and 30 s. After this, the parameters are reset to their default protection settings defined for normal operation.

In a self-powered ETU, monitoring of the switch-on phase and activation of the alternative protection parameters are started every time the circuit breaker closes.

In an externally powered ETU, you define an activation threshold between 0.1 and 10 x I_n. Startup is possible again whenever the peak value of the phase with the largest current falls below this threshold. If this threshold is then crossed as the current rises, the new monitoring is automatically started again.

DAS - Arc fault mitigation

The DAS function provides a way of defining a reduced, alternative operating value of the instantaneous short-circuit protection (INST), but otherwise it behaves in the same way.

This function is advantageous if you want to reduce the operating value of the instantaneous short-circuit protection automatically and immediately with an external command or input to provide a certain level of protection for persons and/or equipment, for example, during maintenance work and on unauthorized access to the switchroom or opening of the control panel door. This can reduce the arc energy released in the event of a fault.

As soon as the command is changed and the input signal is canceled, the parameters for instantaneous short circuit protection are reset back to their default protection settings defined for normal operation.

There are different ways of activating the DAS function:

- Locally, on the display of the ETU of the 6-series
- Via communication
- By input at the digital I/O module IOM040 or IOM300, which was triggered by an external signal
- By input at the digital I/O module IOM040 or IOM300, which was triggered by an internal signal, for example, the pre-alarm response thresholds (PAL)
- Automatically after a defined delay time, after the circuit breaker has been closed.

MCR - making current release

Statistically, most short-circuits and faults occur when the power distribution is connected or reconnected after commissioning or maintenance (connection to existing short-circuit).

The making current release (MCR) for early detection of short-circuits increases short-circuit protection at the moment the circuit breaker is closed by enabling definition of individual operating currents and faster break times. For this, the ETU requires an external power supply.

The MCR protection function is based on the behavior of the instantaneous short-circuit protection (INST) and can be used as an alternative to it. This means that, when this function is activated, the INST is disabled, which is indicated by a message on the display of the ETU.

A time is also defined within which the MCR protection will remain active after closure. After this time, the function, and therefore also instantaneous short-circuit protection, is automatically deactivated. Unless it is activated in another way, only ST protection is then still active after the switch-on phase in normal operation of the installation to achieve optimum selectivity.

Current unbalance I-NBA

The current unbalance protection function provides protection from undesired unbalance of the current between the phases and load unbalances in the distribution and at the load. It can open the circuit breaker with a constant, definable delay time $t_{nba(I)}$ if a phase current (L1, L2, L3) deviates by more than the set operating value I_{nba} from the arithmetic mean of the phase currents. The deviation of the operating value from the mean value is stated as a percentage [%].

Additional functions

Pre-alarms response thresholds - PAL (function trigger)

This function permits definition of four independent current setting thresholds that can be configured and switched when freely definable outputs are crossed (e.g. via the IOM040/IOM300 input and output modules). In this way, the logic functions can be defined and corrective action taken that, for example, triggers cooling systems in the plant, or sheds loads to prevent the overload release from tripping the circuit breaker.

Two thresholds are defined as a selectable multiple of the overload current I_r and two thresholds as a selectable multiple of the circuit breaker current rating I_n.

It is also possible to choose the direction in which the threshold is crossed. For example, a signal can be set if a current falls and the threshold is crossed in the downward direction.

2nd parameter set (set A/B)

The ETUs of the 6-series can store and manage a complete second set of alternative parameters for the protection functions. It is possible to switch to this second set of protection parameters (set B) with an external command or input. It then replaces the default parameter set A.

The command to switch over can be issued if the circumstances of the power system change, for example, when an emergency generator kicks in with the resulting load currents or protection requirements.

Note

The second parameter set exists for all protection functions and thus also for DAS mode that provides reduced, alternative protection settings just for the instantaneous short circuit protection (INST).

There are various ways of switching between parameter sets A and B:

- Locally, on the display of the ETU of the 6-series
- Via communication
- By input at the digital I/O module IOM040 or IOM300, which was triggered by an external signal
- By input at the digital I/O module IOM040 or IOM300, which was triggered by an internal signal, for example, the pre-alarm response thresholds (PAL)
- Automatically after a defined delay time, after the circuit breaker has been closed.

Thermal memory

The electronic trip units have a thermal memory for the overload protection function (LT) to protect equipment from overheating due to overload.

The thermal memory maps the circuit breaker's thermal state as determined by the load current. It shortens the delay time of the protection function, considering the existing thermal load of the circuit breaker. This can be the case after fast reclosure of the circuit breaker following an overload trip. The size of the overcurrent that caused the trip and therefore the amount of overheating is considered.

The thermal memory can be disabled on electronic trip units of the 6-series. The thermal memory should remain activated in normal operation. It is the responsibility of the commissioning engineer/company operating the installation to provide additional thermal overload protection for the downstream power distribution system while the thermal memory is deactivated.

Enhanced protection functions expanded with the MF Advanced metering module for ETUs of the 6-series.

The protection functionalities of the ETUs of the 6-series can be enhanced if the ETU is expanded with the MF Advanced metering function. In this way, complex protection functions can be generated based on simultaneous processing of current and voltage signals and the circuit breaker becomes a central control and protection element in the installation.

The enhanced protection functions can be set to the operating modes: "closed", "only alarm" or "open".

With open contacts, too, signals can be provided if the voltage is sensed on the line side to detect anomalies or faults in the voltage applied before the main contacts of the circuit breaker are closed.

Reverse active power protection: Reverse power protection (RP)

If the power flows through the device in the opposite direction to the direction of power flow defined as 'normal,' the reverse power protection RP detects this and can trip the circuit breaker when an operating value for the active power is exceeded. The user can freely define the direction of power flow in the parameters.

For reverse power protection RP, the direction of the power flow is determined continuously in the ETU based on the power factor (PF) by evaluation of the current and voltage signal and the active and apparent power are placed in relation to each other. Based on the sign of the PF or the phase displacement angle φ between the current and voltage signal, deviating or reversing power flows are identified. Besides the RP protection function, the DST protection function is also a typical application for this.

Power factor PF_{avg} - alarm

A warning signal can also be transmitted as soon as a defined deviation of the averaged power factor PF_{avg} of the 3-phase system of < 1 is reached, i.e. increasing generation of reactive power and an undesired large phase difference between the current and voltage. Corrective action can be derived from this (e.g. reactive power compensation).

DST - directed short-time protection

Directed (directional) short-time protection DST behaves like short-time-delayed short-circuit protection (ST) except that the tripping current and the delay time depend on the direction of power flow. The user can define which direction is the forward direction. Based on this, it is possible to define individually the current operating values and time delays in this forward direction (FW) and in the backward direction (BW). This ensures differently selective behavior of the device depending on the direction of power flow.

Voltage unbalance V-NBA

The voltage unbalance protection function provides protection from unwanted unbalance of the voltage between the phases and load unbalances in the distribution and at the load. It can open the circuit breaker with a constant, definable delay time $t_{nba(U)}$ if a phase-to-phase voltage (U_{ph}-U_{ph}) deviates by more than the set operating value U_{nba} from the arithmetic mean of the phase-to-phase voltages. The deviation of the operating value from the mean value is stated as a percentage [%].

Underfrequency protection (f_u)

Underfrequency protection responds with a definable definite-time delay $t_u(f)$ as soon as the line frequency falls below the operating value f_u.

The operating value is described as factor < 1 of the line frequency - settable to 50 Hz or 60 Hz.

In this way, the distribution board can be protected from impermissible deviations in the line frequency.

Overfrequency protection (f_o)

Overfrequency protection responds with a definable definite-time delay $t_o(f)$ as soon as the line frequency exceeds the operating value f_o.

The operating value is described as factor > 1 of the line frequency - settable to 50 Hz or 60 Hz.

In this way, the distribution board can be protected from impermissible deviations in the line frequency.

Undervoltage protection (V_u)

The undervoltage protection responds with a definable definite-time delay $t_u(U)$ as soon as a phase-to-phase voltage (U_{ph}-U_{ph}) falls below the operating value U_u.

The operating value is described as factor < 1 of the rated voltage U_n of the power system.

The rated voltage U_n can be variably set from 100 V to 690 V.

In this way, the distribution board can be protected from impermissible deviations in the line voltage.

Overvoltage protection (V_o)

The overvoltage protection responds with a definable definite-time delay $t_o(U)$ as soon as a phase-to-phase voltage (U_{ph}-U_{ph}) rises above the operating value U_o.

The operating value is described as factor > 1 of the rated voltage U_n of the power system.

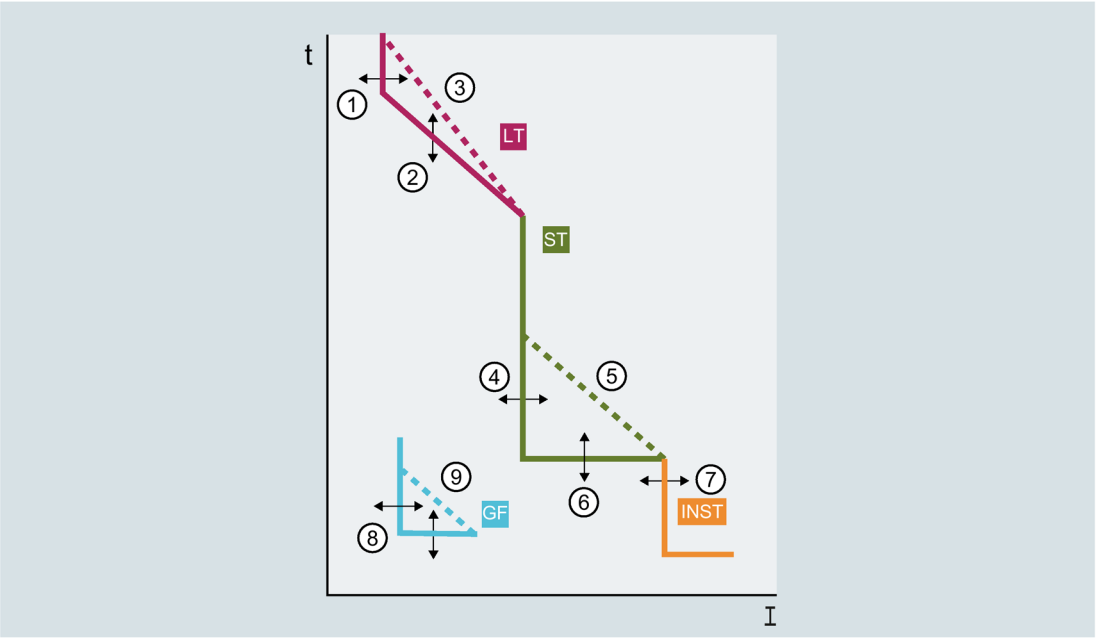
The rated voltage U_n can be variably set from 100 V to 690 V.

In this way, the distribution board can be protected from impermissible deviations in the line voltage.

2.8.4.1 Characteristic curves

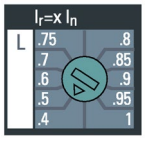
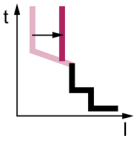
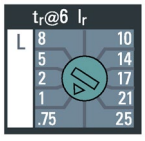
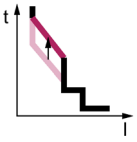
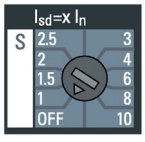
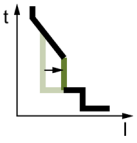
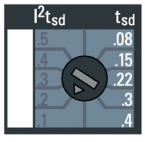
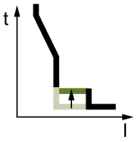
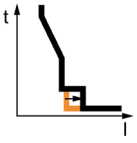
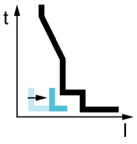
The settings selected for the trip unit of a circuit breaker depend on the technical environment (e.g. switchboard and applications) and the type of equipment to be protected. It is the responsibility of the system planner to calculate and dimension the protection settings in accordance with the valid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

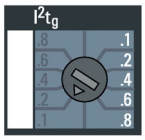
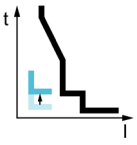
The following diagram shows the tripping characteristics of the circuit breaker.



①	Setting value of the long-time-delayed protection
②	Delay time of the long-time-delayed protection
③	Switchover of the overload characteristic (I^4t and VI, SI, EI)
④	Setting value of the short-time-delayed protection
⑤	I^2t characteristic ON/OFF of the short-time-delayed protection
⑥	Delay time of the short-time-delayed protection
⑦	Setting value of the instantaneous protection
⑧	Setting value of the ground-fault protection
⑨	Switchover to the I^2t characteristic of the ground-fault protection
LT	Overload range
ST	Short-time-delayed short-circuit protection range
INST	Instantaneous short-circuit protection range
GF	Ground-fault protection

Basic rules of parameterization and basic protection functions

	Parameter	Effect on characteristic curve	Description	Cause	Example
L	I_r 		Current setting value of the overload protection: I_r =0.4…1.0 × I_n absolute values in A	Setting of the overload protection to the load current of the circuit to be protected	I_r = 0.9 x I_n (where I_n=1000A) Overload range as of I_r = 900 A
	t_r 		Delay time in the overload range The set time is the tripping time at 6 × I_r.	Use for current and time selectivity	The set delay time t_r of, for example, 10 s always applies at the reference point 6 x I_r. In this case, it is therefore 6 x 900 A = 5400 A The tripping characteristic in the overload range can be plotted in the same way as for I^2t dependency.
S	I_{sd} 		Operating current of the short-time-delayed short-circuit protection I_{sd} = 1.0 … 10 x I_n	Limitation of the short-circuit range in which the current has to be interrupted as quickly as possible, but with a defined time delay	I_{sd} = 8 x I_n = 8000 A (at I_n = 1000 A) Range of the short-time delay as of 8000 A
	t_{sd} 		Delay time of the short-time-delayed short-circuit protection	Use for time selectivity. Time delay of t_{sd} can be definite-time or inverse-time in relation to I^2t	For example, at t_{sd} = 0.4 s (constant): Tripping after 400 m for short-circuit values above 8000 A and below a value of I_i
I	I_i 		Current setting value of the instantaneous short-circuit protection I_i = 1.5 … 15 x I_n	Limitation of the short-circuit range in which the impermissibly high current has to be interrupted as quickly as possible	I_{sd} = 12 x I_n = 12000 A (at I_n = 1000 A) Range of the instantaneous tripping on short-circuits as of 12000 A
G	I_g 		Current setting value of the ground-fault protection	Line protection	On ground-fault current as of 0.1 x I_n = 100 A (at I_n = 1000 A) Tripping, for example, after a time of t_g = 0.1 s

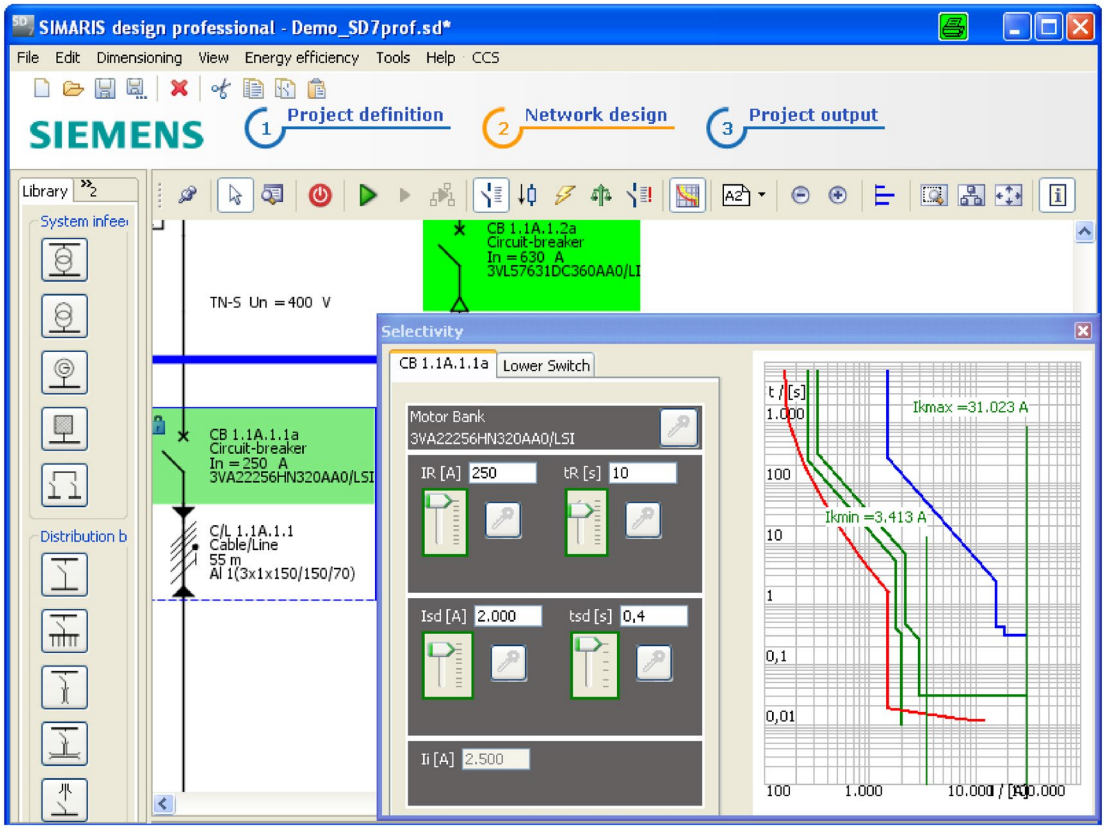
	Parameter	Effect on characteristic curve	Description	Cause	Example
	t_g 		Delay time until disconnection	Line protection	Tripping after a time of t_g = 0.1 s

See also

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

SIMARIS design

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



You will find more information on SIMARIS design in the Internet (http://www.siemens.com/simaris).

2.8.4.2 Features and options

The electronic trip unit is available in two basic versions:

- Electronic trip unit of the 3-series with rotary coding switches
- Electronic trip unit of the 6-series with LC display and modularly expandable functionality

Protection	ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
Line protection	●	●	●	●	●
Generator protection	●	●	●	●	●
Residual current (Rc) protection function	—	—	—	●	●
Ground-fault protection with current measurement at the star point (G_{RET})	—	—	—	●	●
MCR protection function - making current release during closure	—	—	—	●	●
Monitoring of direction of power flow and power factor determination (with metering function MF)	—	—	—	●	●
2nd parameter set	—	—	—	●	●

Equipment	ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
Display (LCD)	—	—	—	●	●
Setting with rotary coding switch	●	●	●	—	—
Setting via control buttons next to the ETU display	—	—	—	●	●
Data display via control buttons next to the ETU display	—	—	—	●	●
Metering function as option MF Basic	—	—	—	●	●
Metering function as option MF Advanced	—	—	—	●	●
Internal I/O module IOM040 with 2 inputs and 2 outputs as an option	—	—	—	●	●
External I/O module IOM300 with 10I and 11O as an option	—	—	—	●	●
Front interface for parameterization, testing, and data read-out	●	●	●	●	●

Communication	ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
Communication Modbus RTU, Modbus TCP, PROFIBUS, or PROFINET as an option	—	—	—	●	●
Write protection for communication	—	—	—	●	●
Deactivation of communication for access from external	—	—	—	●	●

Self-monitoring / diagnostics	ETU320 LI	ETU350 LSI	ETU360 LSIG	ETU650 LSI	ETU660 LSIG
Watchdog monitored (hardware, firmware) (tripping or only alarm)	•	•	•	•	•
Continuous CT and tripping coil monitoring (tripping or only alarm)	•	•	•	•	•
Protection by temperature monitoring (can be deactivated)	•	•	•	•	•
Thermal memory (LT adaptation) can be deactivated	—	—	—	•	•
Write protection for communication	—	—	—	•	•
Deactivation of communication for access from external	—	—	—	•	•

Exchanging rating plugs

The rating plugs can be exchanged on the front of all electronic trip units. With this option of exchanging the rating plug, the current rating can be reduced to adapt to a changed situation of the overall installation. The I_n of the rating plug remains less than or equal to the maximum I_n of the device. This function is suitable for installations for which further development is planned or in cases, in which the power export could be temporarily limited (e.g. mobile generator set).

The overload protection function (LT) can be deactivated if the "L off" rating plug version is used in conjunction with the ETU of the 6-series.

For residual-current protection with a suitable summation current transformer, there are rating plugs with a residual-current (Rc) protection function.

Communication of the ETUs of the 6-series (optional)

The electronic trip units of the 6-series can be expanded with communication connections because of their modularity. Depending on the communication modules used, the following protocols are available:

- Modbus RTU via RS485
- Modbus TCP via Ethernet and other IP communication
- PROFIBUS DP (planned for 2019)
- PROFINET IO (planned for 2019)

Communication is used for software integration into

- powerconfig for parameterization and maintenance
- powermanager for power monitoring and operational monitoring
- Totally Integrated Automation TIA for automation and process integration
- Energy automation

Metering functions of the ETUs of the 6-series (optional)

For the electronic trip units of the 6-series, there are two metering function modules:

- MF Basic
- MF Advanced

These modules allow determination of the following additional measured quantities:

- Voltage
- Power
- Energy

Additional features of the MF Advanced version:

- Implementation of the enhanced protection functions that are based on the variables voltage and power
- Power supply of the ETU from the busbar voltage (for line voltages above 80 V, phase-to-phase) and therefore also activation of further functions such as powering the external ground-fault neutral transformer G_{ret}, or the making current release, without an external power source, and, for example, measurement and activation of the overvoltage protection, without and before connection of the contacts. (In this case, the voltage must be picked off on the incoming side so that the ETU can be powered)
- Implementation of the Rc residual current protection function via an external summation current transformer

2.8.5 Parameters of the trip units

The parameter values of the trip units that can be set are listed below.

Electronic trip units of the 3-series

Protection functions of the ETU		ETU320 LI	ETU350 LSI	ETU360 LSIG
L	**LT: Overload protection**			
	Setting range of operating value $I_r = I_n$ x …	0.4; 0.5: 0.6; 0.7; 0.75; 0.8; 0.85; 0.9; 0.95; 1 Default value: 0.4 Tolerance[1]: Tripping between 1.05 and 1.2 x I_r	0.4; 0.5: 0.6; 0.7; 0.75; 0.8; 0.85; 0.9; 0.95; 1 Default value: 0.4 Tolerance[1]: Tripping between 1.05 and 1.2 x I_r	0.4; 0.5: 0.6; 0.7; 0.75; 0.8; 0.85; 0.9; 0.95; 1 Default value: 0.4 Tolerance[1]: Tripping between 1.05 and 1.2 x I_r
	Setting range for delay time t_r at I^2t (reference point 6 x I_r)	0.75; 1; 2; 5; 8; 10; 14; 17; 21; 25 s Default value: 0.75 s Tolerance[1]: ± 10% I ≤ 6 x I_n ± 20% I > 6 x I_n	0.75; 1; 2; 5; 8; 10; 14; 17; 21; 25 s Default value: 0.75 s Tolerance[1]: ± 10% I ≤ 6 x I_n ± 20% I > 6 x I_n	0.75; 1; 2; 5; 8; 10; 14; 17; 21; 25 s Default value: 0.75 s Tolerance[1]: ± 10% I ≤ 6 x I_n ± 20% I > 6 x I_n
	Overload pre-alarm	50 to 100% x I_r (in steps of 1%) Default value: 90%	50 to 100% x I_r (in steps of 1%) Default value: 90%	50 to 100% x I_r (in steps of 1%) Default value: 90%
S	**ST: Short-time-delayed short-circuit protection**			
	Protection function can be enabled/disabled	—	●	●
	Setting range of operating value $I_{sd} = I_n$ x …	—	1; 1.5; 2; 2.5; 3; 4; 6; 8; 10 Default value: OFF Tolerance[1]: ± 7% I ≤ 6 x I_n ± 10% I ≤ 6 x I_n	1; 1.5; 2; 2.5; 3; 4; 6; 8; 10 Default value: OFF Tolerance[1]: ± 7% I ≤ 6 x I_n ± 10% I ≤ 6 x I_n
	Characteristic (switchover possible)	—	I^2t / t = constant	I^2t / t = constant
	Setting range for delay time t_{sd} (fixed delay) t=k	—	0.08; 0.15; 0.22; 0.3; 0.4 Tolerance[1]: The better value out of ± 10% or ± 40ms	0.08; 0.15; 0.22; 0.3; 0.4 Tolerance[1]: The better value out of ± 10% or ± 40ms
	Setting range for delay time t_{sd} at I^2t (reference point 10 x I_n)	—	0.1; 0.2; 0.3; 0.4; 0.5 Default value: 0.1	0.1; 0.2; 0.3; 0.4; 0.5 Default value: 0.1
I	**INST: Instantaneous short-circuit protection**			
	Protection function can be enabled/disabled	●	●	●
	Setting range for operating value $I_i = I_n$ x …	1.5; 2; 3; 4; 6; 8; 10; 12; 15 Default value: 1.5 Tolerance[1]: ± 10%	1.5; 2; 3; 4; 6; 8; 10; 12; 15 Default value: 1.5 Tolerance[1]: ± 10%	1.5; 2; 3; 4; 6; 8; 10; 12; 15 Default value: 1.5 Tolerance[1]: ± 10%
N	**Neutral protection**			

Protection functions of the ETU		ETU320 LI	ETU350 LSI	ETU360 LSIG
	Neutral protection can be enabled/disabled	●	●	●
	Current setting value $I_N = I_n$ x …	0.5; 1; 2 Default value: 0.5	0.5; 1; 2 Default value: 0.5	0.5; 1; 2 Default value: 0.5
G	GF: Ground-fault protection			
	Protection function can be enabled/disabled	—	—	●
	Characteristic (switchover possible)	—	—	I^2t / t = constant Default value: I^2t
	Setting range for operating value $I_g = I_n$ x … (The range <0.2 I_n or <0.25 I_n (for I_n = 400 A) requires an external auxiliary power supply of the ETU)	—	—	0.1; 0.2; 0.3; 0.4; 0.5; 0.6; 0.7; 0.8; 1 Default value: 0.1 Tolerance[1]: ± 7%
	Setting range for delay time t_g (fixed) t=k	—	—	0.1; 0.2; 0.4; 0.6; 0.8 s Tolerance[1]: The better value out of ± 10% or ± 40 ms or 50 ms with t_g = instantaneous
	Setting range for delay time t_g at I^2t (reference point 2 x I_g)	—	—	0.1; 0.2; 0.4; 0.6; 0.8 s Default value: 0.1 (I^2t)
Functions	Frequency adaptation			
	Setting of the line frequency on ETUs of the 3-series with DIP switches	50 Hz; 60 Hz Default value: 50 Hz	50 Hz; 60 Hz Default value: 50 Hz	50 Hz; 60 Hz Default value: 50 Hz

[1] ETU powered in at least 2 phases or self-powered with auxiliary voltage. In all other cases, the following tolerances apply:

	Current setting value	Tripping time
L	Tripping between 1.05 and 1.2 x I_r	± 20 %
S	± 10 %	± 20 %
I	± 15 %	≤ 60 ms
G	± 15 %	± 20 %

Electronic trip units of the 6-series

Protection functions of the ETU		ETU650 LSI	ETU660 LSIG
L	**LT: Overload protection**		
	Protection function can be enabled/disabled	Via rating plug "L = off"	Via rating plug "L = off"
	Setting range of operating value $I_r = I_n$ x …	0.4 to 1 (in steps of 0.001) Default value: 1 Tolerance[1]: Tripping between 1.05 and 1.2 x I_r	0.4 to 1 (in steps of 0.001) Default value: 1 Tolerance[1]: Tripping between 1.05 and 1.2 x I_r
	Setting range for delay time t_r at I^2t (reference point 6 x I_n)	0.75 to 36 s (in steps of 0.25) Default value: 36 s Tolerance[1]: ± 10% I ≤ 6 x I_n ± 20% I > 6 x I_n	0.75 to 36 s (in steps of 0.25) Default value: 36 s Tolerance[1]: ± 10% I ≤ 6 x I_n ± 20% I > 6 x I_n
	Switchable overload protection characteristic IEC 60255-151 $t_{trip}=(t_r \bullet b)/((I_{load}/I_r)^{\wedge}\alpha-1)$	I^4t: α=4, b=1296 standard inverse SI: α=0.02, b=0.0364 very inverse VI: α=1, b=5 extremely inverse EI: α=2, b=35.2 Default value: I^2t	I^4t: α=4, b=1296 standard inverse SI: α=0.02, b=0.0364 very inverse VI: α=1, b=5 extremely inverse EI: α=2, b=35.2 Default value: I^2t
	Setting range for delay time t_r for characteristic IEC 60255-151 (reference point 6 x I_n)	0.75 to 5 s (in steps of 0.25) Default value: 5 s Tolerance[1]: ± 10% I ≤ 6 x I_n ± 20% I > 6 x I_n	0.75 to 5 s (in steps of 0.25) Default value: 5 s Tolerance[1]: ± 10% I ≤ 6 x I_n ± 20% I > 6 x I_n
	Thermal memory can be enabled/disabled	●	●
	Overload pre-alarm	50 to 100% x I_r (in steps of 1%) Default value: 90%;	50 to 100% x I_r (in steps of 1%) Default value: 90%;
S	**ST: Short-time-delayed short-circuit protection**		
	Protection function can be enabled/disabled	●	●
	Setting range of operating value $I_{sd} = I_n$ x …	0.6 to 10 (in steps of 0.1) Default value: OFF Tolerance[1]: ± 7% I ≤ 6 x I_n ± 10% I ≤ 6 x I_n	0.6 to 10 (in steps of 0.1) Default value: OFF Tolerance[1]: ± 7% I ≤ 6 x I_n ± 10% I ≤ 6 x I_n
	Short-circuit protection characteristic	Switchable I^2t / t = constant	Switchable I^2t / t = constant
	Setting range for delay time t_{sd} (fixed delay) t=k	0.05 to 0.4 s (in steps of 0.01) Default value: 0.05 Tolerance[1]: The better value out of ± 10% or ± 40ms	0.05 to 0.4 s (in steps of 0.01) Default value: 0.05 Tolerance[1]: The better value out of ± 10% or ± 40ms
	Setting range for delay time t_{sd} at I^2t (reference point 10 x I_n)	0.05 to 0.5 s (inverse-time in relation to I^2t) (in steps of 0.01)	0.05 to 0.5 s (inverse-time in relation to I^2t) (in steps of 0.01)
	Tripping can be deactivated	●	●

Protection functions of the ETU		ETU650 LSI	ETU660 LSIG
	Switchover to alternative operating values with short-time-delayed short-circuit current during the switch-on phase (inrush adaptation) for tripping characteristic t=k (fixed) possible	● Default value: OFF	● Default value: OFF
	Setting range of the switch-on phase (inrush adaptation)	0.1 to 30 s (in steps of 0.01) Default value: 0.1	0.1 to 30 s (in steps of 0.01) Default value: 0.1
	Setting range Isd = In x … during the switch-on phase (inrush adaptation)	0.6 to 10 (in steps of 0.1) Default value: 10	0.6 to 10 (in steps of 0.1) Default value: 10
I	**INST: Instantaneous short-circuit protection I_i**		
	Protection function can be enabled/disabled	●	●
	Setting range for operating value $I_i = I_n$ x …	1.5 to 15 (in steps of 0.1) Default value: 2 Tolerance[1]: ± 10%	1.5 to 15 (in steps of 0.1) Default value: 2 Tolerance[1]: ± 10%
	Switchover to alternative operating values with instantaneous short-circuit current during the switch-on phase (inrush adaptation) for tripping characteristic t=k (fixed) possible	● Default value: OFF	● Default value: OFF
	Setting range of the switch-on phase (inrush adaptation)	0.10 to 30 s (in steps of 0.01) Default value: 0.1 Tolerance[1]: ≤ 30 ms	0.10 to 30 s (in steps of 0.01) Default value: 0.1 Tolerance[1]: ≤ 30 ms
	Setting range $I_i = I_n$ x … during the switch-on phase (inrush adaptation)	1.5 to 15 (in steps of 0.1) Default value: 1.5	1.5 to 15 (in steps of 0.1) Default value: 1.5
N	**Neutral protection**		
	Neutral protection can be enabled/disabled	●	●
	Current setting value $I_N = I_n$ x …	50%; 100%; 150%; 200%	50%; 100%; 150%; 200%
G	**GF: Ground-fault protection**		
	Protection function can be enabled/disabled	—	●
	Characteristic	—	I^2t / t = constant Default value: t = constant
	Setting range for operating value $I_g = I_n$ x …	—	0.1 to 1 (in steps of 0.001) Default value: 0.1 Tolerance[1]: ± 7%
	Setting range for delay time t_g (fixed) t=k	—	0.1 to 1 s (in steps of 0.05) Default value: 0.1s Tolerance[1]: The better value out of ± 10% or ± 40 ms or 50 ms with t_g = instantaneous
	Setting range for delay time t_g at I^2t (reference point 2 x I_g)	—	0.1 to 1 s (in steps of 0.05)
	Ground-fault protection pre-alarm	—	50 to 90% x I_r (in steps of 1%) Default value: 90%
	Tripping can be deactivated	—	●

Protection functions of the ETU		**ETU650 LSI**	**ETU660 LSIG**
	Switchover to the alternative of the external, directly measured ground-fault protection	—	• Default value: OFF
	Switchover to alternative operating values with ground-fault current during the switch-on phase (inrush adaptation) for tripping characteristic t=k (fixed) possible	—	• Default value: OFF
	Setting range of the switch-on phase (inrush adaptation)	—	0.1 to 30 s (in steps of 0.01) Default value: 0.1
	Setting range $I_g = I_n$ x … during the switch-on phase (inrush adaptation)	—	0.2 to 1 (in steps of 0.01) Default value: 1
	Extended parameter range with ext. auxiliary power supply of the ETU	—	- I_g full range, otherwise I_g limited to min. 0.2 I_n or 0.25 I_n (for I_n = 400A) - t_g possible instantaneously
G direct	**GF direct: Ground-fault protection direct measurement**	—	• Default set: Not installed
	Protection function can be selected • R_c - residual-current protection (with summation current transformer) • G_{ret} - ground-fault return protection (transformer in the star point)	—	Ground return CT; Rc CT; necessary
	Rc - residual-current protection (with summation current transformer)	—	• Alternative to GF and G_ret Default value: OFF Possible with current sensor Rc & MF advanced
	Setting range operating value residual current $I_{\Delta n}$	—	3; 5; 7; 10; 20; 30 A Default value: OFF Possible with current sensor Rc & MF advanced
	Setting range for delay time $t_{\Delta n}$	—	0.06; 0.1; 0.2; 0.3; 0.4; 0.5; 0.8 s
	Gret ground-fault return protection (ground return - transformer in the star point)	—	• Alternative to GF and Rc
	Design of G_{ret} transformer (ground fault return CT, I_{CT_rating})	—	100; 250 A Default value: 100 A
	Setting range operating value ground fault return $I_{g\_ret} = I_{CT\_rating}$ x ...	—	0.1 to 1 x I_{CT_rating} (in steps of 0.001) Default value: 0.1
	Setting range of delay time t_{g_ret} (fixed) t=k	—	0.1 to 1 s (in steps of 0.05) Default value: 0.1s
	Setting range for delay time t_{g_ret} at I^2t (reference point 4 x I_n)	—	0.1s to 1s (in steps of 0.05)

Protection functions of the ETU		ETU650 LSI	ETU660 LSIG
	Ground-fault return protection pre-alarm	—	50 to 90% x I_r (in steps of 1%) Default value: 90%
	Switchover to alternative operating values with ground-fault current during the switch-on phase (inrush adaptation) for tripping characteristic t=k (fixed) possible	—	● Default value: OFF
	Setting range of the switch-on phase (inrush adaptation)	—	0.1 to 30 s (in steps of 0.01) Default value: 0.1
	Setting range $I_g = I_n$ x … during the switch-on phase (inrush adaptation)	—	0.1 to 1 (in steps of 0.01) Default value: 1
DAS	DAS (Arc fault mitigation)		
	Protection function can be enabled/disabled	●	●
	Setting range for operating value $I_{i\_arc} = I_n$ x …	1.5 to 15 (in steps of 0.1) Default value: 1.5	1.5 to 15 (in steps of 0.1) Default value: 1.5
I-NBA	Phase current unbalance I-NBA		
	Protection function can be enabled/disabled	●	●
	Setting range I_{nba} phase current unbalance	2 to 90% (in steps of 1%) Default value: 50%	2 to 90% (in steps of 1%) Default value: 50%
	Setting range of the delay time t_{nba} for phase current unbalance	0.50 to 60 s (in steps of 0.5) Default value: 10 s	0.50 to 60 s (in steps of 0.5) Default value: 10 s
	Enabling/disabling of tripping on phase current unbalance	●	●

[1] ETU powered in at least 2 phases or self-powered with auxiliary voltage. In all other cases, the following tolerances apply:

	Current setting value	Tripping time
L	Tripping between 1.05 and 1.2 x I_r	± 20 %
S	± 10 %	± 20 %
I	± 15 %	≤ 60 ms
G	± 15 %	± 20 %
Other protection functions	± 15 %	± 20 %

Enhanced protection functions - only available with MF Advanced metering function		ETU650 LSI	ETU660 LSIG
DST	Directed short-circuit protection DST	●	●
	Protection function can be enabled/disabled	●	●
	Enabling/disabling of tripping on directed (directional) short-circuit protection	●	●
	Setting range $I_{dsd} = I_n$ x … in forward direction FW (top → bottom)	0.6 to 10 (in steps of 0.1) Default value: 2	0.6 to 10 (in steps of 0.1) Default value: 2
	Setting range $I_{dsd} = I_n$ x … in backward direction BW (bottom → top)	0.6 to 10 (in steps of 0.1) Default value: 2	0.6 to 10 (in steps of 0.1) Default value: 2

Enhanced protection functions - only available with MF Advanced metering function		**ETU650 LSI**	**ETU660 LSIG**
	Switchable short-time-delayed short-circuit protection (inverse-time in relation to I²t)	●	●
	Setting range of delay time t_{dsd} FW in forward direction	0.1 to 0.5 s (in steps of 0.01) Default value: 0.2 s	0.1 to 0.5 s (in steps of 0.01) Default value: 0.2 s
	Setting range of delay time t_{dsd} BW in backward direction	0.1 to 0.5 s (in steps of 0.01) Default value: 0.2 s	0.1 to 0.5 s (in steps of 0.01) Default value: 0.2 s
	Switchover to alternative operating values with directed (directional) short-circuit current during the switch-on phase (inrush adaptation) for tripping characteristic t=k (fixed) possible	●	●
	Setting range of the switch-on phase	0.10 to 30 s (in steps of 0.01) Default value: 0.1	0.10 to 30 s (in steps of 0.01) Default value: 0.1
	Setting range $I_{dsd} = I_n$ x … during the switch-on phase in the forward direction FW	0.6 to 10 (in steps of 0.1) Default value: 2	0.6 to 10 (in steps of 0.1) Default value: 10
	Setting range $I_{dsd} = I_n$ x … during the switch-on phase in the backward direction BW	0.6 to 10 (in steps of 0.1) Default value: 2	0.6 to 10 (in steps of 0.1) Default value: 10
	Settings DST phase difference angle	3.6°; 7.2°; 10.8°; 14.5°; 18.2°; 22.0°; 25.9°; 30°; 34.2°; 38.7°; 43.4°; 48.6°; 54.3°; 61.0°; 69.6° Default value: 3.6°	
	Definition of direction of power flow	Bottom → top; top → bottom Default value: top → bottom	
V-NBA	**Phase voltage unbalance V-NBA**		
	Protection function can be enabled/disabled	●	●
	Setting range U_{nba} phase voltage unbalance	2 to 90% (in steps of 1%) Default value: 50%	2 to 90% (in steps of 1%) Default value: 50%
	Setting range of the delay time t_{nba} for phase voltage unbalance	0.50 to 60 s (in steps of 0.5) Default value: 10 s	0.50 to 60 s (in steps of 0.5) Default value: 10 s
	Enabling/disabling of tripping on phase voltage unbalance	●	●
V_u	**Undervoltage protection V_u**		
	Protection function can be enabled/disabled	●	●
	Setting range of undervoltage protection $U_u = U_n$ x ...	0.5 to 0.98 (in steps of 0.01) Default value: 0.9	0.5 to 0.98 (in steps of 0.01) Default value: 0.9
	Setting range of the delay time for undervoltage protection	0.05 to 120 s (in steps of 0.01) Default value: 10 s	0.05 to 120 s (in steps of 0.01) Default value: 10 s
	Enabling/disabling of tripping on undervoltage protection	●	●
V_o	**Overvoltage protection V_o**		
	Protection function can be enabled/disabled	●	●
	Setting range of overvoltage protection $U_o = U_n$ x ...	1.02 to 1.5 (in steps of 0.01) Default value: 1.05	1.02 to 1.5 (in steps of 0.01) Default value: 1.05

Enhanced protection functions - only available with MF Advanced metering function		**ETU650 LSI**	**ETU660 LSIG**
	Setting range of the delay time for overvoltage protection	0.05 to 120 s (in steps of 0.01) Default value: 10 s	0.05 to 120 s (in steps of 0.01) Default value: 10 s
	Enabling/disabling of tripping on overvoltage protection	●	●
f_u	**Underfrequency protection f_u**		
	Protection function can be enabled/disabled	●	●
	Setting range for underfrequency protection f_u = f_n x …	0.9 to 0.999 (in steps of 0.001) Default value: 0.9	0.9 to 0.999 (in steps of 0.001) Default value: 0.9
	Setting range of the delay time for underfrequency protection	3 to 300 s (in steps of 0.01) Default value: 3 s	3 to 300 s (in steps of 0.01) Default value: 3 s
	Enabling/disabling of tripping on underfrequency protection	●	●
f_o	**Overfrequency protection f_o**		
	Protection function can be enabled/disabled	●	●
	Setting range for overfrequency protection f_o = f_n x …	1.001 to 1.1 (in steps of 0.001) Default value: 1.1	1.001 to 1.1 (in steps of 0.001) Default value: 1.1
	Setting range of the delay time for overfrequency protection	3 to 300 s (in steps of 0.01) Default value: 3 s	3 to 300 s (in steps of 0.01) Default value: 3 s
	Enabling/disabling of tripping on overfrequency protection	●	●
PP	**Reverse power protection RP**		
	Protection function can be enabled/disabled	●	●
	Setting range for reverse power PR = S_n x …	-0.050 … -1.0 (in steps of 0.001) Default value: -0.1	-0.050 … -1.0 (in steps of 0.001) Default value: -0.1
	Setting range of the delay time for reverse power protection	0.5 to 100 s (in steps of 0.1) Default value: 5 s	0.5 to 100 s (in steps of 0.1) Default value: 5 s
	Definition of direction of power flow	Bottom → top; top → bottom Default value: top → bottom	
	Enabling/disabling of tripping on reverse power	●	●

Alarms and functions		ETU650 LSI	ETU660 LSIG
Alarms	**Pre-alarms PAL response thresholds - function trigger**		
	Enabling/disabling of PAL response threshold overload current $I_{r\ pal(1)}$	●	●
	Enabling/disabling of PAL response threshold overload current $I_{r\ pal(2)}$	●	●
	Setting range for PAL response threshold overload current $I_{r\ pal(1)} = I_r$ x …	50%, 100% (in steps of 1%) Default value: 50%	50%, 100% (in steps of 1%) Default value: 50%
	Setting range for PAL response threshold overload current $I_{r\ pal(2)} = I_r$ x …	50%, 100% (in steps of 1%) Default value: 50%	50%, 100% (in steps of 1%) Default value: 50%
	Enabling/disabling of PAL response threshold rated current $I_{n\ pal(1)}$	●	●
	Enabling/disabling of PAL response threshold rated current $I_{n\ pal(2)}$	●	●
	Setting range for PAL response threshold rated current $I_{n\ pal(1)} = I_n$ x …	0.1 to 10 (in steps of 0.01) Default value: 3	0.1 to 10 (in steps of 0.01) Default value: 3
	Setting range for PAL response threshold overload current $I_{n\ pal(2)} = I_n$ x …	0.1 to 10 (in steps of 0.01) Default value: 3	0.1 to 10 (in steps of 0.01) Default value: 3
	Crossing the response threshold rated current $I_{n\ pal(1)}$ Direction: from bottom, or from top	Default value: bottom → top	Default value: bottom → top
	Crossing the response threshold rated current $I_{n\ pal(2)}$ Direction: from bottom, or from top	Default value: bottom → top	Default value: bottom → top
	Checking the phase sequence / alarm[1)]	●	●
	Checking the phase sequence can be enabled/disabled	●	●
	Setting range for phase sequence	L1L2L3; L3L2L1 Default value: L1L2L3	L1L2L3; L3L2L1 Default value: L1L2L3
	Trip/alarm COS PHI[1)]	●	●
	Trip COS PHI can be enabled/disabled	●	●
	Setting range for checking the COS PHI	0.50 to 0.95 (in steps of 0.01) Default value: 0.95	0.50 to 0.95 (in steps of 0.01) Default value: 0.95
Functions	**Frequency adaptation**	●	●
	Frequency adaptation with the ETU of the 3-series with a DIP switch, with the ETU of the 6-series with menu	50Hz; 60Hz Default value: 50Hz	50Hz; 60Hz Default value: 50Hz
	Nominal voltage adaptation	●	●
	Nominal voltage	100 V AC to 690 V AC Default value: 400 V AC	100 V AC to 690 V AC Default value: 400 V AC

1) Only available with MF Basic or MF Advanced metering function

Software-based parameterization

The ETUs of the 6-series can be parameterized and commissioned manually on the display, or in an efficient, clear, and error-avoiding manner with the freely available powerconfig software.

Settings can be stored and are thus reproducible at any time.

Note

powerconfig is commissioning and maintenance software for all communication-capable SENTRON products from Siemens. With this software, the circuit breaker can be parameterized and commissioned and its settings can be archived and, in the operating phase, values from the plant (current, voltage, etc.) can be read out and the status of the circuit breaker can be acquired.

The powerconfig (https://support.industry.siemens.com/cs/ww/en/view/63452759) software is freely available.

2.8.5.1 Metering functions

Measured values of the ETUs of the 3-series

The electronic trip units of the 3-series save a range of measured values that are based exclusively on status changes and current signals. In addition to the visual display of maintenance signals, trip reasons, overload measurements, etc. indicated by LEDs on the ETU, a number of measured values such as trip history or maintenance information can be read out on the ETUs of the 3-series, too, via the TD410/420 test devices on the front interface of the ETU.

Measured values of the ETUs of the 3-series				
Instantaneous values				
		Measured value	**Measuring accuracy**	**Reference standard**
Currents (rms value) Reference standard: Class 1 acc. to IEC 61557-12	A	I_1, I_2, I_3, neutral	1%	Class 1 acc. to IEC 61557-12
Ground fault current	A	I_g	2%	—
Measuring interval memory of the individual parameters for each interval with a time stamp				
		Measured value	**Clocking**	**Monitoring period**
Current: smallest and largest	A	I_{min}, I_{max}	Fixed or synchro-nizable via test device	Duration: 5 to 120 min Number of intervals: 24
Information for tripping and switch-off data stored in ETU with or without auxiliary power supply after a fault				
		Measured value		
Type of protection function tripped		e.g. L, S, I, G - via LED display and info button and powerconfig		
Fault values per phase	A	e.g. L1, L2, L3, N		
Time stamp		Date, time, and consecutive number		

Measured values of the ETUs of the 3-series			
Maintenance displays			
		Parameter	
Information on the last 30 trips		Type of protection function, fault values, and time stamp	
Information on the last 200 events		Type of event, time stamp	
Number of mechanical switching operations [1]	No.	Can be assigned to alarm	
Total number of trips	No.	—	
Operating hours counter	h	—	
Contact wear	%	Pre-alarm > 80% Alarm = 100%	
Date of maintenance performed		Last	
Direction to perform necessary maintenance		—	
Key data		Type of circuit breaker, name assigned to the device, serial number	
Self-diagnostics			
		Parameter	**Precision**
Open-circuit detection Watchdog: constant CT monitoring, monitoring of the electronics and tripping coil		Alarm due to disconnection Current transformer, rating plug, tripping coil	Optional: Only alarm or tripping of the circuit breaker
Temperature (T)		Pre-alarm and alarm due to overheating	

[1] If auxiliary power supply is connected

Metering functions of the ETUs of the 6-series

The electronic trip units of the 6-series can be expanded with the metering functions MF Basic or MF Advanced. These measure the voltage between the phases with internal voltage tap - optionally on the incoming or outgoing feeder side, i.e. internally before or after the contact interruption point - and can therefore calculate and transmit values for power, energy, phase difference, etc., taking the current signals into consideration.

- MF Basic provides many measured values in accordance with IEC 61557-12
- MF Advanced provides not only the measured values described but also many enhanced protection functions, which are listed in Chapter Parameters of the trip units (Page 72). In this way, the ETU can also power the metering module MF Advanced directly from the busbar itself if no auxiliary power supply is provided via the Breaker Connect module. Faults such as overvoltages in the power system can therefore be detected before the contacts of the circuit breaker are closed.

Metering functions of the ETUs of the 6-series

Instantaneous values

		Measured values	Precision Reference standard: IEC 61557-12	Metering module MF required
Currents (rms value)	A	L1, L2, L3, N	1%, class 1	—
Ground fault current	A	I_g	2%	—
Phase-to-phase voltage (rms value)	V	U12, U23, U31	0.5%	●
Phase-to-neutral voltage (rms value)	V	U1, U2, U3	0.5%	●
Phase sequence		—	—	●
Frequency	Hz	f	0.2%	●
Active power	kW	P1, P2, P3, P_{tot}	2%	●
Reactive power	kvar	Q1, Q2, Q3, Q_{tot}	2%	●
Apparent power	kVA	S1, S2, S3, S_{tot}	2%	●
Power factor (p.f.)		L1, L2, L3, N	2%	●
Peak factor		total	—	●

Counter
(recorded since installation or last reset)

		Measured values	Precision	Metering module MF required
Active energy	kWh	E_p total E_p drawn E_p consumed	2%	●
Reactive energy	kvarh	E_q total E_q drawn E_q consumed	2%	●
Apparent energy	kVAh	E_s total	2%	●

Measuring interval memory of the individual parameters for each interval with a time stamp

		Measured value	Clocking	Monitoring period	Metering module MF required
Current: smallest and largest	A	I_{min}, I_{max}	Fixed or synchronizable via test device	Duration: 5 to 120 min Number of intervals: 24	—
Phase-to-phase voltage: smallest and largest	V	U_{min}, U_{max}			●
Active power: mean and largest	kW	P_{mean}, P_{max}			●
Reactive power: mean and largest	kvar	Q_{mean}, Q_{max}			●
Apparent power: mean and largest	kVA	S_{mean}, S_{max}			●

Data log - can be analyzed with the freely available powerservice software[4)]
Recording and storage of measured values with high-resolution sampling rate (buffer memory)

		Measured values	Metering module MF required
Currents	A	L1, L2, L3, N, I_g	—
Voltages	V	U12, U23, U31	●

Metering functions of the ETUs of the 6-series				
Sampling rate	Hz	1200-2400-4800-9600		—
Max. recording duration	s	16		—
Recording stop delay	s	0 to 10		—
Number of registers	No.	2 independent		—
Information on tripping and switch-off data				
		Parameter		**Metering module MF required**
Type of protection function tripped		e.g. L, S, I, G, V_o, V_u (can also be queried via info button when ETU is unpowered)		—
Fault values per phase	A / V / Hz w / VAR	e.g. L1, L2, L3, N U12, U23, U31 for V_o, V_u		—
Time stamp		Date, time, and consecutive number		—
Maintenance displays				
		Parameter		**Metering module MF required**
Information on the last 30 trips		Type of protection function, fault values, and time stamp		—
Information on the last 200 events		Type of event, time stamp		—
Number of mechanical switching operations [1]	No.	Can be assigned to alarm		—
Total number of trips	No.	—		—
Operating hours counter	h	—		—
Contact wear	%	Pre-alarm > 80% Alarm = 100%		—
Date of maintenance performed		Last		—
Direction to perform necessary maintenance		—		—
Key data		Type of circuit breaker, assigned name, serial number		—
Self-diagnostics				
		Parameter		**Metering module MF required**
Watchdog: constant CT monitoring, monitoring of the electronics and tripping coil		Alarm due to disconnection Current sensor, sensors, tripping coil	Note: Tripping of the circuit breaker can be set in the case of an alarm	—
Temperature (T)		Pre-alarm and alarm due to overheating		—

[1] After a fault with or without auxiliary power supply
[2] After a fault without auxiliary power supply
[3] If auxiliary power supply is connected
[4] Available in the SIOS Portal, see below

You will find the powerservice software (planned for the end of 2018) in the SIOS Portal (https://support.industry.siemens.com/cs/ww/en/view/109749079).

Powerservice software

If a laptop with the powerservice software is connected to an ETU of the 6-series, the following data can be recorded.

That is the data log described above can be called up or the TD420 can be read out. In the powerservice program, a high-resolution analysis of the 3-phase current and voltage curves can be performed for fault analysis or to identify system anomalies.

The on-board buffer memory (= register) of the ETUs of the 6-series is constantly written to. You can set up to two trigger points at which the memory is to be frozen with its symmetrical time interval before and after this point or these points. You can also import simulated current and voltage curves into the device with the powerservice software and then test and document how it would respond. In this test environment, real test tripping is generated. In this way, the software helps to find the optimized parameter settings for the user's application.

		Parameters
Currents	A	L1, L2, L3, Ne, I_g
Voltages	V	U12, U23, U31
Sampling rate	Hz	1200 - 2400 - 4800 - 9600
Max. recording duration	s	16
Recording stop delay	s	0 to 10
Number of registers	No.	2 independent

2.9 Communication

The circuit breaker can be integrated into an industrial communication network via communication modules for remote monitoring and remote operation of a circuit breaker. The communication modules are used with the electronic releases of ETUs of the 6-series. Its most important functions are power distribution and generator protection.

Depending on the communication modules used, the following protocols are available:

- Modbus RTU via RS485 (COM042)
- Modbus TCP via Ethernet and other IP communication (COM043)
- PROFIBUS DP (COM040) (planned for 2019)
- PROFINET IO (COM041) (planned for 2019)

Up to two different communication modules can be installed at the same time so that connection to the communication systems is possible with different protocols.

The standards demanded of air circuit breakers in terms of their electrical and mechanical properties, cost-effectiveness, and adaptability are increasing as a result of ongoing

rationalization and automation. The merging of power distribution engineering and information technology has opened up a diverse range of new applications for air circuit breakers.

The power distribution system can be integrated into the information system of the relevant application, but it can also have its own independent information system.

Siemens considers the following four scenarios to be potential applications:

- Totally Integrated Automation (TIA) for production facilities
- Total Building Solution (TBS) for non-residential buildings
- Totally Integrated Power (TIP) as the power distribution system for the two applications above
- Energy management with powermanager

More information

You will find detailed information on communication interfaces of circuit breakers in the 3WL10 communication manual or the 3VA communication manual (see Chapter Reference documents (Page 10)).

Planning

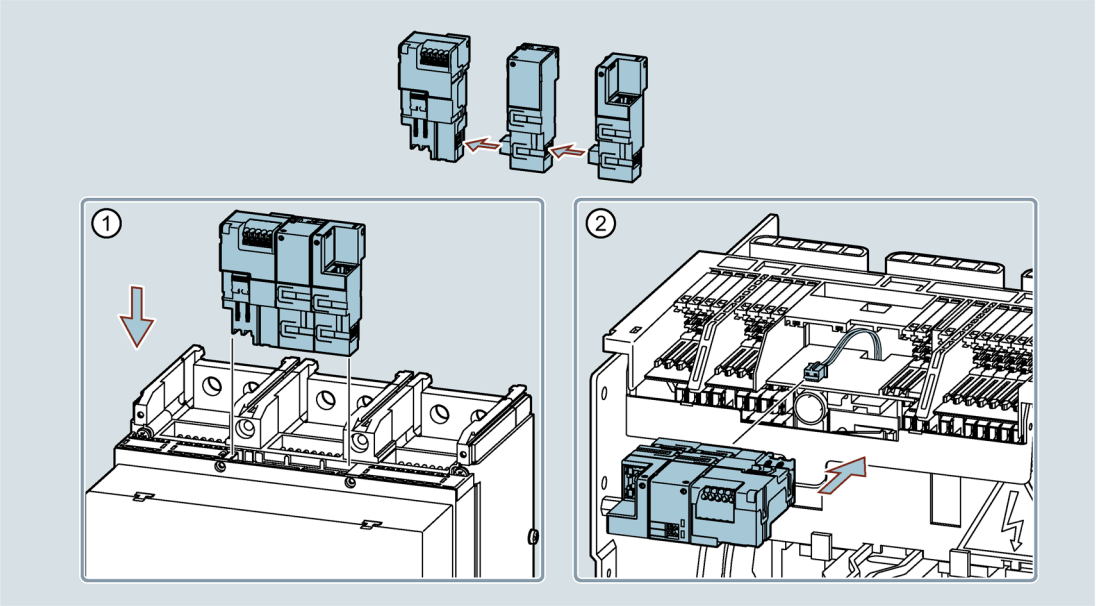
With the circuit breaker and the electronic trip units of the 6-series, Siemens low-voltage products offer an integrated communication concept together with the 3VA molded case circuit breakers and the 7KM PAC measuring devices.

Features:

- The high level of modularity of circuit breakers and accessories allows easy retrofitting of all communication components
- Up to two communication modules can be used at the same time.
- Simple integration into power monitoring systems with the modular metering functions MF Basic or MF Advanced according to IEC 61557-1
- Simple integration into plant monitoring systems for monitoring
  - Status
  - Measured values
  - Alarms and warnings
  - Diagnostics
  - Maintenance
- Significant additional benefits for the switchboard due to the possibility of connecting external input and output modules to the 3WL10 air circuit breaker
- Innovative software products for commissioning, testing, parameterization, operation, monitoring, documentation, and diagnostics of circuit breakers on site at the display, via the front interface using test devices or communication modules
- Integration of the circuit breakers into the Totally Integrated Power (TIP) and Totally Integrated Automation (TIA) solutions

Direct connection via two communication modules

Connection to the communication environment is established directly via modular, pluggable communication modules in conjunction with the Breaker Connect module on the auxiliary conductor terminal system.



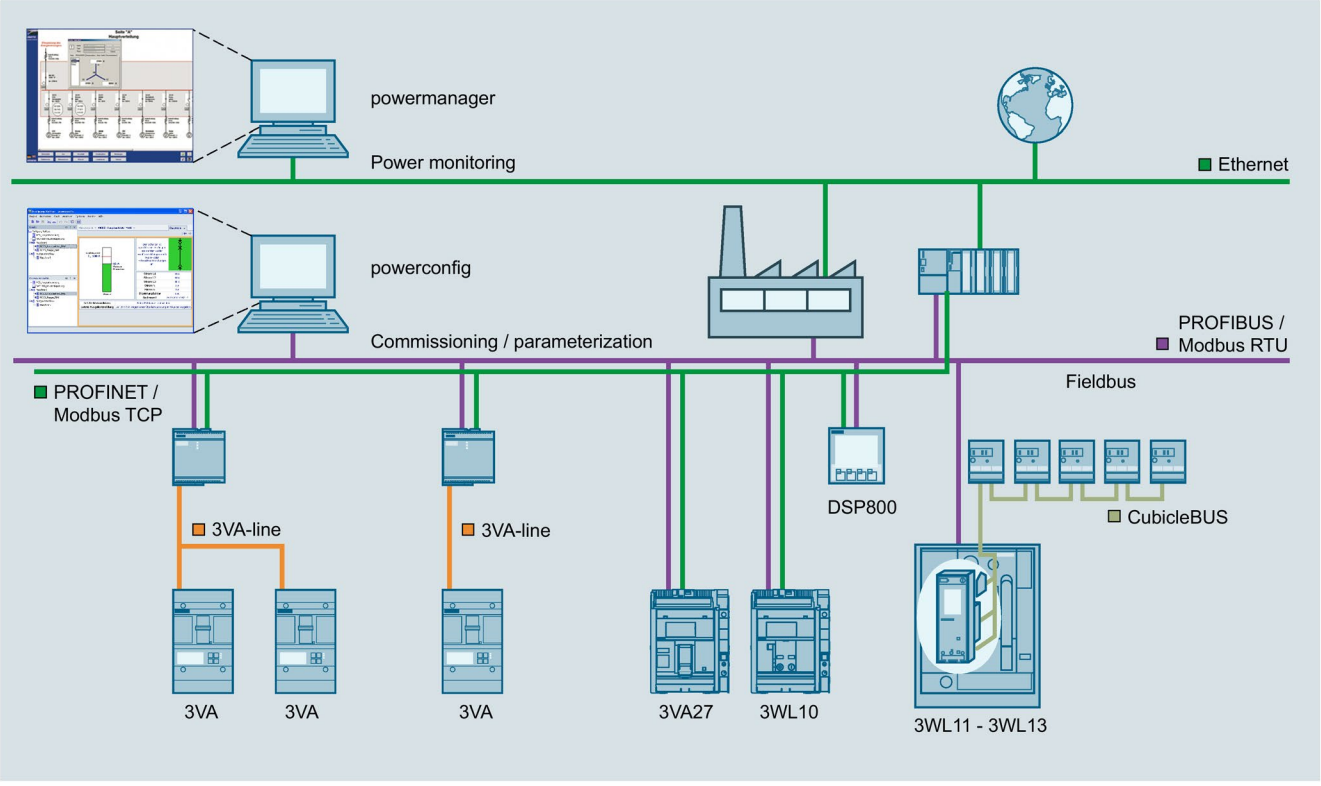
① Fixed-mounted breaker
② Withdrawable breaker

Because the circuit breaker is designed for up to two communication modules, it can be integrated into the communication environment with two different protocols. For example, simultaneous connection of a fieldbus for automation or remote control applications (incl. parameterization and remote switching) and Modbus TCP Ethernet communication link for communicating measured values for efficient and safe power monitoring.

For the remote control switch of the 3VA27, you require the version of the stored energy operating mechanism to be able to connect the device via the closing coil / shunt release and Com Act when the spring is charged. The automatic spring charging motor is recommended for this. (Info: Opening the circuit breaker is always possible when the spring is not charged.)

Communication applications

- Parameterization and configuration
  - With the powerconfig software (as of Version 3.9)
- Energy management
  - Metering function MF Basic / MF Advanced
  - Remote access and remote switching
  - Integration in powermanager and TIA



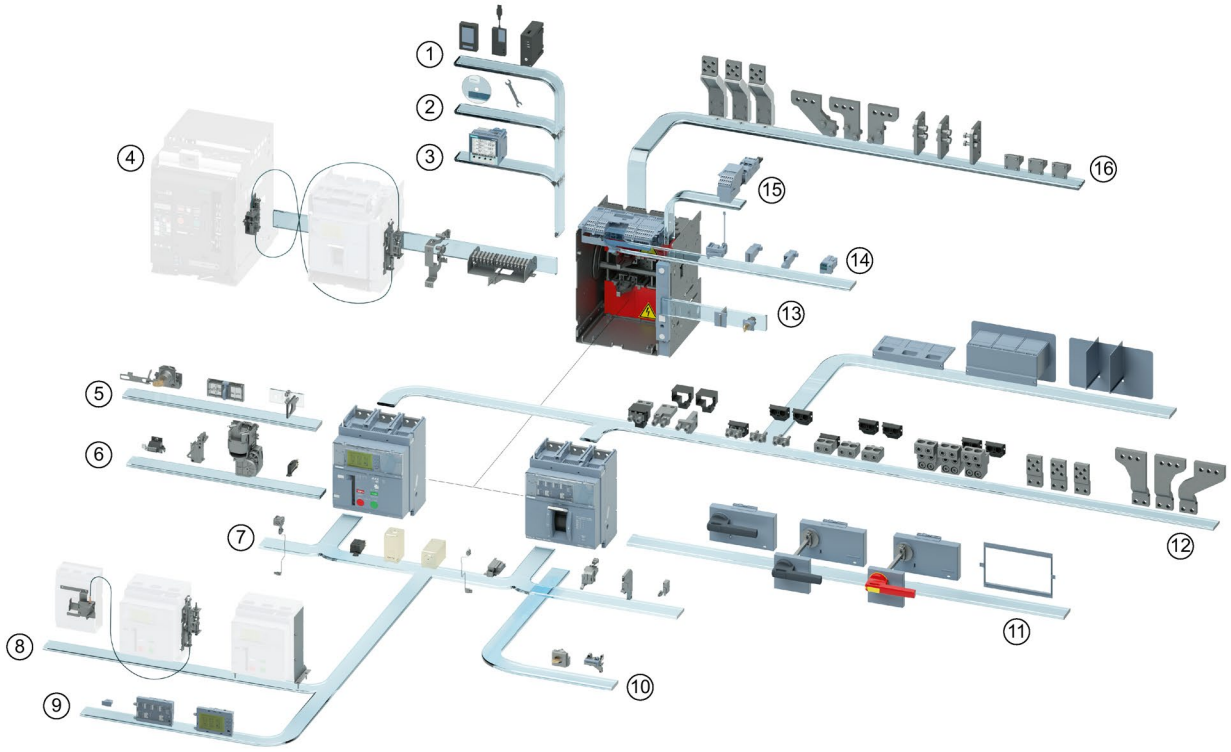
You will find further information on the communication link:

- in the 3WL10 communication manual and in the 3VA communication manual, see Chapter Reference documents (Page 10)
- in the Modbus Map in the SIOS Portal (https://support.industry.siemens.com/cs/ww/en/view/109749079).

2.10 Accessories overview

The 3WL10 / 3VA27 circuit breaker can be adapted to the most varied application requirements with its wide range of accessories. You will find an overview of the available accessories below. You can obtain the complete description in Chapter Accessories (Page 91).

Overview of the accessories



① Test devices
② powerconfig software
③ Display
④ Interlocking for the guide frame/ext. accessories
⑤ Locking and interlocking for breaker with stored energy operating mechanism
⑥ Spring charging motor and accessories
⑦ Auxiliary and alarm switches/auxiliary releases
⑧ Interlocking for fixed-mounted circuit breakers
⑨ Electronic trip units
⑩ Handle blocking device
⑪ Manual rotary operators
⑫ Connection technology for fixed-mounted circuit breakers
⑬ Locks for guide frame
⑭ Communication modules
⑮ Position signaling switch for guide frame
⑯ Connection technology for guide frame

Accessories

3

The internal and external accessories of the 3WL10 and the 3VA27 with stored energy operating mechanism are identical. In some cases, they may however differ from the the 3VA27 with toggle operating mechanism.

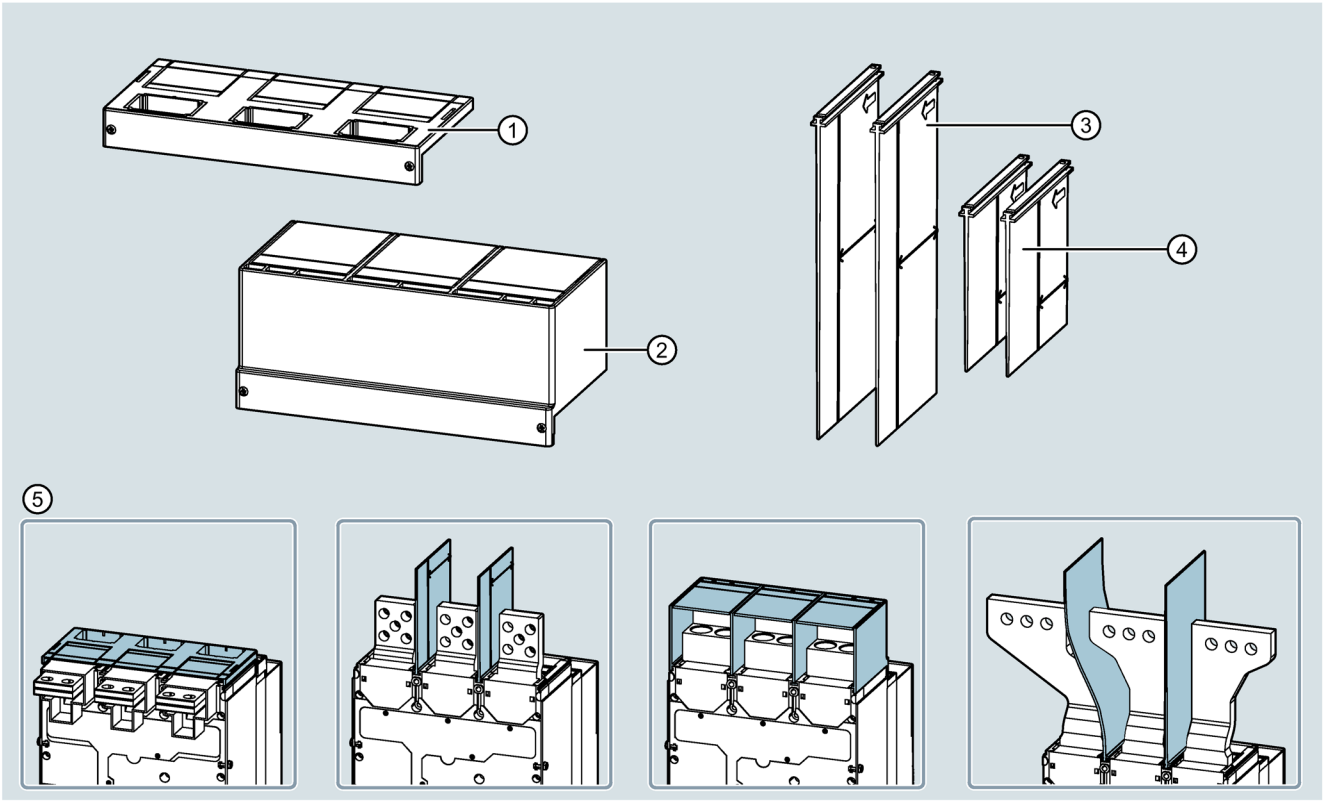
Overview:

	3WL10 (stored energy operating mechanism)	3VA27 (stored energy operating mechanism)	3VA27 (toggle operating mechanism)
Accessories for connection and insulation	✓	✓	✓
Undervoltage release (UVR)	✓	✓	✓
Shunt release (ST)	✓	✓	✓
Shunt release (ST2)	✓	✓	✓
Closing coil (CC)	✓	✓	-
Spring charging motor (MO)	✓	✓	-
Ready-to-close signaling switch (RTC)	✓	✓	-
Remote reset magnet (RR)	✓	✓	-
Spring charged signaling switch (S21)	✓	✓	-
Position signaling switch PSS for guide frame	✓	✓	✓
Tripped signaling switch (TAS) - signals the tripped position	-	-	✓
Auxiliary switch (AUX1-AUX2)	✓	✓	✓
Auxiliary switch (AUX3-AUX4)	✓	✓	✓
Tripped signaling switch (S24) - tripped by ETU	✓	✓	✓
Tripped signaling switch via auxiliary release (S25)	-	-	✓
Leading changeover switch (S26)	-	-	✓
Mechanical operating cycles counter (MOC)	✓	✓	-
Position signaling switch communication (COM PSS)	✓	✓	✓
Breaker Connect module, external power supply	✓	✓	✓

	3WL10 (stored energy operating mechanism)	3VA27 (stored energy operating mechanism)	3VA27 (toggle operating mechanism)
Communication modules (COM040-COM044)	✓	✓	✓
Digital I/O module IOM040	✓	✓	✓
Ready-to-close signaling switch for communication (COM RTC)	✓	✓	-
Actuator module (COM ACT)	✓	✓	-
Door mounted rotary operator, incl. locking devices	-	-	✓
Front mounted rotary operator, incl. locking devices	-	-	✓
External digital I/O module IOM300	✓	✓	✓
DSP800 display	✓	✓	✓
External current transformer for N conductor	✓	✓	✓
External CT for grounding conductors of the main power supply GF-CT	✓	✓	✓
Summation current transformer Rc CT	✓	✓	✓
Protective covers to prevent unintended mechanical operation	✓	✓	-
Locking device, OFF position, Ronis lock	✓	✓	-
Locking device, OFF position, Ronis lock, for circuit breaker with toggle operating mechanism	-	-	✓
Locking device, OFF position, for padlocking, circuit breaker with toggle operating mechanism	-	-	✓
Padlockable protective cover ON/OF	✓	✓	-
Locking device, OFF position, for padlocking	✓	✓	-
Breaker Data Adapters and test devices	✓	✓	✓

3.1 Accessories for connection and insulation

3.1.1 Insulating measures



① Low cover
② Extended cover
③ Phase barrier 200 mm
④ Phase barrier 100 mm
⑤ Application examples

Terminal cover

On fixed-mounted circuit breakers, the cover is installed over the termination area and reduces the risk of direct contact with live parts.

The cover is available in two versions:

- Low cover of front main terminal
- Extended cover of front main terminal

Phase barriers

Phase barriers provide insulation between the individual phases of the circuit breaker. They are installed in the front termination area between the phases of the fixed-mounted breaker version.

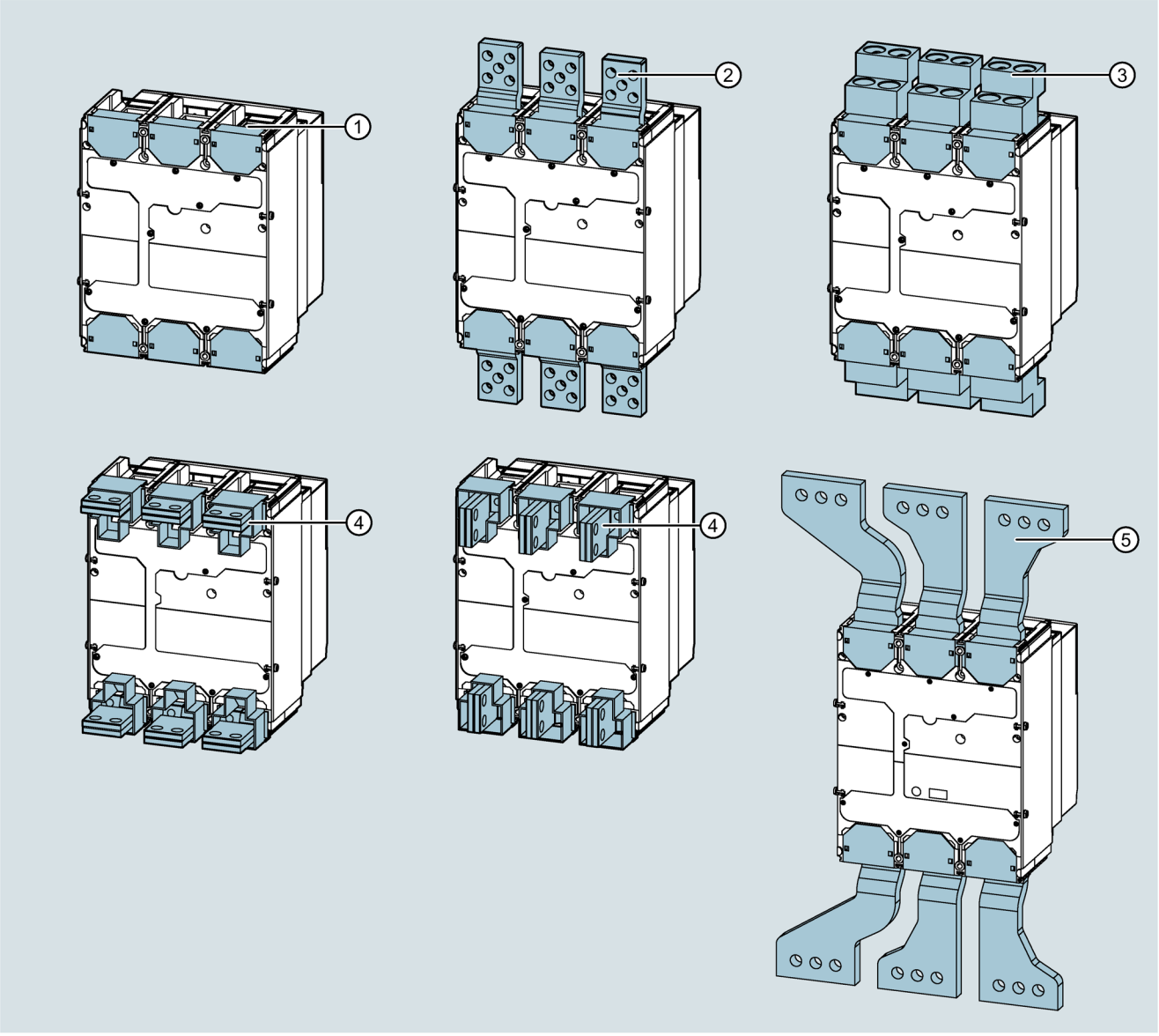
Note

You will find connections that necessitate mandatory insulation measures in Chapter Isolating distances and insulating equipment (Page 156).
In these cases, the measures are contained in the scope of delivery by default.

Rear connections of the fixed-mounted breaker version and the entire withdrawable breaker do not require insulation measures.

On the fixed-mounted breaker version with rear connections, the low terminal cover nevertheless permits optimum front touch protection.

3.1.2 Connections of the fixed breaker version



① Front terminals for main circuit connection
② Front connection bars, extended
③ Circular conductor terminal for Cu/Al cable
④ Horizontally / vertically orientable rear connection
⑤ Front connection bars, broadened

Front terminals for main circuit connection

The front terminals, which are standard equipment, are nut keeper kits (clip-in nut-insulator assembly and clamping screw). They fit entirely into the terminal area of the circuit breaker and do not protrude beyond the circuit breaker contour.

Front connection bars, extended

The front connection bars, extended permit variable and flexible connection of bars and cable lugs. They are mounted on the front terminals and are used to extend the jumper lug of the circuit breaker. The extended connections protrude from the circuit breaker and are not delivered preassembled on the circuit breaker.

Circular conductor terminal for Cu/Al cable

The cable terminals CuAl 4 x 240 mm^2 are mounted on the front terminals. They project beyond the circuit breaker contour.

A total of up to four cables with a maximum cross section of 240 mm^2 can be connected to the cable terminal CuAl 4 x240 mm^2.

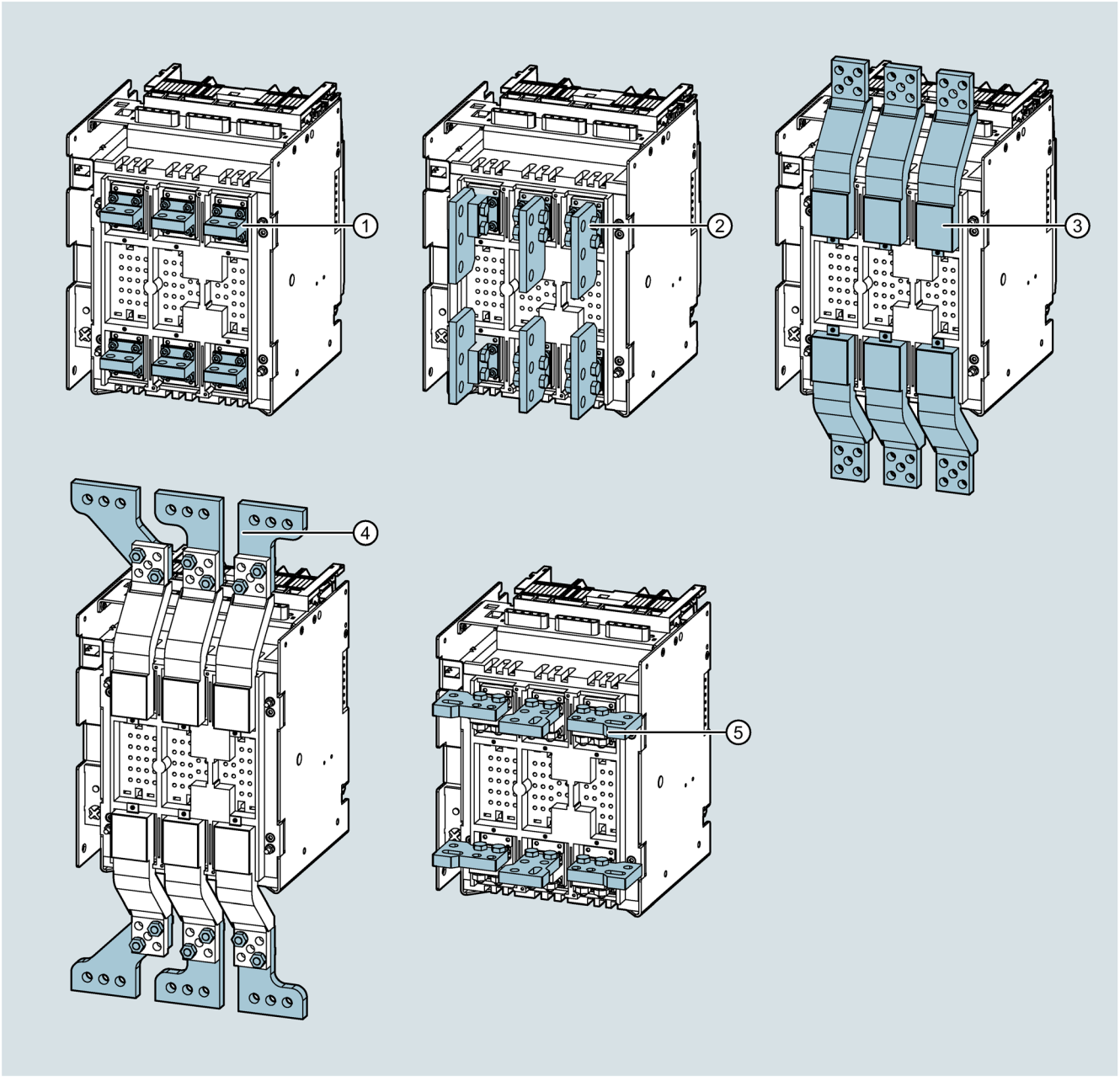
Horizontally / vertically orientable rear connections

The rear connection with variable orientation permits connection of connecting bars and cable lugs to the rear of the circuit breaker. It can be mounted both horizontally and vertically or subsequently turned horizontally / vertically by the user.

Front connection bars, broadened

The front connection bars, broadened permit connection of broadened busbars and up to four cable lugs per phase and thus provide additional flexibility. The broadened connections protrude from the circuit breaker and are not delivered preassembled on the circuit breaker.

3.1.3 Connections of the withdrawable breaker version



① Horizontally / vertically orientable rear terminal for main circuit connection
② Copper/aluminum cable connection bar
③ Front extended terminal
④ Front connection bars, broadened
⑤ Rear connection bars, broadened

Horizontally / vertically orientable rear terminal for main circuit connection

The rear connection with variable orientation permits connection of connecting bars and cable lugs to the rear of the guide frame. The rear main terminal is supplied mounted on the flange of the guide frame and can also be rotated subsequently by the user.

Copper/aluminum cable connection bar

A cable lug is required for connection.

The circular conductor terminal is mounted on the vertically oriented rear terminals of the guide frame.

A total of up to four cables with a maximum cross section of 240 mm^2 can be connected to the cable terminal CuAl 4 x240 mm^2.

Extended front connection

The extended front connection for the withdrawable breaker is an alternative to the rear connection. It enables the connections to be accessed from the front. It is mounted directly on the guide frame and projects beyond the guide frame contour.

Front connection bars, broadened

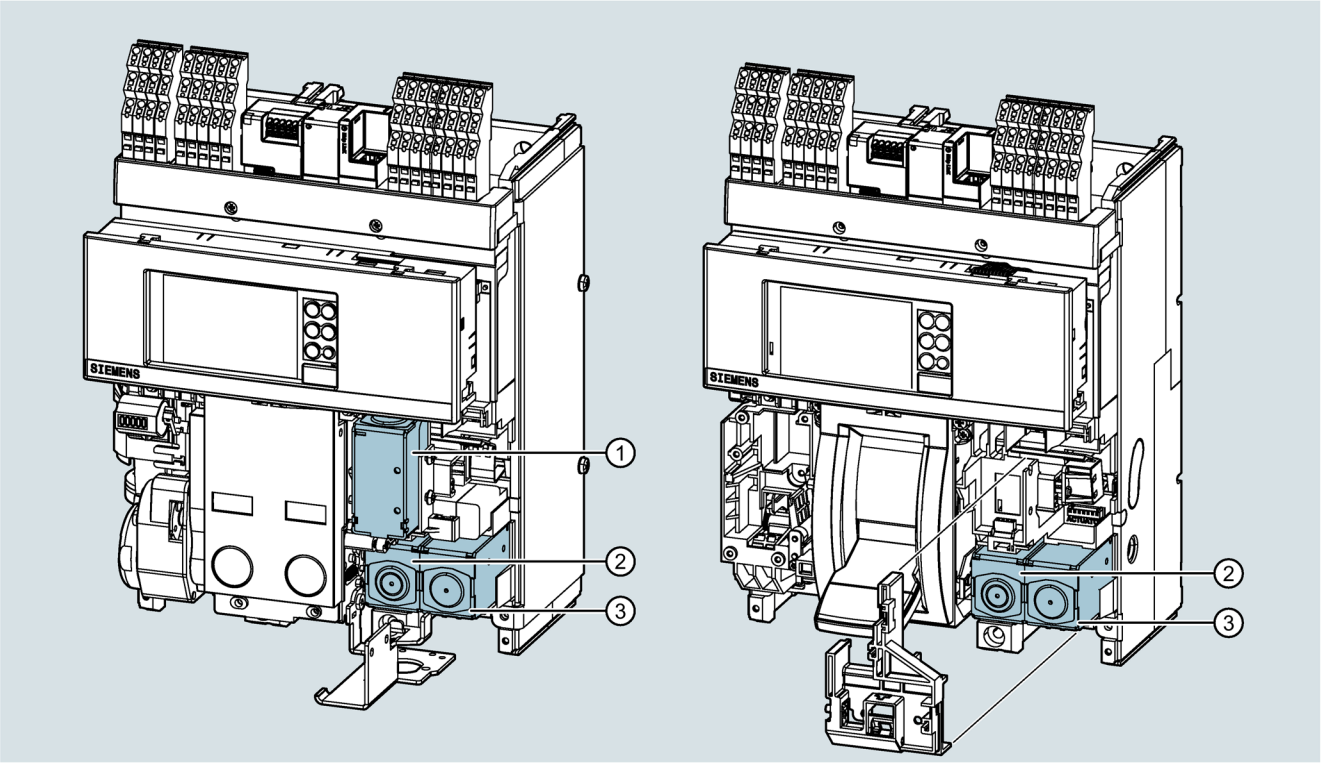
The front connection bars, broadened permit front connection of broadened connecting bars and up to four cable lugs per phase and thus provide additional flexibility. They are screwed to the extended front connections (not included in the scope of delivery) and protrude beyond the guide frame contour.

Rear connection bars, broadened

The rear connection bars, broadened provide more space for connection of broadened busbars. They are mounted on the horizontally oriented rear connections of the guide frame.

3.2 Electromechanical accessories

3.2.1 Auxiliary releases for 3VA27 / 3WL10



① Closing coil (CC) (for breaker with stored energy operating mechanism only)
② Undervoltage release (UVR) / shunt release (ST2)
③ Shunt release (ST)

Undervoltage release (UVR)

The undervoltage release trips the circuit breaker if the rated control supply voltage U_s fails or drops to between 70% and 35% of its normal value (in compliance with the relevant standard). The undervoltage release can be used for:

- Safe remote tripping
- Interlocking during closure
- Checking the voltage in the primary and secondary circuits

The undervoltage release is powered via the auxiliary conductor terminal system.

Note

The circuit breaker can be reclosed at a coil supply voltage of 85% to 110% U_n.

Suitable for continuous operation: 100% ON time

Technical specifications		AC	DC
Rated control supply voltage U_s	24 V	✓	✓
	30 V	✓	✓
	48 V	✓	✓
	60 V	✓	✓
	110 to 120 V	✓	✓
	120 to 127 V	✓	✓
	220 to 240 V	✓	✓
	240 to 250 V	✓	✓
	380 to 400 V	✓	—
	415 to 440 V	✓	—
Operating limits		UVR: ON: 85 to 110% U_s UVR: OFF: ...< 70% U_s	
Switch-on power		300 VA	300 W
Continuous power		3.5 VA	3.5 W
Break time UVR		30 ms	

Closing coil (CC) / shunt release (ST)

With the auxiliary solenoids (CC and ST), the circuit breaker can be closed (CC) and opened (ST) remotely by electrical signals connected at the auxiliary conductor terminal system or via communication.

Closing (breaker position CLOSED) is only possible if the closing springs are charged and the circuit breaker is ready for closing. Opening (breaker position OPEN) is always possible.

The coils work with a current pulse ≥ 100 ms or with constant power input (100% ON time in %).

Note

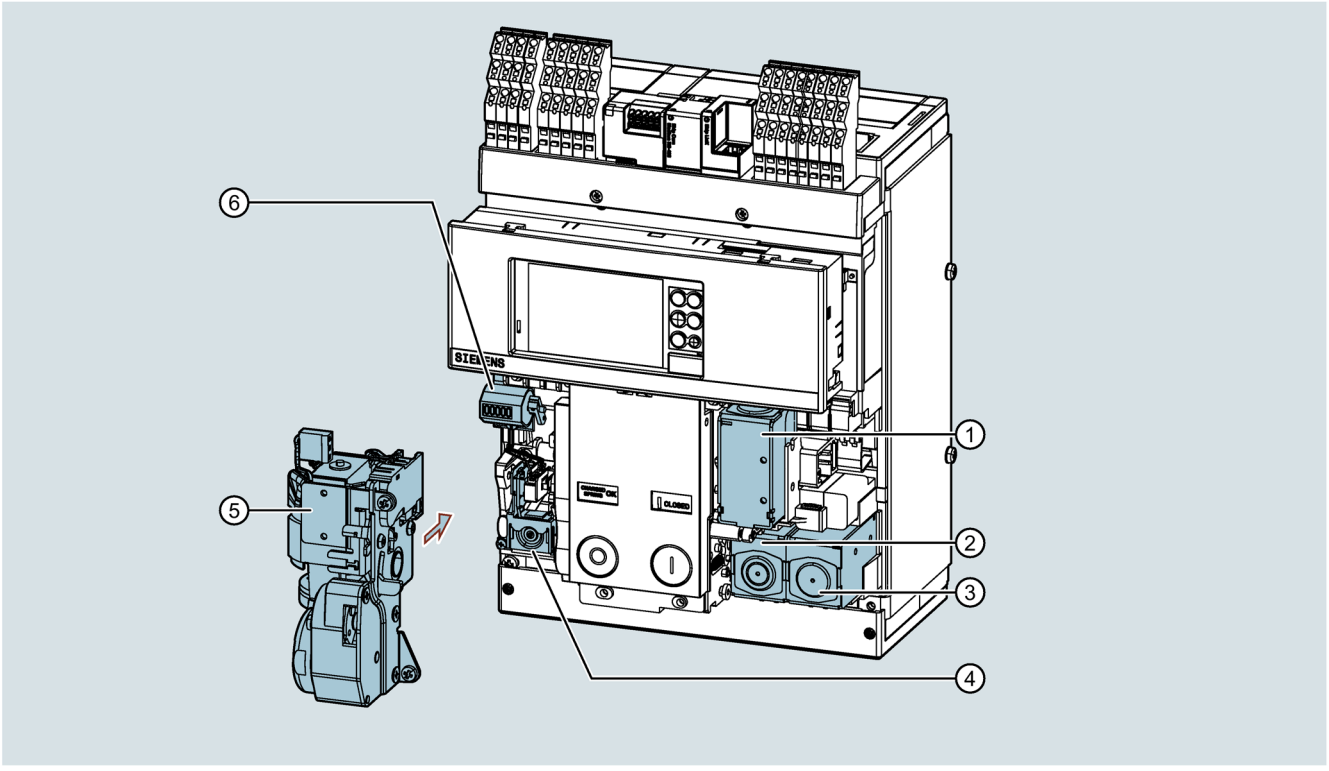
If the opening command was issued with a shunt release, the circuit breaker can be reclosed with a closing command after the shunt release has been switched off followed by a wait time ≥ 30 ms.

The opening command always has priority over the closing signal.

Technical specifications		AC	DC
Rated control supply voltage U_s	24 V	✓	✓
	30 V	✓	✓
	48 V	✓	✓
	60 V	✓	✓
	110 to 120 V	✓	✓
	120 to 127 V	✓	✓
	220 to 240 V	✓	✓
	240 to 250 V	✓	✓
	380 to 400 V	✓	✓
	415 to 440 V	✓	✓
Operating limits		ST: 70 to 110% U_s CC: 85 to 110% U_s	
Switch-on power		300 VA	300 W
Continuous power		3.5 VA	3.5 W
Break time ST		35 ms	
Make time CC		50 ms	

3.2.2 Accessories for circuit breakers

3VA27 / 3WL10 breakers with stored energy operating mechanism



① Closing coil (CC) (Page 99)
② Undervoltage release (UVR) / shunt release (ST2) (Page 99)
③ Shunt release (ST2) (Page 99)
④ Remote reset magnet (RR)
⑤ Spring charging motor (MO)
⑥ Mechanical operating cycles counter (MOC)

Spring charging motor (MO)

The spring charging motor (MO) automatically charges the closing springs when they are discharged. If no power supply is available, the springs must be charged manually with the manual lever of the operator on the circuit breaker.

Technical specifications		AC	DC
Rated control supply voltage U_s	24 to 30 V	✓	✓
	48 to 60 V	✓	✓
	100 to 130 V	✓	✓
	220 to 250 V	✓	✓
Operating limits (acc. to IEC 60947-2)		85 to 110% U_s	
Switch-on power		300 VA	300 W
Continuous power		100 VA	100 W
Make time [1]		200 ms	
Charging time		7 s	

[1] Make time = magnetization time: Time with voltage applied that the spring charging motor requires to start charging. Charging the spring energy store then takes approx. 7 s.

Note

The motor is always supplied with the spring charged signaling switch (S21), which signals the state of the springs.

The use of the spring charging motor does not reduce the life, the operating cycles, and the frequency of operation of the whole product.

Remote reset magnet (RR)

With the remote reset magnet (RR), the circuit breaker can be reset remotely when the trip unit has opened the circuit breaker.

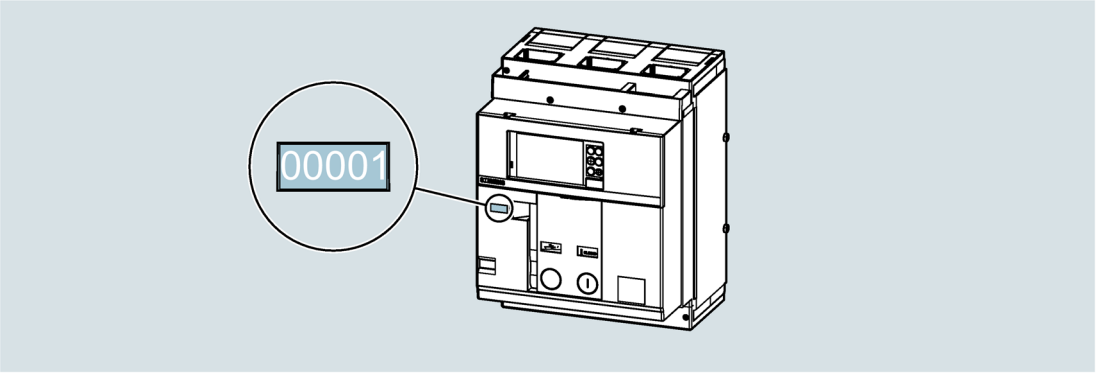
Deliberate resetting of the ETU by mechanical operation on the device or remote resetting via the RR is necessary for safety after overcurrent tripping. All faults in the distribution board should be cleared first.

The reset coil is available for different voltage supplies.

Technical specifications		AC	DC
Rated control supply voltage U_s	24 V	✓	✓
	110 V	✓	✓
	220 V	✓	✓
Operating limits		90 to 110% U_s	

Mechanical operating cycles counter (MOC)

Unlike the communication link accessories, the mechanical operating cycles counter MOC does not have a remote signaling option. It displays the number of mechanical switching operations performed by the circuit breaker directly on the front of the circuit breaker.



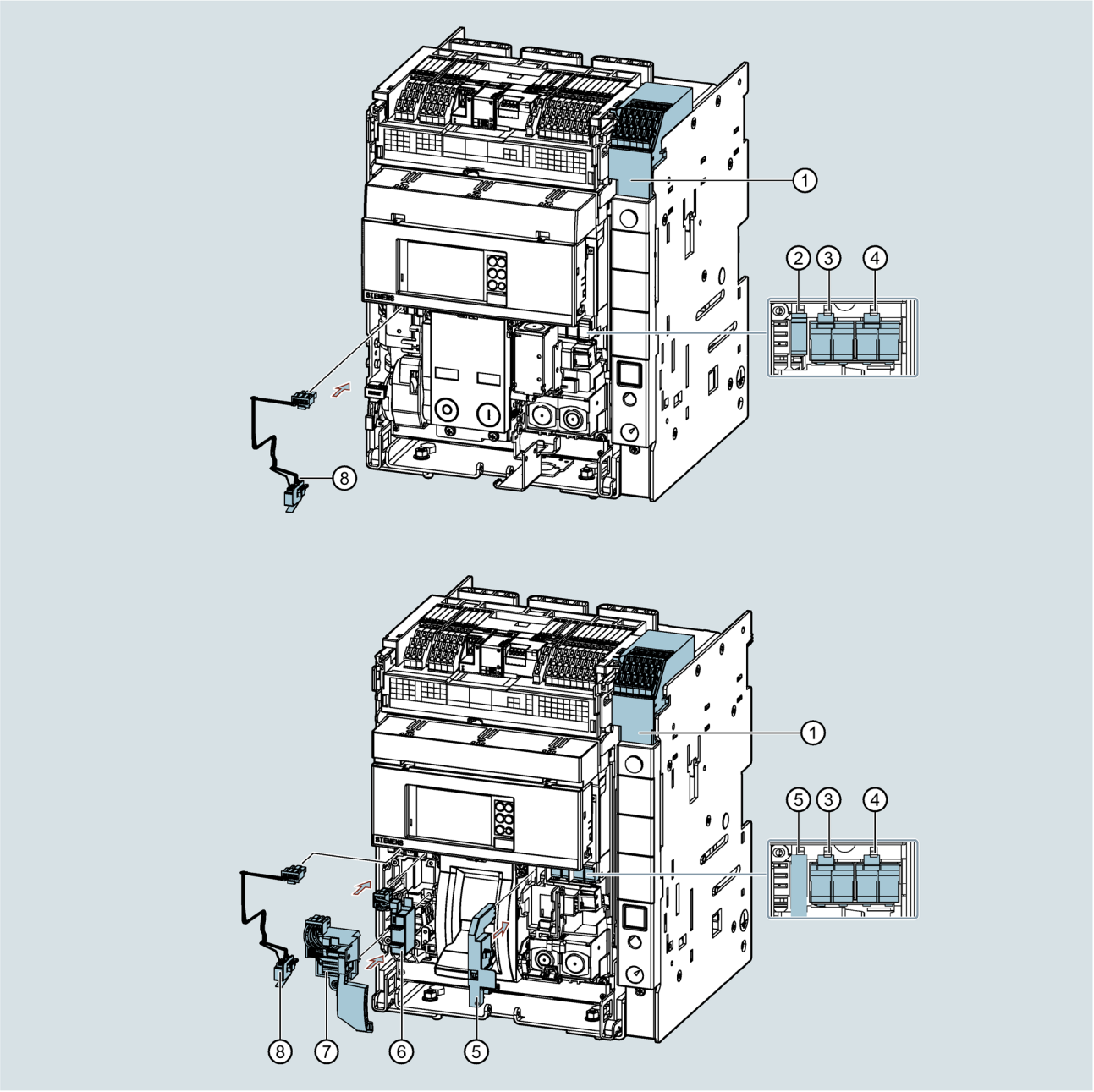
Note

Because the number of operating cycles performed influences the maintenance intervals, the mechanical operating cycles counter MOC can provide the necessary basis for defining them.

You will find information on maintenance in Chapter Service and maintenance (Page 211)

The MOC can only be installed in conjunction with a spring charging motor.

3.2.3 Auxiliary, alarm, and signaling switches



① Position signaling switch PSS for guide frame
② Ready-to-close signaling switch RTC (S20)
③ Auxiliary switch (AUX1 - AUX2)
④ Auxiliary switch (AUX3 - AUX4)
⑤ Tripped signaling switch via auxiliary release (S25)
⑥ Tripped signaling switch (TAS)
⑦ Leading changeover switch (S26)
⑧ Tripped signaling switch (S24 - tripped by the electronic trip units)

Position signaling switch PSS for guide frame

The position auxiliary contacts are used in the withdrawable breaker and signal whether the circuit breaker is in the racking position DISCONNECT, Test, or CONNECT.

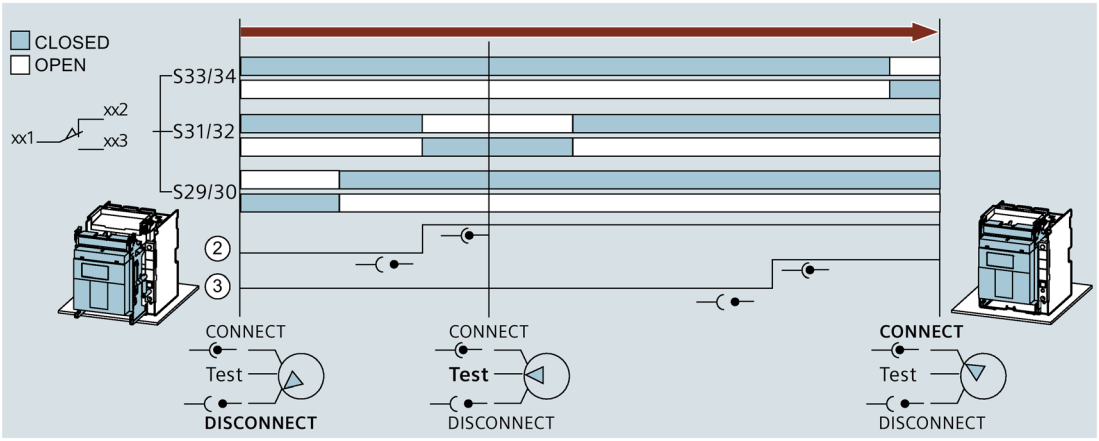
Breaker position	Auxiliary contacts	Main circuit connection
CONNECT: Inserted	Connected	Connected
TEST: Test position	Connected	Isolated
DISCON (DISCONNECT): Removed	Disconnected	Isolated

The position signaling switches are always installed in the guide frame. However, the user can modify 24 V digital signals in the device configuration to meet the requirements for small loads, e.g. for PLC connection.

Configuration	Position auxiliary contacts - PSS 6 auxiliary contacts
Standard contact 400 V	•
Contact for digital signal 24 V	•

			Standard contact	Contact for digital signal
Type			Changeover contact	Changeover contact
Smallest load			100 mA at 24 V	1 mA at 5 V
Breaking capacity	DC	24 V	—	0.1 A
		125 V	0.3 A at 0 ms	—
		250 V	0.15 A at 0 ms	—
	AC	250 V	5 A at cosφ 1	—
			5 A at cosφ 0.7	—
			5 A at cosφ 0.3	—
		400 V	3 A at cosφ 1	—
			2 A at cosφ 0.7	—
			1 A at cosφ 0.3	—

Signaling diagram of the position signaling switch PSS:



Tripped signaling switch (TAS)

The tripped signaling switch (TAS) signals every type of tripping of the circuit breaker:

- Tripping of the ETU due to overcurrent (overload, short-circuit, …)
- Tripping of the ETU by the residual current module Rc
- Tripping of the shunt or undervoltage release
- Mechanical tripping by PUSH TO TRIP pushbutton

Mechanical tripped signal RESET button

The circuit breaker can only be reclosed once the mechanical signaling button for "ETU tripped" (reset) has been operated or the circuit breaker has been reset to its normal operating position manually or by means of the remote reset magnet RR.

The trip alarm switch (TAS) can only be used for 3VA27 molded case circuit breakers with toggle.

Auxiliary switch AUX

The auxiliary contacts signal the current CLOSED or OPEN position of the circuit breaker.

The four internal auxiliary contacts AUX 4CO are installed in each circuit breaker and non-automatic air circuit breaker as standard. The user can modify these for 24 V digital signals or mixed contacts during device configuration as shown in the following table. An additional external breaker position query is possible with an expansion by 15 external auxiliary switches with AUX 15CO. You will find the necessary modification of the circuit breaker side wall in Chapter External accessories (Page 117).

If both auxiliary contact modules are installed, up to 19 auxiliary contacts CLOSED / OPEN are available.

Configuration	**AUX 4CO / 2CO + 2CO 4 auxiliary contacts (internal)**	**AUX 15CO Additional external 15 auxiliary contacts**
Standard contact	✓	✓
Contact for digital signal	✓	✓
Mixed signals AUX 2CO + 2CO	✓	✓

			Standard contact	**Contact for digital signal**
Type			Changeover contact	Changeover contact
Smallest load			100 mA at 24 V	1 mA at 5 V
Breaking capacity	DC	24 V	—	0.1 A
		125 V	0.3 A at 10 ms	—
		250 V	0.15 A at 10 ms	—
	AC	250 V	5 A at cosφ 1	—
			5 A at cosφ 0.7	—
			5 A at cosφ 0.3	—
		400 V	3 A at cosφ 1	—
			2 A at cosφ 0.7	—
			1 A at cosφ 0.3	—

Tripped signaling switch (S24)

The contact signals tripping of the circuit breaker by the electronic trip unit ETU.

The changeover contact is always contained in the scope of delivery of the circuit breaker (not non-automatic air circuit breakers) and can be obtained in a version for digital signals by configuration modification.

			Standard contact	Contact for digital signal
Type			Changeover contact	Changeover contact
Smallest load			100 mA at 24 V	1 mA at 5 V
Breaking capacity	DC	24 V	—	0.1 A
		250 V	0.5 A at 0 ms	—
			0.2 A at 10 ms	—
	AC	250 V	3 A at cosφ 0.7	—

Mechanical tripped signal RESET button

The circuit breaker can only be reclosed once the mechanical signaling button for "ETU tripped" (reset) has been operated or the circuit breaker has been reset to its normal operating position manually or by means of the remote reset magnet RR.

Tripped signaling switch via auxiliary release (S25)

The tripped signaling switch via auxiliary release (S25) signals tripping of the circuit breaker by the shunt release or undervoltage release.

The tripped signaling switch via auxiliary release (S25) can only be used for 3VA27 molded case circuit breakers with toggle.

Leading changeover switch (S26)

The leading changeover switch (S26) signals opening of the main contacts in advance of circuit breaker trips and are thus used for load shedding, for example.

The leading changeover switch (S26) can only be used for 3VA27 molded case circuit breakers with toggle.

Ready-to-close signaling switch (RTC)

The signaling contact for ready-to-close (RTC) is used to query whether the circuit breaker is ready for closing. This signaling contact is always included in the scope of delivery of the circuit breaker with a stored energy operating mechanism.

The following conditions must be met before the circuit breaker is ready to close:

- Circuit breaker in the OPEN position
- Springs charged
- Switch-off command or interlocking with switch-off command is not pending
- Circuit breaker reset due to tripping of the electronic trip unit ETU

			Standard contact	Contact for digital signal
Type			Changeover contact	Changeover contact
Smallest load			100 mA at 24 V	1 mA at 5 V
Breaking capacity	DC	24 V	—	0.1 A
		250 V	0.5 A at 0 ms	—
			0.2 A at 10 ms	—
	AC	250 V	3 A at cosφ 0.7	—

Spring charged signaling switch (S21)

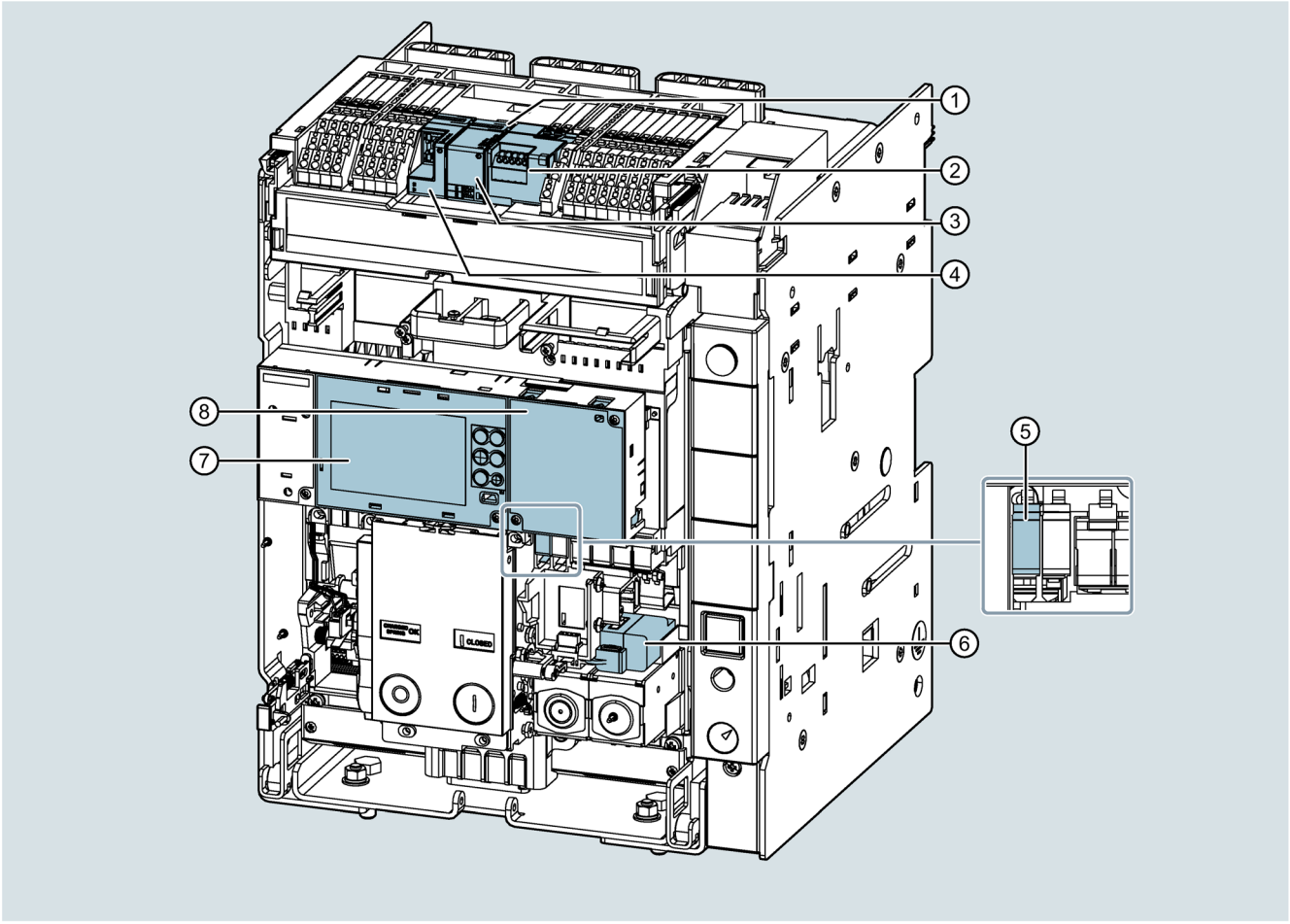
The spring charged signaling switch (S21) signals the state of the operator closing springs of the circuit breaker on the auxiliary conductor terminal system. This signaling switch is also supplied if a circuit breaker is configured with a spring charging motor.

The contact is available in the standard version or in a version for digital signals.

			Standard contact	Contact for digital signal
Type			Changeover contact	Changeover contact
Smallest load			100 mA at 24 V	1 mA at 5 V
Breaking capacity	DC	24 V	—	0.1 A
		125 V	0.3 A at 0 ms	—
		250 V	0.15 A at 0 ms	—
	AC	250 V	5 A at cosφ 1	—
			5 A at cosφ 0.7	—
			5 A at cosφ 0.3	—
		400 V	3 A at cosφ 1	—
			2 A at cosφ 0.7	—
			1 A at cosφ 0.3	—

The signaling contact can only be operated in conjunction with the spring charging motor.

3.3 Accessories for communication link, remote switching, and I/O modules



① Position signaling switch of the circuit breaker in the guide frame (COM PSS), not shown in the figure.
② Breaker Connect module, external power supply
③ Communication modules
④ Digital I/O module IOM040
⑤ Ready-to-close signaling switch for communication (COM RTC) - only available for the version with a spring energy store
⑥ Actuation module for remote operation (COM ACT) - only available for the version with a spring energy store
⑦ ETU
⑧ Metering function

Position signaling switch communication (COM PSS)

Via the communication link, the position signaling switch COM PSS provides the signal indicating whether the circuit breaker in the guide frame is inserted or removed.

Unlike the position signaling switch PSS, whose signals are available at the auxiliary conductor terminal system (see Section Auxiliary, alarm, and signaling switches (Page 105)), the position signaling switch COM PSS only signals two different states:

- INSERTED breaker position (circuit breaker in the CONNECT position)
- ISOLATED breaker position (circuit breaker in the TEST **or** DISCON position)

Breaker Connect module, external power supply

Via the Breaker Connect module, the electronic trip units (3- and 6-series) and the communication modules can be supplied with power externally at the auxiliary terminal block (auxiliary power supply).

Note

To provide the functionality of the circuit breaker as a protective device, the ETU is powered via an internal transformer in the operating state when the main contacts are closed. When the contacts are open, the ETU can optionally be powered via the metering function MF Advanced and the internal voltage tap.

The Breaker Connect module can be installed on the terminal strip of the circuit breaker and permits installation of communication modules in the ETUs of the 6-series. In this way, the module establishes connectivity of the circuit breaker with a communication environment.

As a further functionality, it enables the internal circuit beaker bus (CB bus) at terminals CB1 and CB2 to be brought out and an external I/O module (IOM300) to be connected to any ETU, which can then be configured via a test device (TD410/420).

Depending on the auxiliary voltage used, the following versions can be used:

- External power supply 110 to 240 V AC/DC
- External power supply 24 to 48 V DC

The Breaker Connect module is supplied as standard if the circuit breaker is configured for communication.

Communication modules

The circuit breakers utilize an innovative, modern communication concept.

The basis for this concept is the communication-capable trip unit of the ETUs of the 6-series, the metering function, and the different communication modules.

The terminal strip provides space for two communication modules. It is thus possible to transmit data simultaneously to two different communication networks or communicate redundantly on one network. The following communication modules are available for this:

- COM040 (PROFIBUS DP)
- COM041 (PROFINET IO)
- COM042 (Modbus TCP)
- COM043 (Modbus RTU)
- COM044 (IEC 61850)

You can find additional information in the 3VA Communication System Manual (http://www.siemens.com/3VA-Documentation).

You will find information about the entire communication system, the ordering options, data structures, and installation instructions, and the Modbus data structure as an Excel file on the Internet at Siemens Online Support (https://support.industry.siemens.com/cs/document/109750691/3wl10-kommunikations%C3%BCbersicht?dti=0&lc=en-WW).

Digital I/O module IOM040

These modules are suitable for all electronic trip units of the 6-series.

The digital I/O modules IOM040 provide two input and two output contacts for control and remote signaling of alarms and tripping of the circuit breaker. They can be used for the electronic trip units with display (6-series). Via the display of the ETU or the powerconfig software, default settings of the inputs and outputs can be selected and configured.

Ready-to-close signaling switch for communication (COM RTC)

The ready-to-close signaling switch COM RTC provides the same information as the ready-to-close signaling switch RTC, see Section Auxiliary, alarm, and signaling switches (Page 105). It is used to query whether the circuit breaker is ready to close.

Unlike the RTC signaling switch, whose signals are available at the auxiliary conductor terminal system, the signals of the ready-to-close signaling switch COM RTC are forwarded via the communication link.

Actuator module (COM ACT)

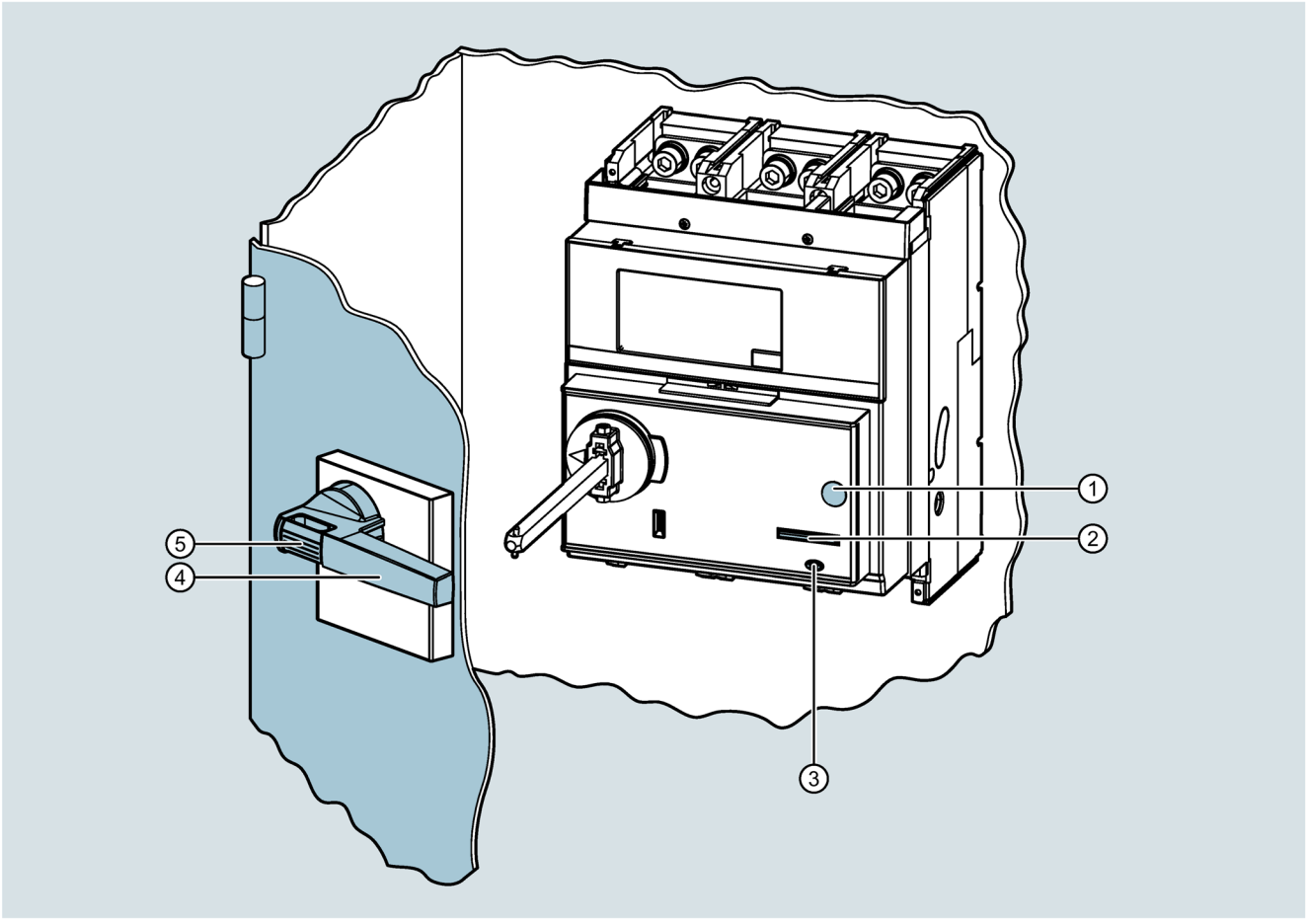
The actuator module (COM ACT) is a communication link for the remote operation of auxiliary solenoids (CC/ST). With the actuator module, the circuit breaker can be opened and closed by remote access.

3.4 Rotary operators

3.4.1 Door mounted rotary operator

With the door mounted rotary operator installed, it is possible to operate the circuit breaker through the panel door without opening the door.

The door mounted rotary operator is only available for 3VA27 circuit breakers with toggle.



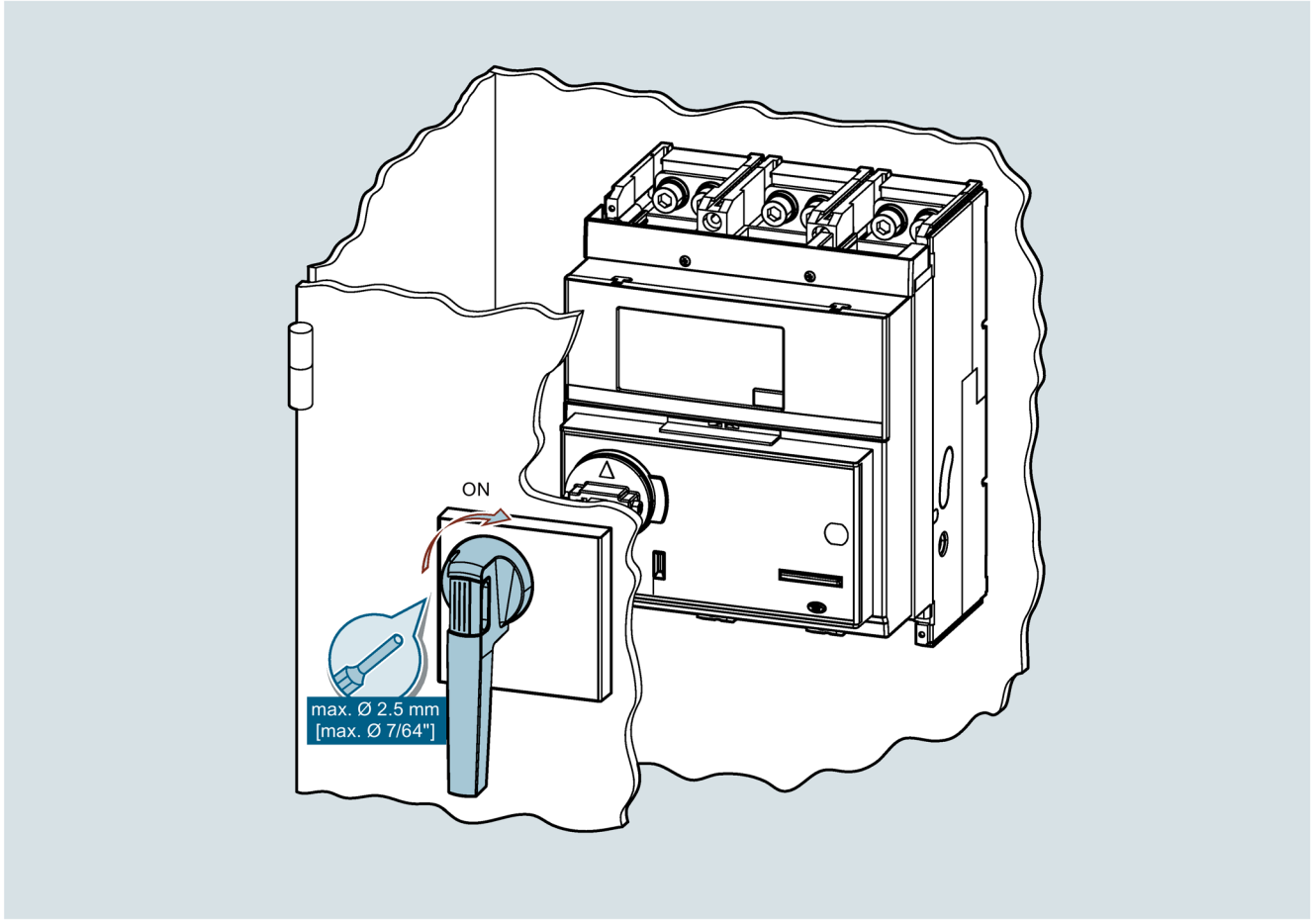
① Device for mounting a cylinder lock
② Device for up to three padlocks (on the breaker)
③ Button for the trip unit <PUSH TO TRIP>
④ Handle
⑤ Device for up to three padlocks

Figure 3-1 The door interlocking pin is not shown. It is located on the left side of the masking plate.

Door interlock

The door interlock of the door mounted rotary operator locks the door as soon as the door mounted rotary operator is turned to position ON.

The door interlock can be overridden by a deliberate action. This is done by pressing the door interlocking pin on the left side of the masking plate with a sharp object (e.g. a narrow screwdriver). This means that the door can be opened with the operator in position ON so that maintenance can be carried out, for example.



Locking

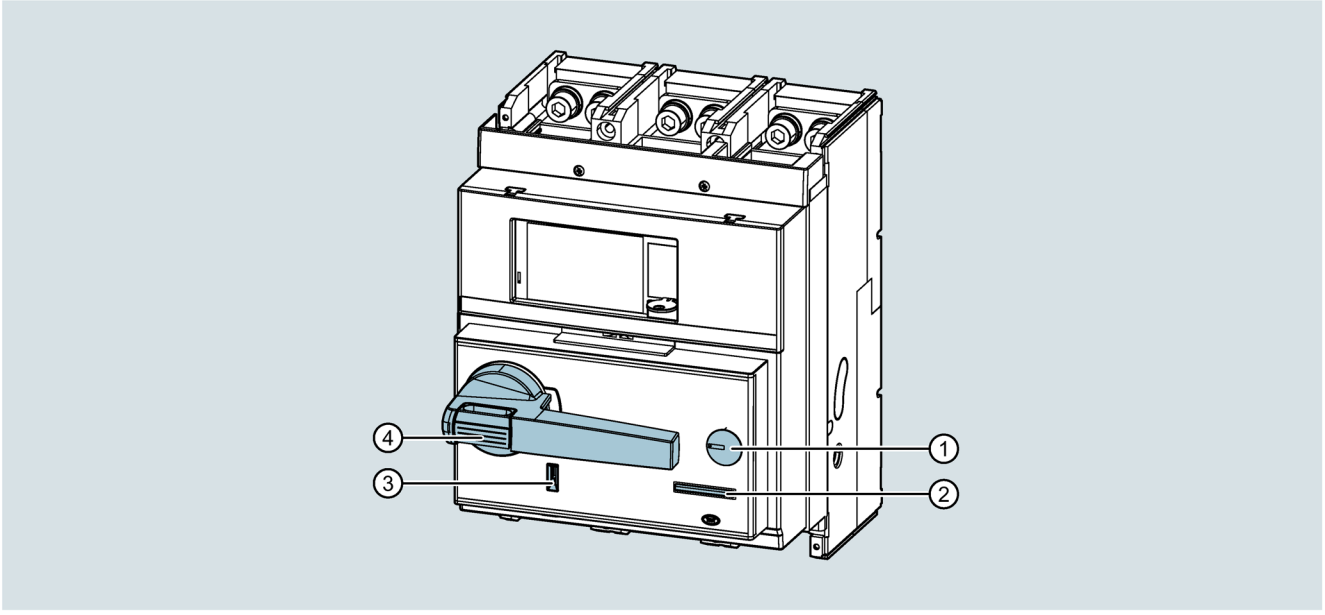
The circuit breaker can be locked via the door mounted rotary operator in three different ways.

1. On the handle: If the circuit breaker on the handle is locked with padlocks (up to three, 5-7 mm diameter), the door cannot be opened when the circuit breaker is open either.
2. On the rotary operator: For locking the circuit breaker while the panel door is open, e.g. for maintenance work, padlocks (up to three, 5-7 mm diameter) can also be used on the operator itself.
3. With cylinder lock on the rotary operator: The circuit breaker can also be prevented from closing with a key and an optionally installable cylinder lock.

3.4.2 Front mounted rotary operator

The front mounted rotary operator with door interlock is a rotary operator that is located directly on the circuit breaker and can also be inserted through the panel door. The front mounted rotary operator locks the door automatically when it is turned to position ON.

The door sealing frame is contained in the scope of delivery of the front mounted rotary operator.



① Device for mounting a cylinder lock
② Device for up to 3 padlocks (on the breaker)
③ Defeat function of the door interlock
④ Handle with device for up to 3 padlocks

You can override the door interlock by a deliberate action. In this way, you can also open the door in the ON (I) position of the molded case circuit breaker.

Door interlock

The door interlock of the door mounted rotary operator locks the door as soon as the door mounted rotary operator is turned to position ON.

The door interlock can be overridden by a deliberate action. This is done by pressing the door interlocking pin on the left side of the masking plate with a sharp object (e.g. a narrow screwdriver). This means that the door can be opened with the operator in position ON so that maintenance can be carried out, for example.

Locking

The circuit breaker can be locked via the front mounted rotary operator in three different ways.

1. On the handle:

   With up to three padlocks (5-7 mm diameter)

2. On the rotary operator:

   With up to three padlocks (5-7 mm diameter)

3. With cylinder lock on the rotary operator:

   The circuit breaker can also be prevented from closing with a key and an optionally installable cylinder lock.

3.5 External accessories

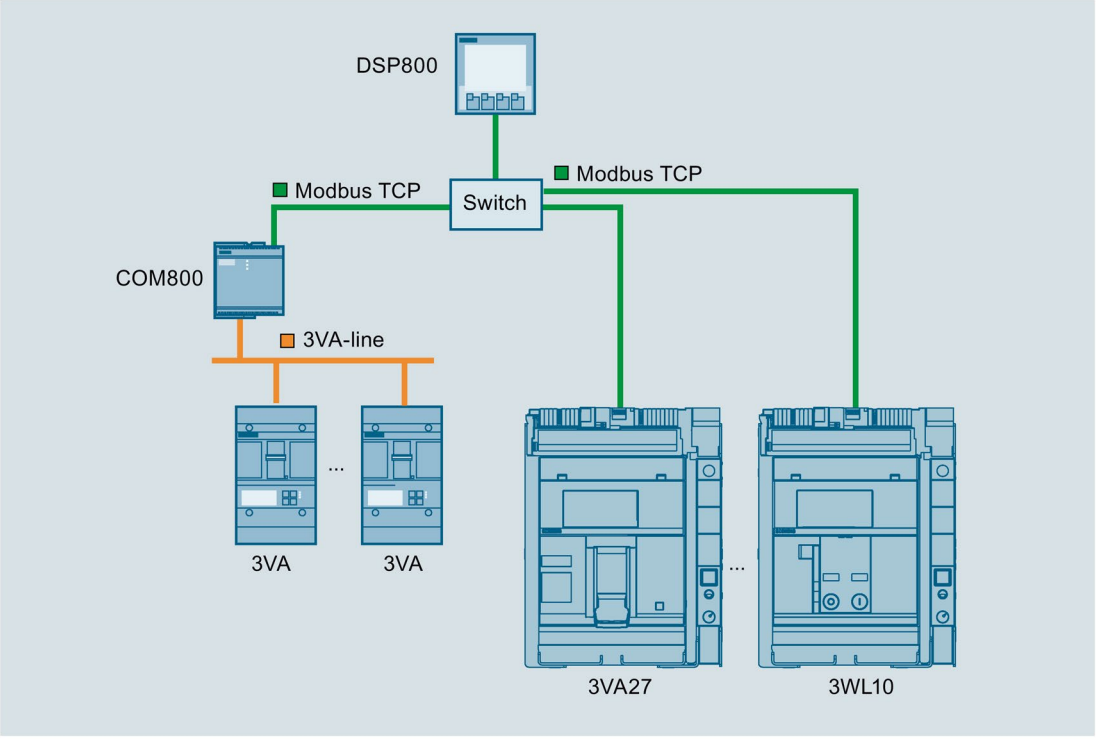
3.5.1 External digital I/O module IOM300

The external digital I/O module IOM300 provides 11 input and 10 output contacts for control and remote signaling of alarms and tripping of the circuit breaker.

It is suitable both for the electronic trip units of the 6-series and of the 3-series because it is connected directly to the CB1 and CB2 terminals of the auxiliary conductor terminal system.

3.5.2 DSP800 display

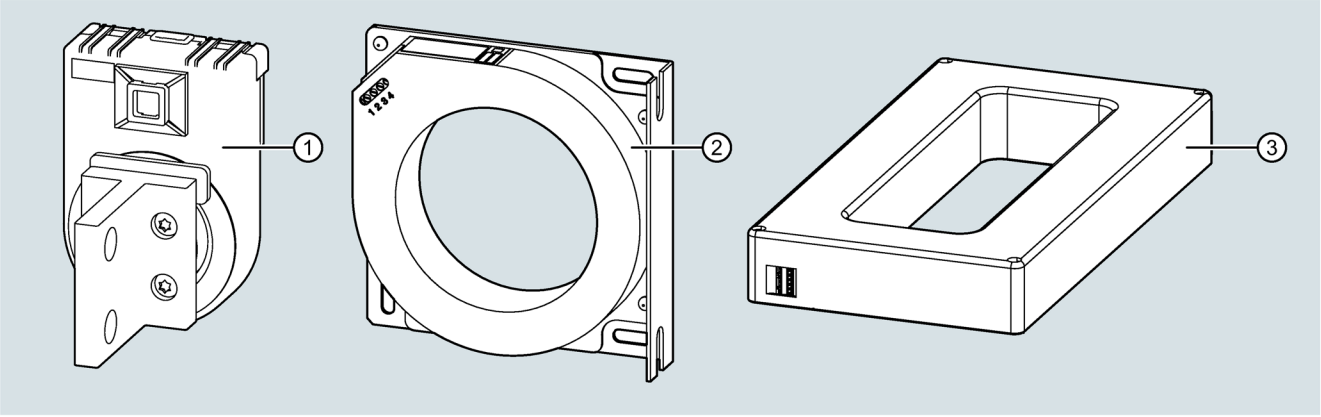
The DSP800 display for mounting in the control panel door is connected to the Ethernet (Modbus TCP) interface of the COM043 module to visualize up to three 3WL10 / 3VA27 circuit breakers and, where required, an additional five circuit breakers of the 3VA2 series. The 3WL10 / 3VA27 circuit breaker can be integrated into the communication via an additional Ethernet switch. In this way, up to three circuit breakers can be visualized on the control panel door with content optimized for the available space and automatically scaled.



The start page of the DSP800 displays the status and maximum current of all circuit breakers. All the detailed information about individual molded case circuit breakers can be selected via the structured menu. This includes:

- Measured values of the ETU
- ETU setting parameters
- Status
- Diagnostics

3.5.3 External current transformers



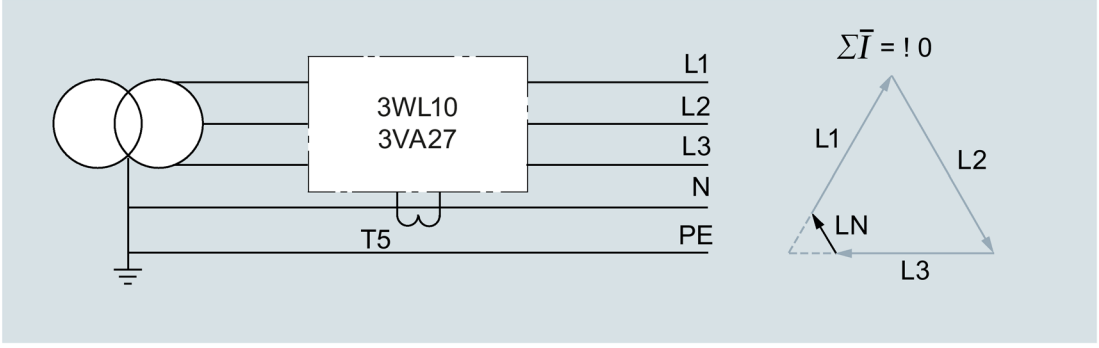
① Rogowski CT solo external neutral
② CT for direct measurement of the ground-fault current in the grounded transformer star point (G_ret), ground return method
③ Summation current transformer for direct residual current measurement across all phases (Rc CT)

The direct measuring methods (② and ③) are more precise in determining the ground-fault current (for details, see Section Parameters of the trip units (Page 72)).

3.5.3.1 Rogowski CT solo external neutral

The optional external current transformer for N conductor is only for three-pole circuit breakers. It enables protection of the neutral conductor from overload and short-circuit by the ETU of the circuit breaker. The transformer is connected directly to the auxiliary conductor terminal system. It is suitable for all electronic trip units of the 3- and 6-series.

The external current transformer for N conductor is also used for determining ground-fault currents by calculation of the vector sum of the currents for trip units with a G protection function (ETU360 and ETU660).

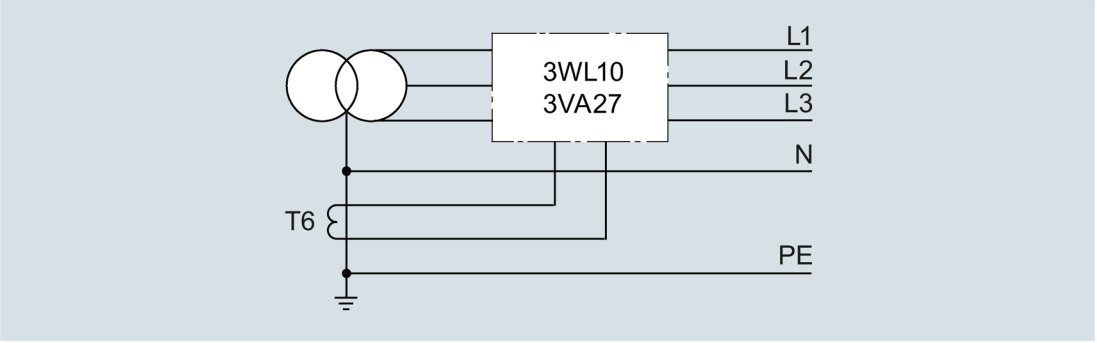


T5 External current transformer for N conductor

3.5.3.2 External CT for grounding conductors of the main power supply (grounded transformer star point) G_ret using the ground fault return

Currents in the grounding conductor of the transformer star point can be directly measured with high accuracy using this toroidal-core transformer and can be evaluated with the ETU660 (LSIG). The transformer is connected to the auxiliary conductor terminal system of the circuit breaker. The external current transformer for the grounding conductor of the power supply is available with rated currents 100 A and 250 A.

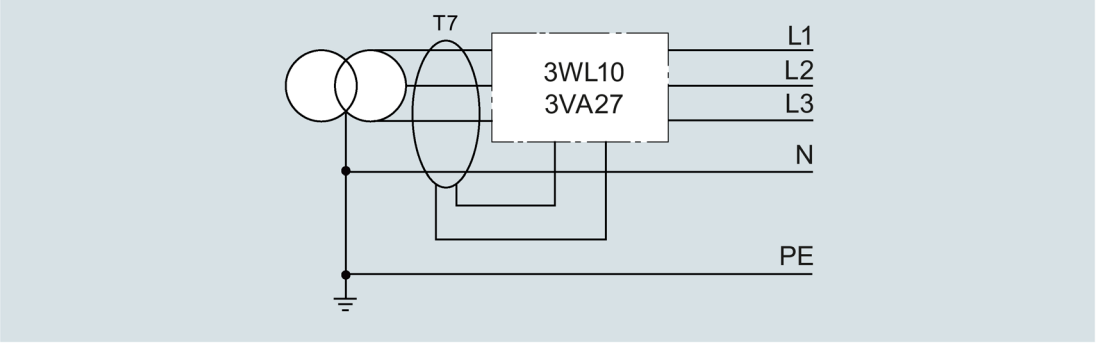
Direct measurement of ground currents is an alternative to the vector sum calculation.



T6 External CT for grounding conductors of the main power supply (grounded transformer star point) GF-CT

3.5.3.3 Summation current transformer Rc CT

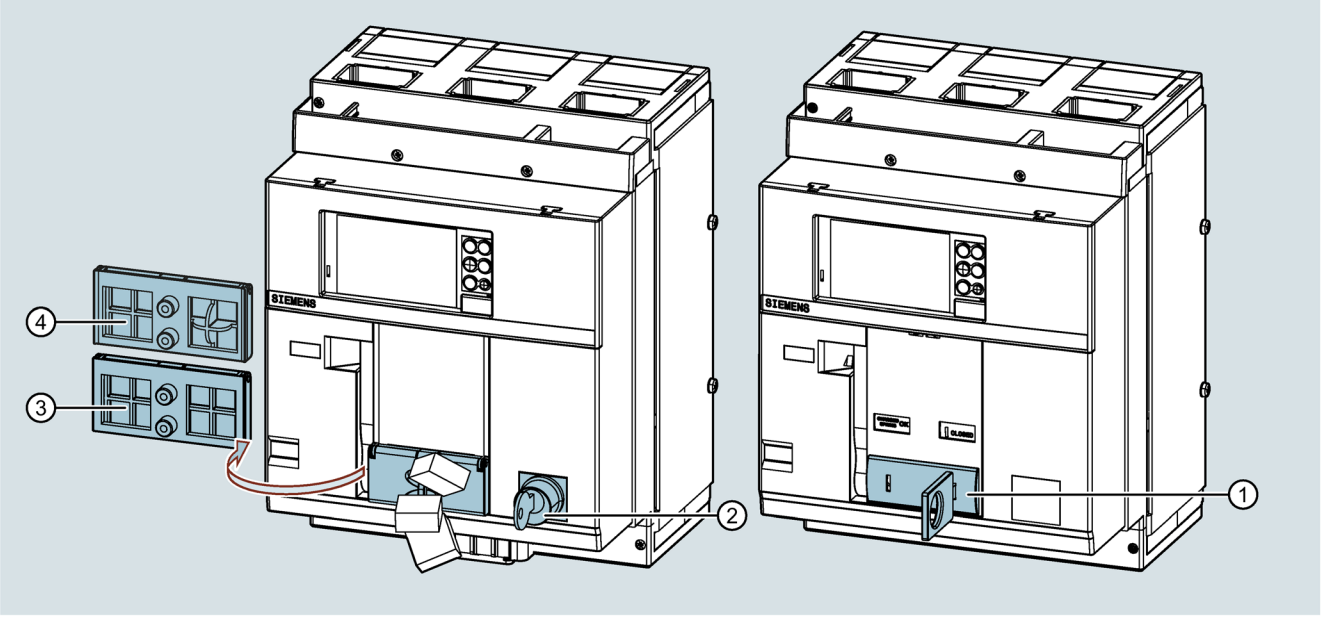
Residual currents of 3 A to 30 A can be measured with a summation current transformer and evaluated by electronic trip units of the 6-series, which is equipped with a rating plug for residual current protection and the metering function MF Advanced. The transformer is connected to the auxiliary conductor terminal system of the circuit breaker.



T7 Summation current transformer

3.5.4 Locking and interlocking

Covers and locking devices to prevent mechanical operations at the operator panel



① Protective covers to prevent unintended mechanical operation
② Locking device, OFF position, Ronis lock
③ Padlockable protective cover ON/OF
④ Locking device, OFF position, for padlocking

Protective covers to prevent unintended mechanical operation

With this protective device, the circuit breaker can be protected from unintended operation. It is mounted on the safety cover of the circuit breaker.

The pushbutton protection device prevents operation of the OFF and ON button unless the special key is used.

This protective cover cannot be combined with the locking device for padlocking.

Locking device, OFF position, Ronis lock

They are locked by a Ronis cylinder lock, which is installed in the operator panel. With this, the circuit breaker can be locked in the OPEN position. The cover of the accessories compartment can be removed when locked to enable maintenance work in this area.

If multiple circuit breakers are locked with cylinder locks, this can be implemented in two versions depending on the lock numbers chosen:

- Locks with different lock numbers: Each lockable circuit breaker has its own key. The lock number can be selected from a choice of four different lock numbers.
- Locks with the same lock numbers: Every key fits in every lockable circuit breaker.

The protection device with a key prevents access to the OFF button and the ON button **simultaneously**. It is not possible to push both buttons. Access is only possible with the relevant key.

This locking device fulfills the conditions for a supply disconnecting (isolating) device according to EN 60204-1.

A Ronis cylinder lock is included in the scope of delivery.

Padlockable protective cover ON / OFF

With this version, one **or** both buttons can optionally be protected from being operated. If only one button is protected, the other button can be operated.

- Locking device made of plastic for up to three padlocks with a diameter of 4 mm (0.16")
- Locking device made of metal for one padlock with a diameter of 7 mm (0.28") or for a padlock holder
- Locking device made of metal for up to 2 padlocks with a diameter of 8 mm (0.32")

Locking device, OFF position, for padlocking

The circuit breaker can be locked in the OPEN position with padlocks. It is therefore safety locked, for example, for service and inspection work.

The two hinged covers can always be moved independently of each other and thus locked individually.

Three different locking devices can be supplied for padlocks:

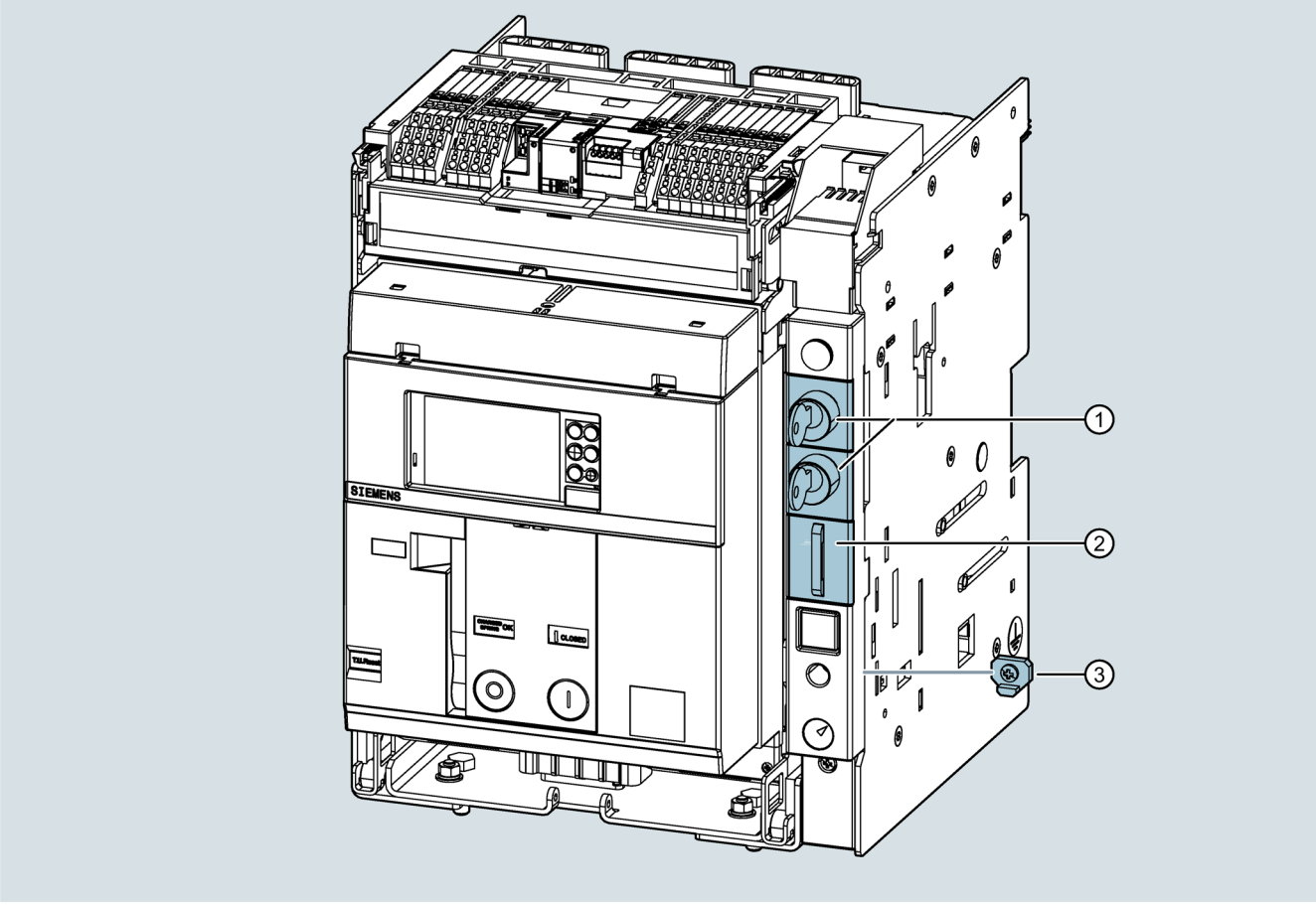
- Locking device made of plastic for up to three padlocks with a diameter of 4 mm (0.16")
- Locking device made of metal for one padlock with a diameter of 7 mm (0.28") or for a padlock holder
- Locking device made of metal for up to 2 padlocks with a diameter of 8 mm (0.32")

This locking device fulfills the conditions for a supply disconnecting (isolating) device according to EN 60204-1.

The locking device for padlocking can be used as an alternative for the protective cover against unintended mechanical operation or as an alternative to the padlockable protective cover ON/OFF. It is not possible to use both the protective cover and the locking device for padlocking at the same time.

The padlocks or padlock support are not included in the scope of delivery of the locking device and must be provided by the customer.

Covers in the frame of the withdrawable breaker version



① Locking device against movement of the withdrawable CB, Ronis lock, in the breaker position DISCONNECT, TEST, or CONNECT

② Locking mechanism to prevent movement of the withdrawable CB with padlock, in the breaker position DISCONNECT, TEST, or CONNECT

③ Locking device in addition to ① or ②, which permits only locking in breaker position DISCONNECT with the cylinder lock (see ①) or padlock (see ②)

Locking device to prevent movement of the withdrawable circuit breaker with cylinder locks

With the cylinder locks on the guide frame, the circuit breaker is secured against racking in the guide frame. The positions CONNECT, TEST, and DISCONNECT can be locked and the circuit breaker can then no longer be racked in or out.

If multiple guide frames are equipped with cylinder locks, Ronis locks with different lock numbers are used. This means each guide frame has its own key.

Locking mechanism to prevent movement of the withdrawable CB

With the locking device for padlocking on the guide frame, the circuit breaker is secured against racking in the guide frame. The positions CONNECT, TEST and DISCONNECT can be locked.

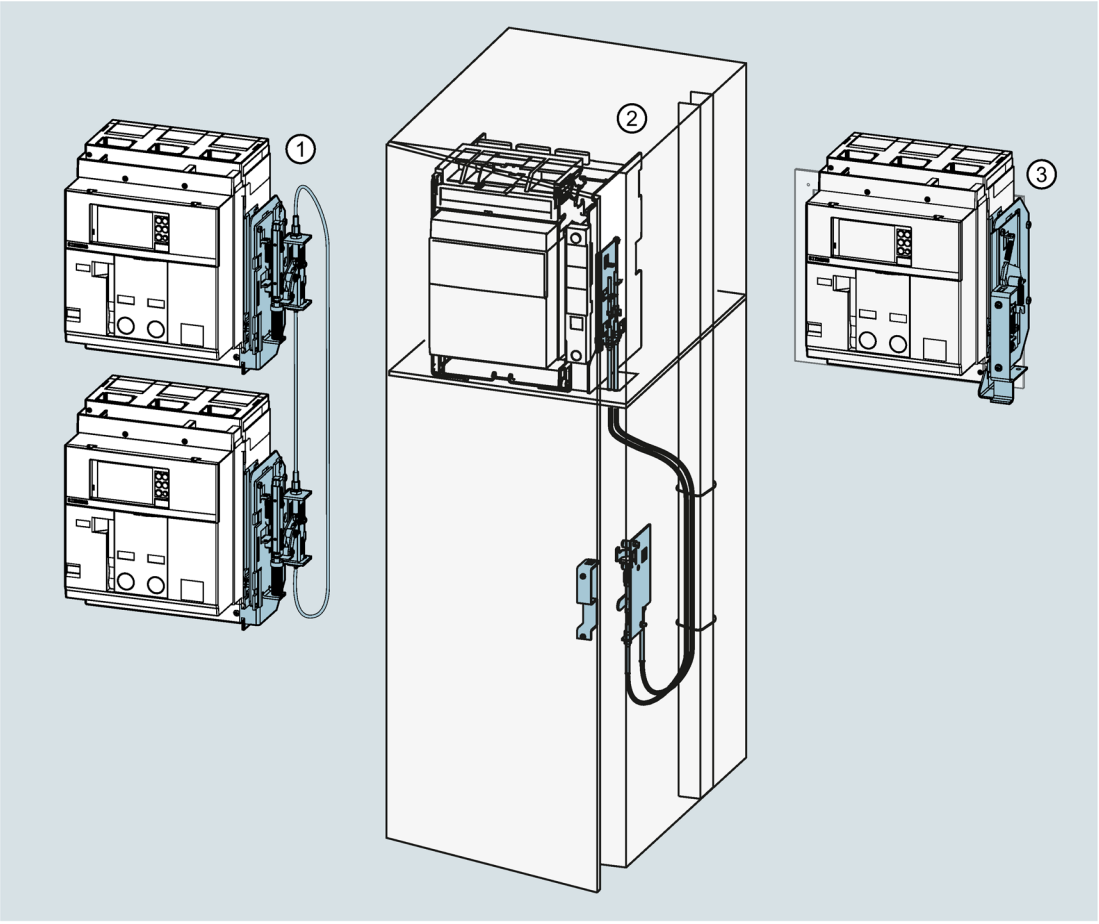
Locking is performed on the guide frame with up to three padlocks (diameter 8 mm / 0.32"). The circuit breaker can then no longer be racked in or out.

The padlocks are not included in the scope of delivery of the locking device and must be provided by the customer.

Additional locking device that permits only locking in breaker position DISCONNECT with the cylinder lock or padlock

When you use cylinder locks, locking can be limited to locking in the DISCONNECT position by the additional accessory "Locking mechanism to prevent movement of the withdrawable CB in the disconnected position". Locking in the CONNECT and TEST positions is then no longer possible. Locking itself is performed with the two devices stated above

Mechanical interlocks of the control panel door and with further 3WL / 3VA circuit breakers



① Mutual mechanical interlocking, Bowden cable
② Locking mechanism to prevent opening, Bowden cable
③ Locking mechanism to prevent opening of the control panel door, direct
Mounting of external auxiliary switches AUX 15CO (not shown)

Mutual mechanical interlocking ①

With the interlocking devices, **two** circuit breakers can be mutually interlocked. The interlocking device only ever releases one circuit breaker at a time, thereby ensuring that only the released circuit breaker can be operated. The other circuit breaker remains in the safe CLOSED position and is blocked by the interlocking mechanism.

Both horizontally and vertically oriented circuit breakers can be mutually mechanically interlocked.

Maximum distances between circuit breakers:

- Horizontal: max. 2750 mm
- Vertical: max. 1000 mm

Mechanical interlocks prevent more than one of a number of mutually interlocked circuit breakers from being in the CLOSED position at the same time. However, all circuit breakers can be in the OPEN breaker position at the same time.

The following interlock combinations are possible:

- Fixed-mounted breaker - fixed-mounted breaker
- Fixed-mounted breaker - withdrawable breaker
- Withdrawable breaker - withdrawable breaker

The circuit breakers can also be interlocked with other sizes of 3WL-series breakers. Interlocking is possible in both directions, i.e. it can be set up from the 3WL10/3VA27 or from the larger-size circuit breaker.
Interlocking with molded case circuit breakers of the 3VA series size 1000 A is also possible. Only a Bowden cable is used that is routed from the 3VA25 blocking device to the resetting device of the 3WL10/3VA27 circuit breaker. This means that when the interlocking slide mechanism for closing the 3VA25 circuit breaker is operated, the 3WL10/3VA27 circuit breaker is automatically opened. To prevent this, the interlocking device can be locked on the 3VA25 with a padlock.

Each of the locking devices listed here is available in versions for the fixed-mounted and withdrawable breaker versions.

- Fixed-mounted breaker:
  To mount the modules on a fixed-mounted breaker, the side wall must be modified so that the main contact position can be mechanically transmitted to the interlocking module. It is important whether the circuit breaker is mounted on the wall or on the floor. In one case (wall mounting), the modification must be made to the side part; in the other (floor mounting), the base support must be modified. The necessary modification is made in the factory before delivery for the configuration ordered by the customer. This requires the correct article number.

Description	Version	Article number	Modification in the factory with option
Mounting support standard (circuit breaker feet) for fixing the circuit breaker on the floor.	Fixed-mounted breaker floor fixation (without externally mounted interlocking module)	3VW9011-0BB51	A06
Mounting support extended (circuit breaker feet); kit incl. mechanical transmission of switch position on circuit breaker side wall	Fixed-mounted breaker floor fixation (with externally mounted interlocking module)	3VW9011-0BB52	S56
Side wall extension kit, modification for mechanical switch position transmission on circuit breaker side wall	Fixed-mounted breaker wall mounting (with externally mounted interlocking module)	3VW9011-0BB53	S57

- Withdrawable breaker version: Here, the modules can be directly mounted on the guide frame; modification of the circuit breaker side wall is not required.

Locking mechanism to prevent opening, direct ③ / Bowden cable ②

These accessories prevent the control panel door from being opened in the following cases:

- Fixed-mounted breaker: The circuit breaker is in the CLOSED switch position.
- Withdrawable breaker: The circuit breaker is in the CONNECT guide frame position and the CLOSED switch position.

The mechanical interlocks and locking devices must not be used together with the following accessories:

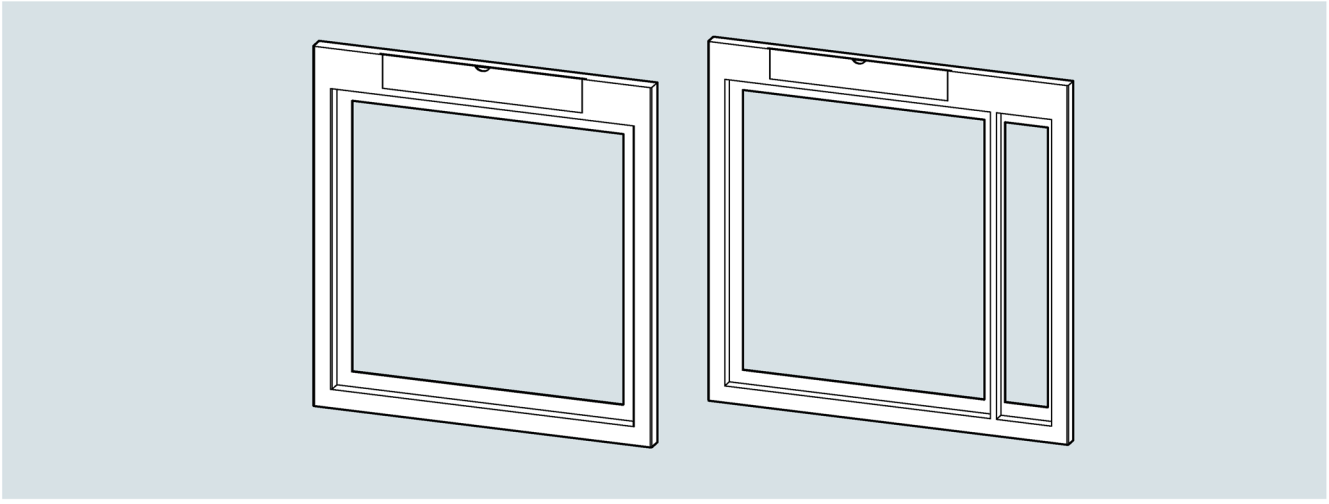
- Auxiliary switch AUX 15Q
- Withdrawable breaker: Direct locking mechanism to prevent opening of the control panel door

If Bowden cables are used, the maximum length is 2 m.

The locking device also locks out the open circuit breaker when the control panel door is open.

Covers

Door sealing frame

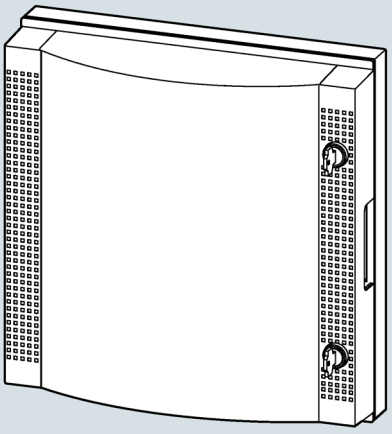


To enable operation of the circuit breaker when a panel door is closed, a cutout must be provided in the panel door. With use of a cover frame, this cutout has a pleasant appearance and achieves the higher degree of protection IP30.

The cover frame is available in two versions:

- Fixed-mounted breaker (top left in the figure)
- Withdrawable breaker (top right in the figure)

IP54 protective cover

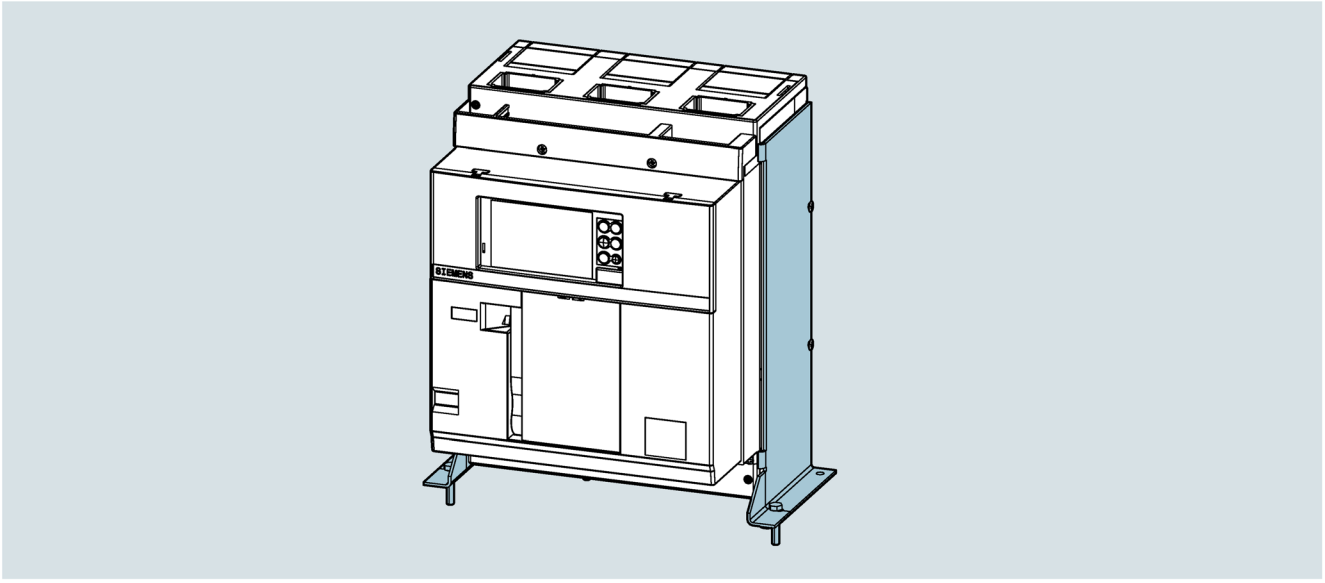


The transparent protective cover protects the complete front face of the circuit breaker. In this way, degree of protection IP 54 is achieved.

The protective cover is equipped with two locks. The locks are available in two versions:

- Same lock number: The locks can be opened with the same key.
- Different lock numbers: Each lock has its own key; both keys are required to open the protective cover.

3.5.5 Support for floor fixation (fixed breaker)

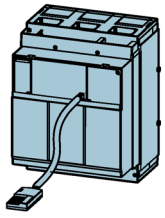
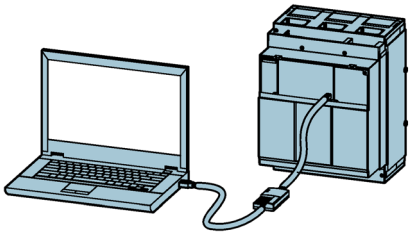
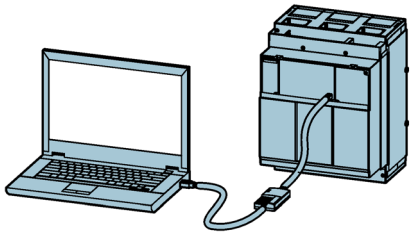


All circuit breakers can be mounted on the wall by their rear face or on the floor (see Section Mounting and connecting the device (Page 164)). To implement floor mounting for a fixed-mounted circuit breaker, mounting feet are provided as additional accessories. This is available in the standard version (see figure above) and in a version for side-mounted accessories (see Section Locking and interlocking (Page 121)). The different versions can be configured in the factory or retrofitted subsequently.

In a withdrawable circuit breaker, supports for floor fixation are not required.

3.6 Breaker Data Adapters and test devices

3.6.1 Overview

TD310 with circuit breaker	PC – TD410 with circuit breaker	PC – TD420 with circuit breaker
		
• Hardware (HW) trip test via ETU control key "i / Test" • Electronics power supply for parameterization of ETUs of the 6-series	Functions of the TD310 + connection with the PC: • Software (SW) trip test • Parameterization of the ETUs of the 6-series • Readout of the status and maintenance information • Readout of the measured-value interval memory	Functions of the TD410 + test functionalities: • Extended test function, guided "teach-in" of the protection parameters • Readout of the datalog, network and fault analysis

	Possible with/via test device:			Via communication interface	Via front interface ETU	Access to functionality with		
	TD310	TD410	TD420			powerconfig via TD410 and TD420	powerservice[2] via TD420	powerservice[2] via TD410
Parameterization	—	●	●	●	●	●[1]	—	—
Trip test	●	●	●	—	●	●	●	●
Enhanced test function	—	—	●	—	●	—	●	—
Data log (ETUs of the 6-series)	—	—	●	—	●	—	●[1]	—
Diagnostic report	—	●	●	—	●	—	●	●

1) For ETUs of the 6-series only
2) Available in the SIOS Portal, see below

The powerservice software can be found in the SIOS Portal (https://support.industry.siemens.com/cs/ww/en/view/109749079).

Note

On the circuit breaker, the connection from the ETU to the trip coil and its ability to function can only be electromechanically tested after a fault, maintenance, or modification of the device. The electronics of the instrument transformers via ETU to the trip coils are continuously monitored during operation to ensure the greatest safety and faults are handled immediately (tripping or only alarm).

3.6.2 TD310 Activation & Trip Box

The TD310 Activation & Trip Box is connected to the front test plug of the ETU. It can be used with all electronic trip units of the 3- and 6-series.

Function scope:

- Activation of the electronic trip units of the 3- and 6-series with a battery built into the test device
- Testing the release and the trip coil of the circuit breaker for correct functioning (trip test)
- By activation via the TD310 Activation & Trip Box, the electronic trip units of the 6-series can be parameterized on the display, even when the circuit breaker is switched off.

Note

With or without an external power supply, the reasons for the last trip are always displayed on the LEDs (ETUs of the 3-series) or on the display (ETUs of the 6-series) when the control key "i / Test" is pressed. To enable this display, the ETU has a battery.

3.6.3 TD410 Breaker Data Adapter

The TD410 Breaker Data Adapter is a gateway and is connected on one side with the USB port of a PC and on the other side to the ETU of the circuit breaker via the cable supplied. It can be used with all electronic trip units of the 3- and 6-series.

Function scope:

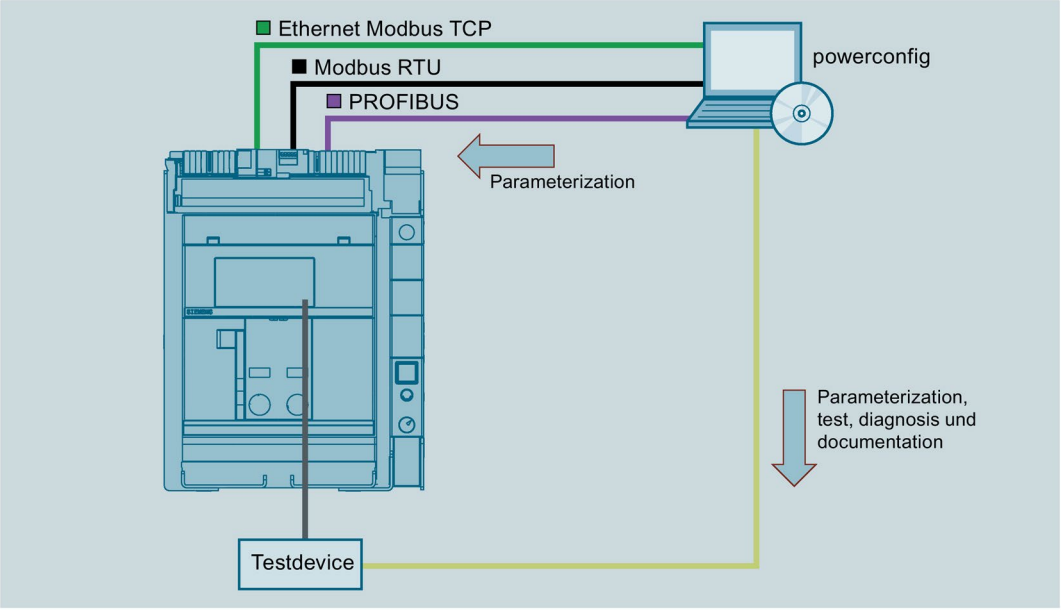
- Activation of the ETU
- Trip tests performed in the same ways as for the TD310
- Gateway between PC and ETU
- Parameterization of the ETUs with the powerconfig software, the standard software for parameterization and commissioning of all communication-capable SENTRON products (see below)
- Documentation and archiving of the parameters set on the ETU with the powerconfig software

3.6.4 TD420 test device

The TD420 test device has the functionality of the TD410 with added test and storage options. It can be used with all electronic trip units of the 3- and 6-series.

Function scope:

- Activation of the ETU
- Trip tests performed in the same ways as for the TD310
- Gateway between PC and ETU
- Parameterization of the ETU with the powerconfig software (see below)
- Trip testing using the powerconfig software
- Generation of a report of the parameters set on the ETU with the powerservice software.
- Testing of the basic protection functions LSING with the powerservice software
- Testing of the enhanced protection functions with the powerservice software
- Test data storage with the powerservice software
- Extended test functionality:
  This is for checking the parameter settings of the ETU and comparing them with standardized, typical applications and network circumstances. In this way, the behavior of the circuit breaker during operation can be forecast and analyzed to prevent undesired false tripping (supporting teach-in).
- Electronic trip units of the 6-series:
  If an ETU of the 6-series trips, the continuously recording buffer memory and therefore the high-resolution current curve can be read out before and after this event using the test device. The triggers for freezing this memory include not only trip reasons but also various other thresholds, alarms, and events that can be selected user-specifically.
  For this expanded functionality, the powerservice software will be available for downloading as of 2018.



Note

powerconfig is commissioning and maintenance software for all communication-capable SENTRON products from Siemens. With this software, the circuit breaker can be parameterized and commissioned and its settings can be archived and, in the operating phase, values from the plant (current, voltage, etc.) can be read out and the status of the circuit breaker can be acquired.

The powerconfig (https://support.industry.siemens.com/cs/ww/us/view/63452759) software is freely available.

Application planning

4

The following chapter contains information about the circuit breaker itself and on installation / mounting of the circuit breaker within the overall system.

It is aimed both at planning engineers and at control panel or switchboard manufacturers.

See also

Accessories for connection and insulation (Page 93)

4.1 Types of installation and installation locations

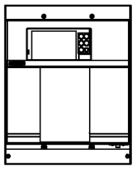
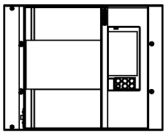
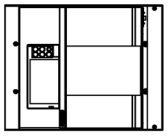
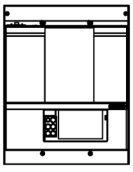
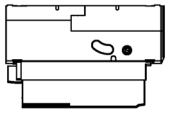
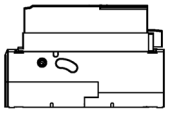
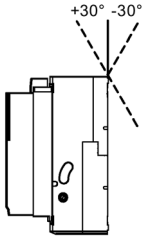
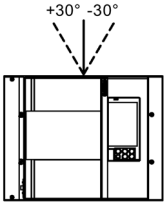
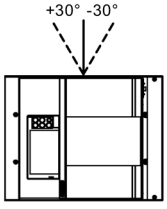
The circuit breaker is designed to be operated in enclosed rooms in which the operating conditions are not affected by dust or corrosive vapors/gases. Suitable enclosures must be used in dusty or damp conditions.

See also

Support for floor fixation (fixed breaker) (Page 130)

Accessories for connection and insulation (Page 93)

4.1.1 Mounting position

	Vertical	Horizontal right	Horizontal left	Vertical - rotated 180°	Ceiling mounting	Floor mounting
	Wall mounting					
						
						
3VA27 molded case circuit breaker - with toggle operating mechanism						
Fixed-mounted breaker	✓	✓	✓	-	✓	✓
Withdrawable breaker	✓	✓	✓	-		
With front mounted rotary operator	✓	✓	✓	-	✓	✓
With door mounted rotary operator	✓	✓	✓	-	✓	✓
Floor mounting	✓	N.A.	N.A.	-	N.A.	N.A.
Wall mounting	✓	✓	✓	-	✓	✓
Interlocks (mechanical, direct, cable, ...)	✓	✓	✓	-	✓	✓
3VA27 molded case circuit breaker - with stored energy operating mechanism						
Fixed mounting incl. spring charging motor	✓	✓	✓	-	-	-
Withdrawable breaker	✓	✓	✓	-	-	-
Floor mounting	✓	N.A.	N.A.	N.A.	N.A.	N.A.
Wall mounting	✓	✓	✓	-	-	-
Interlocks (mechanical, direct, cable, ...)	✓	✓	✓	-	-	-

Note

To integrate the circuit breaker optimally into the control panel, the 4-pole circuit breaker can optionally be ordered with the neutral pole on the right or left-hand side of the circuit breaker. These are basic versions of the circuit breaker and are permanently defined in the circuit breaker. In all these versions, the circuit breaker is capable of full performance (no derating, full current carrying capacity, and protection settings).

Phase sequence neutral left: N - L1 - L2 - L3

Phase sequence neutral right: L1 - L2 - L3 - N

The phase sequence L1, L2, L3 can be subsequently changed (to L3, L2, L1) by the user in the electronic trip units of the 6-series to match any system configuration.

Mounting options

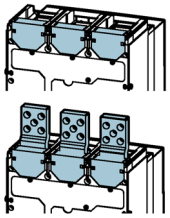
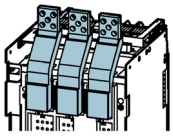
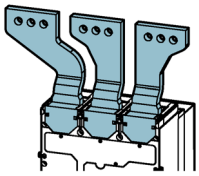
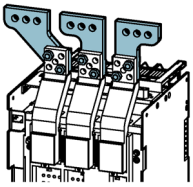
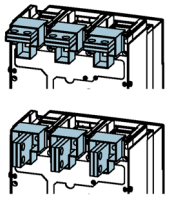
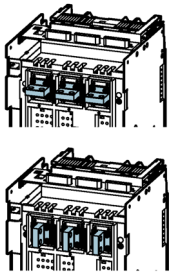
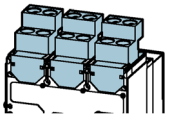
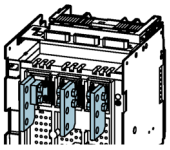
In addition to floor mounting, both the fixed-mounted breaker and the withdrawable breaker permit direct rear wall mounting.

For floor mounting of the fixed-mounted breaker version, mounting supports are required (see Section Support for floor fixation (fixed breaker) (Page 130)).

Connection versions - overview

Numerous connection versions are available (see also Section Accessories for connection and insulation (Page 93)). All versions can be used both for floor mounting and for rear wall mounting:

- Front terminals:
  - For fixed-mounted breakers: directly or with extended terminal elements, as in the case of the molded case circuit breakers. This saves work and costs.
  - For withdrawable breakers: with extended terminal elements accessible from the front
- Rear connection:
  - For fixed-mounted breakers and withdrawable breakers: Horizontal or vertical orientation
- Cable connection for copper/aluminum cable:
  - For fixed-mounted breakers: on the front directly with cable clamps
  - For withdrawable breakers: on the rear with cable lug

Connection	Fixed-mounted breaker	Withdrawable breaker
Front		
Front broadened terminals for main circuit connection		
Rear		
Cables		

4.1.2 Degree of protection

The circuit breaker has the following degrees of protection (fixed-mounted breaker and withdrawable breaker):

- IP20 for circuit breakers, except for the terminals
- IP30 for the front of the circuit breaker if installed in switchboards with a door sealing frame IP30 (see Chapter Accessories for connection and insulation (Page 93))
- IP54 for the front of the circuit breaker if installed in switchboards with a padlockable protective cover IP54 (see Chapter Accessories for connection and insulation (Page 93))

4.1.3 Power loss

To ensure the electrical switchboards have the capacity to carry rated uninterrupted current, the power loss of the circuit breaker must be considered in planning the electrical switchboard.

The values shown in the table refer to the total power for three and four-pole circuit breakers with balanced loads at a current that correspond to the rated uninterrupted current I_u at 50/60Hz.

Power loss 3WL10					
	I_u	**630 A**	**800 A**	**1000 A**	**1250 A**
Fixed-mounted breaker	[W]	31	50	78	122
Withdrawable breaker	[W]	62	100	156	244

Power loss 3VA27					
	I_u	**800 A**	**1000 A**	**1250 A**	**1600 A**
Fixed-mounted breaker	[W]	19.3	30	47	77
Withdrawable breaker	[W]	35.3	55	86	141

The power losses have been calculated according to IEC 60947.

4.1.4 Ambient conditions

Pollution degree

Operation of the circuit breaker is approved in accordance with IEC / EN 60947 for pollution degree 3.

The circuit breaker also complies with the following standards:

- IEC60721-3-6 class 6C3
- IEC60721-3-3 class 3C2

Ambient temperature

The circuit breaker can be operated in ambient temperatures from -25 °C to +70 °C. At temperatures of up to +70 °C, too, the rated current is not reduced (derating, see below).

The display of the electronic trip units of the 6-series is active over the entire operating range.

The permissible storage temperature in original Siemens packaging is between -40 °C and +70 °C.

Installation altitudes

An installation altitude above 2000 m can result in higher temperatures on the switching devices. The lower density of air can significantly reduce heat dissipation. The arcing behavior and the conductivity of the density-dependent ionized gas mixture are also less favorable at greater altitudes. This makes it necessary to decrease rated operational voltage and the rated uninterrupted current.

Altitude [m]	2000	3000	4000	5000
Rated voltage 440 V [V]	440	387	343	300
Rated voltage 690 V [V]	690	607	538	470
Rated uninterrupted current [% I_n]	100	98	93	90
Rated ultimate short-circuit breaking capacity AC I_{cu} [% I_{cu}@U_e]	100	100	100	100

See also

Installation in the switchboard (Page 147)

4.1.5 Current reduction

4.1.5.1 Current reduction depending on the ambient temperature on the 3WL10

The circuit breaker itself has no derating within the application temperatures.

Current rating I_n [A]	Ambient temperature						
	< 40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C
630	100%	100%	100%	100%	100%	100%	100%
800	100%	100%	100%	100%	100%	100%	100%
1000	100%	100%	100%	100%	100%	100%	100%
1250	100%	100%	100%	100%	100%	100%	100%

Note

All values refer to the withdrawable breakers and fixed-mounted breakers and to the conductor cross-sections stated in the table in Section Installation in the switchboard (Page 147) and to the overriding standard IEC 60947.

The values do not apply to all mounting conditions for circuit breakers and may deviate depending upon factors such as packing density, ventilation, internal separation of the installation, etc.

Please observe the applicable overriding guidelines (e.g. IEC 61439).

4.1.5.2 Current reduction depending on the ambient temperature on the 3VA27

Fixed-mounted

for

- Rear vertical main circuit connection
- Broadened bus connectors
- Front circular conductor terminal for CuAl cables (4x240 mm²)

Rated operational current I_n [A]	Min. copper cross section [mm²]	Ambient temperature						
		< 40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C
800	500	800	800	800	800	800	778	755
		100%	100%	100%	100%	100%	97%	94%
1000	600	1000	1000	1000	1000	1000	949	894
		100%	100%	100%	100%	100%	95%	89%
1250	800	1250	1250	1250	1250	1192	1131	1066
		100%	100%	100%	100%	95%	90%	85%
1600	1000	1600	1600	1537	1470	1403	1329	1255
		100%	100%	96%	92%	88%	83%	78%

for

- Straight bus connectors extended
- Rear horizontal main circuit connection

Rated operational current I_n [A]	Min. copper cross section [mm²]	Ambient temperature						
		< 40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C
800	500	800	800	800	800	800	750	700
		100%	100%	100%	100%	100%	94%	88%
1000	600	1000	1000	1000	971	942	885	827
		100%	100%	100%	97%	94%	88%	83%
1250	800	1250	1250	1250	1184	1118	1049	980
		100%	100%	100%	95%	89%	84%	78%
1600	1000	1600	1541	1481	1417	1352	1281	1209
		100%	96%	93%	89%	85%	80%	76%

for

- Nut keeper kit

Rated operational current I_n [A]	Min. copper cross section [mm²]	Ambient temperature						
		< 40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C
800	500	800	800	800	800	800	750	700
		100%	100%	100%	100%	100%	94%	88%
1000	600	1000	1000	1000	971	942	885	827
		100%	100%	100%	97%	94%	88%	83%
1250 Bars 2x40x10	800	1250	1250	1250	1184	1118	1049	980
		100%	100%	100%	95%	89%	84%	78%
1250 Bars 2x50x10	1000	1250	1250	1250	1240	1182	1122	1057
		100%	100%	100%	99%	95%	90%	85%
1600 Bars 2x50x10	1000	1400	1350	1296	1240	1183	1122	1058
		88%	84%	81%	78%	74%	70%	66%
1600 Bars 3x50x10 *)	1500	1600	1541	1481	1417	1352	1281	1209
		100%	96%	93%	89%	85%	80%	76%

*) Socket head cap screw DIN 7984 – M10x50 – 8.8 required

Withdrawable

for

- Rear vertical main circuit connection
- Rear connection bars for CuAl cables using cable lug

Rated operational current I_n [A]	Min. copper cross section [mm²]	Ambient temperature						
		< 40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C
800	500	800	800	800	800	800	759	716
		100%	100%	100%	100%	100%	95%	89%
1000	600	1000	1000	1000	1000	953	905	853
		100%	100%	100%	100%	95%	90%	85%
1250	800	1250	1250	1250	1250	1192	1131	1066
		100%	100%	100%	100%	95%	90%	85%
1600	1000	1600	1600	1537	1470	1403	1329	1255
		100%	100%	96%	92%	88%	83%	78%

for

- Rear horizontal main circuit connection
- Rear bus connectors broadened

Rated operational current I_n [A]	Min. copper cross section [mm²]	Ambient temperature						
		< 40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C
800	500	800	800	800	800	800	750	700
		100%	100%	100%	100%	100%	94%	88%
1000	600	1000	1000	1000	971	942	885	827
		100%	100%	100%	97%	94%	88%	83%
1250	800	1250	1250	1250	1184	1118	1049	980
		100%	100%	100%	95%	89%	84%	78%
1600	1000	1600	1541	1481	1417	1352	1281	1209
		100%	96%	93%	89%	85%	80%	76%

for

- Broadened bus connectors
- Straight bus connectors extended

Rated operational current I_n [A]	Min. copper cross section [mm²]	Ambient temperature						
		< 40 °C	45 °C	50 °C	55 °C	60 °C	65 °C	70 °C
800	500	800	800	800	766	730	693	653
		100%	100%	100%	96%	91%	87%	82%
1000	600	1000	1000	961	920	877	832	784
		100%	100%	96%	92%	88%	83%	78%
1250	800	1250	1205	1157	1108	1056	1002	945
		100%	96%	93%	89%	85%	80%	76%
1600	1000	1400	1350	1296	1240	1183	1122	1058
		88%	84%	81%	78%	74%	70%	66%

Note

All values refer to the withdrawable breakers and fixed-mounted breakers and to the conductor cross-sections stated in the table in Section Installation in the switchboard (Page 147) and to the overriding standard IEC 60947.

The values do not apply to all mounting conditions for circuit breakers and may deviate depending upon factors such as packing density, ventilation, internal separation of the installation, etc.

Please observe the applicable overriding guidelines (e.g. IEC 61439).

4.1.6 Use in IT systems

The devices have been tested and are ready for use in terms of their IT network capability according to IEC 60947-2 Annex H, including maximum rated operational voltage

- 3VA27: 690 V
- 3WL10: 690 V Class N and Class S / 440 V Class B

Failure probability acc. to B10d

- 3WL10 = 20,000 mechanical operating cycles
- 3VA27 = 10,000 mechanical operating cycles

Vibration resistance and shock resistance

The circuit breaker is insensitive to vibrations and meets the requirements relating to mechanical and electromechanical vibration resistance according to the following standard:

- IEC 60068-2-6
  - 1 to 13 Hz with a vibration amplitude of 1 mm
  - 13 to 100 Hz with constant acceleration of 0.7 g
- IEC 60721-3-1
  - Storage: 1M3
- IEC60721-3-2
  - Transport: 2M2
- IEC60721-3-3
  - Operating conditions: 3M2
- Shipping register or certifications

See also

Use in IT systems (Page 146)

4.1.7 Electromagnetic compatibility

The user of specific devices in an industrial environment can result in electromagnetic interference in the electrical installation. The circuit breaker has been developed and tested for electromagnetic compatibility in compliance with IEC 60947-2, Annexes J and F.

4.1.8 Installation in the switchboard

The switchboard version and the installation and ambient conditions can have a great influence on the ratings of the circuit breakers. The circuit breaker is also optimized for advantageous switchboard integration and provides savings and reduced engineering in respect of

- Copper busbars
- Connection architecture
- Segregation and internal separation
- Mounting options

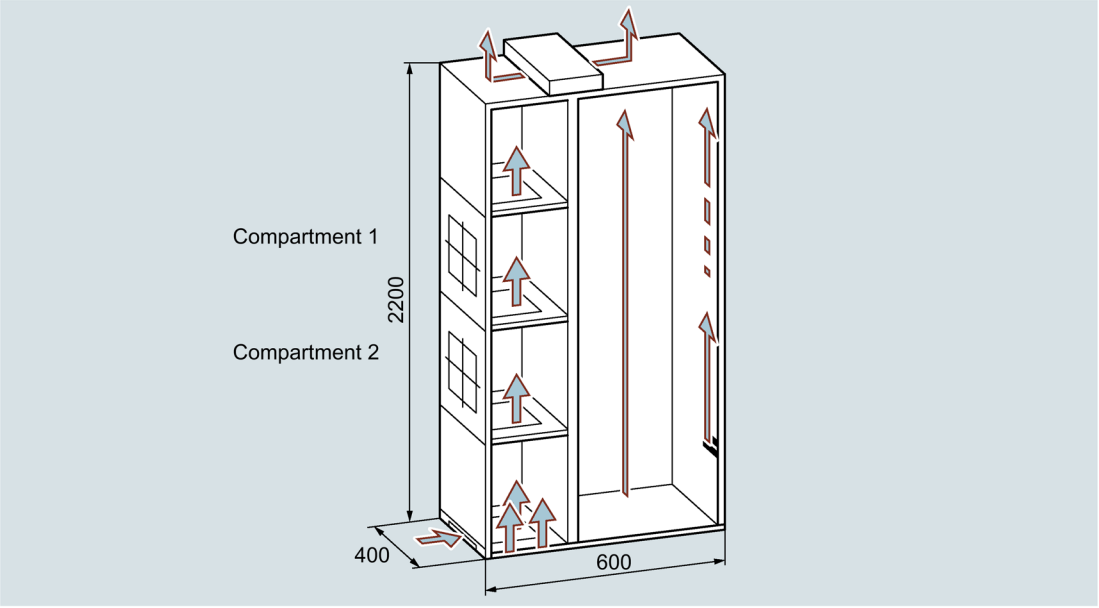
In the following mounting conditions (see Section "Power in the switchboard"), the most important factors have been taken into account that can affect the power ratings of the circuit breaker in the switchboard. These factors are:

- Switchboard type
- Degree of protection of the switchboard
- Separation type 3
- Number of devices that are connected to the same switchboard panel at the same time
- Type of connection and terminal
- Ambient temperature T_a (IEC61439-1)
- Circuit breaker with guide frame
- Maximum permissible temperature at the terminal 120 °C

Power in the switchboard

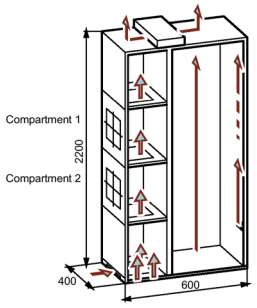
The following tables provide data about the power of the circuit breaker within the switchboard. The data communicated are a summary of computer simulations and tests actually performed. They are valid as guide values both for the fixed-mounted breakers and the withdrawable breakers and are not a substitute for an insulation test according to IEC 61439.

The switchboard used in the test has degree of protection IP31 and has the following design and dimensions (figure shows the cross section of the side view):



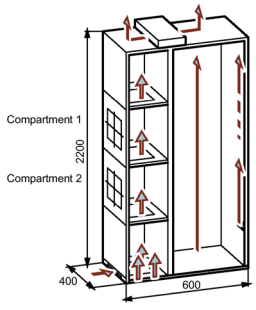
3WL10

1 circuit breaker per panel width section in the switchboard



I_u [A]	Busbar connection [mm]	Compartment	Circuit breaker power with rear terminals for main circuit connection					
			Horizontally oriented			Vertically oriented		
			Ambient temperature			Ambient temperature		
			35 °C	45 °C	55 °C	35 °C	45 °C	55 °C
630	2 x 40 x 5	2	630 A	630 A	630 A	630 A	630 A	630 A
800	2 x 50 x 5	2	800 A	800 A	800 A	800 A	800 A	800 A
1000	2 x 50 x 10 / 2 x 50 x 8 [1]	2	1000 A	1000 A	1000 A	1000 A	1000 A	1000 A
1250	2 x 50 x 10 / 2 x 50 x 8 [1]	2	1250 A	1250 A	1200 A	1250 A	1250 A	1250 A

[1] Horizontally oriented: 2 x 50 x 10 mm / vertically oriented: 2 x 50 x 8 mm

2 circuit breakers per panel width section in the switchboard									
				Circuit breaker power with rear terminals for main circuit connection					
				Horizontally oriented			Vertically oriented		
	I_u [A]	Busbar connection [mm]	Compartment	Ambient temperature			Ambient temperature		
				35 °C	45 °C	55 °C	35 °C	45 °C	55 °C
	630	2 x 40 x 5	2	630 A	630 A	630 A	630 A	630 A	630 A
			1	630 A	630 A	630 A	630 A	630 A	630 A
	800	2 x 50 x 5	2	800 A	800 A	800 A	800 A	800 A	800 A
			1	800 A	800 A	800 A	800 A	800 A	800 A
	1000	2 x 50 x 10 / 2 x 50 x 8 [1]	2	1000 A	960 A	920 A	1000 A	1000 A	970 A
			1	970 A	930 A	900 A	1000 A	1000 A	950 A
	1250	2 x 50 x 10 / 2 x 50 x 8 [1]	2	1250 A	1200 A	1140 A	1250 A	1250 A	1200 A
			1	1200 A	1150 A	1100 A	1250 A	1250 A	1150 A

[1] Horizontally oriented: 2 x 50 x 10 mm / vertically oriented: 2 x 50 x 8 mm

You will find information about the terminals used in Chapter Accessories for connection and insulation (Page 93).

All other types of connection described (fixed-mounted and withdrawable) can be assumed analogously with the horizontal rear terminals.

4.2 Power supply, grounding, and connection

The circuit breaker can be powered through the main circuit connection terminals. The electronic trip unit is therefore self-powered in all phases via internal current transformers in compliance with the standard to ensure its protection function without additional conditions in the event of a fault.

Even if, with open main contacts, the electronic components ETU, metering function, and CB bus modules are operated or protection functions, such as MCR or G_ret are activated (e.g. for communication of circuit breaker status, applied line voltage signal etc.), these components can be externally powered via the auxiliary voltage.

The external power supply can be achieved in two ways:

- The Breaker Connect module is mainly used for this and the auxiliary power supply of the control panel can be connected directly to it. The auxiliary power supply is always necessary for the communication function.
- As a further option, the MF Advanced metering module can be used. If the voltage is tapped internally on the line side with the contacts open, this can also be used to power the electronics directly and independently.

If a metering module is present, the voltage taps must be installed on the line side. In the circuit breaker OPEN position, this also ensures that all relevant information is available.

Cables and busbars and connection methods

The connection bars and cables can be connected directly to the air circuit breaker.

The cables and busbars can be made of the following materials:

- Copper
- Silver-plated copper
- Zink-plated aluminum if the main distribution system is made of aluminum.

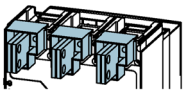
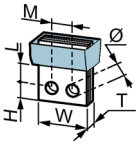
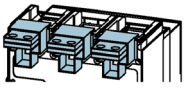
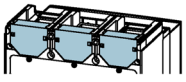
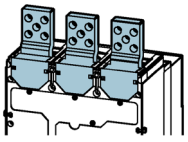
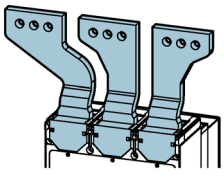
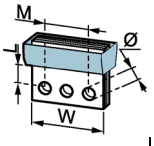
The following connection methods can be used (see also Chapter Accessories for connection and insulation (Page 93)):

- For fixed-mounted breakers:
  - Front terminals for busbars, cable lugs, and cables
  - Rear terminals for busbars, cable lugs, and cables
- For withdrawable breakers:
  - Front terminals for busbars and cable lugs
  - Rear terminals for busbars and cable lugs

The possible combinations of cables/busbars and connection methods are shown in the following table:

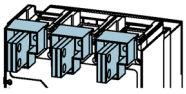
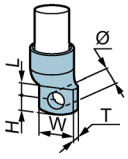
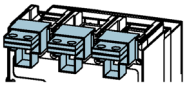
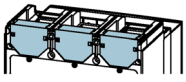
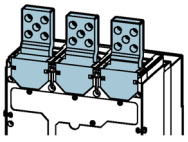
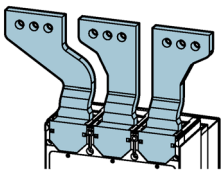
4.2.1 Power supply, grounding, and connection

Connections, fixed-mounted version

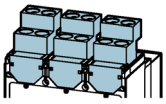
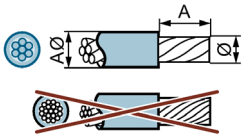
		W_{min} mm [in]	W_{max} mm [in]	D_{min} mm [in]	D_{max} mm [in]	L mm [in]	Ø mm [in]	H mm [in]	M mm [in]	* Nm [lb-in]
Vertically orientable rear terminals 		40 [1.58]	—	10 [0.39]	—	12.5 [0.49]	11 [0.43]	12.5 [0.49]	25±0.1 [0.98± 0.004]	40 [354]
Horizontally orientable rear terminals 		40 [1.58]	50 [1.97]	10 [0.39]	—	12.5 [0.49]	11 [0.43]	12.5 [0.49]	25±0.1 [0.98± 0.004]	40 [354]
Front terminals for main circuit connection 		40 [1.58]	50 [1.97]	10 [0.39]	20 [0.79]	16 [0.63]	11 [0.43]	14 [0.55]	25±0.1 [0.98± 0.004]	18 [159.3]
Front connection bars, extended 		40 [1.58]	50 [1.97]	10 [0.39]	—	14 [0.55]	11 [0.43]	—	25±0.1 [0.98± 0.004]	40 [354]
Front connection bars, broadened 		40 [1.58]	90 [3.54]	10 [0.39]	—	20 [0.78]	13 [0.51]	—	45±0.1 [1.77± 0.004]	40 [354]

* Tightening torque

I_n	[mm]	Horizontal front terminals	Vertical front terminals
630	2 x 40 x 5	✓	✓
800	2 x 50 x 5	✓	✓
1000	2 x 50 x 10	✓	—
	2 x 50 x 8	—	✓
1250	2 x 50 x 10	✓	—
	2 x 50 x 8	—	✓

		W_{min} mm [in]	W_{max} mm [in]	n	D_{max} mm [in]	Ø mm [in]	H mm [in]	* Nm [lb-in]
Vertically orientable rear terminals 		—	24 [0.95]	1 … 4	—	11 [0.43]	12.5 [0.49]	40 [354]
Horizontally orientable rear terminals 		—	24 [0.95]	1 … 4	—	11 [0.43]	12.5 [0.49]	40 [354]
Front terminals for main circuit connection 		—	24 [0.95]	1 … 2	20 [0.79]	11 [0.43]	14 [0.55]	18 [159.3]
Front connection bars, extended 		—	50 [1.97]	1 … 2	—	11 [0.43]	—	40 [354]
		—	24 [0.95]	1 … 4				
Front connection bars, broadened 		—	22 [0.86]	1 x 3 1 x 2	—	13 [0.5]	—	40 [354]
			44 [1.73]	1 … 4				

* Tightening torque

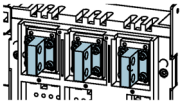
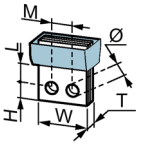
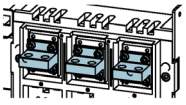
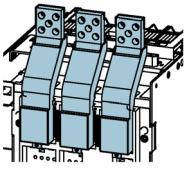
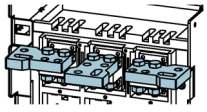
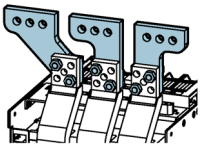
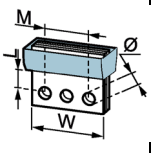
Means of connection, cables		A [mm]	⌀ [mm]	A ⌀ [mm²]	* Nm [lb-in]
Connections of the fixed-mounted breaker version					
Circular conductor terminal, adapter 4x240 		30	21.5	120 to 240	43 [380.6]

* Tightening torque

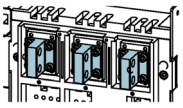
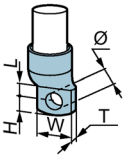
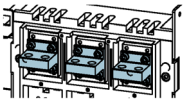
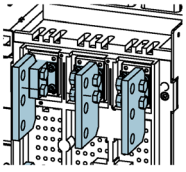
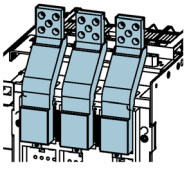
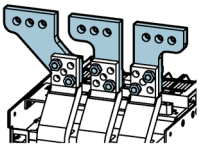
The following applies to connecting bars to horizontally / vertically orientable rear terminals for main circuit connection:

Rated uninterrupted current I_u [A]	Busbar dimensions	Horizontally oriented rear terminals	Vertically oriented rear terminals
630	2 x 40 x 5	✓	✓
800	2 x 50 x 5	✓	✓
1000	2 x 50 x 10	✓	—
	2 x 50 x 8	—	✓
1250	2 x 50 x 10	✓	—
	2 x 50 x 8	—	✓

Connections, withdrawable version

		W_{min} mm [in]	W_{max} mm [in]	D_{min} mm [in]	D_{max} mm [in]	L mm [in]	Ø mm [in]	H mm [in]	M mm [in]	* Nm [lb-in]
Vertically orientable rear terminals for main circuit connection 		40 [1.58]	—	10 [0.39]	—	12.5 [0.49]	11 [0.43]	12.5 [0.49]	25±0.1 [0.98± 0.004]	40 [354]
Horizontally orientable rear terminals for main circuit connection 		40 [1.58]	50 [1.97]	10 [0.39]	—	12.5 [0.49]	11 [0.43]	12.5 [0.49]	25±0.1 [0.98± 0.004]	40 [354]
Front extended terminals 		40 [1.58]	50 [1.97]	10 [0.39]	—	12.5 [0.49]	11 [0.43]	12.5 [0.49]	25±0.1 [0.98± 0.004]	40 [354]
Rear connection bars, broadened 		40 [1.58]	60 [2.36]	10 [0.39]	—	12.5 [0.49]	11 [0.43]	12.5 [0.49]	25±0.1 [0.98± 0.004]	40 [354]
Front connection bars, broadened 		40 [1.58]	90 [3.54]	10 [0.39]	—	20 [0.78]	13 [0.51]	—	45±0.1 [1.77± 0.004]	40 [354]

* Tightening torque

		W_{min} mm [in]	W_{max} mm [in]	n	D_{max} mm [in]	Ø mm [in]	H mm [in]	* Nm [lb-in]
Vertically orientable rear terminals for main circuit connection 		—	24 [0.95]	1 … 4	—	11 [0.43]	12.5 [0.49]	40 [354]
Horizontally orientable rear terminals for main circuit connection 		—	24 [0.95]	1 … 4	—	11 [0.43]	12.5 [0.49]	40 [354]
Copper/aluminum cable connection bar 		—	35 [1.37]	1 … 6	—	14.5 [0.57]	17.5 [0.69]	40 [354]
Front extended terminals 		—	50 [1.97]	1 … 2	—	11 [0.43]	12.5 [0.49]	40 [354]
		—	24 [0.95]	1 … 4				
Front connection bars, broadened 		—	22 [0.86]	1 x 3 1 x 2	—	13 [0.5]	—	40 [354]
			44 [1.73]	1 … 4				

* Tightening torque

See also

Accessories for connection and insulation (Page 93)

Grounding

The fixed-mounted circuit breaker does not require grounding.

For the withdrawable breaker, two alternatives are possible to achieve continuity and equipotentiality of the grounding between the circuit breaker and the protection circuit of the switchboard:

- Connection of the guide frame to the protection circuit with a cable in accordance with IEC 61439-1, Section 10.5.2
- If a conductive connection between the guide frame and the grounding of the switchboard is ensured via the metal base (floor mounting) or the metal wall (wall mounting) of the switchboard panel, no additional grounding is required. This means there must be no insulation material between the circuit breaker and the grounded metal of the switchboard panel.

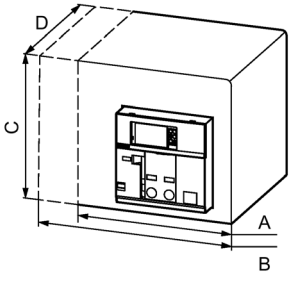
4.2.2 Isolating distances and insulating equipment

When live parts are installed, the following rules must be followed:

- Minimum isolating distance between the phases:

Rated insulation voltage U_i	Smallest distance
1000 V	acc. to IEC 61439: 14 mm
	Siemens recommendation: 25 mm

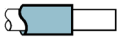
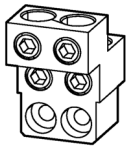
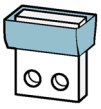
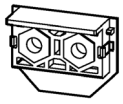
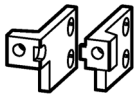
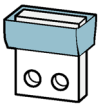
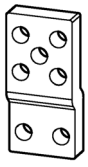
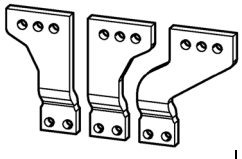
- Isolating distances within the switchboard panel
  To observe the isolating distances inside the panel, the following minimum dimensions for the interior of the panel must be observed:

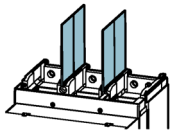
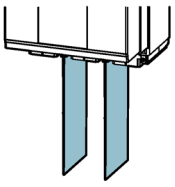
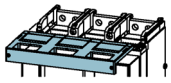
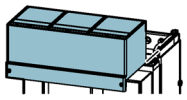
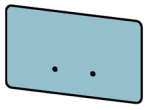
		A 3-pole	W 4-pole	C	D
	Fixed-mounted breaker	250 mm	322 mm	≤ 440 V: 332.5 mm > 440 V: 382.5 mm	130 mm
	Withdra-wable breaker	280 mm	350 mm	≤ 440 V: 390 mm > 440 V: 440 mm	252 mm

Insulating measures

Note

The insulating equipment is only required for the fixed-mounted version of the circuit breaker. No insulating equipment is required in the withdrawable breaker.

	Connection	Article No.	Insulation requirement
		3VW9011-0AL71 3VW9011-0AL72	**E + F**
		3VW9011-0AL01 3VW9011-0AL02	—
		3VW9011-0AL32 3VW9011-0AL33	**D**
		3VW9011-0AL77 3VW9011-0AL78	**A + F** **B + F** **E + F**
  		3VW9011-0AL73 3VW9011-0AL74	**B + F**

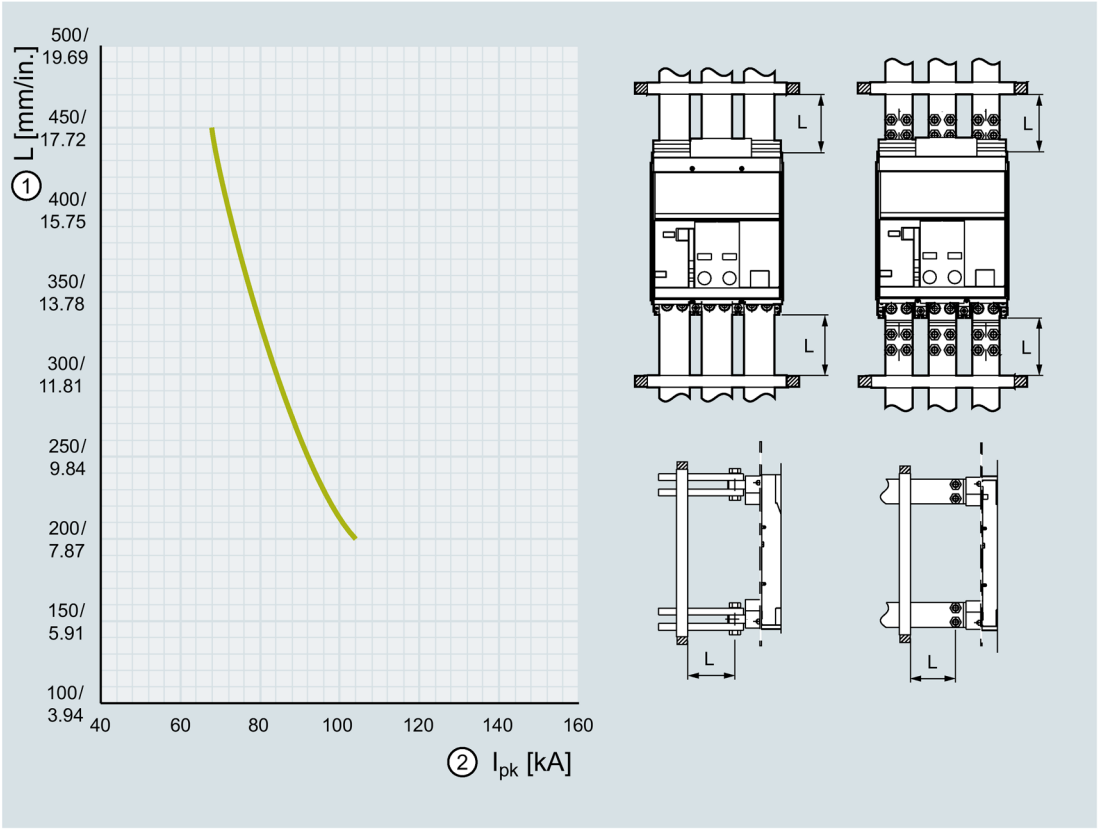
Insulating measure		Article No.	contained in
A		3VW9723-0WA00 3VW9724-0WA10	3VW9011-0AL77 3VW9011-0AL78
B		3VW9723-0WA01 3VW9724-0WA11	3VW9011-0AL73 3VW9011-0AL74
D		3VW9723-0WD30 3VW9724-0WD40	3VW9011-0AL32 3VW9011-0AL33
E		3VW9723-0WF30 3VW9724-0WF40	3VW9011-0AL71 3VW9011-0AL72
F			3VW9011-0AL71 3VW9011-0AL72 3VW9011-0AL73 3VW9011-0AL74 3VW9011-0AL77 3VW9011-0AL78

4.2.3 Armature plates

The electrodynamic forces that arise during a short-circuit can result in high mechanical loads in and on the switchboard. To minimize the effects, armature plates must be mounted in the vicinity of the terminals of the circuit breaker.

Busbars

The following diagram shows the distance of the first armature plate depending on the prospective short-circuit current when busbars are used:



① Distance of the first armature plate to the terminals of the circuit breaker
② Prospective short-circuit current

Cables

If cables are used in the installation, the armature plates must be mounted at a distance of 150 mm from the connection.

4.3 Communication planning

Planning

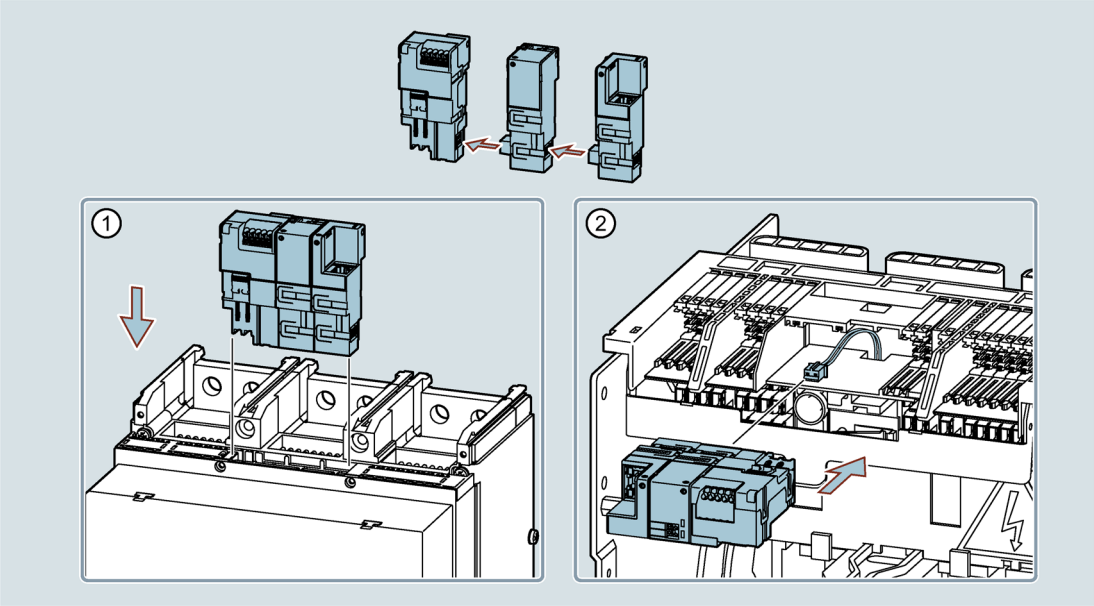
With the circuit breaker and the electronic trip units of the 6-series, Siemens low-voltage products offer an integrated communication concept together with the 3VA molded case circuit breakers and the 7KM PAC measuring devices.

Features:

- The high level of modularity of circuit breakers and accessories allows easy retrofitting of all communication components
- Up to two communication modules can be used at the same time.
- Simple integration into power monitoring systems with the modular metering functions MF Basic or MF Advanced according to IEC 61557-1
- Simple integration into plant monitoring systems for monitoring
  - Status
  - Measured values
  - Alarms and warnings
  - Diagnostics
  - Maintenance
- Significant additional benefits for the switchboard due to the possibility of connecting external input and output modules to the 3WL10 air circuit breaker
- Innovative software products for commissioning, testing, parameterization, operation, monitoring, documentation, and diagnostics of circuit breakers on site at the display, via the front interface using test devices or communication modules
- Integration of the circuit breakers into the Totally Integrated Power (TIP) and Totally Integrated Automation (TIA) solutions

Direct connection via two communication modules

Connection to the communication environment is established directly via modular, pluggable communication modules in conjunction with the Breaker Connect module on the auxiliary conductor terminal system.



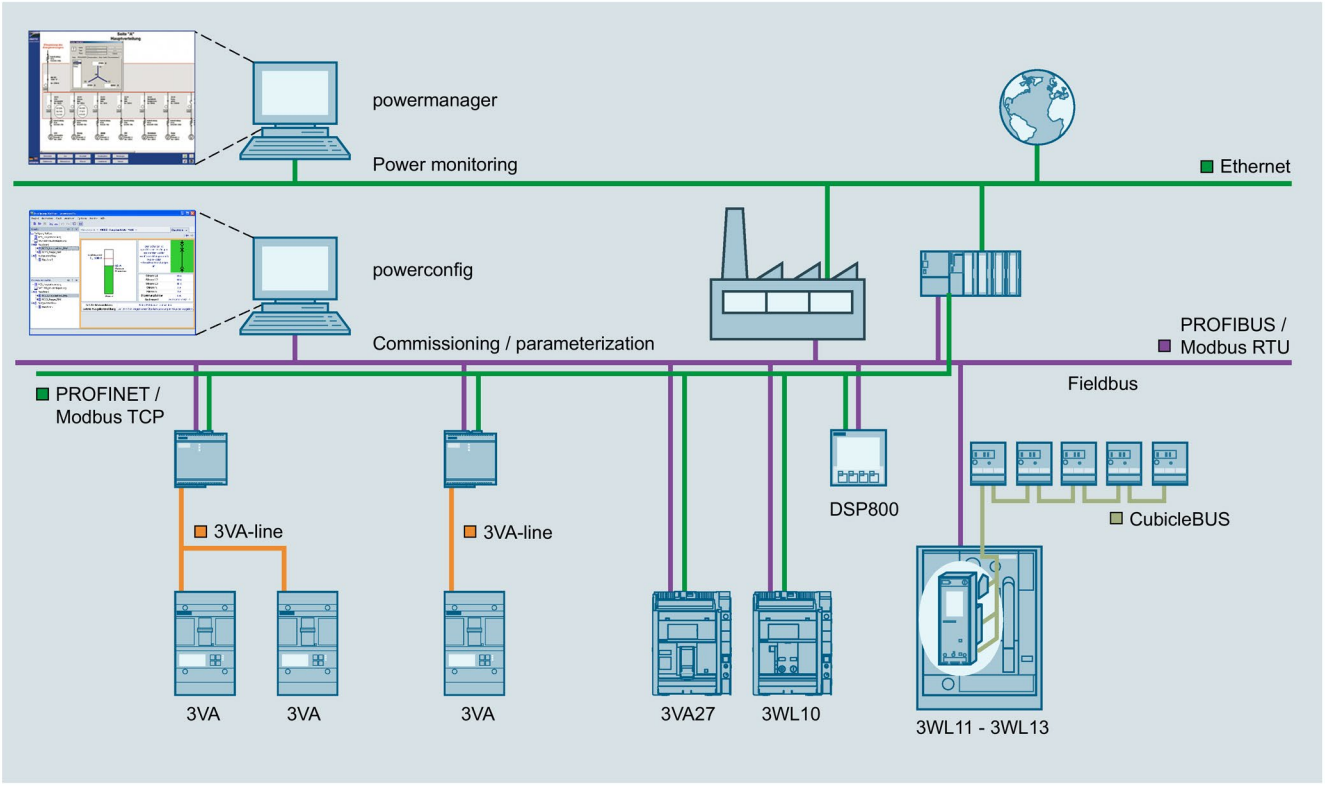
① Fixed-mounted breaker
② Withdrawable breaker

Because the circuit breaker is designed for up to two communication modules, it can be integrated into the communication environment with two different protocols. For example, simultaneous connection of a fieldbus for automation or remote control applications (incl. parameterization and remote switching) and Modbus TCP Ethernet communication link for communicating measured values for efficient and safe power monitoring.

For the remote control switch of the 3VA27, you require the version of the stored energy operating mechanism to be able to connect the device via the closing coil / shunt release and Com Act when the spring is charged. The automatic spring charging motor is recommended for this. (Info: Opening the circuit breaker is always possible when the spring is not charged.)

Communication applications

- Parameterization and configuration
  - With the powerconfig software (as of Version 3.9)
- Energy management
  - Metering function MF Basic / MF Advanced
  - Remote access and remote switching
  - Integration in powermanager and TIA



You will find further information on the communication link:

- in the 3WL10 communication manual and in the 3VA communication manual, see Chapter AUTOHOTSPOT
- in the Modbus Map in the SIOS Portal.

Connection and commissioning 5

5.1 Safety regulations and information

DANGER

Hazardous voltage

- Disconnect the power supply from the circuit breaker (circuit and auxiliary circuits).
- Make sure that the circuit breaker is disconnected from all power sources.
- Switch the circuit breaker to the OPEN position and discharge the spring energy store.
- Also note the relevant notes in Chapter Safety instructions (Page 11).

NOTICE

Damage due to setting down on the rear face.

Circuit breakers and guide frames must not be set down on their rear face.

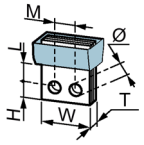
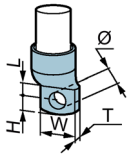
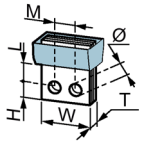
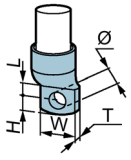
After unpacking, stand the circuit breaker / guide frame upright on its underside.

Note

- Clean the main conductor terminals.
- Clean busbars, stripped cable ends, and cable lugs.
- The contacts of the busbars, cable lugs, or cables must be free of burr, dents, signs of rust, dust, or grease.
- Aluminum busbars must be tin-plated in the contact zones.
- The busbars or cables must not exert forces on the terminals in any direction.

5.2 Mounting and connecting the device

5.2.1 Tightening torques at a glance

Connection technology	Tightening torque		
	Connection Connection methods - Circuit breakers [Nm]	Connection Connection method - Cables and busbars[1)] [Nm]	
Connections of the fixed-mounted breaker version			
Horizontally / vertically orientable rear connections	20		40
Front terminals for main circuit connection	18		18
Front connection bars, extended	18		40
Front connection bars, broadened	18		40
Copper/aluminum cable connection bar			18
Connections of the guide frame			
Horizontally / vertically orientable rear connections	20		40
Front terminals for main circuit connection	12		40
Front connection bars, extended	12		40
Front connection bars, broadened	40		40
Copper/aluminum cable connection bar			40

[1)] You will find the dimensions for the diagrams in Chapter Power supply, grounding, and connection (Page 150).

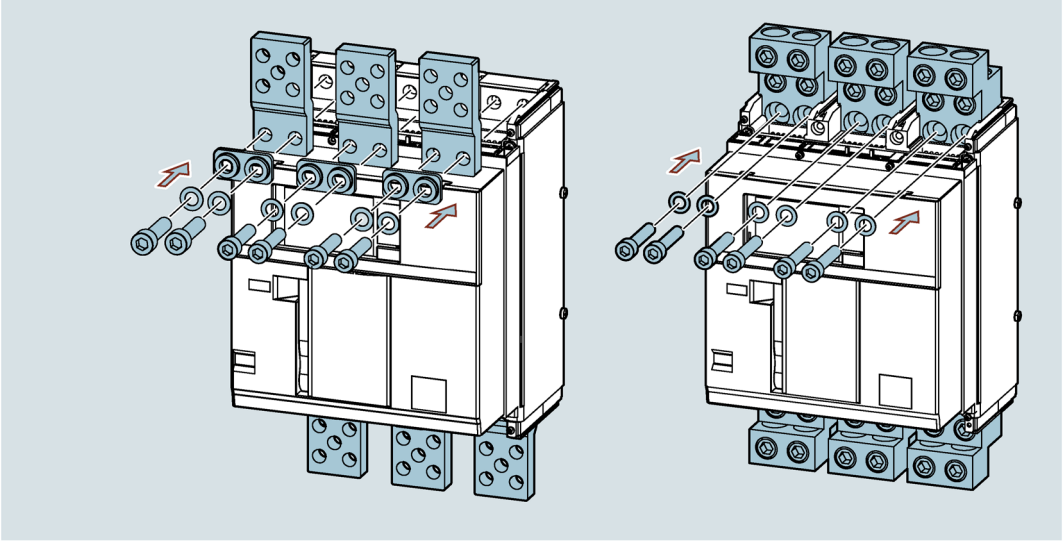
5.2.2 Mounting connections

The rear terminals, horizontally and vertically oriented, are configured in the factory both on the fixed-mounted breaker version and on withdrawable breakers. All other connections are mounted on these or different basic connections (e.g. front terminal for main circuit connection for the fixed-mounted breaker, flange for the withdrawable breaker). The circuit breaker is delivered to the user with the connections chosen in the basic configuration of the circuit breaker. Any necessary installation of connections is described below.

Mounting front extended terminals for main circuit connection and circular conductor terminals 4x240

Front extended terminals for main circuit connection and circular conductor terminals are supplied unmounted with the circuit breaker.

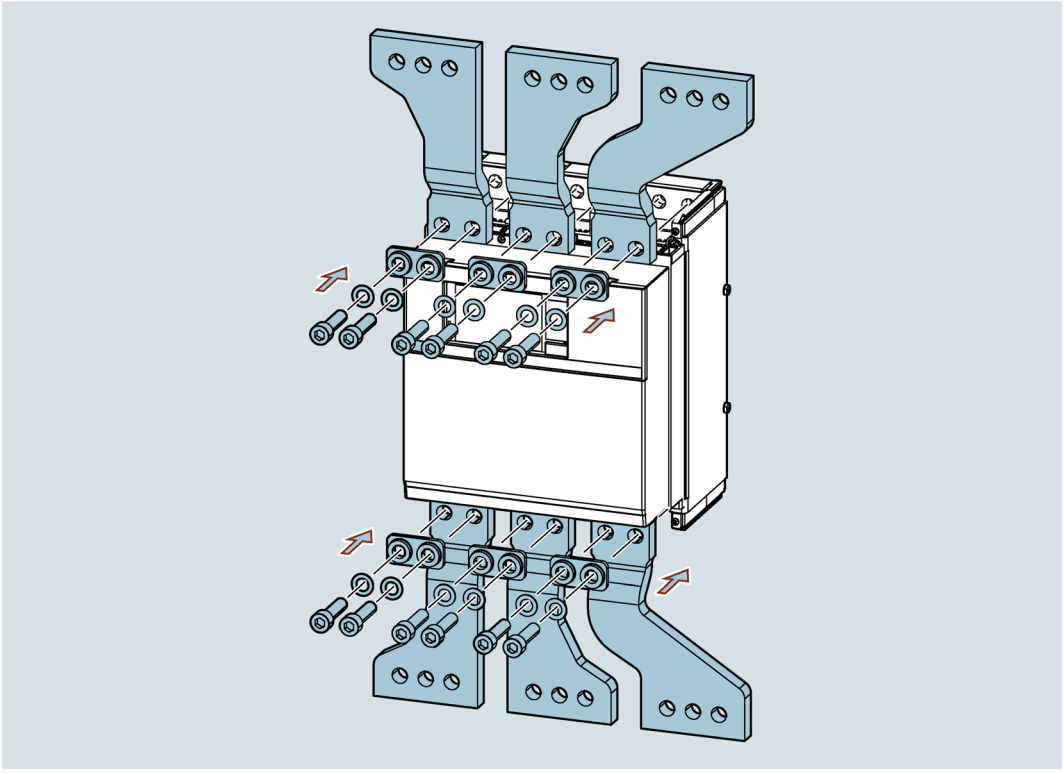
- Screw the front extended terminals for main circuit connection or circular conductor terminals to the front terminals for main circuit connection.
- Note the operating instructions of the relevant connection system (see Chapter Product-specific information (Page 9)).



Front terminals for main circuit connection, broadened

Front terminals for main connection, broadened are supplied unmounted with the circuit breaker

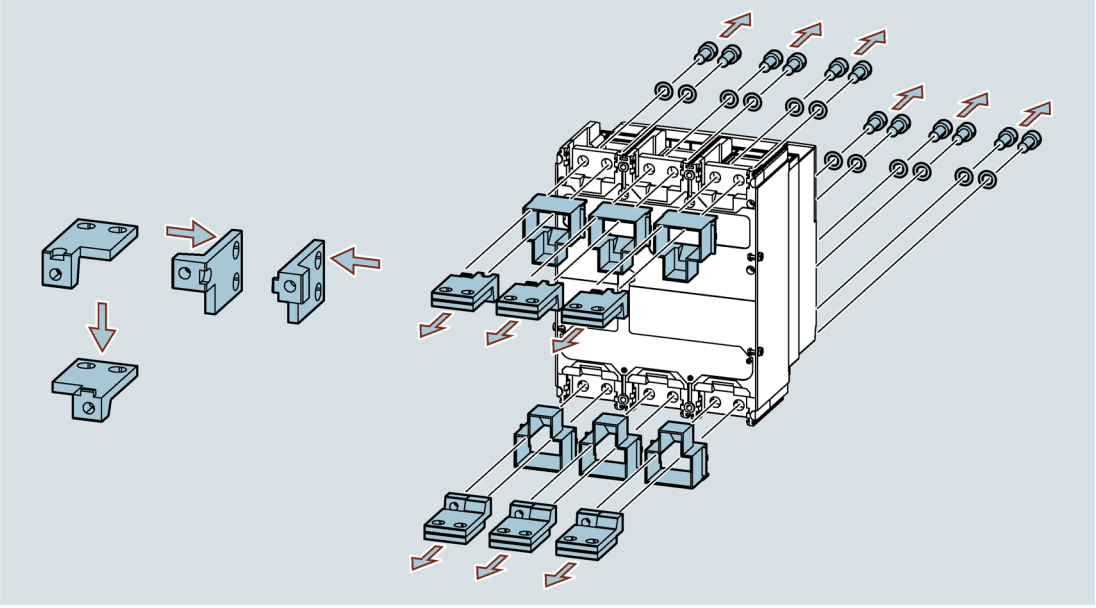
- Screw the front terminals for main circuit connection, broadened, or circular conductor terminals to the front terminals for main circuit connection.
- Note the operating instructions of the relevant connection system (see Chapter Product-specific information (Page 9)).



Changing the orientation of the rear terminals for main circuit connection (vertical/horizontal)

The rear terminals of the circuit breaker are delivered completely mounted. They can be turned from the horizontal to the vertical orientation and vice verse if necessary.

1. Remove the rear terminals for main circuit connection from the circuit breaker and pull the terminals out of the insulating frame.

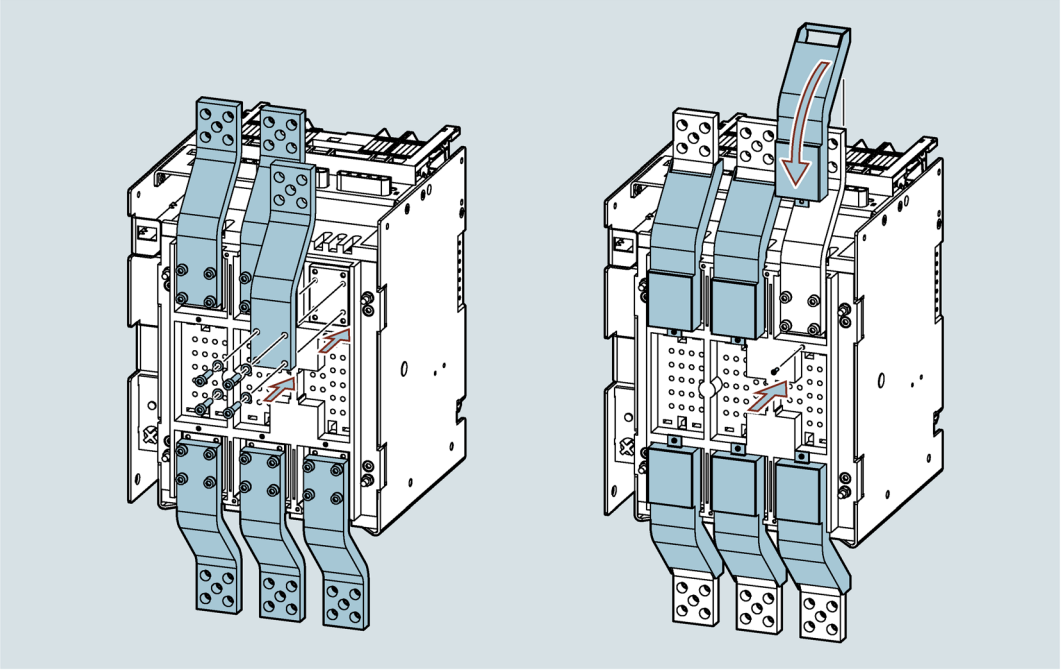


2. Disconnect the two parts of each terminal and place one on top of the other again.
   - For vertical orientation: The two widened ends are opposite each other (see figure below).
   - For horizontal orientation: The two widened ends are next to each other and point in the same direction (see figure above)
3. Turn the terminals into the required orientation and insert them back into the insulating frame.
4. Remount the rear terminals for main circuit connection on the circuit breaker.

Mounting extended front terminals on the guide frame

The extended front terminals are supplied unmounted with the circuit breaker.

- Screw the extended front terminals on the circuit breaker to the unconnected flange and place the insulating caps on them.

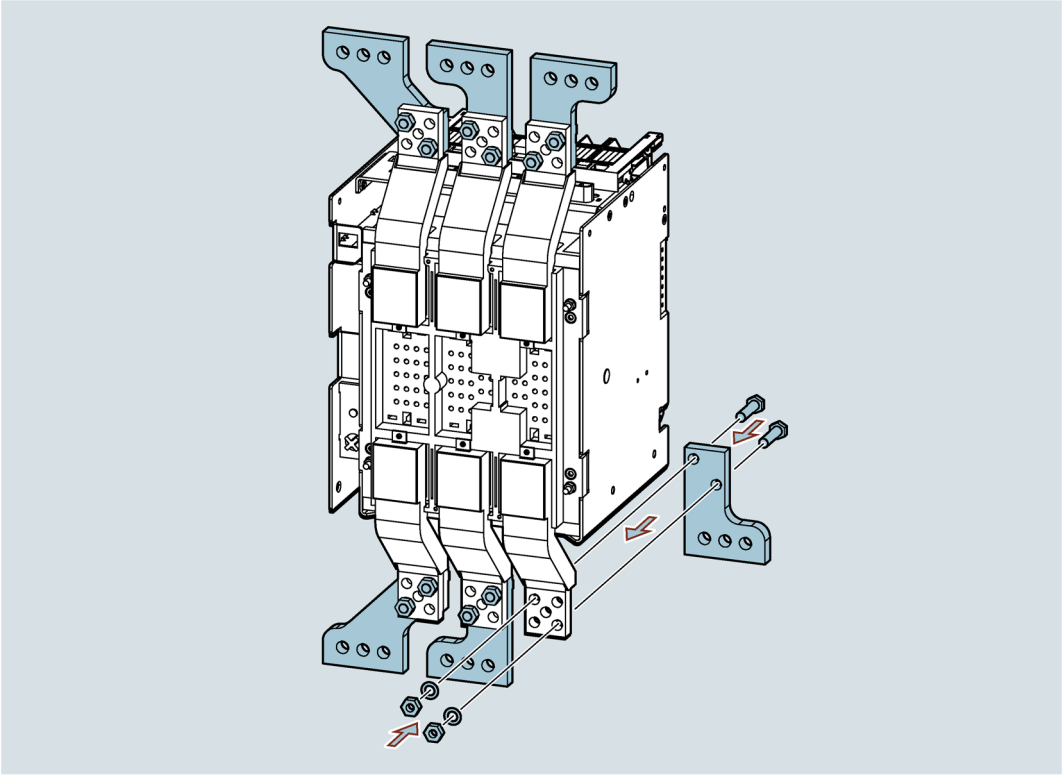


- Mount the insulation protection (see dimension drawing (Page 236)) before or during the following assembly work in the switchboard panel.

Mounting broadened front terminals on the guide frame

The broadened front terminals are supplied unmounted with the circuit breaker.

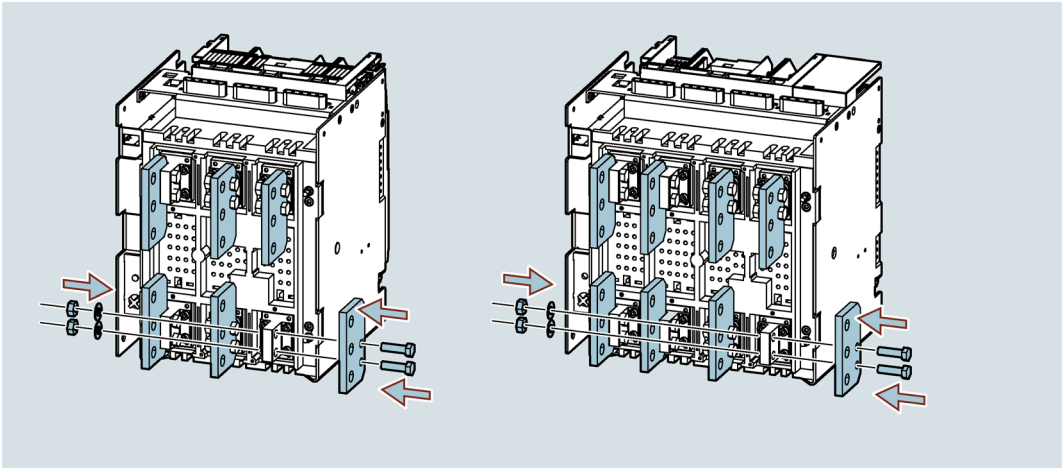
- Screw the extended front terminals on the circuit breaker to the unconnected flange and place the insulating caps on them.

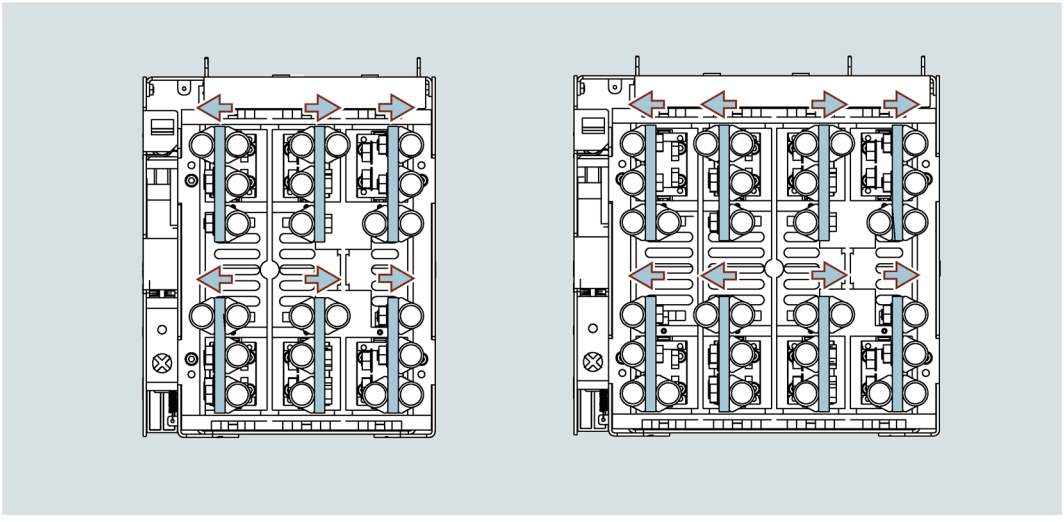


Mounting circular conductor terminals 4x 240 mm² on the guide frame

The circular conductor terminals 4x 240 mm² are provided unmounted with the circuit breaker.

- Screw the circular conductor terminals 4x 240 mm² to the rear terminals for main circuit connection. Pay attention to the prescribed positioning on the right or left on each terminal for main circuit connection.



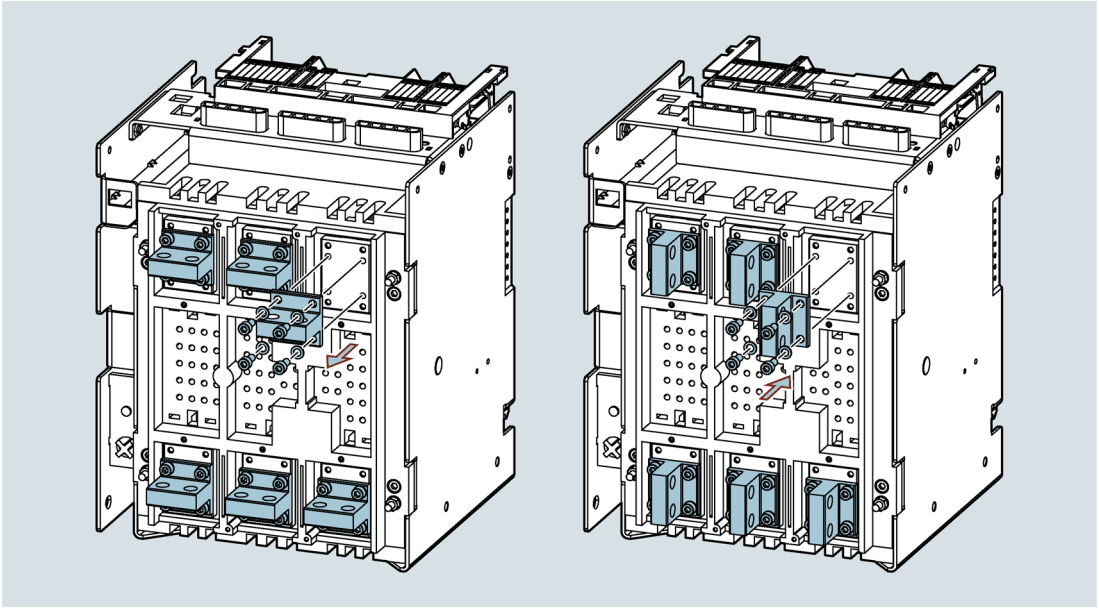


You will find more information in the relevant Operating Instructions (see Chapter Product-specific information (Page 9)).

Changing the orientation of the rear terminals for main circuit connection (vertical/horizontal) on the guide frame

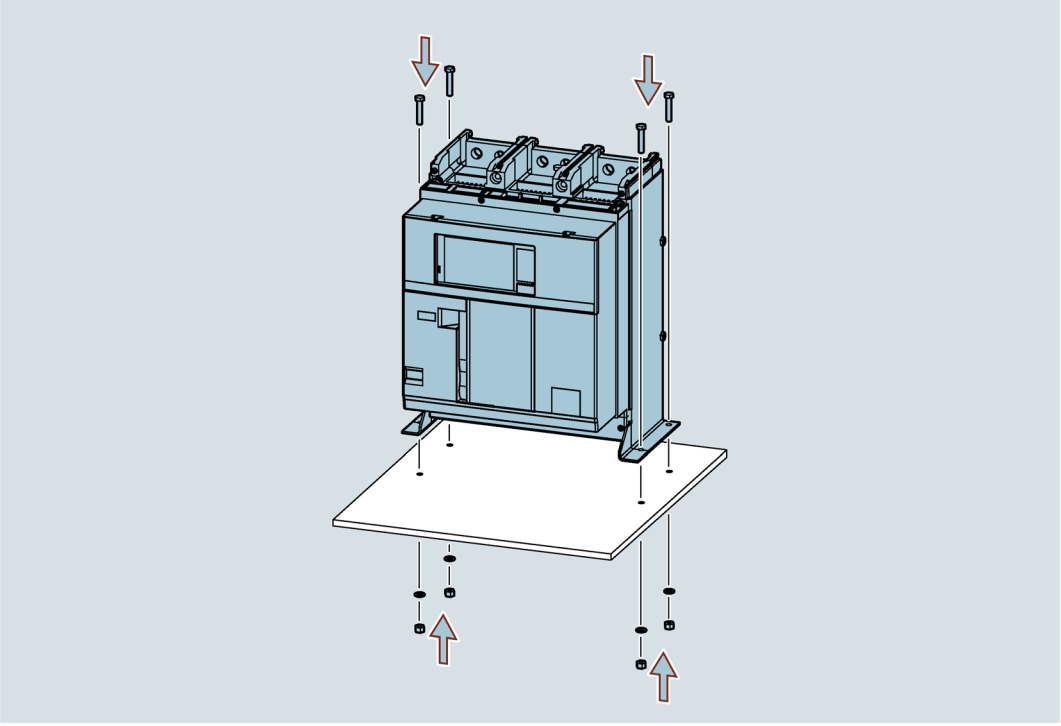
The rear terminals for main circuit connection of the guide frame are delivered completely mounted. They can be turned from the horizontal to the vertical orientation and vice verse if necessary.

1. Remove the rear terminals for main circuit connection from the guide frame.
2. Turn the terminals into the required orientation and mount them back on the flange of the guide frame.



5.2.3 Fixed breaker: Installing the circuit breaker

1. Mount the circuit breaker in the switchboard panel:
   Floor mounting: (For the drilling template, see Chapter Switchboard panel, hole and drilling templates, fixed breaker (Page 228)):
   - Mount the supports for floor fixation on the circuit breaker following the relevant Operating Instructions (see Chapter Reference documents (Page 10)).
   - Fasten the circuit breaker to the compartment floor of the switchboard panel with four screws M5 x 25 with a tightening torque of 4 Nm.



Note

The mounting supports are not part of the basic circuit breaker, but can be configured onto the device via the Z option and ordered separately.

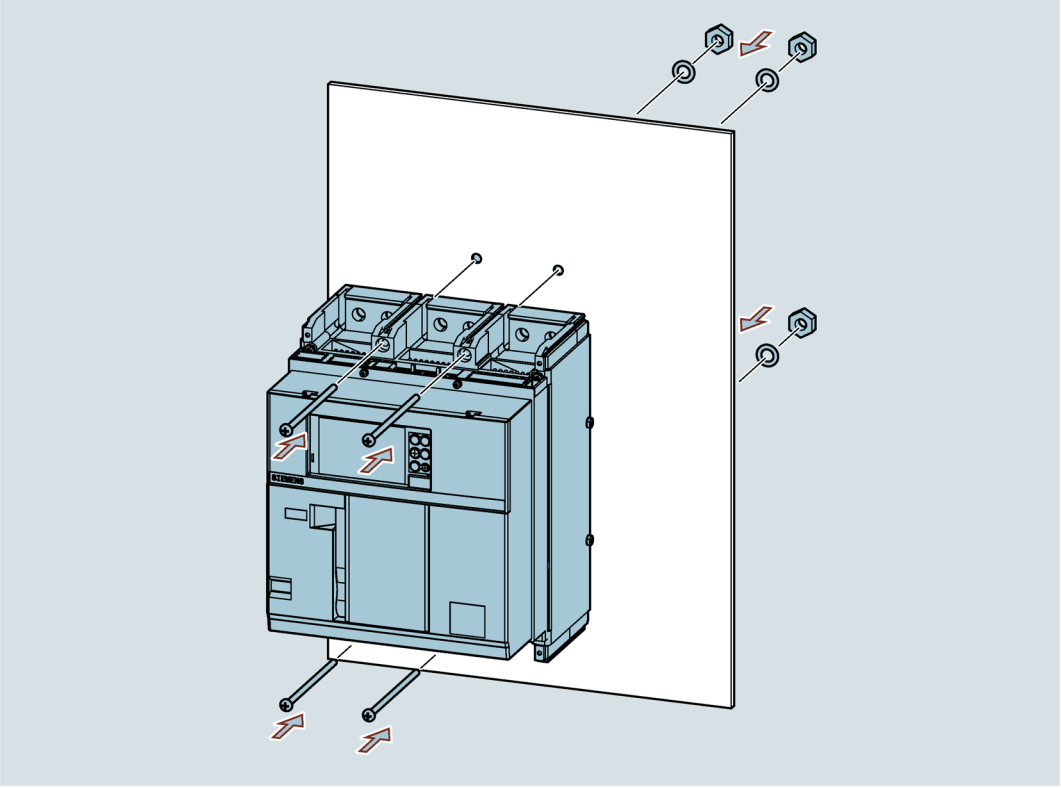
Wall mounting

Note

This type of mounting also permits rear connections provided the specifications for the rear wall cutouts are considered.

(For the drilling template, see Chapter Switchboard panel, hole and drilling templates, fixed breaker (Page 228)):

– Fasten the circuit breaker to the rear wall of the switchboard panel with 4 screws (included in the scope of delivery) with a tightening torque of 8.6 Nm.



2. Screw the busbars/cables of the main conductor paths to the connections of the circuit breaker (for tightening torques, see table Tightening torques at a glance (Page 164)). Note the operating instructions of the relevant connection system (see Chapter Reference documents (Page 10)).
3. Mount the prescribed insulation accessories.
   You will find information about the insulation measures in Chapter Isolating distances and insulating equipment (Page 156). When mounting the insulation accessories, follow the relevant Operating Instructions (see Chapter Reference documents (Page 10)).
4. Mount the armature plates for protection from short-circuits (see Chapter Armature plates (Page 159)).

Note

Fixed-mounted circuit breakers do not need to be grounded.

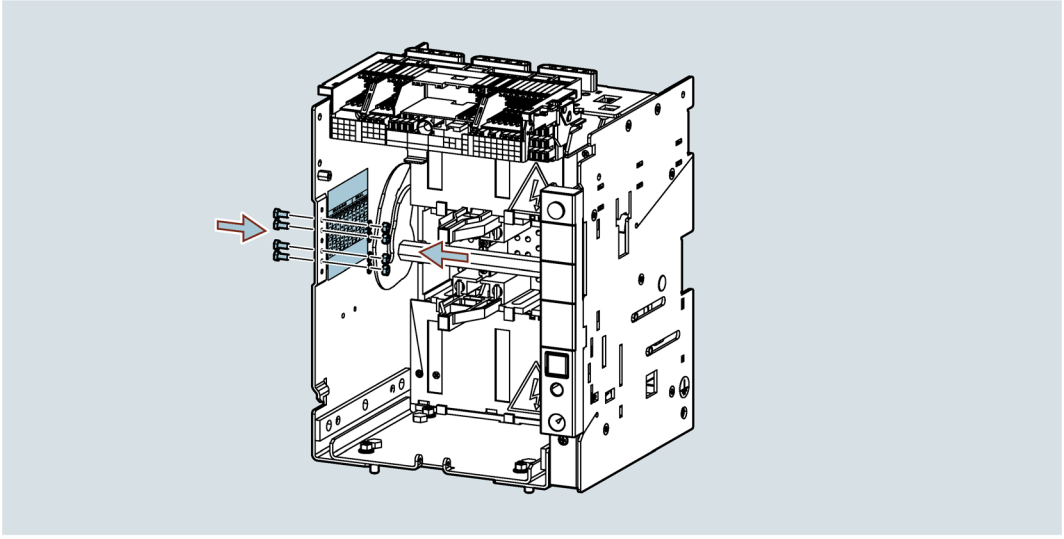
5.2.4 Withdrawable breaker: Installing the circuit breaker / guide frame

Coding the guide frame

The coding of the guide frame prevents circuit breakers with incompatible characteristics from being inserted into the guide frame.

When a withdrawable circuit breaker is delivered, the guide frame is already correctly coded. The user only needs to code the guide frame if the guide frame and circuit breaker are ordered separately.

1. Screw the screws supplied into the holes of the left-hand guide frame side wall. You will find the correct coding for the circuit breaker on the label next to the holes.



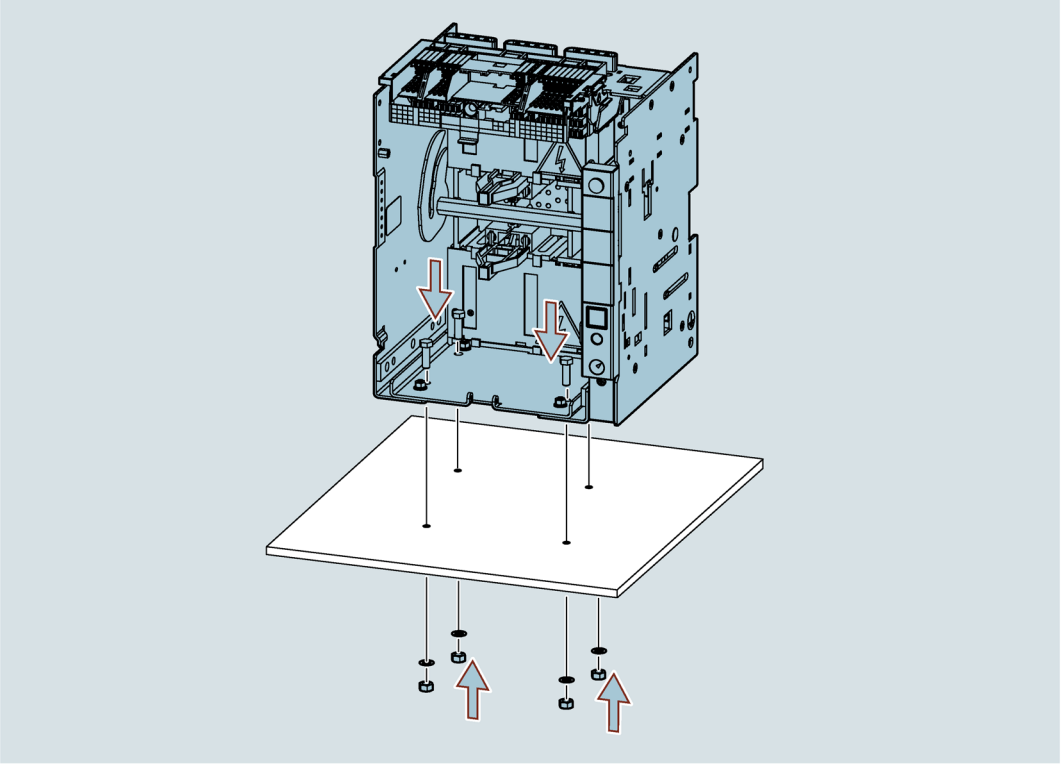
2. Check whether the circuit breaker belonging to the guide frame can be inserted into the guide frame. Correct the position of the coding screws if necessary.

Installing the guide frame

1. Install the guide frame in the switchboard panel:

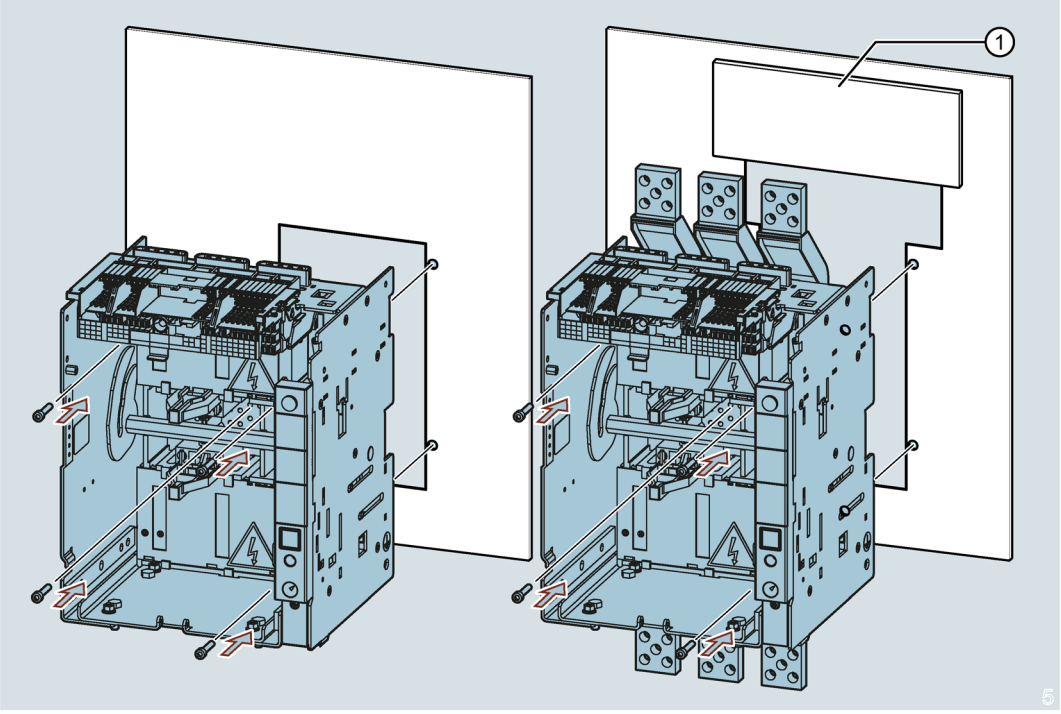
   Floor mounting (For the drilling template, see Chapter Switchboard panel, hole and drilling templates, fixed breaker (Page 228)):

   – Fasten the guide frame to the base of the switchboard panel with four screws M8 x 25 (included in the scope of delivery) with a tightening torque of 21 Nm.



Wall mounting (For the drilling template, see Chapter Switchboard panel, hole and drilling templates, fixed breaker (Page 228)):

– Fasten the guide frame to the rear wall of the switchboard panel with 4 screws (included in the scope of delivery) with a tightening torque of 21 Nm.



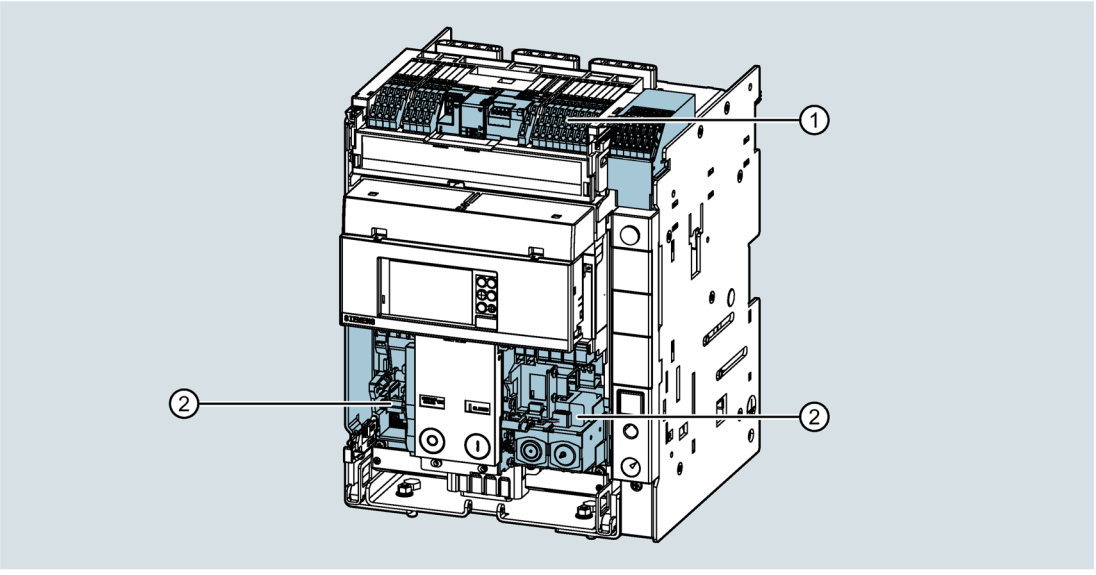
① Insulating plate for extended front terminals, to be provided by the customer

2. Ensure that the guide frame is grounded (see Chapter Power supply, grounding, and connection (Page 151)).
3. Screw the busbars/cables of the main conductor paths to the connections of the withdrawable breaker version (for tightening torques, see table Tightening torques at a glance (Page 164)).
   Note the operating instructions of the relevant connection system (see Chapter Reference documents (Page 10)).
4. Mount the armature plates for protection from short-circuits (see Chapter Armature plates (Page 159)).
5. Insert the circuit breaker into the guide frame (see Chapter Racking the circuit breaker (withdrawable breaker) (Page 200)).

5.3 Mounting accessories

5.3.1 Installing accessories

⚠ WARNING
Hazardous voltage
The front cover and terminal covers must only be removed when the circuit breaker is open.
Follow all safety instructions in Chapter Safety instructions (Page 11).
Put the circuit breaker into the OPEN position.
Discharge the spring energy store.

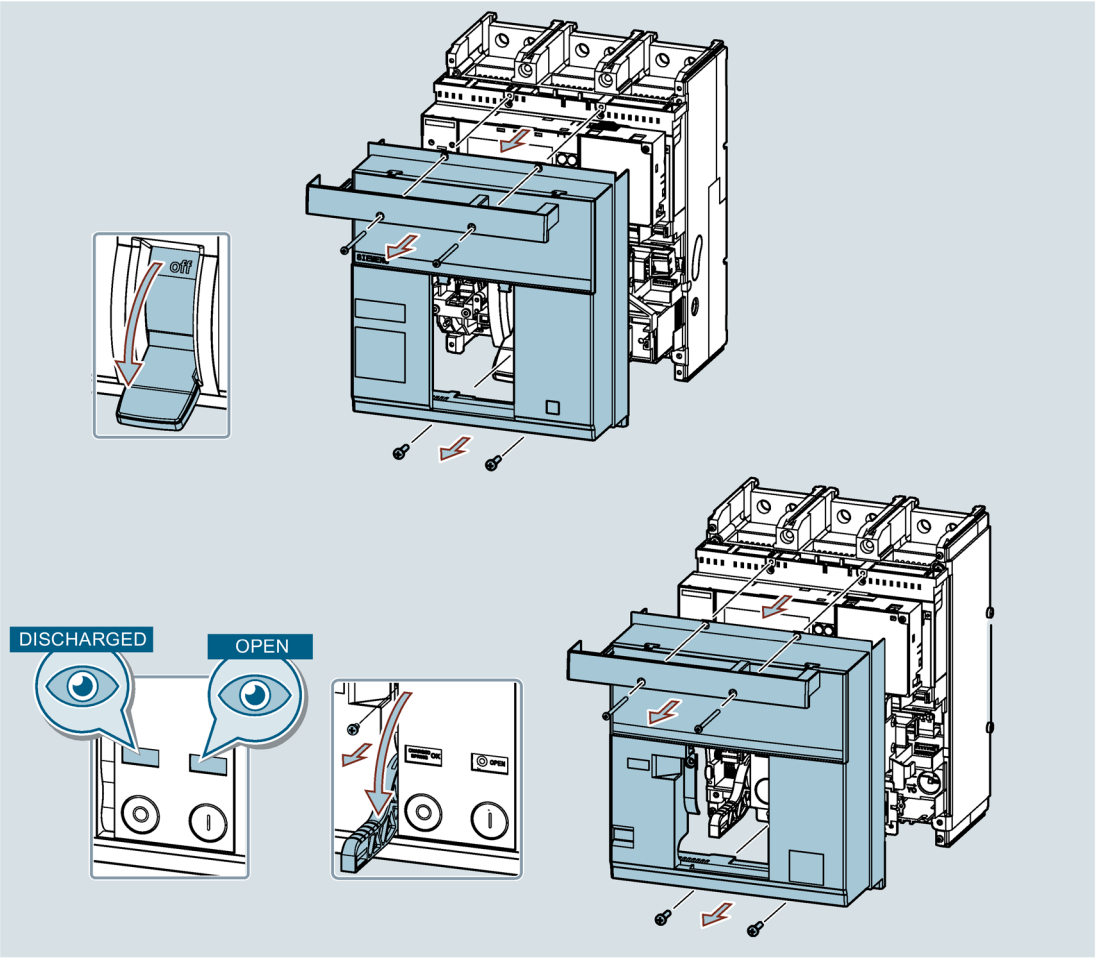


① Auxiliary conductor termination area
② Accessories area

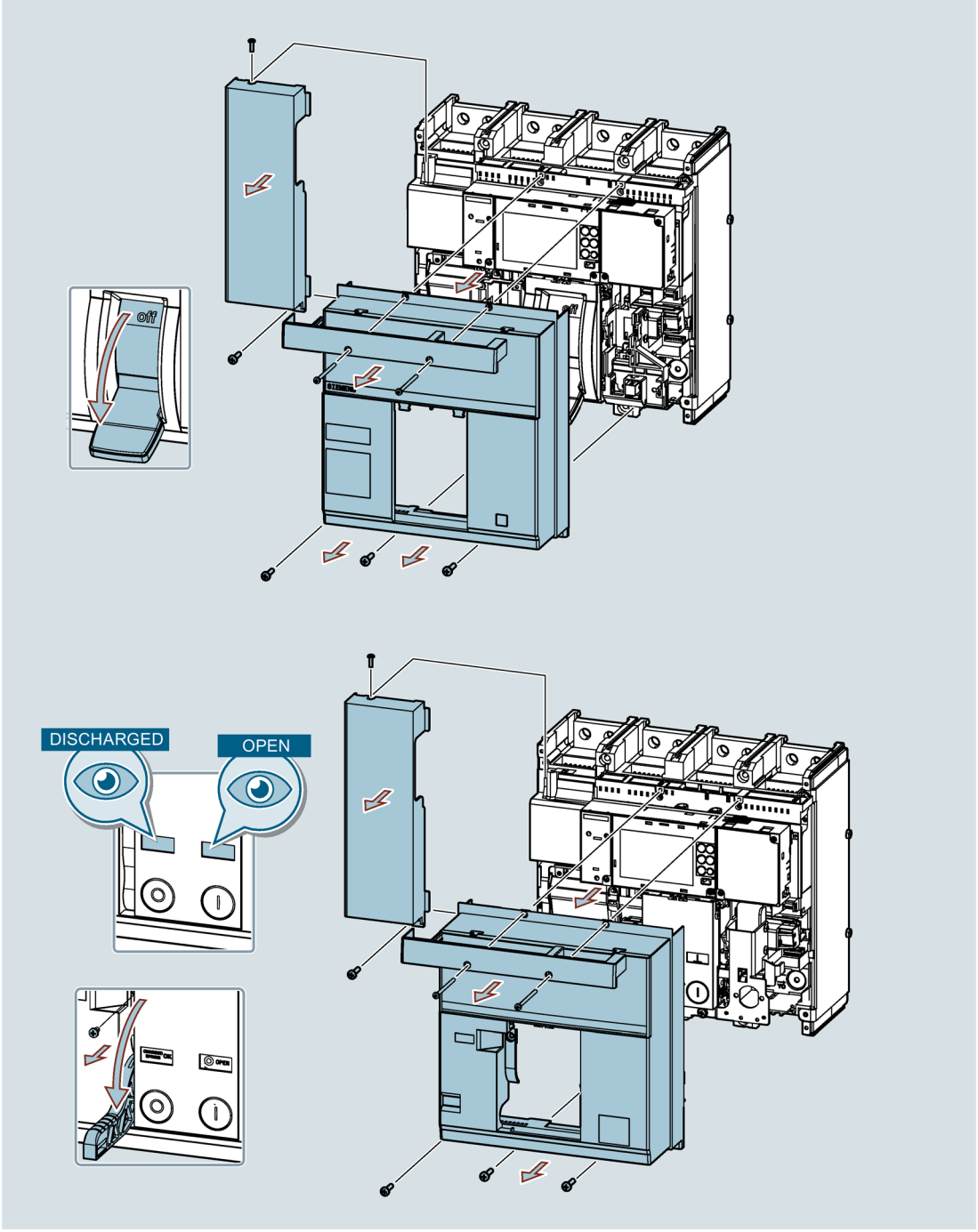
The internal accessories are installed in the accessories area of the circuit breaker behind the front cover. This is where all auxiliary and signaling switches that communicate states as well as auxiliary solenoids and components that provide extra functionality are placed. This area is local, functional, and therefore strictly physically segregated from areas of the device such as the operator, the contact system, the current conducting paths, the arc chute, and the electronics, for safety reasons, too.

1. Remove the front cover and the terminal covers of the circuit breaker to install internal accessories.

   3-pole circuit breaker:



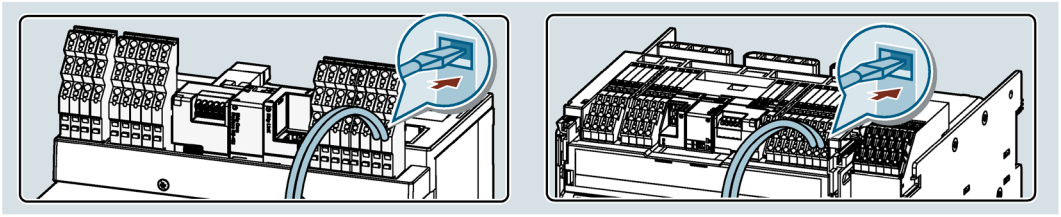
   4-pole circuit breaker:



2. Install the accessories as described in the relevant Operating Instructions (https://support.industry.siemens.com/cs/ww/en/ps).

   You will find a few examples in Chapter Examples of mounting internal accessories (Page 184), too.

3. Wire the accessories to the terminals for auxiliary supply connection as required.



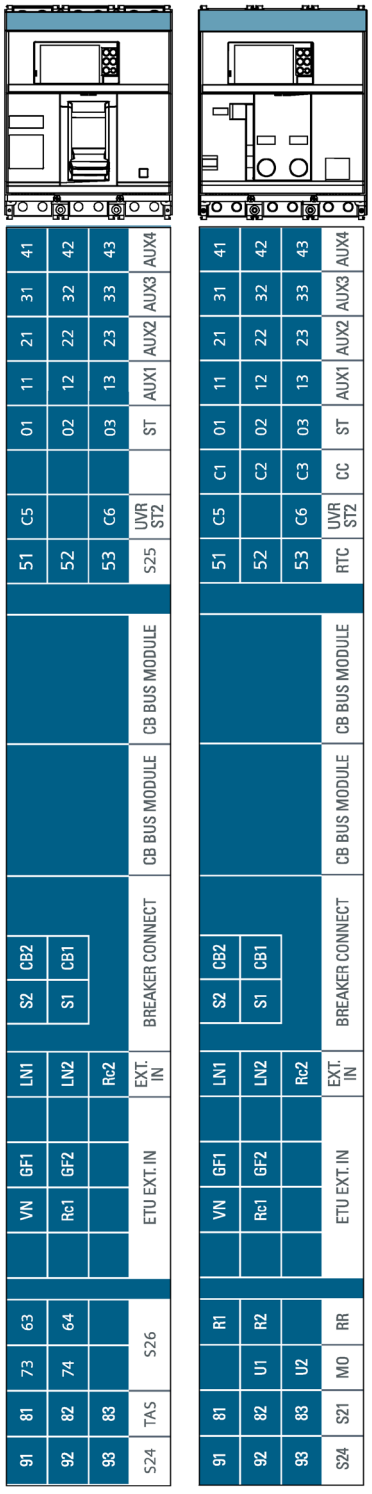
All commands and signals for interaction with the circuit breaker pass through the auxiliary conductor terminal system and the auxiliary conductor terminals it contains or the CB Bus Module that is plugged in. The internal wiring to the corresponding pins is available on every circuit breaker. By studying the labeling shown below, the user will find the relevant pin assignment for the external wiring of the user's accessories to the corresponding auxiliary conductor terminals. These are implemented with a screwless push-in method and are pre-installed in the factory when internal accessories are configured.

For the precise wiring of each accessory item, see the circuit diagrams (see Chapter Circuit diagrams (Page 245)).

Overview of auxiliary conductor connections version 3WL10 / 3VA27 - fixed-mounted circuit breaker

On left: Breaker with toggle operating mechanism

On right: Breaker with stored energy operating mechanism



Auxiliary Switch AUX4

Auxiliary Switch AUX3

Auxiliary Switch AUX2

Auxiliary Switch AUX1

Auxiliary solenoid Shunt release ST

Auxiliary solenoid Closing coil CC

Under Voltage Release UVR
Auxiliary solenoid Shunt release ST2

Triped Signalling switch - S25
Ready to close signaling switch RTC

Modbus RTU Gateway with COM042
Modbus TCP Gateway with COM043
PROFIBUS Gateway with COM040
PROFINET Gateway with COM041
IEC 61850 Gateway with COM044
Digital I/O module IOM040

Modbus RTU Gateway with COM042
Modbus TCP Gateway with COM043
PROFIBUS Gateway with COM040
PROFINET Gateway with COM041
IEC 61850 Gateway with COM044
Digital I/O module IOM040

Breaker Connect module

Rogowski CT solo external Neutral

Summation Current Transformer Rc CT
CT for earthed transformer star point G_ret CT

Leading change over switch S26
Remote reset magnet RR

Leading change over switch S26
Spring charging motor MO

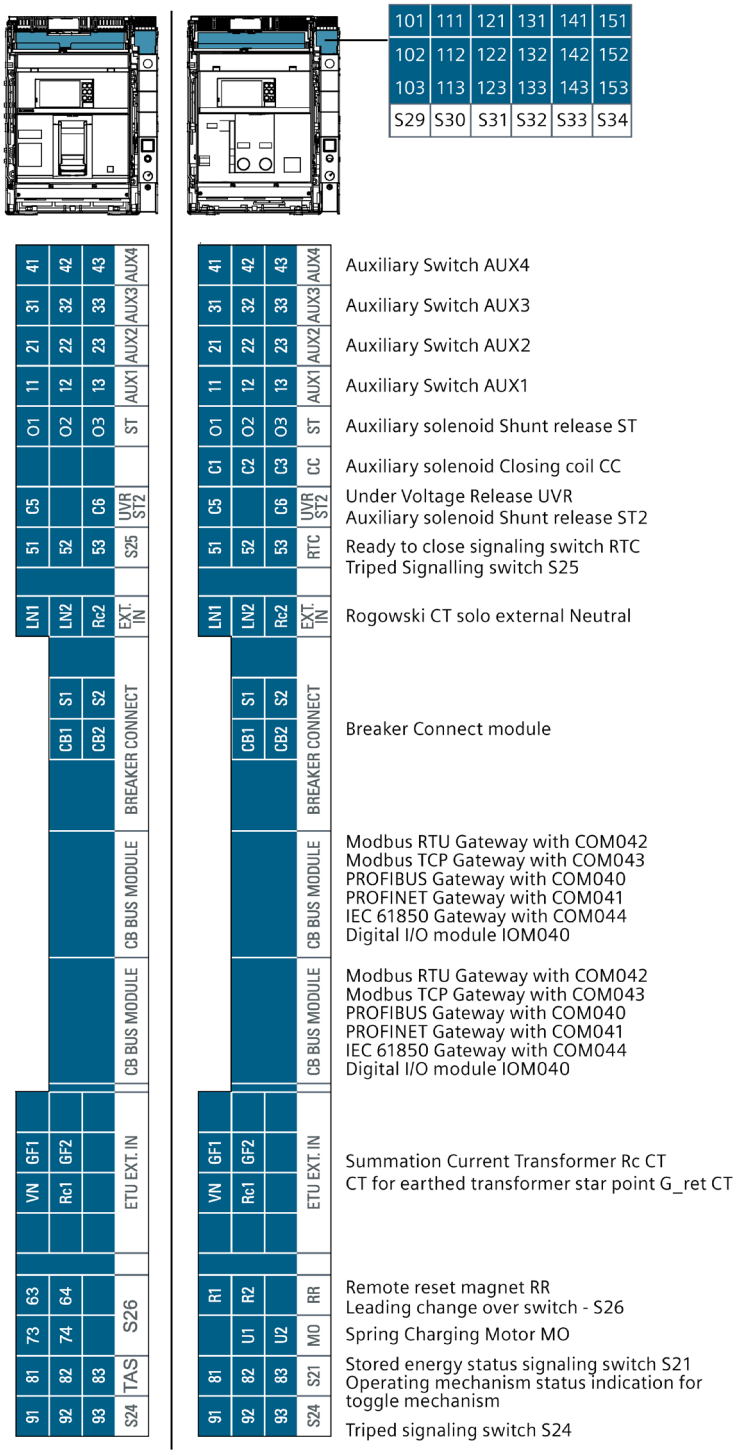
Operating mechanism status indication for toggle mechanism
Stored energy status signaling switch S21

Triped signalling switch S24

Overview of auxiliary conductor connections version 3WL10 / 3VA27 - withdrawable circuit breaker

On left: Breaker with toggle operating mechanism

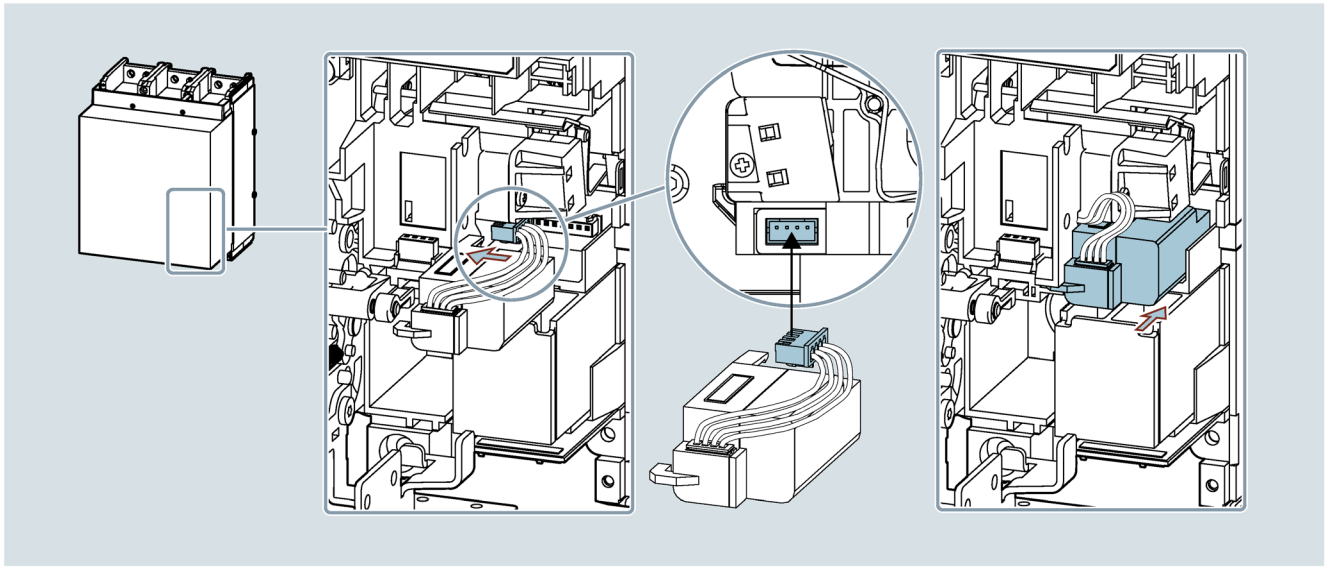
On right: Breaker with stored energy operating mechanism



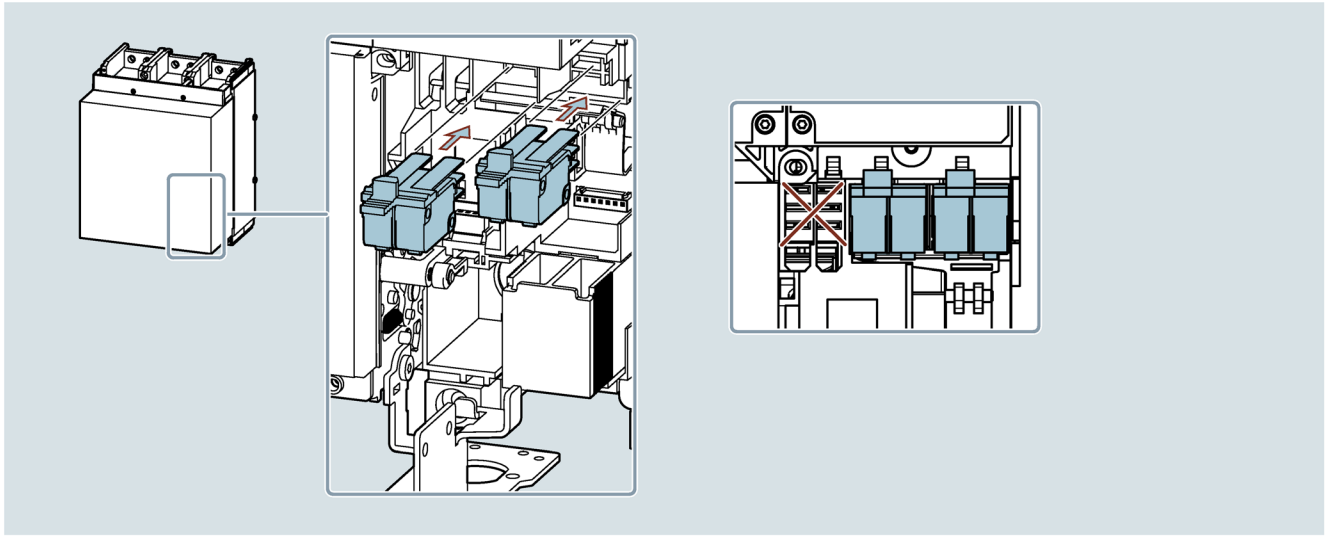
4. Remount the front plates and terminal covers on the circuit breaker if they have been removed.
   Proceed in the reverse sequence from that for removal.

5.3.2 Examples of mounting internal accessories

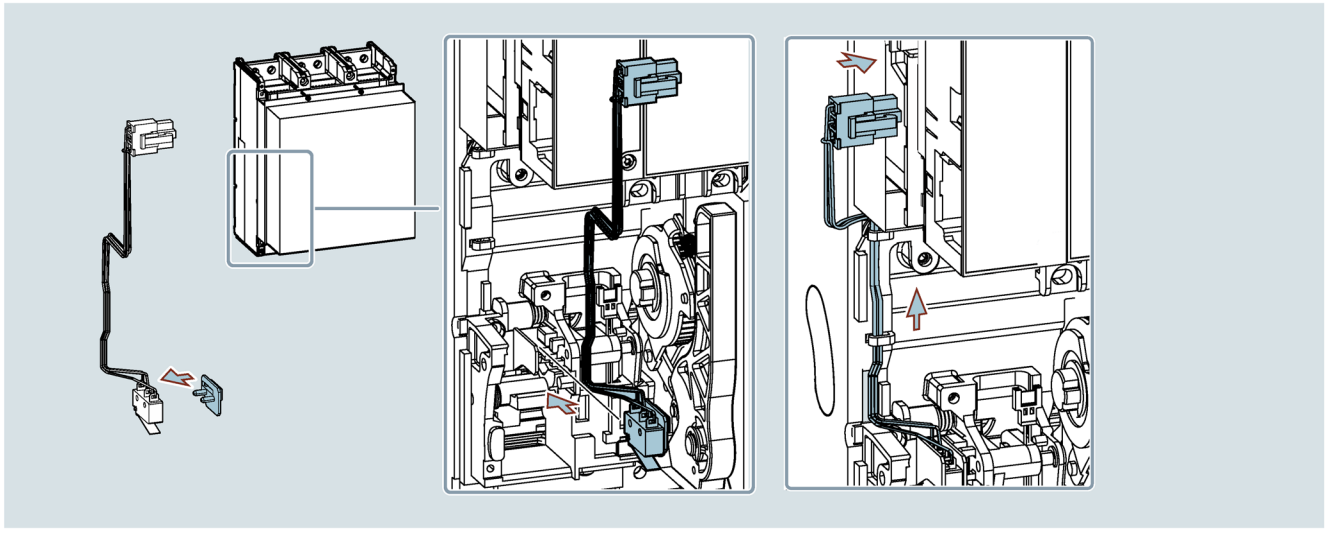
Mounting the actuator module



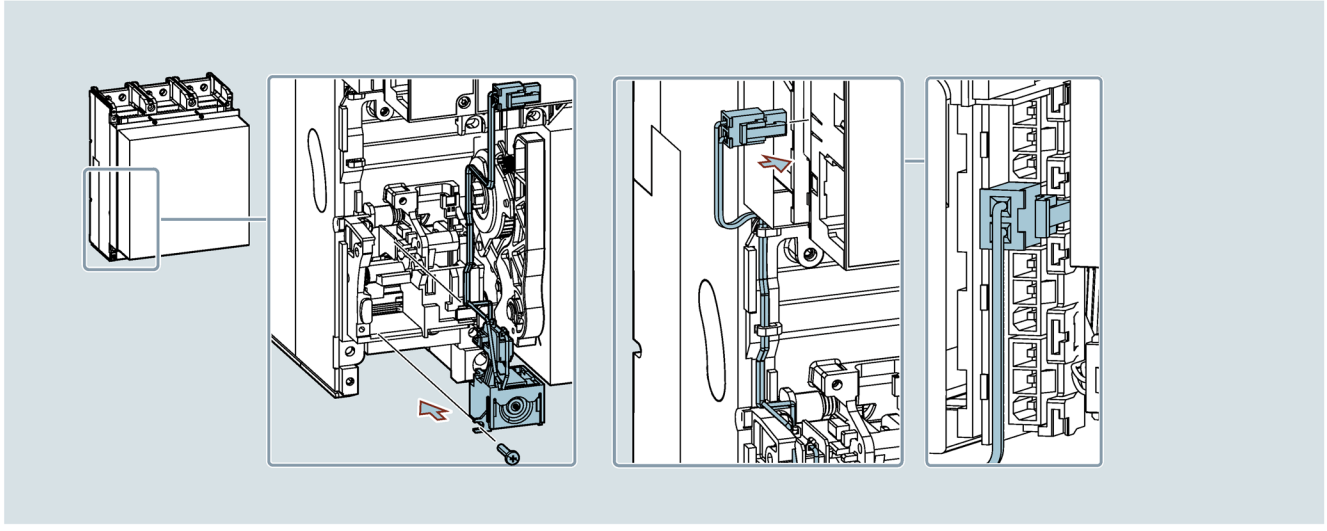
Mounting the auxiliary switch AUX 4CO / AUX 2CO+2CO changeover contacts



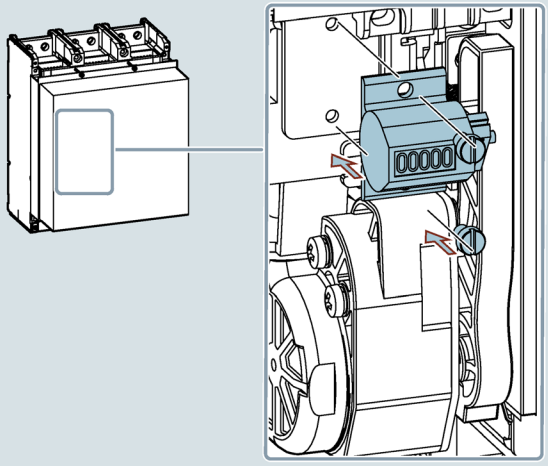
Mounting the tripped signaling switch S24



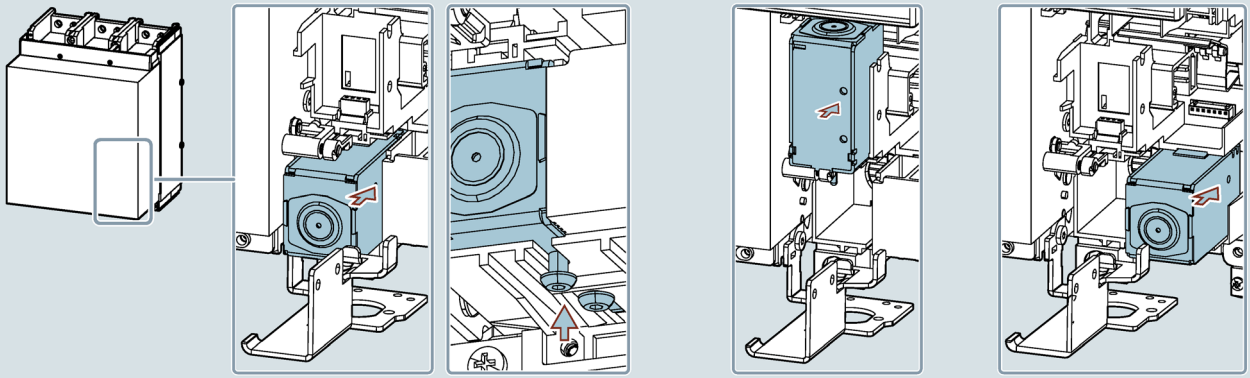
Mounting the remote reset magnet RR



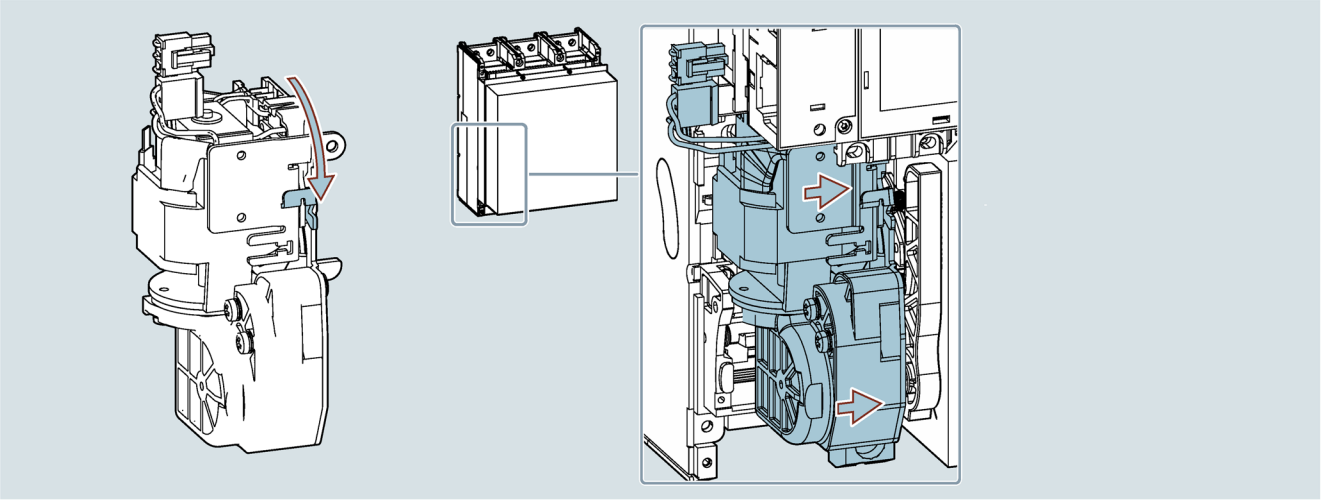
Mounting the mechanical operating cycles counter



Mounting the undervoltage release (UVR) / auxiliary coil (ST/CC)



Mounting the spring charging motor



5.4 Function test of the ETU

⚠ WARNING

Hazardous voltage

The power supply of the ETUs through the main circuits must only be used after commissioning.

Before the ETU can be supplied with power through the main current paths, the tests in the chapter on commissioning (see Chapter "Commissioning (Page 189)") must be performed.

In the following table, the functions and properties of the ETU to be tested are described. For the necessary tests, see the relevant chapters (e.g. commissioning, maintenance, etc.)

The ETU can be supplied with power through the TD310, TD410, or TD420 test devices.

Test	Checks
LED test (ETUs of the 3-series)	1. Connect the test device TD410 or TD420 to the ETU. 2. Press the test button of the ETU for at least 6 seconds, but for no longer than 9 seconds. Release the key as soon as the LEDs on the ETU light up. 3. Check whether the following LED sequence is followed correctly: – LEDs of S, I, and G light up. – LED of L changes three times between yellow and red. – All LEDs go out.
Battery test	The battery test is integrated into the LED test. • If the battery is missing or flat, the LED of L flashes yellow five times after the LED test. • If the battery is working normally, the LED test is passed as described above.
Protection function test	1. Make sure that the circuit breaker is in the CLOSED (ON) position and that the main circuits are not carrying any current. 2. Connect the ETU via the TD410 or TD420 test device with a laptop on which the powerservice software is installed. 3. Run the protection function test with powerservice and check whether all protection functions are working correctly.
Trip test (ETU of the 3-series)	1. Make sure that the circuit breaker is in the CLOSED (ON) position and that the main circuits are not carrying any current. 2. Connect the test device TD410, TD420, or TD310 to the ETU. 3. Press the test key of the ETU for at least 9 seconds. 4. Check whether the circuit breaker has tripped or the TU reset button has moved forward.
Trip test (ETUs of the 6-series)	1. Make sure that the circuit breaker is in the CLOSED (ON) position and that the main circuits are not carrying any current. 2. Connect the ETU via the TD410 or TD420 test device with a laptop on which the powerconfig software is installed. 3. Perform the trip test with powerconfig 4. Check whether the circuit breaker has tripped or the TU reset button has moved forward.

5.5 Commissioning

You can read how to operate the circuit breaker during each test point in Chapter Operation (Page 195).

5.5.1 General tests

DANGER

Electric shock!

Test the circuit breaker only while the switchboards are de-energized.

Note

General testing of the circuit breaker is necessary in the following cases:

- The circuit breaker is put into operation for the first time.
- The circuit breaker is inactive for a long time and during storage under certain environmental conditions

The tests contain the procedures that must only ever be performed by electrically skilled persons.
Electrically skilled person (IEV 195-04-01): Person with relevant education and experience to enable him or her to perceive risks and to avoid hazards which electricity can create.

The following table describes the general testing of the circuit breaker and its installed environment:

Items to be tested[1)]	Checks
Switchboard	1. Sufficient ventilation to avoid overtemperatures
	2. Clean installation location, free of all installation waste (e.g. cables, tools, metal splinters)
	3. Circuit breaker correctly mounted (tightening torques and ventilation clearances observed)
	4. The environmental conditions of the installation must match the specifications (see Chapter Application planning (Page 137)).
Connections	1. Electrical connections at the terminals of the circuit breaker tightened
	2. Cables, busbars, and auxiliary current wiring have sufficient conductor cross sections
	3. Required insulation clearances between the phases (if necessary with phase barriers) and from phases to the switchboard panel.
Operations	Perform a few open and close operations. It must be possible to operate the lever of the operator normally and to charge the spring energy store.
	Note: If an undervoltage coil is present, the circuit breaker can only be closed when a voltage is applied at the corresponding auxiliary conductor terminals.

1) If present

The following tests must be conducted for inspection before re-commissioning after tripping and after lengthy storage under certain environmental conditions. These can be performed with a TD310 test device to power the ETU. They are not mandatory for a device from the factory because the circuit breaker is completely and thoroughly tested, including all installed accessories, before delivery. A trip test confirms correct mechanical functioning of the tripping plunger on the trip coil, actuated by the ETU. Electronic monitoring of the entire connection between the current transformers, ETU, and trip coil is performed continuously by the electronics itself (watchdog).

Items to be tested[1)]	Checks
Enable alarms	Connect the ETU to a test device and check that no alarms are present.
Status of the circuit breaker	On the ETUs of the 3-series, the status of the circuit breaker must not be incorrect (see tables of the LED display in Chapter Alarms (Page 203)). Perform a close/open operation on the circuit breaker and check that no alarms have occurred.
	On the ETUs of the 6-series, the status of the circuit breaker must be correctly shown on the display. Perform a close/open operation on the circuit breaker and check that the change in circuit breaker status is correctly displayed.
Trip test	Make a trip attempt with the circuit breaker closed during an idle period (without circulating currents of the mains connection) and check that the circuit breaker opens.

1) If present

5.5.2 Procedure for testing the accessories

To meet the high quality requirements of Siemens, this points are already tested if the circuit breaker is configured in the factory.

The accessories therefore only need to be tested after installation or conversion by the user. The following points must be considered during commissioning after conversion or installation:

Accessories to be tested	Method
Geared motor	1. Run the geared motor for charging the springs at the appropriate nominal voltage.
	Result: The springs are correctly charged. The signals are normal. When the springs are charged, the geared motor stops.
	2. Perform a few close and open operations.
	Result: The geared motor charges the springs again after every closing operation.
	NOTE: If there is one, switch on the undervoltage coil in advance.
Undervoltage coil	1. Run the undervoltage coil at the appropriate rated voltage and perform the closing operation on the circuit breaker.
	Result: The circuit breaker closes correctly. The behavior and the signals of the auxiliary switches are normal.
	2. Switch off the power supply of the undervoltage release. The circuit breaker opens.
	3. Operate the undervoltage coil at the appropriate nominal voltage and perform the closing operation on the circuit breaker.
	Result: The circuit breaker closes. The behavior and the signals of the auxiliary switches are correct.
	Note: If the undervoltage coil is tripped by a shunt release (ST), the circuit breaker cannot be reclosed until voltage is applied to the undervoltage coil again. Make sure that the coil was really tripped by a power failure. Otherwise examine the circuit breaker and the device in question to see whether both are fully functional.
Shunt release (ST)	1. Close the circuit breaker.
	2. Operate the opening coil at the appropriate nominal voltage.
	Result: The circuit breaker opens correctly. The signals at the auxiliary switches are correct.
Closing coil (CC)	1. Open the circuit breaker.
	2. Charge the springs manually or electrically.
	3. Operate the closing coil at the appropriate nominal voltage.
	Result: The circuit breaker closes correctly. The signals at the auxiliary switches are correct.
Shunt release (ST) with actuator module COM ACT	1. Supply power to the ETU with the auxiliary voltage at the Breaker Connect module.
	2. Switch on the contacts of the actuator module.
	3. Close the circuit breaker.
	4. Choose item "Open CB" in the menu of ETUs of the 6-series.
	Result: The circuit breaker opens correctly. The behavior and the signals of the auxiliary switches are normal.
	Note: The test can be conducted if voltage is applied to the ETU and to the coils.
Closing coil (CC) with actuator module COM ACT	1. Supply power to the ETU with the auxiliary voltage at the Breaker Connect module.
	2. Switch on the contacts of the actuator module.
	3. Charge the springs.

Accessories to be tested	Method
	4. Choose item "Close CB" in the menu of ETUs of the 6-series.
	Result: The circuit breaker closes correctly. The behavior and the signals of the auxiliary switches are normal.
	NOTE: The test can be conducted if voltage is applied to the protection enable and to the coils.
Interlocking for circuit breakers in the open position (cylinder lock or padlock)	1. Open the circuit breaker.
	2. Hold the pushbutton for opening pressed or press the cover onto the mechanical pushbutton while you hook in the padlock.
	3. Turn the key and then remove it.
	4. Attempt to close the circuit breaker.
	Result: Both manual and electrical closing are prevented.
Auxiliary contacts of the circuit breaker	1. Connect the auxiliary contacts to the corresponding signaling circuits.
	2. Perform a few close and open operations on the circuit breaker.
	Result: Signaling performed normally.
Circuit breaker position in the guide frame. Position signaling contacts PSS for signal: CB inserted, test position, and disconnected position[1)]	1. Connect the auxiliary contacts to the corresponding signaling circuits.
	2. Put the circuit breaker into the following positions: CONNECT, TEST, and DISCONNECT.
	Result: The signals caused by each operation are correct.
Mutual mechanical interlocking between circuit breakers installed side by side or one above the other	Perform the function tests.
	Result: The interlockings function correctly.
Racking of the circuit breaker in the guide frame[1)]	Move the circuit breaker out of and into the guide frame several times.
	Result: In the CONNECT position, the circuit breaker is correctly connected. No particular resistance is felt during the first turns of the racking handle.
Auxiliary solenoids power supply	Check the installation: The value of the auxiliary voltage of the auxiliary solenoids must be between 85 % and 110 % of the rated voltage for the auxiliary coils.
CB Bus Module	Supply power to the ETU.
	Result: Check that the LEDs that signal readiness on each of the installed accessory items light up.
	Check that the communication cable for the local bus on the ETU is activated.
External current transformers	**WARNING!** Before this test, the circuit breaker must be in the OPEN position and, if it is a withdrawable breaker, in the DISCONNECT position.
	Connect a single-pole neutral transformer / summation current transformer to the auxiliary conductor terminal system. Set the parameters and select the configuration in accordance with the ETU.
	Result: No alarm pending on the ETU.

1) Withdrawable breaker only:

5.5.3 Final tests

After completion of the general and accessory tests, perform the activities in the final checklist table.

No.	Activity	Description
1	Circuit breaker open	Put the circuit breaker into the OPEN position.
2	Circuit breaker connected	On the withdrawable breaker, move the circuit breaker into the CONNECT position. Stow the racking handle in the recess provided for it.
3	Parameterization	Parameterize ETUs of the 3-series directly with the rotary coding switch and ETUs of the 6-series with the TD310 test device through the power supply. If parameterization is not performed, the default values of the parameters are so high that the highest safety is ensured (minimally sensitive protection setting). Only the overload release (LT) on an ETU of the 6-series has a medium operating value that prevents direct tripping when a circuit breaker is closed, if it has not been modified by the user.
4	Removing the TD310 test device	Remove the TD310 test device, if connected.
5	Connecting the voltage	Connect the auxiliary voltage.
6	Closing the switchboard	Close the control panel door.
7	Charging the springs	Charge the springs with the manual lever.
8	Undervoltage release	Make sure that voltage is applied to the undervoltage release.
9	Open and close the closing coil and shunt release	Make sure no voltage is applied to the closing coil and shunt release.
10	Mutual mechanical interlocking of the circuit breaker	Make sure that the mutual mechanical interlocking of the circuit breaker is not active, if installed.
11	Interlocks and locking devices	Make sure that the interlocking devices of the circuit breaker, if installed, are not operated or enabled.
12	Status signals	Check whether the display on the front of the circuit breaker functions: Circuit breaker OPEN: The springs are charged and the status indicator shows "CHARGED".

Note

To perform the insulation test on the switchboard, the voltage circuit of the metering function must be interrupted. This is done by pulling out the metering module MF Basic / Advanced to its dedicated disconnect position, which is located next to the ETU.

The general rules for the insulation test procedure for switchboards acc. to **IEC 60364-6** must be followed.

Operation

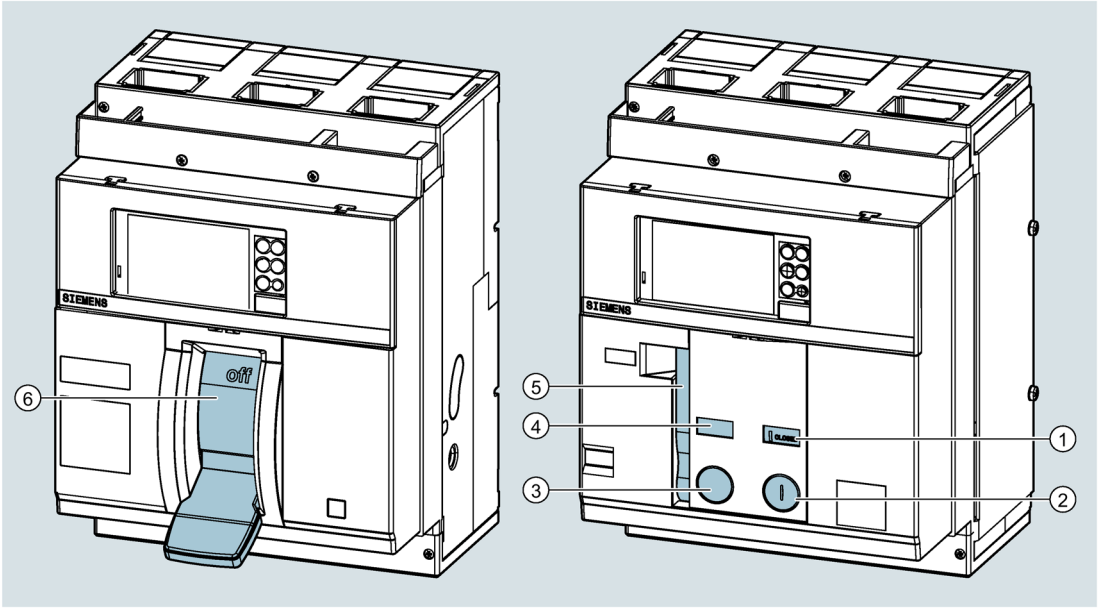
6

6.1 Operation

6.1.1 Closing and opening manually

Closing and opening manually

The air circuit breaker can be closed and opened manually with the pushbuttons on the front.



① Switch position indicator contacts OPEN / CLOSED
② "Mechanical ON" pushbutton
③ "Mechanical OFF" pushbutton
④ Status indicator of spring energy store CHARGED / DISCHARGED
⑤ Manual lever for charging the spring energy store
⑥ Toggle

The following conditions must be met before the circuit breaker can be closed:

- Circuit breaker in the OPEN position
- Spring energy store compressed
- Open command via remote access is not pending
- Interlocking with open command is not pending (mechanical and electrical interlocks)

Charging the spring energy store of the circuit breaker

The spring energy store transmits its energy to the contact system during the opening operation of the circuit breaker and is then discharged. The contact system will now stay together with this energy to be able to withstand substantial short-circuits (I_{cw} value of an air circuit breaker). After this transfer to the contact system, the spring energy store can immediately be charged with stored energy again (circuit breaker is in the CLOSED position).
The contact system can also be opened at any time without additional energy input. This means, when the circuit breaker trips, it transmits this stored energy of the spring energy store to the contact system and the circuit breaker can be reclosed immediately.
This enables the following switching sequence in the CLOSED state and with the spring energy store CHARGED: Open ⇒ Closed ⇒ Open

A discharged spring energy store is indicated by the DISCHARGED symbol.

To charge the spring energy store, proceed as follows:

1. Move the manual lever down 9 times until the spring energy store audibly engages.

The spring energy store is now charged and the status indicator changes to the CHARGED symbol.

Close circuit breaker

1. Check whether the spring energy store is charged.
2. Press the "Mechanical ON" pushbutton

The circuit breaker closes the contacts to the current paths. The switch position indicator changes to the CLOSED symbol and the spring energy store changes to the DISCHARGED state.

The spring energy store can then be charged again.

Open circuit breaker

1. Press the "Mechanical OFF" pushbutton

The circuit breaker opens the contacts to the current paths. The switch position indicator changes to the OPEN symbol.

The status and the status indicator of the spring energy store do not change.

Opening and closing via remote access

Remote access is possible in two ways:

- Via the communication system, the precondition being a COM connection and the COM actuator module
- Via direct electrical signals on the auxiliary conductor terminal system

The circuit breaker can be closed and opened by remote access. For this purpose, the optional closing coils (CC) / shunt releases (ST) must be installed. You will find information on these coils in Section AUTOHOTSPOT.

Closing/opening the circuit breaker via the communication system

1. Charge the storage spring if it is not already charged.
   It is advisable to use the accessory spring charging motor (MO) so that the spring energy store can be charged via the communication system, too.
2. Transmit a closing/opening command via the COM connection and control system.

Closing/opening the circuit breaker via the auxiliary conductor terminal system

1. Charge the spring energy store if it is not already charged.
2. Transmit the closing/opening command to the closing coil (CC, CLOSED) or the shunt release (ST, OPEN).

6.1.2 Entering parameters

Note

A change of parameters during operation is accepted unless the protection function affected is in the picked-up condition (is actively metering or is above the newly set threshold value).

Software: powerconfig

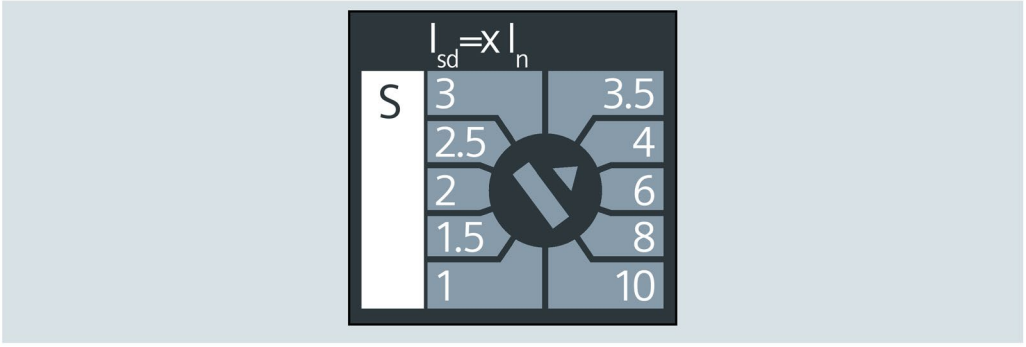
powerconfig is a commissioning and maintenance software for all communication-capable SENTRON products from Siemens. With this software, the circuit breaker can be parameterized, commissioned and its settings can be archived and, in the operating phase, values from the installation (current, voltage, etc.) read out and the status of the circuit breaker can be acquired.

Setting the parameters and line frequency on the electronic trip units of the 3-series

The releases of the ETUs of the 3-series have rotary coding switches and DIP switches. The parameters of the protection releases L, S, I, and G are set with the relevant rotary coding switch; the neutral protection and the line frequency are set with the DIP switches.

Setting parameters with the rotary coding switch

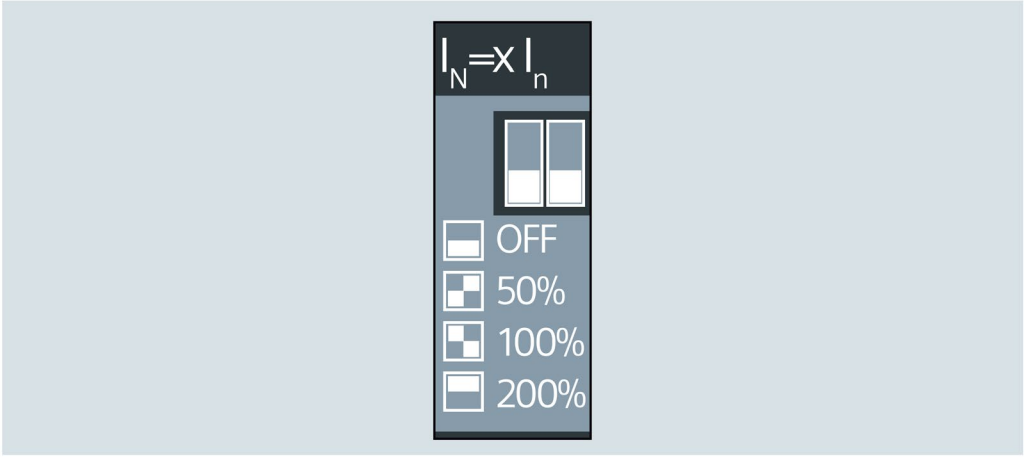
1. Select the rotary coding switch of the protection release for which you want to set or modify the parameters.
2. Turn the arrow of the rotary coding switch to the required parameter value using a suitable screwdriver. The rotary switch must noticeably engage at the value and the arrow must **not** point to one of the lines.
   Example short-time-delayed short-circuit protection ST, parameter set I_{sd} = 4 x I_n:



   The new parameter value is set and active.

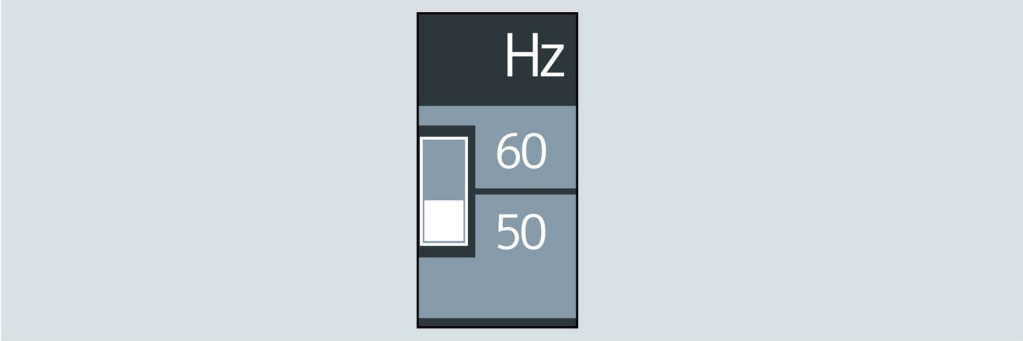
Setting the neutral protection with the DIP switches

1. Set the neutral protection with the two DIP switches in the range "I_N". The setting symbols below the DIP switches show the necessary position of the DIP switches in relation to each other.
   Example neutral protection OFF.



Setting the line frequency with the DIP switches

1. Set the DIP switches in the "Hz" area to the correct line frequency.
   Example line frequency 50 Hz:

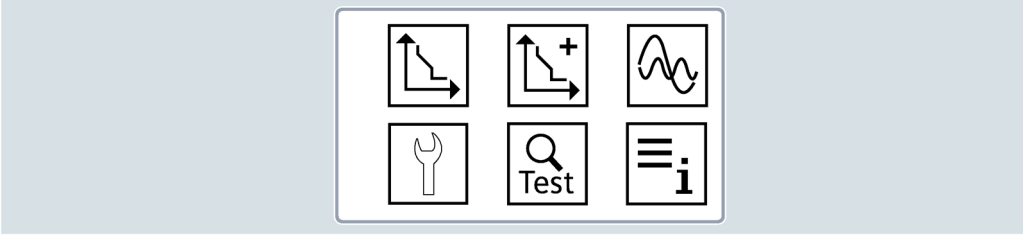


Entering parameters on the electronic trip units of the 6-series

The parameters of each protection release are entered with the control keys of the ETU to the right of the display. You will find information on the control keys and the menu structure in Chapter Design of the electronic trip units (Page 52).

Entering parameters

1. Use the arrow keys to navigate to the parameter display.



2. Press the OK control key.
   Parameter editing mode is active. The password has its default setting "0001".
3. Use the arrow keys to navigate to the parameter area of the required protection release.
4. Press the control key OK.
   The parameter can now be set or modified.
5. Use the arrow keys to set the parameter and confirm the value with the control key OK.
   The newly set parameter value is now active.
6. With the control key HOME, go back to the start screen.

6.1.3 Racking the circuit breaker (withdrawable breaker)

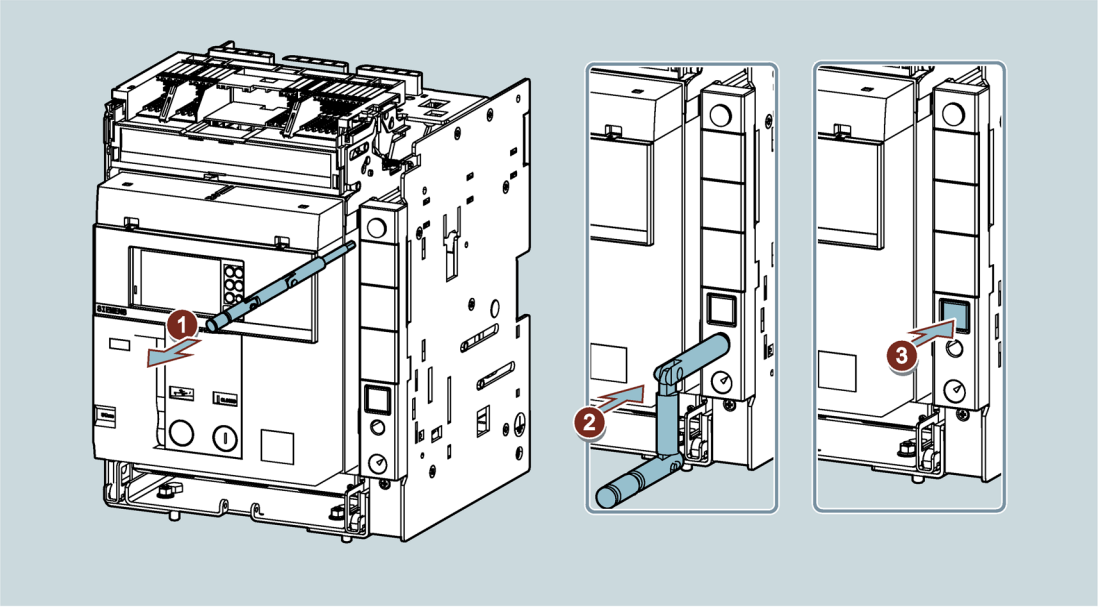
WARNING

Hazardous voltage

The circuit breaker must only ever be racked while it is open.

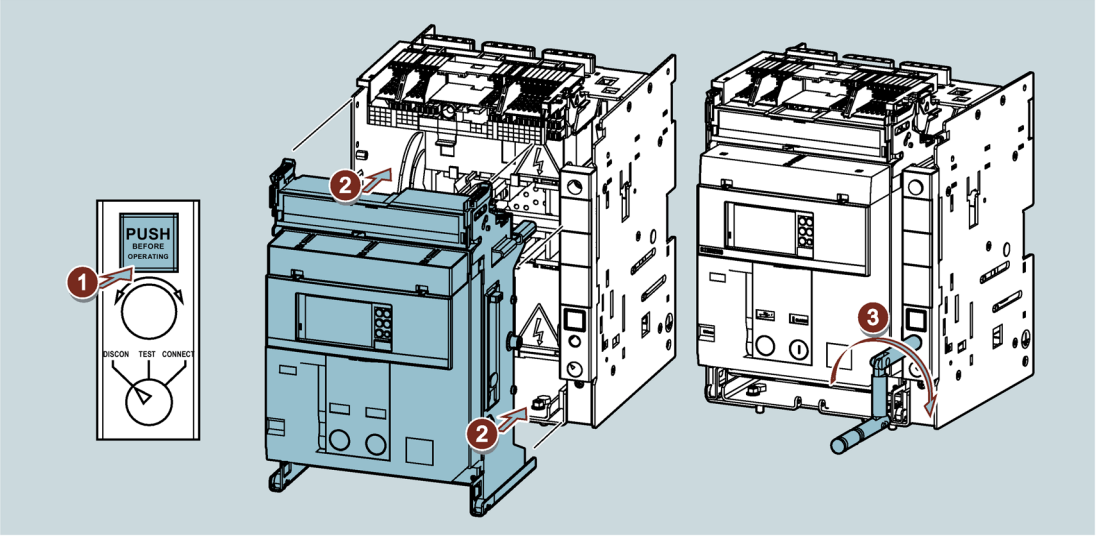
- Switch the circuit breaker into the OPEN position.
- Discharge the spring energy store.

Inserting the racking handle



1. Pull the racking handle out of the guide frame.
2. Fold the handle of the racking handle into position.
3. Insert the racking handle into the opening above the position indicator and press the unlocking button PUSH before Operating.

Inserting the circuit breaker



1. Check that the position indicator on the guide frame is showing the DISCONNECT (DISCON) position.

   If a different position is displayed, use the racking handle to set the DISCONNECT position (see Section "Moving between switch positions" below).

2. Place the circuit breaker into the racking rails of the guide frame and push it as far as it will go.
3. Insert the racking handle, see Section "Inserting and removing the racking handle" above.
4. Turn the hand crank clockwise until the position indicator shows TEST and the circuit breaker engages.
   It is then not possible to turn the racking handle any further and the PUSH before Operating enabling pushbutton is now flush with the front of the guide frame.

In the TEST position, the internal accessories are contacted and can be tested.

Moving between switch positions

Note

The circuit breaker engages in each switch position. To move it to the next switch position, you have to press the unlocking button PUSH for Operating again.

Precondition: Hand crank handle is inserted (see Section "Inserting the racking handle" above).

1. If you want to move the circuit breaker to the next switch position, press the unlocking button PUSH before Operating again and turn the racking handle until the circuit breaker reaches the breaker position and engages.
2. Stow the racking handle in the storage compartment again, see Section "Removing the racking handle" below.

Retracting the circuit breaker

CAUTION
Risk of injury due to circuit breaker falling
Take suitable precautions to be able to remove the circuit breaker safely.

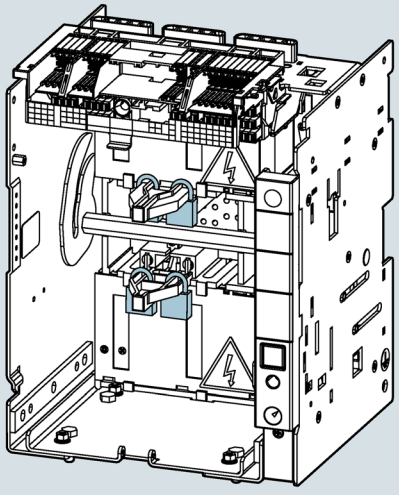
1. Insert the racking handle, see Section "Inserting and removing the racking handle" above.
2. Move the circuit breaker into the DISCONNECT position.
3. Operate the side locking lever above the racking rail and remove the circuit breaker from the guide frame.

Removing the racking handle

1. Pull the racking handle out.
2. Fold the handle back into line and return the racking handle to its storage compartment.

Locking the guide frame – interlocking the shutter

In order to safeguard an installation and its sub-distribution board in a no-current condition (e.g. in the event of maintenance work) or until a new device is available to replace the device after a delay, it is possible to achieve a simple and easily visible disconnection of the system by removing the circuit breaker from the guide frame. In the meantime, undesired insertion of a circuit breaker into the guide frame can be reliably prevented by padlocks on the shutter, see diagram below.

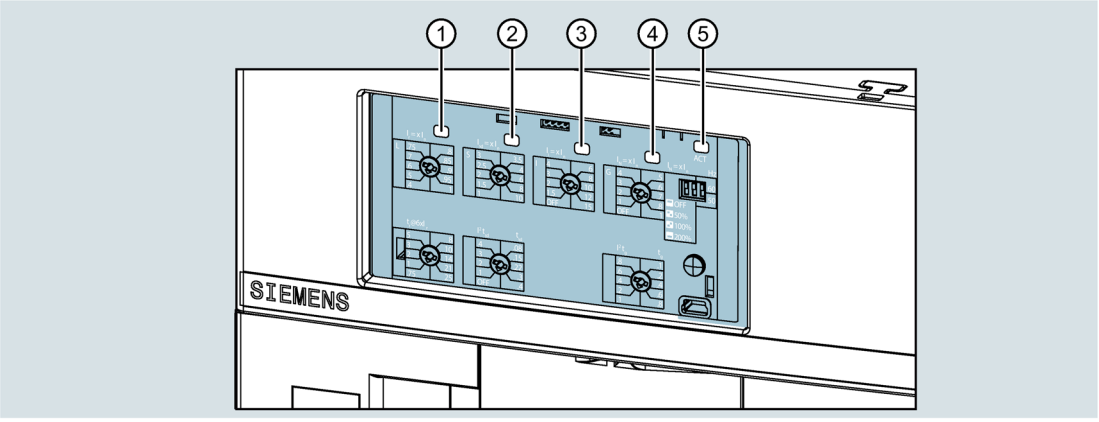


6.2 Alarms

The electronic trip units permanently monitor their own status and the status of all connected devices.

Indications of the current status are output via the LEDs (electronic trip units of the 3-series) or via the display / warning displays (electronic trip units of the 6-series) of the ETU.

Indications of ETUs of the 3-series



① LED protection release L
② LED protection release S
③ LED protection release I
④ LED protection release G
⑤ LED ACT

The electronic trip units of the 3-series display the indications and alarms on the LEDs on their front face.

Note

The diagram shows the maximum possible number of LEDs. Depending on the version of your ETU, they may also have fewer LEDs.

Depending on the color and flashing frequency, the LEDs indicate the statuses described below.

Display of the LED ACT

The LED name "ACT" stands for ACTIVE. This LED indicates that the ETU is ready for operation. If the LED does not light up, the power supply of the ETU is interrupted and the ETU is not ready to operate.

ACT	Alarm / status	Measure / comment
 Flashing slowly (1 Hz; 0.1 s on / 0.9 s off)	ETU ready	No measures required
 Off	ETU without power supply	Check the power supply of the ETU via the main circuit or the auxiliary current conductors.

LED displays of the protection releases

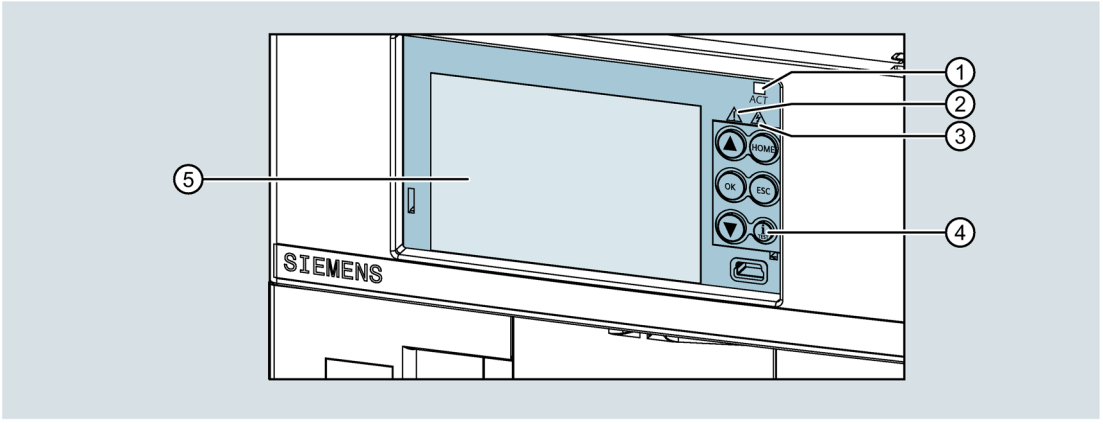
L	S	I	G	Alarm / status	Measure / comment
 Flashing fast (2 Hz)	 Flashing fast (2 Hz)	 Flashing fast (2 Hz)	 Flashing fast (2 Hz)	Auxiliary solenoid closing coil / shunt release (CC/ST) not connected or trip command failed	Check connections.
 Flashing slowly (0.5 Hz)	 Flashing fast (2 Hz)	 Flashing fast (2 Hz)	 Flashing fast (2 Hz)	Current sensor not connected	Check connections.
 Flashing slowly (0.5 Hz) with 2 s pause	 Flashing slowly (0.5 Hz) with 2 s pause	 Flashing slowly (0.5 Hz) with 2 s pause	 Flashing slowly (0.5 Hz) with 2 s pause	Fault in rating plug	Check the connection between the release and the rating plug. Perform installation.
 Flashing slowly (0.5 Hz)	 Flashing slowly (0.5 Hz)	 Flashing slowly (0.5 Hz)	 Flashing slowly (0.5 Hz)	Internal configu-ration error	Contact Siemens Technical Support.
 On		 On		Tripping on hardware fault	Check the circuit brea-ker and accessories.

L	S	I	G	Alarm / status	Measure / comment
 Flashing fast (2 Hz)		 Flashing fast (2 Hz)		Temperature alarm	Lower the ambient temperature or reduce the continuous operating current.
 On				Pre-alarm L, power flow is greater than 90 % of the threshold value	
 On				Circuit breaker has been tripped by the L release	Clear faults in the power system and close the circuit breaker again.
	 On			Circuit breaker has been tripped by the S release	Clear faults in the power system and close the circuit breaker again.
		 On		Circuit breaker has been tripped by the I release	Clear faults in the power system and close the circuit breaker again.
			 On	Circuit breaker has been tripped by the G release	Clear faults in the power system and close the circuit breaker again.
 Flashing fast (2 Hz)				Threshold has been exceeded, tripping delay is elapsing	Reduce rated current (disconnect loads)
 Flashing fast (2 Hz) with 2 s pause				Parameter error, rotary coding switch in wrong position	Check and correct: • $I_r < I_{sd}$ or $I_{sd} < I_i$ • $I_u < (2 \times I_n \times I_r)$ if $I_N = 200$ % • $I_g > 0.25 \times I_n$ with a rating plug for 400 A; otherwise $I_g > 0.2 \times I_n$

L	S	I	G	Alarm / status	Measure / comment
 Flashing fast (2 Hz)				Installation error	Check and correct the installation.
 Flashing slowly (0.5 Hz)				Circuit breaker in undefined or faulty state	Check the position of the circuit breaker in the guide frame; check the functioning of the modules signaling the main contacts.
 Flashing slowly (3 x 0.5 Hz) with 3 s pause				Maintenance necessary	Perform maintenance.
 5 x flashing fast (5 x 2 Hz)				Battery of the connected test device almost empty (in self-test)	Insert battery.

Alarms of ETUs of the 6-series

The electronic trip units of the 6-series indicate the signals and alarms on the display and with the warning displays. This LED ACT additionally indicates that the ETU is ready for operation.



① LED ACT
② Warning display 1
③ Warning display 2
④ "i Test" control key
⑤ Display

Display of the LED ACT

The LED name "ACT" stands for ACTIVE. This LED indicates that the ETU is ready for operation. If the LED does not light up, the power supply of the ETU is interrupted and the ETU is not ready to operate.

ACT	Alarm / status	Measure / comment
Flashing slowly (1 Hz; 0.1 s on / 0.9 s off)	ETU ready	No measures required
Off	ETU without power supply	Check the power supply of the ETU via the main circuit or the auxiliary current conductors.

Warning displays

Warning display 1	Warning display 2	Alarm / status	Measure / comment
 On		Pre-alarm L, power flow is greater than 90 % of the setting value I_r	
		Temperature alarm	Lower the ambient temperature or reduce the continuous operating current.
		Contact erosion > 80%	Prompt maintenance and replacement of the circuit breaker required
		Line frequency outside the tolerance	Check possible interference factors.
		I_{n_pal} warning	Pre-alarm threshold has been exceeded.
	 Flashing fast (2 Hz)	A warning is pending	Press the control key "i Test" to display a list of warning messages on the display. You can read what action to take in response to which alarm in the table "LED displays of the protection releases" (ETUs of the 3-series).

6.3 Troubleshooting

Note

If the circuit breaker is constantly tripping during operation, first check and correct the protection functions (parameter settings).

If problems occur that you cannot resolve yourself, Siemens will provide you with two-level support:

- Level one:
  Contact Siemens Technical Support (see Chapter Product-specific information (Page 9)).
  Have the data of the circuit breaker in question at hand.
- Level two:
  If the problem is not solved directly with Technical Support, a diagnostic report can be created with the powerservice software and evaluated by Technical Support. This requires a test device (TD410 or TD420) and the powerconfig and powerservice software.
  - Load the powerconfig (https://support.industry.siemens.com/cs/ww/en/view/63452759) software onto a laptop computer connected to the Internet.
  - Download the powerservice software from the SIOS Portal (https://support.industry.siemens.com/cs/ww/en/view/109749079).
  - Connect the PC via the test device TD410 or TD420 to the front interface of the ETU (see Chapter Breaker Data Adapters and test devices (Page 131)).
  - With powerconfig, the parameter settings can first be checked and viewed. Incorrect settings can be identified if necessary.
  - If this does not solve the problem, the next step is to create a diagnostic report with powerservice and send it to Technical Support.

  Technical Support will evaluate the diagnostic report and connect you with a solution for your problem.

Service and maintenance 7

7.1 Safety regulations

Only spare parts approved by the manufacturer must ever be used.

The prescribed maintenance intervals and the instructions on repair and replacement must be complied with to avoid injury to people and damage to equipment.

Safety measures

Before work starts, the following steps must be performed:

1. Open the circuit breaker (OPEN position).
2. On the **fixed-mounted breaker**:
   Disconnect the circuit breaker from the power system and auxiliary circuit and visibly ground the connections on the line side and on the load side.

   On the **withdrawable breaker**:
   Rack the circuit breaker into the breaker position DISCONNECT. If necessary, secure it against falling.
   Disconnect the guide frame from the power system and auxiliary circuit and visibly ground the terminals on the line side and on the load side.
3. Discharge the springs by closing and opening the circuit breaker again (display DISCHARGED)

Note

Put the circuit breaker into a safe state that corresponds to the applicable standards and laws.

Qualified personnel

The circuit breaker must only ever be serviced and maintained by qualified personnel. For the purpose of the safety information in these operating instructions, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

7.2 Tests during inspections and after tripping

The following tests must be conducted during inspection, after tripping, and after lengthy storage under certain environmental conditions before re-commissioning. These can be performed with a TD310 test device to power the ETU. They are not absolutely necessary after delivery from the factory because the devices are 100 % tested before shipment. A trip test confirms correct mechanical functioning of the tripping plunger on the trip coil, actuated by the ETU. Electronic monitoring of the entire connection between the current transformers, ETU, and trip coil is performed continuously by the electronics itself (watchdog).

Items to be tested	Checks
Enable alarms	Connect the ETU to a test device and check that no alarms are present.
Status of the circuit breaker	On the ETUs of the 3-series, the status of the circuit breaker must not be incorrect (see tables of the LED display in Chapter Alarms (Page 203)). Perform a close/open operation on the circuit breaker and check that no alarms have occurred.
	On the ETUs of the 6-series, the status of the circuit breaker must be correctly shown on the display. Perform a close/open operation on the circuit breaker and check that the change in circuit breaker status is correctly displayed.
Trip test	Make a trip attempt with the circuit breaker closed during an idle period (without circulating currents of the mains connection) and check that the circuit breaker opens.

7.3 Maintenance intervals

Environment with standard conditions

Following initial commissioning, the equipment/system must be serviced at least once per year or after 2000 switching operations.

Note

These maintenance intervals also apply to circuit breakers that are used irregularly or that remain in the same switch position for long periods.

Dusty environment

If the circuit breaker is operated in a dusty environment (dust component > 1 mg/m^3), it should be maintained at least twice a year or after 1000 switching operations.

7.4 Enclosure, terminals, and control panel

7.4.1 Checking and cleaning the housing

⚠ DANGER

Hazardous voltage

Follow the safety instructions in Chapter Safety instructions (Page 11).

Checking and cleaning the housing

1. Remove dust, traces of oil, and leaked lubricant with a clean and dry cloth.
   In the case of severe contamination, you can use a cleaning agent such as Henkel 273471, Chemma 18 or an equivalent cleaner.
2. Remove all foreign bodies that are on or next to the circuit breaker or the guide frame.
3. Check whether the labels with the technical data are still affixed and legible.
   Clean the labels if necessary with a clean, dry cloth.
4. Check the enclosure for damage (visual inspection).

Checking connections and installation

Check the connections

1. Remove dust and dirt from the terminals with a dry brush or cloth. If necessary, you can use a mild cleaning agent.
   In the case of severe contamination, you can use a cleaning agent such as Henkel 273471, Chemma 18 or an equivalent cleaner.
2. Check that the terminals do not exhibit any signs of overheating.
   One indication of overheating is discoloration in the region of the contacts (without overheating: bright silver).
3. Check that the connections are firmly secured. If necessary, retighten the connections with the specified tightening torque (see Chapter Tightening torques at a glance (Page 164)).

Check installation in the control panel

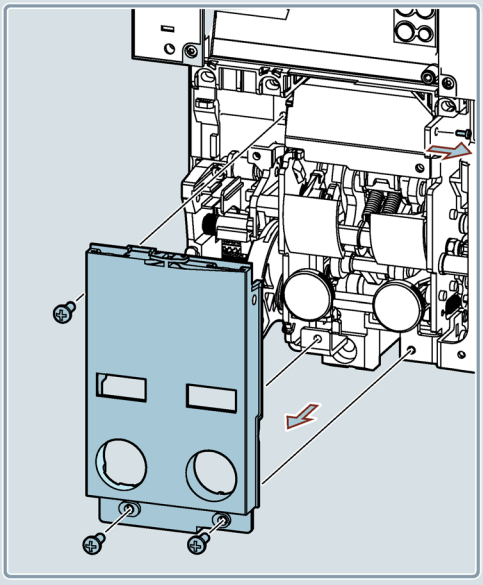
1. Check that the circuit breaker is securely fastened (fixed-mounted breaker) or that the guide frame is securely fastened in the control panel.
2. Check correct fastening of the accessories mounted in the control panel (locking device, cover frame, etc.).

7.5 Basic unit and accessories

7.5.1 Removing the front plate and accessories

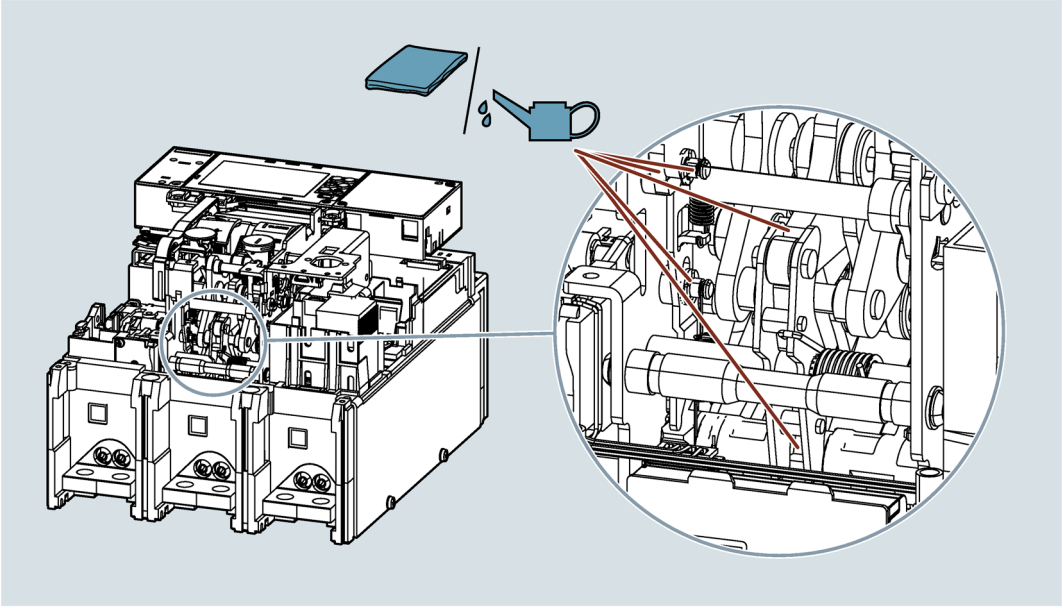
For further maintenance, the circuit breaker must be partially disassembled:

1. Remove the front plates and terminal covers, see Chapter Installing accessories (Page 177).
2. Remove the spring charging motor MO (Page 184), if installed.
3. Remove the undervoltage release UVR (Page 184), if installed.
4. Discharge the springs of the tripping mechanism.
5. Remove the cover over the mechanical pushbuttons.



7.5.2 Cleaning and lubricating the tripping mechanism

1. Clean the points shown in the diagram below.
   In the case of severe contamination, you can use a cleaning agent such as Henkel 273471, Chemma 18 or an equivalent cleaner.
2. Lubricate the opening and closing links and the shafts at the points shown below with Mobilgrease 28 from EXXON MOBIL.



3. Make sure that the shafts of the opening and closing mechanism can be moved freely.

7.5.3 Inspecting the accessories

1. Check that the accessories are firmly seated in the circuit breaker.
2. Check correct connection between the circuit breaker and the accessories.
3. Make sure that any auxiliary solenoids are in a good condition:
   - No increased wear
   - No signs of overheating
   - No cracks or damage
4. Check whether the mechanical operating cycles counter MOC (if installed) is functioning correctly by tripping the circuit breaker.
5. Check the wear on the brushes of the spring charging motor.

7.5.4 Testing the ETU

Test with the TD310 Activation & Trip Box

1. Connect the TD310 Activation & Trip Box to the ETU.
2. Perform the trip test (see Chapter Application planning (Page 137) and Operating Instructions).
3. Check the correct cable connection to the tripping modules and to the release.
4. ETUs of the 6-series only: Call up the wear indicator on the contacts of the circuit breaker on the display.
5. After the work, remove the TD310 Activation & Trip Box from the ETU.

Check the TD410 Breaker Data Adapter and the TD420 test device.

1. Connect the TD 410 or TD420 to the ETU and to a PC with the powerconfig software.
2. Check whether there are any alarm messages and evaluate them (see Chapter Alarms (Page 203)).
3. If there are no alarm messages, perform the trip tests and self-tests with the test button on the ETU or with the corresponding software functions of powerconfig.
4. After the tests, remove the TD410 Breaker Data Adapter or TD420 test device from the ETU and the PC.

7.6 Final tests

1. Mount all removed parts and covers on the circuit breaker again.
   Proceed as shown in the Section Removing the front plate and accessories (Page 214) in the reverse order.
2. Reconnect the terminals for auxiliary supply connection (if required).
3. Withdrawable breaker only: Move the circuit breaker into the TEST position.
4. Perform the following operations ten times using the relevant accessories (including via remote access, if available):
   - Open
   - Close
   - Trip with the test button on the ETU

   Perform the operations in the following order:
   - Open - spring discharged
   - Open - spring charged
   - Close - spring discharged
   - Close - spring charged
5. Check whether the following modules respond correctly (if available):
   - Accessories
   - Spring charging motor MO
   - Undervoltage release UVR
   - Auxiliary solenoids (closing coil (CC) / shunt release (ST))
   - Auxiliary switches and signaling switches
   - Locking and interlocking devices

   Note

   For withdrawable breaker only: Interlocking devices cannot be tested in the breaker positions DISCONNECT and TEST.

Technical specifications

8

8.1 Technical data 3WL10

3WL10 air circuit breaker

Breaking capacity				B	N	S
Number of poles				3, 4		
Rated current	I_n	40 °C	A	630, 800, 1000, 1250		
Rated operational voltage	U_e	AC (50/60 Hz)	V	Up to 690		
Rated insulation voltage	U_i	AC (50/60 Hz)	V	1000		
Rated impulse withstand voltage	U_{imp}		kV	12		
Current-carrying capacity of the neutral pole for 4-pole circuit breakers			% I_n	100		
Rated ultimate short-circuit breaking capacity	I_{cu}	415 V AC	kA	42	55	66
		500 V AC	kA	42	50	50
		690 V AC	kA	—	42	50
Rated service short-circuit breaking capacity	I_{cs}	415 V AC	kA	42	50	50
		500 V AC	kA	42	50	50
		690 V AC	kA	—	42	50
Rated short-circuit making capacity	I_{cm}	415 V AC	kA	88	121	145
		500 V AC	kA	88	105	105
		690 V AC	kA	—	88	105
Rated short-time withstand current	I_{cw}	1 s	kA	42	42	50
		3 s	kA	24	24	36
Break time		$I < I_{cw}$	ms	40		
		$I > I_{cw}$	ms	25		
Rated conditional short-circuit current of the non-automatic air circuit breakers	I_{cc}		kA	—	42	50

Dimensions and weights, see Chapter Technical overview (Page 36).

8.2 Technical specifications - 3VA27

3VA27 molded case circuit breaker

Breaking capacity				M	H	C
Number of poles				3, 4		
Rated operational current	I_n	40 °C	A	630, 800, 1000, 1250		
Rated operational voltage	U_e	AC (50-60 Hz)	V	690		
Rated insulation voltage	U_i	AC (50-60 Hz)	V	1000		
Rated impulse withstand voltage	U_{imp}		kV	8		
Current-carrying capacity of the neutral pole for 4-pole circuit breakers			% I_n	100		
Rated ultimate short-circuit breaking capacity	I_{cu}	220/230 V	kA	100	150	200
		380/400/415 V	kA	55	85	110
		440 V	kA	55	85	100
		500 V	kA	36	55	85
		690 V	kA	25	36	50
Rated service short-circuit breaking capacity	I_{cs}	220/230 V	kA	100	150	200
		380/400/415 V	kA	55	85	110
		440 V	kA	55	85	100
		500 V	kA	36	55	63
		690 V	kA	25	36	37
Rated short-circuit making capacity	I_{cm}	220/230 V	kA	220	330	440
		380/400/415 V	kA	121	187	242
		440 V	kA	121	187	220
		500 V	kA	75.6	121	187
		690 V	kA	52.5	75.6	105
Rated short-time withstand current	I_{cw}	1 s	kA	20		

Dimensions and weights, see Chapter Technical overview (Page 36).

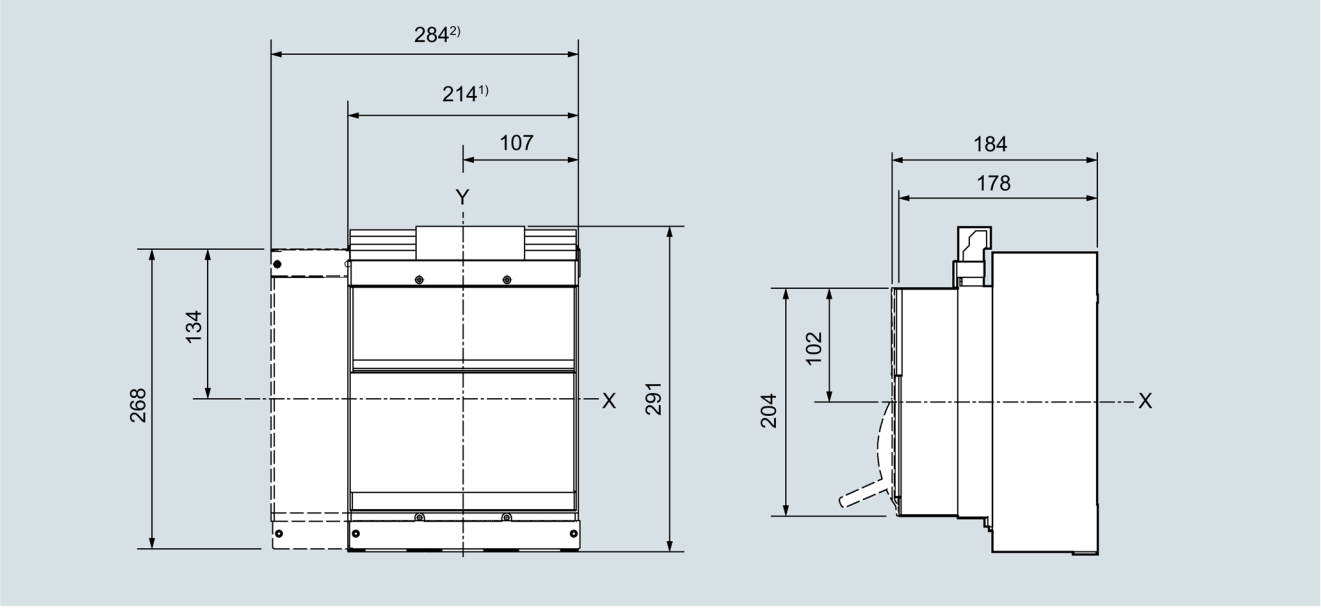
Dimension drawings

9

9.1 Fixed-mounted breaker

9.1.1 Circuit breaker without connections

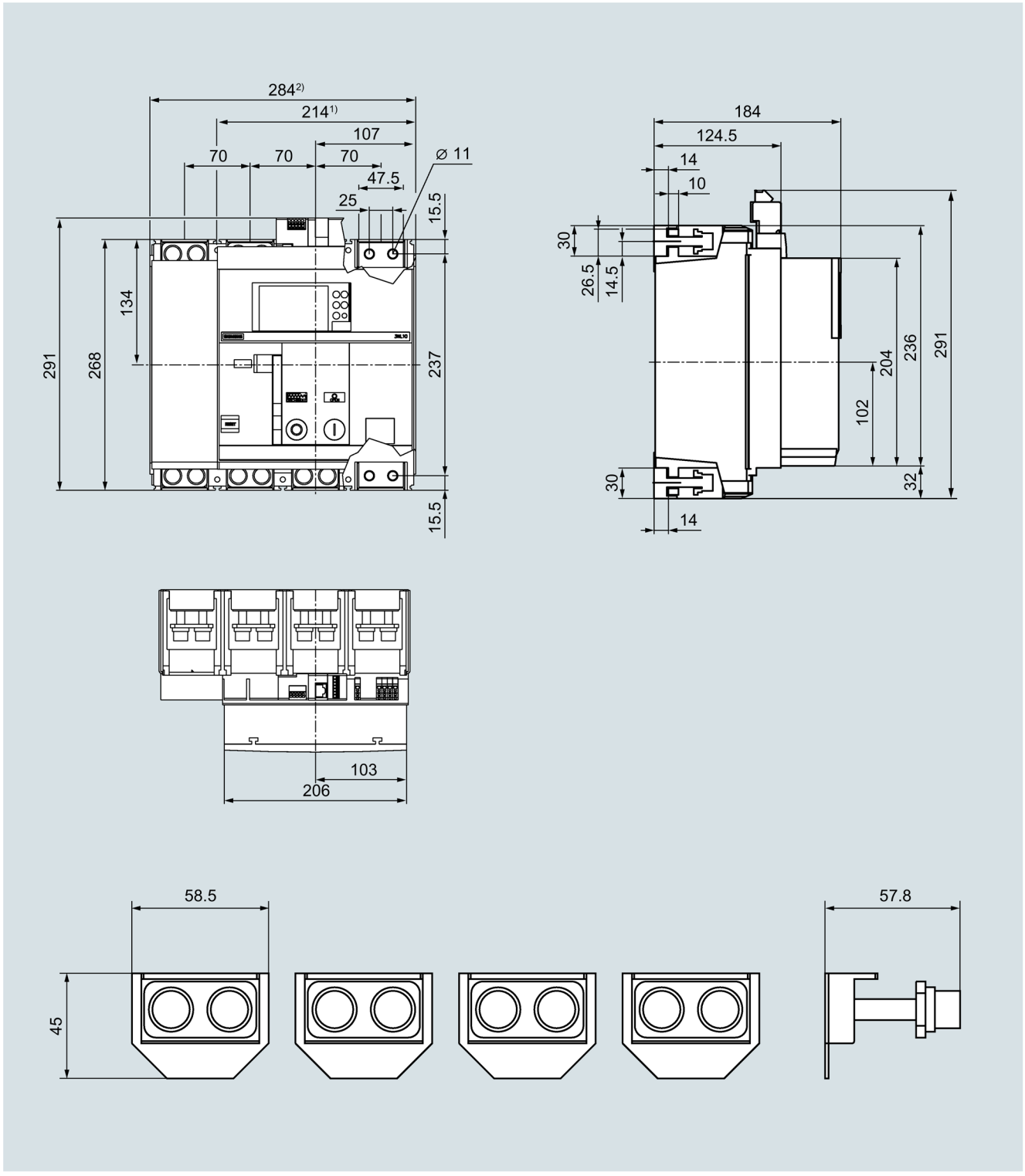
Stored energy operating mechanism / toggle operating mechanism



1) 3-pole

2) 4-pole

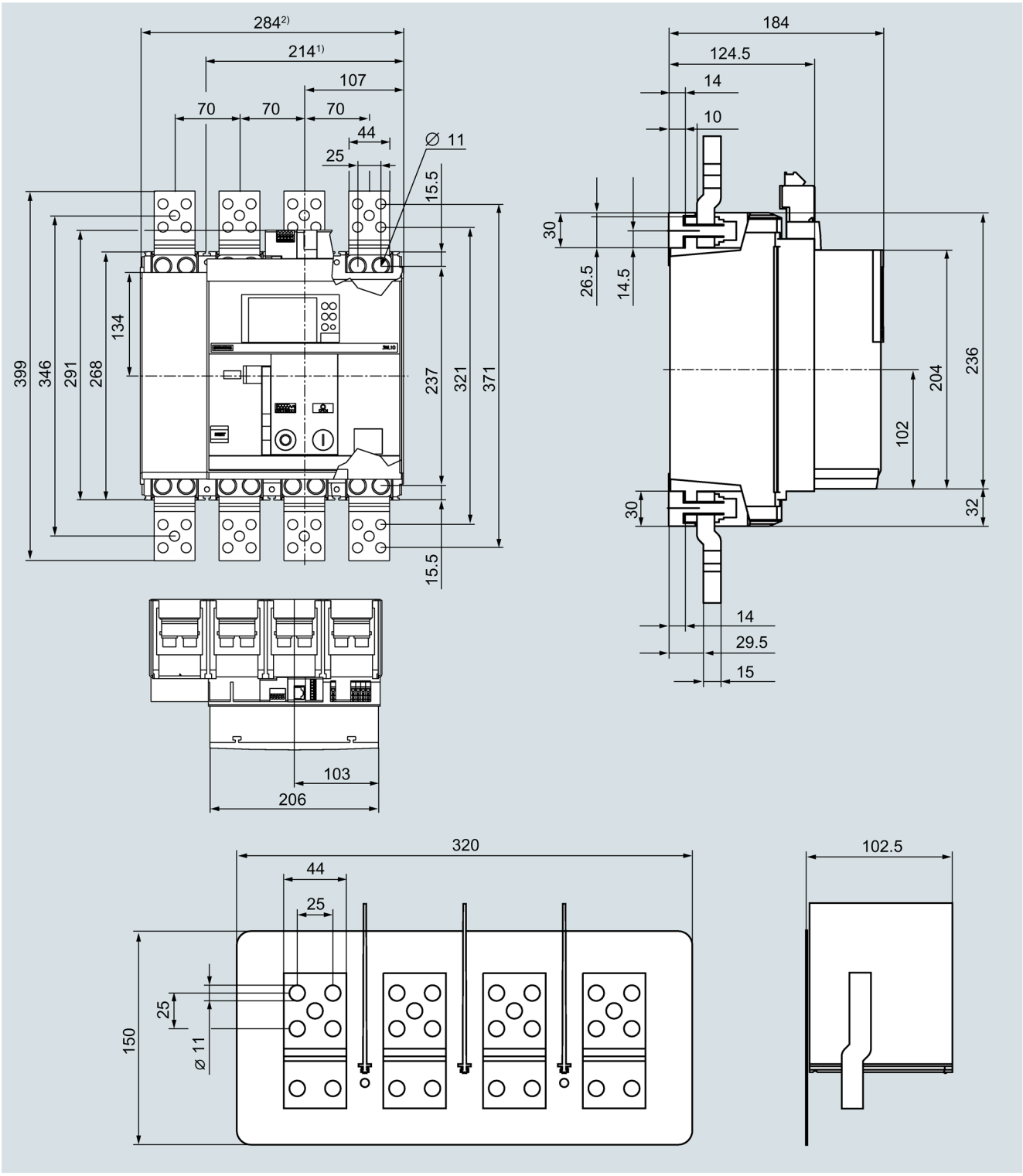
9.1.2 Front terminals for main circuit connection



1) 3-pole

2) 4-pole

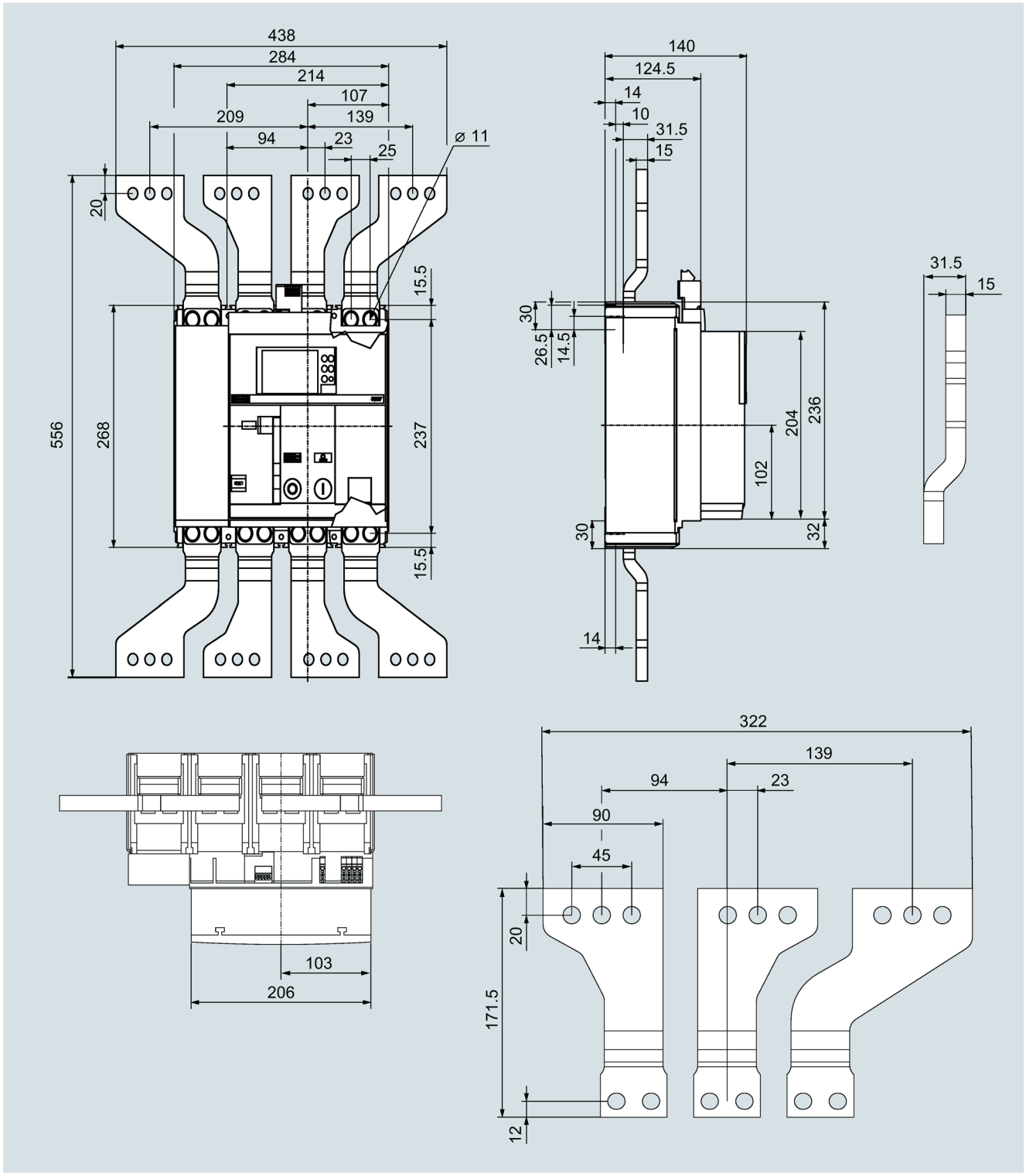
9.1.3 Front terminals for main circuit connection, extended



1) 3-pole

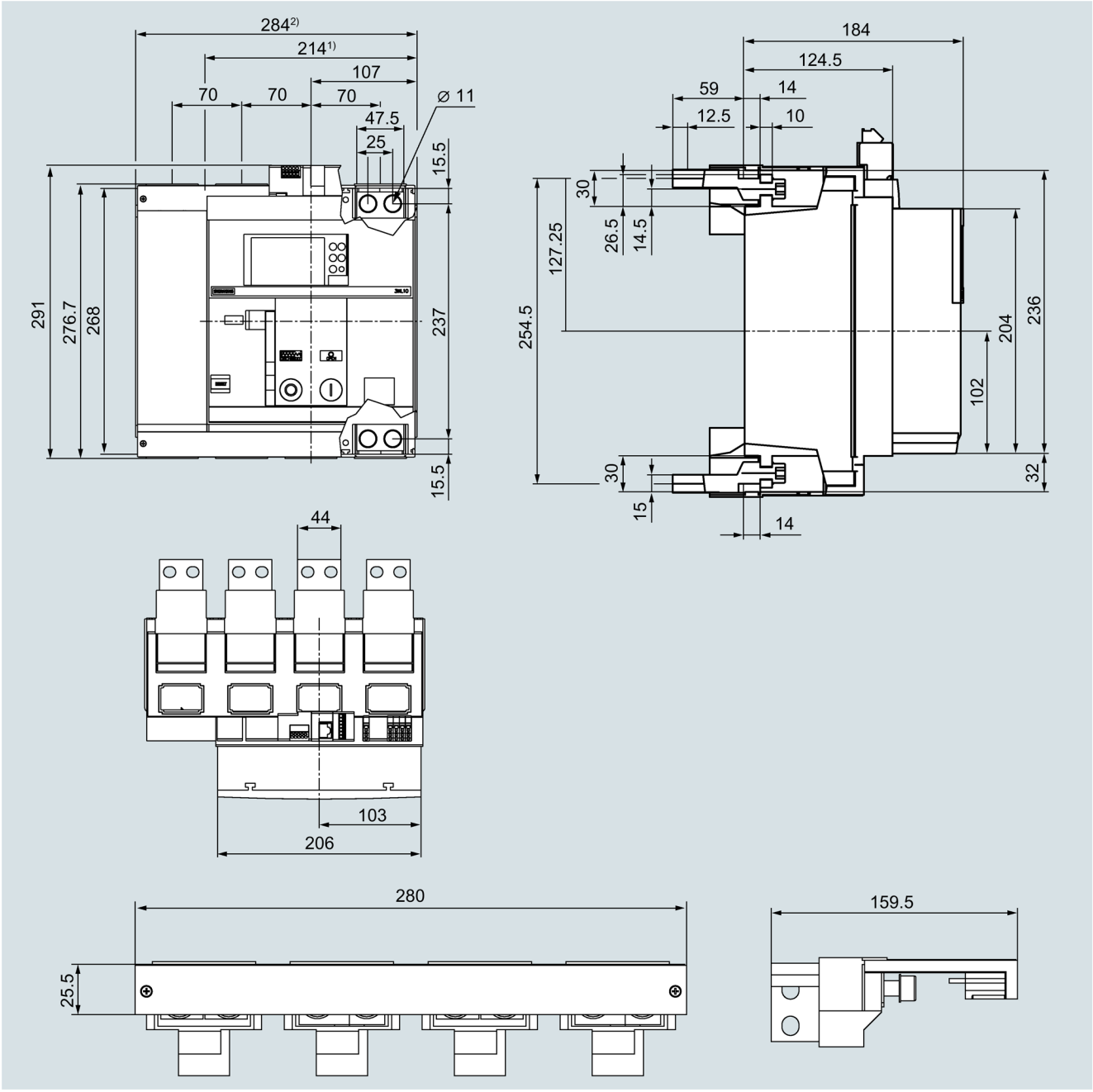
2) 4-pole

9.1.4 Front connection bars, broadened



9.1.5 Horizontally / vertically orientable rear connection

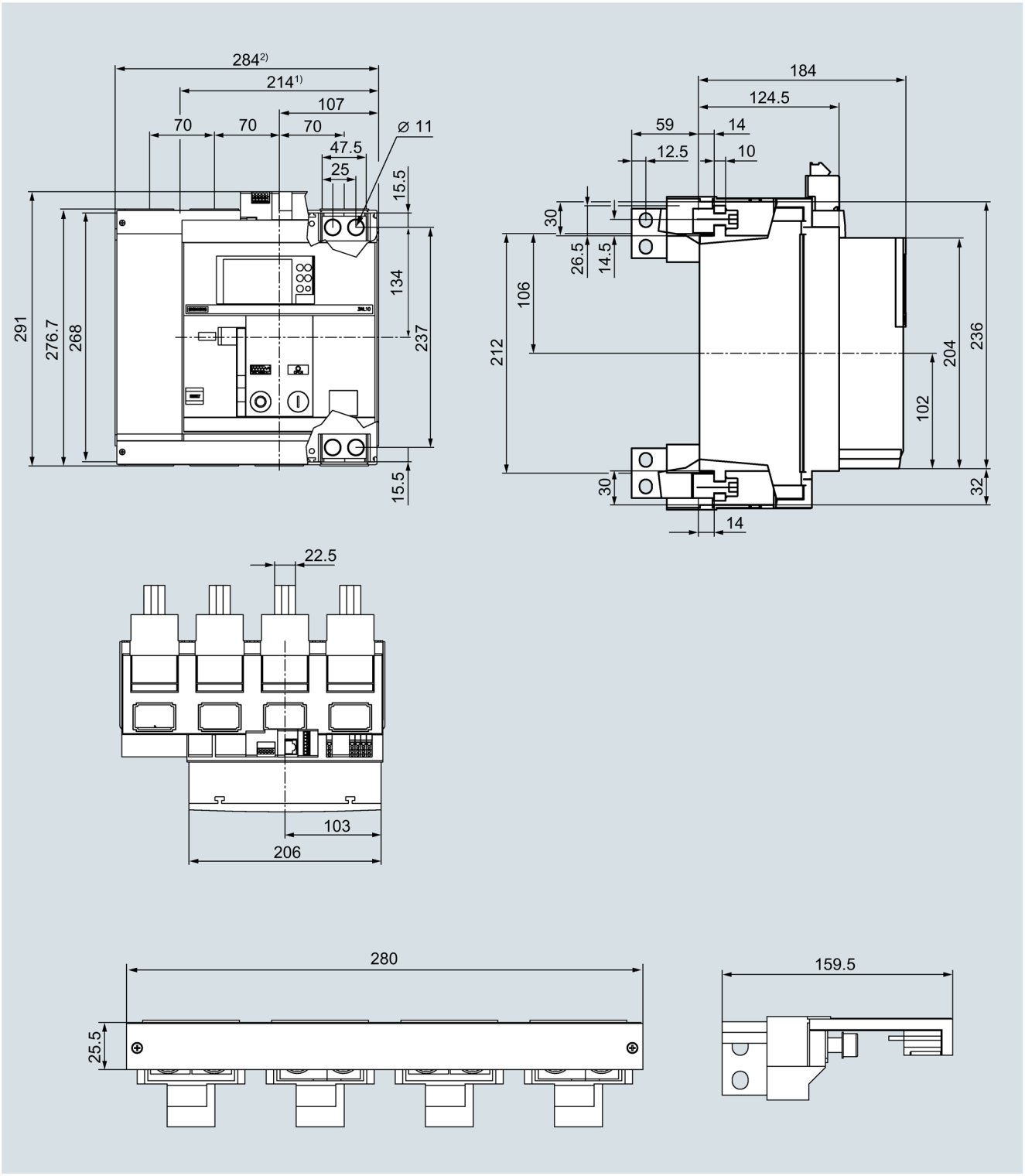
Orientable rear connection - horizontal



1) 3-pole

2) 4-pole

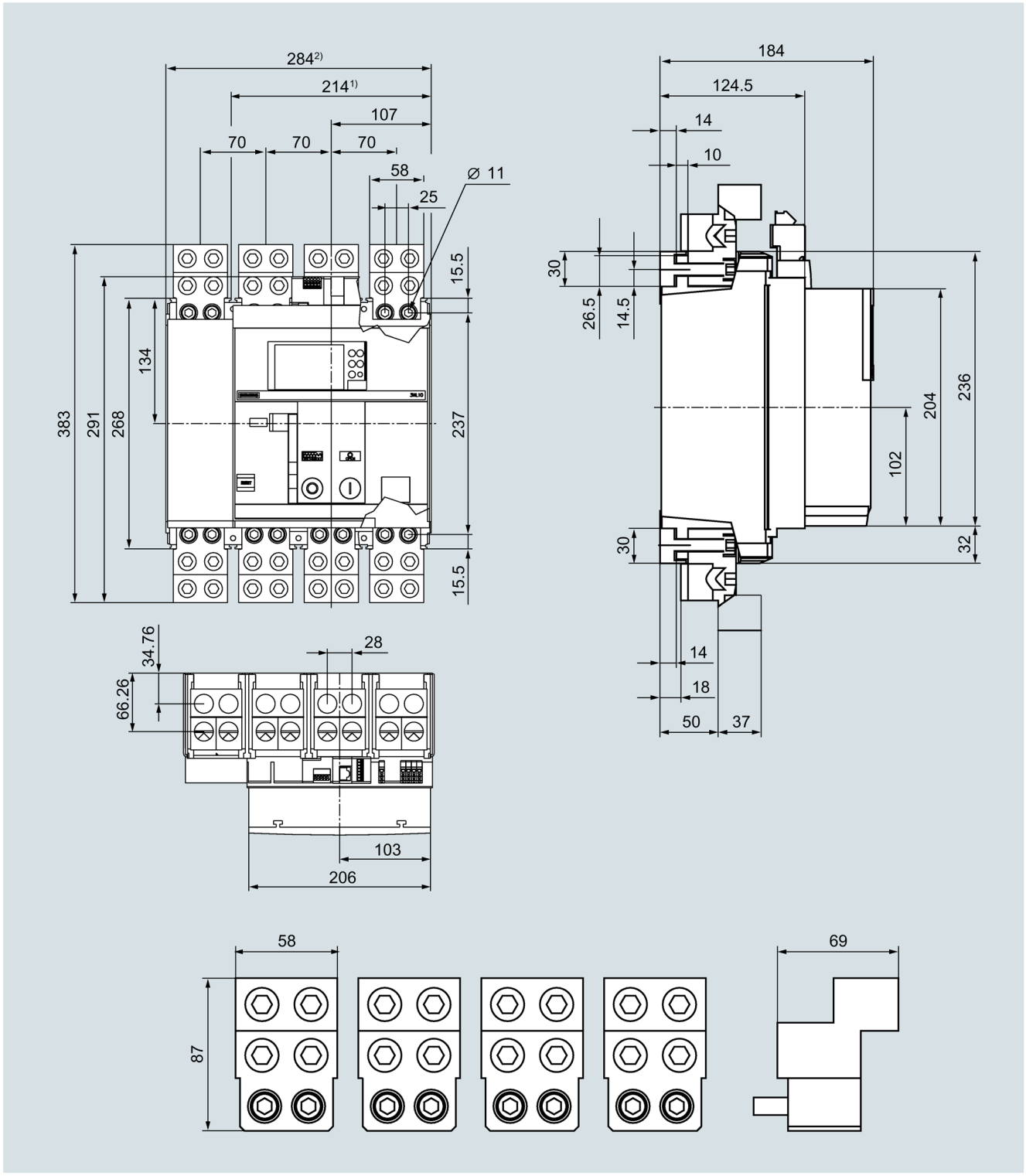
Orientable rear connection - vertical



1) 3-pole

2) 4-pole

9.1.6 Circular conductor terminal, adapter 4x240

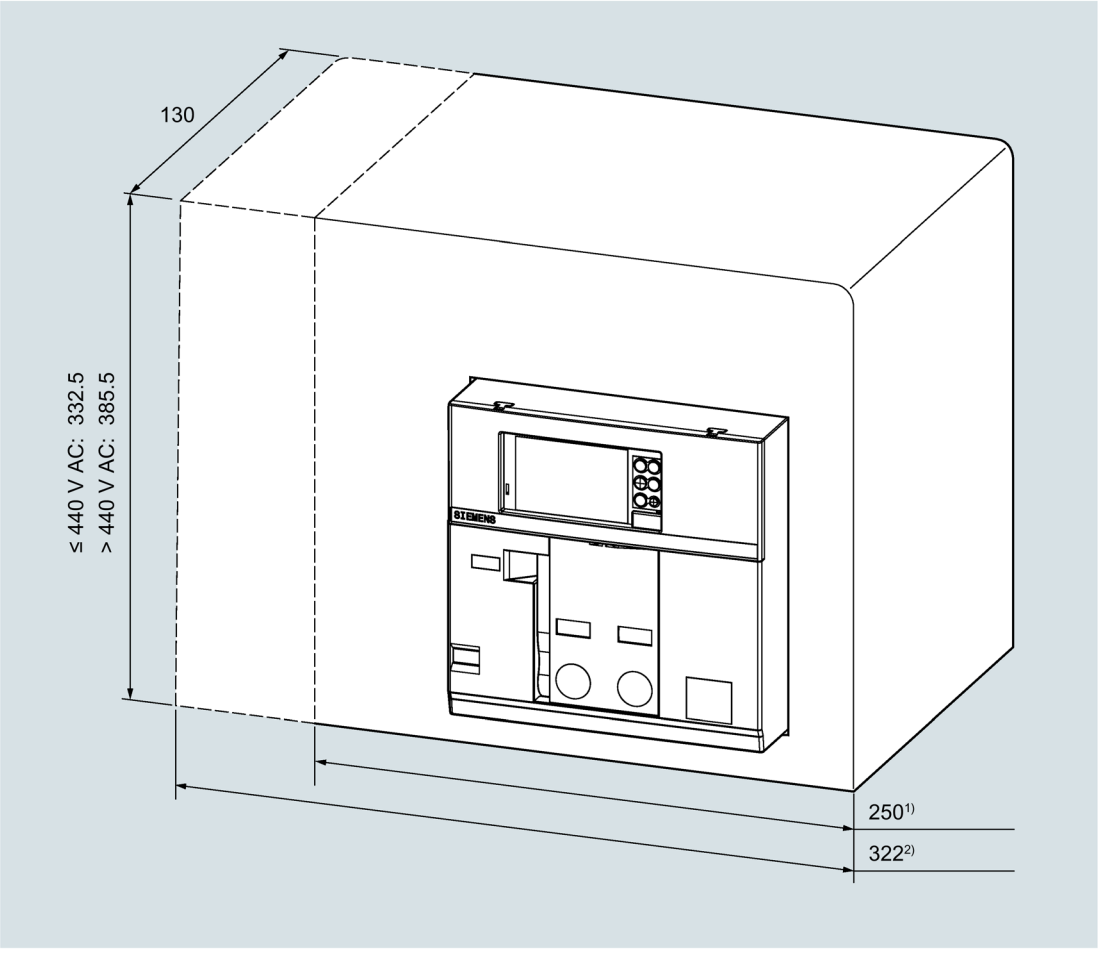


1) 3-pole

2) 4-pole

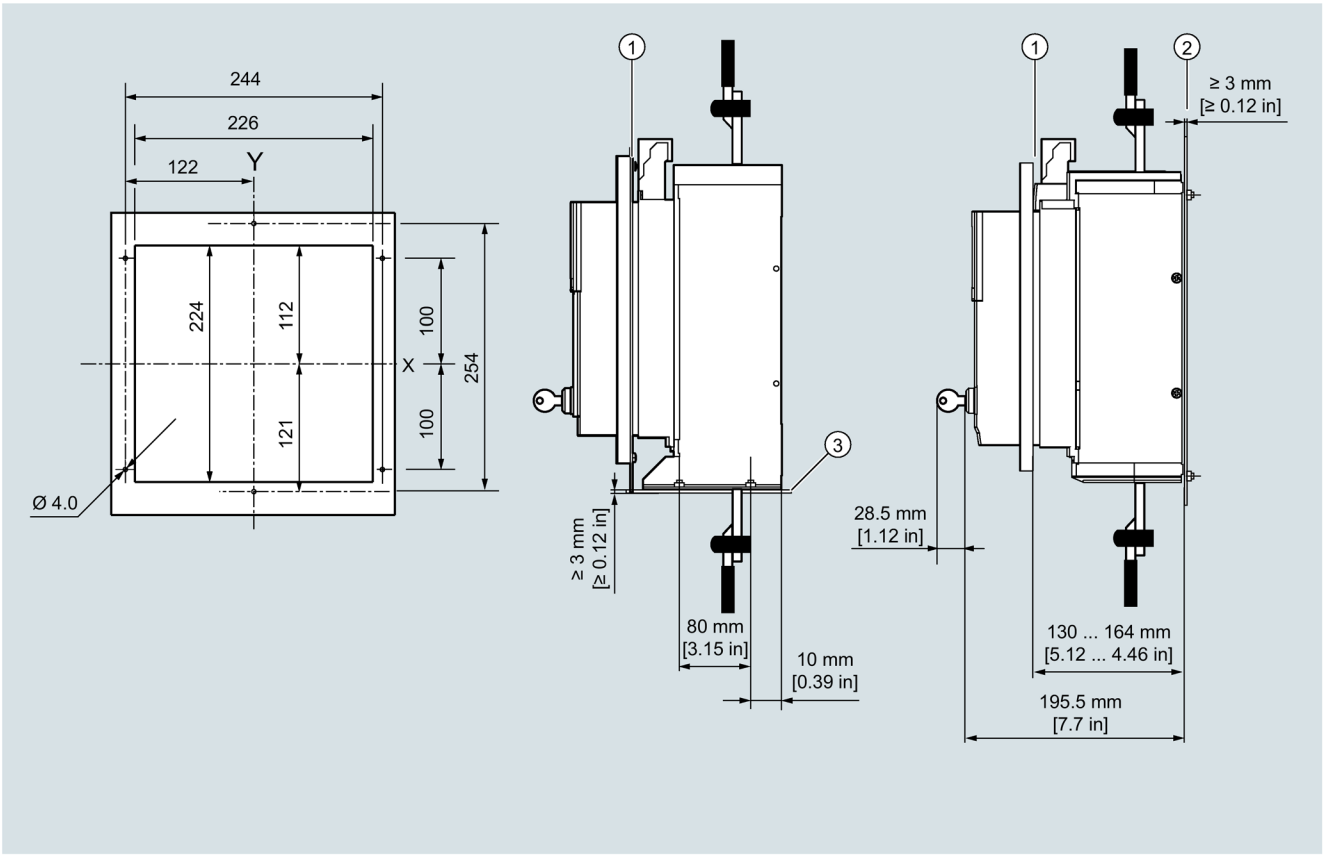
9.1.7 Switchboard panel, hole and drilling templates, fixed breaker

Dimensions of switchboard panel



1) 3-pole
2) 4-pole

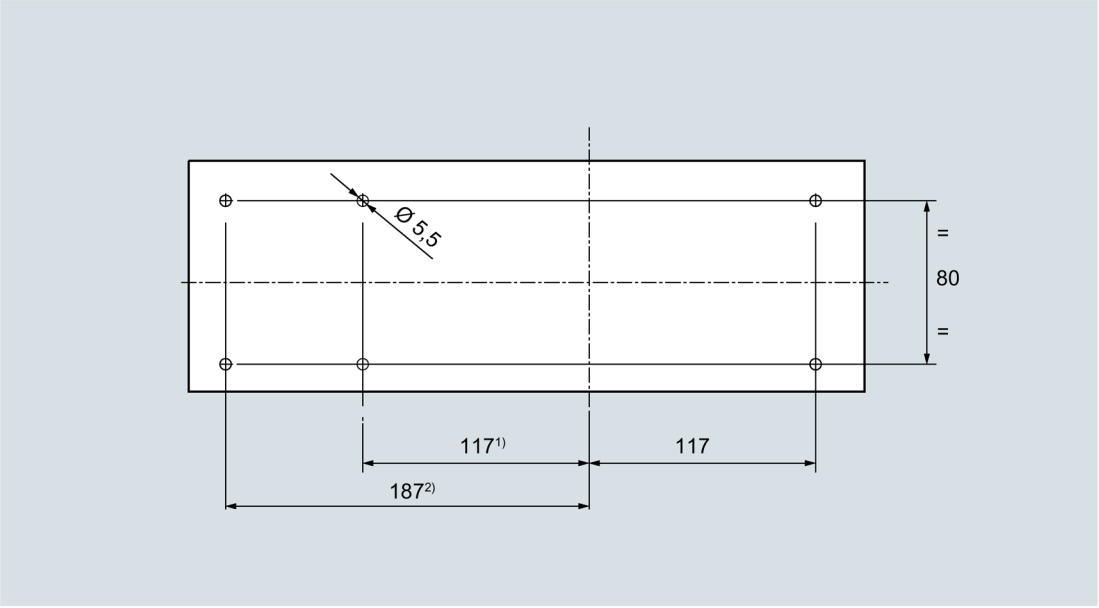
Hole pattern for switchboard panel door



① Control panel door
② Rear wall
③ Base plate

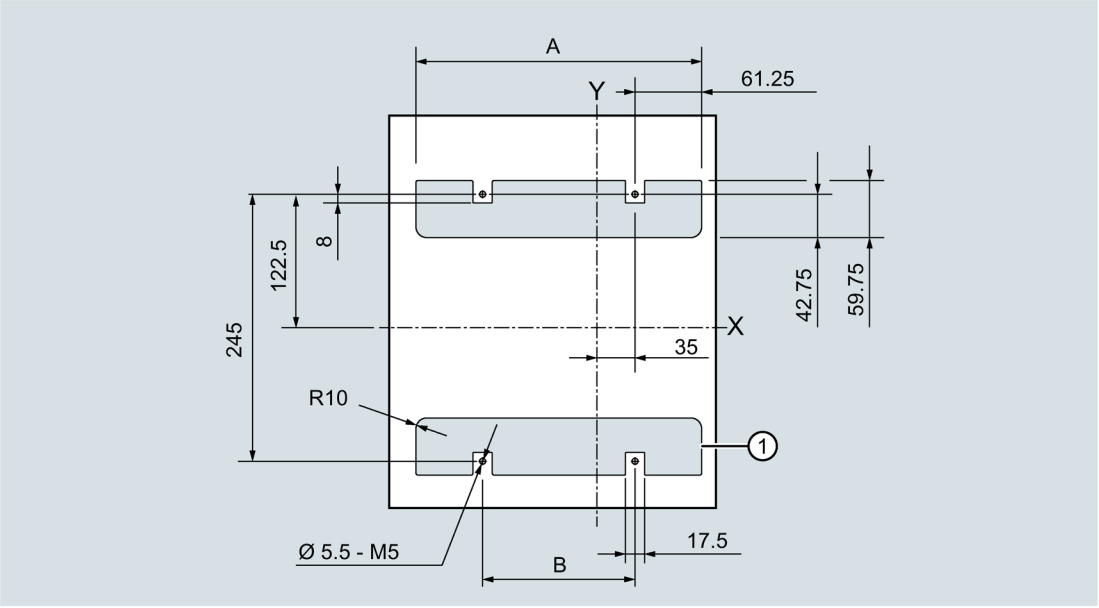
		Standard	Locking device, OFF pos. Ronis lock to prevent unauthorized closing
A	MIN	49.5 mm	63.5 mm
A	MAX	83.5 mm	97.5 mm

Drilling pattern for floor fixation



1) 3-pole
2) 4-pole

Drilling pattern for wall mounting and cutout for rear terminals for main circuit connection version (horizontal/vertical)

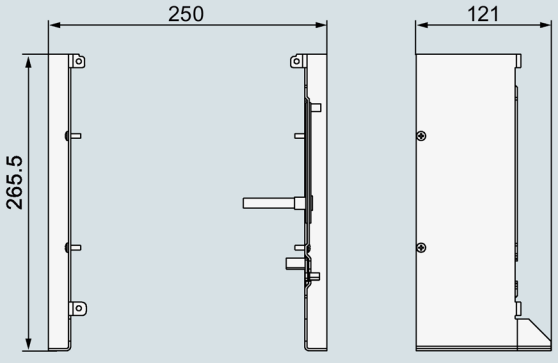


① Cutouts (top and bottom) only required with rear connections

A 3-pole: 192.5 mm
4-pole 262.5 mm

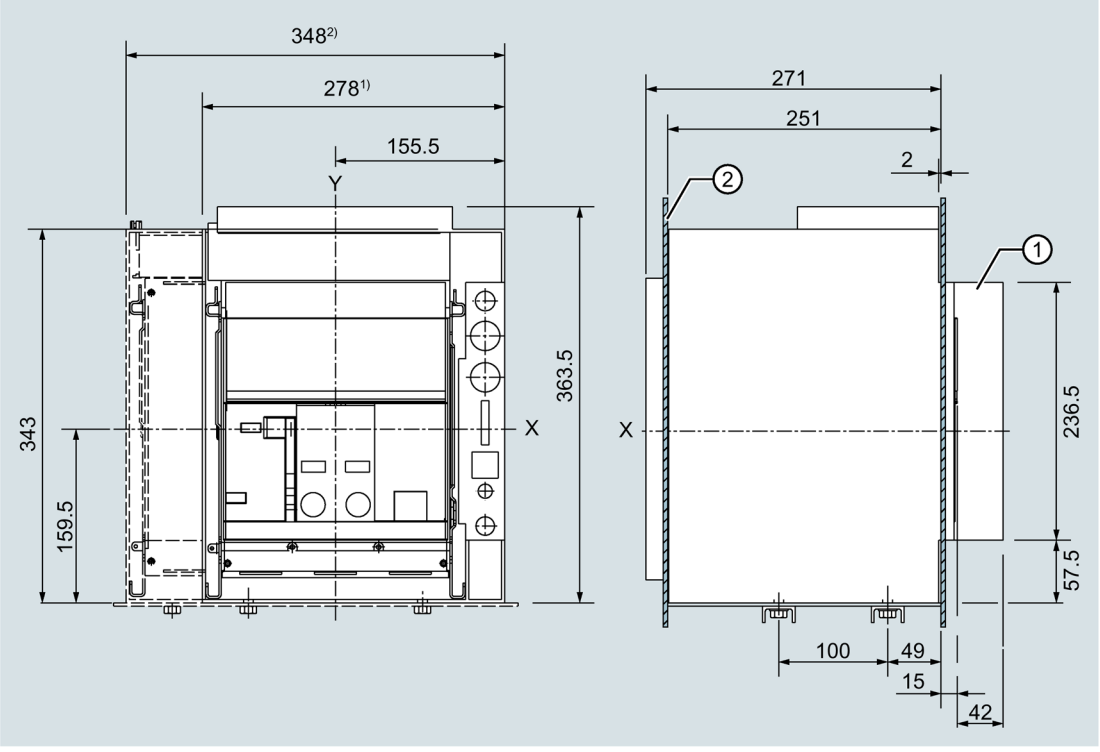
W 3-pole: 70 mm
4-pole: 140 mm

9.1.8 Fixed-mounted version with mounting support



9.2 Withdrawable breaker

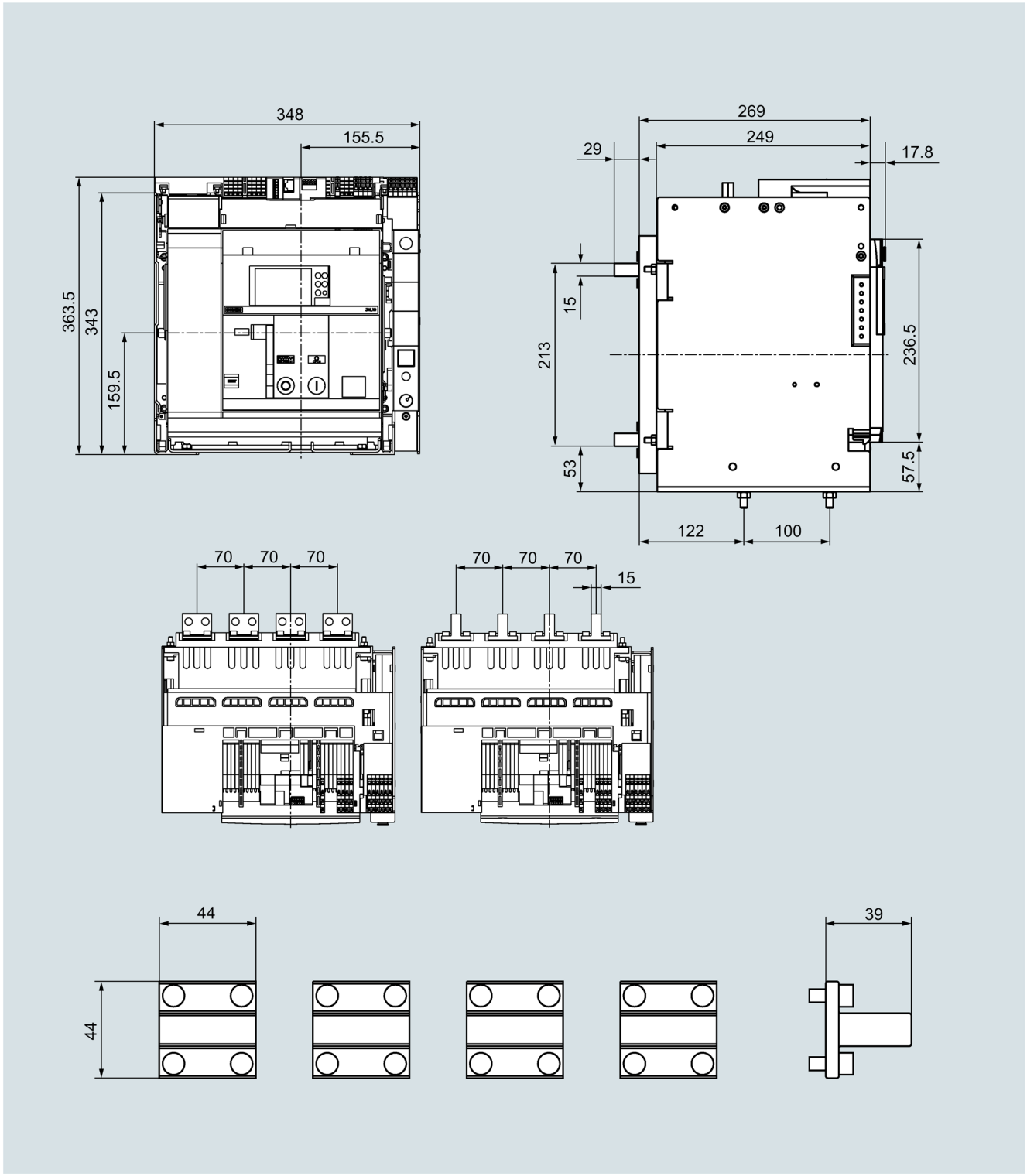
9.2.1 Circuit breaker without connections



① Distance from CONNECT position to DISCONNECT position
② Rear partition for rear terminals
1) 3-pole
2) 4-pole

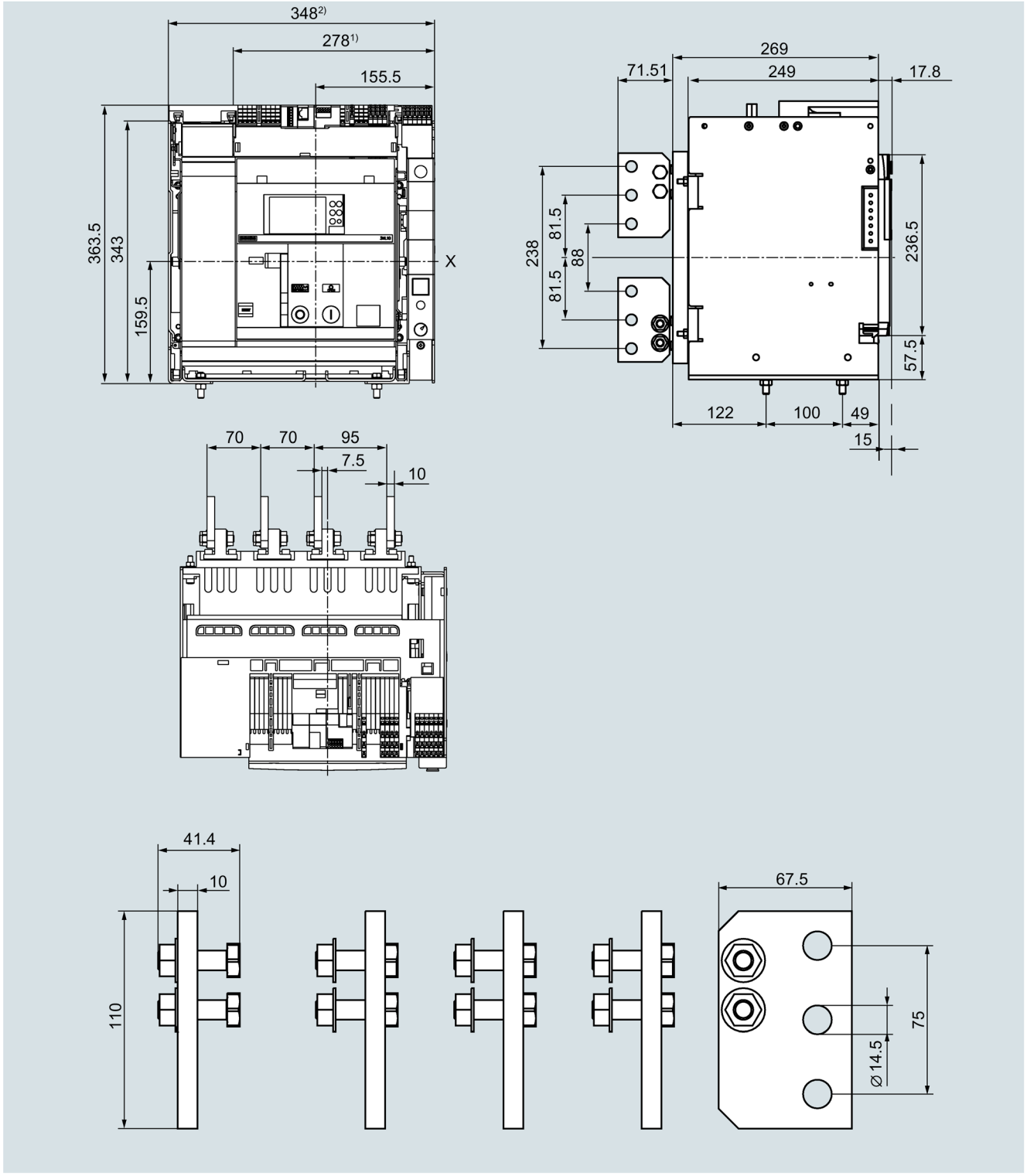
9.2.2 Horizontally / vertically orientable rear terminal for main circuit connection

Orientable rear terminal for main circuit connection



9.2.3 Copper/aluminum cable connection bar

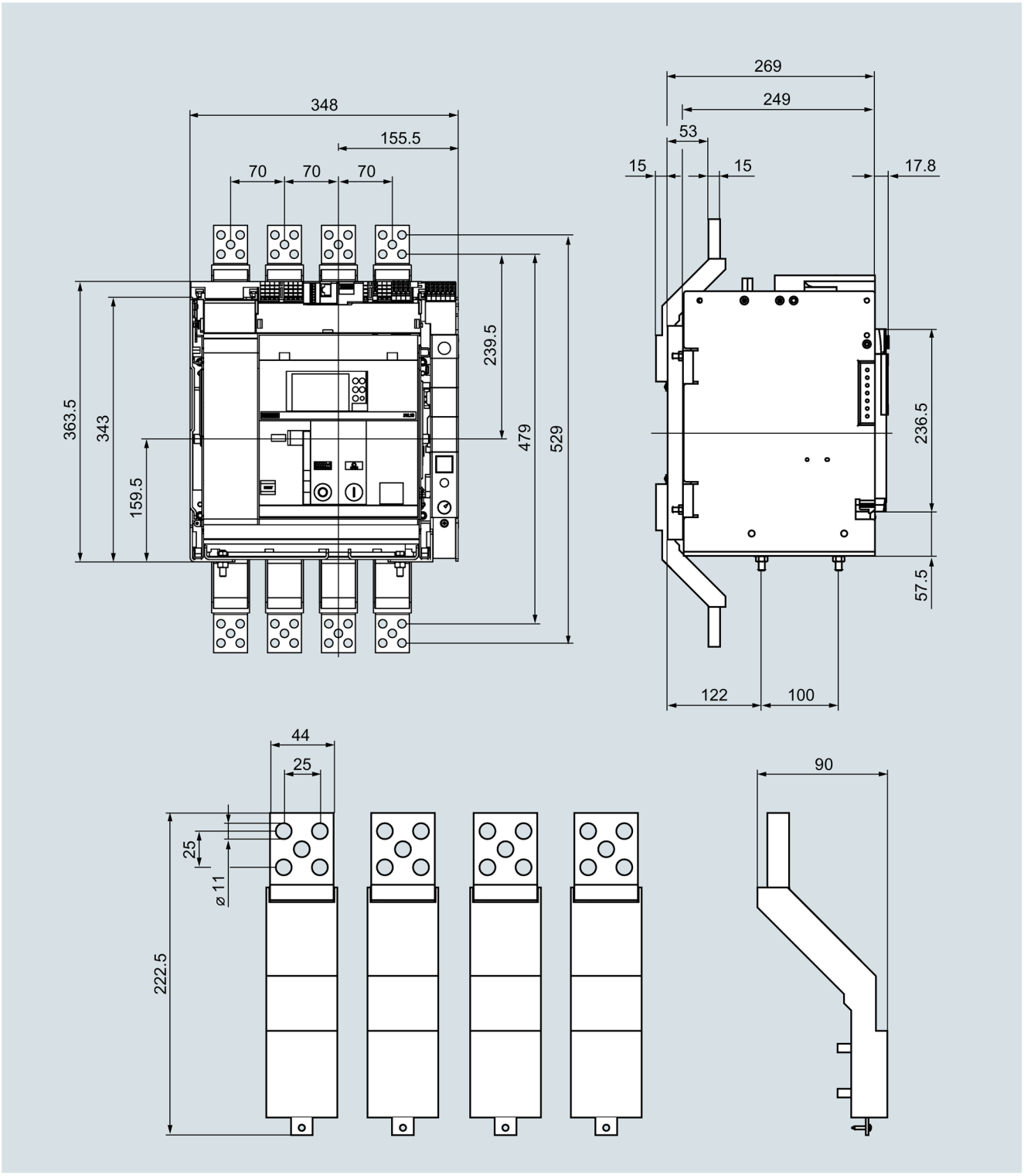
A cable lug is required for connection



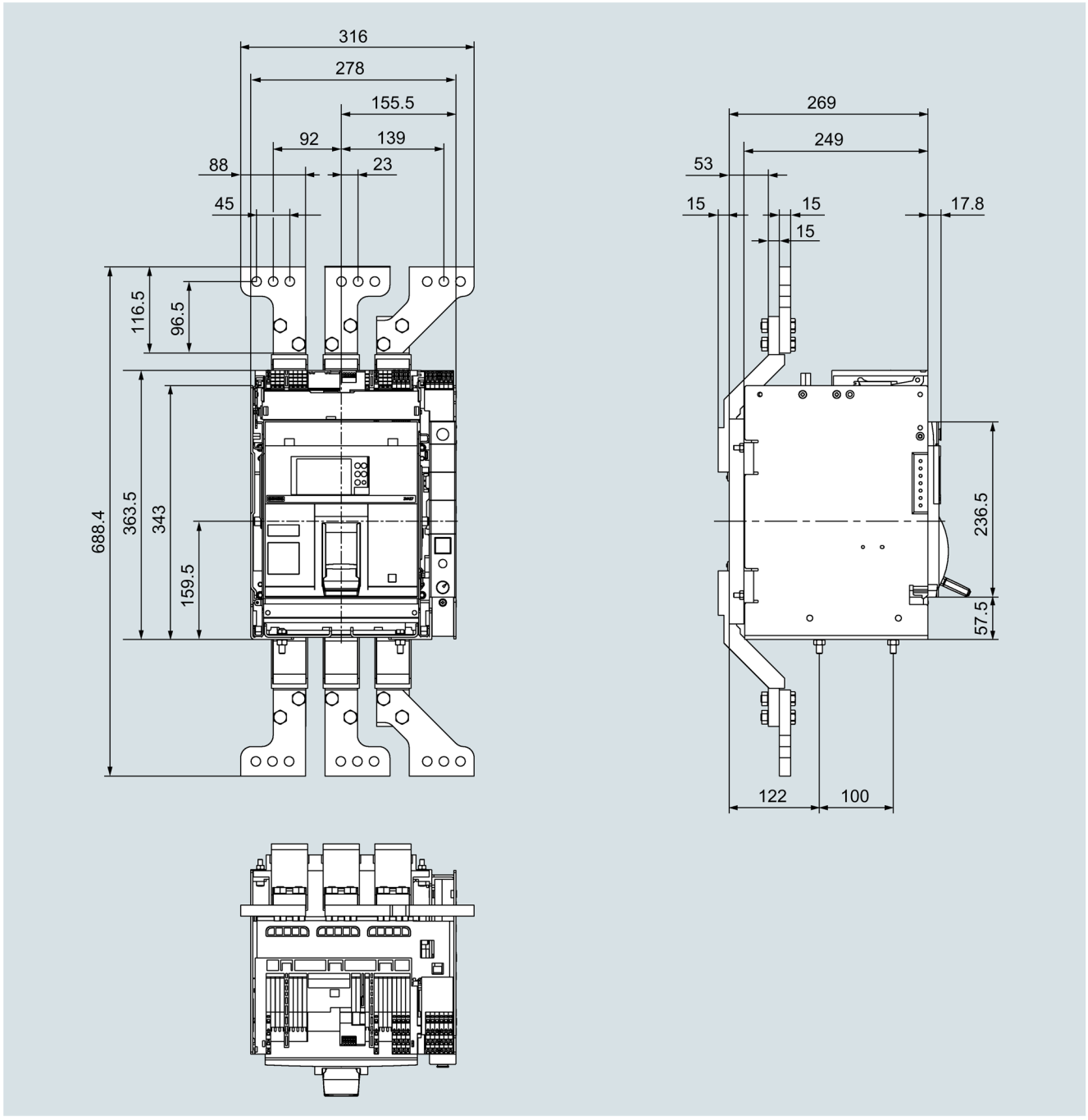
1) 3-pole

2) 4-pole

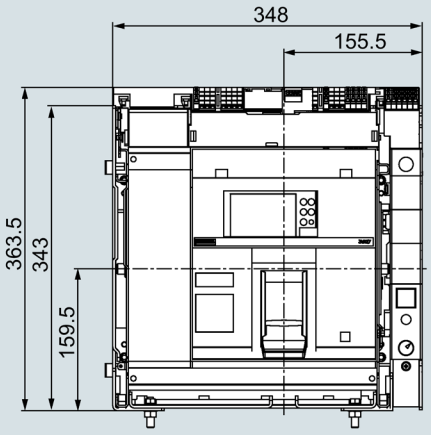
9.2.4 Front extended terminal

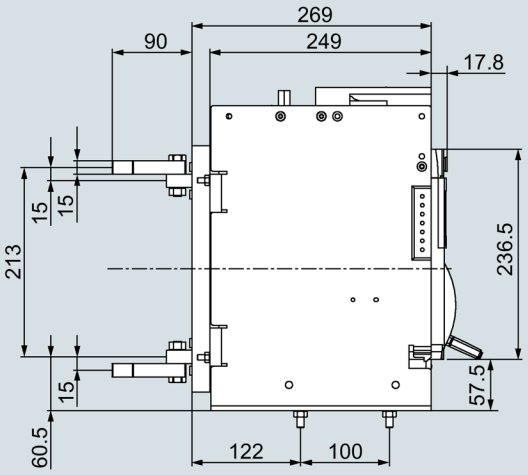


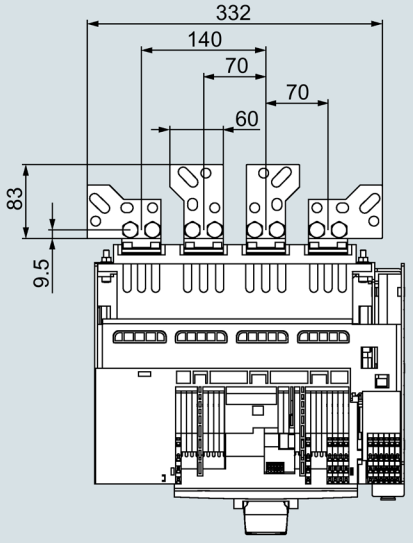
9.2.5 Front connection bars, broadened



9.2.6 Rear connection bars, broadened

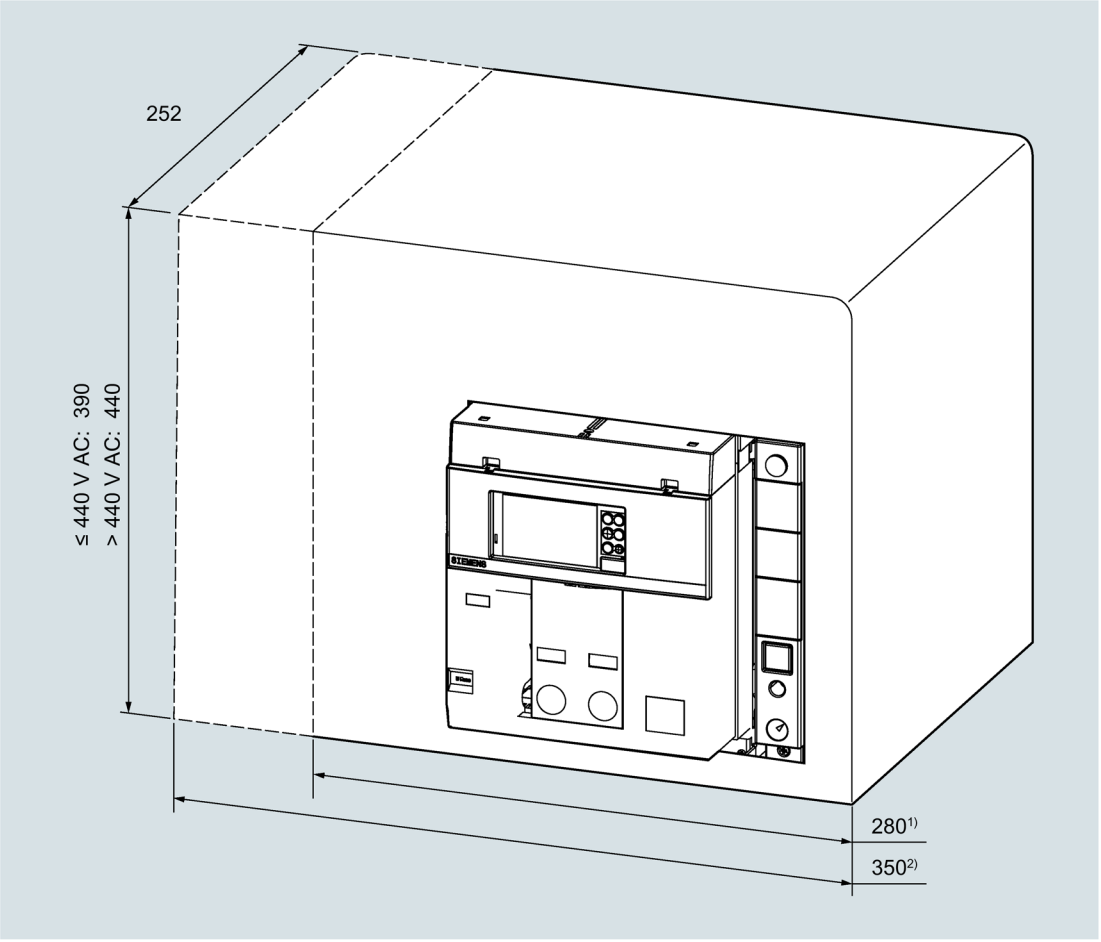






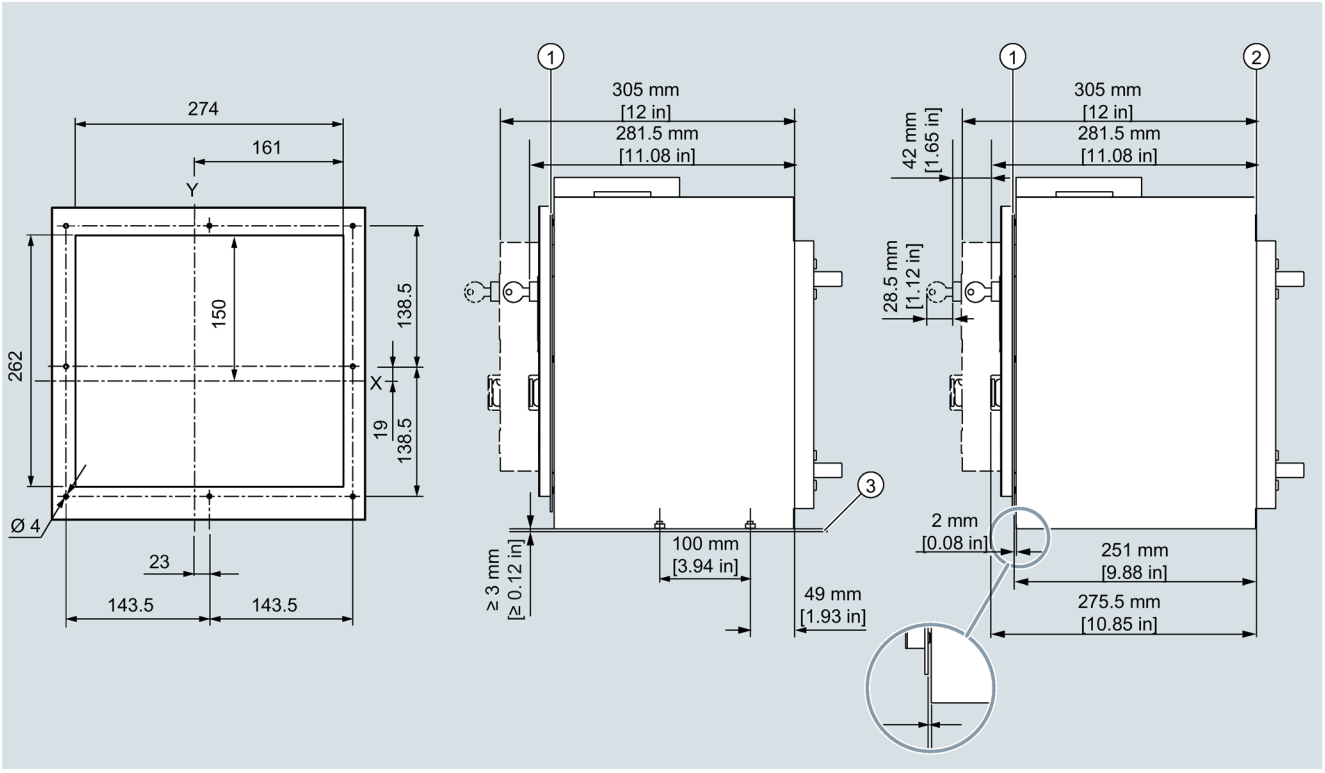
9.2.7 Switchboard panel, hole and drilling templates, withdrawable breaker

Dimensions of switchboard panel



1) 3-pole
2) 4-pole

Hole pattern for switchboard panel door

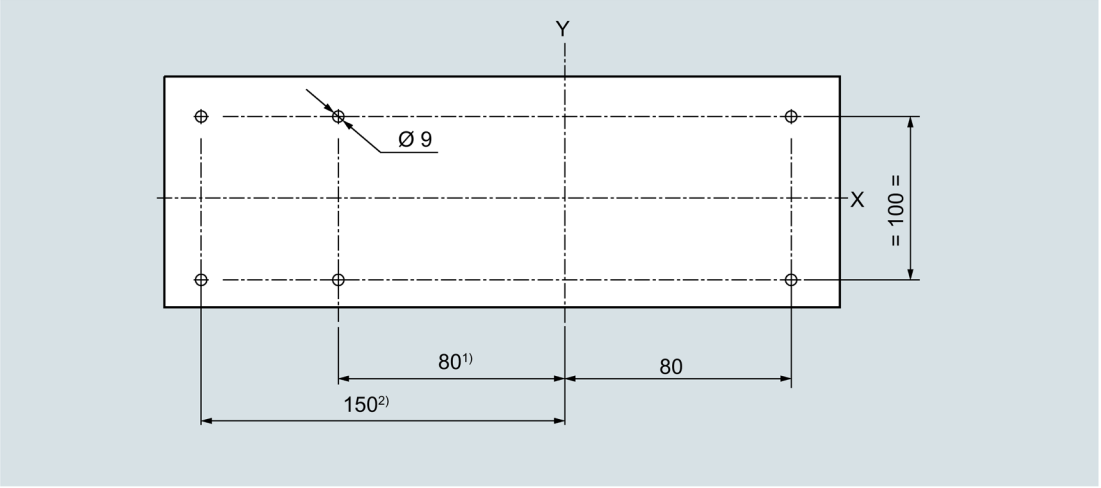


① Control panel door
② Rear wall
③ Base plate

	Standard	
A	36 mm	**Locking device against racking of the withdrawable CB** 46.5 mm
W	44.5 mm	**Locking device, OFF pos. Ronis lock to prevent unauthorized closing** 55 mm

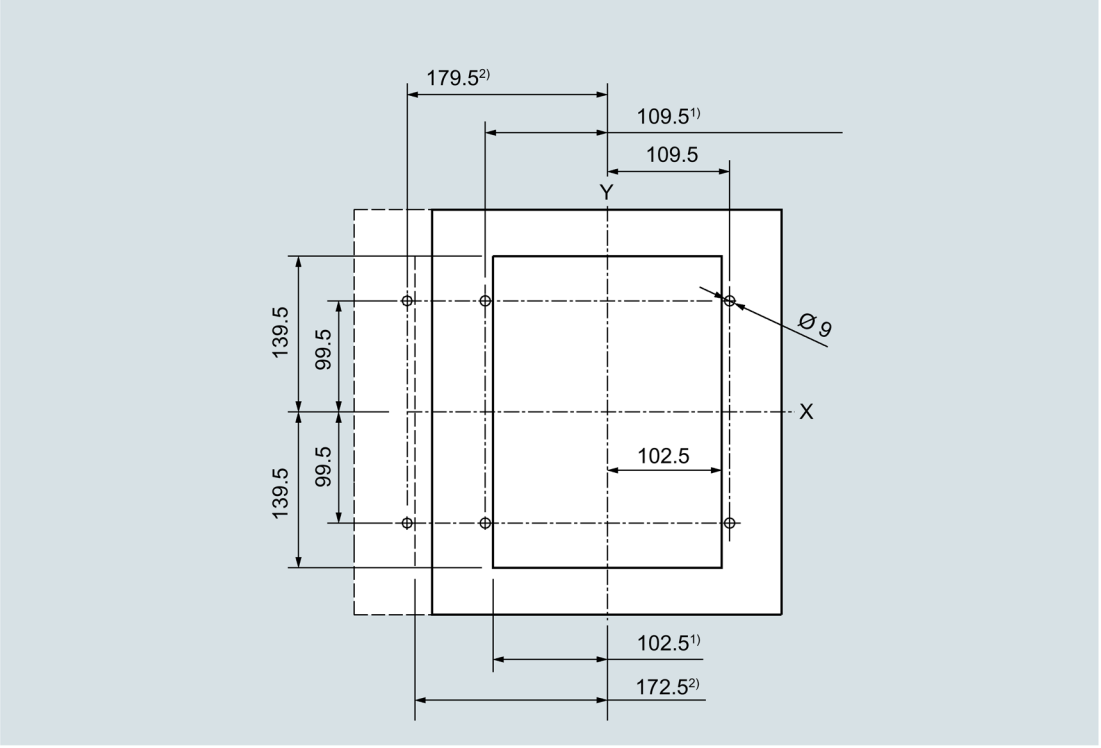
1) Distance from CONNECT position to DISCONNECT position

Drilling pattern for floor fixation and fixation on support plate



1) 3-pole
2) 4-pole

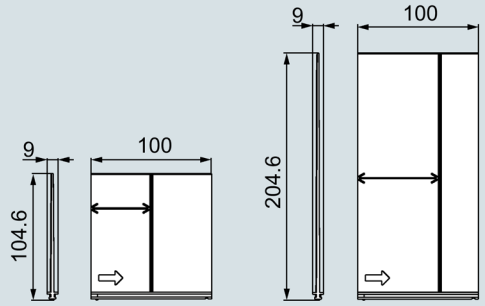
Drilling pattern for wall mounting



1) 3-pole
2) 4-pole

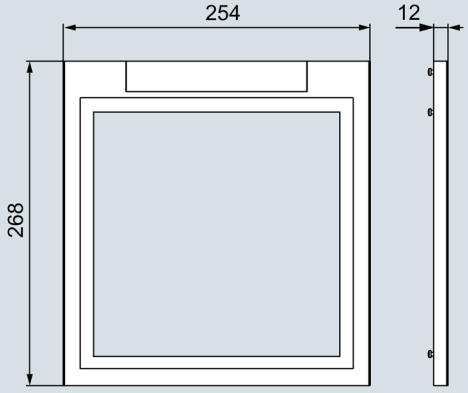
9.3 Further dimension drawings

9.3.1 Phase barrier

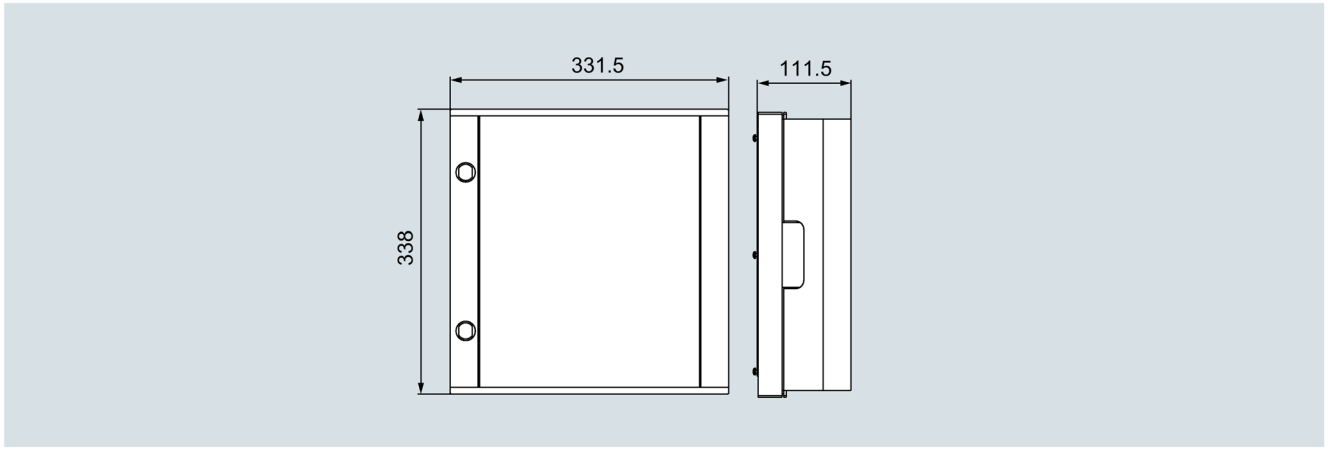


9.3.2 Door covers

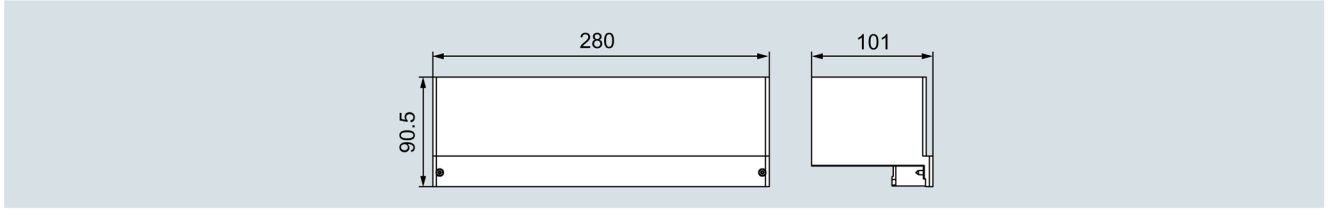
Door sealing frame



IP54 protective cover



9.3.3 Terminal cover



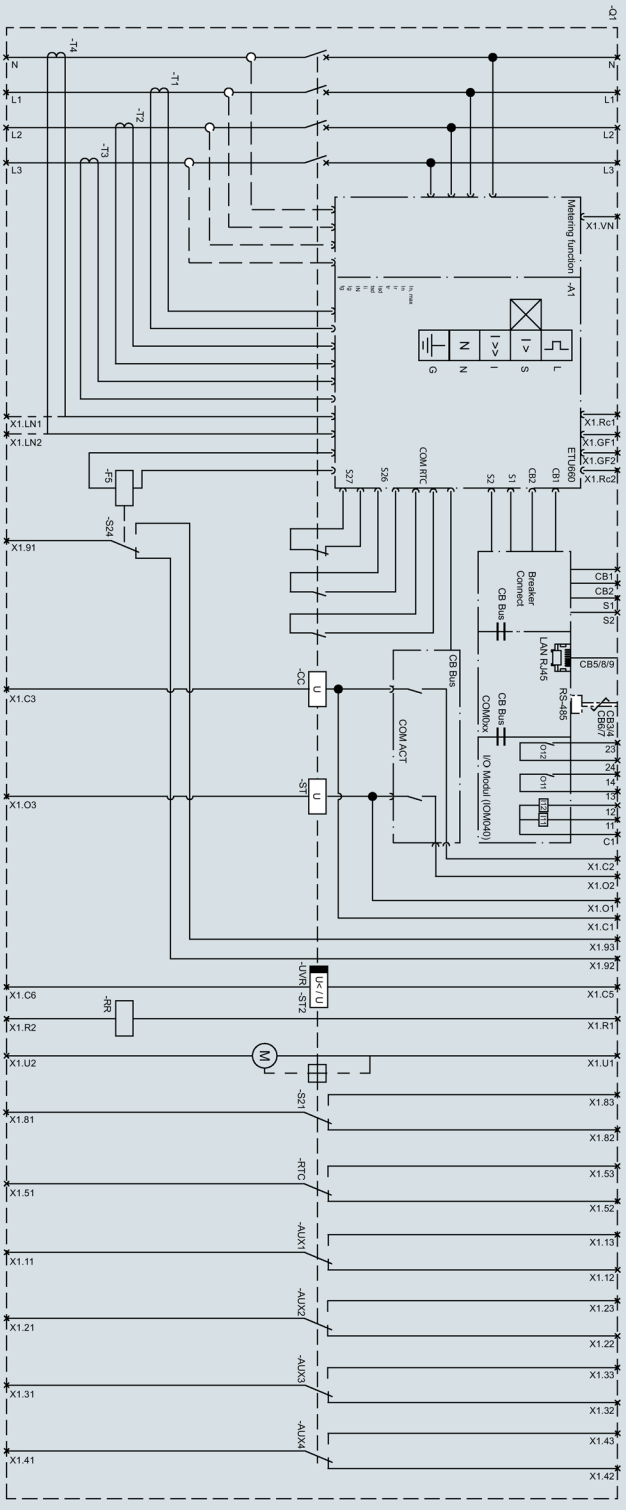
Circuit diagrams

10

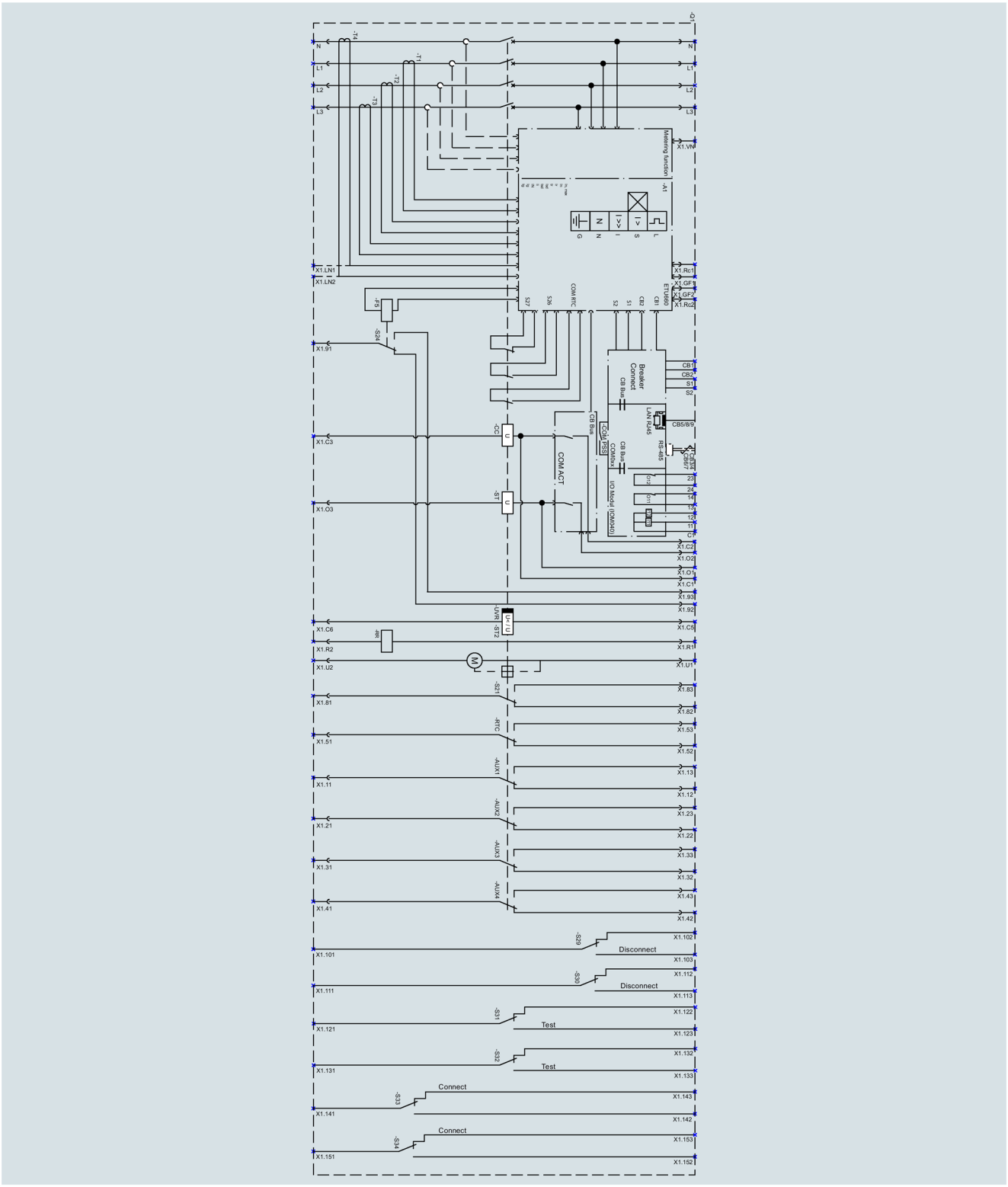
The basic state of the circuit breaker, which is used as the basis for the circuit diagrams:

- Circuit breaker OFF, main contacts open
- Withdrawable circuit breaker in "connected" position
- Discharged
- Stored energy operating mechanism with discharged spring

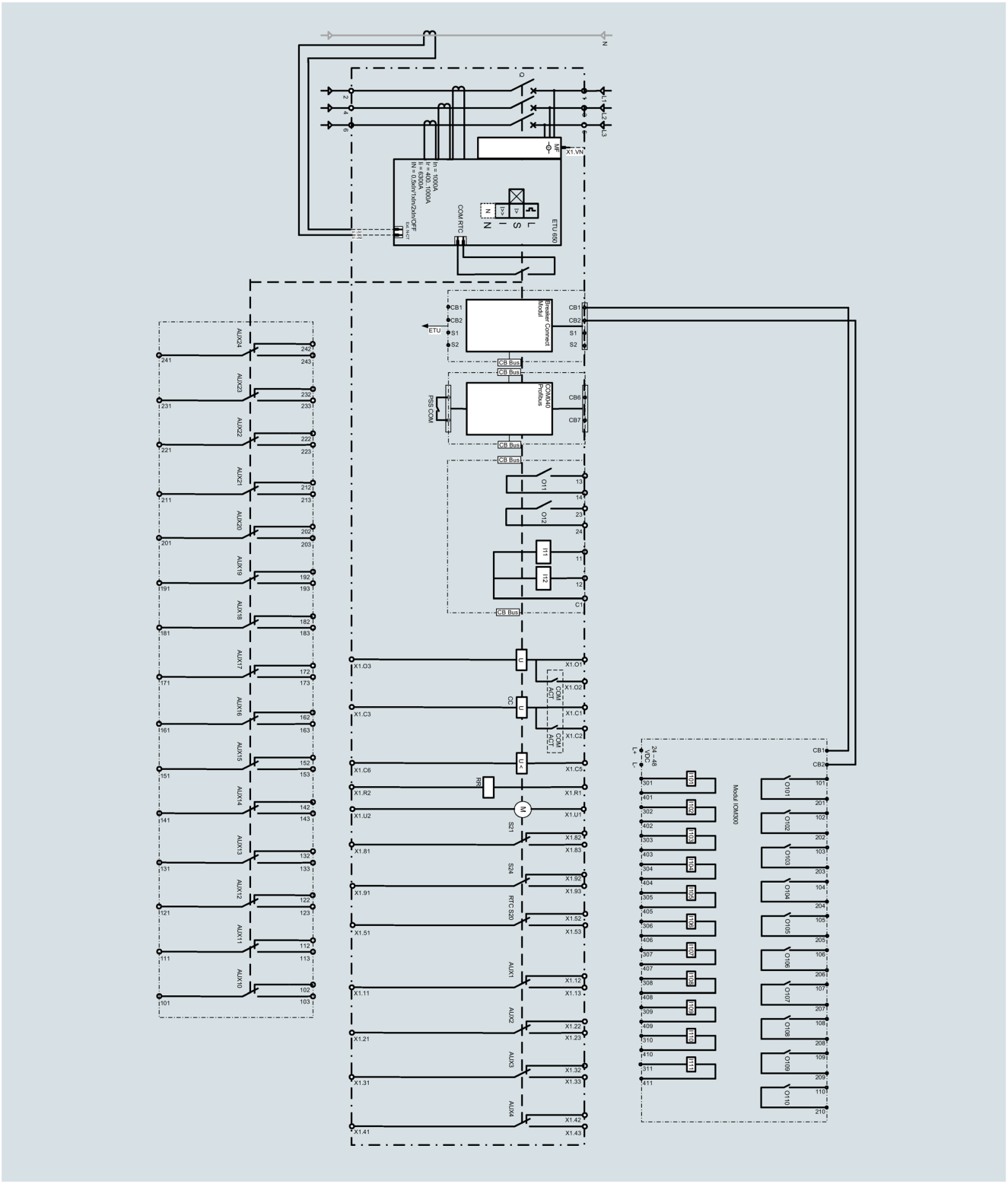
Overall circuit diagram for 3WL10 fixed-mounted breakers



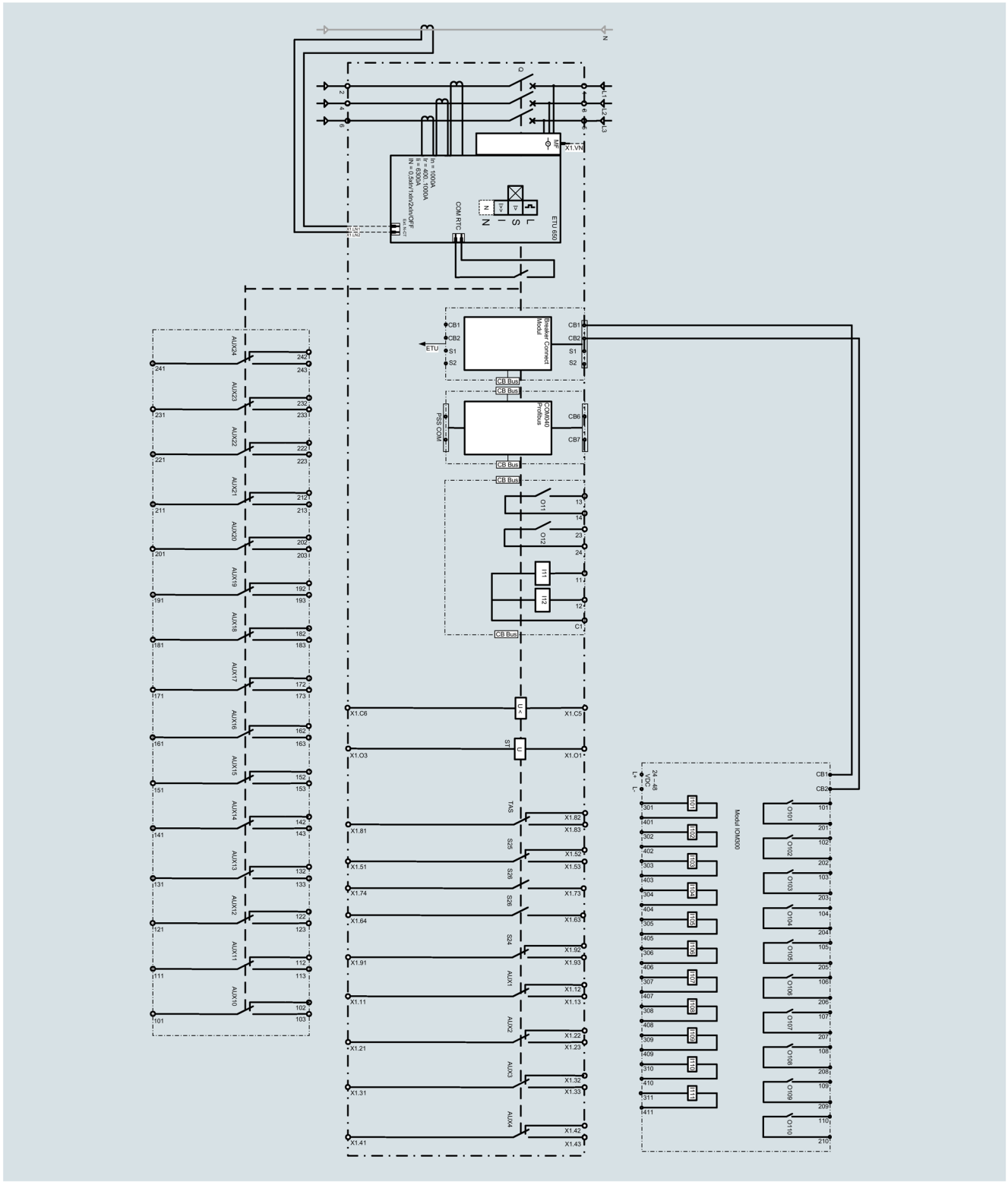
Overall circuit diagram for 3WL10 withdrawable breakers



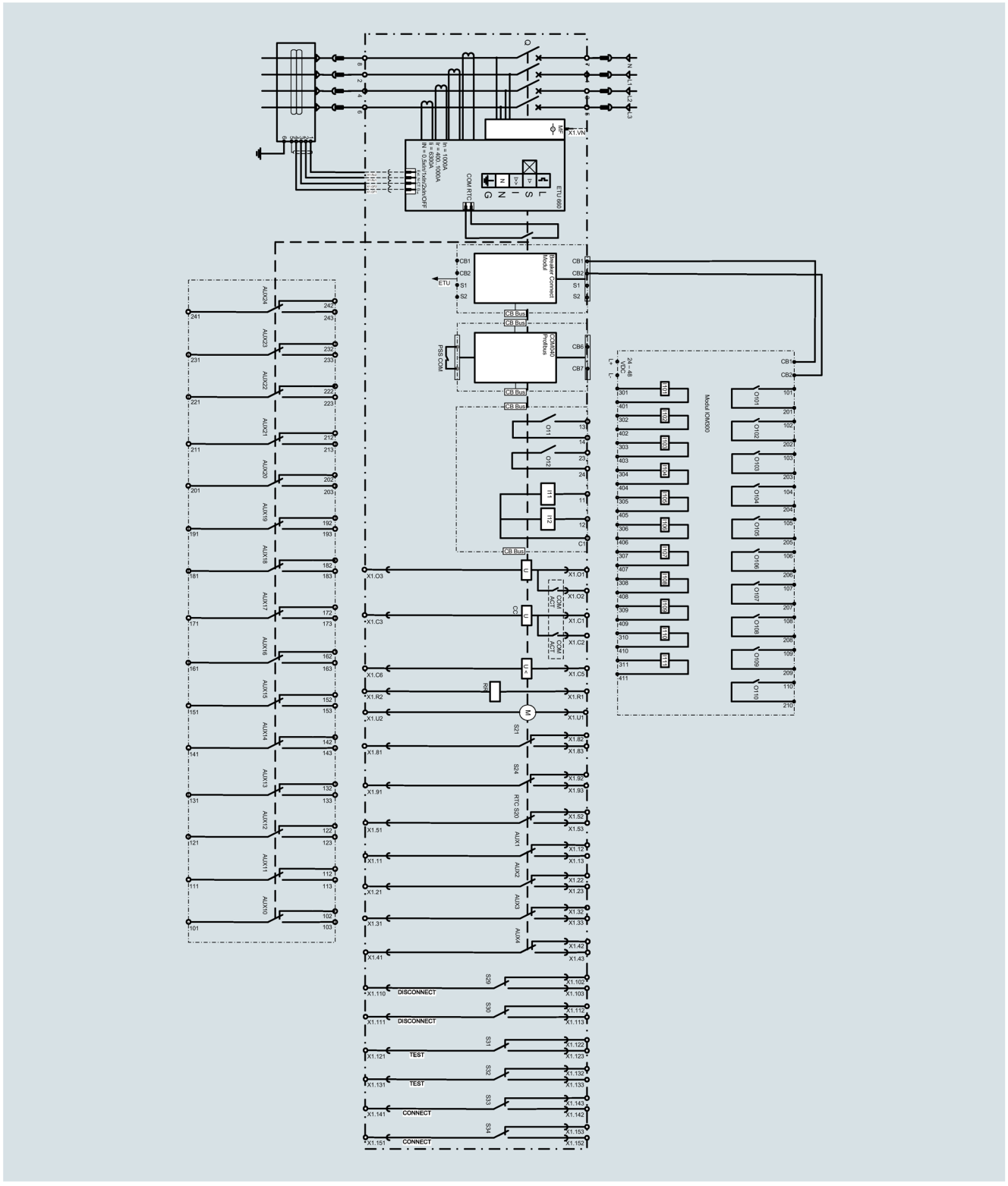
Overall circuit diagram for 3VA27 fixed-mounted breakers with stored energy operating mechanism



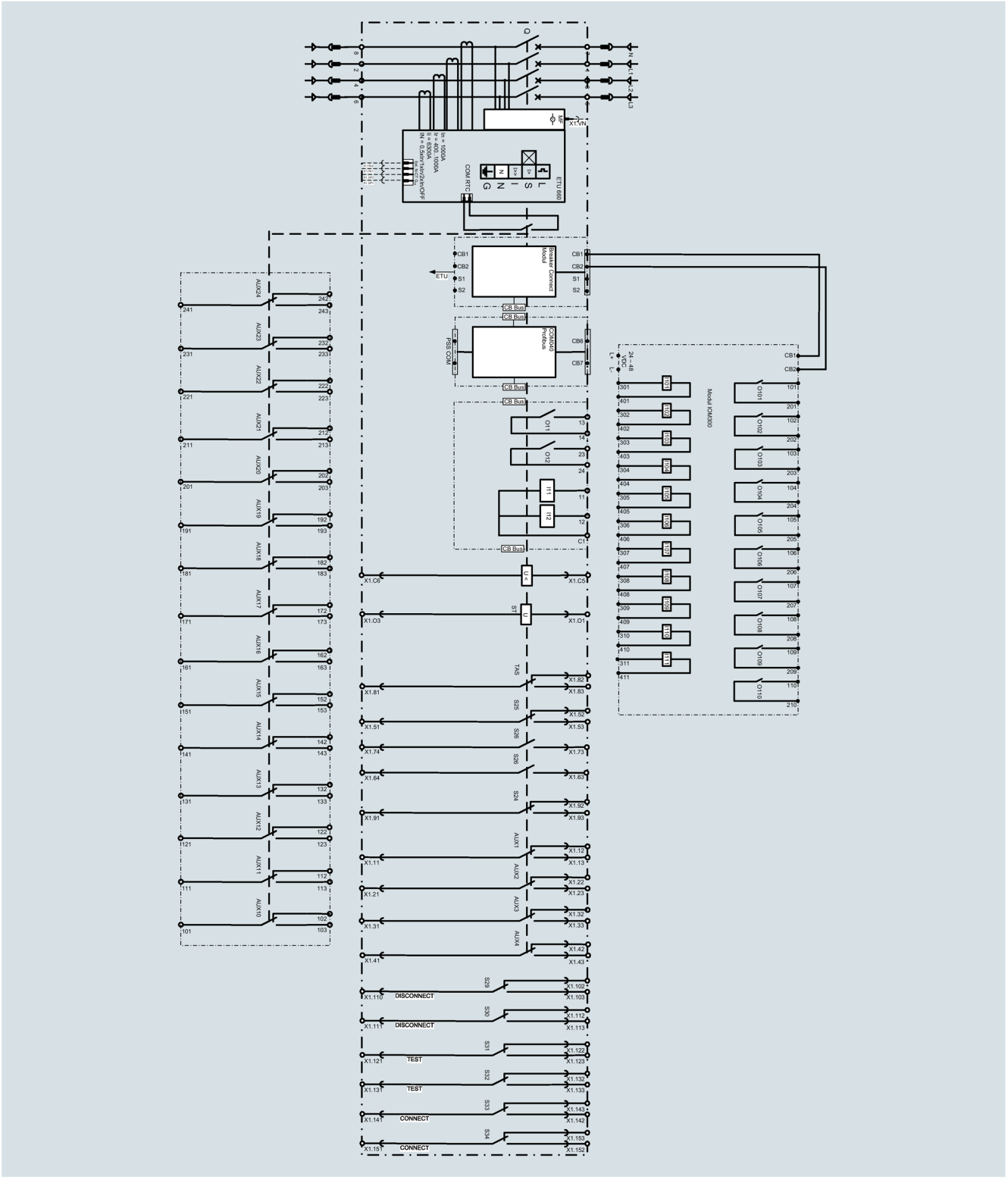
Overall circuit diagram for 3VA27 fixed-mounted breakers with toggle operating mechanism



Overall circuit diagram for 3VA27 withdrawable breakers with stored energy operating mechanism



Overall circuit diagram for 3VA27 withdrawable breakers with toggle operating mechanism



Note

The following circuit diagrams each have a circuit diagram number. This number is shown again in Chapter Installing accessories (Page 177)in the diagram of the auxiliary conductor terminal block.

10.1 Circuit diagrams of accessories

The connection diagram of the accessories and control wire taps shows details from left to right of the withdrawable circuit breaker by way of example for all circuit breakers.

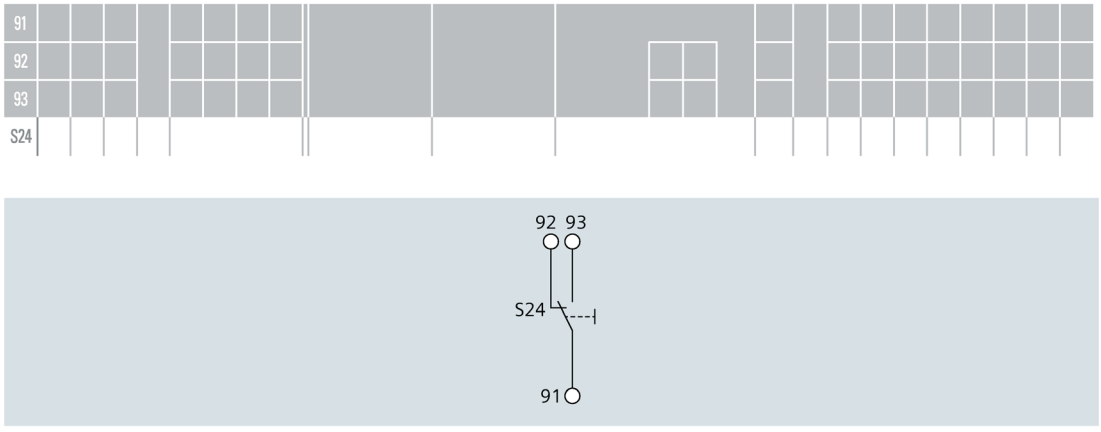
The following abbreviations are used:

3WL10 / 3VA27 SE: Stored Energy / stored energy operating mechanism

3VA27 toggle: Toggle operating mechanism, manual operation, not motorizable

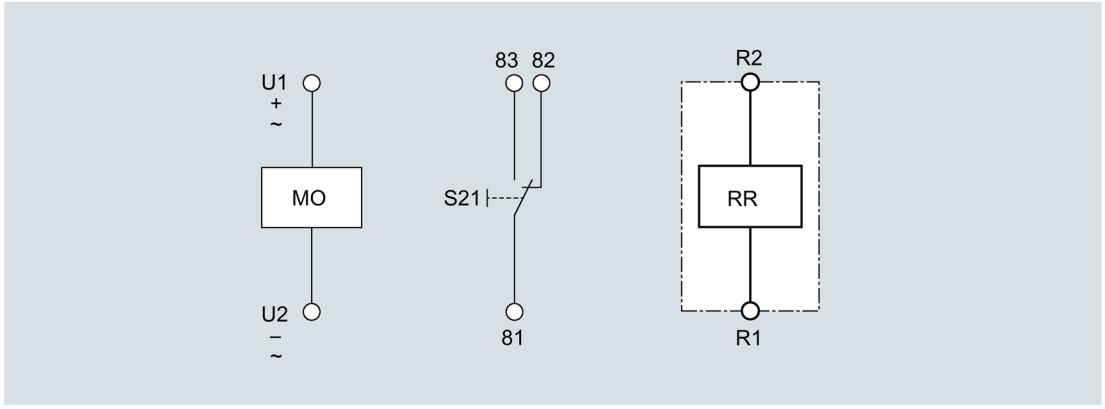
10.1.1 Tripped signaling switch (S24)

3WL10 / 3VA27 SE + 3VA27 toggle



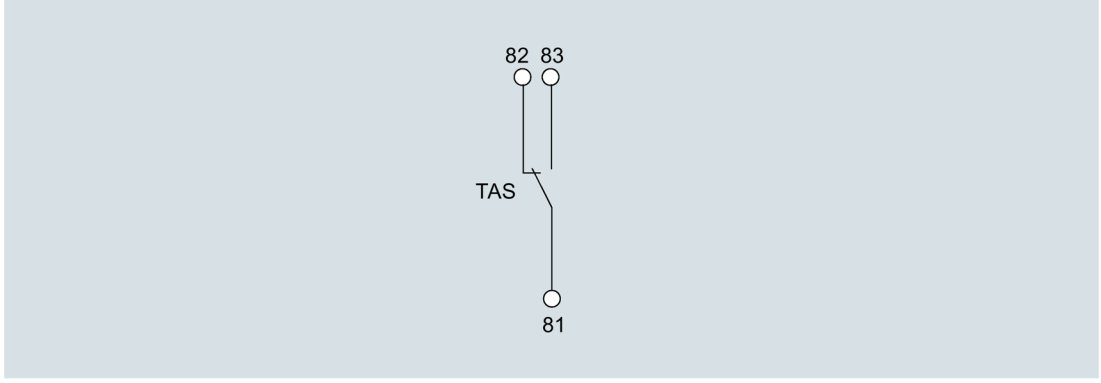
10.1.2 Spring charging motor (MO), spring charged signaling switch (S21), remote reset magnet (RR)

3WL10 / 3VA27 SE



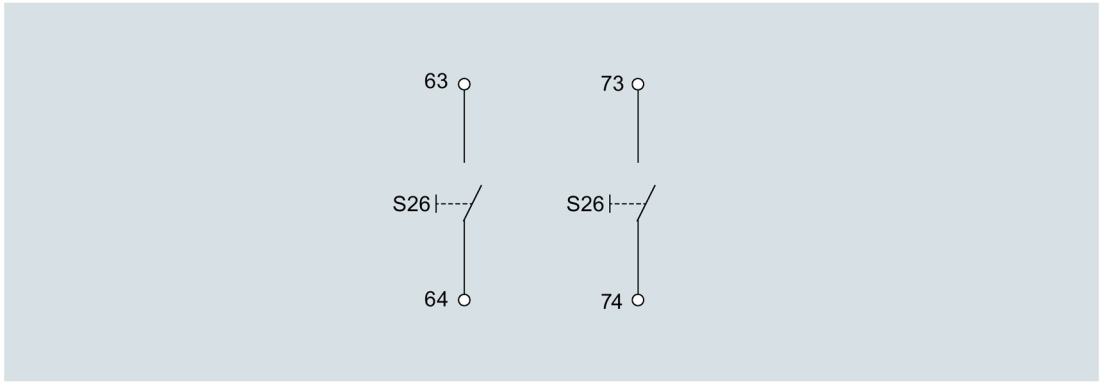
10.1.3 Tripped signaling switch, toggle operating mechanism MCCB (TAS)

3VA27 toggle



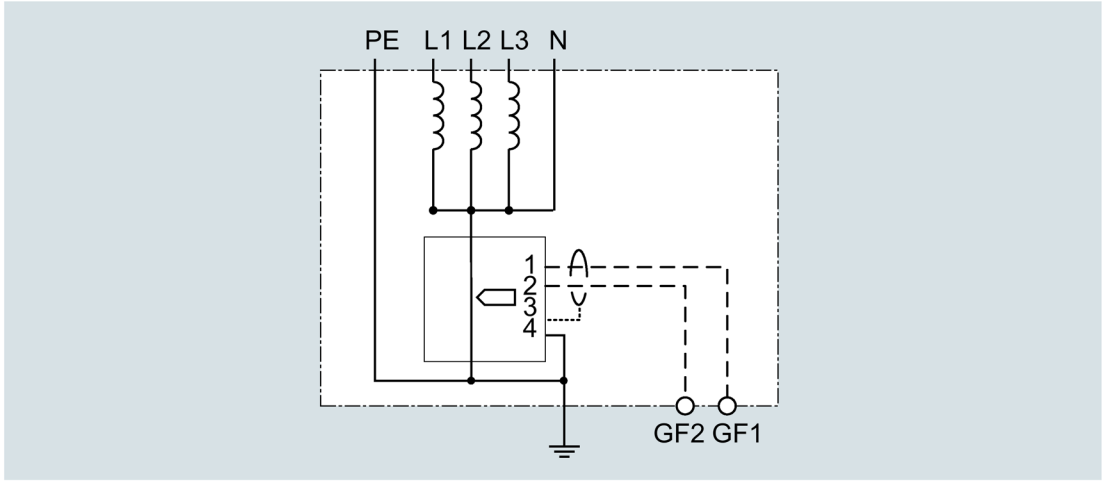
10.1.4 Leading changeover switch (S26)

3VA27 toggle



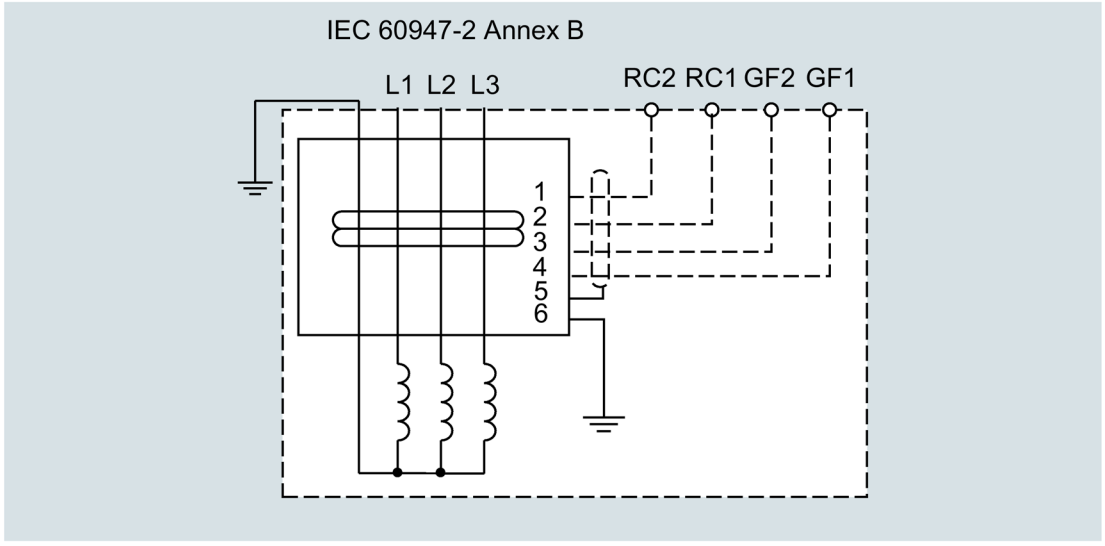
10.1.5 CT for grounded transformer star point (G_ret)

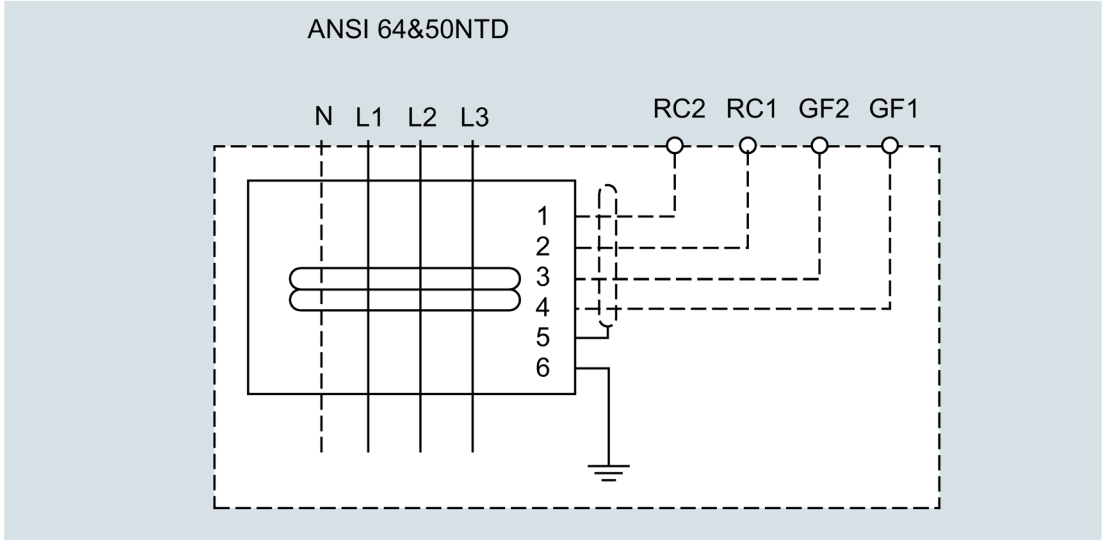
3WL10 / 3VA27 SE + 3VA27 toggle



10.1.6 Summation current transformer (Rc CT)

3WL10 / 3VA27 SE + 3VA27 toggle

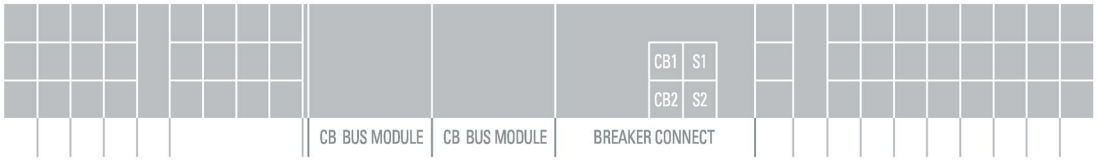




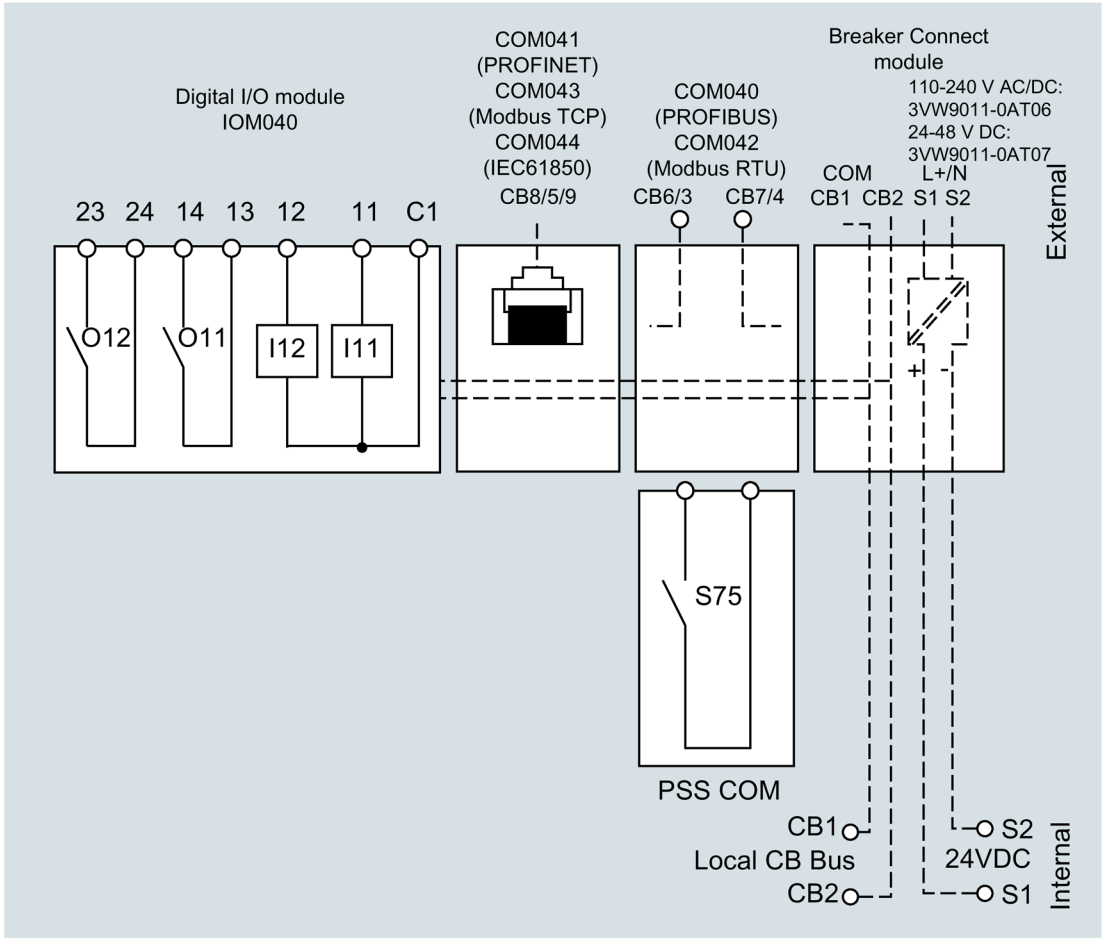
10.1.7 CB bus module

Breaker Connect module (external power supply), communication modules, digital I/O module IOM040, position signaling switch PSS for guide frame (PSS COM)

3WL10 / 3VA27 SE + 3VA27 toggle

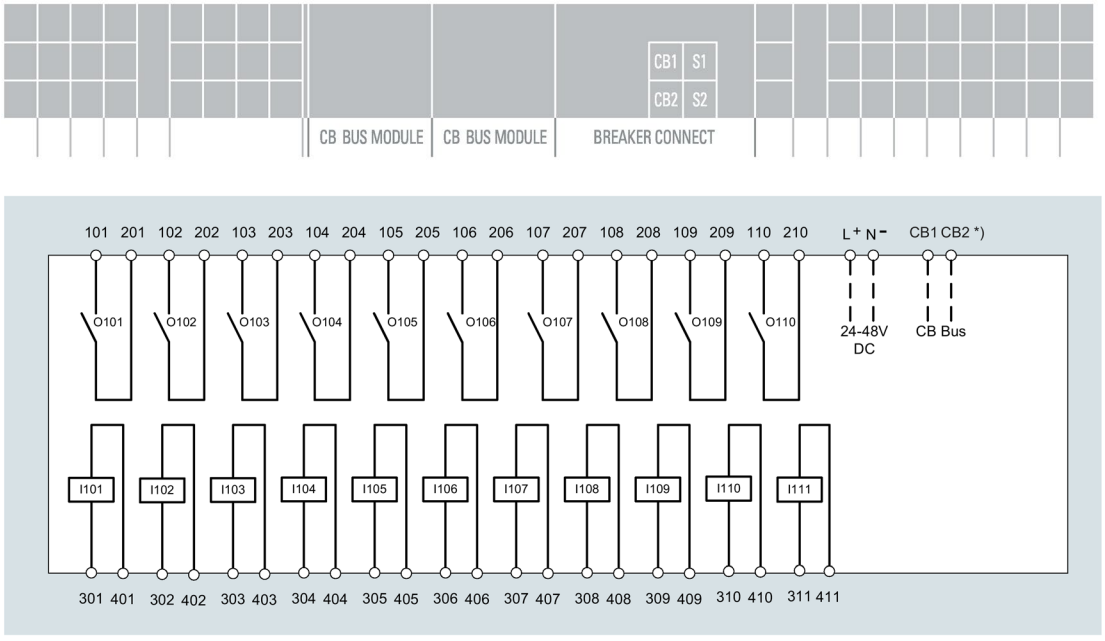


Digital I/O module IOM040, COM041 (PROFINET), COM043 (Modbus TCP), COM044 (IEC 61850), COM040 (PROFIBUS), COM042 (Modbus RTU): Of these three modules, a maximum of two modules can be installed.



10.1.8 External I/O module IOM300

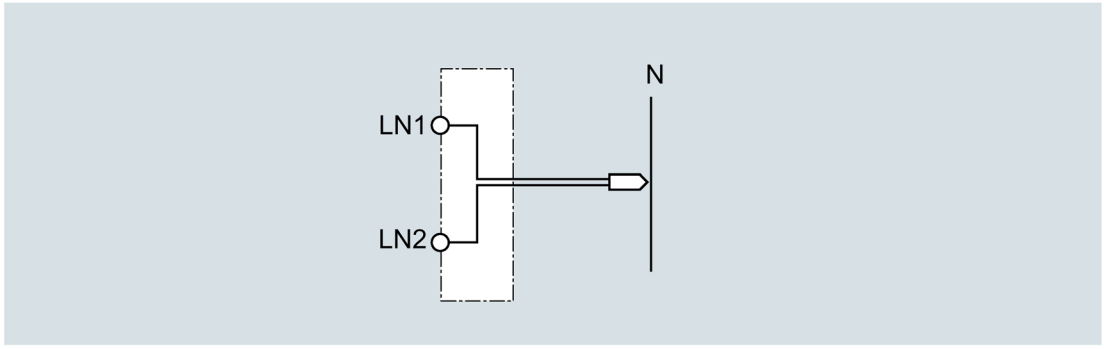
3WL10 / 3VA27 SE + 3VA27 toggle



*) Connection on the Breaker Connect module or optionally directly on the auxiliary conductor terminal system via the auxiliary conductor terminal

10.1.9 External current transformer for N conductor, for 3-pole circuit breakers only

3WL10 / 3VA27 SE + 3VA27 toggle

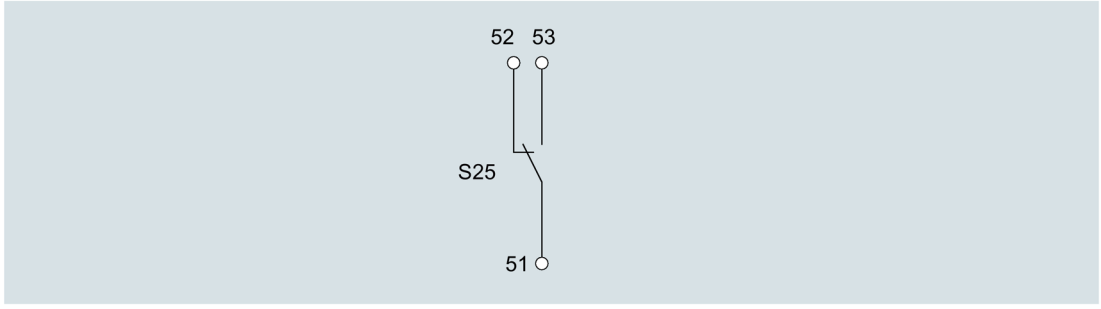


Note

In the 4-pole circuit breaker, one internal N-conductor current transformer is always included.

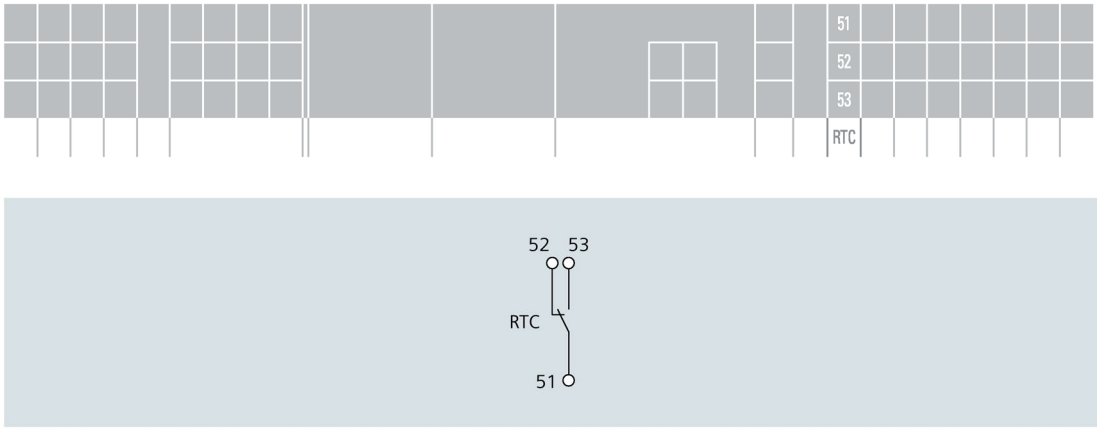
10.1.10 Tripped signaling switch via auxiliary release (S25)

3VA27 toggle



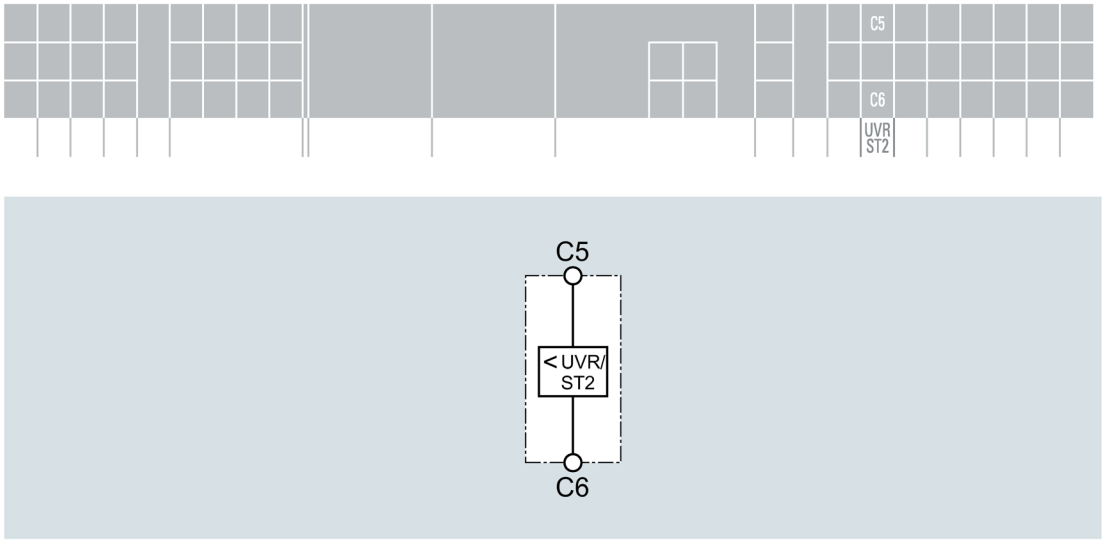
10.1.11 Ready-to-close signaling switch (RTC)

3WL10 / 3VA27 SE



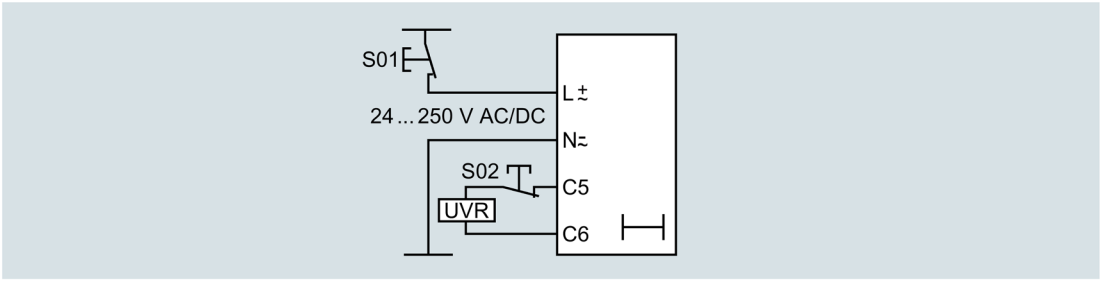
10.1.12 Undervoltage release / shunt release (UVR / ST2)

3WL10/3VA27 SE + 3VA27 toggle



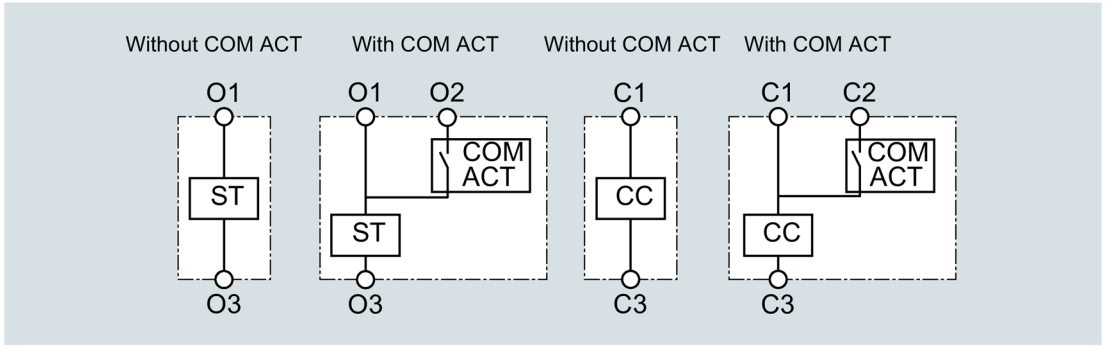
10.1.13 Time-delay device for UVR (external monitoring of UVR can be mounted on the DIN rail)

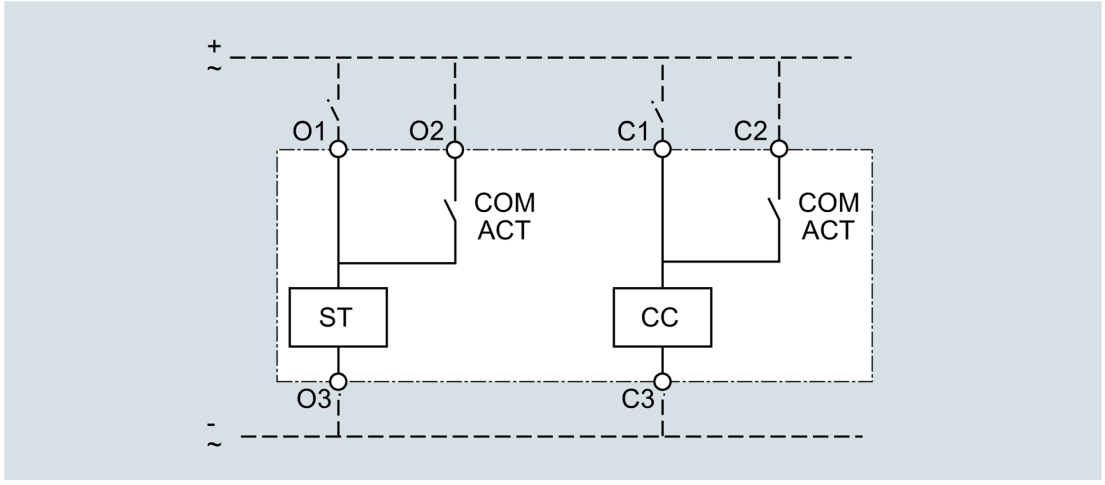
3WL10/3VA27 SE + 3VA27 toggle



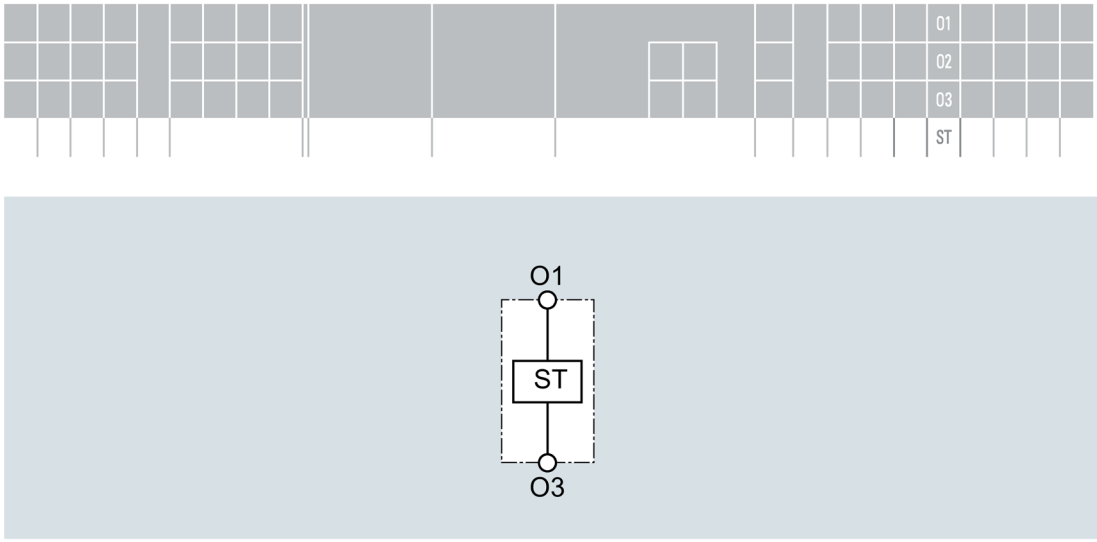
10.1.14 Closing coil (CC) / shunt release (ST) / actuator module (COM ACT)

3WL10/3VA27 SE



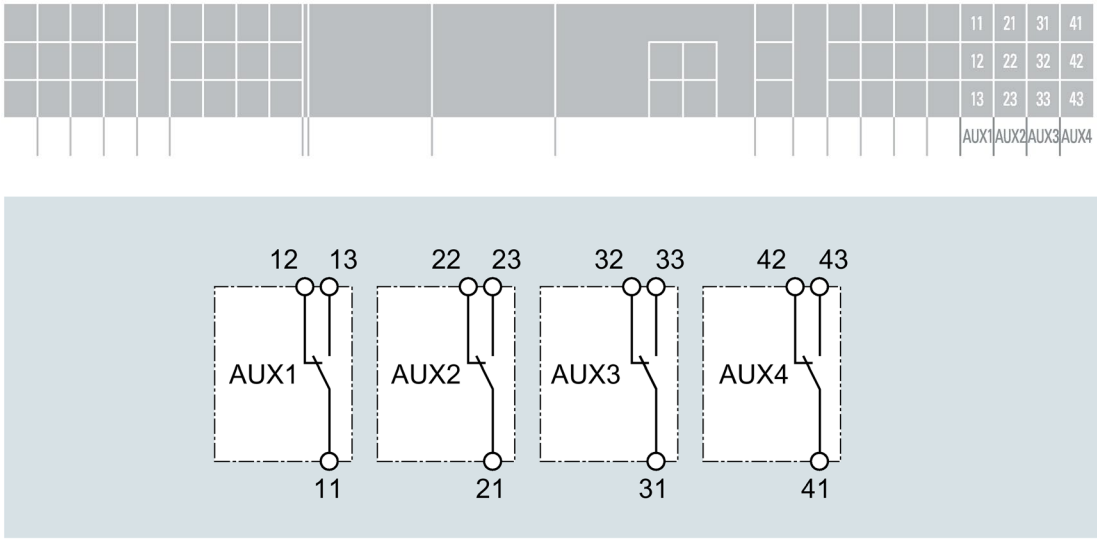


3VA27 toggle



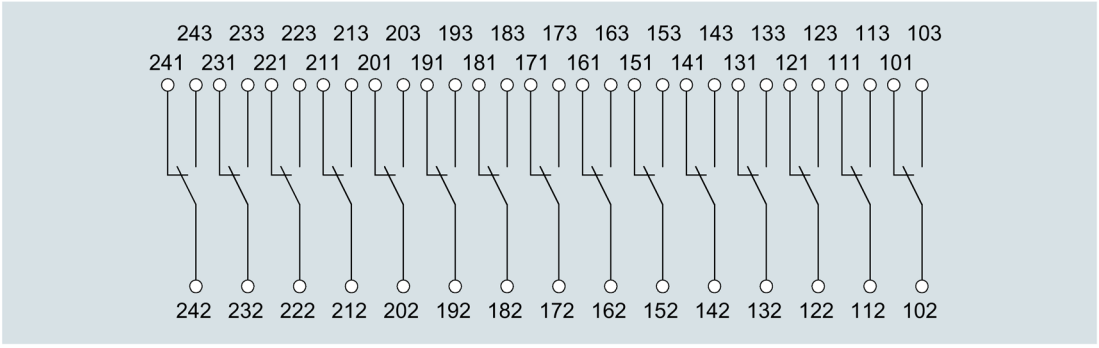
10.1.15 Auxiliary switch AUX

3WL10/3VA27 SE +3VA27 toggle



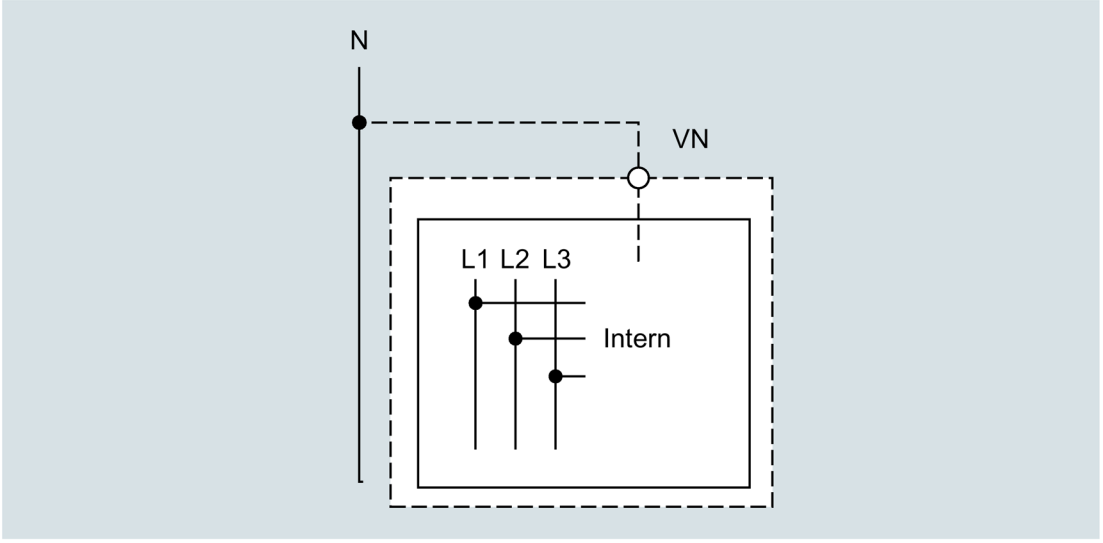
10.1.16 Auxiliary switch AUX 15, external

3WL10/3VA27 SE + 3VA27 toggle



10.1.17 Optional voltage input, external neutral for the metering function of a 3-pole circuit breaker

3WL10 / 3VA27 SE + 3VA27 toggle



10.1.18 Position signaling switch PSS for guide frame

3WL10/3VA27 SE + 3VA27 toggle

Appendix A

A.1 The article number system

Note

You can simply and quickly put together the article number of an individually configured circuit breaker using the Online Configurator.

Online configurator for 3VA27 (https://mall.industry.siemens.com/mall/en/CN/Catalog/StartConfigurator?configId=11&nodeId=9990301&kmat=3VA27)

Online configurator for 3WL10 (https://mall.industry.siemens.com/mall/en/WW/Catalog/StartConfigurator?configId=11&nodeId=10027213&kmat=3WL10&bookmark=)

In the Online Configurator, impermissible combinations are automatically excluded in the article number. If you compile the article number yourself based on the following lists, you must check the exclusion criteria yourself.

You will find more information in the catalogs for 3WL10 and 3VA27 (see Chapter Reference documents (Page 10)).

Article number

Position 1-5: Basic version of the circuit breaker

With the first 5 positions of the article number, the basic version of the circuit breaker is coded.

3WL10: Air circuit breaker ACB for the IE

Article number, 3WL10:

3	W	L	1	0													

3VA27: Circuit breakers, molded case circuit breakers, advanced, selective applications, 1600 A

Article number, 3VA27:

3	V	A	2	7													

Position 6 - 7: Rated current I_n

3WL10		3VA27	
630 A:	*06*	800 A	*08*
800 A:	*08*	1000 A	*10*
1000 A:	*10*	1250 A	*12*
1250 A:	*12*	1600 A	*16*

Example article number 3WL10, rated current 1000 A:

3	W	L	1	0	1	0											

Example article number 3VA27, rated current 1600 A:

3	V	A	2	7	1	6											

Position 8: Breaking capacity

3WL10		3VA27		
			Stored energy operating mechanism	Toggle operating mechanism
Class B:	1	Class M:	1	5
Class N:	2	Class H:	2	6
Class S:	3	Class C:	3	7

Example article number, breaking capacity N:

3	W	L	1	0	1	0	-	2									

Position 9: Metering function and communication link

Without a metering function / without a communication link:	A
Without a metering function / with a communication link	B
Metering function Basic, voltage tap bottom / with communication link[1)]:	C
Metering function Basic, voltage tap top / with communication link[1)]:	D
Metering function Advanced, voltage tap bottom / with communication link[1)]:	E
Metering function Advanced, voltage tap top / with communication link[1)]:	F

) Including: Breaker Connect module, COM ACT, COM RTC, COM PSS (for withdrawable breaker)

Example article number, metering function Basic, voltage tap bottom / with communication link:

3	W	L	1	0	1	0	-	2	C								

Position 10: ETU

Switch disconnector: *A*

ETU320:	B	ETU650:	E
ETU350:	C	ETU660:	F
ETU360:	D		

Example article number, ETU660:

3	W	L	1	0	1	0	-	2	C	F							

Position 11: Number of poles, neutral conductor, and installation type

3 poles / fixed-mounted breaker: 0	3 poles / withdrawable breaker: 3
4 poles, neutral left / fixed-mounted breaker: 1	4 poles, neutral left / withdrawable breaker: *4*
4 poles, neutral right / fixed-mounted breaker: 2	4 poles, neutral right / withdrawable breaker: 5

Example article number, 4 poles, neutral left / withdrawable breaker:

3	W	L	1	0	1	0	-	2	C	F	4						

Position 12: Connection technology

3WL10

Withdrawable breaker version without guide frame:	0
Orientable, rear connection - mounted vertically (fixed / withdrawable breaker):	1
Orientable, rear connection - mounted horizontally (fixed / withdrawable breaker):	2
Front connection (fixed-mounted breaker) or flange (withdrawable breaker):	3
Circular conductor terminal for copper/aluminum cable (fixed / withdrawable breaker):	4
Front connection bar, extended (withdrawable breaker):	5

3VA27

Fixed-mounted	**Withdrawable**	
—	Withdrawable version without guide frame	0
Rear vertical (convertible)	Rear vertical (convertible)	1
Rear horizontal (convertible)	Rear horizontal (convertible)	2
Nut keeper kit	—	3
Straight bus connectors extended	Front straight bus connectors extended	5
Broadened bus connectors	Front broadened bus connectors	6
—	Rear broadened bus connectors	7

Example article number, orientable, rear connection - mounted vertically:

3	W	L	1	0	1	0	-	2	C	F	4	1					

Position 13: Spring charging motor (MO)

3WL10/3VA27 - stored energy operating mechanism

Spring charging motor (MO):

24 to 30 V AC / DC:	1
48 - 60 V AC / DC	2
110 V AC / DC	3
230 V AC / DC	4

3VA27 - toggle operating mechanism

Alarm switches

Without alarm switch	0
TAS + S25	1
S26	2
TAS + S25 + S26	3

Example article number, spring charging motor 24 - 30 V AC / DC:

3	W	L	1	0	1	0	-	2	C	F	4	1	-	1			

Position 14: Auxiliary release - closing coil (CC) and remote reset magnet (RR)

Without closing coil (CC) and without remote reset magnet (RR): *A*

3WL10/3VA27 - stored energy operating mechanism

24 V AC/DC: *B*	110 V to 120 V AC/DC: *F*
30 V AC/DC: *C*	120 V to 127 V AC/DC: *G*
48 V AC/DC: *D*	220 V to 240 V AC/DC: *H*
60 V AC/DC: *E*	240 V to 250 V AC/DC: *J*

Closing coil (CC) together with remote reset magnet (RR):

24 V AC/DC: *K* 110 V AC/DC: *L*
220 V AC/DC: *M*

Example article number, shunt release (CC) and remote reset magnet (RR) 110 V AC/DC:

3	W	L	1	0	1	0	-	2	C	F	4	1	-	1	L		

Position 15: Auxiliary release - undervoltage release (UVR), undervoltage release (UVR) with time-delay device and second shunt release (ST2)

Without UVR / UVR with time-delay device / CC: *A*

UVR:

24 V AC/DC: *B* 110 V to 120 V AC/DC: *F* 380 V to 400 V AC/DC: *K*
30 V AC/DC: *C* 120 V to 127 V AC/DC: *G* 415 V to 440 V AC/DC: *L*
48 V AC/DC: *D* 220 V to 240 V AC/DC: *H*
60 V AC/DC: *E* 240 V to 250 V AC/DC: *J*

UVR with time-delay device:
(versions 48 V AC/DC and 60 V AC/DC can be ordered separately)

24 V - 30 V DC 110 V to 127 V AC/DC: N
with 24 V UVR: M 220 V to 250 V AC/DC: P

Second shunt release (ST2):

24 V AC/DC: *Q* 110 V to 120 V AC/DC: *U*
30 V AC/DC: *R* 120 V to 127 V AC/DC: *V*
48 V AC/DC: *S* 220 V to 240 V AC/DC: *W*
60 V AC/DC: *T* 240 V to 250 V AC/DC: *X*

Example article number, undervoltage release (UVR) 24 V AC/DC:

3	W	L	1	0	1	0	-	2	C	F	4	1	-	1	L	B	

Position 16: Auxiliary release - shunt release (ST)

Without shunt release (ST): *0*

Shunt release (ST):

24 V AC/DC: *1* 110 V to 120 V AC/DC: *5*
30 V AC/DC: *2* 120 V to 127 V AC/DC: *6*
48 V AC/DC: *3* 220 V to 240 V AC/DC: *7*
60 V AC/DC: *4* 240 V to 250 V AC/DC: *8*

Example article number, shunt release (ST) 24 V AC/DC:

3	W	L	1	0	1	0	-	2	C	F	4	1	-	1	L	W	1

Z options

For some positions of the article number, a more detailed selection can be useful or necessary. For example, when selecting a communication connection (position 9), the communication module (PROFIBUS, PROFINET, etc.) must be defined.

This is done with the Z options that are appended to the article number. The number of Z options depends on the individual configuration of the circuit breaker. No Z options are also possible.

Z option rated current I_n: Choice of rating plug

You can choose a rating plug that is below the rated current I_n of the circuit breaker. This is useful, for example, if the circuit breaker has already been chosen with a higher rated current than is required for the existing installation with a view to future expansion of the overall installation.

Rating plug: *Z option code*

Rating plug	Rating plug L = OFF	Rating plug with RC function
400 A: *B04*	400 A: *L04*	400 A: *G04*
630 A: *B06*	630 A: *L06*	630 A: *G06*
800 A: *B08*	800 A: *L08*	800 A: *G08*
1000 A: *B10*	1000 A: *L10*	1250 A: *G12*
1250 A: B12*	1250 A: *L12*	
	1600 A: L16*	

3VA27 only

Z option choice of communication module

With this Z option, the communication module for the first slot is defined.

A second communication module with a further Z option can additionally be selected from the list. This module then occupies a further slot that is no longer available for other modules.

PROFIBUS module COM040:	*F02*
PROFINET module COM041:	*F03*
Modbus TCP module COM043:	*F11*
Modbus RTU module COM042:	*F12*
IEC 61850 module COM044:	*F13*
Digital I/O module IOM040:	*K56*

Example article number, a PROFINET module COM41:

3	W	L	1	0	1	0	-	2	C	F	4	1	-	1	L	W	1	-	Z	L08	+	*F03*

Z option digital signaling switch

As standard, every ETU is delivered with a ready-to-close signaling switch (RTC) with four auxiliary switches AUX 4CO and one tripped signaling switch (S24) with a standard contact. These accessories can optionally also be ordered with digital and mixed contacts. You will find more information in the catalogs for 3WL10 and 3VA27 (see Chapter Reference documents (Page 10)).

For the withdrawable breaker, the position signaling switch 400 V AC is delivered as standard with the guide frame. The guide frame signaling switch can also be ordered optionally with digital contacts.

The spring charged signaling switch (S21) is delivered with standard contacts. It can optionally be replaced by the version with a contact for the digital signal.

In the catalogs for 3WL10 and 3VA27, you will also find information on the configurable locks and interlocking methods.

Compilation of the article number has been completed. The individually configured circuit breaker can now be ordered with it.

A.2 Menu structure of the ETUs of the 6-series

Level 1 (main menu)	**Level 2**	**Level 3**
Protection	LT protection *Overload protection*	Characteristic • I^2t • IEC 60255-151 SI • IEC 60255-151 VI • IEC 60255-151 EI • IEC 60255-151 I^4t
		Current setting value I_r
		Delay time t_r
		Pre-alarm I_r
	ST protection *Short-time-delayed short-circuit protection*	Enable
		Enable tripping
		Characteristic • I^2t OFF / I^2t ON
		Operating value I_{sd}
		Delay time t_{sd}
		Activate startup
		Startup operating value
		Startup time delay
	INST protection *Instantaneous short-circuit protection*	Enable
		Operating value I_i
		Activate startup
		Startup operating value
		Startup time delay
	GF protection *Ground-fault protection*	Enable
		Ground-fault protection method • I^2t OFF / I^2t ON
		Operating value I_g
		Delay time t_g
		Pre-alarm I_r
		Enable tripping
		Activate startup
		Startup operating value
		Startup time delay

Level 1 (main menu)	**Level 2**	**Level 3**
Enhanced protection functions	DAS protection *DAS (arc fault mitigation mode)*	Enable
		Operating value I_{i_arc}
	Directed ST protection *Directed (directional) short-time-protection*	Enable
		Enable tripping
		Operating value I_{dsd} Fw
		Operating value I_{dsd} Bw
		t_{dsd} Fw
		t_{dsd} Bw
		Enable startup
		Startup operating value Fw
		Startup operating value Bw
		Startup time delay
		DST Min Angle
	I-NBA protection *Current unbalance*	Enable
		Operating value I_{nba}
		Delay time t_{nba}(I)
		Enable tripping
	V_u protection *Undervoltage*	Enable
		Operating value U_u
		Delay time t_u(U)
		Enable tripping
	V_o protection *Overvoltage*	Enable
		Operating value U_o
		Delay time t_o(U)
		Enable tripping
	V-NBA protection *Voltage unbalance*	Enable
		Operating value U_{nba}
		Delay time t_{nba}(U)
		Enable tripping
	f_u protection *Underfrequency*	Enable
		Operating value f_u
		Delay time t_u(f)
		Enable tripping
	f_o protection *Overfrequency*	Enable
		Operating value f_o
		Delay time t_o(f)
		Enable tripping
	RP protection *Reverse active power protection*	Enable
		Operating value P_{rv}
		Delay time t_{rv}(P)

Level 1 (main menu)	**Level 2**	**Level 3**
		Enable tripping
	Pre-alarm PAL *Phase, cos Ø*	Operating value 1 $I_{r\_pal}(1)$
		Operating value 2 $I_{r\_pal}(2)$
		Operating value 1 $I_{n\_pal}(1)$
		Operating value 2 $I_{n\_pal}(2)$
		Phase sequence
		Cos Ø
	Functions	External tripping
		DAS mode (arc fault mitigation)
		Reset tripped signal

Level 1 (main menu)	**Level 2**	**Level 3**
Measured values	History *Tripping, measured values, log*	Tripping history
		Event
		Measured values: • Power – P_{max} – P_{mean} – Q_{max} – Q_{mean} – S_{max} – S_{mean} • Current – I_{min} – I_{max} • Voltage – U_{min} – U_{max}
		Reset values
	Power factor (p.f.) *Measured cos Ø*	[value]
	Frequency *Measured frequency*	[value]
	Energy *Energy counter*	Energy counter: • EP [value] kWh • EQ [value] kvarh • ES [value] kVAh
		Reset energy counter: Yes / No
		Reset energy: Function / time delay

Level 1 (main menu)	**Level 2**	**Level 3**
	Peak factor *Peak/RMS Rate*	• L1 [value] • L2 [value] • L3 [value] • N [value]
	Maintenance	Contact erosion in %
		Last maintenance contacts in %
		Installation
		Last maintenance
		Reset after maintenance: Yes / No

Level 1 (main menu)	**Level 2**	**Level 3**
Settings	Circuit breaker *Circuit breaker settings*	Hardware trip: Off / on
		Temperature protection: Off / on
		Neutral protection: • Enable: Off / on • Operating value neutral protection: Value in %
		Ground-fault protection method: • External current transformer • Rating of G_ret transformer
	Line frequency *Values*	50 Hz / 60 Hz
	Phase sequence *Setting*	[list]
	Module *Optional modules*	Local / remote
		Local CB Bus
		Metering MF Basic: • Voltage transformer, external unused • Rated voltage (MIN to MAX) • Primary voltage (MIN to MAX) • Secondary voltage (MIN to MAX) • Positive power flow: Bottom → top → bottom
		Functions: • Activate LOCAL mode: Function / time delay • Reset IOM040 module: Function / time delay
	Recording time	MIN to MAX in min
	Data logger *Settings*	Number of data loggers
		Sampling frequency in Hz

Level 1 (main menu)	**Level 2**	**Level 3**
		Data logger 1: • Stop event • Stop delay time in s (MIN to MAX) • Restart • Stop
		Data logger 2: • Stop event • Stop delay time in s (MIN to MAX) • Restart • Stop
	System settings	Date
		Time
		Language
		New password
	View	User info page: Off / on
	Display contrast	MIN to MAX in %
	Functions	ST command: Function / time delay (MIN to MAX)
		CC command: Function / time delay (MIN to MAX)
	Maintenance *Settings*	Alarms: Off / on

ESD guidelines

B

B.1 Electrostatic sensitive devices (ESD)

ESD components are destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged. ESD components which have been subject to such voltage are usually not recognized immediately as being defective, because the malfunction does not occur until after a longer period of operation.

ESD Guidelines

NOTICE

Electrostatic sensitive devices

Electronic modules contain components that can be destroyed by electrostatic discharge. These modules can be easily destroyed or damaged by improper handling.

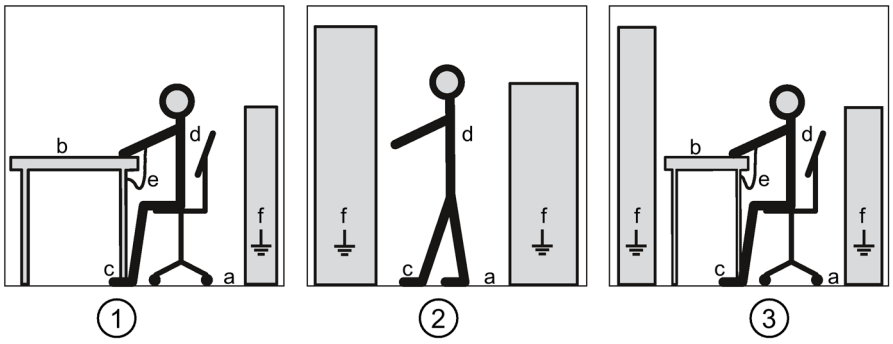
- You must discharge your body electrostatically immediately before touching an electronic component. To do this, touch a conductive, grounded object, e.g., a bare metal part of a switch cabinet or the water pipe.
- Always hold the component by the plastic enclosure.
- Electronic modules should not be brought into contact with electrically insulating materials such as plastic film, plastic parts, insulating table supports or clothing made of synthetic fibers.
- Always place electrostatic sensitive devices on conductive bases.
- Always store and transport electronic modules or components in ESD-safe conductive packaging, e.g. metallized plastic or metal containers. Leave the component in its packaging until installation.

NOTICE

Storage and transport

If you have to store or transport the component in non-conductive packaging, you must first pack the component in ESD-safe, conductive material, e.g., conductive foam rubber, ESD bag.

The diagrams below illustrate the required ESD protective measures for electrostatic sensitive devices.



(1) ESD seat
(2) ESD standing position
(3) ESD seat and ESD standing position

Protective measures

a Conductive floor
b ESD table
c ESD footwear
d ESD smock
e ESD bracelet
f Cubicle ground connection

Figure B-1 ESD work center

List of abbreviations

C

C.1 Table of abbreviations

Overview

Table C- 1 Meaning of abbreviations used in this document

Abbreviation	Meaning
AC	AC voltage
ACB	Air circuit breaker
ACT	Actuator module
AUX	Auxiliary switch
CC	Closing coil
DC	Direct voltage
DIN	Deutsches Institut für Normierung e. V. (German Institute for Standardization)
DISCON	DISCONNECT
ESD	Electrostatic sensitive devices
EMC	Electromagnetic compatibility
EN	European Standard
ETU	Electronic trip unit
G	Ground fault (ground-fault protection GF)
GF	Ground fault (protection)
I	Instantaneous (instantaneous short-circuit protection INST)
I/O	Input / Output
IEC	International Electrotechnical Commission
INST	Instantaneous (short-circuit protection)
IP	International Protection
L	Long time delay (overload protection LT), overload release
LT [tripping characteris-tic]	Partial overload range of the characteristic curve of a switching device
MF	Metering function
MO	Motor operator (spring charging motor)
MOC	Mechanical Operating Counter (mechanical operating cycles counter)
N	Neutral conductor, neutral protection
LV	Low voltage
LV fuse	Low-voltage fuse
PSS	Position signaling switch
Rc CT	Summation current transformer

Abbreviation	Meaning
RCD	Residual Current Device
RR	Remote reset magnet
RTC	Ready to close signaling switch
S	Short-time-delayed short-circuit protection (ST)
ST	Short-time-delayed short-circuit protection
ST/CC	Auxiliary solenoid
TCP	Transmission Control Protocol
TD	Test Device
USB	Universal Serial Bus
UVR	Undervoltage release
VDE	Verein Deutscher Ingenieure (Association of German Electrical Engineers)
VDI	Verein Deutscher Ingenieure (Association of German Engineers)

Table C- 2 Meaning of symbols and abbreviations

Sym-bol/abbreviation	Meaning
Δt	Delay time
$I_{\Delta n}$	Residual current; rated residual current; response current
I_1	Inrush current
I''_{KG}	Initial balanced short-circuit current
I^2t	Let-through energy
I_{cm}	Making capacity; rated short-circuit making capacity
I_{cn}	Rated breaking capacity; rated short-circuit breaking capacity
I_{cs}	Maximum short-circuit breaking capacity (partial selectivity); rated service short-circuit breaking capacity
I_{cu}	Maximum short-circuit breaking capacity (full selectivity); rated ultimate short-circuit breaking capacity
I_{cw}	Rated short-time withstand current; rated short-time current
I_d	Prospective current; residual current; response residual current
I_D	Let-through current
I_g	Ground-fault protection; ground-fault release; ground-fault current setting value
I_i	Instantaneous tripping current; instantaneous short-circuit protection; instantaneous magnetic protection; rated tripping current of instantaneous trip
I_k	Short-circuit current
I_{KD}	Uninterrupted short-circuit current
$I_{K\ MAX}$	Maximum short-circuit current
$I_{Kmaxline}$	Uninterrupted short-circuit current of system
I_n	Rated current
I_P	Rated peak withstand current, impulse short-circuit current
I_r	Thermal protection; setting current; response value; current setting value of adjustable overload protection (pickup value overload protection)

Sym-bol/abbreviation	Meaning
I_s	Limit current with selectivity; maximum short-circuit current for selectivity limit
I_{sc}	Prospective current
I_{sd}	Short-time delayed tripping current; response current of S protection; short-time delayed short-circuit release; short-time delayed short-circuit protection; delay time of S protection
I_{th}	Conventional free-air thermal current
I_U	Rated uninterrupted current
R_A	Contact resistance of exposed conductive part ground
t_1	Time of inrush current
t_2	Ramp up time
t_A	Safety clearance
t_g	Delay time associated with the adjustable response current; trip time associated with ground-fault current setting value
T_p	Trip time; delay time; time-lag class
t_r	Trip time associated with current setting value of adjustable overload protection
t_{sd}	Trip time associated with short-time delayed tripping current; delay time of S protection
U	Voltage across main contacts of the molded case circuit breaker
U_e	Maximum voltage; rated operational voltage
U_{Nn}	Nominal system voltage
U_s	Rated control supply voltage

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Further Information

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