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MANUAL

SENTRON

Protection devices

3WA1 Air Circuit Breakers

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Protection devices
3WA1 air circuit breaker

Equipment Manual

10/2023

92310000002-08

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 Aktiengesellschaft. 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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Ⓟ 11/2023 Subject to change

Table of contents

Introduction

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1.1 Scope of validity of this document

This Equipment Manual is a reference manual for technical information that users will need to configure, connect, and operate the 3WA circuit breakers and their accessories.

1.2 Target readers of this documentation

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

- Planners
- Power distribution equipment manufacturers/builders
- Commissioning engineers
- Users
- Maintenance personnel

1.3 Technical Support

You can find further support on the Internet at:

TechnicalSupport (https://www.siemens.com/support-request)

1.4 Reference documents

For more information, refer to the following documents:

Title	Article number
3WA Circuit Breaker Communication System Manual (https://support.industry.siemens.com/cs/ww/en/view/109792368)	
3WA1 air circuit breakers, IEC 60947-2, Chapter 1 of Catalog LV 10 Catalog LV 10 - Low-Voltage Power Distribution and Electrical Installation Technology (https://support.industry.siemens.com/cs/ww/en/view/109795913)	
3WA3 air circuit breakers, UL 1066 / IEC 60947-2, Chapter 1 of Catalog LV 18 Catalog LV 18 - Air Circuit Breakers and Molded Case Circuit Breakers with UL Certification (https://support.industry.siemens.com/cs/ww/en/view/109761061)	

Title	Article number
GSDML file (https://support.industry.siemens.com/cs/WW/en/view/109793939) for the COM190 communications module of the 3WA circuit breaker	
Modbus register (https://support.industry.siemens.com/cs/de/en/view/109794278) for the COM150 and COM190 communications modules of the 3WA circuit breaker	
3KC ATC3100 Transfer Control Devices Manual (https://support.industry.siemens.com/cs/ww/en/view/100341671)	
3KC ATC6300 Transfer Control Devices Manual (https://support.industry.siemens.com/cs/ww/en/view/109755149)	
3KC ATC6500 Transfer Control Devices Manual (https://support.industry.siemens.com/cs/ww/en/view/109758018)	
7KN Powercenter 3000 Manual (https://support.industry.siemens.com/cs/ww/en/view/109763838)	
Hartmut Kiank, Wolfgang Fruth: Planning Guide for Power Distribution Plants, Publicis Publishing	ISBN-10 3895783595
Schalten, Schützen, Verteilen in Niederspannungsnetzen (Switching, Protection and Distribution in Low-Voltage Networks), substantially extended and revised edition 1997	ISBN-10 3895780413

1.5 Advanced training courses

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

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

Here you can choose from:

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

If the correct training course is not shown, you can also get information from your local sales representative.

1.6 Safety instructions

DANGER

Hazardous voltage
Will cause death, serious personal injury, or equipment damage.

During operation, parts of the device or system are carrying hazardous electrical voltage. Improper handling of the device or system can result in death or serious injury, as well as significant material damage.

- Inspection and maintenance may only be performed by qualified personnel.
- Pay attention to all the notices provided on the product and in this manual.
- Before commencing maintenance work, ensure that no voltage is present on the power distribution equipment and make sure that this condition is maintained while work is being performed (according to EN 50110-1, DIN VDE 0105-100 and BGV A2).
  Proceed in accordance with the Five Safety Rules:
  – Turn off all power supplying the equipment.
  – Lock out all power supplying the equipment to secure against reconnection.
  – Verify that no voltage is present on the device.
  – Ground and short the circuit.
  – Provide protection against adjacent live parts.

Qualified personnel

Inspection and maintenance may only be performed by qualified personnel.

In the context of these operating instructions and the warning notices on the product, qualified personnel refers to persons who are familiar with the erection, installation, commissioning and operation of the product and who possess the qualifications appropriate for their activities, e.g.:

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

Spare parts

Only spare parts approved by the manufacturer may be used.

1.6.1 Cybersecurity information

Siemens provides products and solutions with industrial cybersecurity 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 cybersecurity concept. Siemens' products and solutions constitute 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 cybersecurity measures that may be implemented, please visit (https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity.html).

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 Cybersecurity RSS Feed at (https://www.siemens.com/global/en/products/automation/topic-areas/industrial-cybersecurity.html):

1.6.2 Open Source Software

This product, solution or service ("Product") contains third-party software components. These components are Open Source Software licensed under a license approved by the Open Source Initiative (https://www.opensource.org) or similar licenses as determined by SIEMENS ("OSS") and/or commercial or freeware software components. With respect to the OSS components, the applicable OSS license conditions prevail over any other terms and conditions covering the Product. The OSS portions of this Product are provided royalty-free and can be used at no charge.

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Technical Support
Postfach 10 09 53
93009 Regensburg
Germany

You will find Technical Support under (https://www.siemens.com/support-request).

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

SIEMENS may charge a handling fee of up to 5 EUR to fulfil the request.

Warranty regarding further use of the Open Source Software

SIEMENS' warranty obligations are set forth in your agreement with SIEMENS. SIEMENS does not provide any warranty or technical support for this Product or any OSS components contained in it if they are modified or used in any manner not specified by SIEMENS.
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1.6.3 More information on Open Source software for 3WA circuit breakers

In addition to the sources listed in Chapter Open Source Software (Page 20), further information about the used OSS licenses can be found on the Internet (https://support.industry.siemens.com/cs/ww/en/view/109782123).

1.7 Standards

The 3WA1 air circuit breakers comply with the following standards:

- IEC 60947-2 / EN 60947-2 (emission limits according to CISPR 11 (Group 1/Class B) and CISPR 32 (Class B))
- IEC 60692-2-5 / EN 60692-2-5
- ETSI EN 301 489-17 (only circuit breakers with radio function)
- ETSI EN 301 328 (only circuit breakers with radio function)
- EN IEC 63000

1.8 Abbreviations

You can find explanations of the abbreviations used in the text in Chapter List of abbreviations (Page 545).

Description 2

2.1 Overview - applications and portfolio

2.1.1 Properties

The 3WA circuit breaker is the new generation of air circuit breakers in the Siemens AG portfolio. It is based on the proven and robust design of its predecessor 3WL. The technical data of the 3WA circuit breaker mechanics and the portfolio have been extended as compared with 3WL, and the electronic components have been completely redeveloped.

The 3WA circuit breaker is part of the product family of SENTRON protection, switching, measuring and monitoring devices and covers applications in the rated current range from 630 A to 6300 A.

- AC devices are available as circuit breakers and non-automatic circuit breakers. For more information, see Chapter Circuit breakers and non-automatic circuit breakers (Page 26).
- DC devices are only available as non-automatic circuit breakers.

The 3WA1 circuit breaker has the following properties:

- Three sizes:
  - Size 1
    AC with a rated current I_n from 630 A to 2500 A
  - Size 2
    AC with a rated current I_n from 2000 A to 4000 A
    DC with a rated current I_n from 1000 A to 4000 A
  - Size 3
    AC with a rated current I_n from 4000 A to 6300 A
- ETU300 electronic trip unit:
  - Functionally expandable with an exchangeable option plug
  - Easy parameterization of the basic protective functions using rotary switches
- ETU600 electronic trip unit:
  - Functionally expandable with an exchangeable option plug and digital function packages
  - Easy parameterization of the basic protective functions using rotary switches or via four operating keys and a color display
  - User-friendly parameter assignment or documentation of settings with the SENTRON powerconfig configuration software via Bluetooth, the USB interface, or a communications module
- Wide range of versatile primary connectors
- Easy integration into power distribution equipment according to IEC 61439-2
- Replacement of the 3WL circuit breaker with minimum design and testing effort

- Optional expansion with a wide range of internal and external accessories
- Integrated and shared communication concept with the 3VA molded case circuit breakers and the 7KM PAC measuring devices.
  Option for direct integration into the Siemens communication environment via optional accessories:
  - Communications modules for PROFINET IO, Modbus TCP, Modbus RTU
  - Digital input/output modules
  - Graded metering functions for efficient energy management
- Integration of the circuit breakers into the Totally Integrated Power (TIP) and Totally Integrated Automation (TIA) solutions
- Integration into the SENTRON software environment, such as SENTRON powerconfig configuration software and powermanager

The 3WA air circuit breaker meets the following basic requirements:

- Highly competitive breaking capacity up to 690 V AC
- Very high breaking capacity at the rated voltages 1000 V AC and 1150 V AC
- Optimum selectivity
- Metering function with internal voltage tap
- Optional connection to a fieldbus communication system or Ethernet-based IP communication system with up to 2 communications modules simultaneously

Product features

The main product features of the 3WA circuit breaker are:

- Compact dimensions
- Rated current range from 630 A to 6300 A
- Breaking capacity up to:
  - 150 kA at 500 V AC
  - 125 kA at 1000 V AC
- Available fixed-mounted and withdrawable versions
- ETU600 electronic trip unit with Bluetooth and USB-C interface, future-oriented with upgradeable functional expansions
- Optional integrated metering function according to IEC 61557-12
- Internal voltage tap up to 1000 V AC
- Use in AC and DC applications
- Optimized, low derating values according to IEC 60947-2
- Modular, easy-to-install accessories

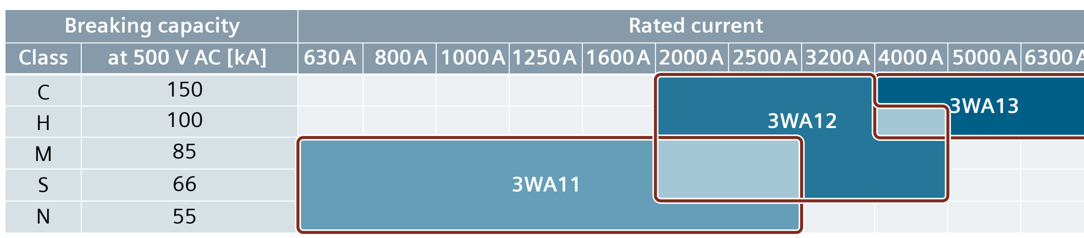
- Accessories are designed for the maximum service life of the circuit breaker.
- Support by CAx files, EPLAN macros and Siemens tools simplifies planning and integration of the circuit breaker into the overall installation.

2.1.2 Portfolio of the 3WA1 circuit breaker

The 3WA1 series comprises the circuit breakers

- 3WA11: Size 1
- 3WA12: Size 2
- 3WA13: Size 3

The series covers breaking capacities up to 150 kA at 500 V AC.



Size 2 covers breaking capacities I_{cc} up to 20 kA at 1500 V DC.

3WA12 DC		**Breaking capacity class I_{cc}**	
		D	**E**
up to 220 V DC		35 kA	
up to 300 V DC		30 kA	
up to 600 V DC		25 kA	
up to 1000 V DC		--	20 kA
up to 1500 V DC	3-pole	--	--
	4-pole	--	20 kA

2.1.3 Advantages

- High modularity
  In order to adapt the circuit breaker to new and changing requirements, components such as auxiliary releases, motorized operating mechanisms, external current sensors, auxiliary circuit signaling switches, automatic reset devices, and interlocks can be retrofit or replaced.
- Quick functional expansion
  The protective functions of the ETU600 electronic trip unit can be quickly adapted to the requirements of the installation site:
  - Ground-fault protection can be added by simply exchanging the option plug (LSIG version).
  - Protection and alarm functions, but also graded metering functions, can be added via digital function packages.
- Flexible communication/metering function
  The communications modules of the 3WA circuit breaker offer the PROFINET IO, Modbus TCP, and Modbus RTU communication protocols, which can be used simultaneously. Furthermore, two communications modules with the same or different protocols can be operated independently of each other on a circuit breaker, for example in a redundancy system. The retrofittable modules can be mounted directly on the circuit breaker to save space or flexibly and externally on a DIN rail. The communications modules are updatable, they provide security functions to protect against unauthorized access.
- Low inspection/maintenance effort
  - Only inspection required
  - No relubrication of moving parts in the circuit breaker
  - Parts only need to be replaced during maintenance if this is deemed necessary based on the inspection results. Accessory components are designed for the maximum specified service life of the circuit breaker under normal operating conditions.
  - Inspection and maintenance work may be carried out by qualified personnel of the operator or by a contracted company.
- Low space requirement
  The 3WA13 circuit breakers (size 3) are extremely compact:
  3-pole circuit breakers fit into an 800 mm wide control panel.
  4-pole circuit breakers can be installed in a 1000 mm wide control panel.

2.2 Circuit breakers and non-automatic circuit breakers

2.2.1 Distinction between circuit breakers and non-automatic circuit breakers

The 3WA can be used as a circuit breaker with electronic trip unit, but also as a non-automatic circuit breaker according to IEC 60947-2.

Circuit breakers

The IEC 60947-2 standard applies to circuit breakers whose main contacts are designed for connection to circuits with rated voltages up to 1000 V AC or 1500 V DC. According to IEC 60947-2, a circuit breaker is "a mechanical switching device, capable of making, carrying and breaking currents under normal circuit conditions and also making, carrying for a specified time and breaking currents under specified abnormal circuit conditions".

Non-automatic circuit breakers

Non-automatic circuit breakers have a rated conditional short-circuit current I_{cc} and may be used as disconnectors, since the IEC 60947-2 standard also defines requirements for the isolating function.

The 3WA non-automatic circuit breakers are tested according to IEC 60947-2 Annex L. Annex L deals with circuit breakers which do not meet the requirements of overcurrent protection. They are called circuit breaker interrupters (CBI). A CBI can be tripped with auxiliary releases, e.g. shunt trips or undervoltage releases, also under short-circuit conditions, and is therefore to be considered a higher-value device compared to switch disconnectors according to IEC 60947-3, since switch disconnectors can disconnect at most the rated current.

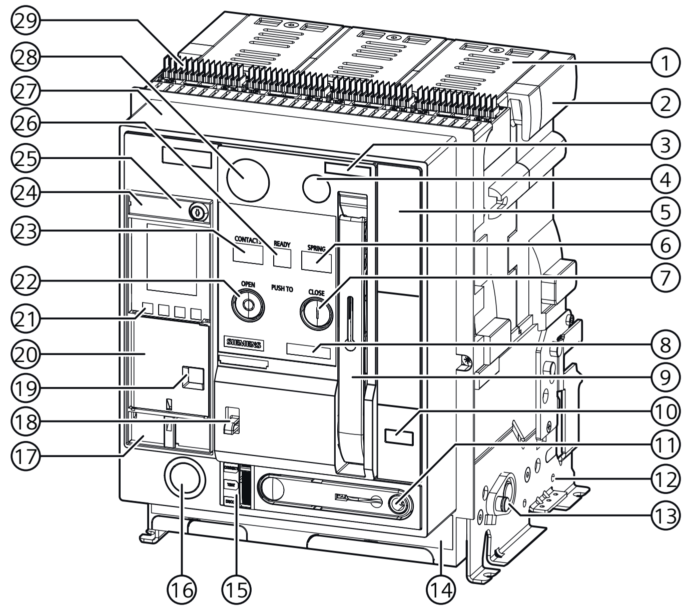
A CBI is part of a circuit breaker series, being derived from the equivalent circuit breaker by omitting the overcurrent release (type Y) or only the overload release (type X).

The following has been implemented for the 3WA non-automatic circuit breaker:

- Implementation of the circuit breaker without overcurrent release as CBI-Y
- The CBI-Y has an "isolating function", hence the name "non-automatic circuit breaker"
- The rated conditional short-circuit current I_{cc} corresponds to the I_{cw} of the non-automatic circuit breaker over 0.5 s.

2.2.2 Design

2.2.2.1 Circuit breakers



(1) Arc chute

(2) Carrying handle

(3) Labeling plate

(4) Motor disconnect switch (option) or local electric close (S10) (option)

(5) Circuit breaker rating plate

(6) Spring charge indicator

(7) Local mechanical close

(8) Max. rated circuit breaker current

(9) Charging handle

(10) Operating cycles counter (option)

(11) Racking handle

(12) Ground connection

(13) Retractable shaft (only withdrawable version)

(14) Accessory label

(15) Position indicator

(16) Locking provision for racking handle (option)

(17) Voltage tap module VTM (option)

(18) Mechanical unlatching of the racking handle

(19) Query button

(20) Electronic trip unit ETU

(21) Operating keys ETU600

(22) Mechanical OPEN button or Emergency OPEN button (mushroom pushbutton, option)

(23) Switch position indicator

(24) Tripped indicator ETU TRIP (reset button)

(25) Trip indicator EXT TRIP (reset button), optional

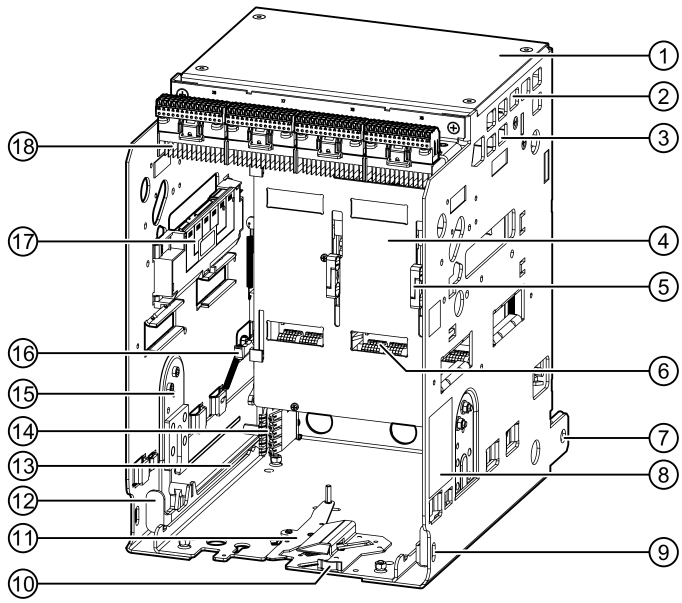
(26) Ready-to-close indicator

(27) Operator panel

(28) Locking provision Safe Open (option)

(29) Base part for secondary disconnect terminal

2.2.2.2 Guide frame

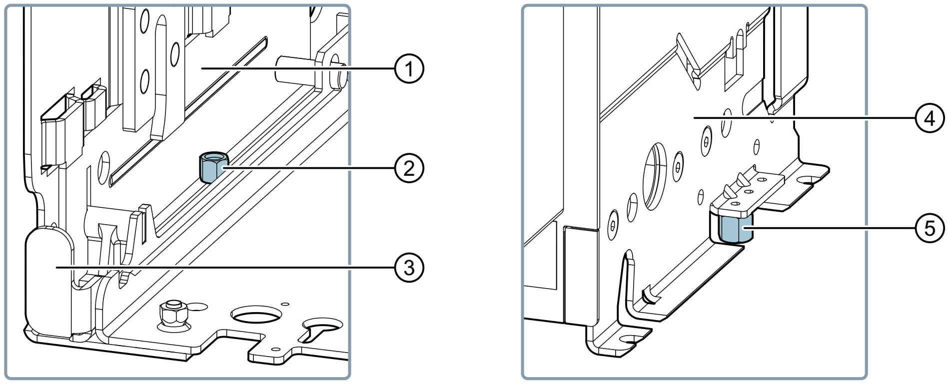


(1)	Arc chute cover (option)	(10)	Locking provision to prevent racking of the withdrawable circuit breaker with the control cabinet door open (option)
(2)	Opening for crane hook	(11)	Locking provision to prevent opening of the control cabinet door when the circuit breaker is closed (option)
(3)	Arcing openings	(12)	Racking rail
(4)	Shutter	(13)	Rated-current coding at factory
(5)	Shutter lever (for opening the shutter during maintenance or inspection)	(14)	Sliding contact for circuit breaker grounding (option)
(6)	Finger clusters	(15)	Equipment-dependent coding (option)
(7)	Ground connection	(16)	Shutter actuator
(8)	Accessory label for guide frame	(17)	Position signaling switch module (option)
(9)	Locking provision for racking rails	(18)	Sliding contact modules with attached push-in plugs

Rated-current coding

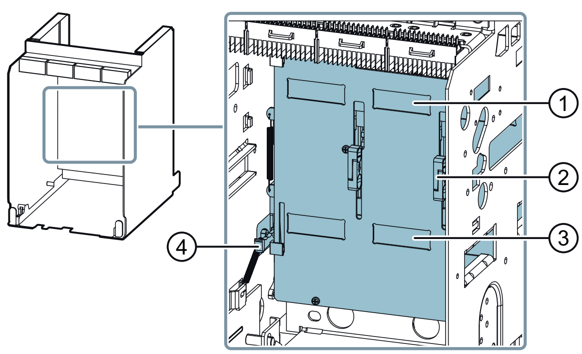
Guide frames and withdrawable circuit breakers are equipped with a rated-current coding as standard.

Rated-current coding ensures that only those circuit breakers whose guide frames are designed for the circuit breakers can be inserted into the guide frame.



(1) Guide frame, left inner side (right inner side accordingly)
(2) Coding pin on the racking rail in the guide frame
(3) Racking rail
(4) Withdrawable circuit breaker, right side (left side correspondingly)
(5) Coding pin on withdrawable circuit breaker

Shutter



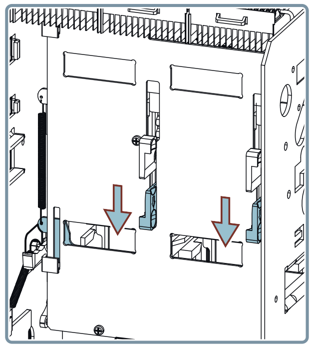
(1) Top sliding cover
(2) Shutter lever (in center position)
(3) Bottom sliding cover
(4) Shutter actuator

The shutter is used for touch protection. It consists of molded-plastic plates and covers the live main circuit in the guide frame.

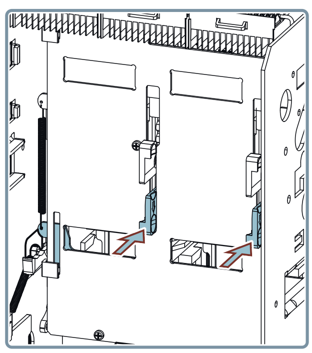
The sliding covers of the shutter close over the contacts of the guide frame in the movement positions "TEST" and "DISCONNECT". Thus the isolation condition is already fulfilled in the movement position "TEST".

For service purposes, the sliding covers can be opened and fixed manually with the aid of the shutter levers.

Example: opening the lower sliding covers



Light pressure on the shutter lever releases the fixation. The shutter levers return to the initial position and close the sliding covers.

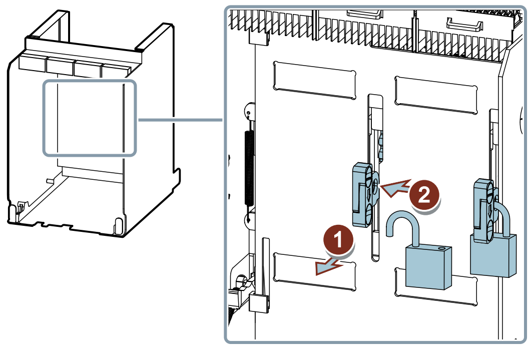


NOTICE
Damage to the shutter If the withdrawable circuit breaker is inserted while the shutter levers are fixed, the shutter may become damaged. Only insert the withdrawable circuit breaker in the guide frame if the sliding covers are closed and the shutter levers are in the central position and unlocked.

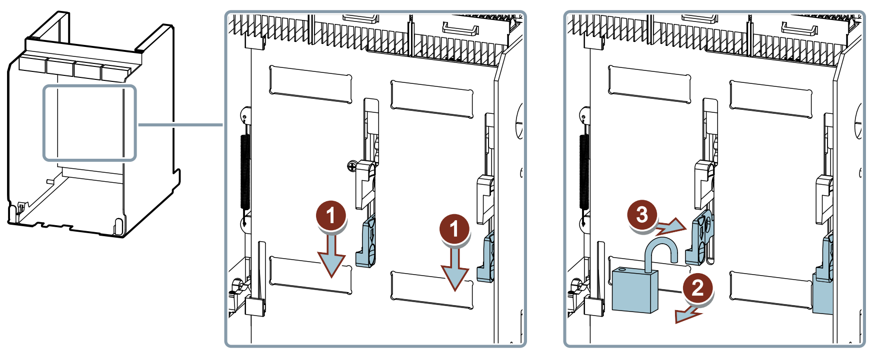
Locking provision for the shutter

The locking provision secures the shutter levers with padlocks in different positions. This protects the openings defined by the shutter lever position against unauthorized alteration.

- Locking in completely closed shutter position



- Locking with shutter open at the bottom



Before inserting the withdrawable circuit breaker, the padlocks must be removed from the shutter levers.

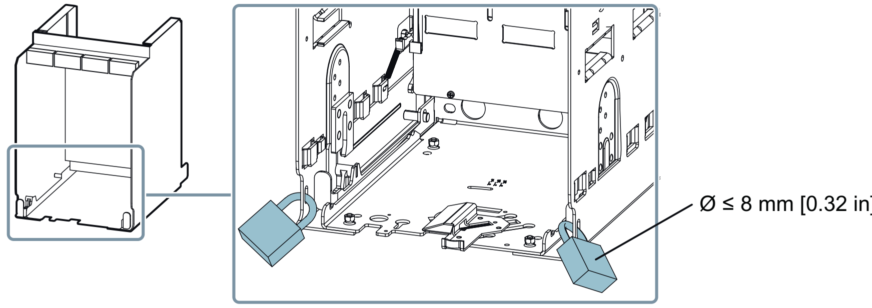
The locking provision for the shutter is installed at the factory as standard and ready for use. Padlocks are not included in the scope of supply.

Locking provision for racking rails

The locking provision prevents the insertion of a circuit breaker in the guide frame. For this purpose, the racking rails are locked with padlocks so that they cannot be pulled out again.

Activation

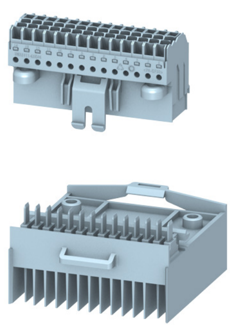
In order to activate the locking provision, once the circuit breaker has been removed, the racking rails are completely inserted into the guide frame and secured in this position with padlocks.



The locking provision for the racking rails is installed at the factory as standard. Padlocks are not included in the scope of supply.

2.2.2.3 Secondary disconnect terminals

Description



Internal electrical accessory components such as the closing coil receive their supply voltage via the secondary disconnect terminals.

A maximum of four secondary disconnect terminal blocks are available for frame size 1 circuit breakers and up to five for frame sizes 2 and 3. Included in the scope of supply as standard:

- Non-automatic circuit breaker: 3 secondary disconnect terminal blocks (X5 to X7)
- Non-automatic circuit breaker ready4COM: 4 secondary disconnect terminal blocks (X5 to X8)
- Circuit breaker: 4 secondary disconnect terminal blocks (X5 to X8)
- Circuit breaker with ETU600 LSIG Hi-Z: 5 secondary disconnect terminal blocks (X5 to X9)

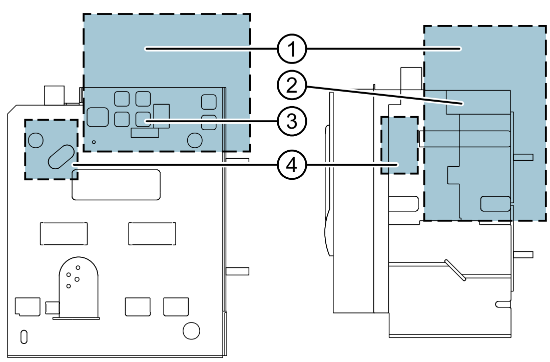
All secondary disconnect terminals are designed with push-in technology as standard. With this innovative technology, solid conductors and conductors with end sleeves are simply inserted all the way into the clamping point (time savings of up to 50%). Finely stranded conductors can also be connected without much effort.

As an option, the control wire taps are also available from the factory with compression screw terminals or ring lug connection terminals.

For more information on the secondary disconnect terminals, see Chapters Secondary disconnect terminals for fixed-mounted circuit breakers (Page 282) and Secondary disconnect terminals for withdrawable circuit breakers (Page 284).

Laying of cables

NOTICE
Damage to cables
Cables in impermissible areas can be damaged.
Route cables **outside** areas shown below.

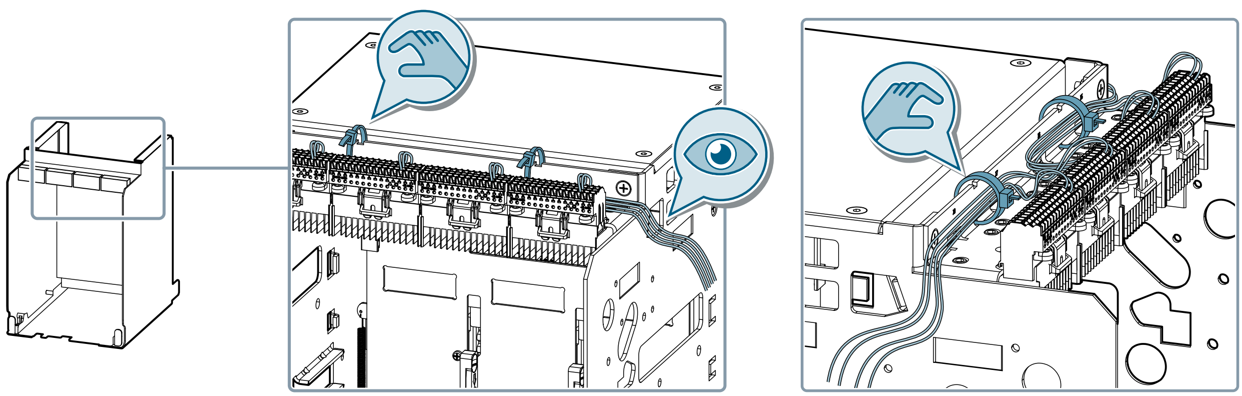


(1) Arcing space
If arc chute covers are provided, the auxiliary conductors must not be laid on these covers.

(2) Carrying handle

(3) Arcing openings

(4) Interlocks



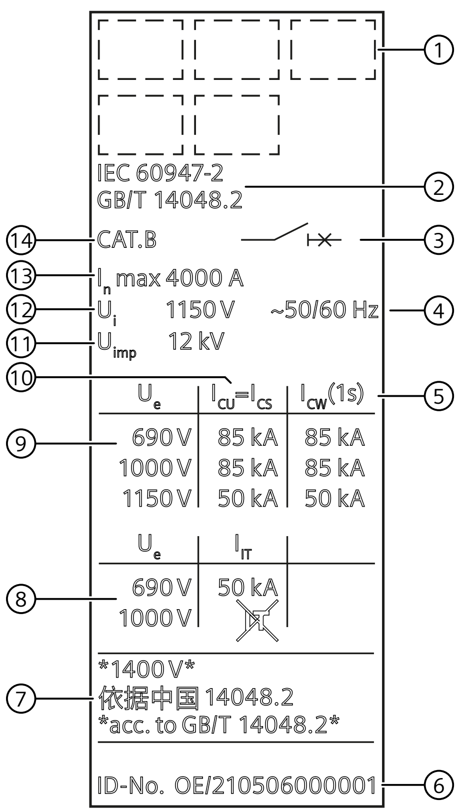
2.2.3 Circuit breaker identification

2.2.3.1 Rating und accessory labels of circuit breaker

The rating and accessory labels provide clear identification of the circuit breaker. They contain the article number, equipment details, and further information on the circuit breaker.

The rated current I_n of the circuit breaker is indicated on the option plug of the electronic trip unit. The option plug is described in Chapter Option plug (Page 45).

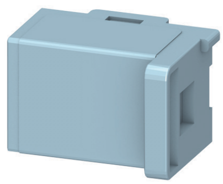
Rating plate



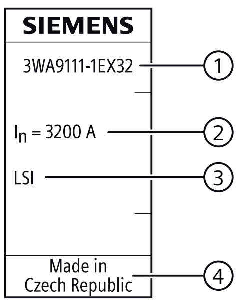
(1)	Approvals, such as CE, UKCA, RCM, CCC, EAC or C-Tick	(8)	Technical specifications for IT system low-voltage network type
(2)	Standards	(9)	Rated operational voltage
(3)	Isolating function	(10)	Rated short-circuit breaking capacity
(4)	Rated frequencies	(11)	Rated impulse withstand voltage
(5)	Rated short-time withstand current	(12)	Rated insulation voltage
(6)	ID number	(13)	Maximum rated current
(7)	Note regarding voltage reduction according to the Chinese standard	(14)	Utilization category

Rated current and basic protective functions

The rated current and the basic protective functions are indicated on the option plug.



The option plug has the following marking.



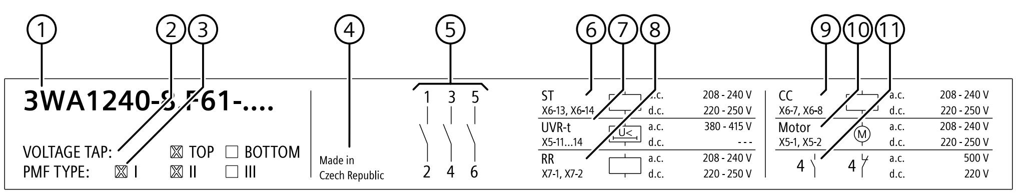
(1) Article number of option plug (on the top, not visible when plugged in)

(2) Rated current

(3) Basic protective functions

(4) Country of origin (on the bottom side, not visible when plugged in)

Accessory labels



(1) Article number without internal accessories

(2) Internal voltage tap

(3) Variant of the metering function

(4) Country of origin

(5) Polarity of main conducting paths

(6) 1st shunt trip (ST or ST-COM)

(7) 2nd shunt trip (ST2) or undervoltage release (UVR or UVR-t)

(8) Remote trip alarm reset coil (RR)

(9) Closing coil (CC or CC-COM)

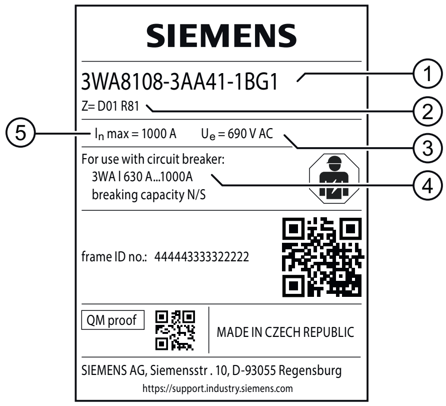
(10) Spring charging motor (M)

(11) Auxiliary contacts (AUX)

When retrofitting internal electrical accessories, e.g. spring charging motor or closing coil, this can be noted on the accessory label.

The self-adhesive labels required for this purpose are included in the scope of supply of the respective accessory.

2.2.3.2 Guide frame rating label



(1) Article number guide frame

(2) Indicator "Further options"

(3) Rated operational voltage

(4) Circuit breakers that can be used

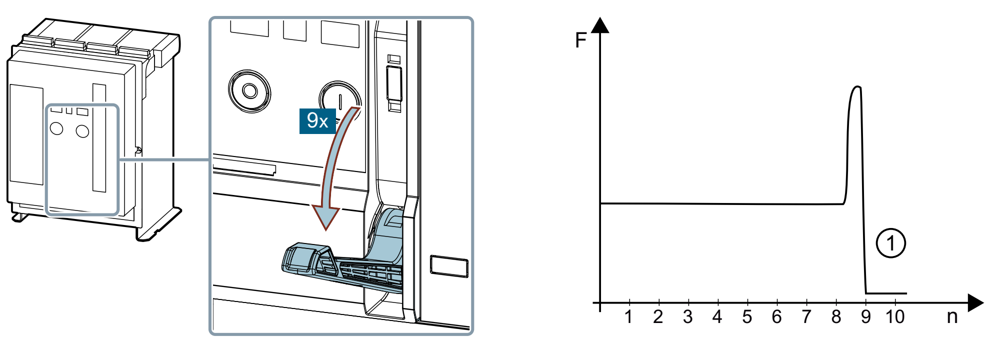
(5) Maximum rated current

2.2.4 Operation

2.2.4.1 Charging the stored-energy spring

To be able to close the circuit breaker, the stored energy mechanism must be charged.

Manually charging the stored energy mechanism



F Actuating force

n Number of strokes

(1) Stored-energy spring is charged

1. Fully grasp the charging handle.
2. Execute nine strokes evenly and completely to the stop.
   Execute the ninth stroke just as far and evenly as the first eight strokes, although the actuating force will increase (see preceding graphic).

Once the stored energy mechanism has been fully charged, the charging handle can be moved without resistance.

Automatically charging the stored energy mechanism

As an option, the stored energy mechanism can also be charged automatically with the spring charging motor. For more information, see Chapter Spring charging motor (Page 245).

2.2.4.2 Closing and opening

Note

The minimum time between ON and OFF command should be at least 100 ms.

Conditions for ready-to-close status

The conditions for the breaker's ready-to-close status can be found in Chapter Commissioning checklist (Page 42).

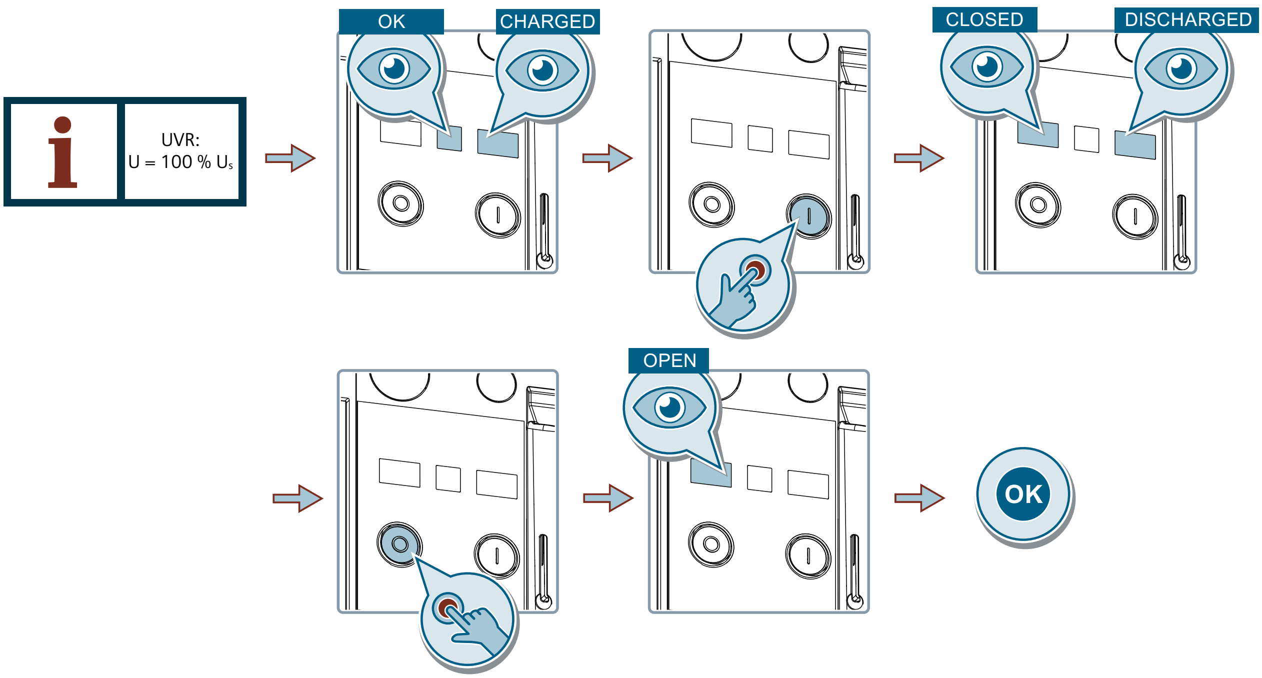
The circuit breaker is ready for closing when the READY window displays OK.

Automatically charging the stored energy mechanism

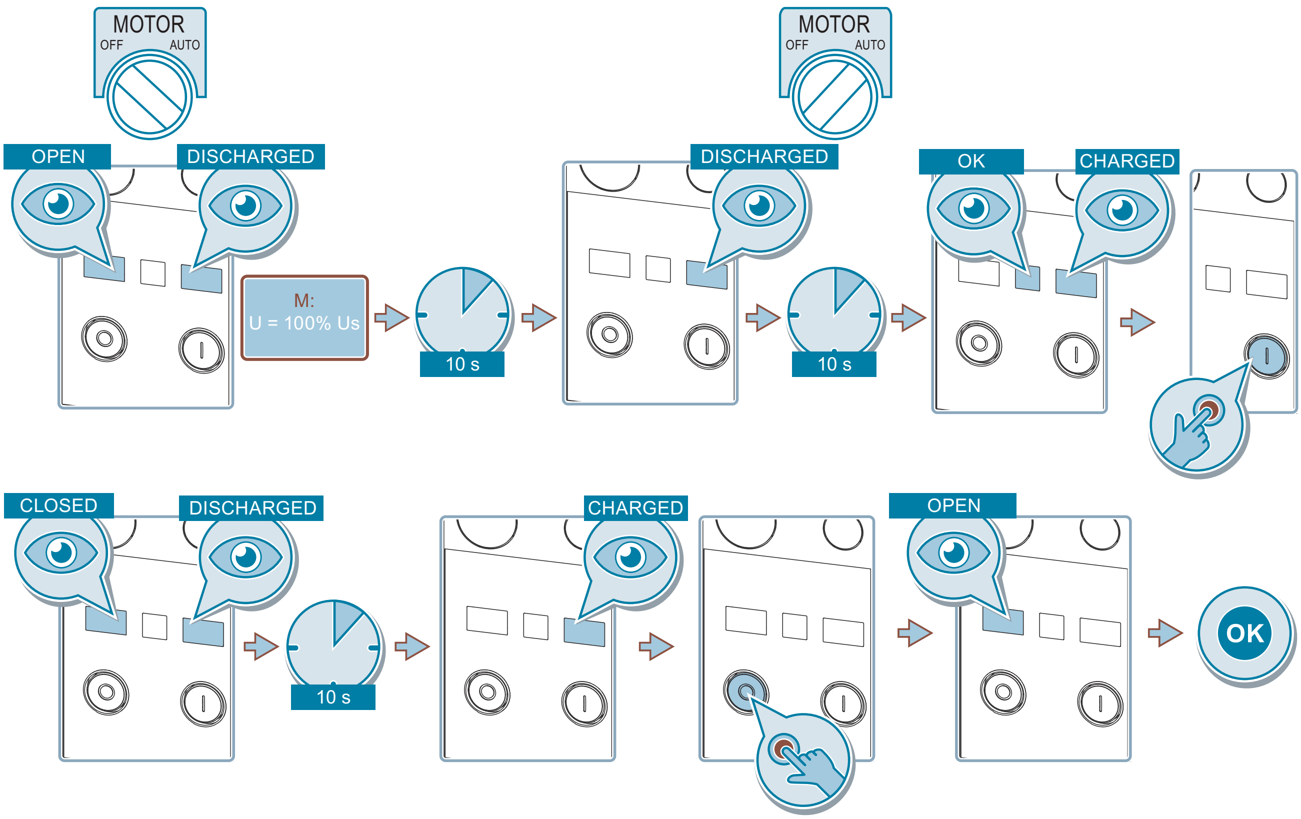
If a spring charging motor is integrated, immediately after switching on, the stored energy mechanism is charged again by the spring charging motor. This can be prevented by an optional motor disconnect switch.

Switching on and off on the operator panel

Switching on and off without spring charging motor and motor disconnect switch



Switching on and off with spring charging motor and motor disconnect switch



Remote switching

Remote switching of the circuit breaker is possible as an option:

- Switching on takes place via the closing coil.
- Switching off takes place via the shunt trips.

Information on these components can be found in Chapter Closing coil, shunt trip, undervoltage release (Page 224).

See also

Communication and system connection (Page 131)

2.2.4.3 Racking the circuit breaker in the guide frame

The withdrawable circuit breaker can be moved to three positions by means of the racking handle. The current position is indicated by the position indicator on the circuit breaker, see Chapter Circuit breakers (Page 28).

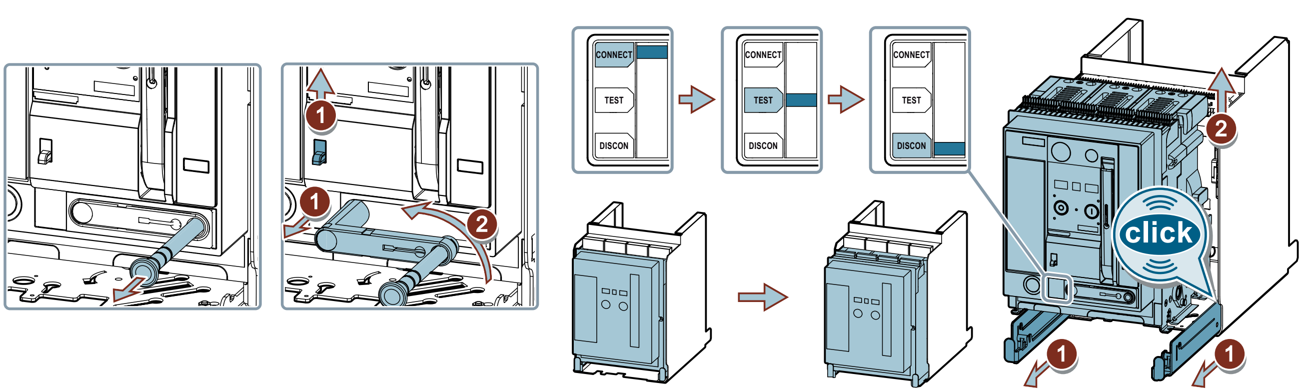
Depending on the position, the main and auxiliary contacts are connected or isolated:

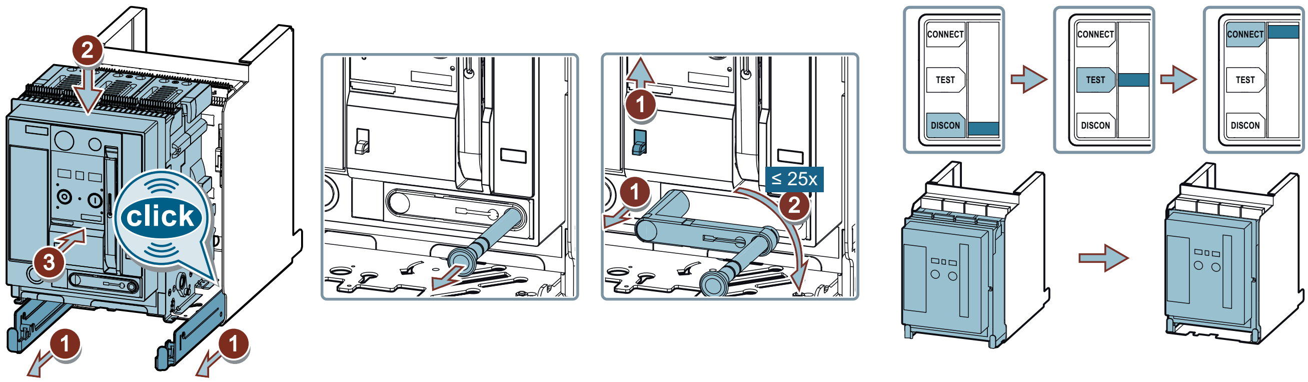
Position	Pictogram display	Main circuit connection	Auxiliary circuits	Shutter	Comment
CONNECT (connected position)	CONNECT	Connected	Connected	Open	
TEST (test position)	TEST	Disconnected and isolated	Connected	Closed	Disconnector condition fulfilled Tests of accessories on the auxiliary circuit possible
DISCONNECT (disconnec-ted position)	DISCON	Disconnected and isolated	Disconnec-ted	Closed	Removal/insertion of the circuit breaker pos-sible

A signal diagram for the positions can be found in Chapter Position signaling switch module for guide frame (Page 260).

Racking the circuit breaker

NOTICE
Material damage due to over-rotation of the racking handle
Over-rotation of the racking handle beyond its end stop can damage the racking mechanism.
Once the end stop is reached, the racking handle must be rotated counterclockwise to the rack-in position.





2.2.4.4 Commissioning checklist

Checks and work to be carried out

Before commencing work on the device, observe the safety instructions in Chapter Safety instructions (Page 19).

1. Open the circuit breaker and discharge the stored energy mechanism.
2. Pull out the racking handle (for withdrawable circuit breakers).
3. Move the circuit breaker to the test position (for withdrawable circuit breakers).
4. Press the red reset buttons to reset the mechanical reclosing lockout.
5. Connect the auxiliary and control voltages.
6. Set the parameters on the electronic trip unit.
7. Parameterize the CubicleBUS² modules.
8. Check the bus wiring and the terminating resistor.
9. Perform a communication test.
10. Test the auxiliary functions.
11. Close the control cabinet door.
12. Move the circuit breaker to the connected position (for withdrawable circuit breaker).
13. Insert the racking handle (for withdrawable circuit breakers).
14. Charge the stored energy mechanism.

Conditions for ready-to-close status (depending on equipment with accessories)

The following conditions must be fulfilled for the ready-to-close status:

Undervoltage release:	energized (auxiliary voltage present)
Shunt trip:	not energized

Closing coil	not energized
Mechanical circuit breaker interlocking	not effective
Locking provisions	not activated

Observing status displays

The circuit breaker is ready for closing when the READY window displays OK. It can then be closed manually or by means of a control command.

2.3 Protection system

2.3.1 General description of function

The protection system of the 3WA circuit breaker consists of:

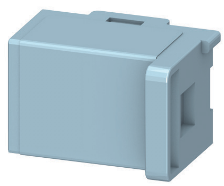
- **Current sensors for measurement**
  The current sensors installed in the 3WA circuit breaker feature a Rogowski coil and an energy core. The measuring signal is provided by the Rogowski coil.
  The Rogowski coil is used as a component in electronic measuring devices to measure alternating current. It is a toroidal coil without a ferromagnetic core and can detect small operational currents as well as large short-circuit currents with very high accuracy.
- **Optional voltage tap at the main conducting paths, including voltage tap module for voltage measurement**
  The optional internal voltage tap is implemented at the lower or upper main conducting paths.
  The voltage is prepared by the voltage tap module and made available to the electronic trip unit for evaluation.
  The voltage tap module is available in 2 versions, see Chapter Voltage tap module VTM for ETU600 (Page 329).
- **Electronic trip unit**
  The electronic trip unit is controlled by a microprocessor and operates independently of an auxiliary voltage. It enables systems to be adapted to the different protection requirements of distribution systems, motors, transformers and generators. In order to enable a quick adaptation to new grid conditions on site, the electronic trip unit has been developed with consistent focus on modularity.
  Among other things, the following functions can be added easily and at any time:
  - Ground-fault protection
  - Changing the current rating
  - Communication
  - Measurement function

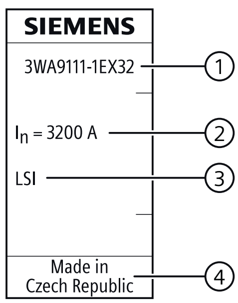
  Depending on the configuration, the electronic trip unit has various protective functions. These protective functions
  - evaluate the measured currents and voltages and
  - compare the measured currents and voltages with the parameterized setting values

  If a measured value exceeds the set threshold, the circuit breaker is tripped with a delay or instantaneously.
  The electronic trip unit is powered (self-acting) by the internal current sensors or optionally via the voltage tap of the measurement function. It can also be powered with a 24 V DC external control voltage.
- **Tripping solenoid to control the mechanical system of the circuit breaker**

2.3.2 Option plug

The option plug determines the current rating and the basic protective functions of the electronic trip unit of the 3WA circuit breaker.





(1) Article number (on top, not visible when plugged in)

(2) Rated current

(3) Basic protective functions

(4) Country of origin (on the bottom side, not visible when plugged in)

The option plug can be replaced to adapt the circuit breaker to changing requirements.

Note

The electronic trip unit continuously monitors the option plug for presence and validity. If no or an impermissible option plug is detected, the electronic trip unit instantaneously trips the 3WA circuit breaker. This is indicated as an error via the red LED INFO as well as in the display of the ETU600.

Changing the current rating

For the 3 sizes of the 3WA circuit breaker, the rated current I_n can be changed to the values given in the table below by means of the option plug. The selected value should correspond to the rated current of the power distribution system and must not exceed the maximum rated current of the circuit breaker $I_{n\ max}$ (see circuit breaker accessory label).

Rated current	Size 1	Size 2	Size 3
250 A	✓	✓	--
315 A	✓	✓	--
400 A	✓	✓	--
500 A	✓	✓	--
630 A	✓	✓	--
800 A	✓	✓	✓

Rated current	Size 1	Size 2	Size 3
1000 A	✓	✓	✓
1250 A	✓	✓	✓
1600 A	✓	✓	✓
2000 A	✓	✓	✓
2500 A	✓	✓	✓
3200 A	--	✓	✓
4000 A	--	✓	✓
5000 A	--	--	✓
6300 A	--	--	✓

Changing the basic protective functions

Option plugs with the following basic protective functions are available for the ETU300 and ETU600 electronic trip units:

	Option plug with protective function LSI	Option plug with protective function LSIG GFx
Overload protection LT	✓	✓
Short-time-delayed short-circuit protection ST	✓	✓
Instantaneous short-circuit protection INST	✓	✓
Ground-fault protection GF	--	✓

By exchanging the option plug and using an LSI option plug, the ground-fault protection GF on the ETU300 LSIG and ETU600 LSIG electronic trip units can be completely deactivated.

2.3.3 Guideline for setting the protection parameters

The protection parameters of the electronic trip unit depend on the technical environment (e.g. power distribution equipment and applications) and the type of equipment to be protected. Therefore, the protection settings must be calculated according to the applicable regulations and the electronic trip unit must be set with these calculated parameters. The Siemens SIMARIS design software is a simple and reliable tool for calculating protection parameters.

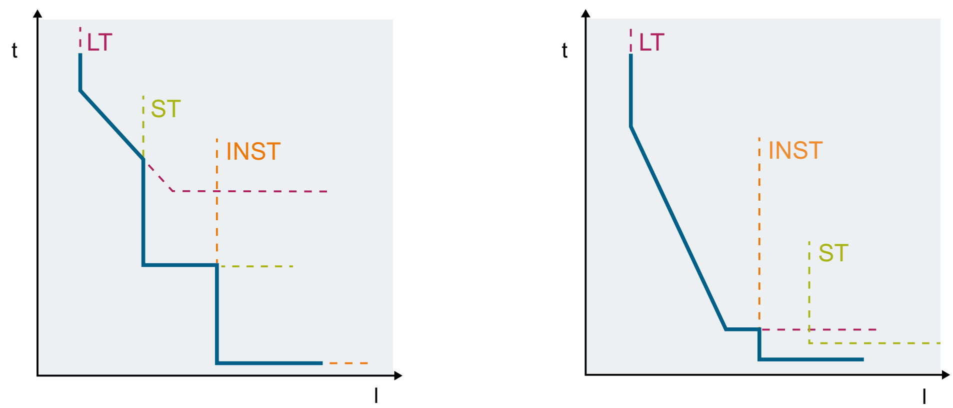
SIMARIS design

The SIMARIS design software will enable you to perform your network calculations based on real products with minimum effort - from the medium-voltage level through to the socket outlet - including the calculations for short-circuit current, load flow, voltage drop and energy balance. SIMARIS design dimensions a reliable solution from the wide range of available products in accordance with recognized rules of technology and the applicable standards (VDE, IEC).

For more information on SIMARIS design, refer to the internet (https://www.siemens.com/simaris).

2.3.4 Time-current characteristic

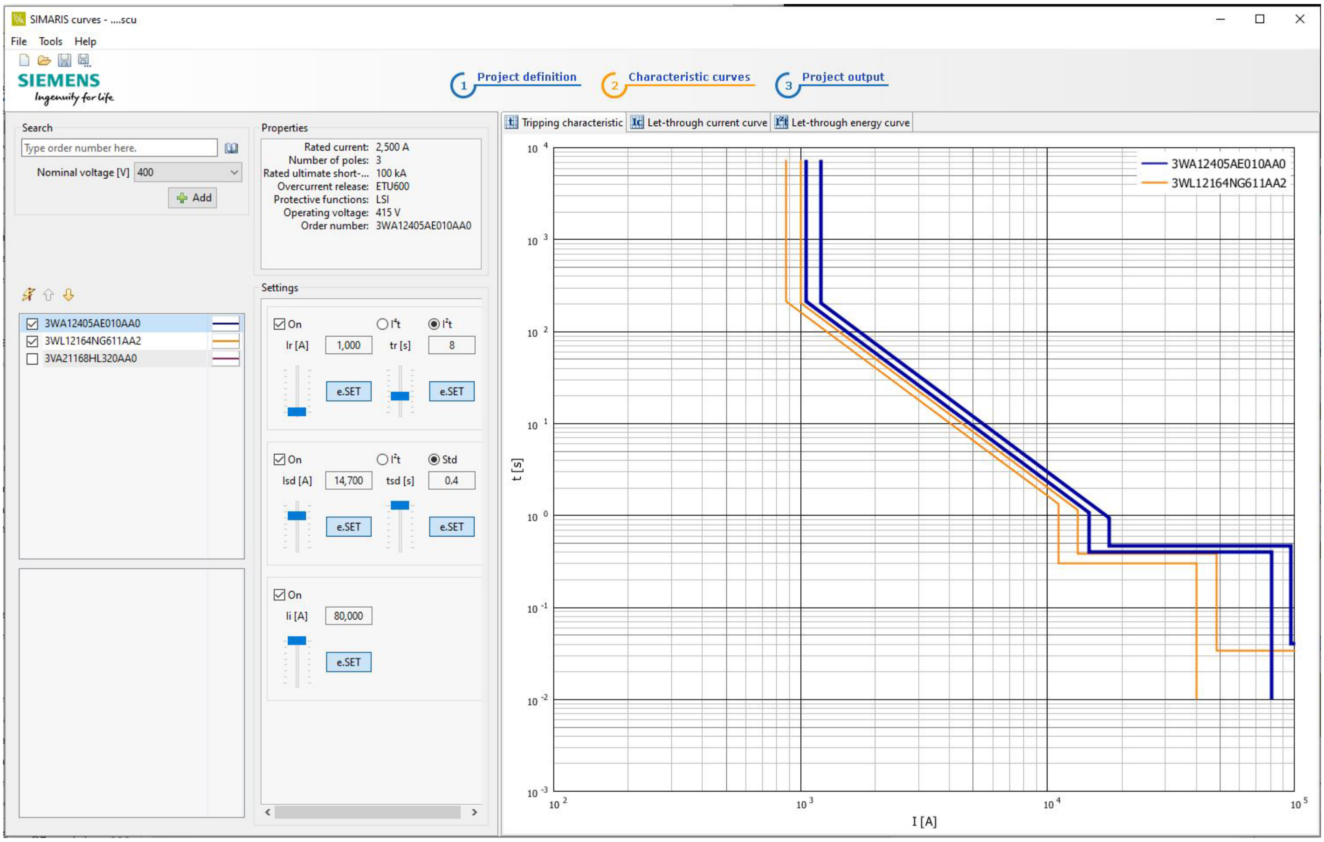
The time-current characteristic of the circuit breaker's electronic trip unit is determined by the individual sub-characteristics of the active protective functions, e.g. overload protection LT, short-time-delayed short-circuit protection ST, and instantaneous short-circuit protection INST.



SIMARIS curves

The Siemens software SIMARIS curves can be used to display the time-current characteristic for one or more devices.

SIMARIS curves displays the tolerances of the electronic trip unit for a graphical evaluation of the selectivity (no overlapping characteristics) of several devices in the time-delayed range. The maximum tolerance may therefore vary slightly from the tolerances listed in Chapter Tolerances for protection functions (Page 63).



Note

Break time of circuit breaker

The tripping times correspond to the operating time of the electronic trip unit. After this time, the break command is irreversible.
In addition to the tripping time of the electronic trip unit, the break time of the circuit breaker includes the mechanical operating time and the arcing time.

For more information on SIMARIS curves, refer to the internet (https://www.siemens.com/simaris).

The electronic trip units features a wide range of setting options. The setting range of the protective functions of the electronic trip units ETU300 and ETU600, which can be set via the 5 rotary coding switches, is shown in the Appendix Time-current characteristic of the ETU300 electronic trip unit (Page 524) and Time-current characteristic of the ETU600 electronic trip unit (Page 525). For the electronic trip unit ETU600, the setting range is also determined by the basic settings on delivery of the circuit breaker for the e.SET rotary coding switch position.

2.3.5 Description of the protective functions

2.3.5.1 General description

Depending on the electronic trip unit and the options selected, the following protective functions are available:

- Long time LT
- Short-time-delayed short-circuit protection ST
- Instantaneous short-circuit protection INST
- Neutral conductor protection N
- Ground-fault alarm
- Ground-fault protection GF
- Ground-fault protection GF Hi-Z
- Directed short-time-delayed short-circuit protection dST
- Reverse power protection RP
- Enhanced protective functions EPF

The setting ranges of the protective functions are described in the chapters on the protection parameters for ETU 300 (Page 80) and ETU600 (Page 105).
With the ETU600 electronic trip unit, individual protective functions can be switched on and off.

In the appendix Device numbers according to IEEE standard C37.2 (Page 538), the device numbers (ANSI code) assigned according to IEEE standard C37.2 are given.

2.3.5.2 Long time LT

The overload protection is current-dependent and long-time delayed. It is based on the rms value of the current and protects cables, busbars and busway systems in the event of overload.

The overload protection is implemented independently for each phase and is equipped with a thermal memory. This stores the circuit breaker's thermal state as determined by the operational current and shortens the tripping time when reclosing following a trip.

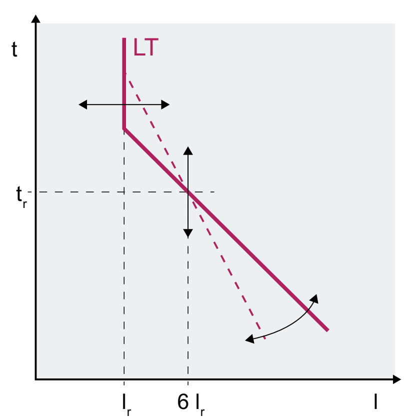
The overload protection delay is defined at 6 times the current setting I_r. The minimum tripping time is limited to 500 ms.

Overload alarm AL1 and AL2

The alarm function of the overload protection is divided into two levels.

- Alarm threshold AL1:
  Alarm threshold AL1 can be set in the range from 40% to 100% of the overload protection current setting I_r using the SENTRON powerconfig configuration software.
  When the alarm threshold AL1 is exceeded, the LED labeled "AL" lights up permanently in yellow and a message is shown on the display of the electronic trip unit.
- Alarm threshold AL2:
  Alarm threshold AL2 cannot be set; it corresponds to the current setting I_r of the overload protection.
  When the alarm threshold AL2 is exceeded, the LED labeled "AL" lights up permanently in red and a message is shown on the display of the electronic trip unit.

Characteristic



The overload protection is available with the following tripping characteristics:

- I^2t characteristic with dependent long-term delay
- I^4t characteristic with dependent long-term delay for optimum selectivity for upstream and downstream fuses

Phase failure detection

If the current of the phase with the lowest load is 50% less than the current of the phase with the highest load, this is interpreted as a phase failure and the setting I_r is automatically reduced to 80%. If the three phase currents do not differ by more than 50% with respect to each other, the setting I_r applies again.

Phase failure detection can be switched on/off for the electronic trip unit ETU600.

Thermal memory

The electronic trip unit offers the possibility to continue the internal mathematical simulation of the thermal processes in downstream systems and loads even if the circuit breaker is switched off and no external power supply to the electronics is available. This ensures effective protection against thermal overload, even with frequent closing and opening operations and fluctuating loads. An earlier, completed overload excitation can have a time-shortening effect on a pending overload trip.

Functional principle of the thermal memory:
The thermal memory operates in the overload range. Currents below the tripping threshold are not included in the evaluation. When the operational current exceeds this threshold, a strictly monotonic thermal evaluation is performed according to the characteristic. When the operational current falls below this threshold once again, cooling takes place according to an exponential function with an adjustable time constant.

- Behavior when thermal memory is switched on:
  The thermal history is taken into account. After tripping, the thermal memories of the phases including the neutral conductor are preset with the thermal equivalent of the warmest phase reduced to 90%. This makes it possible to reclose the circuit breaker. Cooling down takes place according to an exponential function with adjustable time constant and is active for a maximum of 30 minutes after overload tripping.
- Behavior when thermal memory is switched off:
  The thermal history is not taken into account.

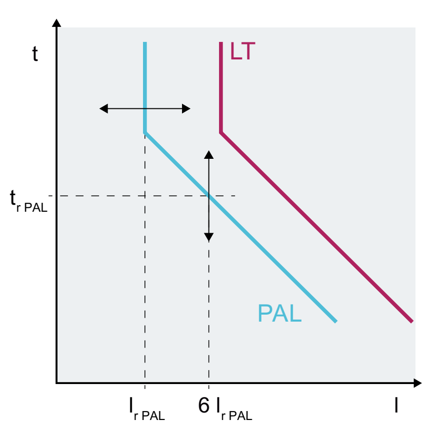
Overload pre-alarm PAL

The overload pre-alarm PAL (= pre-alarm) has separate current and time settings and the same characteristic as the overload protection.

Instead of a tripping operation, a message is output on the CubicleBUS[2] for overload pre-alarm PAL. This message can control an output of a digital input/output module or be transmitted via the communications interface.

The overload pre-alarm PAL can also be used with overload protection LT deactivated.

The overload pre-alarm PAL is set in the "Active protection parameters" of the electronic trip unit.



2.3.5.3 Short time ST

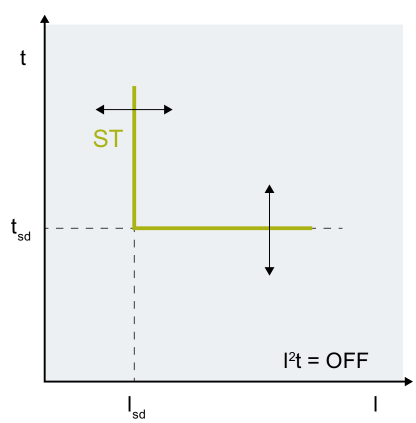
With short time ST, the power distribution system is protected against power system faults such as:

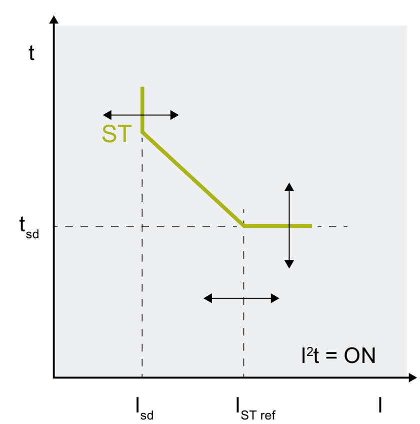
- Phase-phase short-circuit
- Phase-neutral conductor short-circuit
- Phase-ground short-circuit

The circuit breaker trips when the rms value of a phase current or the neutral current exceeds the setting of the short-time-delayed tripping current for the duration of the set delay.

This protective function can also be used to detect intermittent fault currents. The intermittent fault currents are totaled over a period of 5 s. The circuit breaker trips when the total time of the short-time fault currents exceeds the set delay t_{sd}.
Intermittent detection can be switched off.

Characteristic





The characteristic is determined by the short-time-delayed tripping current I_{sd}, the adjustable tripping time t_{sd}, the characteristic type, and a reference point I_{ref}.

Depending on the setting for I^2t, there are two characteristic curve forms:

- I^2t = OFF (top left figure):
  Tripping takes place independently of the current when the setting I_{sd} is exceeded after the set delay t_{sd}.
- I^2t = ON (top right figure):
  After exceeding the setting I_{sd}, tripping occurs with an inverted time characteristic. When the reference current value I_{ref} is exceeded, the current-dependent short-time delay ends and the circuit breaker trips after the set delay time t_{sd}. This ensures the selectivity for fuses even in the short-circuit current range.

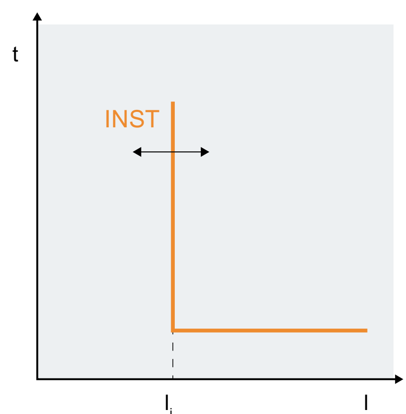
2.3.5.4 Instantaneous short-circuit protection INST

With the instantaneous short-circuit protection, the power distribution system is protected against power system faults such as:

- Phase-phase short-circuit
- Phase-neutral conductor short-circuit
- Phase-ground short-circuit

The circuit breaker trips when the rms value of a phase current or the neutral current exceeds the setting of the instantaneous tripping current I_i.

Characteristic



2.3.5.5 Neutral protection N

The neutral conductor can be protected against overload and short-circuit with the electronic trip unit. The neutral conductor protection consists of a separate overload protection and a common short-circuit protection for the three phases and the neutral conductor.

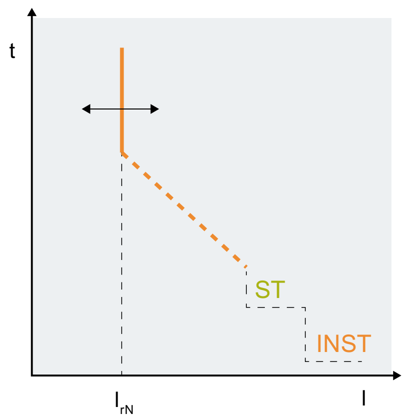
The overload protection has the setting I_{rN}. The delay, the overload characteristic, and the thermal memory correspond to the settings of the overload protection of the three phases. For four-pole circuit breakers, the setting I_{rN} of the overload protection is limited by the maximum rated current $I_{n\ max}$ of the circuit breaker.

For the short-circuit protection of the N-conductor, the settings of the short-time-delayed short-circuit protection ST and the instantaneous short-circuit protection INST are adopted.

Note

For a 3-pole circuit breaker, an external current sensor (N-CT) is required to protect the neutral conductor, see Chapter External current sensor for neutral pole (Page 327).
For 4-pole circuit breakers, the internal current sensor for the neutral conductor is pre-installed at the factory.

Characteristic



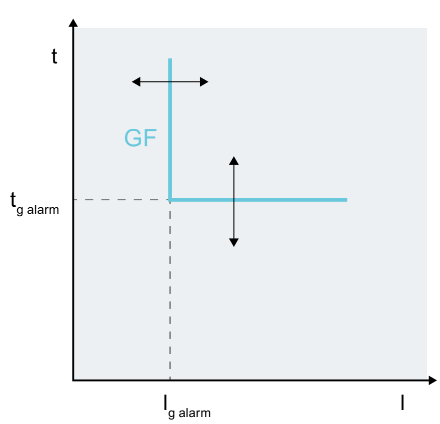
2.3.5.6 Ground-fault alarm

A ground fault can occur due to aging and the resulting deterioration of an insulating component in a power distribution system or due to a foreign body in the system. If the fault resistance is so high that the ground-fault current is below the settings of the ground-fault protection, the electronic trip unit will not trip. With the ground-fault alarm, a high-resistance ground fault can be detected without switching off the system. Then the elimination of the fault must be initiated.

The ground-fault alarm detects fault currents between the conductors and grounded parts of the power distribution system. It responds when the rms value of the ground-fault current exceeds the set alarm threshold $I_{g\ alarm}$ for the duration of the set delay $t_{g\ alarm}$.

As an option, the ground-fault alarm function can detect intermittent faults over a period of 5 s.
The intermittent detection is only available if a GF protective function is present and intermittent detection for the GF protective function is activated. For more information, see Chapter Ground-fault protection GF (Page 55).

Characteristic



2.3.5.7 Ground-fault protection GF

The ground-fault protection detects residual currents between the conductors and grounded parts of the power distribution system. The ground-fault protection function responds when the rms value of the ground-fault current exceeds the set tripping current I_g for the set delay time t_g.

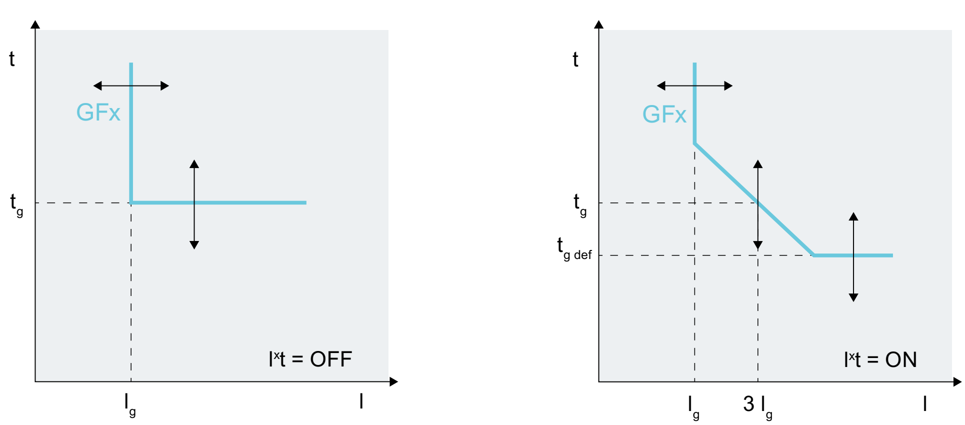
Ground-fault protection can be implemented either as a current-independent or a current-dependent function.
The electronic trip unit ETU300 LSIG has a current-independent characteristic with a fixed current setting.
The electronic trip unit ETU600 with the LSIG GFx option plug has a current-independent or current-dependent characteristic curve with the following characteristics for ground-fault protection:

- I^2t
- I^4t
- I^6t

In the case of a current-independent characteristic curve, the circuit breaker trips when the tripping current is exceeded after the set delay t_g. In the case of a current-dependent characteristic, the circuit breaker trips according to the inverse-time characteristic.

This protective function can also be used to detect intermittent ground faults. The intermittent fault currents are totaled over a period of 5 s. The circuit breaker trips when the total time of the short-time fault currents exceeds the set delay t_g.
Intermittent detection can be switched off.

Characteristic with LSIG GFx option plug

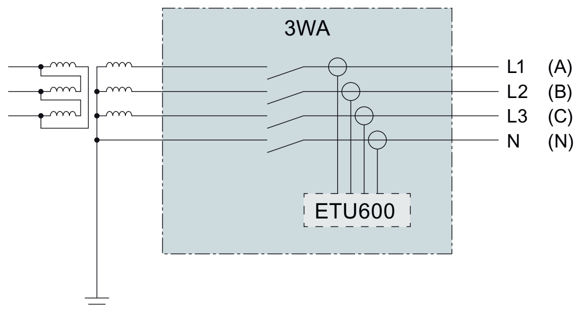


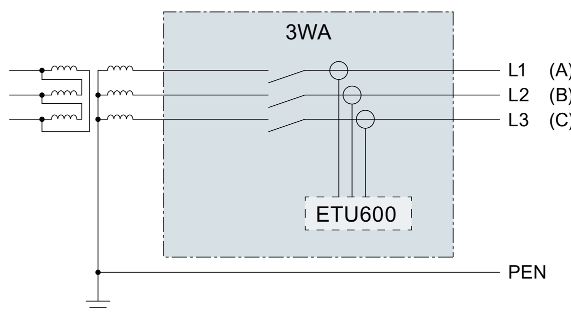
GF mode

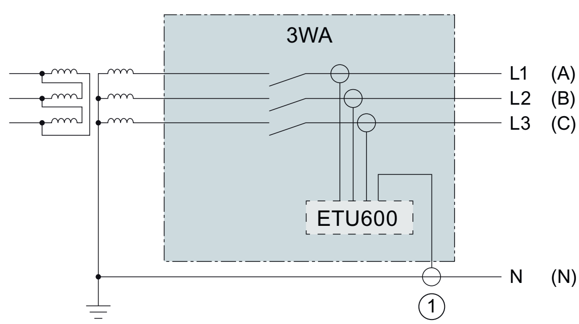
A ground-fault current can be calculated mathematically or measured directly. The 3 GF modes available on the electronic trip unit ETU600 are described below.

GF Residual

The ground current is formed by the vectorial sum of the currents measured with the internal current sensors and the external N conductor sensor (N-CT). All four-pole circuit breakers have an internal N conductor sensor.





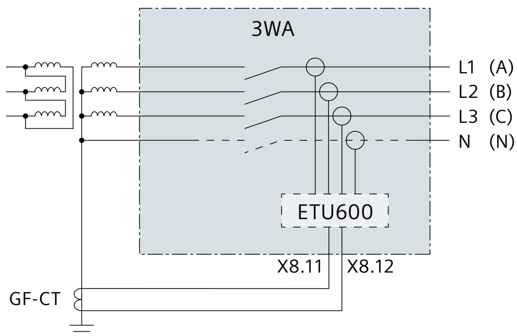


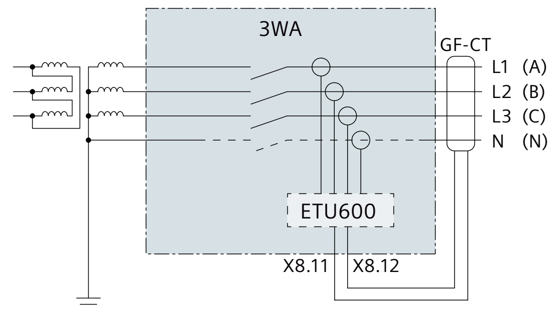
(1) External N conductor sensor (N-CT)

GF Direct

The ground-fault current is measured directly, e.g. in the cable of the transformer neutral point, with a current transformer. Commercially available measuring transformers with primary rated current I_{pr} = 150 A to 2000 A and secondary rated current I_{sr} = 1 A can be used for this purpose.

The current setting I_g of the ground-fault protection depends on the primary rated current I_{pr} of the current transformer and can be used in the range 0.06 to 1.0 x I_{pr}.

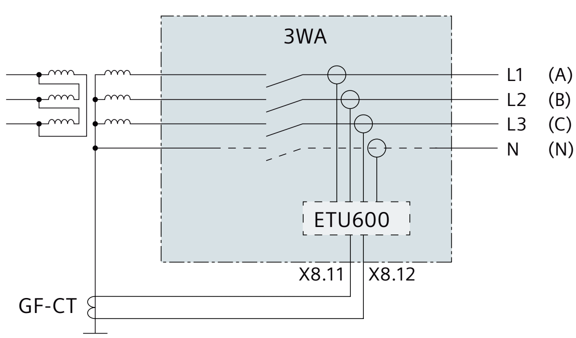




GF Dual

With the setting GF Dual, the acquisition methods GF Residual (calculation of the vectorial sum of the currents) and GF Direct (direct measurement of the ground-fault current with an external current transformer) can be used simultaneously. This provides the user with 2 independent characteristics for ground-fault protection.

In this GF mode, the electronic trip unit ETU600 LSIG can detect an infeed-side ground fault and an outgoing-side ground fault. The ground fault on the outgoing side can be interrupted with the circuit breaker. When a ground fault is detected on the infeed side on terminals X7.11 and X7.12 (outputs REF.0 and REF.1) of the circuit breaker, the electronic trip unit outputs a signal. This must be integrated in the control in order to open the upstream medium-voltage circuit breaker.



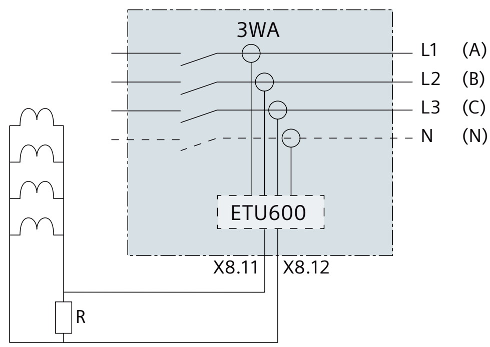
2.3.5.8 High-impedance ground-fault protection GF Hi-Z

In addition to the GF modes mentioned in Chapter "Ground-fault protection GF", the 3WA circuit breaker with the electronic trip unit ETU600 LSIG Hi-Z offers the possibility of connecting a current transformer combination for ground-fault protection between the transformer and the circuit breaker. The current transformer combination consists of several current transformers.

The ground-fault protection GF Hi-Z is only available with the electronic trip unit ETU600 LSIG Hi-Z. This was specially developed for the detection of ground-fault currents on the infeed side of the circuit breaker. The ETU600 LSIG Hi-Z provides the necessary inputs for connecting the current transformers and resistor required for this application. This makes it possible to dispense with the protection relay which would otherwise be required for protection between the transformer and the circuit breaker. The ETU600 LSIG Hi-Z takes over this task completely.

Two independent ground-fault protective functions are available to the user, the first one toward the transformer and the second one toward the load side.

For this purpose, commercially available Class TPS current sensors, which are interconnected in a group and connected in parallel via a high-resistance load resistor, are connected to terminals X8.11 and X8.12 of the secondary disconnect terminal of the circuit breaker.



Note

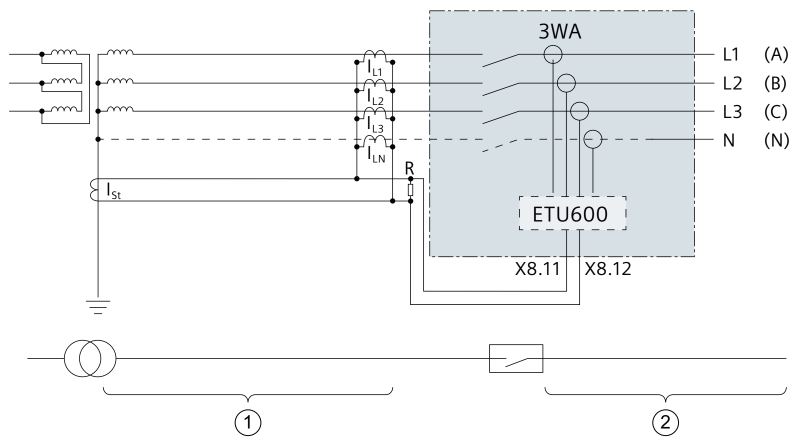
The maximum voltage at the measuring input of the electronic trip unit is 150 V rms. This must not be exceeded. A varistor or other suitable voltage limitation device must be connected in parallel to the load for this reason.

Note

Proper operation of the combination of current transformers and the load is not monitored by the electronic trip unit ETU600.

The electronic trip unit ETU600 LSIG Hi-Z can differentiate between an infeed-side ground fault and an outgoing-side ground fault. In countries where British standards are used, the areas before and after the circuit breaker are referred to as the "restricted zone" and "unrestricted zone" respectively. Derived from this, this type of ground-fault protection is called "Restricted Earth Fault (REF)" and "Unrestricted Earth Fault (UREF)".

Please note that ground-fault protection with ETU600 LSIG Hi-Z differs from high-resistance neutral point grounding and must not be confused with it.



(1) Restricted zone of protection

(2) Unrestricted zone of protection

Current transformer configurations

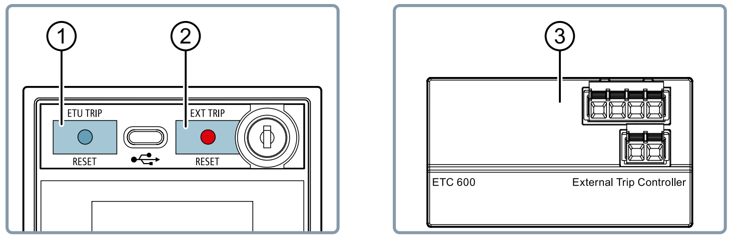
Depending on the network topology of the power distribution system, several current transformers are required for the detection of ground-fault currents on the infeed side. In practice, current transformers of class TPS (former designation class X) according to IEC 60044-6 are used in a transformer combination. If only one current transformer is used in the neutral point of the transformer, the ground-fault currents of the outgoing feeders are also acquired via this transformer.

Ground fault interruption

The ground fault on the outgoing side can be interrupted with the circuit breaker.

When a ground fault is detected on the infeed side, the electronic trip unit ETU600 LSIG Hi-Z issues a signal to open the medium-voltage circuit breaker on terminals X7.11 and X7.12 of the circuit breaker. In this case, the ETC600 external trip controller can be integrated in the intertripping circuit of the medium-voltage circuit breaker and can also open the low-voltage 3WA circuit breaker by means of the second tripping solenoid F6.

The tripping solenoid F6 operates independently of the electronic trip unit ETU600 and prevents reclosing after the circuit breaker has been opened. The circuit breaker can only be closed after resetting the reclosing lockout locally, marked EXT TRIP in the figure below. The 3WA is the only circuit breaker capable of this functionality.



(1) ETU TRIP, reclosing lockout not active

(2) EXT TRIP, reclosing lockout active

(3) ETC600 external trip controller

2.3.5.9 Directional short time dST

With the directional short-time-delayed short-circuit protection dST, the power distribution system is protected against power system faults such as:

- Phase-phase short-circuit
- Phase-neutral conductor short-circuit
- Phase-ground short-circuit

The circuit breaker trips when the rms value of a phase current exceeds the set directional short-time-delayed tripping current for the duration of the set directional delay.

For the dST protective function, the forward direction for the short-circuit current must be defined and parameterized on the ETU600 electronic trip unit.

To avoid unintentional tripping of protection devices, a uniform direction definition should be made for all devices in the distribution network. The direction "away from the busbar" could be defined as the forward direction for all protection devices.

This function requires an internal voltage tap or external voltage transformers and a voltage tap module VTM.

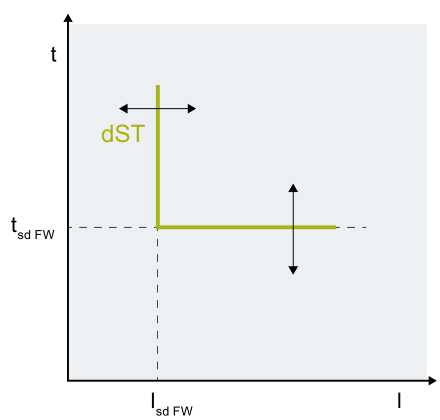
Note

Residual voltage equal to the peak arc voltage is required to detect the direction of energy flow in the event of a short-circuit.
Therefore, take the short-time-delayed short-circuit protection ST into account when considering selectivity. The short-time-delayed short-circuit protection ST can assume the function of backup protection.

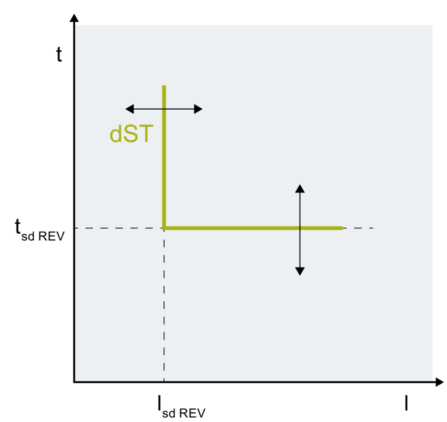
Characteristic

The characteristic is determined by the short-time-delayed tripping currents $I_{sd\ FW}$ (forward direction) and $I_{sd\ REV}$ (reverse direction) and the adjustable tripping times $t_{sd\ FW}$ and $t_{sd\ REV}$.

Forward



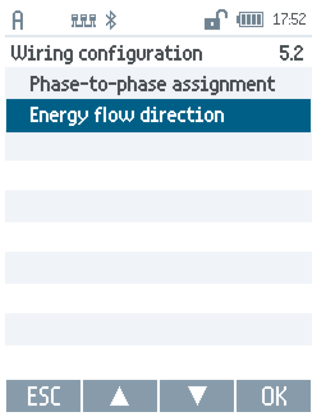
Reverse

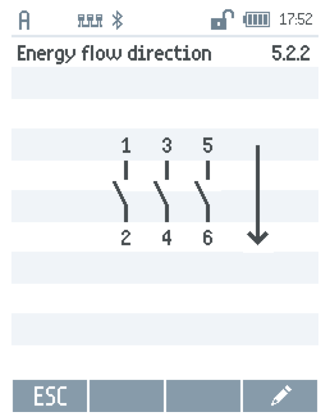


2.3.5.10 Reverse power protection RP

The reverse power protection trips the circuit breaker when the power flow through the device reverses against the defined direction and exceeds the set value for the adjusted and definite-time delay. The setting is referred to the rated active power P_n as a percentage. This is dependent on the rated current I_n of the circuit breaker and the rated voltage U_n parameterized on the electronic trip unit.

For this protection function RP and the power measurements, the energy flow direction defined in menu item 5.2.2 is used as parameter.



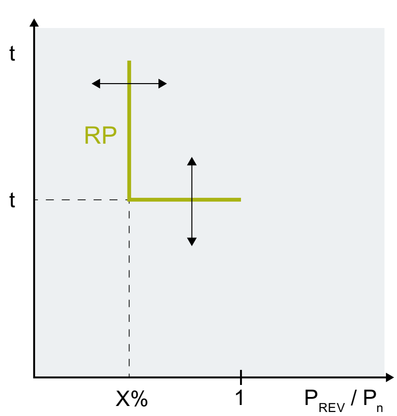


From the user's point of view, the positive energy flow direction could be defined as the energy flow from the busbar in the direction of the cable outlet.

For reverse power protection, the current and voltage signals are evaluated and the active and apparent power are put into relation. A reversing power flow is identified by the phase offset between current and voltage signal.

This function also requires internal voltage taps or external voltage transformers and the voltage metering module VTM.

Characteristic



2.3.5.11 Enhanced protective functions EPF

Enhanced protective functions can be added to the function scope of the ETU600 electronic trip unit. On the basis of the measured currents, voltages and frequency, overshooting or undershooting of the resulting metering values can cause tripping of the circuit breaker.

The following enhanced protective functions can be used:

- Phase current unbalance
- Phase voltage unbalance
- Total harmonic distortion for current and voltage
- Undervoltage, overvoltage (device number 59)
- Forward power (ANSI 32F), reverse power (ANSI 32R)
- Underfrequency (device number 81U), overfrequency (device number 81O)
- Reverse-phase sequence protection (device number 46)

Note

2 different calculation methods are used for the calculation of phase unbalance.

- ANSI definition:
  Ratio of the greatest difference of the phases from the arithmetic mean value of the phases.
- IEC definition:
  Ratio of the greatest difference of the phase from the phase with the highest load.

The method to be used can be parameterized on the electronic trip unit.

One of the enhanced protective functions trips the circuit breaker when the corresponding measured value exceeds or falls below the set delay time.

The required voltage tap module is a component of the ETU600 electronic trip unit from metering function type PMF-I on. The enhanced protective functions are part of the standard scope of a circuit breaker with metering function from type PMF-II. You will find more information in Chapter Metering function (power metering function) (Page 123).

No external auxiliary voltage is required for the enhanced protective functions.

2.3.6 Tolerances for protection functions

The following sections state the tolerances of the protective functions of the electronic trip units. These depend on the equipment of the 3WA circuit breaker. The tolerances apply to the electronic trip units ETU300 and ETU600.

The minimum or maximum tolerance of the tripping time may depend on several factors. These are represented in the formula by A, B and C.

Example: $t_{trip} = max\ [A; B; C]$

The tolerance in this case is the maximum value of A, B or C.

The following constraints apply to the tolerances:

- The parameterized rated frequency is the line frequency at the place of use. On delivery of the 3WA1 circuit breaker, the rated frequency is parameterized at 50 Hz.
  All settings of the electronic trip unit of the circuit breaker at the time of delivery are listed in Chapter Basic settings of the electronic trip unit on delivery (Page 519).
- The ambient temperature is in the range -5 °C to +55 °C.
- The minimum requirements for determining the direction of energy flow for dST and RP are 0.1 x I_n and 0.1 x U_n.

Note

Break time of circuit breaker

The tripping times listed in the chapter correspond to the operating time of the electronic trip unit.
The break time of the circuit breaker is the interval between the start of the operating time of the electronic trip unit and the end of the arcing time.

L: Overload protection LT

- Current response value

  Minimum: $I_{MIN} = 1.05 \times I_r$

  Maximum: $I_{MAX} = 1.20 \times I_r$

- Tripping time, I^2t characteristic

  Minimum:
  $$t_{trip_{MIN}} = max\left[\frac{(6 \times I_r)^2 \times 0.8 \times t_r}{I^2}\ ; 0.5\ s\right]$$

  Maximum:
  $$t_{trip_{MAX}} = max\left[\frac{(6 \times I_r)^2 \times 1.0 \times t_r}{I^2}\ ; 0.7\ s;\ t_{trip_{MIN}} + 0.2\ s\right]$$

- Tripping time, I^4t characteristic

  Minimum:
  $$t_{trip_{MIN}} = max\left[\frac{(6 \times I_r)^4 \times 0.8 \times t_r}{I^4}\ ; 0.5\ s\right]$$

  Maximum:
  $$t_{trip_{MAX}} = max\left[\frac{(6 \times I_r)^4 \times 1.0 \times t_r}{I^4}\ ; 0.7\ s;\ t_{trip_{MIN}} + 0.2\ s\right]$$

L: Overload protection LT, neutral conductor

- Current response value

  Minimum: $I_{MIN} = 1.05 \times I_{rN}$

  Maximum: $I_{MAX} = 1.20 \times I_{rN}$

- Tripping time, I^2t characteristic

Minimum: $$t_{trip_{MIN}} = max\left[\frac{(6\ x\ I_{rN})^2\ x\ 0.8\ x\ t_r}{I^2}; 0.5\ s\right]$$

Maximum: $$t_{trip_{MAX}} = max\left[\frac{(6\ x\ I_{rN})^2\ x\ 1.0\ x\ t_r}{I^2}; 0.7\ s; t_{trip_{MIN}} + 0.2\ s\right]$$

- Tripping time, I^4t characteristic

  Minimum: $$t_{trip_{MIN}} = max\left[\frac{(6\ x\ I_{rN})^4\ x\ 0.8\ x\ t_r}{I^4}; 0.5\ s\right]$$

  Maximum: $$t_{trip_{MAX}} = max\left[\frac{(6\ x\ I_{rN})^4\ x\ 1.0\ x\ t_r}{I^4}; 0.7\ s; t_{trip_{MIN}} + 0.2\ s\right]$$

S: Short-time-delayed short-circuit protection ST, directed short-time-delayed short-circuit protection dST

- Current response value

  Minimum: I_{MIN}=1.00 x I_{sd}

  Maximum: I_{MAX}=1.20 x I_{sd}

- Tripping time, I^2t = OFF (current-independent)

  Minimum: $t_{trip_{MIN}} = t_{sd}$

  Maximum: $t_{trip_{MAX}} = max\ [1.1\ x\ t_{sd}; t_{sd} + 50\ ms]$

- Tripping time, I^2t = ON (current-dependent)

  Minimum: $$t_{trip_{MIN}} = max\left[\frac{(6\ ...\ 12\ x\ I_r)^2\ x\ 1.0\ x\ t_{sd}}{I^2}; t_{sd}\right]$$

  Maximum: $$t_{trip_{MAX}} = max\left[\frac{(6\ ...\ 12\ x\ I_r)^2\ x\ 1.2\ x\ t_{sd}}{I^2}; t_{sd} + 50\ ms; t_{trip_{MIN}} + 50\ ms\right]$$

I: Instantaneous short-circuit protection INST

- Current response value

  Minimum: I_{MIN}=1.00 x I_i

  Maximum: I_{MAX}=1.20 x I_i

- Tripping time

  Minimum: $t_{trip_{MIN}}$ = 20 ms

  Maximum: $t_{trip_{MAX}}$ = 40 ms

G: Ground-fault protection GF with LSIG GFx option plug

- Current response value
  Minimum: $I_{MIN} = 1.00 \ x \ I_g$
  Maximum: $I_{MAX} = 1.20 \ x \ I_g$
- Tripping time, I^2t = OFF (current-independent)
  Minimum: $t_{trip_{MIN}} = t_g$
  Maximum: $t_{trip_{MAX}} = max \ [1.1 \ x \ t_g \ ; \ t_g + 50 \ ms]$
- Tripping time, I^2t = ON (current-dependent)
  Minimum: $$t_{trip_{MIN}} = max \left[\frac{(3 \ x \ I_g)^2 \ x \ 1.0 \ x \ t_g}{I^2} \ ; \ t_{g \ def} \right]$$
  Maximum: $$t_{trip_{MAX}} = max \left[\frac{(3 \ x \ I_g)^2 \ x \ 1.2 \ x \ t_g}{I^2} \ ; \ t_{g \ def} + 50 \ ms \right]$$
- Tripping time, I^4t = ON (current-dependent)
  Minimum: $$t_{trip_{MIN}} = max \left[\frac{(3 \ x \ I_g)^4 \ x \ 1.0 \ x \ t_g}{I^4} \ ; \ t_{g \ def} \right]$$
  Maximum: $$t_{trip_{MAX}} = max \left[\frac{(3 \ x \ I_g)^4 \ x \ 1.44 \ x \ t_g}{I^4} \ ; \ t_{g \ def} + 50 \ ms \right]$$
- Tripping time, I^6t = ON (current-dependent)
  Minimum: $$t_{trip_{MIN}} = max \left[\frac{(3 \ x \ I_g)^6 \ x \ 1.0 \ x \ t_g}{I^6} \ ; \ t_{g \ def} \right]$$
  Maximum: $$t_{trip_{MAX}} = max \left[\frac{(3 \ x \ I_g)^6 \ x \ 1.728 \ x \ t_g}{I^6} \ ; \ t_{g \ def} + 50 \ ms \right]$$

G: Ground fault alarm GF alarm

- Current response value
  Identical to G: Ground-fault protection GF
- Tripping time
  Identical to G: Ground-fault protection GF

Reverse power protection RP

- Response value
  Minimum: $1.00 \ x \ \frac{P_{RP_x}}{P_{n_x}}$

Maximum: $1.10\ x\ \frac{P_{RP_x}}{P_{n_x}}$

- Tripping time

  Minimum: $t_{trip_{MIN}} = t_{RP}$

  Maximum: $t_{trip_{MAX}} = max\ [1.1\ x\ t_{RP}\ ;\ t_{RP} + 50\ ms]$

Enhanced protective functions EPF

The response values of the enhanced protective functions have the accuracy of the associated metering value, see Chapter Metering function (power metering function) (Page 123).
The tripping time of the enhanced protective functions Unbalance, Harmonic analysis, Voltage, Power and Phase rotation has the tolerances:

Minimum: $t_{trip_{MIN}} = 0\ s$

Maximum: $t_{trip_{MAX}} = 0.6\ s$

The tripping time of the enhanced protective function Frequency has the tolerances:

Minimum: $t_{trip_{MIN}} = 0\ s$

Maximum: $t_{trip_{MAX}} = 1.2\ s$

Maintenance mode DAS+

- Current response value

  Minimum: I_{MIN}=1.00 $x\ I_i$

  Maximum: I_{MAX}=1.20 $x\ I_i$

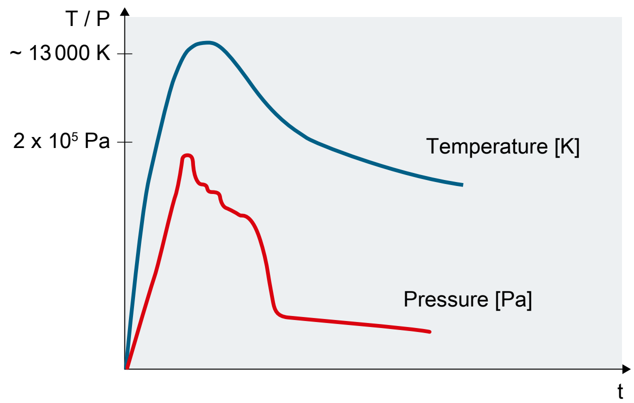
- Tripping time

  Minimum: $t_{trip_{MIN}} = 20\ ms$

  Maximum: $t_{trip_{MAX}} = 40\ ms$

2.3.7 Maintenance mode DAS+

An arcing fault can be described as a gas discharge with plasma formation and temperatures up to 20,000 K, in which the electric current flows through unintended dynamic paths. In addition to the extreme temperatures, very high pressures are also generated.



Arcing events typically result from:

- Human error, such as accidental contact with voltages above ground potential, tools or debris inadvertently left behind after maintenance, or improper assembly
- Lack of adequate maintenance for the operating or ambient conditions
- Insulation failure due to aging, environmentally-related degradation, animals in the system (e.g. snakes or rodents), or operation not in accordance with the product ratings

After ignition, the arc transforms its surroundings by ionizing the air and converting metallic materials into conductive plasma and expands with explosive force under extreme heat. The more material is vaporized, the stronger the arc.

Maintenance mode DAS+

Fast tripping of circuit breakers and extinction of the arc are extremely important in order to protect staff working in the immediate vicinity of live parts.

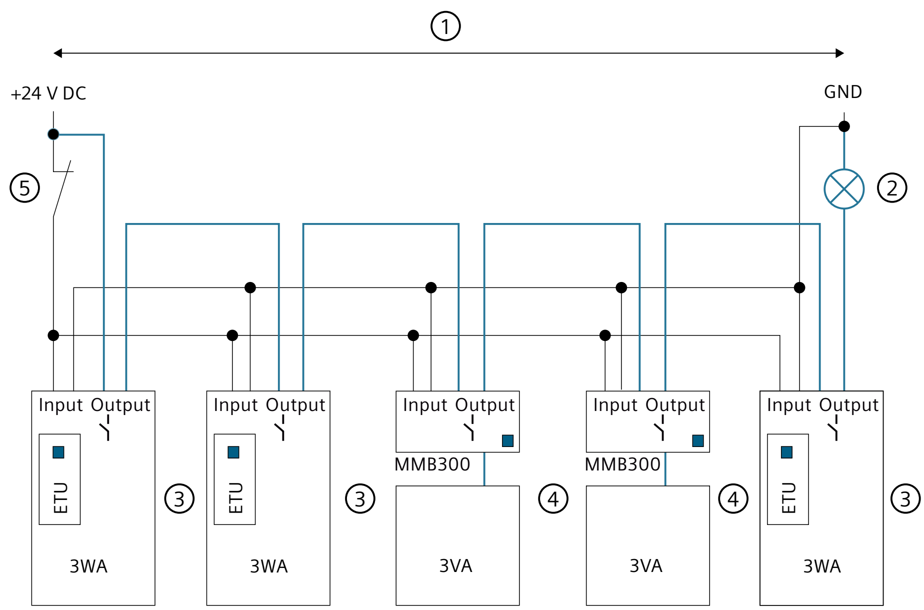
To this end, the maintenance mode DAS+ operates with its own set of protection parameters to reduce the trip threshold, thus ensuring that the circuit breaker trips at a lower threshold than would be necessary for normal operation and without delay times.

The maintenance mode DAS+ is a function for reducing the arcing fault energy that can potentially occur during maintenance in the event of a fault. The maintenance mode with a local status signal is used to comply with the following standards:

- National Electrical Code (NEC) Section 240.87 (B) (3) Arc-Flash energy reduction (Energy-reducing maintenance switching with local status indicator)
- NFPA 70E Standard for Electrical Safety in the Workplace
- DIN EN 50110-1 Operation of electrical installations/B.6 Arc hazard

DAS+ system

The following shows how to integrate several circuit breakers in the maintenance mode DAS+. The activation is done via a switch. The activated maintenance mode on all the circuit breakers is signaled by a "DAS+ active" light. If this message is to be output with very small currents of one or more circuit breakers or open circuit breakers, the electronic trip unit must be additionally supplied with an external auxiliary voltage of 24 V DC for signaling.



(1) To ensure proper performance, the total cable length of the system must not exceed 50 m (165 ft).

(2) The "DAS+ active" light should be installed in such a way that it is clearly visible to maintenance personnel.
It is only active when all circuit breakers are in the maintenance mode DAS+. The maximum switching and continuous current of the digital output ETU-OUT is 0.1 A at 24 V DC. A coupling relay must be used for higher loads or other voltages.

(3) 3WA circuit breaker

(4) 3VA6 molded case circuit breaker with Maintenance Mode Box MMB300

(5) On/off switch for activating the maintenance mode DAS+
The switch should be installed in a suitable position outside the arc-flash zone.

The DAS+ system is compatible with the 3WL circuit breaker with COM35. For more information, refer to the "3WL air circuit breakers via COM35 - PROFINET IO, Modbus TCP" Communication Manual; see Chapter Reference documents (Page 17).

DAS+ is not compatible with 3WL10 and 3VA27 circuit breakers.

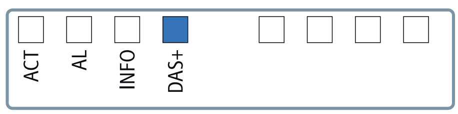
Activation

The maintenance mode DAS+ can be activated in various ways.

Activation options:

- Digital ETU input of the circuit breaker, secondary disconnect terminals X8.5 and X8.6. Depending on the selected signal state (LOW/HIGH), the input can be controlled via an NC contact or an NO contact.
- Operating key on the display of the electronic trip unit ETU600
- Input of a digital input/output module
- Via the fieldbus interfaces of a communications module, see Chapter Communication and system connection (Page 131).
- Via Bluetooth or the USB-C interface and the SENTRON powerconfig configuration software.

The activated maintenance mode DAS+ is indicated by the blue LED on the electronic trip unit and on the display.



A message can also be sent via the following signals:

- Digital ETU output of the circuit breaker, secondary disconnect terminals X8.7 and X8.8
- Via an output of a digital input/output module
- Via fieldbus communication

Note

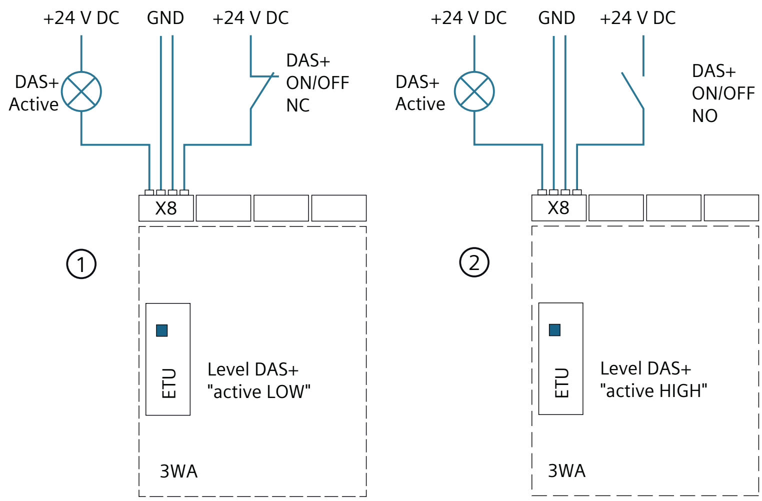
For security reasons, the maintenance mode DAS+ can only be deactivated using the same method by which it was activated.

Application examples

The following figure shows the activation of the maintenance mode DAS+ by the digital ETU input with a normally-closed contact (NC) and a normally-open contact (NO).

- LOW signal (NC):
  The maintenance mode DAS+ is active when there is no signal present at the secondary disconnect terminals X8.5 and X8.6 (example ①)
- HIGH signal (NO):
  The maintenance mode DAS+ is active when there is a signal present at the secondary disconnect terminals X8.5 and X8.6 (example ②)

The digital ETU output, secondary disconnect terminals X8.7 and X8.8, is used for signaling "DAS+ ON".



Terminal assignment for maintenance mode DAS+:

X8													
14	13	12	11	10	9	8	7	6	5	4	3	2	1
						DO ETU.1	DO ETU.0	DI ETU.1	DI ETU.0				

2.3.8 Activation limits and power supply

The electronic trip unit does not require auxiliary power. The electronic trip unit is powered by the circuit breaker's internal current sensors. Depending on the operational current, the electronic trip unit of the circuit breaker is activated from:

Operational current	ACT LED (Active)		Description
70 A		Flashing (frequency: 1 Hz)	Electronic trip unit active ETU600: Display off
110 A		Flashing (frequency: 1 Hz)	Electronic trip unit active ETU600: Display on
150 A		Flashing (frequency: 1 Hz)	Electronic trip unit active ETU600: Display on TUI600: active

Alternatively, the VTM680 voltage tap module can take over the power supply of the electronic trip unit ETU600 for a circuit breaker with integrated voltage tap.

If you use functions with data exchange via the CubicleBUS² with the electronic trip unit ETU600, an external 24 V DC power supply must be connected to the secondary disconnect terminals X8.3 and X8.4. With this external voltage supply, the ETU600 is active even when the circuit breaker is open or when the operational current is below the activation limit.

WARNING

Loss of direct-acting circuit breaker functionality with option code Z = K60 (internal current sensors, without energy cores, for applications with frequency converters)

When the circuit breaker is equipped with current sensors without energy cores, the electronic trip unit is not self-powered.

For these applications, an undervoltage release and an external 24 V DC power supply are required for activating the electronic trip unit.

The auxiliary power supplying the electronic trip unit is internally coupled to the undervoltage release of the circuit breaker.

2.3.9 Differences between the electronic trip units ETU300 and ETU600

Function	Electronic trip unit ETU300	Electronic trip unit ETU600
Protective function LSI	✓	✓
Protective function LSIG	✓	✓
Protective function LSIG Hi-Z	--	✓
Neutral conductor protection (N)	✓	✓
Metering function	--	✓
Enhanced protective functions	--	✓
CubicleBUS²	--	✓
Display	--	✓
DAS+ input/output	✓	✓
LED for trip cause indication	✓	✓
Bluetooth and USB	--	✓
FW updates	--	✓
Internal self-test with and without tripping	✓	✓
Extended test option (tripping characteristic)	--	✓
Activation of the ETU via power bank	--	✓
Activation of the ETU for self-test via TD400	✓	✓

Note

An upgrade from ETU300 to ETU600 is possible by replacing the electronic trip unit.

2.4 Electronic trip unit ETU300

2.4.1 Overview of variants

All circuit breakers with integrated ETU300 electronic trip units have a microprocessor.

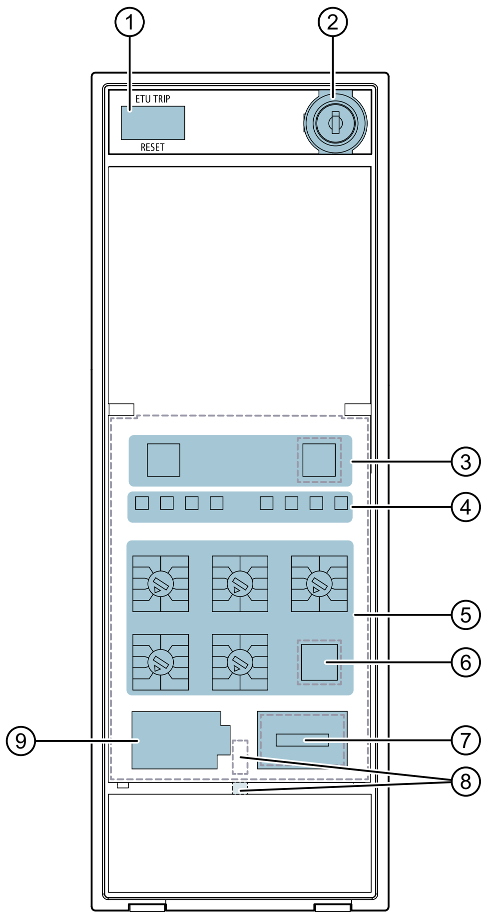
In contrast to the ETU600 electronic trip unit, it is not possible to extend the functions by adding additional function packages. For necessary function extensions, it is possible to replace the ETU300 electronic trip unit with the ETU600 and use its modularity.

The protective functions of the ETU300 comply with the regulations for electrical installations and protect them against overcurrent and short circuit. The ETU300 electronic trip unit is available in the following versions:

- ETU300 LSI
  This version has overload protection, short-time and instantaneous short-circuit protection as basic protective functions. The basic protective functions do not require an auxiliary power supply; they are supplied by the current flowing through the circuit breaker.
- ETU300 LSIG
  In addition to the basic protective functions of the ETU300 LSI, this version offers ground-fault protection with a permanently set current setting and tripping time.

2.4.2 Operator controls and displays

2.4.2.1 Overview



(1) ETU TRIP: Trip indication and mechanical RESET of the reclosing lockout after a trip by the ETU300 electronic trip unit

(2) Lockable cover with safety lock, prevents a manual RESET of the reclosing lockout (option)

(3) CLEAR and TEST operating keys

(4) LED displays

(5) Rotary switches

(6) Query button for displaying the last trip cause when the ETU300 is not activated

(7) Interface for activation with an external voltage

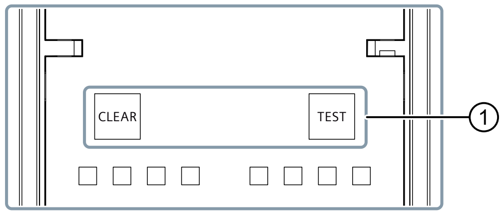
(8) Eye for lead seal for sealable cover (option)

(9) Option plug

2.4.2.2 Operating keys

The trip cause stored in the ETU300 can be deleted via the CLEAR operating key.

Pressing the TEST operating key starts the internal self-test of the ETU.



(1) CLEAR and TEST operating keys

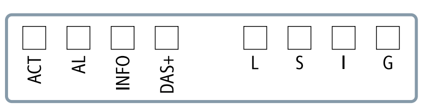
Internal self-test

The internal test function with tripping of the circuit breaker can be started by pressing the two CLEAR and TEST operating keys simultaneously and for a long time and then releasing the CLEAR key.
The internal self-test can be canceled by pressing and holding the CLEAR key.

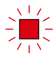
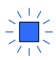
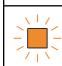
For more information about the internal self-test, see Chapter Internal self-test ETU300 (Page 163).

2.4.2.3 LED displays

Status information of the ETU300 electronic trip unit and the last trip cause are indicated by LEDs.



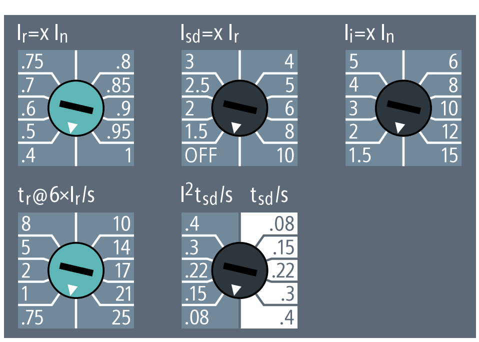
LED	Meaning	Description
ACT (active) Activation of the ETU		
	Off	Electronic trip unit not activated
	Flashing (frequency: 1 Hz)	Electronic trip unit activated
AL (alarm) Two-stage overload alarm		
	Off	Current is less than 90% of the setting value Ir of the overload protection
	On	Current in a phase is between 90% and 100% of the setting value Ir of the overload protection
	On	Current in a phase is greater than or equal to the setting Ir of the overload protection
INFO Display of status infor-mation		
	Off	Normal operating state
	On	Warning is present

<table>
<tr><th>LED</th><th>Meaning</th><th colspan="2">Description</th></tr>
<tr><td></td><td>On</td><td colspan="2">Error present</td></tr>
<tr><td>DAS+
Maintenance mode DAS+</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td>Off</td><td colspan="2">DAS+ not activated</td></tr>
<tr><td></td><td>On</td><td colspan="2">DAS+ activated</td></tr>
<tr><td>L, S, I, G
Last trip cause</td><td></td><td colspan="2"></td></tr>
<tr><td></td><td>Off</td><td colspan="2">Normal operating state</td></tr>
<tr><td rowspan="5"></td><td rowspan="5">On</td><td colspan="2">Tripping due to:</td></tr>
<tr><td>L</td><td>Overload LT</td></tr>
<tr><td>S</td><td>Short-circuit ST</td></tr>
<tr><td>I</td><td>Short-circuit INST</td></tr>
<tr><td>G</td><td>Ground fault GF</td></tr>
<tr><td colspan="4">If the ETU300 is not activated, the trip cause can be displayed by pressing the Query button. A prerequisite for the display of the trip cause is that the ETU300 was activated for at least 2 hours before the tripping operation. The trip cause is stored for 24 hours in this case.</td></tr>
</table>

Additional information on the display of error messages can be found in Chapter Display of errors and alarms (Page 171).

2.4.2.4 Rotary coding switches

The ETU300 electronic trip unit has 5 rotary coding switches for parameterizing the basic protective functions.



10 fixed values can be mechanically set on each rotary coding switch.

2.4.3 Interfaces

2.4.3.1 Interface for external voltage supply via the TD400

The electronic trip unit ETU300 can be supplied with external voltage for activation and status checking using the TD400 commissioning, test and service tool, article number 3VW9011-0AT40.

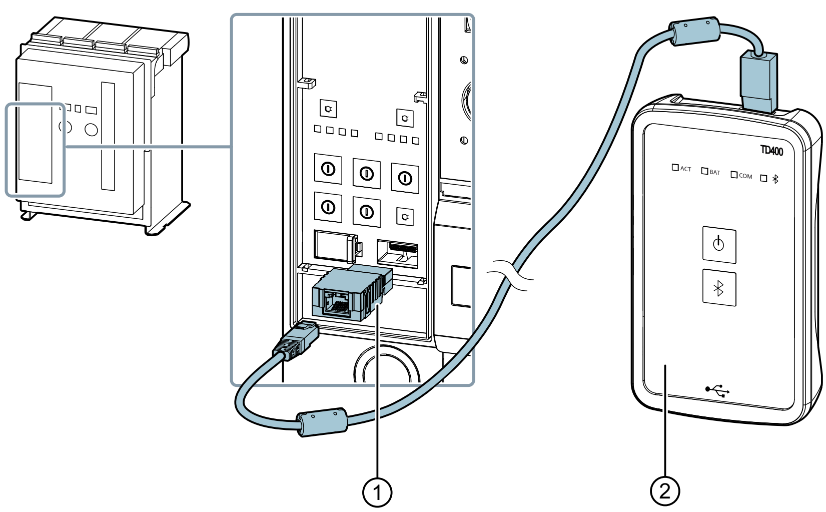
The TD400 is connected to the ETU300 using the separately available adapter with article number 3VW9011-0AT46.

The external voltage supply of the ETU300 is possible from firmware version V1.3.1 of the TD400.

Note

Firmware update

With firmware version V1.2 or older, the firmware must first be updated to firmware version V1.3. Only then is a firmware update to version V1.3.1 (or higher) possible.



(1) Adapter

(2) TD400 commissioning, test and service tool

2.4.3.2 Digital input and output

The electronic trip unit ETU300 has one digital input and one digital output.

The input responds to a 24 V signal with signal level HIGH and activates the maintenance mode DAS+.

The floating output is a normally open contact (NO). It is activated when the maintenance mode DAS+ is active.

Technical specifications and connection

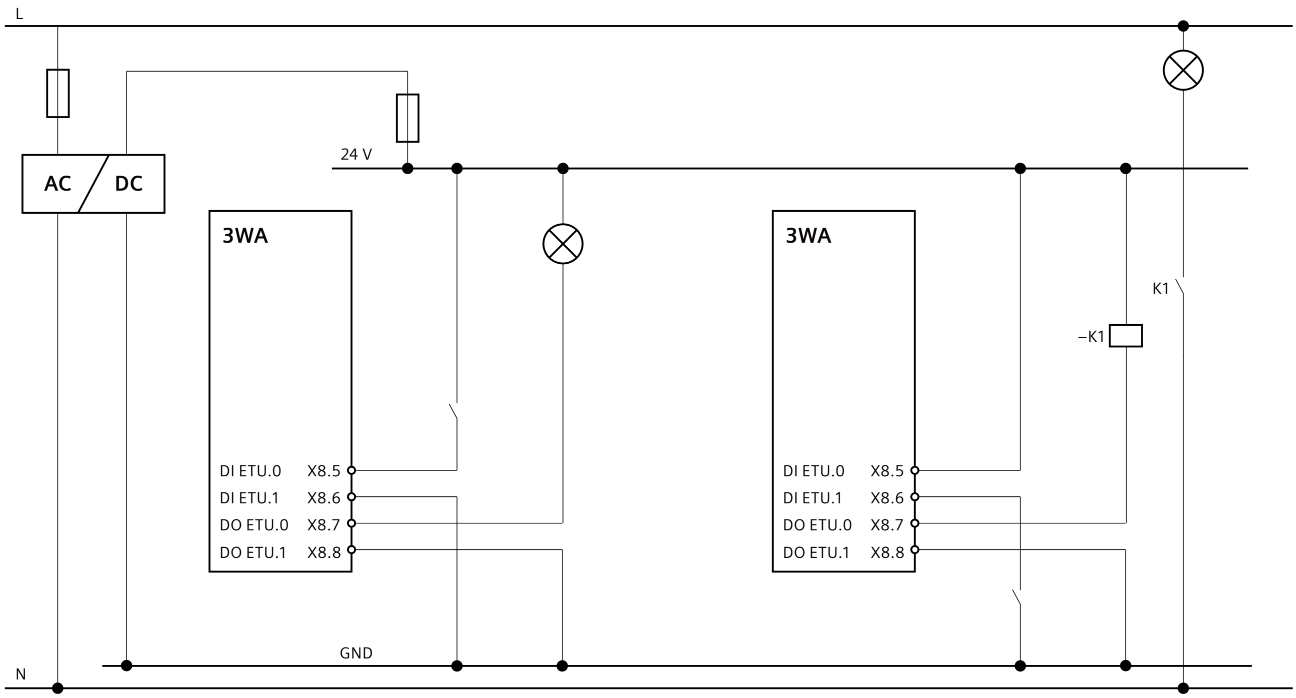
The connection is made at the secondary disconnect terminal system of the 3WA circuit breaker.

Digital input ETU-IN	
Connection	X8.5 and X8.6
Number of inputs	1
SELV/PELV suitable	✓
Rated voltage	24 V DC ± 20%
Voltage value for reliable detection of a "1 signal":	≥15 V DC
Current consumption at signal voltage of > 15 V DC	< 10 mA
Minimum signal duration	100 ms

Floating output ETU-OUT	
Connection	X8.7 and X8.8
Number of outputs	1
Contact	Normally open contact (NO)
Rated voltage	24 V DC ±20%
Maximum switching current	0.1 A at 24 V DC
Maximum continuous current	0.1 A at 24 V DC

- The digital input is designed for a control supply voltage of 24 V DC.
  No polarity is specified at the DI ETU.0 and DI ETU.1 input terminals.
- The digital outputs DO ETU.0 and DO ETU.1 are designed for 24 V DC and as a normally open contact (NO).
  If the power to be switched exceeds the breaking capacity of the output, a suitable coupling relay must be used.

The following circuit diagram shows the integration of the digital input and output of the ETU into a control and signaling system using the example of 2 circuit breakers. Depending on the load, a coupling relay must be used at the output.
The example also shows the polarity-independent control of the input.



2.4.3.3 External current sensor

The neutral current can be measured with a current sensor. With a 3-pole circuit breaker, the external current sensor for the N-conductor must be used for this purpose.

The external current sensor for the N conductor (N-CT) is connected to secondary disconnect terminals X8.9 and X8.10.

The external current sensors for the N conductor are suitable for the electronic trip units ETU300 and ETU600 and are described in Chapter External current sensor for neutral pole (Page 327).

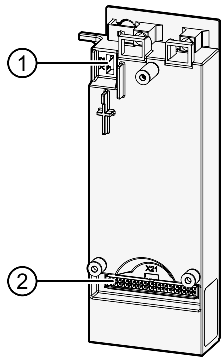
Note

The electronic trip unit ETU300 monitors the current sensors of the phases. If no external current sensor for the N conductor is connected on a 3-pole circuit breaker, secondary disconnect terminals X8.9 and X8.10 must be terminated using terminating resistor "L", which is included in the scope of supply of the circuit breaker. A wire jumper for short-circuiting the input can also be used as an alternative.

2.4.3.4 Rear interfaces

On the rear of the ETU300 electronic trip unit, there are terminals to ensure the circuit breaker functions.

The terminals are only accessible after removing the electronic trip unit. The plug-in connections may only be disconnected for the exchange of the electronic trip unit.



(1) X22 terminal for tripping solenoid F5
(2) X21 terminal for ETU cable harness

2.4.4 Protection parameters

2.4.4.1 Introduction

Note

Do not change any parameters during operation, as this may result in unexpected tripping.

2.4.4.2 Setting range

The protective functions have adjustable and non-adjustable parameters. (For basic settings on delivery from the factory, see Chapter Basic settings of the electronic trip unit on delivery (Page 519)):

ETU300 LSI, ETU300 LSIG		
Protective function	**Setting range and un-changeable parameters**	**Settings**
L: Overload protection LT		
Tripping	activated	
Current setting I_r	0.4 ... 1.0 x I_n	0.4 / 0.5 / 0.6 / 0.7 / 0.75 / 0.8 / 0.85 / 0.9 / 0.95 / 1.0 x I_n
Tripping time t_r at 6 x I_r	0.75 ... 25 s	0.75 / 1 / 2 / 5 / 8 / 10 / 14 / 17 / 21 / 25 s
Characteristic LT curve	I^2t (current-dependent)	
Thermal memory	activated	
Cooling time constant	18 x t_r	
Phase failure detection	activated	
L: Overload protection LT, neutral conductor		
Tripping	activated	
Current setting I_{rN}	1.0 x I_n	
S: Delayed short-circuit protection ST		

ETU300 LSI, ETU300 LSIG		
Protective function	**Setting range and un-changeable parameters**	**Settings**
Tripping	Can be switched on/off	
Current setting I_{sd}		OFF / 1.5 / 2 / 2.5 / 3 / 4 / 5 / 6 / 8 / 10 x I_r Maximum 0.8 x I_{cw} 1)
Tripping time t_{sd}	0.08 ... 0.4 s	At I^2t = OFF (current-independent): 0.08 / 0.15 / 0.22 / 0.3 / 0.4 s At I^2t = ON (current-dependent): 0.08 / 0.15 / 0.22 / 0.3 / 0.4 s
Characteristic ST curve	I^0t (current-independent) / I^2t (current-dependent)	
Reference point $I_{ST\ ref}$	8 x I_r	
I: Instantaneous short-circuit protection INST		
Tripping	activated	
Current setting I_i	1.5 ... 15 x I_n Maximum 0.8 x I_{cs} 1)	1.5 / 2 / 3 / 4 / 5 / 6 / 8 / 10 / 12 / 15 x I_n Maximum 0.8 x I_{cs} 1)

1) The setting is limited depending on the breaking capacity at rated operational voltage U_e.

ETU300, LSIG, with LSIG option plug	
Protective function	**Setting range**
G: Ground-fault protection GF	
Tripping	activated
Method of ground-fault detection	Residual: Recording of the ground-fault current by means of total current formation across all phases and the N conductor
Characteristic GF curve	I^0t (current-independent)
Current setting I_g	0.2 x I_n (min. 100 A, max. 1200 A)
Tripping time t_g	0.2 s

2.4.4.3 Parameter DAS+ maintenance mode

Parameters		
DAS+ maintenance mode		
Current setting $I_{i\ DAS+}$	1.5 x I_n	Activation via ETU input

2.4.5 Maintenance mode DAS+

Maintenance mode DAS+ can be activated for the electronic trip unit ETU300 via the digital ETU input. The input signal must have the signal state HIGH for this purpose.

The activated maintenance mode DAS+ is indicated by the blue DAS+ LED on the ETU300.

The digital ETU output of the circuit breaker is set when the maintenance mode DAS+ is switched on.

The connection is made at the secondary disconnect terminal system of the 3WA circuit breaker.

Digital input ETU-IN	
Connection	X8.5 and X8.6
Floating output ETU-OUT	
Connection	X8.7 and X8.8

2.5 Electronic trip unit ETU600

2.5.1 Overview of variants

All the circuit breakers with integrated ETU600 electronic trip units have two independently operating microprocessors - one for protective functionality and one for metering and accessory functionality.

Function packages can be added to the ETU600 electronic trip unit to add protective functions and additional measurement capabilities. This makes the ETU600 a future-proof protection and measuring device in the age of digitalization.

The protective functions of the ETU600 comply with the regulations for electrical installations and protect them against overcurrent and short circuit.

The optionally integrated metering function supplies the metering values for energy management and can be referred to as a "power metering function" in a circuit breaker as defined in IEC 61557-12. The functionality is equivalent to a power metering and monitoring device.

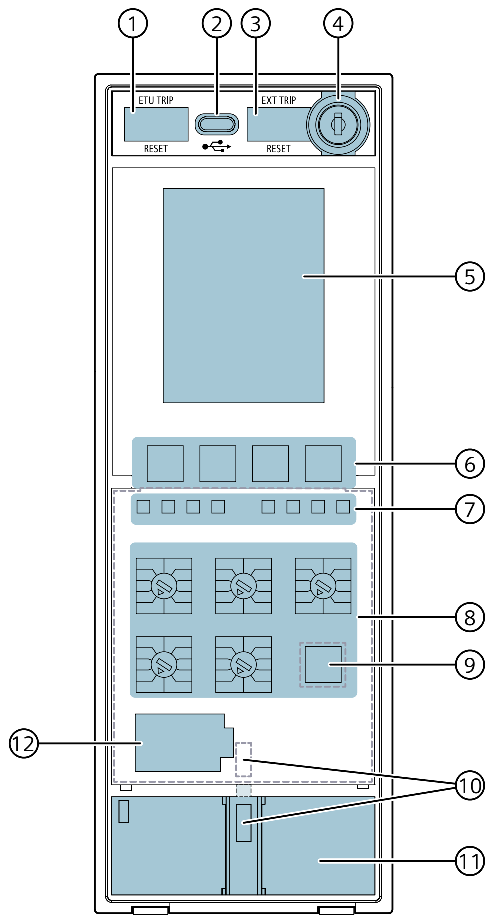
The ETU600 electronic trip unit is available in the following versions:

- ETU600 LSI
  This version has overload protection, short-time and instantaneous short-circuit protection as basic protective functions. The basic protective functions do not require an auxiliary power supply; they are supplied by the current flowing through the circuit breaker.
- ETU600 LSIG
  In addition to the basic protective functions of the ETU600 LSI, this version offers ground-fault protection, see Chapter Ground-fault protection GF (Page 55).
- ETU600 LSIG Hi-Z
  Compared to the ETU600 LSIG, this version offers enhanced ground-fault protection, see Chapter High-impedance ground-fault protection GF Hi-Z (Page 57).

The function scope of all versions can be extended by directional or enhanced protective functions.

2.5.2 Operator controls, displays and voltage tap module

2.5.2.1 Overview



(1) ETU TRIP: Trip indication and mechanical RESET of the reclosing lockout after a trip by the ETU600 electronic trip unit

(2) USB connection (USB-C)

(3) EXT TRIP: Trip indication and mechanical RESET of the reclosing lockout after an external switch-off

(4) Lockable cover with safety lock, prevents a RESET of the reclosing lockout (option)

(5) Display

(6) Operating keys F1 to F4

(7) LED displays

(8) Rotary switch

(9) Query button for querying the last trip cause when ETU600 is not activated

(10) Eye for lead seal for sealable cover

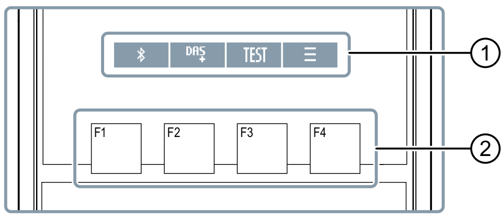
(11) Voltage tap module VTM (option)

(12) Option plug

2.5.2.2 Display and operating keys F1 to F4

The ETU600 electronic trip unit has an integrated color display. This can be used to display measured values and report events. You can set parameters in combination with the four operating keys.

The four operating keys F1 to F4 are assigned menu-dependent actions. One to four operating keys can be active.



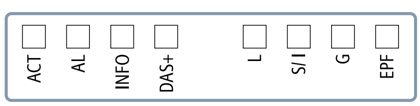
(1) Action that is executed by the assigned operating key

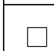
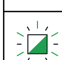
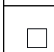
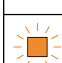
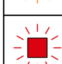
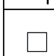
(2) Operating keys

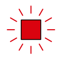
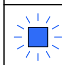
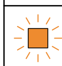
The display is also used for detailed representation of events. A description of selected events is given in Chapter Display and menu structure (Page 88).

2.5.2.3 LED displays

Status information of the ETU600 electronic trip unit and the last trip cause are indicated by LEDs.



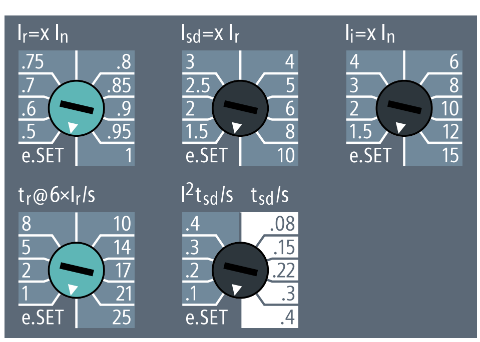
LED	Meaning	Description
ACT (active) Activation of the ETU		
	Off	Electronic trip unit not activated
	Flashing (frequency: 1 Hz)	Electronic trip unit activated
AL (alarm) Two-stage overload alarm		
	Off	Current is less than the set alarm threshold AL1
	On	Current in a phase exceeds the set alarm threshold AL1
	On	Current in a phase is greater than or equal to the setting I_r of the overload protection (alarm threshold AL2)
INFO Display of status information		
	Off	Normal operating state

LED	Meaning	Description	
	On	Warning is present	
	On	Error present	
DAS+ Maintenance mode DAS+			
	Off	DAS+ not activated	
	On	DAS+ activated	
L, S/I, G, EPF Last trip cause			
	Off	Normal operating state	
	On	Tripping due to:	
		L	Overload LT
		S/I	Short circuit ST, dST or INST
		G	Ground fault GF
		EPF	Reverse power protection RP, enhanced protective function EPF
Details on tripping are shown on the display and stored in the trip log of the ETU600. If the ETU600 is not activated, the trip cause can be displayed by pressing the Query button. A prerequisite for the display of the trip cause is that the ETU600 was activated for at least 2 hours before tripping. The trip cause reason is stored for 24 hours in this case.			

Additional information on the display of error messages can be found in Chapter Display of errors and alarms (Page 171).

2.5.2.4 Rotary coding switch

The electronic trip unit ETU600 has five rotary coding switches for parameterizing the basic protective functions.



When the circuit breaker is delivered, the values below are stored as the basic settings for the "e.SET" position:

- I_r: 0.4 x I_n
- t_r: 0.5 s
- I_{sd}: 0.6 x I_n
- t_{sd}: 0.1 s
- I_i 1.5 x I_n

Nine fixed values can be mechanically set on each rotary coding switch. The tenth position is marked with "e.SET". In this position, the parameter can be set using the operating keys on the display or with the help of the SENTRON powerconfig configuration software via Bluetooth or communication.

Note

Active protection parameters

All currently used parameters of the protective functions are shown in the display menu "Active protection parameters 2.0".

2.5.2.5 Voltage tap module

A voltage tap module VTM is required for measuring the voltage and calculating further metering values. It is available as an option for 3WA circuit breakers with ETU600 and metering functions PMF-I to PMF-III.

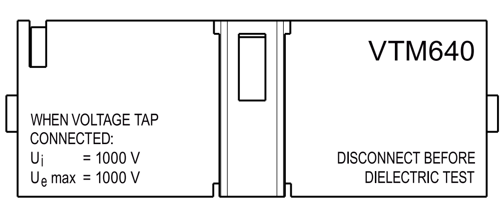
The voltage tap module is available in two versions for circuit breakers with an internal voltage tap on the upper or lower main conducting paths:

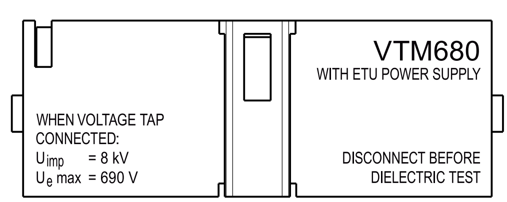
- VTM680 voltage tap module
  For 3WA circuit breakers with a maximum rated voltage of 690 V AC (breaking capacity N, S, M, H and C)
  The VTM680 supplies power to the electronic trip unit ETU600 via the voltage present on the main conducting paths. The ETU600 is activated from the phase-to-phase voltage of 110 V AC.
- VTM640 voltage tap module
  For 3WA circuit breakers with a maximum rated voltage of 1000 V AC (breaking capacity E).

  Note

  Breaking capacity E and internal voltage tap

  For circuit breakers with breaking capacity E, an internal voltage tap and metering functions PMF-I to PMF-III, the rated insulation voltage U_i and the rated operational voltage voltage U_e are reduced to 1000 V AC.
  It is not possible to use this combination with a line voltage of 1150 V AC.





If an internal voltage tap is retrofit to the lower main conducting paths, the voltage tap module is provided depending on the rated voltage of the circuit breaker, see Chapter Retrofit of the internal voltage tap (Page 342).

Voltage measurement is also possible via external voltage transformers with frame sizes 2 and 3. The retrofit kit for connecting external voltage transformers includes a VTM640 voltage tap module, see Chapter Connection of an external voltage transformer (Page 343).

Metering values

If a voltage tap module is retrofit on the circuit breaker, the following metering values are available:

- Phase-to-phase voltage U_{LL}
- Phase voltage U_{LN}
- Active energy E_a

This makes the 3WA circuit breaker a PMF-I type measuring device (for definition, see IEC 61557-12).

Test position

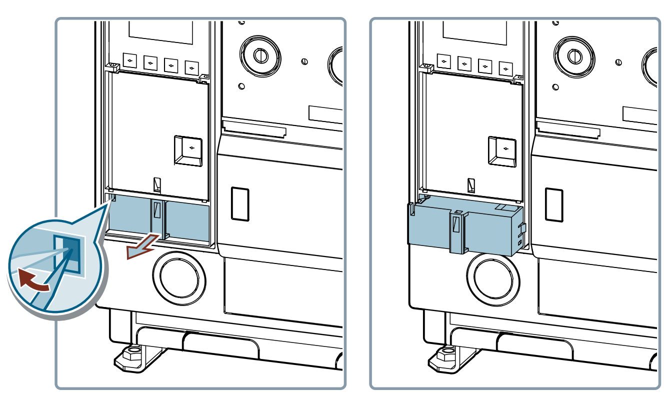
Before performing the insulation test of the power distribution equipment, the voltage tap module must be pulled out into its test position. This provides galvanic isolation between the electronics and the main circuit.

NOTICE
Damage due to lack of isolation If the internal voltage converter is connected to the metering function during the insulation test, damage may occur as a result. Before the insulation test of the power distribution equipment, disconnect the internal voltage converter from the metering function.

Note

The voltage on the top or bottom main connections is tapped on the rear of the circuit breaker and supplied to the voltage tap module via insulated cables with a series-connected fuse. The voltage tap module contains a high-resistance voltage divider. As withdrawal of the voltage tap module creates galvanic isolation, no leakage currents can flow across the high-resistance voltage divider of the VTM during the insulation test of the power distribution equipment.

Performing an insulation test without pulling the voltage tap module into its test position may result in a failed insulation test. This will not affect the circuit breaker functionality.

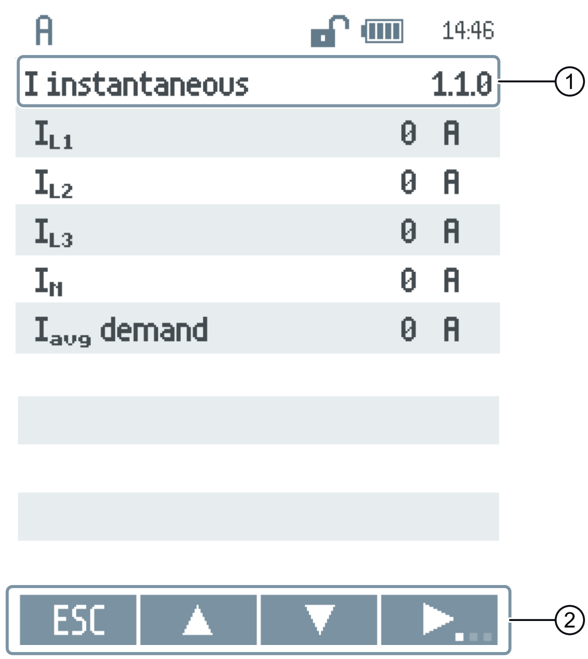


2.5.3 Display and menu structure

2.5.3.1 Operating philosophy

For a simple and intuitive operation of the ETU600 electronic trip unit, the following two properties are important:

- In each menu, the menu name and the corresponding menu number are displayed in the top line.
- The operating keys F1 to F4 have a menu-dependent assignment.



(1) Menu name and menu number

(2) Assignment of the operating keys (menu bar)

Icons of the functions

The assignment of the operating keys F1 to F4 is indicated by the following icons in the menu bar:

Icon	Function
	Navigation in the menu - up
	Navigation in the menu - down
	Confirmation
	Edit settings

Icon	Function
	Escape / back If the operating key is pressed for more than > 3 s: Return to the main menu
	Main menu
	Test menu
  	Selection of a "Shadow" menu
	Activating the maintenance mode DAS+
	Generation of a QR code
	Activation/deactivation of Bluetooth

Additional symbols

If a menu has to be displayed across several pages, this can be recognized by the following symbols on the right-hand side:

Icon	Meaning
	Scroll menu - further menu items are located above the displayed menu items
	Scroll menu - there are further menu items below the displayed menu items

The following symbols are used to represent a state:

Icon	Meaning
	Status: OK
	Status: Error

2.5.3.2 Menu structure

The menu commands are shown in the display of the electronic trip unit ETU600 depending on the version and the available options.

The main menu comprises the following menu commands:

Name	Menu number
Main menu	0.0
Measured values	1.0
Active protection parameters	2.0
Change protection parameters	3.0
Status and maintenance	4.0
Device configuration	5.0
Test	6.0
System configuration	7.0

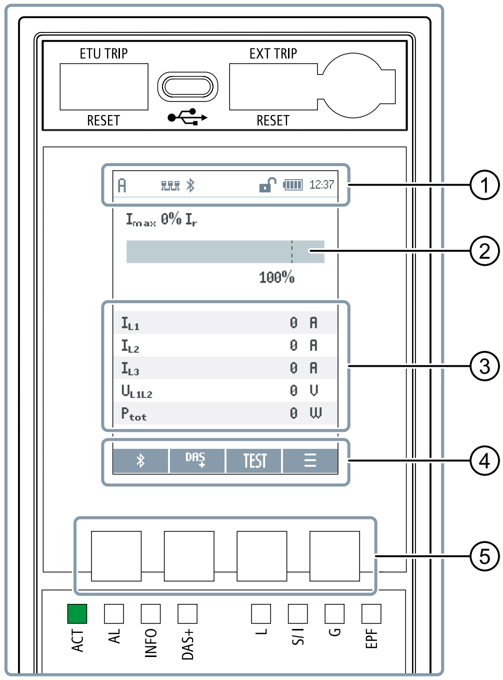
You will find the entire menu structure and selected screenshots in the Appendix, see Chapter ETU600 menu structure (Page 527).

Note

Displaying and changing protection parameters

All currently used parameters of the protective functions are shown in the display menu "Active protection parameters 2.0". Protection parameters can only be changed in the menu "Change protection parameters 3.0".

2.5.3.3 Start screen



(1) Status bar

(2) Maximum instantaneous value of phase current with respect to overload protection

(3) Measured values

(4) Menu bar

(5) Operating keys

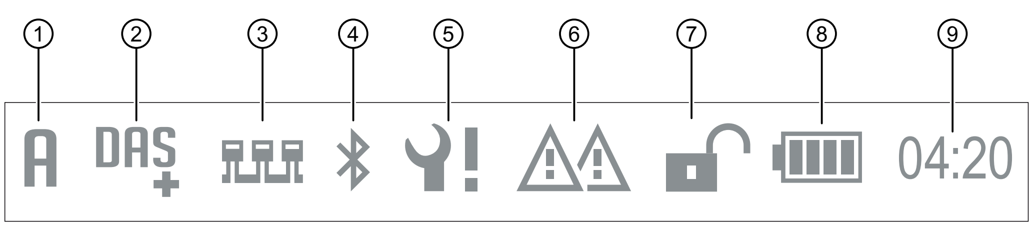
When the electronic trip unit is activated, the start screen appears.

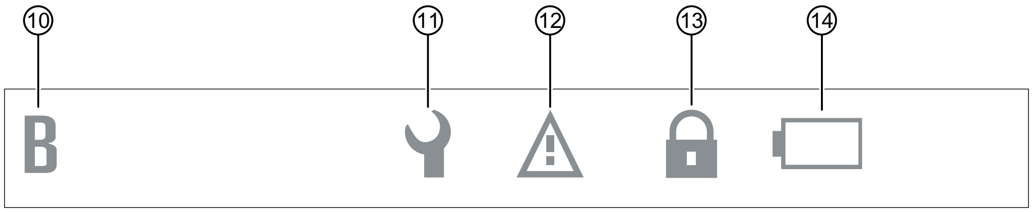
It is also displayed with dimmed backlighting after the time set in menu item 5.5.5 if none of operating keys F1 to F4 have been operated.

When the backlighting is dimmed, briefly pressing one of the operating keys increases the brightness of the backlighting.

Status bar

In the status bar, the statuses of the circuit breaker are represented by symbols.

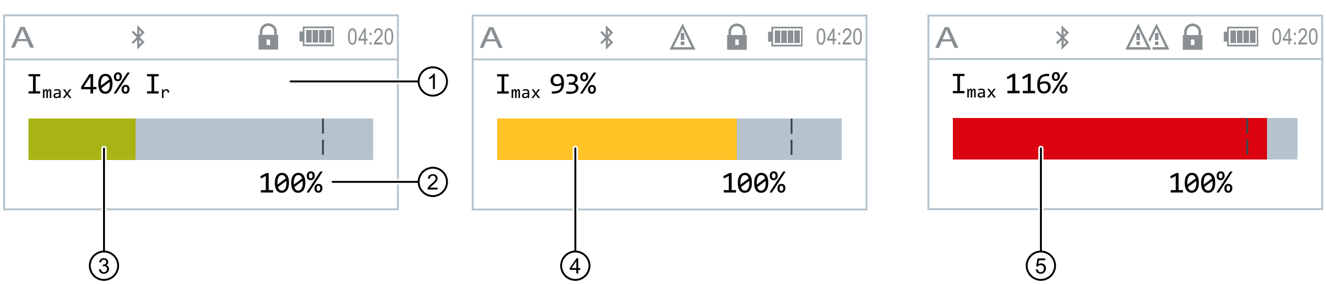




(1) Parameter set A of the protective functions active
(2) Maintenance mode DAS+
(3) CubicleBUS^2 stations available
(4) Existing Bluetooth connection
(5) Maintenance required
(6) Overload alarm AL2
(7) Password protection not set
(8) Battery charge level good
(9) System time
(10) Alternatively to (1): Parameter set B active
(11) Inspection required
(12) Overload alarm AL1
(13) Alternatively to (7): Password protection set
(14) Alternatively to (8): Battery charge level low

Maximum instantaneous value of the phase current

The maximum phase current is displayed as a numerical value as a percentage of the setting value of the overload protection. A colored bar chart shows the level of the current.



(1) Percentage value of the maximum phase current
(2) Reference point, setting for overload protection I_r
(3) Bar chart, maximum phase current < alarm threshold AL1
(4) Bar chart, alarm threshold AL1 < maximum phase current < setting for overload protection I_r
(5) Bar chart, maximum phase current > setting for overload protection I_r

Measured values

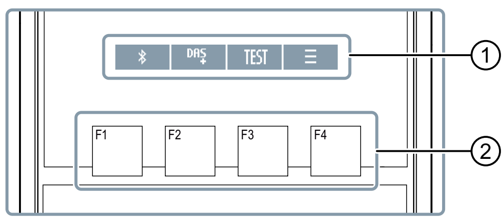
The start screen of the ETU600 can display up to 6 measured values simultaneously.

Select the displayed measured values using the SENTRON powerconfig configuration software.

Menu bar and operating keys

You can call the following functions directly from the start screen with the operating keys:

- F1: Activate Bluetooth connection
- F2: Activate maintenance mode DAS+ (option)
- F3: Call up the test menu
- F4: Call up the main menu of the display



(1) Menu bar
(2) Operating keys

2.5.3.4 Display after a trip

Note

Trip indication via the display is only possible with an activated ETU600 electronic trip unit. Alternatively, by pressing the "QUERY" button on the front of the ETU, you can display the last trip cause via LED.

The LED for the last trip cause lights up for at least 10 s when the storage capacitor for the LED is fully charged. The storage capacitor is fully charged when the electronic trip unit was activated continuously for at least 2 hours and was deactivated no more than 24 hours after tripping.

A trip of the circuit breaker is indicated by an orange trip cause LED, stored in the trip log of the ETU600, and shown on the display with "TRIP".

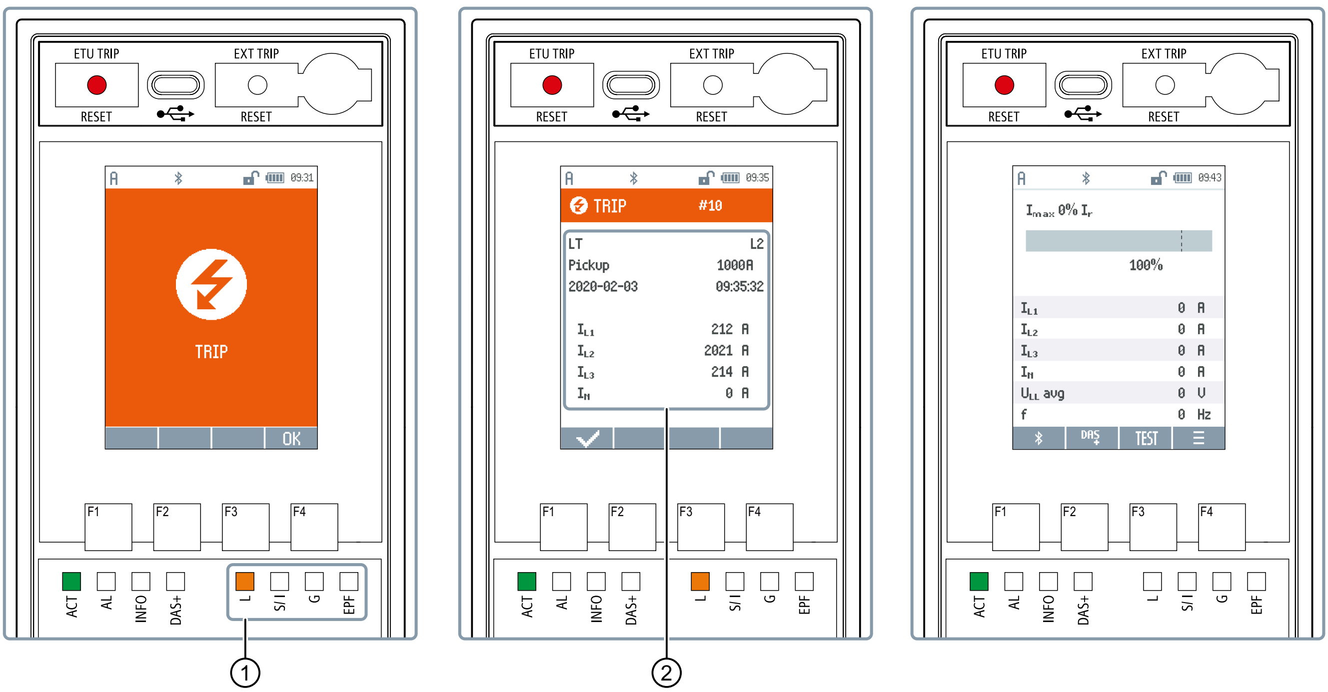
After acknowledging the trip by pressing the F4 operating key, details regarding the trip become visible. These always contain:

- Sequence number of the trip
- Trip cause with specification of the phase
- Associated setting
- Time stamp and last measured values before tripping

The details are acknowledged using the F1 operating key. When the F1 operating key is pressed, the system returns to the menu page which was displayed before tripping.

Note

For circuit breakers without external power supply or a VTM640 voltage tap module, the ETU600 will not be active after tripping. In order to obtain detailed information about the trip cause, you can activate the ETU600 via the USB-C interface using a notebook, via a USB power supply unit, or via a USB power bank.



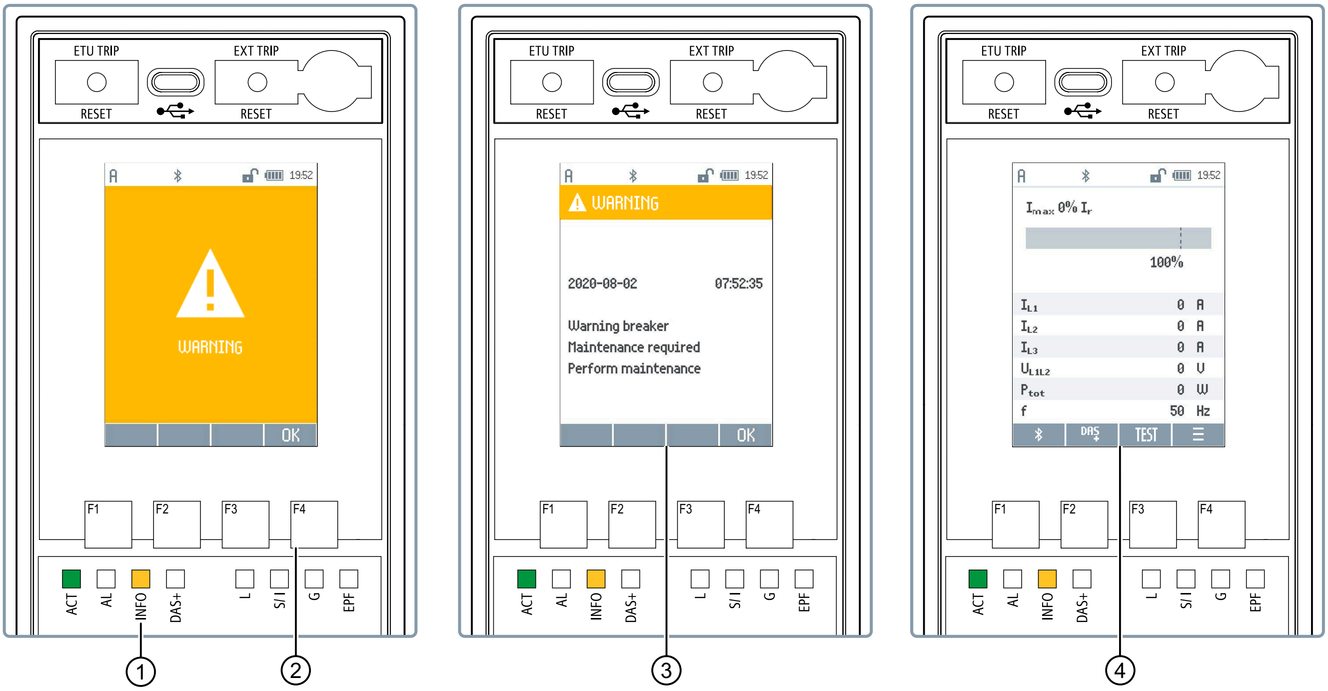
(1) Trip cause LED (here overload)

(2) Tripping details

2.5.3.5 Display in case of a warning

Warnings are indicated by a yellow INFO LED and shown on the color display of the ETU600 electronic trip unit.

The warning is acknowledged by pressing the F4 operating key. Afterwards, the time stamp and details of the warning will be visible on the display. After pressing the operating key F4 again, the warning disappears and the last selected menu appears.



(1) INFO LED

(2) F4 operating key

(3) Details, description of the warning, and instructions for action

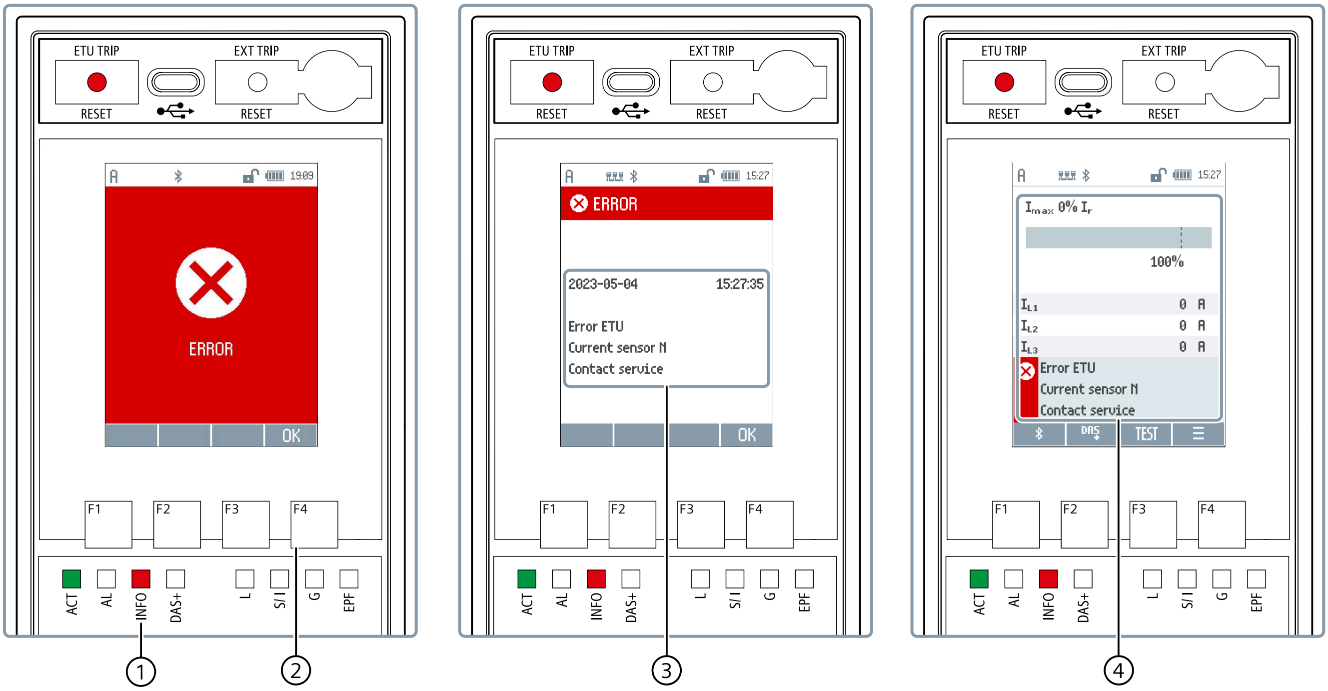
(4) Last selected menu

2.5.3.6 Display of an error message

Detected errors are indicated by a red LED signaling indicator and shown on the display of the electronic trip unit ETU600.

The error is acknowledged by pressing the F4 operating key. Afterwards, the time stamp and details of the error are shown on the display. After pressing the F4 operating key again, the full-screen error display disappears.
When the electronic trip unit is activated, a pop-up window on the display continues to indicate errors until they are eliminated and the ETU600 is restarted.

The error message below is displayed in the event of a wire break in the current sensor of the neutral conductor. However, it is also displayed if no external current sensor for the neutral conductor (N-CT) is connected on a 3-pole circuit breaker, or if the input for this is not terminated with terminating resistor "L".



(1) LED signaling indicator
(2) F4 operating key
(3) Error display
(4) Start screen with error display, visible until error is rectified

2.5.4 Interfaces

2.5.4.1 Bluetooth and USB-C interface

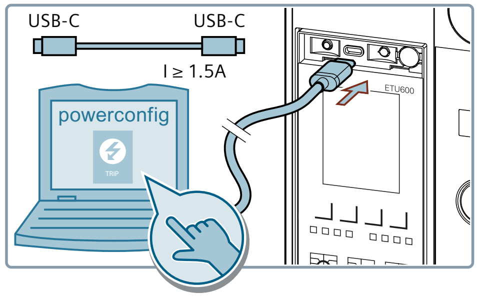
You can use the SENTRON powerconfig configuration software for parameterization. The current version of the SENTRON powerconfig configuration software can be found on the internet (https://support.industry.siemens.com/cs/ww/en/view/63452759).

USB-C interface

The ETU600 electronic trip unit has a USB-C interface on the front. The electronic trip unit can be activated and parameterized via this interface.

ETU600 activation requires that the interface (USB connection, USB power supply unit, or power bank) can supply a minimum of 1.5 A at 5 V.

This requirement can be met by using a power source with a USB-C to USB-C connection cable.
The USB-C standard always supplies the required output voltage. A notebook with a USB interface should be suitable for activation.



Note

Using the USB-C interface

The USB-C interface of the ETU600 is designed for temporary use during commissioning, maintenance or service. No USB cable may be connected to the interface during normal operation. The Bluetooth interface makes local access possible during operation.

Bluetooth interface

Parameterization of the ETU is also possible via the integrated Bluetooth interface. The interface complies with the Bluetooth Low Energy standard.

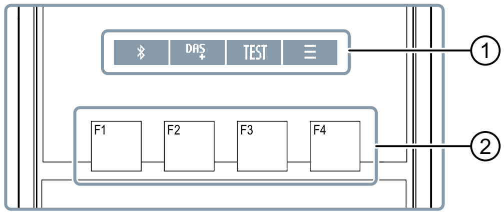
The 3WA circuit breaker is also available as a special version "Circuit breaker without Bluetooth functionality" with the order suffix Z=D80.

Note

On delivery of the 3WA circuit breaker, the Bluetooth interface is deactivated. The Bluetooth interface can be activated via communication, using the operating keys on the display of the ETU600 electronic trip unit, via USB-C, or using the SENTRON powerconfig configuration software.
The Bluetooth interface is automatically deactivated when the communication is interrupted and after a timeout. The timeout starts as soon as there is no more data traffic. It is factory-set to 60 seconds and can be increased to a maximum of 3600 seconds using the SENTRON powerconfig configuration software.

Bluetooth certifications can be found on the internet (https://support.industry.siemens.com/cs/ww/en/ps/18354/cert?ct=443).

To connect with a compatible device via Bluetooth, activate the Bluetooth interface by pressing operating key F1 on the start screen.
The activated Bluetooth interface is indicated in the status bar.



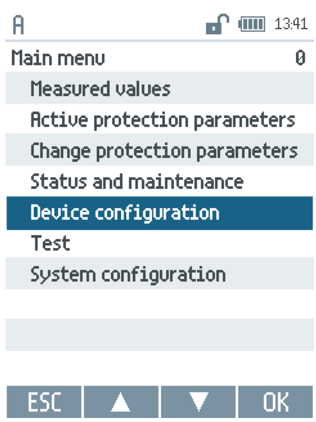
(1) Menu bar

(2) Operating keys

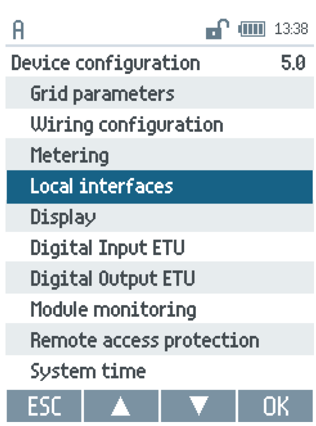
Available devices and devices which have previously been paired are automatically connected.

A long press of operating key F1 calls up Bluetooth menu 5.4.1. You can connect a new device here.
Alternatively, you can proceed as follows:

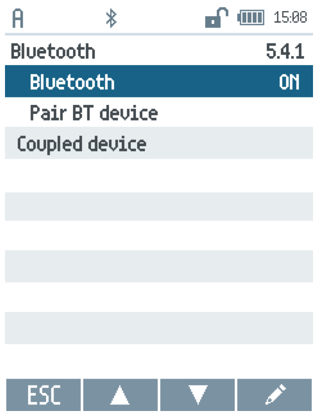
1. Select the "Device configuration" menu item in the main menu of the ETU600.



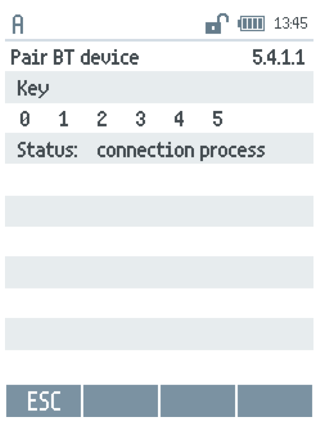
2. Select the menu item "Local interfaces".



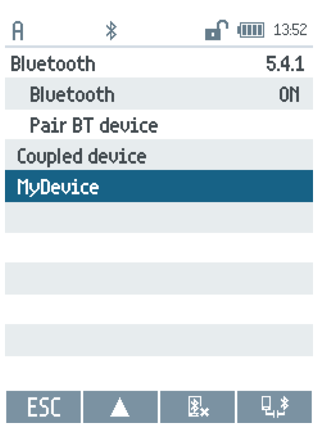
3. Select the "Bluetooth" interface and switch it on, if it is not yet activated.



4. Activate pairing mode on the device to be paired and select ETU600 as the connection partner.
   Select the ETU600 menu item "Pair BT device".
   A connection code is displayed.



   A prompt requesting you to enter the code appears on the device to be paired.
5. Enter the displayed code on the device to be paired.
6. Pairing is complete and the connected device appears on the ETU600 display.



Technical specifications of 3WA Bluetooth

Standard	Bluetooth 5 Low Energy
Transmit power	4 dBm
Encryption	✓
Pairing	6-digit PIN
Updatable	Signed security updates

You will find information about the FCC and ISED certificates on the internet (https://support.industry.siemens.com/cs/ww/en/ps/3WA./cert).

2.5.4.2 Digital input and output

The electronic trip unit ETU600 has one digital input and one digital output. Both can be configured in the device configuration menu using the operating keys on the display of the electronic trip unit ETU600 or with the help of the SENTRON powerconfig configuration software.

The 24 V input permits the following:

- Activating the maintenance mode DAS+
- Switchover to the second protection parameter set (parameter set B).

The meaning of the input signal (low or high) is configurable.

The floating output is a normally open contact. It is available for the ETU600 with internal and external power supply and permits the following displays:

- Signaling of the error-free operating state of the ETU600
  When this signal is integrated into a control system, the status of the functionality of the electronic trip unit is transmitted at all times. If an internal fault is detected by the electronic trip unit or if the ETU600 is no longer able to control this output, the contact is opened and the message "Fault-free operating state of the ETU600" disappears. The function of the digital ETU output is described as "life contact".
- Leading signaling contact for tripping of the circuit breaker (leading trip alarm switch)
  In the event of the electronic trip unit tripping, the signal is output 15 to 45 ms before the contacts open.
  The leading signal can be used to shut down thyristor control devices, for example.
  The signal is also output if the circuit breaker is tripped by the internal self-test and software-assisted testing.
- Maintenance mode DAS+ active
- Second protection parameter set (parameter set B) active

Technical specifications and connection

The connection is made at the secondary disconnect terminal system of the 3WA circuit breaker.

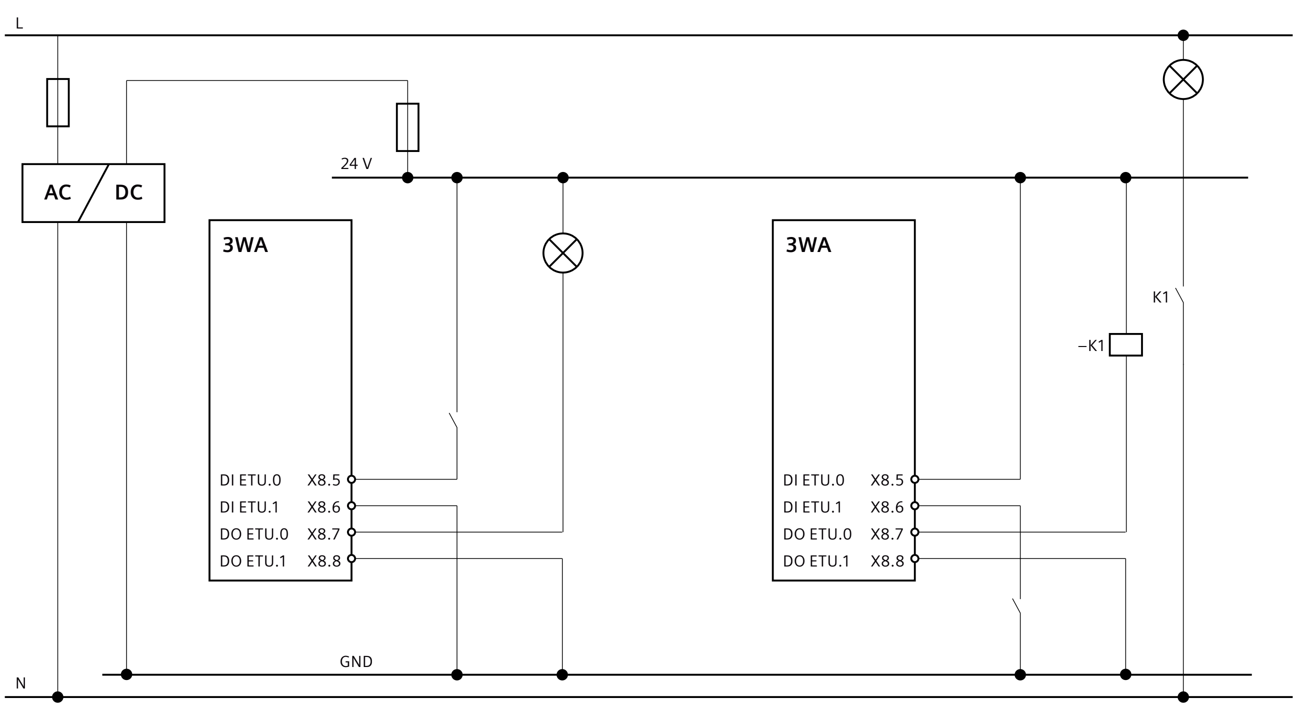
Digital input ETU-IN	
Connection	X8.5 and X8.6
Number of inputs	1

Digital input ETU-IN	
SELV/PELV suitable	✓
Rated voltage	24 V DC ±20%
Voltage value for reliable detection of a "1 signal":	15 V DC
Current consumption at signal voltage of >15 V DC	< 10 mA
Minimum signal duration	100 ms

Floating output ETU-OUT	
Connection	X8.7 and X8.8
Number of semiconductor relay outputs	1
Contact	Normally open contact
Rated voltage	24 V DC ±20%
Maximum switching current	0.1 A at 24 V DC
Maximum continuous current	0.1 A at 24 V DC

- The digital input is designed for a control supply voltage of 24 V DC.
  No polarity is specified at the DI ETU.0 and DI ETU.1 input terminals.
- The digital outputs DO ETU.0 and DO ETU.1 are designed for 24 V DC and as a normally open contact (NO).
  If the power to be switched exceeds the breaking capacity of the output, a suitable coupling relay must be used.

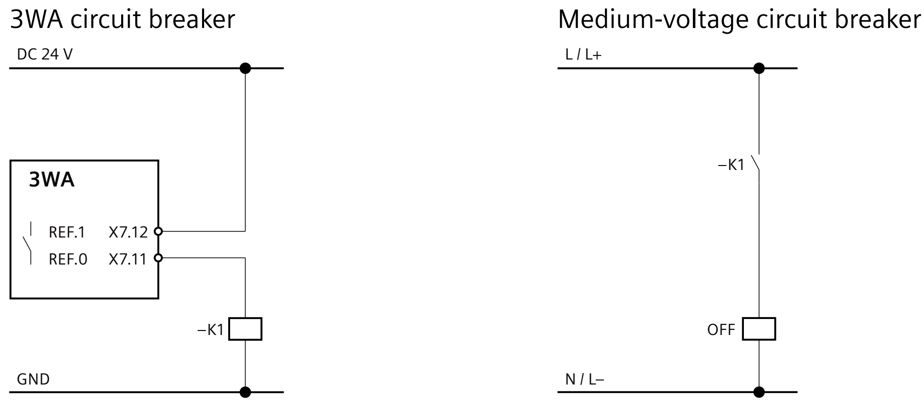
The following circuit diagram shows the integration of the digital input and output of the ETU into a control and signaling system using the example of two circuit breakers. Depending on the load, a coupling relay must be used at the output. The example also shows the polarity-independent control of the input.



2.5.4.3 Digital output for ground-fault alarm REF

The electronic trip unit ETU600 has a digital output for signaling a detected ground fault on the infeed side of the circuit breaker. This signal is available at terminals X7.11 and X7.12 of the secondary disconnect terminal.

The ground fault can only be eliminated via the upstream medium-voltage circuit breaker. The signaling contact must be integrated into the control of the medium-voltage circuit breaker via a coupling relay for this purpose.



The floating output is a normally open contact. It is available for both internal and external power supply of the ETU600.

Technical specifications and connection

The connection is made at the secondary disconnect terminal system of the 3WA circuit breaker.

Floating output for ground-fault alarm REF	
Connection	X7.11 and X7.12
Number of semiconductor relay outputs	1
Contact	Normally open contact
Rated voltage	24 V DC ±20%
Maximum switching current	0.1 A at 24 V DC
Maximum continuous current	0.1 A at 24 V DC

2.5.4.4 External current sensors

Current sensor for the N conductor

The neutral current can be measured with a current sensor. With a 3-pole circuit breaker, the external current sensor for the N conductor must be used for this purpose.

The external current sensor for the N conductor (N-CT) is connected to secondary disconnect terminals X8.9 and X8.10.

The external current sensors for the N conductor are suitable for the electronic trip units ETU300 and ETU600 and are described in Chapter Accessories for the ETU300 and ETU600 electronic trip units (Page 326).

Note

The electronic trip unit monitors the current sensors of the phases. If no external current sensor for the N conductor is connected on a 3-pole circuit breaker, secondary disconnect terminals X8.9 and X8.10 must be terminated using terminating resistor "L", which is included in the scope of supply of the circuit breaker. A wire jumper for short-circuiting the input can also be used as an alternative.

Current sensor for ground-fault current

For direct measurement of the ground-fault current, an external current transformer (GF-CT) can be connected to terminals X8.11 and X8.12 of the secondary disconnect terminal of the 3WA circuit breaker.

The current transformer must have the following properties:

- Primary rated current I_{pr} = 150 A to 2000 A
- Secondary rated current I_{sr} = 1 A
- Accuracy class 1

NOTICE
Damage to electronic trip unit (ETU) due to incorrectly dimensioned current transformer
The measuring input of the electronic trip unit is designed for a maximum current of 4 A over 500 ms. This value must not be exceeded. The selection of the current transformer must take into account the internal circuit breaker load of 0.11 Ω.

Note

Proper operation of the external current transformer is not monitored by the electronic trip unit ETU600.

The transformation ratio of the current transformer must be set on the electronic trip unit ETU600. This can be done in menu item 5.3.6 Ground-fault current using the operating keys on the display of the electronic trip unit ETU600 or with the help of the SENTRON powerconfig configuration software.

2.5.4.5 Battery

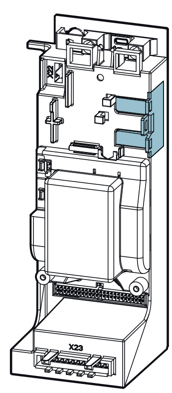
The internal clock of the electronic trip unit ETU600 is powered by a lithium battery when the ETU600 is not activated. The charge status is shown in the status bar of the display.

 Battery full

 Battery empty, replacement necessary

The battery is only used when the ETU600 has not been activated by another energy source (self-powering or 24 V auxiliary power supply). The service life of the battery depends on the ambient conditions and the duration of use when the ETU is not activated. It is usually 10 to 15 years, but at least five years.

The battery can be replaced on site. To do this, the operator panel of the circuit breaker must be removed, see Chapter Preparatory and concluding steps for the installation of internal accessories (Page 219). The battery compartment is then accessible from the side without dismantling the ETU600.



An empty battery does not affect the protective function of the circuit breaker. When the battery is empty, the system time of the circuit breaker may be inaccurate and events may be given an incorrect time stamp. The battery warning message remains active until a fully charged battery is detected.

The system time can be set via the display of the ETU600 (menu 5.10), the SENTRON powerconfig configuration software or SNTP (Simple Network Time Protocol), see Chapter 2.8.3.8 System time (Page 159).

Note

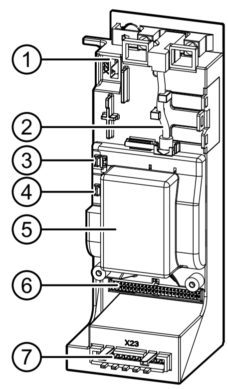
If you are putting a spare circuit breaker or electronic trip unit ETU600 into storage, we recommend that you remove the battery and store it separately so as to prevent it from discharging.

The lithium battery can be ordered as a spare part, see Chapter Replacement battery for ETU600 (Page 339).

2.5.4.6 Rear interfaces

On the rear of the electronic trip unit ETU600, there are terminals to ensure the circuit breaker functions.

The terminals are only accessible after removing the electronic trip unit. The plug-in connections may only be disconnected for the exchange of the electronic trip unit.



(1) X22 terminal for tripping solenoid F5
(2) X28 terminal for internal USB cable
(3) X29 terminal for X8.1 to X8.4
(4) X27 terminal for ETU cable harness
(5) Bluetooth and USB-C interface TUI600
(6) X21 terminal for ETU cable harness
(7) X23 terminal for voltage measurement

2.5.5 Protection parameters

2.5.5.1 Introduction

Note

Do not change any parameters during operation, as this may result in unexpected tripping.

2.5.5.2 Parameter set A

The basic protective functions of the ETU600 electronic trip unit can be set quickly and easily using the rotary coding switches on the front of the ETU600, see Chapter Rotary coding switch (Page 85).

Each rotary coding switch has nine permanently assigned values and the position e.SET.

If the rotary coding switch is set to "e.SET", the parameter can be freely selected within its limits and set using the operating keys on the display or with the help of the SENTRON powerconfig configuration software via Bluetooth or communication.

In addition to the five parameters for the basic protective functions, there are other parameters which influence the behavior of the circuit breaker in the overcurrent range. All the parameters are shown below. The factory settings of the electronic trip unit on delivery of the circuit breaker are described in the Appendix Rotary coding switch (Page 85).

Protective functions whose parameters cannot be selected via the rotary coding switches must be set via the operating keys on the display or with the help of the SENTRON powerconfig configuration software via Bluetooth or communication.

See also

Basic settings of the electronic trip unit on delivery (Page 519)

2.5.5.3 Parameter set B (optional)

The electronic trip unit ETU600 allows the storage of two different sets of parameters for the protective functions. This allows the changed protection requirements to be taken into account in the event of changed power supply conditions, e.g. in the event of emergency supply via an emergency power generator.

All data of parameter set B can only be changed using the operating keys on the display or with the help of the SENTRON powerconfig configuration software.

Switching between the parameter sets

Switching between the parameter sets A and B can be done manually via:

- Operating keys on the display of the electronic trip unit ETU600
- Digital ETU600 input on circuit breaker, terminals X8.5 and X8.6
- Input signal on a digital input/output module
- Switchover command via a communications module
- SENTRON powerconfig configuration software

For security reasons, parameter set B can only be deactivated using the same method by which it was activated.

2.5.5.4 Setting range for parameter sets A and B

Each parameter set contains the following data (for basic settings on delivery from the factory, see Chapter Basic settings of the electronic trip unit on delivery (Page 519)):

Note

When instantaneous short-circuit protection INST is deactivated, the rated service short-circuit breaking capacity I_{cs} of the circuit breaker is reduced to rated short-time current I_{cw} ($I_{cs} = I_{cw}$).

With the electronic trip unit ETU600, short-time-delayed short-circuit protection ST and instantaneous short-circuit protection INST cannot be deactivated simultaneously.

- If INST is deactivated while ST is already deactivated, instantaneous short-circuit protection INST is automatically activated with the maximum current setting I_i.
- If ST is deactivated while INST is already deactivated, instantaneous short-circuit protection INST is automatically activated with the maximum current setting I_i.

ETU600 LSI, ETU600 LSIG, ETU600 LSIG Hi-Z		
Protective function	**Setting range for parameter sets A and B**	**Settings with rotary coding switch only possible in parameter set A**
L: Overload protection LT		
Tripping	Can be switched on/off	
Current setting I_r	0.4 ... 1.0 x I_n	0.5 / 0.6 / 0.7 / 0.75 / 0.8 / 0.85 / 0.9 / 0.95 / 1.0 x I_n
Tripping time t_r at 6 x I_r	At I^2t: 0.5 ... 30 s At I^4t: 0.5 ... 5 s	1 / 2 / 5 / 8 / 10 / 14 / 17 / 21 / 25 s
Characteristic LT curve	Current-dependent: I^2t / I^4t	
Thermal memory	Can be switched on/off	
Cooling time constant	10 / 18 x t_r	
Phase failure detection	Can be switched on/off	
Overload pre-alarm PAL	Can be switched on/off	
Current setting $I_{r\ PAL}$	0.7 ... 1.0 x I_r	
Delay time $t_{r\ PAL}$	0.5 ... 1.0 x t_r	
L: Overload protection LT, neutral conductor		
Tripping	Can be switched on/off	
Current setting I_{rN}	3-pole: 0.2 ... 2.0 x I_n 4-pole: 0.2 x I_n ... $I_{n\ max}$	
Current setting $I_{rN\ PAL}$	0.7 ... 1.0 x I_N	
S: Delayed short-circuit protection ST		
Tripping	Can be switched on/off	
Current setting I_{sd}	0.6 x I_n ... 0.8 x I_{cw} max. 0.8 I_{cw} 1)	1.5 / 2 / 2.5 / 3 / 4 / 5 / 6 / 8 / 10 x I_r max. 0.8 x I_{cw} 1)
Tripping time t_{sd}	0.02 ... 0.4 s	At I^2t = OFF (current-independent): 0.08 / 0.15 / 0.22 / 0.3 / 0.4 s At I^2t = ON (current-dependent): 0.1 / 0.2 / 0.3 / 0.4 s

ETU600 LSI, ETU600 LSIG, ETU600 LSIG Hi-Z		
Protective function	**Setting range for parameter sets A and B**	**Settings with rotary coding switch only possible in parameter set A**
Characteristic ST curve	I^0t (current-independent) / I^2t (current-dependent)	
Reference point $I_{ST\ ref}$	6 ... 12 x I_r	
Intermittent detection	Can be switched on/off	
S: Directed short-time-delayed short-circuit protection dST (optional)		
Tripping	Can be switched on/off	
Direction setting	forward: ↓ or ↑	
Current setting I_{sd} FW	0.6 x I_n ... max. 0.8 x I_{cw} [1)]	
Current setting I_{sd} REV	0.6 x I_n ... max. 0.8 x I_{cw} [1)]	
Tripping time t_{sd} FW	0.05 ... 0.4 s	
Tripping time t_{sd} REV	0.05 ... 0.4 s	
I: Instantaneous short-circuit protection INST		
Tripping	Can be switched on/off	
Current setting I_i	1.5 x I_n ... 0.8 x I_{cs} max. 0.8 I_{cs} [1)]	1.5 / 2 / 3 / 4 / 6 / 8 / 10 / 12 / 15 x I_n max. 0.8 I_{cs} [1)]
Reverse power protection RP (optional)		
Tripping	Can be switched on/off	
Setting P_{RP}	0.05 ... 0.5 x P_n	
Tripping time t_{RP}	0.01 ... 25 s	

1) The setting is limited depending on the breaking capacity of the set rated voltage.

ETU600 LSIG with LSIG GFx (GF extended) option plug		
Protective function	**Setting range**	
G: Ground-fault protection GF		
Tripping	Can be switched on/off	
Method of ground-fault detection	Residual	Detection of the ground-fault current through total current formation in all phases and the N conductor
	Direct	Direct measurement of the ground-fault current using a current transformer
	Dual	UREF protection zone: Detection of the ground-fault current through total current formation REF protection zone: Measurement of the ground-fault current using an external current transformer
Characteristic GF curve	I^0t (current-independent) / I^2t / I^4t / I^6t	

ETU600 LSIG with LSIG GFx (GF extended) option plug		
Protective function	**Setting range**	
Current setting I_g	Residual acquisition method	Depending on the frame size: • Frame size 1 / 2: 100 ... 2000 A • Frame size 3: 400 ... 2000 A
	Direct acquisition method	Depends on the current transformer (GF-CT) used, adjustable in the range 0.1 ... 1.0 x I_{pr}, e.g. • 150 A / 1 A: 15 ... 150 A • 1200 A / 1 A: 120 ... 1200 A • 2000 A / 1 A: 200 ... 2000 A
Tripping time t_g	For $I^x t$ = OFF (current-independent)	0 ... 5 s
	For $I^x t$ = ON (current-dependent) at 3 x I_g	0 ... 30 s
Minimum tripping time $t_{g\ def}$	For $I^x t$ = ON	0.05 ... 0.5 s
Intermittent detection	Can be switched on/off	
G: Ground-fault GF alarm		
Alarm	Can be switched on/off	
Current setting $I_{g\ alarm}$	Residual acquisition method	Depending on the frame size: • Frame size 1 / 2: 100 ... 5000 A • Frame size 3: 400 ... 5000 A
	Direct acquisition method	15 ... 5000 A
Alarm time $t_{g\ alarm}$	0 ... 0.5 s	

ETU600 LSIG Hi-Z with LSIG GFx (GF extended) option plug		
Protective function	**Setting range**	
G: Ground-fault protection GF		
Ground-fault protection GF Hi-Z	Can be switched on/off	
Method of ground-fault detection	Residual	Detection of the ground-fault current through the total current formation in all phases and the N conductor (UREF protection zone only)
	Dual Hi-Z, for high-impedance connection of the external current transformers	UREF protection zone: Detection of the ground-fault current through total current formation REF protection zone: Measurement of the ground-fault current using an external current transformer combination

ETU600 LSIG Hi-Z with LSIG GFx (GF extended) option plug		
Protective function	**Setting range**	
UREF protection zone	Tripping	If ground-fault protection GF Hi-Z is activated
	Current setting I_g	Depending on the frame size: • Frame size 1 / 2: 100 ... 2000 A • Frame size 3: 400 ... 2000 A
	Characteristic GF curve	I^0t (current-independent) / I^2t / I^4t / I^6t
	Tripping time t_g	• For I^xt = OFF (current-independent): 0 ... 5 s • For I^xt = ON (current-dependent) at 3 x I_g: 0 ... 30 s
	Minimum tripping time $t_{g\ def}$	For I^xt = ON: 0.05 ... 0.5 s
REF protection zone	Alarm	If ground-fault protection GF Hi-Z is activated
	Current setting I_g	Resulting from: • Transformation ratio of the current transformer (1 ... 7000) • Shunt (10 ... 1000 Ω) • Secondary current via shunt (11 ... 5000 mA)
	Alarm time t_g	0 ... 5 s
Intermittent detection	Can be switched on/off	
G: Ground-fault GF alarm		
Alarm	Can be switched on/off	
Current setting $I_{g\ alarm}$	UREF protection zone	Depending on the frame size: • Frame size 1 / 2: 100 ... 5000 A • Frame size 3: 400 ... 5000 A
Alarm time $t_{g\ alarm}$	0 ... 0.5 s	

2.5.5.5 Enhanced protective functions EPF

In addition to the two sets of protection parameters A and B, enhanced protective functions are optionally available for the electronic trip unit ETU600.

Enhanced protective function	Setting range
Current unbalance [1) 2)]	
Tripping	Can be switched on/off
Setting	5 ... 50%
Tripping time	0 ... 15 s
Voltage unbalance [1) 3)]	
Tripping	Can be switched on/off
Setting	5 ... 50%
Tripping time	0 ... 15 s
Harmonic analysis of current [2)]	

Enhanced protective function	Setting range
Tripping	Can be switched on/off
Setting	3 ... 50%
Tripping time	5 ... 15 s
Harmonic analysis of voltage [3)]	
Tripping	Can be switched on/off
Setting	3 ... 50%
Tripping time	5 ... 15 s
Undervoltage U_{LL} (phase-phase)	
Tripping	Can be switched on/off
Setting	100 ... 1100 V
Tripping time	0 ... 15 s
Overvoltage U_{LL} (phase-phase)	
Tripping	Can be switched on/off
Setting	200 ... 1200 V
Tripping time	0 ... 15 s
Undervoltage U_{LN} (phase-neutral conductor)	
Tripping	Can be switched on/off
Setting	60 ... 600 V
Tripping time	0 ... 15 s
Overvoltage U_{LN} (phase-neutral conductor)	
Tripping	Can be switched on/off
Setting	120 ... 690 V
Tripping time	0 ... 15 s
Forward power [4)]	
Tripping	Can be switched on/off
Setting	1 ... 12000 kW
Tripping time	0 ... 15 s
Reverse power [4)]	
Tripping	Can be switched on/off
Setting	1 ... 12000 kW
Tripping time	0 ... 15 s
Underfrequency [3)]	
Tripping	Can be switched on/off
Setting [5)]	0.5 ... 10 Hz
Tripping time	0 ... 15 s
Overfrequency [3)]	
Tripping	Can be switched on/off
Setting [5)]	0.5 ... 10 Hz
Tripping time	0 ... 15 s
Phase rotation	
Tripping	Can be switched on/off
Tripping time	0 s

1) ANSI definition: Ratio of the greatest difference of the phases to the mean value of the phases
IEC definition: Ratio of the greatest difference of the phase to the phase with the highest load

2) Max. (I_{L1}, I_{L2}, I_{L3}) ≥ 100 A

3) Max. (U_{L1L2}, U_{L2L3}, U_{L3L1}) > 50 V

4) I_{Lx} ≥ 100 A and U_{LxN} > 30 V

5) The setting is the deviation from parameterized rated frequency f_n

2.5.5.6 Parameter DAS+ maintenance mode

The settings for the maintenance mode DAS+ are independent of protection parameter sets A and B.

Maintenance mode DAS+	Setting range	Condition
Maintenance mode DAS+	Can be switched on/off	--
Current setting $I_{i\ DAS+}$	1.5 ... 10 x I_n	--
Current setting $I_{g\ DAS+}$	$I_{g\ min}$ ... 2000 A [1]	LSIG option plug
Time setting $I_{g\ DAS+}$	0 ... 5 s	LSIG option plug

1) Depending on frame size
$I_{g\ min}$: Frame sizes 1 and 2 = 100 A; size 3 = 400 A

2.5.5.7 Zone-selective interlocking ZSI parameters

The settings for the zone selective interlocking ZSI function are independent of protection parameter sets A and B. They require the presence of the ZSI200 module.

Zone-selective interlocking ZSI (requires the ZSI200 module)

Parameters	Value
Received signal acts on short-time-delayed short-circuit protection ST	Can be switched on/off
Received signal acts on ground-fault protection GF	Can be switched on/off
Sends signal on pick-up of short-time-delayed short-circuit protection ST	Can be switched on/off
Sends signal on pick-up of ground-fault protection GF	Can be switched on/off
Delay tZSI for short-time-delayed short-circuit protection ST	0.04 ... 0.4 s
Delay tZSI for ground-fault protection GF	0.04 ... 0.4 s
Monitoring of the ZSI200 module in the startup phase	Can be switched on/off

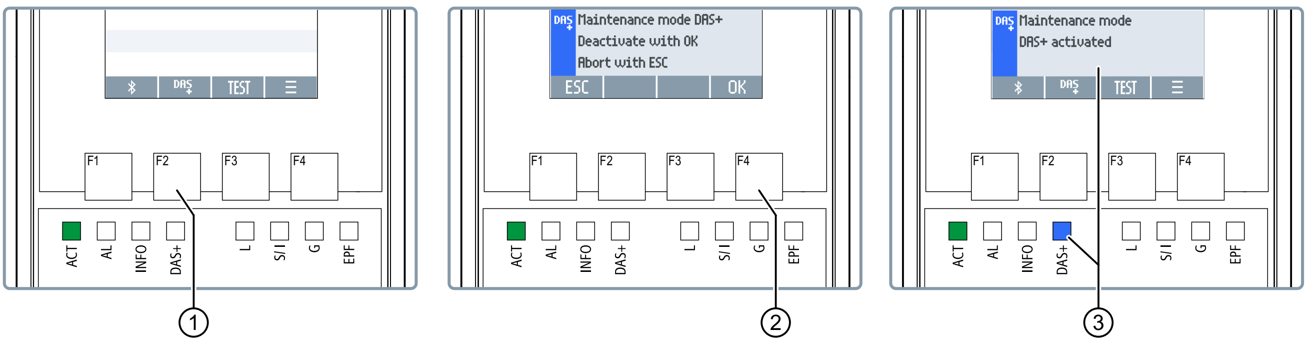
2.5.6 DAS+ maintenance mode

The ETU600 electronic trip unit offers the possibility of activating the maintenance mode DAS+ using the operating keys on the display and parameterization of the desired signal state (LOW/HIGH) of the digital ETU input.

Activation / deactivation using the operating keys on the display of the ETU600

Activation

Activate the maintenance mode DAS+ of the 3WA circuit breaker with ETU600 electronic trip unit locally by pressing the F2 operating key on the start screen.



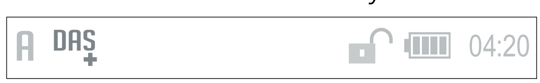
(1) Start of activation

(2) Confirmation

(3) Maintenance mode DAS+ switched on

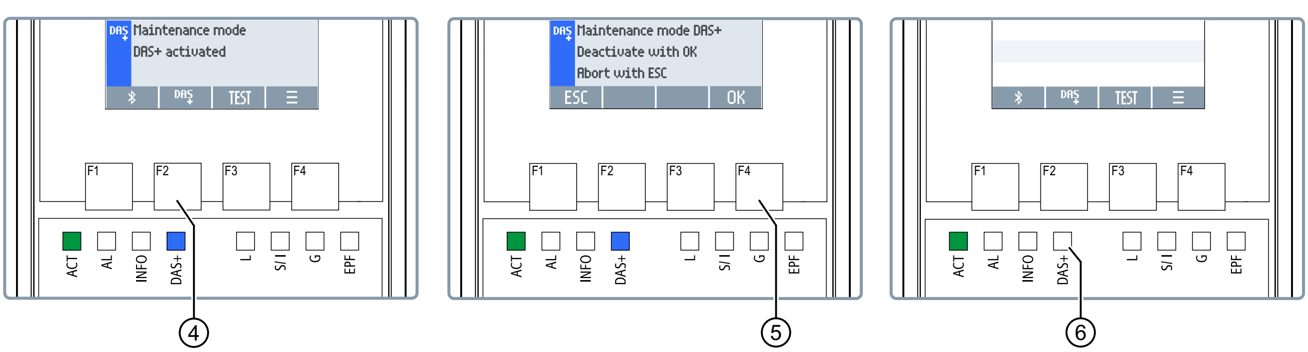
The activated maintenance mode DAS+ is indicated by the blue LED DAS+ as well as on the display of the ETU600:

- Alarm window above the menu bar, see graphic above
- In the status bar via the DAS+ symbol



Deactivation

In this case, the maintenance mode DAS+ must also be deactivated again with the F2 operating key, because the maintenance mode DAS+ must always be deactivated in the same way as it was activated.



(4) Start of deactivation

(5) Confirm

(6) Maintenance mode DAS+ switched off

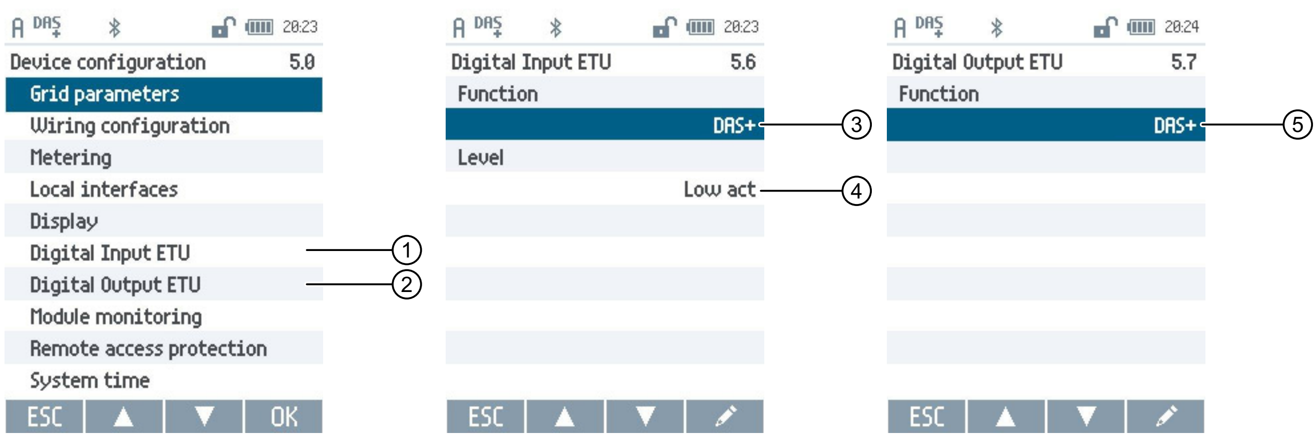
Parameterization of the ETU input and output

To activate the maintenance mode DAS+ via the circuit breaker's digital ETU input, 2 parameter assignments are necessary:

1. The parameterization of the input to the maintenance mode DAS+ function
2. The parameterization of the signal state. This determines whether the ETU input reacts to a LOW or HIGH level.

The digital ETU output of the circuit breaker can also be parameterized to "Maintenance mode DAS+ activated".

Configure the settings in the menu "Device configuration 5.0" using the operating keys on the display or with the help of the SENTRON powerconfig configuration software. Parameterization using the operating keys on the display comprises the following steps:



(1)	Device configuration digital ETU input
(2)	Device configuration digital ETU output
(3)	ETU input affects maintenance mode DAS+
(4)	Input reacts to LOW signal (NC contact)
(5)	ETU output signals the activated maintenance mode DAS+

2.5.7 Technical specifications

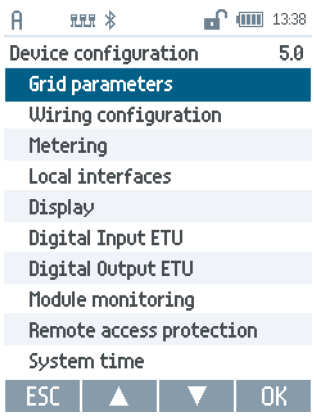
Design of the power supply	DC power supply unit
DC power supply unit	IEC 61558 SELV/PELV
Rated supply voltage U_s	24 V DC
Operating range	U_s ± 20%
Power consumption	2.9 W
Maximum current consumption	0.12 A
Starting current / maximum (for 5 ms)	0.35 A
Overvoltage category	CAT I

Integrated short-circuit protection	✓
Protected against polarity reversal	✓

2.5.8 ETU600 commissioning

When commissioning the ETU600 electronic trip unit, device parameters must be set in addition to the parameters for the protection functions. The setting can be made on the ETU600 display, menu item 5.0 "Device configuration".

The following description refers to the menu items in the display of the ETU600.



Alternatively, the settings can also be made using the SENTRON powerconfig configuration software via Bluetooth or communication.

2.5.8.1 Grid parameters

Rated current I_n

The menu shows the parameter Rated current I_n. It corresponds to the current value of the option plug.

Rated voltage U_{LL}

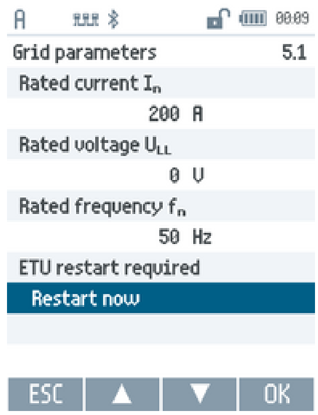
The rated voltage U_{LL} parameter defines the phase-to-phase voltage for which the circuit breaker is to be used.

The set value affects the maximum current setting of the short-circuit protective functions. These can be set to up to 80% of the voltage-dependent breaking capacity.

Note

Restart of ETU600 required

Changing the rated voltage U_{LL} parameter requires a restart of the ETU600 electronic trip unit. The restart can be performed after the change by pressing the F4 operating key on the display.



Rated frequency f_n

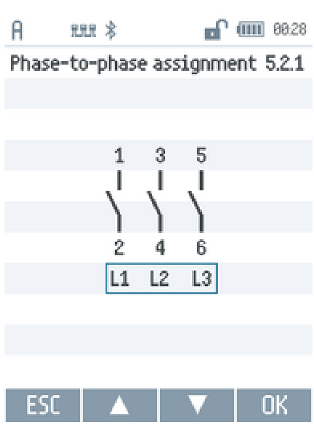
The rated frequency f_n parameter defines the frequency of the network where the circuit breaker is to be used.

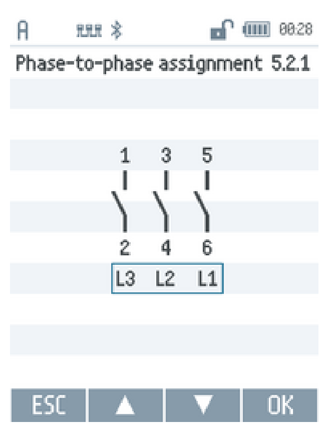
The setting affects the accuracy of the current and voltage measurement of the electronic trip unit.
A difference between the parameterized rated frequency and the measured frequency is detected by the ETU600 electronic trip unit and signaled as a warning message, see Chapter Display of errors and alarms (Page 171).

2.5.8.2 Wiring configuration

Phase-to-phase assignment

Under this menu item, the phase-to-phase assignment can be set.





Energy flow direction

In the Energy flow direction submenu, the direction for the energy flow is defined.
This setting is used for the following calculations:

- Calculation of the measured power values
- Reverse power protective function RP
- Enhanced protective functions EPF

2.5.8.3 Metering

The following parameters are defined under this menu item:

- Calculation method for phase unbalance
  The calculation methods for phase unbalance are explained in Chapter Enhanced protective functions EPF (Page 62).
- Phase rotation and the sign for the power factor
  The specifications for the power factor are explained in Chapter Metering function (power metering function) (Page 123).

Voltage measurement

In the case of a circuit breaker with measurement function, the location of the voltage sensors is displayed in the "Voltage measurement" submenu.
If the metering function is retrofit, the location of the voltage measurement must be set as follows:

- Internal: internal voltage tap
- External: use of an external voltage transformer

Voltage FFT

In the "Voltage FFT" submenu, the voltage used for the fast Fourier transform (FFT) (U_{LL} or U_{LN}) is specified.

Ground-fault current

If the ground-fault protection function is present, the ground-fault current menu item is also available.
For the ground-fault protection GF, the primary current I_{pr} of the external current transformer GF-CT can be set here.

Note

ETU600 LSIG Hi-Z

For the ETU600 LSIG Hi-Z version, the shunt resistance value and the transformation ratio of the current transformer combination must be set in this menu item.

2.5.8.4 Local interfaces

Bluetooth can be configured in a submenu.

2.5.8.5 Display

The following parameters are set in this menu:

- Display language
- Unit for the temperature
- Password for write protection via the display
- Threshold for the display of current measured values

- Time until the start screen appears in case of inactivity
- Current value for alarm threshold AL1

2.5.8.6 Digital input

The function and the signal level for the digital input of the ETU600 are set here.

2.5.8.7 Digital output

Under this menu item, the event for controlling the digital output can be set.

2.5.8.8 Module monitoring

When module monitoring is switched on, the presence of the VTM voltage tap module and the ZSI200 zone selectivity module is continuously monitored and the absence of the module is signaled.

2.5.8.9 Remote access protection

In this menu the possibility of remote switching and remote parameterization is shown for existing communication modules.

2.5.8.10 System time

The following parameters can be set in this menu:

- Date
- Time of day
- Automatic/manual switchover to daylight saving time
- Time zone

2.6 Function packages

2.6.1 General

The properties of the 3WA circuit breaker can be extended by digital function packages. They allow an individual and application-specific design of the protection and metering functionality.

Note

The function packages can only be used with the ETU600 electronic trip unit. Installation is not possible when using the ETU300 electronic trip unit.

The function packages can be installed in the ETU600 electronic trip unit via the USB-C interface using the SENTRON powerconfig configuration software. This is also possible directly before the switchgear is commissioned and without having to replace the electronic trip unit.

2.6.2 Ground-fault alarm

With this function package, a high-resistance ground fault can be detected and signaled without switching off the system.

2.6.3 Directional protective functions

The basic protection of the ETU600 electronic trip unit can be extended with directional protective functions:

- Directional short-time-delayed short-circuit protection dST
- Reverse power protection RP

2.6.4 Enhanced protective functions

The enhanced protective functions complement the functionality of the ETU600 electronic trip unit and can be added in sub-packages or as a complete function package:

- Phase unbalance current, phase unbalance voltage
- Total harmonic distortion for current and voltage
- Undervoltage, overvoltage
- Forward power, reverse power
- Underfrequency, overfrequency
- Reverse-phase sequence protection

2.6.5 Second set of protection parameters

A second parameter set (parameter set B) enables switching between two characteristics of the ETU600 electronic trip unit.

2.6.6 Metering values

The integrated metering function of the circuit breaker can be extended by means of function packages. This provides additional metering values. A metering function type PMF-I (Energy Efficiency) can be extended to type PMF-II (Basic Power Monitoring). It is also possible to upgrade to type PMF-III (Advanced Power Monitoring).

2.7 Limit values

The electronic trip unit ETU600 can simultaneously monitor 20 measured values for exceeding or falling below a limit value.

The accuracy of a limit value is identical to the assigned measured value.

When the limit value is violated, a message is generated, which is output via the outputs of a digital input/output module IOM and via the communications interface. An adjustable delay and hysteresis provide additional safety during monitoring.

Defining the limit values

The number of limit values to be monitored is selectable. The following must be specified for each of the maximum of 20 limit values:

- Limit monitoring ON/OFF
- Monitored measured variable
- Numerical value of the limit
- Upper or lower limit violated
- Time delay
- Hysteresis

Parameterizing limit values

The SENTRON powerconfig configuration software can be used to display and set the limit values via the following interfaces:

- Bluetooth
- USB interface
- Communications module

In the following example, the voltage U_{L1N} is monitored as a lower limit value with the numerical value 277 with hysteresis and delay.

Limit values		
Limit value 0	1	
Monitoring	2	Yes
Source	3	Voltage L1-N
Numerical value	4	277
Unit	5	V
Mode	6	Less than
Hysteresis (%)	7	20
Delay (s)	8	1
Limit value 1		
Limit value 2		

(1) Limit value 0 ... limit value 19:

Menu options for limit values. Each limit has the following properties (2) - (8).

(2) Monitoring

Activation of limit monitoring

- Yes: Limit monitoring switched on
- No: Limit monitoring switched off

(3) Source

Monitored measured value or data source

The table in the Appendix AUTOHOTSPOT lists the selectable data and measured variables.

(4) Numerical value

Corresponds to the numerical value of the measured variable

(5) Unit

Display of the unit of the measured variable

(6) Mode

Comparison operators refer to the numerical value of the measured variable.

- Greater than
- Less than

(7) Hysteresis (%)

Threshold value buffer with setting range 0% ... 20%, step size 1%

The buffer causes the message for limit value violation to persist. The percentage value of the hysteresis refers to the limit value output of the measured variable.

Hysteresis 0% means that the message is output (immediately) when the limit value is exceeded/ undershot.

With the setting 20% and mode "greater than", the limit value violation is reported when the limit value is overshot and reset by 20% when the value falls below the limit value.

With the setting 20% and mode "less than", the limit value violation is reported when the limit value is undershot and reset by 20% when the value exceeds the limit value.

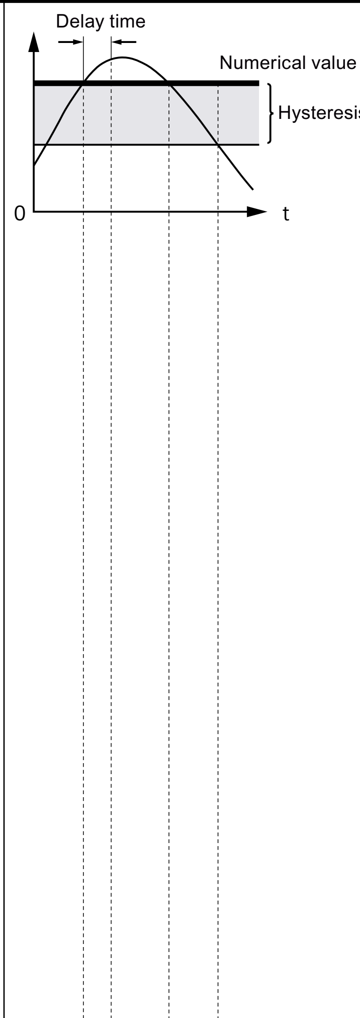
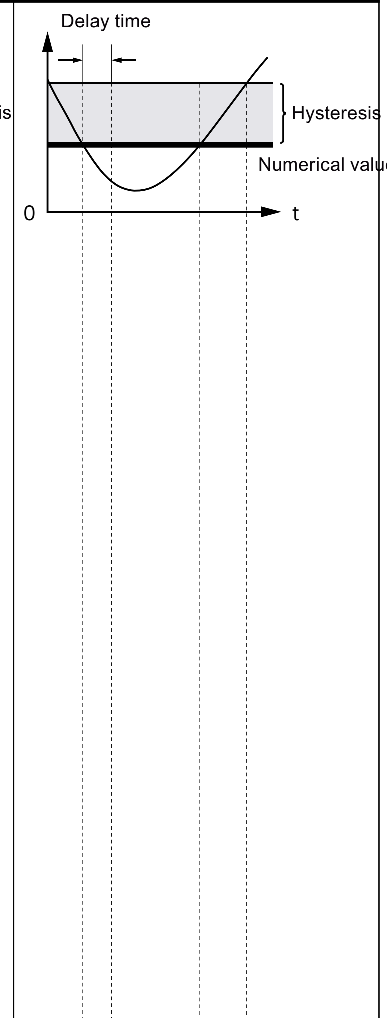
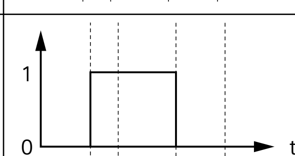
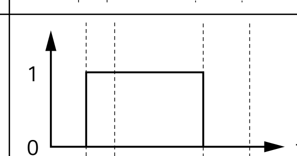
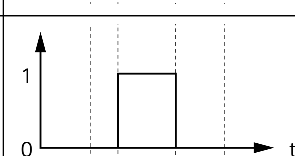
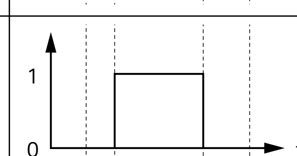
(8) Delay (s)

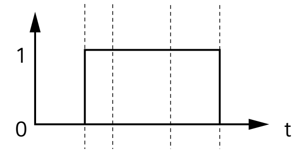
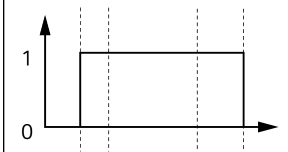
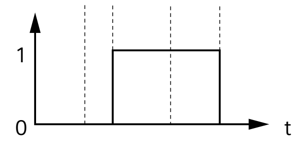
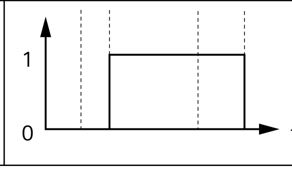
Delay in seconds before reporting the limit violation

The delay, setting range 0 s ... 255 s with step size 1 s, refers to the occurrence of the limit value violation and is the time until the message is set.

Effect of pick-up delay and hysteresis

The graphics in the following table show the effect of pick-up delay and hysteresis on upper and lower limit violations.

Limit value signal	Upper limit violation	Lower limit violation
		
• Without delay • Without hysteresis		
• With delay • Without hysteresis		

Limit value signal	Upper limit violation	Lower limit violation
• Without delay • With hysteresis		
• With delay • With hysteresis		

2.8 Metering function (power metering function)

Energy transparency runs through the entire life cycle of an electrical power distribution system. The foundation stone for this is laid during the planning stage.

When installing the system, VDE 0100-801 (Low-voltage electrical installations, Part 8-1: Energy efficiency) must be applied and the values of the German Energy Saving Ordinance (EnEV) must be observed. During operation, ISO 50001 aims for continuous system optimization. The acquisition of reliable data and its evaluation are the first step toward transparency.

The 3WA circuit breaker can be used in accordance with the above-mentioned standards and offers the user the following for this purpose:

- The data required for energy efficiency
- Comparable and transparent metering values with the same time base
- The energy values required in the energy industry

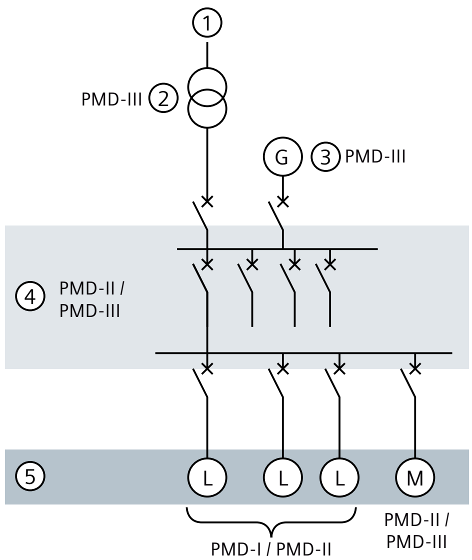
The 3WA circuit breaker with electronic trip unit ETU600 always includes metering function hardware and can display the phase currents and neutral conductor current on the display of the electronic trip unit ETU600. An internal voltage tap is required to determine metering values other than current.

The metering function supplied with the circuit breaker is comparable to a power metering and monitoring device for the specified metering values and meets the requirements of the IEC 61557-12 standard (Electrical safety in low voltage distribution systems up to 1000 V AC and 1500 V DC - Equipment for testing, measuring or monitoring of protective measures - Part 12: Power metering and monitoring devices (PMD)).

The optional metering function is available in the PMF-I (Energy Efficiency), PMF-II (Basic Power Monitoring) and PMF-III (Advanced Power Monitoring) versions. It is also possible to upgrade the metering function to a higher level at a later date by means of a function package containing software activations.

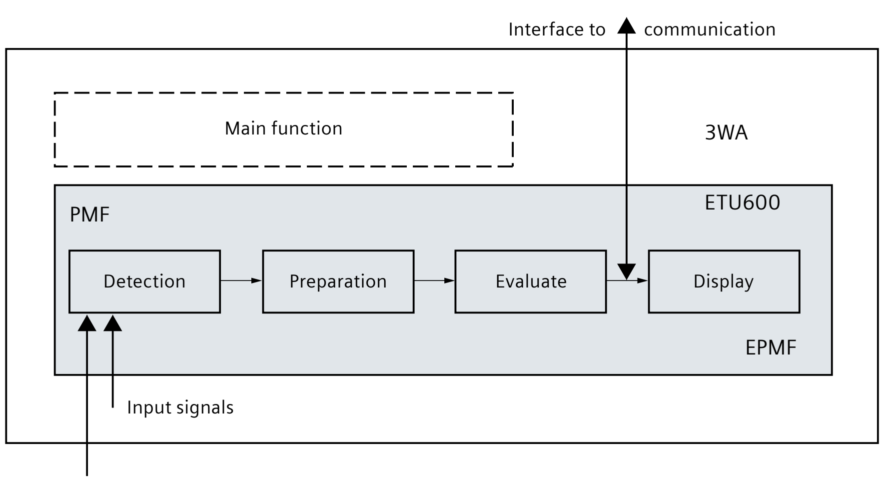
Power metering and monitoring device

Depending on the location of use in the power distribution system, different metering values are required for the assessment and evaluation of efficiency.



(1) Infeed
(2) Transformer
(3) Generator
(4) Distribution
(5) Loads, consumers

The energy values must be provided by power metering and monitoring device (PMD) or an "equipment embedding a power metering and monitoring function (EPMF)". The power metering function contained in the latter is equivalent to a power metering and monitoring device and is therefore referred to as PMF (power metering and monitoring function) in IEC 61557-12.



With its integrated current sensors, the internal voltage tap and the electronic trip unit ETU600, the 3WA circuit breaker constitutes a PMF-DD power metering and monitoring device according to IEC 61557-12 for the measured variables current, voltage, active energy and active power. Accuracy class 0.5 is achieved for the voltages, class 1 for the currents and class 2 for active energy and active power.

The integrated metering function requires no external power supply of the electronic trip unit ETU600. A 24 V DC external auxiliary power supply is only required for transferring the metering values via a communications module, e.g. COM190.

Measured variables and accuracy

In order to fulfill the different requirements, the 3WA circuit breaker can provide the following measured values based on phase currents, neutral conductor current and voltages depending on its level of functionality and the desired application package.

Application package				**Current metering**	**ready4COM**	**PMF-I Energy Efficiency**	**PMF-II Basic Power Monitoring**	**PMF-III Advanced Power Monitoring**
Integral voltage tap top/bottom				--	--	✓	✓	✓
Voltage tap module VTM				--	--	✓	✓	✓
Metering function acc. to IEC 61557-12	PMF-I			--	--	✓	✓	✓
	PMF-II			--	--	--	✓	✓
	PMF-III			--	--	--	--	✓
	Accuracy							
	Class	**Acc. to manufacturer**	**Acc. to IEC 61557-12**					
Phase current I_{L1}, I_{L2}, I_{L3}	1		✓	✓	✓	✓	✓	✓
Neutral conductor current I_N	1		✓	✓	✓	✓	✓	✓
Ground-fault current I_g with ETU600 LSI	2	✓		--	--	--	✓	✓
Ground-fault current I_g with ETU600 LSIG, ETU600 LSIG Hi-Z	2	✓		✓	✓	✓	✓	✓
Temperature				--	✓	✓	✓	✓
Voltage U_{LN}	0.5		✓	--	--	✓	✓	✓
Voltage U_{LL}	0.5		✓	--	--	✓	✓	✓
Active energy E_a	2		✓	--	--	✓	✓	✓
Reactive energy E_r	2	✓		--	--	--	✓	✓
Apparent energy E_{ap}	2	✓		--	--	--	✓	✓
Active power P	2		✓	--	--	--	✓	✓
Reactive power Q	2	✓		--	--	--	✓	✓
Apparent power S	2	✓		--	--	--	✓	✓
Power factor PF	6	✓		--	--	--	✓	✓

Application package				Current metering	ready4COM	PMF-I Energy Efficiency	PMF-II Basic Power Monitoring	PMF-III Advanced Power Monitoring
cos φ	6	✓		--	--	--	✓	✓
Frequency f	0.5	✓		--	--	--	✓	✓
Current unbalance	2.5	✓		--	--	--	✓	✓
Voltage unbalance	1.5	✓		--	--	--	✓	✓
Total harmonic distortion THD-I [1)]	2	✓		--	--	--	--	✓
Total harmonic distortion THD-U [1)]	2	✓		--	--	--	--	✓
Harmonic I, U [1)]	2	✓		--	--	--	--	✓

[1)] for 2nd to 15th harmonic component ±2% and 16th to 31st harmonic component ±5%

The accuracy of the current metering of a circuit breaker without the metering function corresponds to the accuracy class specified by the manufacturer.

The accuracies of the metering values for metering functions PMF-I to PMF-III according to IEC 61557-12 are valid for the 3WA circuit breaker for one year after calibration following delivery from the factory only.

In the case of metering values specified by the manufacturer, the ranges specified in IEC 61557-12 are also valid, as are their intrinsic safety limits. The accuracy of these metering values is not confirmed during routine testing and only applies for one year if delivered from the factory.

The voltage can be measured using the VTM voltage tap module in a range of 100 V up to 120% of the rated voltage of the circuit breaker (phase-to-phase voltage).

Current and voltage unbalance are determined according to different calculation methods:

- ANSI definition:
  Ratio of the greatest difference of the phases to the mean value of the phases.
- IEC definition:
  Ratio of the greatest difference of the phase to the phase with the highest load.

Note

The circuit breaker loses its certification according to IEC 61557-12 if any one of the following components required for measurement is subsequently replaced: ETU600, VTM680, VTM640, internal voltage tap or internal current sensors.

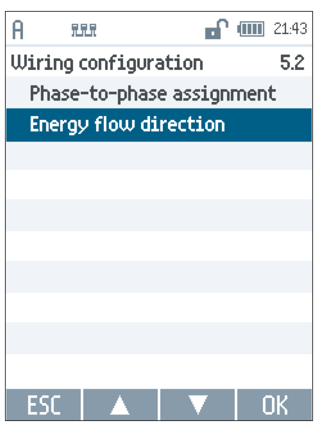
For measuring the temperature, a thermocouple is mounted on the Breaker Status Sensor BSS200 internal module and the optional communications module. The temperature at both points can be measured with very high accuracy. However it is very strongly influenced by the intrinsic heating of the installed electronic components and their ambient temperature. The available metering values can therefore be used for comparative measurements and as an indicator for changes.

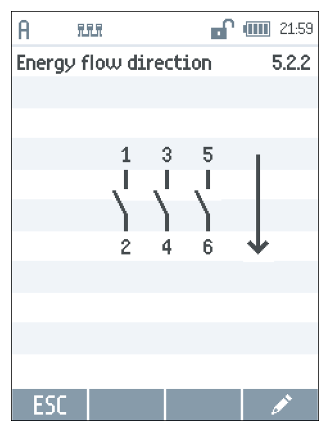
The specified accuracies apply given the following reference conditions:

- Operating temperature 23 °C ±2 °C
- Relative humidity 40% to 60% RH
- Auxiliary power supply of 24 V DC ±1%
- Three-phase current system, 3 phases available
- Voltage unbalance ≤ 0.1%
- No DC component for voltage and current
- Sinusoidal waveform
- Frequency, rated frequency (50 Hz or 60 Hz) ±0.2 %

Interpretation of metering values

The energy flow direction must be set on the circuit breaker so that the metering values can be displayed correctly. This can be done in menu item 5.2.2 using the operating keys on the display of the electronic trip unit ETU600 or with the help of the SENTRON powerconfig configuration software.

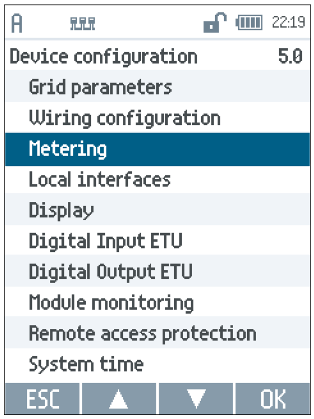


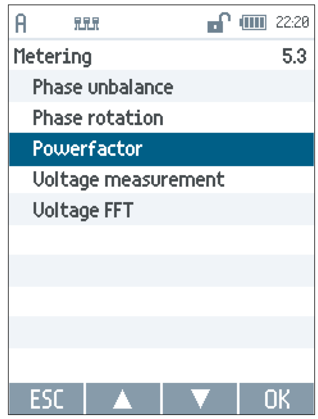


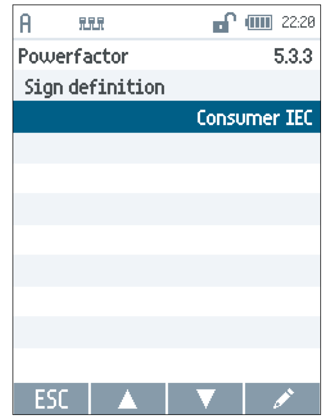
In accordance with Annex C of the standard IEC 61557-12, the user can select from three definitions for the display of the power factor.

- IEC consumer (IEC-C)
- IEEE consumer (IEEE-C)
- IEC producer (IEC-P)

The selection can be made using the operating keys on the display of the electronic trip unit ETU600, in menu item 5.3.3 or with the help of the SENTRON powerconfig configuration software.



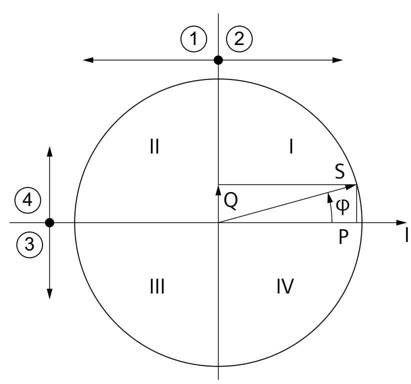
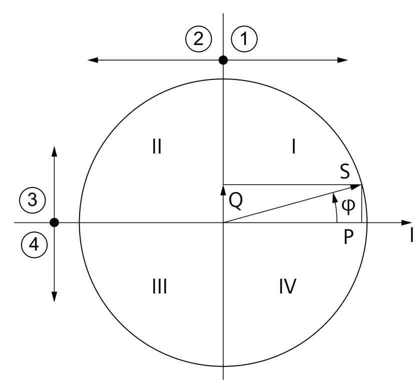




The definition of the power factor determines the signs for active and reactive power. The display of the cos φ is identical to the power factor.

Measured current and voltage values are always positive.

Definitions for the power factor:

<table>
<tr><th>Quadrant</th><th colspan="3">Consumer perspective</th><th colspan="2">Producer perspective</th></tr>
<tr><td></td><td colspan="3">
(1) Active power export
(2) Active power import
(3) Reactive power export
(4) Reactive power import</td><td colspan="2">
(1) Active power export
(2) Active power import
(3) Reactive power export
(4) Reactive power import</td></tr>
<tr><td></td><td>Meaning</td><td colspan="2">Specification</td><td>Meaning</td><td>Specification</td></tr>
<tr><td></td><td></td><td>IEC-C</td><td>IEEE-C</td><td></td><td>IEC-P</td></tr>
<tr><td>I
P>0, Q>0</td><td>Import P,
Import Q,</td><td>+
(inductive)</td><td>-
(lagging)</td><td>Export P,
Export Q,</td><td>+
(overexcited)</td></tr>
<tr><td>II
P<0, Q>0</td><td>Export P,
Import Q,</td><td>-
(capacitive)</td><td>+
(leading)</td><td>Import P,
Export Q,</td><td>-
(overexcited)</td></tr>
</table>

Quadrant	Consumer perspective			Producer perspective	
III P<0, Q<0	Export P, Export Q,	- (inductive)	- (lagging)	Import P, Import Q,	- (underexcited)
IV P>0, Q<0	Import P, Export Q,	+ (capacitive)	+ (leading)	Export P, Import Q,	+ (underexcited)

Expansions by means of function packages for metering values

A factory-installed PMF metering function can be expanded by means of function packages in order to provide additional metering values, see Chapter Function packages for metering values (Page 348). These have the accuracy specified in the preceding table in Section "Measured variables and accuracy".

Retrofitting the metering function

It is also possible to retrofit a metering function for a circuit breaker. The metering values provided as a result have the accuracy specified by the manufacturer. This restriction is necessary, as standard IEC 61557-12 requires routine testing for the metering function of a circuit breaker.

The retrofit is performed in 2 steps:

1. Retrofit of internal voltage tap at the lower main conducting paths, see Chapter Retrofit of the internal voltage tap (Page 342), or retrofit of option for connection of external voltage transformers, see Chapter Connection of an external voltage transformer (Page 343).
   In both variants, voltage tap module VTM is added to the electronic trip unit ETU600 and the additional metering values for voltage and active energy of the PMF-I application package are enabled.
2. Expansion of the metering value scope by means of function packages.

The metering values of application packages PMF-II and PMF-III can be provided by means of function packages for the metering function, see Chapter Function packages for metering values (Page 348).

2.9 Waveform memory

The electronic trip unit ETU600 may have the optional two independent waveform memories (A and B) which are used to record current measured values for 200 ms. The waveform memory can be retrofit from firmware version FW uCA V03.00.00 using function package 3WA9111-0ES24. The memory (buffer) is continuously overwritten with the new measured values. If a trigger event occurs, the measured values are stored for subsequent analysis of the event.

Typically, the function is used to analyze the cause of the tripping operation of the circuit breaker, e.g. after a short-circuit protection tripping operation.

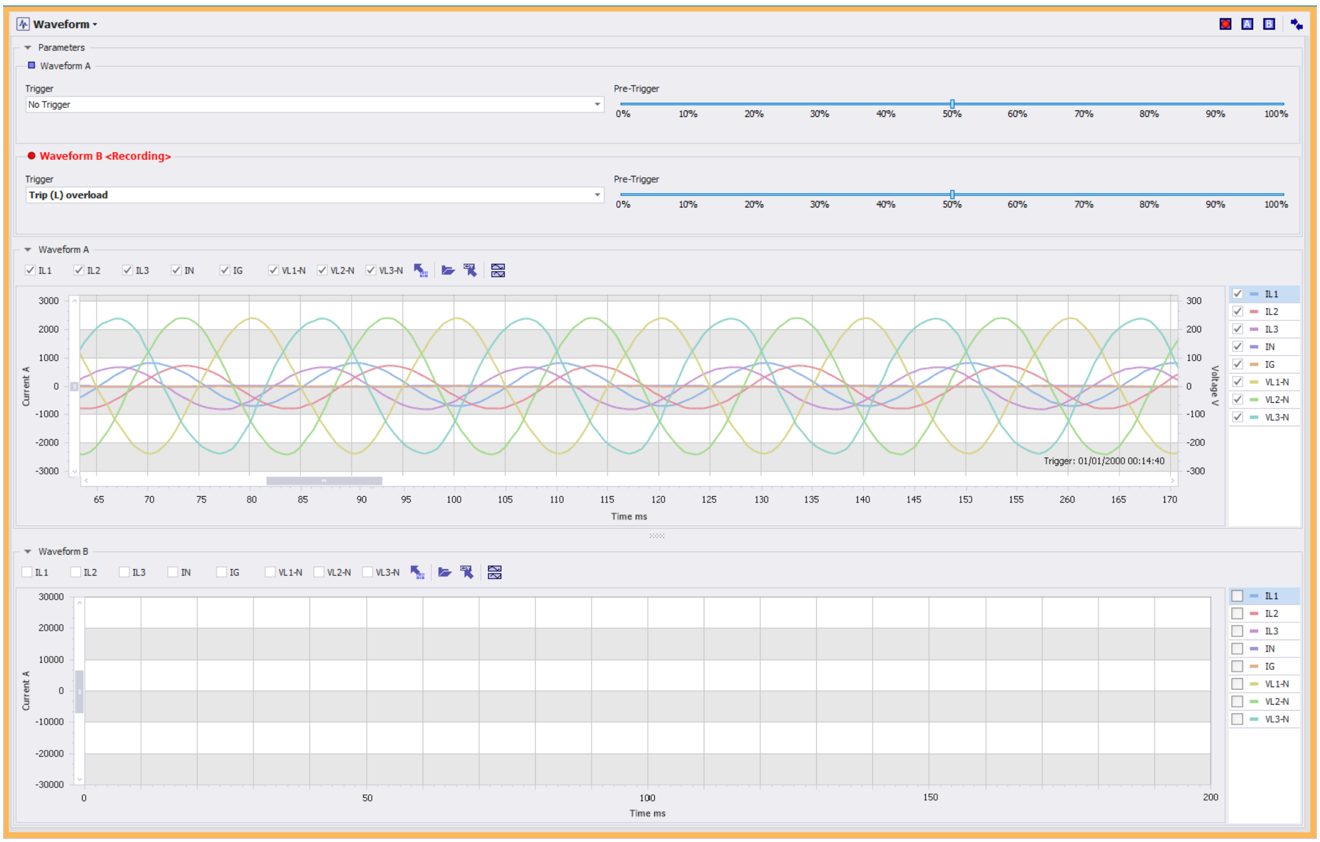
Each waveform memory has eight channels and stores the following currents and voltages:

- I_{L1}, I_{L2}, I_{L3}, I_N and I_g
  The detected ground-fault current I_g is determined by the parameterized detection method for ground-fault protection.
- U_{L1N}, U_{L2N} and U_{L3N}

In each channel, 64 instantaneous values per full wave are stored over 200 ms.

The waveform memory requires the electronic trip unit ETU600 to be supplied with the 24 V DC auxiliary voltage.

The waveform can be represented and exported using the SENTRON powerconfig configuration software.



Trigger settings

In the event of an undervoltage trip, the voltage curve can be automatically recorded, for example. Alternatively, the waveform memory can also be triggered manually.
Recording of the trigger events is automatically stopped when the electronic trip unit ETU600 trips.

The pre-trigger can be used to determine the trigger time. The relationship between pre-history and post-history can be set in this way. The pre-trigger is configured in percent.
If the pre-history of the trigger event is to be analyzed, the pre-trigger can be set to 80%, for example. When the event occurs, 160 ms of pre-history and 40 ms of post-history are stored in the waveform memory with this setting.

The trigger event is given a time stamp.

Data export

The stored data can be exported, displayed and analyzed with the SENTRON powerconfig configuration software via Bluetooth, the USB interface, or a communications module.

Before downloading, the desired channels can be selected. The download progress is displayed in the SENTRON powerconfig configuration software.

2.10 Communication and system connection

2.10.1 CubicleBUS²

2.10.1.1 The bus system

The CubicleBUS² is a closed bus system and allows communication between the circuit breaker with electronic trip unit ETU600 and internal and external modules located in the circuit breaker panel. The following data can be transmitted via this system:

- Measured values
- Maintenance information
- Statuses
- Events and parameters of the circuit breaker
- Firmware update

CubicleBUS² nodes

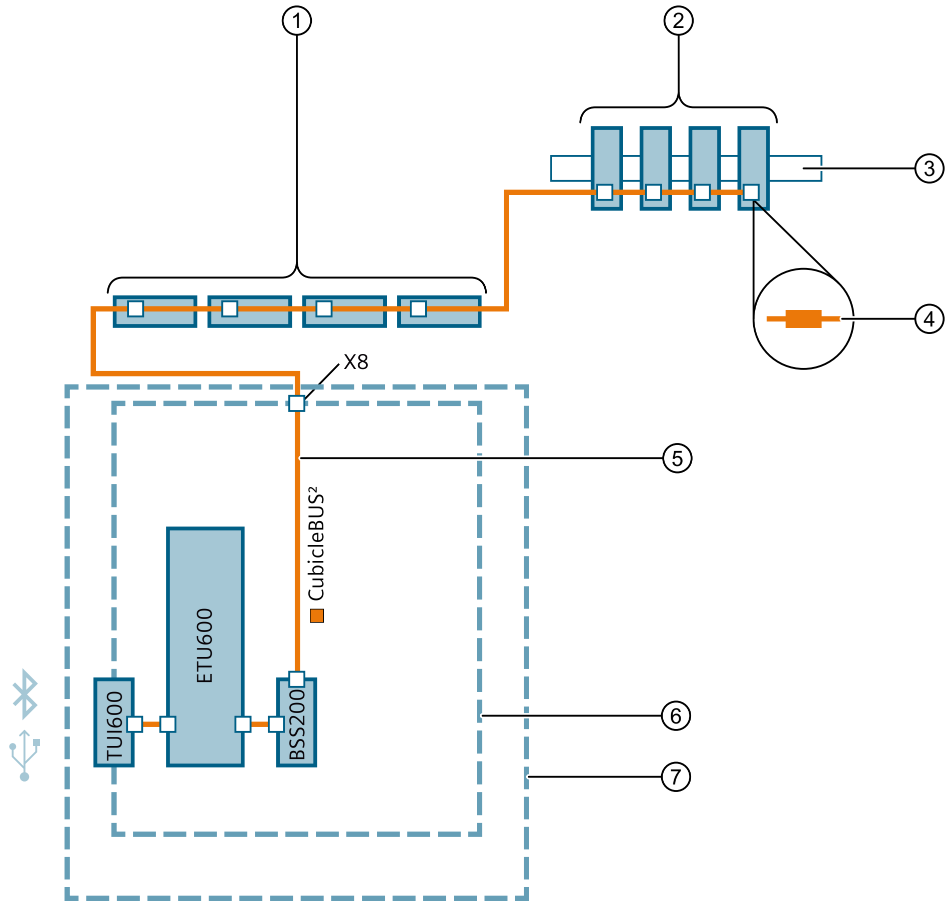
The following CubicleBUS² devices are available for the 3WA circuit breaker. They are described in the respective chapters of the manual.

- Internal status sensors for Status acquisition with Breaker Status Sensor BSS200 (Page 162)
- Communications interfaces:
  - Bluetooth and USB-C interface (Page 96)
  - Modbus RTU module COM150 (Page 352)
  - PROFINET IO/Modbus TCP module COM190 (Page 350)
- Digital input/output modules (Page 235)

Data is exchanged internally via the CubicleBUS² and output at the local interface, I/O modules, or fieldbus interfaces.

The CubicleBUS² is a serial bus and is looped through from one module to the next. The CubicleBUS² must be terminated at the final module with a 120 Ω terminating resistor (article number 3WA9111-0EC50). Spur lines are not permitted.

The first CubicleBUS² module is connected to secondary disconnect terminals X8.1 to X8.4 of the circuit breaker.



(1) CubicleBUS² modules on the circuit breaker
(2) External CubicleBUS² modules
(3) DIN rail
(4) 120 Ω terminating resistor of the CubicleBUS²
(5) CubicleBUS²
(6) 3WA circuit breaker
(7) Guide frame of the 3WA circuit breaker (optional)

Requirements

- 3WA circuit breaker
- Electronic trip unit ETU600
- Terminating resistor (120 Ω)
- Optional CubicleBUS² module

Note

Compatibility with legacy product

The CubicleBUS² applied in the 3WA circuit breaker is an enhanced development of the CubicleBUS system applied in the 3WL circuit breaker. They are not compatible with each other.

See also

Position signaling switch module for guide frame (Page 260)

2.10.1.2 Technical specifications

Designation	CubicleBUS²
Required connection cable	Twisted pairs Shielded and grounded at one end for EMC interference
Conductor cross-section	
Solid	0.2 ... 1.5 mm² / 24 ...16 AWG
Finely stranded/ with insulated conductor end processing	0.2 ... 1.5 mm² / 24 ...16 AWG
Length	Up to 9 m outside the circuit breaker
Terminating resistor on the last device	120 Ω / 0.5 W
Installation type	Serial bus without spur lines

2.10.1.3 Selecting the power supply

When selecting the power supply, observe the following notes:
The type and number of modules determine the continuous current. The power supply must be able to supply the starting current of all connected modules for a duration of 100 ms.

The power supply must meet the following requirements:
- DC power supply unit IEC 61558 SELV/PELV
- Rated supply voltage U_s 24 V DC
- Operating range U_s ±20%

The following table contains the data required for dimensioning the power supply for the CubicleBUS² system:

	Number of modules on the CubicleBUS²	**Max. power consumption per module**	**Starting current for 5 ms per module**
ETU600 incl. TUI600	1	0.12 A	0.35 A
BSS200	1	0.05 A	0.35 A
ZSI200	1	0.03 A	0.20 A

	Number of modules on the CubicleBUS²	Max. power consumption per module	Starting current for 5 ms per module
COM150	max. 2	0.09 A	0.10 A
COM190	max. 2	0.09 A	0.32 A
IOM230	max. 5	0.05 A	0.35 A
IOM350	max. 5	0.12 A	0.35 A

2.10.2 Firmware update

Note

Risk of functional interruption

Following a firmware update, all connected circuit breaker modules may restart. This restart will cause a brief functional interruption. With communications modules, communication is momentarily interrupted. With the electronic trip unit ETU600, digital input/output modules, and the ZSI module, the outputs can briefly change state.

With the electronic trip unit ETU600, only the application processor is restarted. The display will restart, and output values may be temporarily unavailable. The "sign-of-life" contact will signal an inactive ETU when the application processor is restarted. The basic protective function of the ETU600 is not impacted by the firmware update and will remain active.

As restarting the components can lead to unintended system states due to temporarily missing or incorrect data or displays, we recommend shutting down the corresponding plant components if the possible effects are not known and the system configuration allows this.

We also recommend considering the possible states during a firmware update in the plant planning, for example by a system maintenance mode.

There are various electronic modules for the 3WA circuit breaker that can be updated to the latest version via firmware update.
Firmware updates are necessary to improve software, to update security settings, or to enable new features and functions.

Current firmware version

You can determine the current firmware version with the SENTRON powerconfig configuration software (menu: Parameter > Device information) or via the display of the ETU600 (menu number 7).

Latest firmware version

Always use the latest firmware version. You can find this on the internet (https://sie.ag/2SUIAc2).

SENTRON powerconfig configuration software

The firmware update is performed via the SENTRON powerconfig configuration software.
For more information and to download the latest version of the SENTRON powerconfig configuration software, visit the internet (https://support.industry.siemens.com/cs/ww/en/view/109782123).

Update of the electronic trip unit ETU600

The ETU600 has two processors. A processor (protection processor) is responsible for protecting the circuit breaker. This has been tested during production (routine test according to IEC 60947-2) and can no longer be changed by a firmware update.

The second processor (application processor) is responsible for the functions that are not relevant to protection. The application processor of the electronic trip unit ETU600 can be updated to the latest version via a firmware update. The firmware update is executed in a fail-safe manner.

The protection processor continues to be active during the firmware update of the ETU600 and the protective functions are executed.

Firmware update

You always perform a firmware update of an 3WA circuit breaker via the SENTRON powerconfig configuration software, see below.

Firmware file

There are different electronic modules for the 3WA circuit breaker.
The respective firmware required for the individual modules is combined in a common firmware container. Therefore, only one firmware file is needed.
The SENTRON powerconfig configuration software checks the respective firmware versions and updates each module automatically with the correct firmware.

The firmware package (firmware container) has a version number. The individual firmware items contained in the package are always the latest versions, although their version numbers may differ from the version number of the package.

Signed firmware

The firmware of the 3WA circuit breaker is signed by Siemens with a private key. During the firmware update, the signature in the device is checked with the public key. Manipulations or errors are detected immediately and reliably prevent a firmware update in such a case. The Siemens private key is stored and protected on a high-security server.

Fail-safe firmware update

The update process of the 3WA circuit breaker is executed in a fail-safe manner. A failed or aborted firmware update cannot render a device unusable.
The firmware update can be executed again at any time.

Performing the update

Note

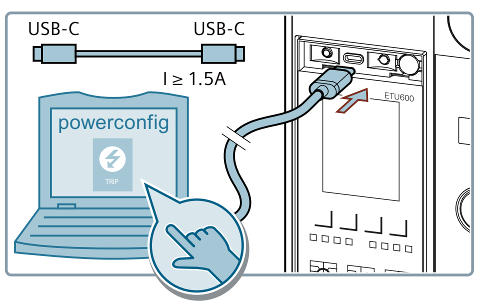
Firmware versions of individual modules

If you wish to update the Breaker Status Sensor BSS200 and the digital input/output module IOM230 to a firmware version higher than 2.0.0, the modules must have at least firmware version 2.0.0. An update to a version higher than 2.0.0 is not possible directly from firmware version 1.x.x.

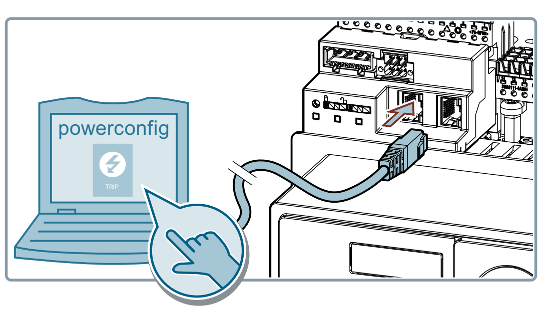
Example:
Current firmware version: 1.0.0 > Update to firmware version 2.0.0 > Update to firmware version 2.1.0

Requirements

1. Download the current version of the SENTRON powerconfig configuration software from the internet (https://sie.ag/2SUlAc2) and install it on your PC.
2. Download the current firmware package for the 3WA circuit breaker. You can find this on the internet (https://support.industry.siemens.com/cs/ww/en/view/109782123).
3. Unpack the zip file containing the current firmware package on your computer.
4. Connect the PC to the 3WA circuit breaker:
   – In the case of a 3WA circuit breaker, connect it to the USB-C interface of the ETU600.

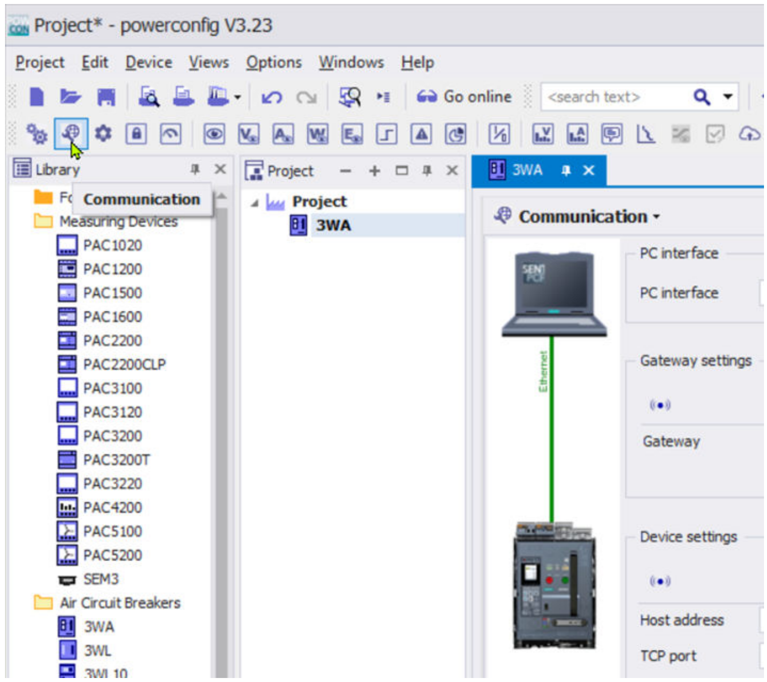


   – For a 3WA non-automatic circuit breaker, connect it to a communications module.

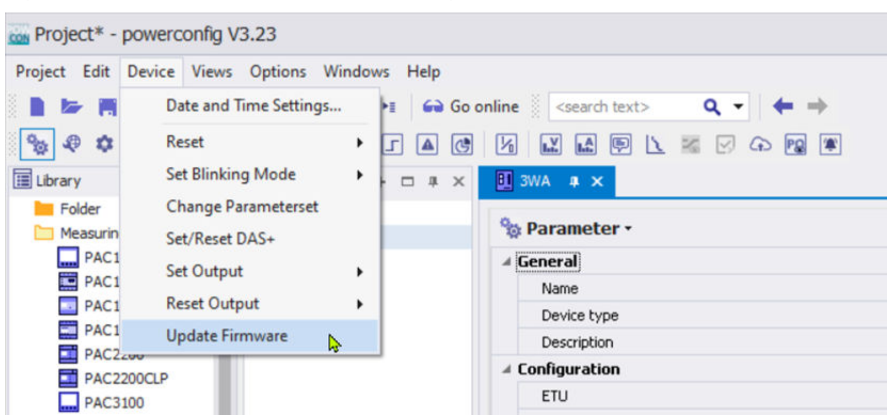


Procedure

1. Open the "Communication" cockpit in the SENTRON powerconfig configuration software.



2. In the "Communication" cockpit, select the connection:
   - Via USB for a 3WA circuit breaker,
   - Via a communications module for a 3WA non-automatic circuit breaker.
3. Open the "Device" menu and select "Update Firmware".



4. Activate the external 24 V DC supply if necessary, as only modules or ETUs that are currently active can be updated.
5. Select the newly downloaded firmware.
6. Follow the instructions in the SENTRON powerconfig configuration software.

A restart is performed automatically after the firmware update. The modules or the ETUs are ready for operation after the restart. The SENTRON powerconfig configuration software shows you which updates were successful.

If all module updates were successful, the firmware update is complete. If a module update was not successful, please repeat the update.

Note

If an update continues to be unsuccessful, refer to Chapter Troubleshooting (Page 507) for information about possible causes or contact Technical Support on the internet (https://www.siemens.com/support-request).

2.10.3 COM190 and COM150 communication modules

The following chapters contain information on the communications modules of the 3WA circuit breakers and their connections.

Information on data points and registers as well as further information on the subject of communication for 3WA circuit breakers can be found in the following documents:

- System Manual - Communication 3WA Circuit Breaker
- Modbus register for the 3WA circuit breaker
- PROFINET data sets for the 3WA circuit breaker
- GSDML file for COM190 (3WA9111-0EC13) of the 3WA circuit breaker

The corresponding links can be found in Chapter Reference documents (Page 17).

2.10.3.1 Overview

As CubicleBUS^2 modules of the 3WA circuit breaker, the COM190 and COM150 communications modules offer a wide range of functions:

- Transfer of circuit breaker data (status, measured values, parameters, messages)
- Setting of parameters
- Closing/opening the circuit breaker via the communication connection
- Reading the maintenance information
- Transmission of communication status, alarms and warnings
- Firmware update of the communications modules

Adapter

The communications modules can be directly mounted on the 3WA circuit breaker or on a DIN rail using adapters. A maximum of two communications modules per circuit breaker may be connected. The order or type of the modules on the circuit breaker or DIN rail is not predetermined.

2.10.3.2 COM190 communication module

Supported protocols COM190

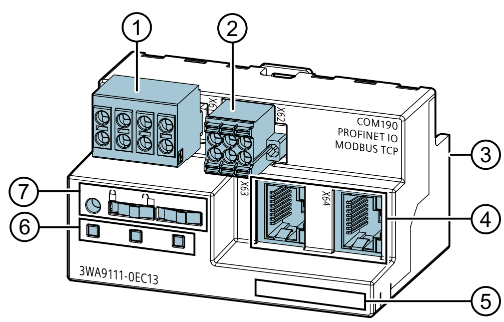
The COM190 communications module supports the following communication protocols:

- PROFINET IO
- Modbus TCP

It is possible to use only one protocol or both protocols simultaneously and independently of each other. Since no configuration is required, the 3WA circuit breaker can be used in different systems simultaneously. A 3WA circuit breaker can be used simultaneously in energy management and automation systems, for example.

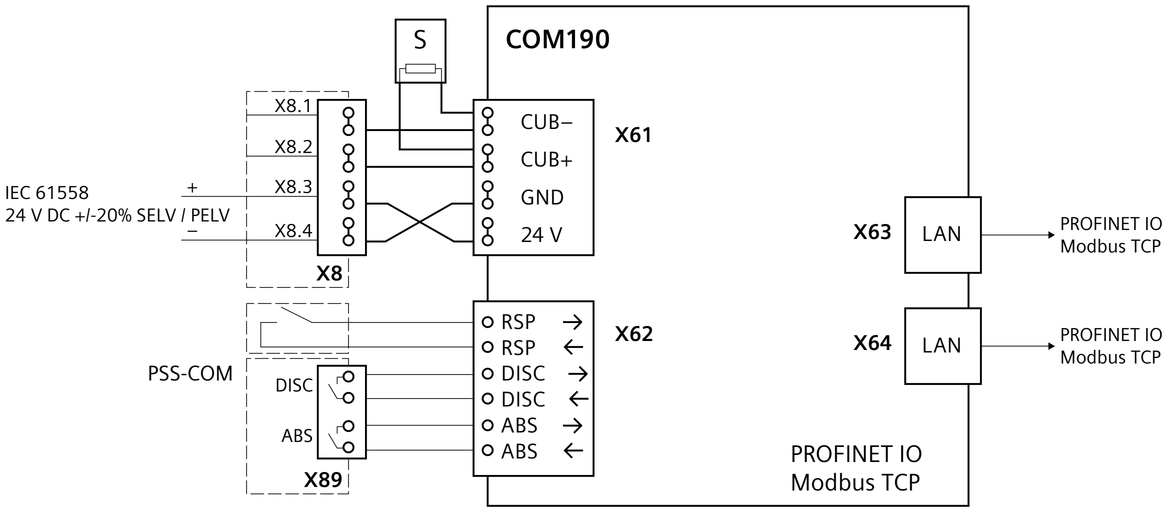
Interfaces, operator controls and status displays

The COM190 communications module for the 3WA circuit breaker has several interfaces, operator controls and status displays, which are described below.



(1)	X61 connector	(5)	MAC address
(2)	X62 connector	(6)	LEDs
(3)	Fixation for mounting adapter	(7)	Operator controls
(4)	Ethernet connections X63 and X64		

The following graphic shows the interconnection of the COM190 communications module (module role selector switch is set "A"), a PSS COM, and an external write protection switch.



X62

RSP	Remote Switching Protection
DISC	Disconnected
ABS	Absent

Connections X63/X64

Connections X63 and X64 are the Switched Ethernet connections of the COM190 communications module.

If the communications module is mounted on the secondary disconnect terminal of the circuit breaker, the space for the Ethernet connectors is restricted by the control cabinet door.

The available space can be used optimally, e.g. by selecting suitable plugs. Examples include:

- 90° right-angled connector, e.g. PROFINET connector 6GK1901-1BB20-2AA0

- Flat ribbon cable with short Ethernet connector

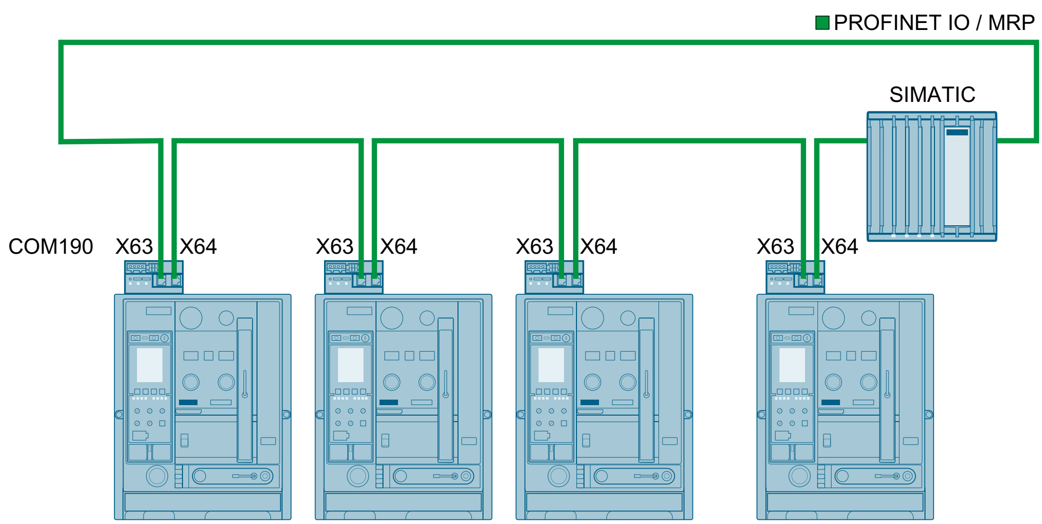
If it is not possible to use the above-mentioned Ethernet connectors and the available space is not sufficient for observing the specified bending radius, the module must be mounted externally on a DIN rail. You will find information on mounting the COM modules on a DIN rail separate from the 3WA circuit breaker in Chapter Mounting adapter for CubicleBUS² modules (Page 356).

You will find more information about the Ethernet connections in the following Chapter Ethernet connections X63 / X64 (Page 141).

Ethernet connections X63 / X64

The COM190 communications module has two independent Ethernet connections X63/X64. The two connections are connected to an internal switch and can simultaneously use the PROFINET IO and the Modbus TCP protocol. A switch function enables the connection of additional PROFINET IO or Modbus stations in a daisy-chain procedure.

The connections support a transmission speed of 100 Mbps. For more information, see Chapter Technical specifications (Page 351).



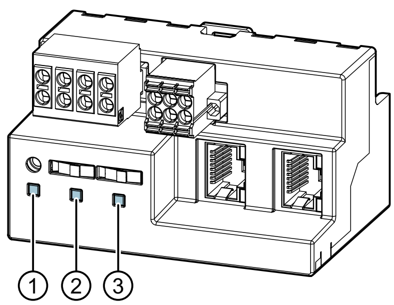
MAC addresses

The COM190 communication module has three MAC addresses. These addresses are divided as follows:

- Two MAC addresses for the Switched Ethernet connections X63/X64
- One MAC address for the COM190 communication module (printed)

LEDs

The COM190 communications module has three LEDs for displaying the status of the COM module and the communications interfaces:



(1) PN (PROFINET IO)

(2) CUB (CubicleBUS²)

(3) TCP (Modbus TCP)

Description of the status displays (normal operating states)

LED	Indication		Description
PN		Green	Normal PROFINET IO communication Communication with PROFINET IO controller
		Flashing green	Active communication only with PROFINET IO supervisor
		Red	No communication with PROFINET IO controller No communication with PROFINET IO supervisor
CUB		Green	CubicleBUS² nodes active
		Red	CubicleBUS² communication disturbed
		Flashing red	Address conflict on the CubicleBUS²: Two COM190 modules have been configured for the same role or there is only one COM B and no COM A.
		Off	No CubicleBUS² nodes active
TCP		Green	At least one opened Modbus TCP connection
		Flashing green	Ethernet link available. No Modbus TCP connection
		Off	No Ethernet link available
		Flashing red	Modbus TCP whitelist cannot be read. The Modbus TCP interface is blocked for security reasons.

Description of the status displays (special operating states)

Indication	LED			Description
	PN	CUB	TCP	
PN and CUB are flashing green alternately. TCP is off.				Visual identification of the COM190 communications module is active. Visual identification can be activated in the SENTRON powerconfig configuration software (blink mode). The identification ends automatically after 10 seconds. You can terminate identification before this time by pressing the function button.
PN and CUB are flashing red alternately. TCP flashes red.				Serious device fault. The COM190 communications module is not operational and may need to be replaced.
PN flashes green. TCP and CUB are off.				Restricted operation. The COM190 communications module is starting.
All LEDs light up orange.				The device is restarting after a reset or after the auxiliary voltage has been switched on. The display is on for 1 second.

Connections X61/X62, functions and operator controls

The description of the common connections and functions of the communication modules can be found in Chapter Common functions and connections (Page 147).

2.10.3.3 COM150 communication module

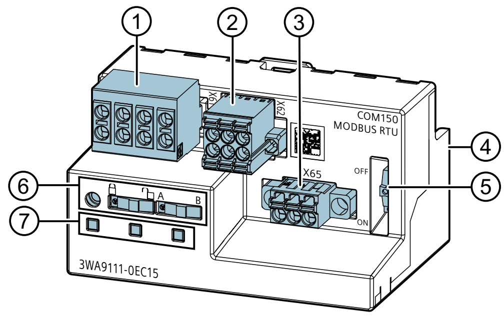
Overview COM150

Supported protocols COM150

The COM150 communications module supports the Modbus RTU protocol.

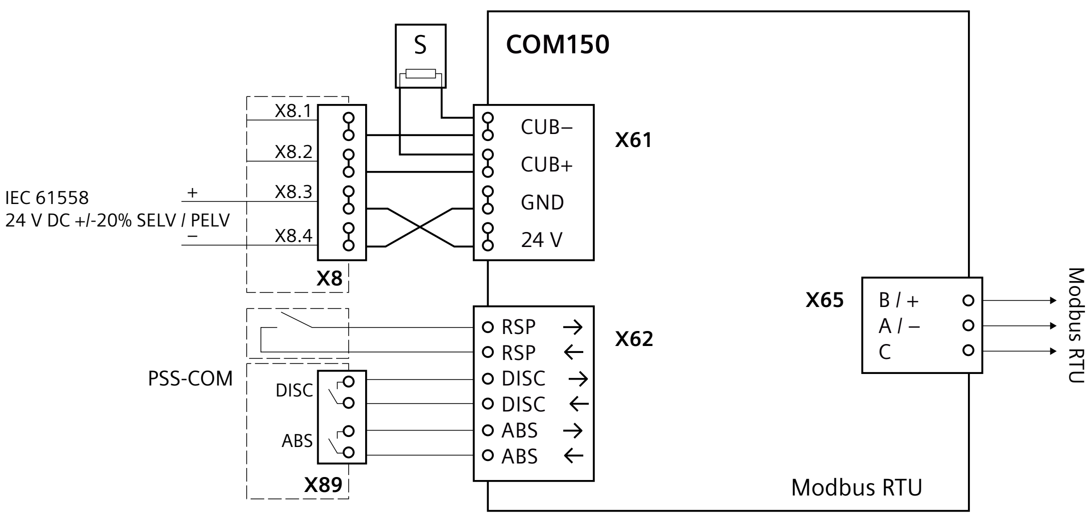
Interfaces, operator controls and status displays

The COM150 communications module for the 3WA circuit breaker has several interfaces, operator controls and status displays, which are described below.



(1)	X61 connector	(5)	Slide switch for Modbus RTU terminating resistor
(2)	X62 connector	(6)	Operator controls
(3)	Modbus RTU connection X65	(7)	LEDs
(4)	Fixation for mounting adapter		

The following graphic shows the interconnection of the COM150 communications module, a PSS COM, and an external write protection switch.



X62

RSP	Remote Switching Protection
DISC	Disconnected
ABS	Absent

X65

B / +	Positive differencial pair wire
A / –	Negative differencial pair wire
C	Common / Ground

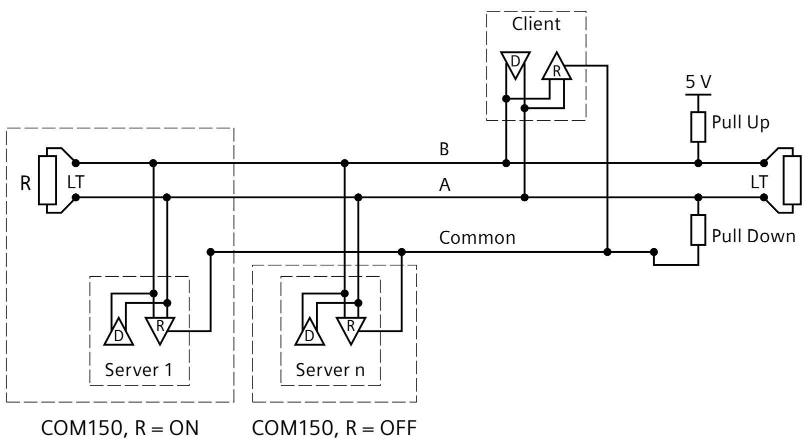
Connection X65 Modbus RTU

The COM150 communication module has a 3-pole connection X65 for the Modbus RTU connection according to the EIA/TIA-485 standard.
The assignment of the poles is as follows:

- B / +
- A / -
- C (Common)

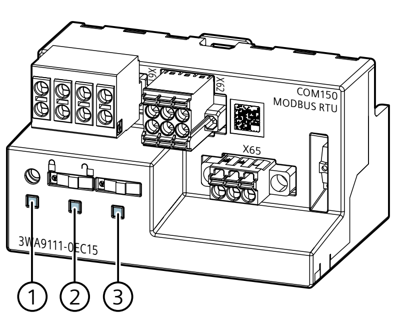
Terminating resistor R

The COM150 communications module has an internal terminating resistor R. This resistor must be activated on the last module of the Modbus RTU line (slide switch in position "ON").



LEDs

The COM150 communications module has three LEDs for displaying the status of the COM module and the communications interfaces:



(1) ACT (active)

(2) CUB (CubicleBUS²)

(3) RTU (Modbus RTU)

Description of the status displays (normal operating states)

LED	Indication		Description
ACT		Green	Normal operation
		Off	Module not active
		Flashing green	LED display is in combination mode (see section Special operating states)
CUB		Green	CubicleBUS^2 nodes active
		Red	CubicleBUS^2 communication disturbed
		Flashing red	Address conflict on the CubicleBUS^2: Two COM modules have been configured for the same role or there is only one COM B and no COM A.
		Off	No CubicleBUS^2 nodes active
RTU		Green	Modbus telegram received with correct checksum and address of the device
		Off	No communication with Modbus client

Description of the status displays (special operating states)

Indication	LED			Description
	ACT	CUB	RTU	
ACT and CUB are flashing green alternately. RTU is off.				Visual identification of the COM150 communications module is active. Visual identification can be activated in the SENTRON powerconfig configuration software (blink mode). The identification ends automatically after 10 seconds. You can terminate identification before this time by pressing the function button.
ACT and CUB are flashing red alternately. RTU flashes red.				Serious device fault. The COM150 communications module is not operational and may need to be replaced.
ACT flashes green. CUB and RTU are off.				Restricted operation. The COM150 communications module is starting up.
All LEDs light up orange.				The device is restarting after a reset or after the auxiliary voltage has been switched on. The display is on for 1 second.

Connections X61/X62, functions and operator controls

The description of the common connections and functions of the communication modules can be found in Chapter Common functions and connections (Page 147).

Default setting of the COM150 communications module

COM150 communications module	Default values
Baud rate	19200
Data format	8N2
Server address	247

2.10.3.4 Common functions and connections

In the following chapters you will find a description of the connections and functions which are identical for the COM190 and COM150 communication modules.

X61 connector

X61 is used to connect:

- Power supply of the communications module with 24 V DC
- CubicleBUS²

The power supply and the CubicleBUS² can be connected to terminals X8.1 to X8.4 of the secondary disconnect terminal of the 3WA circuit breaker or to a further CubicleBUS² module, see Chapters COM190 communication module (Page 402) and COM150 communication module (Page 143).

The power supply is protected against polarity reversal.

The communications module does not start if the polarity is reversed. No LED lights up, see Chapter LEDs (Page 142). Once the polarity reversal has been corrected, the communications module starts.

X62 connector

The X62 connector has 6 contacts for the following functions:

- Connection of S48 and S49 signaling switches of the PSS COM position signaling switch module
- Connection of Remote Switching Protection (RSP)

NOTICE
Unequal potential
The 24 V DC outputs on the X62 connector for the PSS COM and RSP functions do not have the same potential as the 24 V DC on the X61 connector. Do not connect the two connectors with each other. Otherwise the module can be damaged.

Position signaling switch module (PSS COM)

The position signaling switch module (PSS COM) can be installed in the guide frame of a communication-capable 3WA withdrawable circuit breaker as an option.

It signals the following additional positions of the circuit breaker in the guide frame (see Chapter Racking the circuit breaker in the guide frame (Page 40)):

- DISC, Disconnect S48
- ABS, Absent S49

The positions are only transmitted to the communications module with module role selector switch position A, which is connected to the position signaling switch module.

Note

Use of two communications modules

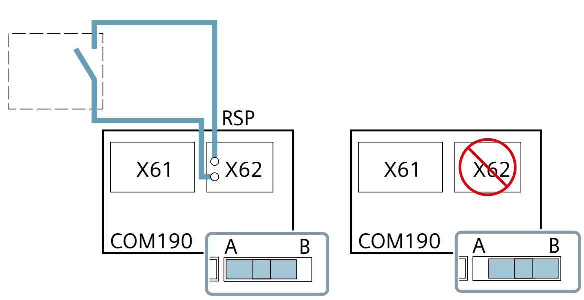
When using two communications modules, the position signaling switch module on the communications module must be connected to the communications module with role A. The information of the "Disconnected" and "Absent" positions is then available on all communications modules.

By default, the "connected position" and "test position" are determined by the Breaker Status Sensor BSS200 in the circuit breaker and transmitted to the communications module. Signals about the withdrawable position do not exist for fixed-mounted circuit breakers.

Remote Switching Protection (RSP)

Remote Switching Protection (RSP) prevents the circuit breaker from opening and closing via the communications interfaces by means of an open/close command.
It consists of a terminal whose pins must be connected to each other for deactivation. Remote Switching Protection is active by default and must be deliberately deactivated.
It is connected to the communications module with the role A and is then effective for communications module A and optionally also for a second communications module B.

Further information on remote switching protection can be found in Chapter Remote Switching Protection (Page 157)



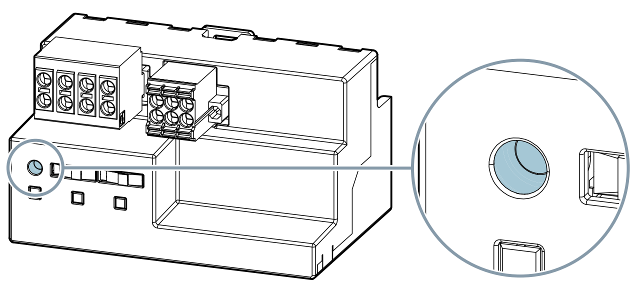
Operator controls

The COM190 and COM150 communications modules have the following operator controls:

- Function button S1
- Slide switch for parameter write protection
- Slide switch for module role selector switch

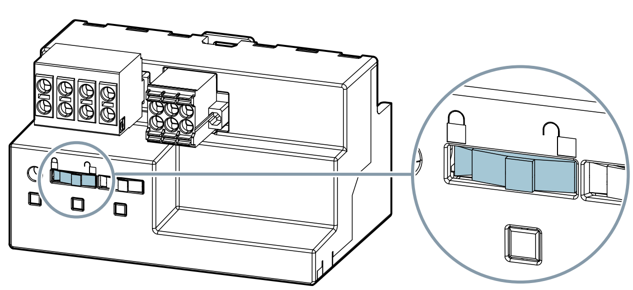
Function button S1

The function button S1 is used to reset the communications module to the factory settings. For more information on the mode of operation, see Chapter Resetting to factory settings (Page 159).



Slide switch for parameter write protection

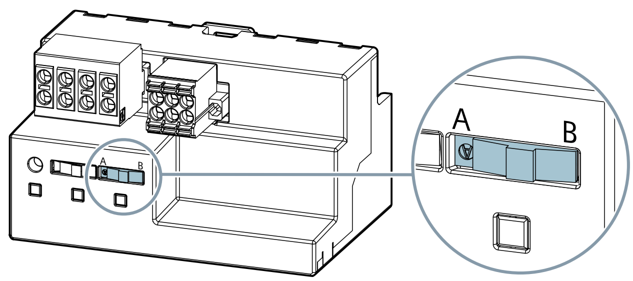
The slide switch for parameter write protection prevents the circuit breaker parameters from being modified via the Ethernet or Modbus RTU interface for the Modbus TCP and PROFINET IO (COM190) or Modbus RTU (COM150) communication protocols. The parameter write protection is activated at the factory and is only valid for this communications module. For a second communications module, parameter write protection must be set separately.
Parameter write protection has no effect on the local communications interfaces USB and Bluetooth. For more information on the mode of operation, see Chapter Resetting to factory settings (Page 159).



Slide switch for module role selector switch

The slide switch module role selector switch (A or B) is used to assign a role A or B to the respective communications module. The switch also serves to uniquely identify the communications module in the system.

Changing the role during operation triggers an immediate restart of the communications module. The communications module is not accessible during the restart. The role change is effective after the restart.



Note

Role assignment

The role assignment between two communications modules must be unique. Two modules must not have the same role, as this will cause an error. The communications modules will then not be ready for operation.

Note

Special functions of role A

Role A has special functions and must therefore always be present. The following elements must only ever be connected to a communications module with role A:

- Position signaling switch module (PSS COM)
- Remote Switching Protection (RSP)

See also

Parameter write protection (Page 156)

Temperature sensor

A temperature sensor is integrated in the COM190 and COM150 communication modules. Since the sensor is installed outside the circuit breaker, it only provides approximate temperature values inside the control cabinet. The temperature is always measured in module A.

An additional temperature sensor is included in the breaker status sensor BSS200. This sensor provides the temperature values in the circuit breaker.

Both temperature sensors require no further calibration.

Note

Accuracy of the measured values

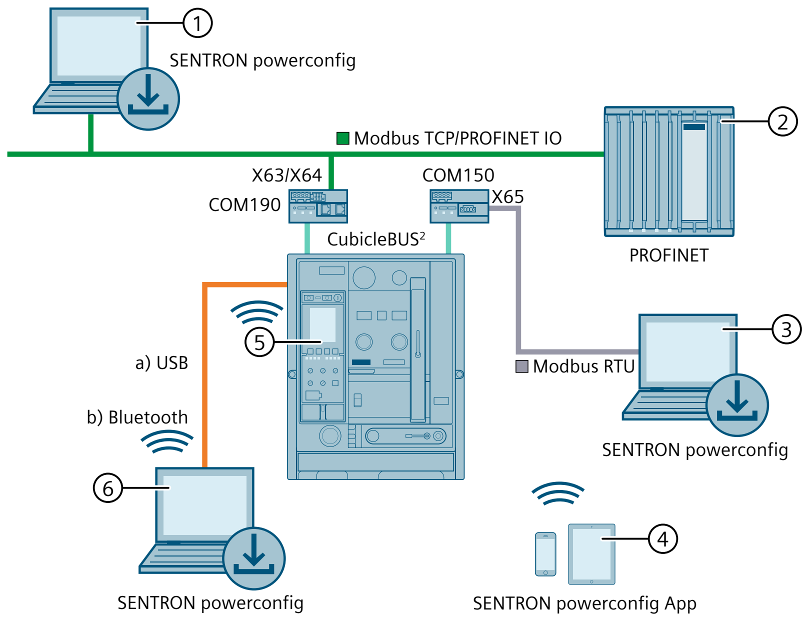
The two temperature sensors may also be warmed by the surrounding electronic components. Thus, deviations of the measured temperature values from the actual ambient temperature are possible.

For more information, see Chapter Metering function (power metering function) (Page 123).

2.10.3.5 Commissioning

The following software options are available for initial commissioning of the COM190 or COM150 communications module:

- SENTRON powerconfig configuration software / SENTRON powerconfig app for commissioning via
  - Ethernet interface of the COM190 communications module
  - Modbus RTU interface of the COM150 communications module
  - USB-C interface of the 3WA circuit breaker
  - Bluetooth interface of the 3WA circuit breaker
- PROFINET commissioning procedures



(1) Ethernet interface of the COM190 communications module
(2) PROFINET commissioning procedures
(3) Modbus RTU interface of the COM150 communications module
(4) SENTRON powerconfig app
(5) Bluetooth interface of the 3WA circuit breaker
(6) USB-C or Bluetooth interface of the 3WA circuit breaker

Note

With options (1) to (3), the parameter write protection of the communications module must be deactivated in order to change parameters via communication.

Commissioning via the Ethernet interface of the COM190

To commission the COM190 communications module via the Ethernet interface, proceed as follows:

1. Connect your notebook/PC to one of the Ethernet ports of the COM190 communications module.
2. Start the SENTRON powerconfig configuration software.
3. Execute the function "Search for accessible devices" (F11 button) in the SENTRON powerconfig configuration software.
   The COM190 communications module appears in the search results.
4. Set the network parameters.

5. Load the network parameters into the COM190 communications module.
   The COM190 communications module can then be accessed under the set network parameters.
6. To make any further changes, save the COM190 communications module into the project of the SENTRON powerconfig configuration software.

Commissioning via Modbus RTU interface of the COM150

To commission the COM150 communications module via the Modbus RTU interface, proceed as follows:

1. Connect your notebook/PC with a USB-RS485 interface converter.
2. Connect the USB-RS485 interface converter to the COM150 communications module. Note that the transmit and receive lines must be swapped.
3. Start the SENTRON powerconfig configuration software.
4. In the SENTRON powerconfig configuration software, drag a 3WA circuit breaker into the project. Then select the connection of the interface converter in the "Communication" cockpit.
5. Set the network parameters; for default values, see Chapter Default setting of the COM150 communications module (Page 147).
6. Load the network parameters into the COM150 communications module.
   The COM150 communications module can then be accessed under the set network parameters.
7. To make further changes, if necessary, load the COM150 communications module into the SENTRON powerconfig configuration software project.

Commissioning via the USB-C interface of the circuit breaker

To commission a communication module via the USB-C interface of the 3WA circuit breaker, proceed as follows:

1. Connect your notebook/PC to the USB-C interface of the 3WA circuit breaker.
2. Start the SENTRON powerconfig configuration software.
3. In the SENTRON powerconfig configuration software, drag a 3WA circuit breaker into the project.
4. Select the USB interface as gateway.
5. Load the current parameters of the 3WA circuit breaker into the project.
6. Edit the network parameters of the communication module.
7. Load the changed parameters into the 3WA circuit breaker.
   The communication module can then be accessed under the set network parameters.
8. Load the communication module into the powerconfig project to make further settings, if necessary.

Commissioning via the Bluetooth interface of the circuit breaker

Notebook / PC via Bluetooth interface

To commission a communication module via the Bluetooth interface of the 3WA circuit breaker, proceed as follows:

1. Connect your notebook/PC to the Bluetooth interface of the 3WA circuit breaker.
2. Start the SENTRON powerconfig configuration software.
3. In the SENTRON powerconfig configuration software, drag a 3WA circuit breaker into the project.
4. Select the Bluetooth interface as gateway.
5. Load the current parameters of the 3WA circuit breaker into the project.
6. Edit the network parameters of the communication module.
7. Load the changed parameters into the 3WA circuit breaker.
   The communication module can then be accessed under the set network parameters.

Smartphone/tablet via Bluetooth interface

To commission a communication module via a smartphone or tablet, proceed as follows:

1. Connect your smartphone/tablet to the Bluetooth interface of the 3WA circuit breaker.
2. Start the SENTRON powerconfig configuration software app.
3. In the SENTRON powerconfig configuration software, drag a 3WA circuit breaker into the project.
4. Select the Bluetooth interface as gateway.
5. Load the current parameters of the 3WA circuit breaker into the project.
6. Edit the network parameters of the communication module.
7. Load the changed parameters into the 3WA circuit breaker.
   The communication module can then be accessed under the set network parameters.

PROFINET commissioning procedures

Requirement

- 3WA circuit breaker with ETU600 electronic trip unit
- COM190 communications module

  Note

  With two communications modules, one module must be configured for module role A and the other module for module role B.

- External 24 V DC power supply
- PROFINET master
- Optional SENTRON powerconfig configuration software version 3.17 or higher
- Optional STEP 7 V5.5 or higher, TIA Portal

Procedure

To commission the COM190 communications module via PROFINET, download the GSDML files for the COM190 from the internet (https://support.industry.siemens.com/cs/WW/en/view/109793939).

The GSDML files can be imported in STEP 7 V5.5 or higher, TIA Portal, and other PROFINET configuration tools.

Note

PROFINET settings made with the SENTRON powerconfig configuration software only become effective after a restart of the COM190 communications module. A restart of the communications module can be initiated by briefly interrupting the 24 V power supply voltage.

2.10.3.6 Access protection functions

Overview

To restrict access to the communications module or prevent unauthorized access, the module offers several access protection functions. These access protection functions are implemented both as hardware and software functions and in network security:

- Hardware protective functions:
  - Parameter write protection
  - Remote Switching Protection
- Software protective functions
  - Modbus TCP whitelist (COM190)
  - Settable TCP port (COM190)
  - Signed firmware
- Protection of the network infrastructure

Hardware-based access protection functions

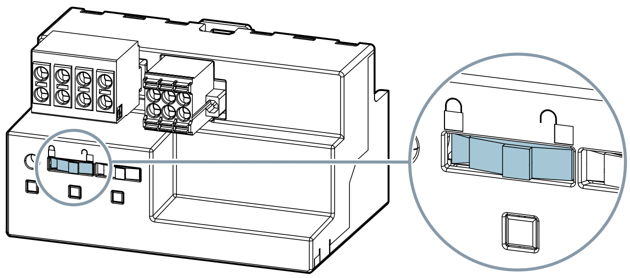
The COM190 and COM150 communication modules have two hardware access protection functions.

The parameter write protection prevents parameters from being changed and unintentional actions from being carried out. It is part of the cybersecurity functions.

Remote Switching Protection prevents the 3WA circuit breaker from being closed and opened via the fieldbus communication connections.

Parameter write protection

The parameter write protection is implemented via a slide switch on the communications module. It prevents unwanted changes to circuit breaker parameters via the fieldbus interfaces of the communications module.



The parameter write protection is an effective way to protect the circuit breaker against unwanted changes, e.g. after installation.

The slide switch for parameter write protection is marked with two icons:

- Parameter write protection is activated
- Parameter write protection is deactivated

When parameter write protection is active, changes to parameters such as protection parameters, communication parameters or device parameters via the PROFINET, Modbus TCP or Modbus RTU communications interfaces are not accepted with a few exceptions.

Note

The parameter write protection is activated by default. To change parameters via the communications interfaces, parameter write protection must be deactivated.

Parameter write protection has no effect on the circuit breaker's USB and Bluetooth interfaces.

Blocked changes and actions

The following changes and actions are blocked when parameter write protection is active:

- Resetting the current tripping operation
- Changing the protection parameters
- Changing the parameters for the enhanced protective function
- Changing the parameters for communication
- Changing the parameters for the metering value setting/metering function
- Resetting of maintenance information (counter)
- Control of digital outputs
- Updating the firmware of the communications module via the SENTRON powerconfig configuration software
- Resetting the settings to factory settings with PROFINET

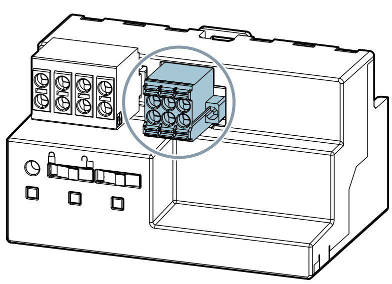
Exceptions

Exceptions are the following modifications and actions that are also permitted in write-protected mode:

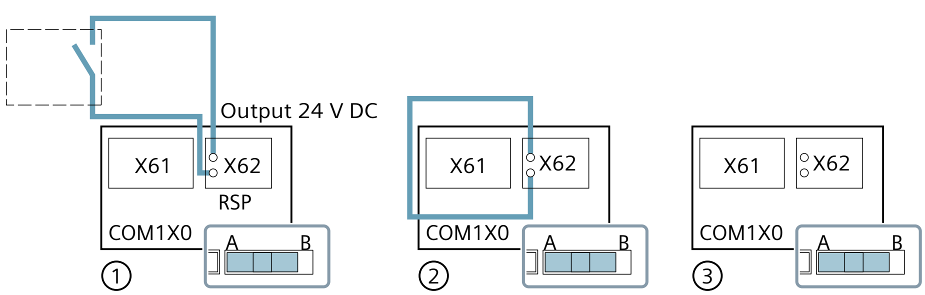
- Setting/modifying the system time
- Modifying the free texts (comment, plant designation)
- Resetting the min./max. values
- Resetting the settings to factory settings with function button S1

Remote Switching Protection

Remote Switching Protection (RSP) prevents the opening/closing of the circuit breaker via the communications interface by means of an open/close command. Remote Switching Protection uses two terminals on the X61 connector. It is connected to the communications module with role A and is then effective for communications module A and optionally also for a second communications module B.



Remote Switching Protection is active by default and must be deliberately deactivated. The connection (RSP) must be bridged for deactivation.



(1) Temporary activation/deactivation of Remote Switching Protection

(2) Permanent deactivation of Remote Switching Protection

(3) Permanent activation of Remote Switching Protection

Temporary activation/deactivation

Remote Switching Protection (RSP) can be temporarily activated, e.g. via a selector switch in the control cabinet door. This prevents the circuit breaker from being opened or closed. This increases the safety for operating and maintenance personnel.
Furthermore, remote switching via the communications interfaces can be temporarily activated if necessary (e.g. via PLC). This measure prevents unintentional switching of the circuit breaker and increases cybersecurity.

You will find more information under White paper (https://new.siemens.com/global/en/products/energy/low-voltage/components/sentron-protection-devices/3wa-air-circuit-breakers.html).

Permanent deactivation

Remote Switching Protection (RSP) can be permanently deactivated if the RSP terminals on the X62 connector are short-circuited. Thus, switching via the PROFINET, Modbus TCP and Modbus RTU communications interfaces is not restricted and is always possible.

Permanent activation

Remote Switching Protection (RSP) can be permanently activated if the RSP terminals on the X62 connector remain open (factory setting). It is therefore not possible to open/close the circuit breaker via the PROFINET, Modbus TCP and Modbus RTU communications interfaces.

Software-based access protection functions

Signed firmware

Firmware updates of the COM190 communication module are digitally signed by Siemens with a private key and thus protected against manipulation. The communication module detects faulty, manipulated firmware packages or firmware packages intended for another device and rejects the installation.

Digitally signed firmware updates make the COM190 communication module future-proof and support the installation of additional security functions and security updates.

Network protection

In addition to using the security functions of the COM190 communications module, the network infrastructure in which the 3WA circuit breaker is operated should also be secured. For this purpose, it makes sense to release only required ports. It is also possible to block ports if communication outside the local network is not desired.

Connection list

Port type	Connection number (decimal)	Service	Description
TCP	502 (default, but freely configurable)	Modbus TCP	The Modbus TCP port should be blocked in the gateway to another network if no Modbus TCP connection to the 3WA from this network is required.
UDP	123	SNTP	Required for time synchronization via SNTP (Simple Network Time Protocol)
	161	SNMP	Necessary for operation of the PROFINET IO interface.
	17008, 17009	Device detection and commissioning	Connections are used by the SENTRON powerconfig configuration software and powermanager for commissioning the COM190. When transitioning to another network (e.g. in a router firewall), these connections should be blocked.
	34964	PROFINET RPC Endpoint Mapper	Necessary for operation of the PROFINET IO interface.

2.10.3.7 Resetting to factory settings

The following options are available to reset the COM190 communications module to factory settings:

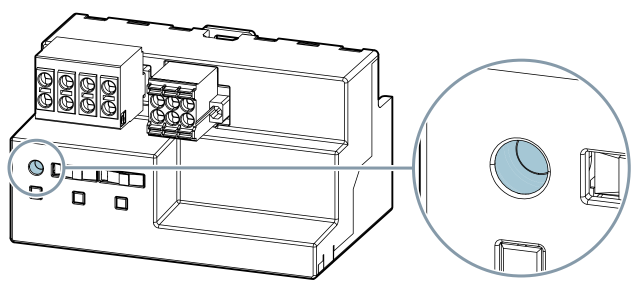
- Function button S1
- PROFINET standard functions

Note

By resetting to the factory settings, all communication parameters and security settings are reset. The COM190 communications module must then be re-parameterized in the same way as for first commissioning.

Procedure

The reset to factory settings is initiated by pressing and holding the S1 operating key for 5 seconds. When the request "Reset to factory settings" is detected, the device signals "restricted operation" (LEDs flash green). This state lasts for about 5 seconds. At this point, function button S1 can be released.



If all LEDs light up orange for 1 second, the device is restarting. The device reboots the application and signals "restricted operation" (LEDs flash green). This state can last up to 10 seconds, depending on the configuration of the circuit breaker.

The COM190 communications module then switches to normal operation.

Note

Preventing a repeated restart

When the COM190 communications module restarts (all LEDs light up orange for 1 s), the function button must be released to prevent another reset to the factory settings.

2.10.3.8 System time

Providing the system time

The system time of the circuit breaker is generated by the ETU600 electronic trip unit.

Synchronization of the system time

The time can be set using the operating keys on the display of the ETU600 electronic trip unit, or via the USB, Bluetooth and field bus interfaces.

The Simple Network Time Protocol (SNTP) can be used for time synchronization via the fieldbus interfaces.

Setting the system time

Setting the system time via the SENTRON powerconfig configuration software

The system time of the 3WA circuit breaker can be set using the SENTRON powerconfig configuration software.

Setting the system time via SNTP at the COM190 communication module

The Simple Network Time Protocol (SNTP) can also be used to set the circuit breaker system time. SNTP is a simplified version of the NTP and sets the system time automatically using NTP servers (time servers).

Note

To activate the SNTP function and enable writing of parameters, the COM190 parameter write protection must be deactivated.

Requirement

- COM190 communication module
- NTP time server
- Optional SENTRON powerconfig configuration software for commissioning

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Note

According to the Siemens Cybersecurity Disclaimer, the COM190 should not be operated in public networks. The SNTP function of the COM190 is therefore designed for a local NTP time server in closed networks.

Setting the system time via the COM190 communication module

The system time can be set as a data point via the Modbus TCP and PROFINET protocols.

Automatic daylight savings switchover

The 3WA circuit breaker operates with a system time generated in the ETU600 electronic trip unit. The system time can be set using the operating keys on the display of the ETU600, via the USB and Bluetooth interfaces, PROFINET IO and Modbus TCP, and it can be automatically synchronized via SNTP.

In order to synchronize the local system time via SNTP, the addition to or subtraction from the UTC time must be set.

As an option it is possible to set up an automatic daylight savings switchover.

Requirement

- ETU600
- Optional COM190/COM150
- Optional SNTP time server
- Optional SENTRON powerconfig configuration software version 3.17 or higher for commissioning

---

Note

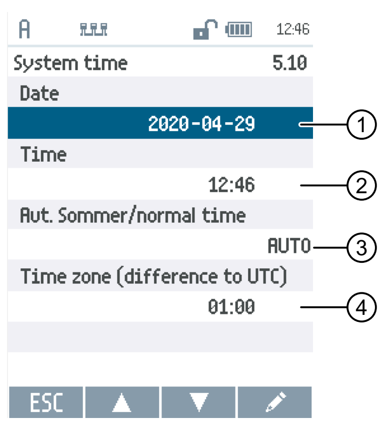
Deactivating the parameter write protection

To be able to change system time parameters, the parameter write protection of the communications module must be deactivated.

The system time itself can be changed even if parameter write protection is active.

Settings

The system time and the automatic daylight savings switchover have the following settings for the 3WA circuit breaker:



(1) Date in year-month-day format

(2) Time in hour:minute format

(3) Automatic daylight savings switchover

(4) Time zone difference to UTC in 15-minute increments

You will find more information in Chapter Reference documents (Page 17).

2.10.4 Status acquisition with Breaker Status Sensor BSS200

The Breaker Status Sensor BSS200 can detect the following statuses and make them available via the internal CubicleBUS[2]:

- Switching state of the main contacts of the circuit breaker OPEN/CLOSED
- Stored energy mechanism charged
- Ready-to-close status
- Circuit breaker tripped
- Status of the second auxiliary release
- TEST and CONNECT positions of the withdrawable circuit breaker

---

Note

The microswitches of the Breaker Status Sensor BSS200 for detection of the circuit breaker status, the stored energy mechanism and the ready-to-close status are monitored for errors.

Technical specifications

Design of the power supply	DC power supply unit
DC power supply unit	See Chapter Selecting the power supply (Page 133)
Rated supply voltage Us	24 V DC
Primary operating range	U_s ± 20%
Power consumption	1.3 W
Maximum current consumption	0.05 A
Starting current / maximum (for 5 ms)	0.35 A
Overvoltage category	CAT I
Integrated short-circuit protection	✓
Protected against polarity reversal	✓

2.11 Self-monitoring and diagnostics

2.11.1 Internal self-test

2.11.1.1 General

For commissioning and a functional check, the electronic trip unit has various integrated test functions depending on the scope of functions. These end with or without tripping the circuit breaker.

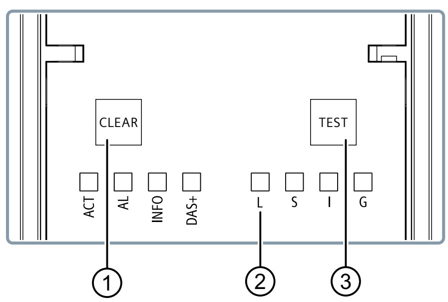
Requirements:

- Electronic trip unit is activated.
- Operational current is not in the overload range.

Note

The internal self-test can be started approx. 45 seconds after activating the electronic trip unit. Initial checks are already running in the ETU after activation. Any detected errors are signaled via the INFO LED.

2.11.1.2 Internal self-test ETU300



(1) CLEAR button

(2) Trip cause LED L

(3) TEST button

Test function without tripping

The internal test function without tripping the circuit breaker is started by pressing the TEST button.

An ongoing test is indicated by a running light of the trip cause LEDs from left to right over the set tripping time t_r.
The execution of the internal test function can be canceled by pressing the CLEAR button for longer than 700 ms.

If the test is completed successfully, the trip cause LED L lights up for 30 seconds. If an error was detected during the internal self-test, this is indicated by the red INFO LED.

Test function with tripping

The internal test function with tripping of the circuit breaker is started by simultaneously pressing the TEST and CLEAR buttons for a long time (> 700 ms) and then releasing the CLEAR key.

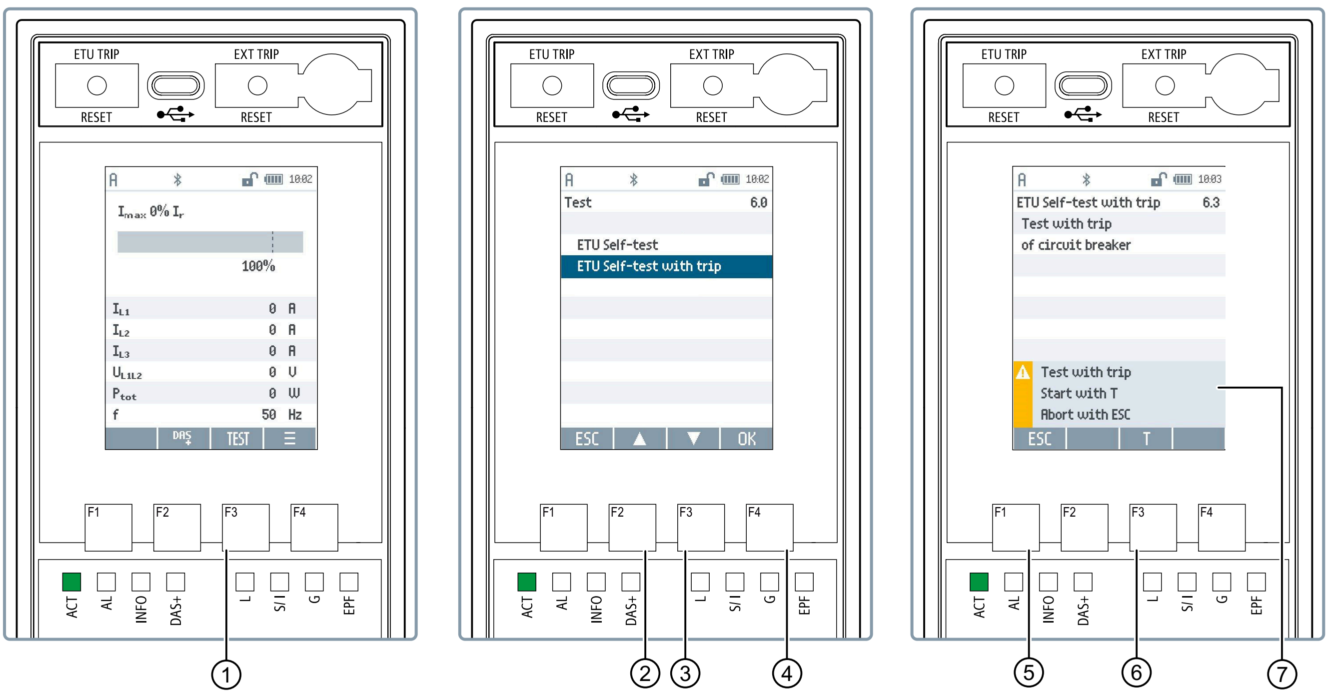
An ongoing test is indicated by a running light of the trip cause LEDs from right to left over the set tripping time t_r.
The execution of the internal test function can be canceled by pressing the CLEAR button for longer than 700 ms.

If the test is completed successfully, the trip cause LED L lights up for 30 seconds and the circuit breaker trips. If an error was detected during the internal self-test, this is indicated by the red INFO LED.

2.11.1.3 Internal self-test ETU600

The TEST menu can be called directly from the ETU600 start screen by pressing the F3 operating key or in the main menu under TEST (6.0). In the TEST menu, the desired test can be selected with the F2 and F3 operating keys and called up with the F4 operating key (OK).

Pressing the F3 (T) operating key starts the test.
The following figure shows the steps to start the test with the circuit breaker tripping.



(1) F3 operating key for direct calling of the TEST menu

(2) F2 operating keys for test selection

(3) F3 operating keys for test selection

(4) F4 operating key to confirm the selection

(5) F1 operating key to abort

(6) F3 operating key for starting

(7) Warning message

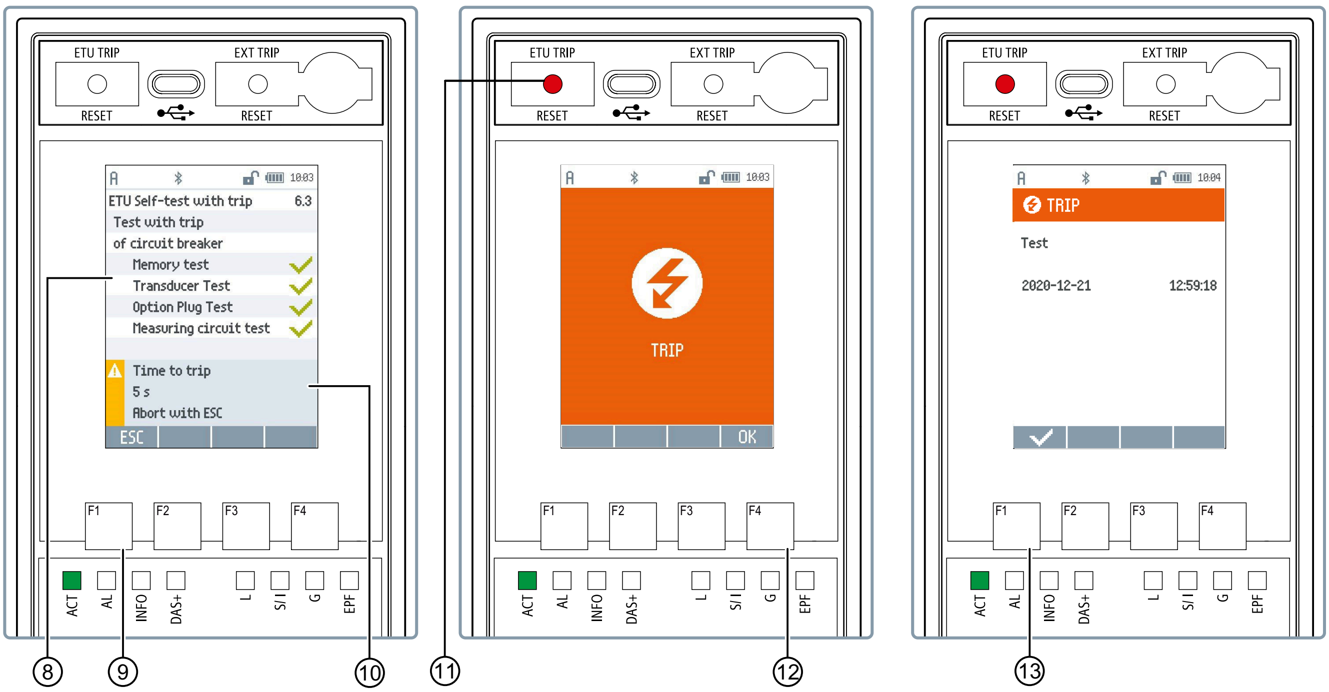
Note

The test with tripping can be aborted by pressing the F1 (ESC) operating key.

Test result

After the start, the checked points and the result of the check are displayed. In addition, the trip cause LED L lights up for 30 seconds. In the case of a test with circuit breaker tripping, reference is also made to the duration until tripping.

Tripping can be identified by the circuit breaker's tripped indicator and the full-screen "TRIP" display.



(8) Information on the points checked and the result
A "?" indicates that the test is still running and the result is not yet available.

(9) Operating key (ESC) to abort the test

(10) Warning message

(11) Tripped indicator of the circuit breaker

(12) F4 operating key for confirmation and for more information

(13) F1 operating key for confirmation

Note

Internal self-test ETU600 with the SENTRON powerconfig configuration software

You can also start the internal self-test of the electronic trip unit ETU600 via the USB-C interface using the SENTRON powerconfig configuration software. When the self-test has finished, you can save a log of the test results.

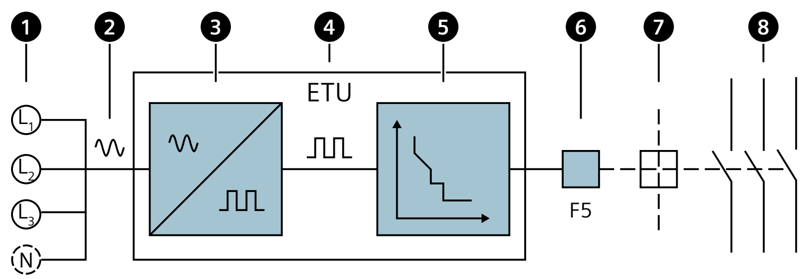
2.11.2 Software-assisted testing

In order to check and log the parameterized protection settings and the functionality of the circuit breaker, the 3WA circuit breaker offers the possibility of software-assisted testing. These tests can be easily performed during commissioning, inspection and maintenance (see Chapter Inspection and maintenance (Page 359)) or service.

In contrast to previously used test equipment and test procedures, software-assisted testing offers simple test execution, without assembly work on the circuit breaker and comprehensive documentation. It is therefore more effective, more fail-safe, and its mode of operation makes it very flexible and meaningful.

2.11.2.1 Circuit breaker operating principle

The basis for testing an 3WA circuit breaker is its operating principle.
The following graphic shows in simplified form what you have to test on a 3WA circuit breaker in order to be able to verify its functionality.



(1)	Current sensors	(5)	Protection electronics
(2)	Analog measured signal	(6)	Tripping solenoid F5
(3)	Analog/digital converter	(7)	Breaker mechanism
(4)	Digital measured signal	(8)	Main contacts

Operating principle

The circuit breaker uses current sensors to measure the current currently flowing through the main contacts. The current sensors convert the primary current into an analog measured signal. The analog measured signal is converted into a digital measured signal in an analog-to-digital converter.

The digital measured signal is compared with the set protection settings in protection electronics. If the current measured by the main contacts exceeds the set limits, the tripping solenoid F5 is activated immediately or after the set delay time. The tripping solenoid F5 unlatches a breaker latching mechanism. The energy stored in the breaker latching mechanism opens the main contacts of the circuit breaker and thus interrupts the electric circuits.

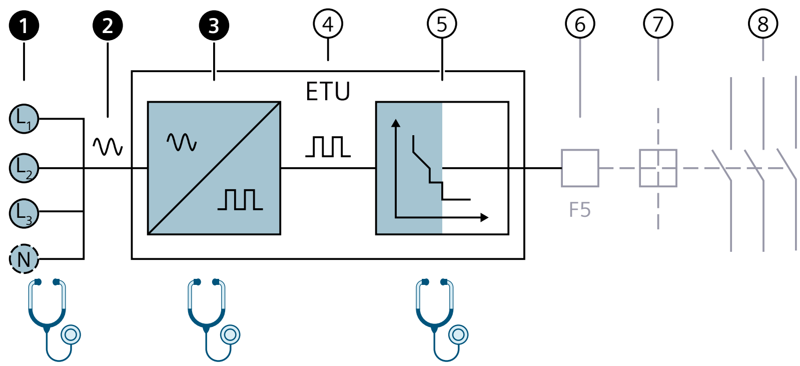
2.11.2.2 Test functions

To check and document the functionality of a circuit breaker, the continuous self-monitoring of the ETU and an externally generated test signal must be considered together.

Only in this combination is it possible to test the entire function chain of a circuit breaker and the correct evaluation of the result.

Self-monitoring

As described in Chapter Circuit breaker operating principle (Page 166), the 3WA circuit breaker features a self-monitoring function for the current sensors and the electronic components. During the continuous self-monitoring of the circuit breaker, points (1) to (5) from the following graphic are monitored.



(1)	Current sensors	(5)	Protection electronics
(2)	Analog measured signal	(6)	Tripping solenoid F5
(3)	Analog/digital converter	(7)	Breaker mechanism
(4)	Digital measured signal	(8)	Main contacts

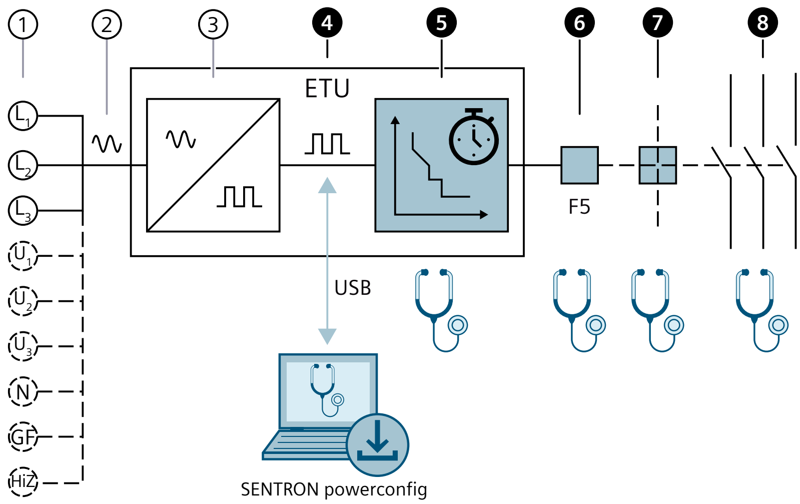
The monitoring function constantly checks the current sensors, the analog-to-digital converter, and the electronic components of the protective function. Errors are detected and reported immediately. The fault-free operation of these components can therefore always be detected and ensured.

The set protection parameters, their correctness, and the mechanical part of the circuit breaker (see points (5) to (8) from the previous graph) are not checked by the self-monitoring function. This is where software-assisted testing comes in, which together with self-monitoring can test the entire functional chain.

The following applies:
Self-monitoring + software-assisted testing = test of the circuit breaker

Software-assisted testing

With software-assisted testing, you can test the parts of the functional chain of the 3WA circuit breaker that cannot be checked with self-monitoring alone.



(1)	Current sensors	(5)	Protection electronics
(2)	Analog measured signal	(6)	Tripping solenoid F5
(3)	Analog/digital converter	(7)	Breaker mechanism
(4)	Digital measured signal	(8)	Main contacts

Test principle

The principle of software-assisted testing is that the SENTRON powerconfig configuration software transmits a test signal (current and/or voltage) to the electronic trip unit ETU600 via the USB-C interface. The test signal is generated individually according to the current circuit breaker protection settings and the selected test function (LT, ST INST, N, GF, etc.).
The ETU600 treats the test signal like an actual current measured via the current sensors and behaves as specified by the set protection parameters. The protective function of the ETU600 is not in test mode, nor is the protection behavior affected. This allows you to check the real protection and system behavior and also detect incorrect protection settings.

Test signal

The test signal corresponds one-to-one to the actually measured signal after digitalization by the analog-to-digital converter. The test signal can be formed for up to nine measuring inputs. The test signal is generated individually by the SENTRON powerconfig configuration software on the basis of the current protection settings of the 3WA circuit breaker and the desired protective function trip. Many network conditions can therefore be simulated.

Tripping

If the test signal exceeds the set limit values of the protection settings and an optionally set delay time has elapsed, the tripping solenoid F5 is actuated. This unlatches the breaker latching mechanism and opens the main contacts.

Tripping time

The time required from exceeding the limit values to actuation of the tripping solenoid is determined, displayed and evaluated as the tripping time. If the determined tripping time is within the specified tolerances, the test is passed.

Mechanical system

During the test, the F5 tripping solenoid, the breaker latching mechanism, and the main contacts are also checked for proper functioning. If a Breaker Status Sensor BSS200 is present and active, the opening of the main contacts is automatically detected and signaled. If there is no BSS200, then the tester must confirm the opening of the main contacts in the software. If the main contacts are open, the test is passed.
A test trip has no influence on the electrical wear of the main contacts, but is counted as a mechanical operating cycle.

Note

Influence of the thermal memory of the 3WA circuit breaker on the test results

Since the protective function is not affected by the test, the thermal memory of the circuit breaker may affect the test results if tests are performed several times. This can lead to an incorrect evaluation of the test result.
To prevent this, turn off the thermal memory before testing or compare the system behavior during repeated testing with and without the thermal memory to avoid errors.

Test report

Each software-assisted test is stored in the SENTRON powerconfig configuration software and a test report can be generated. The test report can be printed out or saved as a PDF.

The ability to print test reports depends on the license.

All results, protection parameters and statistics of the self-monitoring functions are stored in the test report. Thus, the system of the 3WA circuit breaker is completely documented until the next inspection and maintenance.
Each test is stored in a test log file in the 3WA circuit breaker. You can read out the test log file using the SENTRON powerconfig configuration software. Thus, you can always see when the 3WA circuit breaker was last tested and what the test result was.

Test requirements

To run a software-assisted test, the following requirements must be met:

- 3WA circuit breaker with electronic trip unit ETU600 and firmware version V2.2 and higher, see Firmware updates (https://support.industry.siemens.com/cs/ww/en/view/109782123)
- SENTRON powerconfig configuration software from V3.22, see current version of powerconfig (https://sie.ag/2SUIAc2)
- Automation License Manager (ALM), see Automation License Manager (https://support.industry.siemens.com/cs/ww/en/view/114358)

- Software license for software-assisted testing (different test scope, depending on the type of license (https://mall.industry.siemens.com/mall/ww/en/Catalog/Product/?mlfb=7KN2720-0CE00-1YC1))
- USB-C cable
- Windows PC/Laptop
- Active USB-C connection to the electronic trip unit ETU600
- All trip alarms are reset
- The main contacts are closed

Note

Current flow

Make sure that no current flows through the main contacts. If a current flow is detected, the test cannot be started.

- Recommendation: Use of an external 24 V DC power supply for the Breaker Status Sensor BSS200

The test can be performed with the circuit breaker installed.
The circuit breaker does not have to be disconnected from the primary voltage supply before performing the test.
During the software-assisted test, the protective function is still active and can open the circuit breaker, for example, in the event of a sudden overcurrent.

2.11.2.3 SENTRON powerconfig configuration software

Software-assisted testing is performed together with the SENTRON powerconfig configuration software for Windows PCs/laptops. The individual test functions are contained in various function packages that are activated through a license.

There are two different function packages with the following scope:

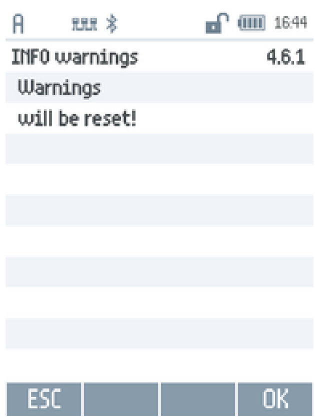
- **Basic**
  In the basic test package, different tripping operations (LT, ST, INST, N, GF) and the associated messages can be generated. The test results can be displayed. It is not possible to print the test results.
  The basic test package is free of charge and not limited in time.
- **Standard**
  In the standard test package, different tripping operations (LT, ST, INST, N, GF) can be generated and the tripping currents can be individually adjusted. The test results can be documented in a comprehensive test report.
  The standard test package is activated via a license and limited to the duration of one year after activation.

You can purchase the function packages and the associated licenses at the Siemens Industry Mall (https://mall.industry.siemens.com/mall/ww/en/Catalog/Product/?mlfb=7KN2720-0CE00-1YC1).
The licenses are managed and installed using the Automation License Manager (ALM), see Software-assisted testing (Page 168).

2.11.3 Display of errors and alarms

The electronic trip units ETU300 and ETU600 have a self-monitoring and diagnostic function. Errors that occur are detected when the electronic trip unit is activated and displayed via the INFO LED. The LED lights up red until the error is eliminated and the electronic trip unit is restarted.
The color display of the ETU600 additionally shows details and an instruction for action.

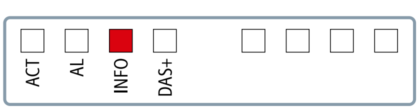
Warnings are indicated by the INFO LED lighting up yellow.
Warnings due to erosion of the main contacts can be deleted from the electronic trip unit ETU600 after an inspection or maintenance using the SENTRON powerconfig configuration software. All other warnings can also be deleted via the ETU600 display in the "4.6.1 INFO warnings" menu.



In principle, occurring errors can be assigned to the following 3 groups.

Serious error with circuit breaker tripping

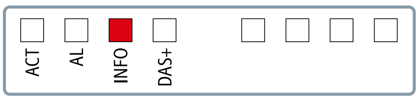
A serious error with tripping is a type of fault that influences the protective function of the circuit breaker so much that regular operation can no longer be ensured. In this case, the circuit breaker is tripped immediately. Further operation of the circuit breaker is then no longer possible. A service assignment by a Siemens-certified technician is necessary.



Error	Description display ETU600
CRC error protection processor	ETU error, system, contact Service
RAM error protection processor	
Error system configuration	
Recurring error in the analog measuring circuit	ETU error, contact Service
Memory error option plug	ETU error, option plug, contact Service
Option plug not approved or missing	ETU error, option plug, replace option plug

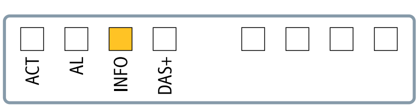
Error without circuit breaker tripping

An error without tripping is a type of error that does not influence the primary protective functions of the circuit breaker. The function of the circuit breaker is restricted because parts are no longer ready for operation. For example, these may be the metering function or the display of the ETU electronic trip unit. A service assignment by a Siemens-certified technician is necessary.



Error	Description display ETU600
CRC error application processor ETU600	ETU error, system, contact Service
RAM error application processor ETU600	
Memory error ETU	
Error in thermal memory	
Error in the analog measuring circuit	
Watchdog error	
Current sensor Rogowski coil defective	ETU error, current sensor [phase / N], contact Service
Limit temperature ETU exceeded	ETU error, limit temperature exceeded, check ETU
Error in the VTM voltage tap module of the ETU600	ETU error, VTM module, contact Service
Error firmware update ETU600	ETU error, firmware update, contact Service
Memory error BIM	Error circuit breaker, system, contact Service
Rotary coding switch ETU defective	ETU error, [protective function parameter], contact Service
Indication of trip cause faulty	ETU error, indication of trip cause, contact Service

Warning



A warning is a type of error that does not influence the protective function of the circuit breaker. Operation of the circuit breaker is still possible with restrictions. Service work may need to be scheduled or the error may have to be rectified as part of the next maintenance.

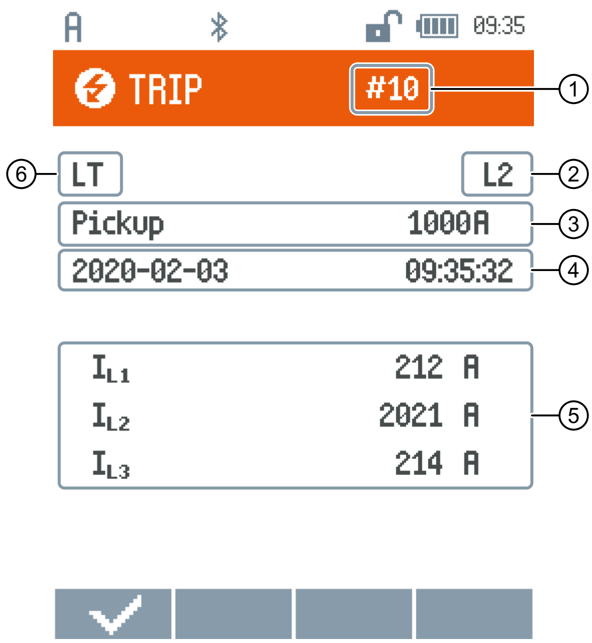
Warning ETU300	
Current sensor energy cores defective	
90% of limit temperature ETU reached	

Warning ETU600	Description display ETU600
Current sensor energy cores defective	ETU error, current sensor [phase], contact Service
Battery low	ETU warning, battery low, replace battery
Time not set	ETU warning, clock not set, set clock

Warning ETU600	Description display ETU600
90% of limit temperature ETU reached	ETU warning, limit temperature reached, check ETU
Limit temperature in COM module exceeded	COM module warning, limit temperature exceeded, check module
Erosion of the main contacts requires maintenance	Circuit breaker warning, maintenance required, perform maintenance
Erosion of the main contacts requires inspection	Circuit breaker warning, inspection required, perform inspection
Parameterized and measured frequency do not match	ETU warning, frequency, parameterize rated frequency
IOM230 module disconnected from the CubicleBUS[2]	IOM230 module warning, module not found, check wiring
Error in IOM230 module	IOM230 module warning, error in module, contact Service
Module IOM350 separated from CubicleBUS[2]	IOM350 module warning, module not found, check wiring
Fault in IOM350 module	IOM350 module warning, fault in module, contact Service
COM module disconnected from CubicleBUS[2]	COM module warning, module not found, check wiring
Error in COM module	COM module warning, error in module, contact Service
BSS200 module disconnected from the CubicleBUS[2]	BSS200 module warning, module not found, check wiring
Error in BSS200 module	BSS200 module warning, error in module, contact Service
ETU system clock not running	ETU warning, uCA RTC, contact Service
TUI600 module disconnected from the CubicleBUS[2]	TUI600 module warning, module not found, check wiring
Error in TUI600 module	TUI600 module warning, error in module, contact Service
Module ZSI200 separated from CubicleBUS[2]	ZSI200 module warning, module not found, check wiring
Error in ZSI200 module	ZSI200 module warning, fault in module, contact Service
Short-circuit on ZSI line	ZSI200 module warning, wiring fault, check wiring

2.11.4 Trip log

Up to 20 trips can be stored in the trip log of the ETU600 electronic trip unit. The trip log takes the form of a circular buffer.



Each trip by the ETU600 electronic trip unit is stored with the following information:

- Trip number (1)
- Trip cause (6) with indication of the phase (2) and the associated setting (3)
- Time stamp (4)
- Last measured values before tripping (5)

Note

No external power supply of the ETU600 is required for the trip log function, but is recommended. In the case of a self-powered electronic trip unit, the contents of the trip log may be lost if the ETU600 power supply is interrupted while writing the trip log.

Stored measured values

Depending on the trip cause, the following measured values are stored and shown on the display:

Basic protective functions	Trip cause	Measured value				
		1	2	3	4	5
L: Overload LT	LT	I_{L1}	I_{L2}	I_{L3}	I_{LN}	--
L: Overload LT, neutral conductor	LT	I_{L1}	I_{L2}	I_{L3}	I_{LN}	--
S: Short time ST	ST	I_{L1}	I_{L2}	I_{L3}	I_{LN}	--

Basic protective functions	Trip cause	Measured value				
		1	2	3	4	5
S: Directed short time dST forward	dST forward	I_{L1}	I_{L2}	I_{L3}	I_{LN}	--
S: Directed short time dST reverse	dST reverse	I_{L1}	I_{L2}	I_{L3}	I_{LN}	--
I: Instantaneous INST	INST	I_{L1}	I_{L2}	I_{L3}	I_{LN}	--
G: Ground fault GF Residual	GF residual	I_{L1}	I_{L2}	I_{L3}	I_{LN}	I_g
G: Ground fault GF Direct	GF direct	I_{L1}	I_{L2}	I_{L3}	I_{LN}	I_g
G: Ground fault GF Dual UREF	GF UREF	I_{L1}	I_{L2}	I_{L3}	I_{LN}	I_g
G: Ground fault GF Hi-Z UREF	GF UREF	I_{L1}	I_{L2}	I_{L3}	I_{LN}	I_g
Reverse power RP	Reverse power	P_{L1}	P_{L2}	P_{L3}	--	--

Enhanced protective functions EPF		Trip cause	Measured value				
			1	2	3	4	5
Unbalance	Current	Unbalance voltage	I_{L1}	I_{L2}	I_{L3}	I_{LN}	I_{nb}
	Voltage	Unbalance current	U_{1N}	U_{2N}	U_{3N}	U_{nb}	--
Harmonic analysis	THD current	Over THD current	I_{L1}	I_{L2}	I_{L3}	I_{LN}	THD I
	THD voltage	Over THD voltage	U_{1N}	U_{2N}	U_{3N}	THD U	--
Voltage	Undervoltage	Undervoltage	U_{1N}	U_{2N}	U_{3N}	--	--
	Overvoltage	Overvoltage	U_{1N}	U_{2N}	U_{3N}	--	--
Power	Power forward	Power forward	P_{L1}	P_{L2}	P_{L3}	--	--
	Power reverse	Power reverse	P_{L1}	P_{L2}	P_{L3}	--	--
Frequency	Underfrequency	Underfrequency	U_{1N}	U_{2N}	U_{3N}	f	--
	Overfrequency	Overfrequency	U_{1N}	U_{2N}	U_{3N}	f	--
Phase rotation		Phase rotation	Phase sequence= {L1L2L3 , L3L2L1}			--	--

2.12 Zone-selective interlocking ZSI

Note

Zone selective interlocking ZSI can be used for the 3WA circuit breakers from the ID No. OE/ 230101500000 in connection with the ZSI200 module.

Zone selective interlocking ZSI requires that the electronic trip unit ETU600 and the ZSI200 module are supplied with 24 V DC by the external power supply.

2.12.1 Advantage

The load on a power distribution system can be reduced under short-circuit and ground fault conditions when circuit breakers are used in a ZSI system.

Short circuits and ground faults are disconnected after a short delay, independently of the coordination of the response characteristics of the circuit breakers.

This zone selective interlocking feature allows full selectivity without time grading to be achieved with a low break time, thereby increasing the supply reliability of non-faulty outgoing feeders.

Definition of "total selectivity" from IEC 60947-2

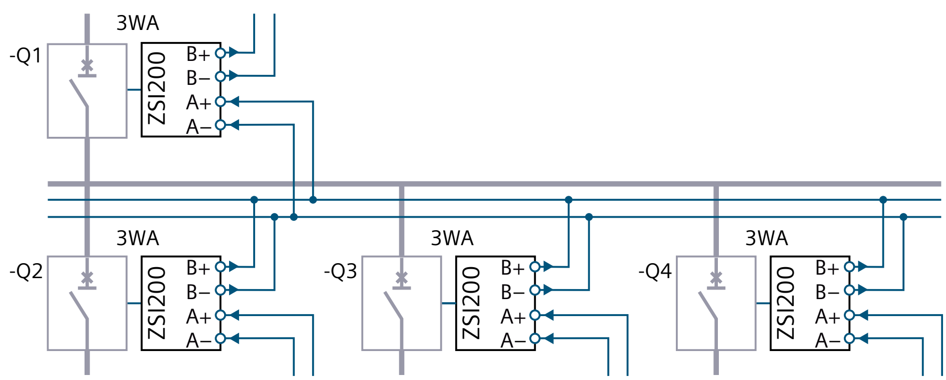
Overcurrent selectivity where, in the presence of two overcurrent protective devices in series, the protective device on the load side effects the protection without causing the other protective device to operate.

2.12.2 Structure and principle of operation of the ZSI system

The ZSI system can be set up with 3WA air circuit breakers with electronic trip unit ETU600 and the ZSI200 module. The ZSI200 module is connected to the electronic trip unit ETU600 of the circuit breaker via the CubicleBUS².

The ZSI interfaces port A and port B of the ZSI200 modules are connected via a two-wire line.

In the example below, the B+ and B- connections of the ZSI200 modules of the circuit breakers -Q2 to -Q4 are connected to the A+ and A- connections of the ZSI200 module of the upstream circuit breaker -Q1. All connections of a grading level are connected in parallel.



Circuit breakers in switchgear couplings as well as an upstream protective device of the medium voltage can be integrated into the ZSI system. Both are shown in the examples, see Chapter Application examples (Page 179).

Up to 20 circuit breakers can be connected to each ZSI interface. The maximum distance of the circuit breakers is determined by the control line used, see Chapter Technical specifications (Page 338).

Mode of operation

The ZSI function is available for ST short-time-delayed short-circuit protection and GF ground-fault protection.

If the electronic trip unit detects a short circuit or ground fault, a control signal is sent to the upstream circuit breakers (feeding side) and these circuit breakers are informed about the pick-up. At the same time, the electronic trip unit ETU600 checks whether a control signal is received from a downstream circuit breaker (load side).

If no control signal is received from a downstream circuit breaker (load side), the circuit breaker is opened after the shorter of the two times, delay time t_{ZSI} and the parameterized

delay time, taking into account the characteristic curve.
The delay times t_{ZSI}, which can be set separately for the short-time-delayed short-circuit protection ST and the ground-fault protection GF, correspond to a guaranteed non-trip time.

If a signal is received and there is no disconnection of the pick-up current by a downstream circuit breaker, the circuit breaker is opened according to its set response characteristic.

2.12.3 Monitoring and ZSI test function

Monitoring function

When the electronic trip unit ETU600 is activated, any existing module on the CubicleBUS² is automatically registered on the ETU600. The electronic trip unit ETU600 then permanently monitors the presence of the registered modules and reports an error if a registered module is no longer detected.

For the ZSI200 module, monitoring can be switched on in the startup phase. From then on, the ETU600 expects the ZSI200 module to be present on the CubicleBUS² whenever it is activated. If the ZSI200 module is not detected when the ETU600 is activated, this is reported as an error.

The ZSI200 module monitors the ZSI control lines for short circuits.
Detected errors are signaled, see Chapter Display of errors and alarms (Page 171).

Test function

The wiring of the ZSI system can be checked with the "ZSI Test" function on the ETU600.

This test function can be used to send a permanent control signal at the ZSI interfaces port A and port B and to check the reception of a control signal.

2.12.4 Parameterization

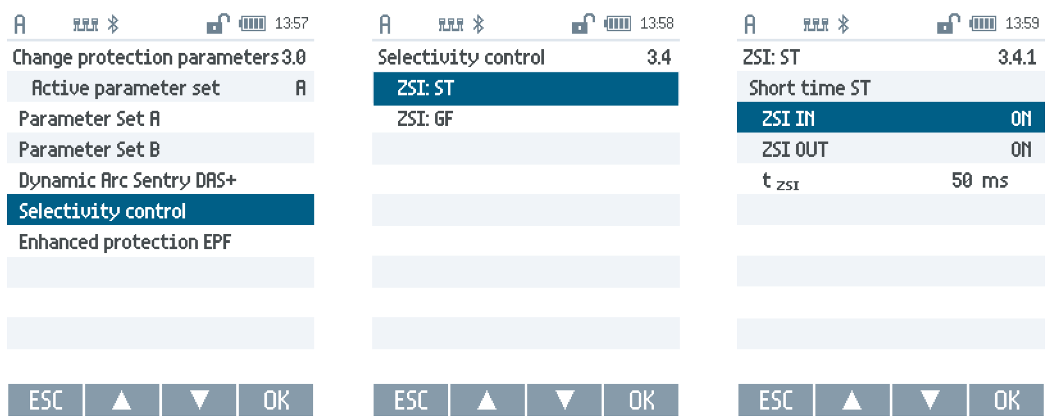
The settings for the ZSI system required for the circuit breaker can be set via the display and the operating keys of the ETU600, or with the help of the SENTRON powerconfig configuration software via Bluetooth or communication.

For the ZSI function, the delays t_{ZSI} and the sending as well as receiving of the control signal must be parameterized.
The following settings are possible:

Setting		Comment
ZSI ST	ZSI IN	Evaluates an incoming control signal for the short-time-delayed short-circuit protection ST (can be switched on/off)
	ZSI OUT	When the short-time-delayed short-circuit protection ST is triggered, a control signal is sent (can be switched on/off)
	t_{ZSI}	Delay t_{ZSI} for short-time-delayed short-circuit protection ST Setting range 0.04 s ... 0.4 s

Setting		Comment
ZSI GF	ZSI IN	Evaluates an incoming control signal for the ground-fault protection GF (can be switched on/off)
	ZSI OUT	When the ground-fault protection GF is triggered, a control signal is sent (can be switched on/off)
	t_{ZSI}	Delay t_{ZSI} for ground-fault protection GF Setting range 0.04 s ... 0.4 s
Monitoring		Monitoring of the ZSI200 module in the startup phase (can be switched on/off) Switching monitoring on and off is only possible via the SENTRON powerconfig configuration software.

The specified parameters can be set in the following menus of the display.



2.12.5 Compatibility

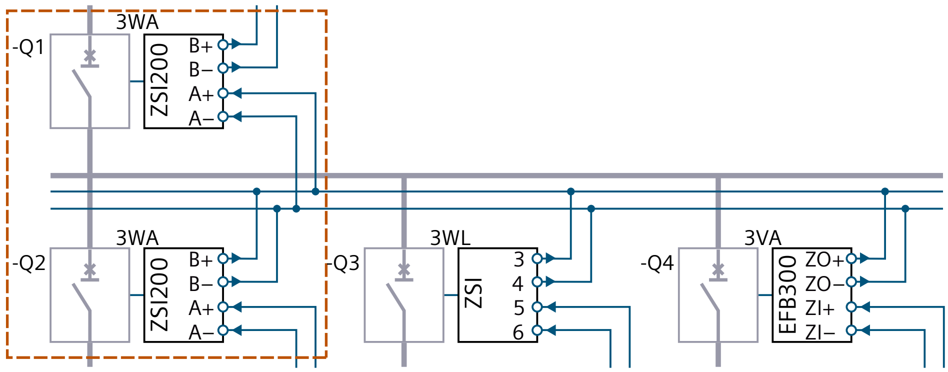
The ZSI function of the 3WA circuit breaker is a further development of existing ZSI systems for SENTRON circuit breakers. With appropriate settings, there is full selectivity even when using older circuit breaker families and fuses.

Note

Backward compatibility

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

The ZSI function of the 3WL and 3VA circuit breakers operates with the fixed delay t_{ZSI} 50 ms for the short-time-delayed short-circuit protection ST and the fixed delay t_{ZSI} 100 ms for the ground-fault protection GF. In contrast to this, the ZSI times can be set for the 3WA circuit breaker.
When used together with the 3WL and 3VA circuit breakers in a power distribution system, the delay times t_{ZSI} must be set to 50 ms (ST) or 100 ms (GF) for each 3WA.



2.12.6 Application examples

The functionality of the ZSI system will be explained using four application examples.

- Radial system with three grading levels
- Multiple infeed with coupler circuit breakers
- Branch circuit with fuse
- Integrating the medium-voltage protection device

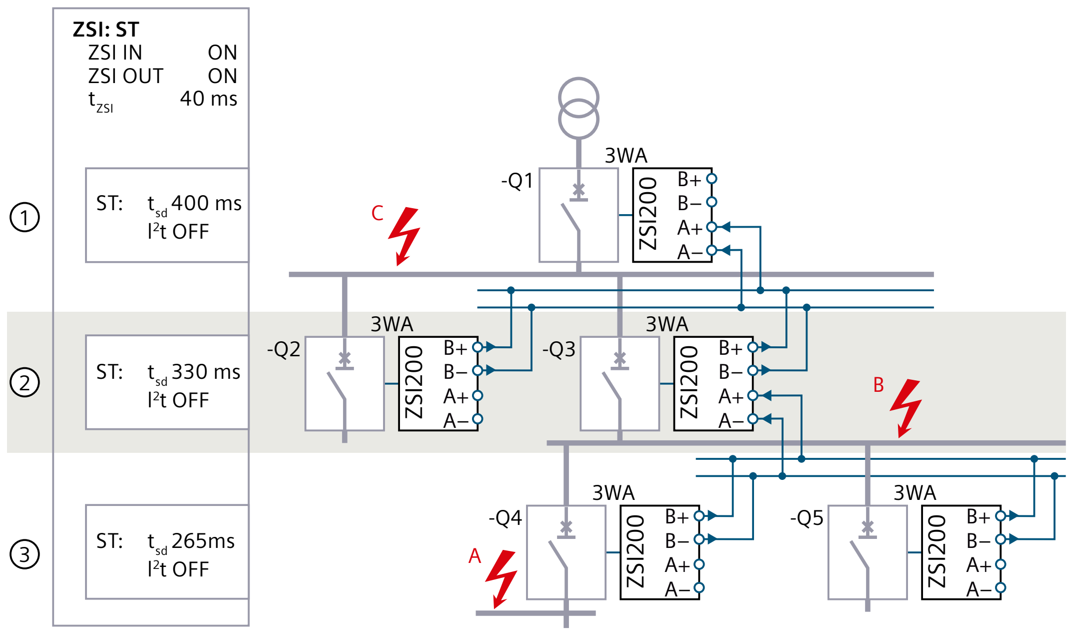
Grading levels

Due to the high accuracy and processing speed of the ETU600 electronic trip unit, up to seven independent grading levels can be selectively set up relative to each other. For the coordination of short-circuit protection, the response characteristics of the circuit breakers can be selectively graded with the times 0.4 / 0.33 / 0.265 / 0.2 / 0.135 / 0.07 / 0 s (via INST):

2.12.6.1 Example: radial system with three grading levels

The following figure shows a power distribution system with three grading levels. The three errors A, B and C are considered in more detail.

The left side of the figure shows the settings of the ZSI function and the delays for the short-time-delayed short-circuit protection ST.



Fault scenario A:

- The -Q4, -Q3 and -Q1 circuit breakers detect the short-circuit. Via the ZSI system, circuit breaker -Q3 is informed of the pick-up of -Q4 and circuit breaker -Q1 is informed of the excitation of -Q3. This prevents tripping of the circuit breakers -Q3 and -Q1 with delay t_{ZSI}.
- The -Q4 circuit breaker does not receive any pick-up information from a downstream circuit breaker at the ZSI interface port A. Therefore, the -Q4 circuit breaker trips after the adjustable delay t_{ZSI} for the short-time-delayed short-circuit protection.
- If the fault current cannot be switched off by the -Q4 circuit breaker, tripping of -Q3 and -Q1 as back-up protection takes place in each case after the parameterized delay time t_{sd}.
- The fault current does not flow through the -Q2 and -Q5 circuit breakers and they are therefore not considered in more detail.

Fault scenario B:

- The -Q3 and -Q1 circuit breakers detect the short-circuit. Via the ZSI system, circuit breaker -Q1 is informed of the pick-up of -Q3. This prevents tripping of -Q1 after the delay t_{ZSI}.
- The -Q3 circuit breaker does not receive any pick-up information from a downstream circuit breaker at its ZSI interface port A. Therefore, the -Q3 circuit breaker trips after the adjustable delay t_{ZSI} for the short-time-delayed short-circuit protection.
- If the fault current cannot be switched off by the -Q3 circuit breaker, tripping of -Q1 as back-up protection takes place after its delay time t_{sd}.

Fault scenario C:

- The -Q1 circuit breaker detects the short-circuit and does not receive any information about the pick-up of a downstream circuit breaker.
  -Q1 therefore trips after the delay t_{ZSI}.

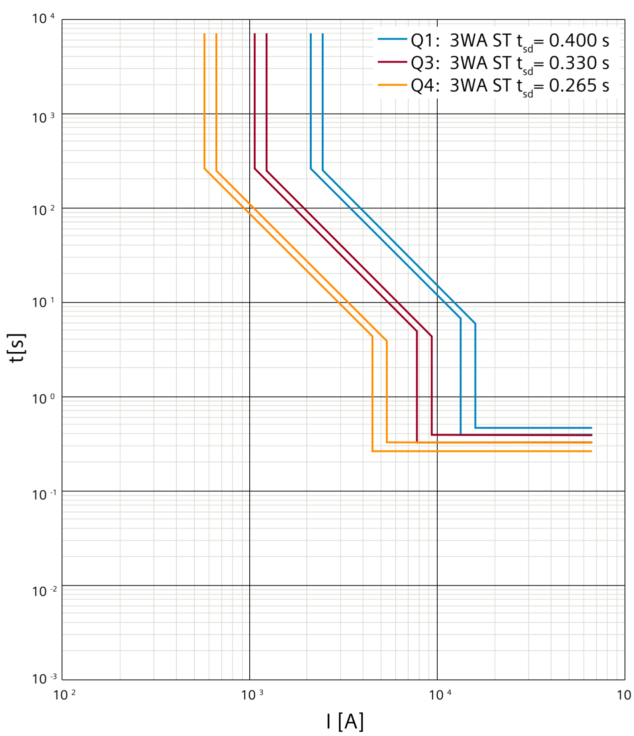
In this example, it can be seen that the load on the power distribution system in the event of a short-circuit is significantly reduced by the ZSI system.

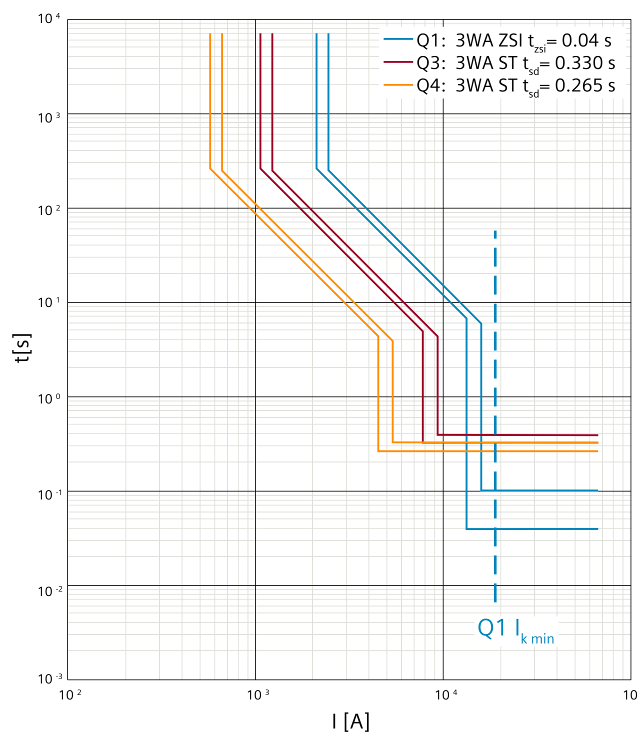
The following table lists the delays of the electronic trip unit ETU600 until the trip command for the three fault cases.

Fault situation	Without ZSI system	With ZSI system
A: Tripping -Q4	0.265 s	0.04 s
B: Tripping -Q3	0.330 s	0.04 s
C: tripping -Q1	0.400 s	0.04 s

The table shows that in fault case C, the duration of the load on the power distribution system is reduced by 0.36 s.

This can also be seen in the grading diagram. The diagram on the left shows the grading times of the power distribution system without the ZSI system.
In the grading diagram on the right-hand side, a significantly shorter tripping time of circuit breaker -Q1 can be seen for fault case C. The ZSI system brings about this reduction.
For the example, the delay t_{ZSI} 0.04 s was chosen.

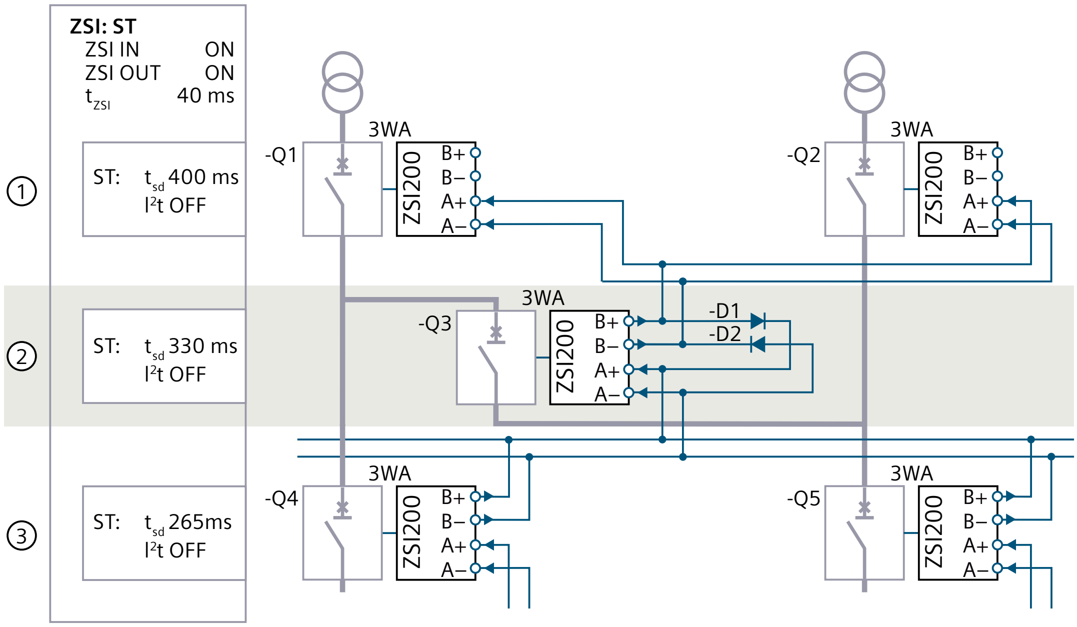




In addition, an example of a ZSI system over seven grading levels is shown in the Appendix ZSI system over seven grading levels (Page 540). The example shows the advantages of the 3WA circuit breaker and the possible complexity of a power distribution system.

2.12.6.2 Example of multiple infeed with coupler circuit breaker

The following figure shows a multiple infeed with bus-coupler:



In the example, the B+ and B- connections of the ZSI200 modules of the -Q4 and -Q5 circuit breakers are connected to the A+ and A- connections of the ZSI200 module of the -Q3 bus-coupler. All connections of this grading level are thus connected in parallel.

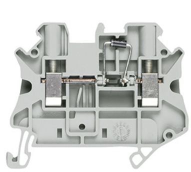
The -Q3 bus-coupler is considered as a separate grading level.
The B+ and B- connections of the ZSI200 module of the -Q3 bus-coupler are connected to the A+ and A- connections of the ZSI200 modules of the upstream -Q1 and -Q2 incoming feeder circuit breakers.

The -Q1 and Q2 circuit breakers belong to the first grading level.

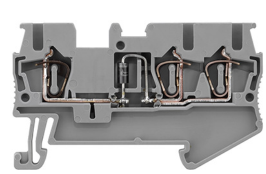
The two diodes -D1 and -D2 pass on the ZSI signal in any case. The switching state of -Q3 is irrelevant.

Diode terminals, with integrated diode type 1N 4007, are recommended for -D1 and -D2 for easy mounting on a DIN rail. These diode terminals are available in both flow directions.

8WH1 and 8WH2 diode terminals:



8WH1



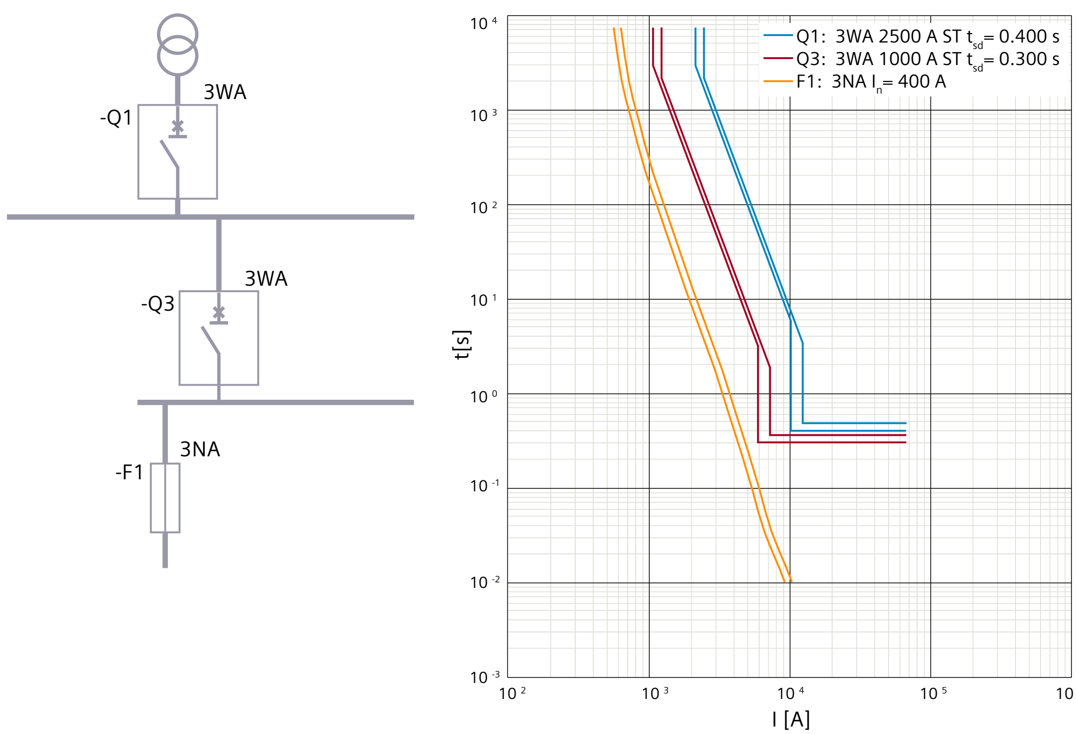
8WH2

Diode terminal Flow direction designation	8WH1 screw terminal	8WH2 spring-loaded terminal
From left to right	8WH1000-6LG00	8WH2003-5DF00
Right to left	8WH1000-6KG00	8WH2003-5CF00

2.12.6.3 Example of branch circuit with fuse

When fuses and circuit breakers are used simultaneously, the fuse characteristic determines the required delay of the circuit breaker for current or time grading.

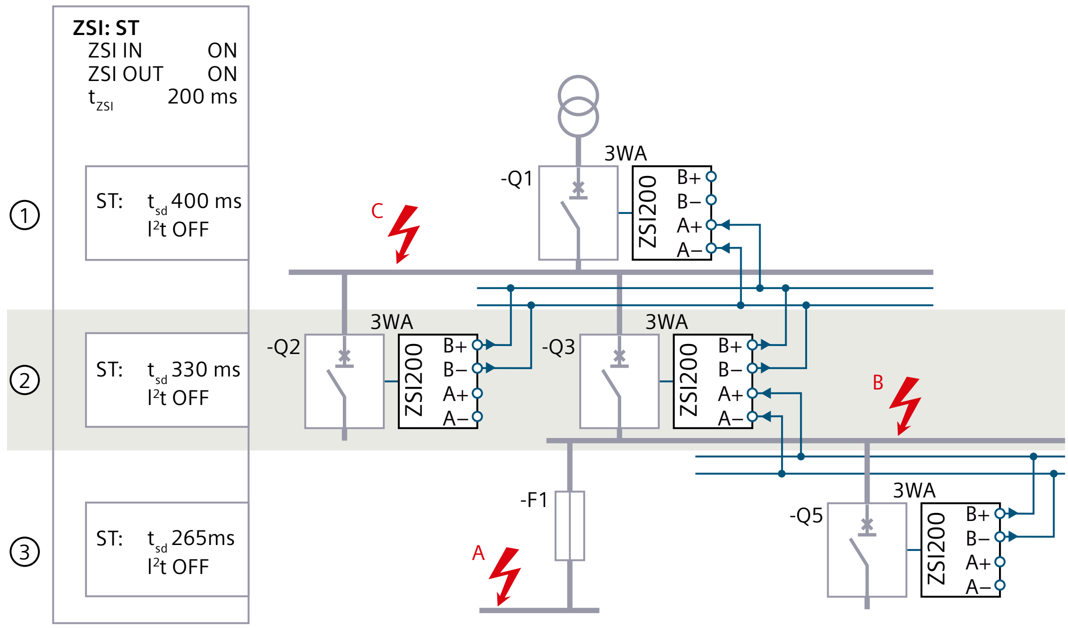
To be able to ensure selectivity, in this example the grading times t_{sd} of the short-time-delayed short-circuit protection ST are 0.3 s for the -Q3 circuit breaker and 0.4 s for the -Q1 circuit breaker.



The following figure shows a ZSI system with one fuse and four circuit breakers. Due to the adjustable delay t_{ZSI}, the break time can be reduced by a ZSI system even when fuses and circuit breakers are used simultaneously.

The delay t_{ZSI} of the short-time-delayed short-circuit protection is matched to the fuse -F1 with 0.2 s in the following example. The grading times t_{sd} of the short-time-delayed short-circuit protection ST of the upstream circuit breakers are unchanged.

For the power distribution system with three grading levels, faults A, B and C are considered in more detail.
The left side of the figure shows the settings of the ZSI function and the delays for the short-time-delayed short-circuit protection ST.



Fault scenario A

- The -F1 fuse switches off the short-circuit according to its characteristic curve.
- Depending on the level of the short-circuit current, the two -Q3 and -Q1 circuit breakers can also be excited by the short-circuit current.
  In this case, the -Q3 circuit breaker does not receive a control signal at the ZSI interface port A from a downstream grading level and would trip after the delay t_{ZSI} 0.2 s if a pick-up is pending.
  In the event of an excitation, it would send this excitation as a control signal via the ZSI interface port B to the -Q1 circuit breaker.

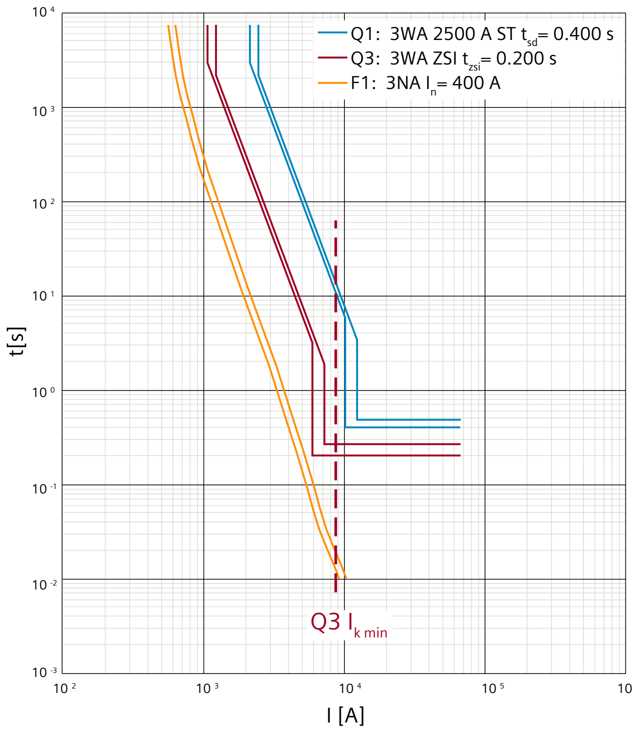
Fault scenario B

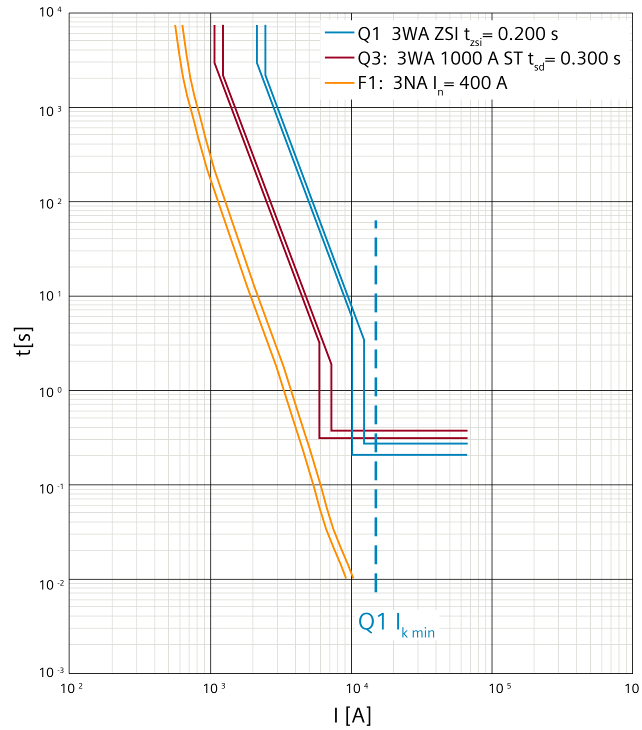
- The -Q3 and -Q1 circuit breakers detect the short-circuit. Via the ZSI system, the -Q1 circuit breaker is informed of the pick-up of -Q3. This prevents tripping of -Q1 after the delay t_{ZSI}.
- The -Q3 circuit breaker does not receive any pick-up information from a downstream circuit breaker at the ZSI interface port A. Therefore, the -Q3 circuit breaker trips after the set delay t_{ZSI} 0.2 s for the short-time-delayed short-circuit protection ST.
- If the fault current cannot be switched off by the -Q3 circuit breaker, tripping of -Q1 as back-up protection takes place after the delay time t_{sd}.

Fault scenario C

- The -Q1 circuit breaker detects the short-circuit and does not receive any information about the pick-up of a downstream circuit breaker.
  Therefore -Q1 trips after the delay t_{ZSI} 0.2 s.

It can also be seen in this example that when fuses and circuit breakers are used, the load on the power distribution system in the event of a short-circuit is significantly reduced by the ZSI system.

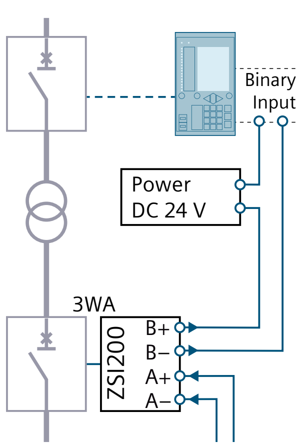




This reduction in load can also be seen in the two grading diagrams. On the left, the grading times for a fault in B and on the right for a fault in C are shown.
For both faults, tripping takes place after the delay t_{ZSI}.

2.12.6.4 Example of integrating the medium-voltage protection relay

The medium-voltage protection relay, e.g. from the SIPROTEC device family, can be controlled via a binary input on the protection relay. The specification of the binary input of the protection relay and the maximum control voltage 24 V DC for the ZSI200 module must be observed.



Applications 3

3.1 Using the 3WA circuit breaker in a system with isolated transformer neutral point (IT system)

3.1.1 General

IT systems are predominantly used in consumer installations with stringent requirements with respect to power supply availability. Circuits are generally only interrupted if two insulation faults occur simultaneously in different phases.

The IT network type is the preferred choice in the following areas, for example:

- Buildings with rooms used for medical purposes
- Chemical industry
- Mineral oil industry
- Steel industry
- Mining

The IT system is a low-voltage system with increased fail-safety in the event of ground faults. The IT system is operated with an isolated neutral point. The 3WA circuit breaker is the perfect solution for protecting these systems.

A ground fault does not result in system shutdown and the system can continue to operate. The standard IEC 60364-4-41 (VDE 0100-410) therefore requires insulation monitoring to indicate a fault of this kind. In the event of a fault on the load side and a simultaneous second fault on the infeed side, the full line-to-line voltage is connected across one contact of the circuit breaker, see example B in Chapter Fault situation (Page 188).

For this reason, the 3WA circuit breakers are tested in accordance with standard IEC / DIN EN 60947-2 Annex H and are suitable for use in IT systems.

3.1.2 Selection criteria

The circuit breaker is generally selected based on the required short-circuit breaking capacity I_{cu} and I_{cs}.
If the operator of the IT system implements suitable measures to rule out the possibility of simultaneous ground faults on the infeed and load sides of the circuit breaker, the suitability of the circuit breaker according to Annex H can be waived provided the operator assumes responsibility for this.

If this is not the case, only circuit breakers which have been successfully tested for the operational voltage according to Annex H may be used. Standard IEC 60947-2 requires testing at full line-to-line voltage with a current which is 1.2 times the maximum setting of the instantaneous short-circuit release, but not more than 50 kA.

The breaking capacities of 3WA circuit breakers in IT systems in the event of simultaneous ground faults on the infeed and load sides are listed in Chapter Technical specifications of 3WA circuit breakers (Page 461).

Circuit breaker markings

The following markings can be found on the circuit breaker rating labels:

- 690 V (IT)
  Suitable for IT systems up to 500 V AC according to IEC 60947-2 Annex H
  (3WA circuit breakers with breaking capacity N, S, M, H or C)
- 1000 V (IT)
  Suitable for IT systems up to 690 V AC according to IEC 60947-2 Annex H
  (3WA circuit breakers with breaking capacity E)

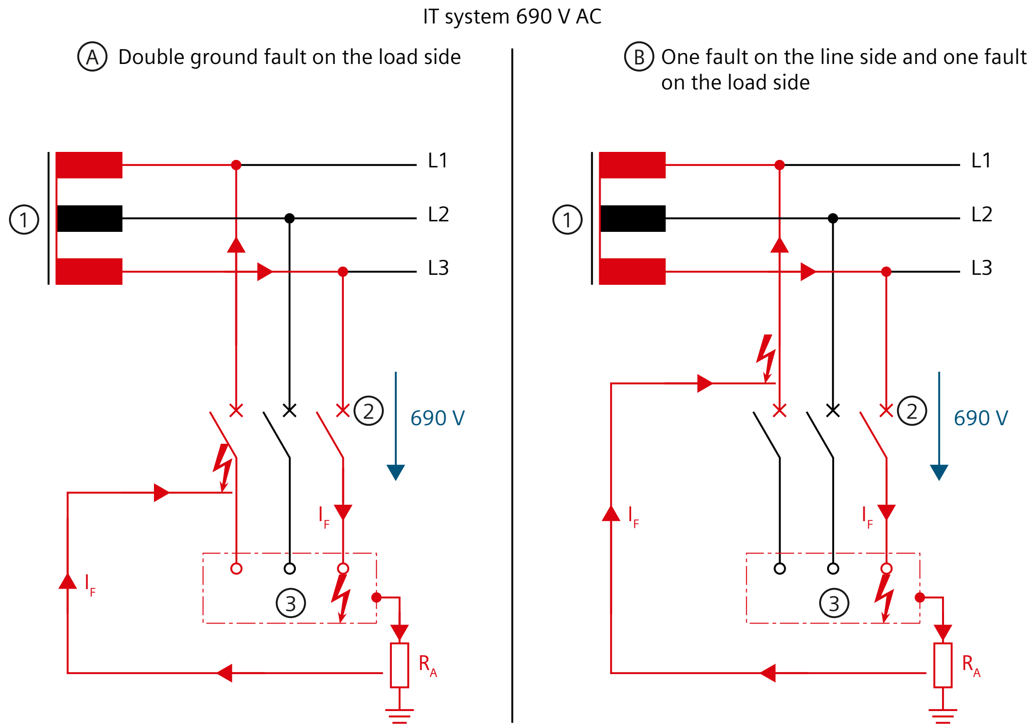
Note

If the operator can rule out the possibility of simultaneous ground faults on the infeed and load sides, 3WA circuit breakers can also be used in IT systems with operational voltages > 690 V AC, provided the operator assumes responsibility for this.

3.1.3 Fault situation

Simultaneous ground faults on the infeed and load sides of the circuit breaker is the most critical scenario for a circuit breaker in an IT system. If this fault occurs, the full line-to-line voltage is applied to one breaking pole of the circuit breaker.

The graphic below shows an example of simultaneous ground faults in an IT system with an operational voltage of 690 V AC.



(1) Ungrounded transformer

(2) Circuit breaker

(3) Exposed conductive part

R_A Contact resistance of exposed conductive part ground

Fault scenario A: Double ground fault on the load side

- On two line conductors, a fault occurs to an exposed conductive part or to ground. The fault pattern corresponds to a 2-pole short circuit.
- A voltage of 690 V is applied at the main contacts. This voltage is disconnected by two breaker poles.
- The circuit breaker is rated for short-circuit breaking capacity I_{cu} and I_{cs} at 690 V AC.

Fault scenario B: One fault on the infeed side and one fault on the load side

- The fault pattern corresponds to a 1-pole short circuit.
- The full line-to-line voltage of 690 V AC is applied to main contact L3. This full line-to-line voltage must be disconnected by a breaking pole.
- The circuit breaker is selected based on suitability for an IT system according to IEC 60947-2, Annex H.

3.2 Using the 3WA non-automatic circuit breaker in DC systems

3.2.1 Main applications in DC installations or DC systems

The main applications in DC installations or systems are:

- UPS systems
- Photovoltaic systems
- Wind farms
- Converter systems

3WA1 DC non-automatic circuit breakers are suitable for use in DC systems.

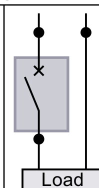
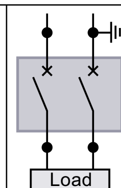
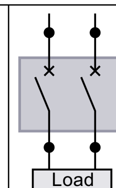
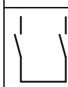
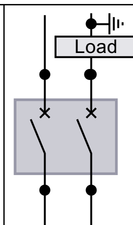
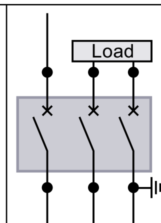
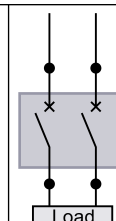
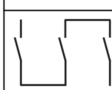
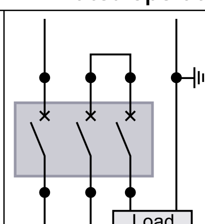
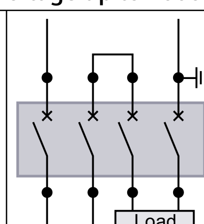
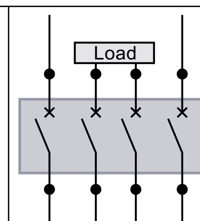
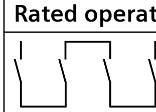
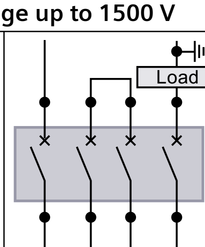
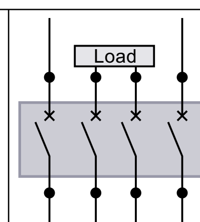
3.2.2 Versions and breaking capacity

Frame size		**3WA12**	
Number of poles		**3 and 4**	
Breaking capacity		**D**	**E**
Rated conditional short-circuit current I_{cc}			
Up to 220 V DC	kA	35	--
Up to 300 V DC	kA	30	--
Up to 600 V DC	kA	25	--
Up to 1000 V DC	kA	--	20
Up to 1500 V DC	kA	--	-- / 20[1)]
Rated short-time withstand current I_{cw} 1 s			
Up to 220 V DC	kA	35	--
Up to 300 V DC	kA	30	--
Up to 600 V DC	kA	25	--
Up to 1000 V DC	kA	--	20
Up to 1500 V DC	kA	--	-- / 20[1)]

1) 3-pole / 4-pole

3.2.3 Application examples

Connection to the circuit breakers is independent of direction and polarity; the circuit diagrams can be converted analogously.
If the parallel or series connections are made directly at the connecting bars, the circuit breakers may only be continuously subjected to 80% of the permissible operational current for thermal reasons. If the parallel or series connection is made at a distance of 1 m from the connecting bars, the circuit breaker can be used at full operational load.

Minimum required contact gaps at nominal voltage	**DC 1-pole disconnection**	**DC 2-pole (all-pole) disconnection**	
	Grounded system	**Grounded system**	**Non-grounded system**
Rated operational voltage up to 300 V			
			
Rated operational voltage up to 600 V			
			
Rated operational voltage up to 1000 V			
			
Rated operational voltage up to 1500 V			
		--	

Note

DC 2-pole (all-pole) disconnection; grounded system

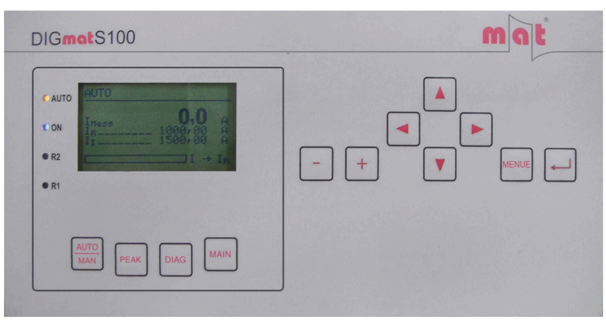
The grounded conductor must always be assigned to the individual switching pole of the non-automatic circuit breaker so that, in the event of a ground fault, there are always 2 conducting paths in series in a circuit with 3-pole circuit breakers, and 3 conducting paths in series in a circuit with 4-pole circuit breakers.

The jumpers between the switching poles must be inherently short-circuit and ground-fault proof.

3.2.4 Overload and short-circuit protection for DC applications

The external protection device DIGmat S100 from mat – Maschinen und Anlagentechnik provides adjustable overload and short-circuit protection for 3WA non-automatic circuit breakers.

This is implemented by means of a measuring chain with a shunt resistor and the DIGmat S100 protection device.



The DIGmat S100 protection device monitors the image of the primary current and compares it with the tripping characteristic that is set on the device.
The tripping curve is determined and described by the following variables:

- Overload protection LT:
  Setting range I_r = 0.4 to 1.0 x I_n
  The characteristic curve has an I^2t characteristic.
  The tripping time t_r is selectable between 2 and 10 s, with t_r defined for 6 × I_r.
- Short-circuit protection ST:
  Setting range I_i = 1.25 × I_r to max. 4 × I_n

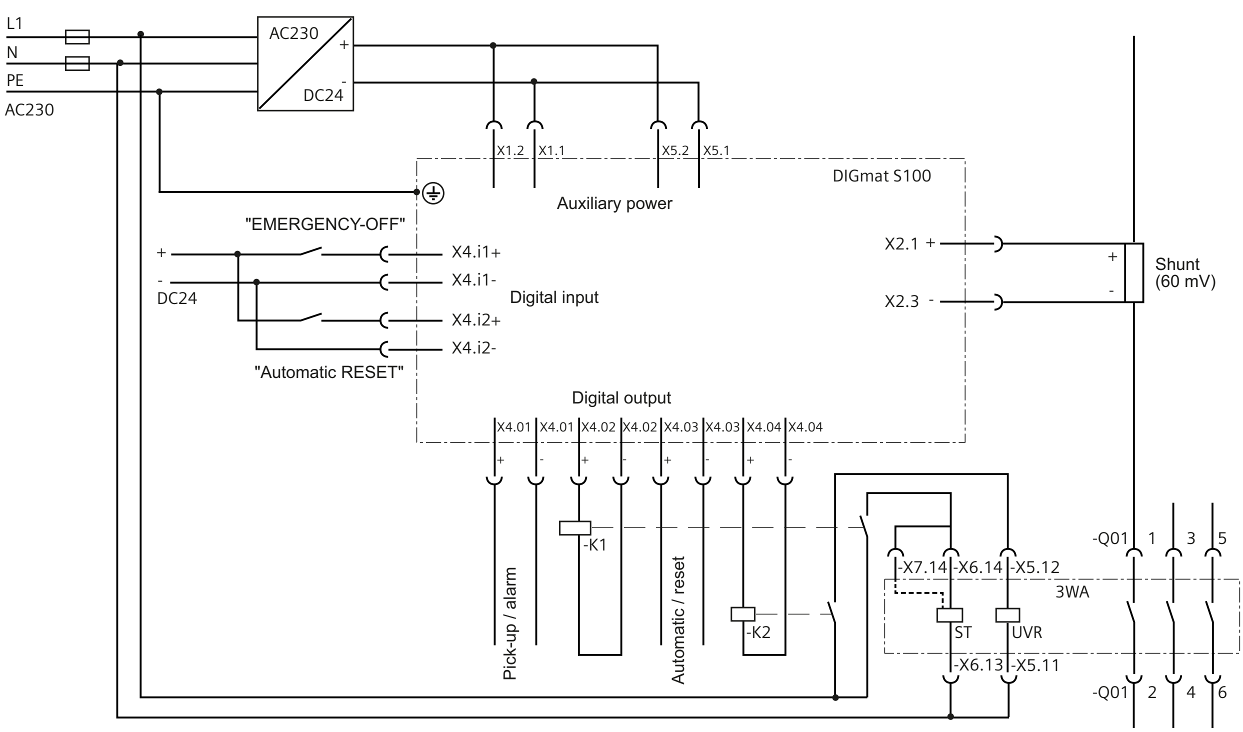
I_n = Rated current of the shunt resistor
I_r = Current setting of the adjustable overload release
t_r = Assigned tripping time of the overload trip
I_i = Instantaneous tripping current of the adjustable short-circuit release

The components are only available from the company mat – Maschinen- und Anlagentechnik:
mat – Maschinen und Anlagentechnik
Dr. Becker GmbH
Rudolf-Diesel-Straße 22
D-22941 Bargteheide
Phone: +49 (4532) 20-2101
Fax: +49 (4532) 20-2121
email: info@m-a-t.de
Internet: www.m-a-t.de

3.2.5 Controlling the 3WA non-automatic circuit breaker via the protection device

The diagram below only shows the schematic connection of the 3WA non-automatic circuit breaker to the DIGmat S100 external protection device.

All other interfaces of the DIGmat S100 external protection device are described in the documentation from the manufacturer "mat – Maschinen und Anlagentechnik".



The following conditions must be met for error-free operation.

- Coupling relays -K1 and -K2 that are required for controlling the shunt trip ST and undervoltage release UVR must be selected based on the power consumption of these magnetic systems. The coupling relays of the 3RQ3118 SIRIUS device series were tested in conjunction with the shunt trip ST and the undervoltage release UVR of the 3WA circuit breaker.
- The interfaces used for connecting the 3WA non-automatic circuit breaker have the following designations and secondary disconnect terminals:
  - Shunt release ST, terminals X6.13 and X6.14
  - Shunt release ST-COM, terminals X6.13, X6.14 and X7.14
  - Undervoltage release UVR, terminals X5.11 and X5.12

3.2.6 Utilization of the 3WA1 DC non-automatic circuit breaker according to IEC 60947 and UL 489b

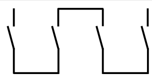
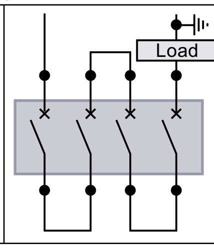
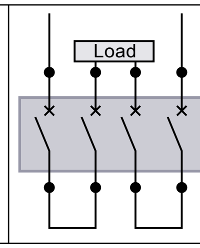
When you order a 3WA1 DC non-automatic circuit with the order number option (Z option) "U09", the non-automatic circuit breakers can also be supplied with certification according to IEC 60947 and UL 489b.

Z option U09 can be used for the following order numbers:

- 3WA1220-8AU12-_ _ _ _
- 3WA1220-8AU42-_ _ _ _
- 3WA1220-8AU72-_ _ _ _
- 3WA1220-8CU12-_ _ _ _
- 3WA1220-8CU42-_ _ _ _
- 3WA1220-8CU72-_ _ _ _

Technical specifications of the non-automatic circuit breakers with the order numbers listed above:

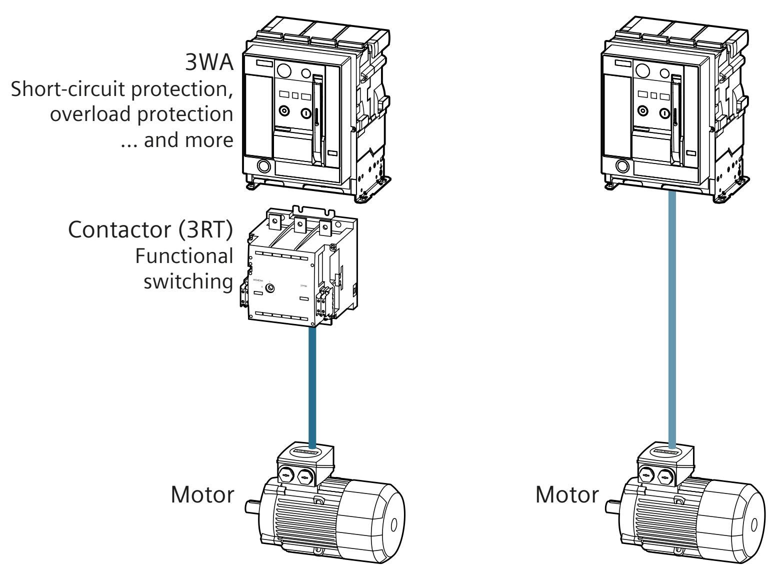
U_e	1500 V
Frame size	2
Number of poles	4-pole
Rated current I_n	2000 A
Rated conditional short-circuit current I_{cc}	20 kA

Minimum required contact gaps at nominal voltage	DC 1-pole disconnection	DC 2-pole (all-pole) disconnection	
	Grounded system	Grounded system	Non-grounded system
Rated operational voltage up to 1500 V			
		--	

3.3 Using the 3WA circuit breaker for motor protection

3WA circuit breakers are suitable for use as a motor protection circuit breakers for IE3 and IE4 motors. The technical specifications of the 3WA circuit breakers and the setting options of the ETU600 electronic trip unit enable use in accordance with IEC EN 60947-4-1.

The graphic below gives an overview of the possible uses of the 3WA circuit breaker for the protection of electric motors.



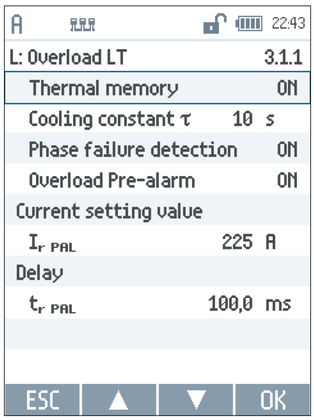
Note

The 3WA circuit breaker can be used for implementing overload and short-circuit protection as well as for operational switching (ON/OFF) of the electric motor. However, as operational switching of the motor according to utilization category AC-3 reduces the electrical endurance of the circuit breaker, this use is only suitable for applications with a low switching frequency.

Motor protection with the ETU600 electronic trip unit

The ETU600 electronic trip unit can be used for motor protection. The protection parameters are listed in Chapter Setting range for parameter sets A and B (Page 107).

For overload protection, the thermal memory must be activated and the cooling constant for the simulation of the warming and cooling process must be set to 10 x I_r. This can be set using the operating keys on the display or with the help of the SENTRON powerconfig configuration software via Bluetooth or communication. For protection parameter set A, the setting is made under display menu item 3.1.1 of the ETU600.



A phase failure is detected if phase failure detection is activated. If the current of the phase with the lowest load is 50% less than the current of the phase with the highest load, this is interpreted as a phase failure and the setting I_r is automatically reduced to 80%. If the three phase currents do not differ by more than 50% with respect to each other, the setting I_r applies again.

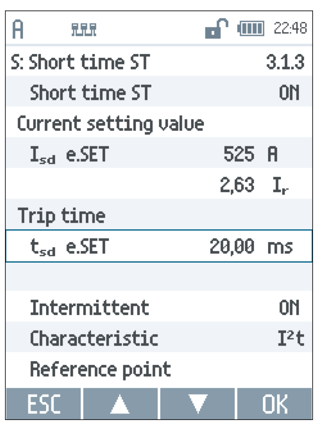
Protective function	Setting range for parameter sets A and B	Settings with rotary switch only possible in parameter set A
L: Overload protection LT		
Tripping	Can be switched on/off	
Current setting I_r	0.4 ... 1.0 x I_n	0.5 / 0.6 / 0.7 / 0.75 / 0.8 / 0.85 / 0.9 / 0.95 / 1.0 x I_n
Tripping time t_r at 6 x I_r	At I^2t: 0.5 ... 30 s At I^4t: 0.5 ... 5 s	1 / 2 / 5 / 8 / 10 / 14 / 17 / 21 / 25 s
Characteristic LT curve	I^2t / I^4t	
Thermal memory	Can be switched on/off	
Cooling time constant	10 / 18 x t_r	
Phase failure detection	Can be switched on/off	

In addition to the phase failure detection mentioned above, the enhanced protective function phase current unbalance, see Chapter Enhanced protective functions EPF (Page 62), also offers protection with an unbalanced load. The setting is made under display menu item 3.5.5.1 of the ETU600.

Non-tripping of the circuit breaker due to the inrush peak current of electric motors and simultaneous protection in case of rotor blocking can be achieved by setting tripping time t_{sd} of the delayed short-circuit protection ST to 0.02 s.

Protective function	**Setting range for parameter sets A and B**	**Settings with rotary switch only possible in parameter set A**
S: Delayed short circuit protection ST		
Tripping	Can be switched on/off	
Current setting I_{sd}	0.6 x I_n ... 0.8 x I_{cw}	1.5 / 2 / 2.5 / 3 / 4 / 5 / 6 / 8 / 10 x I_r
Tripping time t_{sd}	0.02 ... 0.4 s	At I^2t = OFF: 0.08 / 0.15 / 0.22 / 0.3 / 0.4 s At I^2t = ON: 0.1 / 0.2 / 0.3 / 0.4 s
Characteristic ST curve	I^0t / I^2t	
Reference point $I_{ST\ ref}$	6 ... 12 x I_r	
Intermittent detection	Can be switched on/off	

This can be set using the operating keys on the display or with the help of the SENTRON powerconfig configuration software via Bluetooth or communication. For protection parameter set A, the setting is made under display menu item 3.1.3 of the ETU600.



Trip classes T_C

Trip class T_C specifies the tripping time T_p with a symmetrical 3-pole load, starting from the cold state, with 7.2 times the set current I_r according to IEC EN 60947 4-1.

Trip class T_C	**Tripping time T_p**
5	0.5 s < T_p < 5 s
10A	2 s < T_p < 10 s
10	4 s < T_p < 10 s
20	6 s < T_p < 20 s
30	9 s < T_p < 30 s

Tripping time t_r of the 3WA circuit breaker's overload protection LT is defined at 6 times the current setting value I_r and can be set in the range from 0.5 to 30 s.

For overload protection LT with I^2t characteristic, tripping time t_r can be assigned to the tripping time T_p and a trip class T_c.

Tripping time t_r	Tripping time T_p	Trip class T_c				
at 6 times the current setting value	**at 7.2 times the current setting value**	**5**	**10A**	**10**	**20**	**30**
0.5 s	0.3 s	--	--	--	--	--
1 s	0.7 s	✓	--	--	--	--
2 s	1.4 s	✓	--	--	--	--
5 s	3.5 s	✓	✓	--	--	--
8 s	5.6 s	--	✓	✓	--	--
10 s	6.9 s	--	✓	✓	--	--
14 s	9.7 s	--	✓	✓	✓	--
17 s	11.8 s	--	--	--	✓	✓
21 s	14.6 s	--	--	--	--	✓
25 s	17.4 s	--	--	--	--	✓
30 s	20.8 s	--	--	--	--	✓

3.4 Transfer control

3.4.1 General

3KC ATC transfer control devices and 3WA circuit breakers with a spring charging motor can be used to implement transfer control between a main source and an alternative power source. The stability of the power supply is analyzed by means of voltage taps upstream of the switching devices in this case. User-defined limiting values (voltage, frequency, phase sequence) function as boundary conditions for analyzing the quality of the power supply. If a limiting value is undershot or exceeded for a specific defined time, the 3KC ATC transfer control devices initiate a transfer to an alternative power source.

The following 3KC ATC transfer control devices can be used with 3WA circuit breakers:

3KC ATC3100

3KC ATC6300

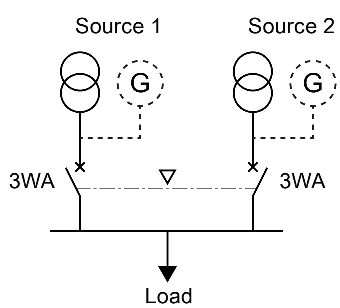
3KC ATC6500

The 3WA circuit breakers require the following accessories for transfer control in conjunction with the transfer control devices:

- Auxiliary switch for electrical interlocking
- Auxiliary switch for status signaling
- Trip alarm switch
- Shunt trip
- Closing coil
- Spring charging motor
- Mechanical interlocking (Bowden cable interlock module, optional)

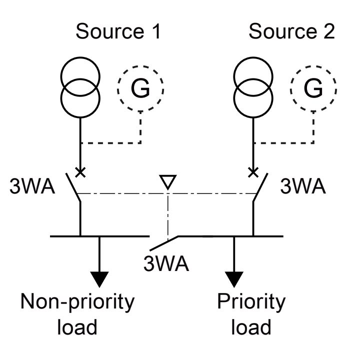
3.4.2 Transfer control with two 3WA circuit breakers

A transfer between two 3WA circuit breakers can be achieved in conjunction with all transfer control devices in the 3KC ATC series:



3.4.3 Transfer control with three 3WA circuit breakers

In conjunction with the 3KC ATC6500 transfer control device, load shedding can be implemented as an additional feature. Transfers are performed between three 3WA circuit breakers in this case:



The three circuit breakers can be electrically interlocked in this application.

For more information, see Chapter Interlocking (Page 309).

3.4.4 Further information

Further information as well as all the circuit diagrams for connection of the 3WA circuit breakers can be found in the relevant manuals of the transfer control devices, see Chapter Reference documents (Page 17).

3.5 Applications with closing coil and shunt trip

3.5.1 Overview

Closing coil CC and at least one shunt trip ST or ST2 are required for electrical switching. Both types are optional accessories of the circuit breaker, see Chapter Closing coil, shunt trip, undervoltage release (Page 224).

Switching via communication is a special application. The closing coil CC-COM and the shunt trip ST-COM are required for this function.

Three types of closing coil and shunt trip are available for the circuit breaker:

- For conventional switching and uninterrupted duty with article number 3WA9111-0AD0_.
  Designations of the magnetic systems: CC, ST or ST2.
  This version is suitable for uninterrupted duty with a duty cycle of 100%.
- For conventional switching and momentary duty with article numbers 3WA9111-0AD1_ and 3WA9111-0AD2_.
  Designations of the magnetic systems: CC, ST or ST2.
  This version is operated in the overexcited condition. The duty cycle is 5%. The switching times of the circuit breaker are reduced with this version. These magnetic systems are **not** suitable for uninterrupted duty.
- For switching via communication with article number 3WA9111-0AD3_.
  Designations of the magnetic systems: CC-COM and ST-COM.
  This version is also suitable for conventional switching and uninterrupted duty with a duty cycle of 100%. The switching commands are forwarded internally to the CC-COM und ST-COM magnetic systems via the communications module.

If the circuit breaker is ordered with an optional closing coil (100% duty cycle) or first shunt trip for uninterrupted duty (100% duty cycle), the "ready4COM" feature is taken into account during production of the circuit breaker. When this feature is available, closing coil CC-COM is used in the circuit breaker instead of the CC closing coil and shunt trip ST-COM is used instead of the first ST shunt trip.
The "ready4COM" feature is available in every switching device whose article number has a 9th digit that is not equal to A.

3WA. ■ (5) ■ (6) ■ (7) – ■ (8) ■ (9) ■ (10) ■ (11) ■ (12) – ■ (13) ■ (14) ■ (15) ■ (16)

				9
Non-automatic circuit breaker				A
Non-automatic circuit breaker, ready4COM feature				C
Application packages with protection and metering function for circuit breakers	ETU 600 electronic trip unit	Current metering		A
		Current metering, ready4COM feature		
	ETU 600 ^electronic trip unit with metering function, internally mounted voltage tap in the circuit breaker, VTM680 voltage tap module and ready4COM	PMF-I Energy Efficiency	Voltage tap on top	
			Voltage tap at the bottom	
		PMF-II Basic Power Monitoring	Voltage tap on top	
			Voltage tap at the bottom	
		PMF-III Advanced Power Monitoring	Voltage tap on top	
			Voltage tap at the bottom	

Note

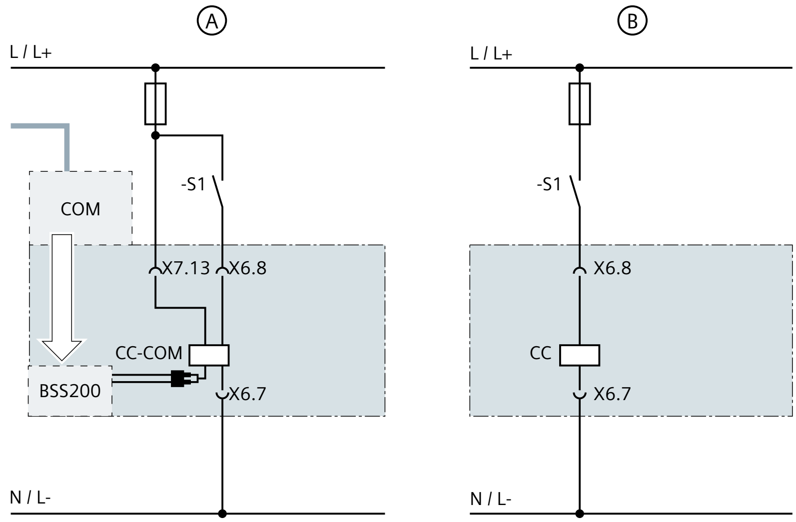
Switching via communication requires magnetic systems for uninterrupted duty (100% duty cycle)

If the circuit breaker is ordered with an optional closing coil for momentary duty (5% duty cycle) or first shunt trip for momentary duty (5% duty cycle), switching via communication is not possible.

3.5.2 Connecting the closing coil

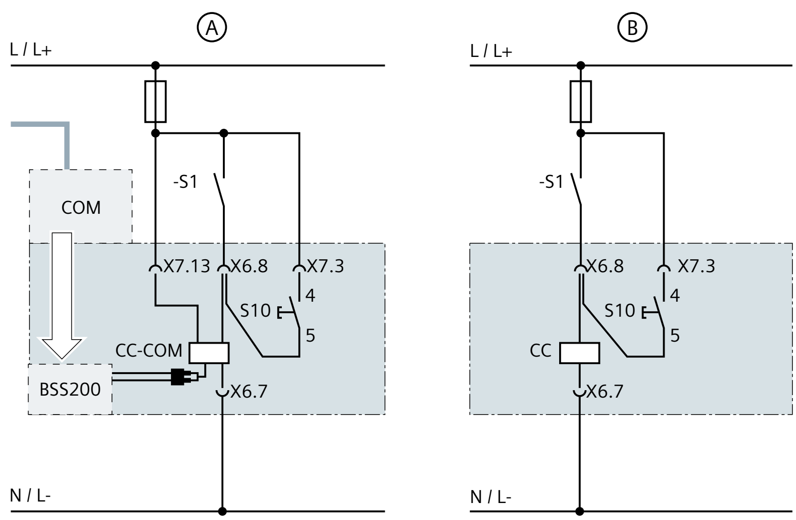
Operation of the closing coil of a circuit breaker is illustrated with and without the "ready4COM" feature in the diagrams below.

When the S1 button is operated, the circuit breaker closes. If the circuit breaker has the "ready4COM" feature and a communication module in addition, closing can also take place via communication.



(A) Circuit breaker with "ready4COM"
(B) Circuit breaker without "ready4COM"

If the local electric CLOSE is available in addition, the following connection is required:

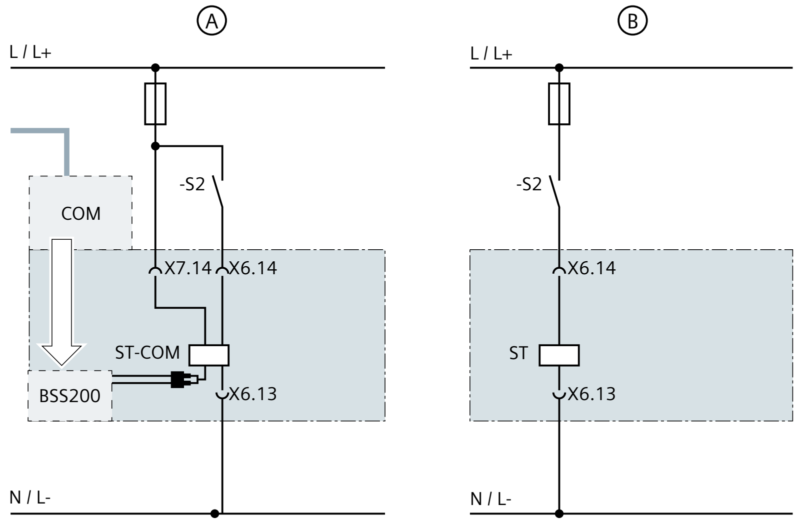


(A) Circuit breaker with "ready4COM"
(B) Circuit breaker without "ready4COM"

3.5.3 Connection of the first shunt trip

Operation of the first shunt trip of a circuit breaker is illustrated with and without the "ready4COM" feature in the diagrams below.

When the S2 button is operated, the circuit breaker opens. If the circuit breaker has the "ready4COM" feature and a communication module in addition, opening can also take place via communication.



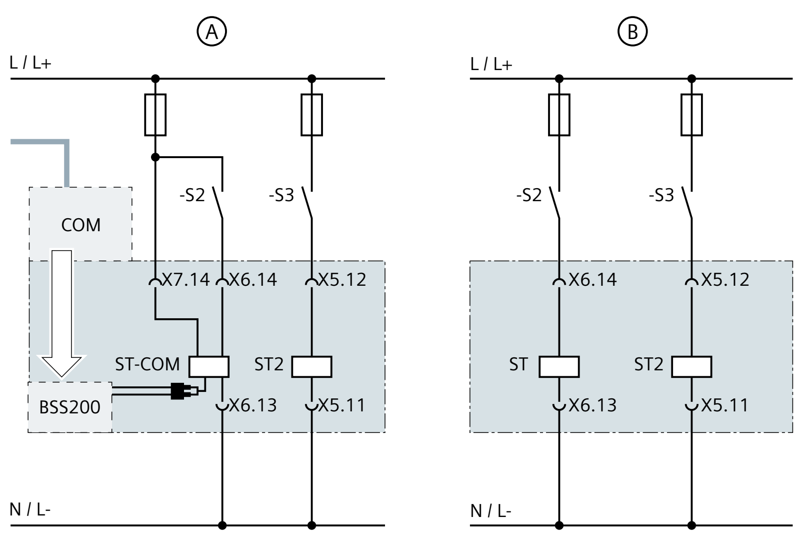
(A) Circuit breaker with "ready4COM"

(B) Circuit breaker without "ready4COM"

3.5.4 Connection of the second shunt trip

In addition to the first shunt trip ST or ST-COM, the circuit breaker can also be equipped with a second shunt trip ST2 as an option. This one is only conventional and cannot be operated via communication.

When the S3 button is operated, the circuit breaker opens via the second shunt trip ST2.



(A) Circuit breaker with "ready4COM"

(B) Circuit breaker without "ready4COM"

3.5.5 Electrical interlocks for switching via communication

Closing and opening via communication can be deliberately controlled by interlocks in the case of a communication-capable circuit breaker.

The following terms are used in the circuit diagrams:

- Local only
  Closing and opening are only possible using the two buttons.
- Remote + Local
  Switching is possible via communication and using the two buttons.
- Remote only
  Closing and opening are only possible via communication.

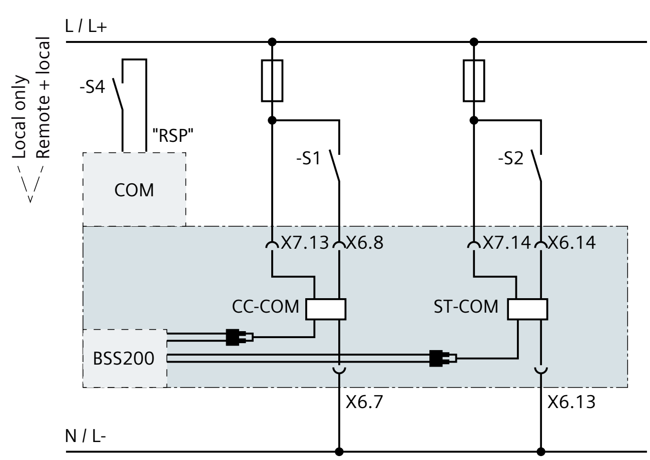
Remote switching protection, controlled via the communications module

The simplest method of preventing switching via communication is to activate remote switching protection on the communications module.

The communications module has an RSP connection which can be used to enable or prevent remote switching. You can find information about the RSP connection in Chapter X62 connector (Page 147).

The following switching operations are possible depending on the position of the -S4 switch.

- -S4 open: RSP active (on communications module with role A)
  The circuit breaker can be electrically closed via S1 and opened via S2.
  Switching via communication is not possible.
- -S4 closed: RSP not active (on communications module with role A)
  The circuit breaker can be electrically closed via S1 and opened via S2. Switching via communication is also possible.



Control via voltage supply to the magnetic system

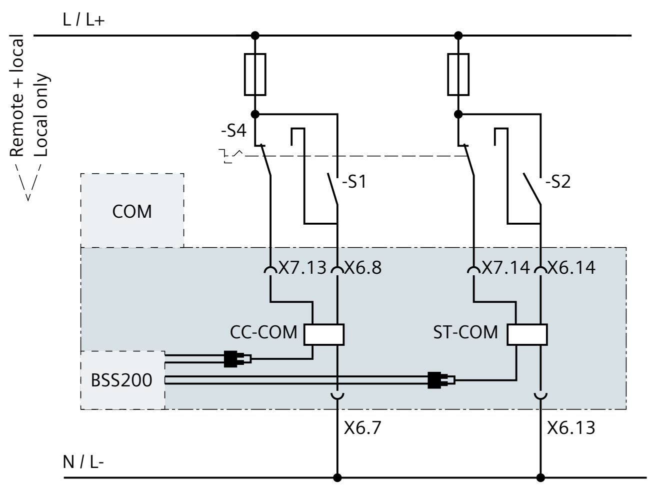
Electrical switching can also be controlled by connecting the control supply voltage to the CC-COM closing coils and the first ST-COM shunt trip.

Combinations of local switching and remote switching via communication are illustrated in the two examples below.
Prerequisite:
The S4 switch (RSP) on the communications module must be closed in order to be able to use switching via communication.

Circuit diagram, example 1

The following switching operations are possible depending on the position of the -S4 switch.

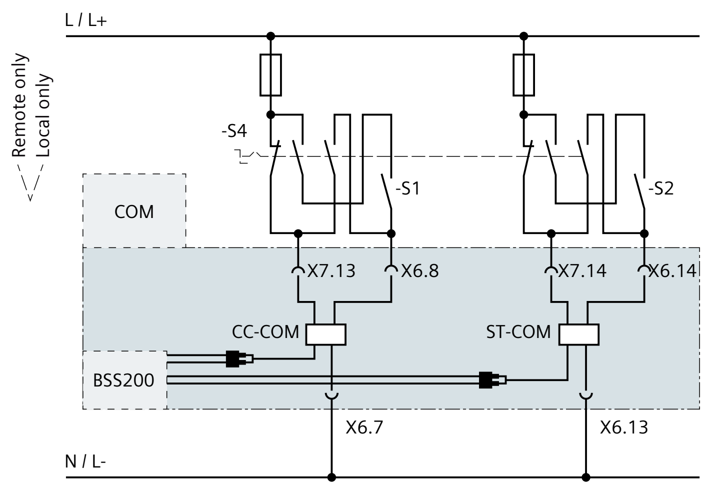
- Position -S4 to the left: Remote + Local
  Closing and opening are possible via communication and using the two buttons.
- Position -S4 to the right: Local only
  Closing and opening are only possible locally using the two buttons.



Circuit diagram, example 2

The following switching operations are possible depending on the position of the -S4 switch.

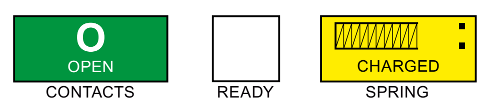
- Position -S4 to the left: Remote only
  Closing and opening are only possible via communication.
- Position -S4 to the right: Local only
  Closing and opening are only possible using the two buttons.



3.5.6 Electrical closing interlock

Mechanical or electrical closing can be prevented with the help of a shunt trip. For this purpose, the control supply voltage must be permanently applied to the first or the second shunt trip. If a shunt trip is permanently energized, the circuit breaker is not ready to close. The ready-to-close status is signaled by the "READY" display.

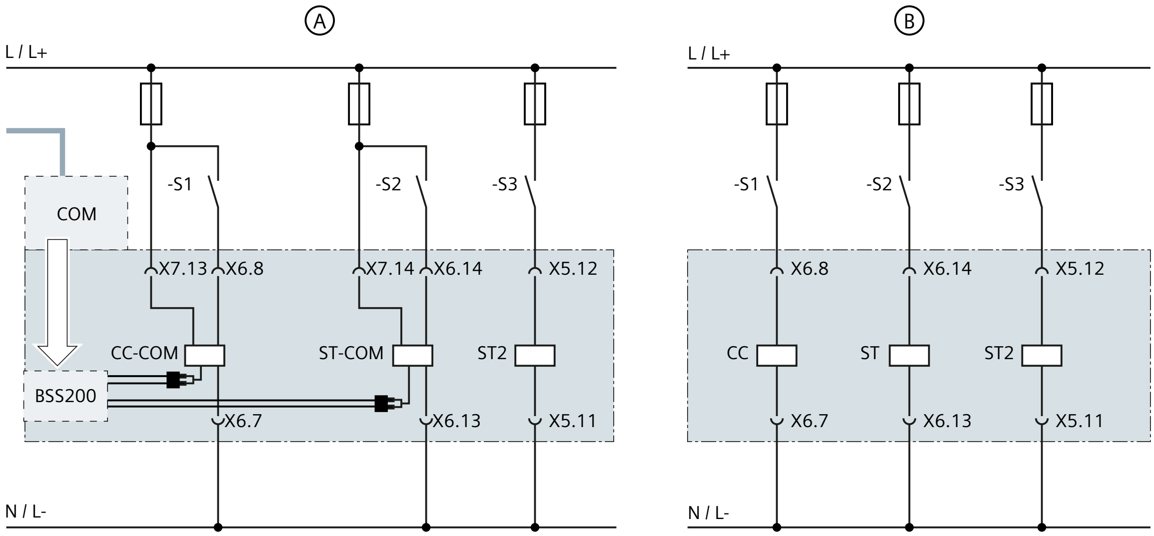
Circuit breaker is not ready to close:



Circuit breaker is ready to close:

Circuit diagram

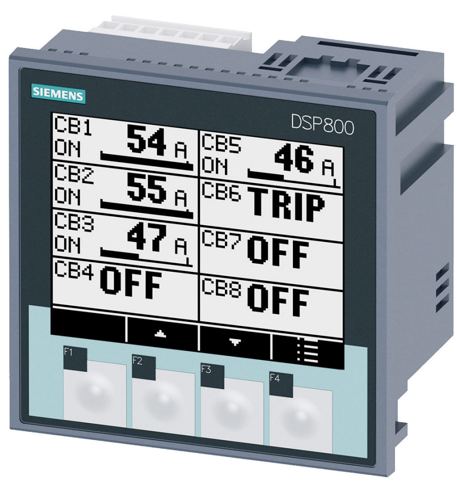
The diagrams show the electrical closing interlock for a circuit breaker with and without the "ready4COM" feature.
If one of the two switches, S2 or S3, is permanently closed, mechanical and electrical switching is not possible via the S1 switch or via communication.



(A) Circuit breaker with "ready4COM"

(B) Circuit breaker without "ready4COM"

3.6 DSP800 display



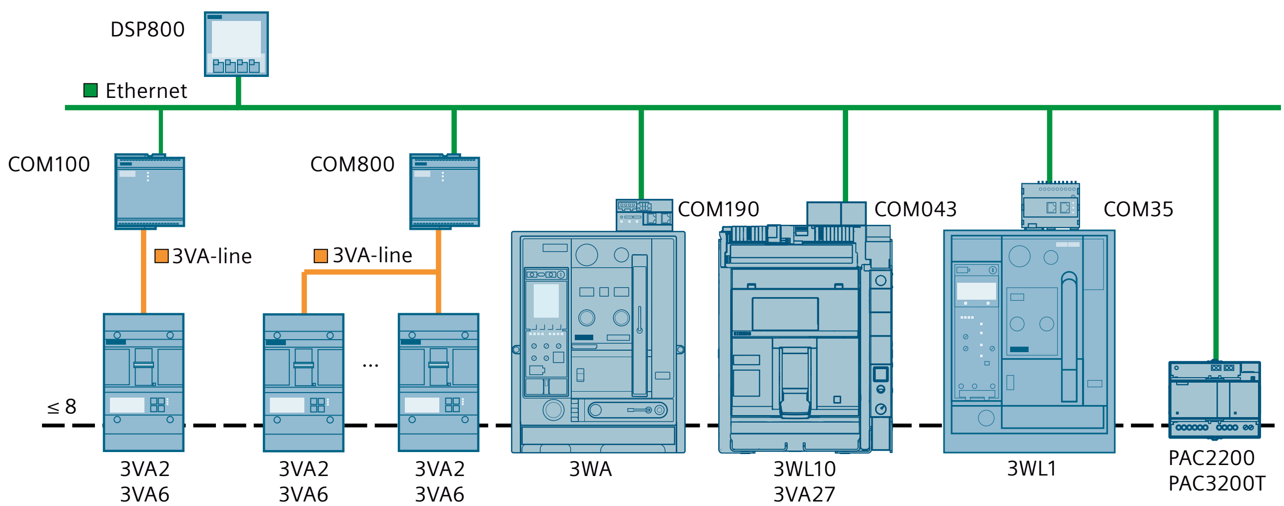
The DSP800 display is used for the visualization of device information and measured data directly at the cubicle door. It can be connected to the Ethernet interface (Modbus TCP protocol) of the COM190 communications module. The DSP800 display is deployed for any application which requires visual indication (i.e. directly at the power distribution equipment) without additional software support. This makes it possible to visualize device information and measured data without operating the ETU of the circuit breaker.

The start page of the DSP800 displays the status and maximum current of all devices. All the detailed information about individual devices can be selected via the efficiently structured

menu.
The detailed information includes:

- Metering values, such as current, voltage and energy values
- ETU setting parameters
- Status of the circuit breaker
- Diagnostics / maintenance information

Information is visualized using ready-made menus and does not require software development. Templates for 1, 2, 4 and 8 devices are available on the start screen. These can either be selected and arranged automatically or they can be manually assigned. In addition, the metering values to be displayed can be selected in the overview.



Compatibility

With firmware version 4.00 and higher, the DSP800 display shows the data from up to eight connected circuit breakers/metering devices.

The following devices are compatible with the DSP800:

- 3WA circuit breaker via COM190
- 3WL1 circuit breaker via COM35
- 3WL10 circuit breaker via COM043
- 3VA molded case circuit breaker via COM100 / COM800
- 3VA27 molded case circuit breaker via COM043
- PAC2200, PAC3200T energy meter

Commissioning

The DSP800 is commissioned using the powerconfig software.

Technical specifications

The backlit liquid crystal display has high resolution and an inverse display for good readability.

Feature	Value
Designation	DSP800
Article number (as spare part)	3VA9987-0TD10
Protocol	Modbus TCP
Transmission medium	Ethernet, IEEE 802.3
Transmission rate	100 Mbps
Connection technology	Via RJ45 socket and Ethernet patch cable
Total circuit breakers	Max. 8
3VA molded case circuit breakers	Max. 8
3WL10 / 3VA27 circuit breakers	Max. 3
Power supply	24 V DC
Power consumption	2.2 W
Door cutout	92 x 92 mm [3.62 x 3.62 in]
Dimensions of LCD	92 x 92 mm [3.62 x 3.62 in]
Type of mounting	Clips

3.7 powermanager

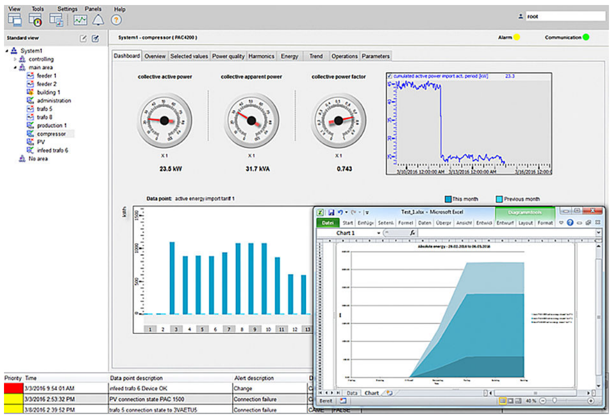
3.7.1 Energy management in accordance with ISO 50001

Efficiency in power distribution

The 3WA circuit breaker ensures safety and cost effectiveness in power distribution. Efficiency is increased even more when combined with software products for simple and fast configuration and reliable monitoring. Further switching, protection and measuring devices from the SENTRON portfolio can be added for an easy introduction to energy management and the cost savings and increased system availability associated with it.

Analyzing energy flows

The powermanager power monitoring software displays key parameters for individual devices and the overall system in a clear dashboard to analyze energy consumption.



Savings can be derived directly and errors can be quickly located, providing greater transparency with respect to energy consumption and lower costs.

High system availability

Continuous monitoring of the power distribution makes it possible to detect critical plant conditions at an early stage, thus preventing irregularities and equipment failures. powermanager offers enhanced monitoring of the system quality and faults are identified in good time. Failures, irreparable damage and system shutdown can basically be prevented with intelligent monitoring.

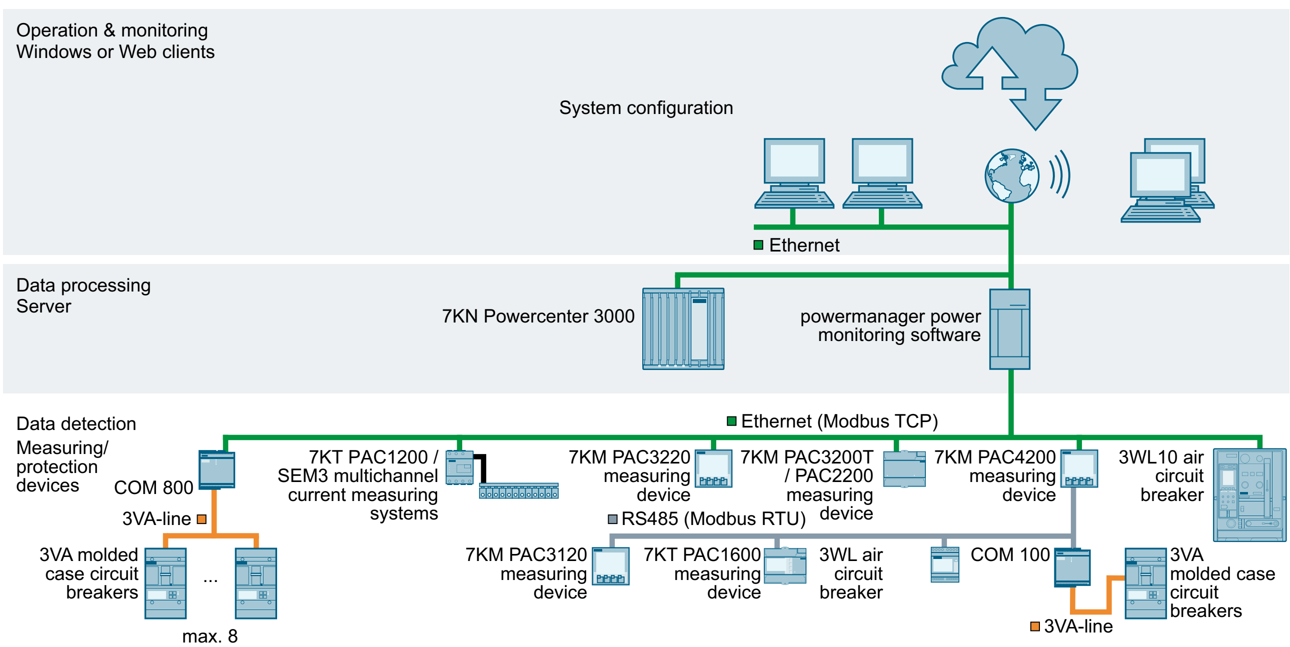
3.7.2 Features

The powermanager power monitoring software is characterized by the following features and the benefits resulting from them:

- Pre-configured project settings
  - Fast commissioning
  - Easy introduction
- Display of load profile and measured variables as a characteristic curve
  - Derived measures for energy savings

- Reports for the allocation of consumption and costs to any cost center
  - Pinpointing of unnecessary consumption
  - Fast fault location
  - Increased energy awareness
- Limit monitoring using configurable alarms
  - Changing the energy consumption
  - Prevention of load peaks

powermanager in the system configuration



3.7.3 Functions

The power monitoring software offers the following functions:

- Stand-alone PC-based power monitoring software for the power monitoring system based on Modbus communication
- Complete integration of the 3WA circuit breaker including metering values and circuit breaker status
- Expandable from the simple standard application to a fully flexible customer solution
- Acquisition, display, archiving and evaluation of measured variables
- Basic reporting with templates for easy introduction to evaluation
- Extended Excel-based reporting for user-specific evaluations
- Monitoring of status and limits, including generation of alarms

- Virtual measuring points and devices
- Dashboard displays for a quick overview on device and system levels
- Control of digital outputs and remote switching
- User administration with different authorization levels
- Distributed multi-server structure
- Load monitoring
- Calculation and display of key performance indicators (KPIs)

3.7.4 TÜV certificate of conformity for energy management

The powermanager energy monitoring software is in compliance with ISO 50001 and energy audits in accordance with EN 16247-1.

The ISO 50001 energy saving standard provides companies with a definition of binding criteria for sustainable energy management. The TÜV certificate of conformity states that the 3WA circuit breaker and other switching, protection and measuring devices from the SENTRON portfolio and the powermanager energy monitoring software support the introduction of an operational energy management system in accordance with ISO 50001.

The TÜV certificate can be obtained on request.

For more information, refer to the internet:

- powermanager (https://www.siemens.com/powermanager)
- Energy monitoring (https://www.siemens.com/powermonitoring)

3.8 7KN Powercenter 3000

3.8.1 IoT gateway for the intelligent power distribution equipment

The 7KN Powercenter 3000 is an IoT (Internet of Things) gateway and can be used in many areas.

It provides an easy and cost-efficient introduction to energy management, power distribution digitalization and cloud applications. It can be used to extend the functionality of the 3WA circuit breaker, e.g.:

- Access to the cloud
- Overview via web interface
- Benchmarking across different locations

3.8.2 IoT data platform

The 7KN Powercenter 3000 acquires and stores information about energy and status values directly from the 3WA circuit breaker, e.g.:

- Current
- Voltage
- Energy

It also acquires and stores information from other lower-level, communication-capable devices, such as 7KM PAC measuring devices and 3VA molded case circuit breakers.

The 7KN Powercenter 3000 makes this information available for visualization and evaluation. This is implemented by the following means:

- Standard web interfaces (PC, smartphones, tablet)
- powermanager power monitoring software
- Cloud-based applications, e.g. MindSphere

The IP-based communication interface can also be used as a simple WLAN and mobile wireless interface.

3.8.3 Parameterization and settings

Parameterization and changes in settings are performed using the SENTRON powerconfig configuration software. The advantages are as follows:

- Simple and cost-effective introduction to the topics of power monitoring and digitalization of power distribution, "IoT – Internet of Things", Industry 4.0, smart building
- Power distribution status can be called up anywhere and at any time
- Transparency for optimized energy supply
- Clear overview of all information (energy values, statistics, warnings, limits, etc.) on the following media:
  - Browser
  - Portable devices
  - Energy management systems
  - Cloud applications
- Intelligent data preprocessing: The bundling of a large number of individual status, statistical and metering values to form "compact data packages" reduces the effort and the costs for the transmission of relevant data into the cloud (keyword: smart data).
- Data security: Communication via a single, protected gateway
- Diagnostics: Simple and fast fault location (status information)
- Meets the requirements of energy audits and operational energy management in accordance with ISO 50001 and ISO 50003, based on the IEC 60364-8-1 standard

For more information, refer to the 7KN Powercenter 3000 manual; see Chapter Reference documents (Page 17).

3.9 SENTRON powermind

The MindSphere application SENTRON powermind stores, evaluates and displays data from low-voltage power distribution equipment, thereby creating transparency. Both actual values and comparisons of historical data are available on predefined dashboards, either device-specifically or in the form of an overview.

SENTRON powermind is based on the open IoT operating system MindSphere.

The application allows the user to visualize and analyze data in the following views:

- Instantaneous values for power import and power factor
- Comparison of stored energy and power values
- Load profiles, bar charts, heatmaps and Sankey diagrams show these values in an attractive graphical format

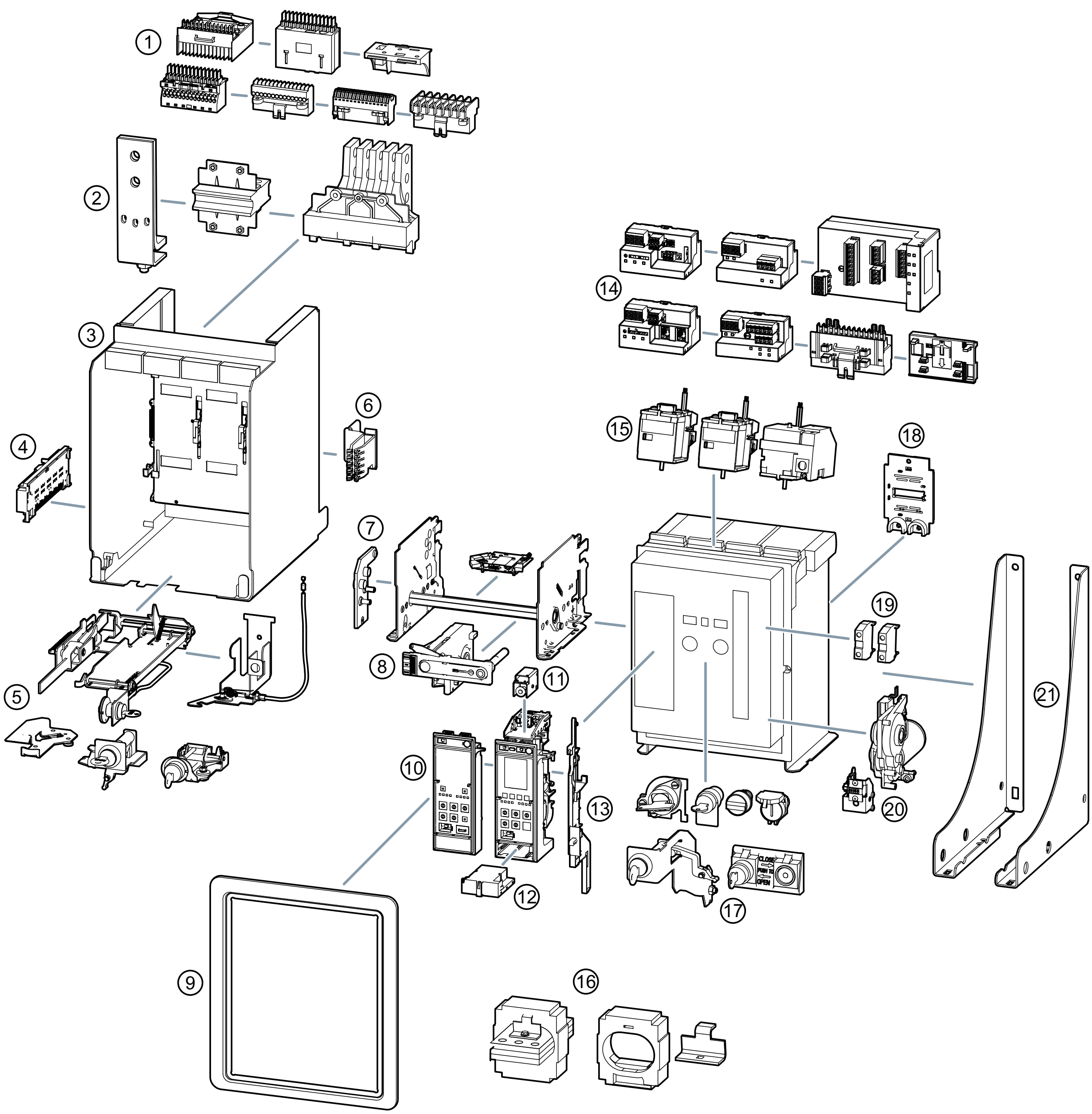
Energy managers, electricians, building managers or maintenance teams - SENTRON powermind offers all the essential insights into energy, status and utilization data. It provides a simple and cost-effective solution which offers an alternative to on-premise solutions that is efficient both in terms of time and expenditure. SENTRON powermind stands out due to predefined dashboards and graphics for immediate results and ensures a fast, easy and trouble-free on-boarding process.

The 3WA circuit breaker is supported by SENTRON powermind versions V1.4.1 and higher.

Accessories

4

4.1 Overview



(1) Secondary disconnect terminals

(2) Main connections

(3) Guide frame with installed shutter
(4) Position signaling switch module
(5) Locking provisions for withdrawable circuit breakers
(6) Contact module for grounding connection between the guide frame and the circuit breaker
(7) Coding for the withdrawable circuit breaker and the guide frame
(8) Conversion set for converting fixed-mounted circuit breakers into withdrawable circuit breakers
(9) Door sealing frame
(10) Electronic trip unit
(11) Remote trip alarm reset coil
(12) Voltage tap module
(13) Control gate
(14) Modules for CubicleBUS^2, mounting adapters
(15) Closing coil, shunt trip, undervoltage release
(16) External current sensors for N conductor
(17) Locking provisions, interlocking set
(18) Internal voltage tap
(19) Auxiliary switch
(20) Spring charging motor, operating cycles counter
(21) Support brackets

The overview shows an extract from the full range of accessories. For more information on the accessory components, refer to the circuit breaker catalog; see Chapter Reference documents (Page 17).

Note

The internal and external accessories of the circuit breaker are identical for all sizes, with the exception of all accessories for which width is significant (e.g. arc chute cover). This allows easy exchange of accessory components between different circuit breakers of the 3WA series.

The following components are included with the 3WA circuit breaker as standard, in contrast to its predecessor 3WL:

- First trip alarm switch S24 (1 changeover contact) for circuit breakers
- Shutter for guide frame
- Ready-to-close signaling switch S20
- Spring charge signaling switch for all circuit breakers with spring charging motor
- Internal current sensor for the neutral pole for 4-pole circuit breakers

4.2 Preparatory and concluding steps for the installation of internal accessories

Opening the circuit breaker and discharging the stored energy mechanism

DANGER

Hazardous voltage
Will cause death, serious personal injury, or equipment damage.

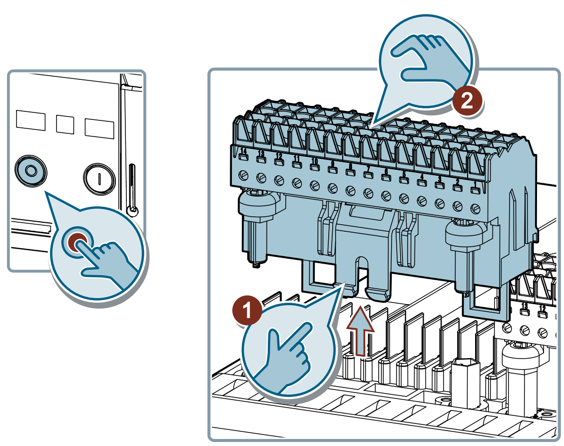
Turn off and lock out all power supplying this equipment before working on this device.

Note

If a spring charging motor is configured, disconnect the control circuit to the spring charging motor first, in order to prevent the stored energy mechanism from recharging.

If an undervoltage release is configured, control voltage must be applied to the UVR.

Disconnecting the control circuit to the spring charging motor



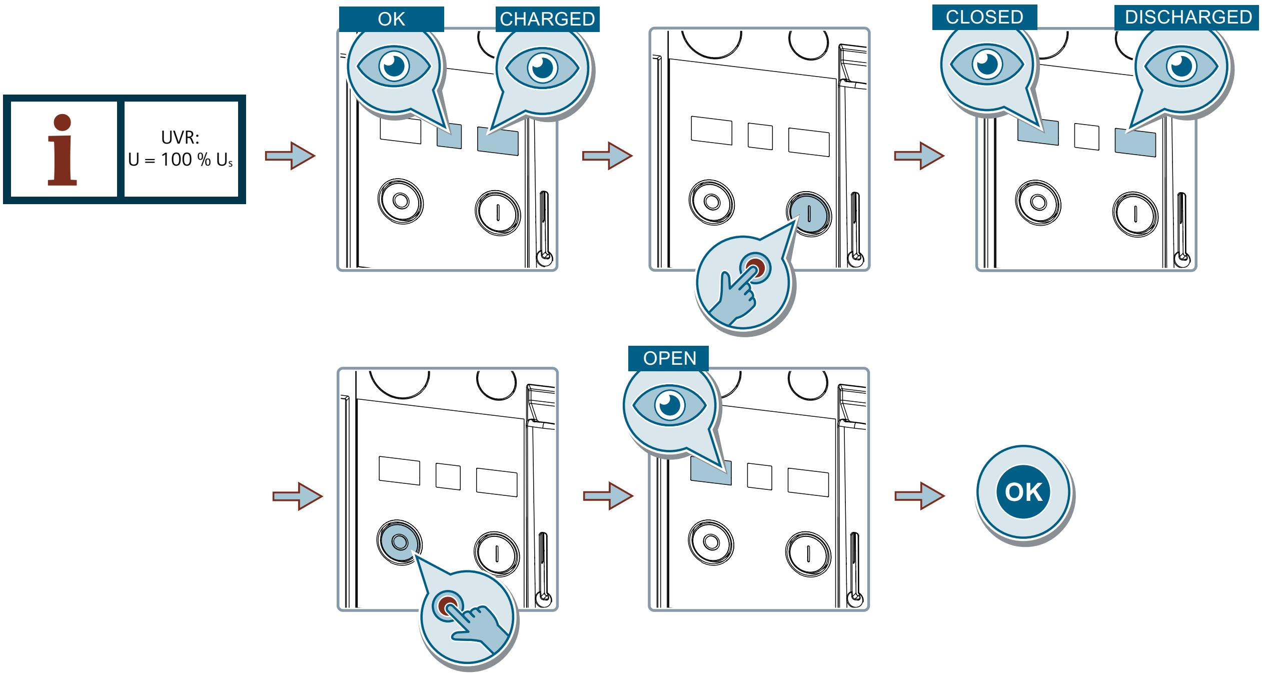
1. Press O / OPEN.
2. Unplug manual connector X5.

Note

Spring charging motor and undervoltage release present

If an undervoltage release is present, do not unplug the entire X5 manual connector, as this will also disconnect the control voltage on the undervoltage release.
Only disconnect cable connections X5.1 and X5.2 in order to disconnect the control circuit to the spring charging motor. For more information, see Chapters ETU300 terminal assignment diagram (Page 390) and ETU600 terminal assignment diagram (Page 391).

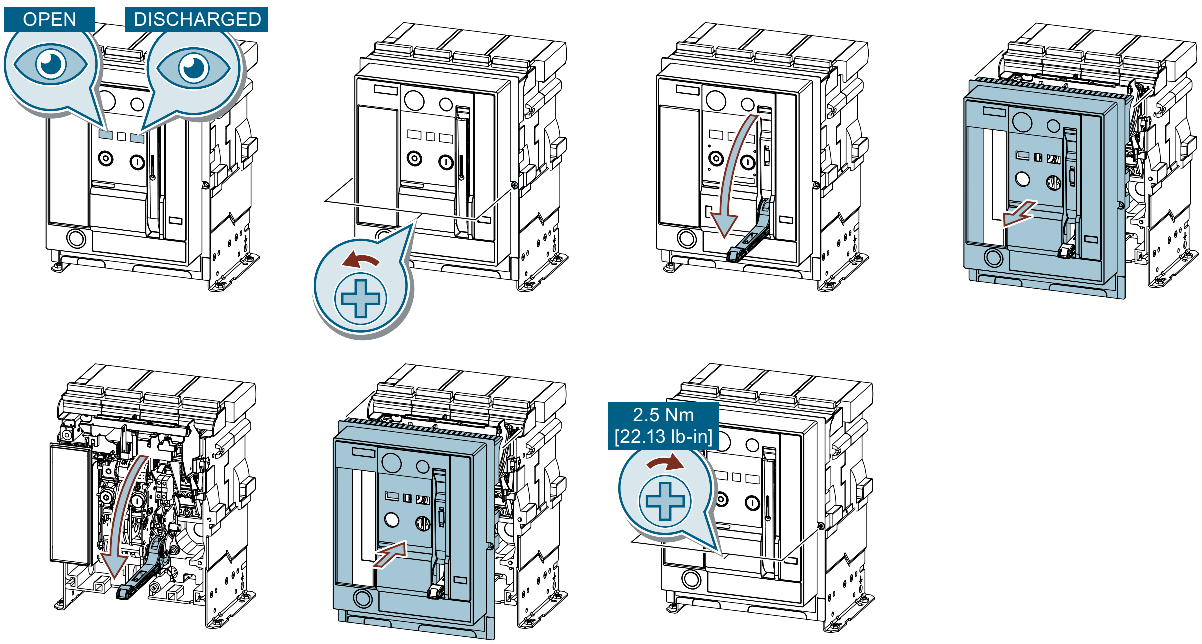
Opening the circuit breaker and discharging the stored energy mechanism



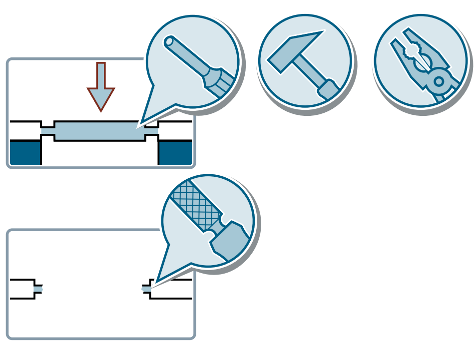
1. Check that the circuit breaker is ready to close ("OK" indication) and the stored energy mechanism is charged ("CHARGED" indication).
2. Press I / CLOSE.
3. Check that the "CLOSED" and "DISCHARGED" indications are active.
4. Press O / OPEN.
5. Check that the "OPEN" indication is active.

Operator panel

Removal and installation



Knocking out the cutouts



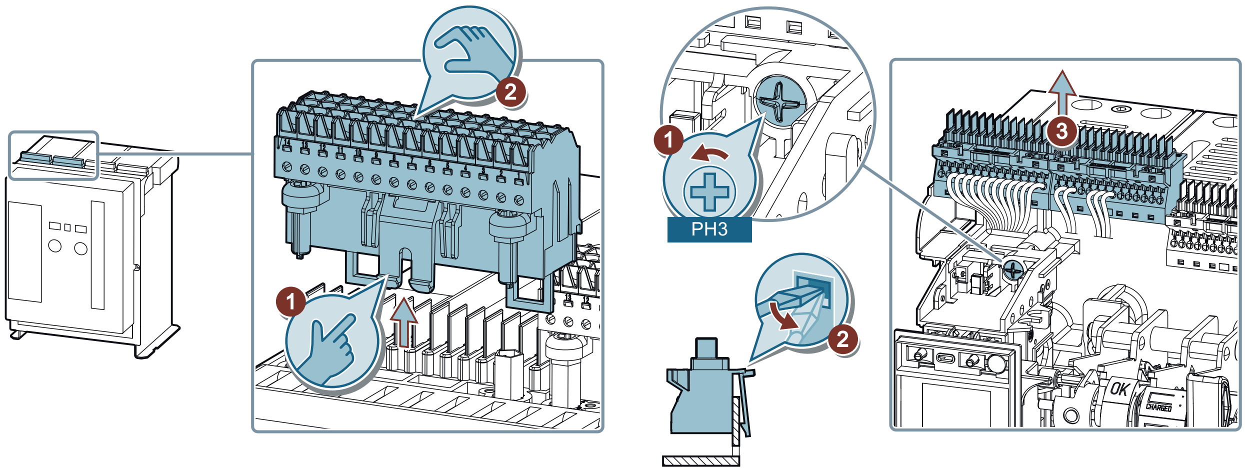
Electronic trip unit

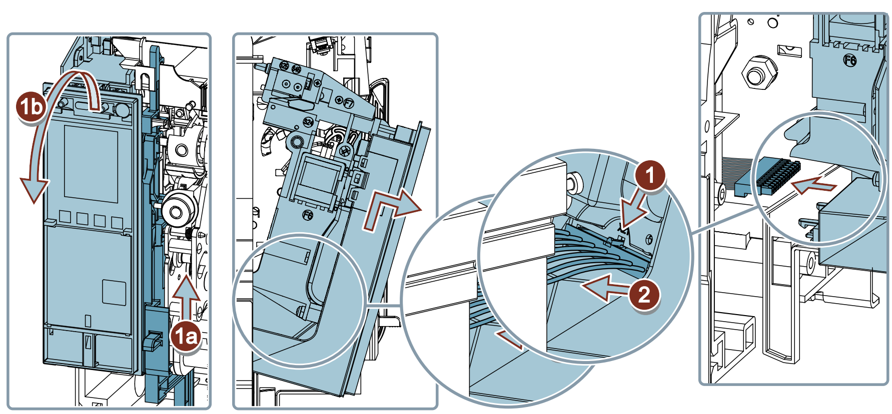
Note

The installation/removal of the complete electronic trip unit is described below.

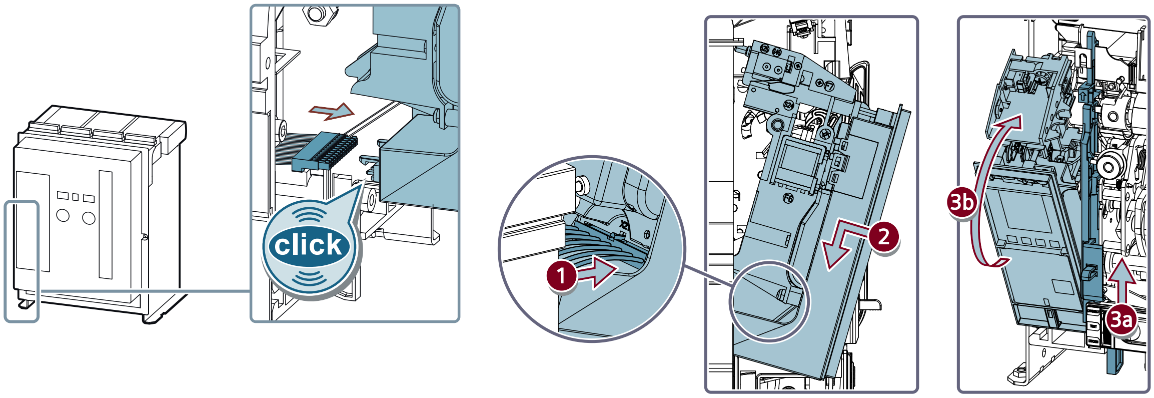
For individual accessory components, the installation/removal of the electronic trip unit may differ from the installation shown here. Alternative installation/removal steps are described in Chapter "Accessories".

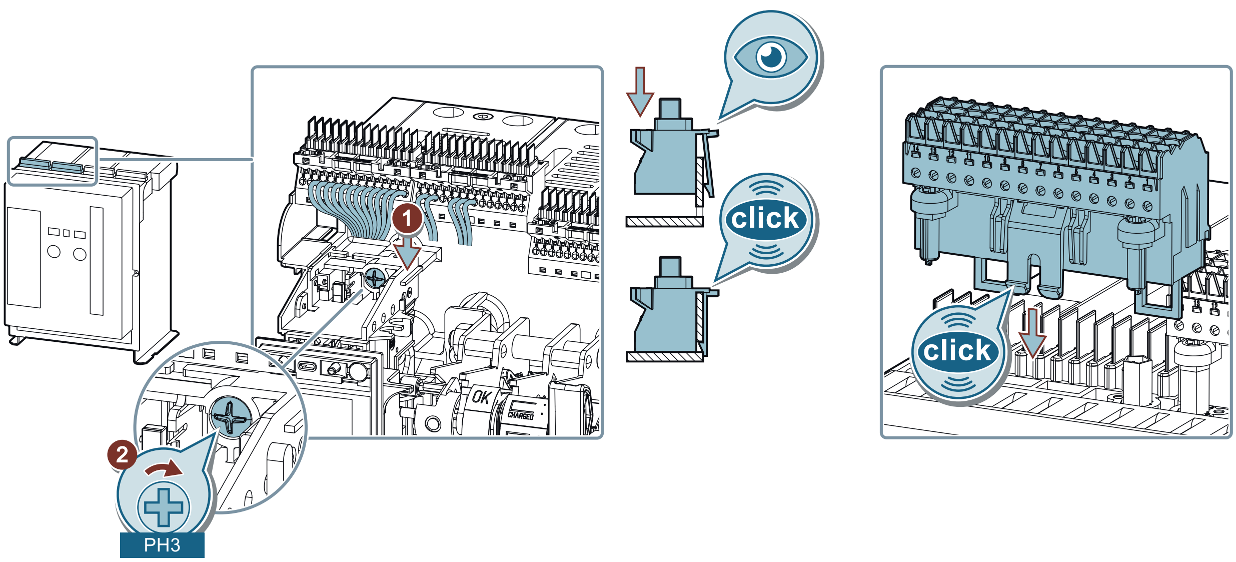
Removal





Installation



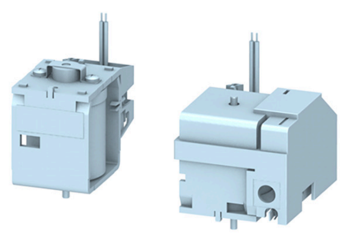


For more information, refer to the Compact Operating Instructions 92310000039 (https://support.industry.siemens.com/cs/ww/en/view/109783659).

4.3 Control and signaling accessories

4.3.1 Closing coil, shunt trip, undervoltage release

4.3.1.1 Description



Closing coil (CC/CC-COM)

The closing coil makes remote closing of the circuit breaker possible. The prerequisite for this is the ready-to-close status of the circuit breaker.

Remote closing can take place both via the communication system and by means of electrical signals on the secondary disconnect terminal system.

The closing coil can be ordered from the factory pre-assembled in the 3WA circuit breaker/ non-automatic circuit breaker or it can be retrofit by the customer.
Closing coils are available in three versions:

- Closing coil (CC) 100% duty cycle, suitable for uninterrupted duty
  This version is suitable for uninterrupted duty with a duty cycle of 100%.
- Closing coil (CC-COM) 100% duty cycle, communication-capable, suitable for uninterrupted duty
  This version is suitable for uninterrupted duty with a duty cycle of 100% and for switching via communication.
- Closing coil (CC) 5% duty cycle, not suitable for uninterrupted duty
  The closing coil for momentary duty reduces the make time of the circuit breaker; the duty cycle is 5%. This closing coil is not suitable for uninterrupted duty.

Shunt trip (ST/ST-COM/ST2)

Up to two shunt trips make remote opening of the circuit breaker possible.

Remote opening can take place both via communication and by means of electrical signals on the secondary disconnect terminal system.

The shunt trips are available in three versions:

- Shunt trip (ST) 100% duty cycle, suitable for uninterrupted duty
  This version is suitable for uninterrupted duty with a duty cycle of 100%.
  - The release can be permanently connected to voltage.
  - It locks out on momentary-contact commands, thus making it possible to set up interlocks.
  - Shunt trip 220 - 250 V DC / 208- 240 V AC can optionally be supplied with power by means of a capacitor trip device during short-time failures of the supply voltage, see Chapter Capacitor trip device for shunt trips (Page 231).
- Shunt trip (ST-COM) 100% duty cycle, communication-capable, suitable for uninterrupted duty
  This version is suitable for uninterrupted duty with a duty cycle of 100% and for switching via communication.
  - The release can be permanently connected to voltage.
  - It locks out on momentary-contact commands, thus making it possible to set up interlocks.
  - Shunt trip 220 - 250 V DC / 208- 240 V AC can optionally be supplied with power by means of a capacitor trip device during short-time failures of the supply voltage, see Chapter Capacitor trip device for shunt trips (Page 231).
- Shunt trip for momentary duty 5% duty cycle, uninterrupted duty not possible
  The shunt trip for momentary duty reduces the break time of the circuit breaker to below 50 ms and is thus synchronizable. The duty cycle is 5%. This shunt trip is not suitable for uninterrupted duty.

Note

Shunt trip ST2 and the undervoltage releases are mounted in the same location. It is **not** possible to use these accessories simultaneously.

The shunt trips can be retrofit.

Undervoltage release (UVR/UVR-t)

The undervoltage release trips the circuit breaker if the control voltage U_S is unavailable or drops to between 70% and 35% of its normal value (in compliance with the relevant standard) and locks it to prevent reclosing until the control voltage is restored. The circuit breaker can then be reclosed mechanically or electrically. The undervoltage release does not need to be reset for this purpose.

If the undervoltage release is delayed, the circuit breaker only trips if the duration of the undervoltage is greater than or equal to the delay time. The undervoltage release therefore prevents tripping of the circuit breaker in the event of a short-time voltage dip or voltage failure.

The undervoltage release can be used for:

- Safe remote-controlled tripping
- Interlocking, to prevent closing
- Checking the voltage in the primary and secondary circuits

The undervoltage release is supplied with voltage via the secondary disconnect terminal system.

It is available in two versions:

- Undervoltage release UVR:
  Tripping occurs instantaneously or with a short-time delay, see Chapter Technical specifications (Page 226).
- Undervoltage release UVR-t:
  Tripping occurs with an adjustable delay time from 0.2 to 3.2 s.

Note

The circuit breaker with an undervoltage release can be closed at a control voltage from 85% to 110% U_S on the undervoltage release.

Note

Undervoltage release UVR or UVR-t and shunt trip ST2 are mounted in the same location. It is **not** possible to use these accessories simultaneously.

Note

The maximum permissible cable length to the EMERGENCY-OFF button (EMERGENCY shutdown) is currently < 50 m (the maximum cable length between X5.13 and X5.14 is < 100 m).

The undervoltage release can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783975).

4.3.1.2 Technical specifications

Closing coil (CC/CC-COM)

Rated control supply voltage U_S	24 ... 30 V DC
	48 ... 60 V DC
	110 ... 127 V AC / 110 ... 125 V DC
	208 ... 240 V AC / 220 ... 250 V DC
Operating range (acc. to IEC 60947-2)	85 ... 110% U_S
Extended operating range for battery operation	85 ... 126% U_S
Integrated freewheeling diode	✓

		100% duty cycle	5% duty cycle
Closing power AC / DC	24 ... 30 V DC	40 VA / 40 W	200 VA / 200 W
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC		250 VA / 250 W
	208 ... 240 V AC / 220 ... 250 V DC		
Continuous power AC / DC		8 VA / 8 W	--
Minimum command time at 100% U_S		60 ms	60 ms
Maximum command time at 100% U_S		--	2000 ms
Make time of the circuit breaker at 100% U_S		80 ms	50 ms
Fuse protection of the control circuit at U_S closing coil			
Fuse gG	24 ... 30 V DC	2 A	10 A
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC		4 A
	208 ... 240 V AC / 220 ... 250 V DC		2 A
Miniature circuit breaker with C characteristic	24 ... 30 V DC	2 A	10 A
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC		4 A
	208 ... 240 V AC / 220 ... 250 V DC		2 A

If the closing coil and the spring charging motor are to be supplied by the same control circuit, the following applies:

Fuse protection of the control circuit at U_S spring charging motor + closing coil		100% duty cycle	5% duty cycle
Fuse gG	24 ... 30 V DC	6 A	10 A
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC	2 A	4 A
	208 ... 240 V AC / 220 ... 250 V DC	2 A	2 A
Miniature circuit breaker with C characteristic	24 ... 30 V DC	6 A	10 A
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC	2 A	4 A
	208 ... 240 V AC / 220 ... 250 V DC	2 A	2 A

Shunt trip (ST/ST-COM/ST2)

Shunt trip

Rated control supply voltage U_S		24 ... 30 V DC	
		48 ... 60 V DC	
		110 ... 127 V AC / 110 ... 125 V DC	
		208 ... 240 V AC / 220 ... 250 V DC	
Operating range (acc. to IEC 60947-1)		85 ... 110% U_S	
Extended operating range for battery operation		85 ... 126% U_S	
Integrated freewheeling diode		✓	
		100% duty cycle	**5% duty cycle**
Closing power AC / DC	24 ... 30 V DC	40 VA / 40 W	200 VA / 200 W
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC		250 VA / 250 W
	208 ... 240 V AC / 220 ... 250 V DC		
Continuous power AC / DC		8 VA / 8 W	--
Minimum command time at 100% U_S		60 ms	60 ms
Maximum command time at 100% U_S		--	2000 ms
Opening time of the circuit breaker at 100% U_S		80 ms	50 ms
Fuse protection of the control circuit			
Fuse gG	24 ... 30 V DC	2 A	10 A
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC		4 A
	208 ... 240 V AC / 220 ... 250 V DC		2 A
Miniature circuit breaker with C characteristic	24 ... 30 V DC	2 A	10 A
	48 ... 60 V DC		
	110 ... 127 V AC / 110 ... 125 V DC		4 A
	208 ... 240 V AC / 220 ... 250 V DC		2 A

Undervoltage release (UVR/UVR-t)

Rated control supply voltage U_S UVR	24 ... 30 V DC
	48 ... 60 V DC
	110 ... 127 V AC / 110 ... 125 V DC
	208 ... 240 V AC / 220 ... 250 V DC
	380 ... 415 V AC

Rated control supply voltage U_S UVR-t[1]		48 V DC
		60 V DC
		110 ... 127 V AC / 110 ... 125 V DC
		208 ... 240 V AC / 220 ... 250 V DC
		380 ... 415 V AC
Operating limits	Operate voltage	< 70% U_S
	Pick-up voltage	85 ... 110% U_S
Integrated freewheeling diode		✓
Closing power AC / DC		50 VA / 50 W
Continuous power AC / DC		5 VA / 5 W
Break time		
U_S = 0 with instantaneous UVR		≤ 80 ms
U_S = 0 with short-time-delayed UVR		≤ 200 ms
U_S = 0 with delayed UVR-t		0.2 ... 3.2 s
For UVR-t by disconnecting the connection at terminals X5.13 and X5.14 (EMERGENCY-STOP circuit)[1]		≤ 100 ms
Fuse protection of the control circuit		
Fuse gG	24 ... 30 V DC (UVR)	2 A
	48 ... 60 V DC (UVR)	
	48 V DC (UVR-t)	
	60 V DC (UVR-t)	
	110 ... 127 V AC / 110 ... 125 V DC	
	208 ... 240 V AC / 220 ... 250 V DC	
	380 ... 415 V AC	
Miniature circuit breaker with C characteristic	24 ... 30 V DC (UVR)	4 A
	48 ... 60 V DC (UVR)	
	48 V DC (UVR-t)	
	60 V DC (UVR-t)	
	110 ... 127 V AC / 110 ... 125 V DC	
	208 ... 240 V AC / 220 ... 250 V DC	6 A
	380 ... 415 V AC	
Miniature circuit breaker with D characteristic	24 ... 30 V DC (UVR)	2 A
	48 ... 60 V DC (UVR)	
	48 V DC (UVR-t)	
	60 V DC (UVR-t)	
	110 ... 127 V AC / 110 ... 125 V DC	
	208 ... 240 V AC / 220 ... 250 V DC	4 A
	380 ... 415 V AC	

1) The maximum permissible cable length to the EMERGENCY-OFF button (EMERGENCY shutdown) is currently < 50 m (the maximum cable length between X5.13 and X5.14 is < 100 m).

4.3.1.3 Article number

Closing coil	Article number
Uninterrupted duty (100% duty cycle)	
24 ... 30 V DC	3WA9111-0AD02
48 ... 60 V DC	3WA9111-0AD04
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AD05
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AD06
Uninterrupted duty, communication-capable (100% duty cycle)	
24 ... 30 V DC	3WA9111-0AD32
48 ... 60 V DC	3WA9111-0AD34
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AD35
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AD36
Momentary duty (5% duty cycle) with cut-off switch S15	
24 ... 30 V DC	3WA9111-0AD12
48 ... 60 V DC	3WA9111-0AD14
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AD15
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AD16

You can purchase the accessories in the Siemens Industry Mall (https://www.siemens.com/product?3WA9111-0AD*).

Shunt trip	Article number
Uninterrupted duty (100% duty cycle)	
24 ... 30 V DC	3WA9111-0AD02
48 ... 60 V DC	3WA9111-0AD04
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AD05
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AD06
Uninterrupted duty, communication-capable (100% duty cycle)	
24 ... 30 V DC	3WA9111-0AD32
48 ... 60 V DC	3WA9111-0AD34
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AD35
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AD36
Momentary duty (5% duty cycle) with cut-off switch S14	
24 ... 30 V DC	3WA9111-0AD22
48 ... 60 V DC	3WA9111-0AD24
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AD25
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AD26

You can purchase the accessories in the Siemens Industry Mall (https://www.siemens.com/product?3WA9111-0AD*).

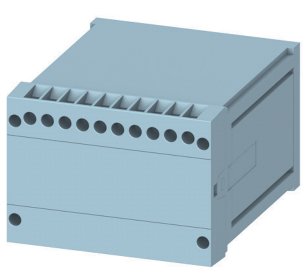
Undervoltage release	Article number
UVR instantaneous / short-time-delayed	
24 ... 30 V DC	3WA9111-0AE02
48 ... 60 V DC	3WA9111-0AE04
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AE05
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AE06
380 ... 415 V AC	3WA9111-0AE07

UVR-t delayed (can be set in the range 0.2 ... 3.2 s)	Article number
48 V DC	3WA9111-0AE13
60 V DC	3WA9111-0AE14
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AE15
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AE16
380 ... 415 V AC	3WA9111-0AE17

You can purchase the accessories in the Siemens Industry Mall (https://www.siemens.com/product?3WA9111-0AE*).

4.3.2 Capacitor trip device for shunt trips

4.3.2.1 Description



In the event of short-time brownouts of the supply voltage, the capacitor trip device takes over the power supply of the shunt trips for uninterrupted duty, see Chapter Closing coil, shunt trip, undervoltage release (Page 224).

Note

Only shunt trips with an operational voltage of 220 V to 250 V DC / 208 V to 240 V AC can be used in combination with the capacitor trip device.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109793919).

4.3.2.2 Technical specifications

Rated control supply voltage U_S	220 ... 250 V DC / 208 ... 240 V AC
Operating range (acc. to IEC 60947-2)	70 ... 110% U_S
Storage time at U_S	Max. 5 min
Recharging time at U_S	Min. 5 s
Continuous power	1 VA DC / 1 W AC
Opening time of the circuit breaker at 100% U_S	80 ms

Fuse protection of the control circuit	
Fuse gG	1 A
Miniature circuit breaker with C characteristic	1 A

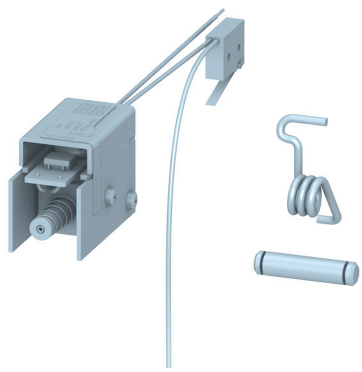
4.3.2.3 Article number

	Article number
Capacitor trip device for shunt trips	3WA9111-0AD81

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AD81).

4.3.3 Remote trip alarm reset coil (incl. automatic reset of the reclosing lockout)

4.3.3.1 Description



Following tripping by the electronic trip unit, the trip indication and the trip alarm can be reset remotely using the remote trip alarm reset coil (RR).

The remote trip alarm reset coil is available for different voltage supplies, see Chapter Technical specifications of the remote trip alarm reset coil (Page 234).

The remote trip alarm reset coil accessory includes an automatic reset of the reclosing lockout. This ensures that the ready-to-close status of the circuit breaker is restored after tripping. The conditions for the ready-to-close status must also be fulfilled, see Chapter Commissioning checklist (Page 42).

The remote trip alarm reset coil can be retrofit.

NOTICE
Overload of the remote trip alarm reset coil If the automatic reset of the reclosing lockout is not installed, the remote trip alarm reset coil may be destroyed by overload. Only use the remote trip alarm reset coil if the spring for automatic reset of the reclosing lockout which is included in the scope of supply has been installed, see Compact Operating Instructions 92310000042 (https://support.industry.siemens.com/cs/ww/en/view/109783977).

Automatic reset of the reclosing lockout

When tripping is performed by the electronic trip unit, a reclosing lockout is activated on the circuit breaker. As an alternative to a manual reset of the reclosing lockout on the electronic trip unit, the reclosing lockout can also be canceled by means of an automatic reset.

The automatic reset of the reclosing lockout can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783977).

4.3.3.2 Technical specifications of the remote trip alarm reset coil

Rated control supply voltage U_S	24 ... 30 V DC
	48 ... 60 V DC
	110 ... 125 V DC / 110 ... 127 V AC
	220 ... 250 V DC / 208 ... 240 V AC
Operating range (acc. to IEC 60947-2)	85 ... 110% U_S
Extended operating range for battery operation	70 ... 126% U_S
Integrated freewheeling diode	✓
Power consumption	60 W DC / 60 VA AC
Min. command duration at 1 x U_S	60 ms
Fuse protection of the control circuit at U_S = 24 ... 60 V DC	
Fuse gG	2 A
Miniature circuit breaker with C characteristic	2 A
Fuse protection of the control circuit at U_S > 100 V DC and 100 V AC	
Fuse gG	1 A
Miniature circuit breaker with C characteristic	1 A

4.3.3.3 Article number

Remote trip alarm reset coil (scope of supply includes automatic reset of the reclosing lockout)	Article number
24 ... 30 V DC	3WA9111-0EM42
48 ... 60 V DC	3WA9111-0EM44
110 ... 125 V DC / 110 ... 127 V AC	3WA9111-0EM45
220 ... 250 V DC / 208 ... 240 V AC	3WA9111-0EM46
Automatic reset of the reclosing lockout	3WA9111-0EM31

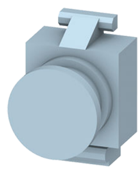
You can purchase the accessories in the Siemens Industry Mall (remote trip alarm reset coil (http://www.siemens.com/product?3WA9111-0EM31) or automatic reset of the reclosing lockout).

See also

http://www.siemens.com/product?3WA9111-0EM4* (http://www.siemens.com/product?3WA9111-0EM4*)

4.3.4 Emergency OPEN button

4.3.4.1 Description



The emergency OPEN button is a mushroom pushbutton and replaces the local mechanical open. The mushroom pushbutton implements the emergency OPEN function.

The emergency OPEN button can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783678).

4.3.4.2 Article number

	Z option	Article number
Emergency OPEN button	C25	3WA9111-0AH25

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH25).

4.3.5 Digital input/output modules

4.3.5.1 Description

General

Digital input/output modules make it possible for the circuit breaker to communicate with secondary devices in the circuit breaker panel. Binary signals can be connected to the inputs and signals can be output at the outputs. The input signals can be processed in the circuit breaker or can be transferred to external systems, e.g. a PLC, via the communications modules.

- A digital input can be used, for example, to switch over to the second parameter set of the electronic trip unit ETU600 or to activate the maintenance mode DAS+.
- The digital outputs can be used to output events and alarms that are present in the circuit breaker.
  Events, alarms and limit values of the electronic trip unit ETU600 can be integrated in the control of the power distribution system in this manner, for example.

Up to five IOM230 digital input/output modules and up to five IOM350 input/output modules can be connected to the CubicleBUS². The CubicleBUS² address is assigned to the module using the rotary coding switch. Each module must be given a unique number between 1 and 5.

Note

Assignment of unique module numbers per module type

Module numbers 1 to 5 must be assigned to each of the IOM230 and IOM350 input/output modules.
An IOM230 and an IOM350 can have the same number, but no number must ever be assigned twice to one module type.

For the selection of input/output modules, the most significant differences are described in the following table.

	IOM230	IOM350
Number of inputs	2	3
Number of outputs	3	5
Type of output contact	NO contact	CO contact
Maximum continuous current of an output at 110 ... 230 V AC	0.2 A	10 A
Mounting on circuit breaker possible	✓	--
Mounting on DIN rail possible	✓	✓
Maximum number of modules	5	5
Module numbers	1...5	1...5

Parameterization

The inputs and outputs can be configured using the SENTRON powerconfig configuration software. You will find information on the SENTRON powerconfig configuration software on the internet (https://sie.ag/2SUIAc2).

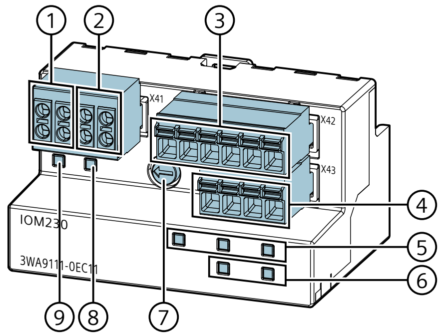
The following actions can be assigned to an input:

- Activate maintenance mode DAS+.
- Switch over to parameter set B.
- Set an input as "Input active". The state of the input is communicated via the fieldbus interface.

The following events can be parameterized on an output of a digital input/output module:

<table>
<tr><th colspan="3">Output</th></tr>
<tr><td rowspan="17">Tripping events</td><td>L tripping</td><td>Overload protection LT</td></tr>
<tr><td rowspan="2">S tripping</td><td>Short-time-delayed short-circuit protection ST</td></tr>
<tr><td>Directed short-time-delayed short-circuit protection dST</td></tr>
<tr><td>I tripping</td><td>Instantaneous short-circuit protection INST</td></tr>
<tr><td>G tripping</td><td>Ground-fault protection GF</td></tr>
<tr><td>Reverse power protection RP tripping</td><td>Reverse power protection</td></tr>
<tr><td rowspan="11">EPF tripping</td><td>Current unbalance</td></tr>
<tr><td>Voltage unbalance</td></tr>
<tr><td>THD current</td></tr>
<tr><td>THD voltage</td></tr>
<tr><td>Undervoltage</td></tr>
<tr><td>Overvoltage</td></tr>
<tr><td>Forward power</td></tr>
<tr><td>Reverse power</td></tr>
<tr><td>Underfrequency</td></tr>
<tr><td>Overfrequency</td></tr>
<tr><td>Reverse-phase sequence protection</td></tr>
<tr><td colspan="2" rowspan="7">Circuit breaker status information</td><td>Maintenance required</td></tr>
<tr><td>Inspection required</td></tr>
<tr><td>ERROR group signal</td></tr>
<tr><td>WARNING group signal</td></tr>
<tr><td>GF REF (restricted earth fault)</td></tr>
<tr><td>Life contact</td></tr>
<tr><td>Control via communication</td></tr>
<tr><td colspan="2" rowspan="7">Electronic trip unit ETU600 status information</td><td>Maintenance mode DAS+ active</td></tr>
<tr><td>Parameter set A active</td></tr>
<tr><td>Parameter set B active</td></tr>
<tr><td>Current above alarm threshold AL1</td></tr>
<tr><td>Current above alarm threshold AL2</td></tr>
<tr><td>Overload pre-alarm PAL</td></tr>
<tr><td>Ground-fault alarm</td></tr>
</table>

IOM230 digital input/output module



(1) CubicleBUS² connection

(2) Power supply connection

(3) Outputs

(4) Inputs

(5) LEDs OUT0 to OUT2

(6) LEDs IN0 and IN1

(7) Module selection switch for setting the module number 1 to 5

(8) CUB LED (CubicleBUS²)

(9) ACT LED (Active)

The IOM230 digital input/output module can be mounted on a DIN rail or on the secondary disconnect terminal system of the circuit breaker.

The IOM230 module features:

- Two digital inputs
- Three digital outputs

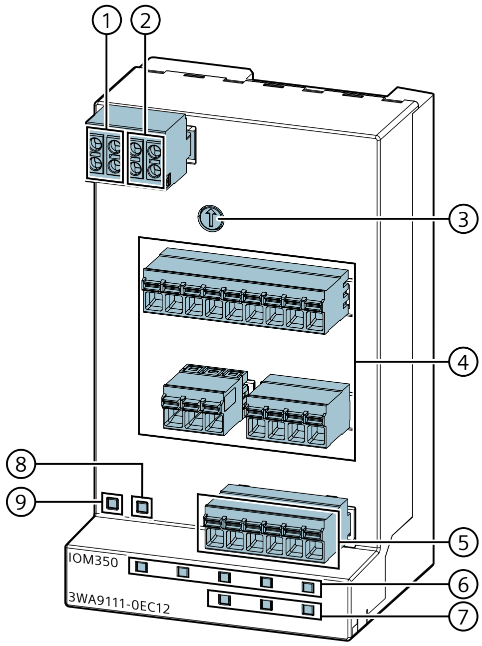
Active outputs are indicated by LEDs OUT0 to OUT2 and active inputs by IN0 and IN1.

The ACT (Active) LED indicates whether the module is ready and the CUB (CubicleBUS²) LED indicates whether communication is taking place via the CubicleBUS².

LED	Meaning	Description
ACT		
	On	Normal operation
	Off	Module without power supply
	Flashing	Restricted operating mode
CUB		
	On	CubicleBUS² communication normal
	Off	No active CubicleBUS² nodes
ACT + CUB		
	Flashing	Identification is active

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109792559).

IOM350 digital input/output module



(1)	CubicleBUS² connection	(6)	LEDs OUT0 ... OUT4
(2)	Power supply connection	(7)	LEDs IN0 ... IN2
(3)	Module selection switch for setting the module number 1 to 5	(8)	LED CUB (CubicleBUS²)
(4)	Outputs	(9)	ACT LED (Active)
(5)	Inputs		

The IOM350 digital input/output module features:

- Three digital inputs
- Five digital outputs

Active outputs are indicated by LEDs OUT0 to OUT4 and active inputs by IN0 and IN2.

The ACT (Active) LED indicates whether the module is ready and the CUB (CubicleBUS²) LED indicates whether communication is taking place via the CubicleBUS².

LED	Meaning	Description
ACT		
	On	Normal operation
	Off	Module without power supply
	Flashing	Restricted operating mode
CUB		
	On	CubicleBUS² communication normal

LED	Meaning	Description
	Off	No active CubicleBUS² nodes
	On	Protocol error detected on CubicleBUS².
	Flashing	Another CubicleBUS² node with the same node address was detected.
ACT + CUB		
	Flashing	Identification is active

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109816036).

4.3.5.2 Technical specifications

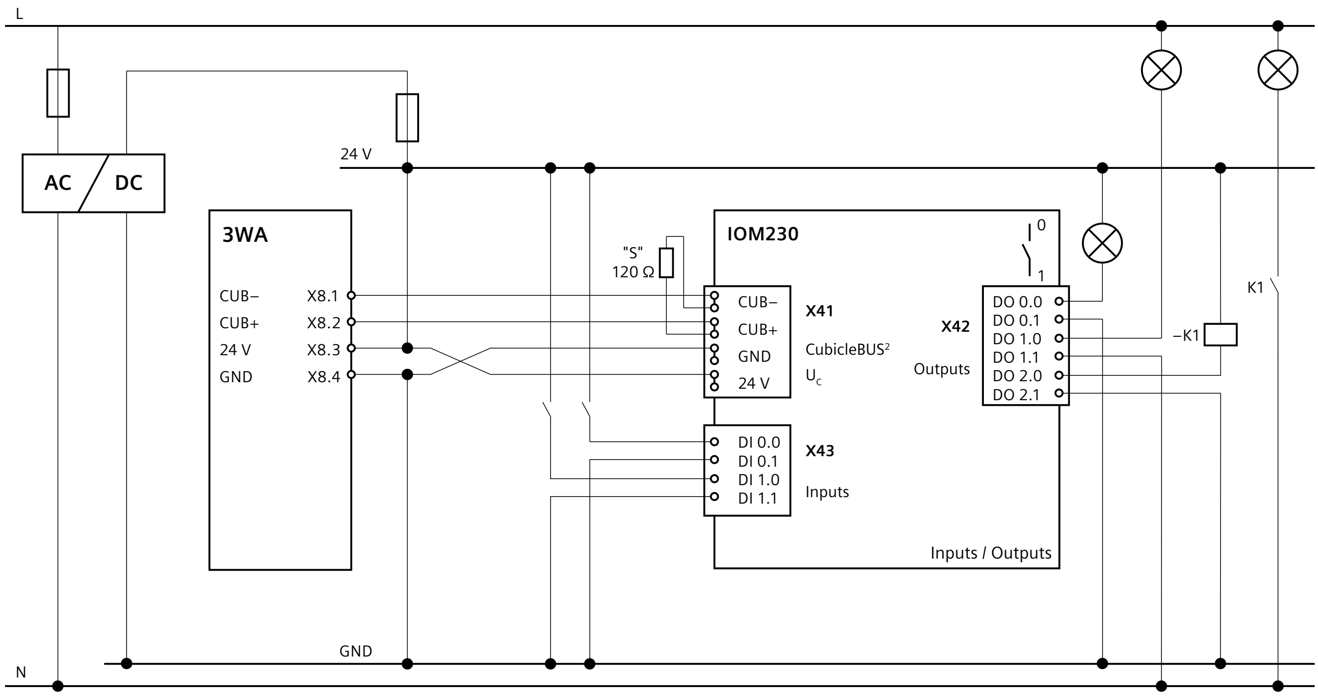
Technical specifications and connection IOM230

Rated control supply voltage U_S	24 V DC ± 20%
Rated power dissipation	1.25 W
Current consumption	51 mA
Suitability for use	Installation in stationary power distribution equipment within closed rooms
Max. number of modules on CubicleBUS²	5
Type of mounting	Mounted on circuit breaker
	DIN rail 35 mm
Mounting position	Vertical or horizontal
Width	72 mm
Height	41 mm
Depth	49 mm
	52 mm with DIN-rail adapter from top edge of DIN rail
Weight (without terminals)	72 g
Degree of protection acc. to IEC 60529	IP20
Digital input IN	
Number	2
Rated voltage	24 V DC
Operating range	± 20%
SELV/PELV	Suitable
Voltage value for reliable detection of a "1" signal	15 V DC
Current consumption at signal voltage of > 15 V DC	< 10 mA
Minimum signal duration	100 ms
Digital output OUT	
Number of semiconductor outputs	3
Contact	Normally open contact

Make/break time	10 ms
Pulse mode	Suitable
SELV/PELV	Suitable
Max. continuous current at 1 output active	2 A at 24 V DC
	0.2 A at 250 V AC
Max. continuous current active at all outputs	0.6 A at 24 V DC
	0.06 A at 250 V AC
Max. switching voltage	30 V DC
	277 V AC
Max. switching current	3 A at 30 V DC
	5 A at 277 V AC resistive
Max. breaking capacity (resistive)	90 W at 30 V DC
	1.385 VA at 277 V AC
Switching frequency	500,000 cycles at 1 A, 250 V AC, ohmic load
Connectable conductor cross-sections (X42, X43)	
Design of electrical connection	Removable / push-in connection terminal
Solid	0.2 ... 1.5 mm^2
Finely stranded / with end sleeve	0.25 ... 1.5 mm^2
Finely stranded	0.2 ... 2.5 mm^2
For solid AWG cable	AWG 24 ... AWG 16
Electromagnetic compatibility	
Conducted or radiated emissions	EN 60947-1
	EN 60947-2 (CISPR 11 (Group 1, Class B))
	FCC Class A
	Shipbuilding requirements
Immunity in industrial environment	EN 60947-1
	EN 60947-2
	Shipbuilding requirements
Ambient conditions	
Operation	–40 ... +70 °C
Transport and storage	–40 ... +80 °C
Degree of pollution	3

- The digital inputs are designed for a control supply voltage of 24 V DC.
  No polarity is specified at the DI x.0 and DI x.1 input terminals. Both inputs are isolated and can be fed from independent sources.
- The three outputs of the digital input/output module IOM230 are normally open contacts (NO).
  If the power to be switched exceeds the breaking capacity of the output, a suitable coupling relay must be used.

The following circuit diagram shows the integration of the digital input/output module IOM230 into a control and signaling system. Depending on the load, a coupling relay must be used at the output.



Chapter The bus system (Page 131) describes the connection of the module at the CubicleBUS².

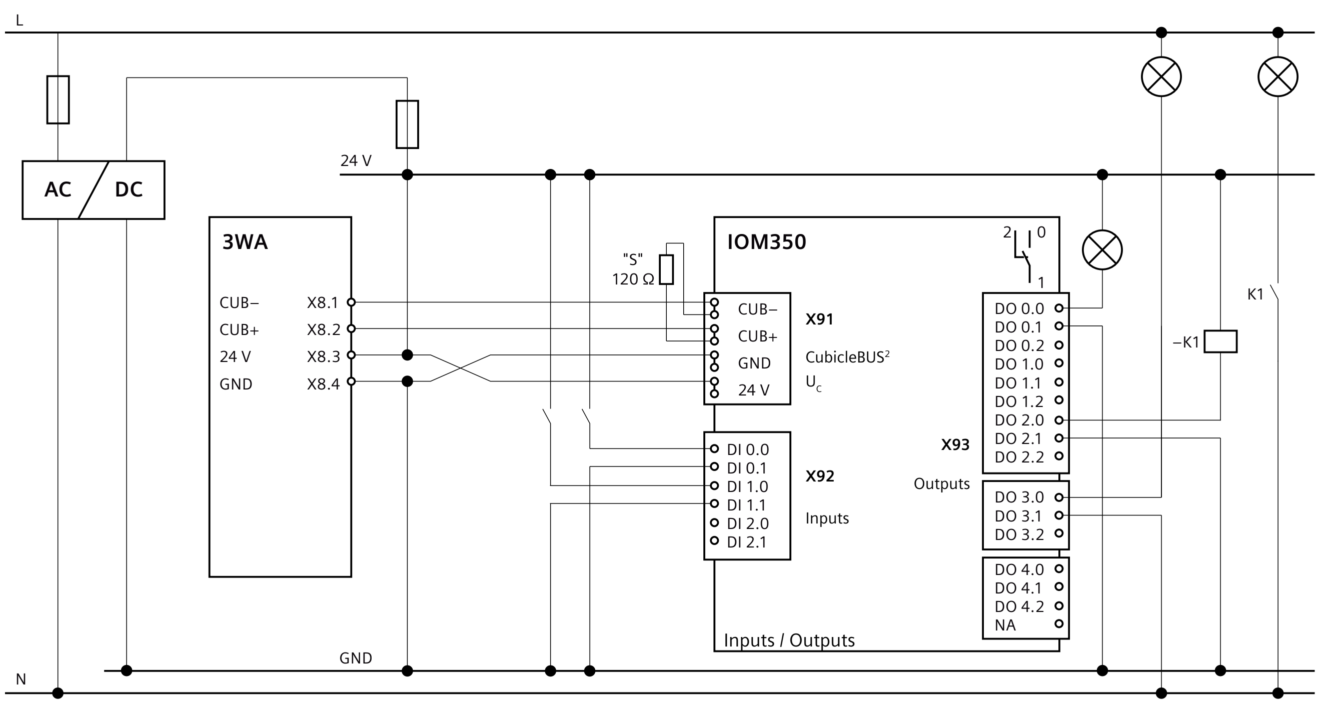
Technical specifications and connection IOM350

Rated control supply voltage US	24 V DC ± 20%
Power consumption	1.25 W
Current consumption	52 mA if no relay is energized
	120 mA if all five relays are energized
Max. number of modules on CubicleBUS²	5
Suitability for use	Installation in stationary power distribution equipment within closed rooms
Type of mounting	DIN rail 35 mm
Mounting position	Vertical or horizontal
Width	120 mm
Height	72 mm
Depth	52 mm From the top edge of the DIN rail
Weight (without terminals)	186 g
Degree of protection acc. to IEC 60529	IP20
Digital input IN	
Number	3
Rated voltage	24 V DC
Operating range	± 20%
SELV/PELV	Suitable

Voltage value for reliable detection of a "1" signal	15 V DC
Current consumption at signal voltage of > 15 V DC	< 10 mA
Minimum signal duration	100 ms
Digital output OUT	
Number of relay outputs	5
Contact	Changeover contact
Make/break time	10 ms
Pulse mode	Suitable
SELV/PELV	Suitable
Max. continuous current at 1 output active	5 A at 24 V DC
	10 A at 250 V AC
Max. continuous current active at all outputs	2 A at 24 V DC
	2 A at 250 V AC
Max. switching voltage	300 V DC
	300 V AC
Max. switching current	7 A at 30 V DC
	0.25 A at 300 V DC
	10 A at 250 V AC resistive
Max. breaking capacity (resistive)	210 W at 30 V DC
	75 W at 300 V DC
	4000 VA at 250 V AC
Switching frequency	350,000 cycles at 10 A, 250 V AC, ohmic load
Connectable conductor cross-sections (X92, X93)	
Design of electrical connection	Removable / push-in connection terminal
Solid	0.2 ... 1.5 mm2
Finely stranded / with end sleeve	0.25 ... 1.5 mm2
Finely stranded	0.2 ... 2.5 mm2
For solid AWG cable	AWG 24 ... AWG 16
Electromagnetic compatibility	
Conducted or radiated emissions	EN 60947-1
	EN 60947-2 (CISPR 11 (Group 1, Class B))
	FCC Class A
	Shipbuilding requirements
Immunity in industrial environment	EN 60947-1
	EN 60947-2
	Shipbuilding requirements
Ambient conditions	
Operation	–40 ... +70 °C
Transport and storage	–40 ... +80 °C
Degree of pollution	3

- The digital inputs are designed for a control supply voltage of 24 V DC.
  No polarity is specified at the DI x.0 and DI x.1 input terminals. All three inputs are isolated and can be fed from independent sources.
- The five outputs of the digital input/output module IOM350 are changeover contacts (CO). If the power to be switched exceeds the breaking capacity of the output, a suitable coupling relay must be used.

The following circuit diagram shows the integration of the IOM350 digital input/output module into a control and signaling system. Depending on the load, a coupling relay must be used at the output.



Chapter The bus system (Page 131) describes the connection of the module at the CubicleBUS².

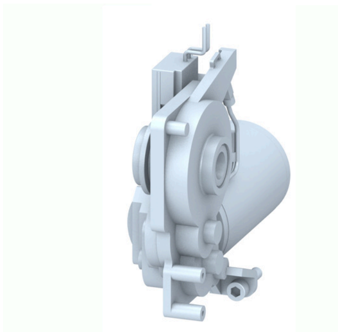
4.3.5.3 Article number

Digital input/output module	Article number
IOM230 digital input/output module	3WA9111-0EC11
IOM350 digital input/output module	3WA9111-0EC12

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EC1*).

4.3.6 Spring charging motor

4.3.6.1 Description



The spring charging motor (M) automatically charges the stored energy mechanism as soon as it is discharged (e.g. after the closing operation). This makes fast reclosing of the circuit breaker possible. When the charging operation is complete, the spring charging motor switches off.

Note

If the circuit breaker is not connected to the power supply, the stored energy mechanism must be charged manually using the charging handle.

The spring charging motor is supplied factory-fitted with the spring charge signaling switch, which indicates the charging state of the stored energy mechanism. If the spring charging motor is retrofit, the spring charge signaling switch can be ordered separately. You can find details of the spring charge signaling switch in Chapter Spring charge signaling switch (Page 257).

The automatic charging operation can be prevented by the motor disconnect switch as an option, see Chapter Motor disconnect switch (Page 247). The motor disconnect switch is an optional accessory and can be retrofit.

The spring charging motor has no effect on the service life or operating cycles of the circuit breaker.

It can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783664).

4.3.6.2 Technical specifications

Rated control supply voltage U_S	24 V DC	
	30 V DC	
	48 V DC	
	60 V DC	
	110 ... 125 V DC / 110 ... 127 V AC	
	220 ... 250 V DC / 208 ... 240 V AC	
Operating range (acc. to IEC 60947-2)	85 ... 110% U_S	
Extended operating range for battery operation	85 ... 126% U_S	
Closing power	135 W AC / 135 VA DC	
Continuous power	135 W AC / 135 VA DC	
Charging time at 100% U_S	≤ 10 s	
Fuse protection of the control circuit at U_S spring charging motor		
Fuse gG	24 ... 30 V DC	6 A
	48 ... 60 V DC	
	110 ... 125 V DC	2 A
	220 ... 250 V DC	
	110 ... 127 V AC	
	208 ... 240 V AC	
Miniature circuit breaker with C characteristic	24 ... 30 V DC	6 A
	48 ... 60 V DC	
	110 ... 125 V DC	2 A
	220 ... 250 V DC	
	110 ... 127 V AC	
	208 ... 240 V AC	

If the spring charging motor and the closing coil are supplied by the same control circuit, the values in the corresponding tables in Chapter Technical specifications (Page 226) apply.

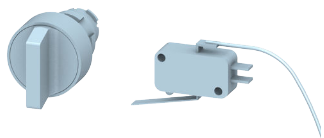
4.3.6.3 Article number

Spring charging motor	Article number
24 ... 30 V DC	3WA9111-0AF02
48 ... 60 V DC	3WA9111-0AF04
110 ... 127 V AC / 110 ... 125 V DC	3WA9111-0AF05
208 ... 240 V AC / 220 ... 250 V DC	3WA9111-0AF06

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AF0*).

4.3.7 Motor disconnect switch

4.3.7.1 Description



The motor disconnect switch prevents automatic charging of the stored energy mechanism by the spring charging motor, see Chapter Spring charging motor (Page 245).

It is activated and deactivated by means of an actuator on the operator panel.

Note

The motor disconnect switch and the local electric close are mounted in the same location. It is **not** possible to use these accessories simultaneously.

The motor disconnect switch can be retrofit.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783677).

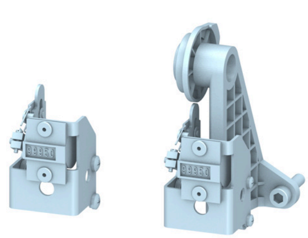
4.3.7.2 Article number

	Z-option	Article number
Motor disconnect switch	C24	3WA9111-0AH24

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH24).

4.3.8 Mechanical operating cycles counter

4.3.8.1 Description



The operating cycles counter shows the number of operating cycles which the circuit breaker has performed directly on the operator panel.

It is available in two versions:

- Mechanical operating cycles counter for circuit breakers with manual operating mechanism
- Mechanical operating cycles counter for circuit breakers with spring charging motor

The number of operating cycles performed influences the frequency of maintenance. The operating cycles counter therefore provides an important basis for helping to determine when maintenance is necessary.

The operating cycles counter can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783665).

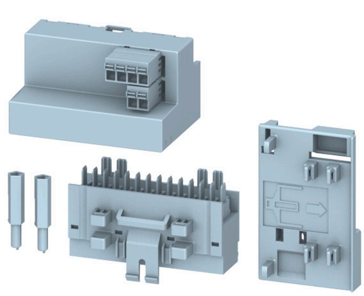
4.3.8.2 Article number

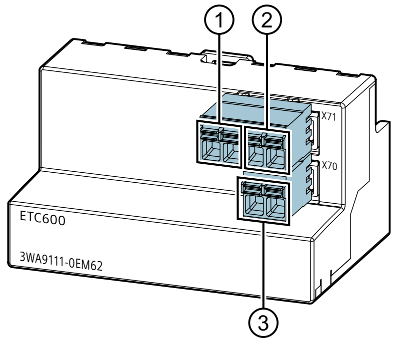
Mechanical operating cycles counter	Article number
For circuit breakers without spring charging motor	3WA9111-0AH04
For circuit breakers with spring charging motor	3WA9111-0AH05

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH0*).

4.3.9 External Trip Controller ETC600

4.3.9.1 Description



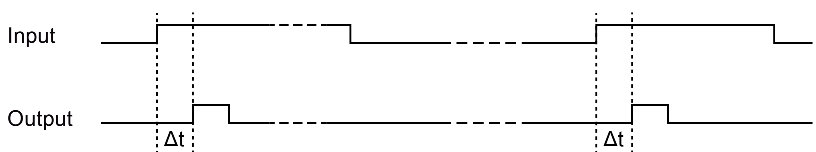


(1) Connection for control voltage signal 24 V DC

(2) Connection for second tripping solenoid (F6)

(3) Connection for control voltage signal 110 V AC to 240 V AC

External Trip Controller ETC600 actuates the second tripping solenoid. It can be operated with an input voltage of 24 V DC or 110 V AC to 240 V AC. When the input voltage pulse is applied, External Trip Controller ETC600 makes the control voltage for the second tripping solenoid available at its output after a brief delay Δt.



External Trip Controller ETC600 is equipped with a protection circuit for protecting the second tripping solenoid F6. A voltage can only be made available at the output with a new input pulse after the input voltage has been removed.

Note

Connection and tripping of the second tripping solenoid F6 are not monitored by External Trip Controller ETC600.

The trip controller is mounted on the secondary disconnect terminal or on a DIN rail using an adapter. Both adapters are included in the scope of supply.

For more information on mounting, see Chapter Mounting adapter for CubicleBUS² modules (Page 356).

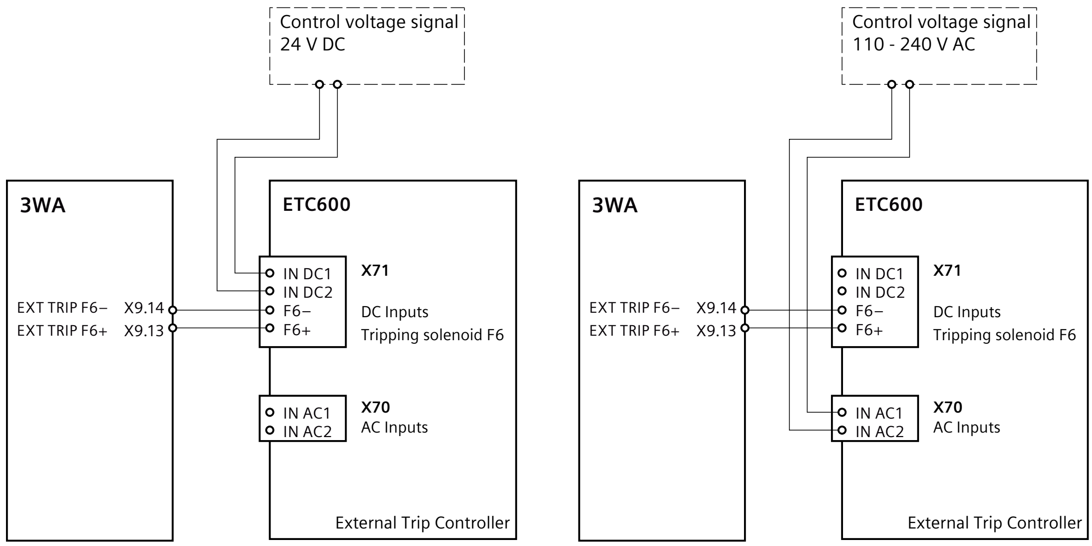
For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109794195).

4.3.9.2 Technical specifications and connection

Dimensions and weights	
Suitability for use	Installation in stationary power distribution equipment within closed rooms
Type of mounting	Mounted on circuit breaker
	DIN rail 35 mm

Mounting position	Vertical
	Horizontal
Width	72 mm
Height	41 mm
Depth	49 mm
	52 mm with DIN-rail adapter from top edge of DIN rail
Weight	72 g
Supply	
Input voltage	24 V DC
	110 ... 240 V AC
Current consumption	100 mA at 24 V DC for 100 ms 20 mA at 230 V AC for 100 ms Current peaks (inrush) < 1 A for 100 μs possible After 100 ms < 10 mA
Required pulse length of input voltage	100 ms
Recommended pulse length of input voltage	200 ms ... 5 s
Reset time	Min. 5 s
Delay Δt of output pulse	Max. 50 ms
Maximum number of control cycles per hour	60
Connection elements and terminals	
Design of electrical connection	Removable/push-in connection terminal
Connectable conductor cross-sections	Solid: 1.5 mm^2
	Finely stranded / with end sleeve 0.75 mm^2
	For solid AWG cable 1 x AWG16, 2 x AWG 19/20
Electromagnetic compatibility	
Conducted or radiated emissions	EN 60947-1
	EN 60947-2 (CISPR 11 (Group 1, Class B))
	FCC Class A
	Shipbuilding requirements
Immunity in industrial environment	EN 60947-1
	EN 60947-2
	Shipbuilding requirements
Ambient conditions	
Operation	–40 ... +70 °C
Transport and storage	–40 ... +80 °C
Degree of pollution	3
Degree of protection	
Degree of protection acc. to IEC 60529	IP20

The following circuit diagram shows the connection of the control signal with an input voltage of 24 V DC (left side) and 110 V AC to 240 V AC (right side) to the ETC600 and the connection of the ETC600 to the circuit breaker.



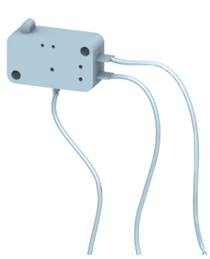
4.3.9.3 Article number

	Article number
External Trip Controller ETC600	3WA9111-0EM62

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EM62).

4.3.10 Second tripping solenoid with reclosing lockout

4.3.10.1 Description



Tripping solenoid F6 enables remote opening with lockout of the circuit breaker with the ETU600. It is equipped with a mechanical reclosing lockout that operates independently of the electronic trip unit.

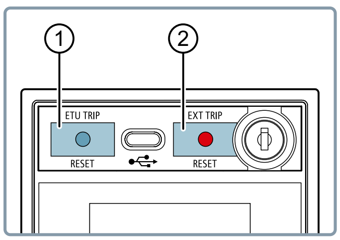
The 3WA circuit breaker, in frame sizes 2 and 3, can be integrated into a redundant protective control using tripping solenoid F6.

Tripping solenoid F6 is connected to secondary disconnect terminals X9.13 and X9.14.

Note

External Trip Controller ETC600 is also required for actuating tripping solenoid F6, see Chapter External Trip Controller ETC600 (Page 248).

The optical EXT TRIP tripped indicator on the operator panel and the signaling switch S26 signal the tripping of the circuit breaker by tripping solenoid F6.



① ETU TRIP: Tripping by electronic trip unit
② EXT TRIP: Tripping by tripping solenoid F6

The mechanical reclosing lockout is reset by pressing the reset plunger back into the enclosure at the EXT TRIP tripped indicator.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109794194).

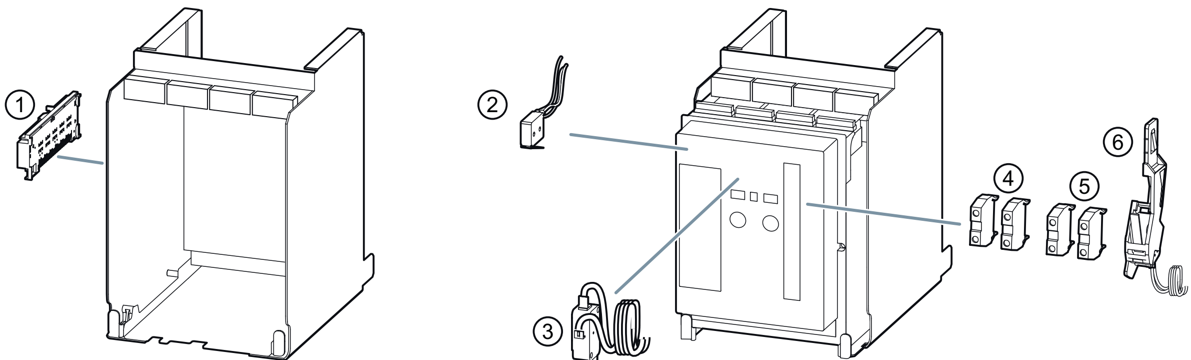
4.3.10.2 Article number

	Article number
Second tripping solenoid F6	3WA9111-0EM61

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EM61).

4.4 Accessory auxiliary switches and signaling switches

4.4.1 Overview



(1) Position signaling switch module (PSS/PSS COM) for the guide frame (S30 to S35, S48, S49)

(2) Second trip alarm switch (S25)

(3) Ready-to-close signaling switch (S20)

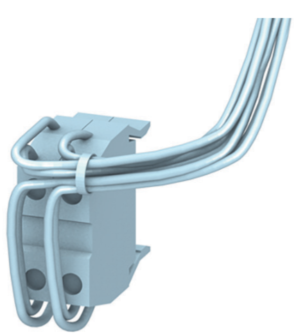
(4) First auxiliary switch block (S1, S2)

(5) Second auxiliary switch block (S3/S4, S7/S8)

(6) Spring charge signaling switch (S21)

4.4.2 Auxiliary switches S1 to S8

4.4.2.1 Description



The auxiliary switches (AUX) signal the open or closed position of the circuit breaker.

A maximum total of four auxiliary switches S1 to S4 with two contacts each can be installed.

The circuit breakers can be equipped with the following optional auxiliary switches at the factory:

- Two auxiliary switches: S1 and S2 (two NO contacts and two NC contacts)
- Four auxiliary switches: S1 to S4 (four NO contacts and four NC contacts)

If only two auxiliary switches are installed at the factory, two auxiliary switches with a maximum of four contacts can be retrofit by the customer. The following auxiliary switch combinations are available for this case:

- Two NO contacts and two NC contacts (S3, S4)
- Two NO contacts (S7)
- One NO contact and one NC contact (S8)

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783675).

4.4.2.2 Technical specifications

Type	NO contact or NC contact	
Contact reliability from [1]	1 mA at 5 V DC	
Rated insulation voltage U_i	500 V DC / 500 V AC 50/60 Hz	
Rated impulse withstand voltage U_{imp}	4 kV	
Rated operational current I_e		
With breaking capacity DC12	24 V	10 A
	30 V	4 A
	48 V	2.5 A
	60 V	1 A
	110 V	0.4 A
	220 / 240 V	0.2 A
With breaking capacity DC13	24 V	3 A
	30 V	2.5 A
	48 V	1 A
	60 V	0.4 A
	110 V	0.2 A
	220 / 240 V	0.1 A
With breaking capacity AC12	≤ 440 V AC	10 A
With breaking capacity AC13	< 220 V	8 A
	220 ... 240 V	4 A
	320 ... 440 V	3 A

[1] To ensure contact reliability at 1 mA, the contacts are gold-plated. If 1 mA is exceeded, the gold-plating is eroded. As a consequence, contact reliability at 1 mA can no longer be ensured.

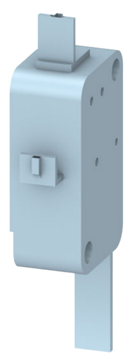
4.4.2.3 Article number

Auxiliary switches S1 to S8	Article number
2 NO contacts and 2 NC contacts (S3, S4)	3WA9111-0AG01
2 NO contacts (S7)	3WA9111-0AG02
1 NO contact and 1 NC contact (S8)	3WA9111-0AG03

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AG0*).

4.4.3 Ready-to-close signaling switch

4.4.3.1 Description



Ready-to-close signaling switch S20 with the signaling contact for the ready-to-close (RTC) status signals whether the circuit breaker is ready to close.

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

- Circuit breaker must be OPEN
- Stored energy mechanism charged
- Shunt trip not energized
- Mechanical reclosing lockout reset
- Undervoltage release energized
- Other external interlocks and locks reset

The ready-to-close signaling switch is included in the scope of supply of the circuit breaker.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109812891).

4.4.3.2 Technical specifications

Type	NO contact	
Contact reliability from [1)]	1 mA at 5 V DC	
Rated insulation voltage U_i	250 V DC / 250 V AC	
Rated operational current I_e		
With breaking capacity DC12	24 V	5 A
	30 V	2.5 A
	48 V	2.5 A
	60 V	0.4 A
	110 / 127 V	0.4 A
	220 / 240 V	0.2 A
With breaking capacity DC13	24 V	2.5 A
	30 V	1 A
	48 V	1 A
	60 V	0.22 A
	110 / 127 V	0.22 A
	220 / 240 V	0.1 A
With breaking capacity AC12	≤ 240 V AC	6 A
With breaking capacity AC13	110 ... 127 V	5 A
	220 ... 240 V	4 A

1) To ensure contact reliability at 1 mA, the contacts are gold-plated. If 1 mA is exceeded, the gold-plating is eroded. As a consequence, contact reliability at 1 mA can no longer be ensured.

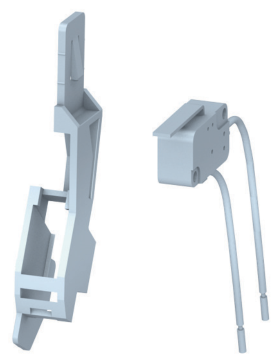
4.4.3.3 Article number

	Article number
Ready-to-close signaling switch S20	3WA9111-0AH01

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH01).

4.4.4 Spring charge signaling switch

4.4.4.1 Description



Spring charge signaling switch S21 signals whether the stored energy mechanism of the circuit breaker is charged. It is typically used in combination with the spring charging motor.

Note

If the spring charging motor is installed at the factory, the spring charge signaling switch is present as standard. If the spring charging motor is retrofit, the switch must be ordered separately if it is required.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783662).

4.4.4.2 Technical specifications

Type	NO contact	
Contact reliability from [1)]	1 mA at 5 V DC	
Rated insulation voltage U_i	250 V DC / 250 V AC 50/60 Hz	
Rated operational current I_e		
With breaking capacity DC12	24 V	5 A
	30 V	2.5 A
	48 V	2.5 A
	60 V	0.4 A
	110 / 127 V	0.4 A
	220 / 240 V	0.2 A

With breaking capacity DC13	24 V	2.5 A
	30 V	1 A
	48 V	1 A
	60 V	0.22 A
	110 / 127 V	0.22 A
	220 / 240 V	0.1 A
With breaking capacity AC12	≤ 240 V AC	6 A
With breaking capacity AC13	110 ... 127 V	5 A
	220 ... 240 V	4 A

1) To ensure contact reliability at 1 mA, the contacts are gold-plated. If 1 mA is exceeded, the gold-plating is eroded. As a consequence, contact reliability at 1 mA can no longer be ensured.

4.4.4.3 Article number

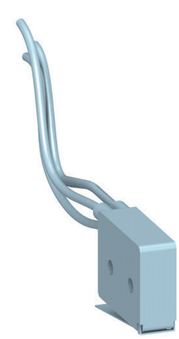
	Article number
Spring charge signaling switch S21	3WA9111-0AH06

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH06).

4.4.5 Trip alarm switch

4.4.5.1 Description

Trip alarm switch S24



Trip alarm switch S25

Trip alarm switches (TAS) S24 and S25 signal every tripping of the circuit breaker by the electronic trip unit ETU.

The first trip alarm switch S24 is always included in the scope of supply of the circuit breaker. The second trip alarm switch S25 can be retrofit.

Note

The trip alarm switches cannot be used in non-automatic circuit breakers.

For more information, refer to the operating instructions on the internet:

- Operating Instructions for trip alarm switch S24 (https://support.industry.siemens.com/cs/ww/en/view/109812892)
- Operating Instructions for trip alarm switch S25 (https://support.industry.siemens.com/cs/ww/en/view/109783658)

4.4.5.2 Technical specifications

First trip alarm switch S24	Changeover contact	
Second trip alarm switch S25	NO contact	
Contact reliability from [1)]	1 mA at 5 V DC	
Rated insulation voltage U_i	250 V DC / 250 V AC 50/60 Hz	
Rated operational current I_e		
With breaking capacity DC12	24 V	5 A
	30 V	2.5 A
	48 V	2.5 A
	60 V	0.4 A
	110 / 127 V	0.4 A
	220 / 240 V	0.2 A
With breaking capacity DC13	24 V	2.5 A
	30 V	1 A
	48 V	1 A
	60 V	0.2 A
	110 / 127 V	0.2 A
	220 / 240 V	0.1 A
With breaking capacity AC12	≤ 240 V AC	6 A
With breaking capacity AC13	110 ... 127 V	5 A
	220 ... 240 V	4 A

[1)] To ensure contact reliability at 1 mA, the contacts are gold-plated. If 1 mA is exceeded, the gold-plating is eroded. As a consequence, contact reliability at 1 mA can no longer be ensured.

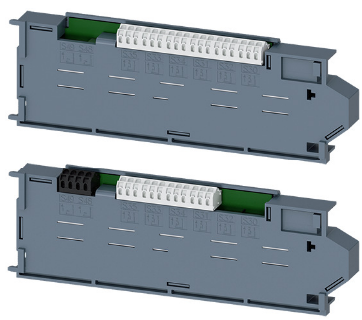
4.4.5.3 Article number

Trip alarm switch	Z option	Article number
Trip alarm switch S24	--	3WA9111-0AH02
Second trip alarm switch S25	K06	3WA9111-0AH03

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH0*).

4.4.6 Position signaling switch module for guide frame

4.4.6.1 Description



The position signaling switch modules (PSS and PSS COM) basically signal the current position of the 3WA circuit breaker in the guide frame:

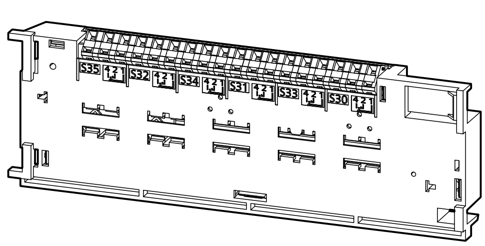
- CONNECT: Connected position
- TEST: Test position (main connections disconnected, auxiliary contacts connected)
- DISCONNECT: Disconnected position (main connections disconnected, auxiliary contacts disconnected)
- ABSENT: Circuit breaker is not present in the guide frame, only for the PSS COM version

One PSS and one PSS COM signaling switch can be used at a time. They can be ordered from the factory preassembled or can be retrofit by the customer.

The position signaling switches are available in the following versions:

- PSS321 and PSS600 position signaling switch modules
- PSS111 COM and PSS400 COM position signaling switch modules (for communication-capable circuit breakers)

PSS321 and PSS600 position signaling switch modules

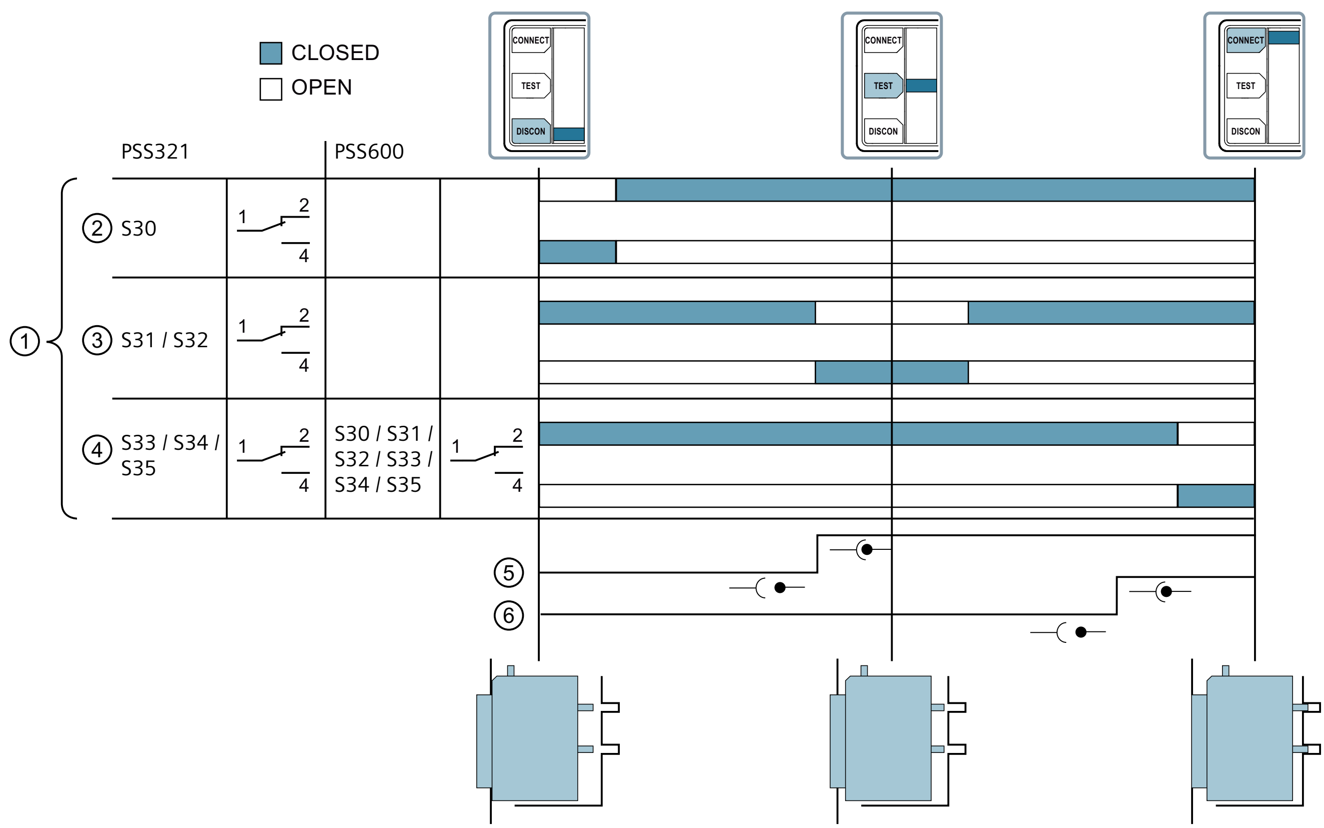


The following signaling switches are available in the PSS position signaling switch module:

PSS321 signaling switch	PSS600 signaling switch
• 3 x connected position S33, S34, S35 • 2 x test position S31, S32 • 1 x disconnected position S30	• 6 x connected position S30, S31, S32, S33, S34, S35

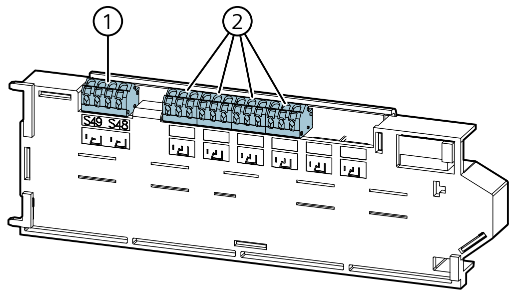
The signaling contacts of the PSS position signaling switch module take the form of changeover contacts.

The graphic below shows the signal diagram of the PSS321 and PSS600 position signaling switch modules:



(1) Position signaling switch module signal
(2) Disconnected position
(3) Test position
(4) Connected position
(5) Auxiliary circuit
(6) Main circuits

PSS111 COM and PSS400 COM position signaling switch modules



(1) Signaling switches for connection to communications module A

(2) Signaling switches for conventional method of connection

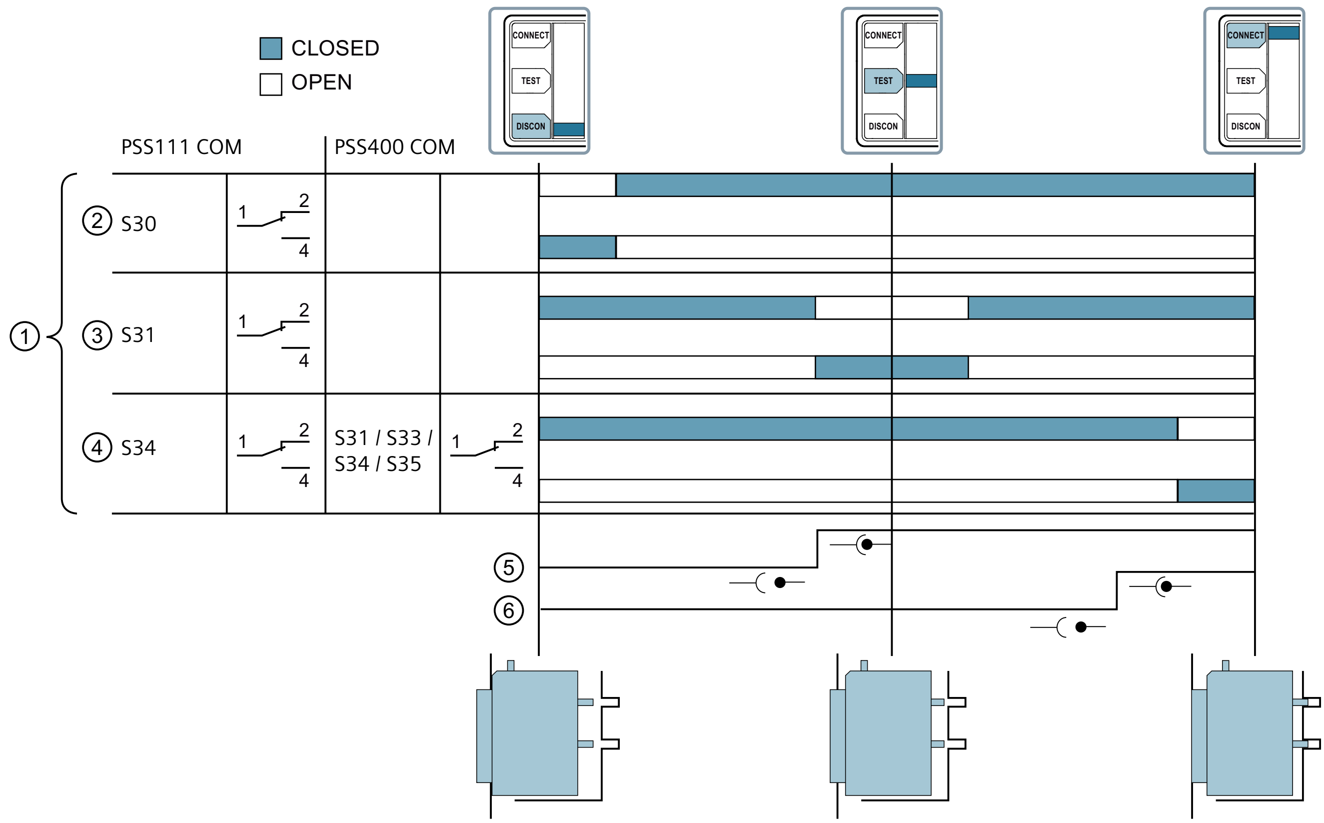
The following signaling switches are available in the PSS COM position signaling switch module:

PSS111 COM signaling switch	PSS400 COM signaling switch
• 1 x connected position S34 • 1 x test position S31 • 1 x disconnected position S30 • Two signaling switches for connection to communications module A – DISC: Disconnected position (DISCONNECT) S48 – ABS: No circuit breaker in the guide frame (ABSENT) S49	• 4 x connected position S31, S33, S34, S35 • Two signaling switches for connection to communications module A – DISC: Disconnected position (DISCONNECT) S48 – ABS: No circuit breaker in the guide frame (ABSENT) S49

The signaling contacts for the connected position, test position and disconnected position of the PSS COM position signaling switch module are designed as changeover contacts.
The DISCONNECT (ABSENT) signaling contacts are normally open contacts.

The graphic below shows the signal diagram of the PSS111 COM and PSS400 COM position signaling switch modules: [3)]

[3)] Only from 01/2023 - this accessory item will contain push-in terminals instead of spring-loaded terminals, just like the new PSS600 design. The connector for the COM connections will be omitted (also implemented as a terminal).



(1) Position signaling switch module signal
(2) Disconnected position
(3) Test position
(4) Connected position
(5) Auxiliary circuit
(6) Main circuits

Note

If a communication-capable 3WA1 circuit breaker with position signaling switch module is ordered, the PSS111 COM module is preassembled.

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783663).

4.4.6.2 Technical specifications

Type	Changeover contact (not COM)
Contact reliability from [1)]	1 mA at 5 V DC
Rated insulation voltage U_i	250 V, 50/60 Hz

Rated impulse withstand voltage U_{imp}	4 kV	
Connection type		
PSS321	Spring-loaded terminal	
PSS600	Push-in	
PSS111 COM	• COM contacts: Push-in • Other contacts: Spring-loaded terminal	
PSS400 COM	Push-in	
Cable cross-sections that can be connected by the customer		
Spring-loaded terminal	1 x 0.5 mm² (AWG 20) ... 1 x 2.5 mm² (AWG 14)	
Push-in solid	1 x 0.5 mm² (AWG 20) ... 1 x 2.5 mm² (AWG 14)	
Push-in finely stranded with end sleeve	1 x 0.5 mm² (AWG 20) ... 1 x 1.5 mm² (AWG 16)	
Fuse protection of the control circuit		
Fuse gG	6 A	
Miniature circuit breaker with C characteristic	6 A	
Rated operational current I_e		
With breaking capacity DC12	24 V	5 A
	30 V	2.5 A
	48 V	2.5 A
	60 V	0.4 A
	110 V	0.4 A
	220 / 240 V	0.2 A
With breaking capacity DC13	24 V	2.5 A
	30 V	1 A
	48 V	1 A
	60 V	0.22 A
	110 V	0.22 A
	220 / 240 V	0.1 A
With breaking capacity R300 DC	24 V	3 A
	30 V	2.5 A
	48 V	1 A
	60 V	0.4 A
	125 V	0.22 A
	250 V	0.11 A
With breaking capacity AC12	≤ 440 V AC	5 A
With breaking capacity AC13	< 220 V	5 A
	220 ... 240 V	4 A
	320 ... 440 V	3 A
With breaking capacity A300 AC	120 V	5 A
	240 V	3 A

[1] To ensure contact reliability at 1 mA, the contacts are gold-plated. If 1 mA is exceeded, the gold-plating is eroded. As a consequence, contact reliability at 1 mA can no longer be ensured.

The COM contacts (X89) may only be connected with the communications module.

4.4.6.3 Article number

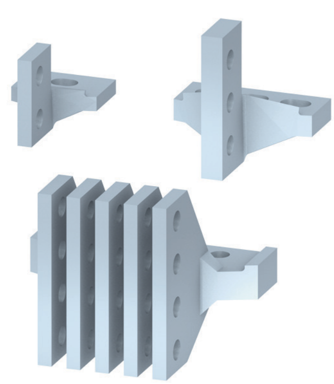
Position signaling switch module for guide frame	Article number
PSS321 3 x connected, 2 x test, 1 x disconnected position	3WA9111-0AH11
PSS600 6 x connected position	3WA9111-0AH14
PSS111 COM for connection to the communications module 1 x connected, 1 x test, 1 x disconnected position and COM (disconnected position and absent)	3WA9111-0AH12
PSS400 for connection to the communications module 4 x connected and COM (disconnected position and absent)	3WA9111-0AH13

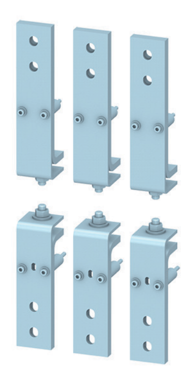
You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH1*).

4.5 Accessories for main connections

4.5.1 Main connections for fixed-mounted circuit breakers

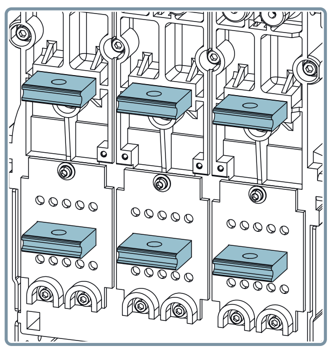
4.5.1.1 Description



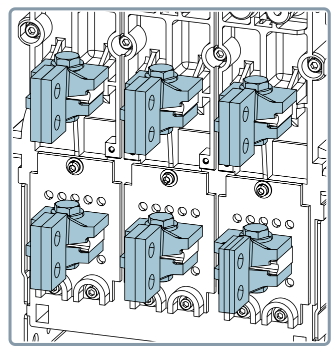


Note

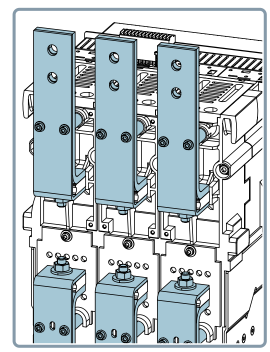
- All main connections are made of copper and the connection surfaces are tinned or silver-plated.
- Whether the different connection methods can be used depends on circuit breaker frame sizes, rated currents, and breaking capacity classes. Possible combinations are shown in the overview table in this chapter.



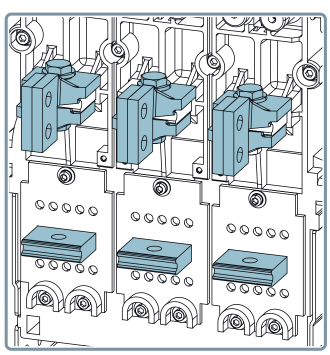
Rear horizontal



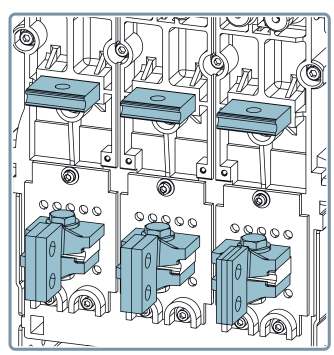
Rear vertical



Front-accessible, double hole



Vertical on top,
horizontal at the bottom



Horizontal on top,
vertical at the bottom

Main connections installed at the factory are available in the following versions:

- Rear horizontal main connection (top/bottom)
- Rear vertical main connection (top/bottom)
- Front-accessible main connections according to DIN 43673 with double hole (top/bottom)

Combinations of different connection types on the same circuit breaker are possible. The following factory-installed combinations are available:

- Rear vertical main connections on top/rear horizontal main connections at the bottom
- Rear horizontal main connections on top/rear vertical main connections at the bottom

Furthermore, main connection components supplied as accessories make it possible for the customer to combine rear vertical and front-accessible main connections.

Note

In the case of combinations of horizontal and vertical connections, the derating of the rear horizontal main circuit connection always applies. This has an inferior derating value due to the higher eddy current losses (see Chapter Derating in the power distribution equipment (Page 486)).

Rear horizontal main connection

The rear horizontal main connection is available on the circuit breakers as standard. It can be used both for the direct connection of busbars and as a basis for mounting different connection methods (e.g. vertical connections).

Rear vertical main connection

The rear vertical main connection is mounted on the rear horizontal connection and can be ordered from the factory preassembled or it can be retrofitted by the customer.

Note

In the case of frame size 2 with 4000 A, rear vertical main connections can be supplied in two versions:

- The first version does not extend beyond the mounting width of the 3WA circuit breaker/non-automatic circuit breaker.
- The second, broadened version corresponds to the connections which were used in 3WL circuit breaker frame size 2 with rated current 4000 A. This version can be installed at the factory by ordering Z option D01.

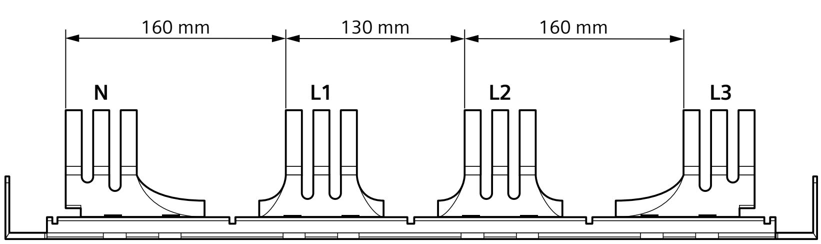
Note

Two connection options are available for 4-pole circuit breakers of frame size 2, 4000 A AC with breaking capacity classes S/M/H/E.

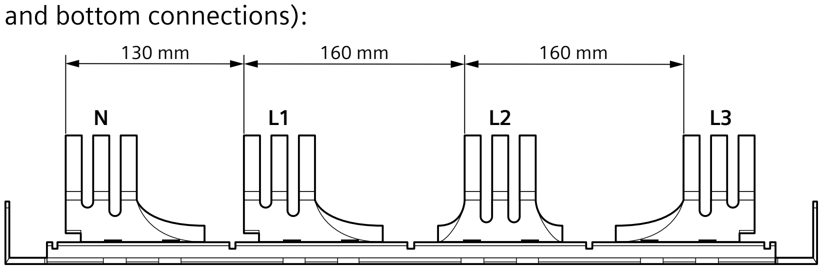
This applies to the order numbers listed below:

- Fixed-mounted circuit breakers:
  - 3WA1240-3 _ _ 11- _ _ _ _
  - 3WA1240-4 _ _ 11- _ _ _ _
  - 3WA1240-5 _ _ 11- _ _ _ _
  - 3WA1240-8 _ _ 11- _ _ _ _
- Withdrawable circuit breakers:
  - 3WA1240-3 _ _ 41- _ _ _ _
  - 3WA1240-3 _ _ 71- _ _ _ _
  - 3WA1240-4 _ _ 41- _ _ _ _
  - 3WA1240-4 _ _ 71- _ _ _ _
  - 3WA1240-5 _ _ 41- _ _ _ _
  - 3WA1240-5 _ _ 71- _ _ _ _
  - 3WA1240-8 _ _ 41- _ _ _ _
  - 3WA1240-8 _ _ 71- _ _ _ _
- Guide frame:
  - 3WA8240-3AA41- _ _ _ _
  - 3WA8240-4AA41- _ _ _ _
  - 3WA8240-5AA41- _ _ _ _
  - 3WA8240-5AA41- _ _ _ _

1. Standard dimensions:



2. Optional dimensions, can be ordered with order number option D04 (this option includes top and bottom connections):



Front-accessible main connections according to DIN 43673 with double hole

The front-accessible main connection with double hole is mounted on the rear horizontal main connection and can be ordered from the factory preassembled or it can be retrofitted by the customer.

Overview of possible connection methods for fixed-mounted circuit breakers

3WA1 circuit breakers / non-automatic circuit breakers - frame size 1							
Short-circuit breaking capacity $I_{cu} = I_{cs}$	**Short-circuit breaking capacity class**	**I_n [A]**	**Vertical**	**Horizontal**	**Front**	**vertical on top / horizontal at the bottom**	**horizontal on top / vertical at the bottom**
55 kA @ 500 V AC	N	630	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓
		2500	✓	✓	--	✓	✓
66 kA @ 500 V AC	S	630	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓
		2500	✓	✓	--	✓	✓
85 kA @ 500 V AC	M	630	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓
		2500	✓	✓	--	✓	✓
85 kA @ 690 V AC 50 kA @ 1000 V AC	E	630	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓
		2500	✓	✓	--	✓	✓

3WA1 circuit breakers / non-automatic circuit breakers - frame size 2							
Short-circuit breaking capacity $I_{cu} = I_{cs}$	**Short-circuit breaking capacity class**	**I_n [A]**	**Vertical**	**Horizontal**	**Front**	**vertical on top / horizontal at the bottom**	**horizontal on top / vertical at the bottom**
66 kA @ 500 V AC	S	2000	✓	✓	✓	✓	✓
		2500	✓	✓	✓	✓	✓
		3200	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--
85 kA @ 500 V AC	M	2000	✓	✓	✓	✓	✓
		2500	✓	✓	✓	✓	✓
		3200	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--
100 kA @ 500 V AC	H	2000	✓	✓	✓	✓	✓
		2500	✓	✓	✓	✓	✓
		3200	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--
130 kA @ 500 V AC	C	2000	✓	✓	--	✓	✓
		2500	✓	✓	--	✓	✓
		3200	✓	✓	--	✓	✓
		4000	--	--	--	--	--
85 kA @ 690 V AC	E	2000	✓	✓	✓	✓	✓
85 kA @ 1000 V AC		2500	✓	✓	✓	✓	✓
50 kA @ 1150 V AC		3200	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--

3WA1 non-automatic circuit breakers for DC - frame size 2							
Short-circuit breaking capacity $I_{cu} = I_{cs}$	**Short-circuit breaking capacity class**	**I_n [A]**	**Vertical**	**Horizontal**	**Front**	**vertical on top / horizontal at the bottom**	**horizontal on top / vertical at the bottom**
25 kA @ 600 V DC	D	1000	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓
		4000	✓	✓	--	✓	✓
20 kA @ 1000 V DC	E	1000	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓
		4000			--		
20 kA @ 1500 V DC	E	1000	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓
		4000	✓	✓	--	✓	✓

3WA1 circuit breakers / non automatic circuit breakers - frame size 3							
Short-circuit breaking capacity $I_{cu} = I_{cs}$	**Short-circuit breaking capacity class**	**I_n [A]**	**Vertical**	**Horizontal**	**Front**	**vertical on top / horizontal at the bottom**	**horizontal on top / vertical at the bottom**
100 kA @ 500 V AC	H	4000	✓	✓	✓	✓	✓
		5000	✓	✓	--	✓	✓
		6300	✓	--	--	--	--
150 kA @ 500 V AC [1)]	C	4000	✓	✓	✓	✓	✓
		5000	✓	✓	--	✓	✓
		6300	✓	--	--	--	--
85 kA @ 690 V AC	E	4000	✓	✓	✓	✓	✓
85 kA @ 1000 V AC		5000	✓	✓	--	✓	✓
50 kA @ 1150 V AC		6300	✓	--	--	--	--

1) 130 kA for 4-pole circuit breakers/non-automatic circuit breakers

For more information, refer to the operating instructions available on the internet:

- Front-accessible main connections for fixed-mounted circuit breakers (https://support.industry.siemens.com/cs/ww/en/view/109783686)
- Rear vertical main connections for fixed-mounted circuit breakers (https://support.industry.siemens.com/cs/ww/en/view/109783687)

4.5.1.2 Technical specifications

You can find the dimensions of the main connections in Chapter Dimension drawings (Page 403).

4.5.1.3 Article number

Note

Each article number only includes *one* main connection, unless specified otherwise in the tables below.
The following must be ordered for the complete conversion of the top and bottom connections:

- 3-pole circuit breaker: 6 main connections, 3 on top and 3 at the bottom
- 4-pole circuit breaker: 8 main connections, 4 on top and 4 at the bottom

Rear vertical main connection		**Article number**
Top or bottom		
Size 1 [1)]	≤ 2000 A	3WA9111-0AM11
	2500 A	3WA9111-0AM12

Rear vertical main connection		Article number
Size 2	≤ 3200 A [2]	3WA9111-0AM21
	4000 A, 3-pole 1 set with 3 units	3WA9111-0AM22
	4000 A, 4-pole 1 set with 4 units	3WA9111-0AM24
	4000 A, broadened, 3-pole 1 set with 3 units Compatible with 3WL	3WA9111-0AM23
	4000 A, broadened, 4-pole 1 set with 4 units Compatible with 3WL	3WA9111-0AM25
Size 3	≤ 6300 A	3WA9111-0AM33

1) With breaking capacity N and S up to 1000 A, 1 x 3WA9111-0AM11 is required for each connection; up to 2000 A or with breaking capacity M and E, 2 x 3WA9111-0AM11 are required for each connection.

2) For breaking capacity S, M, H, E, D up to 2500 A, 1 x 3WA9111-0AM21 is required for each connection, for 3200 A or for breaking capacity C or D/E 4000 A DC, 2 x 3WA9111-0AM21 are required for each connection.

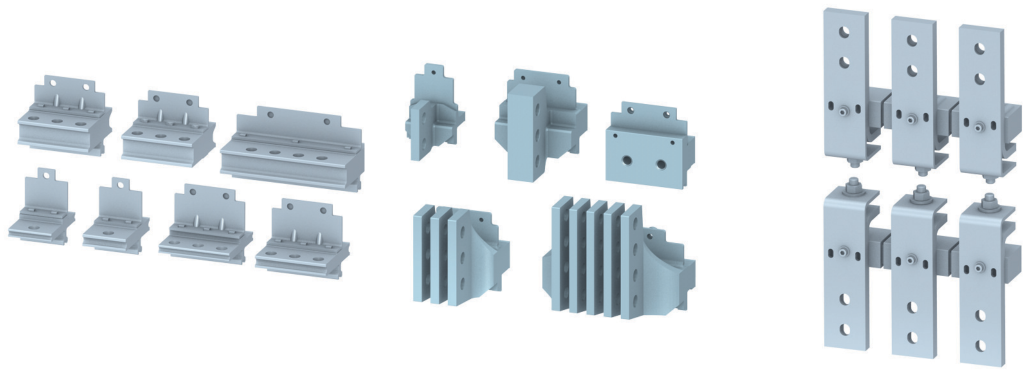
You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AM*).

Front-accessible main connections according to DIN 43673, double hole		Article number
Top		
Size 1	≤ 1000 A	3WA9111-0AL11
	1250 ... 2000 A	3WA9111-0AL12
Size 2	≤ 2000 A	3WA9111-0AL21
	2500 A	3WA9111-0AL22
	3200 A	3WA9111-0AL23
Size 3	4000 A	3WA9111-0AL31
Bottom		
Size 1	≤ 1000 A	3WA9111-0AL13
	1250 ... 2000 A	3WA9111-0AL14
Size 2	≤ 2000 A	3WA9111-0AL24
	2500 A	3WA9111-0AL25
	3200 A	3WA9111-0AL26
Size 3	4000 A	3WA9111-0AL32

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AL*).

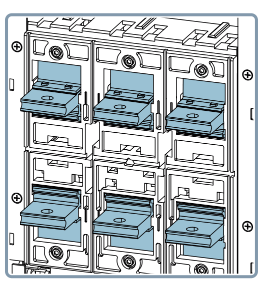
4.5.2 Main connections for withdrawable circuit breakers

4.5.2.1 Description

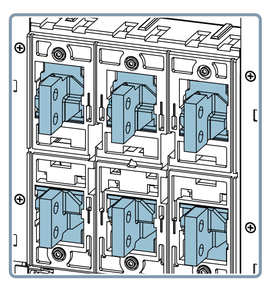


Note

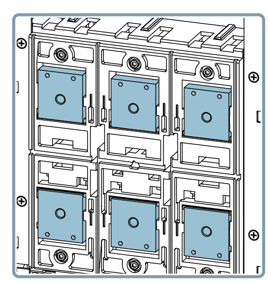
- All main connections are made of copper and the connection surfaces are tinned or silver-plated.
- Whether the different connection methods can be used depends on circuit breaker frame sizes, rated currents, and breaking capacity classes. Possible combinations are shown in the overview table in this chapter.



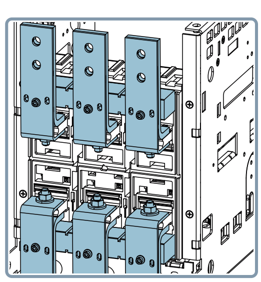
Rear horizontal



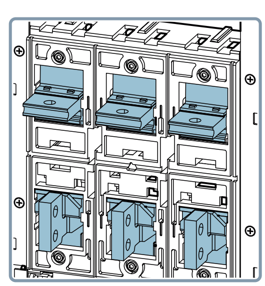
Rear vertical



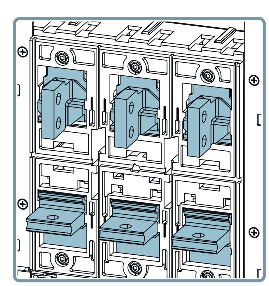
Flange



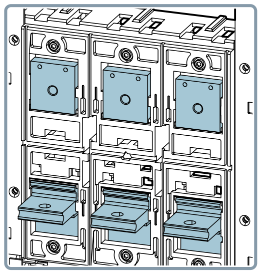
Front-accessible, double hole



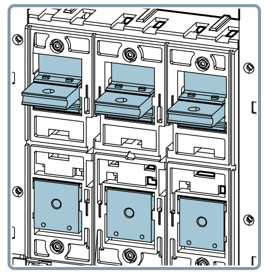
Horizontal on top, vertical at the bottom



Vertical on top, horizontal at the bottom



Flange on top,
horizontal at the bottom



Horizontal on top,
flange at the bottom

Main connections installed at the factory are available in the following versions:

- Rear horizontal main circuit connection (top / bottom)
- Rear vertical main circuit connection (top / bottom)
- Flange connection (top / bottom)
- Rear vertical on top - rear horizontal at the bottom
- Rear horizontal on top - rear vertical at the bottom
- Front-accessible main connectors according to DIN 43673 with double hole

Main connection components supplied as accessories make it possible to install other combinations or to replace main connections if the guide frame has been ordered with the incorrect main connections or if the requirements of the power distribution equipment change.

Note

Only rear vertical main connections are permitted for rated currents 2500 A in frame size 1, 4000 A in frame size 2 and 6300 A in frame size 3.

Note

In the case of combinations of horizontal and vertical connections, derating of the rear horizontal main circuit connection always applies. This has a higher derating value due to the higher eddy current losses, see Chapter Derating in the power distribution equipment (Page 486).

Rear horizontal main connection

The rear horizontal main connection makes it possible to connect connecting bars to the rear of the guide frame.

It can be pre-installed at the factory. If it is ordered as an accessory, it can retrofit by the customer to replace the originally supplied main circuit connection.

Rear vertical main connection

The rear vertical main circuit connection makes it possible to connect connecting bars to the rear of the guide frame.

It can be pre-installed at the factory. If it is ordered as an accessory, it can retrofit by the customer to replace the originally supplied main circuit connection.

Note

In the case of frame size 2 with rated current 4000 A, rear vertical main connections can be supplied in 2 versions:

- The first version has different dimensions to the connections of the 3WL air circuit breaker.
- The second, broadened version corresponds to the connections which were used in 3WL air circuit breaker frame size 2 with rated current 4000 A. This version can be installed at the factory by ordering Z option D01.

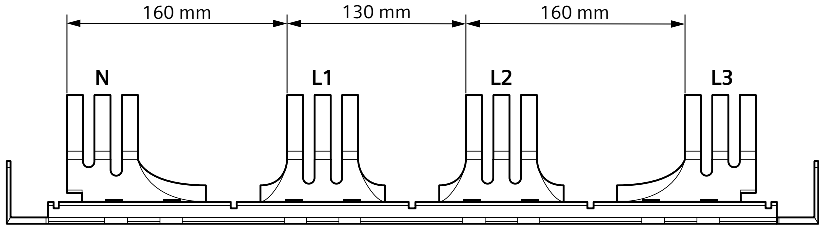
Note

Two connection options are available for 4-pole circuit breakers of frame size 2, 4000 A AC with breaking capacity classes S/M/H/E.

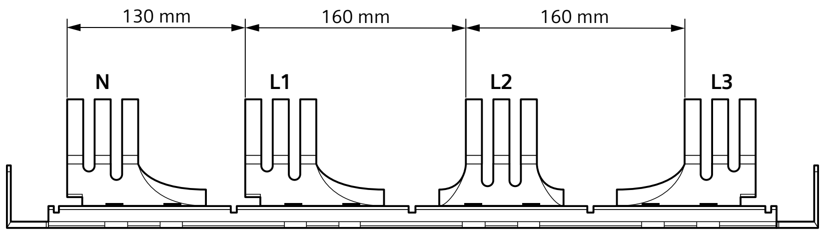
This applies to the order numbers listed below:

- Fixed-mounted circuit breakers:
  – 3WA1240-3 _ _ 11- _ _ _ _
  – 3WA1240-4 _ _ 11- _ _ _ _
  – 3WA1240-5 _ _ 11- _ _ _ _
  – 3WA1240-8 _ _ 11- _ _ _ _
- Withdrawable circuit breakers:
  – 3WA1240-3 _ _ 41- _ _ _ _
  – 3WA1240-3 _ _ 71- _ _ _ _
  – 3WA1240-4 _ _ 41- _ _ _ _
  – 3WA1240-4 _ _ 71- _ _ _ _
  – 3WA1240-5 _ _ 41- _ _ _ _
  – 3WA1240-5 _ _ 71- _ _ _ _
  – 3WA1240-8 _ _ 41- _ _ _ _
  – 3WA1240-8 _ _ 71- _ _ _ _
- Guide frame:
  – 3WA8240-3AA41- _ _ _ _
  – 3WA8240-4AA41- _ _ _ _
  – 3WA8240-5AA41- _ _ _ _
  – 3WA8240-5AA41- _ _ _ _

1. Standard dimensions:



2. Optional dimensions, can be ordered with order number option D04 (this option includes top and bottom connections):



Flange connection

The flange connection makes it possible to connect connecting bars to the rear of the guide frame.

It can be pre-installed at the factory. If it is ordered as an accessory, it can retrofit by the customer to replace the originally supplied main circuit connection.

Note

The flange connection **cannot** be used for:

- Frame size 1 with rated current 2500 A
- Frame size 2 with rated current 4000 A
- Frame size 3 with rated current 5000 A and 6300 A

Front-accessible main connections according to DIN 43673 with double hole

The front-accessible main circuit connections according to DIN 43673 with double hole make it possible to connect connecting bars to the guide frame.

It is installed on the rear horizontal main circuit connection of the guide frame and can only be ordered as an accessory for installation by the customer. It is not possible to have this installed at the factory.

Note

If the front-accessible main connections are used in withdrawable circuit breakers, supports for front and DIN connecting bars are required for mounting.

Overview of possible connection methods for withdrawable circuit breakers

3WA1 circuit breakers / non-automatic circuit breakers - frame size 1										
Short-circuit breaking capacity $I_{cu} = I_{cs}$	**Short-circuit breaking capacity class**	**I_n [A]**	**Vertical**	**Horizontal**	**Front**	**Flange**	**vertical on top / horizontal at the bottom**	**horizontal on top / vertical at the bottom**	**flange on top / horizontal at the bottom**	**horizontal on top / flange at the bottom**
55 kA @ 500 V AC	N	630	✓	✓	✓	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	--	--	--	--	--	--	--
66 kA @ 500 V AC	S	630	✓	✓	✓	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	--	--	--	--	--	--	--
85 kA @ 500 V AC	M	630	✓	✓	✓	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	--	--	--	--	--	--	--
85 kA @ 690 V AC 50 kA @ 1000 V AC	E	630	✓	✓	✓	✓	✓	✓	✓	✓
		800	✓	✓	✓	✓	✓	✓	✓	✓
		1000	✓	✓	✓	✓	✓	✓	✓	✓
		1250	✓	✓	✓	✓	✓	✓	✓	✓
		1600	✓	✓	✓	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	--	--	--	--	--	--	--

3WA1 circuit breakers / non-automatic circuit breakers - frame size 2										
Short-circuit breaking capacity $I_{cu} = I_{cs}$	**Short-circuit breaking capacity class**	**I_n [A]**	**Vertical**	**Horizontal**	**Front**	**Flange**	**vertical on top / horizontal at the bottom**	**horizontal on top / vertical at the bottom**	**flange on top / horizontal at the bottom**	**horizontal on top / flange at the bottom**
66 kA @ 500 V AC	S	2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	✓	✓	✓	✓	✓	✓	✓
		3200	✓	✓	✓	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--	--	--	--
85 kA @ 500 V AC	M	2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	✓	✓	✓	✓	✓	✓	✓
		3200	✓	✓	✓	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--	--	--	--
100 kA @ 500 V AC	H	2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	✓	✓	✓	✓	✓	✓	✓
		3200	✓	✓	✓	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--	--	--	--
130 kA @ 500 V AC	C	2000	✓	✓	--	--	✓	✓	--	--
		2500	✓	✓	--	--	✓	✓	--	--
		3200	✓	✓	--	--	✓	✓	--	--
		4000	--	--	--	--	--	--	--	--
85 kA @ 690 V AC 85 kA @ 1000 V AC 50 kA @ 1150 V AC	E	2000	✓	✓	✓	✓	✓	✓	✓	✓
		2500	✓	✓	✓	✓	✓	✓	✓	✓
		3200	✓	✓	✓	✓	✓	✓	✓	✓
		4000	✓	--	--	--	--	--	--	--

3WA1 non-automatic circuit breakers for DC - frame size 2										
Short-circuit breaking capacity $I_{cu} = I_{cs}$	**Rated short-circuit breaking capacity class**	**I_n [A]**	**Vertical**	**Horizontal**	**Front**	**Flange**	**vertical on top / horizontal at the bottom**	**horizontal on top / vertical at the bottom**	**flange on top / horizontal at the bottom**	**horizontal on top / flange at the bottom**
25 kA @ 600 V DC	D	1000	✓	✓	✓	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓	✓	✓	✓
		4000	✓	✓	--	✓	✓	✓	✓	✓
20 kA @ 1000 V DC	E	1000	✓	✓	✓	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓	✓	✓	✓
		4000	✓	✓	--	✓	✓	✓	✓	✓

3WA1 non-automatic circuit breakers for DC - frame size 2										
Short-circuit breaking capacity $I_{cu} = I_{cs}$	Rated short-circuit breaking capacity class	I_n [A]	Vertical	Horizontal	Front	Flange	vertical on top / horizontal at the bottom	horizontal on top / vertical at the bottom	flange on top / horizontal at the bottom	horizontal on top / flange at the bottom
20 kA @ 1500 V DC	E	1000	✓	✓	✓	✓	✓	✓	✓	✓
		2000	✓	✓	✓	✓	✓	✓	✓	✓
		4000	✓	✓	--	✓	✓	✓	✓	✓

3WA1 circuit breakers / non-automatic circuit breakers - frame size 3 fixed-mounted										
Short-circuit breaking capacity $I_{cu} = I_{cs}$	Rated short-circuit breaking capacity class	I_n [A]	Vertical	Horizontal	Front	Flange	vertical on top / horizontal at the bottom	horizontal on top / vertical at the bottom	flange on top / horizontal at the bottom	horizontal on top / flange at the bottom
100 kA @ 500 V AC	H	4000	✓	✓	✓	✓	✓	✓	✓	✓
		5000	✓	✓	--	--	✓	✓	--	--
		6300	✓	--	--	--	--	--	--	--
150 kA @ 500 V AC [1]	C	4000	✓	✓	--	--	✓	✓	--	--
		5000	✓	✓	--	--	✓	✓	--	--
		6300	✓	--	--	--	--	--	--	--
85 kA @ 690 V AC 85 kA @ 1000 V AC 50 kA @ 1150 V AC	E	4000	✓	✓	--	--	✓	✓	--	--
		5000	✓	✓	--	--	✓	✓	--	--
		6300	✓	--	--	--	--	--	--	--

[1] 130 kA for 4-pole circuit breakers/non-automatic circuit breakers

For more information, refer to the operating instructions on the internet:

- Front-accessible main connections for withdrawable circuit breakers (https://support.industry.siemens.com/cs/ww/en/view/109783667)
- Rear vertical main connections for withdrawable circuit breakers (https://support.industry.siemens.com/cs/ww/en/view/109783668)
- Rear horizontal connections for withdrawable circuit breakers (https://support.industry.siemens.com/cs/ww/en/view/109783681)

4.5.2.2 Technical specifications

You can find the dimensions of the main connections in Chapter Dimension drawings (Page 403).

4.5.2.3 Part number

Note

Each article number only includes *one* main connection, unless specified otherwise in the tables below.
The following must be ordered for the complete conversion of the top and bottom connections:

- 3-pole circuit breaker: 6 main connections
- 4-pole circuit breaker: 8 main connections

Rear horizontal main connection		Article number
Top or bottom		
Size 1	≤ 1000 A	3WA9111-0AX11
	1250 ... 2000 A	3WA9111-0AX12
Size 2	≤ 2000 A [1)]	3WA9111-0AX21
	2500 A [1)]	3WA9111-0AX22
	3200 A [1)]	3WA9111-0AX23
	≤ 3200 A, only for breaking capacity C	3WA9111-0AX24
Size 3	≤ 5000 A	3WA9111-0AX31

1) Not for breaking capacity C

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AM*).

Rear vertical main connection		Article number
Top or bottom		
Size 1	≤ 1000 A	3WA9111-0AV11
	1250 ... 2000 A	3WA9111-0AV12
	2500 A	3WA9111-0AV13

Rear vertical main connection		**Article number**
Size 2	≤ 2000 A [1]	3WA9111-0AV21
	2500 A [1]	3WA9111-0AV22
	3200 A [1]	3WA9111-0AV23
	1600 ... 3200 A, only for breaking capacity C	3WA9111-0AV24
	4000 A, 3-pole, 1 set with 3 units	3WA9111-0AV25
	4000 A, 4-pole, 1 set with 4 units	3WA9111-0AV28
	≤ 4000 A, broadened, 3-pole 1 set with 3 units Compatible with 3WL	3WA9111-0AV26
	≤ 4000 A, broadened, 4-pole 1 set with 4 units Compatible with 3WL	3WA9111-0AV27
Size 3	≤ 5000 A	3WA9111-0AV31

[1] Not for breaking capacity C

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AV*).

Flange connection		**Article number**
Top or bottom		
Size 1	≤ 1000 A	3WA9111-0AW11
	1250 ... 2000 A	3WA9111-0AW12
Size 2	≤ 2000 A	3WA9111-0AW21
	2500 A	3WA9111-0AW22
	3200 A	3WA9111-0AW23
Size 3	4000 A	3WA9111-0AW31

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AW*).

Front-accessible main connections according to DIN 43673, double hole		**Article number**
Main connection		
Size 1	< 1000 A	3WA9111-0AN11
	1250 ... 2000 A	3WA9111-0AN12
Size 2	≤ 2000 A	3WA9111-0AN21
	2500 A	3WA9111-0AN22
	3200 A	3WA9111-0AN23

Front-accessible main connections according to DIN 43673, double hole		Article number
Size 3	4000 A	3WA9111-0AN31
Supports for front and DIN connection bars		
Size 1	Set for 3 poles	3WA9111-0AN81
	Set for 3 poles + N	3WA9111-0AN84
Size 2	Set for 3 poles	3WA9111-0AN82
	Set for 3 poles + N	3WA9111-0AN85
Size 3	Set for 3 poles	3WA9111-0AN83
	Set for 3 poles + N	3WA9111-0AN86

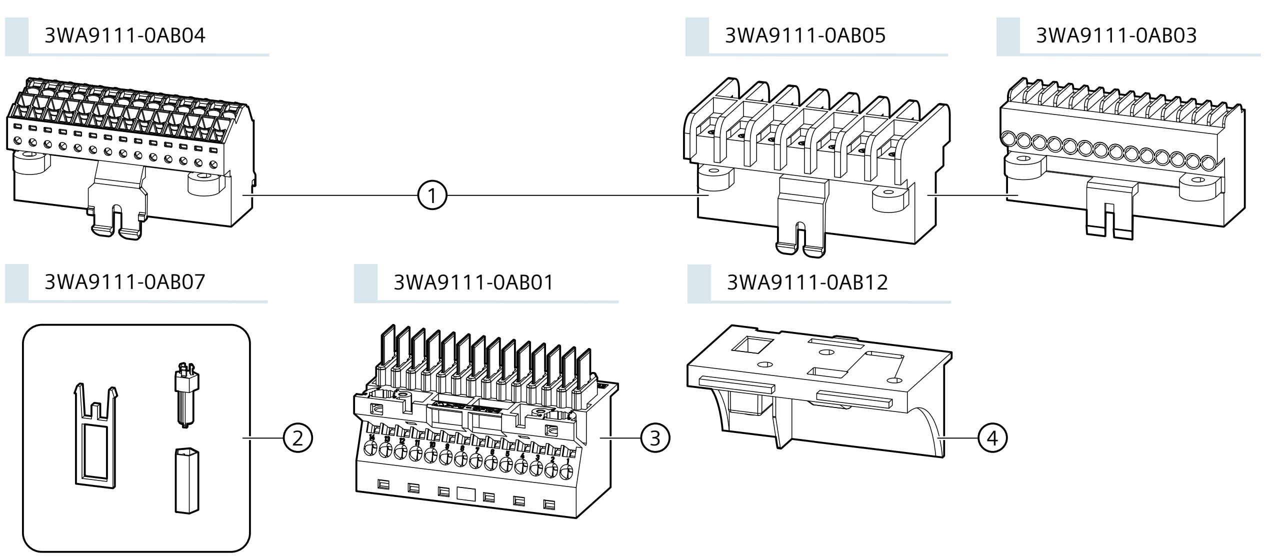
You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AN*).

4.6 Accessories for secondary disconnect terminals

4.6.1 Secondary disconnect terminals for fixed-mounted circuit breakers

4.6.1.1 Description

The secondary disconnect terminal for fixed-mounted circuit breakers comprises:

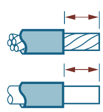
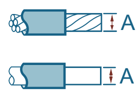
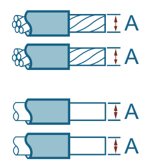
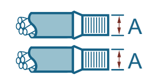
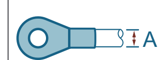
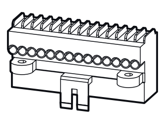
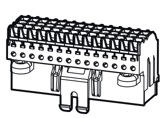
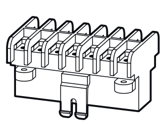


- Base for secondary disconnect terminal (3), permanently mounted on the circuit breaker
- Coding kit for secondary disconnect terminal (2)
- Manual connector (1) for connection of the auxiliary and control lines.
  Manual connectors with push-in connection terminals, compression screw terminals and ring lug connection terminals are available depending on the connection method.

The dummy block (4) is also available as an accessory for unused secondary disconnect terminal blocks.

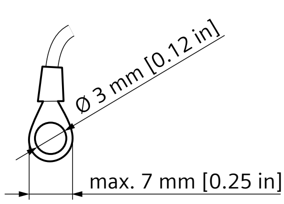
For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109781519).

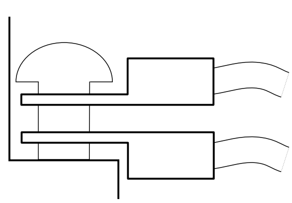
4.6.1.2 Connection

						
3WA9111-0AB03 	7 mm [0.28 in]	0.5 ... 2.5 mm^2 [AWG 20 ... 14]	–	0.5 ... 2.5 mm^2 [AWG 20 ... 14]	–	–
3WA9111-0AB04 	10 mm [0.39 in]		0.5 ... 2.5 mm^2 [AWG 20 ... 14]		0.5 ... 1.5 mm^2 [AWG 20 ... 16]*	–
3WA9111-0AB05 	–	–	–	–	–	1.5 ... 2.5 mm^2 [AWG 16 ... 14]

* DIN 46228-A/DIN 46228-C: A = 0.5 ... 2.5mm² [AWG 20 ... 14]

Note the following requirements for optional connection with ring or fork lugs:





Maximum width of lug:	7 mm [0.25 in]
Hole diameter:	> 3 mm [> 0.12 in]
Tightening torque:	0.5 Nm [4.5 lb-in]
Screwdriver:	Philips #1
Recommendation: TE, PIDG series (catalog number)	PIDG R 16-14 6 (# 50881)
Max. number of lugs per connection:	2 (back to back)

4.6.1.3 Article number

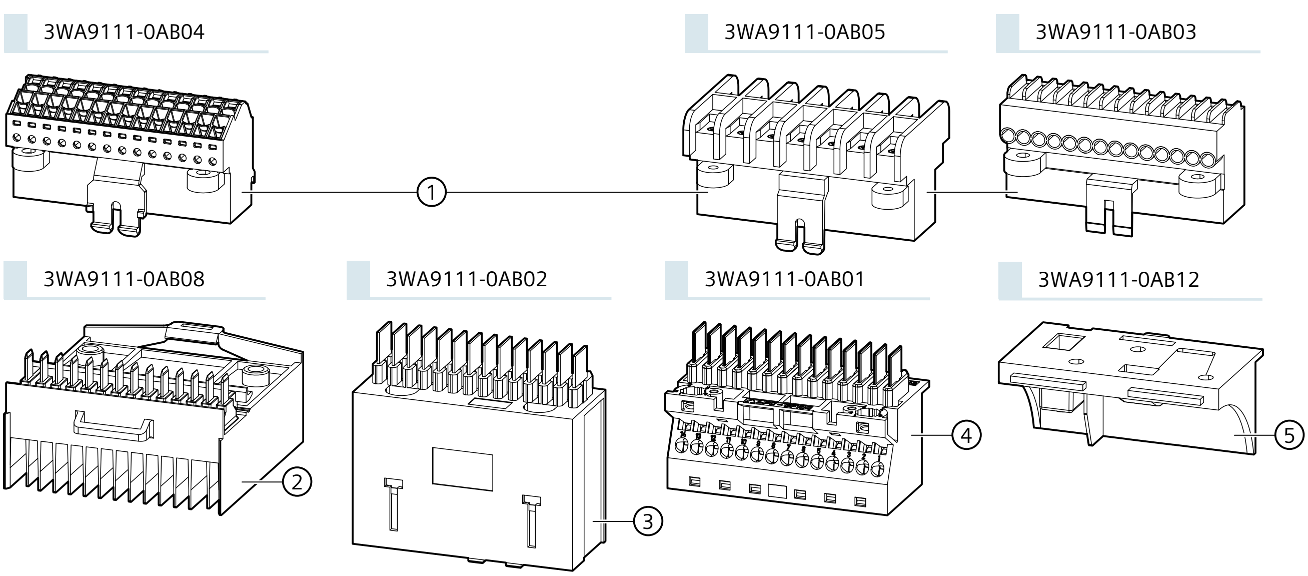
Secondary disconnect terminals for fixed-mounted circuit breakers	Z option	Article number
Base	--	3WA9111-0AB01
Manual connector with compression screw terminals	N03	3WA9111-0AB03
Manual connector with push-in connection terminals	--	3WA9111-0AB04
Manual connector with ring lug connection terminals	N05	3WA9111-0AB05
Coding kit for secondary disconnect terminal blocks X5 to X9	--	3WA9111-0AB07
Dummy block	--	3WA9111-0AB12

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AB*).

4.6.2 Secondary disconnect terminals for withdrawable circuit breakers

4.6.2.1 Description

The secondary disconnect terminal for the withdrawable circuit breaker comprises:



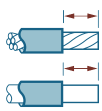
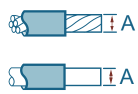
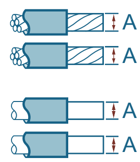
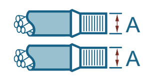
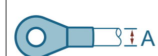
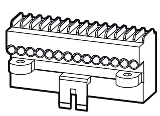
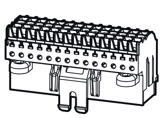
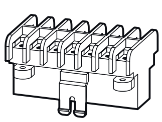
- Base for secondary disconnect terminal (4), permanently mounted on the circuit breaker
- Sliding contact module (2) on guide frame
- Manual connector (1) for connection of the auxiliary and control lines.
  Manual connectors with push-in connection terminals, compression screw terminals and ring lug connection terminals are available depending on the connection method.
- The dummy block (5) is also available as an accessory for unused secondary disconnect terminal blocks.

Note

Circuit breakers with breaking capacity E and frame size 3 with breaking capacity C also require the extension for secondary disconnect terminals (3).

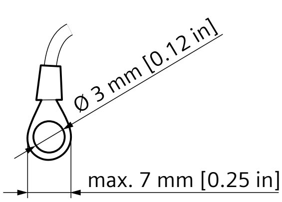
For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109781519).

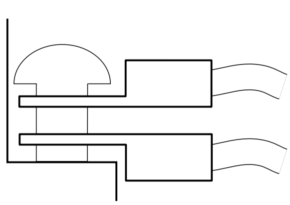
4.6.2.2 Connection

						
3WA9111-0AB03 	7 mm [0.28 in]	0.5 ... 2.5 mm² [AWG 20 ... 14]	–	0.5 ... 2.5 mm² [AWG 20 ... 14]	–	–
3WA9111-0AB04 	10 mm [0.39 in]		0.5 ... 2.5 mm² [AWG 20 ... 14]		0.5 ... 1.5 mm² [AWG 20 ... 16]*	–
3WA9111-0AB05 	–	–	–	–	–	1.5 ... 2.5 mm² [AWG 16 ... 14]

* DIN 46228-A/DIN 46228-C: A = 0.5 ... 2.5mm² [AWG 20 ... 14]

Note the following requirements for optional connection with ring or fork lugs:





Maximum width of lug:	7 mm [0.25 in]
Hole diameter:	> 3 mm [> 0.12 in]
Tightening torque:	0.5 Nm [4.5 lb-in]
Screwdriver:	Philips #1
Recommendation: TE, PIDG series (catalog number)	PIDG R 16-14 6 (# 50881)
Max. number of lugs per connection:	2 (back to back)

4.6.2.3 Article number

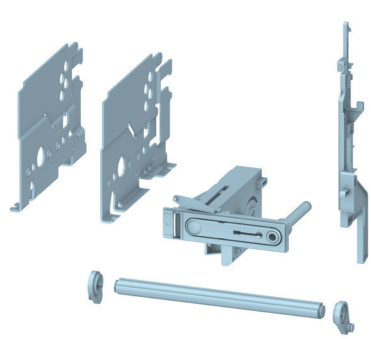
Secondary disconnect terminals for withdrawable circuit breakers	Z option	Article number
Base	--	3WA9111-0AB01
Extension for secondary disconnect terminals for circuit breakers with breaking capacity E and frame size 3 with breaking capacity C	--	3WA9111-0AB02
Manual connector with compression screw terminals	N03	3WA9111-0AB03
Manual connector with push-in connection terminals	--	3WA9111-0AB04
Manual connector with ring lug connection terminals	N05	3WA9111-0AB05
Sliding contact module for guide frame	--	3WA9111-0AB08
Dummy block	--	3WA9111-0AB12

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AB*).

4.7 Conversion kit for withdrawable circuit breakers and rating coding of the guide frame

4.7.1 Conversion kit for converting fixed-mounted circuit breakers/non-automatic circuit breakers into withdrawable circuit breakers

4.7.1.1 Description



The conversion kit can be used for converting fixed-mounted circuit breakers into withdrawable circuit breakers.

The conversion is performed on site by the customer.

The conversion kit which must be ordered for this purpose comprises:

- Complete racking mechanism
- Racking shaft
- Control gate
- Shorter circuit breaker feet for withdrawable circuit breakers
- Coding pins for withdrawable breaker and guide frame for rated-current coding

WARNING
Overheating and fire hazard as a result of missing rated-current coding. An incorrect combination of guide frame and circuit breaker in the guide frame can result in a lack of contact at the blade contacts, leading to overheating and fire hazard. Rated-current coding must be installed to ensure that only withdrawable circuit breakers with the appropriate blade contacts can be used in the guide frames.

Rated-current coding

Rated-current coding ensures that only those circuit breakers whose guide frames are suitable for the circuit breakers can be inserted into the guide frame.

Every design version has a separate coding.

When converting a fixed-mounted circuit breaker into a withdrawable circuit breaker, the coding for rated current and breaking capacity must be retrofit by the customer on both the circuit breaker and the guide frame.

Note

When withdrawable circuit breakers are ordered, withdrawable circuit breakers and guide frames are already equipped with coding for rated current and breaking capacity at the factory.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109792973).

4.7.1.2 Technical specifications

You can find the dimensions of the guide frame in Chapter Dimension drawings (Page 403).

4.7.1.3 Part number

Conversion set for converting fixed-mounted circuit breakers into with-drawable circuit breakers, max. 690 V AC [1)]	Part number
3-pole	
Size 1	3WA9111-0BC11
Size 2	3WA9111-0BC12

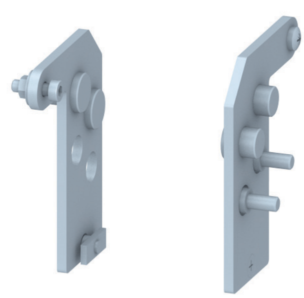
Conversion set for converting fixed-mounted circuit breakers into withdrawable circuit breakers, max. 690 V AC [1)]	Part number
Size 3	3WA9111-0BC13
4-pole	
Size 1	3WA9111-0BC14
Size 2	3WA9111-0BC15
Size 3	3WA9111-0BC16

1) Only for breaking capacity N, S, M and H

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BC1*).

4.7.2 Equipment-dependent coding

4.7.2.1 Description



Equipment-dependent coding for circuit breakers and guide frames prevents the mix-up of circuit breakers of the same frame size but with different equipment when they are being inserted into a guide frame.

A total of 36 different coding variants are possible during installation and can be used by the customer according to requirements. In the Appendix Overview of possible coding variants (Page 541), all possible codings are listed.

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109792972).

4.7.2.2 Article number

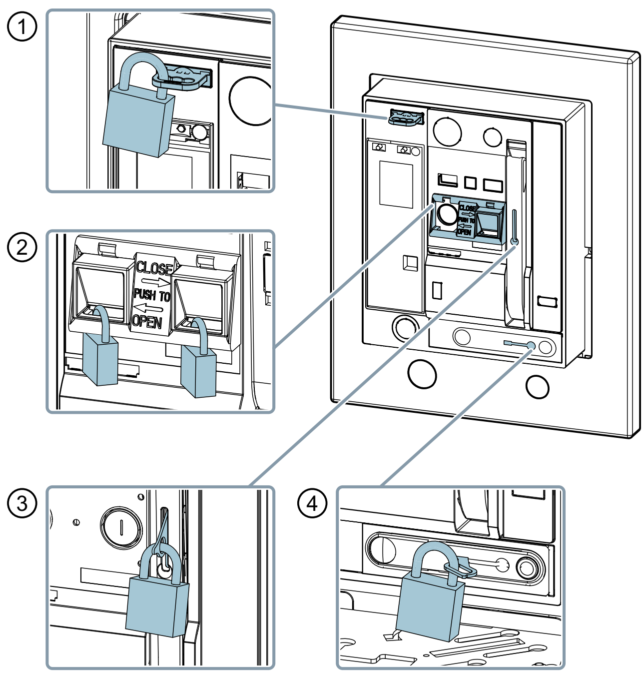
Equipment-dependent coding	Article number
Size 1 / 2	3WA9111-0AR11
Size 3	3WA9111-0AR12

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AR1*).

4.8 Accessories for protection against unauthorized operation

4.8.1 Overview of locking devices and locking provisions

Locking provision for padlocks



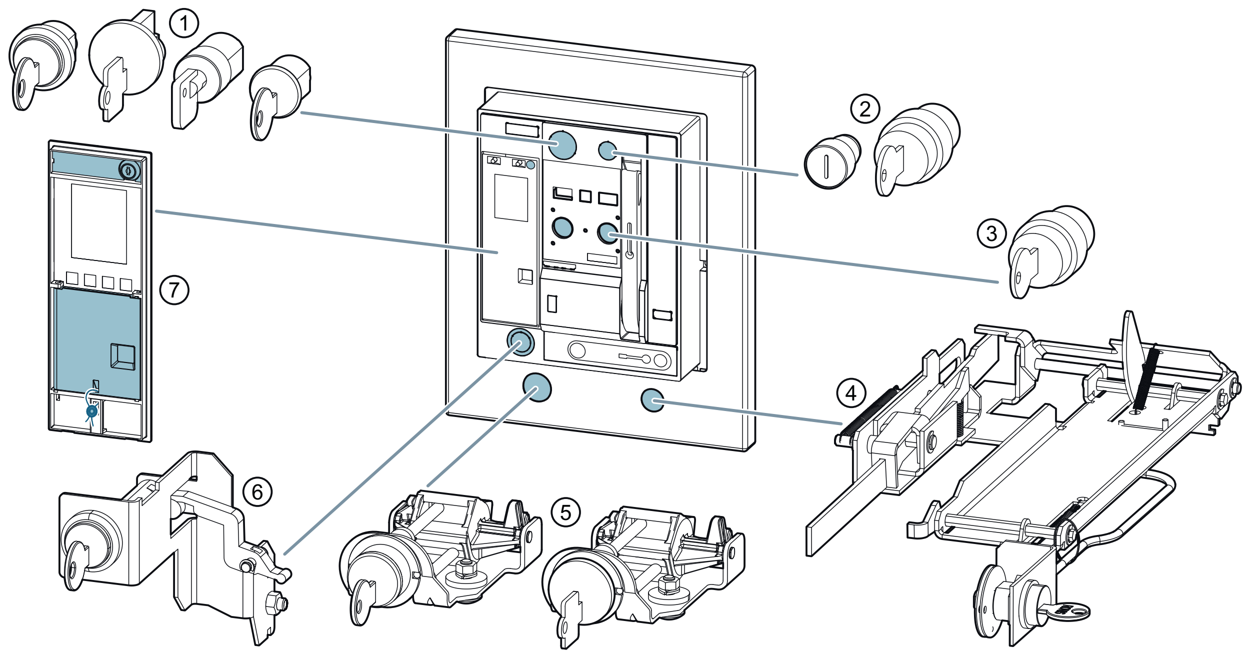
(1) Locking provision to prevent unauthorized closing - Safe Open

(2) Locking provision for mechanical close/open

(3) Locking provision for charging handle

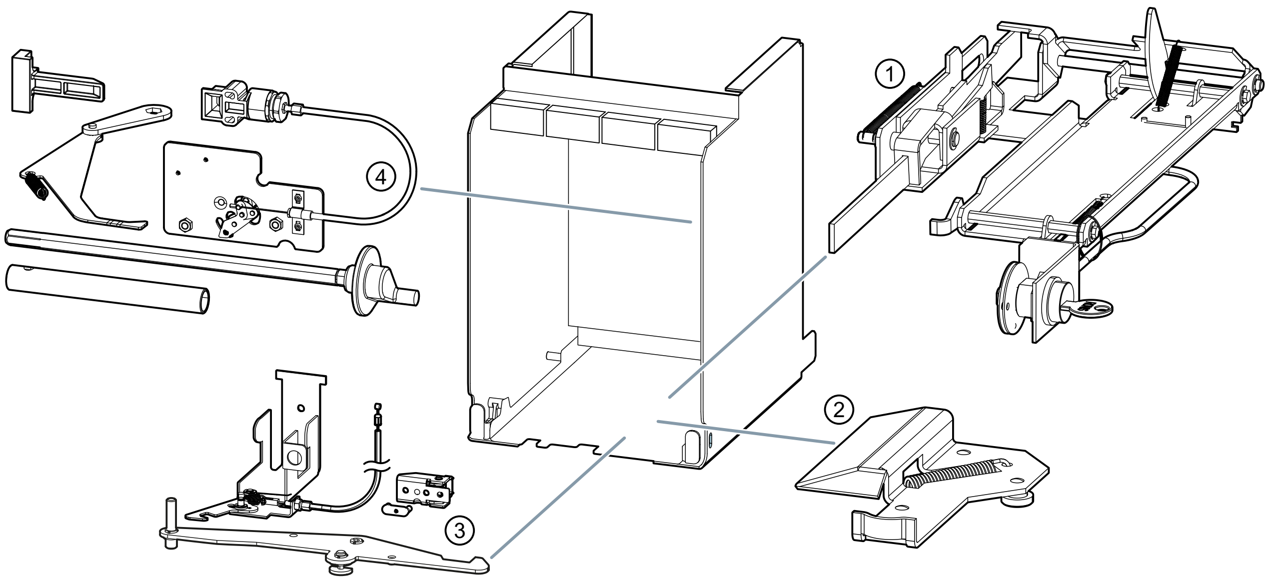
(4) Locking provision for racking handle

Locking provision for safety locks



(1) Locking provision to prevent unauthorized closing - Safe Open
(2) Locking provision for local electric close
(3) Key operation for local mechanical close
(4) Locking provision to prevent racking of the withdrawable circuit breaker in the disconnected position
(5) Locking provision to prevent unauthorized closing of the withdrawable circuit breaker
(6) Locking provision for racking handle
(7) Lockable and sealable cover for the electronic trip unit

Locking provisions



(1) Locking provision to prevent racking of the withdrawable circuit breaker in the disconnected position

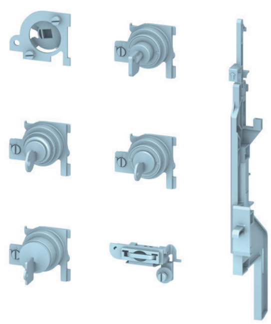
(2) Locking provision to prevent racking of the withdrawable circuit breaker when the control cabinet door is open

(3) Locking provision to prevent opening of the control cabinet door when the circuit breaker is closed

(4) Locking provision to prevent closing of the withdrawable circuit breaker when the control cabinet door is open

4.8.2 Locking provision to prevent unauthorized closing - Safe Open

4.8.2.1 Description



In the case of locking provisions to prevent unauthorized closing - Safe Open, either padlocks or safety locks securely lock the circuit breaker in the open state (e.g. during service calls and inspections). Closing is not possible either locally or remotely.

The conditions for switch disconnectors in the OPEN position are fulfilled according to IEC60947-2 and this locking provision fulfills the main switch conditions for a supply disconnecting (isolating) device according to EN 60204-1 in the OPEN position.

⚠ WARNING
Loss of locking function when the circuit breaker is replaced.
This lock only affects the circuit breaker in which it is installed. If the circuit breaker is replaced, closing is no longer prevented unless the new circuit breaker is also protected against unauthorized closing.
Circuit breakers with a locking provision should only be replaced with circuit breakers that are also fitted with a locking provision.

The following devices are available for retrofitting:

- Locking provision with lock operation
  - Made by Fortress
  - Made by Castell
  - Made by Ronis
  - Made by KIRK Key
  - Made by Profalux
  - Made by CES
  - Made by IKON
- Locking provision for padlocks
  The locking device is for up to four padlocks with a diameter of 6 mm (0.25 in). Padlocks are not included in the scope of supply.

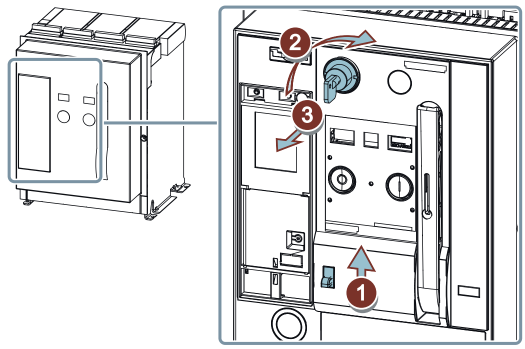
The locking provisions can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783685).

4.8.2.2 Activation

The lock can only be activated when the circuit breaker is open. The locking provision is disabled when the circuit breaker is closed.

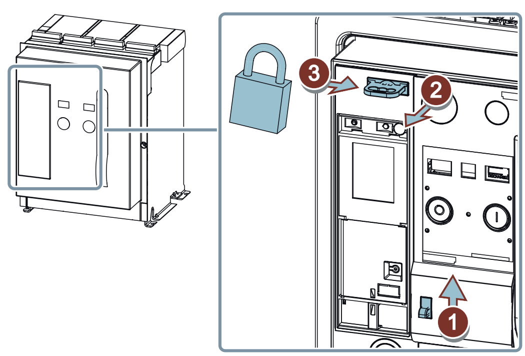
Activation of the locking provision with a safety lock



Note

The lock is only operational when the key is removed. The safety key can only be removed in the OPEN position.

Activation of the locking provision with a padlock



4.8.2.3 Part number

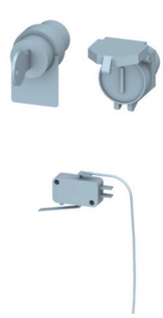
Locking provision to prevent unauthorized closing - Safe Open	Z-option	Part number
For key operation		
Made by Fortress or Castell The lock is not included in the scope of supply and must be ordered from the manufacturer by the customer. Suitable lock Fortress CLIS-X005 or Castell FS2.	S05	3WA9111-0BA31
Made by Ronis	S08	3WA9111-0BA32

Locking provision to prevent unauthorized closing - Safe Open	Z-option	Part number
Made by KIRK Key The lock is not included in the scope of supply and must be ordered from the manufacturer by the customer. Suitable cylinder lock KIRK Key C 900-301. The lock for KIRK Key is only available as an accessory for self-assembly and cannot be preinstalled at the factory.	--	3WA9111-0BA33
Made by Profalux	S09	3WA9111-0BA34
Made by CES	S01	3WA9111-0BA35
Made by IKON	S03	3WA9111-0BA36
Assembly kit for padlocks The padlock is not included in the scope of supply.	S07	3WA9111-0BA37

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BA3*).

4.8.3 Local electric close

4.8.3.1 Description



The local electric close makes operational closing possible. External electrical interlocks can easily bet set up by means of a series connection with this button. The local electric close on the circuit breaker can replace the "local control station" at the control cabinet.

Note

The combination of the local electric close with the local mechanical close/open interlock also prevents mechanical closing, see Chapter Interlock for mechanical close/open (Page 317).

The local electric close is available in three versions:

- With sealing cap
- With lock made by CES
- With lock made by IKON

Note

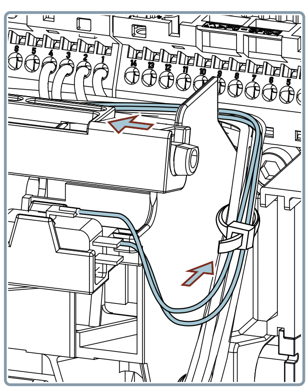
The local electric close and the motor disconnect switch are mounted in the same location. It is **not** possible to use these accessories simultaneously.

The local electric close can be retrofit.

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783677).

4.8.3.2 Connection

3WA9111-0AH21
3WA9111-0AH22
3WA9111-0AH23



4.8.3.3 Activation

Note

The lock is only operational when the key is removed.

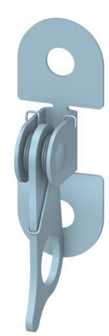
4.8.3.4 Article number

Locking provision for local electric close	Z option	Article number
With sealing cap	C11	3WA9111-0AH21
Key operation with CES lock	C12	3WA9111-0AH22
Key operation with IKON lock	--	3WA9111-0AH23

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AH2*).

4.8.4 Locking provision for charging handle for padlocks

4.8.4.1 Description



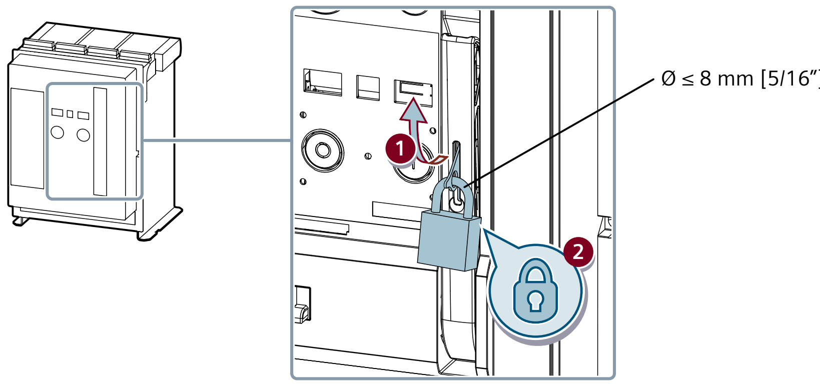
This locking provision can be used to lock the charging handle with a padlock. The stored energy mechanism can then no longer be charged manually.

The locking provision is for one padlock with a maximum diameter of 8 mm.

It can be retrofit.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783679).

4.8.4.2 Activation



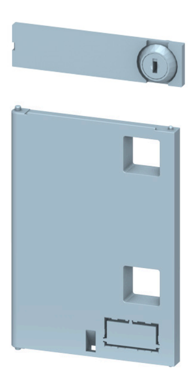
4.8.4.3 Article number

	Z-option	Article number
Locking provision for charging handle for padlocks	S33	3WA9111-0BA71

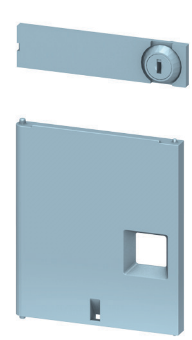
You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BA71).

4.8.5 Cover for the electronic trip unit

4.8.5.1 Description



Cover for ETU300



Cover for ETU600

A two-part transparent cover is available as an accessory for the electronic trip unit.

- The top cover can be locked with a safety lock and prevents unauthorized resetting of the reclosing lockout of the circuit breaker.
- The bottom cover positioned over the rotary coding switches of the electronic trip unit. The cover can be sealed in order to prevent unauthorized changes to the settings of the electronic trip unit.
- This lower cover is included in the scope of delivery of the circuit breaker and is already mounted when the circuit breaker is delivered.

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783656).

4.8.5.2 Article number

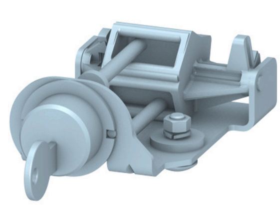
Cover for the electronic trip unit	Z option	Article number
Cover for the electronic trip unit	F40	
Cover for the electronic trip unit ETU300[1)]		3WA9111-0EM21
Cover for the electronic trip unit ETU600[1)]		3WA9111-0EM22

1) The scope of supply includes both the top cover and the bottom cover of the rotary coding switches.

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EM22*). The scope of delivery includes both the cover of the electronic trip unit (ETU) and the cover of the reset plunger.

4.8.6 Locking provision to prevent unauthorized closing of the withdrawable circuit breaker

4.8.6.1 Description



This locking provision uses a safety lock to securely lock the withdrawable circuit breaker in the open state (e.g. during service calls and inspections). Closing is not possible either locally or remotely.

The conditions for switch disconnectors in the OPEN position are fulfilled according to IEC60947-2.

Note

As the mounting location is in the guide frame, closing is prevented independently of the breaker in the case of withdrawable circuit breakers. Unauthorized closing remains impossible even after the circuit breaker has been replaced.

The following locks are available for retrofitting:

- Made by CES
- Made by IKON
- Made by KIRK Key
- Made by Ronis
- Made by Profalux

The locking provision can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783676).

4.8.6.2 Activation

The lock can only be activated when the circuit breaker is open. The locking provision is disabled when the circuit breaker is closed.

Note

The lock is only operational when the key is removed. The safety key can only be removed in the OPEN position.

4.8.6.3 Part number

Locking provision to prevent unauthorized closing of the withdrawable circuit breaker	Z-option	Part number
For key operation		
Made by CES	R61	3WA9111-0BA51
Made by IKON	--	3WA9111-0BA52
Made by KIRK Key The lock is not included in the scope of supply and must be ordered from the manufacturer by the customer. Suitable cylinder lock KIRK Key C 900-301.	--	3WA9111-0BA57
Made by Ronis	R68	3WA9111-0BA58
Made by Profalux	R60	3WA9111-0BA50

[1)] The lock is not included in the scope of supply.

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BA5*).

4.8.7 Locking provision with padlock for the racking handle of the racking mechanism

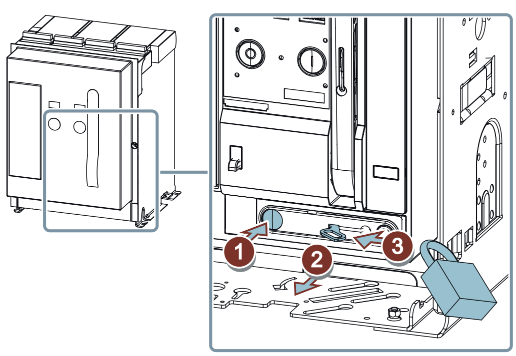
4.8.7.1 Description

Locking with padlocks prevents the racking handle of the racking mechanism from being pulled out. Up to three padlocks can be used.

This accessory forms part of the withdrawable circuit breaker and the conversion kit for converting fixed-mounted circuit breakers to withdrawable circuit breakers.

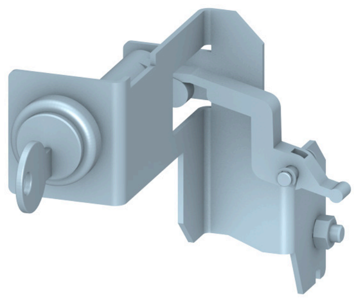
The padlocks are not included in the scope of supply.

4.8.7.2 Activation



4.8.8 Locking provision with safety lock for the racking handle

4.8.8.1 Description



The locking provision locks the racking handle of the racking mechanism with a safety lock which is installed on the withdrawable circuit breaker. The racking handle is prevented from being pulled out and the withdrawable circuit breaker is protected against racking.

Five versions are available:

- Locking provision with lock operation, made by CES
- Locking provision with lock operation, made by Profalux
- Locking provision with lock operation, made by Ronis
- Locking provision with lock operation, made by IKON
- Locking provision for lock operation, made by KIRK Key.

The locking provision for the racking handle can be retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783974).

4.8.8.2 Activation

Note

The lock is only active when the key is removed.

4.8.8.3 Article number

Locking provision with safety lock for the racking handle	Z option	Article number
Made by CES	S71	3WA9111-0BA73
Made by IKON The lock must be retrofit by the customer; it is not available from the factory preinstalled.	--	3WA9111-0BA75
Made by Profalux	S75	3WA9111-0BA76

Locking provision with safety lock for the racking handle	Z option	Article number
Made by Ronis	S76	3WA9111-0BA77
Made by KIRK Key The lock is not included in the scope of supply and must be ordered from the manufacturer by the customer. Suitable cylinder lock KIRK Key C 900-301. The lock must be retrofit by the customer; it is not available from the factory preinstalled.	--	3WA9111-0BA80

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BA*).

4.8.9 Shutters

Shutters are molded-plastic plates for covering the live main circuit in the guide frame (touch protection).

The shutter is installed in the guide frame as standard. A replacement in the event of repairs is described below.

You can find general information about the shutter in Chapter Guide frame (Page 29).

4.8.9.1 Article number

Shutters	Article number
3-pole	
Size 1	3WA9111-0AP04
Size 2 [1)]	3WA9111-0AP06
Size 2 [2)]	3WA9111-0AP43
Size 3	3WA9111-0AP07
4-pole	
Size 1	3WA9111-0AP08
Size 2 [1)]	3WA9111-0AP11
Size 2 [2)]	3WA9111-0AP44
Size 3	3WA9111-0AP12

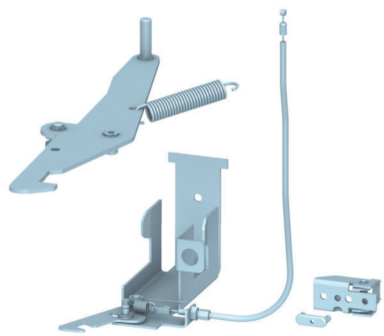
[1)] Not for 3WA12..-6... (breaking capacity C)

[2)] Only for 3WA12..-6... (breaking capacity C)

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AP*).

4.8.10 Locking provision to prevent opening of the control cabinet door when the circuit breaker is closed

4.8.10.1 Description



The locking provision prevents opening of the control cabinet door when the fixed-mounted circuit breaker/non-automatic circuit breaker is closed or when the withdrawable circuit breaker is in the connected position. This increases personal safety for operating and service personnel or for persons standing in front of the power distribution equipment, as, in the case of opening operations, the arcing gases remain in the compartment where the circuit breaker is installed thanks to the closed door and cannot be released to the outside.

The locking signal is transferred via a Bowden cable:

- Fixed-mounted circuit breakers: Between the circuit breaker/non-automatic circuit breaker and the control cabinet door
- Withdrawable circuit breakers: Between the guide frame and the control cabinet door

The locking provision for **withdrawable circuit breakers** cannot be combined with the

- Locking provision to prevent racking of the circuit breaker in the disconnected position, all makes of safety lock

---

Note

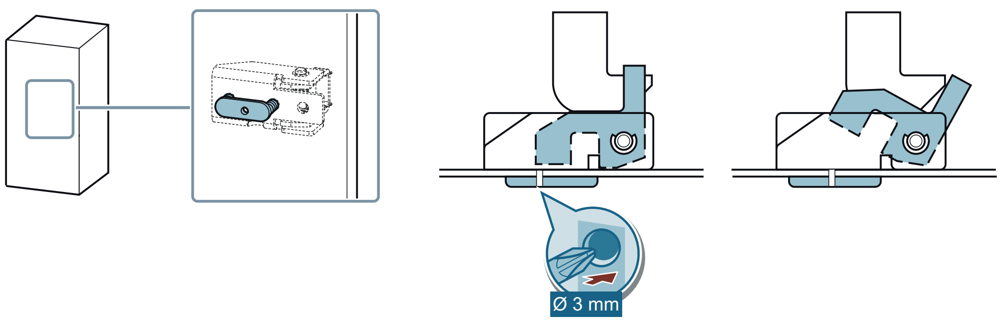
The locking provision can be overridden by a deliberate action if necessary, see Chapter Activation / override (Page 304).

The locking provision can be retrofit.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783680).

4.8.10.2 Activation / override

The locking provision is automatically active when the control cabinet door is closed and the circuit breaker/non-automatic air circuit breaker is closed. However, the locking provision can be overridden by a deliberate action if necessary:



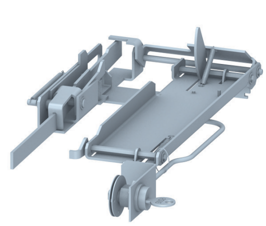
4.8.10.3 Article number

Locking provision to prevent opening of the control cabinet door when the circuit breaker is closed	Z-option	Article number
Fixed-mounted, can be overridden	S30	3WA9111-0BB12
Withdrawable, can be overridden	R30	3WA9111-0BB13

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BB1*).

4.8.11 Locking provision to prevent racking of the withdrawable circuit breaker in the disconnected position

4.8.11.1 Description



This locking provision prevents racking in of the withdrawable circuit breaker from the disconnected position to the test position by blocking the racking handle in the disconnected position such that it cannot be pulled out.

A Bowden cable transfers the locking signal from a safety lock to the locking provision. The Bowden cable and safety lock are included in the scope of supply.

Note

When the locking provision is activated, the circuit breaker cannot be removed from the guide frame. Nor is it possible to insert a circuit breaker in the guide frame.

The locking provision is available in four versions:

- Key operation with CES lock
- Key operation with IKON lock
- Key operation with Profalux lock
- Key operation with Ronis lock

This locking provision **cannot** be combined with the following locking provisions or locking devices:

- Locking provision to prevent opening of the control cabinet door when the circuit breaker is closed
- Locking provision to prevent racking of the withdrawable circuit breaker when the control cabinet door is open
- Locking provision to prevent unauthorized closing of the withdrawable circuit breaker, all makes of safety lock

The locking provision can be retrofit.

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783670).

4.8.11.2 Activation

The locking provision can only be activated in the disconnected position or when the guide frame is empty. Activation is performed by turning the key in the clockwise direction and then removing it.

The key cannot be turned and removed in the test and connected positions.

Note

To release the racking lock, first move the key a little in the lock such that the block in the lock releases itself. Then turn the key counterclockwise to unlock.

4.8.11.3 Part number

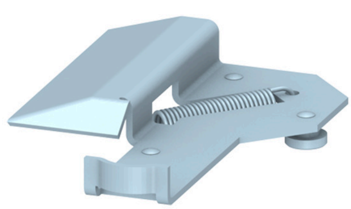
Locking provision to prevent racking of the withdrawable circuit breaker in the disconnected position		Z option	Article number
For key operation	Made by CES[1]	R82	3WA9111-0BA81
	Made by IKON [1] The lock must be retrofit by the customer; it is not available from the factory preinstalled.	--	3WA9111-0BA82
	Made by Profalux [1]	R85	3WA9111-0BA83
	Made by Ronis [1]	R86	3WA9111-0BA84

[1] The scope of supply comprises the Bowden cable and the lock in the control cabinet door.

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BA8*).

4.8.12 Locking provision to prevent racking of the withdrawable circuit breaker when the control cabinet door is open

4.8.12.1 Description



This locking provision for withdrawable circuit breakers prevents racking of the withdrawable circuit breaker independently of the breaker when the control cabinet door is open.

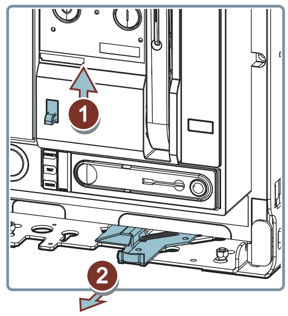
This locking provision **cannot** be combined with the following locking provisions:

- Locking provision to prevent closing of the withdrawable circuit breaker when the control cabinet door is open
- Locking provision to prevent racking of the withdrawable circuit breaker in the disconnected position, all makes of safety lock

This locking provision can be retrofit.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783669).

4.8.12.2 Activation



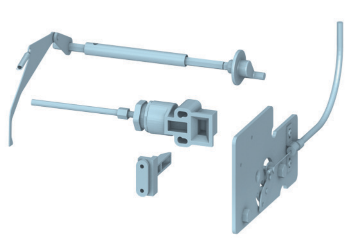
4.8.12.3 Article number

	Article number
Locking provision to prevent racking of the withdrawable circuit breaker when the control cabinet door is open	3WA9111-0BB15

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BB15).

4.8.13 Locking provision to prevent closing of the withdrawable circuit breaker when the control cabinet door is open

4.8.13.1 Description



The locking provision for withdrawable circuit breakers prevents closing independently of the breaker when the control cabinet door is open. A Bowden cable is used for interlocking.

This locking provision **cannot** be combined with:

- Locking provision to prevent racking of the circuit breaker when the control cabinet door is open

On request only, it can be combined with:

- Locking provision to prevent racking of the circuit breaker in the disconnected position, all makes of safety lock

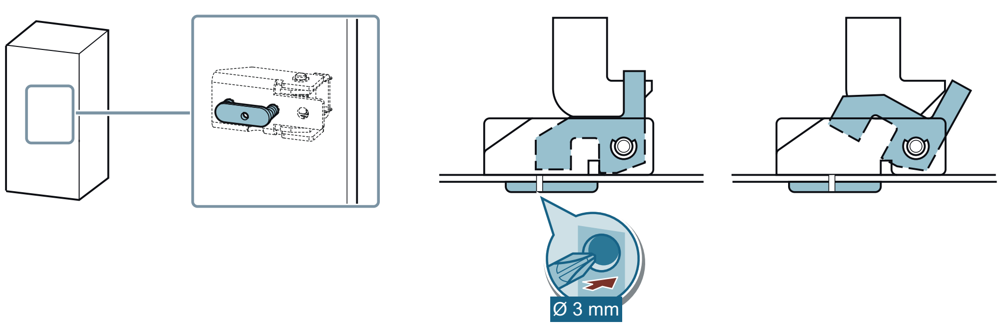
---

Note

The locking provision to prevent closing of the withdrawable circuit breaker when the control cabinet door is open can only be installed at the factory. Retrofitting is not possible.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109782564).

4.8.13.2 Activation / override



4.8.13.3 Part number

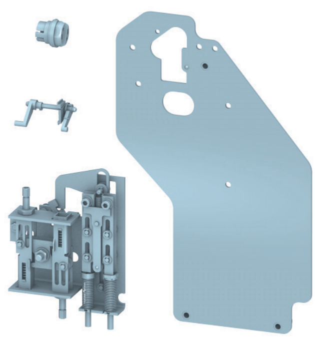
	Z-option	Part number
Locking provision to prevent closing of the withdrawable circuit breaker when the control cabinet door is open	R40	-- 1)

1) The locking provision can only be installed at the factory. Retrofitting is not possible.

4.9 Interlocking

4.9.1 Mechanical interlocking (Bowden cable interlocking)

4.9.1.1 Description



Mechanical interlocking interlocks **two** or **three** circuit breakers. The circuit breakers can be installed both horizontally and vertically.

- The interlocking device for **two** circuit breakers only ever releases one circuit breaker at a time, thereby ensuring that only the released circuit breaker can be operated. The other circuit breaker is open and is disabled by the interlocking device.
- When **three** circuit breakers are interlocked, a maximum of two circuit breakers can be closed. However, all circuit breakers can also be in the OPEN breaker position at the same time.

Note

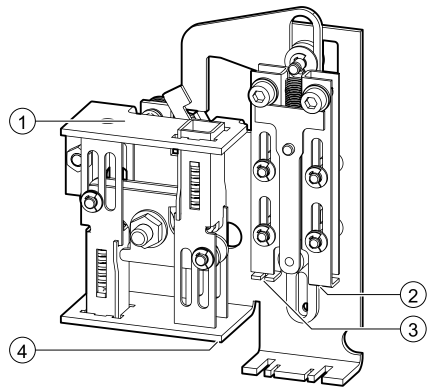
Interlocking between different circuit breaker generations

You can also interlock 3WA circuit breakers with the following circuit breaker generations:

- 3WL sizes 1 to 3
- 3WL10 (only interlocking of two circuit breakers possible)
- 3VA27 (only interlocking of two circuit breakers possible)

Standard mechanical interlocking comprises an interlocking module and a 2 m Bowden cable.

Interlocking module with connections for the Bowden cables:



(1)	Output 1	(3)	Input 2
(2)	Input 1	(4)	Output 2

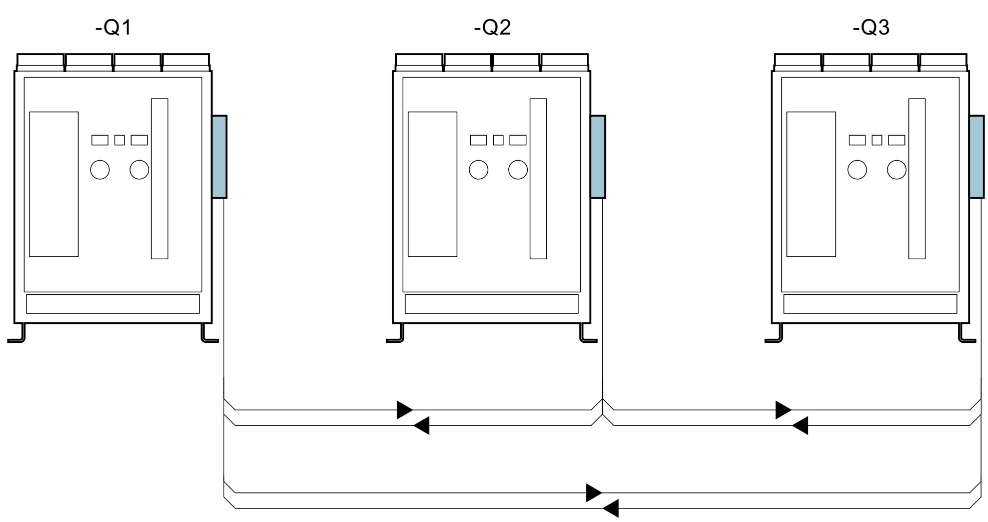
Additional Bowden cables can be ordered separately, also in different lengths. The following Bowden cable lengths are available:

- 2 m
- 3 m
- 4.5 m

Accessories required for interlocks

Mechanical interlocking must be ordered separately for each of the circuit breakers to be interlocked.

- Two interlocking modules and two Bowden cables are required for interlocking **two** circuit breakers. This means it is sufficient to order two mechanical interlocks provided the required Bowden cable length does not exceed 2 m.
- However, three interlocking modules and six Bowden cables are required for interlocking **three** circuit breakers. Three mechanical interlocks and three additional Bowden cables must therefore be ordered for this purpose.



Note

In the case of withdrawable circuit breakers in size 3, an adapter must also be ordered.

General information about the following configuration instructions:

Terms and abbreviations

The following terms are used in the configuration instructions from Chapter AUTOHOTSPOT onwards:

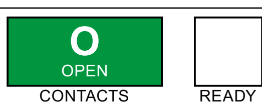
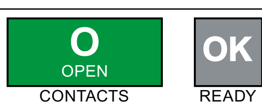
- A1: Output information 1
- A2: Output information 2
- E1: Input information 1
- E2: Input information 2
- Q1: Circuit breaker 1
- Q2: Circuit breaker 2
- Q3: Circuit breaker 3

To connect output information 1 of circuit breaker 1 with input information 2 of circuit breaker 2, for example, this abbreviation is used:

Q1 A1 - Q2 E2

Switching states on the operator panel

The states of the circuit breakers are indicated on the operator panel as follows:

Indication	Meaning
	Circuit breaker closed
	Circuit breaker open and not ready to close (interlocked)
	Circuit breaker open and ready to close (not interlocked)

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109792564).

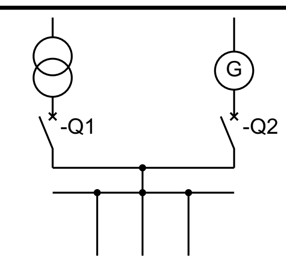
4.9.1.2 Article number

Mechanical interlock (Bowden cable interlocking)	Z option	Article number
For fixed-mounted circuit breakers [1]	S55	3WA9111-0BB21
For withdrawable circuit breakers [1]	R55	3WA9111-0BB22
For the guide frame [1] [2]	R56	3WA9111-0BB23
For withdrawable circuit breakers without guide frame [1] [3]	R57	3WA9111-0BB24
Adapter for frame size 3 circuit breaker [4] to install mechanical interlock for withdrawable circuit breakers	--	3WA9111-0BB25
Coupling on the circuit breaker	--	3WA9111-0BB31
Bowden cable 2000 mm	--	3WA9111-0BB41
Bowden cable 3000 mm	--	3WA9111-0BB42
Bowden cable 4500 m	--	3WA9111-0BB43

[1] Length of Bowden cable: 2000 mm; one required for each circuit breaker.
[2] Can only be used with separately ordered guide frame.
[3] Can only be used with separately ordered circuit breaker without guide frame.
[4] One required for each frame size 3 circuit breaker

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BB*).

4.9.1.3 Bowden cable interlocking of two circuit breakers

<table>
<tr><th rowspan="2">Example</th><th colspan="2">Possible circuit breaker statuses</th></tr>
<tr><th>Q1</th><th>Q2</th></tr>
<tr><td rowspan="3">
</td><td>O OPEN CONTACTS — OK READY</td><td>O OPEN CONTACTS — OK READY</td></tr>
<tr><td>I CLOSED CONTACTS — READY</td><td>O OPEN CONTACTS — READY</td></tr>
<tr><td>O OPEN CONTACTS — READY</td><td>I CLOSED CONTACTS — READY</td></tr>
</table>

Description

In the case of a line infeed via transformer and a generator infeed, a circuit breaker can only ever be closed when the other one is open. Power is provided either by the normal power supply (circuit breaker Q1) or the standby power supply (circuit breaker Q2).

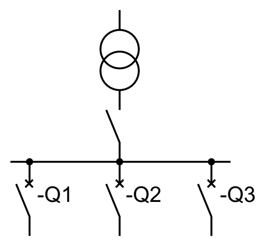
Required materials

An interlocking module with a Bowden cable is required for each circuit breaker, i.e. two mechanical interlocks must be ordered.

Connections of the Bowden cables

1st Bowden cable:	Q1 A1 - Q2 E1
2nd Bowden cable:	Q2 A1 - Q1 E1

4.9.1.4 Bowden cable interlocking of three circuit breakers (one of three)

Example	Possible circuit breaker statuses					
	Q1		Q2		Q3	
	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY
	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY	O OPEN CONTACTS	READY
	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY
	O OPEN CONTACTS	READY	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY

Description

In the case of parallel circuit breakers (e.g. redundancy), when one circuit breaker is closed, the other two cannot be closed.

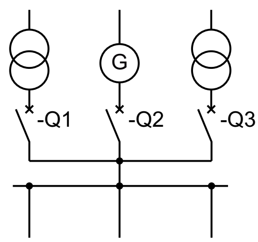
Required materials

An interlocking module with a Bowden cable and an extra Bowden cable are required for each circuit breaker, i.e. three mechanical interlocks and three Bowden cables must be ordered.

Connections of the Bowden cables

1st Bowden cable:	Q1 A1 - Q2 E1
2nd Bowden cable:	Q1 A2 - Q3 E1
3rd Bowden cable:	Q2 A1 - Q1 E1
4th Bowden cable:	Q2 A2 - Q3 E2
5th Bowden cable:	Q3 A1 - Q1 E2
6th Bowden cable:	Q3 A2 - Q2 E2

4.9.1.5 Bowden cable interlocking of three circuit breakers

Example	Possible circuit breaker statuses					
	Q1		Q2		Q3	
	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY
	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY	O OPEN CONTACTS	OK READY
	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY
	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY
	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY

Description

In the case of parallel infeeds from the normal power supply (circuit breakers Q1 and Q3) and a standby power supply (circuit breaker Q2), the standby power supply may only be switched on when the two normal line infeeds are switched off.

The two breakers for the normal power supply (Q1, Q3) can be closed and opened independently of each other.

The following conditions apply:

- The third circuit breaker (Q2) is only ready to close when the other two circuit breakers are open.
- When the third circuit breakers is closed, the other two circuit breakers cannot be closed.

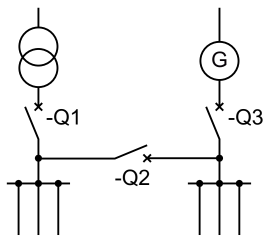
Required materials

An interlocking module with a Bowden cable and an extra Bowden cable are required for each circuit breaker, i.e. three mechanical interlocks and three Bowden cables must be ordered.

Connections of the Bowden cables

1st Bowden cable:	Q1 A1 - Q2 E1
2nd Bowden cable:	Q2 A1 - Q1 E1
3rd Bowden cable:	Q2 A2 - Q3 E1
4th Bowden cable:	Q3 A1 - Q2 E2

4.9.1.6 Bowden cable interlocking of three circuit breakers, two of which are interlocked

Example	Possible circuit breaker statuses					
	Q1		Q2		Q3	
	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY
	O OPEN CONTACTS	OK READY	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY
	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY
	I CLOSED CONTACTS	READY	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY
	I CLOSED CONTACTS	READY	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY
	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY

Description

The normal power supply (circuit breaker Q1) and the standby power supply (circuit breaker Q3) are isolated by means of a coupling (circuit breaker Q2). The normal power supply can also supply the loads of the standby power supply via the coupling. The standby power supply can only supply the loads of the standby power supply. The normal power supply circuit breaker (Q1) can be closed and opened independently of the other two. As the standby power supply can only supply the loads of the standby power supply, the coupling (circuit breaker Q2) must be opened when the standby power supply infeed (circuit breaker Q3) is switched on. Only interlocking of the two circuit breakers Q2 and Q3 is required for this reason.

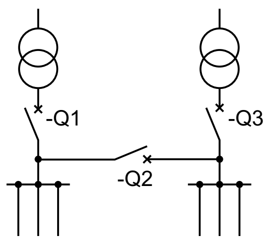
Required materials

An interlocking module with a Bowden cable is required for each circuit breaker, i.e. three mechanical interlocks must be ordered.

Connections of the Bowden cables

1st Bowden cable:	Q2 A1 - Q3 E1
2nd Bowden cable:	Q3 A1 - Q2 E1

4.9.1.7 Bowden cable interlocking of three circuit breakers

Example	Possible circuit breaker statuses					
	Q1		Q2		Q3	
	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY
	I CLOSED CONTACTS	READY	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY
	O OPEN CONTACTS	OK READY	I CLOSED CONTACTS	READY	O OPEN CONTACTS	OK READY
	O OPEN CONTACTS	OK READY	O OPEN CONTACTS	OK READY	I CLOSED CONTACTS	READY
	I CLOSED CONTACTS	READY	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY
	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY	I CLOSED CONTACTS	READY
	I CLOSED CONTACTS	READY	O OPEN CONTACTS	READY	I CLOSED CONTACTS	READY

Description

In order to minimize the short-circuit load on the power supply, the two infeeds may not be switched on when the coupling is closed. Up to two circuit breakers can be closed at any time, but the third is interlocked.

Required materials

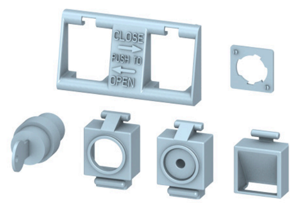
An interlocking module with a Bowden cable and an extra Bowden cable are required for each circuit breaker, i.e. three mechanical interlocks and three Bowden cables must be ordered.

Connections of the Bowden cables

1st Bowden cable:	Q1 A1 - Q2 E1
2nd Bowden cable:	Q1 A2 - Q3 E1
3rd Bowden cable:	Q2 A1 - Q1 E1
4th Bowden cable:	Q2 A2 - Q3 E2
5th Bowden cable:	Q3 A1 - Q1 E2
6th Bowden cable:	Q3 A2 - Q2 E2

4.9.2 Interlock for mechanical close/open

4.9.2.1 Description



This interlock can be used to protect the mechanical close and/or the mechanical open against operation. Unauthorized mechanical closing and/or opening is prevented.

Note

Closing by the local electric close or by remote closing remains possible.

Remote opening (e.g. via shunt trip) remains possible.

This interlock is always offered as a set with several types of interlocking and is available in three versions:

- The version with a **lock mount without safety locks** comprises:
  - Two lock mounts without safety locks
  - Two transparent covers for sealing or for attaching up to three padlocks
  - Two covers with a hole (∅ 6.35 mm) for tool actuation
- The version with a **lock mount with CES locks** comprises:
  - Two lock mounts with CES safety locks
  - Two transparent covers for sealing or for attaching up to three padlocks
  - Two covers with a hole (∅ 6.35 mm) for tool actuation
- The version with a **lock mount with IKON locks** comprises:
  - Two lock mounts with IKON safety locks
  - Two transparent covers for sealing or for attaching up to three padlocks
  - Two covers with a hole (∅ 6.35 mm) for tool actuation

The seal and the padlocks are not included in the scope of supply.

The interlock for mechanical close/open can be retrofit. It is not possible to have this preinstalled at the factory.

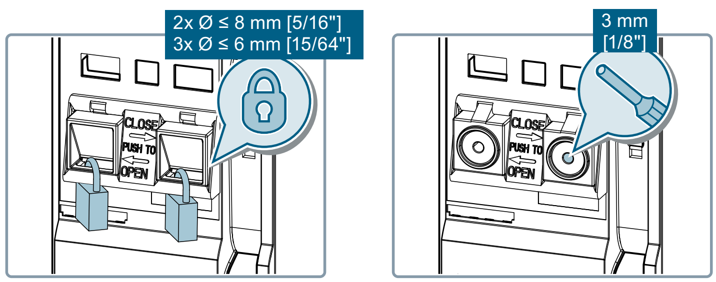
For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783678).

4.9.2.2 Activation

Note

In the case of interlocking with safety locks:

- The mechanical close/open can only be operated when the key is inserted (key operation).
- The lock is only active when the key is removed.



4.9.2.3 Article number

Interlock for mechanical close/open	Article number
Without safety lock[1)]	3WA9111-0BA21
For key operation [1)]	
Made by CES	3WA9111-0BA22
Made by IKON	3WA9111-0BA23

[1)] Set consisting of 2 transparent covers for sealing or for attaching padlocks, 2 covers with 6.35 mm hole (for tool actuation) and 2 lock mounts for safety lock for key operation.

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BA2*).

4.9.3 Interlock system to prevent unauthorized closing

4.9.3.1 Description

An interlock system for interlocking three circuit breakers is available in which only two circuit breakers can be closed.
In this interlock system, the open circuit breaker can only be closed if one of the two closed circuit breakers is opened first.

The interlock system is based on the locking provision to prevent unauthorized closing - Safe Open. The locks used have the same cylinder. However, only two keys are provided and this ensures that one circuit breaker must always remain open.

The interlock system is not supplied preinstalled and can only be installed by the customer.

The scope of supply includes:

- Three locks with the same cylinders for three circuit breakers
- Two identical keys

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783685).

4.9.3.2 Activation

Activation is identical to the activation of a locking provision to prevent unauthorized closing - Safe Open, see Chapter Activation (Page 292) on this topic.

4.9.3.3 Article number

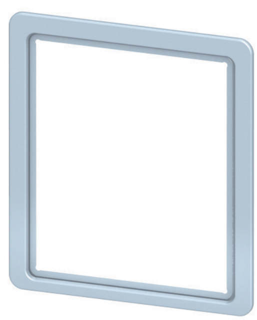
Interlock system to prevent unauthorized closing	**Article number**
For 3 circuit breakers with key operation, made by CES	3WA9111-0BA43

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BA43).

4.10 Accessories for integration in the power distribution equipment

4.10.1 Door sealing frame

4.10.1.1 Description



A cutout in the control cabinet door is required in order to operate the circuit breaker when the control cabinet door is closed. Use of the door sealing frame provides:

- Clean and attractive overall appearance of the cutout
- Degree of protection IP41

The door sealing frame can be used for both fixed-mounted and withdrawable circuit breakers.

Note

The door sealing frame **cannot** be combined with the IP55 protective cover.

The door sealing frame can be retrofit. If it is ordered at the same time as a circuit breaker, it is enclosed loose in the circuit breaker package.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783683).

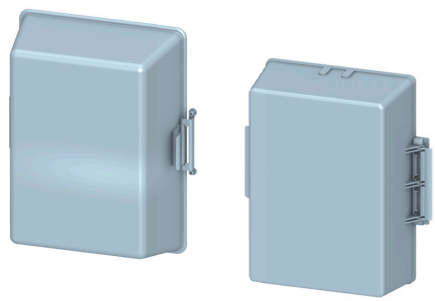
4.10.1.2 Article number

	Z-option	Article number
Door sealing frame	T40	3WA9111-0AP01

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AP01).

4.10.2 IP55 protective cover

4.10.2.1 Description



The transparent protective cover protects the complete front side of the circuit breaker. In this way, degree of protection IP 55 is achieved.

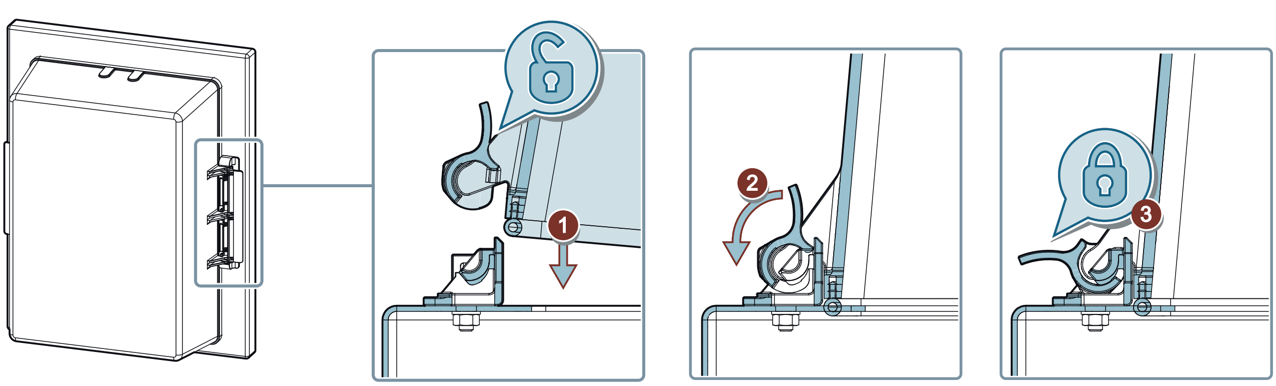
Note

Check the position and seal of the protective cover after a short-circuit trip.

The effect of high breaking capacities on the IP55 protective cover must be determined based on the configuration of the power distribution equipment in each case.

Opening and removal of the protective cover:

- Opening:
  Unlock the locking lever of a hinge in the direction of the hinge center and gently press the sides of the protective cover together.
  The protective cover can be opened on both sides.
- Removal:
  Unlock hinges.



Note

The protective cover **cannot** be combined with the door sealing frame.

The effects of high breaking capacities on the protective cover must be determined based on the configuration of the power distribution equipment in each case. After a short-circuit trip, the protective cover must be inspected for correct mounting, correct position and the correct position of the seals.

The protective cover can only be ordered as an accessory component.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783684).

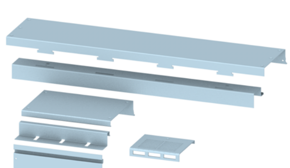
4.10.2.2 Article number

	Article number
IP55 protective cover	3WA9111-0AP03

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AP03).

4.10.3 Arc chute cover

4.10.3.1 Description



The arc chute cover is used with guide frames. It serves to protect power distribution equipment components which are located directly above the circuit breaker. The arcing spaces and consequently the required clearances to live or grounded components located above the circuit breaker are minimized. You will find information about the required safety clearances in Chapter Dimension drawings (Page 403).

Arc chute covers are available for withdrawable AC circuit breakers and non-automatic circuit breakers with breaking capacity N, S, M and H.

Note

If the main contacts and arc chutes need to be replaced during maintenance, the arc chute cover must always be replaced as well.

The arc chute cover for guide frames can be retrofit.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783976).

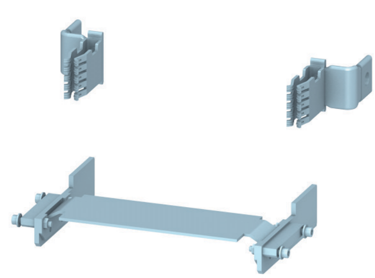
4.10.3.2 Article number

Arc chute cover	Article number
3-pole	
Size 1	3WA9111-0AS31
Size 2	3WA9111-0AS32
Size 3	3WA9111-0AS33
4-pole	
Size 1	3WA9111-0AS41
Size 2	3WA9111-0AS42
Size 3	3WA9111-0AS43

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AS*).

4.10.4 Grounding connection between the guide frame and the circuit breaker

4.10.4.1 Description



Normally, the metal parts on the circuit breaker are grounded through the direct contact of the circuit breaker feet with the guide frame. The accessory "Grounding connection between the guide frame and the circuit breaker" uses contact modules to provide an additional grounding connection for ground short-circuit currents ≤ 60 kA independent of its mounting configuration.

- When the circuit breaker is **racked into** the guide frame, the leading grounding connection contacts before the main contacts make contact.
- When the circuit breaker is **racked out**, the grounding connection is maintained until the main contacts are isolated.

The grounding connection between the guide frame and the withdrawable circuit breaker comprises:

- For the guide frame:
  - Ground short-circuit currents ≤ 30 kA: One contact module
  - Ground short-circuit currents ≤ 60 kA: Two contact modules
- For the withdrawable circuit breaker:
  - One contact module

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783682).

4.10.4.2 Article number

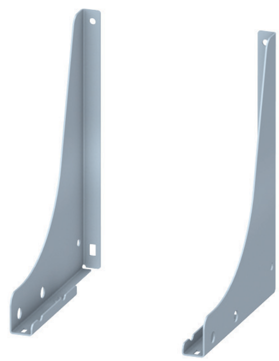
Contact module	Article number
For the guide frame [1]	
Size 1 / 2	3WA9111-0BG01
Size 3	3WA9111-0BG02
For 3-pole withdrawable circuit breakers	
Size 1	3WA9111-0BG11
Size 2 [2]	3WA9111-0BG12
Size 3 [3]	3WA9111-0BG13
For 4-pole withdrawable circuit breakers	
Size 1	3WA9111-0BG21
Size 2 [2]	3WA9111-0BG22
Size 3	3WA9111-0BG23

1) For 30 kA ground short-circuit current: order 1 x; for 60 kA ground short-circuit current: order 2 x
2) Cannot be used for breaking capacity C and size 2, 4000 A
3) Cannot be used for breaking capacity E

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BG*).

4.10.5 Support brackets

4.10.5.1 Description



The support brackets make it possible to install a fixed-mounted circuit breaker on a vertical plane.

They are always supplied in pairs (left and right support bracket) and can be used for:

- Frame size 1
- Frame size 2

The support brackets can only be ordered as an accessory and are supplied separately.

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783666).

4.10.5.2 Article number

	Article number
Support bracket, scope of supply: 2 units	3WA9111-0BB50

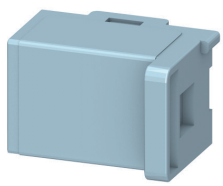
Can only be used for sizes 1 and 2

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0BB50).

4.11 Accessories for the ETU300 and ETU600 electronic trip units

4.11.1 Option plug

4.11.1.1 Description



The option plug determines:

- The current rating of the circuit breaker
- The basic protective functions of the electronic trip unit

Replacing the option plug makes it possible to adapt the circuit breaker to changes in the power distribution equipment. The ground-fault protection for the electronic trip unit can be retrofit and the current rating of the circuit breaker can be reduced in this way. The permissible rated currents for the circuit breaker depend on the size and are listed in Chapter Option plug (Page 45).

The option plug can be replaced.

NOTICE
Circuit breaker damage if operated without option plug
Circuit breakers with an electronic trip unit must not be operated without an option plug.
Before closing the circuit breaker, check that an option plug is installed in the electronic trip unit.

NOTICE
Circuit breaker damage if option plug is not replaced properly
Circuit breaker damage can result if the option plug is not replaced properly.
The option plug may only be replaced under the following conditions: • The withdrawable circuit breaker is in the disconnected position • **or** the fixed-mounted circuit breaker is open and the electronic trip unit is disconnected from the auxiliary power supply • **or** the electronic trip unit is removed.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783657).

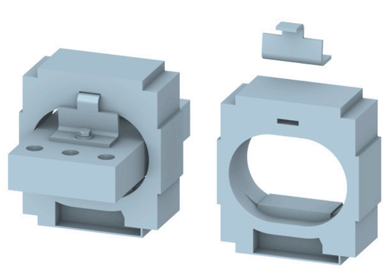
4.11.1.2 Article number

Option plug		Article number
Basic protective function	LSI	3WA9111-0EB..
	LSIG GFx - Ground-fault protection GF extended	3WA9111-0EX..
Rated current	250 A	02
	315 A	03
	400 A	04
	500 A	05
	630 A	06
	800 A	08
	1000 A	10
	1250 A	12
	1600 A	16
	2000 A	20
	2500 A	25
	3200 A	32
	4000 A	40
	5000 A	50
	6300 A	63

You can purchase the accessories in the Siemens Industry Mall (3WA9111-0EB.. (http://www.siemens.com/product?3WA9111-0EB*) or 3WA9111-0EX.. (http://www.siemens.com/product?3WA9111-0EX*)).

4.11.2 External current sensor for neutral pole

4.11.2.1 Description



Note

This accessory is only intended for 3-pole circuit breakers.

The external current sensor for the neutral conductor (N-CT) enables protection of the neutral conductor against overload and short-circuit by the electronic trip unit (ETU) of the circuit breaker. This current sensor is also used for calculating ground-fault currents using the vectorial sum (GF Residual) with the electronic trip unit.

The external current sensor for the neutral conductor is available in two versions:

- Current sensor for busbar mounting
  The sensor is pushed onto the busbar and bolted in place.
- Current sensor for busbar connection
  The sensor has a short copper connection element which is connected to two busbar ends.

The external sensor for the N conductor is connected to secondary disconnect terminals X8.9 and X8.10 of the circuit breaker.
The current sensor is supplied with a 2 m long twisted connection cable that is fitted with the appropriate plug-in connector for the sensor.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783671).

4.11.2.2 Technical specifications

All versions of the external current sensor for the N conductor have the same output signal and are compatible.

You can find the dimensions in Chapter External current sensor for the neutral pole (N-CT) (Page 455).

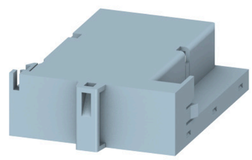
4.11.2.3 Article number

External current sensor for the N-conductor	Article number
Version for system-side copper bar	
For size 1	3WA9111-0AA21
For size 2	3WA9111-0AA22
For size 3	3WA9111-0AA23
Version with copper connection elements	
For size 1	3WA9111-0AA31
For size 2	3WA9111-0AA32
For size 3	3WA9111-0AA33

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0AA*).

4.11.3 Voltage tap module VTM for ETU600

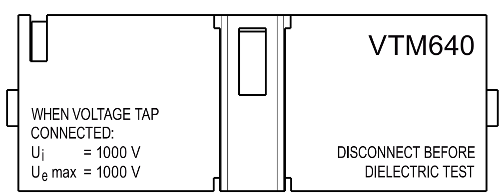
4.11.3.1 Description

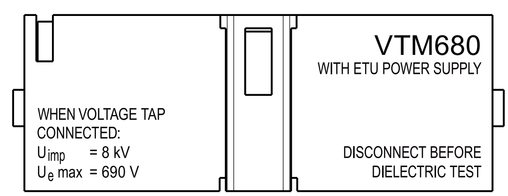


The voltage tap module extends the functional scope of the electronic trip unit ETU600 and is required for measuring voltage and for calculating other metering values.

The voltage tap module is available in two versions:

- VTM680 voltage tap module
  For circuit breakers with breaking capacity N, S, M, H and C with a maximum rated voltage of 690 V AC
  - Includes the power supply for the electronic trip unit ETU600 via the voltage of the main conducting paths.
- VTM640 voltage tap module
  For circuit breakers with breaking capacity E and a maximum rated voltage of 1000 V AC





The voltage tap module also requires a voltage tap internally mounted in the circuit breaker. This tap is present in all circuit breakers with a metering function.

Note

When replacing the VTM680 voltage tap module in an 3WA air circuit breaker with ID number lower than ID No. OE/230101500000,
the internal cable harness of the voltage tap must also be replaced.
In this case, the accessory "Internal voltage tap on main current paths (Page 340)" is required.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783655).

See also

Retrofit of the internal voltage tap (Page 342)

4.11.3.2 Article number

Voltage tap module VTM	Article number
VTM640	3WA9111-0EM11
VTM680	3WA9111-0EM12

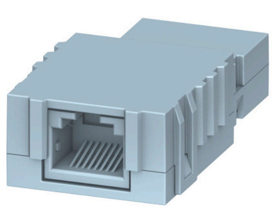
You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EM1*).

VTM680 voltage tap module and internal cable harness for voltage tap for 3WA circuit breakers with ID number lower than ID No. OE/230101500000	Article number
3-pole	
Size 1	3WA9111-0EK51
Size 2	3WA9111-0EK52
Size 3	3WA9111-0EK53
4-pole	
Size 1	3WA9111-0EK61
Size 2	3WA9111-0EK62
Size 3	3WA9111-0EK63

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EK*).

4.11.4 Adapter for the activation of the ETU300

4.11.4.1 Description



The ETU300 electronic trip unit can be supplied with external voltage and activated using the TD400 commissioning, test and service tool. A status check of the ETU300 is then possible.

The external voltage supply of the ETU300 is possible from firmware version V1.3.1 of the TD400 test and service tool.

Note

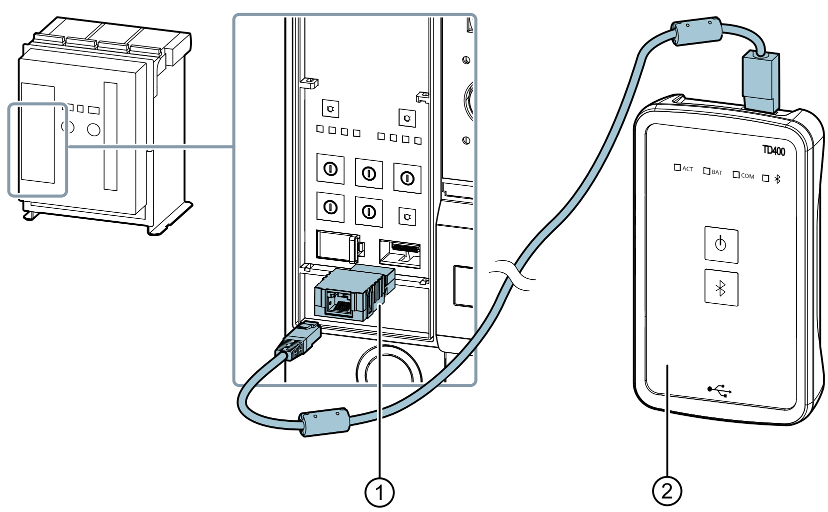
Firmware update

For a firmware version V1.2 or older, the firmware must first be updated to firmware version V1.3. Only then is a firmware update to version V1.3.1 (or higher) possible.

The TD400 commissioning, test and service tool is connected to the ETU300 via the 3WA-ETU300 adapter.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109770304).

4.11.4.2 Connection



① Adapter
② TD400 commissioning, test and service tool

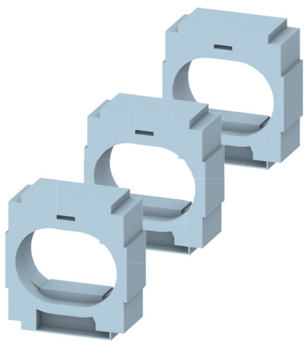
4.11.4.3 Article number

	Article number
TD400 commissioning, test and service tool	3VW9011-0AT40
3WA-ETU300 adapter	3VW9011-0AT46

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3VW9011-0AT4*).

4.11.5 Internal current sensors without energy cores for ETU600

4.11.5.1 Description



If the circuit breaker is used in a power distribution system with very high harmonic components, e.g. in applications with frequency converters, significant intrinsic heating of the current sensors is possible. In this case, the energy cores integrated in the current sensors which are required for the power supply of the electronic trip unit may be overloaded.

For this particular application, a circuit breaker with the electronic trip unit ETU600 can be equipped with a special version of the internal current sensors at the factory as an option. Internal current sensors without energy cores are installed at the factory with option code Z = K60. The electronic trip unit ETU600 must be powered by an external auxiliary voltage of 24 V DC. The circuit breaker must be equipped with an undervoltage release in addition.

Due to the necessity of an auxiliary power supply for the electronic trip unit, option K60 can only be used in conjunction with an ETU600.

The connected auxiliary voltage is monitored. If the 24 V DC auxiliary voltage fails, the circuit breaker is opened by the monitoring function that is connected to the undervoltage release.

WARNING

Loss of direct-acting circuit breaker functionality with option code Z = K60 (internal current sensors, without energy cores, for applications with frequency converters)

When the circuit breaker is equipped with current sensors without energy cores, the electronic trip unit is not self-powered.

For these applications, an undervoltage release and an external 24 V DC power supply are required for activating the electronic trip unit.

The auxiliary power supply for the electronic trip unit is internally coupled to the undervoltage release of the circuit breaker.

For more information, refer to the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109816505).

4.11.5.2 Technical specifications

The internal current sensors without energy cores can only be installed at the factory for 3WA1 circuit breakers with an electronic trip unit ETU600. A retrofit is not technically possible.

Note

If the option Z = K60 is installed, an optional metering function PMF-I to PMF-III is possible. This metering function has the accuracy specified by the manufacturer. A certificate according to IEC 61557-12 cannot be created in this case.

4.11.5.3 Connection

The electronic trip unit ETU600 must be powered by an external auxiliary voltage of 24 V DC, which must be connected to secondary disconnect terminals X8.3 and X8.4. The circuit breaker must be equipped with an undervoltage release in addition. This is available for 24 V DC control supply voltages up to 208 - 240 V AC / 220 - 250 V DC. The 380 - 415 V AC version is not possible for this application.

The following undervoltage releases can be selected when configuring the circuit breaker.

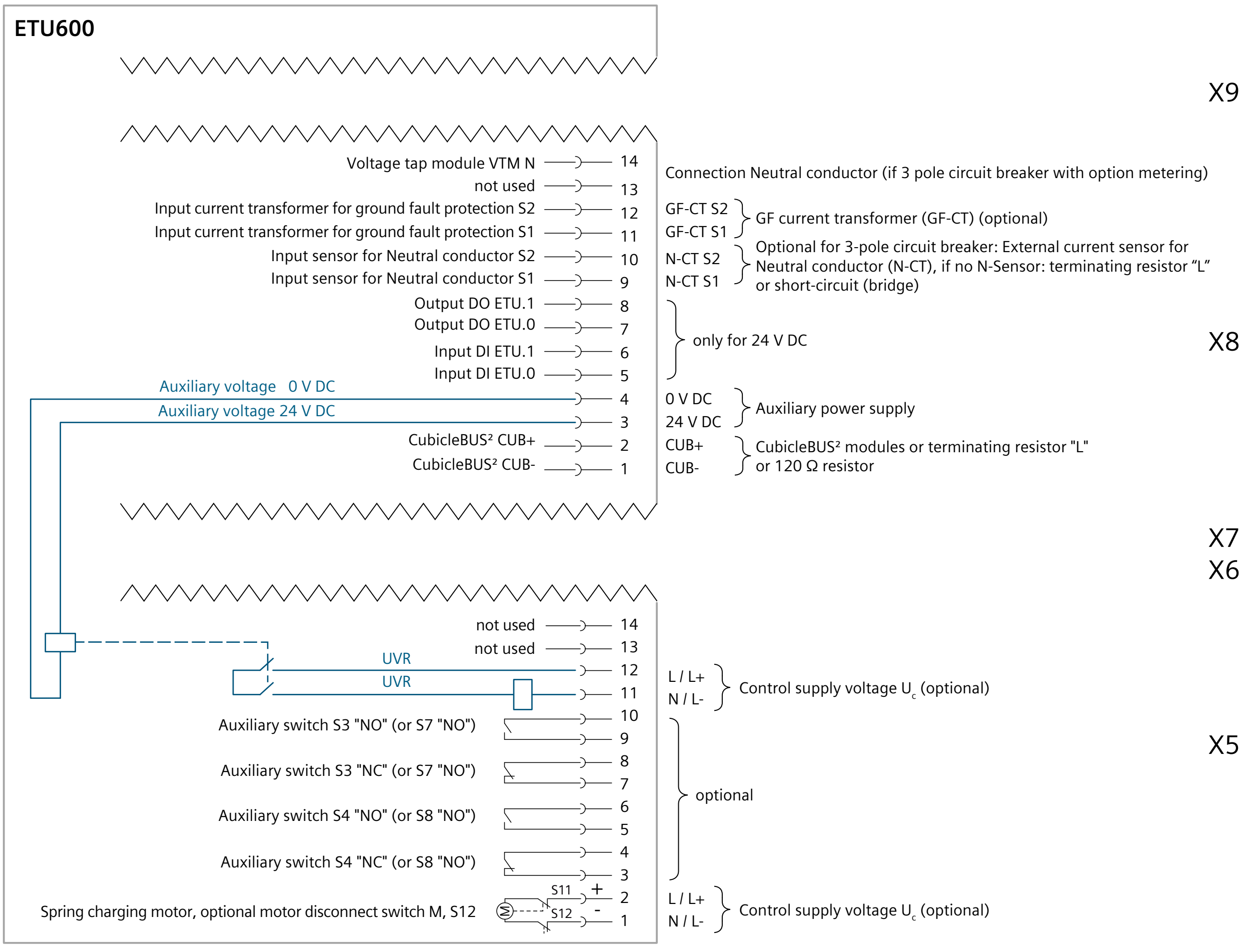
Auxiliary releases	Type	15th digit of the article number [1)]
Undervoltage release (UVR), instantaneous (≤ 0.08 s) and short-time-delayed (≤ 0.2 s)	24 V DC	L
	48 V DC	N
	110 ... 127 V AC/110 ... 125 V DC	P
	208 ... 240 V AC/220 ... 250 V DC	Q

[1)] The article number comprises up to 16 digits, e.g. 3WA1 ....-....-..x.
The 15th digit represents the selection of accessories such as the undervoltage release.

The control supply voltage of the undervoltage release must be connected to secondary disconnect terminals X5.11 and X5.12.

The connected auxiliary voltage of 24 V DC is monitored by an internal relay. If the auxiliary voltage fails, the circuit breaker is opened by the relay contacts that are connected in the control circuit of the undervoltage release.

Terminal assignment diagram of secondary disconnect terminals X5 and X8



4.11.5.4 Article number

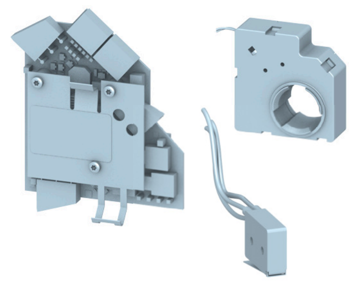
	Z option	Article number
Internal current sensors without energy cores for ETU600	K60	3WA---

Note

Option Z=K60 is not technically feasible for the electronic trip unit ETU300.

4.11.6 Ready4COM thanks to BSS200 Breaker Status Sensor for ETU600

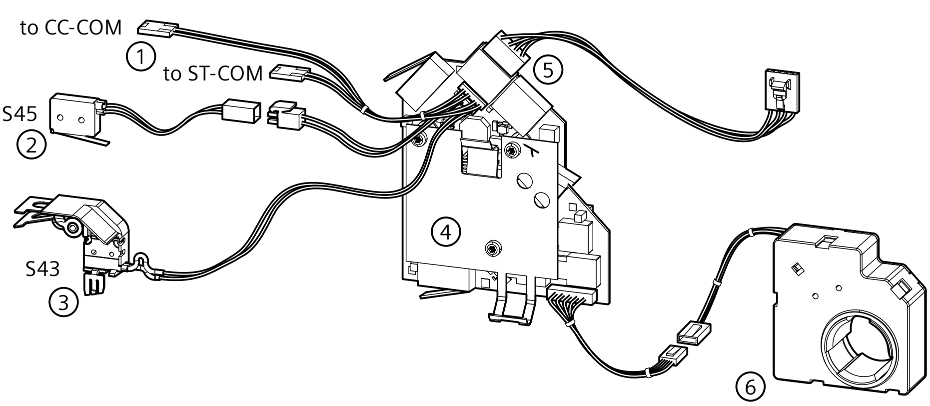
4.11.6.1 Description



The 3WA circuit breaker obtains the "ready4COM" feature thanks to the Breaker Status Sensor BSS200.

The Breaker Status Sensor BSS200 forms part of every circuit breaker with the electronic trip unit ETU600 with the "ready4COM" application package or metering functions PMF-I to PMF-III.

The Breaker Status Sensor BSS200 collects information about status states of the circuit breaker with the signaling switch and transmits it to the CubicleBUS². In addition, it controls the communication-capable CC-COM closing coil and the ST-COM shunt trip in a circuit breaker with the "ready4COM" feature.



(1) Connection for CC-COM closing coil and ST-COM shunt trip

(2) Trip alarm switch S45

(3) S43 signaling switch for second auxiliary release (ST2, UVR, or UVR-t)

(4) Module with the ready-to-close signaling switches S40, spring charge status S41, and main contacts (open/closed) S44

(5) CubicleBUS² connection

(6) Position signaling switch connected position S46 and test position S47

Note

Connections not used

If there is no CC-COM closing coil or ST-COM shunt trip in the circuit breaker, the connections for the magnetic systems are not used and are located at the mounting positions of the magnetic systems. The same applies to the signaling switch S43 for the second auxiliary release (ST2, UVR, or UVR-t).

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109816503).

4.11.6.2 Technical specifications

Rated control supply voltage U_S	24 V DC ± 20%
Power consumption	1.3 W
Current consumption	50 mA

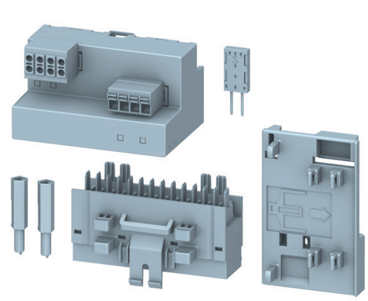
4.11.6.3 Article number

	Article number
BSS200 breaker status sensor	3WA9111-0EC40

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EC40).

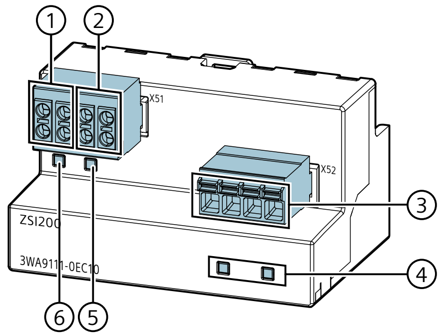
4.11.7 ZSI200 zone selective interlocking module

4.11.7.1 Description



The load on a power distribution system can be reduced under short-circuit and ground fault conditions when circuit breakers are used in a ZSI system.

Short-circuits and ground faults are disconnected after a short delay, independently of the coordination of the response characteristics of the circuit breakers. The zone-selective interlocking feature allows full selectivity to be achieved with a low break time. This increases the supply reliability of the non-faulty feeders. You can find detailed information in Chapter Zone-selective interlocking ZSI (Page 175).



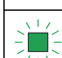
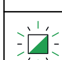
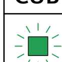
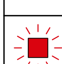
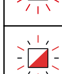
(1)	CubicleBUS² connection	(4)	LEDs port A and port B
(2)	Power supply connection	(5)	LED CUB (CubicleBUS²)
(3)	ZSI interfaces port A and port B	(6)	ACT LED (Active)

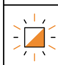
The ZSI200 zone selective interlocking module has two ZSI interfaces:

- Port A
- Port B

Active interfaces are signaled via the LEDs port A and port B.

The ACT (Active) LED indicates whether the module is ready and the CUB (CubicleBUS²) LED indicates whether communication is taking place via the CubicleBUS².

LED	Meaning	Description
ACT		
	On	Normal operation
	Off	Module without power supply
	Flashing	Restricted operating mode
CUB		
	On	CubicleBUS² communication normal
	Off	No active CubicleBUS² nodes
	On	Protocol error detected on CubicleBUS²
	Flashing	Another CubicleBUS² node with the same node address was detected
ACT + CUB		
	Flashing	Identification active

LED	Meaning	Description
Port A, port B		
	Off	ZSI control signal not present
	On	Sends ZSI control signal
	Flashing	Receives ZSI control signal

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109816504).

4.11.7.2 Technical specifications

Rated control supply voltage U_S	24 V DC ± 20%
Rated power dissipation	0.72 W
Current consumption	30 mA
Suitability for use	Installation in stationary power distribution equipment within closed rooms
Type of mounting	Mounted on circuit breaker DIN rail 35 mm
Mounting position	Vertical or horizontal
Width	72 mm
Height	41 mm
Depth	49 mm 52 mm with DIN-rail adapter
Weight (without terminals)	60 g
Degree of protection according to IEC 60529	IP20
Number of ZSI interfaces	2 (port A, port B)
Maximum number of ZSI200 modules per circuit breaker	1
Maximum number of circuit breakers per ZSI interface	20
Connectable conductor cross-sections	
Design of electrical connection	Removable/push-in connection terminal
Solid	0.2 ... 1.5 mm²
Finely stranded/with end sleeve	0.25 ... 1.5 mm²
Finely stranded	0.2 ... 2.5 mm²
For solid AWG cable	AWG 24 ... AWG 16
Maximum distance between 2 modules for twisted pair cables with a minimum cross-section of 2 x 0.75 mm² (AWG 19)	100 m
Maximum distance between 2 modules for twisted pair cables with a minimum cross-section of 2 x 1.5 mm² (AWG 16)	1000 m
Electromagnetic compatibility	

Conducted or radiated emissions	EN 60947-1
	EN 60947-2 (CISPR 11 (Group 1, Class B))
	FCC Class A
	Shipbuilding requirements
Immunity in industrial environment	EN 60947-1
	EN 60947-2
	Shipbuilding requirements
Ambient conditions	
Operation	-40 ... +70 °C
Transport and storage	-40 ... +80 °C
Degree of pollution	3

4.11.7.3 Article number

Article	Article number
ZSI200 zone selective interlocking module	3WA9111-0EC10

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EC10).

4.11.8 Replacement battery for ETU600

4.11.8.1 Description

The ETU600 electronic trip unit is equipped with a lithium battery. This powers the internal clock of the electronic trip unit.

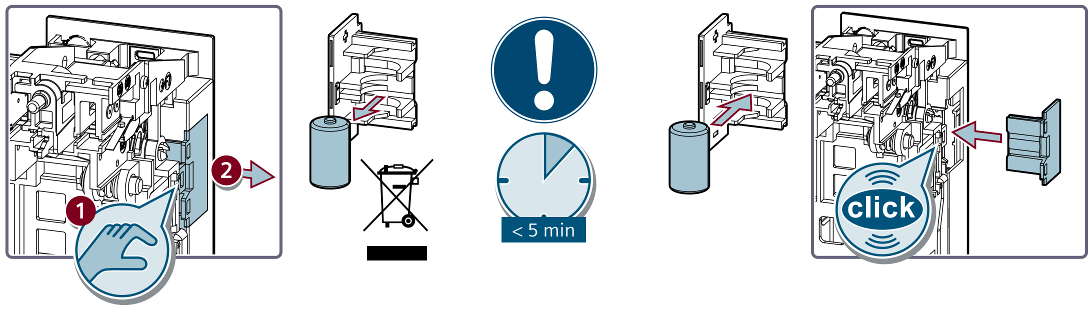
The service life of the battery depends on the ambient conditions; it is at least five years. The current state of charge is displayed in the upper display line of the ETU600 electronic trip unit:

 Battery full

 Battery empty, replacement necessary

The battery can be ordered as a spare part from Siemens and replaced on site.

4.11.8.2 Replacing the battery



4.11.8.3 Article number

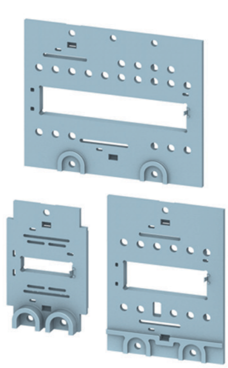
	Article number
Replacement battery for the ETU600 electronic trip unit	3WA9111-0EE81

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EE81).

4.12 Internal voltage tap on main current paths

4.12.1 Voltage tap conversion

4.12.1.1 Description



The circuit breaker can optionally be equipped with an internal voltage tap on the top or bottom main connections. The position (upper stab/lower stab) can be changed using a conversion kit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783660).

4.12.1.2 Article number

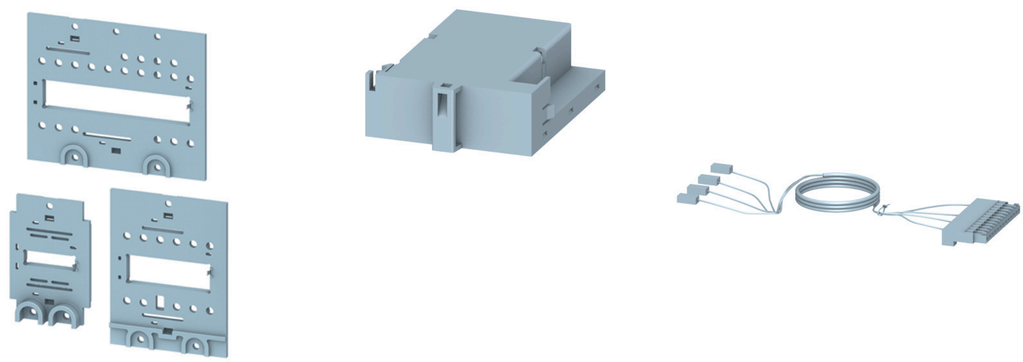
Voltage tap conversion - from lower to upper stab	Article number
3-pole	
Frame size 1	3WA9111-0EK11
Frame size 2	3WA9111-0EK12
Frame size 3	3WA9111-0EK13
4-pole	
Frame size 1	3WA9111-0EK21
Frame size 2	3WA9111-0EK22
Frame size 3	3WA9111-0EK23

Voltage tap conversion - from upper to lower stab	Article number
3-pole	
Frame size 1	3WA9111-0EK31
Frame size 2	3WA9111-0EK32
Frame size 3	3WA9111-0EK33
4-pole	
Frame size 1	3WA9111-0EK41
Frame size 2	3WA9111-0EK42
Frame size 3	3WA9111-0EK43

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EK*).

4.12.2 Retrofit of the internal voltage tap

4.12.2.1 Description



The internal voltage tap can be retrofit on the lower main conducting paths of a circuit breaker ordered without an internal voltage tap pre-assembled in the factory.

The retrofit kit supplied for this purpose comprises:

- Required covers for the current sensors
- Voltage tap module VTM
- Cable harness for connecting the voltage tap module

Note

It is not possible to move the voltage tap from the bottom to the top main connections during a retrofit.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109795042).

4.12.2.2 Article number

Retrofit kit for the internal voltage tap	Article number
3-pole, breaking capacity N, S, M, H, C (not for E) [1)]	
Size 1	3WA9111-0EK51
Size 2	3WA9111-0EK52
Size 3	3WA9111-0EK53
3-pole, breaking capacity E [2)]	
Size 1	3WA9111-0EK55
Size 2	3WA9111-0EK56
Size 3	3WA9111-0EK57
4-pole, breaking capacity N, S, M, H, C (not for E) [1)]	

Retrofit kit for the internal voltage tap	Article number
Size 1	3WA9111-0EK61
Size 2	3WA9111-0EK62
Size 3	3WA9111-0EK63
4-pole, breaking capacity E [2]	
Size 1	3WA9111-0EK65
Size 2	3WA9111-0EK66
Size 3	3WA9111-0EK67

[1] The scope of supply includes: VTM680

[2] The scope of supply includes: VTM640

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EK*).

4.13 Connection of an external voltage transformer

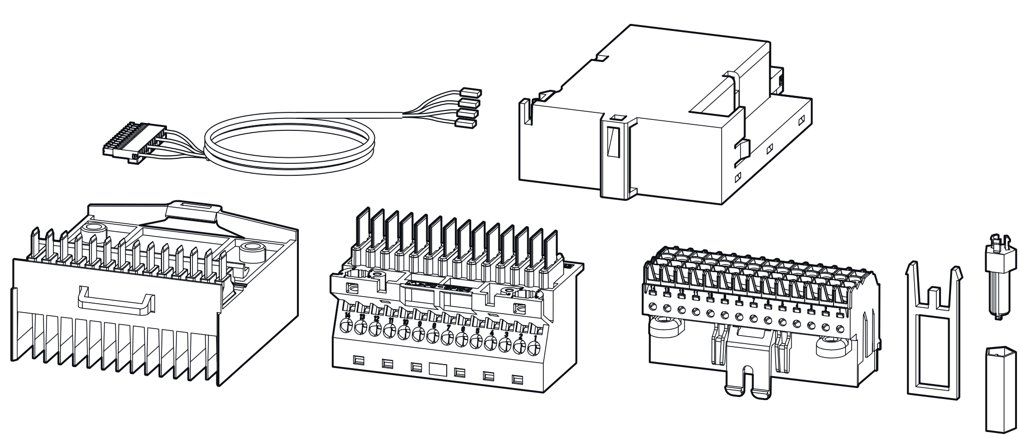
4.13.1 Description

A circuit breaker with the electronic trip unit ETU600 can be configured with an optional metering function. An internal voltage tap or an external voltage transformer in conjunction with a VTM voltage tap module is required for measuring the voltage.

It is possible to retrofit the connection for an external voltage transformer on frame size 2 and frame size 3 circuit breakers with ETU600.

The retrofit kit comprises:

- Internal cable harness
- Voltage tap module VTM640
- Components required for the secondary disconnect terminal



The voltage transformers are connected in a star connection to terminals X9.1 to X9.4 of the secondary disconnect terminal of the circuit breaker.

Please comply with the following specifications for connecting external voltage transformers:

- Primary voltage U_{pr} = 100 V AC to 690 V AC (selection according to phase voltage of the system)
- Secondary voltage U_{sr} = 100 V AC to 120 V AC
- Output load of the voltage transformers through the electronic trip unit ETU600: 100 kΩ
- The 1% measuring accuracy for the voltage requires voltage transformers in accuracy class 0.5.

The transformation ratio of the voltage transformers must be set on the electronic trip unit ETU600. This can be done in menu item 5.3.4 "Voltage measurement" using the operating keys on the display of the electronic trip unit ETU600 or with the help of the SENTRON powerconfig commissioning and service software.

Note

The primary voltage of the voltage transformers used should match the phase voltages of the power distribution system.

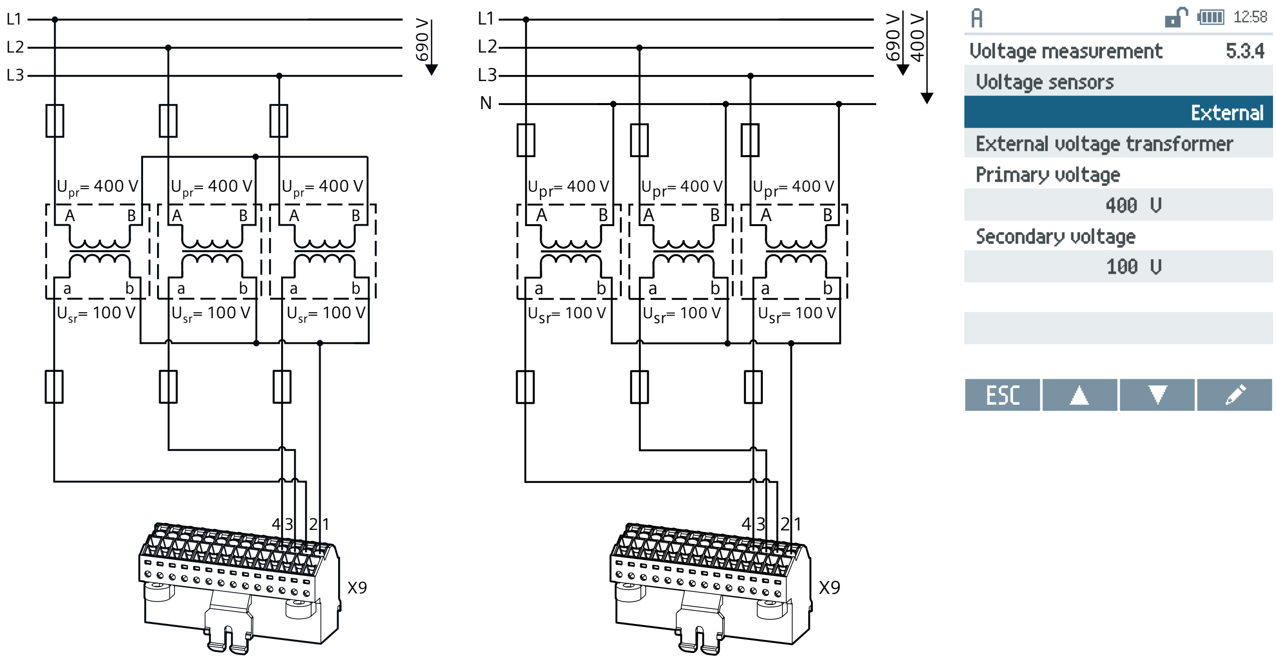
Example:
The phase voltage in a 690 V system is 400 V. Primary voltage U_{pr} of the voltage transformers used should be 400 V.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109795097).

4.13.2 Connection

The voltage transformers must be wired as shown in the circuit examples and fused on both the primary and secondary sides.

Example in a system with a rated voltage of 690 V AC:



X9		
Connection	**3WA designation**	**Signal designation**
X9.1	C	External voltage transformer NEUTRAL POINT
X9.2	L3	External voltage transformer L3
X9.3	L2	External voltage transformer L2
X9.4	L1	External voltage transformer L1

Note

The fuse protection of the primary and secondary circuits of the voltage transformers used is implemented according to the manufacturer's specifications.

4.13.3 Article number

	Article number
Retrofit kit to connect an external voltage transformer	3WA9111-0EK81

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EK81).

4.14 Function packages for the ETU600 electronic trip unit

4.14.1 Description

The properties of the ETU600 electronic trip unit can be extended using digital function packages. The different function packages make it possible to configure customized protection and metering functionality for the circuit breaker to suit the particular application.

The function packages can be installed in the ETU600 electronic trip unit via the USB-C interface using the SENTRON powerconfig configuration software.

The function packages can be installed at a later stage or immediately before commissioning of the power distribution equipment and without the need to replace the electronic trip unit.

4.14.2 Function packages for protection and alarm functions

4.14.2.1 Description

The function packages for protection and alarm functions include:

- Ground-fault alarm
  The ground-fault alarm makes it possible to detect a high-resistance ground fault without switching off the system.
- Short-time-delayed short-circuit protection dST and reverse power protection RP
  Directed short-time-delayed short-circuit protection dST and reverse power protection RP extend the basic protection of the ETU600 electronic trip unit.

Note

The directed protective functions require a voltage tap module. This can be retrofit (see Chapter Voltage tap module VTM for ETU600 (Page 329)) but is included with the electronic trip unit in the case of circuit breakers with a measurement function.

For more information on the protective functions, see Chapter Protection system (Page 44).

4.14.2.2 Article number

Function packages for protection and alarm functions	Article number
Ground-fault alarm	3WA9111-0ES01
Directional short time dST and reverse power protection RP [1)]	3WA9111-0ES05

1) Requires an additional voltage tap module

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0ES0*).

4.14.3 Function packages for enhanced protective functions EPF

4.14.3.1 Description

The enhanced protective functions EPF add the following to the protective function of the ETU600 electronic trip unit:

- Unbalance
  Phase current unbalance, phase voltage unbalance
- Voltage
  Undervoltage, overvoltage
- Active power
  Active power import, active power export
- Frequency
  Underfrequency, overfrequency
- THD
  Total harmonic distortion for current and voltage
- Reverse-phase sequence protection

For more information on the enhanced protective functions, see Chapter Function packages for function extensions (Page 348).

Note

The enhanced protective functions require a voltage tap module. This can be retrofit (see Chapter Voltage tap module VTM for ETU600 (Page 329)) but is included with the electronic trip unit in the case of circuit breakers with a measurement function.

The enhanced protective functions do not require an additional 24 V DC voltage supply for the ETU600 electronic trip unit.

They can be added individually or as a complete package.

4.14.3.2 Article number

Function packages for enhanced protective functions	Article number
Complete package: Unbalance, voltage, active power, frequency, THD, reverse-phase sequence protection	3WA9111-0ES11
Unbalance	3WA9111-0ES12
Voltage	3WA9111-0ES13
Active power	3WA9111-0ES14
Frequency	3WA9111-0ES15
THD: Total harmonic distortion for current and voltage	3WA9111-0ES16
Reverse-phase sequence protection	3WA9111-0ES17

The packages requires an additional voltage tap module.

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0ES1*).

4.14.4 Function packages for function extensions

4.14.4.1 Description

The functional expansions include a second protection parameter set.

This makes it possible to store a second parameter set for protective functions.

4.14.4.2 Article number

Function packages for function extensions	Article number
Second protection parameter set	3WA9111-0ES21

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0ES21).

4.14.5 Function packages for metering values

4.14.5.1 Description

Function packages can be used for circuit breakers with a metering function to activate the additional metering values of the PMF-II and PMF-III application packages.

<table>
<tr><th colspan="2">Metering values</th><th>PMF-I Energy Efficiency</th><th>PMF-II Basic Power Monitoring</th><th>PMF-III Advanced Power Monitoring</th></tr>
<tr><td colspan="2">Phase current I_{L1}, I_{L2}, I_{L3}</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Neutral conductor current I_N</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td rowspan="3">Ground-fault current I_g</td><td>ETU600 LSI</td><td>--</td><td>✓</td><td>✓</td></tr>
<tr><td>ETU600 LSIG</td><td rowspan="2">✓</td><td rowspan="2">✓</td><td rowspan="2">✓</td></tr>
<tr><td>ETU600 LSIG Hi-Z</td></tr>
<tr><td colspan="2">Temperature</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Voltage U_{LN}</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Voltage U_{LL}</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Active energy E_a</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Reactive energy E_r</td><td>--</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="2">Apparent energy E_{ap}</td><td>--</td><td>✓</td><td>✓</td></tr>
</table>

Metering values	PMF-I Energy Efficiency	PMF-II Basic Power Monitoring	PMF-III Advanced Power Monitoring
Active power P	--	✓	✓
Reactive power Q	--	✓	✓
Apparent power S	--	✓	✓
Power factor PF	--	✓	✓
cos φ	--	✓	✓
Frequency f	--	✓	✓
Current unbalance	--	✓	✓
Voltage unbalance	--	✓	✓
Total harmonic distortion THD-I	--	--	✓
Total harmonic distortion THD-U	--	--	✓
Harmonic I, U	--	--	✓

✓ Available

-- Not available

Note

Metering functions PMF-I to PMF-III require a voltage tap module and an internal voltage tap on the main conducting paths or the presence of external voltage transformers, see Chapters Voltage tap module VTM for ETU600 (Page 329) and Internal voltage tap on main current paths (Page 340).

If a voltage tap module is installed, the metering values of the PMF-I application package are automatically available.

Metering functions PMF-II and PMF-III can be ordered along with the circuit breaker or can be retrofit by means of function packages.

4.14.5.2 Article number

Function packages for metering values	Article number
PMF-II Basic Power Monitoring	3WA9111-0ES52
PMF-III Advanced Power Monitoring	3WA9111-0ES53

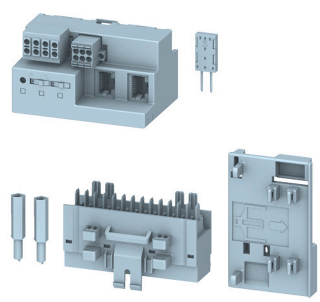
Requires a voltage tap module

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0ES5*).

4.15 Communication interface

4.15.1 PROFINET IO/Modbus TCP module COM190

4.15.1.1 Description



The COM190 is the communications module for the 3WA circuit breaker. It forms part of the internal circuit breaker communications system (CubicleBUS^2) and provides a wide range of functions in conjunction with other CubicleBUS^2 nodes, e.g.:

- Readout of circuit breaker data and metering values
- Readout of circuit breaker status
- Transfer of alarms and warnings
- Setting of parameters
- Closing and opening of circuit breaker via the communications interface
- Readout of status and maintenance information
- Firmware update of all CubicleBUS^2 nodes (currently only if the switch is executed as a non-automatic circuit breaker)
- Security functions

COM190 supports the PROFINET IO and Modbus TCP communication protocols. The two protocols can be used simultaneously and independently of each other. It is not necessary to configure which protocol will be used. This makes it possible to use the circuit breaker in different systems simultaneously (e.g. energy management and process control). Use of only one protocol is also possible.

Two COM190 modules can also be operated simultaneously on the same circuit breaker. This allows the circuit breaker to provide new redundancy solutions, as it can be used simultaneously in two independent communications systems.

COM190 is a modern communications module and offers security functions to prevent unauthorized access to the circuit breaker or unauthorized changes to data via communication.

It is equipped with Ethernet interfaces for connecting to the PC or network.

The COM190 communications module can either be installed on the circuit breaker or operated externally on a DIN rail.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783978).

4.15.1.2 Technical specifications

Device configuration

- X61 and X62 terminals
- Ethernet interfaces for connecting to the PC or network
- CubicleBUS² module

Design of the power supply	DC power supply unit
	IEC 61558 SELV/PELV
Operating range	24 V DC ± 20%
Power consumption	1.7 W
Current consumed / maximum	0.09 A
Overvoltage category	CAT I
Short-circuit protection	Yes
Protected against polarity reversal	Yes
Width	72 mm
Height	41 mm
Depth	49 mm 52 mm with DIN-rail adapter from top edge of DIN rail
Weight	190 g
Protection class acc. to IEC 61558	Protection class III
Degree of protection acc. to IEC 60529	IP20
Communication	
Protocols	Modbus TCP, PROFINET IO
Ethernet connection	2 x RJ45 (8P8C) Ethernet switch functionality
Data rate	100 Mbps
Number of active PROFINET IO connections	Up to 4
Number of active Modbus TCP connections	Up to 10
Connectable conductor cross-sections of the inputs	
Solid	0.2 ... 1.5 mm^2
Finely stranded with end sleeve	0.2 ... 1.5 mm^2
For AWG cable	AWG 24 ... AWG 16
Ambient conditions	
Operation	–40 ... +70 °C
Transport and storage	–40 ... +80 °C
Degree of pollution	3

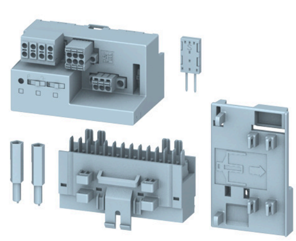
4.15.1.3 Article number

PROFINET IO/Modbus TCP module COM190	Article number
COM190 spare part with adapters for mounting on the circuit breaker or DIN rail, connection cable, terminating resistor and instructions	3WA9111-0EC13
Circuit breaker/non-automatic circuit breaker with "ready4COM" feature and COM190 with adapters for mounting on the circuit breaker, preassembled connection cable, terminating resistor and instructions (requirement: article number digit 9 ≥ C)	3WA_____-_C___-____Z + F19
DC non-automatic circuit breaker with "ready4COM" feature and COM190 with adapters for mounting on the non-automatic circuit breaker, preassembled connection cable, terminating resistor and instructions	3WA_____-_C___-____Z + F19

You can purchase the accessories in the Siemens Industry Mall (https://www.siemens.com/product?3WA9111-0EC13).

4.15.2 Modbus RTU module COM150

4.15.2.1 Description



The COM150 is a communications module for the 3WA circuit breaker. It forms part of the internal circuit breaker communications system (CubicleBUS^2) and provides a wide range of functions in conjunction with other CubicleBUS^2 nodes, e.g.:

- Readout of circuit breaker data and metering values
- Readout of circuit breaker status
- Transfer of alarms and warnings
- Setting of parameters
- Closing and opening of circuit breaker via the communications interface
- Readout of status and maintenance information
- Security functions

The COM150 supports the Modbus RTU communication protocol.

Two communications modules can be operated simultaneously on one circuit breaker. The communications modules are independent of each other and several different communication protocols can be used. This allows the circuit breaker to provide new redundancy solutions, as it can be used simultaneously in two independent communications systems.

COM150 is a modern communications module and offers security functions to prevent unauthorized access to the circuit breaker or unauthorized changes to data via communication.

It has a Modbus RTU interface for connection to the PC or network.

The COM150 communications module can either be installed on the circuit breaker or operated externally on a DIN rail.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/de/view/109816501).

4.15.2.2 Technical specifications

Device configuration

- X61, X62, and X65 terminals
- Modbus RTU interface for connecting to the PC or network
- CubicleBUS² module
- Factory settings: 19,200 baud, 8N2, server address 247

Design of the power supply	DC power supply unit
	IEC 61558 SELV/PELV
Operating range	24 V DC ± 20%
Power consumption	1.7 W
Current consumed / maximum	0.09 A
Overvoltage category	CAT I
Short-circuit protection	Yes
Protected against polarity reversal	Yes
Width	72 mm
Height	41 mm
Depth	49 mm 52.7 mm with DIN-rail adapter from top edge of DIN rail
Weight	190 g
Protection class acc. to IEC 61558	Protection class III
Degree of protection acc. to IEC 60529	IP20
Communication	
Protocol	MODBUS RTU
Supported baud rate	4800 / 9600 / 19200 / 38400 / 57600 / 115200
Data format	8N1 / 8N2 / 8E1 / 8O1
Supported address range	1 ... 247

Connectable conductor cross-sections	
Solid	0.2 ... 1.5 mm^2
Finely stranded with end sleeve	0.2 ... 1.5 mm^2
For AWG cable	AWG 24 ... AWG 16
Ambient conditions	
Operation	–40 ... +70 °C
Transport and storage	–40 ... +80 °C
Degree of pollution	3

4.15.2.3 Article number

Modbus RTU module COM150	Article number
COM150 spare part with adapters for mounting on the circuit breaker or DIN rail, connection cable, terminating resistor and instructions	3WA9111-0EC15
Circuit breaker/non-automatic circuit breaker with "ready4COM" feature and COM150 with adapters for mounting on the circuit breaker, preassembled connection cable, terminating resistor and instructions (requirement: article number digit 9 ≥ C)	3WA_____-_C___-____Z + F15
DC non-automatic circuit breaker with "ready4COM" feature and COM150 with adapters for mounting on the non-automatic circuit breaker, preassembled connection cable, terminating resistor and instructions	3WA_____-_C___-____Z + F15

You can purchase the accessories in the Siemens Industry Mall (https://www.siemens.com/product?3WA9111-0EC15).

4.15.3 Position signaling switch module for connection to the communication module

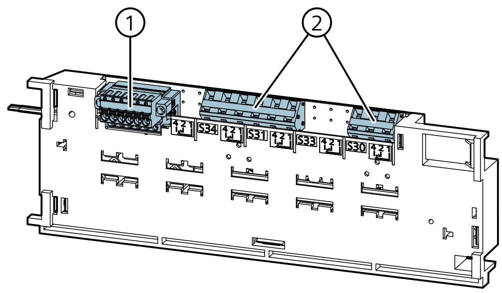
4.15.3.1 Description

Note

The position signaling switch modules are described in Chapter Position signaling switch module for guide frame (Page 260). Only the communications link is described here.

The PSS COM position signaling switch module has two signaling switches for connection to communications module A. This allows the following items to be transferred via the communication system:

- Disconnected position
- No circuit breaker in the guide frame



(1) Position signaling switch module

(2) Signaling switches for connection to communications module A
- DISC ... Disconnected position S48
- ABS ... No circuit breaker in the guide frame (absent) S49

(3) Signaling switches for conventional method of connection (floating contacts)
- Disconnected position S30
- Test position S31
- Connected position S34

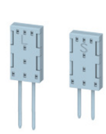
You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109783663).

4.15.3.2 Article number

You can find the article number in Chapter Position signaling switch module for guide frame (Page 260).

4.15.4 CubicleBUS² terminating resistor

4.15.4.1 Description



The CubicleBUS² must be terminated at the final module with a 120 Ω terminating resistor.

The required terminating resistor forms part of the scope of supply of every CubicleBUS² module and circuit breaker.

The terminating resistor can be reordered as an accessory should it get lost.

The terminating resistor for connection to the circuit breaker differs in the length of the contact pin. Version L (long version) is intended for connection to the manual connector of the secondary disconnect terminals of the circuit breaker and version S (short version) for connection to a CubicleBUS² module.

Both versions are supplied in the event of a reorder.

For more information, refer to the operating instructions on the internet (https://support.industry.siemens.com/cs/ww/en/view/109792563).

4.15.4.2 Technical specifications

Resistance	120 Ω
Power rating	0.25 W

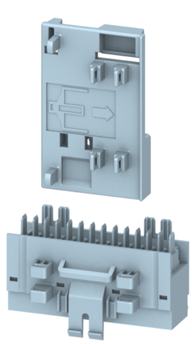
4.15.4.3 Article number

	Article number
CubicleBUS² terminating resistor	3WA9111-0EC50

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EC50).

4.15.5 Mounting adapter for CubicleBUS² modules

4.15.5.1 Description



CubicleBUS² modules are installed with an adapter on the circuit breaker or on a 35 mm DIN rail in the secondary compartment of the power distribution equipment.

The mounting adapters are included in the scope of supply of the modules. Both versions of the mounting adapter can also be ordered separately as an accessory.

You will find more information in the operating instructions available on the internet (https://support.industry.siemens.com/cs/ww/en/view/109792563).

4.15.5.2 Article number

Mounting adapter for CubicleBUS² modules	Article number
For the secondary disconnect terminal system	3WA9111-0EC60
For DIN rail mounting	3WA9111-0EC61

You can purchase the accessories in the Siemens Industry Mall (http://www.siemens.com/product?3WA9111-0EC6*).

4.16 Special packaging

4.16.1 Description

Cardboard packaging with a water-repellent coating can be ordered for transport with increased moisture protection requirements, e.g. during the rain season in the tropics.

4.16.2 Article number

	Z-option
Special packaging	P61

Inspection and maintenance 5

5.1 General

In addition to the costs of purchasing the switching devices and power distribution equipment, the expenditure associated with service and maintenance are a significant cost and time factor for the operator.

- Inspection:
  Inspection refers to visual inspection of the circuit breaker and testing of the electrical and mechanical functions of the circuit breaker.
- Maintenance:
  If a defect or problem becomes apparent during the inspection, the circuit breaker must be subjected to a maintenance procedure. During maintenance, parts can be replaced, wiring changed or secured, and installed or fitted parts can be refastened.

The following factors have an impact on expenditure and downtimes:

1. **Time between inspection intervals**
   The operator defines the inspection intervals based on the operating conditions of the circuit breaker. In normal operation, the circuit breaker must be inspected at least once a year.
2. **Scope of work, tests and checks to be performed**
   Only inspections are required for the 3WA circuit breaker. It currently boasts the lowest inspection requirements of all products on the global market.
   For more information on the scope of the inspections, see Chapter Planning of inspection and maintenance (Page 361).
   For more information about testing, refer to Chapter Self-monitoring and diagnostics (Page 162).
3. **Number and frequency of components and accessories requiring replacement**
   Parts only need to be replaced during maintenance:
   - If this is deemed necessary based on the inspection results
   - When the contacts of the circuit breaker have reached their specified service life and require replacement
   - When the circuit breaker has reached the maximum number of operating cycles without maintenance

   Provided the specified operating conditions are observed, the service life of the accessory components corresponds to the maximum mechanical service life of the 3WA circuit breaker. The 3WA circuit breaker can be operated at low cost. Among other things, no relubrication of moving parts is necessary thanks to its grease reserves.

4. **Qualification of inspection and maintenance personnel**
   Inspection and maintenance work may only be performed by qualified operator personnel or by a qualified contracted company. This includes replacement of the contact system. For more information, see Chapter Maintaining the main contacts (Page 374).
   Siemens offers training measures for performing maintenance work on the 3WA circuit breaker. At the end of the training course, it is possible to take a certification exam. This training course qualifies participants to maintain the 3WA circuit breaker and to replace components, thus reducing external maintenance costs and the necessity of returns.
   For more information on this training course, refer to the internet (https://www.siemens.com/sitrain-lowvoltage).
5. **Time required until the circuit breaker or power distribution equipment is ready for operation**
   The low inspection and maintenance requirements and the possibility for work to be performed locally by qualified personnel mean that the circuit breaker and power distribution equipment are ready to return to operation in a very short time.

See also

Inspection interval (Page 361)

5.2 Safety regulations

DANGER

Hazardous voltage
Will cause death, serious personal injury, or equipment damage.

During operation, parts of the device or system are carrying hazardous electrical voltage. Improper handling of the device or system can result in death or serious injury, as well as significant material damage.

- Inspection and maintenance may only be performed by qualified personnel.
- Pay attention to all the notices provided on the product and in this manual.
- Before commencing maintenance work, ensure that no voltage is present on the power distribution equipment and make sure that this condition is maintained while work is being performed (according to EN 50110-1, DIN VDE 0105-100 and BGV A2).
  Proceed in accordance with the Five Safety Rules:
  – Turn off all power supplying the equipment.
  – Lock out all power supplying the equipment to secure against reconnection.
  – Verify that no voltage is present on the device.
  – Ground and short the circuit.
  – Provide protection against adjacent live parts.

Qualified personnel

Inspection and maintenance may only be performed by qualified personnel.

In the context of these operating instructions and the warning notices on the product, qualified personnel refers to persons who are familiar with the erection, installation, commissioning and operation of the product and who possess the qualifications appropriate for their activities, e.g.:

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

Spare parts

Only spare parts approved by the manufacturer may be used.

5.3 Planning of inspection and maintenance

5.3.1 Inspection interval

WARNING
Malfunction due to insufficient inspection or maintenance
The circuit breaker may not function properly if inspection intervals are not adhered to or if maintenance measures are not performed.
It is absolutely necessary to adhere to the prescribed inspection and maintenance intervals and the instructions on repair and replacement in order to avoid personal injury and damage to equipment.

The operator defines the inspection intervals within the following constraints based on the operating conditions of the circuit breaker:

- At least once a year.
- After each short-circuit trip
- After five overload trips
- After 1000 rated current trips up to 1000 V
- After 500 rated current trips at 1150 V

5.3.2 Scope

Inspection

The inspection comprises:

- Visual inspection for:
  - Pollution
  - Damage
  - Corrosion
    To remove the corrosion on the contact surfaces and thereby reduce power losses, Siemens recommends closing and opening the circuit breaker once a year with a minimum current load of 200 A.
- Check of available documentation and of rating/accessory label to ensure that they correspond to the actual circuit breaker equipment.
- Testing of the mechanical function of the circuit breaker by closing and opening.
- Mechanical and electrical testing of the rack-in position indicators.
- Testing of auxiliary circuits and of cables to external current sensors for secure fitting of auxiliary supply connectors and for correct connection.
- Testing of mechanical and electrical function of internal accessories.
- Testing of settings of electronic trip unit for plausibility in accordance with the system conditions specified during system planning.
- Inspection of the electronic trip unit by reading out the status and maintenance information.
- Inspection of the arc chutes and arc chute cover for damage or impermissible contact erosion.
- Inspection of the main contacts by means of a visual check of the contact system or the permanently integrated contact erosion indicator.
- Check as to whether the latest firmware version is available, and perform a firmware update if necessary.
- Testing of the function of the CubicleBUS² modules based on diagnostics LEDs.
- Inspection of the IP55 protective cover for correct mounting, correct position and the correct position of the seals.
- Optional: Performance of the internal self-test or software-assisted testing, see Chapter Self-monitoring and diagnostics (Page 162).

Checklists and further information regarding the inspection

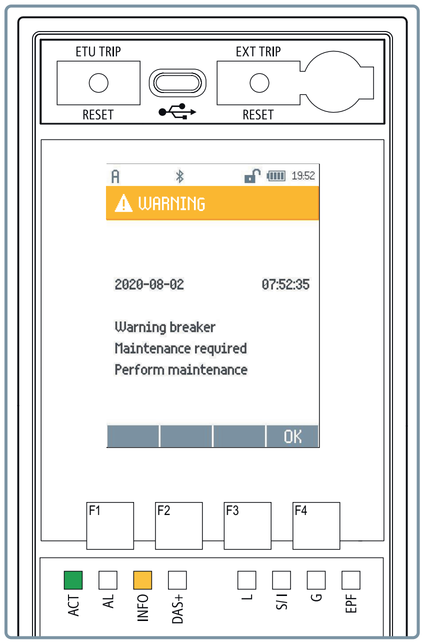
For recommended checklists and further information, see Chapter Performing inspection (Page 365).

Maintenance

For 3WA1 circuit breakers, only the arc chutes, the arc chute covers and the contact system require maintenance.

Replacing arc chutes and the contact system

The arc chutes and the contact system may need to be replaced depending on their condition and at the latest when the number of electrical and mechanical operating cycles without maintenance has been reached. After replacing the arc chutes and the contact system, reset the maintenance alarm with the help of the configuration software SENTRON powerconfig.



For more information on the warning message, see Chapter Display in case of a warning (Page 94).

For information about the number of electrical and mechanical operating cycles, see Chapter Technical specifications of 3WA circuit breakers (Page 461).

Note

The contact system may only be replaced if the maximum permissible number of operating cycles with maintenance has not been exceeded.

Replacing the arc chute cover (withdrawable circuit breaker)

Optionally fitted arc chute covers must be replaced in the following cases:

- At the latest after three circuit breaker short-circuit trips
- Whenever the arc chutes are replaced

For information about the arc chute cover and installation instructions, see Chapter Arc chute cover (Page 322).

5.3.3 Logging

Note

Obligation to maintain logs for warranty claims

The operator must log all inspection and maintenance work. The logs should be kept in the archive for at least ten years.

In order to make it possible to clearly identify the circuit breaker and the general data, every log should contain the following information:

- General information:
  - Date of inspection/maintenance
  - Name of person responsible for inspection/maintenance
  - Names of other persons involved in inspection/maintenance
  - Date of last inspection/maintenance
  - Mounting location of the circuit breaker (room, power distribution equipment, section, cell)
  - Ambient conditions (temperature, air humidity, pollution degree)
  - Field of application, sector
  - Special events during operation (e.g. short-circuit or overload trips)
  - Known fault scenarios in the past
- Information about the circuit breaker:
  - Circuit breaker type
  - Article number and options
  - Circuit breaker ID number
  - ID number of electronic trip unit
  - Fixed-mounted or withdrawable version
  - Operating cycles recorded by means of mechanical operating cycles counter, electronic trip unit, communication or an estimated number, grouped according to mechanical and electrical operating cycles
- Information about inspection work performed

5.4 Performing inspection

5.4.1 General

NOTICE
Material damage resulting from relubrication
The circuit breaker mechanism is sufficiently lubricated during production. Relubrication of the circuit breaker mechanism is unnecessary and may result in material damage.
Never lubricate the breaker mechanism or the contacts of the circuit breaker.

NOTICE
Material damage due to blown particulates
Disturbed dust can affect the function of the circuit breaker.
Vacuum the dust using suitable equipment. Never blow out dust using compressed air or similar.

The following checklists are non-binding. Not all of the items listed are relevant for the inspection depending on the scope of supply of the circuit breaker and the installed accessory components.

5.4.2 Visual inspection

Inspect the following components for pollution, damage and rust:

- Operator panel including external electronic trip unit
- Display and operator controls
- If present: lateral front covers on both sides of the operator panel
- Circuit breaker enclosure
- Arc chute covers
- Circuit breaker feet
- Busbar connections (check for signs of overheating and deposits)
- Finger clusters in the guide frame
- When the operator panel is removed: Breaker mechanism (where accessible)
- Internal accessories: e.g. closing coil, shunt trip, spring charging motor

5.4.3 Check of the available documentation and of the rating/accessory label

Check the documentation and the rating/accessory label:

- Document is available and complete.
- Accessory label and labeling of operator panel, including the article number, correspond to the installed internal accessories and available documentation.

5.4.4 Testing of mechanical function of the circuit breaker

Check the following items:

- Manual operating mechanism:
  - Perform nine strokes (final stroke requires slightly more force)
  - Display of charged stored energy mechanism
  - Ready-to-close indicator OK

  Circuit breaker can only be operated when OK is indicated.
- Spring charging motor (optional) with auxiliary voltage, general functioning of the motor
- CLOSE – OPEN test:
  Perform each of the following test sequences for mechanically closing and opening the circuit breaker once.
  - Operating sequence:
    Charge – CLOSE – OPEN
  - Operating sequence:
    Charge – CLOSE – Charge – OPEN – CLOSE – OPEN
- CLOSE – OPEN test via electronic accessories:
  Perform the test sequences also using the spring charging motor, shunt trip, or UVR if available in your system.
- The following conditions prevent indication of the ready-to-close status:
  - Stored energy mechanism not charged
  - Circuit breaker tripped by ETU without a reset of the reclosing lockout
  - Undervoltage release (optional), not energized
  - Effect of control gate and interlocking functions on ready-to-close indication
- Mechanical interlock (optional):
  - Mounting: Secure fitting
  - Adjustment
  - Function
- Permissible bending radii on the installed Bowden cables (optional)
  You will find information on the bending radii in the operating instructions in the internet (https://support.industry.siemens.com/cs/ww/en/view/109792564).

5.4.5 Testing of mechanical function of the withdrawable circuit breaker and the guide frame

Note

The inspection of the withdrawable circuit breaker also includes all the items in Section Testing of mechanical function of the circuit breaker (Page 366).

Check the following items:

- Guide frame and racking mechanism including position indicator
- Visual inspection of finger clusters for damage
- Reliable function of control gate
- Mechanical function:
  - Racking of circuit breaker
  - Opening of shutter
- Function of position signaling switch module
- Position indicator corresponds to actual position of circuit breaker
- Release of racking mechanism interlock in the defined positions
- Effectiveness of racking mechanism interlock in the intermediate positions
- Coding of the withdrawable circuit breaker and the guide frame

5.4.6 Testing of auxiliary circuits and of cables to external current sensors

Check the following items:

- Connections to the circuit breaker in accordance with circuit diagram:
  - Secure fitting
  - Correct terminal assignment
- Withdrawable version: Auxiliary supply connector with sufficient tolerance for insertion in the guide frame. Always correct rigid or non-flexible wiring.

5.4.7 Testing of mechanical and electrical function of internal accessories

NOTICE
Damage to accessories
Incorrect auxiliary power supply can damage internal accessories.
The electrical functions of the internal accessories may only be tested with the control voltage that is specified in each case.
Ensure that the rated control voltage level is applied to the internal accessories.

Note

The test routines of the accessory components are described in the relevant operating instructions.

Check the following items:

- Electrical function, e.g. of:
  - Shunt trip, undervoltage release and closing coil
  - Auxiliary switch
  - Signaling switch
- Mechanical functions for auxiliary releases:
  - Free movement of armature
    Ensure that the armature moves back to its initial position when no voltage is present.
- Smooth running of armature of auxiliary releases
- Function of locks
- Function of interlocks

5.4.8 Testing of settings and inspection of electronic trip unit

Note

The electronic trip unit monitors itself continuously and signals detected errors.

The SENTRON powerconfig configuration software assists with the documentation. For more information on powerconfig, refer to the internet (https://mall.industry.siemens.com/mall/en/WW/Catalog/Products/10230050).

Check the following items or perform the following checks:

- Visual inspection of the electronic trip unit
- Query of stored tripping operations (QUERY button)
- Function and readability of the display of the electronic trip unit ETU600

- Compliance of protection settings with specifications or available documents
- Documentation of the protection settings. The protection settings of the electronic trip unit ETU600 can be stored using the SENTRON powerconfig configuration software.
- Readout of status and maintenance information (logs) of the electronic trip unit ETU600 using the SENTRON powerconfig configuration software
- Check as to whether the latest firmware version is available, and perform a firmware update if necessary; see Chapter AUTOHOTSPOT
- Performance of internal self-test of the electronic trip unit with tripping of the circuit breaker, or software-assisted testing (only with ETU600); see Chapter Self-monitoring and diagnostics (Page 162)

5.4.9 Inspection of the arc chutes, arc chute cover and the contact system

Check the following items:

- Optical condition of arc chutes as per Chapter Maintaining the arc chutes (Page 372)
- Damage to the arc chute covers on the guide frame (option)
- Main contacts with contact erosion indicator as per Chapter Maintaining the main contacts (Page 374)

5.4.10 Testing of the function of the CubicleBUS² modules

Check the following items:

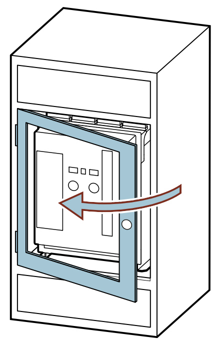
- Secure fitting and wiring damage for the following components:
  - All modules mounted on the circuit breaker, e.g. COM190 or IOM230
  - Internal CubicleBUS² components, e.g. Breaker Status Sensor BSS200
  - Externally installed CubicleBUS² modules, e.g. IOM350
- Error conditions of the CubicleBUS² modules indicated by LED statuses.
  For more information on LED statuses, see Chapters Communication and system connection (Page 131) and Accessories (Page 217).
- Presence of CubicleBUS² terminating resistor:
  - Either on the last module (marked S, 120 Ω)
    or
  - If no modules are connected, on terminals X8.1 and X8.2 (marked L, 120 Ω)
- Observance of voltage tolerances

5.5 Preparing for maintenance work

Note

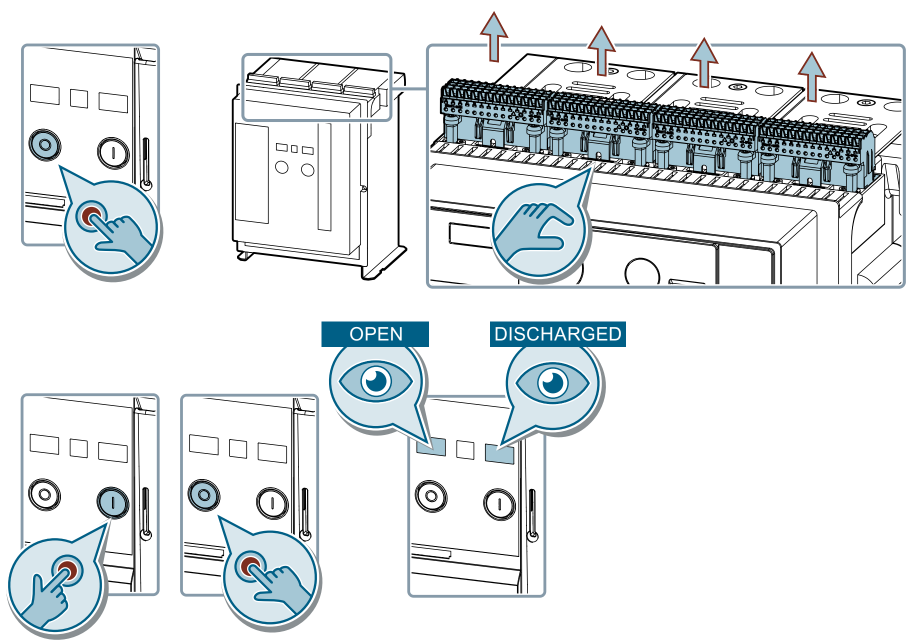
Observe the instructions in Chapter Safety regulations (Page 360).

1. Open the control cabinet door.

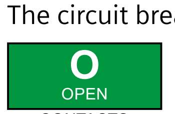


   Follow the instructions in the operating instructions for the relevant interlock to bypass an optionally installed interlock.

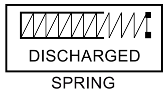
2. Open the circuit breaker and discharge the stored-energy spring.



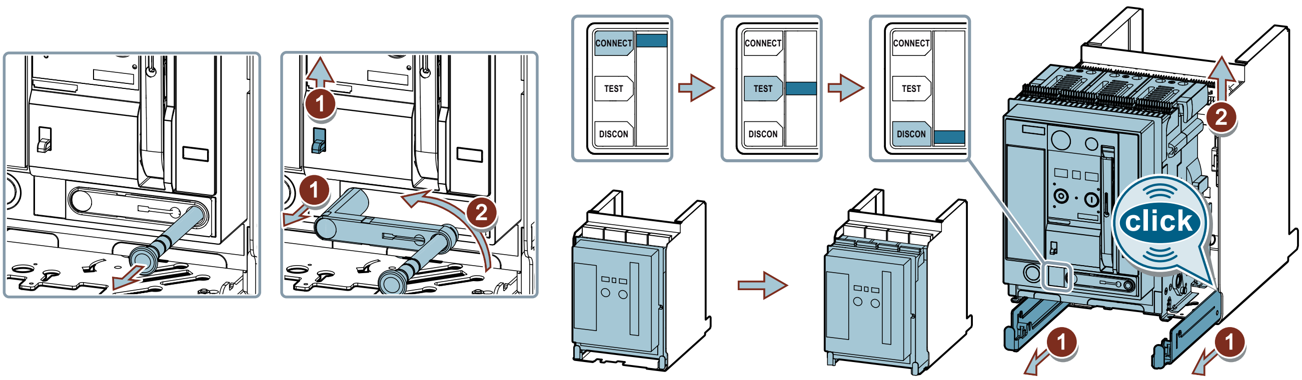
   – Press O / OPEN.
   – Isolate the auxiliary circuits by unplugging the manual connectors.
   – Press I / CLOSE.
     A charged stored-energy spring is discharged.
   – Press O / OPEN.
   – Ensure that the switch position indicator shows OPEN.
     The circuit breaker is open.



– Ensure that the switch position indicator shows DISCHARGED.
  The stored-energy spring is discharged.



3. Withdrawable version: Remove the circuit breaker from the guide frame.

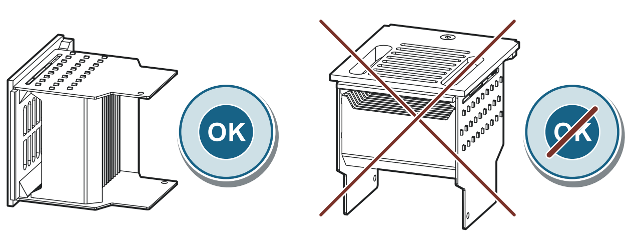


Note

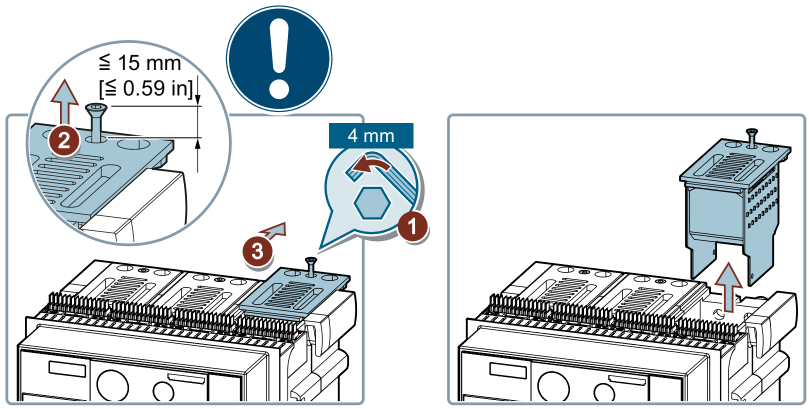
Use the handles of the circuit breaker for lifting and craning.

5.6 Maintaining the arc chutes

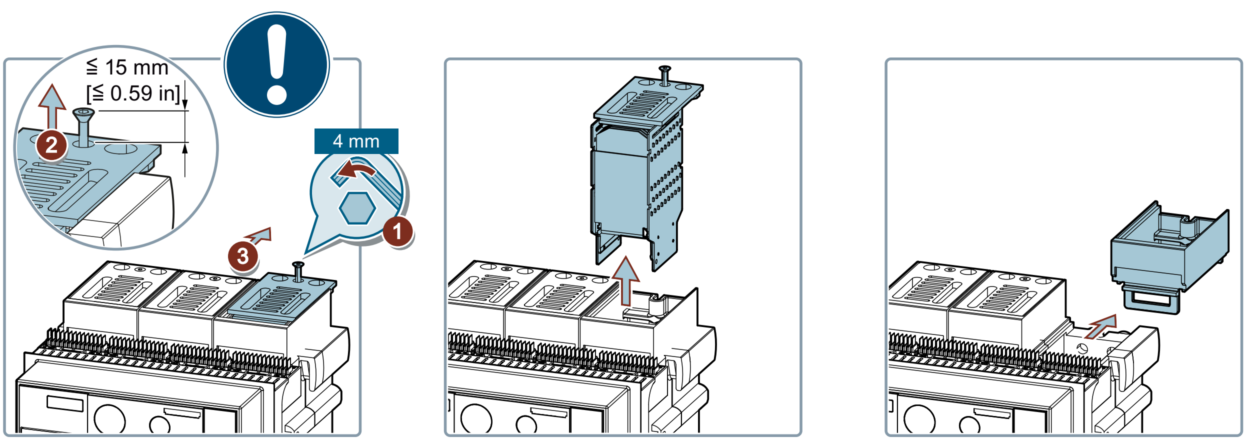
NOTICE
Damage to the arc chutes If the disassembled chutes are set down in the vertical position, the insulating walls of the arc chutes can be damaged. Always lay arc chutes on their sides.



1. Remove the arc chute.
   – Standard arc chute:



   – High arc chutes:



2. Perform a visual inspection for severe wear.
   Wear is indicated by burnout on the arc quenching plates or holes in the side walls of the arc chutes.
3. If you detect severe wear, such as burnout or holes, you must replace the arc chute and the main contact system.
   You will find more information in Chapter Maintaining the main contacts (Page 374).
   Refer to the table of article numbers below when reordering.
4. Install the arc chute in the reverse sequence to removal.
   Tighten the screw with a tightening torque of 8 Nm.

Arc chute article numbers

	Article number
Size 1	
Breaking capacity N and S	3WA9111-0AS01
Breaking capacity M	3WA9111-0AS02

		Article number
Breaking capacity E	Fixed-mounted	3WA9111-0AS04
	Withdrawable	3WA9111-0AS05
DC non-automatic circuit breaker, breaking capacity E		3WA9111-0AS06
Size 2		
Breaking capacity S, M and H		3WA9111-0AS10
Breaking capacity C		3WA9111-0AS11
Breaking capacity E		3WA9111-0AS12
DC non-automatic circuit breaker, breaking capacity D		3WA9111-0AS13
DC non-automatic circuit breaker, breaking capacity E		3WA9111-0AS14
Size 3		
Breaking capacity H		3WA9111-0AS17
Breaking capacity E and C		3WA9111-0AS18

You can purchase the accessories in the Siemens Industry Mall (Page 374).

See also

http://www.siemens.com/product?3WA9111-0AS* (http://www.siemens.com/product?3WA9111-0AS*)

5.7 Maintaining the main contacts

5.7.1 Introduction

The main contacts can be replaced as often as required until the circuit breaker has reached its maximum mechanical service life including maintenance. As soon as the circuit breaker has reached its maximum mechanical service life with maintenance, it must be replaced.

The maximum mechanical service life of the circuit breaker depends on the total number of operating cycles achieved. A distinction is made between electrical and mechanical operating cycles.

- Electrical operating cycles:
  Every switching operation (ON or OFF) of a circuit breaker with current flow via the main contacts up to the maximum rated current is considered an electrical operating cycle. Due to the current flow, wear of the contacts is higher here than in case of a purely mechanical operating cycle.
- Mechanical operating cycles:
  Every switching operation of a circuit breaker consisting of a complete ON/OFF switching procedure (with or without current flow) is considered a mechanical operating cycle.
  The electrical operating cycles are thus a subset of the mechanical operating cycles. The number of mechanical operating cycles is usually greater than the number of purely electrical operating cycles; they can be equal at most.

For information on the maximum mechanical service life of the circuit breaker, see Chapter Technical specifications of 3WA circuit breakers (Page 461).

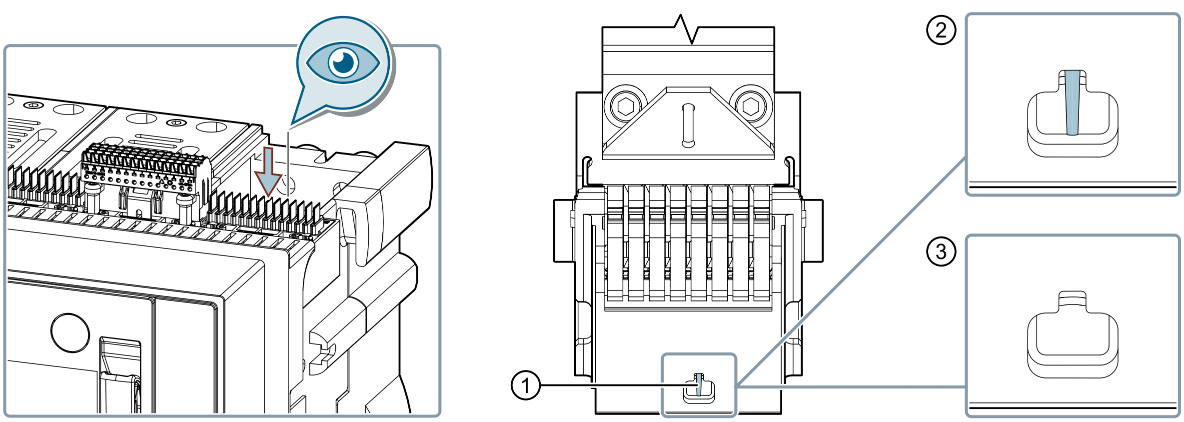
5.7.2 Maintaining the main contacts and replacing the contact system

A check for contact erosion is performed during maintenance of the main contacts:

1. Perform all the steps outlined in Chapter Preparing for maintenance work (Page 370).
2. Charge the stored energy mechanism manually.
3. If an undervoltage release is installed, take off the operator panel and remove the undervoltage release. Removal is performed in the reverse sequence.
4. Close the circuit breaker.
5. Remove the arc chute, see Chapter Maintaining the arc chutes (Page 372).
6. Check whether the indicator pin is still visible.

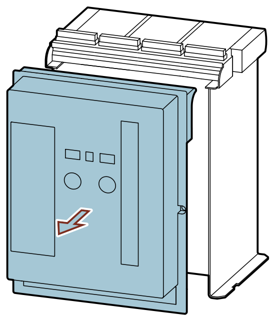
Note

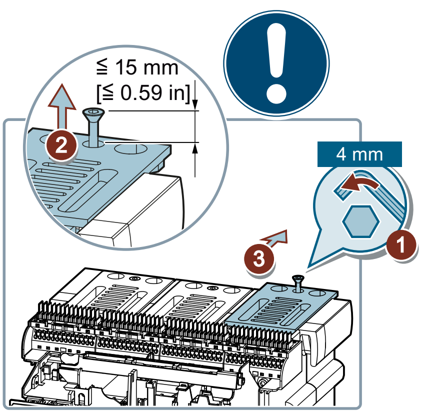
Use a mirror or a camera (e.g. smartphone) to perform the visual inspection on fixed-mounted circuit breakers.

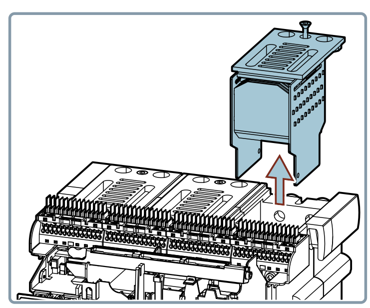


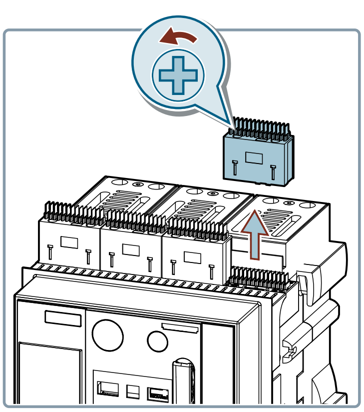
(1) Indicator pin
(2) Indicator pin visible
(3) Indicator pin no longer visible

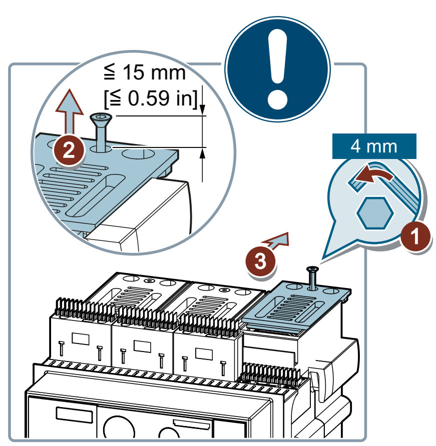
7. If the indicator pin is no longer visible, you must replace the contact system.
   Please refer to the table of article numbers when reordering, see Chapter Article number (Page 385).

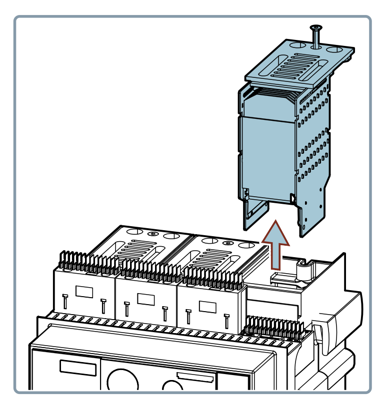


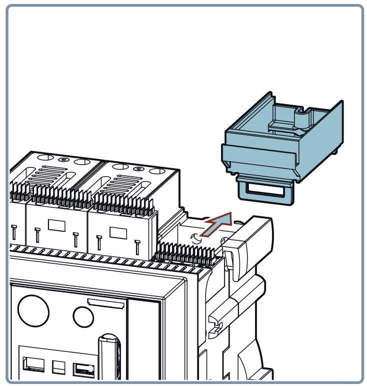


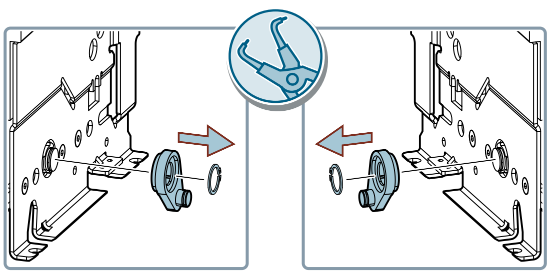




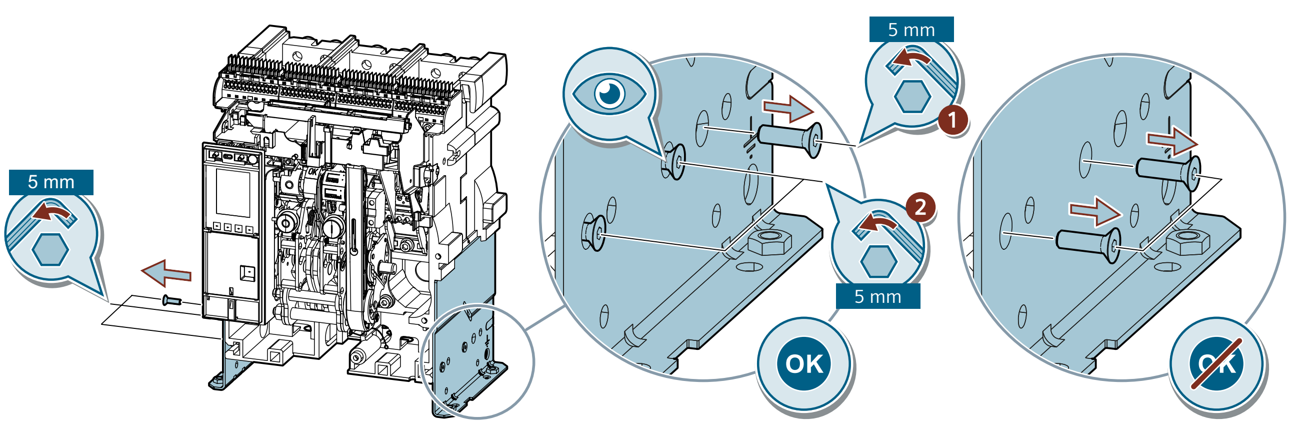


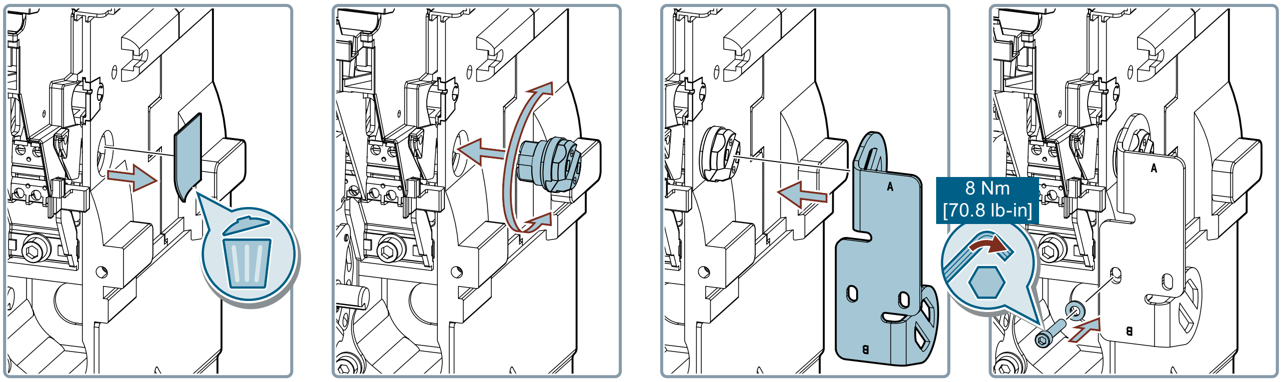




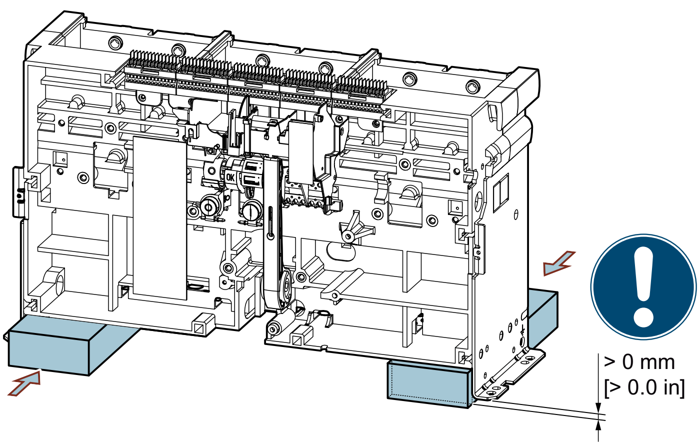


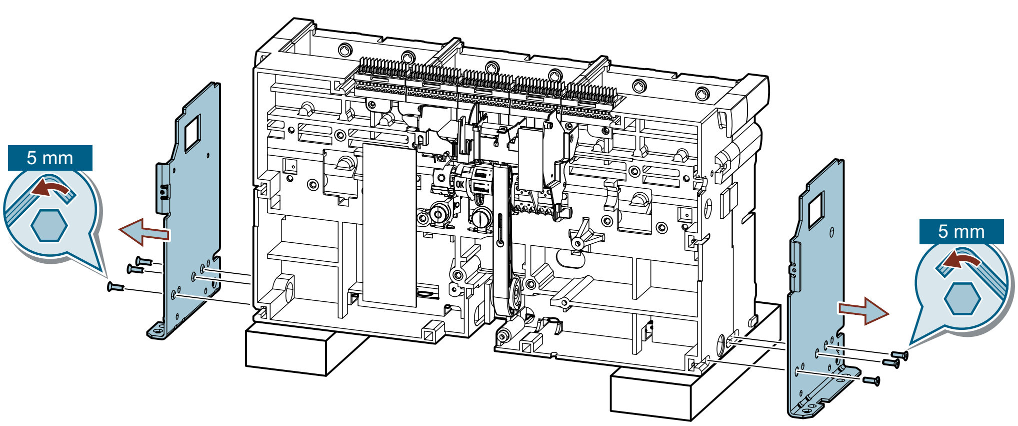
3WA.1, 3WA.2

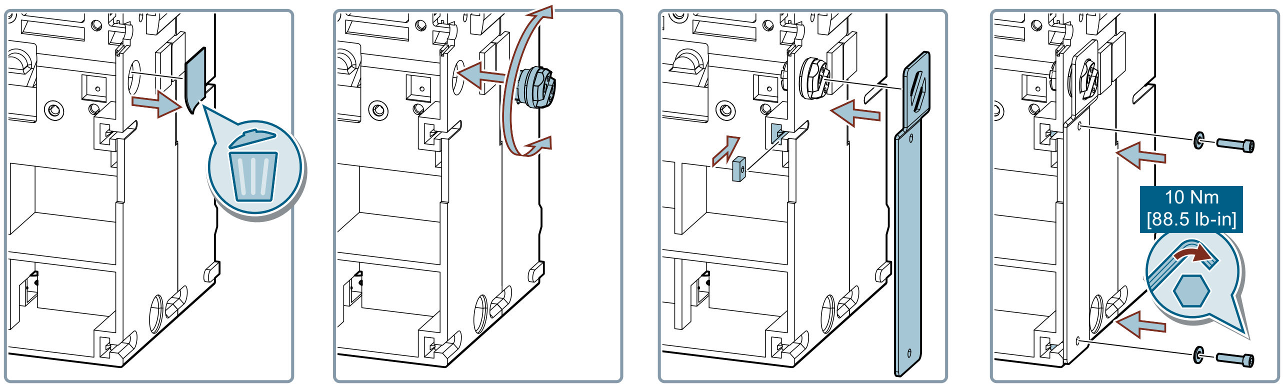




3WA.3

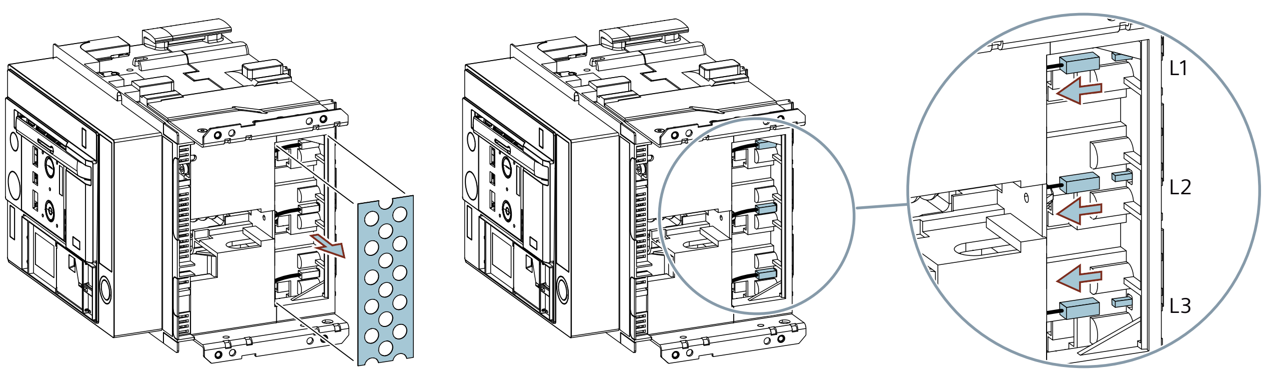






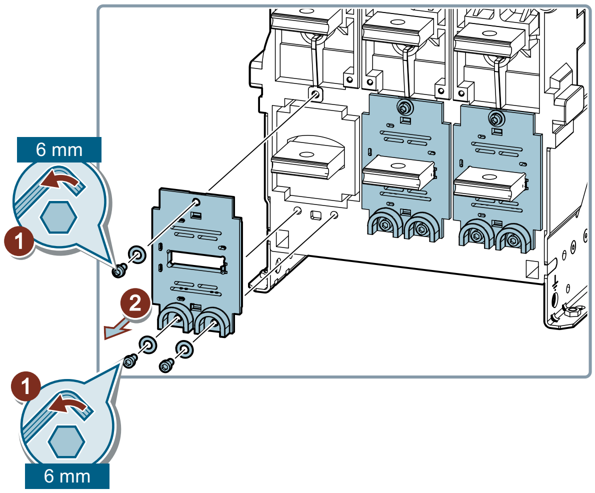
Note

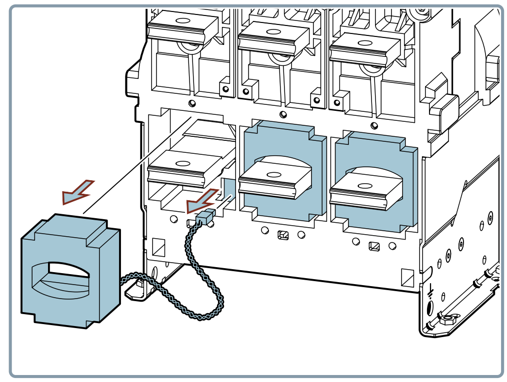
Before unplugging the connectors, take note of the cable routing. The cable routing must be restored in the same way during installation, in order to prevent cables from being trapped during assembly.



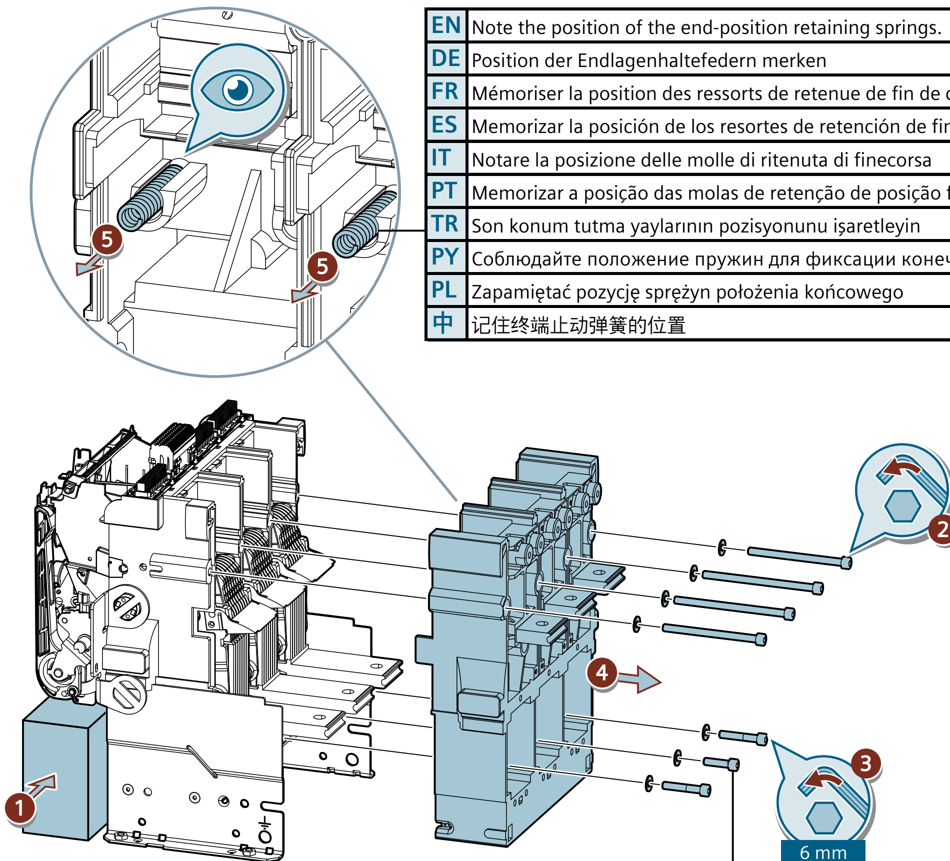
Note

Before removing a transformer, take note of its installation position. The transformer must be installed in the same position in order to ensure the accuracy of the protective functions and metering values.


6 mm
1
2
1
6 mm

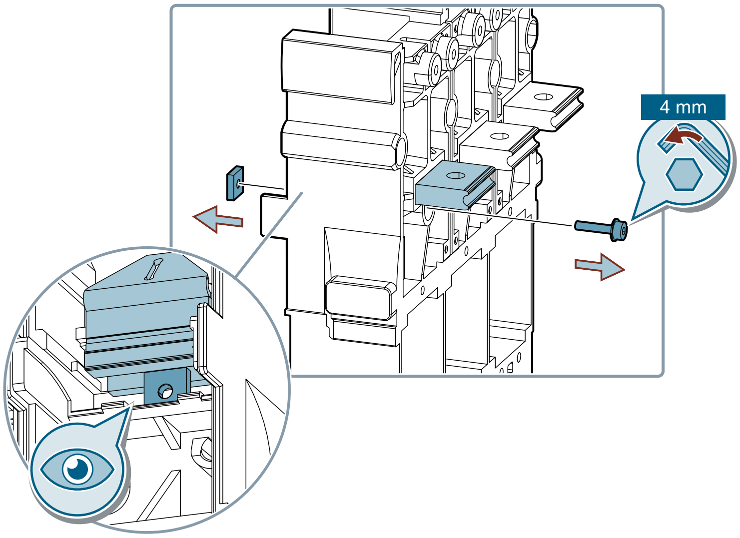


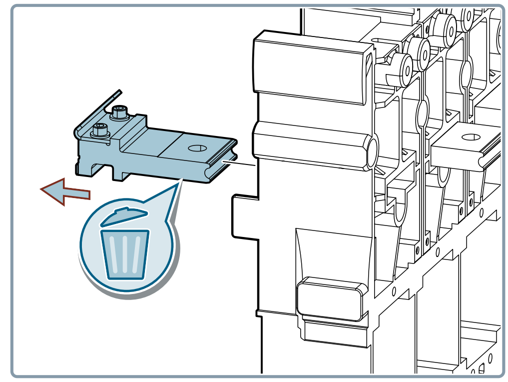
EN	Note the position of the end-position retaining springs.
DE	Position der Endlagenhaltefedern merken
FR	Mémoriser la position des ressorts de retenue de fin de course
ES	Memorizar la posición de los resortes de retención de fin de carrera
IT	Notare la posizione delle molle di ritenuta di finecorsa
PT	Memorizar a posição das molas de retenção de posição final
TR	Son konum tutma yaylarının pozisyonunu işaretleyin
PY	Соблюдайте положение пружин для фиксации конечных положений
PL	Zapamiętać pozycję sprężyn położenia końcowego
中	记住终端止动弹簧的位置

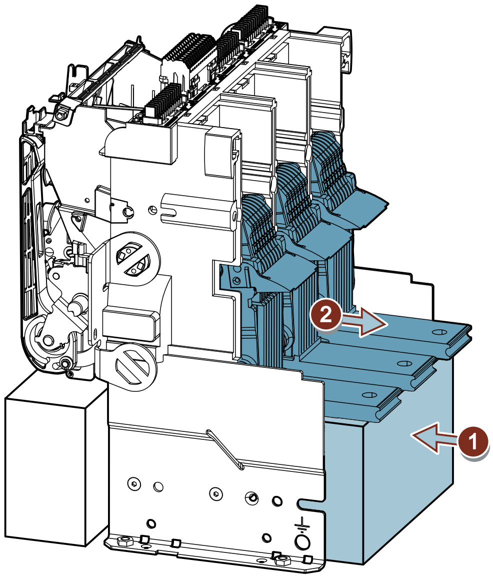


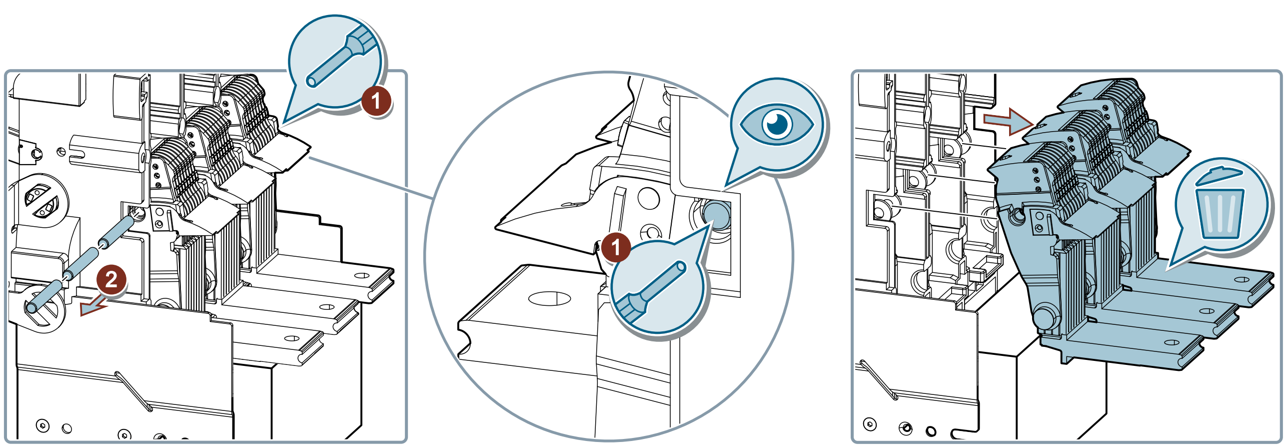
3WA.1	6 mm
3WA.2	6 mm
3WA.3	8 mm

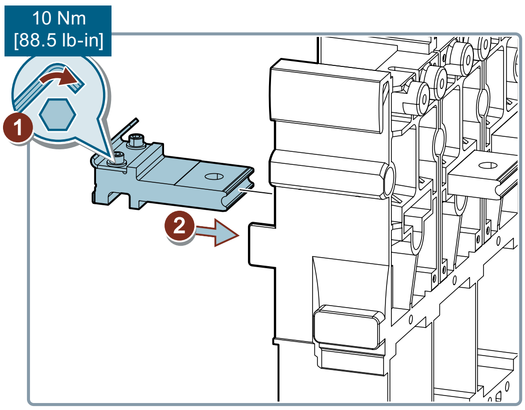
EN	Not necessary for 3WA11, switching capacity classes N and S.	PT	Não necessário em 3WA11, classes de potência de chaveam- ento ponto neutro e contacto de fecho.
DE	Nicht notwendig bei 3WA11, Schaltleistungsklassen N und S.	TR	3WA11, anahtarlama kapasitesi sınıfları N ve S için gerekli değil.
FR	Non requis pour 3WA11, classes de pouvoir de coupure N et S.	РУ	Не нужно для 3WA11 с классами коммутационной способ ности N и S.
ES	No es necesario para 3WA11, clases de poder de corte N y S.	PL	Niewymagane w przypadku 3WA11, w klasach zdolności łączeniowej N i S.
IT	Non necessario per 3WA11, classi di potenza di manovra N e S.	中	对于 3WA11、接通/开断容量等级 N 和 S 来说不是必需的。

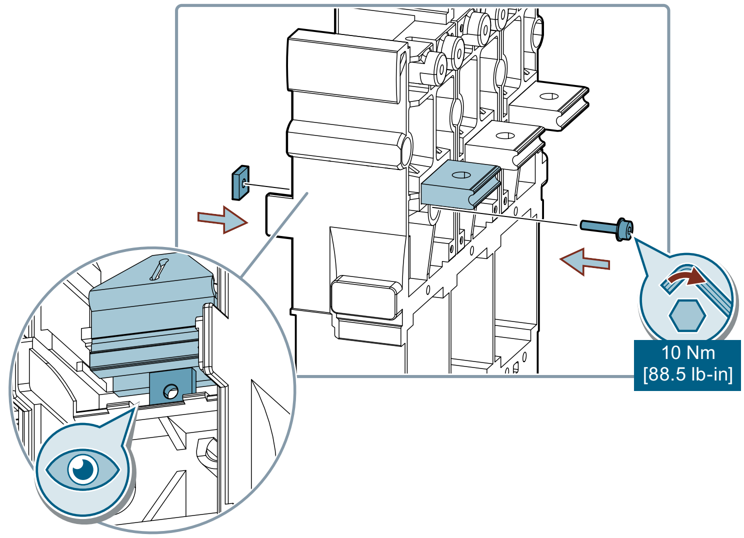

4 mm







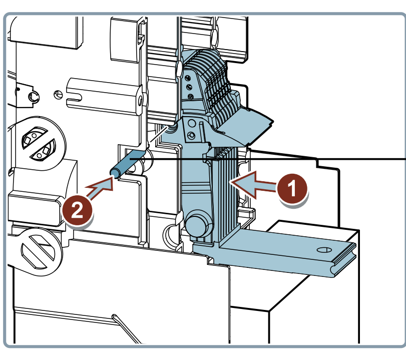




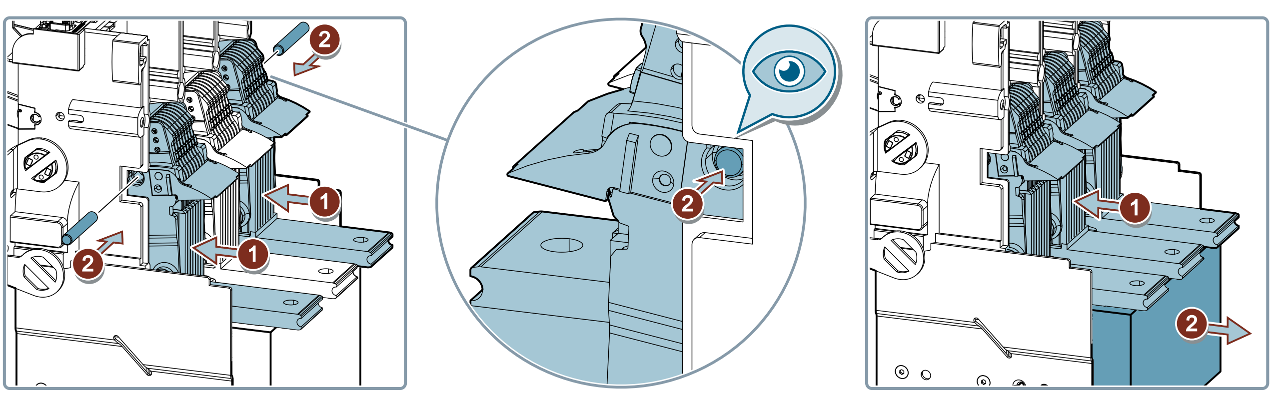
Note

Clean and lubricate the bearing points and coupling bolts prior to assembly.

Grease: Isoflex Topas NB52, Klüber Lubrication München SE & Co. KG



EN	Ensure the coupling pins are centered.
DE	Auf mittigen Sitz der Koppelbolzen achten.
FR	Veiller à ce que les boulons de couplage soient bien au centre.
ES	Asegurarse de que los pernos de acoplamiento estén bien centrados.
IT	Fare attenzione alla centratura dei perni di accoppiamento.
PT	Certifique-se de que os pernos de união estão colocados ao centro.
TR	Bağlantı saplamasının ortaya oturmasına dikkat edin.
PY	Убедитесь, что соединительные болты отцентрированы.
PL	Uważać na wyśrodkowanie trzpieni łączących.
中	确保耦合螺栓位于中间位置。



8. Reassemble the circuit breaker in the reverse sequence to removal. Ensure that the transformers are installed in the correct positions.
   Tighten the screws with a tightening torque of 10 Nm and 8 Nm for the arc chutes.

9. If you have removed an undervoltage release, reinstall it now.
10. After replacing the contact system, reset the maintenance alarm of the electronic trip unit ETU600 with the help of the SENTRON powerconfig configuration software.

5.7.3 Article number

Note

Replacement only to be performed by the manufacturer

In the case of the following circuit breakers, only Siemens may replace the main contacts, as a special calibration procedure is required:

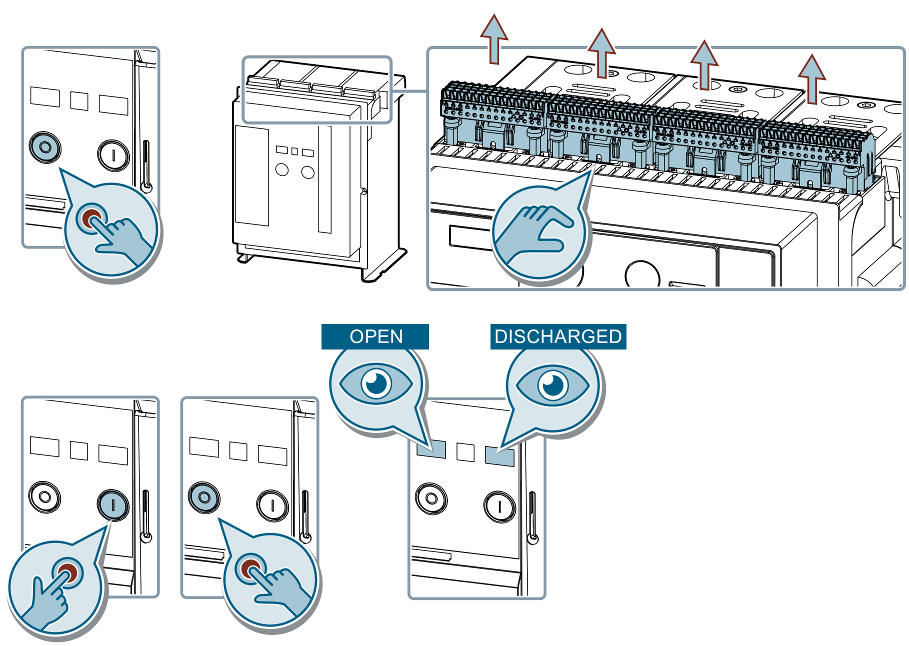
- Size 1:
  - 3WA11..-4..., devices with breaking capacity M
  - 3WA11..-8..., devices with breaking capacity E
  - 3WA112.-..., devices with rated current of 2000 A or 2500 A
- Size 2:
  - 3WA12..-4..1..., 3WA12..-4..4..., devices with breaking capacity M in 4-pole version
  - 3WA12..-5..1..., 3WA12..-5..4..., devices with breaking capacity H in 4-pole version
  - 3WA12..-6..., devices with breaking capacity C
  - 3WA12..-8..1..., 3WA12..-8..4..., devices with breaking capacity E in 4-pole version
- Size 3:
  - 3WA13..-6..., devices with breaking capacity C
  - 3WA13..-8..., devices with breaking capacity E

	Rated current	Breaking capacity	Article number
3-pole (scope of supply, 3 units)			
Size 1	≤ 1000 A	N	3WA9111-0AQ01
		S	3WA9111-0AQ03
	1250 A	N	3WA9111-0AQ02
	1250 A, 1600 A	S	3WA9111-0AQ04
	1600 A	N	
Size 2	2000 A	S, M, H, E [AC]	3WA9111-0AQ08
	2500 A	S, M, H, E [AC]	3WA9111-0AQ11
	3200 A	S, M, H, E [AC]	3WA9111-0AQ13
	4000 A	S, M, H, E [AC]	3WA9111-0AQ15
	1000 A, 2000 A	D, E [DC]	3WA9111-0AQ17
	4000 A	D, E [DC]	3WA9111-0AQ18
Size 3	4000 A		3WA9111-0AQ20
	5000 A, 6300 A		3WA9111-0AQ22
4-pole (scope of supply, 4 units)			

	Rated current	Breaking capacity	Article number
Size 1	≤ 1000 A	N	3WA9111-0AQ51
		S	3WA9111-0AQ53
	1250 A	N	3WA9111-0AQ52
	1250 A, 1600 A	S	3WA9111-0AQ54
	1600 A	N	
Size 2	2000 A	S [AC]	3WA9111-0AQ58
	2500 A	S [AC]	3WA9111-0AQ61
	3200 A	S [AC]	3WA9111-0AQ63
	4000 A	S [AC]	3WA9111-0AQ65
	1000 A, 2000 A	D, E [DC]	3WA9111-0AQ67
	4000 A	D, E [DC]	3WA9111-0AQ68
Size 3	4000 A	H	3WA9111-0AQ70
	5000 A, 6300 A	H	3WA9111-0AQ72

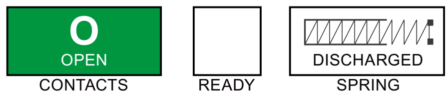
You can purchase the accessories in the Siemens Industry Mall (https://www.siemens.com/product?3WA9111-0AQ*).

5.8 Decommissioning



1. Press O / OPEN.
2. Isolate the auxiliary circuits.
3. Remove the terminal connectors.

4. Press I / CLOSE.
5. Press O / OPEN.
6. Check the switch position indicators.

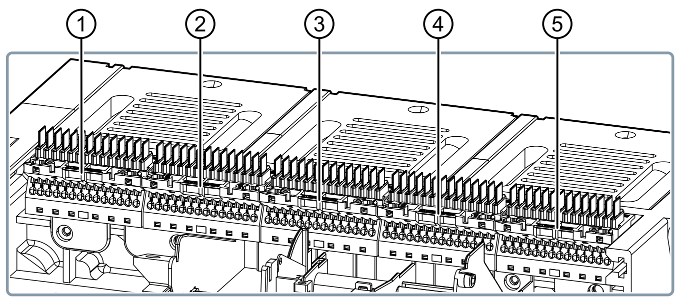


Technical specifications 6

6.1 Circuit diagrams

6.1.1 Secondary disconnect terminal blocks X5 to X9 and their terminal markings

The secondary disconnect terminal blocks are mounted above the operator panel.



(1) Secondary disconnect terminal block X9 (sizes 2 and 3 only)

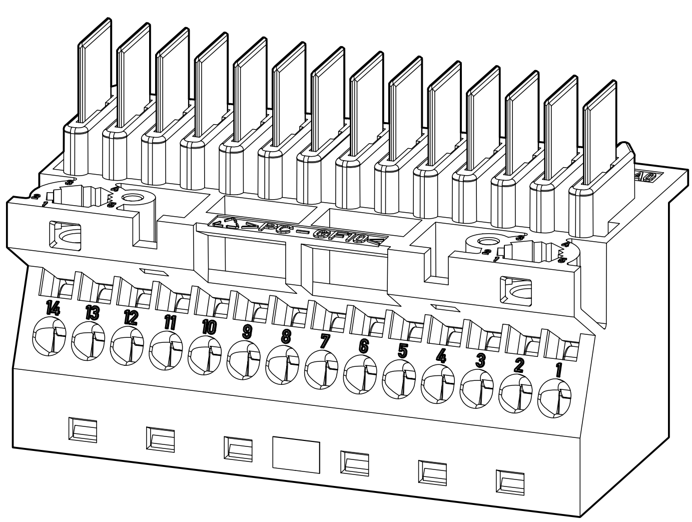
(2) Secondary disconnect terminal block X8

(3) Secondary disconnect terminal block X7

(4) Secondary disconnect terminal block X6

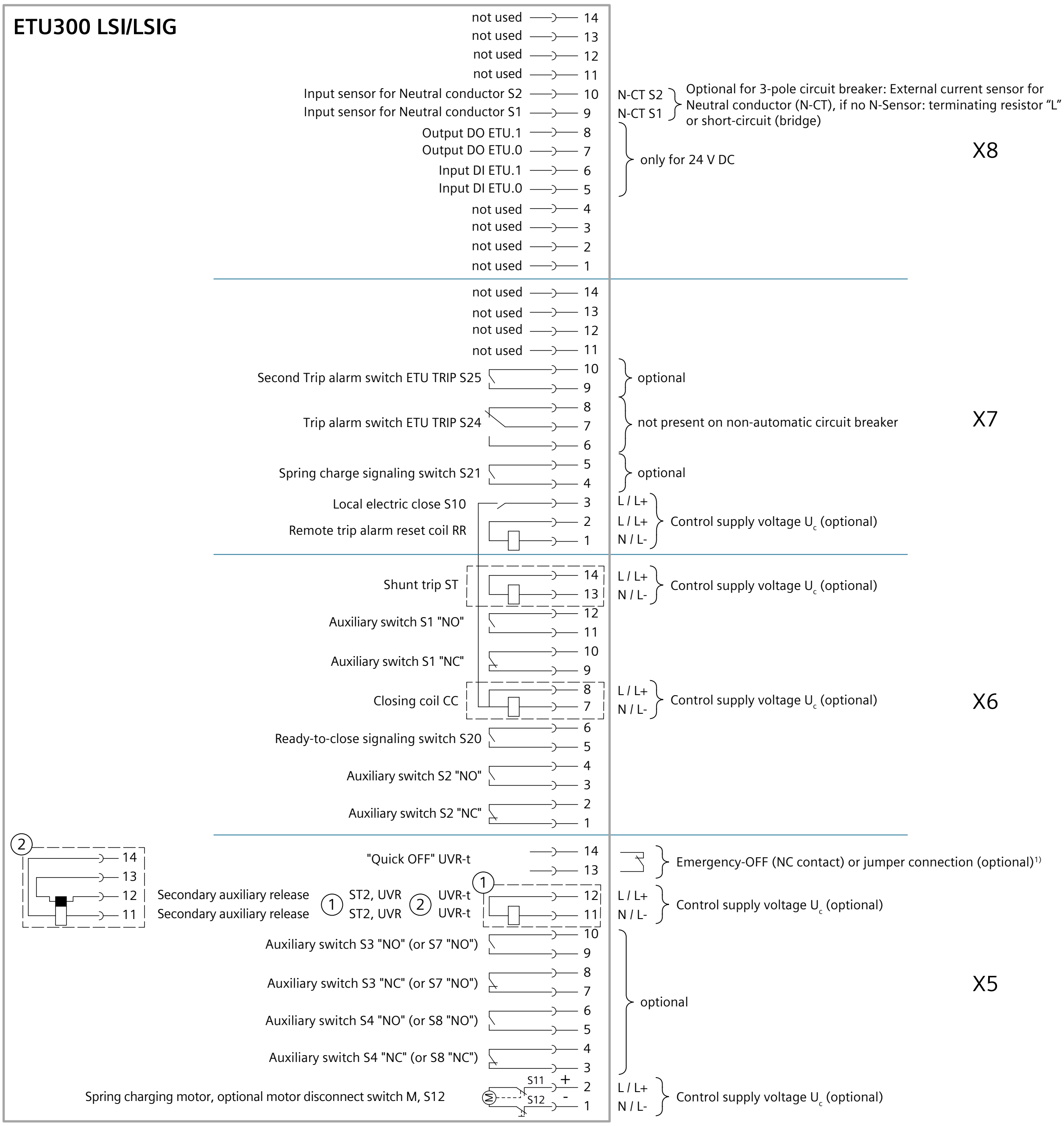
(5) Secondary disconnect terminal block X5

The terminals of each of the secondary disconnect terminal blocks are numbered in descending order from left to right.



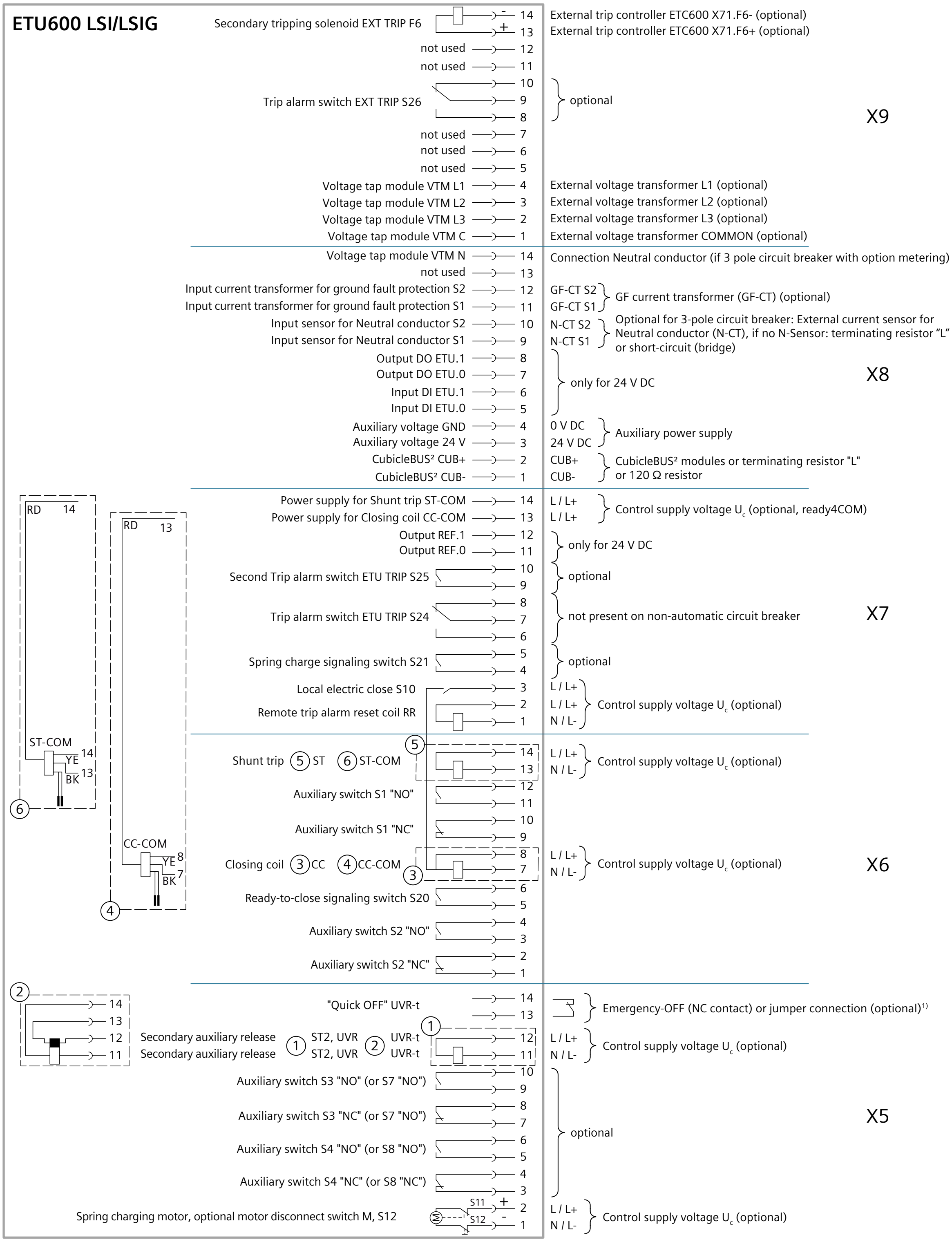
6.1.2 Terminal connection diagrams of secondary disconnect terminal

6.1.2.1 ETU300 terminal assignment diagram

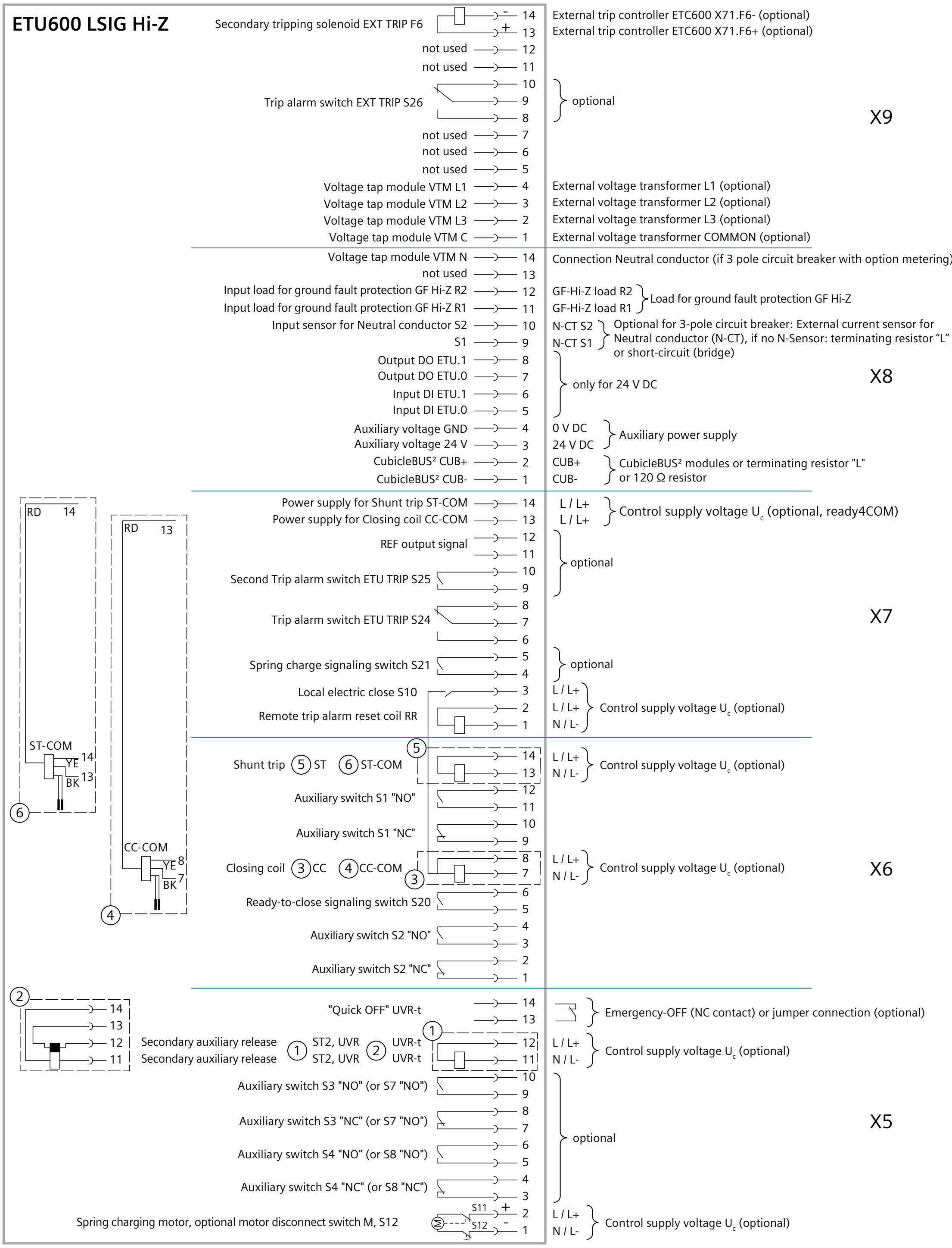


[1] The maximum permissible cable length to the EMERGENCY-OFF button (EMERGENCY shutdown) is currently < 50 m (the maximum cable length between X5.13 and X5.14 is < 100 m)

6.1.2.2 ETU600 terminal assignment diagram



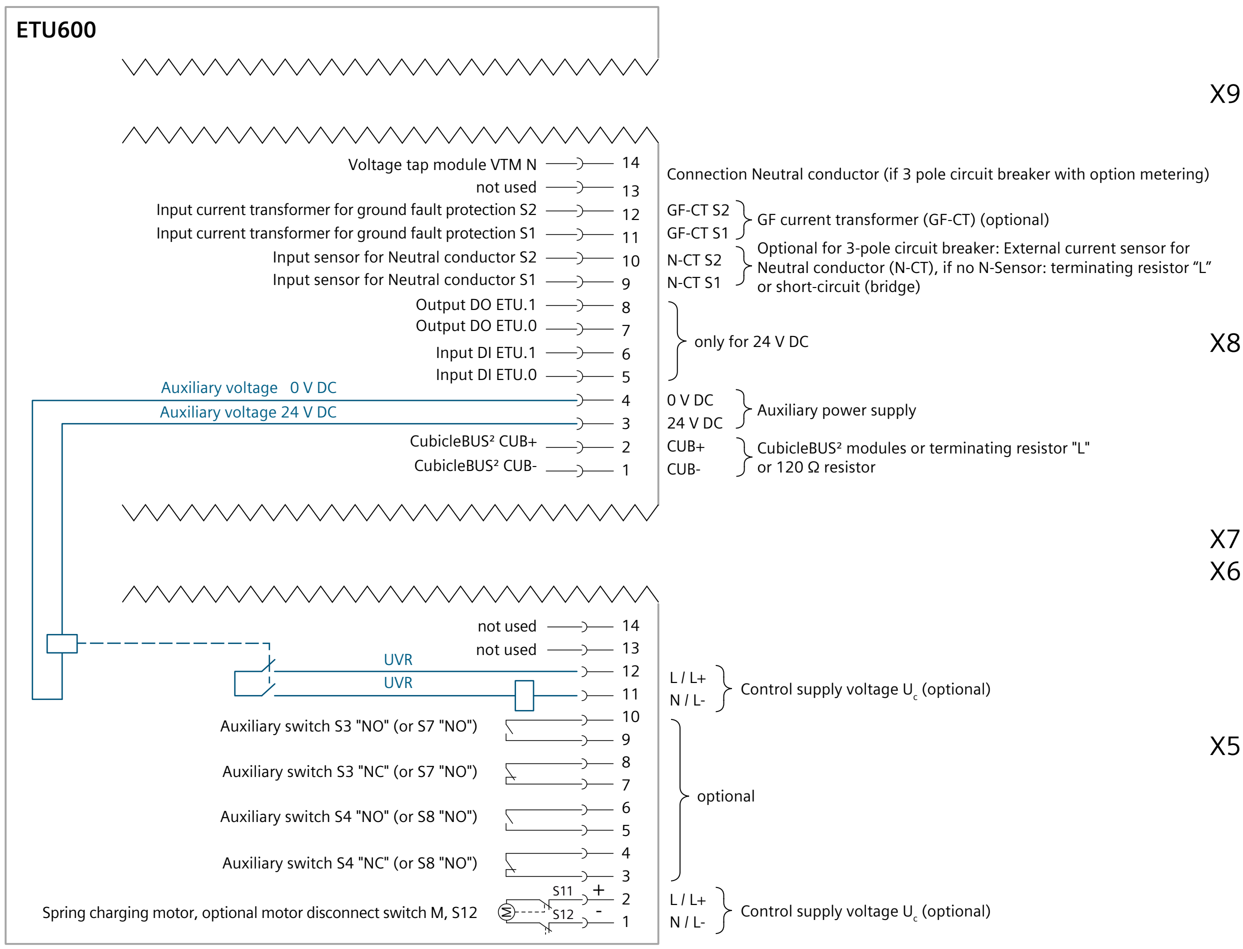
1) The maximum permissible cable length to the EMERGENCY-OFF button (EMERGENCY shutdown) is currently < 50 m (the maximum cable length between X5.13 and X5.14 is < 100 m)



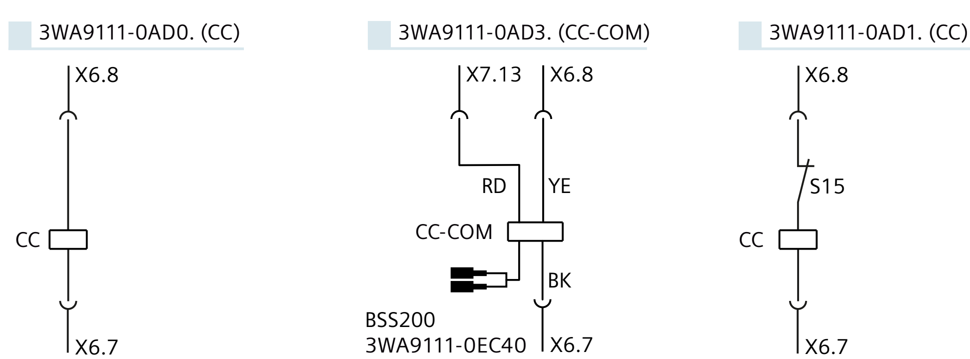
See also

Terminal assignment diagram supplement for circuit breakers with ETU600 and the K60 option (with integrated undervoltage release) (Page 393)

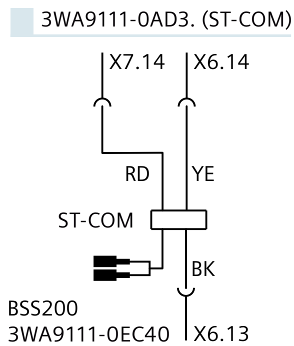
6.1.2.3 Terminal assignment diagram supplement for circuit breakers with ETU600 and the K60 option (with integrated undervoltage release)



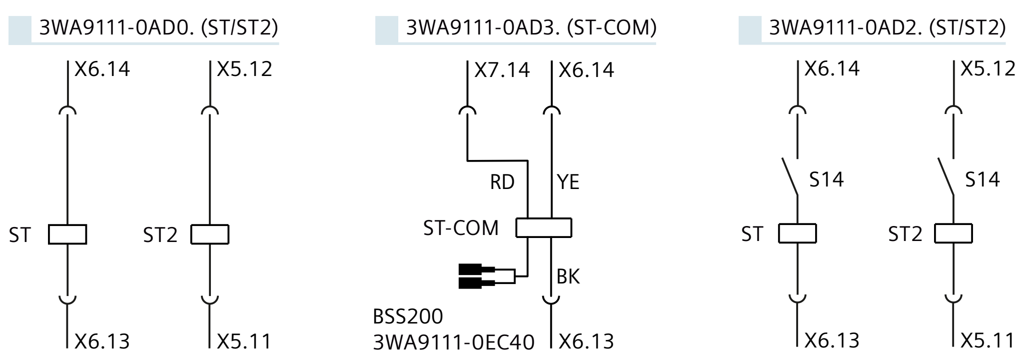
6.1.3 Closing coil CC / CC-COM



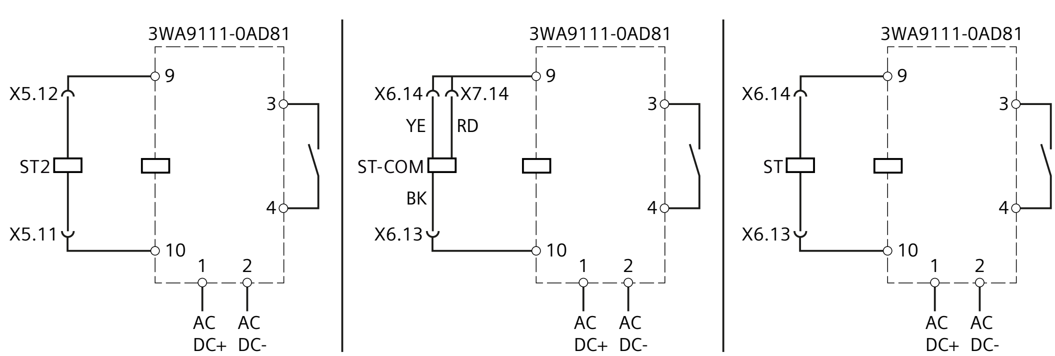
6.1.4 Remote trip alarm reset coil RR



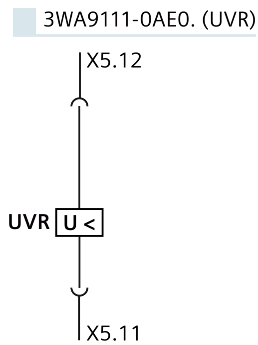
6.1.5 Shunt trip ST / ST-COM / ST2

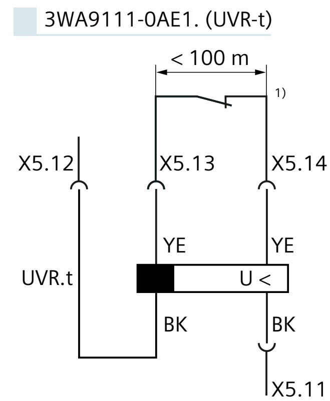


6.1.6 Capacitor trip device for shunt trips



6.1.7 Undervoltage release UVR / UVR-t

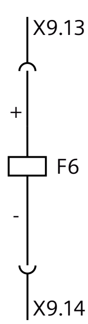




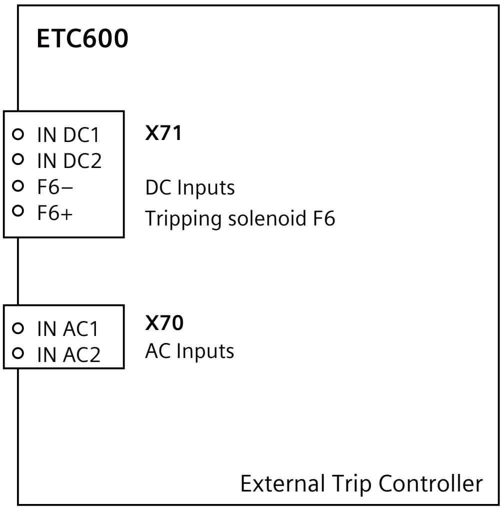
1) EMERGENCY-OFF or jumper. Shunt trip with 100% duty cycle can be used as an electrical closing lockout.

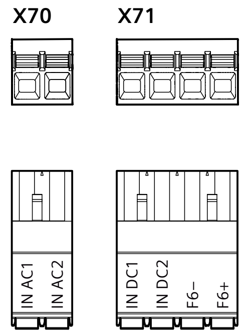
The maximum permissible cable length to the EMERGENCY-OFF button (EMERGENCY shutdown) is currently < 50 m (the maximum cable length between X5.13 and X5.14 is < 100 m).

6.1.8 Second tripping solenoid F6 with reclosing lockout

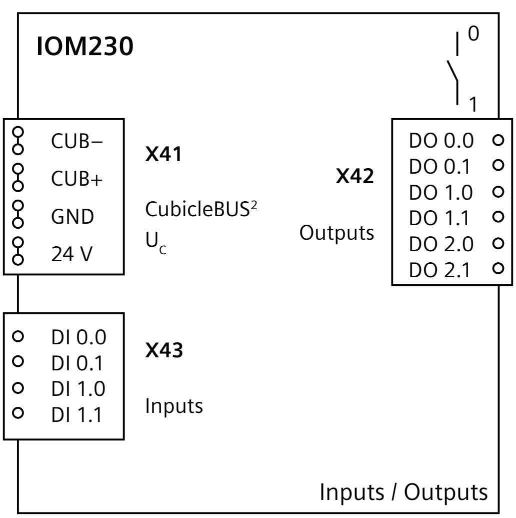


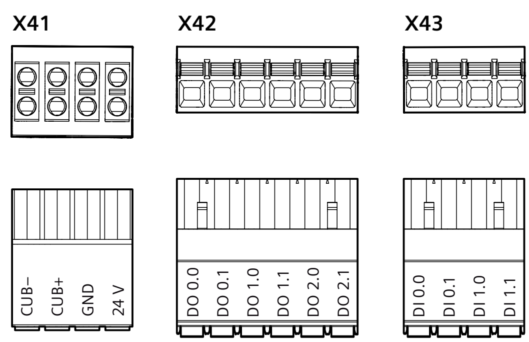
6.1.9 External Trip Controller ETC600



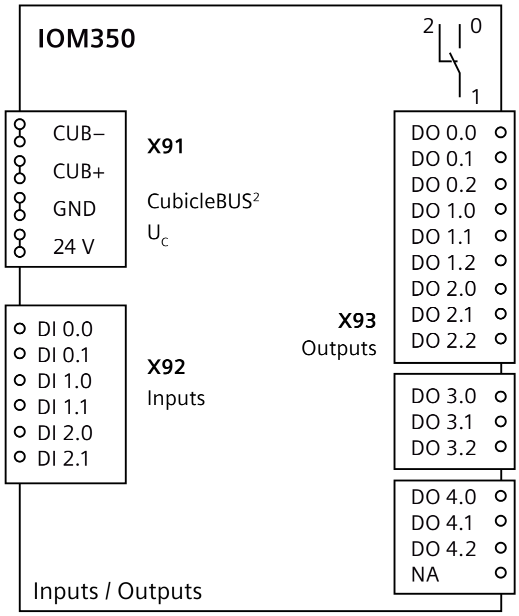


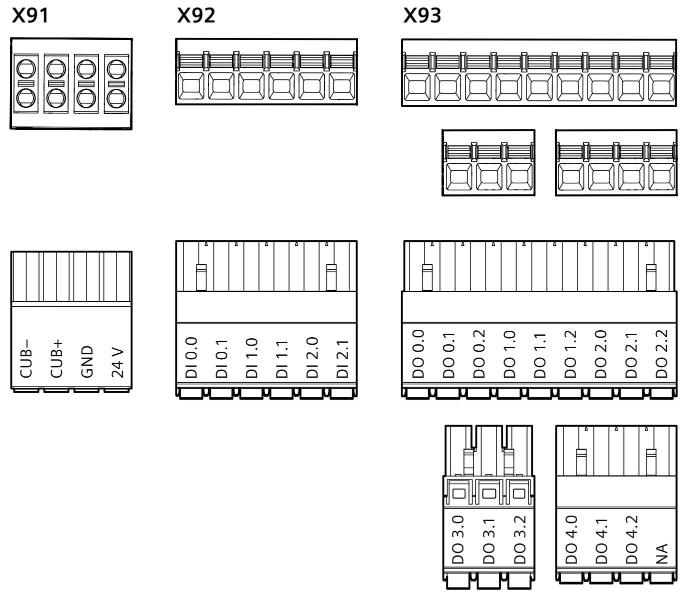
6.1.10 Digital input / output module IOM230



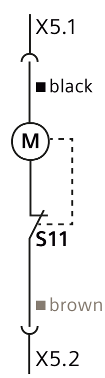


6.1.11 Digital input/output module IOM350

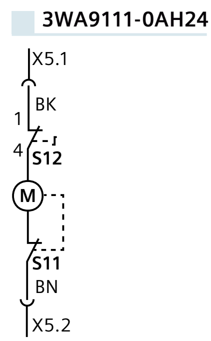




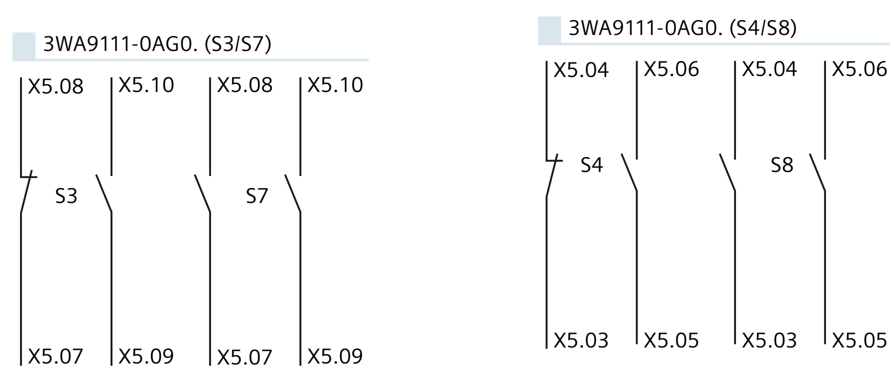
6.1.12 Spring charging motor



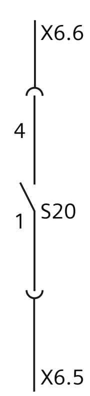
6.1.13 Motor disconnect switch



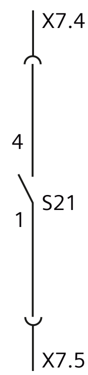
6.1.14 Auxiliary switch



6.1.15 Ready-to-close signaling switch S20



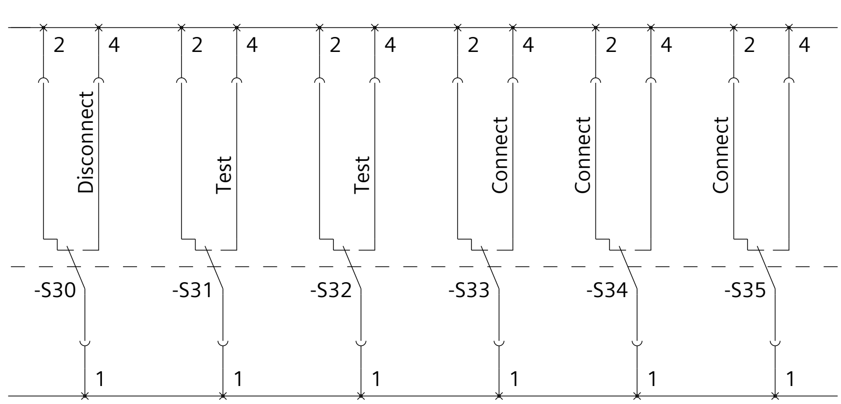
6.1.16 Spring charge signaling switch S21



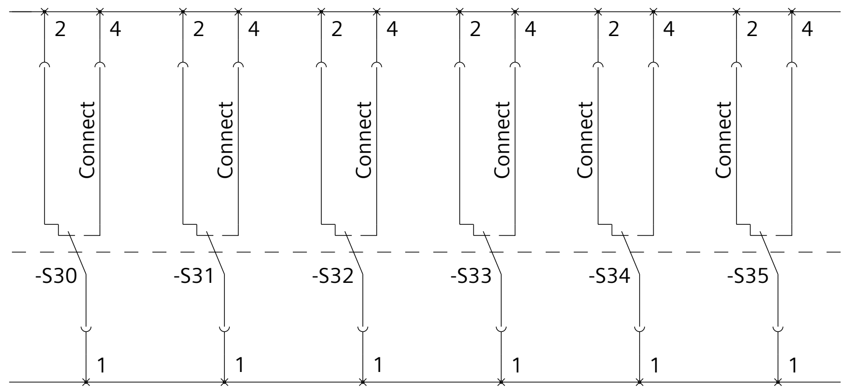
6.1.17 Trip alarm switches S24 and S25

6.1.18 PSS and PSS COM position signaling switch modules

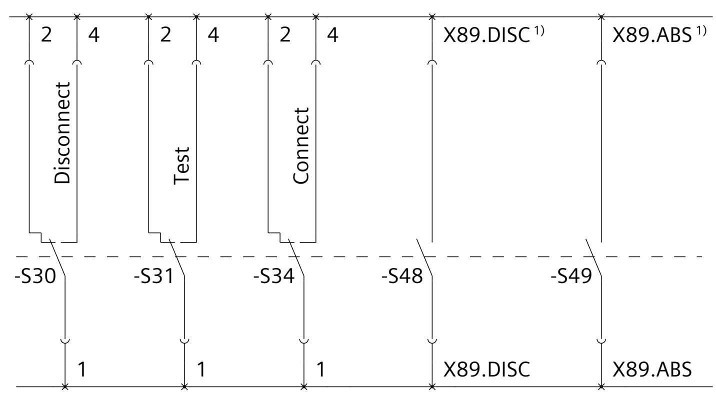
PSS321 position signaling switch module



PSS600 position signaling switch module

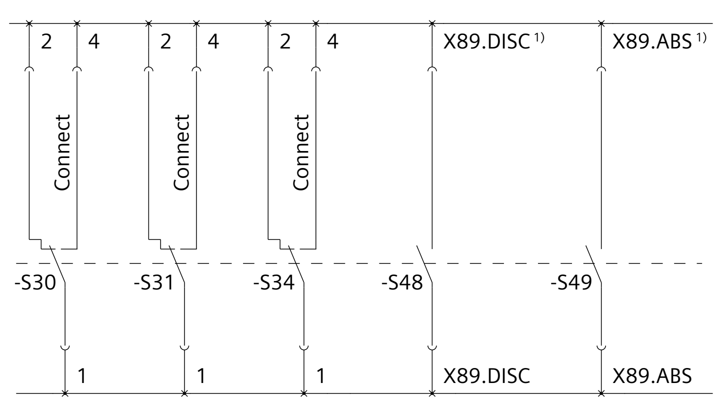


PSS111 COM position signaling switch module



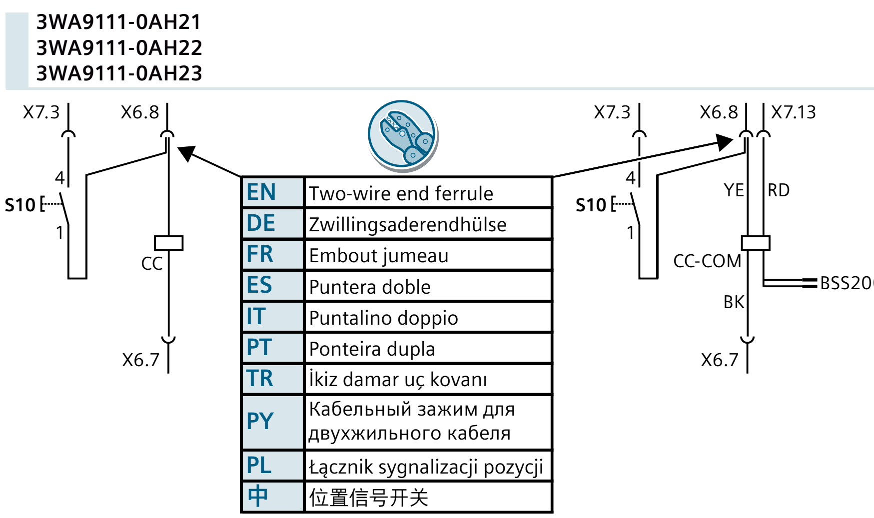
1) Can only be used for the connection to the first communications module (role A)

PSS400 COM position signaling switch module



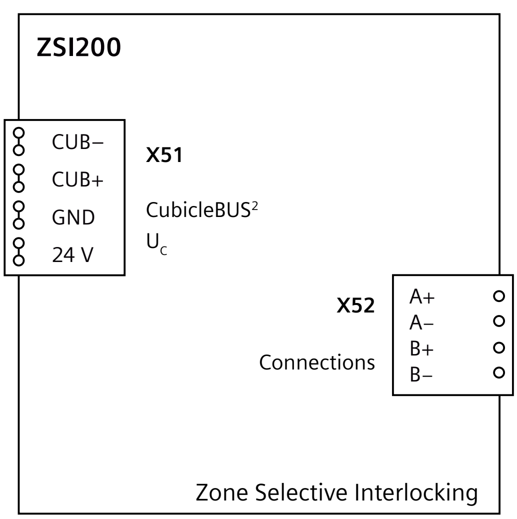
1) Can only be used for the connection to the first communications module (role A)

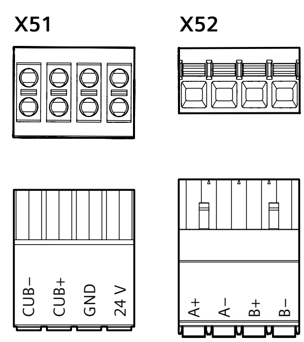
6.1.19 Local electric close S10



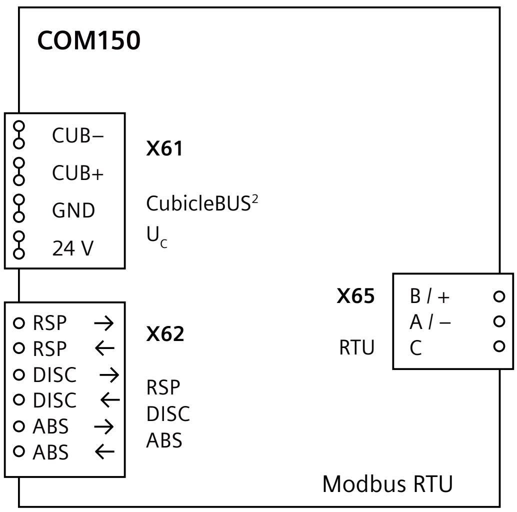
EN	Two-wire end ferrule
DE	Zwillingsaderendhülse
FR	Embout jumeau
ES	Puntera doble
IT	Puntalino doppio
PT	Ponteira dupla
TR	İkiz damar uç kovanı
PY	Кабельный зажим для двухжильного кабеля
PL	Łącznik sygnalizacji pozycji
中	位置信号开关

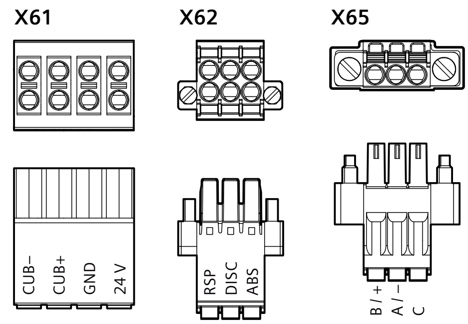
6.1.20 ZSI200 zone selective interlocking module



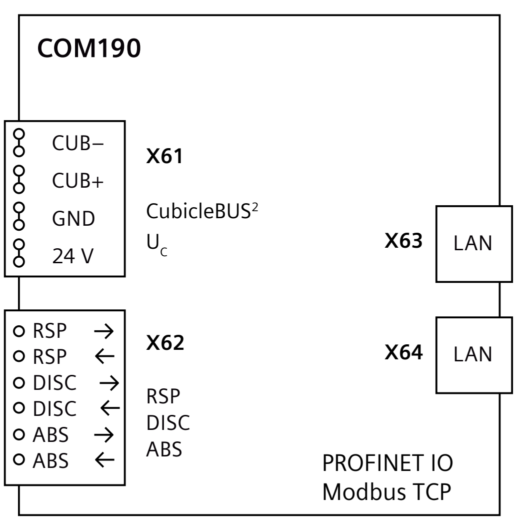


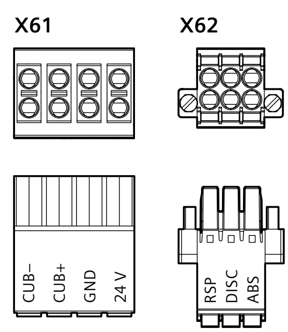
6.1.21 COM150 communication module



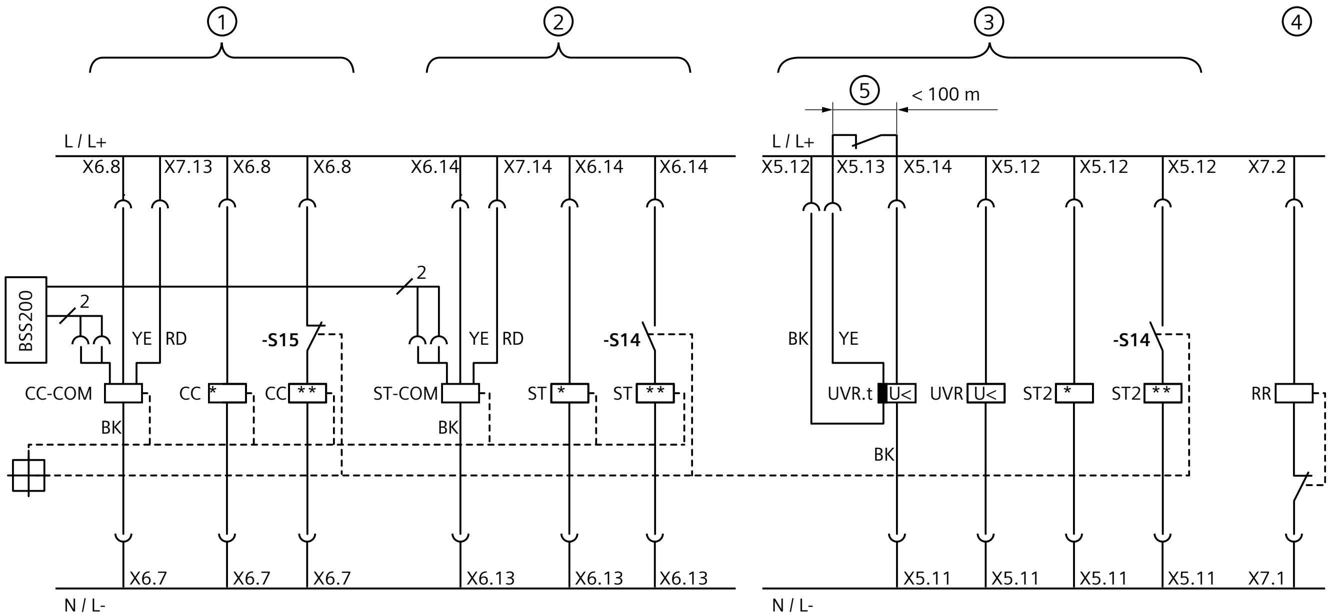


6.1.22 COM190 communication module





6.1.23 Breaker Status Sensor BSS200



(1) Closing coil

(2) First auxiliary release

(3) Second auxiliary release

(4) Remote trip alarm reset coil

(5) EMERGENCY-OFF or jumper.
The maximum permissible cable length to the EMERGENCY-OFF button (EMERGENCY shutdown) is currently < 50 m (the maximum cable length between X5.13 and X5.14 is < 100 m).

* 100% duty cycle

** 5% duty cycle

6.2 Dimension drawings

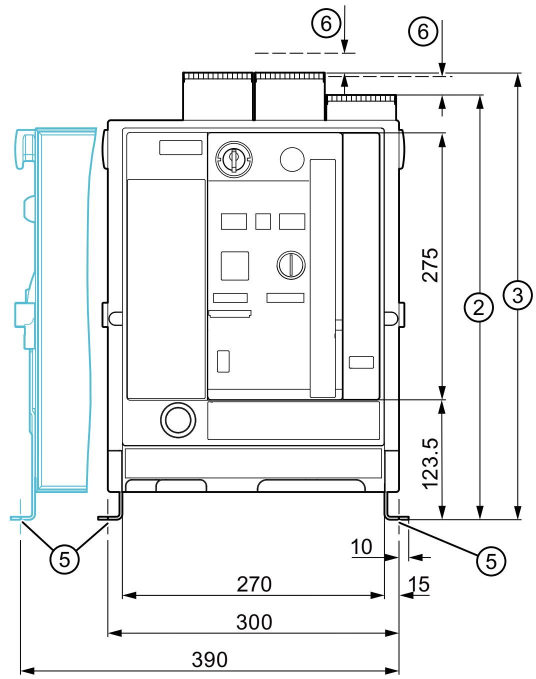
6.2.1 3WA1 - size 1

6.2.1.1 Fixed-mounted circuit breakers

Front view of 3WA11 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(2)	Dimension at auxiliary supply connector (push-in)	437.5 mm
(3)	Dimension at auxiliary supply connector (push-in) in combination with COM/IO modules	460.5 mm
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)	
(6)	Space for cable harness to electrical auxiliary circuit connections	20 mm

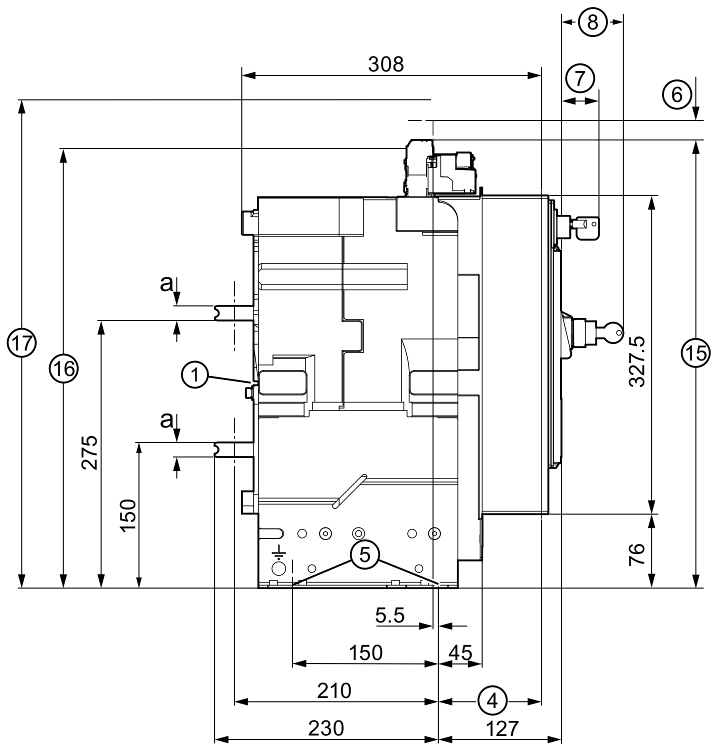
See also

Safety clearances (Page 447)

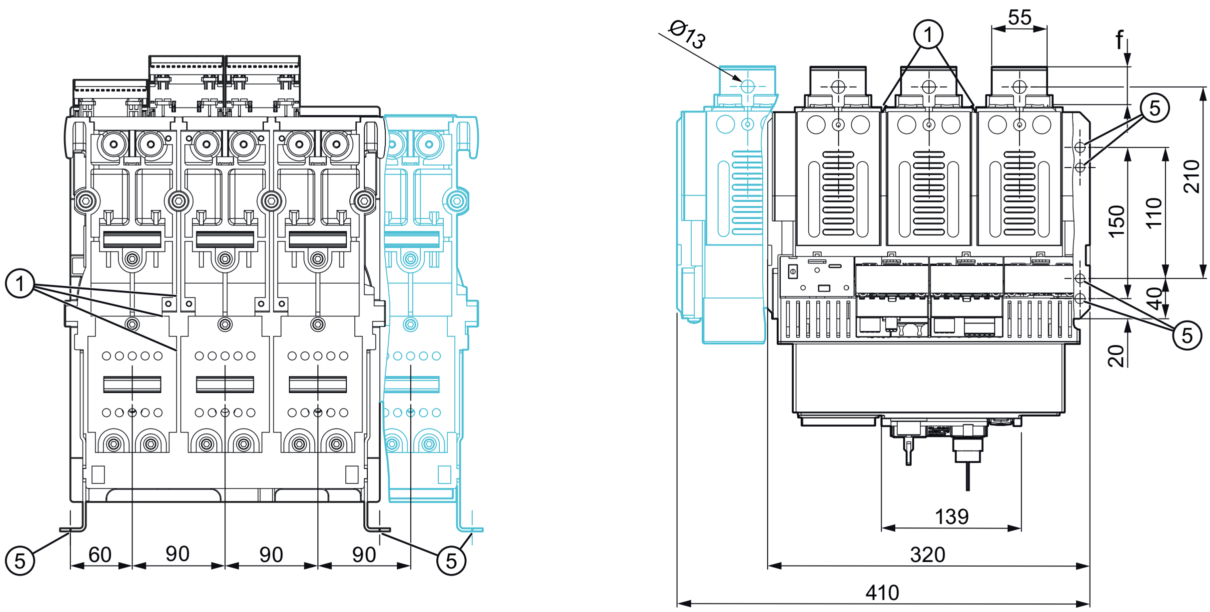
Horizontal connection of 3WA11 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(4)	Dimension to inside surface of the closed control cabinet door			106 mm
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)			
(6)	Space for cable harness to electrical auxiliary circuit connections			20 mm
(7)	"Safe Open" locking provision			38.5 mm
(8)	Key operation			63.6 mm
(15)	Maximum device height			460.5 mm
(16)	Top edge of arc chutes	For N, S, M		401 mm
		For E		451 mm
(17)	Mounting space for removal of the arc chutes	For N, S, M		541 mm
		For E		591 mm
a	Busbar thickness	For N, S	≤ 1000 A AC	10 mm
			≤ 2000 A AC	15 mm
			≤ 2500 A AC	15 mm
		For M, E	≤ 2000 A AC	15 mm
			≤ 2500 A AC	15 mm

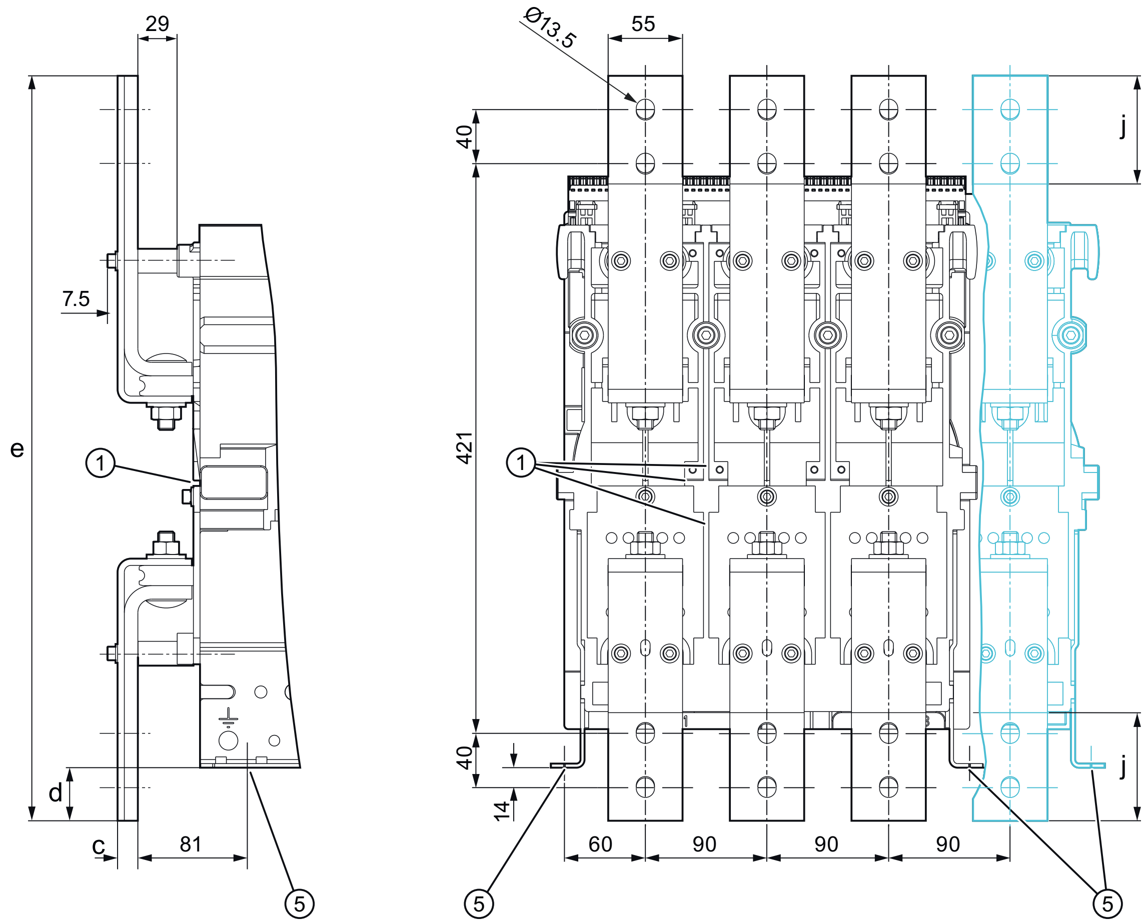


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)			
f	Terminal face length	For N, S	≤ 1000 A AC	35 mm
			≤ 2000 A AC	35 mm
			≤ 2500 A AC	35 mm
		For M, E	≤ 2000 A AC	35 mm
			≤ 2500 A AC	35 mm

Front connection (double hole) of 3WA11 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



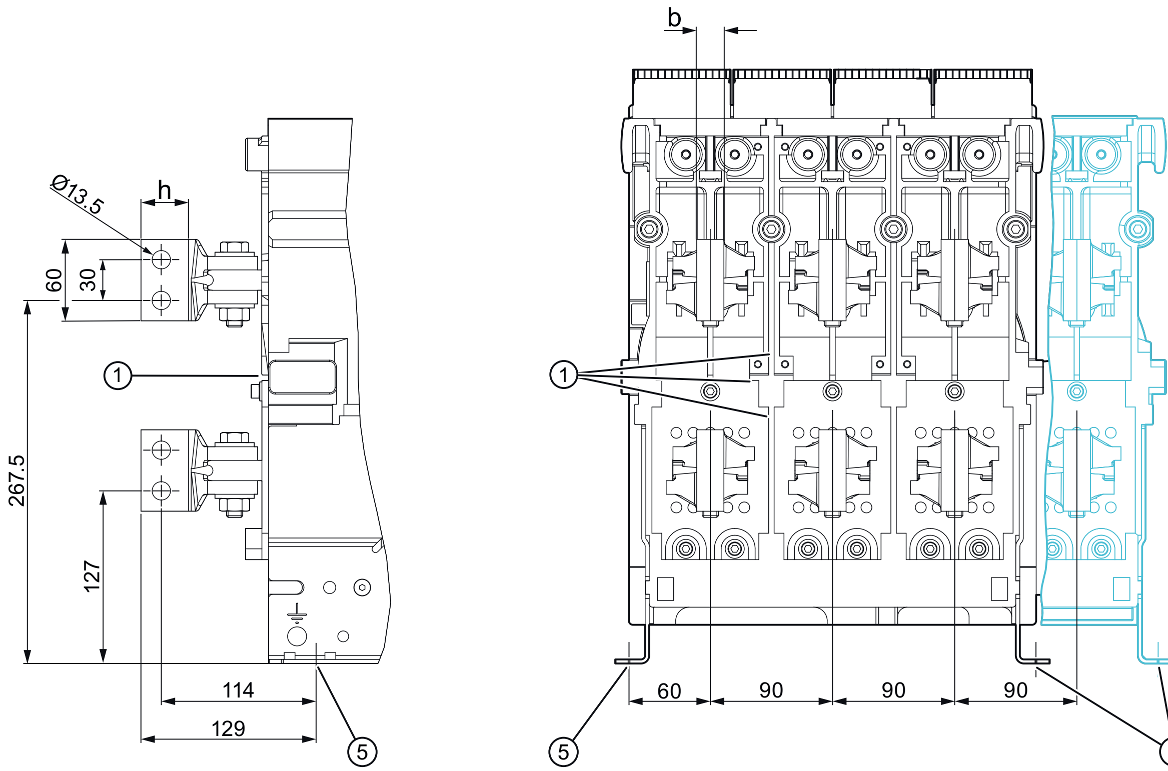
(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)			
c	Busbar thickness	For N, S	≤ 1000 A AC	10 mm
			≤ 2000 A AC	15 mm
		For M, E	≤ 2000 A AC	15 mm
d	Clearance	For N, S	≤ 1000 A AC	34 mm
			≤ 2000 A AC	39 mm
		For M, E	≤ 2000 A AC	39 mm
e	Clearance	For N, S	≤ 1000 A AC	541 mm
			≤ 2000 A AC	551 mm
		For M, E	≤ 2000 A AC	551 mm
j	Terminal face length	For N, S, M, E	≤ 1000 A AC	80 mm
			≤ 2000 A AC	80 mm

Vertical connection of 3WA11 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

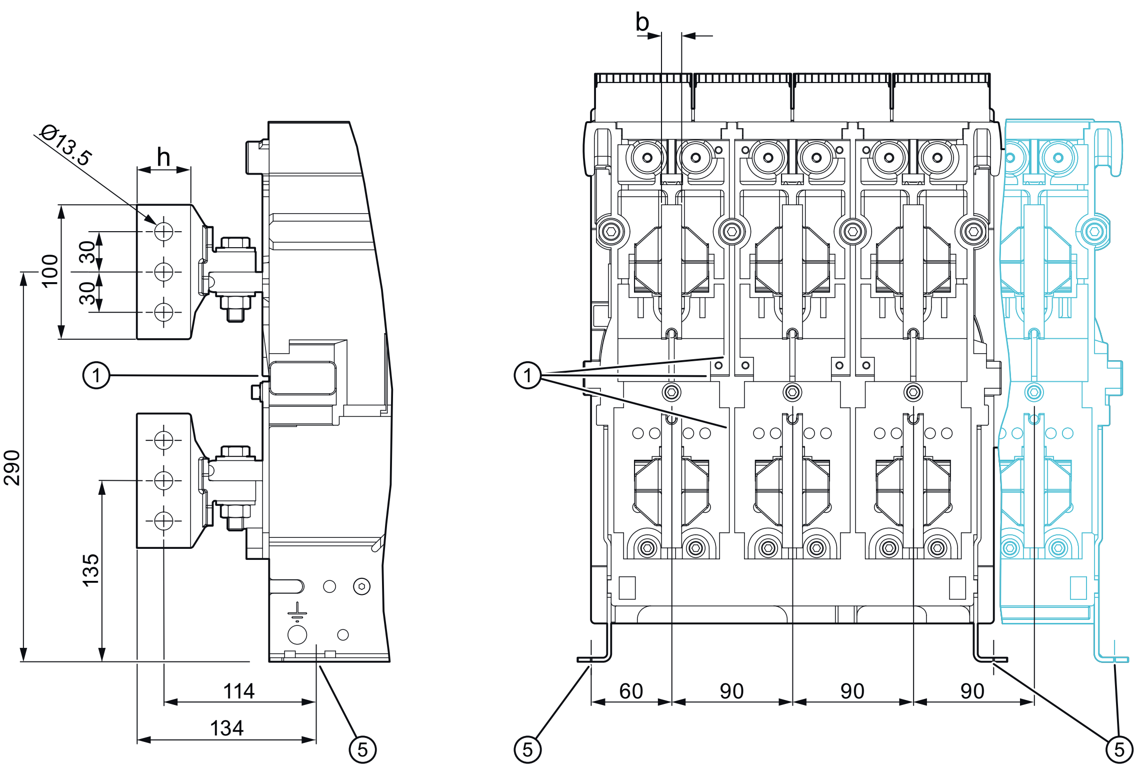
All dimensions in [mm].

Maximum rated current ≤ 2000 A AC



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)			
b	Busbar thickness	For N, S	≤ 1000 A AC	10 mm
			≤ 2000 A AC	20 mm
		For M, E	≤ 2000 A AC	20 mm
h	Terminal face length	For N, S, M, E	≤ 1000 A AC	35 mm
			≤ 2000 A AC	35 mm

Maximum rated current ≤ 2500 A AC



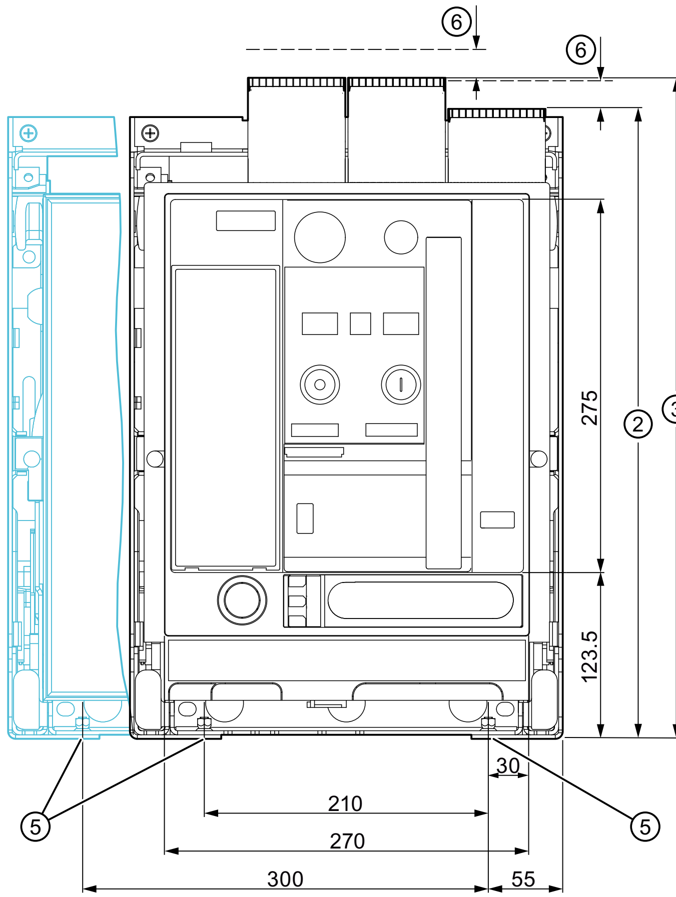
(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)			
b	Busbar thickness	For N, S	≤ 2500 A AC	15 mm
		For M, E	≤ 2500 A AC	15 mm
h	Terminal face length	For N, S, M, E	≤ 2500 A AC	40 mm

6.2.1.2 Withdrawable circuit breakers

Front view of 3WA11 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(2)	Dimension at auxiliary supply connector (push-in)	For N, S, M For E	466 mm 516 mm
(3)	Dimension at auxiliary supply connector (push-in) in combination with COM/IO modules	For N, S, M For E	489 mm 539 mm
(5)	Mounting holes		⌀ 9 mm
(6)	Space for cable harness to electrical auxiliary circuit connections		20 mm

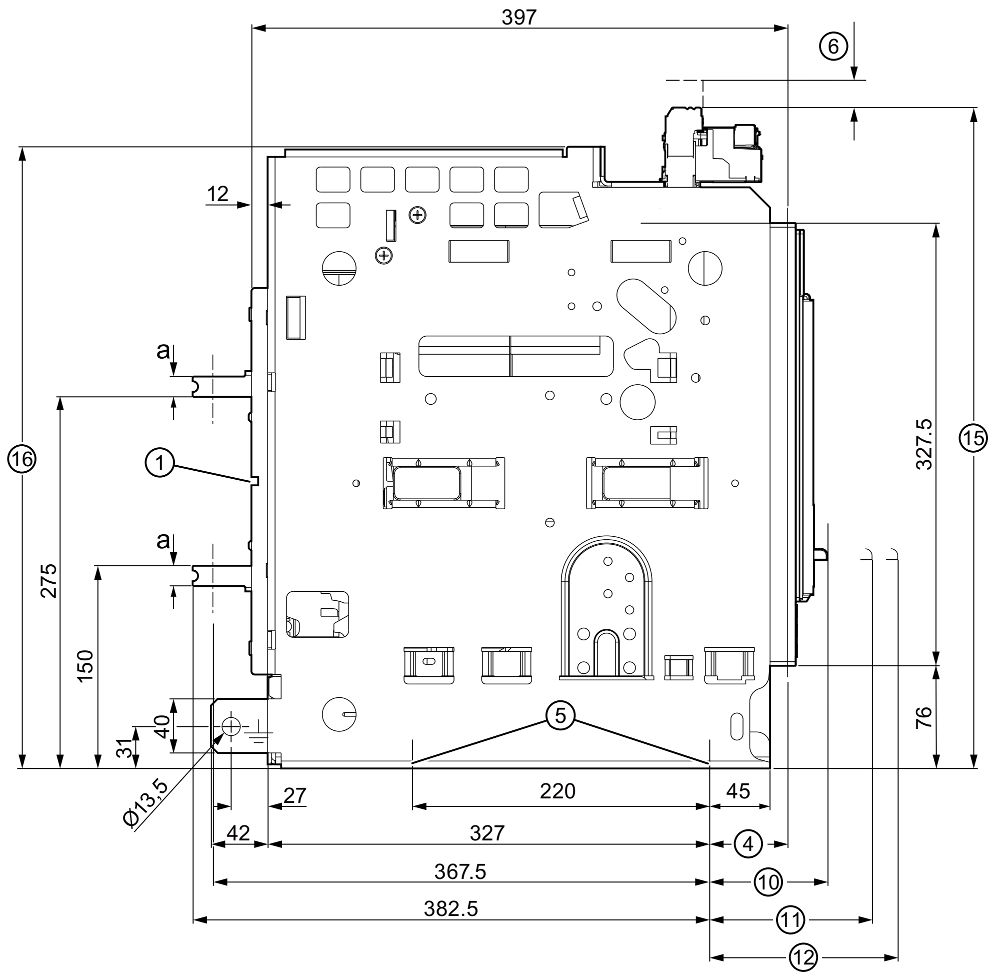
See also

Safety clearances (Page 447)

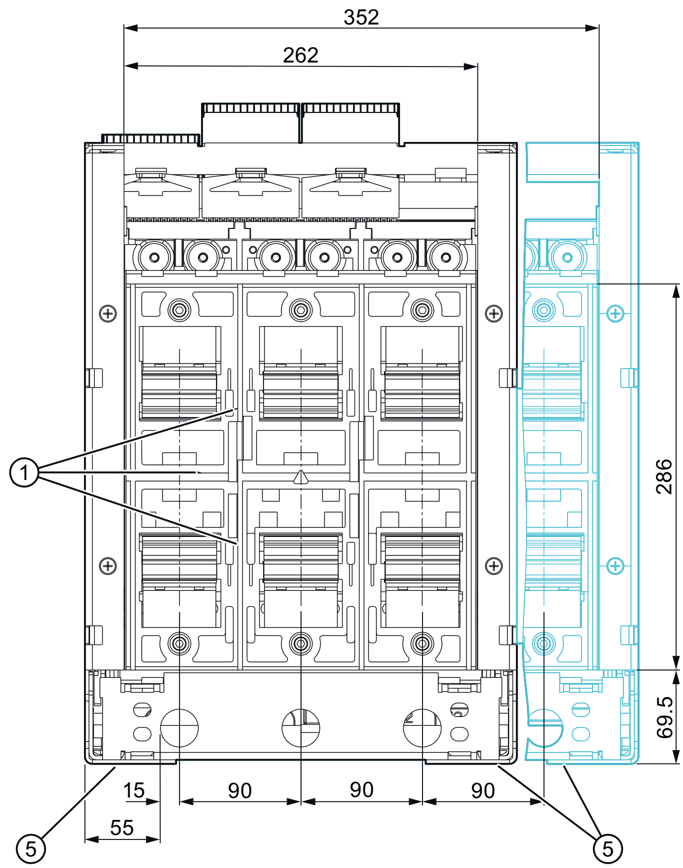
Horizontal connection of 3WA11 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

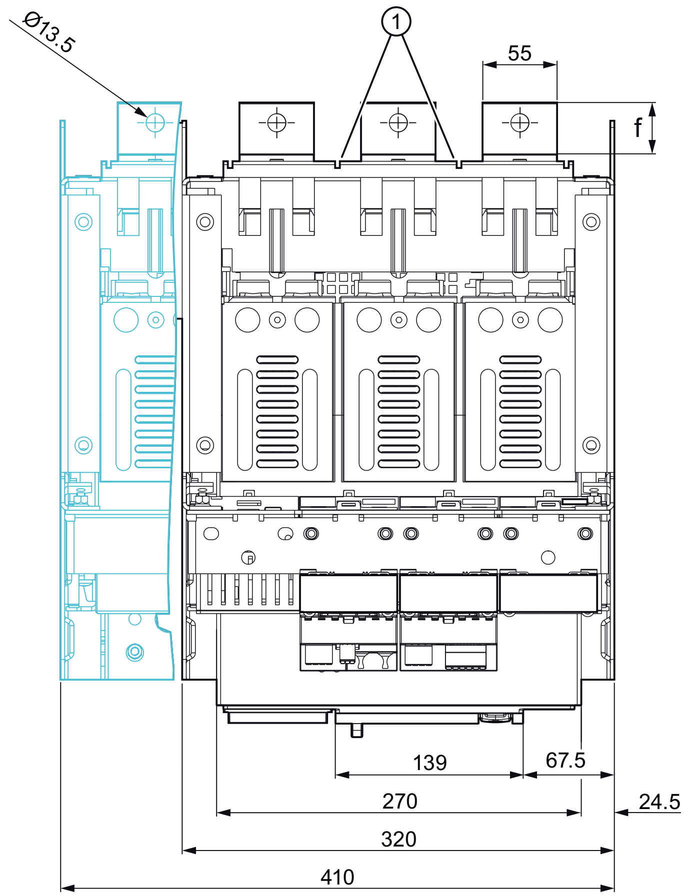
All dimensions in [mm].



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(4)	Dimension to inside surface of the closed control cabinet door			58 mm
(5)	Mounting holes			∅ 9 mm
(6)	Space for cable harness to electrical auxiliary circuit connections			20 mm
(10)	Circuit breaker in connected position			88.5 mm
(11)	Circuit breaker in test position			121.5 mm
(12)	Circuit breaker in disconnected position			140.5 mm
(15)	Maximum device height	For N, S, M		489 mm
		For E		539 mm
(16)	Guide frame upper edge	For N, S, M		460 mm
		For E		510 mm
a	Busbar thickness	For N, S	≤ 1000 A AC	10 mm
			≤ 2000 A AC	15 mm
		For M, E	≤ 2000 A AC	15 mm



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	∅ 9 mm

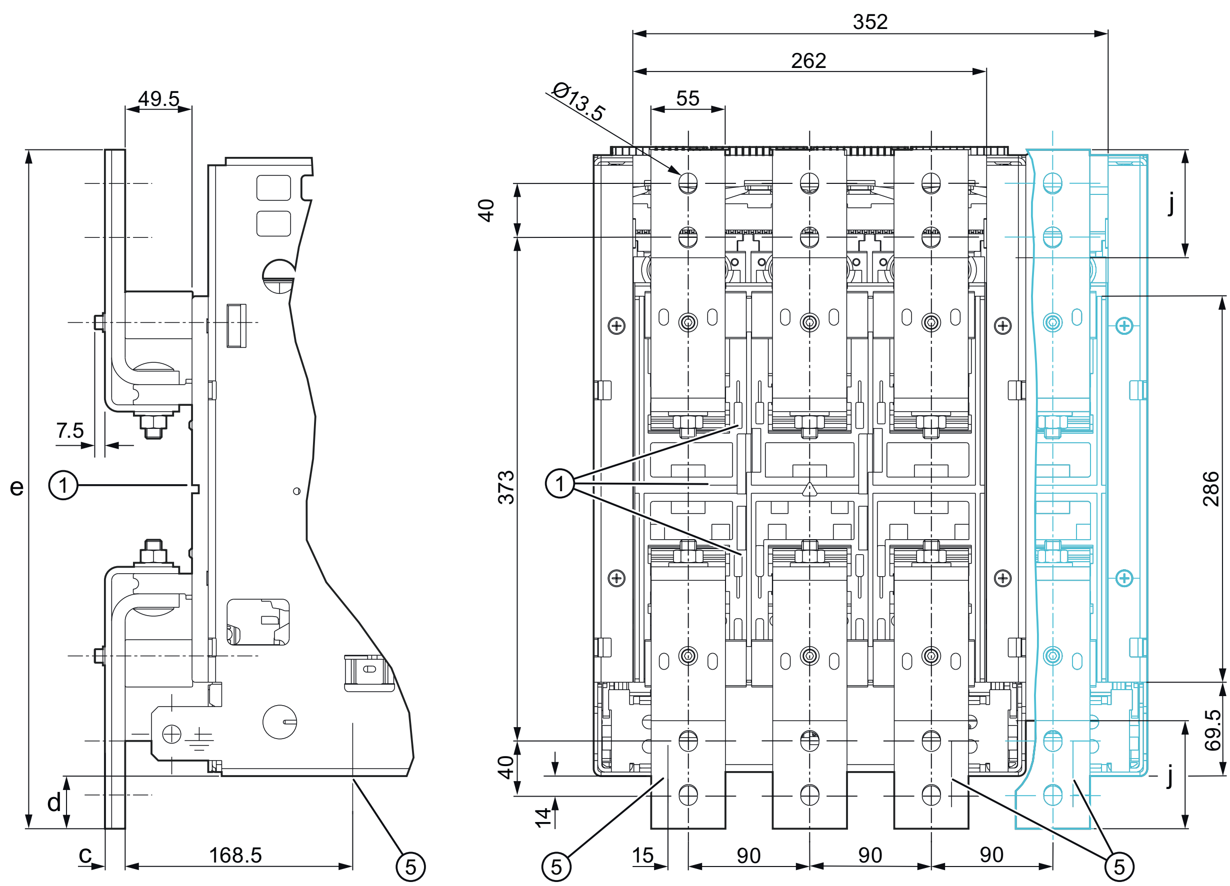


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
f	Terminal face length	For N, S	≤ 1000 A AC	38 mm
			≤ 2000 A AC	38 mm
		For M, E	≤ 2000 A AC	38 mm

Front connection (double hole) of 3WA11 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



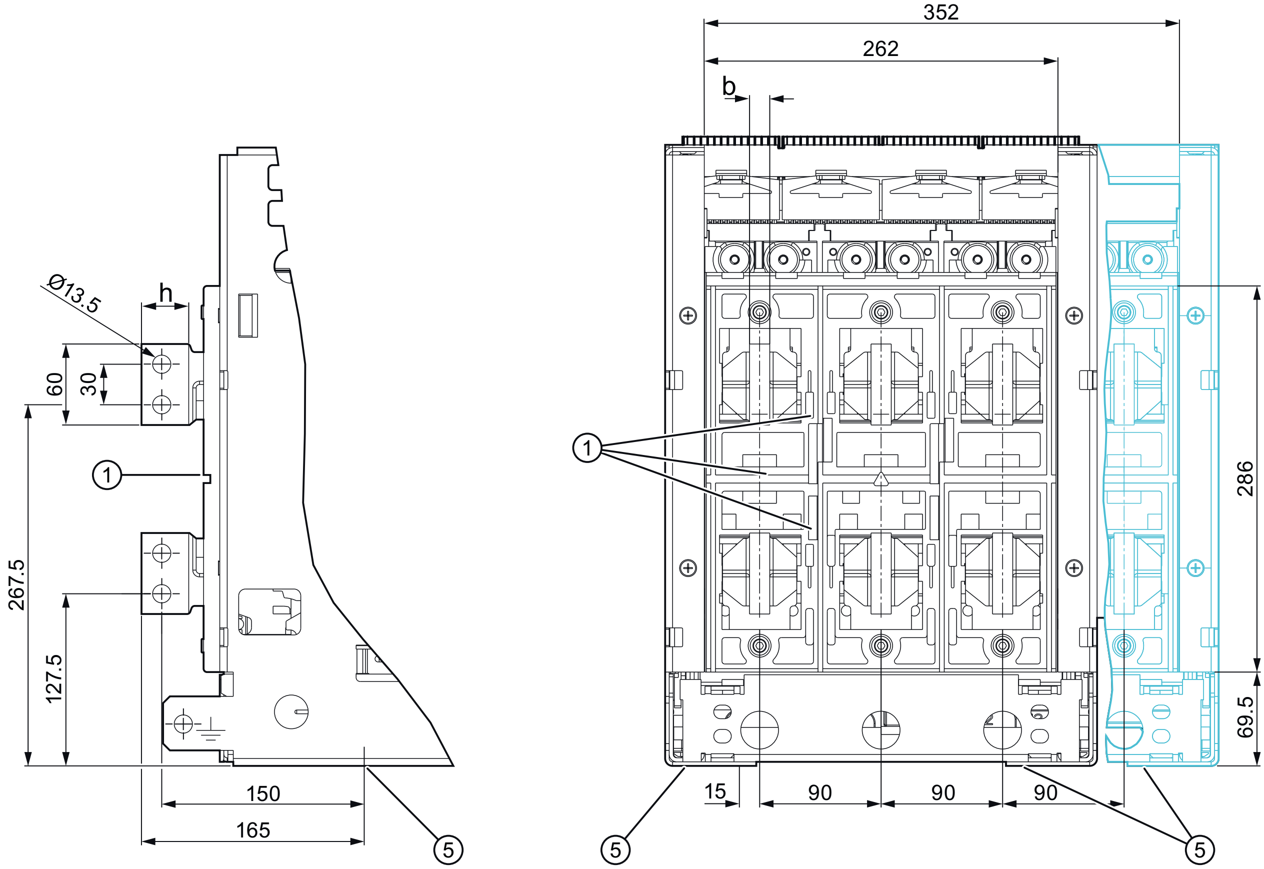
(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Mounting holes			∅ 9 mm
c	Busbar thickness	For N, S	≤ 1000 A AC	10 mm
			≤ 2000 A AC	15 mm
		For M, E	≤ 2000 A AC	15 mm
d	Clearance	For N, S	≤ 1000 A AC	34 mm
			≤ 2000 A AC	39 mm
		For M, E	≤ 2000 A AC	39 mm
e	Clearance	For N, S	≤ 1000 A AC	493 mm
			≤ 2000 A AC	503 mm
		For M, E	≤ 2000 A AC	503 mm
j	Terminal face length	For N, S	≤ 1000 A AC	80 mm
			≤ 2000 A AC	80 mm
		For M, E	≤ 2000 A AC	80 mm

Vertical connection of 3WA11 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

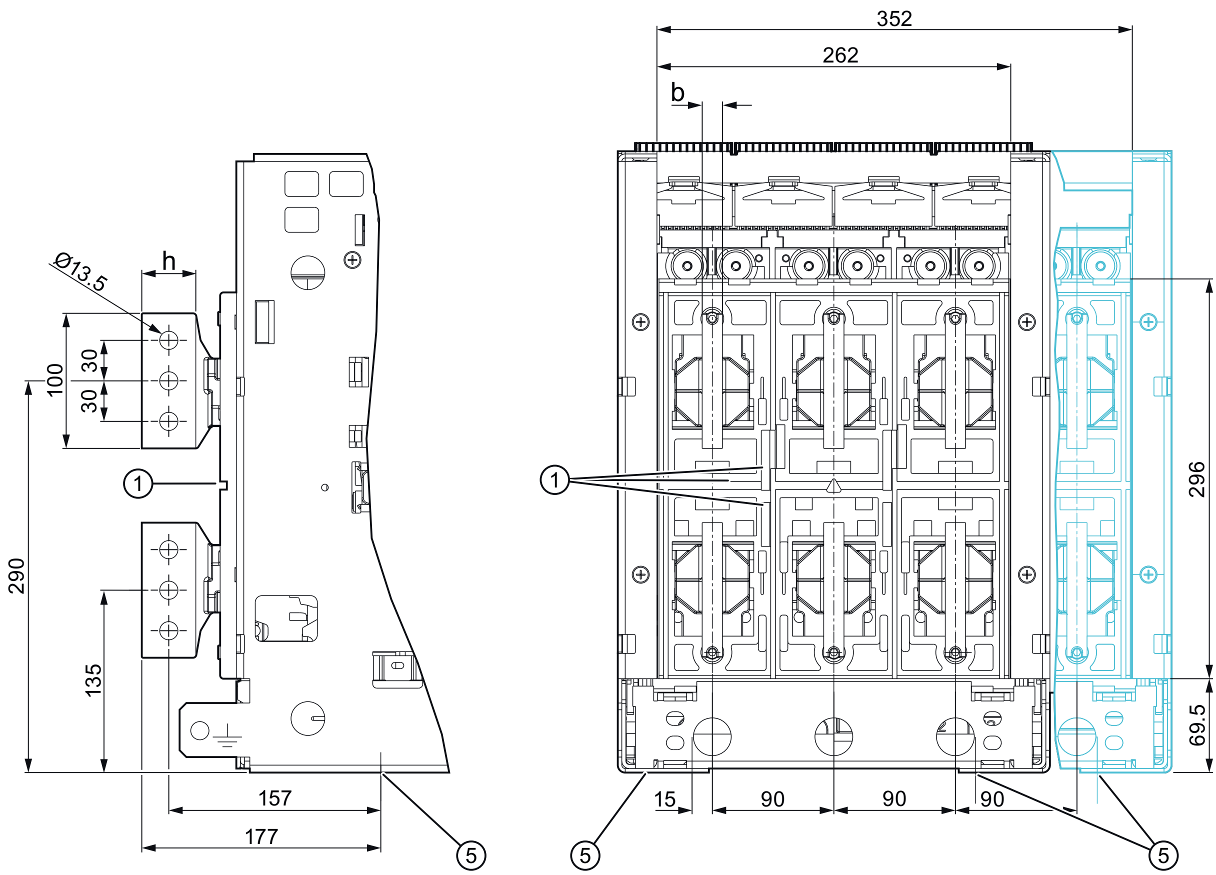
All dimensions in [mm].

Maximum rated current ≤ 2000 A AC



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Mounting holes			Ø 9 mm
b	Busbar thickness	For N, S	≤ 1000 A AC	10 mm
			≤ 2000 A AC	15 mm
		For M, E	≤ 2000 A AC	15 mm
h	Terminal face length	For N, S	≤ 1000 A AC	38 mm
			≤ 2000 A AC	38 mm
		For M, E	≤ 2000 A AC	38 mm

Maximum rated current ≤ 2500 A AC

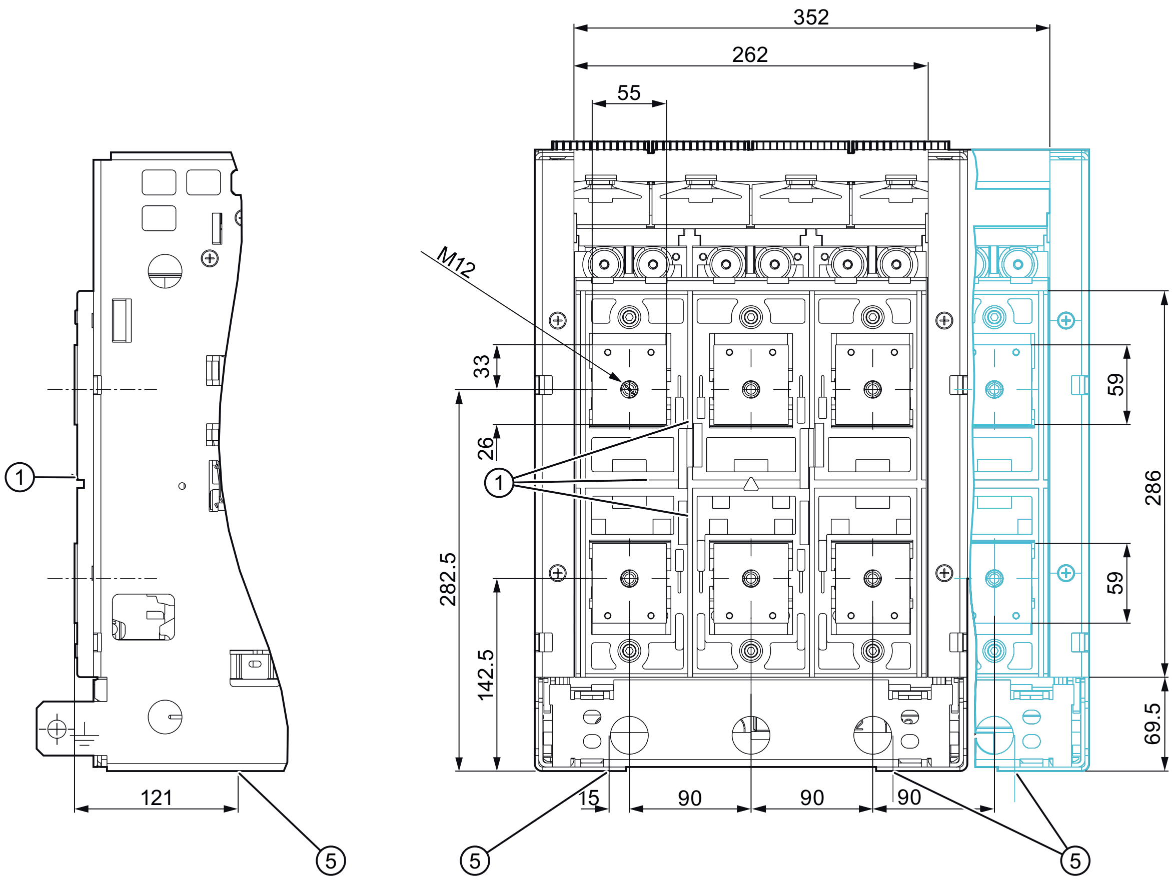


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Mounting holes			Ø 9 mm
b	Busbar thickness	For N, S	≤ 2500 A AC	15 mm
		For M, E	≤ 2500 A AC	15 mm
h	Terminal face length	For N, S	≤ 2500 A AC	40 mm
		For M, E	≤ 2500 A AC	40 mm

Flange connection of 3WA11 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	Ø 9 mm

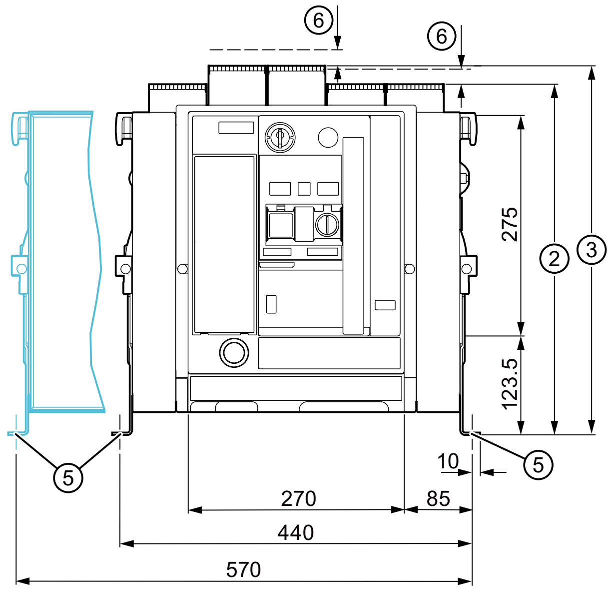
6.2.2 3WA1 - size 2

6.2.2.1 Fixed-mounted circuit breakers

Front view of 3WA12 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(2)	Dimension at auxiliary supply connector (push-in)	437.5 mm
(3)	Dimension at auxiliary supply connector (push-in) in combination with COM/IO modules	460.5 mm
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)	
(6)	Space for cable harness to electrical auxiliary circuit connections	20 mm

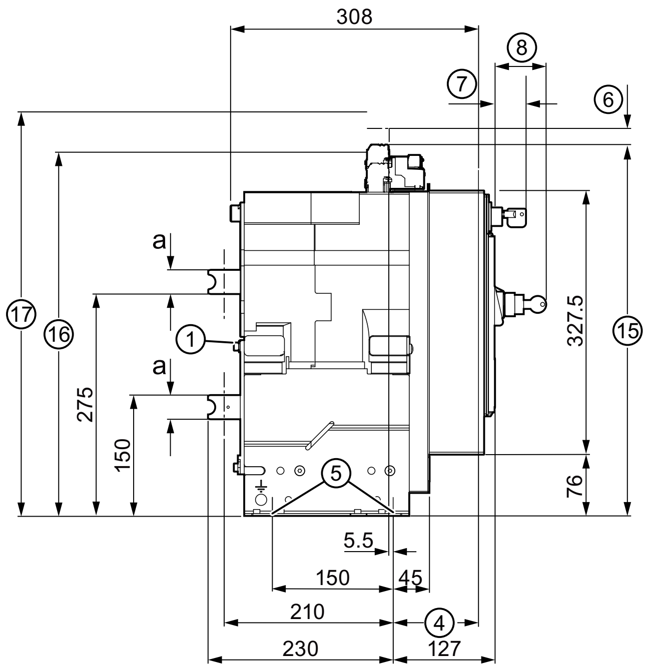
See also

Safety clearances (Page 447)

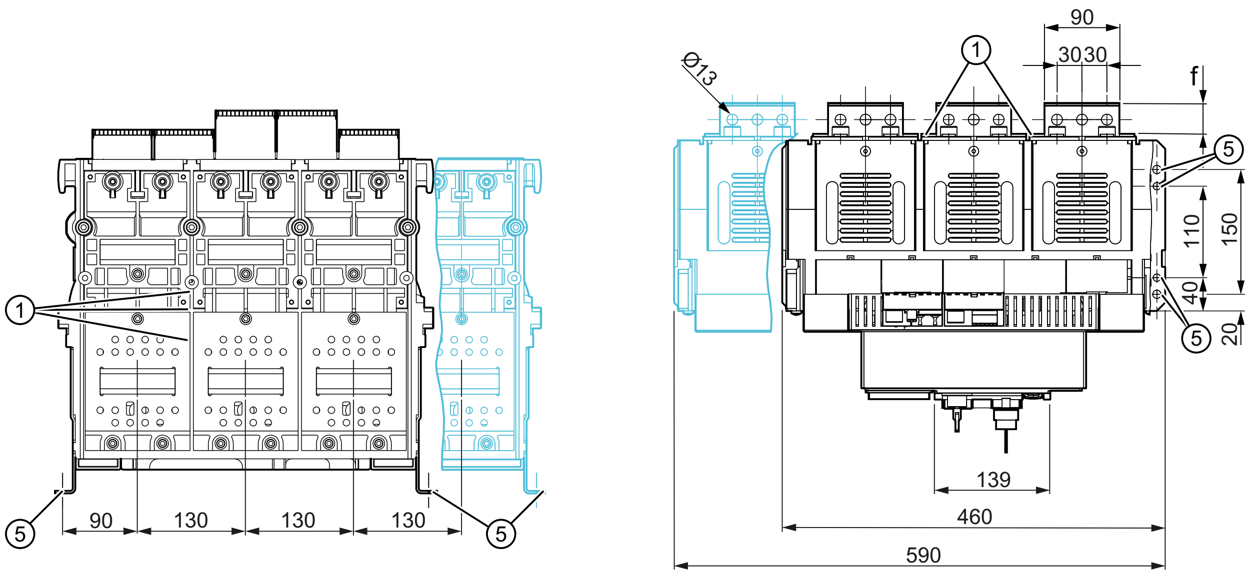
Horizontal connection of 3WA12 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(4)	Dimension to inside surface of the closed control cabinet door			106 mm
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)			
(6)	Space for cable harness to electrical auxiliary circuit connections			20 mm
(7)	"Safe Open" locking provision			38.5 mm
(8)	Key operation			63.6 mm
(15)	Maximum device height			460.5 mm
(16)	Top edge of arc chutes	For S, M, H, D		401 mm
		For C, E		451 mm
(17)	Mounting space for removal of the arc chutes	For S, M, H, D		541 mm
		For C, E		591 mm
a	Busbar thickness	For S, M, H, D, E	≤ 2000 A AC/DC	10 mm
			≤ 2500 A AC	15 mm
			≤ 3200 A AC / 4000 A DC	30 mm
		For C	≤ 3200 A AC	30 mm

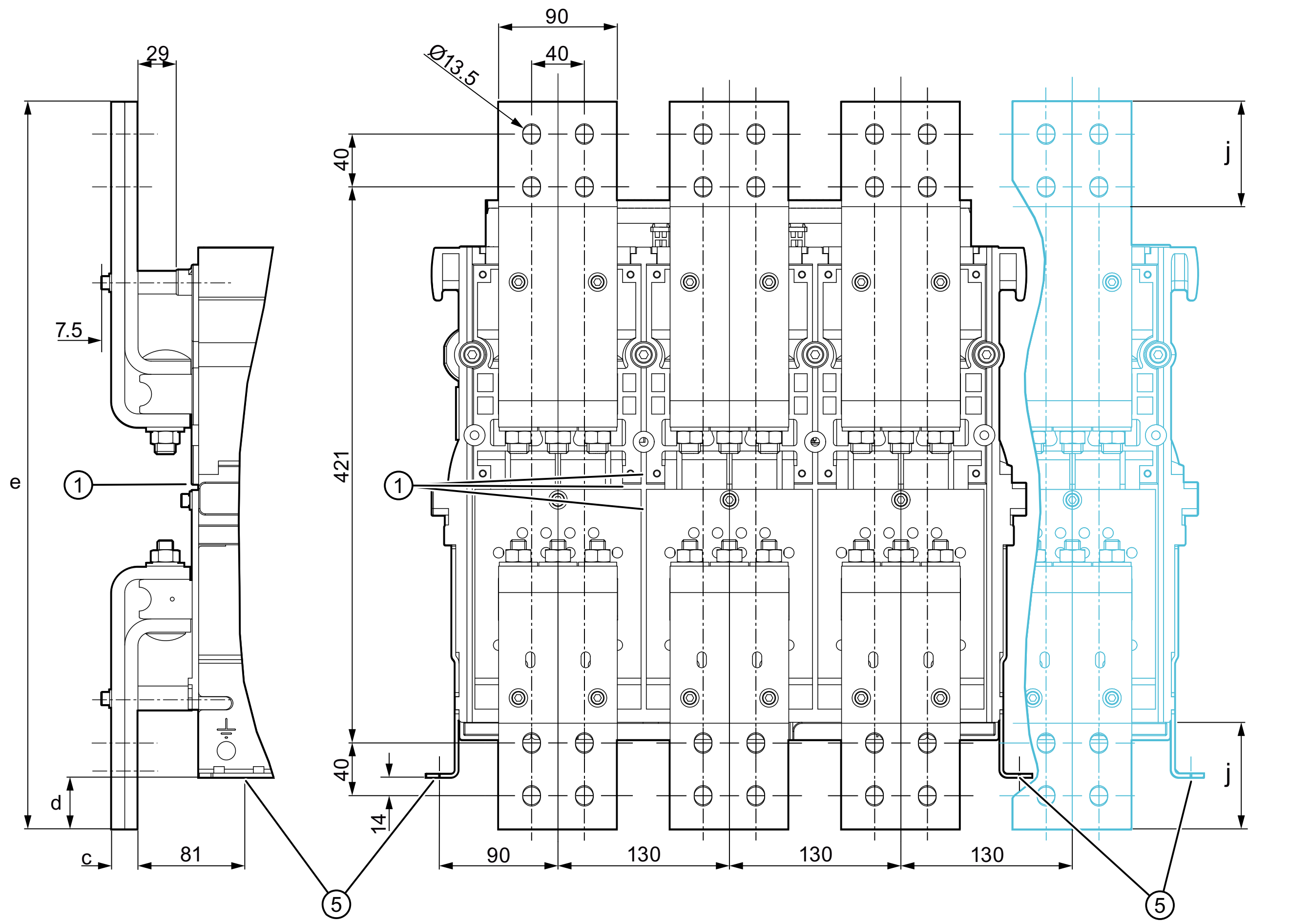


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)			
(f)	Terminal face length	For S, M, H, D, E	≤ 2000 A AC/DC	35 mm
			≤ 2500 A AC	35 mm
			≤ 3200 A AC / 4000 A DC	35 mm
		For C	≤ 3200 A AC	35 mm

Front connection (double hole) of 3WA12 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(1) Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system

(5) Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)

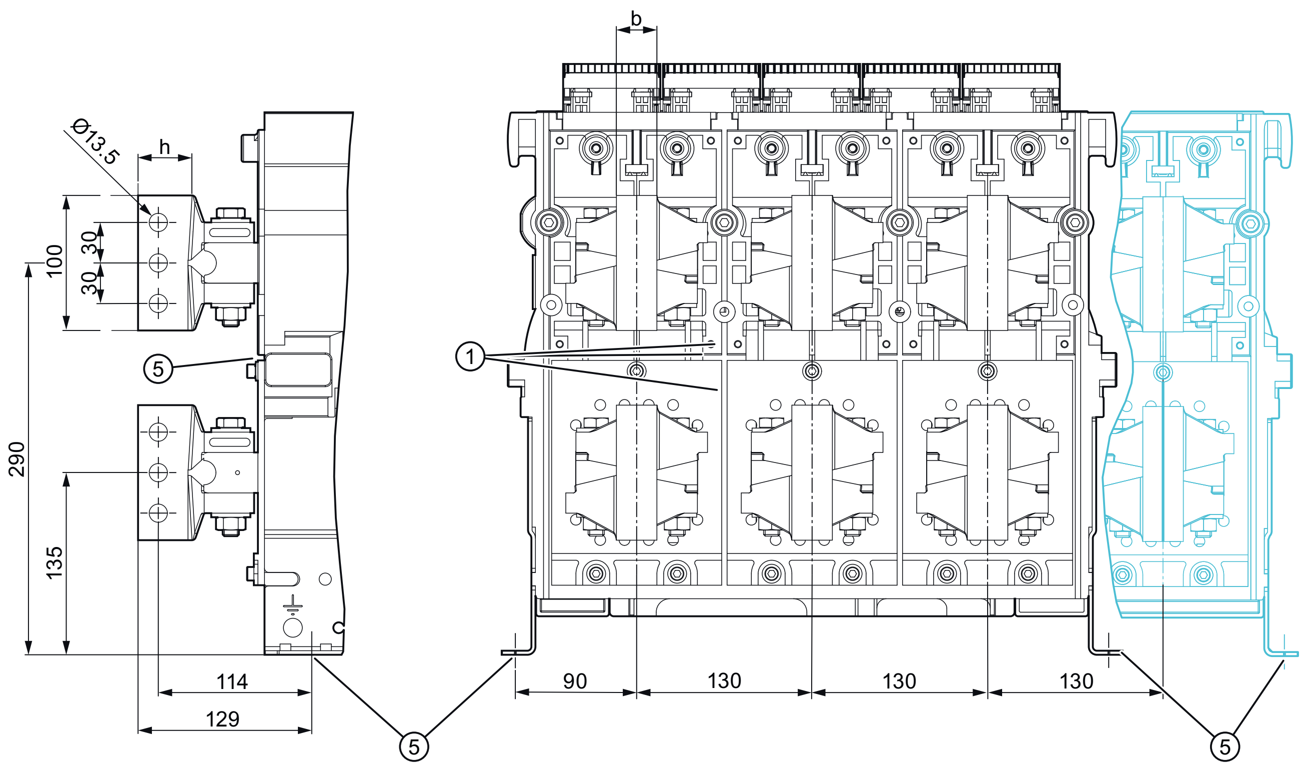
c	Busbar thickness	For S, M, H, D, E	≤ 2000 A AC/DC	10 mm
			≤ 2500 A AC	20 mm
			≤ 3200 A AC / 4000 A DC	20 mm
d	Clearance	For S, M, H, D, E	≤ 2000 A AC/DC	34 mm
			≤ 2500 A AC	39 mm
			≤ 3200 A AC / 4000 A DC	39 mm
e	Clearance	For S, M, H, D, E	≤ 2000 A AC/DC	541 mm
			≤ 2500 A AC	551 mm
			≤ 3200 A AC / 4000 A DC	551 mm
j	Terminal face length	For S, M, H, D, E	≤ 2000 A AC/DC	80 mm
			≤ 2500 A AC	80 mm
			≤ 3200 A AC / 4000 A DC	80 mm

Vertical connection of 3WA12 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

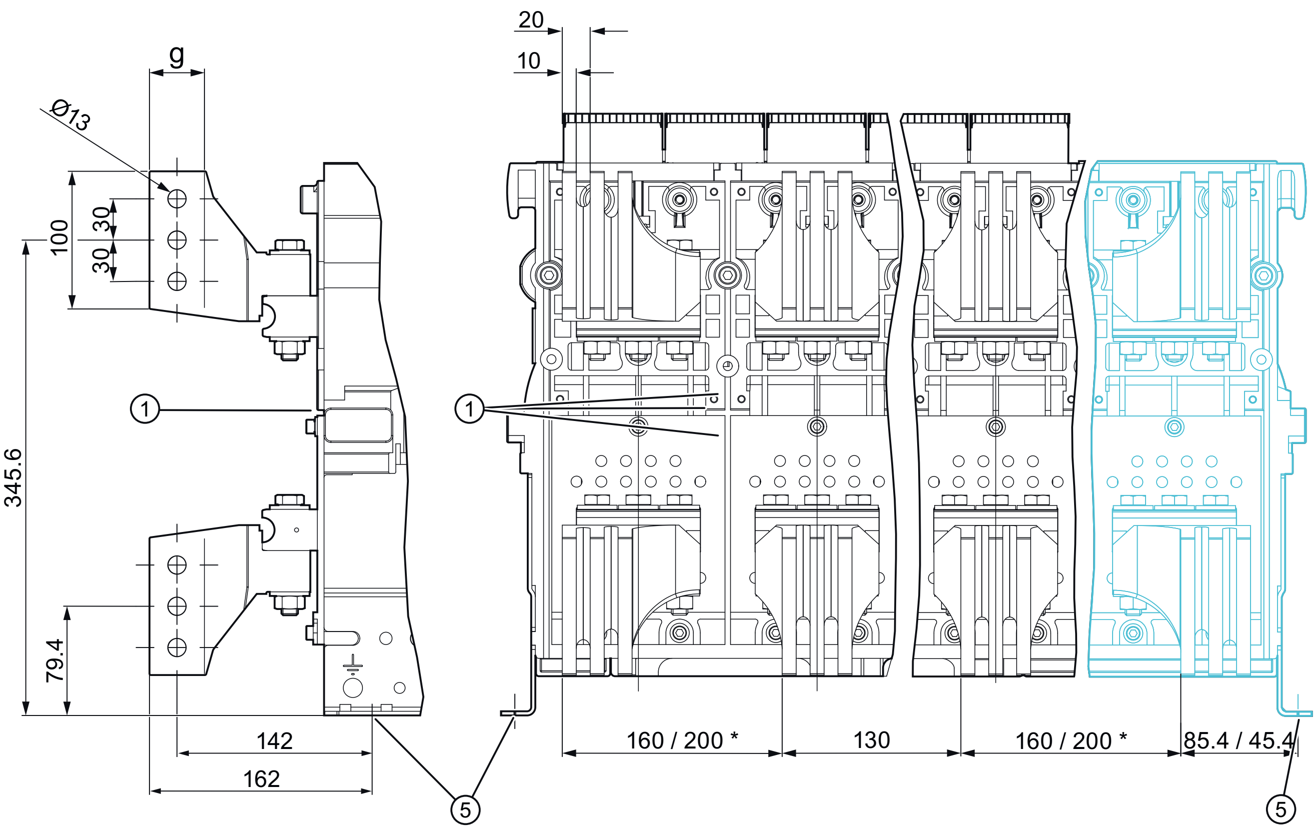
All dimensions in [mm].

Maximum rated current ≤ 3200 A AC / 4000 A DC



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)			
b	Busbar thickness	For S, M, H, D, E	≤ 2000 A AC/DC	15 mm
			≤ 2500 A AC	15 mm
			≤ 3200 A AC / 4000 A DC	30 mm
		For C	≤ 3200 A AC	30 mm
h	Terminal face length	For S, M, H, D, E	≤ 2000 A AC/DC	35 mm
			≤ 2500 A AC	35 mm
			≤ 3200 A AC / 4000 A DC	35 mm
		For C	≤ 3200 A AC	35 mm

Maximum rated current ≤ 4000 A AC



* The standard version of the vertical connection (up to 4000 A AC) with narrow connections (dimension 160 mm) is shown here.

Broadened connections (dimension 200 mm) for retrofit 3WL1240 are available with Z option D01.

(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)			
g	Terminal face length	For S, M, H, D, E	≤ 4000 A AC	40 mm

Note

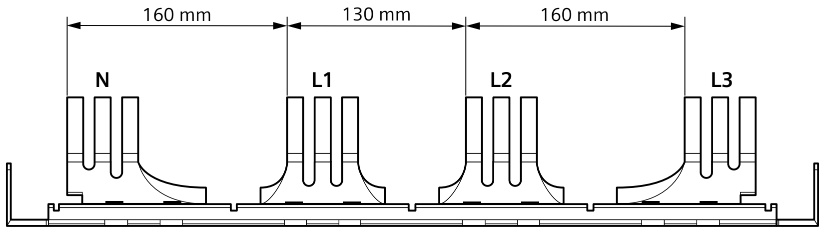
Two connection options are available for 4-pole circuit breakers of frame size 2, 4000 A AC with breaking capacity classes S/M/H/E.

1. Standard dimensions
2. Optional dimension with order number option D04

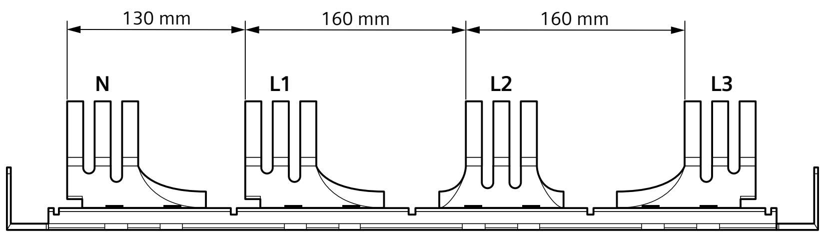
This applies to the order numbers listed below:

- 3WA1240-3 _ _ 11- _ _ _ _
- 3WA1240-4 _ _ 11- _ _ _ _
- 3WA1240-5 _ _ 11- _ _ _ _
- 3WA1240-8 _ _ 11- _ _ _ _

1. Standard dimensions:



2. Optional dimensions, can be ordered with order number option D04 (this option includes top and bottom connections):

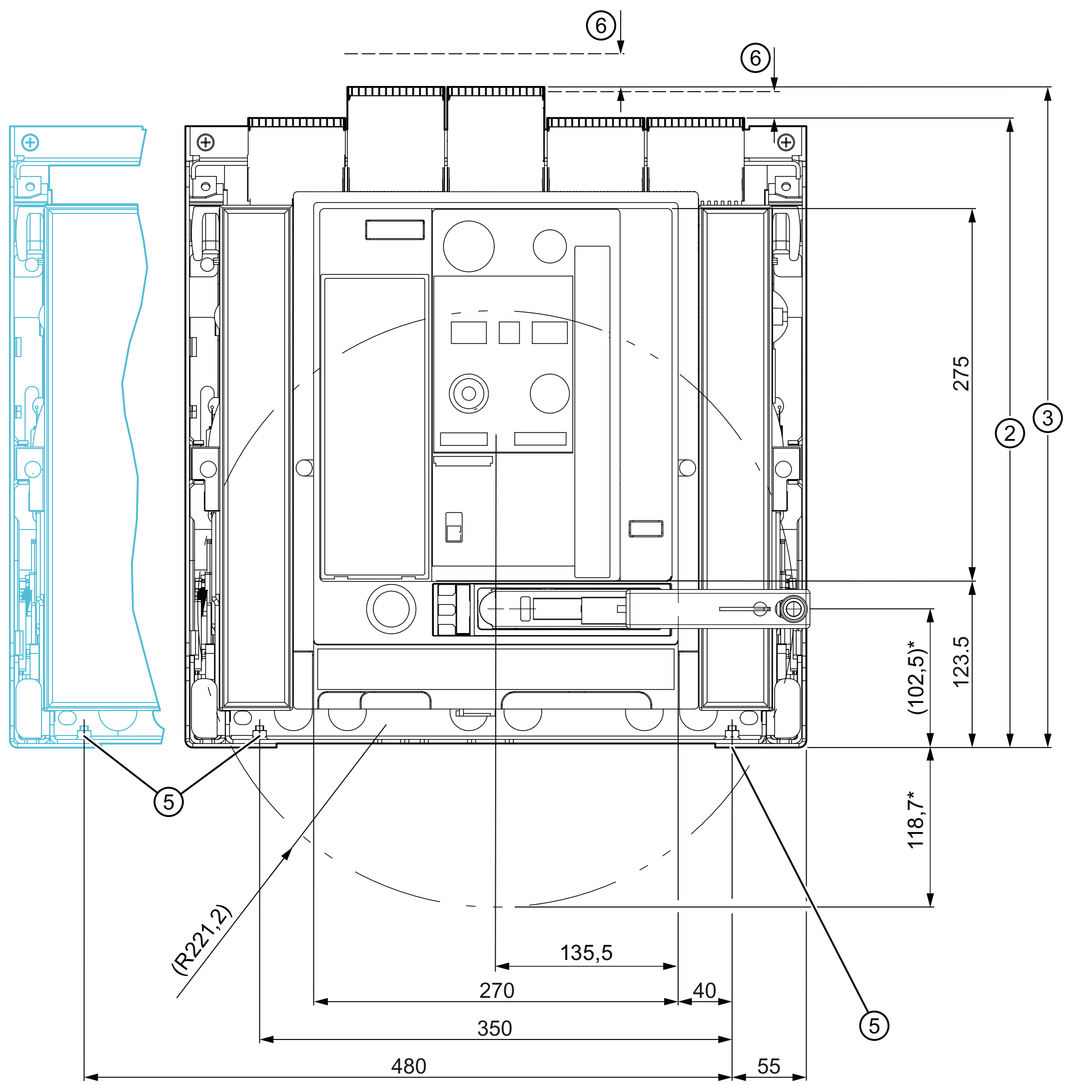


6.2.2.2 Withdrawable circuit breakers

Front view of 3WA12 withdrawable circuit breaker

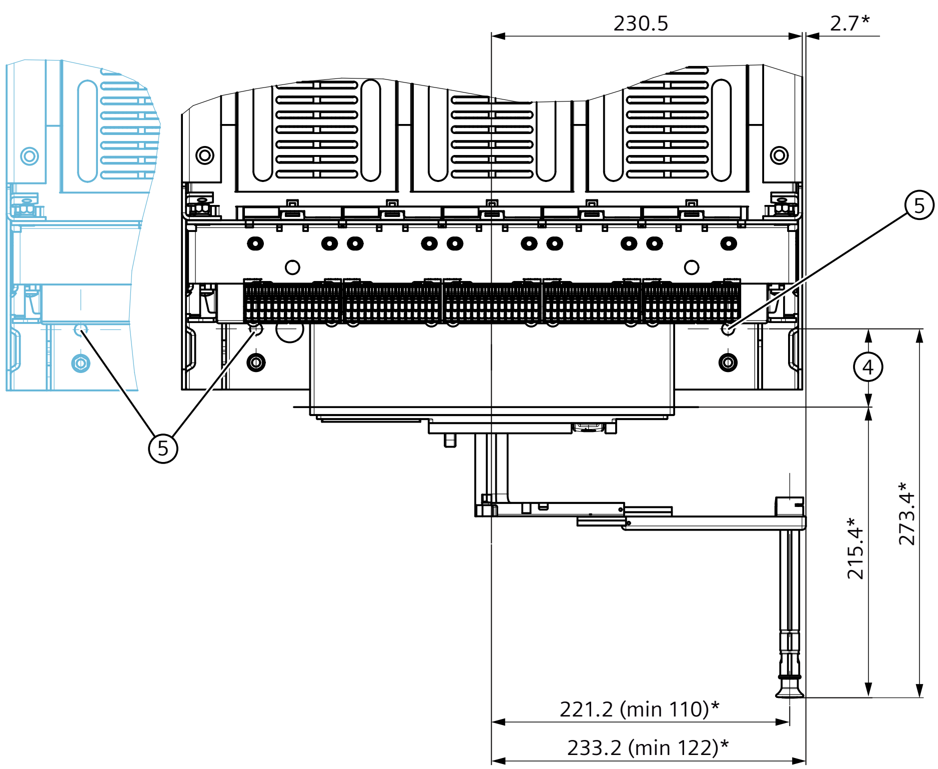
The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(2)	Dimension at auxiliary supply connector (push-in)	For S, M, H, D	466 mm
		For C, E	516 mm
(3)	Dimension at auxiliary supply connector (push-in) in combination with COM/IO modules	For S, M, H, D	489 mm
		For C, E	539 mm
(5)	Mounting holes		Ø 9 mm
(6)	Space for cable harness to electrical auxiliary circuit connections		20 mm
(*)	Extended racking handle only for frame size 2, 4000 A		

Maximum rated current 4000 A - extended crank



(4)	Dimension to inside surface of the closed control cabinet door	58 mm
(5)	Mounting holes	∅ 9 mm

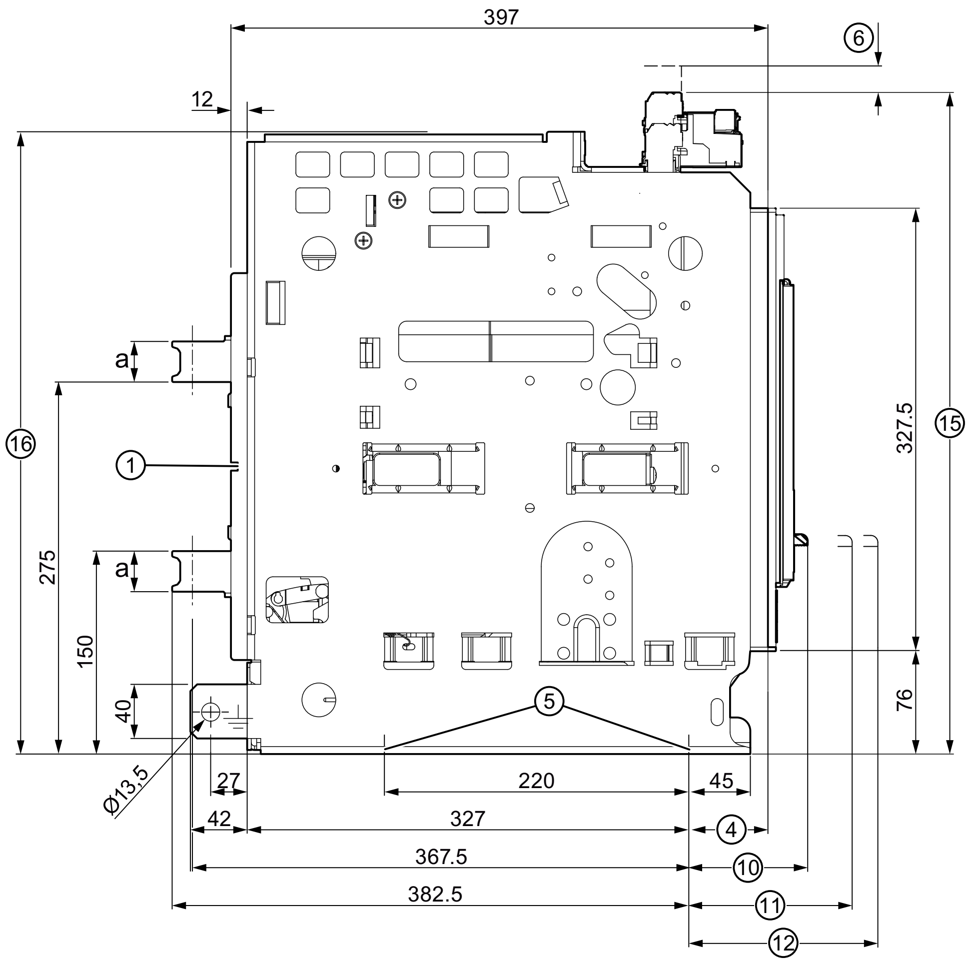
See also

Safety clearances (Page 447)

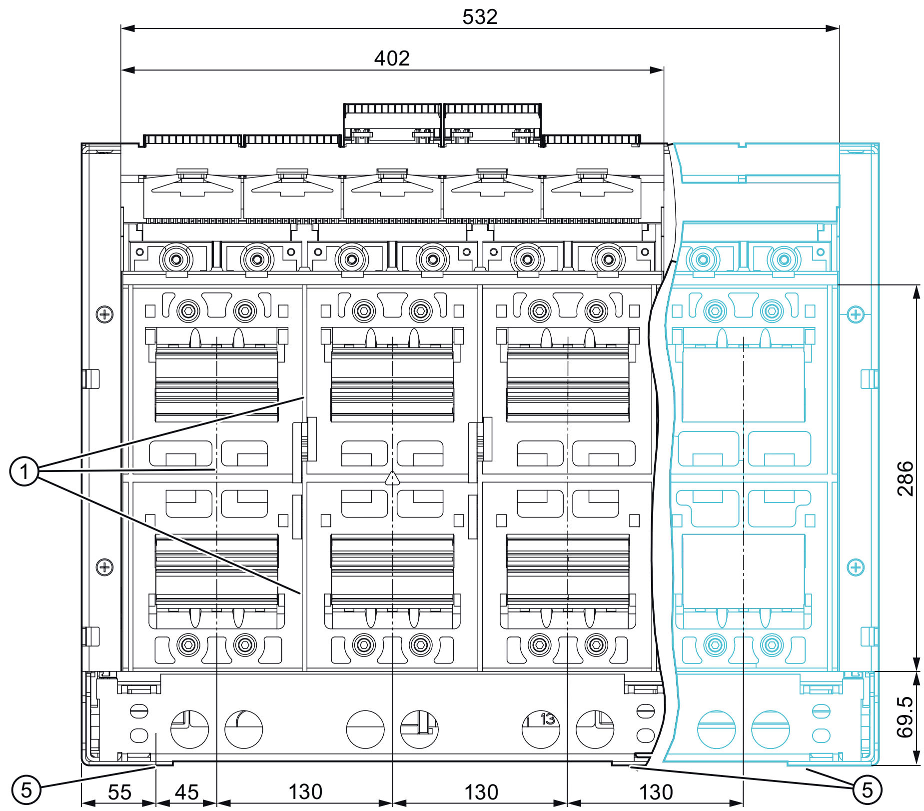
Horizontal connection of 3WA12 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

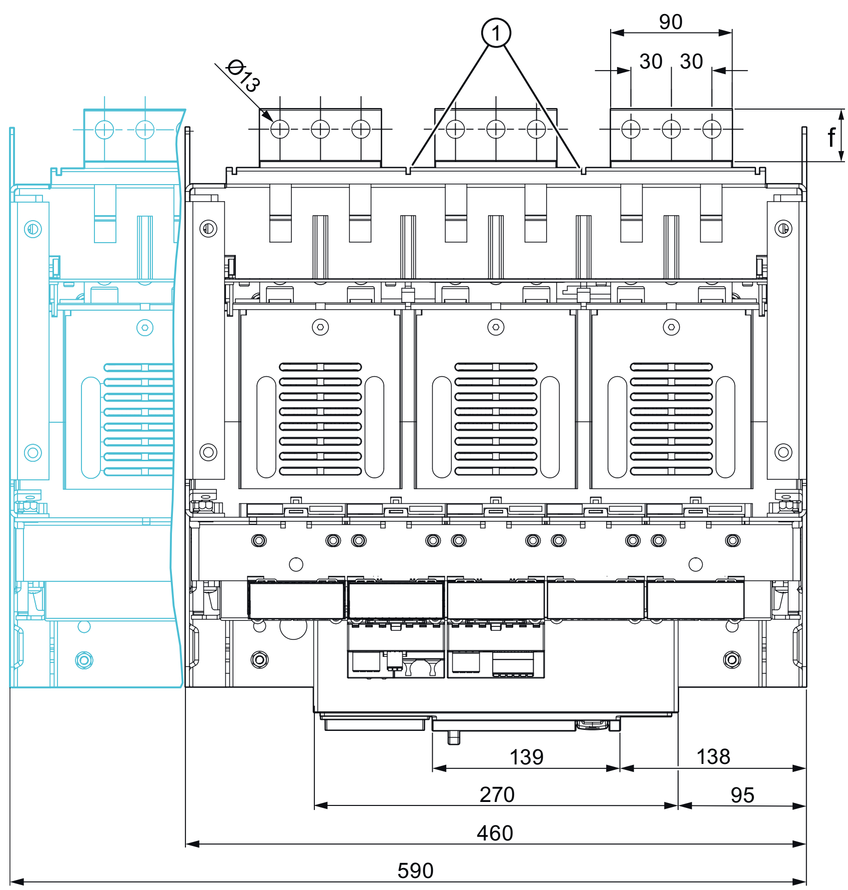
All dimensions in [mm].



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(4)	Dimension to inside surface of the closed control cabinet door			58 mm
(5)	Mounting holes			Ø 9 mm
(6)	Space for cable harness to electrical auxiliary circuit connections			20 mm
(10)	Circuit breaker in connected position			88.5 mm
(11)	Circuit breaker in test position			121.5 mm
(12)	Circuit breaker in disconnected position			140.5 mm
(15)	Maximum device height	For S, M, H, D		489 mm
		For C, E		539 mm
(16)	Guide frame upper edge	For S, M, H, D		460 mm
		For C, E		510 mm
a	Busbar thickness	For S, M, H, D, E	≤ 2000 A AC/DC	10 mm
			≤ 2500 A AC	15 mm
			≤ 3200 A AC / 4000 A DC	30 mm
		For C	≤ 3200 A AC	30 mm



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	⌀ 9 mm

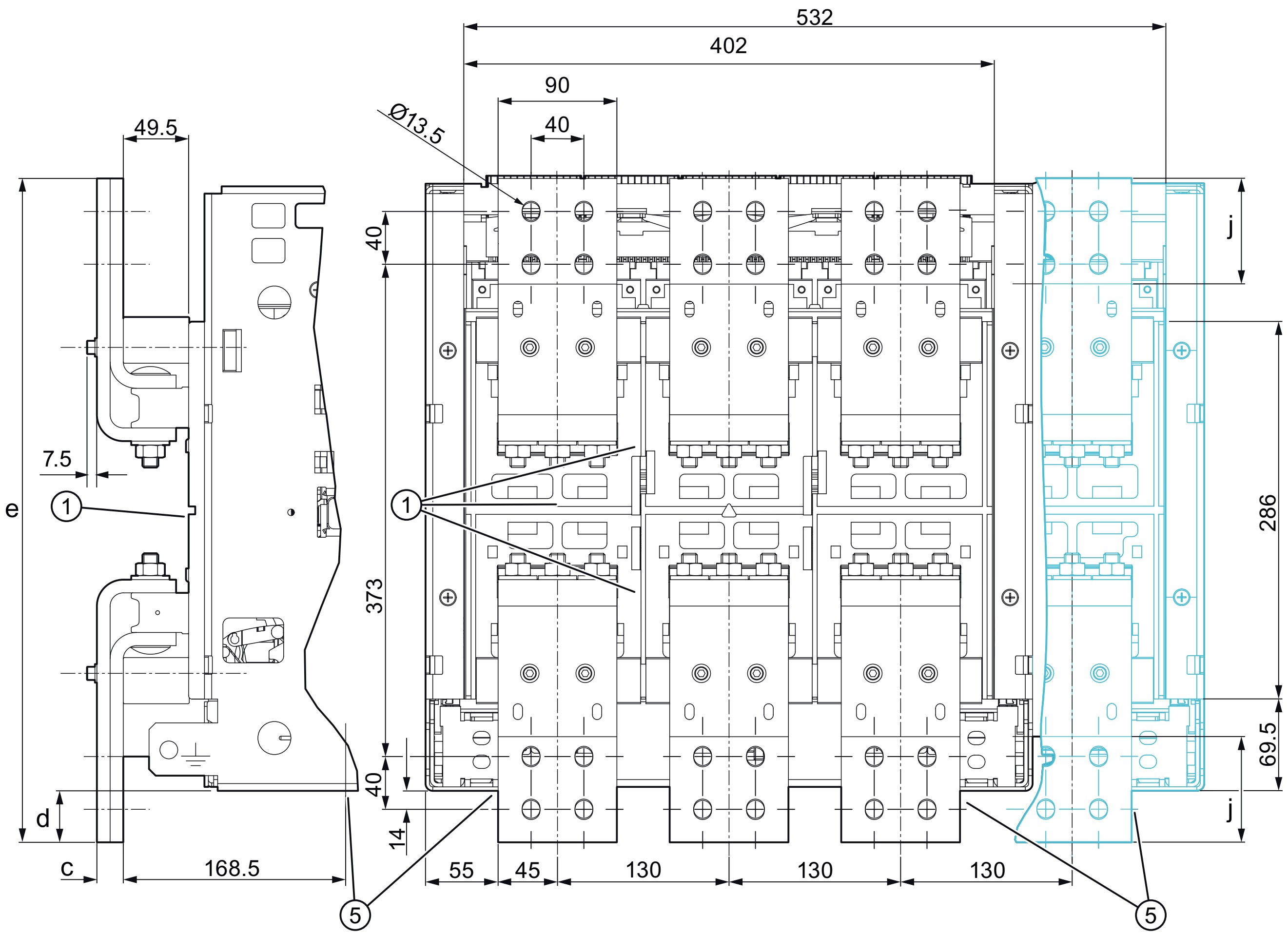


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
f	Terminal face length	For S, M, H, D, E	≤ 2000 A AC/DC	35 mm
			≤ 2500 A AC	35 mm
			≤ 3200 A AC / 4000 A DC	35 mm
		For C	≤ 3200 A AC	35 mm

Front connection (double hole) of 3WA12 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



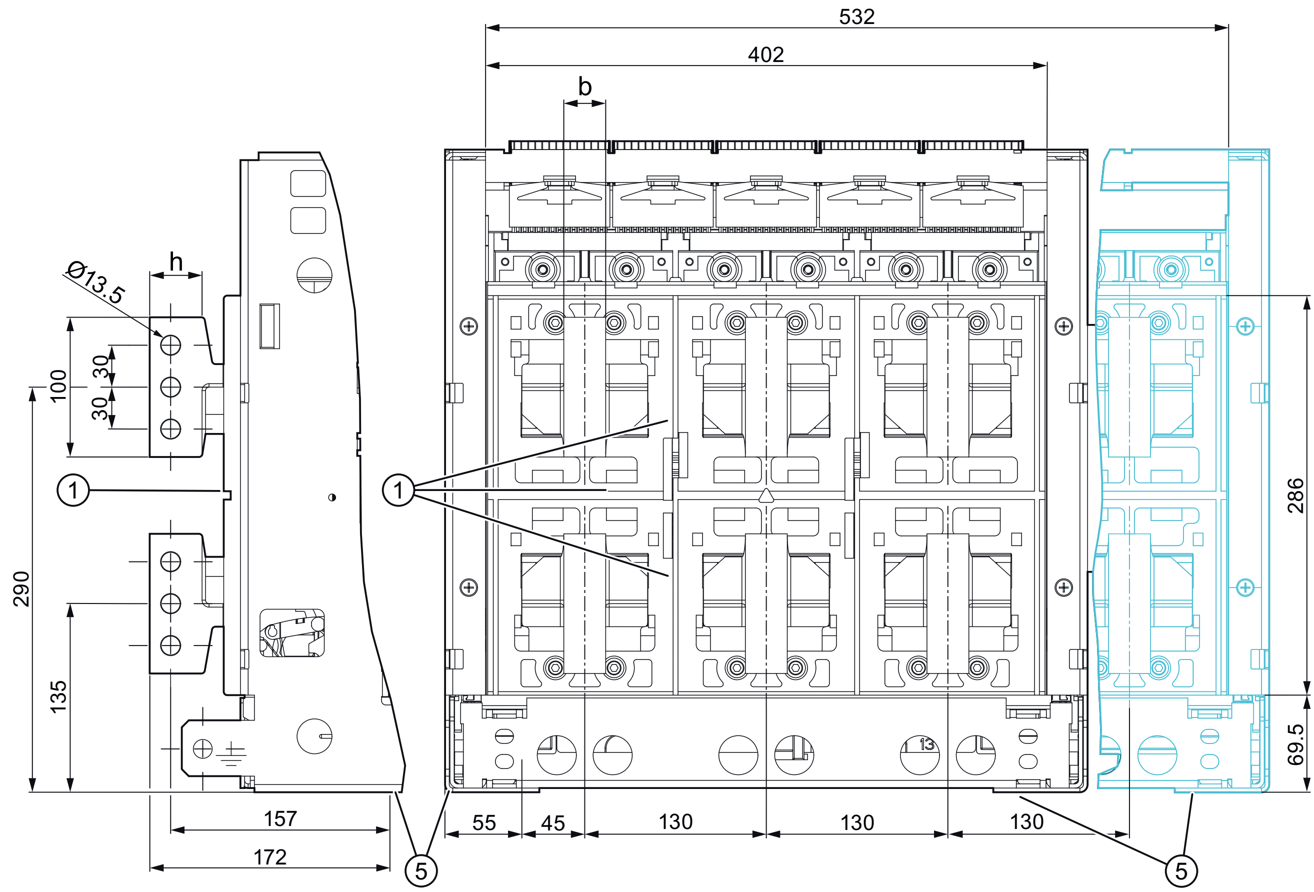
(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Mounting holes			Ø 9 mm
c	Busbar thickness	For S, M, H, D, E	≤ 2000 A AC/DC	10 mm
			≤ 2500 A AC	20 mm
			≤ 3200 A AC / 4000 A DC	20 mm
d	Clearance	For S, M, H, D, E	≤ 2000 A AC/DC	34 mm
			≤ 2500 A AC	39 mm
			≤ 3200 A AC / 4000 A DC	39 mm
e	Clearance	For S, M, H, D, E	≤ 2000 A AC/DC	493 mm
			≤ 2500 A AC	503 mm
			≤ 3200 A AC / 4000 A DC	503 mm
j	Terminal face length	For S, M, H, D, E	≤ 2000 A AC/DC	80 mm
			≤ 2500 A AC	80 mm
			≤ 3200 A AC / 4000 A DC	80 mm

Vertical connection of 3WA12 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

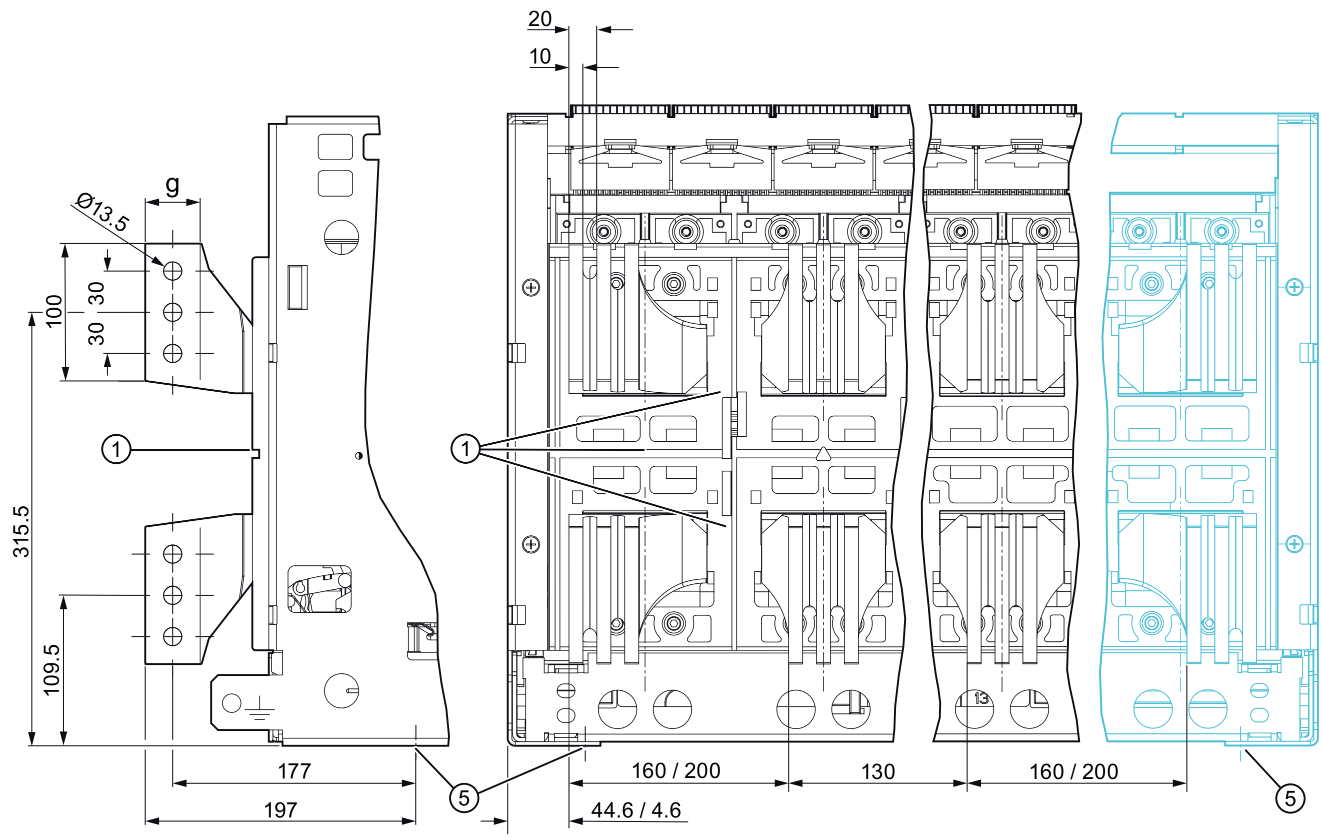
All dimensions in [mm].

Maximum rated current ≤ 3200 A AC / 4000 A DC



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Mounting holes			Ø 9 mm
b	Busbar thickness	For S, M, H, D, E	≤ 2000 A AC/DC	10 mm
			≤ 2500 A AC	15 mm
			≤ 3200 A AC / 4000 A DC	30 mm
		For C	≤ 3200 A AC	30 mm
h	Terminal face length	For S, M, H, D, E	≤ 2000 A AC/DC	38 mm
			≤ 2500 A AC	38 mm
			≤ 3200 A AC / 4000 A DC	38 mm
		For C	≤ 3200 A AC	38 mm

Maximum rated current ≤ 4000 A AC



* The standard version of the vertical connection (up to 4000 A AC) with narrow connections (dimension 160 mm) is shown here.

Broadened connections (dimension 200 mm) for retrofit 3WL1240 are available with Z option D01.

(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system			
(5)	Mounting holes			Ø 9 mm
g	Terminal face length	For S, M, H, D, E	≤ 4000 A AC	40 mm

Note

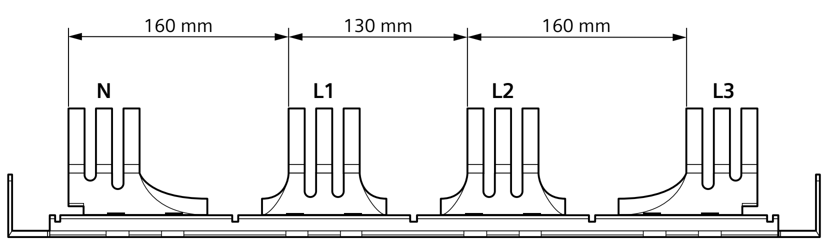
Two connection options are available for 4-pole circuit breakers of frame size 2, 4000 A AC with breaking capacity classes S/M/H/E.

1. Standard dimensions
2. Optional dimensions with order number option D04

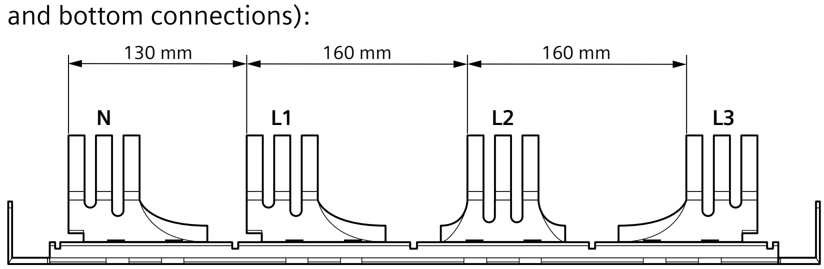
This applies to the order numbers listed below:

- Withdrawable circuit breakers:
  - 3WA1240-3 _ _ 41- _ _ _ _
  - 3WA1240-3 _ _ 71 - _ _ _ _
  - 3WA1240-4 _ _ 41 - _ _ _ _
  - 3WA1240-4 _ _ 71 - _ _ _ _
  - 3WA1240-5 _ _ 41 - _ _ _ _
  - 3WA1240-5 _ _ 71- _ _ _ _
  - 3WA1240-8 _ _ 41 - _ _ _ _
  - 3WA1240-8 _ _ 71- _ _ _ _
- Guide frame:
  - 3WA8240-3AA41- _ _ _ _
  - 3WA8240-4AA41- _ _ _ _
  - 3WA8240-5AA41, _ _ _ _
  - 3WA8240-5AA41. _ _ _ _

1. Standard dimensions:



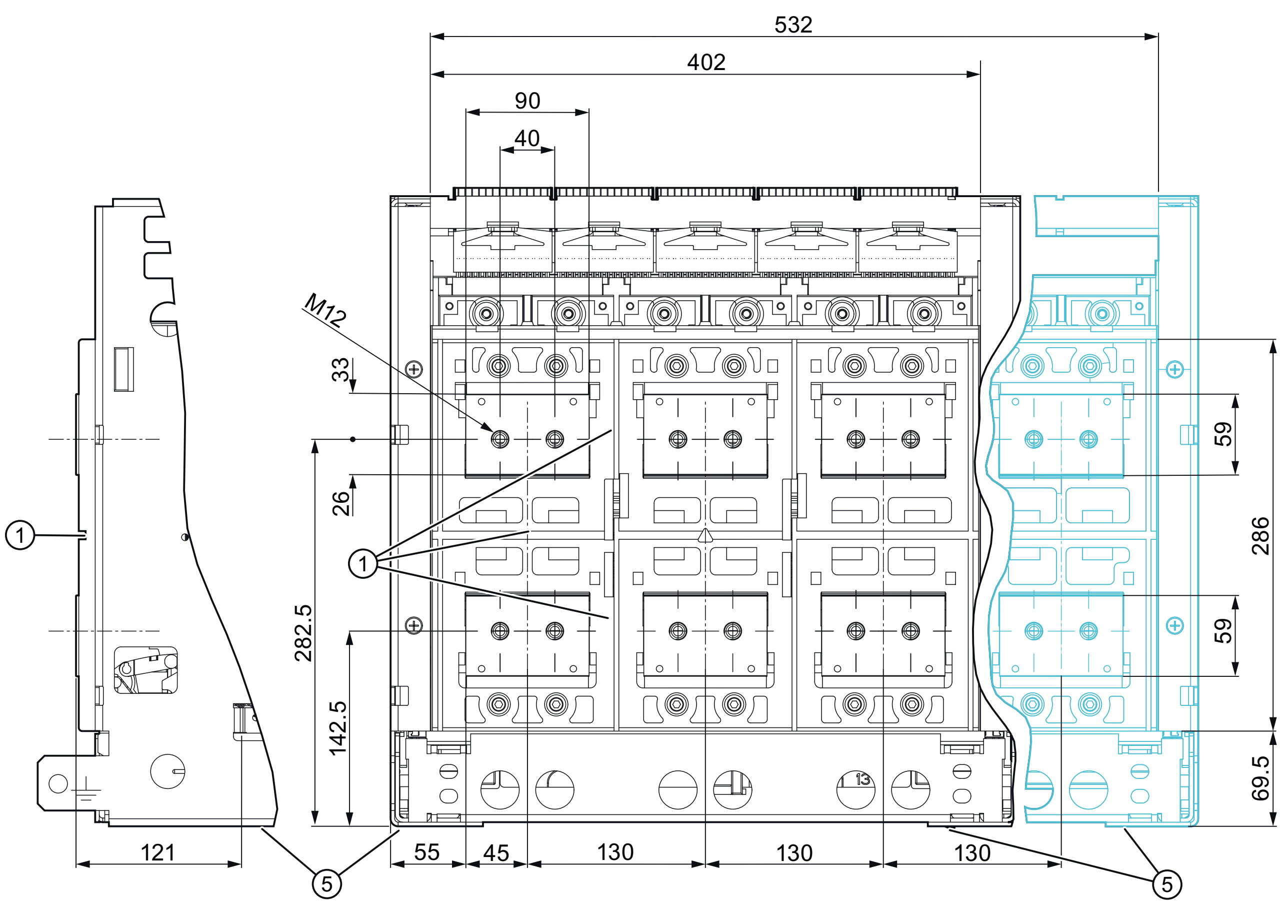
2. Optional dimensions, can be ordered with order number option D04 (this option includes top and bottom connections):



Flange connection of 3WA12 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	⌀ 9 mm

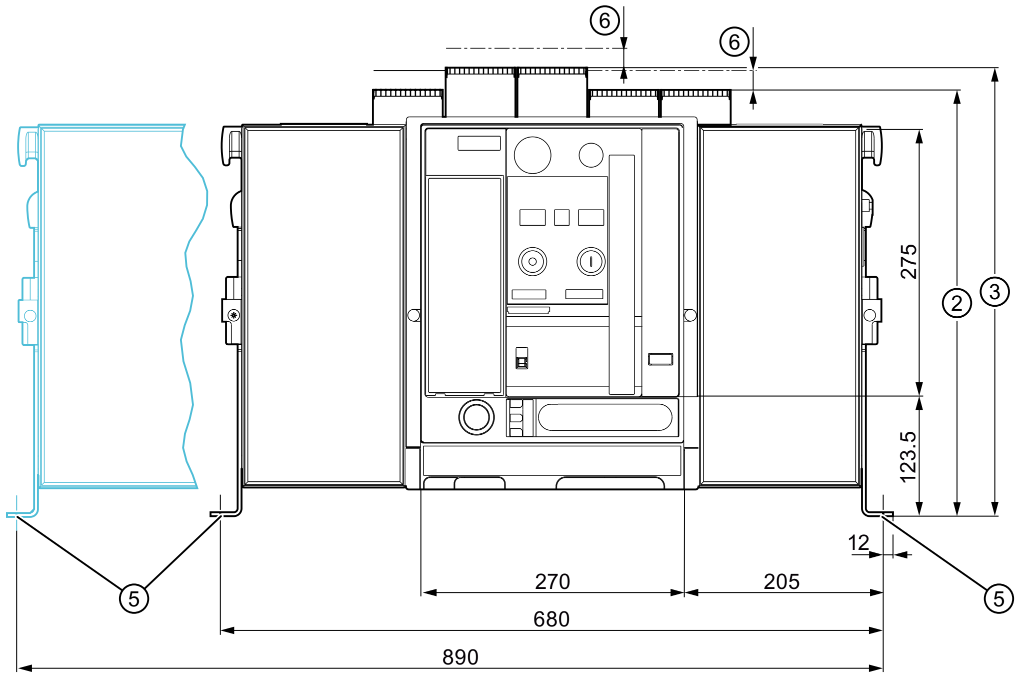
6.2.3 3WA1 - size 3

6.2.3.1 Fixed-mounted circuit breakers

Front view of 3WA13 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(2)	Dimension at auxiliary supply connector (push-in)	439 mm
(3)	Dimension at auxiliary supply connector (push-in) in combination with COM/IO modules	462 mm
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)	
(6)	Space for cable harness to electrical auxiliary circuit connections	20 mm

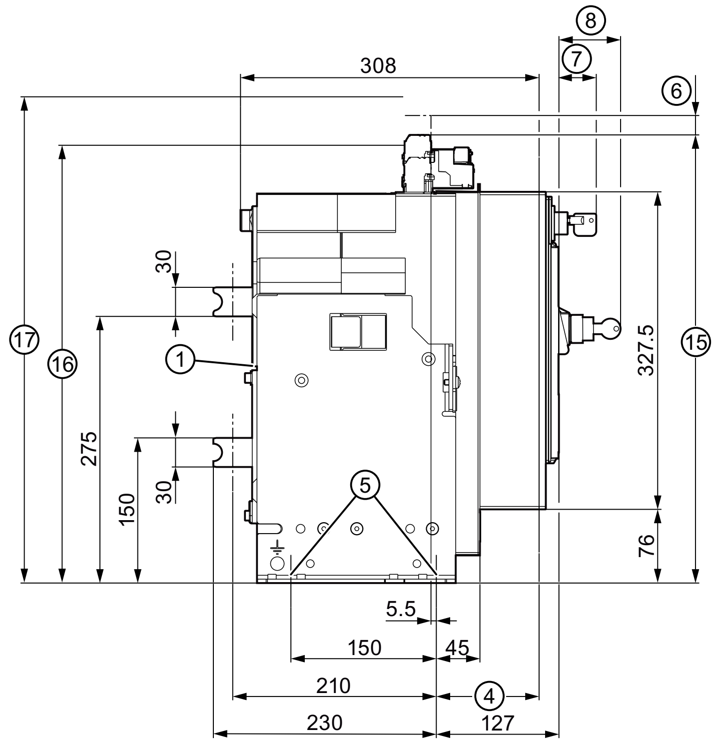
See also

Safety clearances (Page 447)

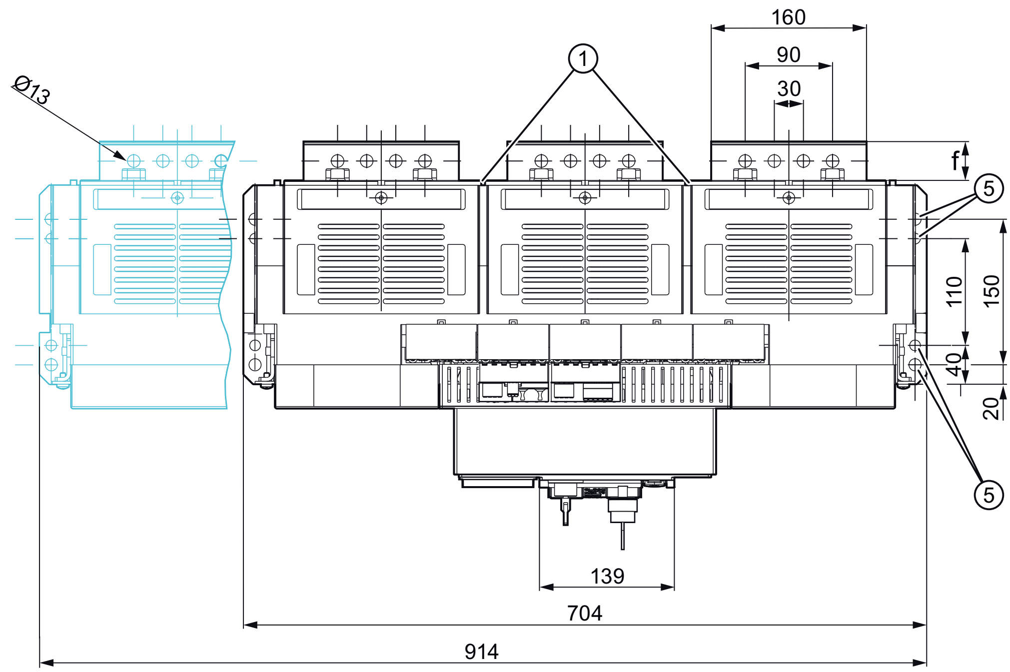
Horizontal connection of 3WA13 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



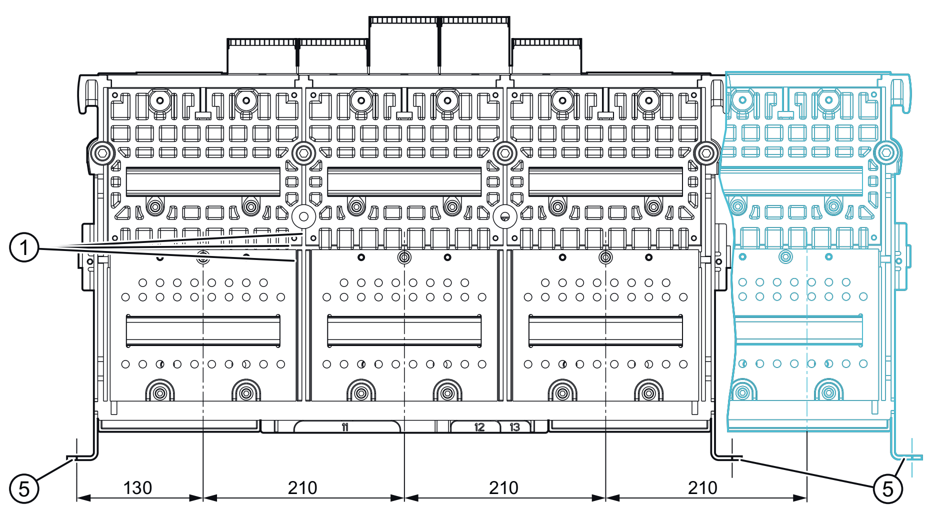
(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system		
(4)	Dimension to inside surface of the closed control cabinet door		106 mm
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)		
(6)	Space for cable harness to electrical auxiliary circuit connections		20 mm
(7)	"Safe Open" locking provision		38.5 mm
(8)	Key operation		63.6 mm
(15)	Maximum device height		462 mm
(16)	Top edge of arc chutes	For H	401 mm
		For C, E	451 mm
(17)	Mounting space for removal of the arc chutes	For H	541 mm
		For C, E	591 mm



(1) Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system

(5) Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)

f	Connection dimension	35 mm



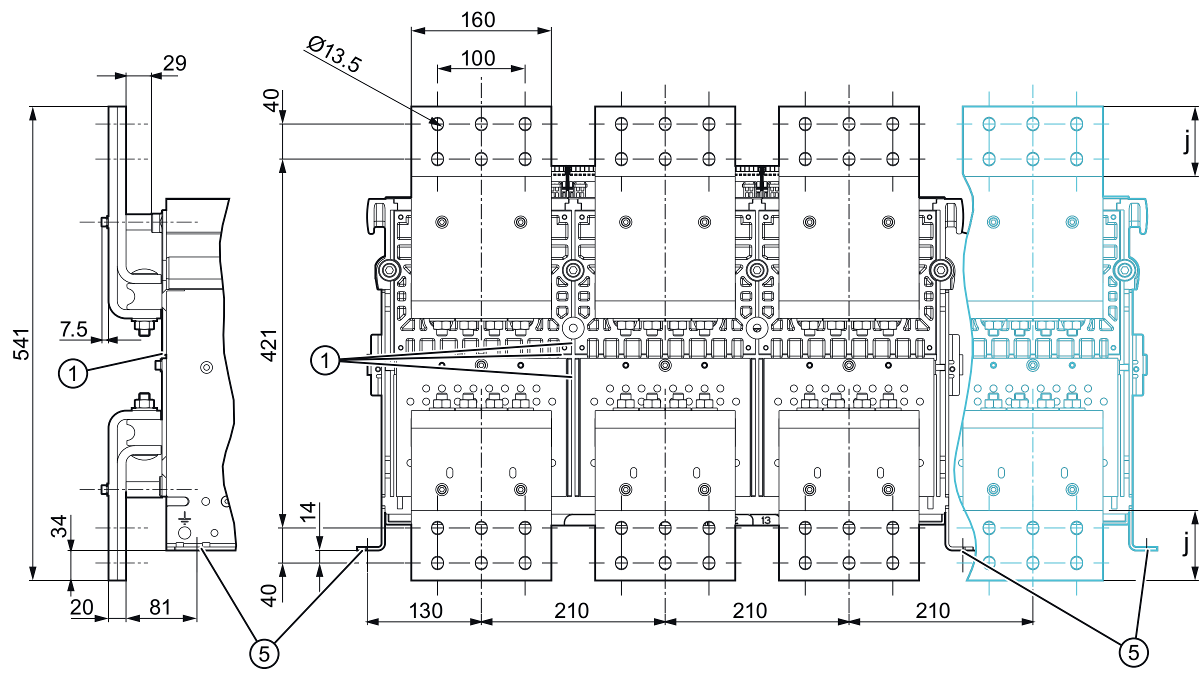
(1) Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system

(5) Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)

Front connection of 3WA13 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].

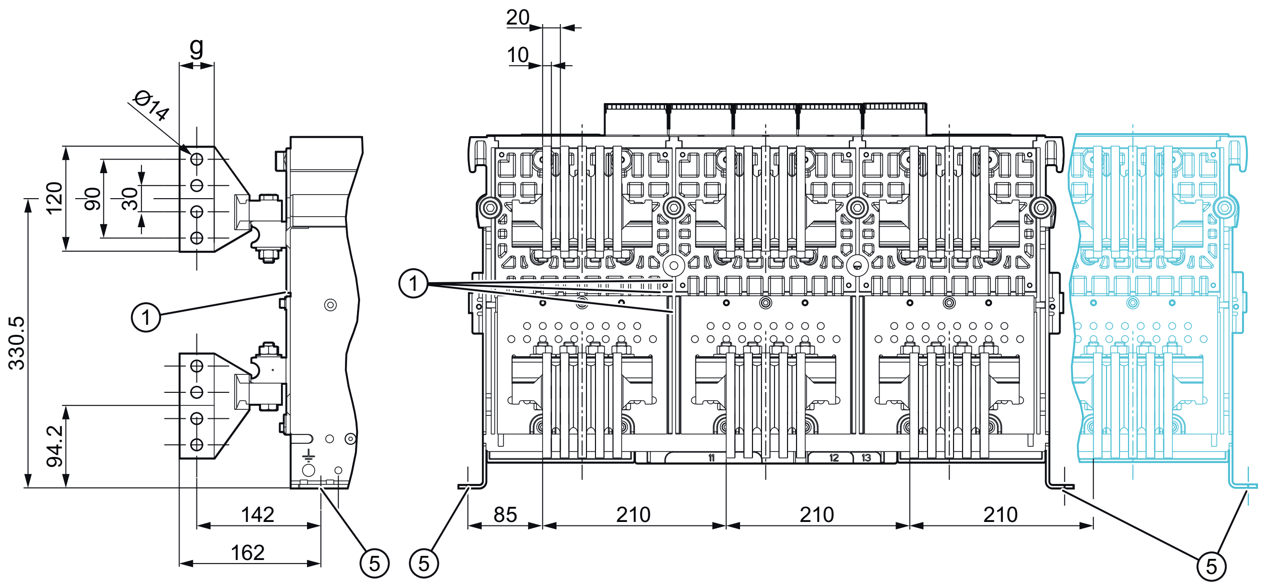


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x ∅ 9 (110)	
j	Connection dimension	80 mm

Vertical connection of 3WA13 fixed-mounted circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(1) Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system

(5) Fixing points for mounting the circuit breaker in the system (grid size in mm) 4 x M8 screw nut (150) and 4 x Ø 9 (110)

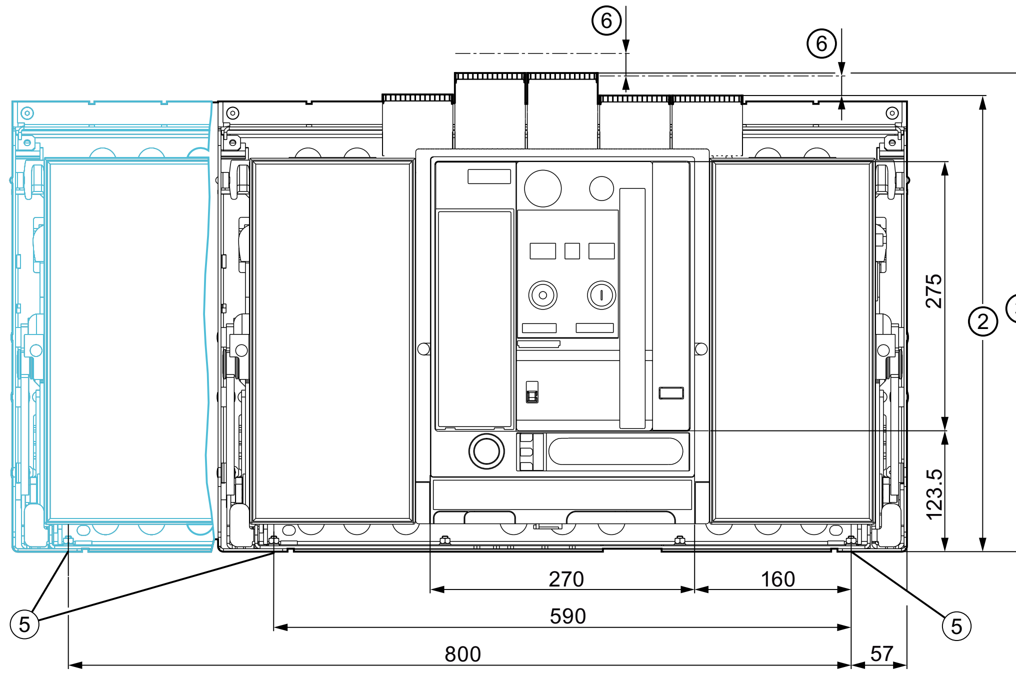
g Connection dimension 40 mm

6.2.3.2 Withdrawable circuit breakers

Front view of 3WA13 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



(2)	Dimension at auxiliary supply connector (push-in)	For H	466 mm
		For C, E	516 mm
(3)	Dimension at auxiliary supply connector (push-in) in combination with COM/IO modules	For H	489 mm
		For C, E	539 mm
(5)	Mounting holes		∅ 9 mm
(6)	Space for cable harness to electrical auxiliary circuit connections		20 mm

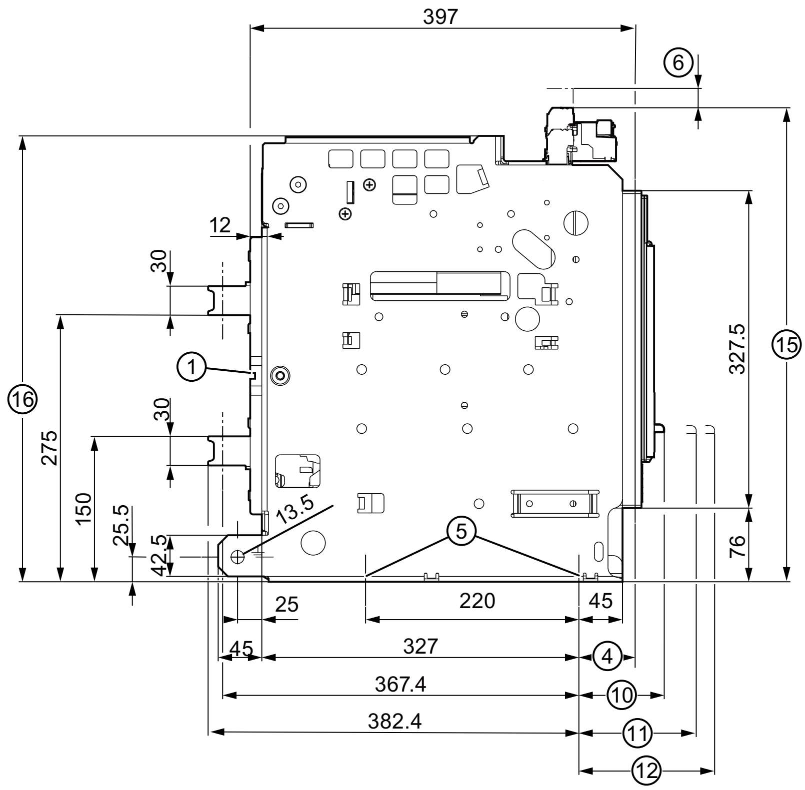
See also

Safety clearances (Page 447)

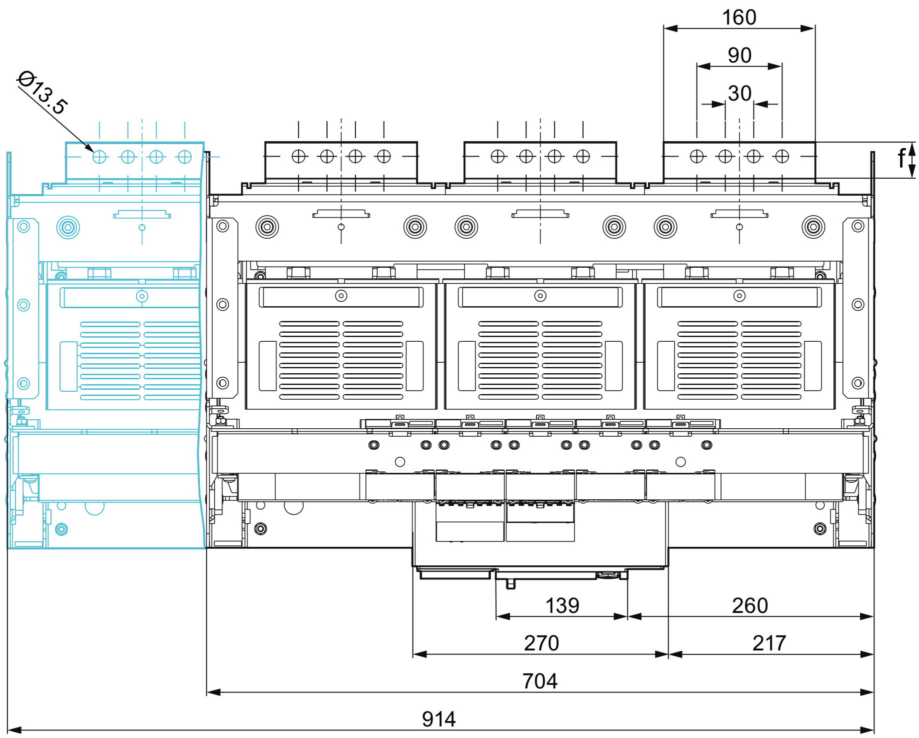
Horizontal connection of 3WA13 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

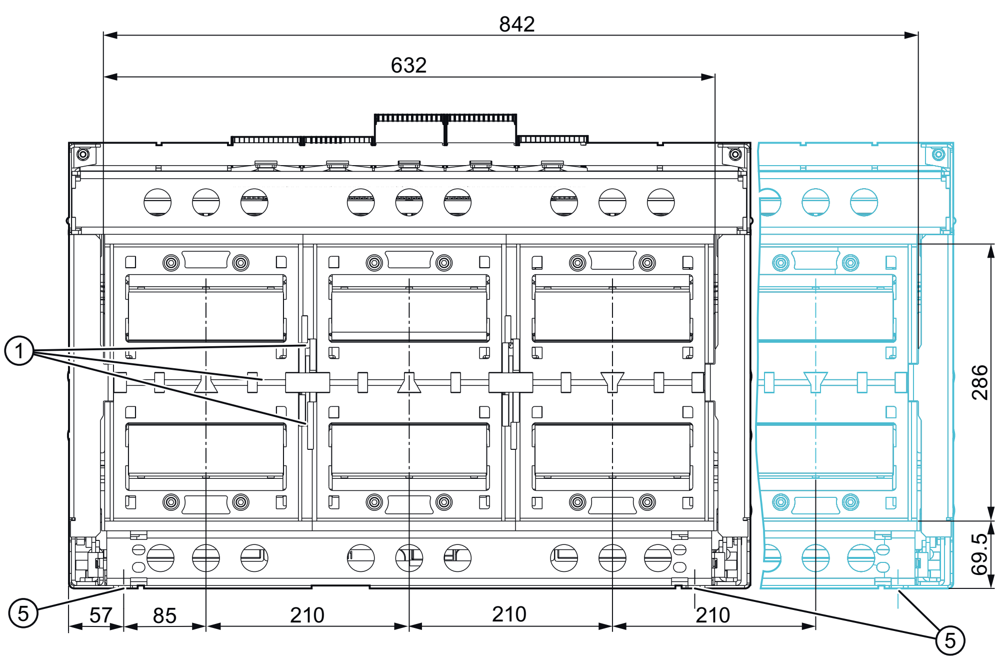
All dimensions in [mm].



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system		
(4)	Dimension to inside surface of the closed control cabinet door		58 mm
(6)	Space for cable harness to electrical auxiliary circuit connections		20 mm
(10)	Circuit breaker in connected position		88.5 mm
(11)	Circuit breaker in test position		121.5 mm
(12)	Circuit breaker in disconnected position		140.5 mm
(15)	Maximum device height	For H	489 mm
		For C, E	539 mm
(16)	Guide frame upper edge	For H	460 mm
		For C, E	510 mm



f	Connection dimension	38 mm

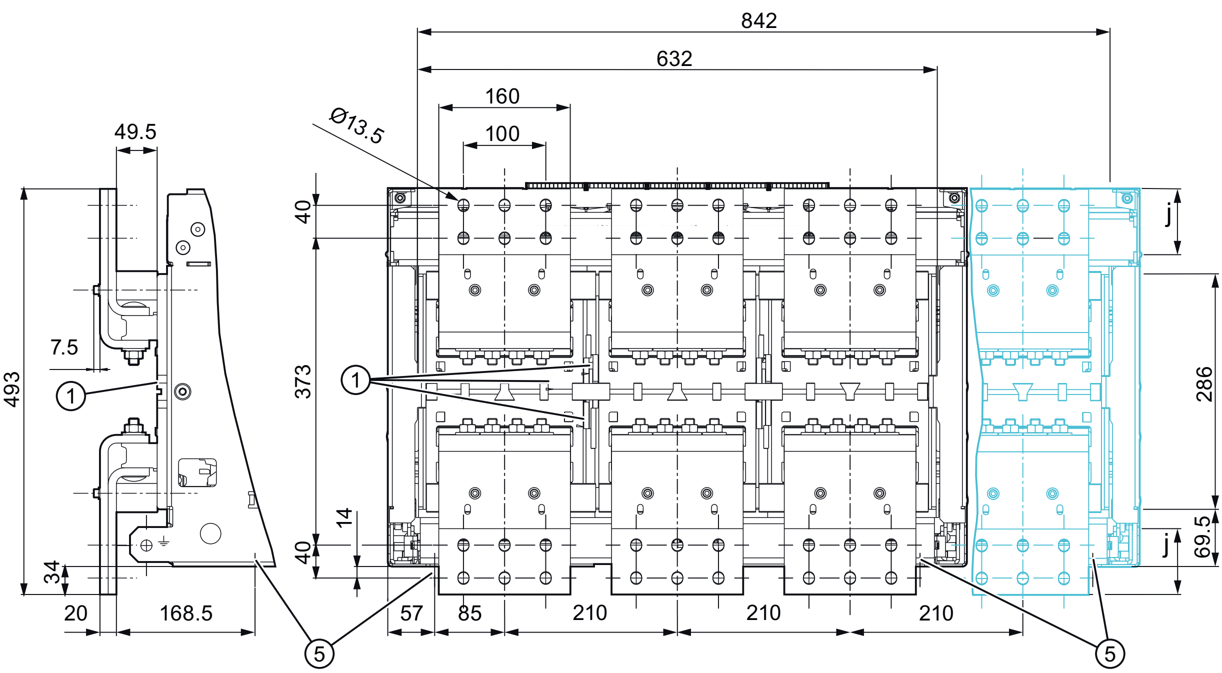


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	∅ 9 mm

Front connection of 3WA13 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].



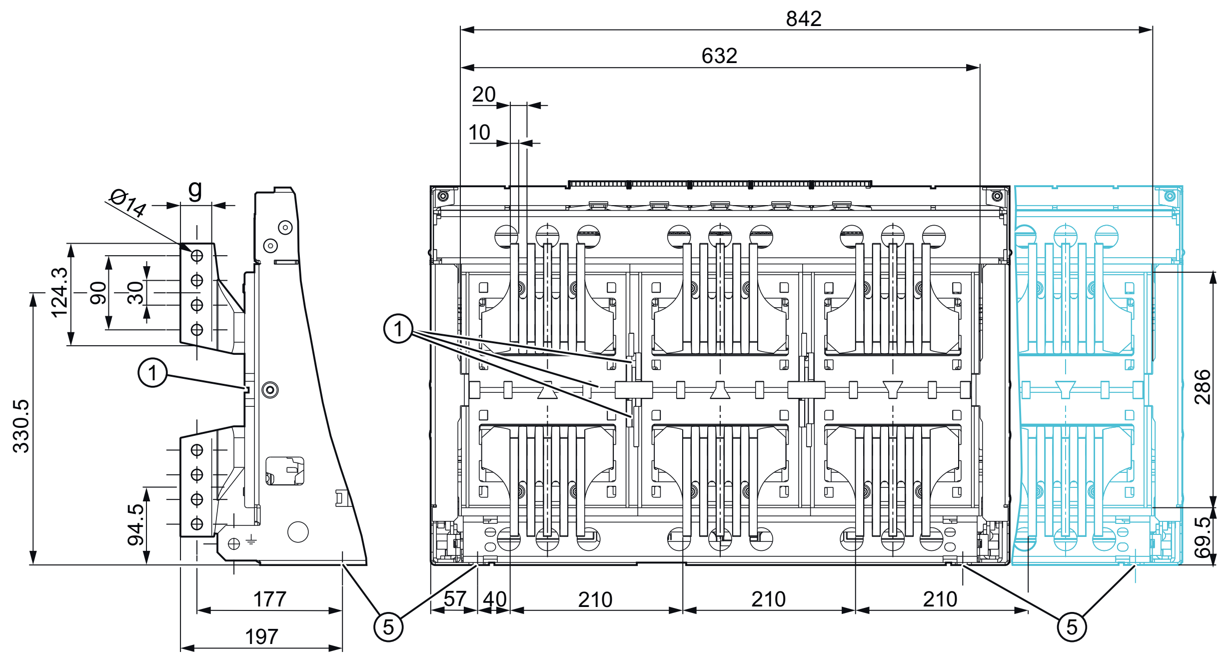
(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	Ø 9 mm
j	Connection dimension	80 mm

Vertical connection of 3WA13 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

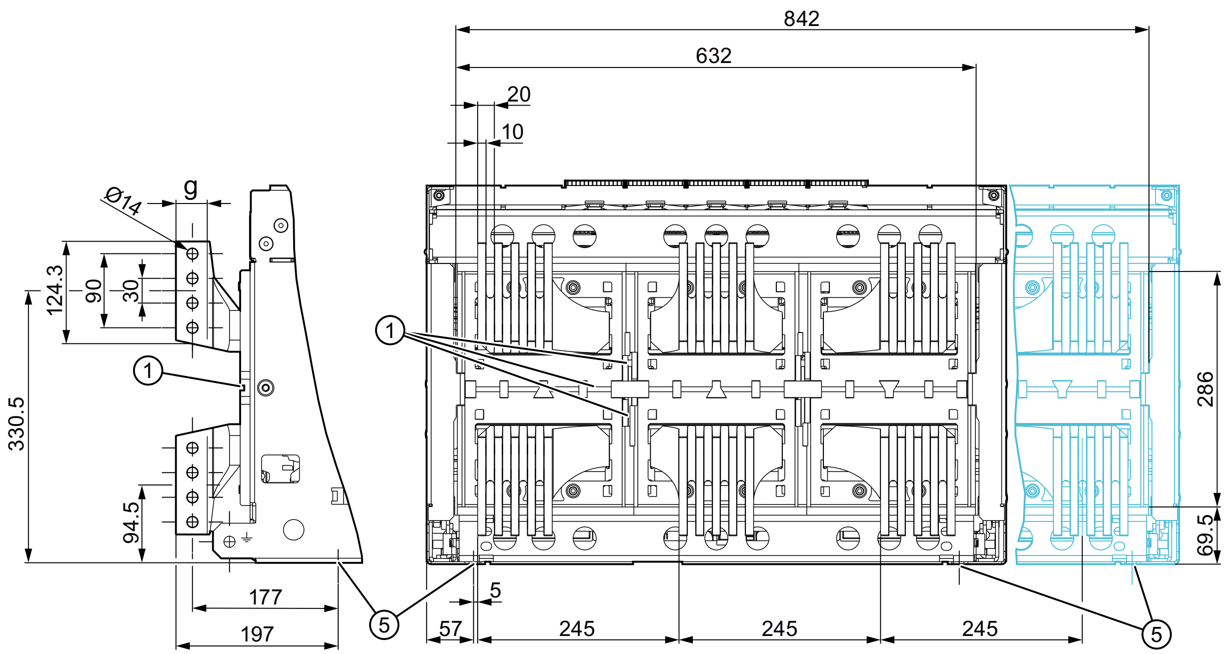
All dimensions in [mm].

Maximum rated current ≤ 5000 A AC



(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	Ø 9 mm
g	Connection dimension	38 mm

Maximum rated current ≤ 6300 A AC

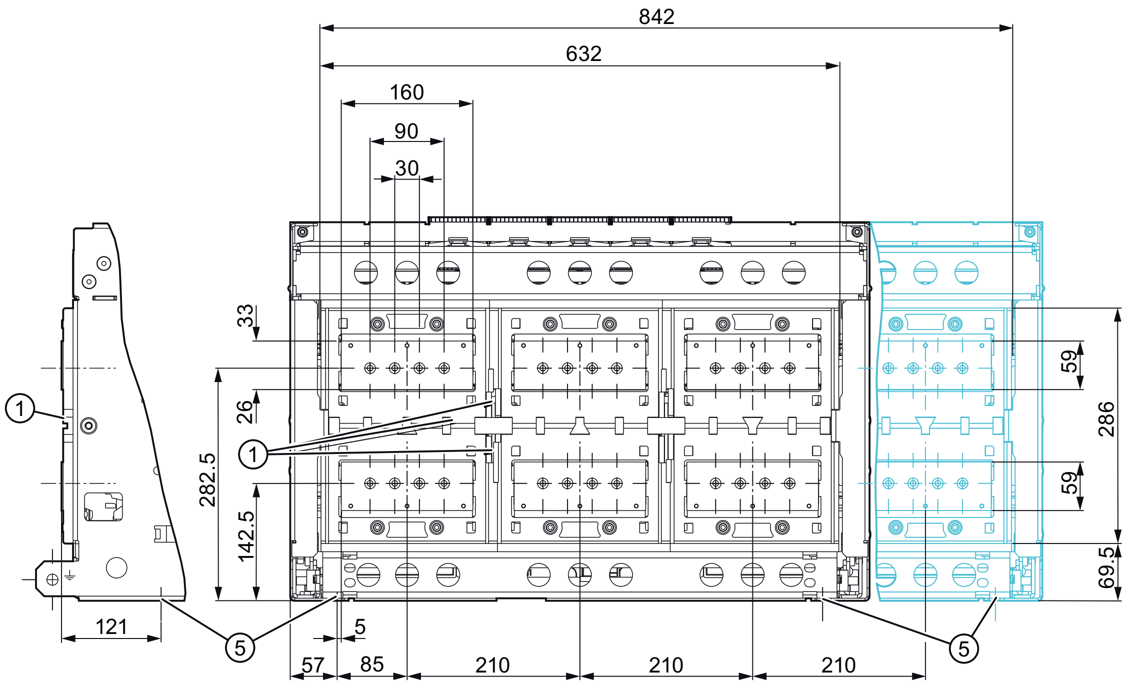


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	Ø 9 mm
g	Connection dimension	38 mm

Flange connection of 3WA13 withdrawable circuit breaker

The broken blue contour on the side corresponds to the 4-pole version.

All dimensions in [mm].

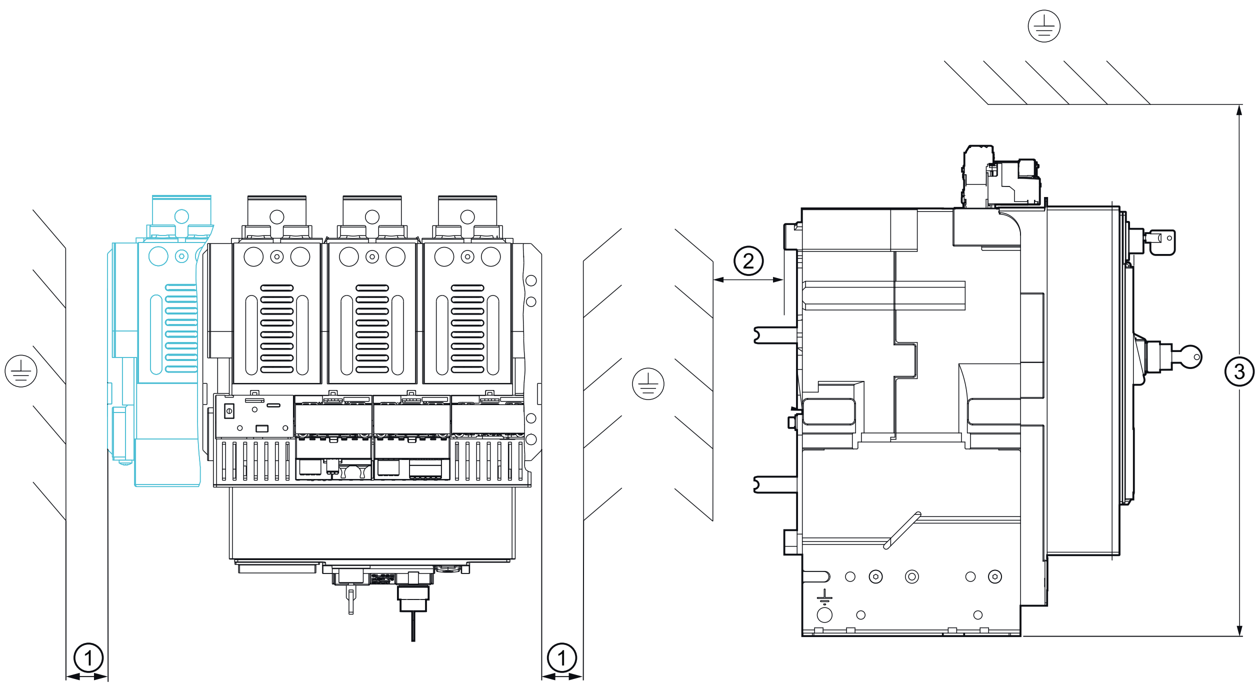


(1)	Grooves (4 mm wide, 5 mm deep) for supporting phase barriers in the system	
(5)	Mounting holes	∅ 9 mm

6.2.4 Safety clearances

6.2.4.1 3WA1 - frame size 1

3WA11 fixed-mounted circuit breakers



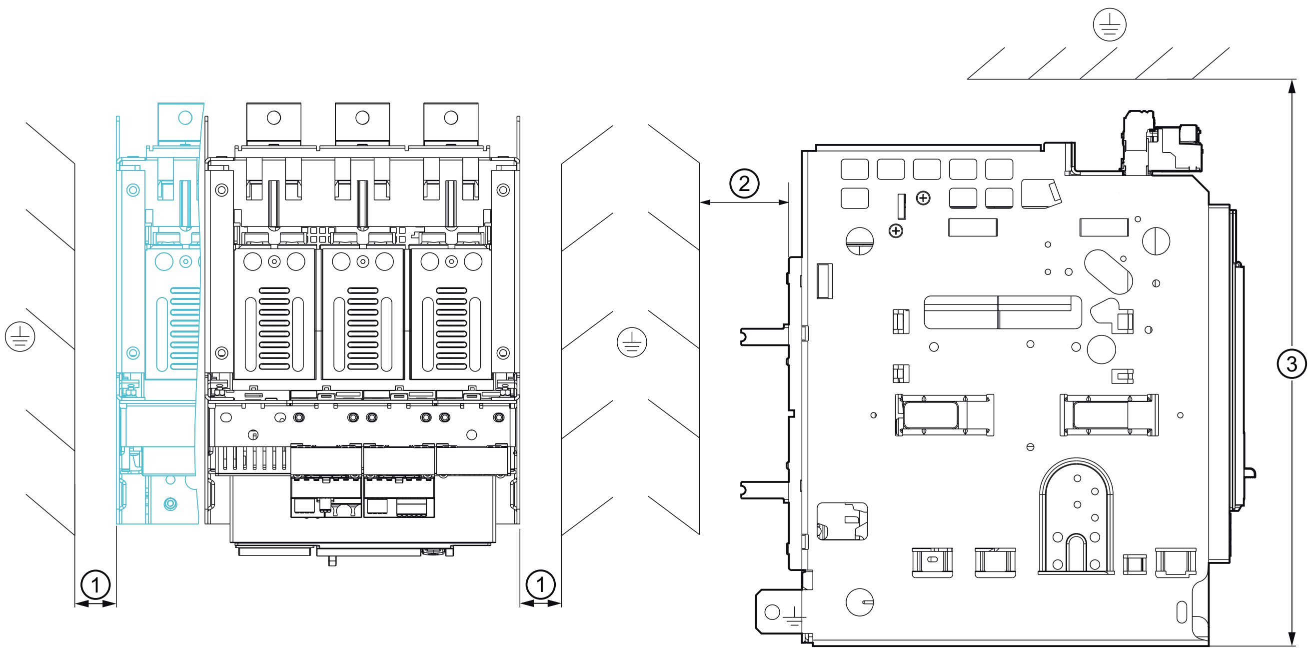
(1) Horizontal clearance

(2) Depth clearance

(3) Vertical clearance

Breaking capacity	Rated voltage U_e / Max. U_e [V]	Vertical clearance (3) [mm]		Horizontal clearance (1) [mm]	Depth clearance (2) [mm]
		Closed panels	Struts / grids / perforated sheets		
N, S	500 / 525	515	460	0	0
	690 / 725	515	460	0	0
M	690 / 725	515	510	0	0
E	690 / 725	560	560	0	0
	1000 / 1050	615	615	0	0
IT system only					
N, S, M	500 / 525	550	550	0	0
E	690 / 725	615	615	0	0

3WA11 withdrawable circuit breakers



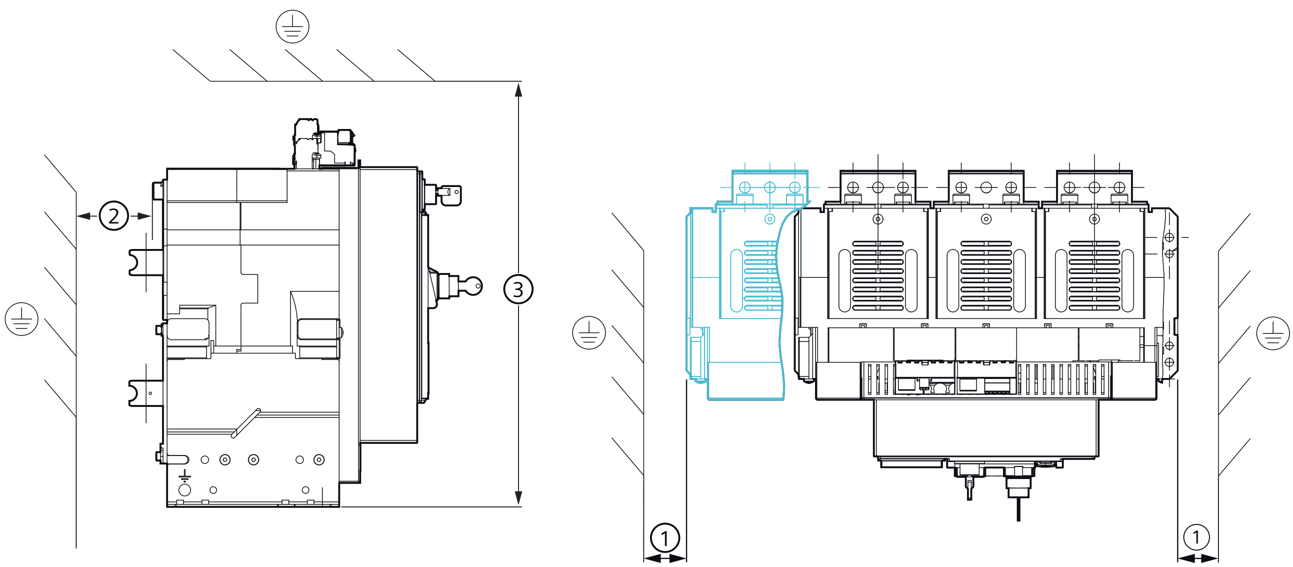
(1) Horizontal clearance
(2) Depth clearance
(3) Vertical clearance

Breaking capacity	Rated voltage U_e / Max. U_e [V]	Vertical clearance (3) [mm]			Horizontal clearance (1) [mm]		Depth clearance (2) [mm]
		Closed panels	Struts / grids / perforated sheets	With arc chute cover		With arc chute cover; against closed panels	
N, S	500 / 525	515	460	461	0	40	0
	690 / 725	515	460	461	0	40	0
M	690 / 725	515	510	461	0	40	0
E	690 / 725	560	560	-- 1)	0	-- 1)	0
	1000 / 1050	615	615		0		0
IT system only							
N, S, M	500 / 525	550	550	-- 1)	0	-- 1)	0
E	690 / 725	615	615		0		0

1) Arc chute cover not permissible

6.2.4.2 3WA1 - frame size 2

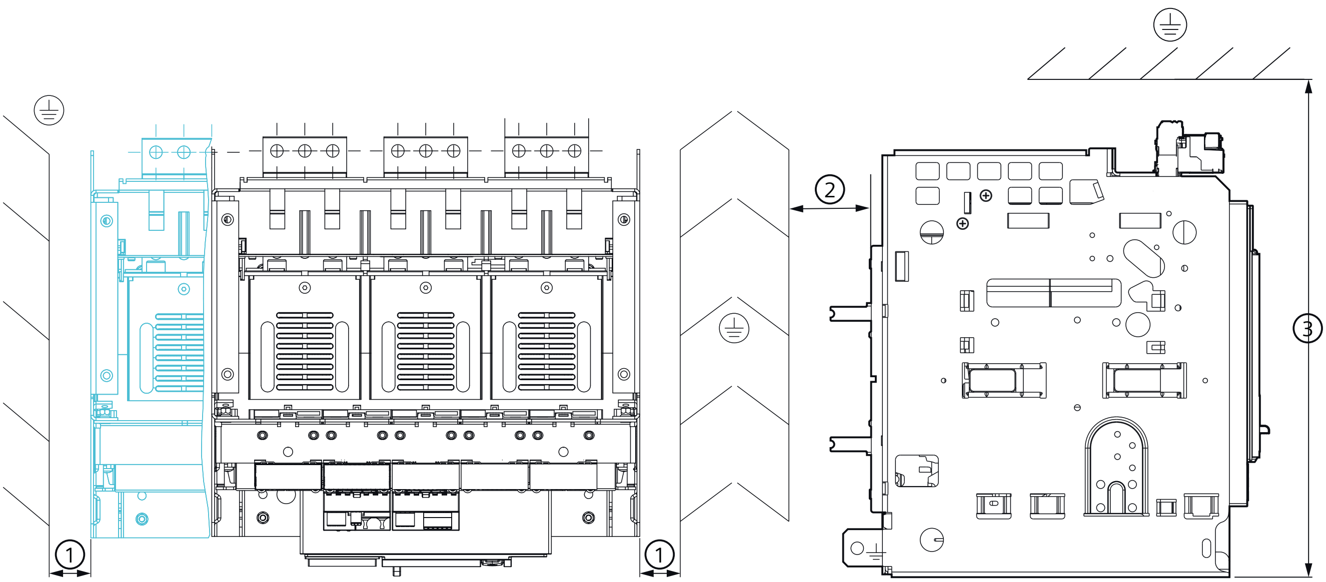
3WA12 fixed-mounted circuit breakers



(1) Horizontal clearance
(2) Depth clearance
(3) Vertical clearance

Breaking capacity	Rated voltage U_e / Max. U_e [V]	Vertical clearance (3) [mm]		Horizontal clearance (1) [mm]	Depth clearance (2) [mm]
		Closed panels	Struts / grids / perforated sheets		
S, M, H	500 / 525	515	460	0	0
	690 / 725	515	460	0	0
C	500 / 525	615	615	0	0
E	690 / 725	560	560	0	0
	1000 / 1050	615	615	0	0
	1000 / 1150	615	615	0	0
IT system only					
S, M, H	500 / 525	550	550	0	0
C	690 / 725	615	615	0	0
E	690 / 725	615	615	0	0

3WA12 withdrawable circuit breakers



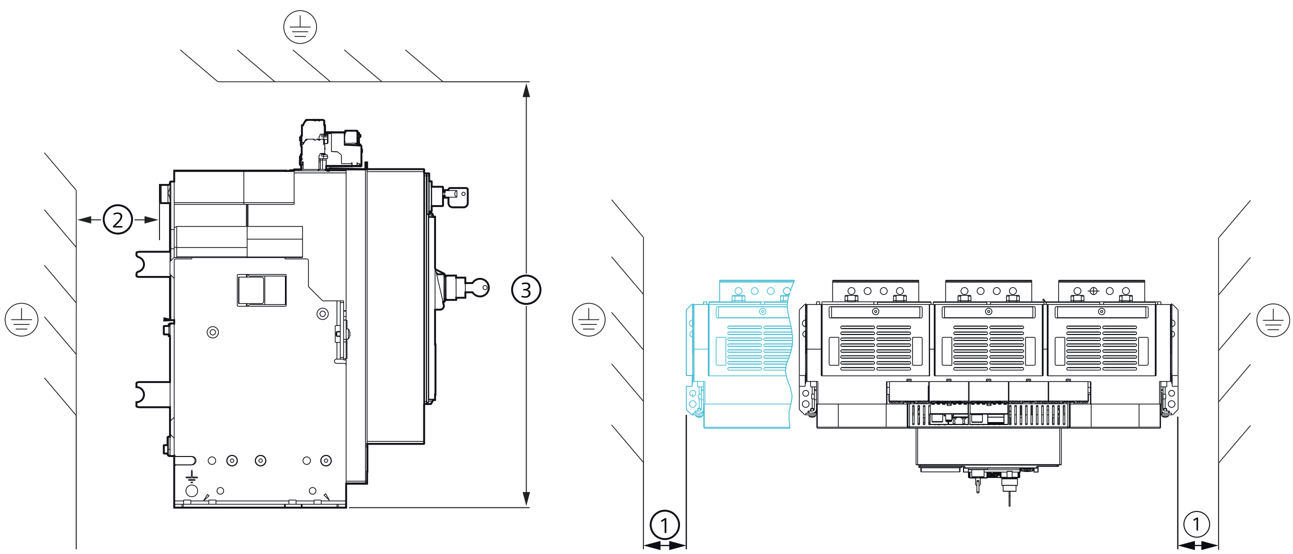
(1) Horizontal clearance
(2) Depth clearance
(3) Vertical clearance

Breaking capacity	Rated voltage U_e / Max. U_e [V]	Vertical clearance (3) [mm]			Horizontal clearance (1) [mm]		Depth clearance (2) [mm]
		Closed panels	Struts / grids / perforated sheets	With arc chute cover		With arc chute cover; against closed panels	
S, M, H	500 / 525	515	460	461	0	70	0
	690 / 725	515	460	461	0	70	0
C	500 / 525	615	615	-- [1]	0	-- [1]	0
E	690 / 725	560	560		0		0
	1000 / 1050	615	615		0		0
	1000 / 1150	615	615		0		0
IT system only							
S, M, H	500 / 525	550	550	-- [1]	0	-- [1]	0
C	690 / 725	615	615		0		0
E	690 / 725	615	615		0		0

[1] Arc chute cover not permissible

6.2.4.3 3WA1 - frame size 3

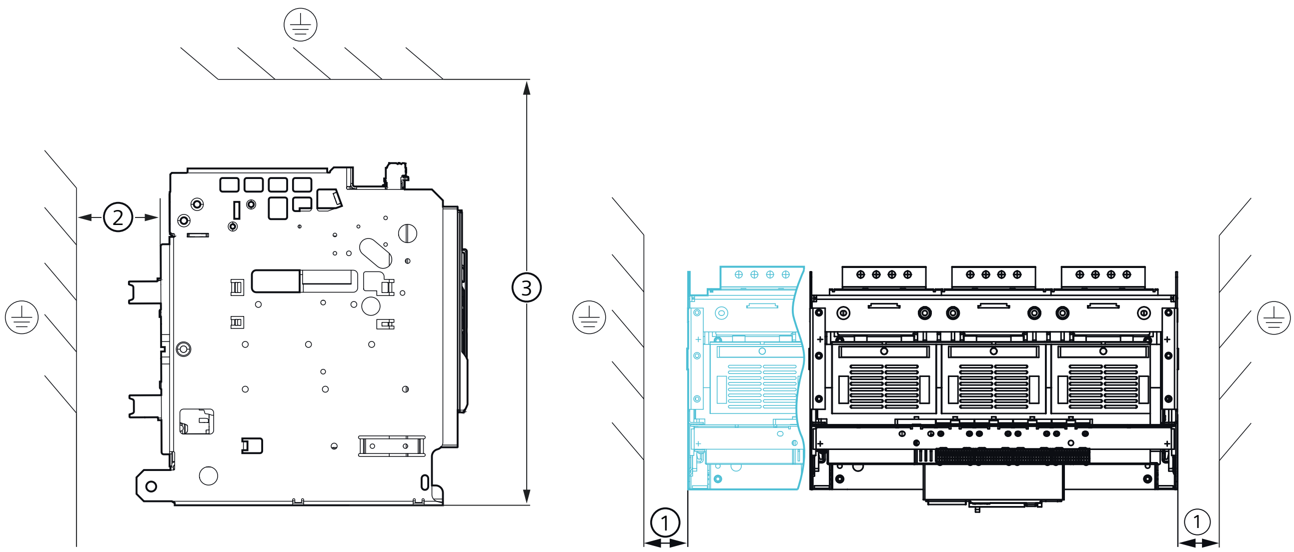
3WA13 fixed-mounted circuit breakers



(1) Horizontal clearance
(2) Depth clearance
(3) Vertical clearance

Breaking capacity	Rated voltage U_e / Max. U_e [V]	Vertical clearance (3) [mm]		Horizontal clearance (1) [mm]	Depth clearance (2) [mm]
		Closed panels	Struts / grids / perforated sheets		
H	500 / 525	515	460	0	0
	690 / 725	515	460	0	0
E	690 / 725	560	560	0	0
	1000 / 1050	615	615	0	0
	1000 / 1150	615	615	0	0
IT system only					
H	500 / 525	550	550	0	0
C	500 / 525	615	615	0	0
	690 / 725	615	615	0	0
E	690 / 725	615	615	0	0

3WA13 withdrawable circuit breakers



(1) Horizontal clearance
(2) Depth clearance
(3) Vertical clearance

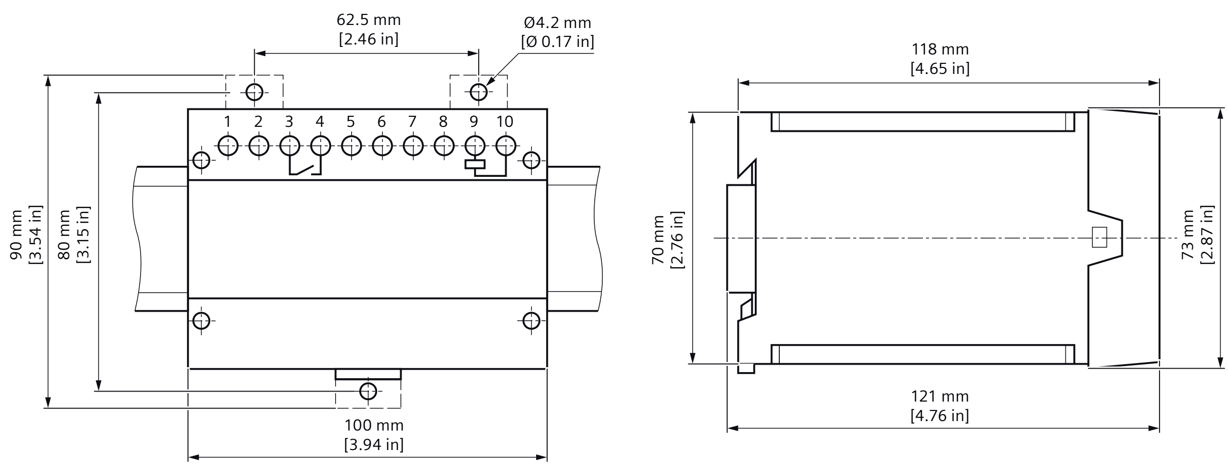
Breaking capacity	Rated voltage U_e / Max. U_e [V]	Vertical clearance (3) [mm]			Horizontal clearance (1) [mm]		Depth clearance (2) [mm]
		Closed panels	Struts / grids / perforated sheets	With arc chute cover		With arc chute cover; against closed panels	
H	500 / 525	515	460	461	0	70	0
H	690 / 725	515	460	461	0	70	0
E	690 / 725	560	560	-- 1)	0	-- 1)	0
E	1000 / 1050	615	615		0		0
E	1000 / 1150	615	615		0		0
IT system only							
H	500 / 525	550	550	-- 1)	0	-- 1)	0
C	500 / 525	615	615		0		0
C	690 / 725	615	615		0		0
E	690 / 725	615	615		0		0

1) Arc chute cover not permissible

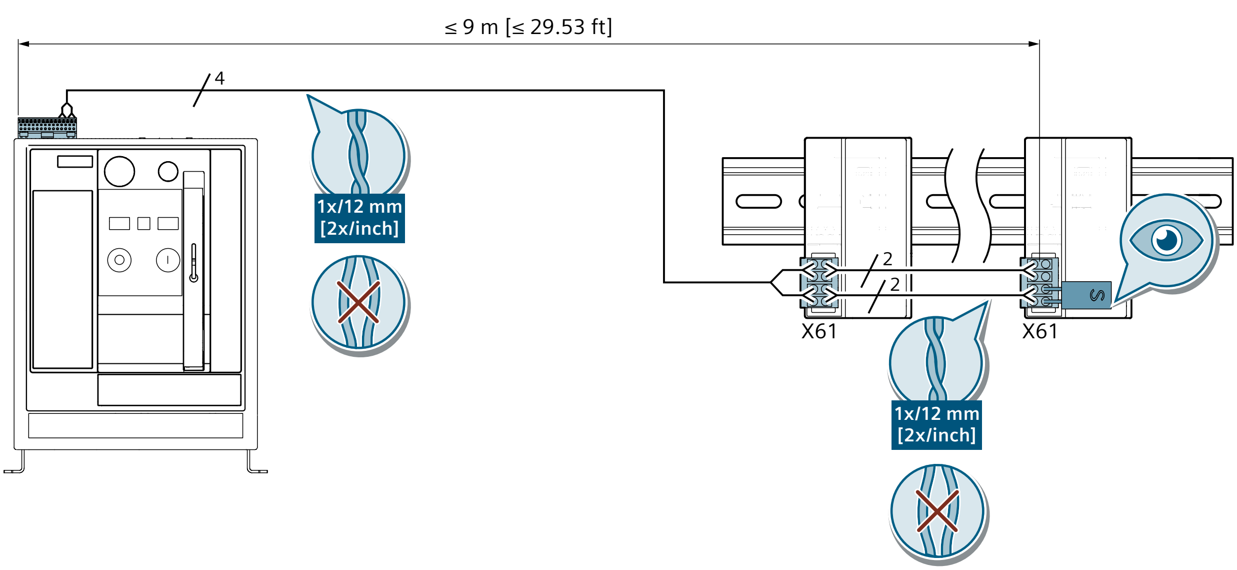
6.2.5 Accessories and door cutouts

6.2.5.1 Capacitor storage device

3WA9111-0AD81

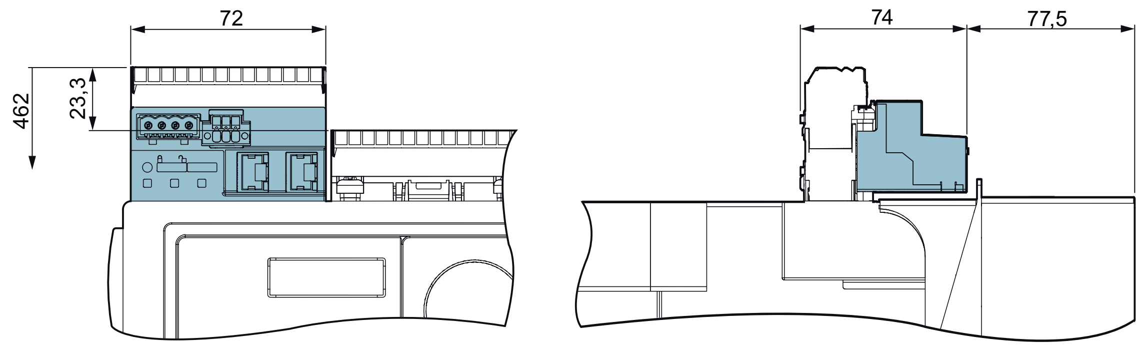


6.2.5.2 Connection of external CubicleBUS² modules

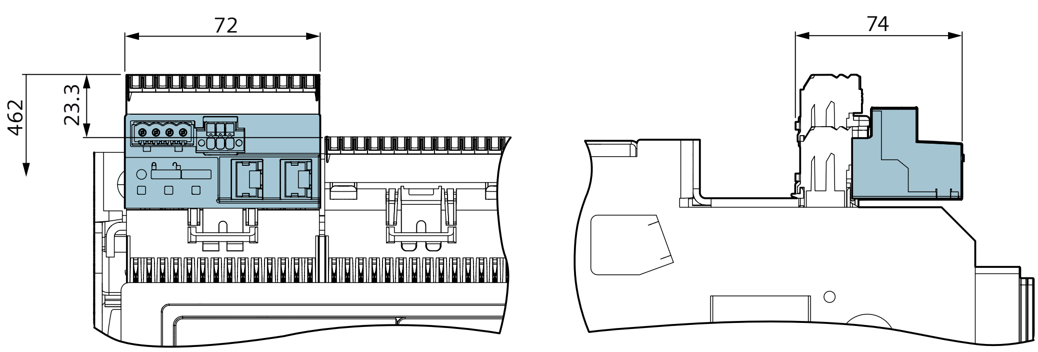


6.2.5.3 COM190 and COM150 communications modules

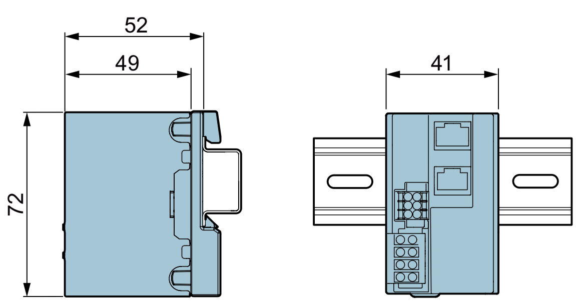
Fixed-mounted



Withdrawable



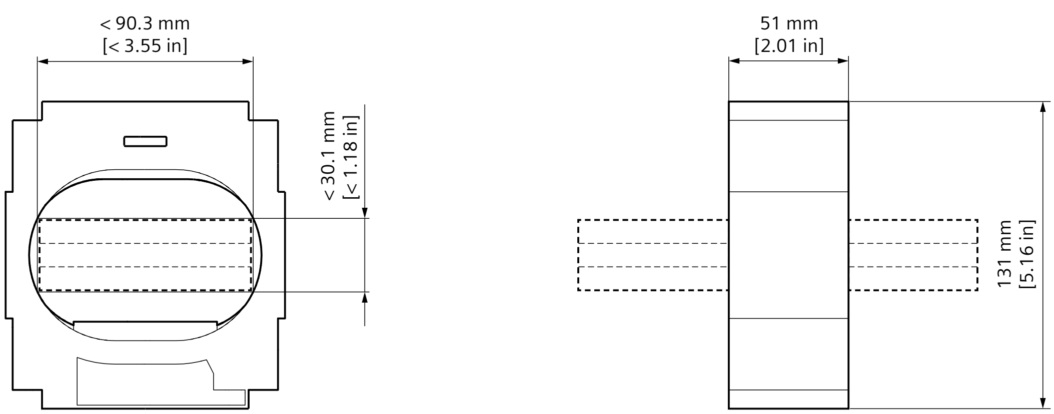
DIN rail



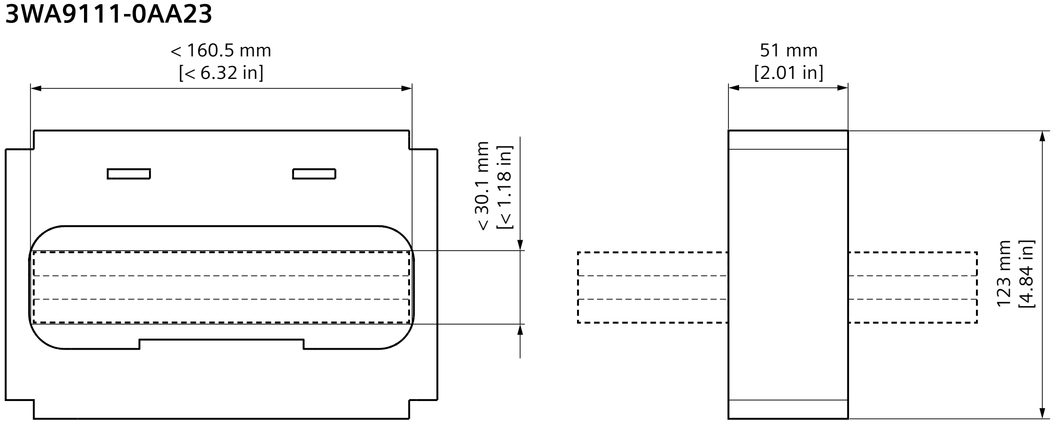
6.2.5.4 External current sensor for the neutral pole (N-CT)

3WA9111-0AA21

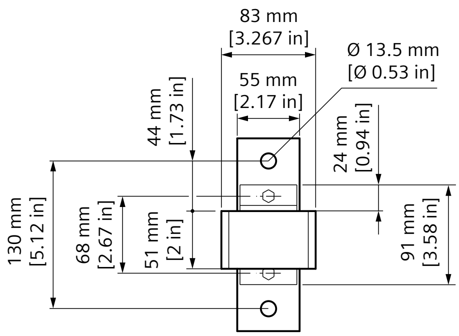
3WA9111-0AA22

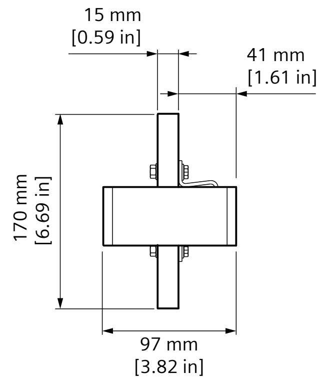


3WA9111-0AA23

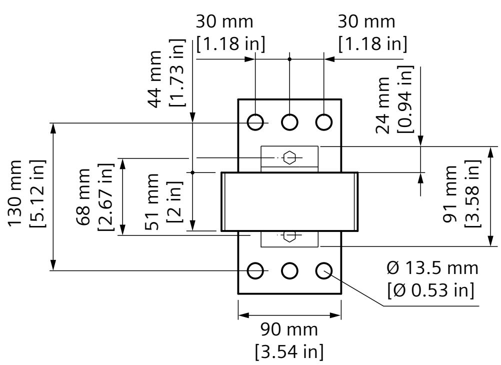


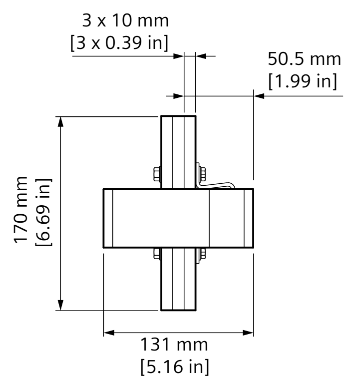
3WA9111-0AA31



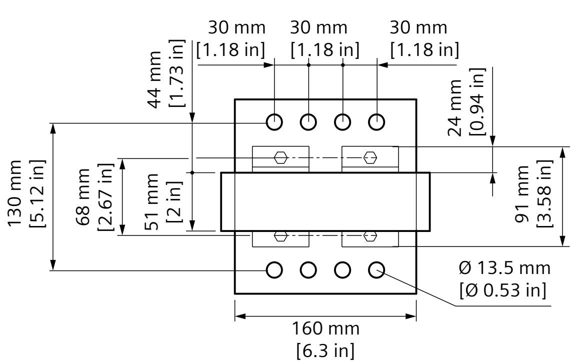


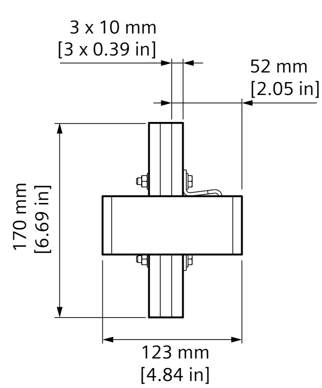
3WA9111-0AA32



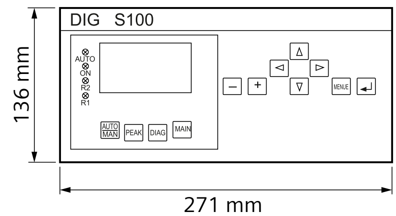


3WA9111-0AA33

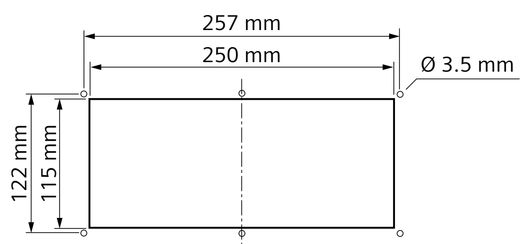




6.2.5.5 DIGmat S100

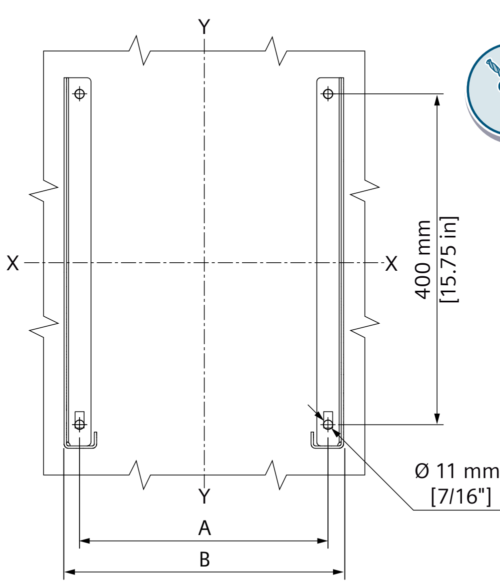


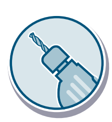
Door cutout and drilling plan



6.2.5.6 Support brackets

3WA9111-0BB50

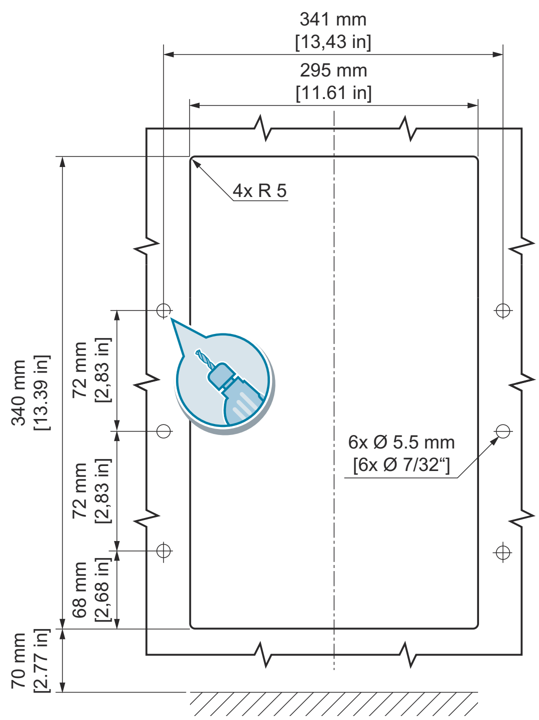




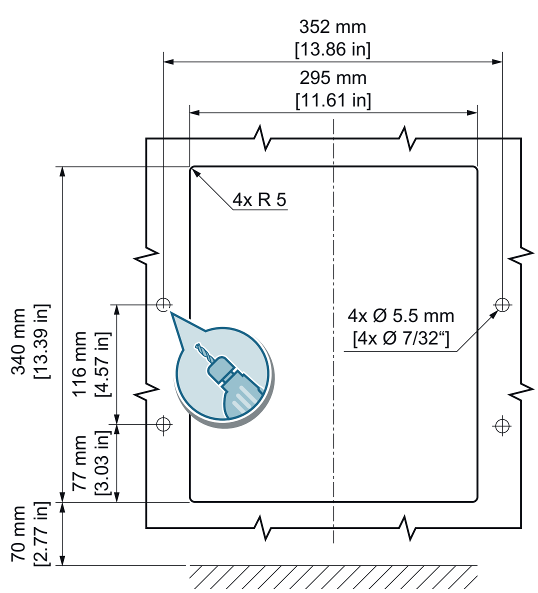
Schalter / Breaker		A	B
BG I / FS I	3 pol 4 pol	300 mm [11.81 in] 390 mm [15.35 in]	338 mm [13.31 in] 428 mm [16.85 in]
BG II / FS II	3 pol 4 pol	440 mm [17.32 in] 570 mm [22.44 in]	478 mm [18.82 in] 608 mm [23.94 in]

6.2.5.7 Door cutout/protective cover IP55

3WA9111-0AP03

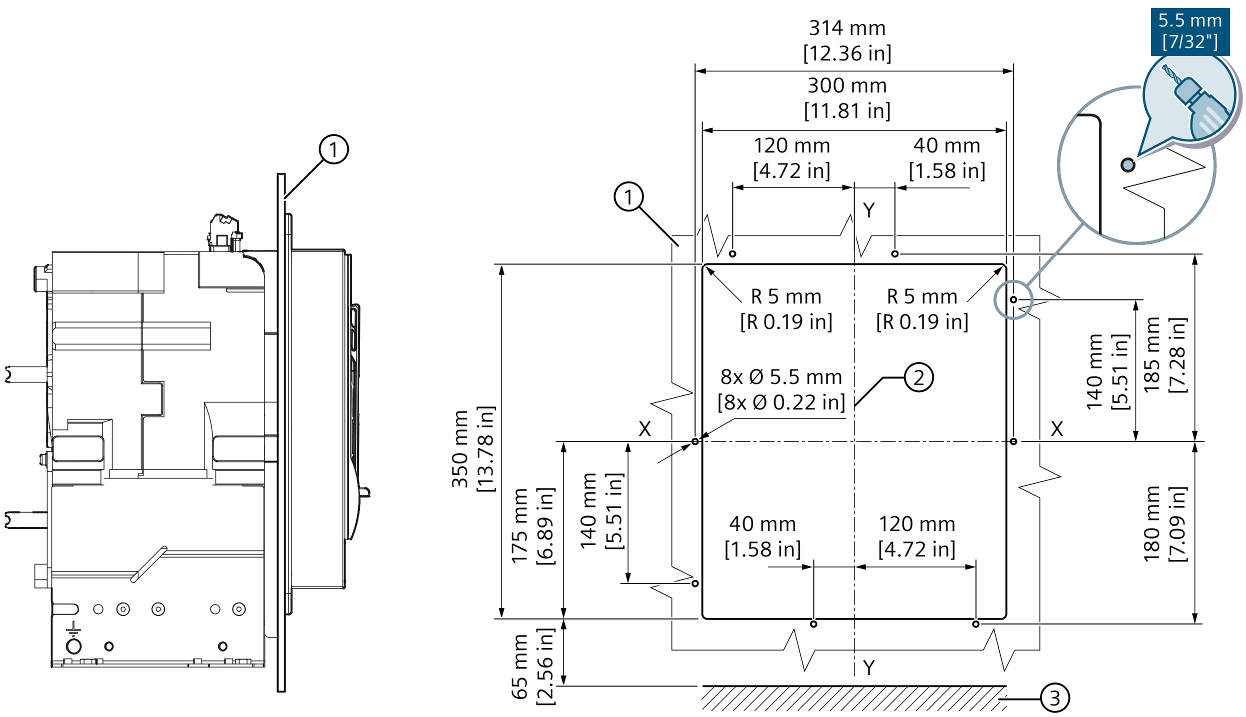


3WA9111-1AP03



6.2.5.8 Door sealing frame

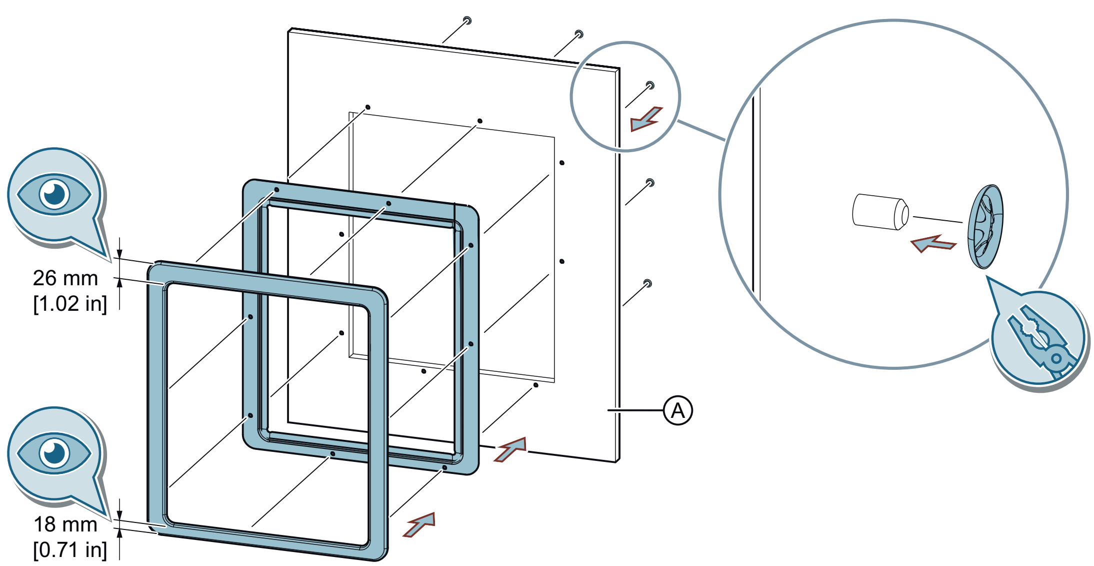
3WA9111-0AP01



① Control cabinet door

② Center of the operator panel of the 3WA circuit breaker

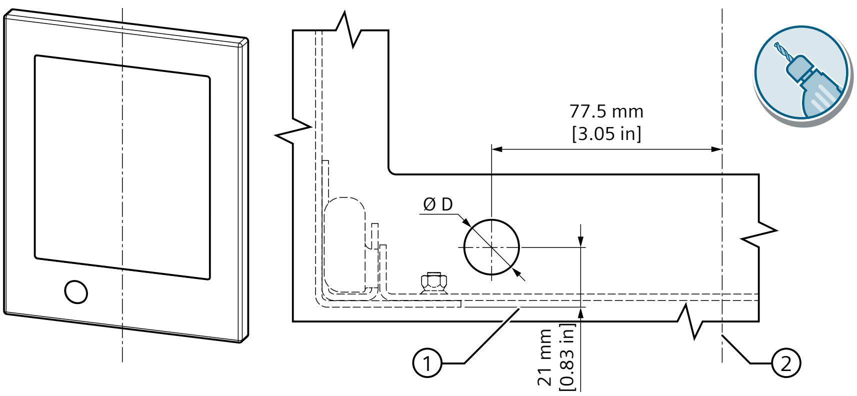
③ Mounting surface for circuit breaker or guide frame



6.2.5.9 Interlocks and locking provisions

Locking provision to prevent unauthorized closing of the withdrawable circuit breaker

3WA9111-0BA5

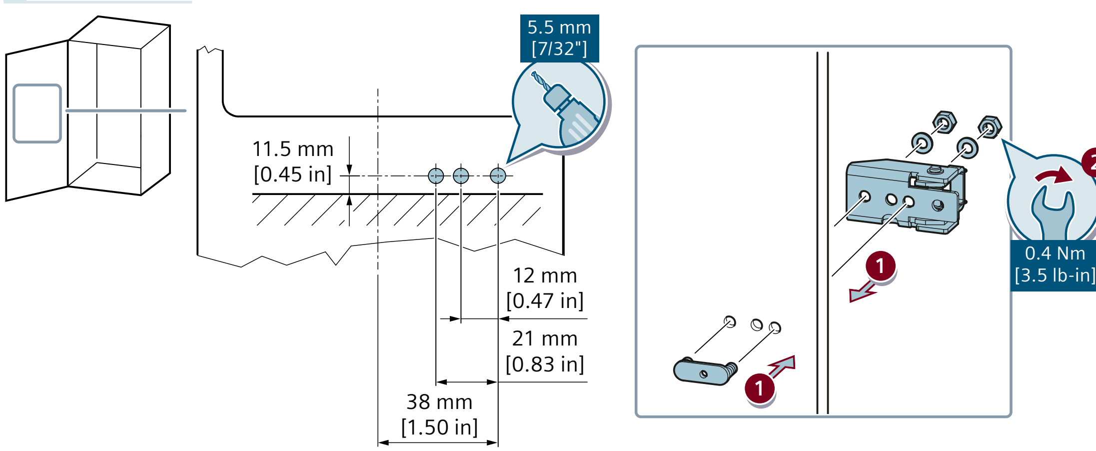


EN	D = Ø Lock type + 1 mm [0.04 in]
DE	D = Ø Schlosstyp + 1 mm [0.04 in]
FR	D = Ø Type de serrure + 1 mm [0.04 in]
ES	D = Ø Tipo de cerradura + 1 mm [0.04 in]
IT	D = Ø Tipo di chiusura + 1 mm [0.04 in]
PT	D = Ø Tipo de fecho + 1 mm [0.04 in]
TR	D = Ø Kilit tipi + 1 mm [0.04 in]
PY	D = Ø Тип замка + 1 mm [0.04 in]
PL	D = Ø Typ zamka + 1 mm [0.04 in]
中	D = Ø 锁扣装置类型 + 1 mm [0.04 in]

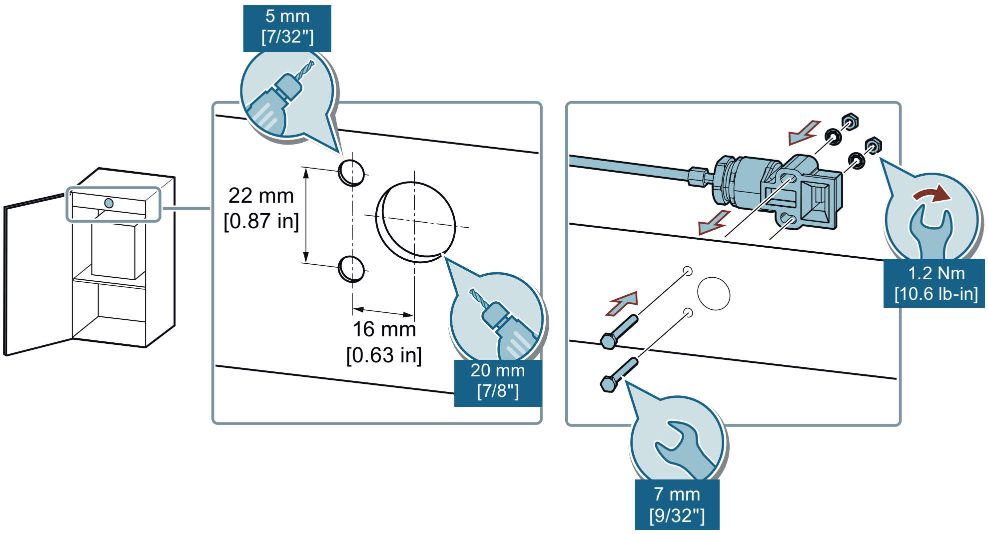
① Mounting surface of the guide frame
② Center of the operator panel of the 3WA circuit breaker

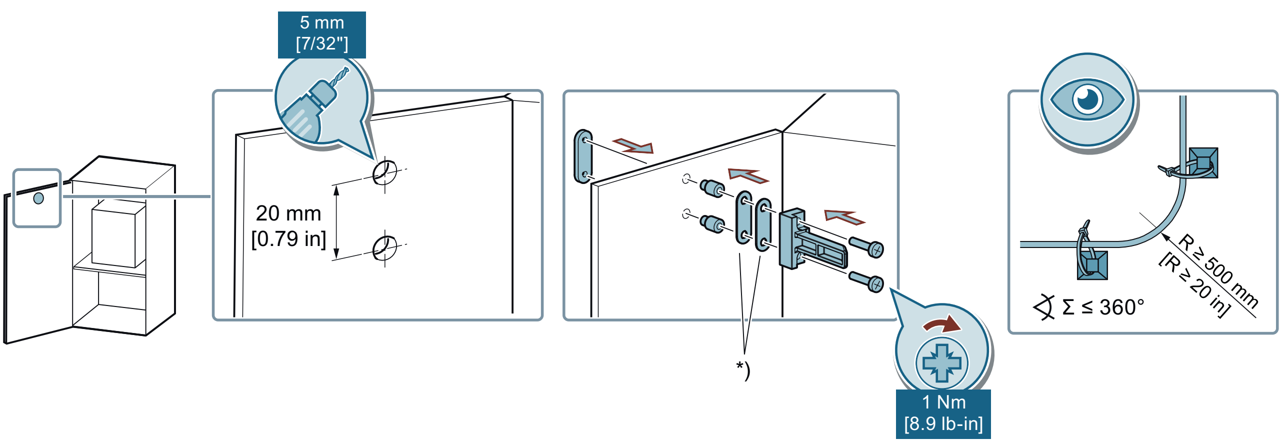
Locking provision to prevent opening of the control cabinet door

3WA9111-0BB12
3WA9111-0BB13



Locking provision to prevent unauthorized closing of the withdrawable circuit breaker



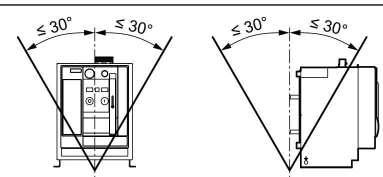
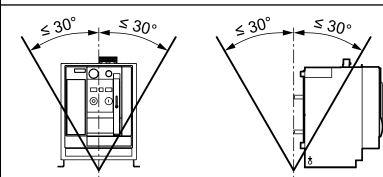


6.3 Technical specifications of 3WA circuit breakers

The following tables list the technical specifications of the basic 3WA breakers.

You can find the technical specifications of the accessories in Chapter Accessories (Page 217).

6.3.1 Basic data for sizes 1 to 3

3WA			AC	
			Fixed-mounted	**Withdrawable**
Key electrical data				
Rated operational voltage U_e		V	≤ 1000 at 50/60 Hz	≤ 1000 at 50/60 Hz
Rated impulse withstand voltage U_{imp}	Main circuit	kV	12	12
	Auxiliary circuits	kV	4	4
	Control circuits	kV	2.5	2.5
	Spring charging motor	kV	1.2	1.2
Isolating function acc. to EN 60947-2			✓	✓
Utilization category			B	B
Type of mounting			✓	✓
Number of poles			3-pole / 4-pole	3-pole / 4-pole
Degree of protection when installed in power distribution equipment				
Without any measures			IP20	IP20
With door sealing frame			IP41	IP41
With IP55 protective cover			IP55	IP55
Permissible ambient temperature				
Operation		°C	–40 ... +70	–40 ... +70
Storage		°C	–40 ... +80	–40 ... +80
Mounting position				

6.3.2 Size 1

6.3.2.1 Basic data

3WA11			AC	
			Fixed-mounted	**Withdrawable**
Key electrical data				
Rated insulation voltage U_i		V	1000	1000
Rated current I_n		A	630 ... 2500	630 ... 2500
Weight				
Circuit breaker	3/4-pole	kg	43/50	45/54
Guide frame	3/4-pole	kg	--	25/30

You will find basic data that are identical for all sizes in Chapter Basic data for sizes 1 to 3 (Page 462).

6.3.2.2 Breaking capacity

3WA11			AC			
			N	S	M	E
Rated short-circuit breaking capacity I_{cu} / I_{cs}						
$U_e \le 415$ V		kA	55 / 55	66 / 66	85 / 85	--
$U_e \le 500$ V		kA	55 / 55	66 / 66	85 / 85	--
$U_e \le 690$ V		kA	42 / 42	50 / 50	66 / 66	85 / 85
$U_e \le 1000$ V		kA	--	--	--	50 / 50
Rated short-circuit making capacity I_{cm}						
$U_e \le 415$ V		kA	121	145	187	--
$U_e \le 500$ V		kA	121	145	187	--
$U_e \le 690$ V		kA	88	105	145	187
$U_e \le 1000$ V		kA	--	--	--	105
Rated short-time withstand current I_{cw}						
$U_e \le 500$ V	0.5 s	kA	55	66	85	--
	1 s	kA	50	66	85	--
	2 s	kA	35 [1)] / 45 [2)]	45	70	--
	3 s	kA	30 [1)] / 35 [2)]	35	60	--
$U_e \le 690$ V	0.5 s	kA	42	50	66	85
	1 s	kA	42	50	66	85
	2 s	kA	35 [1)] / 42 [2)]	45	66	70
	3 s	kA	30 [1)] / 35 [2)]	35	60	60
$U_e \le 1000$ V	0.5 s	kA	--	--	--	50
	1 s	kA	--	--	--	50
	2 s	kA	--	--	--	50
	3 s	kA	--	--	--	50
[1)] $I_{nmax} \le 1250$ A [2)] $I_{nmax} \ge 1600$ A						
Rated conditional short-circuit current I_{cc} of the non-automatic circuit breakers						
$U_e \le 500$ V		kA	55	66	85	--
$U_e \le 690$ V		kA	42	50	66	85
$U_e \le 1000$ V		kA	--	--	--	50
Single-pole short-circuit breaking capacity I_{IT} acc. to IEC 60947-2 Annex H (IT network capability)						
≤ 500 V		kA	50	50	50	--
≤ 690 V		kA	--	--	--	50
1000 V		kA	--	--	--	--

6.3.2.3 Ampacity, power loss

3WA11		AC						
		630 A	800 A	1000 A	1250 A	1600 A	2000 A	2500 A
Permissible load for fixed-mounted versions (bare copper connection bars)								
For all connection types (except rear vertical main connections)								
≤ 60 °C	A	630	800	1000	1250	1600	2000	2500[1)]
≤ 70 °C	A	630	800	1000	1250	1600	2000	--
For rear vertical connections								
≤ 60 °C	A	630	800	1000	1250	1600	2000	2500[1)]
≤ 70 °C	A	630	800	1000	1250	1600	2000	2500
[1)]Only for horizontal connection copper bars painted black								
Permissible load for withdrawable versions								
For all connection types (except rear vertical main connections)								
≤ 55 °C	A	630	800	1000	1250	1600	2000	--
≤ 60 °C	A	630	800	1000	1250	1600	1930	--
≤ 70 °C	A	630	800	1000	1210	1490	1780	--
For rear vertical connections								
≤ 55 °C (Cu bare)	A	630	800	1000	1250	1600	2000	2500
≤ 60° C (Cu, bare)	A	630	800	1000	1250	1600	2000	2370
≤ 70 °C	A	630	800	1000	1250	1545	1855	2060
Power loss with 3-phase symmetrical load with rated current								
Fixed-mounted	W	30	45	70	105	135	240	360
Withdrawable	W	55	85	130	205	310	440	600

6.3.2.4 Switching times, endurance (operating cycles)

3WA11		AC						
		630 A	800 A	1000 A	1250 A	1600 A	2000 A	2500 A
Switching times								
Make time	ms	35	35	35	35	35	35	35
Opening time	ms	38	38	38	38	38	38	38
Electrical make time (through closing coil)	ms	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]
Electrical opening time (through shunt trip)	ms	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]
Electrical opening time (through instantaneous undervoltage release)	ms	80 [3)]	80 [3)]	80 [3)]	80 [3)]	80 [3)]	80 [3)]	80 [3)]
Opening time through electronic trip unit	ms	50	50	50	50	50	50	50
[1)] Make time through short-time excited closing coil (5% OP)								
[2)] Opening time through short-time excited shunt trip (5% OP)								
[3)] Opening time with short-time-delayed undervoltage release: 200 ms								
Endurance (operating cycles)								

3WA11			AC						
			630 A	800 A	1000 A	1250 A	1600 A	2000 A	2500 A
Breaking capacity N									
Mechanical	Without maintenance		15000	15000	15000	15000	15000	15000	15000
	With maintenance [4]		30000	30000	30000	30000	30000	30000	30000
Electrical	Without maintenance ≤ 690 V		10000	10000	10000	10000	10000	7500	5000
	With maintenance [4]		30000	30000	30000	30000	30000	30000	30000
Breaking capacity S									
Mechanical	Without maintenance		15000	15000	15000	15000	15000	15000	15000
	With maintenance [4]		30000	30000	30000	30000	30000	30000	30000
Electrical	Without maintenance ≤ 690 V		10000	10000	10000	10000	10000	7500	5000
	With maintenance [4]		30000	30000	30000	30000	30000	30000	30000
Breaking capacity M [5]									
Mechanical	Without maintenance		10000	10000	10000	10000	10000	10000	10000
	With maintenance [4]		15000	15000	15000	15000	15000	15000	15000
Electrical	Without maintenance ≤ 690 V		10000	10000	10000	10000	10000	7500	5000
	With maintenance [4]		15000	15000	15000	15000	15000	15000	15000
Breaking capacity E [5]									
Mechanical	Without maintenance		10000	10000	10000	10000	10000	10000	10000
	With maintenance [4]		15000	15000	15000	15000	15000	15000	15000
Electrical	Without maintenance ≤ 690 V		10000	10000	10000	10000	10000	7500	5000
	Without maintenance ≤ 1000 V		1000	1000	1000	1000	1000	1000	1000
	With maintenance [4]		15000	15000	15000	15000	15000	15000	15000
[4] Maintenance means: Replace main contacts and arc chutes (see Chapter Inspection and maintenance (Page 359)) [5] The main contact elements can only be replaced in the factory.									
Switching frequency [6]									
Breaking capacity N and S									
Electrical	3-pole		45 / h	45 / h	45 / h	45 / h	45 / h	45 / h	45 / h
	4-pole		45 / h	45 / h	45 / h	45 / h	45 / h	45 / h	45 / h
Breaking capacity M									
Electrical	3-pole		45 / h	45 / h	45 / h	45 / h	45 / h	45 / h	45 / h
	4-pole		60 / h	60 / h	60 / h	60 / h	60 / h	60 / h	60 / h
Breaking capacity E									
Electrical	≤ 1000 V	3-pole	45 / h	45 / h	45 / h	45 / h	45 / h	45 / h	45 / h
		4-pole	60 / h	60 / h	60 / h	60 / h	60 / h	60 / h	60 / h
[6] Minimum interval time between two operations									

6.3.2.5 Minimum cross-sections of main conductors

3WA11	AC						
	630 A	**800 A**	**1000 A**	**1250 A**	**1600 A**	**2000 A**	**2500 A**
Minimum cross-sections of main conductors Copper bars, bare or painted black							
Horizontal connection	--	--	1 x 60 mm x 10 mm	2 x 40 mm x 10 mm	2 x 50 mm x 10 mm	3 x 50 mm x 10 mm	4 x 50 mm x 10 mm
Vertical connection	--	--	1 x 60 mm x 10 mm	2 x 40 mm x 10 mm	2 x 50 mm x 10 mm	2 x 80 mm x 10 mm	4 x 100 mm x 5 mm / 2 x 100 mm x 10 mm

6.3.3 Size 2

6.3.3.1 Basic data

3WA12				AC		DC	
				Fixed-mounted	**Withdrawable**	**Fixed-mounted**	**Withdrawable**
Key electrical data							
Rated operational voltage U_e			V	≤ 1150 at 50/60 Hz	≤ 1150 at 50/60 Hz	600 / 1000 / 1500	600 / 1000 / 1500
Rated insulation voltage U_i			V	≤ 1150	≤ 1150	600 / 1000 / 1500	600 / 1000 / 1500
Rated current			A	2000 ... 4000	2000 ... 4000	1000 ... 4000	1000 ... 4000
Size				2	2	2	2
Weight							
Circuit breaker	3-pole / 4-pole	2000 A	kg	56 / 67	56 / 67	60 / 72	60 / 72
		2500 A	kg	59 / 71	59 / 71	63 / 76	63 / 76
		3200 A	kg	64 / 77	64 / 77	68 / 82	68 / 82
		4000 A	kg	85 / 103	85 / 103	121 / 146	121 / 146
Guide frame	3-pole / 4-pole	2000 A	kg	--	--	31 / 37	31 / 37
		2500 A	kg	--	--	39 / 47	39 / 47
		3200 A	kg	--	--	45 / 54	45 / 54
		4000 A	kg	--	--	52 / 62	52 / 62

You will find basic data that are identical for all sizes in Chapter Basic data for sizes 1 to 3 (Page 462).

6.3.3.2 Breaking capacity for AC

3WA12			AC				
			S	**M**	**H**	**C**	**E**
Rated short-circuit breaking capacity I_{cu} / I_{cs}							
$U_e \leq 415$ V		kA	66 / 66	85 / 85	100 / 100	130 / 130	--
$U_e \leq 500$ V		kA	66 / 66	85 / 85	100 / 100	130 / 130	--
$U_e \leq 690$ V		kA	50 / 50	66 / 66	85 / 85	100 / 100	85 / 85
$U_e \leq 1000$ V		kA	--	--	--	--	85 / 85
$U_e \leq 1150$ V		kA	--	--	--	--	50 / 50
Rated short-circuit making capacity I_{cm}							
$U_e \leq 415$ V		kA	145	187	220	286	--
$U_e \leq 500$ V		kA	145	187	220	286	--
$U_e \leq 690$ V		kA	105	145	187	220	187
$U_e \leq 1000$ V		kA	--	--	--	--	187
$U_e \leq 1150$ V		kA	--	--	--	--	105
Rated short-time withstand current I_{cw}							
$U_e \leq 500$ V	0.5 s	kA	66	85	100	100	--
	1 s	kA	66	85	85	100	--
	2 s	kA	66	66 [1] / 85 [2]	66 [1] / 85 [2]	85	--
	3 s	kA	55 [1] / 66 [2]	55 [1] / 75 [2]	55 [1] / 75 [2]	75	--
$U_e \leq 690$ V	0.5 s	kA	50	66	85	100	85
	1 s	kA	50	66	85	100	85
	2 s	kA	50	66	66 [1] / 85 [2]	85	66 [1] / 85 [2]
	3 s	kA	50	55 [1] / 66 [2]	55 [1] / 75 [2]	75	55 [1] / 75 [2]
$U_e \leq 1000$ V	0.5 s	kA	--	--	--	--	85
	1 s	kA	--	--	--	--	85
	2 s	kA	--	--	--	--	66 [1] / 85 [2]
	3 s	kA	--	--	--	--	55 [1] / 75 [2]
$U_e \leq 1150$ V	0.5 s	kA	--	--	--	--	50
	1 s	kA	--	--	--	--	50
	2 s	kA	--	--	--	--	50
	3 s	kA	--	--	--	--	50
[1] $I_{nmax} \leq 2500$ A [2] $I_{nmax} \geq 3200$ A							
Rated conditional short-circuit current I_{cc} of the non-automatic circuit breakers							
$U_e \leq 500$ V		kA	66	85	100	--	
$U_e \leq 690$ V		kA	50	66	85	100	85
$U_e \leq 1000$ V		kA	--	--	--	--	85
$U_e \leq 1150$ V		kA	--	--	--	--	50
Single-pole short-circuit breaking capacity I_{IT} acc. to IEC 60947-2 Annex H (IT network capability)							

3WA12		AC				
		S	M	H	C	E
≤ 500 V	kA	50	50	50	50	--
≤ 690 V	kA	--	--	--	--	50
1000 V	kA	--	--	--	--	--

6.3.3.3 Ampacity, power loss for AC

3WA12		AC			
		2000 A	2500 A	3200 A	4000 A
Permissible load for fixed-mounted versions (bare copper connection bars)					
For all connection types (except rear vertical main connections)					
≤ 60° C	A	2000	2500	3200	--
≤ 70° C	A	2000	2500	3200	--
For rear vertical main connections					
≤ 60° C	A	2000	2500	3200	4000
≤ 70° C	A	2000	2500	3200	4000
Permissible load for withdrawable versions					
For all connection types (except rear vertical main connections)					
≤ 55° C	A	2000	2500	3200	--
≤ 60° C	A	2000	2500	3020	--
≤ 70° C	A	2000	2280	2870	--
For rear vertical main connections					
≤ 55° C	A	2000	2500	3200	4000
≤ 60° C	A	2000	2500	3200	3910
≤ 70° C	A	2000	2390	2945	3645
Power loss at I_n with 3-phase symmetrical load, complete device (3-/4-pole)					
With 3-phase symmetrical load, complete device (3-/4-pole)					
Fixed-mounted	W	180	270	410	750
Withdrawable	W	320	520	710	1040

6.3.3.4 Switching times, endurance (operating cycles) for AC

3WA12			AC			
			2000 A	2500 A	3200 A	4000 A
Switching times						
Make time		ms	35	35	35	35
Opening time		ms	34	34	34	34
Electrical make time (through closing coil)		ms	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]
Electrical opening time (through shunt trip)		ms	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]
Electrical opening time (through instantaneous undervoltage release)		ms	80 [3)]	80 [3)]	80 [3)]	80 [3)]
Opening time through electronic trip unit		ms	50	50	50	50
[1)] Make time through short-time excited closing coil (5% OP) [2)] Opening time through short-time excited shunt trip (5% OP) [3)] Opening time with short-time-delayed undervoltage release: 200 ms						
Endurance (operating cycles)						
Breaking capacity S, M and H						
Mechanical	Without maintenance		10000	10000	10000	10000
	With maintenance [4)]		20000	20000	20000	20000
Electrical	Without maintenance ≤ 690 V		7500	7500	4000	2000
	With maintenance [4)]		20000	20000	20000	20000
Breaking capacity C [5)]						
Mechanical	Without maintenance		5000	5000	5000	5000
	With maintenance [4)]		10000	10000	10000	10000
Electrical	Without maintenance ≤ 690 V		5000	5000	4000	1000
	With maintenance [4)]		10000	10000	10000	10000
Breaking capacity E						
Mechanical	Without maintenance		10000	10000	10000	10000
	With maintenance [4)]		20000	20000	20000	20000
Electrical	Without maintenance ≤ 690 V		7500	7500	4000	2000
	Without maintenance ≤ 1000 V		1000	1000	1000	1000
	Without maintenance ≤ 1150 V		500	500	500	500
	With maintenance [4)]		20000	20000	20000	20000
[4)] Maintenance means: Replace main contacts and arc chutes (see Chapter Inspection and maintenance (Page 359)) [5)] The main contact elements can only be replaced in the factory.						
Switching frequency [6)]						

3WA12			AC			
			2000 A	2500 A	3200 A	4000 A
Breaking capacity S, M and H						
Electrical	3-pole		45 / h	45 / h	45 / h	45 / h
	4-pole		60 / h	60 / h	60 / h	60 / h
Breaking capacity E						
Electrical	≤ 1150 V	3-pole	45 / h	45 / h	45 / h	45 / h
		4-pole	60 / h	60 / h	60 / h	60 / h
Breaking capacity C						
Electrical	3-pole		60 / h	60 / h	60 / h	--
	4-pole		60 / h	60 / h	60 / h	--
[6] Minimum interval time between two operations						

6.3.3.5 Minimum cross-sections of main conductors for AC

3WA12	AC			
	2000 A	2500 A	3200 A	4000 A
Minimum cross-sections of main conductors				
Copper bars, bare or painted black	3 x 50 mm x 10 mm	2 x 100 mm x 10 mm	3 x 100 mm x 10 mm	4 x 120 mm x 10 mm

6.3.3.6 Breaking capacity for DC

3WA12			DC		
			1000 A	2000 A	4000 A
Rated operational voltage U_e					
Breaking capacity D		V	600	600	600
Breaking capacity E	3-pole	V	1000	1000	1000
	4-pole	V	1500	1500	1500

3WA12				DC	
				D	E
Rated short-time withstand current I_{cw} **at DC**					
U_e ≤ 220 V		1 s	kA	35	--
U_e ≤ 300 V		1 s	kA	30	--
U_e ≤ 600 V		1 s	kA	25	--
U_e ≤ 1000 V		1 s	kA	--	20
U_e ≤ 1500 V	3-pole	1 s	kA	--	--
	4-pole	1 s	kA	--	20
Rated conditional short-circuit current I_{cc} **of the non-automatic circuit breakers**					

3WA12			DC	
			D	E
$U_e \leq 220$ V		kA	35	--
$U_e \leq 300$ V		kA	30	--
$U_e \leq 600$ V		kA	25	--
$U_e \leq 1000$ V		kA	--	20
$U_e \leq 1500$ V	3-pole	kA	--	--
	4-pole	kA	--	20

6.3.3.7 Ampacity, power loss for DC

3WA12		DC		
		1000 A	2000 A	4000 A
Permissible load for fixed-mounted versions (copper connection bars, painted black)				
≤ 55 °C	A	1000	2000	3640
≤ 60 °C	A	1000	2000	3500
≤ 70 °C	A	1000	2000	3250
Permissible load for withdrawable versions (copper connection bars, painted black)				
For all connection types (except rear vertical main connections)				
≤ 55 °C	A	1000	2000	3640
≤ 60 °C	A	1000	2000	3500
≤ 70 °C	A	1000	1950	3250
For rear vertical main connections				
≤ 55 °C	A	1000	2000	3740
≤ 60 °C	A	1000	2000	3640
≤ 70 °C	A	1000	2000	3380
Power loss at I_n with symmetrical load, complete device				
Fixed-mounted	W	140	390	820
Withdrawable	W	280	770	1640

6.3.3.8 Switching times, endurance (operating cycles) for DC

3WA12			DC		
			1000 A	2000 A	4000 A
Switching times					
Make time		ms	35	35	35
Opening time		ms	34	34	34
Electrical make time (through closing coil)		ms	80 / 50 [1)]	80 / 50 [1)]	80 / 50 [1)]
Electrical opening time (through shunt trip)		ms	80 / 50 [2)]	80 / 50 [2)]	80 / 50 [2)]
Electrical opening time (through instantaneous undervoltage release)		ms	80 [3)]	80 [3)]	80 [3)]
[1)] Make time through short-time excited closing coil (5% OP) [2)] Opening time through short-time excited shunt trip (5% OP) [3)] Opening time with short-time-delayed undervoltage release: 200 ms					
Endurance (operating cycles)					
Breaking capacity D					
Mechanical	Without maintenance		10000	10000	10000
	With maintenance [4)]		20000	20000	20000
Electrical	Without maintenance ≤ 600 V		6000	6000	4000
	With maintenance [4)]		20000	20000	20000
Breaking capacity E					
Mechanical	Without maintenance		10000	10000	10000
	With maintenance [4)]		20000	20000	20000
Electrical	Without maintenance ≤ 1000 V		1000	1000	1000
	With maintenance ≤ 1000 V [4)]		2000	2000	2000
	Without maintenance ≤ 1500 V [5)]		1000	1000	1000
	With maintenance ≤ 1500 V [4)]		20000	20000	20000
[4)] Maintenance means: Replace main contacts and arc chutes (see Chapter Inspection and maintenance (Page 359)) [5)] 1500 V DC only with 4-pole non-automatic circuit breakers					
Switching frequency					

3WA12		DC		
		1000 A	2000 A	4000 A
Breaking capacity D				
Electrical	3-pole	45 / h	45 / h	45 / h
	4-pole	60 / h	60 / h	60 / h
Breaking capacity E				
Electrical	3-pole	45 / h	45 / h	45 / h
	4-pole	60 / h	60 / h	60 / h

6.3.3.9 Minimum cross-sections of main conductors for DC

3WA12	DC		
	1000 A	2000 A	4000 A
Minimum cross-sections of main conductors			
Copper bars, bare or painted black	1 x 50 x 10 mm	2 x 50 x 10 mm	On the infeed and outgoing sides: 3 x 100 x 10 mm For jumpers: 6 x 250 x 5 mm

6.3.4 Size 3

6.3.4.1 Basic data

3WA13				AC	
				Fixed-mounted	Withdrawable
Key electrical data					
Rated operational voltage U_e			V	≤ 1150 at 50/60 Hz	≤ 1150 at 50/60 Hz
Rated insulation voltage U_i			V	≤ 1150	≤ 1150
Rated current			A	4000 ... 6300	4000 ... 6300
Size				3	3
Weight					
Circuit breaker	3-pole / 4-pole	4000 A	kg	82 / 99	88 / 106
		5000 A	kg	82 / 99	88 / 106
		6300 A	kg	90 / 108	96 / 108
Guide frame	3-pole / 4-pole	4000 A	kg	--	60 / 84
		5000 A	kg	--	60 / 84
		6300 A	kg	--	70 / 119

You will find basic data that are identical for all sizes in Chapter Basic data for sizes 1 to 3 (Page 462).

6.3.4.2 Breaking capacity

3WA13			AC				
			H	C		E	
				3-pole	4-pole	3-pole	4-pole
Rated short-circuit breaking capacity I_{cu} / I_{cs}							
U_e ≤ 440 V		kA	100 / 100	150 / 150	130 / 130	--	--
U_e ≤ 500 V		kA	100 / 100	150 / 150	130 / 130	--	--
U_e ≤ 690 V		kA	85 / 85	150 / 150	130 / 130	150 / 150	130 / 130
U_e ≤ 1000 V		kA	--	--	--	125 / 125	125 / 125
U_e ≤ 1150 V		kA	--	--	--	70 / 70	70 / 70
Rated short-circuit making capacity I_{cm}							
U_e ≤ 440 V		kA	220	330	286	--	--
U_e ≤ 500 V		kA	220	330	286	--	--
U_e ≤ 690 V		kA	187	330	286	330	286
U_e ≤ 1000 V		kA	--	--	--	275	275
U_e ≤ 1150 V		kA	--	--	--	154	154
Rated short-time withstand current I_{cw}							
U_e ≤ 500 V	0.5 ... 3 s	kA	100	130	120	--	--
U_e ≤ 690 V	0.5 ... 3 s	kA	85	130	120	130	120
U_e ≤ 1000 V	0.5 ... 3 s	kA	--	--	--	125	120
U_e ≤ 1150 V	0.5 ... 3 s	kA	--	--	--	70	70
Rated conditional short-circuit current I_{cc} of the non-automatic circuit breakers							
U_e ≤ 500 V		kA	100	130	120	--	--
U_e ≤ 690 V		kA	85	130	120	130	120
U_e ≤ 1000 V		kA	--	--	--	125	120
U_e ≤ 1150 V		kA	--	--	--	70	70
Single-pole short-circuit breaking capacity IIT acc. to IEC 60947-2 Annex H (IT network capability)							
≤ 500 V		kA	50	50	50	--	--
≤ 690 V		kA	--	--	--	50	50
1000 V		kA	--	--	--	--	--

6.3.4.3 Ampacity, power loss

3WA13		AC		
		4000 A	5000 A	6300 A
Permissible load for fixed-mounted versions (bare copper connection bars)				
For all connection types (except rear vertical main connections)				
≤ 60 °C	A	4000	5000	--
≤ 70 °C	A	4000	5000	--
For rear vertical main connections				
≤ 60 °C	A	4000	5000	6300
≤ 70 °C	A	4000	5000	5920

3WA13		AC		
		4000 A	5000 A	6300 A
Permissible load for withdrawable versions				
For all connection types (except rear vertical main connections)				
≤ 60 °C	A	4000	5000	--
≤ 70 °C	A	4000	5000	--
For rear vertical main connections				
≤ 55 °C	A	4000	5000	5920
≤ 60 °C	A	4000	5000	5810
≤ 70 °C	A	4000	5000	5500
Power loss at I_n with 3-phase symmetrical load, complete device (3-pole / 4-pole)				
Fixed-mounted	W	520	630	900
Withdrawable	W	810	1050	1600

6.3.4.4 Switching times, endurance (operating cycles)

3WA13		AC		
		4000 A	5000 A	6300 A
Switching times				
Make time	ms	35	35	35
Opening time	ms	34	34	34
Electrical make time (through closing coil)	ms	80 / 50 1)	80 / 50 1)	80 / 50 1)
Electrical opening time (through shunt trip)	ms	80 / 50 2)	80 / 50 2)	80 / 50 2)
Electrical opening time (through instantaneous undervoltage release)	ms	80 3)	80 3)	80 3)
Opening time through electronic trip unit	ms	50	50	50
1) Make time through short-time excited closing coil (5% OP) 2) Opening time through short-time excited shunt trip (5% OP) 3) Opening time with short-time-delayed undervoltage release: 200 ms				
Endurance (operating cycles)				

3WA13			AC		
			4000 A	5000 A	6300 A
Breaking capacity H					
Mechanical		Without maintenance	7500	7500	7500
		With maintenance [4)]	15000	15000	15000
Electrical		Without maintenance ≤ 690 V	2000	2000	2000
		With maintenance [4)]	15000	15000	15000
Breaking capacity C [5)]					
Mechanical		Without maintenance	5000	5000	5000
		With maintenance [4)]	10000	10000	10000
Electrical		Without maintenance ≤ 690 V	1000	1000	1000
		With maintenance [4)]	10000	10000	10000
Breaking capacity E [5)]					
Mechanical		Without maintenance	5000	5000	5000
		With maintenance [4)]	10000	10000	10000
Electrical		Without maintenance ≤ 690 V	1000	1000	1000
		Without maintenance ≤ 1000 V	1000	1000	1000
		Without maintenance ≤ 1500 V	500	500	500
		With maintenance [4)]	10000	10000	10000
[4)] Maintenance means: Replace main contacts and arc chutes (see Chapter Inspection and maintenance (Page 359)) [5)] The main contact elements can only be replaced in the factory.					
Switching frequency [6)]					
Breaking capacity H and C					
Electrical	3-pole		60 / h	60 / h	60 / h
	4-pole		60 / h	60 / h	60 / h
Breaking capacity E					
Electrical	≤ 1150 V	3-pole	60 / h	60 / h	60 / h
		4-pole	60 / h	60 / h	60 / h
[6)] Minimum interval time between two operations					

6.3.4.5 Minimum cross-sections of main conductors

3WA13	AC		
	4000 A	5000 A	6300 A
Minimum cross-sections of main conductors			
Copper bars, bare or painted black	4 x 100 mm x 10 mm	6 x 100 mm x 10 mm	6 x 120 mm x 10 mm

6.3.5 Connection options for auxiliary conductor plug-in system

Auxiliary conductors (copper, max. number of auxiliary conductors × cross-section (solid/stranded))	
Push-in connections as standard	
Without end sleeve	2 × 0.5 ... 2.5 mm² (AWG 20 ... 14)
With end sleeve acc. to DIN 46228 Part 2	2 × 0.5 ... 2.5 mm² (AWG 20 ... 14)
With end sleeve acc. to DIN 46228 Part 4	2 × 0.5 ... 1.5 mm² (AWG 20 ... 16)
With twin end sleeve	2 × 0.5 ... 1.5 mm² (AWG 20 ... 16)
Stripped length	10 ... 11 mm (0.39 ... 0.43 inch)
Connections with screw terminals as an option	
Without end sleeve	2 × 0.5 ... 2.5 mm² (AWG 20 ... 14)
With end sleeve acc. to DIN 46228 Part 2	1 × 0.5 ... 1.5 mm² (AWG 20 ... 16)
With end sleeve acc. to DIN 46228 Part 4	2 × 0.5 ... 1.5 mm² (AWG 20 ... 16)
With twin end sleeve	1 × 0.5 ... 1.5 mm² (AWG 20 ... 16)
Stripped length	7 ... 8 mm (0.28 ... 0.31 inch)
Position signaling switch module	
Spring-loaded terminal connections for standard signaling contacts	
Without end sleeve	0.08 ... 2.5 mm² (AWG 20 ... 12)
With end sleeve acc. to DIN 46228 Part 2	0.25 ... 1.5 mm² (AWG 20 ... 16)
Stripped length	5 ... 6 mm (0.2 ... 0.24 inch)
Push-in technology for standard signaling contacts (from 01/2023)	
Solid	0.5 ... 2.5 mm² (AWG 20 ... 12)
Finely stranded with end sleeve	0.5 ... 1.5 mm² (AWG 20 ... 16)
Stripped length	10 ... 12 mm (0.39 ... 0.47 inch)
Push-in connections for communication signaling contacts	
Without end sleeve	0.14 ... 1.5 mm² (AWG 20 ... 16)
With end sleeve acc. to DIN 46228 Part 2	0.25 ... 1.5 mm² (AWG 20 ... 16)
Stripped length	9 mm (0.35 inch)

6.4 Ambient conditions

Note

You can find information about derating in Chapter Derating in the power distribution equipment (Page 486).

The 3WA circuit breakers are intended for operation in closed rooms and for stationary use.

Ambient temperature

The ambient temperatures specified in Chapter Technical specifications of 3WA circuit breakers (Page 461) for storage and operation of the circuit breakers must be observed. Please also note with respect to operation that the display of the electronic trip unit ETU600 switches off at temperatures below -25 °C and above +60 °C.

Degree of pollution

The 3WA circuit breakers can be operated according to IEC 61010 at ambient conditions with pollution degree 3.

Environmental conditions acc. to IEC 60721-3

Stress	Storage IEC 60721-3-1	Transport[1)] IEC 60721-3-2	Stationary use IEC 60721-3-3
Climatic	1K5 [2), 3)]	2K2	3K6 [2), 4)]
Biological	1B2	2B2	3B2
Chemical	1C2 [5)]	2C1	3C3 [5)]
Particles / dirt	1S2 [6)]	2S1	3S2 [7)]
Mechanical	1M2	2M2 [8)]	3M6 [9)]

1) If the ambient conditions exceed the specified values during transport, the protection of the device must be ensured by the packaging.

2) With the following restrictions:
- Condensation only occasionally
- No precipitation
- No spray water from other sources
- Humidity: 10 ... 95% rel. humidity

3) Upper limit temperature extended to 80 °C.

4) With the following restrictions:
- No ice formation
- Upper temperature limit of +70 °C permissible with reduced performance data.
- With air pressure < 90 kPa: Reduced performance data

5) No salt spray

6) Sand must not get into the devices.

7) As [6)] and with the highest requirements regarding contact reliability Class 3S1

8) Maximum drop height: 0.3 m

9) The device remains operational. Undisturbed operation under load is not guaranteed in every case.

6.5 Installation altitudes

The low air density at installation altitudes above 2000 m can reduce heat dissipation. This results in increased temperatures on the switching devices. The arcing behavior and the conductivity of the density-dependent ionized gas mixture are also less favorable at greater altitudes.

The following are reduced as a result:

- Operational voltage
- Operational current
- Short-time current
- Short-circuit breaking capacity

Maximum values of circuit breaker depending on installation altitude

<table>
<tr><th colspan="2">Installation altitude up to</th><th>2000 m</th><th>2500 m</th><th>3000 m</th><th>3500 m</th><th>4000 m</th><th>4500 m</th><th>5000 m</th></tr>
<tr><td>Max. operational voltage</td><td>% of U_e</td><td>100</td><td>94</td><td>89</td><td>83</td><td>78</td><td>73</td><td>68</td></tr>
<tr><td>Max. operational current</td><td>% of I_n</td><td>100</td><td>99</td><td>98</td><td>96</td><td>94</td><td>92</td><td>90</td></tr>
<tr><td>Max. short-time current</td><td>% of I_{cw}</td><td>100</td><td colspan="2">99</td><td>98</td><td>97</td><td>96</td><td>95</td></tr>
<tr><td>Short-circuit breaking capacity</td><td>% of I_{cu}</td><td>100</td><td colspan="2">99</td><td>98</td><td>97</td><td>96</td><td>95</td></tr>
</table>

6.6 Standards

The 3WA circuit breaker complies with the following standards:

- IEC 60947-2 / EN 60947-2 (emission limits according to CISPR 11 (Group 1/Class B) and CISPR 32 (Class B))
- IEC 60692-2-5 / EN 60692-2-5
- ETSI EN 301 489-17 (only circuit breakers with radio function)
- ETSI EN 301 328 (only circuit breakers with radio function)
- EN IEC 63000

6.7 Approvals

The 3WA circuit breaker has received the following product approvals, wireless approvals, and marine/shipbuilding certifications.

General product approvals

- VDE
- CE
- UKCA
- EAC
- CCC
- C-Tick

Shipbuilding certifications

- GL (Germanischer Lloyd)
- LRS (Lloyds Register)
- BV (Bureau Veritas)
- DNV (Det Norske Veritas)
- RMRS (Russian Maritime Register)
- PRS (Polski Rejestr Statków)
- ABS (American Bureau of Shipping)
- CCS (China Classification Society)

Wireless approvals

- ANATEL
  The 3WA circuit breaker contains the ETU600 electronic trip unit certified by ANATEL under the number 01201-23-01556.

ANATEL
01201-23-01556

"Este equipamento não tem direito à proteção contra interferência prejudical e não pode causar interferência em sistemas devidamente autorizados."

You will find the certificates on the internet (https://support.industry.siemens.com/cs/ww/en/ps/3WA1/cert).

6.8 Failure probability acc. to B10 and B10d

Endurance

The listed B10 values are based on the maximum electrical operating cycles without maintenance.

The following values are valid for the endurance of the 3WA circuit breakers:

Frame size 1 AC:

	Frame size 1						
	630 A	**800 A**	**1000 A**	**1250 A**	**1600 A**	**2000 A**	**2500 A**
Breaking capacity N ≤ 690 V AC							
Electrical operating cycles without maintenance	10000	10000	10000	10000	10000	7500	5000
B10 values	10000	10000	10000	10000	10000	7500	5000
B10d values	20000	20000	20000	20000	20000	15000	10000
Breaking capacity S ≤ 690 V AC							
Electrical operating cycles without maintenance	10000	10000	10000	10000	10000	7500	5000
B10 values	10000	10000	10000	10000	10000	7500	5000
B10d values	20000	20000	20000	20000	20000	15000	10000
Breaking capacity M ≤ 690 V AC							
Electrical operating cycles without maintenance	10000	10000	10000	10000	10000	7500	5000
B10 values	10000	10000	10000	10000	10000	7500	5000
B10d values	20000	20000	20000	20000	20000	15000	10000
Breaking capacity E at 690 V AC							
Electrical operating cycles without maintenance	10000	10000	10000	10000	10000	7500	5000
B10 values	10000	10000	10000	10000	10000	7500	5000
B10d values	20000	20000	20000	20000	20000	15000	10000
Breaking capacity E at 1000 V AC							
Electrical operating cycles without maintenance	1000	1000	1000	1000	1000	1000	1000
B10 values	1000	1000	1000	1000	1000	1000	1000
B10d values	2000	2000	2000	2000	2000	2000	2000

Frame size 2 AC:

	Frame size 2			
	2000 A	**2500 A**	**3200 A**	**4000 A**
Breaking capacity S and M ≤ 690 V AC				
Electrical operating cycles without maintenance	7500	7500	4000	2000
B10 values	7500	7500	4000	2000
B10d values	15000	15000	8000	4000
Breaking capacity H ≤ 690 V AC				
Electrical operating cycles without maintenance	7500	7500	4000	2000
B10 values	7500	7500	4000	2000
B10d values	15000	15000	8000	4000
Breaking capacity C ≤ 690 V AC				

	Frame size 2			
	2000 A	2500 A	3200 A	4000 A
Electrical operating cycles without maintenance	5000	5000	4000	1000
B10 values	5000	5000	4000	1000
B10d values	10000	10000	8000	2000
Breaking capacity E at 690 V AC				
Electrical operating cycles without maintenance	7500	7500	4000	2000
B10 values	7500	7500	4000	2000
B10d values	15000	15000	8000	4000
Breaking capacity E at 1000 V AC				
Electrical operating cycles without maintenance	1000	1000	1000	1000
B10 values	1000	1000	1000	1000
B10d values	2000	2000	2000	2000
Breaking capacity E at 1150 V AC				
Electrical operating cycles without maintenance	500	500	500	500
B10 values	500	500	500	500
B10d values	1000	1000	1000	1000

Frame size 2 DC:

	Frame size 2		
	2000 A	2500 A	3200 A
Breaking capacity D ≤ 600 V DC			
Electrical operating cycles without maintenance	6000	6000	6000
B10 values	6000	6000	10000
B10d values	12000	12000	20000
Breaking capacity E ≤ 1000/1500 V DC			
Electrical operating cycles without maintenance	1000	1000	1000
B10 values	1000	1000	10000
B10d values	2000	2000	20000

Frame size 3 AC:

	Frame size 3		
	4000 A	5000 A	6300 A
Breaking capacity H ≤ 690 V AC			
Electrical operating cycles without maintenance	2000	2000	2000
B10 values	2000	2000	2000

	Frame size 3		
	4000 A	5000 A	6300 A
B10d values	4000	4000	4000
Breaking capacity C ≤ 690 V AC			
Electrical operating cycles without maintenance	1000	1000	1000
B10 values	1000	1000	1000
B10d values	2000	2000	2000
Breaking capacity E at 690 V AC			
Electrical operating cycles without maintenance	1000	1000	1000
B10 values	1000	1000	1000
B10d values	2000	2000	2000
Breaking capacity E at 1000 V AC			
Electrical operating cycles without maintenance	1000	1000	1000
B10 values	1000	1000	1000
B10d values	2000	2000	2000
Breaking capacity E at 1150 V AC			
Electrical operating cycles without maintenance	500	500	500
B10 values	500	500	500
B10d values	1000	1000	1000

Premises

The determination of B10/B10d values acc. to IEC 62061 and ISO 13849-1 is based on the following premises:

- The devices comply with product standard IEC 60947-2. They are used according to this standard and operate under undisturbed operating conditions.
  Undisturbed operation can be guaranteed under rated conditions provided the inspection intervals are observed:
  - At least 1 x per year
  - After each short-circuit trip
  - After five overload trips
  - After 1000 rated current trips ≤ 1000 V
  - After 500 rated current trips at 1150 V
  - Additional check of downstream non-automatic circuit breakers
- As stipulated in ISO 13849-2, D.3, Table D.2, table row "Overdimensioning" and IEC 62061, 6.7.9.2.2, Notes 1 and 2, the devices are subjected to underload such that the current conducted through the switching contacts is less than half the rated current I_n.
- It is assumed that the circuit breakers will only be integrated in a safety function via an undervoltage release (closed-circuit principle).

- B10 corresponds to the electrical endurance.
- The percentage of critical failures is 50% acc. to ISO 13849-1, Table C.1, Note 1.
- The B10d value is therefore calculated as: B10 / 0.5 = 2 x B10.

A lifetime (= T1 value) of 20 years is assumed.
According to ISO 13849-1, 3.1.28, 4.5.4 and C.4.2, the lifetime is the period which covers the specified use of the device and during which the failure rate is regarded as constant.

6.9 Electromagnetic compatibility

The use of specific devices in an industrial environment can result in electromagnetic interference in the electrical installation.
The 3WA circuit breaker and the accessories are tested for electromagnetic compatibility (EMC) according to IEC/EN 60947-2.
The CISPR 11 (Group 1/Class B) and CISPR 32 (Class B) emission limits are observed.

Integration in power distribution equipment 7

7.1 Compact design

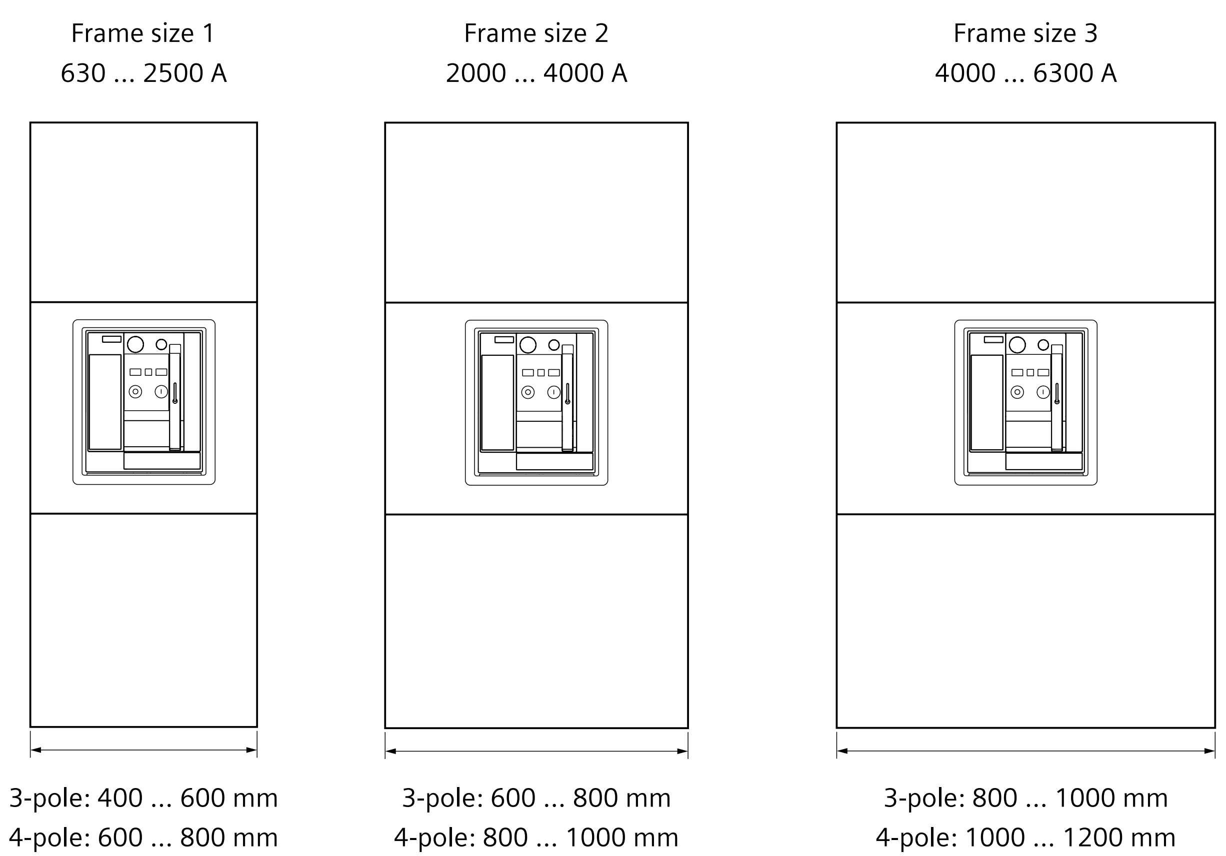
The 3WA circuit breaker makes it possible to build compact power distribution equipment thanks to its compact design. For example, frame size 1 devices - up to 2500 A - fit into a 400 mm wide control panel. In addition to the three compact 3WA circuit breaker frame sizes, the 3WL10 circuit breaker is also available for rated currents up to 1250 A.

The 3-pole version of the frame size 3 3WA circuit breaker is the smallest device of its kind (information correct in 2022). With its mounting width of 704 mm, it fits into an 800 mm wide control panel.

The compact design and consequently optimized, reduced panel widths result in cost savings with respect to:

- Copper bars (shorter main busbars)
- Control panel profiles
- Paneling and internal separation
- Installation in the control cabinet (lower space requirement)

Control panel widths when using 3WA circuit breakers



7.2 Influencing factors

The power distribution equipment design and the installation and ambient conditions can have a significant effect on the circuit breaker.

The following installation situations take into account the most important factors affecting the circuit breaker:

- Type of power distribution equipment
- Degree of protection of the power distribution equipment
- Shape of internal separation according to IEC 61439
- Location of busbars in the power distribution equipment (e.g. at the rear, top or bottom)
- Number of devices that are installed and connected in the same control panel at the same time
- Connection type (e.g. horizontal or vertical)
- Ambient temperature
- Type of mounting of circuit breaker (fixed-mounted or withdrawable)

For more information on the ratings in the power distribution equipment, see Chapter Overview (Page 486).

7.3 Derating in the power distribution equipment

7.3.1 Overview

The following tables provide information about the rating of the 3WA circuit breaker within the power distribution equipment. The data presented here is a summary of computer simulations and tests actually performed. They represent guide values for both fixed-mounted and withdrawable breakers.

Note

The derating specifications are not a replacement for an integration test according to IEC 61439.

The derating values were determined within the following constraints:

- Minimal conductor cross-section of copper busbars, as specified in the 3WA catalog
- Control panels with internal separation according to shape 4
- Installed power loss of 100 W provided for auxiliary and control components in the control panel

If copper busbars with a greater cross-section or control panels with internal separation up to shape 2b are used, the derating values improve significantly.

7.3.2 Derating 3WA11

The following tables show the derating for size 1, installed in a control panel.

Note

The 3WA11 2500 A circuit breaker is currently (status in 2022) not yet integrated in the Siemens power distribution equipment. The derating values are therefore not yet available for installation of the size 1 3WA circuit breaker 2500 A in the power distribution equipment.

Fixed-mounted, IP31/IP41 - ventilated

Control panel dimensions H x W x D [mm]: 2200 x 600 x 600 (1 circuit breaker), 2200 x 600 x 800 (2 circuit breakers or 3 circuit breakers ≤ 1000 A), 2200 x 600 x 1200 (3 circuit breakers ≤ 1600 A)									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
630 A	1 x 60 mm x 10 mm	1	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		2	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		3	630 A	630 A	630 A	630 A	630 A	630 A	630 A
800 A	1 x 60 mm x 10 mm	1	800A	800A	800A	800A	800A	800A	800A
		2	800A	800A	800A	800A	800A	800A	800A
		3	800A	800A	800A	800A	800A	800A	800A
1000 A	1 x 60 mm x 10 mm	1	1000A	1000A	1000A	1000A	1000A	1000A	1000A
		2	1000A	1000A	1000A	1000A	1000A	1000A	1000A
		3	1000 A	1000 A	1000 A	1000 A	1000 A	1000 A	985 A
1250 A	2 x 40 mm x 10 mm	1	1250 A	1250 A	1250 A	1250 A	1250 A	1250 A	1250 A
		2	1250 A	1250 A	1250 A	1250 A	1250 A	1250 A	1250 A
		3	1250 A	1250 A	1250 A	1250 A	1250 A	1250 A	1210 A
1600 A	2 x 50 mm x 10 mm	1	1600 A	1600 A	1600 A	1600 A	1600 A	1600 A	1600 A
		2	1600 A	1600 A	1600 A	1580 A	1540 A	1500 A	1460 A
		3	1600 A	1570 A	1530 A	1500 A	1460 A	1420 A	1390 A
2000 A	3 x 50 mm x 10 mm	1	2000 A	2000 A	2000 A	2000 A	1980 A	1930 A	1890 A
		2	2000 A	2000A	1980 A	1940 A	1890 A	1840 A	1790 A

Fixed-mounted, IP55

Control panel dimensions H x W x D [mm]: 2200 x 600 x 600 (1 circuit breaker), 2200 x 600 x 800 (2 circuit breakers or 3 circuit breakers ≤ 1000 A), 2200 x 600 x 1200 (3 circuit breakers ≤ 1600 A)									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
630 A	1 x 60 mm x 10 mm	1	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		2	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		3	630 A	630 A	630 A	630 A	630 A	630 A	630 A
800 A	1 x 60 mm x 10 mm	1	800 A	800 A	800 A	800 A	800 A	800 A	800 A
		2	800 A	800 A	800 A	800 A	800 A	800 A	800 A
		3	800 A	800 A	800 A	800 A	800 A	800 A	800 A
1000 A	1 x 60 mm x 10 mm	1	1000 A	1000 A	1000 A	1000 A	1000 A	1000 A	1000 A
		2	1000 A	1000A	960 A	925 A	890 A	855 A	820 A
		3	960 A	925 A	890 A	855 A	820 A	795 A	755 A
1250 A	2 x 40 mm x 10 mm	1	1250 A	1250 A	1250 A	1250 A	1250 A	1230 A	1200 A
		2	1250 A	1250 A	1250 A	1230 A	1200 A	1170 A	1140 A
		3	1250 A	1230 A	1200 A	1170 A	1140 A	1110 A	1070 A
1600 A	2 x 50 mm x 10 mm	1	1600 A	1600 A	1600 A	1560 A	1520 A	1480 A	1450 A
		2	1500 A	1450 A	1400 A	1350 A	1300 A	1250 A	1200 A
		3	1400 A	1350 A	1300 A	1250 A	1200 A	1150 A	1090 A
2000 A	3 x 50 mm x 10 mm	1	2000 A	2000 A	1920 A	1840 A	1760 A	1680 A	1590 A
		2	1920 A	1840 A	1760 A	1680 A	1590 A	1500 A	1410 A

Withdrawable, IP31/IP41 - ventilated

Control panel dimensions H x W x D [mm]: 2200 x 600 x 600 (1 circuit breaker), 2200 x 600 x 800 (2 circuit breakers or 3 circuit breakers ≤ 1000 A), 2200 x 600 x 1200 (3 circuit breakers ≤ 1600 A)									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
630 A	1 x 60 mm x 10 mm	1	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		2	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		3	630 A	630 A	630 A	630 A	630 A	630 A	630 A
800 A	1 x 60 mm x 10 mm	1	800 A	800 A	800 A	800 A	800 A	800 A	800 A
		2	800 A	800 A	800 A	800 A	800 A	800 A	800 A
		3	800 A	800 A	800 A	800 A	800 A	800 A	800 A
1000 A	1 x 60 mm x 10 mm	1	1000 A	1000 A	1000 A	1000 A	1000 A	1000 A	1000 A
		2	1000 A	1000 A	1000 A	1000 A	985 A	960 A	935 A
		3	1000 A	1000 A	985 A	960 A	935 A	905 A	875 A

Control panel dimensions H x W x D [mm]: 2200 x 600 x 600 (1 circuit breaker), 2200 x 600 x 800 (2 circuit breakers or 3 circuit breakers ≤ 1000 A), 2200 x 600 x 1200 (3 circuit breakers ≤ 1600 A)									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
1250 A	2 x 40 mm x 10 mm	1	1250 A	1250 A	1250 A	1250 A	1250 A	1250 A	1250 A
		2	1250 A	1250 A	1250 A	1250 A	1210 A	1170 A	1130 A
		3	1250 A	1250 A	1210 A	1170 A	1130 A	1090 A	1050 A
1600 A	2 x 50 mm x 10 mm	1	1600 A	1600 A	1600 A	1600 A	1600 A	1550 A	1510 A
		2	1540 A	1500 A	1460 A	1420 A	1390 A	1350 A	1320 A
		3	1460 A	1420 A	1390 A	1350 A	1320 A	1280 A	1240 A
2000 A	3 x 50 mm x 10 mm	1	1980 A	1930 A	1890 A	1840 A	1790 A	1740 A	1690 A
		2	1890 A	1840 A	1790 A	1740 A	1690 A	1640 A	1590 A

Withdrawable, IP55

Control panel dimensions H x W x D [mm]: 2200 x 600 x 600 (1 circuit breaker), 2200 x 600 x 800 (2 circuit breakers or 3 circuit breakers ≤ 1000 A), 2200 x 600 x 1200 (3 circuit breakers ≤ 1600 A)									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
630 A	1 x 60 mm x 10 mm	1	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		2	630 A	630 A	630 A	630 A	630 A	630 A	630 A
		3	630 A	630 A	630 A	630 A	630 A	630 A	630 A
800 A	1 x 60 mm x 10 mm	1	800 A	800 A	800 A	800 A	800 A	800 A	800 A
		2	800 A	800 A	800 A	800 A	800 A	800 A	800 A
		3	800 A	800 A	800 A	800 A	800 A	780 A	750 A
1000 A	1 x 60 mm x 10 mm	1	1000 A	1000 A	1000 A	1000 A	1000 A	1000 A	985 A
		2	890 A	855 A	820 A	795 A	755 A	710 A	665 A
		3	820 A	795 A	755 A	710 A	665 A	615 A	560 A
1250 A	2 x 40 mm x 10 mm	1	1250 A	1230 A	1200 A	1170 A	1140 A	1110 A	1070 A
		2	1200 A	1170 A	1140 A	1110 A	1070 A	1030 A	1000 A
		3	1140 A	1110 A	1070 A	1030 A	1000 A	960 A	930 A
1600 A	2 x 50 mm x 10 mm	1	1520 A	1480 A	1450 A	1410 A	1370 A	1330 A	1290 A
		2	1300 A	1250 A	1200 A	1150 A	1090 A	1030 A	965 A
		3	1200 A	1150 A	1090 A	1030 A	965 A	895 A	815 A
2000 A	3 x 50 mm x 10 mm	1	1760 A	1680 A	1590 A	1500 A	1400 A	1300 A	1190 A
		2	1590 A	1500 A	1400 A	1300 A	1190 A	1090 A	1000 A

7.3.3 Derating 3WA12

The following tables show the derating for size 2, installed in a control panel.

Fixed-mounted, IP31/IP41 - ventilated

Control panel dimensions H x W x D [mm]: 2200 x 800 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
2000 A	3 x 50 mm x 10 mm	1	2000 A	2000 A	2000 A	2000 A	2000 A	2000 A	1970 A
		2	2000 A	2000 A	2000 A	2000 A	1960 A	1910 A	1870 A
2500 A	2 x 100 mm x 10 mm	1	2500 A	2500 A	2500 A	2500 A	2500 A	2440 A	2380 A
		2	2500 A	2500 A	2480 A	2430 A	2380 A	2330 A	2270 A
3200 A	3 x 100 mm x 10 mm	1	3200 A	3200 A	3200 A	3200 A	3140 A	3070 A	3000 A
		2	3200 A	3120 A	3040 A	2960 A	2880 A	2820 A	2750 A
4000 A	4 x 120 mm x 10 mm	1	4000 A	4000 A	4000 A	3930 A	3860 A	3790 A	3720 A

Note

When the 3WA12 circuit breaker is used in the range I_n ≤ 1600 A, no derating needs to be considered.

Fixed-mounted, IP55

Control panel dimensions H x W x D [mm]: 2200 x 800 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
2000 A	3 x 50 mm x 10 mm	1	1910 A	1870 A	1830 A	1790 A	1750 A	1710 A	1670 A
		2	1830 A	1790 A	1750 A	1710 A	1670 A	1630 A	1590 A
2500 A	2 x 100 mm x 10 mm	1	2300 A	2250 A	2200 A	2150 A	2100 A	2050 A	2000 A
		2	2290 A	2230 A	2170 A	2110 A	2050 A	1990 A	1920 A
3200 A	3 x 100 mm x 10 mm	1	2900 A	2840 A	2780 A	2720 A	2660 A	2600 A	2530 A
		2	2540 A	2480 A	2420 A	2360 A	2300 A	2250 A	2200 A
4000 A	4 x 120 mm x 10 mm	1	3720 A	3650 A	3580 A	3510 A	3440 A	3370 A	3300 A

Note

When the 3WA12 circuit breaker is used in the range I_n ≤ 1250 A, no derating needs to be considered.

Withdrawable, IP31/IP41 - ventilated

Control panel dimensions H x W x D [mm]: 2200 x 800 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
2000 A	3 x 50 mm x 10 mm	1	2000 A	2000 A	1970 A	1920 A	1870 A	1810 A	1760 A
		2	1960 A	1910 A	1870 A	1820 A	1770 A	1720 A	1670 A
2500 A	2 x 100 mm x 10 mm	1	2500 A	2440 A	2380 A	2320 A	2260 A	2190 A	2130 A
		2	2380 A	2330 A	2270 A	2230 A	2150 A	2090 A	2030 A
3200 A	3 x 100 mm x 10 mm	1	3140 A	3070 A	3000 A	2920 A	2840 A	2760 A	2680 A
		2	2880 A	2820 A	2750 A	2670 A	2610 A	2540 A	2460 A
4000 A	4 x 120 mm x 10 mm	1	3860 A	3790 A	3720 A	3650 A	3590 A	3520 A	3450 A

Note

When the 3WA12 circuit breaker is used in the range I_n ≤ 1250 A, no derating needs to be considered.

Withdrawable, IP55

Control panel dimensions H x W x D [mm]: 2200 x 800 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
2000 A	3 x 50 mm x 10 mm	1	1750 A	1710 A	1670 A	1630 A	1580 A	1540 A	1490 A
		2	1670 A	1630 A	1590 A	1550 A	1510 A	1460 A	1420 A
2500 A	2 x 100 mm x 10 mm	1	2100 A	2050 A	2000 A	1950 A	1900 A	1840 A	1790 A
		2	2050 A	1990 A	1920 A	1880 A	1790 A	1720 A	1650 A
3200 A	3 x 100 mm x 10 mm	1	2660 A	2600 A	2530 A	2470 A	2400 A	2340 A	2270 A
		2	2300 A	2250 A	2200 A	2140 A	2080 A	2020 A	1960 A
4000 A	4 x 120 mm x 10 mm	1	3440 A	3370 A	3300 A	3230 A	3160 A	3090 A	3020 A

Note

When the 3WA12 circuit breaker is used in the range I_n ≤ 1250 A, no derating needs to be considered.

7.3.4 Derating 3WA13

The following tables show the derating for size 3, installed in a control panel.

Fixed-mounted, IP31/IP41 - ventilated

Control panel dimensions H x W x D [mm]: 2200 x 1000 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
4000 A	4 x 100 mm x 10 mm	1	4000 A	4000 A	4000 A	4000 A	3980 A	3890 A	3800 A
5000 A	6 x 100 mm x 10 mm	1	5000 A	5000 A	5000 A	5000 A	5000 A	5000 A	5000 A
6300 A	6 x 120 mm x 10 mm	1	6100 A	5990 A	5880 A	5770 A	5660 A	5550 A	5440 A

Fixed-mounted, IP55

Control panel dimensions H x W x D [mm]: 2200 x 1000 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
4000 A	4 x 100 mm x 10 mm	1	3190 A	3120 A	3050 A	2980 A	2910 A	2840 A	2770 A
5000 A	6 x 100 mm x 10 mm	1	3950 A	3840 A	3730 A	3620 A	3510 A	3400 A	3290 A
6300 A	6 x 120 mm x 10 mm	1	4280 A	4190 A	4100 A	4010 A	3920 A	3830 A	3740 A

Withdrawable, IP31/IP41 - ventilated

Control panel dimensions H x W x D [mm]: 2200 x 1000 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
4000 A	4 x 100 mm x 10 mm	1	3980 A	3890 A	3800 A	3700 A	3600 A	3500 A	3400 A
5000 A	6 x 100 mm x 10 mm	1	5000 A	5000 A	5000 A	4840 A	4670 A	4480 A	4290 A
6300 A	6 x 120 mm x 10 mm	1	5660 A	5550 A	5440 A	5330 A	5220 A	5110 A	4990 A

Withdrawable, IP55

Control panel dimensions H x W x D [mm]: 2200 x 1000 x 800									
Rated current	**Conductor cross-section**	**Number of 3WAs**	**Max. operational current at ambient temperature**						
			20 °C	**25 °C**	**30 °C**	**35 °C**	**40 °C**	**45 °C**	**50 °C**
4000 A	4 x 100 mm x 10 mm	1	2910 A	2840 A	2770 A	2700 A	2630 A	2550 A	2480 A
5000 A	6 x 100 mm x 10 mm	1	3510 A	3400 A	3290 A	3180 A	3070 A	2950 A	2820 A
6300 A	6 x 120 mm x 10 mm	1	3920 A	3830 A	3740 A	3640 A	3550 A	3450 A	3340 A

7.4 Requirement according to IEC 61439

7.4.1 Standard IEC 61439

Standard IEC 61439 describes the design verification for IEC equipment and controlgear assemblies and the responsibilities of the original equipment manufacturer (OEM) or builder.

The IEC 61439 standard consists of several parts:

- The general Part 1 applies to power distribution equipment and power distribution boards, as well as control and switchgear cabinets.
- Part 2 applies to power switchgear and controlgear assemblies.

The 3WA circuit breaker can be flexibly and easily integrated into power distribution equipment according to IEC 61439. The following chapter describes how to integrate the circuit breaker in your power distribution equipment and what you have to watch out for during this procedure.

7.4.2 Simplified integration

7.4.2.1 Structural integration in power distribution equipment

A 3WA circuit breaker can be installed without any testing or structural changes if a 3WL circuit breaker has already been tested in the power distribution equipment.

The technical requirements for this are defined in IEC 61439-1:

- The installation dimensions (terminals, cross-sections and mounting points) remain unchanged.
- The thermal losses and derating values of the circuit breaker are the same or better.
- The arcing spaces are the same size or smaller.
- The required main conductor connection cross-sections remain the same.
- The copper connections stay the same.
- The short-circuit breaking capacity (short circuit values I_{cw}) for the power distribution equipment remain the same.
- The insulation conditions (required clearances and creepage distances) remain the same.
- The EMC classification is the same or higher.
- The mechanical functions and operation remain the same.
- The power distribution equipment design is unchanged.

You can find detailed information in Chapter Checklist for replacing 3WL with 3WA circuit breaker according to IEC 61439-2 (Page 501).

Note

If a 3WL circuit breaker is integrated, no mechanical changes are required for integration of the 3WA circuit breaker.

Checks and tests

A short-circuit test is only necessary when the following two conditions are fulfilled:

- Unlike the existing 3WL circuit breakers with article numbers 3WL....-...3.-.... and 3WL....-... 4.-...., the power distribution equipment is to be adapted to the higher short-circuit breaking capacity of the 3WA circuit breakers.
- The higher values of the 3WL circuit breakers with article numbers 3WL....-...6.-.... and 3WL....-...7.-.... have not been tested yet.

If the power distribution equipment is not designed for the increased short-circuit values, the operator must make structural changes to the switchboard design.

No further tests (e.g. temperature-rise tests and EMC tests) are required.

7.4.2.2 Using 3WA circuit breakers in 3WL guide frames

3WA circuit breakers are compatible with existing 3WL guide frames and are therefore easily integrated in existing power distribution equipment.

Many advanced features of the 3WA circuit breaker are not available when using a 3WL guide frame. Only the specifications of the 3WL circuit breaker are achieved. It is essential that this is taken into consideration before retrofitting 3WA circuit breakers in place of 3WL circuit breakers.

3WA circuit breakers and non-automatic circuit breakers in size 3 and breaking capacity class E cannot be used in a 3WL guide frame. In this case, a new 3WA8 guide frame must be ordered.

Note

When a withdrawable 3WL circuit breaker is replaced at the end of its service life, the guide frame must also be replaced with a 3WA guide frame, see Chapter Retrofit: Simple replaceability in existing power distribution equipment (Page 495).

- Case 1: Expansion reserve
  An empty 3WL guide frame is available in the existing system.
  The operator is installing a 3WA circuit breaker in the existing guide frame.
- Case 2: Stocks of spare parts
  The operator has a 3WL guide frame in his spare parts store and does not want to order a new one.
  The operator only orders a 3WA circuit breaker. This is installed in the 3WL guide frame.

No rewiring is required in the power distribution equipment for electrical accessories which are positioned at secondary disconnect terminal blocks X5 and X6 of the circuit breaker.

Rewiring is necessary when installing accessories positioned at secondary disconnect terminal blocks X7 and X8.

7.4.2.3 Retrofit: Simple replaceability in existing power distribution equipment

Turning old into new

The term retrofit refers to modification of the electrical installation of existing power distribution equipment whereby old devices are replaced with new devices at the end of their service life. Please note: When a withdrawable circuit breaker is replaced at the end of its service life, both the circuit breaker and the guide frame must be replaced.

Prerequisites for retrofit according to IEC 61439-1

A 3WL circuit breaker can be replaced by a 3WA circuit breaker according to IEC 61439 without any additional testing or structural changes if the 3WA is to be operated with the same technical requirements as the 3WL.

The following criteria must be fulfilled in order to be able to replace the circuit breakers in a retrofit procedure:

- Certification available with respect to compliance of power distribution equipment with standards at the time of commissioning (e.g. according to DIN VDE 0660, Part 500)
- Assessment of possible change of use
- The rated and short-circuit currents of the system are not increased.
- Ambient conditions are not changed.
- The feed-in power is not increased (no photovoltaics, cogeneration units or electrical energy stores are added).

If the prerequisites are fulfilled, the advantages are as follows:

- No modification (e.g. no change when connecting the door or copper bars)
- No EMC tests
- No temperature-rise tests
- No short-circuit tests

Note

The technical requirements defined according to IEC 61439-1 must also be fulfilled here, see Chapter Structural integration in power distribution equipment (Page 493).

Two-step retrofit

The retrofit combines extremely easy integration of the 3WA circuit breakers into the power distribution equipment with short downtime and high system availability. The retrofit only requires two steps:

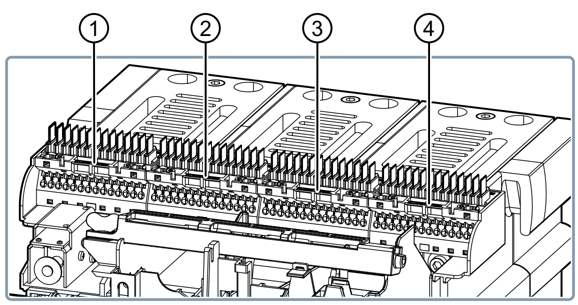
1. Remove the 3WL circuit breaker and 3WL guide frame from the existing power distribution equipment.
2. Install the 3WA circuit breaker and 3WA guide frame in the existing power distribution equipment.

Important information about replacing the 3WL with a 3WA

Secondary disconnect terminal wiring

The use of new functions (e.g. DAS+ Dynamic Arc-Flash Sentry) changes the assignment of the secondary disconnect terminals for the 3WA circuit breaker compared with the 3WL circuit breaker.

No rewiring is required in the power distribution equipment for electrical accessories which are positioned at secondary disconnect terminal blocks X5 and X6 of the circuit breaker. Rewiring is necessary when installing accessories positioned at secondary disconnect terminal blocks X7 and X8.



(1) Secondary disconnect terminal block X8
(2) Secondary disconnect terminal block X7
(3) Secondary disconnect terminal block X6
(4) Secondary disconnect terminal block X5

The wiring for the following electrical accessory components remains the same (connection via secondary disconnect terminal blocks X5 and X6):

- Spring charging motor
- Closing coil
- First auxiliary release
- Second auxiliary release
- Ready-to-close signaling switch
- Auxiliary contacts for switch position

- CubicleBUS[2] connection
- 24 V DC connection

New wiring is necessary for the following electrical accessory components (connection via secondary disconnect terminal blocks X7 and X8):

- First trip alarm switch
- Second trip alarm switch
- External voltage transformer
- External current sensors for N conductor
- External ground fault transformer
- Remote trip alarm reset coil
- Local electric close
- Spring charged signaling switch

You can find the new wiring in Chapter Circuit diagrams (Page 389).

Note

Changed performance data for shunt trips and closing coils

The performance data of shunt trips (ST) and closing coils (CC) have changed.

When performing a retrofit from 3WL to 3WA, check the technical specifications regarding the supply of these auxiliary circuits (see tables below) as well as the function of the shunt trips (ST) and closing coils (CC).

Closing coil / shunt trip 100% duty cycle									
AC / DC [V]	3WL article number 13th digit		3WL article number 14th digit		3WL article number 15th digit		3WL circuit breaker Z option	Closing power [W]	Opera-tional power [W]
	CC (Y1) 100% duty cy-cle	or	ST (F1) 100% duty cy-cle	or	ST2 (F2) 100% duty cy-cle	or	CC (Y1) 100% duty cy-cle		
24			B		B		M21	40	8
30			C		C		M22		
48			D		D		M23		
60			E		E		M24		
110	2, 5		F		F		M25		
220	3, 4		G		G		M26		

Closing coil / shunt trip 100% duty cycle					
AC [V]	DC [V]	3WL accessory article number (discontinued) 3WL9111-...	3WA accessories article number 3WA9111-...	Closing power [W]	Opera-tional power [W]
--	24	...-0AD01-0AA0	...-0AD02	40	8
	30	...-0AD02-0AA0			
--	48	...-0AD03-0AA0	...-0AD04		
	60	...-0AD04-0AA0			
110...127	110...125	...-0AD05-0AA0	...-0AD05		
208...240	220...250	...-0AD06-0AA0	...-0AD06		

Closing coil / shunt trip 5% duty cycle				
AC / DC [V]	3WL circuit breaker Z option	or	3WL circuit breaker Z option	Closing power [W]
	CC (Y1) 5% duty cycle		ST (F1) 5% duty cycle	
24	M31		M41	200
48	M33		M43	
110	M35		M45	250
220	M36		M46	

Closing coil 5% duty cycle				
AC [V]	DC [V]	3WL accessory article number (discontinued) 3WL9111-...	3WA accessories article number 3WA9111-...	Closing power [W]
--	24...30	...-0AD11-0AA0	...-0AD12	200
--	48...60	...-0AD12-0AA0	...-0AD14	
110...127	110...125	...-0AD13-0AA0	...-0AD15	250
208...240	220...250	...-0AD14-0AA0	...-0AD16	

Shunt trip 5% duty cycle				
AC [V]	DC [V]	3WL accessory article number (discontinued) 3WL9111-...	3WA accessories article number 3WA9111-...	Closing power [W]
--	24...30	...-0AD11-0AA0	...-0AD22	200
--	48...60	...-0AD12-0AA0	...-0AD24	
110...127	110...125	...-0AD13-0AA0	...-0AD25	250
208...240	220...250	...-0AD14-0AA0	...-0AD26	

Changing the rated-current coding

Note

The information in this section applies exclusively to the following cases:

- Retrofit of a 3WL1 circuit breaker in frame size 1 with breaking capacity S
  - Article number 3WL11..-**3**..**3**.-.... (3-pole)
  - Article number 3WL11..-**3**..**4**.-.... (4-pole)

  or
- Use in a 3WL1 guide frame
  - Article number 3WL9211-**1B**...-....
  - Article number 3WL9211-**2B**...-....

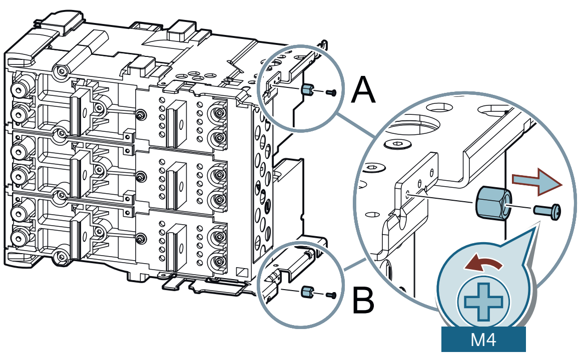
Changing the rated-current coding is only permitted in these special retrofit cases. In all other cases, the coding must not be changed.

In the event of the retrofit of a 3WL1 circuit breaker in frame size 1 with breaking capacity S or use in a 3WL1 guide frame, which is either installed in the control panel as an expansion reserve or still in storage, the rated-current coding must be adapted in addition to adapting the secondary disconnect terminal wiring.

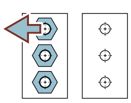
If an upgraded 3WL1 upgrade circuit breaker / non-automatic circuit breaker or guide frame is already in use, this modification is not necessary:

- Article numbers of 3WL1 circuit breaker upgrade
  - 3WL11..-**3**..**6**.-.... (3-pole)
  - 3WL11..-**3**..**7**.-.... (4-pole)
- Article numbers of 3WL1 guide frame upgrade
  - 3WL9211-**1G**...-.... (≲ 1000 A)
  - 3WL9211-**2G**...-.... (1250 A to 1600 A)

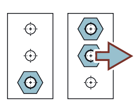
In order to adapt the rated-current coding, one coding pin must be removed from each of the 3WA11 circuit breakers with breaking capacity S (article number 3WA11..-3...-....) with rated current I_n = 630 A to 1600 A.



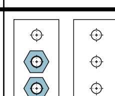
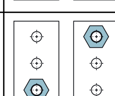
I_n = 630 A ... 1000 A



I_n = 1250 A ... 1600 A



Adapted rated-current coding of 3WA11 circuit breaker with breaking capacity S:

Frame size	Breaking capacity; max. rated current	Coding terminals Circuit breaker A B
1	S; ≤ 1000 A	
	S; ≤ 1600 A	

CubicleBUS² modules

The functionality of the 3WA circuit breaker can be extended by means of integrated CubicleBUS² modules, e.g. communication and input/output modules. If the modules are integrated in the circuit breaker, the height of the circuit breaker increases by 23 mm.

Remedy:
The CubicleBUS² modules can also be positioned externally on a DIN rail, see Chapter

Mounting adapter for CubicleBUS² modules (Page 356). With this solution, a 3WA circuit breaker has the same height as a 3WL circuit breaker.

Note

Existing CubicleBUS modules of the 3WL circuit breaker must be replaced with 3WA CubicleBUS² modules.

The 3WL CubicleBUS and 3WA CubicleBUS² modules are not compatible.

7.4.2.4 Checklist for replacing 3WL with 3WA circuit breaker according to IEC 61439-2

Integration of the 3WA circuit breaker instead of the 3WL circuit breaker is possible without testing provided the following criteria are fulfilled:

- The rated current does not change.
- The rated short-time withstand current I_{cw} of the power distribution equipment does not change.
- All the points in the following checklist can be answered with "Yes".

The power distribution equipment is referred to as the reference design in the checklist.

No.	Factors to be considered	Answer for 3WA instead of 3WL
1	Is the rated value for the short-circuit strength of each circuit of the switchgear and controlgear assembly to be tested less than or equal to that of the reference design?	Yes
2	Are the cross-section dimensions of the busbars and the connections of each circuit of the switchgear and controlgear assembly to be tested greater than or equal to those of the reference design?	Yes
3	Are the centerline spacings of the busbars and the connections of each circuit of the switchgear assembly to be tested greater than or equal to those of the reference design?	Yes
4	Are the busbar holders of each circuit of the switchgear and controlgear assembly to be tested of the same type, of the same form and of the same material as the reference design? Do they have the same or a smaller centerline spacing over the length of the busbar as the reference design? Does the support structure for the busbar holder have the same design and mechanical strength?	Yes
5	Are the materials and the material properties of the conductors of each circuit of the switchgear and controlgear assembly to be tested the same as those of the reference design?	Yes
6	Are the short-circuit protection devices of each circuit of the switchgear and controlgear assembly to be tested equivalent, i.e. same manufacturer and same series[1)] with the same or better current-limiting properties (I^2t, I_{pk}) based on information from the device manufacturer, and is their arrangement identical to that of the reference design?	Yes

No.	Factors to be considered	Answer for 3WA instead of 3WL
7	Is the length of the unprotected active conductors according to standard IEC 61439-2 of each unprotected circuit of the switchgear and controlgear assembly to be tested less than or equal to that of the reference design?	Yes
8	Switchgear and controlgear assembly with enclosure to be tested: Does the reference design also take an enclosure into account during verification testing?	Yes[2)]
9	Is the enclosure of the switchgear and controlgear assembly to be tested identical in design and type to that of the reference design? Are its dimensions at least the same?	Yes[2)]
10	Is the compartment of each circuit of the switchgear and controlgear assembly to be tested identical to the mechanical design of the reference design? Are their dimensions at least the same?	Yes[2)]

1) Short-circuit protective devices from the same manufacturer, but from a different series may be regarded as equivalent if the device manufacturer confirms that the behavioral properties are the same or better in every relevant respect as those of the series used for verification (e.g. breaking capacity, current-limiting properties (I^2t, I_{pk}) and critical spacings).

2) The circuit breaker requires no changes provided the rated current and breaking capacity remain the same.

- If you can answer "Yes" to all the points in the checklist, you can replace the 3WL circuit breaker with a 3WA circuit breaker without any further verification.
- If you answer "No" to one or more of the points in the checklist, you must provide further verification with respect to the integrity of the power distribution equipment in order to replace the 3WL circuit breaker with a 3WA circuit breaker.

Note

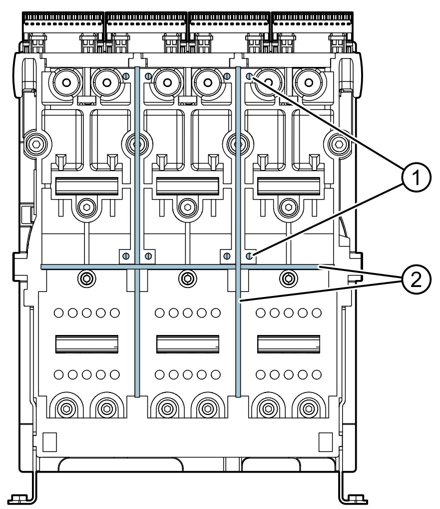
Observe the instructions for partitions in Chapter Phase barriers and horizontal partitions (Page 502).

7.5 Phase barriers and horizontal partitions

Functional safety is assured up to a nominal voltage of 1150 V AC without phase barriers or horizontal partitions on the 3WA circuit breaker. In the event of special requirements, phase barriers may be installed by the customer to act as arcing fault barriers.

Mounting phase barriers/horizontal partitions as arcing fault barriers

1. Fabricate the phase barriers/horizontal partitions using the following materials:
   – NEMA GPO-3 material, minimum thickness 2.3 mm (0.91 in), max. 4.0 mm (0.16 in) (e.g. G-Etronax PM GPO-3 from Isola AG)
   – Or similar material: e.g. Durapol FR-HA2 from Isola AG
2. Insert the phase barriers/horizontal partitions into the grooves on the rear of the fixed-mounted circuit breakers or guide frames.
3. Screw the inserted phase barriers/horizontal partitions into the mounting holes, see graphic below.
   Proceed as follows: Tighten the screws until the screw head makes contact. Then tighten the screws with a torque of 1.2 ± 0.2 Nm.

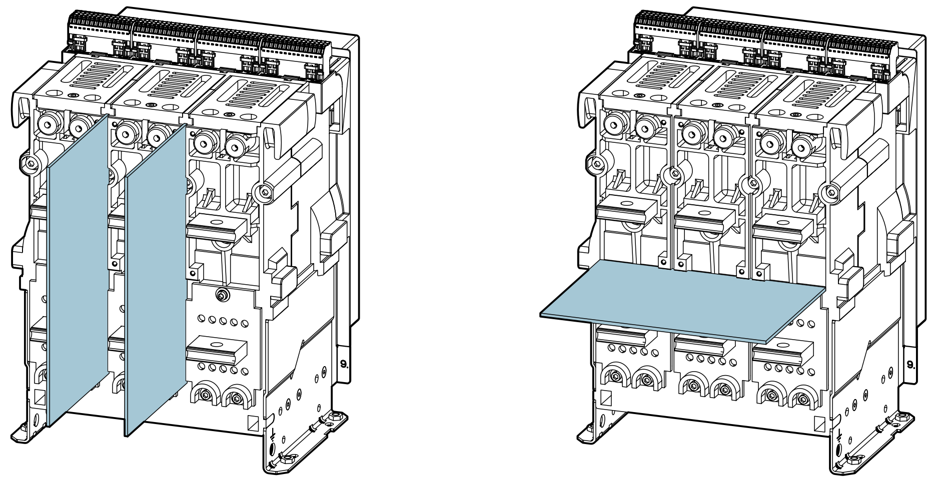


(1) 8 mounting holes for self-tapping screws (Ø 4.2 mm, max. screw-in depth 16 mm)
(2) Guide groove, width: 4 mm (0.16 in)

Observe the spacing to live parts on the rear panel of the circuit breaker.
Perform an insulation test of the switchgear prior to commissioning.
Do not use conductive material for phase barriers or partitions.

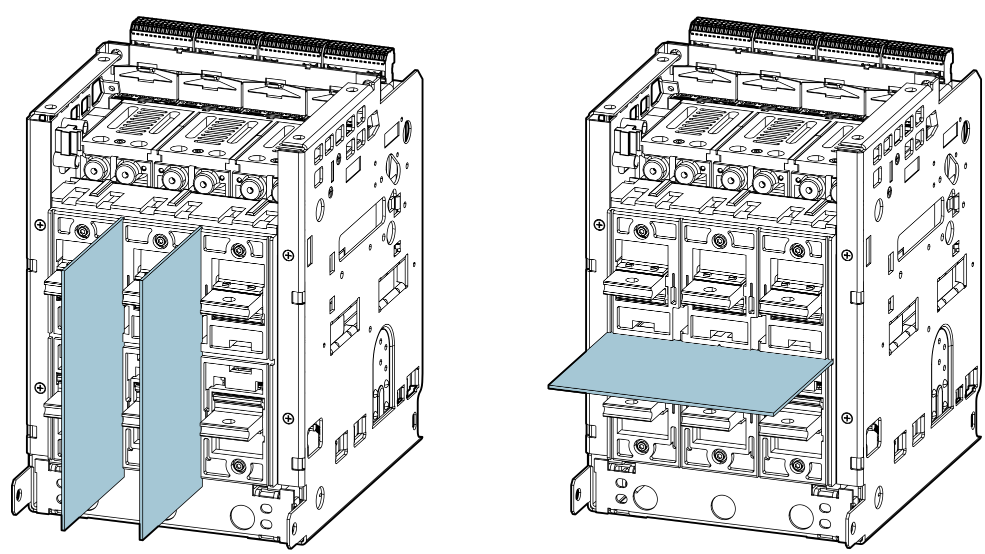
Fixed-mounted**:**

Vertical Horizontal



Withdrawable:

Vertical Horizontal



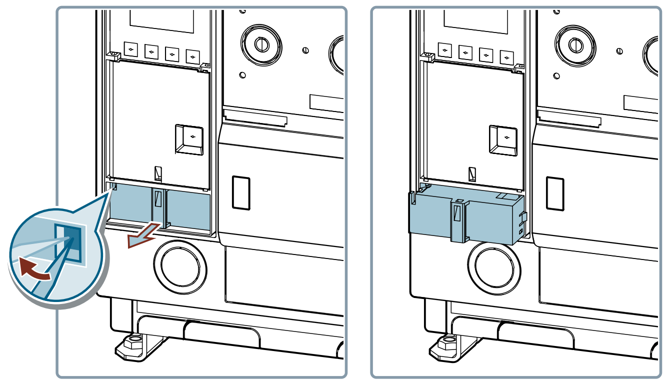
7.6 Insulation test of the power distribution equipment

Note

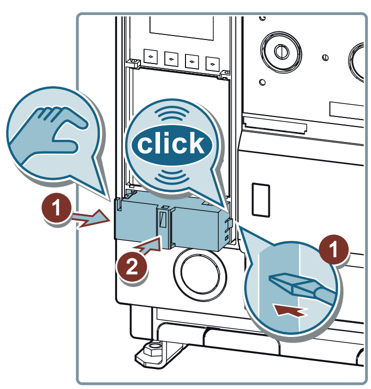
An insulation test must be performed according to IEC 60364-6 / DIN VDE 0100-600 before power distribution equipment is commissioned.

In the case of circuit breakers with an internal voltage tap, the insulation test requires that the connections of the voltage tap module (VTM) be isolated before performing the test. This is achieved by pulling the voltage tap module from the lower part of the electronic trip unit.

Remove voltage tap module (VTM)



Insert voltage tap module (VTM)



7.7 Main connection

The circuit breaker can either be fed from the upper or the lower connection terminals. Changing the infeed connection has no effect on the technical specifications of the circuit breaker.

Note

Installation of voltage taps when metering function is configured

If a metering function is configured, the voltage taps should be installed on the infeed side. This means that information about the operational voltage is still available when the circuit breaker is open.

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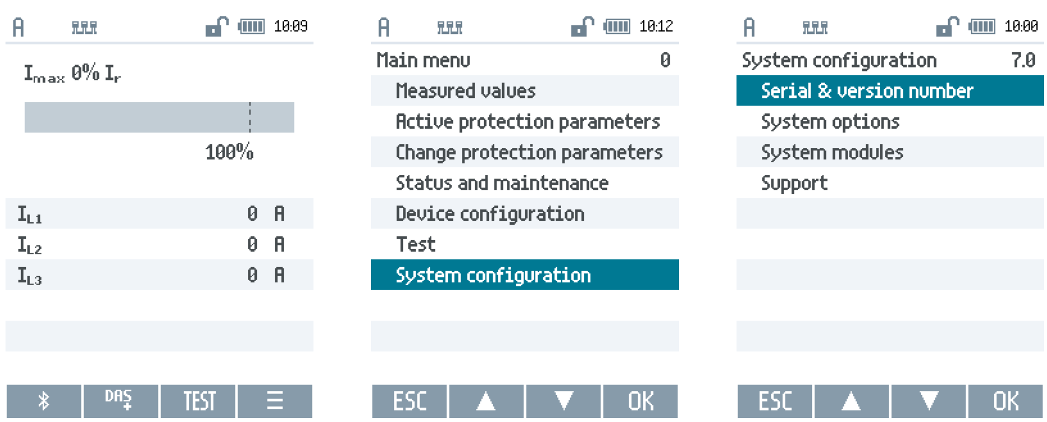
8 Troubleshooting

8.1 Introduction

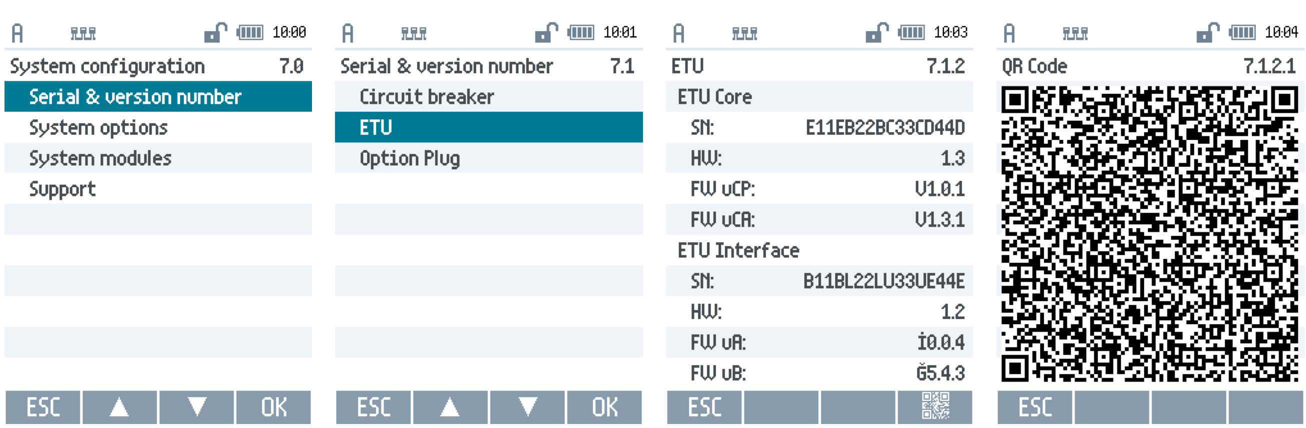
Faults in the circuit breaker, the electronic trip unit and the communications modules are described in this chapter.

Should it not be possible to rectify a fault, a Support Request (www.siemens.com/support-request) can be submitted. The ID number of the circuit breaker is required for this purpose. The ID number can be found on the operator panel of the circuit breaker, see Chapter Rating und accessory labels of circuit breaker (Page 35).

When contacting us about a fault in the electronic trip unit ETU600 or in CubicleBUS[2] modules that are connected to it, the name and development status of the hardware and firmware must be specified. These details can be viewed on the ETU600 display by calling up menu 7.0. They are displayed in plain text and in the form of a QR code and can be read out and transmitted using a QR code reader for forwarding to Support.

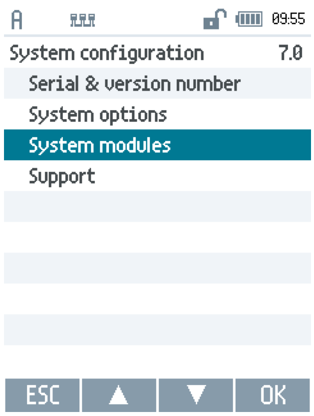


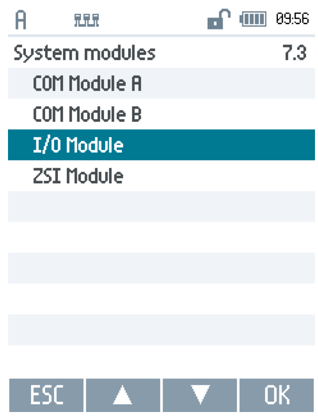
The ID number of the circuit breaker and the development status of the ETU600 or option plug are displayed in menu 7.1.



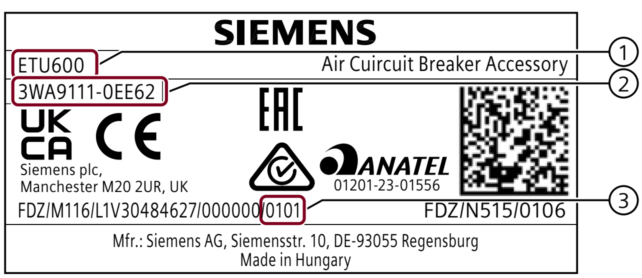
The serial and version numbers of the ETU detected by the QR code reader are displayed in the format "SN:E11EB22BC33CD44D;HW:01.03;FW uCP:86.01.00.01;FW uCA:86.01.03.01;SN:B11BL22LU33UE44E;HW:01.02;FW uA:01.00.00.04;FW uB:02.05.04.03;".

The details of the CubicleBUS^2 modules are displayed in menu 7.3.





The designation, the article number and the development status of the hardware and firmware is also shown on the rating plate of the accessory component.



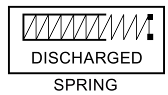
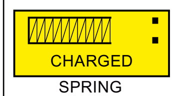
(1) Designation

(2) Article number

(3) Development status of the hardware and firmware

8.2 Troubleshooting for circuit breaker

General troubleshooting

Fault	Cause	Remedy
Circuit breaker cannot be closed: Circuit breaker is not ready to close.	Stored-energy spring is not charged. 	Charge the stored-energy spring. 
	The undervoltage release is not energized.	Connect the undervoltage release to the power supply.
	Mechanical reclosing lockout is active.	Eliminate the trip cause by the electronic trip unit and press the reset button.
	Electrical closing lockout is active.	Disconnect the control voltage of the closing lockout.[1)]
	The O / OPEN button is locked with padlocks (accessory).	Remove the padlocks.[1)]
	The O / OPEN button is locked with a safety lock (accessory).	Release the O / OPEN button.[1)]
	The emergency OPEN button is locked in the OPEN position (accessory).	Unlock the emergency OPEN button (turn in the counterclockwise direction).[1)]
	The lock to prevent closing when the control cabinet door is active (accessory).	Close the control cabinet door.
	Mechanical interlocking is active (accessory).	Open the interlocked circuit breaker or rack it to the disconnected position.[1)]
	Electronic trip unit is incorrectly installed.	Install the electronic trip unit correctly.
	The shunt trip is energized.	Switch off the shunt trip.
	Closing coil is energized.	Disconnect the closing coil from the control voltage for a short time.
Circuit breaker cannot be closed: Circuit breaker is ready for operation.	The control voltage of the closing coil is incorrect or not present.	Check the control voltage.

1) Safety device. The safety measure can only be removed after it has been checked that this is operationally permissible.

Troubleshooting for fixed-mounted circuit breaker

Fault	Cause	Remedy
Circuit breaker cannot be closed electrically: Circuit breaker is ready for operation.	The auxiliary supply connectors are unplugged.	Plug in the auxiliary supply connectors.
The control cabinet door cannot be opened (door interlocking as accessory).	Closing the circuit breaker locks the control cabinet door.	Open the circuit breaker. [1)]

1) Safety device. The safety measure can only be removed after it has been checked that this is operationally permissible.

Troubleshooting for withdrawable circuit breaker

Fault	Cause	Remedy
The circuit breaker cannot be switched from the "ABS" (absent) position to the disconnected position.	The racking mechanism is not in the disconnected position.	Rack the racking mechanism to the disconnected position (green position indicator).
The circuit breaker cannot be inserted in the guide rails.	The factory coding of the circuit breaker and the guide frame do not match.	Use the circuit breaker as indicated on the guide frame.
When you rack the circuit breaker from the disconnected position to the test position, the circuit breaker does not move for the first six rotations approximately.	Not a fault, function-related.	Continue racking.
The racking handle cannot be pulled out for racking.	The circuit breaker is closed.	Press the O / OPEN button and lift the racking handle lock.[1)]
	The control cabinet door is not completely closed (racking lock as accessory).	Close the control cabinet door.
The racking handle cannot be reinserted.	The racking handle is locked.	Rack the circuit breaker to the disconnected, test or connected position. Unlock the racking handle and insert it such that it is flush.
The control cabinet door cannot be opened (door interlocking as accessory).	The circuit breaker is in the connected position.	Rack the circuit breaker to the test or disconnected position.[1)]

[1)] Only permissible if the main circuit may be interrupted.

8.3 Troubleshooting for the electronic trip unit

Errors and warnings are indicated via the INFO LED on the electronic trip unit. In addition, the electronic trip unit ETU600 displays information in the event of a fault on the display.

Electronic trip unit ETU300

Fault	Cause	Remedy
ACT LED does not flash when the main contacts are closed.	Electronic trip unit is not activated; the operational current via the main contacts is too low.	Increase the operational current.

Fault	Cause	Remedy
Circuit breaker trips and INFO LED lights up red.	Error in protection processor	Replace the electronic trip unit.
	Recurring error in the analog measuring circuit	
	Error in option plug	Replace the option plug.
	Option plug not approved or missing	Check the technical specifications of the option plug and replace if necessary.

Fault	Cause	Remedy
INFO LED lights up red.	Error in application processor	Replace the electronic trip unit.
	Error in analog measuring circuit or watchdog error	
	Current sensor Rogowski coil defective	Replace all current sensors of the circuit breaker.
	External current sensor for neutral conductor not connected or terminating resistor not set.	Connect the external current sensor for the neutral conductor or the terminating resistor to X8.9 and X8.10. Alternatively, a wire jumper can be used for termination.
	Current sensor (Rogowski coil) for neutral conductor defective	Replace the current sensor for the neutral conductor.
	Upper/lower temperature limit of electronic trip unit violated	Replace the electronic trip unit.
	BIM error	SIEMENS Service required, replace circuit breaker if necessary.
	Rotary coding switch of the electronic trip unit defective	Turn the rotary coding switch by 720° and check whether this rectifies the error, use the "e.SET" position if necessary, replace the electronic trip unit if necessary.
	Indication of trip cause faulty	Replace the electronic trip unit.
INFO LED lights up yellow.	Current sensor energy cores defective	Replace all current sensors of the circuit breaker.
	90% of limit temperature of electronic trip unit reached	Decrease temperature load.

Electronic trip unit ETU600

Fault	Cause	Remedy
ACT LED does not flash when the main contacts are closed.	Electronic trip unit is not activated; the operational current via the main contacts is too low.	An external power supply from an external 24 V DC power supply or the VTM680 voltage tap module is required for activating the electronic trip unit ETU600 below the activation limit.
Internal self-test cannot be started.		
ACT LED flashes; the display is dark.	The ambient temperature is outside the range -25 °C to 60 °C.	Implement suitable measures to change the ambient temperature.
	The operational current is close to the activation limit of the ETU within a narrow range. The protective function is already activated, but not the display; see Chapter Activation limits and power supply (Page 71).	The display is automatically activated when the load is greater. If this occurs frequently: Connect the ETU600 to the external 24 V DC power supply.
No tripping during internal self-test with tripping operation.	The main contacts of the circuit breaker are not closed.	Close the main contacts.
	Tripping solenoid F5 is defective.	Contact Siemens Service.

Fault	Cause	Remedy
Connection between electronic trip unit and SENTRON powerconfig configuration software cannot be made via the USB-C interface or Bluetooth.	Bluetooth and USB-C interface TUI600 is defective.	Replace the ETU including the TUI600 module.
	Bluetooth is not active.	Activate Bluetooth.
	The TUI600 module is not active because of low energy (only for ETU with its own power supply)	Check power supply of the ETU600.
	USB-A to USB-C connecting cable is used.	USB-C to USB-C connecting cable is used.
Write protection cannot be removed on the display.	PIN code for write protection has been lost.	Reset the PIN code using the SENTRON powerconfig configuration software: 1. Connect powerconfig via USB-C. 2. Call up the menu "Device > Reset > ETU600 password" menu.

Fault	Indication on the display	Cause	Remedy
Circuit breaker trips and INFO LED lights up red.	ETU error, system, contact Service	Error in protection processor	Replace the electronic trip unit.
	ETU error, contact Service	Recurring error in the analog measuring circuit	
	ETU error, option plug, contact Service	Error in option plug	Replace the option plug.
	ETU error, option plug, replace option plug	Option plug not approved or missing	Check the technical specifications of the option plug and replace if necessary.

Fault	Indication on the display	Cause	Remedy
INFO LED lights up red.	ETU error, system, contact Service	Error in application processor	Replace the electronic trip unit.
	ETU error, contact Service	Error in analog measuring circuit or watchdog error	
	ETU error, current sensor [phase], contact Service	Current sensor Rogowski coil defective	Replace all current sensors of the circuit breaker.
	ETU error, current sensor N, contact Service	External current sensor for neutral conductor not connected or terminating resistor not set.	Connect the external current sensor for the neutral conductor or the terminating resistor to X8.9 and X8.10. Alternatively, a wire jumper can be used for termination.
	ETU error, current sensor N, contact Service	Current sensor (Rogowski coil) for neutral conductor defective	Replace the current sensor for the neutral conductor.
	ETU error, limit temperature exceeded, check ETU	Upper/lower temperature limit of electronic trip unit violated	Replace the electronic trip unit.
	ETU error, VTM module, contact Service	Error in voltage tap module VTM	Can occur during insulation testing of the power distribution equipment. Insert the voltage tap module (VTM) correctly or replace if necessary.
	ETU error, firmware update, contact Service	Error during firmware update of electronic trip unit	Repeat the update and replace the electronic trip unit if necessary.
	Circuit breaker error, system, contact Service	BIM error	SIEMENS Service required, replace circuit breaker if necessary.
	ETU error [protective function parameter], contact Service	Rotary coding switch of electronic trip unit defective	Turn the rotary coding switch by 720° and check whether this rectifies the error, use the "e.SET" position if necessary, replace the electronic trip unit if necessary.
	Electronic trip unit error, indication of trip cause, contact Service	Indication of trip cause faulty	Replace the electronic trip unit.
	Circuit breaker error, end of service life reached, replace the main contacts	The circuit breaker has reached the specified number of mechanical operating cycles.	Perform maintenance, replace the main contacts.
	Circuit breaker error, end of service life reached, replace the circuit breaker	The main contacts have reached the end of their mechanical service life.	Replace the circuit breaker.

Fault	Indication on the display	Cause	Remedy
INFO LED lights up yellow.	ETU error, current sensor [phase], contact Service	Current sensor energy cores defective	Replace all current sensors of the circuit breaker.
	ETU warning, battery low, replace battery	Battery low	Replace the battery of the electronic trip unit.
	ETU warning, clock not set, set clock	Time not set	Set the clock of the electronic trip unit.
	ETU warning, limit temperature reached, check ETU	90% of limit temperature of electronic trip unit reached	Decrease temperature load.
	COM module warning, limit temperature exceeded, check module	Ambient temperature above 70 °C	Decrease temperature load.
	Circuit breaker warning, inspection required, perform inspection	Contact erosion of the main contacts requires inspection.	Perform inspection.
	Circuit breaker warning, maintenance required, perform maintenance	Maintenance required due to number of operating cycles.	Perform maintenance, replace the main contacts.
		Contact erosion of the main contacts requires maintenance.	
	ETU warning, frequency, parameterize rated frequency	Parameterized and measured frequencies do not match.	Parameterize the rated frequency.
	IOM230 module warning, module not found, check wiring	The IOM230 module is disconnected from the CubicleBUS².	Check the CubicleBUS² wiring, replace the IOM230 module if necessary.
	IOM230 module warning, error in module, contact Service	Error in IOM230 module	Replace the IOM230 module.
	IOM350 module warning, module not found, check wiring	The IOM350 module is disconnected from the CubicleBUS².	Check the CubicleBUS² wiring, replace the IOM350 module if necessary.
	IOM350 module warning, error in module, contact Service	Error in IOM350 module	Replace the IOM350 module.
	COM module warning, module not found, check wiring	The communications module is disconnected from the CubicleBUS².	Check the CubicleBUS² wiring, replace the communications module if necessary.
	COM module warning, error in module, contact Service	Error in communications module	Replace the communications module.
	BSS200 module warning, module not found, check wiring	The BSS200 module is disconnected from the CubicleBUS².	Check the CubicleBUS² wiring inside the circuit breaker, replace the BSS200 module if necessary.

Fault	Indication on the display	Cause	Remedy
	BSS200 module warning, error in module, contact Service	Error in BSS200 module	Replace the BSS200 module.
	ETU warning, uCA RTC, contact Service	System clock of ETU is not running.	Replace the electronic trip unit.
	TUI600 module warning, module not found, check wiring	The TUI600 module is disconnected from the CubicleBUS^2.	Check the wiring on the rear of the electronic trip unit, replace the TUI600 module if necessary.
	TUI600 module warning, error in module, contact Service	Error in TUI600 module	Replace the TUI600 module.
	ZSI200 module warning, wiring fault, check wiring	Short circuit on ZSI line	Check the wiring of the ZSI line.
	ZSI200 module warning, module not found, check wiring	Module ZSI200 separated from CubicleBUS^2	Check the CubicleBUS^2 wiring, replace the ZSI200 module if necessary.
	ZSI200 module warning, fault in module, contact Service	Error in ZSI200 module	Replace the ZSI200 module.

8.4 Troubleshooting for COM150 / COM 190 communications module

Fault	Cause	Remedy
Network parameters (e.g. IP addresses) cannot be changed during commissioning.	Write protection on the COM module (DIP switch) is active.	Set the slide switch on the communications module to the position (open padlock). For more information, see Chapter Access protection functions (Page 155).
Network parameters (e.g. IP addresses) cannot be changed using SENTRON powerconfig configuration software during commissioning.	Edit mode is inactive by default in the device search (F11) of the SENTRON powerconfig configuration software.	Activate (unlock) edit mode in the device search of the SENTRON powerconfig configuration software.
Circuit breakers cannot be closed/opened via the communication connection.	Remote switching protection is active.	Connect the RSP (remote switching protection) pins on the X62 connector of the communications module. For more information, see Chapter Access protection functions (Page 155).
LEDs flash on one installed communications module, communication is not possible.	Role assignment is incorrect.	The communications module has a slide switch for role A or role B. Assign role A using the slide switch.

Fault	Cause	Remedy
LEDs flash on two installed communications modules, communication is not possible.	Role assignment is incorrect.	The communications module has a slide switch for role A or role B for assigning role A to one module and role B to the other. Remote switching protection and the position signaling switch modules of the withdrawable circuit breaker are connected to the module with role A.
The communications module cannot be started up properly or it reboots sporadically.	The 24 V power supply is not adequately dimensioned.	Use a larger 24 V power supply unit or a separate power supply unit for the communications module.
CubicleBUS² nodes fail sporadically, CubicleBUS² LED (CUB) flashes green sporadically or is continuously lit up green.	Cubicle-BUS² connection is interrupted.	Check the points of contact and connectors of the CubicleBUS² and reconnect, if necessary.
Sporadically, not all circuit breaker data are available.	Cubicle-BUS² is not terminated with a terminating resistor.	Connect the supplied terminating resistor (S, 120 Ω) to the last node of the CubicleBUS².
	Modbus RTU terminating resistor is not installed.	Terminate the last module on the CubicleBUS² with the terminating resistor.
Sporadically, not all circuit breaker data are available, CubicleBUS² LED (CUB) flashes red sporadically or is continuously lit up red.	Disturbance due to high EMC interference	Implement suitable measures to reduce EMC interference.
All LEDs on the communications module flash red.	The communications module has detected faults and is not ready for operation.	Reset the communications module to the factory settings. If the error message persists, replace the communications module.
The communications module cannot be addressed via Modbus TCP.	Access is restricted due to security functions.	Check the security functions.
	Write protection is active.	Set the slide switch on the communications module to the 🔓 position (open padlock). For more information, see Chapter Access protection functions (Page 155).

Disposal 9

9.1 End of maximum service life

When the maximum service life with maintenance is reached, the operator must ensure that the circuit breaker and replaced parts are disposed of properly in accordance with the applicable laws and regulations.

9.2 Disposal of low-voltage circuit breakers

Siemens low-voltage circuit breakers are environmentally sustainable products consisting largely of recyclable materials.

For the purposes of disposal, we recommend dismantling/separation into the following material fractions:

- Metals:
  For forwarding to the recycling facility as mixed scrap
- Plastics:
  Disposal as commercial waste for thermal recycling
- Electronics, insulated cables, motors:
  Recycling by electrical scrap company

Due to the long service life of the Siemens low-voltage circuit breakers, it may be the case that the instructions for disposal are no longer up to date at the time of decommissioning or that other disposal methods are prescribed by national regulations.

The local customer service centers are available at all times to answer questions with respect to disposal.

9.3 Disposal of waste electronic equipment

Disposal of waste electronic equipment

Waste electronic equipment must not be disposed of as unsorted municipal waste, e.g. household waste. When disposing of waste electronic equipment, the current local national/international regulations must be observed.

Disposal of batteries

Batteries must not be disposed of as unsorted municipal waste, e.g. household waste. When disposing of batteries, the current local national/international regulations must be observed.

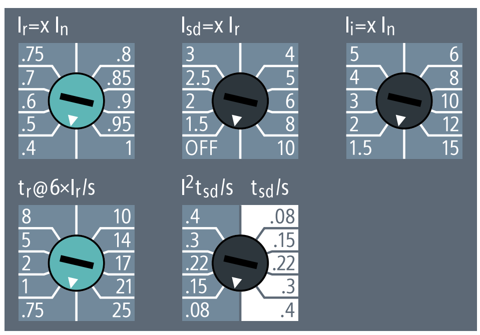
Appendix

A

A.1 Basic settings of the electronic trip unit on delivery

ETU300 electronic trip unit

The rotary coding switches of the ETU300 electronic trip unit have the following settings when delivered ex works.



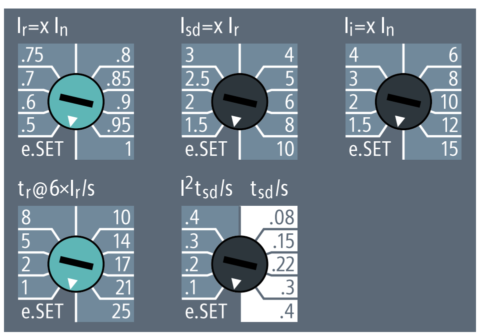
The tables below list the basic settings of the parameter sets for the ETU300 on delivery from the factory.

ETU300 LSI, ETU300 LSIG	
Protective function	**Basic setting**
L: Overload protection LT	
Current setting I_r	0.4 x I_n
Tripping time t_r at 6 x I_r	0.75 s
L: Overload protection LT, neutral conductor	
Current setting I_{rN}	1.0 x I_n
S: Delayed short circuit protection ST	
Current setting I_{sd}	OFF (tripping ST switched off)
Tripping time t_{sd}	0.08 s with ST characteristic: I^2t
I: Instantaneous short-circuit protection INST	
Current setting I_i	1.5 x I_n
Maintenance mode DAS+	
Current setting $I_{i\ DAS+}$	1.5 x I_n
Digital input / output	
Digital ETU input	Activate maintenance mode DAS+.
Digital ETU output	Maintenance mode DAS+

ETU300 LSIG	
Protective function	**Basic setting**
G: Ground-fault protection GF	
Current setting I_g	0.2 x I_n min. 100 A, max. 1200 A
Tripping time t_g	0.2 s

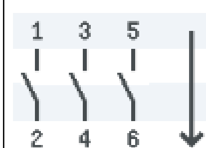
ETU600 electronic trip unit

The rotary coding switches of the ETU600 electronic trip unit have the following settings when delivered ex works.



The tables below list the basic settings of the parameter sets for the ETU600 on delivery from the factory.

ETU600 LSI, ETU600 LSIG, ETU600 LSIG Hi-Z	
Protective function	**Basic setting**
L: Overload protection LT	
Tripping	On
Current setting I_r	0.4 x I_n
Tripping time t_r at 6 x I_r	0.5 s
Characteristic LT curve	I^2t
Thermal memory	Off
Cooling time constant	18 x t_r
Phase failure detection	Off
Overload pre-alarm PAL	Off
Current setting $I_{r\ PAL}$	0.7 x I_r
Delay time $t_{r\ PAL}$	1.0 x t_r
L: Overload protection LT, neutral conductor	
Tripping	Off
Current setting I_{rN}	0.2 x I_n
Current setting $I_{rN\ PAL}$	0.7 x I_N
S: Short-time-delayed short-circuit protection ST	
Tripping	On
Current setting I_{sd}	0.6 x I_n

ETU600 LSI, ETU600 LSIG, ETU600 LSIG Hi-Z	
Protective function	**Basic setting**
Tripping time t_{sd}	0.1 s
Characteristic ST curve	I^0t
Reference point $I_{ST\ ref}$	8
Intermittent detection	Off
S: Directed short-time-delayed short-circuit protection dST (optional)	
Direction setting	Forward 
Tripping FW	Off
Tripping REV	Off
Current setting I_{sd} FW	0.6 x I_n
Current setting I_{sd} REV	0.6 x I_n
Tripping time t_{sd} FW	0.1 s
Tripping time t_{sd} REV	0.1 s
I: Instantaneous short-circuit protection INST	
Tripping	On
Current setting I_i	1.5 x I_n
Reverse power protection RP (optional)	
Tripping	Off
Setting P_{RP}	0.05 x P_n
Tripping time t_{RP}	0.1 s
Maintenance mode DAS+	
Current setting $I_{i\ DAS+}$	1.5 x I_n
Current setting $I_{g\ DAS+}$ (LSIG and LSIG HI-Z versions only)	Depending on the size: • Sizes 1 and 2: 100 A • Size 3: 400 A
Tripping time $t_{g\ DAS+}$	0 s
Digital input / output	
Digital ETU input	Without function
Digital ETU input signal level	Active at HIGH
Digital ETU output	Life contact
Second parameter set (option)	
Parameter set switchover	Parameter set A
Enhanced protective functions EPF (optional)	
Unbalance, harmonic analysis, voltage, power, frequency, phase rotation; For details see Chapter Enhanced protective functions EPF (Page 110)	Off
Zone-selective interlocking ZSI (requires the ZSI200 module)	

ETU600 LSI, ETU600 LSIG, ETU600 LSIG Hi-Z	
Protective function	**Basic setting**
Received signal acts on short-time-delayed short-circuit protection ST	On
Received signal acts on ground-fault protection GF	On
Sends signal on pick-up of short-time-delayed short-circuit protection ST	On
Sends signal on pick-up of ground-fault protection GF	On
Delay t_{ZSI} for short-time-delayed short-circuit protection ST	0.05 s
Delay t_{ZSI} for ground-fault protection GF	0.1 s
Monitoring of the ZSI200 module	Off
Rated voltage U_{LL}	
Size 1, 2, 3 with breaking capacity N/S/M/H/C	690 V AC
Size 1 with breaking capacity E	1000 V AC
Size 2, 3 with breaking capacity E	1150 V AC
Rated frequency f_n	
Sizes 1, 2, 3	50 Hz

ETU600 LSIG	
Protective function	**Basic setting**
G: Ground-fault protection GF	
Tripping	Off
Method of ground-fault detection	Residual
Characteristic GF curve	I^0t
Current setting I_g	Depending on the size: • Sizes 1 and 2: 100 A • Size 3: 400 A
Tripping time t_g	0.1 s
Intermittent detection	Off
G: Ground-fault GF alarm	
Alarm	Off
Current setting $I_{g\ alarm}$	Depending on the size: • Sizes 1 and 2: 100 A • Size 3: 400 A
Alarm time $t_{g\ alarm}$	0 s

ETU600 LSIG Hi-Z	
Protective function	**Basic setting**
Configuration, measurement of ground-fault current	
Shunt resistance	100 Ω
Primary/secondary ratio	1000
G: Ground-fault protection GF Hi-Z	

ETU600 LSIG Hi-Z	
Protective function	**Basic setting**
Tripping	Off
Method of ground-fault detection	Dual Hi-Z
Characteristic GF curve	I^0t
UREF current setting I_g	Depending on the size: • Size 2: 100 A • Size 3: 400 A
UREF tripping time t_g	0.1 s
REF secondary current setting I_g	0.05 A
REF alarm time t_g	0.1 s
Intermittent detection	Off
G: Ground-fault GF alarm	
Alarm	Off
Current setting $I_{g\ alarm}$	Depending on the size: • Size 2: 100 A • Size 3: 400 A
Alarm time $t_{g\ alarm}$	0.1 s

A.2 Time-current characteristic of the ETU300 electronic trip unit

SIEMENS Type: ETU300 3WA1...-..[B/C]..-....

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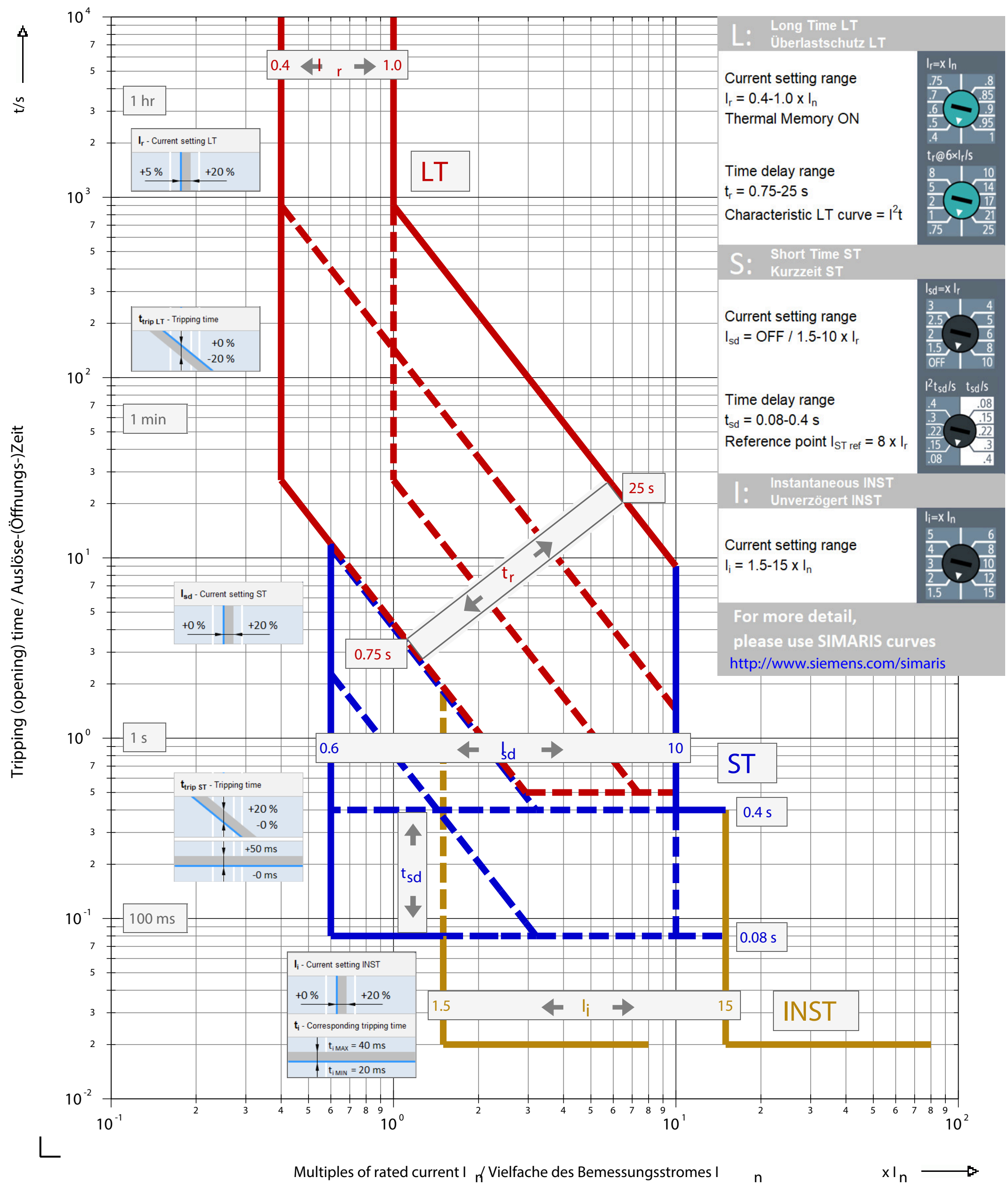
Time Current Characteristic for protective functions LSI using the rotary switches and default settings. IEC 60947-2
Strom-Zeit-Kennlinie für Schutzfunktionen LSI beim Verwenden der Drehkodierschalter und Grundeinstellungen.
Rated current / Bemessungsstrom I_n : 630, 800, 1000, 1250, 1600, 2000, 2500, 3200, 4000, 5000, 6300 A



Drawing number: L1V 308 23 297 001 A DS02
Creation date: 2022-04-22
Latest approval date: 2023-06-23

A.3 Time-current characteristic of the ETU600 electronic trip unit

SIEMENS Type: ETU600 3WA1...-..[E/F/G]..-....

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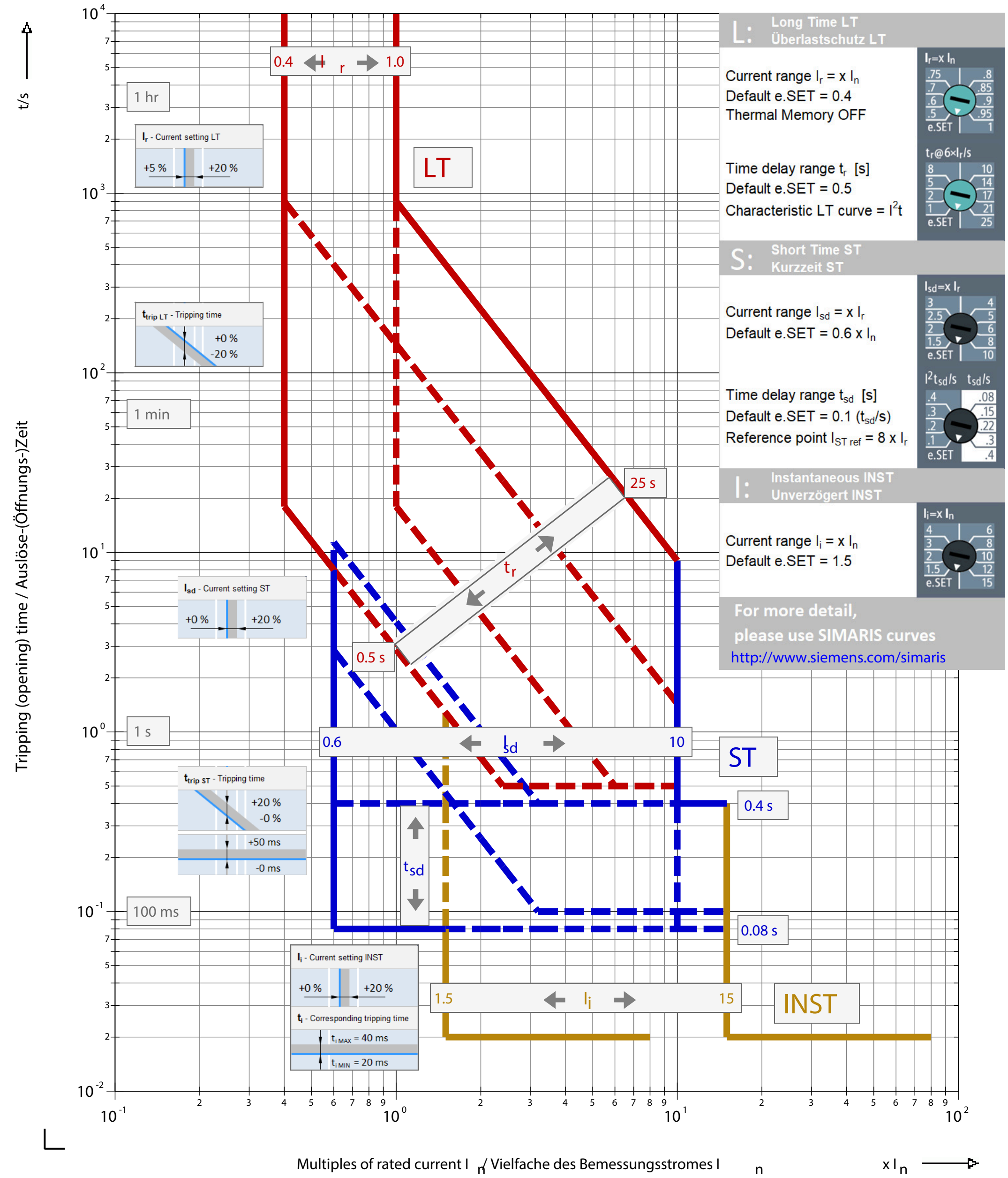
Time Current Characteristic for protective functions LSI using the rotary switches and default settings. IEC 60947-2
Strom-Zeit-Kennlinie für Schutzfunktionen LSI beim Verwenden der Drehkodierschalter und Grundeinstellungen.
Rated current / Bemessungsstrom I_n : 630, 800, 1000, 1250, 1600, 2000, 2500, 3200, 4000, 5000, 6300 A



Drawing number: L1V 308 23 297 000 A DS03
Creation date: 2020-09-16
Latest approval date: 2023-06-23

A.4 Sources for limit value monitoring

The following table lists measured variables and data that can be monitored as limit values 0 to 19. There are no predefined limit values for the sources.

Source	
Current L1	I_{L1}
Current L2	I_{L2}
Current L3	I_{L3}
3-phase average current	I_{avg}
Neutral current	I_N
Ground-fault current Direct	I_g Direct
Ground-fault current Residual	I_g Residual
Ground-fault current Dual UREF	I_g Dual UREF
Ground-fault current Dual REF	I_g Dual REF
Ground-fault current Hi-Z UREF	I_g Hi-Z UREF
Ground-fault current Hi-Z REF sec.	I_g Hi-Z REF sec.
Ground-fault current Hi-Z REF prim.	I_g Hi-Z REF prim.
Current unbalance	I_{bal}
Voltage L1-N	U_{L1N}
Voltage L2-N	U_{L2N}
Voltage L3-N	U_{L3N}
Voltage L1-L2	U_{L1L2}
Voltage L2-L3	U_{L2L3}
Voltage L3-L1	V_{L3L1}
3-phase average voltage L-N	$U_{LN\ avg}$
3-phase average voltage L-L	$U_{LL\ avg}$
Voltage unbalance	U_{bal}
Active power L1	P_{L1}
Active power L2	P_{L2}
Active power L3	P_{L3}
Reactive power L1 (Q1)	Q_{1L1}
Reactive power L2 (Q1)	Q_{1L2}
Reactive power L3 (Q1)	Q_{1L3}
Reactive power L1 (Qn)	Q_{nL1}
Reactive power L2 (Qn)	Q_{nL2}
Reactive power L3 (Qn)	Q_{nL3}
Arithmetic total reactive power	Q_A
Vectorial total reactive power	Q_V
Apparent power L1	S_{L1}
Apparent power L2	S_{L2}
Apparent power L3	S_{L3}
Frequency	f
Power factor L1	PF_{L1}
Power factor L2	PF_{L2}

Source	
Power factor L3	PF_{L3}
Displacement power factor L1	Cos φ L1
Displacement power factor L2	Cos φ L2
Displacement power factor L3	Cos φ L3
THD current L1	THD-I_{L1}
THD current L2	THD-I_{L2}
THD current L3	THD-I_{L3}
THD voltage L1	THD-U_{L1N} [1)]
THD voltage L2	THD-U_{L2N} [1)]
THD voltage L3	THD-U_{L3N} [1)]
THD voltage L1-L2	THD-U_{L1L2} [1)]
THD voltage L2-L3	THD-U_{L2L3} [1)]
THD voltage L3-L1	THD-U_{L3L1} [1)]
Temperature at the circuit breaker (COM150 / COM190 module)	--
Temperature in the circuit breaker (BSS200 module)	--
Total number of operating cycles	--
Electrical operating cycles	--
Mechanical operating cycles	--

1) depending on device configuration, measurement, voltage FFT (line-to-line or line-to-neutral)

A.5 ETU600 menu structure

Main menu

Content	Menu number
Measured values	1.0
Active protection parameters	2.0
Change protection parameters	3.0
Status and maintenance	4.0
Device configuration	5.0
Test	6.0
System configuration	7.0

Measured values

The instantaneous, the minimum and the maximum measured value is provided for each measured value.

Content	Menu number
Measured values	1.0
Current	1.1
Voltage ULN	1.2

Content	Menu number
Voltage ULL	1.3
Active power P, W	1.4
Reactive power Q, VAR	1.5
Apparent power S, VA	1.6
Total power S, P, Q	1.7
Power factor PF	1.8
Cos phi	1.9
Frequency f	1.10
Unbalance %V, %A	1.11
THD I	1.12
THD U_{LN}	1.13
THD U_{LL}	1.14
Active energy kWh	1.15
Reactive energy kvarh	1.16
Apparent energy kVAh	1.17
Temperature	1.18

Active protection parameters

In these menus, the parameters currently used by the electronic trip unit ETU600 for protection are displayed.

Content	Menu number
Active protection parameters	2.0
L: Overload LT	2.1
L: Overload LT Neutral	2.2
S: Short time ST	2.3
S: Direct. short time dST	2.4
I: Instantaneous INST	2.5
G: Ground fault GF Residual	2.6
G: Ground fault GF Direct	2.7
G: Ground fault GF Dual	2.8
G: Ground fault GF Hi-Z	2.9
Reverse power RP	2.11
GF alarm	2.12
DAS+ Dynamic Arc-Flash Sentry	2.13
Zone-selective interlocking ZSI	2.14
Enhanced protective functions EPF	2.15

Change protection parameters

The parameters available for the two parameter sets A and B (option) are listed in Chapter 2.4.6 "Protection parameters".

Content	Menu number
Change protection parameters	3.0
Parameter set A	3.1
Parameter set B	3.2
DAS+ Dynamic Arc-Flash Sentry	3.3
Zone-selective interlocking ZSI	3.4
Enhanced protective functions EPF	3.5

Status and maintenance

Information about the status and any required maintenance of the circuit breaker is provided in these menus.

Content	Menu number
Status and maintenance	4.0
Trip log	4.1
Operating hours	4.2
Operating cycles	4.3
Inspection	4.4
Maintenance	4.5
Reset INFO	4.6

Device configuration

The device must be configured during commissioning. The necessary parameters are set under this menu item.

Content	Menu number
Device configuration	5.0
Grid parameters	5.1
Wiring configuration	5.2
Metering	5.3
Local interfaces	5.4
Display	5.5
Digital Input ETU	5.6
Digital Output ETU	5.7
Module monitoring	5.8
Remote access protection	5.9
System time	5.10

Test

You can use this menu to start the internal self-test of the electronic trip unit.

Content	Menu number
Test	6.0
ETU Self-test	6.2
ETU self-test with tripping operation	6.3
Zone-selective interlocking ZSI	6.4

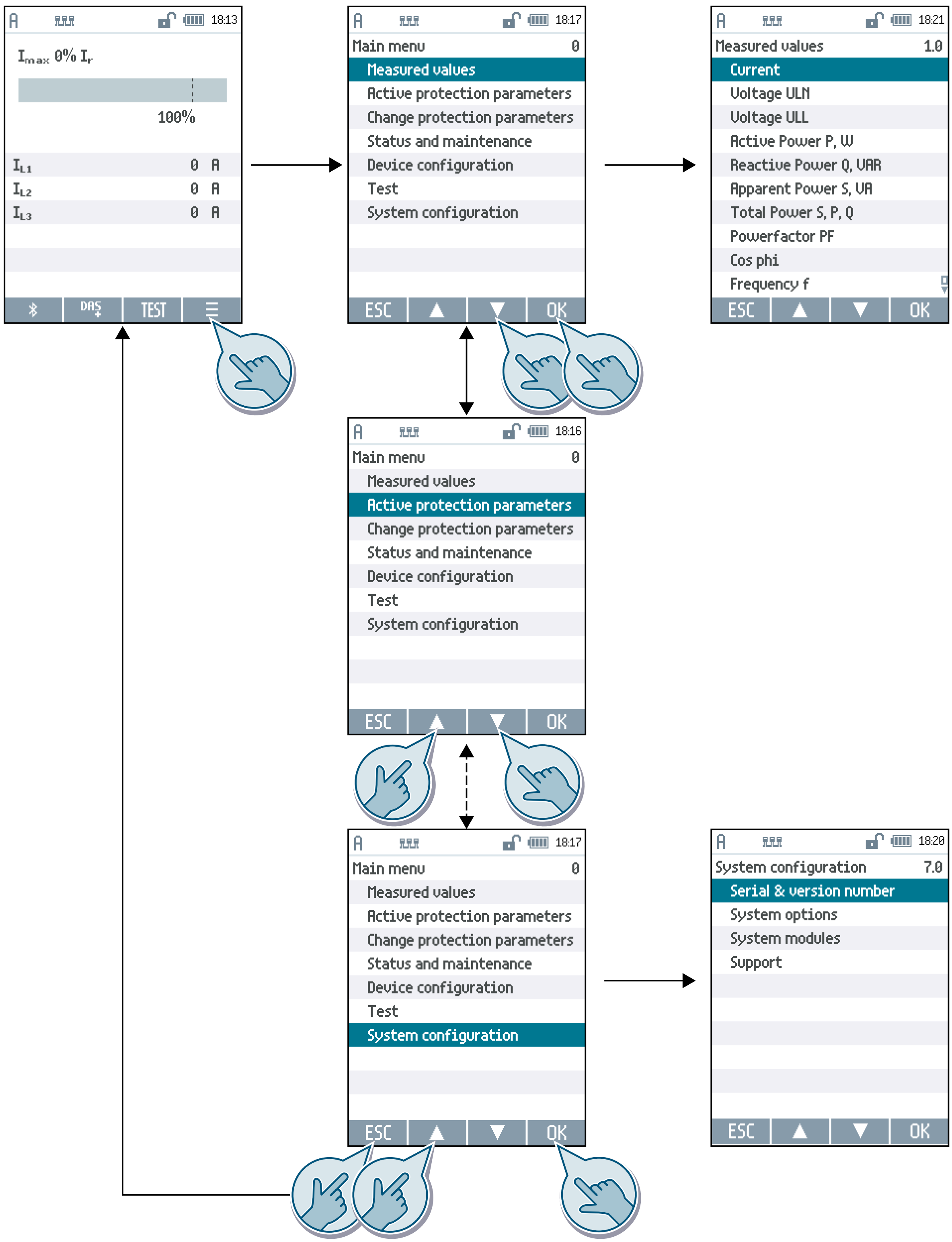
System configuration

Information about the existing system components is specified here.

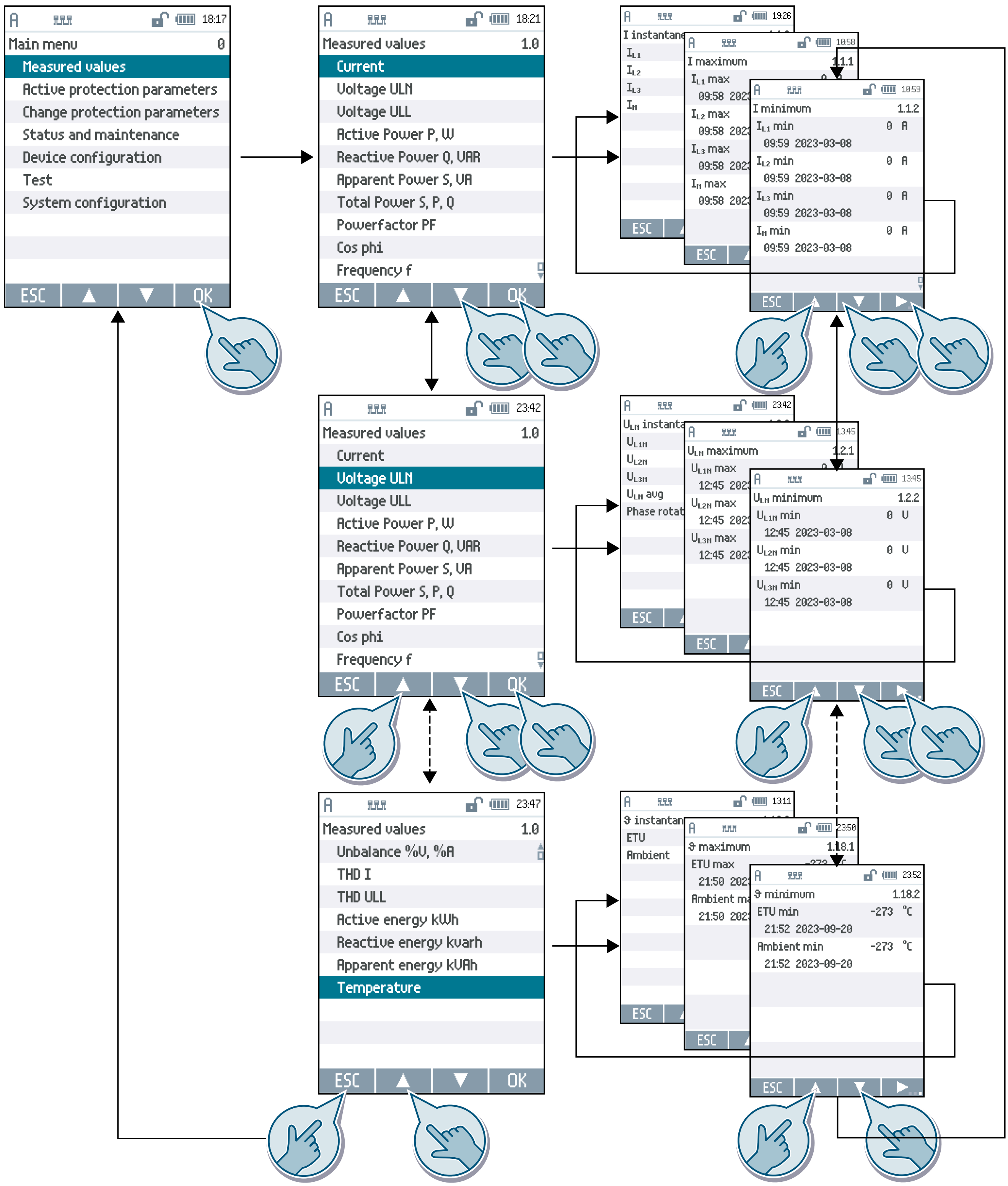
Content	Menu number
System configuration	7.0
Serial & version number	7.1
System options	7.2
System modules	7.3
Support	7.5

Selected screenshots

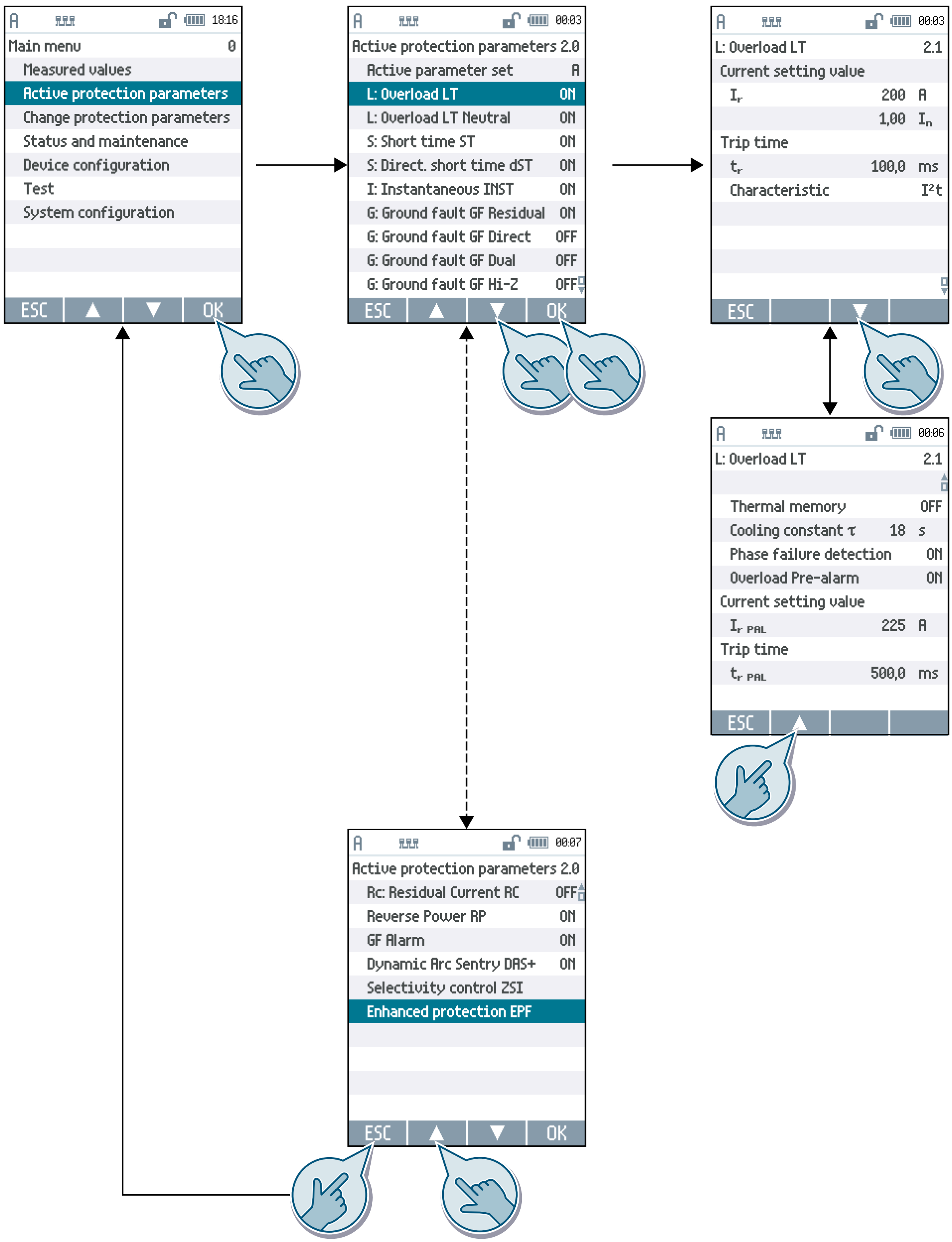
Main menu



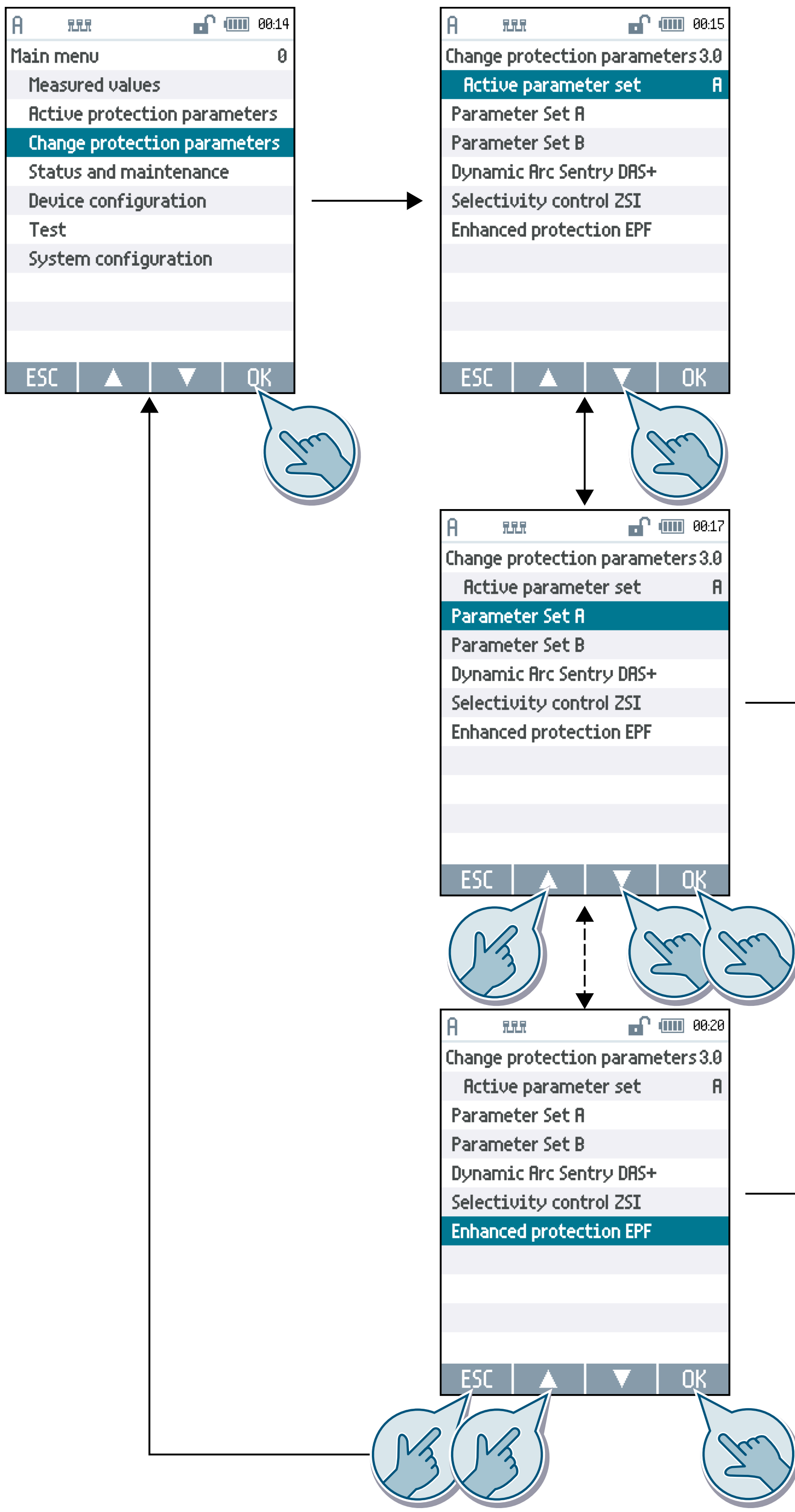
"Measured values 1.0" menu



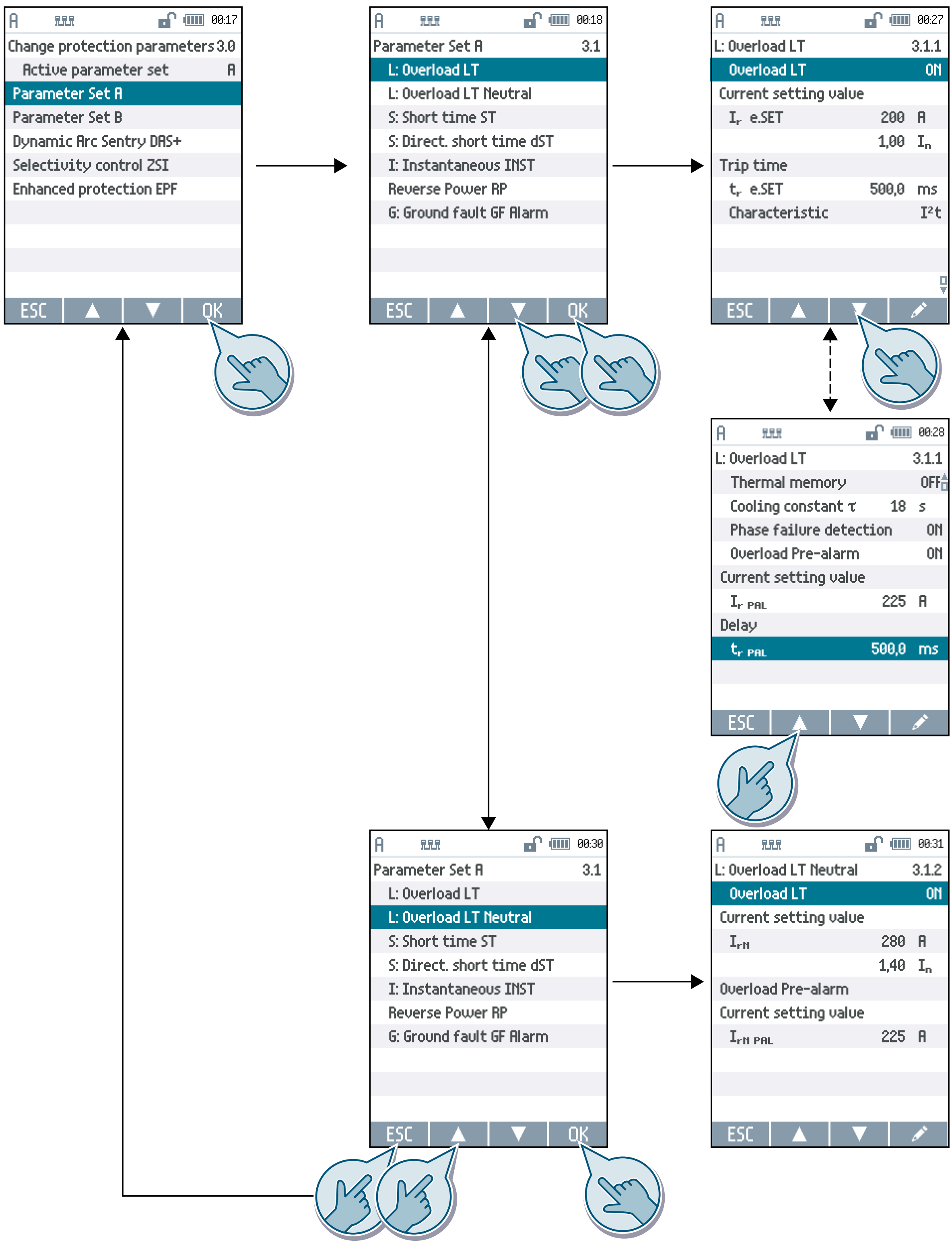
"Active protection parameters 2.0" menu



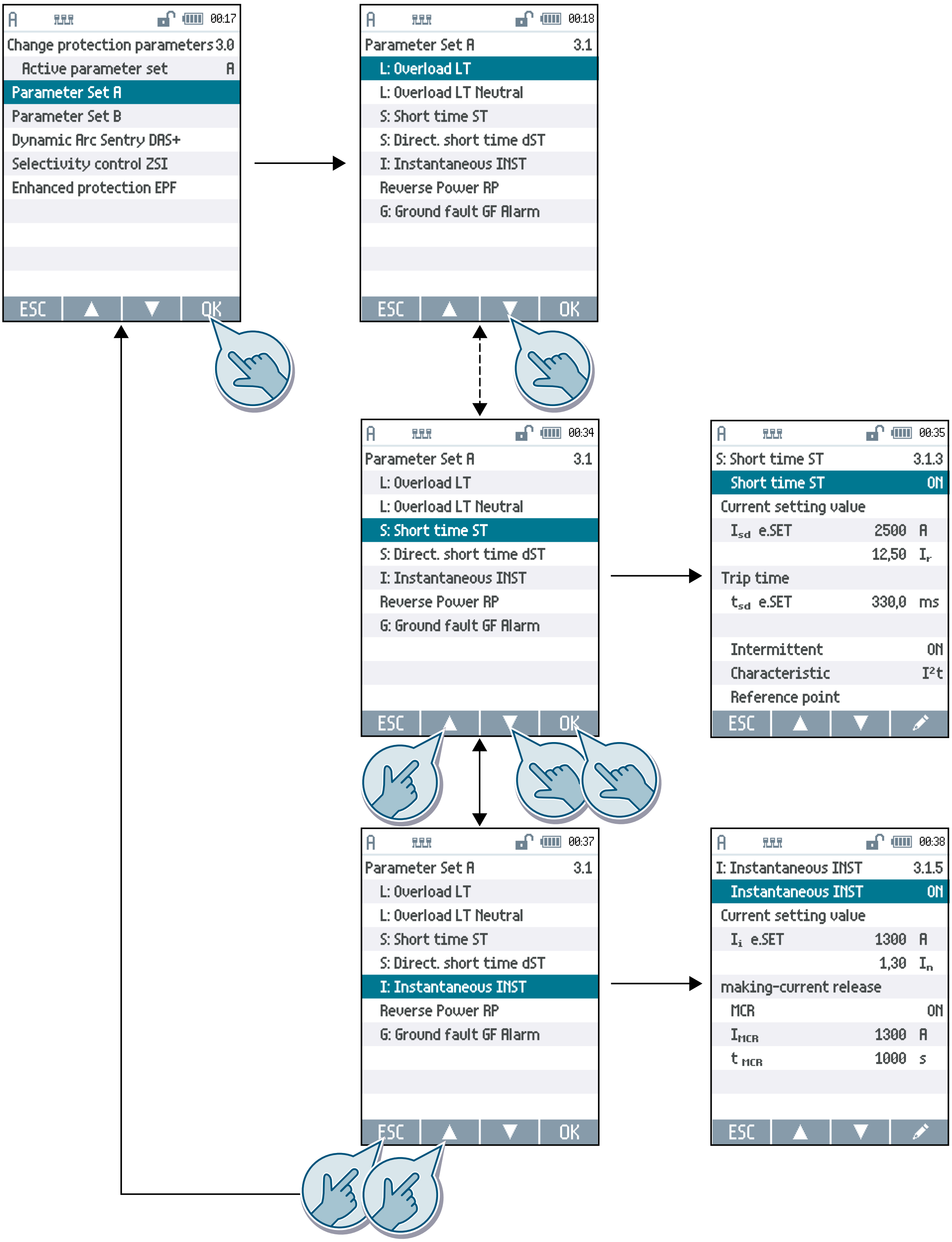
"Change protection parameters 3.0" menu



Example: Overload LT / Overload LT Neutral

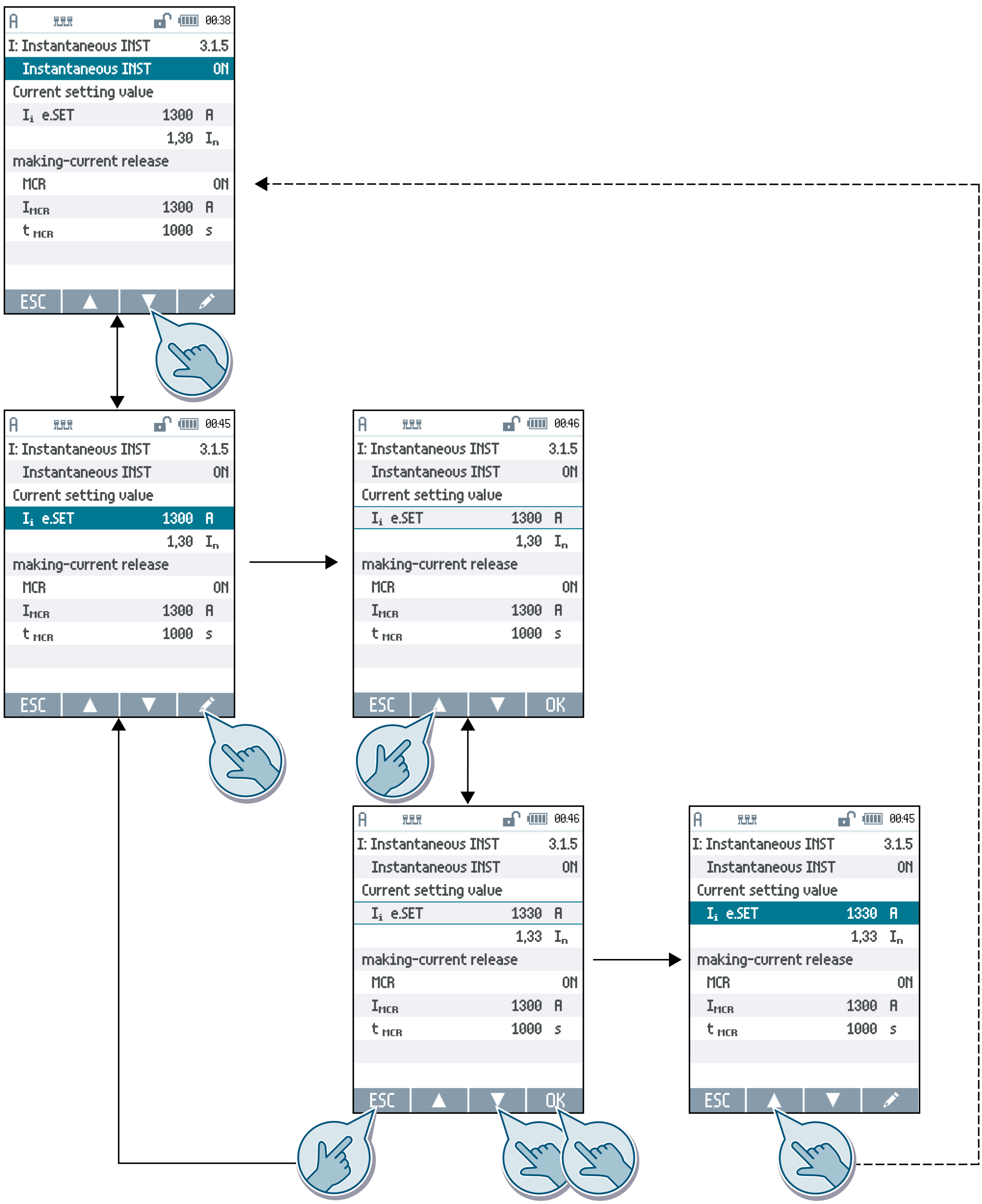


Example: Short time ST / Instantaneous INST



Changing a parameter

Example: Instantaneous INST / I_i e.SET



A.6 Device numbers according to IEEE standard C37.2

The 3WA1 air circuit breaker can be assigned the following device numbers according to IEEE Standard C37.2 "Standard for Electrical Power System Device Function Numbers, Acronyms, and Contact Designations (3rd October 2008)". The device numbers describe features of the electronic trip units and characteristics of the circuit breaker including its accessories.

Depending on the ETU300 and ETU600 electronic trip units, the available protection functions can be assigned to the device numbers:

Protective function		Device number	Function according to IEEE C37.2
L: Long time LT		49	Thermal overload protection of the phases
L: Long time LT, neutral conductor		49N	Thermal overload protection of the neutral conductor
S: Delayed short circuit protection ST	I^2t = OFF	50TD, 50N	Independent overcurrent protection, phases, and neutral conductor
	I^2t = ON	51, 51N	Dependent overcurrent protection, phases and neutral conductor
S: Directional short time dST		67	Directed overcurrent protection
I: Instantaneous short-circuit protection INST		50, 50N	Independent overcurrent protection, phases, and neutral conductor
G: Ground-fault GF alarm		74G	Ground-fault alarm
G: Ground-fault protection GF	I^xt = OFF	50G	Independent overcurrent protection
	I^xt = ON	51G	Dependent overcurrent protection
	GF residual	50G, 51G	Independent overcurrent protection
	GF direct	50G, 51G	Dependent overcurrent protection
	GF dual REF	87N	Ground-fault differential protection
Reverse power protection RP		32R	Directional performance monitoring
Zone-selective interlocking ZSI, requires the ZSI200 module		68	Selective

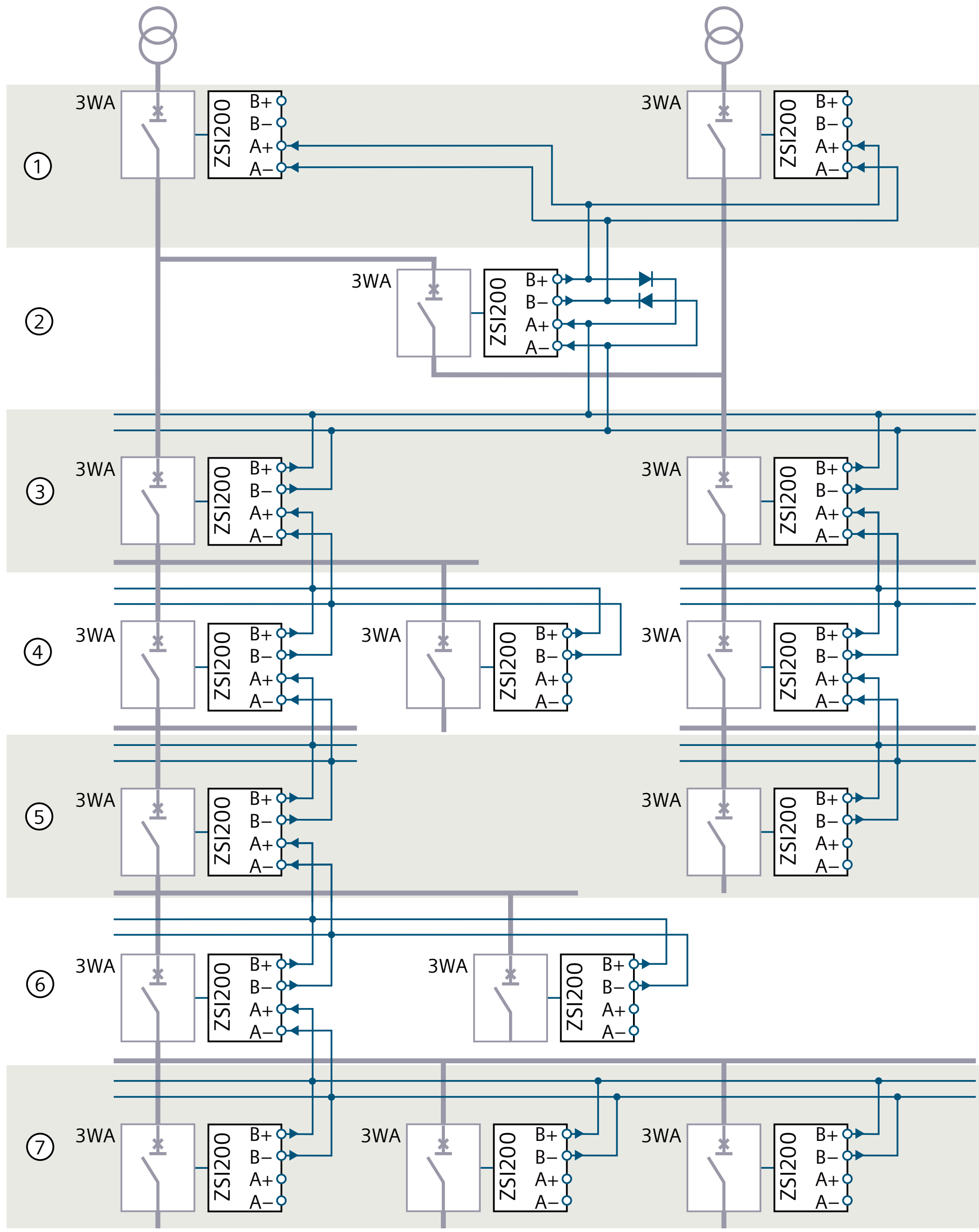
The enhanced protective functions of the ETU600 electronic trip unit can be described by the following device numbers:

Enhanced protective functions EPF	Device number	Function according to IEEE C37.2
Current unbalance	46	Current unbalance protection
Voltage unbalance	47	Voltage unbalance protection
Undervoltage	27	Undervoltage protection
Overvoltage	59	Overvoltage (surge) protection
Forward power	32F	Active power protection
Reverse power	32R	Reverse power protection
Underfrequency	81O	Underfrequency protection
Overfrequency	81U	Overfrequency protection
THD current	81THDC	Voltage distortion protection
THD voltage	81THDV	Current distortion protection
Phase rotation	46R	Phase rotation protection (phase sequence protection)

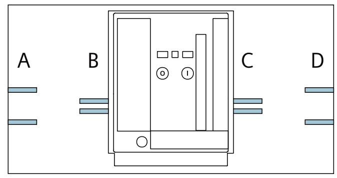
The circuit breaker and accessories fulfill these functions of the IEEE C37.2 standard:

Function of the circuit breaker	**Device number**	**Function according to IEEE C37.2**
Output from digital input/output module IOM230 and IOM350 as well as ETU300 and ETU600	74	Alarm relay
AC circuit breaker	52	AC circuit breaker
DC non-automatic air circuit breakers	72	DC non-automatic air circuit breakers
COM150, COM190 communication modules	16	Data communication device, communications interface

A.7 ZSI system over seven grading levels

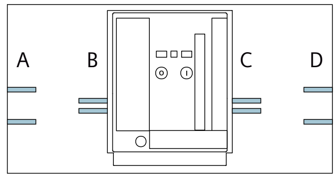


A.8 Overview of possible coding variants



● = with coding element
○ = without coding element

	A	B	C	D		A	B	C	D
1	● ● ○ ○	○ ○ ● ●	○ ○ ● ●	● ● ○ ○	10	● ○ ● ○	○ ● ○ ●	● ○ ○ ●	○ ● ● ○
2	● ● ○ ○	○ ○ ● ●	○ ● ○ ●	● ○ ● ○	11	● ○ ● ○	○ ● ○ ●	● ○ ● ○	○ ● ○ ●
3	● ● ○ ○	○ ○ ● ●	○ ● ● ○	● ○ ○ ●	12	● ○ ● ○	○ ● ○ ●	● ● ○ ○	○ ○ ● ●
4	● ● ○ ○	○ ○ ● ●	● ○ ○ ●	○ ● ● ○	13	● ○ ○ ●	○ ● ● ○	○ ○ ● ●	● ● ○ ○
5	● ● ○ ○	○ ○ ● ●	● ○ ● ○	○ ● ○ ●	14	● ○ ○ ●	○ ● ● ○	○ ● ○ ●	● ○ ● ○
6	● ● ○ ○	○ ○ ● ●	● ● ○ ○	○ ○ ● ●	15	● ○ ○ ●	○ ● ● ○	○ ● ● ○	● ○ ○ ●
7	● ○ ● ○	○ ● ○ ●	○ ○ ● ●	● ● ○ ○	16	● ○ ○ ●	○ ● ● ○	● ○ ○ ●	○ ● ● ○
8	● ○ ● ○	○ ● ○ ●	○ ● ○ ●	● ○ ● ○	17	● ○ ○ ●	○ ● ● ○	● ○ ● ○	○ ● ○ ●
9	● ○ ● ○	○ ● ○ ●	○ ● ● ○	● ○ ○ ●	18	● ○ ○ ●	○ ● ● ○	● ● ○ ○	○ ○ ● ●



● = with coding element
○ = without coding element

	A	B	C	D		A	B	C	D
19	○ ● ● ○	● ○ ○ ●	○ ○ ● ●	● ● ○ ○	28	○ ● ○ ●	● ○ ● ○	● ○ ○ ●	○ ● ● ○
20	○ ● ● ○	● ○ ○ ●	○ ● ○ ●	● ○ ● ○	29	○ ● ○ ●	● ○ ● ○	● ○ ● ○	○ ● ○ ●
21	○ ● ● ○	● ○ ○ ●	○ ● ● ○	● ○ ○ ●	30	○ ● ○ ●	● ○ ● ○	● ● ○ ○	○ ○ ● ●
22	○ ● ● ○	● ○ ○ ●	● ○ ○ ●	○ ● ● ○	31	○ ○ ● ●	● ● ○ ○	○ ○ ● ●	● ● ○ ○
23	○ ● ● ○	● ○ ○ ●	● ○ ● ○	○ ● ○ ●	32	○ ○ ● ●	● ● ○ ○	○ ● ○ ●	● ○ ● ○
24	○ ● ● ○	● ○ ○ ●	● ● ○ ○	○ ○ ● ●	33	○ ○ ● ●	● ● ○ ○	○ ● ● ○	● ○ ○ ●
25	○ ● ○ ●	● ○ ● ○	○ ○ ● ●	● ● ○ ○	34	○ ○ ● ●	● ● ○ ○	● ○ ○ ●	○ ● ● ○
26	○ ● ○ ●	● ○ ● ○	○ ● ○ ●	● ○ ● ○	35	○ ○ ● ●	● ● ○ ○	● ○ ● ○	○ ● ○ ●
27	○ ● ○ ●	● ○ ● ○	○ ● ● ○	● ○ ○ ●	36	○ ○ ● ●	● ● ○ ○	● ● ○ ○	○ ○ ● ●

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 damaged by electrostatic discharge as a result of improper handling.

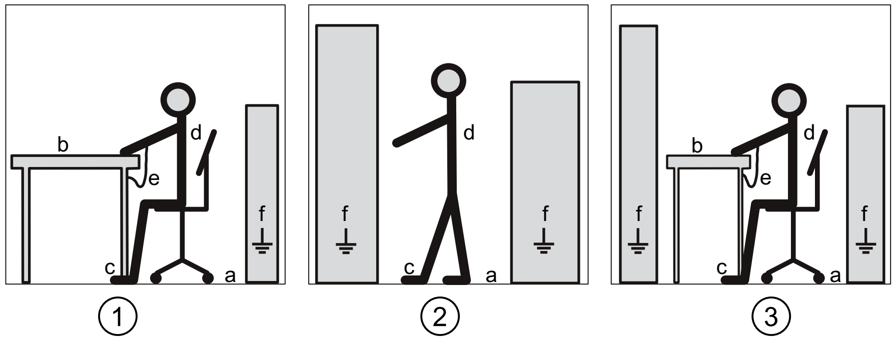
- You must discharge your body electrostatically immediately before touching an electronic module. To do this, touch a conductive, grounded object, e.g., a bare metal part of a switch cabinet or the water pipe.
- Always hold the component by the plastic enclosure.
- Electronic modules should not be brought 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. metalized 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

List of abbreviations

C

Abbreviation	Meaning
$O_{1, 2}$	Output information $_{1, 2}$ (Mechanical circuit breaker interlocking)
AMP	AMP Incorporated, Harrisburg
ANSI	American National Standards Institute
AUX	Auxiliary switch
AWG	American Wire Gauge
Size	Size
BIM	Breaker identification module
BSS	Breaker Status Sensor
CC	Closing coil
COM	Communications module
CONNECT	Connected position
CSA	Canadian Standards Association
CT	Current transformer
CUB–	CubicleBUS^2 connection, –
CUB+	CubicleBUS^2 connection, +
D	Duty cycle, see OP (ON period)
DAS+	Dynamic Arc-Flash Sentry
DC	Direct current
DIN	Deutsches Institut für Normung e. V. (German Institute for Standardization)
DISCON	Disconnected position
$I_{1, 2}$	Input information $_{1, 2}$ (Mechanical circuit breaker interlocking)
OP	ON period
ESD	Electrostatic sensitive device
EN	European Standard
EPF	Enhanced Protective Function
ESD	Electrostatic sensitive device
ETU	Electronic Trip Unit
EXTEND.	Enhanced protective function
F5	Tripping solenoid
F6	Second tripping solenoid
FFT	Fast Fourier Transform
FS	(Frame) size
GF alarm	Ground-fault alarm
G tripping	Ground-fault tripping
GF	Ground fault

Abbreviation	Meaning
GFx	Ground fault extended
I^2t	Current dependency of the delay time according to a formula whereby the product of the time and the square of the current is constant
I^2t_g	Current dependency of the delay time t_g according to a formula whereby the product of the time and the square of the current is constant
I^2t_{sd}	Current dependency of the delay time t_{sd} according to a formula whereby the product of the time and the square of the current is constant
I^4t	Current dependency of the delay time according to a formula whereby the product of the time and the value of the fourth power of the current is constant
I tripping	Instantaneous short-circuit trip
I_{avg}	Instantaneous average value of the current
I_{cm}	Rated short-circuit making capacity
I_{cs}	Rated service short-circuit breaking capacity
I_{cu}	Rated ultimate short-circuit breaking capacity
I_{cw}	Rated short-time withstand current
ID	ID number
IEC	International Electrotechnical Commission
I_g	Setting for ground-fault protection
I_i	Setting for instantaneous short-circuit trip
I_{IT}	1-pole short-circuit test current (IT systems)
I_N	Setting for N-conductor protection
I_n	Rated current
$I_{n\ max}$	Maximum rated current
IOM	Input/output module
I_r	Setting for inverse-time delayed overload trip
I_{sd}	Setting for short-time-delayed short-circuit trip
I_{THD}	Setting for total harmonic distortion (THD) current
L1	Phase 1
L2	Phase 2
L3	Phase 3
L tripping	Inverse-time delayed overload trip
LED	Light emitting diode
M	Motor
MLFB	Machine-readable product designation (German acronym)
N	Neutral conductor
N 117	Australian approval mark
NC	Normally closed contact
NEMA	National Electrical Manufacturers Association
NO	Normally open contact
NIOSH	National Institute for Occupational Safety and Health
N tripping	Tripping due to overcurrent in the N-conductor
NC	NC contact
OSHA	Occupational Safety and Health Administration
PAL	Pre-alarm

Abbreviation	Meaning
PIDG	AMP crimp eyelets
PSS	Position signaling switch (module)
PZ 3 ... 6	Crimping tools from Weidmüller in Detmold
REF	Restricted Earth Fault
RR	Remote Reset (remote trip alarm reset coil)
RSP	Remote Switching Protection
NO	NO contact
$CB_{1, 2, 3}$	Circuit breakers $_{1, 2, 3}$ (mechanical circuit breaker interlocking)
S1	Switch position signaling switch
S2	Switch position signaling switch
S3	Switch position signaling switch
S4	Switch position signaling switch
S7	Switch position signaling switch
S8	Switch position signaling switch
S10	Local electric close (S10)
S11	Motor limit switch
S12	Motor disconnect switch
S13	Disconnect switch for remote reset
S14	Disconnect switch for shunt trip ST (overexcited)
S15	Disconnect switch for closing coil CC (overexcited)
S20	Ready-to-close signaling switch
S21	Signaling switch for spring charge status
S22	Signaling switch on 1st auxiliary release
S23	Signaling switch on 2nd auxiliary release
S24	First trip alarm switch
S25	Second trip alarm switch
S30	Signaling switch for disconnected position
S31	Signaling switch for test position
S32	Signaling switch for test position
S33	Signaling switch for connected position
S34	Signaling switch for connected position
S35	Signaling switch for connected position
S40	Signaling switch on BSS200: Ready-to-close status
S41	Signaling switch on BSS200: Spring charge status
S43	Signaling switch on BSS200: Second auxiliary release
S44	Signaling switch on BSS200: Switch position of main contacts (ON/OFF)
S45	Signaling switch on BSS200: Trip alarm switch
S46	Signaling switch on BSS200: Connected position
S47	Signaling switch on BSS200: Test position
S48	Signaling switch on PSS COM: Disconnected position
S49	Signaling switch on PSS COM: No circuit breaker in the guide frame
S tripping	Short-time-delayed short-circuit trip
SIGUT	Siemens strain-relief clamp

Abbreviation	Meaning
ST	Shunt trip
ST2	Shunt trip 2 (2nd shunt trip)
TEST	Test position
t_g	Delay time of ground-fault tripping
t_r	Delay time of overload trip (defined as 6 x I_r)
TRIP GF	Trip reason was ground fault
TRIP INST	Trip reason was short circuit (instantaneous)
TRIP LT	Trip reason was overload in a main conductor
TRIP ST	Trip reason was short circuit (delayed)
TRIP TEST	Test trip for circuit-breaker testing
t_{sd}	Delay time of short-circuit trip
U_c	Rated control circuit voltage
U_e	Rated operational voltage
U_i	Rated insulation voltage
U_{imp}	Rated impulse withstand voltage
U_{THD}	Setting for total harmonic distortion (THD) voltage
UVR	UnderVoltage Release (undervoltage release, instantaneous)
UVR-t	UnderVoltage Release - time delay (undervoltage release, delayed)
VDE	Verband der Elektrotechnik Elektronik und Informationstechnik e. V. (German Association for Electrical, Electronic and Information Technologies)
V-TAP	Voltage tap (internal)
WBT	Web-based training
X	Terminal marking according to DIN
Z = ...	Supplement to article number "Further options"
ZSI	Zone Selective Interlocking

Further Information

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