

# SIEMENS



Manual

## SENTRON

3VA Molded Case Circuit Breakers  
with UL and IEC Certification

Edition

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# SIEMENS

## SENTRON

### Protection devices 3VA molded case circuit breakers with UL and IEC certification




Manual

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# Introduction

## 1.1 About this documentation

### 3VA molded case circuit breakers with UL 489 certification for the North American market

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

For global applications, a special product portfolio has been developed that has the required approvals according to standards UL 489 as well as IEC 60947. 3VA molded case circuit breakers certified to UL 489 are suitable for the following applications:

- Incoming circuit breakers (feeders) and outgoing circuit breakers (branches) in distribution systems
- Switching and protection devices for motors (motor protection in combination with a contactor and motor protection relay), transformers and capacitors
- Disconnecting means with features for stopping and switching off in an emergency (main disconnecting means and EMERGENCY-OFF switches) in conjunction with lockable rotary operators.

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

1. For line protection:  
The overload and short-circuit releases are designed for the protection of wiring and non-motor loads.
2. For starter combinations:  
These instantaneous trip circuit breakers are used for short-circuit protection as well as for the disconnecter function, which may be required in Combination Motor Controllers consisting of instantaneous trip circuit breaker, overload relay and motor contactor. These instantaneous trip circuit breakers are all equipped with adjustable, instantaneous short-circuit releases.
3. As molded case switches:  
These molded case switches can be used as feeder switches, main switches or non-automatic circuit breakers without overload protection. They incorporate an integrated short-circuit self-protection system.

## Scope of validity of this document

This manual has been specially compiled for the 3VA molded case circuit breakers certified to UL 489, or 3VA UL for short.

The accessories of the 3VA UL molded case circuit breakers are also described in this manual.

This manual serves as a reference manual for technical information regarding the configuration, commissioning and operation of 3VA UL molded case circuit breakers and corresponding accessories.

This manual does not purport to cover all details or variations in equipment, or to provide for every possible contingency in connection with installation, operation, or maintenance. Should additional information be desired, please refer to the individual product instruction sheets or contact the local Siemens sales office.

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment, or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

## 1.2 Product-specific information

### 1.2.1 Target readers

#### Target readers of this documentation

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

- Users
- Control panel manufacturers
- Switchboard manufacturers
- Maintenance personnel

### 1.2.2 Technical Support

You can find further support on the Internet at:

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

### 1.2.3 Reference documents

#### Further documents

You will find further information in the following documents:

Table 1- 1 Reference documents

Title	Article number		Link
3VA IEC Molded Case Circuit Breakers manual	DE	3ZW1012-0VA10-0AB1	3VA molded case circuit breakers documentation ( <a href="https://support.industry.siemens.com/cs/ww/en/view/90318775">https://support.industry.siemens.com/cs/ww/en/view/90318775</a> )
	EN	3ZW1012-0VA10-0AC1	
3VA UL Molded Case Circuit Breakers catalog (for the European-supported markets)	DE	E86060-K8290-A101-A1	3VA UL Molded Case Circuit Breakers catalog ( <a href="https://support.industry.siemens.com/cs/ww/en/view/109744301">https://support.industry.siemens.com/cs/ww/en/view/109744301</a> )
	EN	E86060-K8290-A101-A1-7600	
3VA UL Molded Case Circuit Breakers operating instructions			3VA UL Molded Case Circuit Breakers operating instructions ( <a href="https://support.industry.siemens.com/cs/ww/en/ps/man">https://support.industry.siemens.com/cs/ww/en/ps/man</a> )
3VA Communication system manual	DE	3ZW1012-0VA20-0BB0	3VA molded case circuit breakers documentation ( <a href="https://support.industry.siemens.com/cs/ww/en/view/98746267">https://support.industry.siemens.com/cs/ww/en/view/98746267</a> )
	EN	3ZW1012-0VA20-0BC0	
Automatic transfer control device ATC5300 - Manual	DE	A5E02469034-01	ATC5300 automatic transfer control device ( <a href="http://support.automation.siemens.com/WW/view/de/41909986/0/en">http://support.automation.siemens.com/WW/view/de/41909986/0/en</a> )
	EN	A5E02469035-01	
ATSE - Remote Control Software Manual	DE	A5E02469028-01	ATSE - Remote Control Software Manual ( <a href="http://support.automation.siemens.com/WW/view/en/41909978">http://support.automation.siemens.com/WW/view/en/41909978</a> )
	EN		
ATSE - Modbus Communication Protocol	DE	A5E02469001-01	ATSE - Modbus Communication Protocol ( <a href="http://support.automation.siemens.com/WW/view/en/40761679">http://support.automation.siemens.com/WW/view/en/40761679</a> )
	EN		
Grundlagen der Niederspannungsschalttechnik (Fundamentals of Low-Voltage Switchgear and Controlgear), Siemens AG © 2008	—		—
Hartmut Kiank, Wolfgang Fruth: Planungsleitfaden für Energieverteilungsanlagen (Planning Guide for Power Distribution Plants), Publicis Publishing	ISBN: A19100-L531-B115		—
Schalten, Schützen, Verteilen in Niederspannungsnetzen (Switching, Protection and Distribution in Low-Voltage Networks), substantially extended and revised edition 1997	ISBN 3-89578-041-3		—



## Description

### 2.1 Overview - applications and portfolio

This chapter provides an overview of all 3VA molded case circuit breakers with certification according to the North American standard UL 489 (3VA UL) and shows the areas in which the various molded case circuit breakers are used.

The topics discussed in this chapter are listed below:

- Applications and possible uses
- Aspects of the UL market - Low-voltage systems in the USA
- Portfolio
- Possible configurations
- Detailed information about applications and possible uses
- Technical specifications
- Molded case circuit breakers and accessories in the system

#### 2.1.1 Applications and possible uses

The 3VA UL molded case circuit breakers can be used in various areas in infrastructure, industry or residential and commercial buildings where they perform different protection tasks.

Portions of this manual are intended to familiarize customers and users residing outside the North American market, who may build and export panels, with some of the unique aspects of UL Certified applications. This range of applications is very diverse, and they are typically solutions for industry.

Applications in infrastructure and buildings in the North American market are generally directly supported from within the respective regions.

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

	3VA5	3VA6
Incoming circuit breakers (feeders) and outgoing circuit breakers (branches) in distribution systems	■	■
Switching and protection device for motors, transformers and capacitors	■	■
Disconnecting means	■	■
Application in DC systems	■	
High breaking capacity		■
Data transmission of metering data and status information (communication)		■

### 2.1.2 Aspects of the UL market - Low-voltage systems in the USA


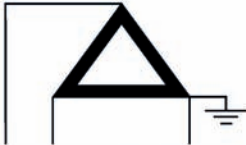
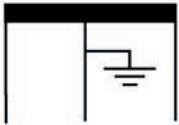
This chapter is an excerpt from the document "The secrets of UL". You will find the complete document under

(<http://w3app.siemens.com/mcms/infocenter/dokumentcenter/ce/Documentsu20Brochures/e20001-a820-p305-v2-7600.pdf>).

#### Low-voltage systems in the USA

The usual system configurations in the USA are very different from those found in Europe. Unlike in the IEC, there is a corner-grounded delta system in addition to the solidly grounded wye system, which is very similar to the TN-S system. In the USA / UL / NEC, all voltages that occur in the respective system configuration are always specified (see table below). When devices are selected, very close attention must be paid to which system configuration is present at the location of use and the system configuration for which the individual devices are approved.

The main configurations in industry and in non-residential buildings are 3-phase networks with 240 V and 480 V, as well as 3- and 4-conductor systems with 480Y/277 V. In residential buildings and in office spaces of industrial and non-residential buildings, the single-phase system with 120/240 V can also be commonly found.

Industry and commercial		Residential
		
Solidly grounded wye, 3 phase, 4 wire	Corner grounded delta, 3 phase, 3 wire	Single phase, 120 / 240 V Grounded midpoint
Notice: The PE must not carry any current. There is no PEN conductor → N = "Grounded Conductor" (white or gray); for PE and N, separate conductors must be used.		Example: 120 V are used on the wall receptacle and 240 V for household cookers, air-conditioning units and laundry dryers.
600Y / 347 V <sup>1)</sup>	600 V	240 V to phase conductor
480Y / 277 V <sup>1)</sup>	480 V	120 V to ground
240Y / 131 V <sup>1)</sup>	240 V	
208Y / 120 V <sup>1)</sup>		

1) Y describes the "Solidly grounded circuit". The value "Y" indicates the voltage between the phases (e.g. 480 V), and the value behind the slash indicates the voltage between the phase and the grounding or the neutral conductor (e.g. 277 V with 480 V voltage between the phases).

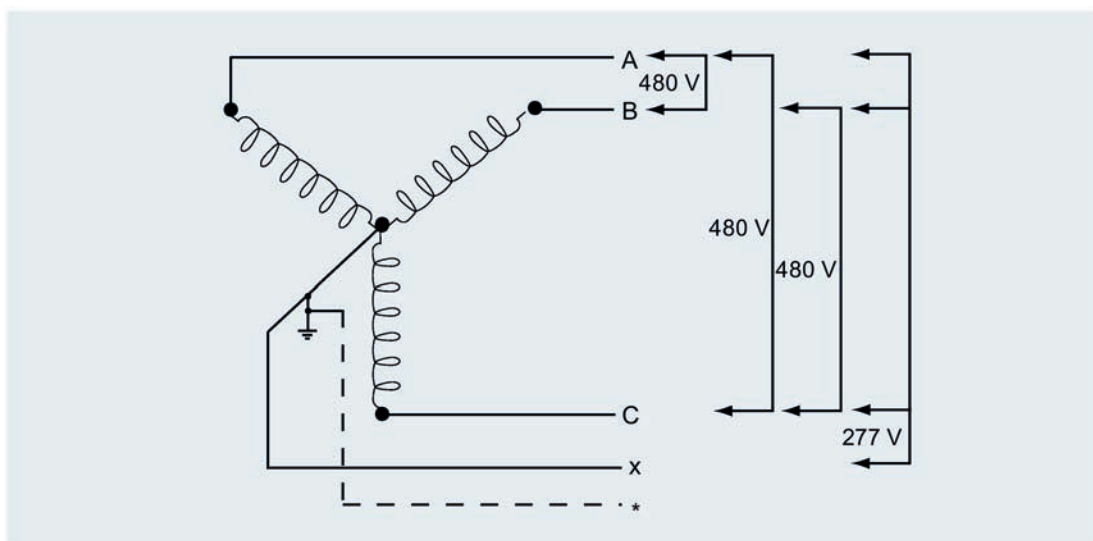


## Electric circuits with "straight" and "slash" voltages

In the USA, voltages are considered from the power supply company side or the secondary side of the power supply company transformers. The connection (wye or delta) of the electric circuit and the method of grounding play a major role here.

In electric circuits with a Grounded Wye, the circuit breaker only switches the full voltage between the phases (e.g. 480 V). The phase-to-ground voltage is only 277 V in this case, which explains the "slash" voltage of 480Y/277 V. Industrial Control Panels in which these devices are installed must be marked with the following inscription: "For use on a solidly grounded wye source only" (UL 508A Art. 54.12).

In ungrounded or high-resistance grounded wye or delta circuits, and in corner-grounded delta circuits, only devices (e.g. circuit breakers) that are labeled with a "straight" voltage, such as 240 V, 480 V or 600 V, may be used. These devices must be able to switch the full voltage between the phases and between one phase to ground.



Grounded wye, 480Y / 277 V, 3 phase, 4 wire

## Short circuit current rating of the control panel main (power) circuit

An industrial control panel must be marked with a short-circuit current rating (SCCR). In IEC terms, this corresponds approximately to the  $I_{cw}$  value of the panel. NEC 2017 Article 409 describes the specifications of the short circuit current rating markings on industrial control panels (with reference to UL 508A, SB4). For the short circuit current rating, not only is the short-circuit breaking capacity (e.g. of the circuit breaker) relevant, but also the short-circuit current rating of each individual device. The SCCR-relevant components in the main circuit include circuit breakers, contactors, overload relays, and solid-state switching devices, as well as terminals, busbars, the line side of control transformers and frequency converters, but not the internal wiring of the control panel.

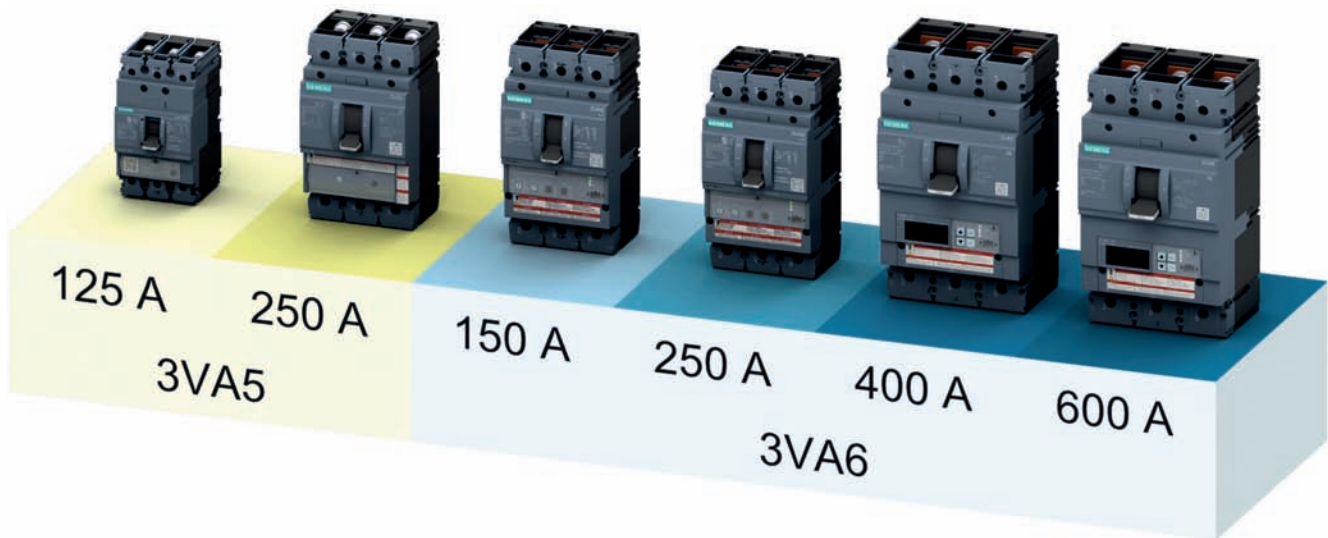
The lowest value applies to the entire control panel. A short-circuit current higher than this must not be available at the input terminals of the control panel.

### 2.1.3 Portfolio

The integrated 3VA UL portfolio consists of two different ranges of molded case circuit breakers in five different rated operational current versions (frame sizes).

#### Sizes

The new 3VA UL molded case circuit breakers set new standards in flexibility and the variety of modular accessories available. Standardized accessories suitable for use with several sizes of circuit breaker from all the 3VA UL ranges help to cut costs and save time.



The new 3VA UL molded case circuit breakers are available in the following ranges:

- 3VA5 with thermal-magnetic trip units
- 3VA6 with electronic trip units

The 3VA5 molded case circuit breakers are available in the following versions:

- 1- and 3-pole version in size up to 125 A (3VA51)
- 2(3)-pole and 3-pole version in size up to 250 A (3VA52)

The 3VA6 molded case circuit breakers are available in the following versions:

- 3- and 4-pole version

The circuit breakers are suitable for rated operational currents ranging from 15 A to 600 A and rated voltages up to 600 V AC, depending on the range and frame size.

## 3VA5 molded case circuit breakers



The new 3VA5 molded case circuit breakers reliably perform all the tasks required for line protection.

### Features

The key features of the 3VA5 range are:

- Compact design
- Number of poles available (dependent on size):
  - 1- and 3-pole versions in size 125 A
  - (2)3-pole<sup>1)</sup> and 3-pole version in size 250 A
  - <sup>1)</sup> 2-pole molded case circuit breaker in 3-pole frame
- Breaking capacity (dependent on size):
  - 1-pole versions:  
Breaking capacity of 25 kA to 50 kA at 277 V AC
  - 3-pole versions:  
Breaking capacity of 25 kA to 65 kA or 100 kA (3VA52) with 480 V AC  
Breaking capacity of 50 kA to 100 kA with 500 V DC
- Fixed mounting
- Thermal-magnetic trip units
- AC/DC applications
- Modular and easy-to-fit internal accessories with diverse functions
- Uniform accessories platform across all 3VA UL molded case circuit breakers

### Compact dimensions

Due to its small dimensions, the 3VA UL molded case circuit breaker 125 A (3VA51) is ideally suited to the protection of cables and systems wherever space is limited.

In addition, the 3VA51 molded case circuit breaker is suitable for mounting on 35 mm DIN rails.

### Thermal-magnetic trip units

The 3VA5 molded case circuit breakers have a thermal-magnetic trip unit with overload and short-circuit protection. This has been developed for implementing economical, cost-efficient installations up to 250 A. It is suitable for use in three-phase networks, AC networks, and 400 Hz applications and with DC currents.

### 3VA6 molded case circuit breakers



The new 3VA6 molded case circuit breakers reliably perform all the tasks required for line protection.

This range is designed for applications with more exacting requirements:

- Increased breaking capacity
- Compact dimensions
- Integrated metering function
- Connection to a fieldbus communication system

#### Features

The key features of the 3VA6 range are:

- Compact dimensions
- 3 and 4-pole versions
- Four breaking capacity classes with breaking capacities of
  - 35 kA to 150 kA with 480 V AC
  - 18 kA to 50 kA with 600 V AC
- Fixed-mounting, plug-in technology, draw-out technology
- Electronic trip units (ETU)
- Retrofittable communication for ETU 5-series and 8-series
- Depending on the ETU: Integrated metering function for voltages, currents, powers, etc.
- AC applications
- No derating up to +50 °C
- Modular and easy-to-fit internal accessories with diverse functions
- Uniform accessories platform across all 3VA UL molded case circuit breakers
- Electronic Trip Units (ETU) with different setting values

#### Compact dimensions with expanded functionality

Besides the expanded functionality, the 3VA6 molded case circuit breaker is also characterized by its compact dimensions for fixed mounting. In addition, plug-in and draw-out sockets are available for 3VA6 molded case circuit breakers. Standard switches can be retrofitted for these mounting methods with little effort.

Moreover, the different breaking capacity classes available and the many possibilities afforded by the various electronic trip units also provide the flexibility needed for planning.

### Electronic trip unit (ETU)

The current sensor of the 3VA6 molded case circuit breaker comprises an iron-cored transformer for the internal power supply and a Rogowski coil for precise sensing and measurement of the current values. Each of these transformers was specifically optimized for its task. Thanks to the high accuracy of current measurement achieved by the Rogowski coil, the 3VA6 molded case circuit breaker is suitable for power and energy measurement. In addition, finer adjustment of ground fault current monitoring is possible.

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

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

Two possibilities are available for protection against residual currents to ground:

- Tripping of the breaker when a ground fault is present and thus disconnection of the system
- Alarm-only indication, via LED, that a ground fault is present. The signal is also available through communication and a digital output, when applied with the appropriate accessories.  
The breaker is not tripped here, the system remains connected although the ground fault still exists.

3VA6 molded case circuit breakers with corresponding ETUs are available for both applications.

### Energy management and communication

The Electronic Trip Units (ETUs) provide the following energy management and communication functions:

- Metering functions for current, voltage, power and energy consumption
- Transfer of measured values and status information of the circuit breaker
- Remote parameter assignment of tripping thresholds and miscellaneous parameters
- Flexible use of digital inputs and outputs of the optionally available EFB300 external function box
- Commissioning/setting the plant topology and also individual breaker parameters with the "powerconfig" software package
- Testing and archiving with the TD300 and TD500 test devices (with powerconfig)

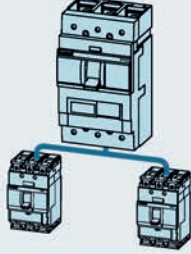
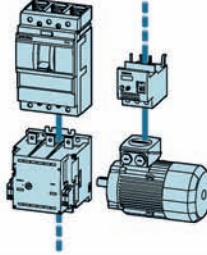
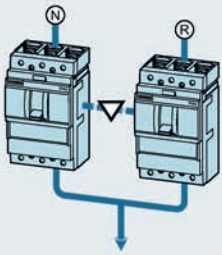
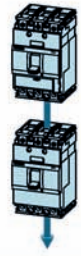
### **100% rated versions of the 3VA UL molded case circuit breaker**

The US National Electrical Code, NEC recognizes two categories of overcurrent protective devices (OCPD) and has different required load calculations for their application. The two categories are standard OCPDs and OCPDs listed for operation at 100% of their rating (commonly referred to as "100 % rated").




For standard OCPDs, the rating selected must be no less than the sum of 100% of the non-continuous loads and 125% of the continuous loads (3 hours or more). For OCPDs listed for operation at 100% of their rating, the calculation for the minimum rating is based on the sum of 100% of the non-continuous loads and 100% of the continuous loads.

For 100% rated circuit breakers, there are additional UL489 requirements for the wire connectors/lugs, conductor sizes and types, and minimum enclosure sizing.

## 2.1.4 Detailed information about applications and possible uses





Application	3VA5	3VA6	Description
Line protection for AC and DC 	■	■	The trip units for line protection are designed for protection against overload and short-circuit in AC and DC supply systems (DC only with 3VA5 molded case circuit breakers): <ul style="list-style-type: none"> <li>- of cables and wires</li> <li>- of non-motor loads</li> </ul>
Protection for starter combinations (MCP) 	■	■	Starter combinations consist of: molded case circuit breaker + contactor + overload relay. <p>In this case, the molded case circuit breaker provides the short-circuit protection and the disconnecter function. The contactor is responsible for operational switching of the feeder. The overload relay handles overload protection that can be specially matched to the motor. The molded case circuit breaker for the starter combination is therefore equipped with an adjustable and instantaneous short-circuit release.</p>
Transfer switching equipment 	■	■	Transfer switching equipment switches loads on two independent supply networks. Transfer switching equipment is used to ensure a reliable supply after failure of the normal supply network.
Molded case switch 	■	■	These molded case switches can be used as feeder switches, main switches or disconnectors without overload protection. They incorporate an integrated short-circuit self-protection system.

2.1.5 Technical specifications

										
Type		3VA51	3VA51	3VA52						
Number of poles		1	3	2(3), 3						
<b>3VA5 molded case circuit breakers for line protection</b>										
Size		125 A	125 A	250 A						
Rated operational current $I_n$ at 40 °C ambient temperature	A	15 ... 125	15 ... 125	100 ... 250						
Frequency	Hz	0 ... 400	0 ... 400	0 ... 400						
<b>Electrical characteristics according to UL 489</b>										
Rated operational voltage AC / 50/60 Hz	V	347	600	600						
Rated operational voltage DC	V	125	500	500/600						
<b>Electrical characteristics according to IEC 60947-2</b>										
Rated operational voltage $U_n$ 50/60 Hz AC	V	415	690	690						
Rated operational voltage $U_n$ DC	V	125	500	500/750						
Rated insulation voltage $U_i$	V	500	800	800						
Rated impulse withstand voltage $U_{imp}$	kV	8	8	8						
<b>Short-circuit breaking capacity according to UL 489</b>										
		S	M	H	S	M	H	M	H	C
120 V AC 50/60 Hz	kA	65	85	100						
240 V AC 50/60 Hz	kA				65	85	100	85	100	200
227 V AC 50/60 Hz	kA	25	35	50						
347 V AC 50/60 Hz	kA	14	14	14						
480Y/277 V AC / 50/60 Hz	kA				25	35	65	35	65	100
480 V AC / 50/60 Hz	kA				25 <sup>1)</sup>	35 <sup>1)</sup>	65 <sup>1)</sup>	35	65	100
600Y/347 V AC / 50/60 Hz	kA				14	18 <sup>2)</sup>	25 <sup>3)</sup>	18	25	35
600 V AC / 50/60 Hz	kA							18	25	35
125 V DC	kA	14	25	30						
250 V DC	kA				50	85	100	50	85	100
500 V DC	kA				50	85	100	50	85	100
600 V DC (3-pole only)	kA							50	85	100
<b>Short-circuit breaking capacity according to IEC 60947-2</b>										
		S	M	H	S	M	H	M	H	C
<b>Rated ultimate short-circuit breaking capacity <math>I_{cu}</math> / Rated service short-circuit breaking capacity <math>I_{cs}</math></b>										
RMS value, according to IEC 60947-2										
240 V AC 50/60 Hz	kA	25/25	36/36	55/55	55/55	85/85	150/150	85/85	100/100	200/200
415 V AC / 50/60 Hz	kA	5/5	5/5	5/5	36/36	55/55	70/70	55/55	70/70	110/110
690 V AC / 50/60 Hz	kA				5/5	7/5	10/5	7/7	10/10	10/10
125 V DC	kA	14	25	30						
250 V DC	kA				50	85	100	50	85	100
500 V DC	kA				50	85	100	50	85	100
750 V DC (3-pole only)	kA							50	85	100




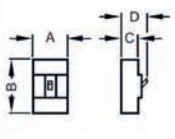
- 1) Applies to  $I_n$  15 A to 90 A
- 2)  $I_n$  100 A to 125 A 14 kA
- 3)  $I_n$  40 A to 90 A 18 kA; 100 A to 125 A 14 kA







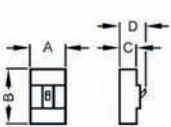
																	
Type	3VA61	3VA62	3VA63	3VA64													
Number of poles	3, 4	3, 4	3, 4	3, 4													
<b>3VA6 molded case circuit breakers for line protection</b>																	
Size	150 A	250 A	400 A	600 A													
Rated operational current $I_n$ at 40 °C ambient temperature	A 40 ... 150	100, 250	250, 400	400, 600													
Frequency	Hz 50/60	50/60	50/60	50/60													
<b>Electrical characteristics according to UL 489</b>																	
Rated operational voltage AC / 50/60 Hz	V 600	600	600	600													
Rated operational voltage DC	V																
<b>Electrical characteristics according to IEC 60947-2</b>																	
Rated operational voltage $U_n$ 50/60 Hz AC	V 690	690	690	690													
Rated operational voltage $U_n$ DC	V																
Rated insulation voltage $U_i$	V 800	800	800	800													
Rated impulse withstand voltage $U_{imp}$	kV 8	8	8	8													
<b>Short-circuit breaking capacity according to UL 489</b>																	
	M	H	C	L	M	H	C	L	M	H	C	L	M	H	C	L	
120 V AC 50/60 Hz																	
240 V AC 50/60 Hz	100	100	200	200	100	100	200	200	100	100	200	200	100	100	200	200	
227 V AC 50/60 Hz																	
347 V AC 50/60 Hz																	
480Y/277 V AC / 50/60 Hz	35	65	100	150	35	65	100	150	35	65	100	150	35	65	100	150	
480 V AC / 50/60 Hz	35	65	100	150	35	65	100	150	35	65	100	150	35	65	100	150	
600Y/347 V AC / 50/60 Hz	18	22	35	50	18	22	35	50	18	22	35	50	18	22	35	50	
600 V AC / 50/60 Hz	18	22	35	50					18	22	35	50	18	22	35	50	
125 V DC																	
250 V DC																	
500 V DC																	
600 V DC (3-pole only)																	
<b>Short-circuit breaking capacity according to IEC 60947-2</b>																	
	M	H	C	L	M	H	C	L	M	H	C	L	M	H	C	L	
<b>Rated ultimate short-circuit breaking capacity <math>I_{cu}</math> / Rated service short-circuit breaking capacity <math>I_{cs}</math></b>																	
RMS value, according to IEC 60947-2																	
240 V AC 50/60 Hz	kA 85/85	110/110	150/150	200/200	85/85	110/110	150/150	200/200	85/85	110/110	150/150	200/200	85/85	110/110	150/150	200/200	
415 V AC / 50/60 Hz	kA 55/55	85/85	110/110	150/150	55/55	85/85	110/110	150/150	55/55	85/85	110/110	150/150	55/55	85/85	110/110	150/150	
690 V AC / 50/60 Hz	kA 2.5/2.5	2.5/2.5	2.5/2.5	2.5/2.5	3/3	3/3	3/3	3/3	5/5	5/5	5/5	5/5	6/6	6/6	6/6	6/6	
125 V DC	kA																
250 V DC	kA																
500 V DC	kA																
750 V DC (3-pole only)	kA																

Description

2.1 Overview - applications and portfolio

					
Type		3VA51	3VA51	3VA52	
Number of poles		1	3	2(3), 3	
<b>3VA5 molded case circuit breakers for line protection</b>					
Rated operational current $I_n$ at 40 °C ambient temperature	A	15 ... 125	15 ... 125	100 ... 250	
<b>Service life (make-break operations)</b>					
Mechanical		15000	15000	15000	
Electrical with $U_n$ UL 489 480 V / IEC 60947 415 V		8000	8000	8000	
Trip units	FTFM	TM210	■	■	
	FTAM	TM230		■	
	LI	ETU320/ETU820			
	LIG	ETU330/ETU830			
	LSI	ETU350			
	LSI	ETU550/ETU850			
	LSI (G alarm) <sup>1)</sup>	ETU556/ETU856			
	LSIG	ETU560/ETU860			
<b>3VA5 motor circuit protectors (circuit breakers for motor starter combinations)</b>					
Rated operational current $I_n$ at 40 °C ambient temperature	A		15 ... 125	100 ... 200	
Breaking capacity according to UL 489 without contactor with 480 V <sup>2)</sup>			65	65/100	
Approval according to IEC 60947-2 Annex O ICB			■	■	
Trip units <sup>3)</sup>	AM	TM120M	■	■	
	I	ETU310M			
<b>3VA5 molded case switches</b>					
Electrical characteristics according to UL 489					
<b>Short-circuit current rating (SCCR) up to 65 kA with 480 V<sup>4)</sup></b>					
Rated continuous current $I_n$ at 40 °C ambient temperature	A		100	150, 250	
<b>Short-circuit current rating (SCCR) up to 100 kA with 480 V<sup>4)</sup></b>					
Rated continuous current $I_n$ at 40 °C ambient temperature	A			100, 150, 250	
Approval according to IEC 60947-2 Annex L CBI-X			■	■	
Trip units <sup>3)</sup>	FM	MCS110	■	■	
<b>Dimensions</b>					
	A	inch mm	1 25.4	3 76.2	4.13 105
	B	inch mm	5.51 140	5.51 140	7.28 185
	C	inch mm	3 76.5	3 76.5	3.27 83
	D	inch mm	3.67 93.4	3.67 93.4	4.21 107
<b>General information</b>					
Standards and specifications		UL 489/CSA22.2/ IEC 60947-2	UL 489/CSA22.2/ IEC 60947-2	UL 489/CSA22.2/ IEC 60947-2	
Suitable for reverse feed applications			yes		
Standard connection technology		No connection technology	No connection technology	No connection technology	

- 1) G alarm, no G protection (the G function sends an alarm message but does not trip the circuit breaker)
- 2) Breaking capacities in combination with contactors (SCCR ratings) may differ
- 3) Integrated instantaneous short-circuit release for self-protection
- 4) The short-circuit current rating (SCCR rating) is the maximum permissible short-circuit current at the installation location of the MCS in combination with an appropriate additional overload protection device.

						
Type		3VA61	3VA62	3VA63	3VA64	
Number of poles		3, 4	3, 4	3, 4	3, 4	
<b>3VA6 molded case circuit breakers for line protection, standard applications</b>						
Rated operational current $I_n$ at 40 °C ambient temperature	A	40 ... 150	100, 250	250, 400	400, 600	
<b>Service life (make-break operations)</b>						
Mechanical		20000	20000	15000	15000	
Electrical with $U_n$ UL 489 480 V / IEC 60947 415 V		9000	6000	6000	4000	
Trip units	FTFM      TM210 FTAM      TM230 LI        ETU320/ETU820 LIG      ETU330/ETU830 LSI      ETU350 LSI      ETU550/ETU850 LSI (G alarm) <sup>5)</sup> ETU556/ETU856 LSIG     ETU560/ETU860					
<b>3VA6 motor circuit protectors (circuit breakers for motor starter combinations)</b>						
Rated operational current $I_n$ at 40 °C ambient temperature	A	25 ... 100	110 ... 200	200, 250	400, 500	
Breaking capacity according to UL 489 without contactor with 480 V <sup>2)</sup>			65	65/100		
Approval according to IEC 60947-2 Annex O ICB						
Trip units <sup>3)</sup>	AM        TM120M I         ETU310M					
<b>3VA6 molded case switch</b>						
Electrical characteristics according to UL 489						
<b>Short-circuit current rating (SCCR) up to 65 kA with 480 V<sup>4)</sup></b>						
Rated continuous current $I_n$ at 40 °C ambient temperature	A					
<b>Short-circuit current rating (SCCR) up to 100 kA with 480 V<sup>4)</sup></b>						
Rated continuous current $I_n$ at 40 °C ambient temperature	A			400	600	
Approval according to IEC 60947-2 Annex L CBI-X						
Trip units <sup>3)</sup>	I        MCS110					
<b>Dimensions</b>						
	A	inch mm	4.13/5.51 105/140	4.13/5.51 105/140	5.43/7.24 138/184	5.43/7.24 138/184
	B	inch mm	7.8 198	7.8 198	9.76 248	9.76 248
	C	inch mm	3.27 83	3.27 83	4.33 110	4.33 110
	D	inch mm	4.21 107	4.21 107	5.39 137	5.39 137
<b>General information</b>						
Standards and specifications		UL 489/CSA22.2/ IEC 60947-2	UL 489/CSA22.2/ IEC 60947-2	UL 489/CSA22.2/ IEC 60947-2		
Suitable for reverse feed applications			yes			
Standard connection technology		No connection technology	No connection technology	No connection technology		

- 1) G alarm, no G protection (the G function sends an alarm message but does not trip the circuit breaker)
- 2) Breaking capacities in combination with contactors (SCCR ratings) may differ
- 3) Integrated instantaneous short-circuit release for self-protection
- 4) The short-circuit current rating (SCCR rating) is the maximum permissible short-circuit current at the installation location of the MCS in combination with an appropriate short-circuit protection device.

### 2.1.6 Molded case circuit breakers and accessories in the system

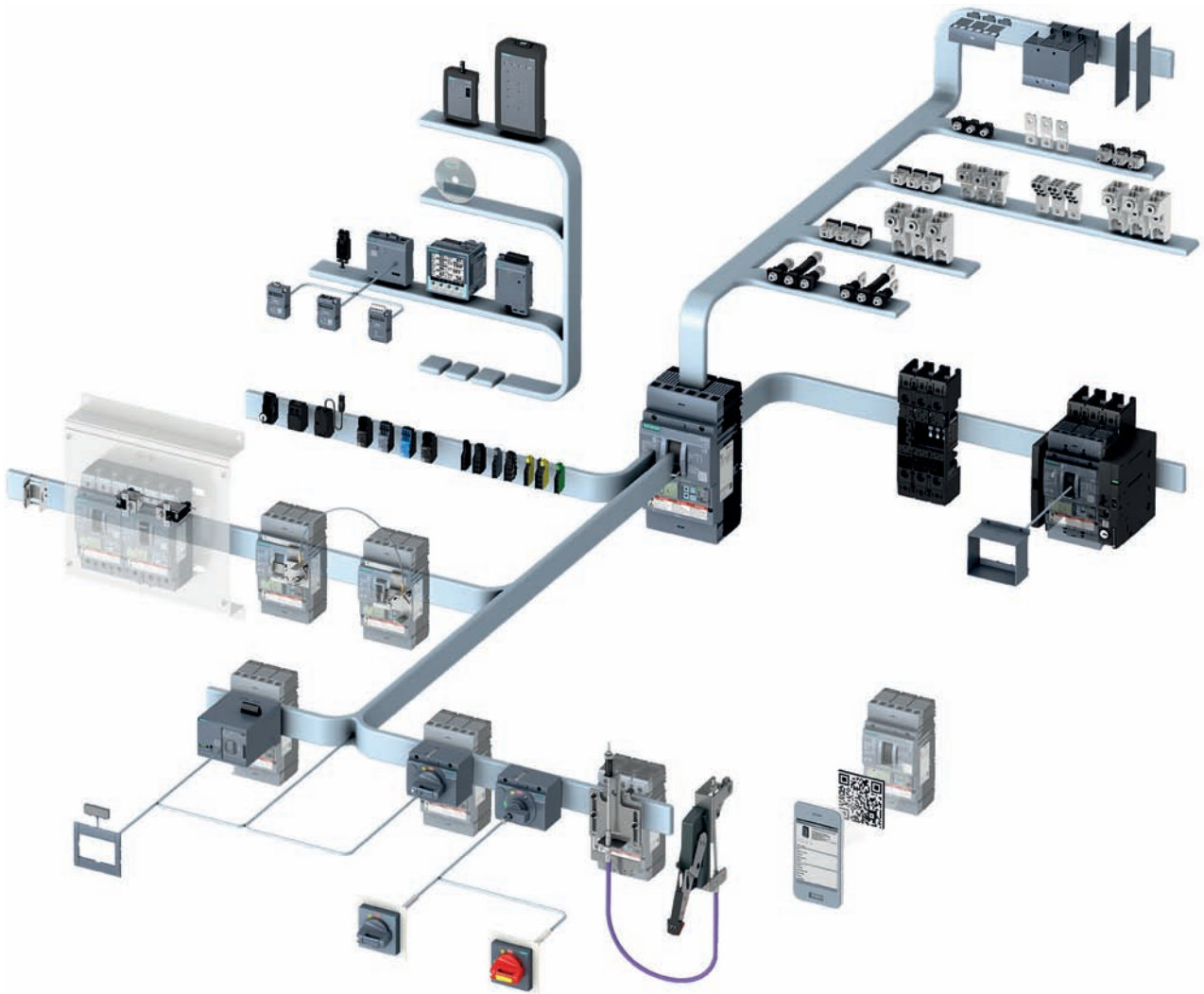
The new 3VA UL molded case circuit breakers come with a large portfolio of accessory components that – depending on the type of accessory – can be flexibly installed internally or externally regardless of the size of circuit breaker.

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

Accessories	3VA5		3VA6			
	125 A	250 A	150 A	250 A	400 A	600 A
Auxiliary and alarm switches	■					
Auxiliary releases	■					
Connection technology	■		■		■	
Plug-in technology			■		■	
Draw-out technology			■		■	
Front mounted rotary operator	■	■		■		
Door mounted rotary operator	■	■		■		
Operator kit with Bowden cable (Max-Flex operator)	■	■		■		
Operator kit with linkage (in preparation)	■	■		■		
Motor operator MO320 (mounted on the front)	■	1)	■		■	
Accessories for locking, blocking and interlocking	■	■		■		
Communication link			■		■	
EFB300			■		■	
MMB300			■		■	
TD300 and TD500			■		■	
Cover frame	■	■	■		■	

1) Only possible with fixed mounting and not when mounted on a DIN rail

Overview of accessories in the system



## 2.2 Ergonomic design

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

The topics discussed in this chapter are listed below:

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

### Integrated system

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

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

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

- Standardized methods of operation
- Standardized scope of functions
- Standardized installation procedures
- The same internal accessories for all circuit breaker sizes from 125 A to 600 A (auxiliary switches, auxiliary releases)

### 2.2.1 Installation variants for 3VA UL

To ensure full flexibility when planning a system, the molded case circuit breaker range can be extended with additional components in such a way that operability is guaranteed in every situation.

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

- Front mounted rotary operator
- Door mounted rotary operator
- Operator kit with Bowden cable (Max-Flex™ operator)
- Operator kit with rigid linkage (in preparation)
- Motor operator

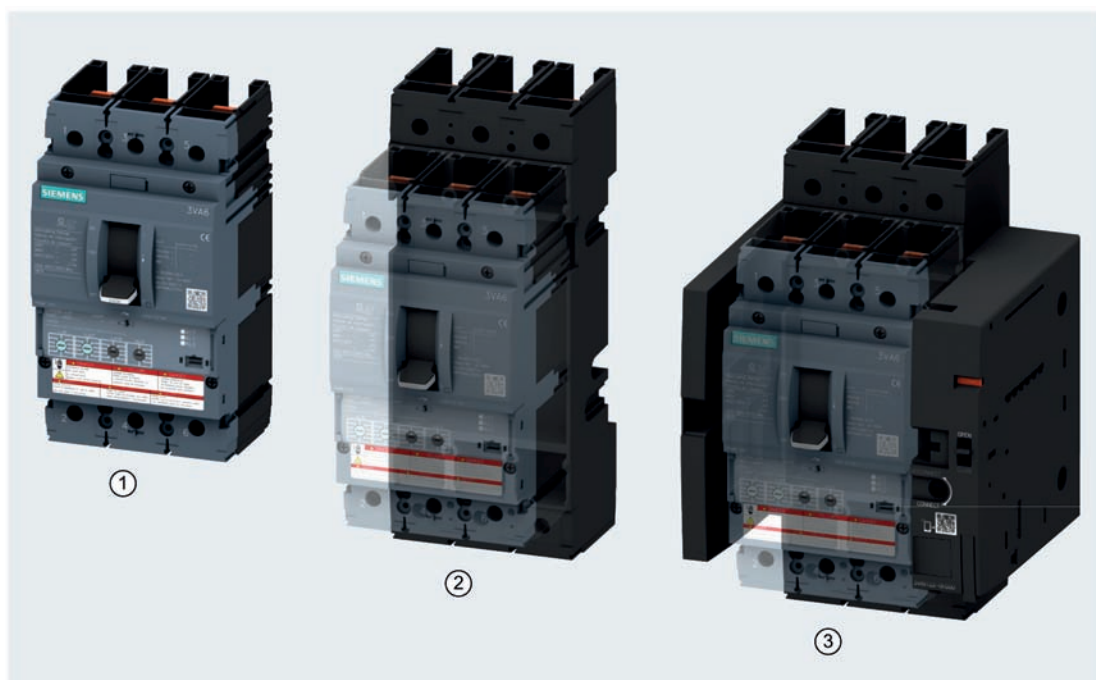
When the 3VA UL molded case circuit breaker is in the OFF position, it ensures that the circuit is reliably disconnected in all current paths. The clearances dimensioned according to UL 489 ensure that, in the event of overvoltages between input and output, isolation is maintained.

The main switch functionality is not diminished by installation of the following accessories:

- Motor operator
- Manual operators
- Plug-in and draw-out technology

### Optional installation variants

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



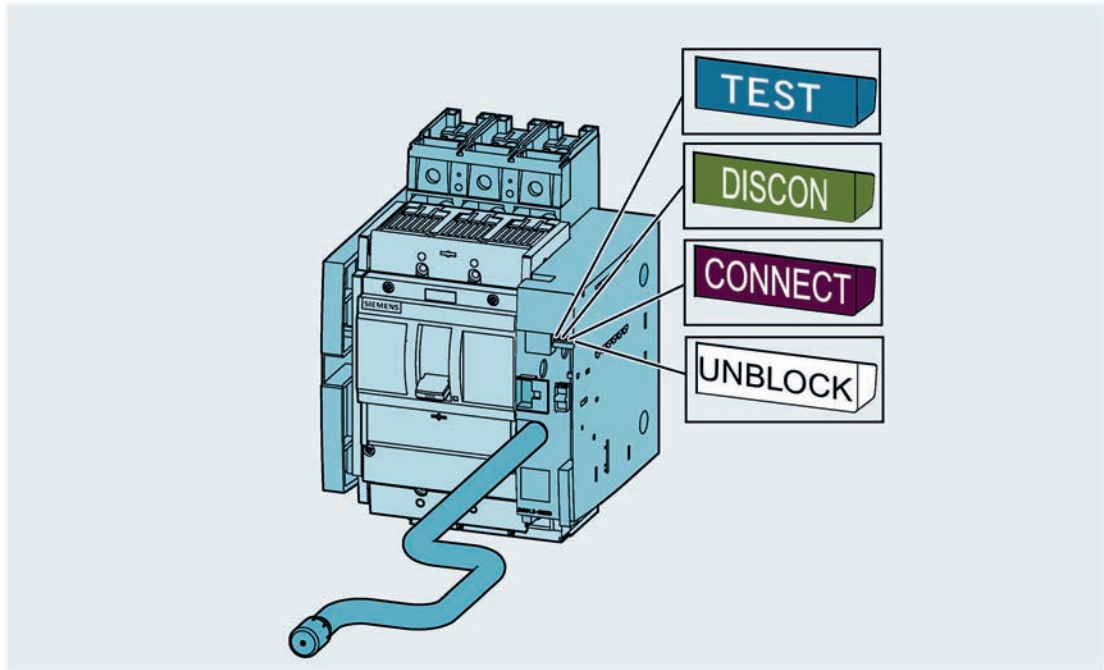
- Fixed-mounted ①
- Plug-in technology ②
- Draw-out technology ③

Plug-in and draw-out technology provide the option of quickly replacing the molded case circuit breakers during maintenance and of establishing visible electrical isolation in the main circuit, when the breaker is removed.

The terminals of the circuit breakers and their corresponding plug-in or draw-out bases are designed the same. This means that all connectors, terminal covers and other connection elements can be mounted on the bases exactly as they would mount on the breakers.

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

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



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

The draw-out unit has three positions:

- **CONNECT:**  
The molded case circuit breaker is connected to the main circuit. The auxiliary circuits are also connected.
- **TEST:**  
In the TEST position, the main contacts of the molded case circuit breaker are not connected to the main circuit, but the auxiliary components are connected to the control circuit. This allows the functionality of the auxiliary circuit and all of its components (auxiliary switches, auxiliary releases, communication, etc.) to be tested when the main circuit is open.
- **DISCONNECT:**  
The molded case circuit breaker is not connected to the main circuit or to the auxiliary circuit. The molded case circuit breaker can be removed.
- **UNBLOCK:**  
The molded case circuit breaker is not in any of the positions defined above and can be moved by means of the crank handle.



### Motor operator for remote control

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

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

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

### Ergonomic handle



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

### Clear status indication



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

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

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

### Active illumination



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

### Operator kit with Bowden cable (Max-Flex operator)






The Max-Flex operator is a hand lever operator for operating the breaker from the outside of the control panel. The handle is connected to the switching mechanism via a Bowden cable.

### Color-coded control elements

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

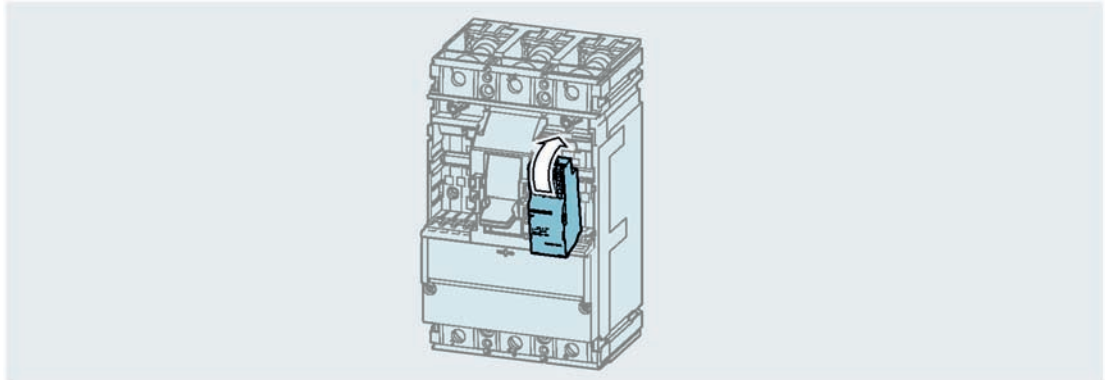


Each colored control element is assigned to a corresponding protective function, helping you to make the required settings quickly.

Color	Function
 Petrol blue	Overload protection
 Black	Short-circuit protection, ground-fault protection
 Gray	Protection of neutral conductor

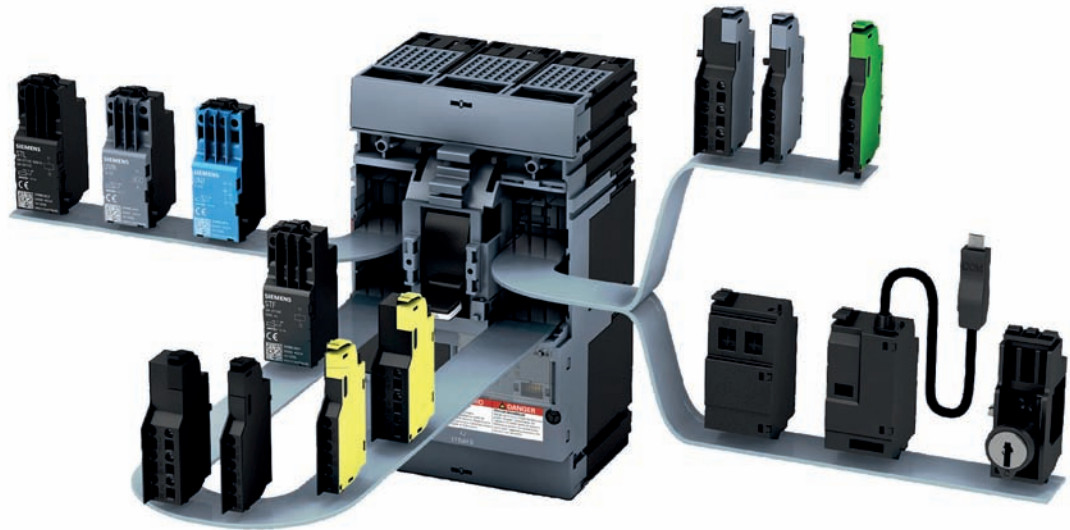
### 2.2.3 Wide range of accessories

The internal accessories (e.g. alarm and auxiliary switches, auxiliary releases, etc.) all belong to one family and can be installed within the 3VA5 and 3VA6 ranges regardless of the circuit breaker size. Installation is carried out quickly and easily by simply snapping on and screwing the connecting cables. Through color and mechanical coding and corresponding information found on the inside of the accessory cover, installation at the right place in the circuit breaker is ensured.



### Color coding of accessories

The internal accessories are color coded to clearly indicate their specific function.



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

Color	Auxiliary switches and alarm switches	Auxiliary releases
Black	Auxiliary switch AUX	Shunt trip left STL Shunt trip flexible STF
Gray	Leading changeover switch LCS	Undervoltage release UVR
Yellow	Trip alarm switch TAS	
Green	Electrical alarm switch EAS	
Blue		Universal release UNI

The cylinder lock and communication accessories shown next to the internal accessories are explained in chapters Locking and interlocking (Page 302) and Communication and system integration (Page 327).

### Fast assembly of motor operators

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



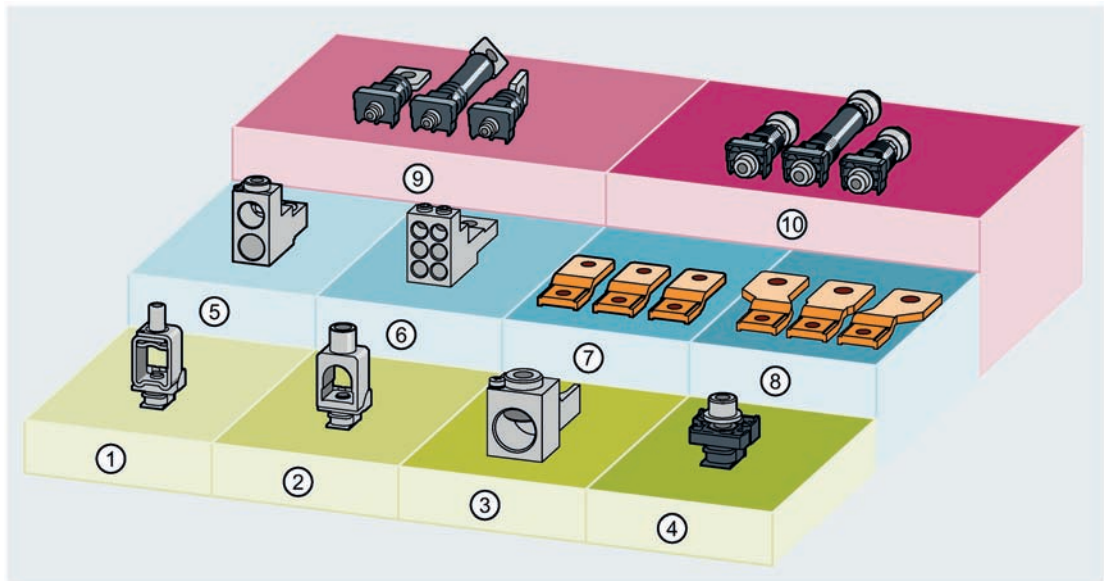
### 2.2.4 Connection technology

A large selection of terminals and connectors are available for the new range of 3VA UL molded case circuit breakers.

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

The connection technology can be easily integrated in the new range of 3VA UL molded case circuit breakers.

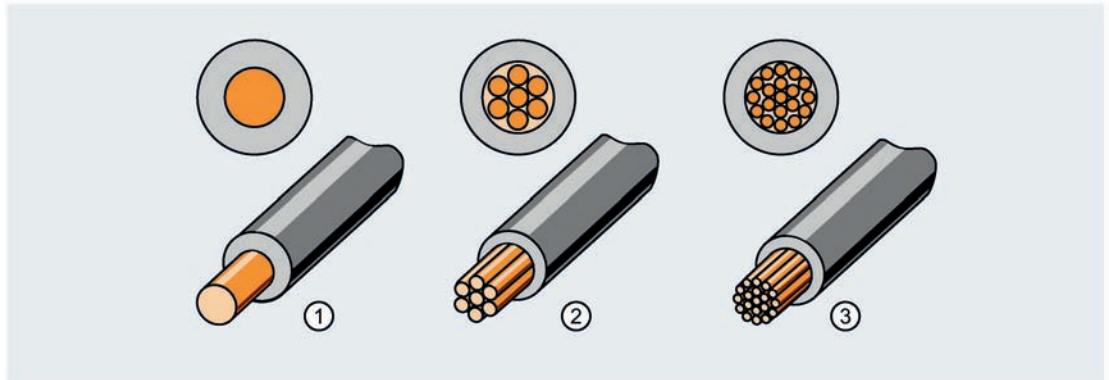
With it you can implement various front and rear main conductor connections for the molded case circuit breakers in all types of installation (fixed-mounted, plug-in and draw-out).



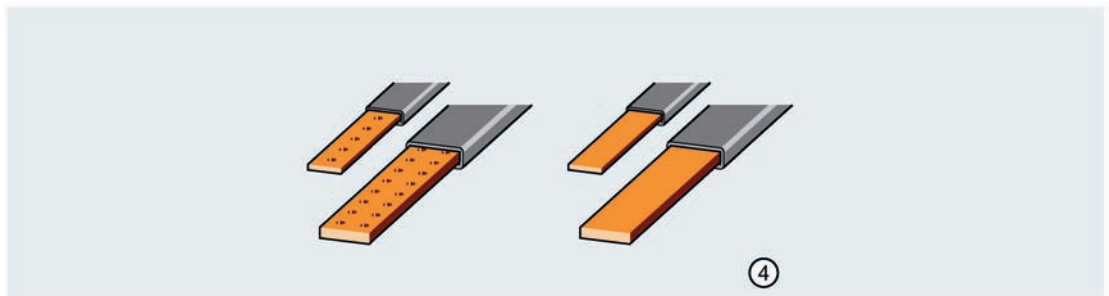
- ① Box terminal
  - ② Wire connector
  - ③ Wire connector, large
  - ④ Nut keeper kit
  - ⑤ Wire connector for 2 cables
  - ⑥ Distribution wire connector for 6 cables
  - ⑦ Front bus connectors extended
  - ⑧ Front bus connectors offset<sup>1)</sup>
  - ⑨ Rear connection stud flat
  - ⑩ Rear connection stud round
- <sup>1)</sup> Only 400/600 A available

## Cables and busbars

The new range of 3VA UL molded case circuit breakers are designed for different cables and busbars:



- Different cable types, e.g.
  - ① Circular conductor - UL cable class Solid
  - ② Stranded - UL cable class B
  - ③ Stranded - UL cable class C



- ④ Rigid busbars
- Different materials
  - Cables/busbars made of copper
  - Cables/busbars made of aluminum

## **2.3 Technical details**

This chapter provides an overview of the technical details of the 3VA UL molded case circuit breakers.

The topics discussed in this chapter are listed below:

- Circuit breaker identification
- Operation
- Current limitation
- Breaking capacity

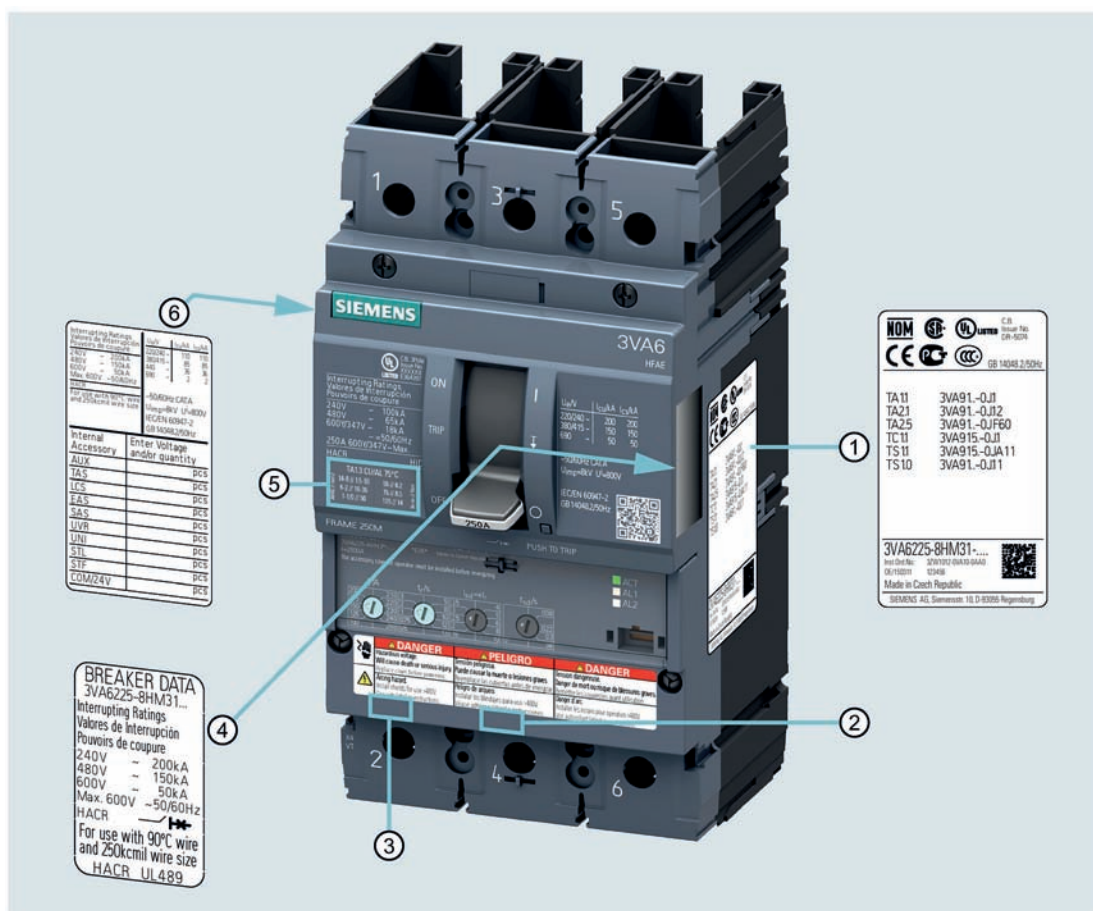
### **2.3.1 Circuit breaker identification**

Each 3VA UL molded case circuit breaker can be clearly identified in several ways.



## Circuit breaker labeling

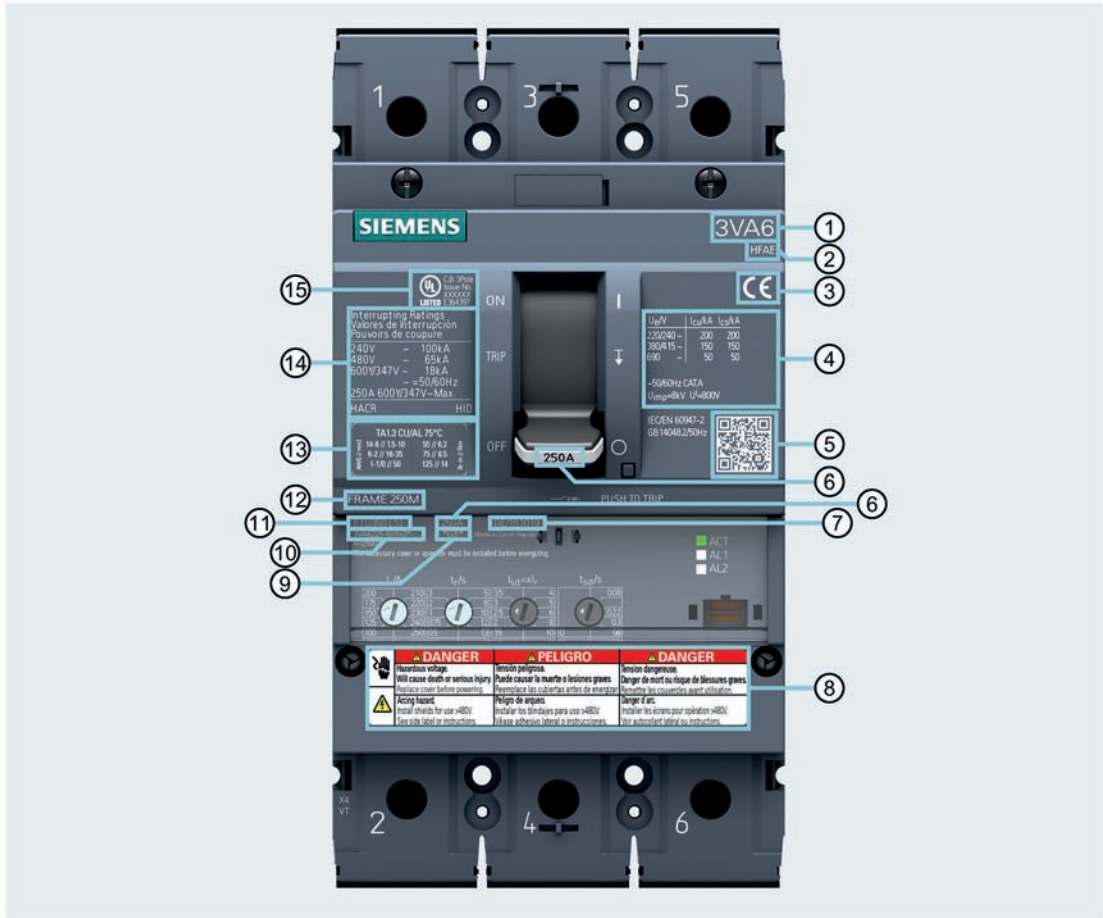
Each 3VA UL molded case circuit breaker is labeled with all UL-required information and is thus clearly identifiable:



- ① "Connection information" adhesive label
- ② Connection socket for EFB300 external function box and MMB300 maintenance mode box on the ETU
- ③ Connection possibility for an external current transformer (for neutral conductor protection, etc.)
- ④ Adhesive label insert (in accessory compartment)
- ⑤ "Detailed information on installed connection technology" adhesive label
- ⑥ "Internal accessories" adhesive label

Front panel: Labeling

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



- ① Circuit breaker designation
- ② UL Type Listing
- ③ CE approval mark
- ④ Key electrical data IEC
- ⑤ Knowledge Manager (see below)
- ⑥ Ampere rating
- ⑦ Date and location of manufacture
- ⑧ Safety labels
- ⑨ Product version
- ⑩ Circuit breaker article number (MLFB)
- ⑪ Trip unit designation
- ⑫ Size and breaking capacity class
- ⑬ Labeling field for installed connection technology
- ⑭ Key electrical data NEMA
- ⑮ UL approval mark

## Knowledge Manager

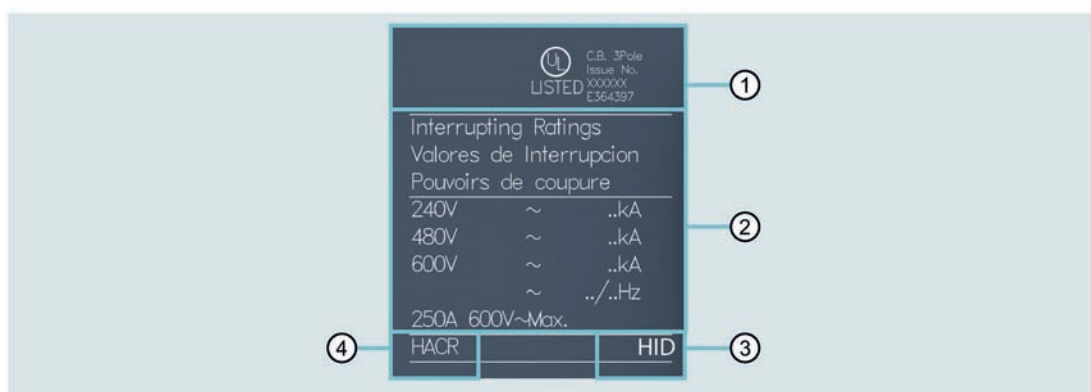
A QR code is attached in a clearly visible location to every 3VA UL molded case circuit breaker. This code can be scanned with a smartphone or a tablet PC. For the full range of QR code functions, use the "Industry Support" app supplied free of charge by Siemens.

All relevant product information regarding the molded case circuit breaker (e.g. operating instructions, characteristic curves, FAQs, etc.) can be quickly accessed and viewed in this way.



## Key electrical data NEMA

The key electrical data for the UL market on the left side of the molded case circuit breaker (when viewed from above) contains the following information:



- ① UL, CSA and NOM approval marks, if valid for this circuit breaker
- ② NEMA breaking capacity values with various voltages
- ③ HID type information (see below)
- ④ HACR type information (see below)

## HID and SWD type information

15 and 20 A circuit breakers marked "SWD" are suitable for use in applications, up to 347 V, intended to switch fluorescent lighting loads on a regular basis.

SWD stands for Switching Duty.

15-50 A circuit breakers marked "HID" are suitable for use in applications intended to switch fluorescent High-Intensity-Discharge lighting loads on a regular basis.

### HACR type information

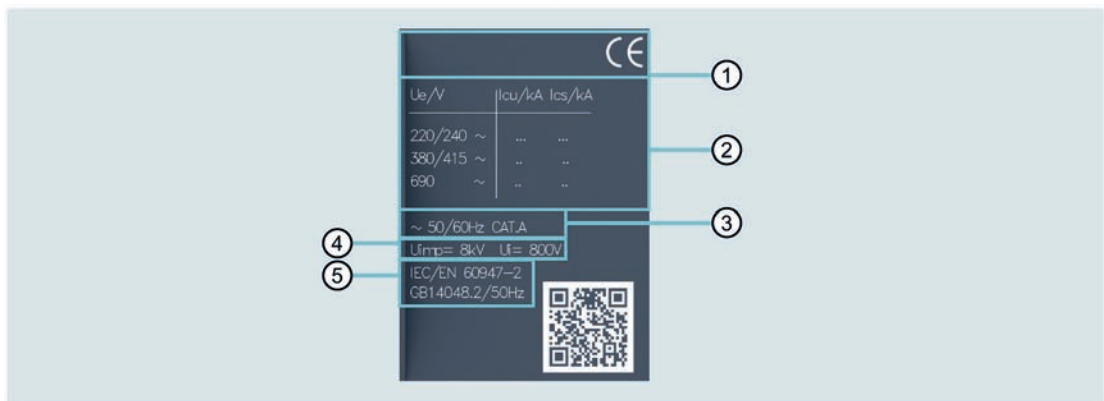
HACR stands for heating, air conditioning and refrigeration. The information on the circuit breaker states that the protective device may be used for overcurrent protection of corresponding systems.

HACR applications are a known example of installations with motor groups. Many modern heating systems operate with fans for exhaust air from combustion systems, exhaust control and ventilation systems for hot air. Air conditioning systems and refrigerators use compressors for coolant and fans for ventilation systems with cold air.

The HACR mark on molded case circuit breakers certified according to UL 489 is actually no longer required. Based on changes in the National Electrical Code® (NEC®) and in UL 489, all UL 489 certified switching devices today are automatically HACR certified and may bear the HACR mark.

### Key electrical data IEC

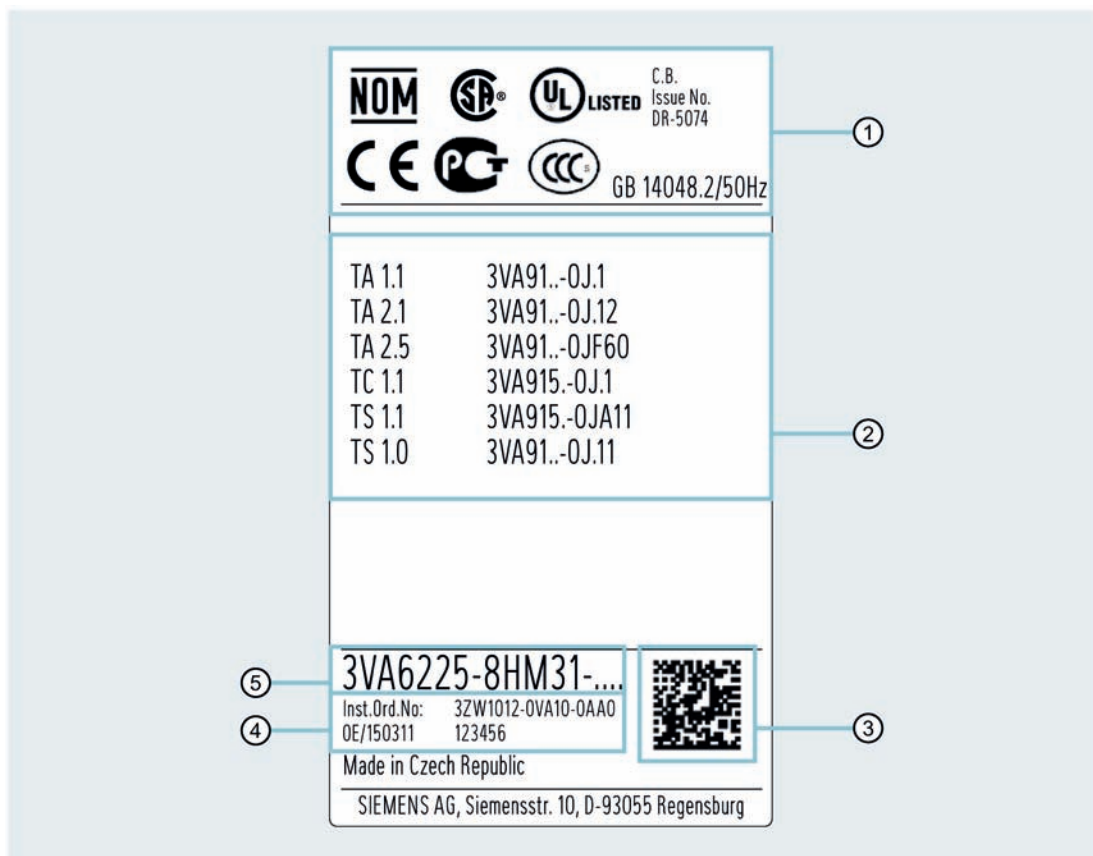
The key electrical data for the IEC market on the right side of the molded case circuit breaker (when viewed from above) contains the following information:



- ① CE, CCC, EAC, etc. approval marks, if valid for this circuit breaker
- ② IEC breaking capacity values at various voltages
- ③ Frequency, utilization category
- ④ Insulation data
- ⑤ Standards data according to IEC and SAC (Standardization Administration of the Peoples Republic of China)

### "Connection information" adhesive label

The "Connection information" label is attached on the side and contains the following information:



- ① UL, CSA and NOM, as well as CE, CCC, etc. approval marks, if valid for this circuit breaker
- ② List of allowed connection technology for this circuit breaker (see below)
- ③ 2D matrix code of production
- ④ Article number for operating instructions
- ⑤ Circuit breaker article number

#### List of allowed connection technology

The table shows the brief terminal designation, on the left, of all terminals and connections that may be installed with this circuit breaker. These terminal designations are unique.

On the right, in the table, are the order numbers for these terminals. The order number is also expressed with dots for wildcards if necessary. This is always the case when several packages are available in which the same terminals are used. The reason for this is that some terminals can be ordered individually or in multiple terminal packages.

### 2D matrix code of production

This is a production code that contains the article number of the device, production date, production facility and other information in encoded form.

This code can also be scanned with the free "Industry Support" app for smartphone and tablet PC. You then receive the same information as with the QR code on the device front.

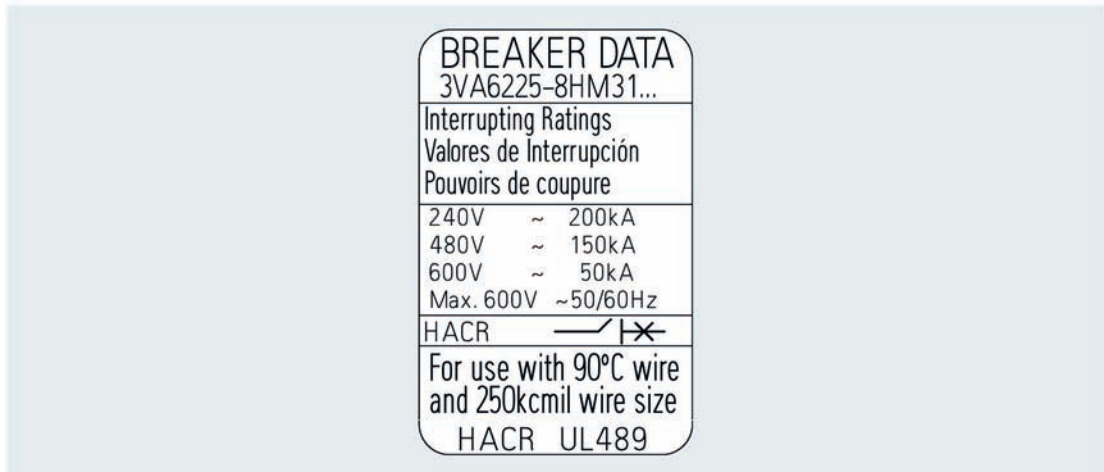
### Adhesive label insert

In the accessory compartment on the right, you can find two adhesive label inserts for 3VA UL: one for use of the circuit breaker in IEC applications and the other for use of the molded case circuit breaker in UL applications.

When an accessory (e.g. motor operator or manual operator) is mounted on the circuit breaker, this adhesive label can be attached to the accessory.

The adhesive labels are shown in the following example of the 3VA62 molded case circuit breaker. The adhesive labels are slightly different for molded case circuit breakers (MCCB), motor circuit protectors (MCP) and molded case switches (MCS). Ultimately, the following information is always specified:

- Article number MLFB
- Size
- Rated currents
- Breaking capacities at listed voltages



### "Detailed information on installed connection technology" adhesive label

This adhesive label accompanies the various terminals. At this time, 3VA UL molded case circuit breakers can only be ordered without preassembled connection technology, i.e. connection terminals or terminal bars for the incoming and outgoing sides must be ordered separately for each circuit breaker. The adhesive label shown below is enclosed with the terminals in duplicate.

An area is kept free on the left side of the accessory cover for the purpose of attaching the adhesive label. The user thus always has all relevant information on the installed connection technology of the circuit breaker concerned.

The adhesive label contains the following information:

TA 1.1 CU / AL75°C	
AWG (mm <sup>2</sup> )	lb-in (Nm)
14-12 (1.5-2.5)	25 (2.8)
10 (4-6)	35 (4)
8 (10)	55 (6.2)
6-3/0 (16-95)	100 (11)

- ① Unique brief terminal designation
- ② Permitted cable materials CU/AL with rated temperature
- ③ Tightening torque in pound-inch (lb-in) and newton meter (Nm)
- ④ Permitted cable diameter in AWG/kcmil and mm<sup>2</sup>

**"Internal accessories" adhesive label**

You can make a note of the number of installed accessory components on the "Internal accessories" adhesive label. This will enable you to ascertain which accessories are installed without removing the accessory cover and to use the information, for example, to reorder components. In addition, the breaking capacities according to UL 489 and IEC 60947-2 are named here again. This information is identical to the information on the accessory cover.

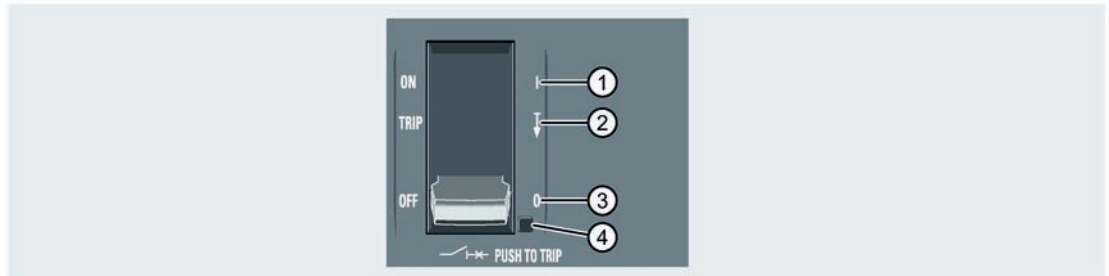
Interrupting Ratings	U <sub>e</sub> /V	I <sub>cu</sub> /kA	I <sub>cs</sub> /kA
Valores de Interrupción	220/240 ~	110	110
Pouvoirs de coupure	380/415 ~	85	85
240V ~200kA	440 ~	36	36
480V ~150kA	690 ~	10	5
600V ~ 50kA			
MAX. 600V ~50/60Hz	~50/60Hz CAT.A		
HACR	U <sub>imp</sub> =8kV U <sub>i</sub> =800V		
For use with 90°C wire and 20k cmil wire size	IEC/EN 60947-2 GB 14048.2/50Hz		

Internal Accessory	Enter Voltage and/or quantity
AUX	pcs
TAS	pcs
LCS	pcs
EAS	pcs
SAS	pcs
UVR	pcs
UNI	pcs
STL	pcs
STF	pcs
COM/24V	pcs



## 2.3.2 Operation



- ① ON: Main contacts closed
- ② TRIP: Switching position following a trip
- ③ OFF: Main contacts open
- ④ PUSH TO TRIP: A mechanical trip is initiated using the button

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

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

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

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

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

### Free tripping

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

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

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

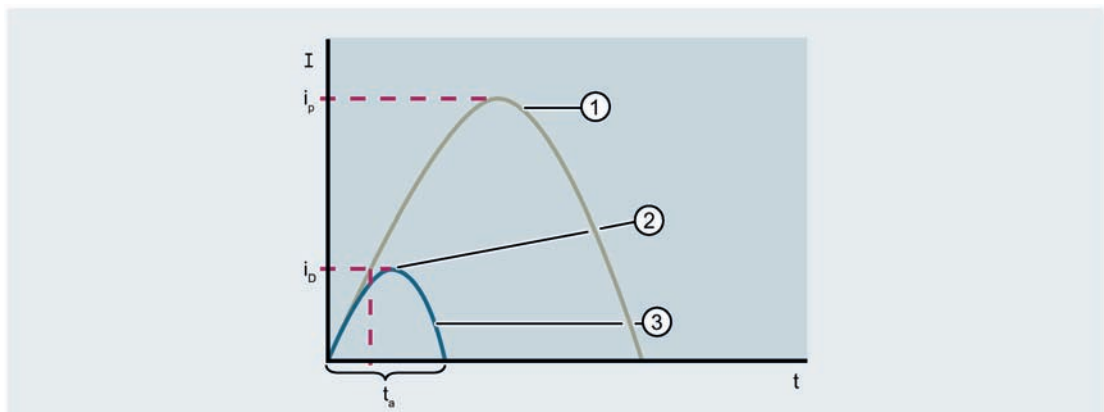
Failure of the molded case circuit breaker to trip indicates that it is defective and must be replaced.

### 2.3.3 Current limitation

The term "current limitation" refers to the action of limiting the peak value of the prospective impulse short-circuit current  $i_p$  to a lower let-through current  $i_D$ .

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

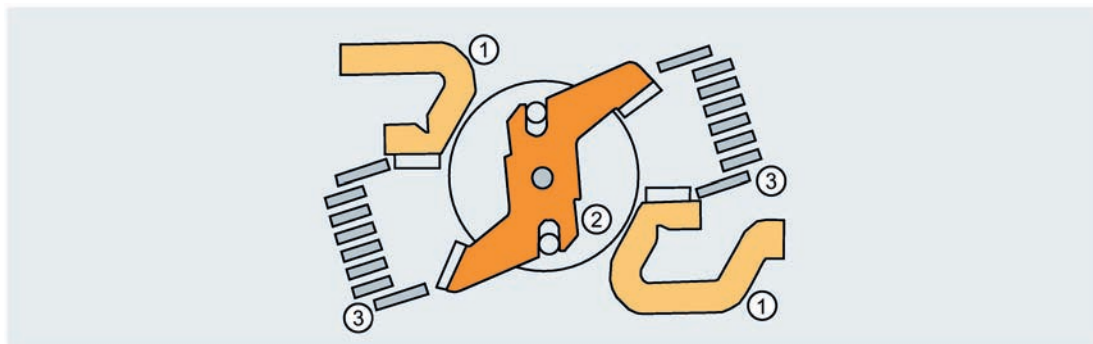
The 3VA UL molded case circuit breakers are designed as current-limiting molded case circuit breakers; however, they do not have "current limiting certification" according to UL 489.



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

## Rotary double-contact system

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



- ① Fixed contacts
- ② Rotary contact system
- ③ Arc splitter chute

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

## 2.4 Standards and guidelines

This chapter provides you with an overview of the standards and guidelines that are met with the 3VA UL molded case circuit breakers

The topics discussed in this chapter are listed below:

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

### 2.4.1 Compliance with standards and electromagnetic compatibility

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

- UL 489
- UL 1053
- IEC / EN 60947-1
- IEC / EN 60947-2
- IEC / EN 60947-6-1
- CISPR11, Class A and Class B

The 3VA UL molded case circuit breakers are adequately protected against the following factors:

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

## 2.4.2 Certificates

Information regarding available certifications such as UL, CE, CSA and marine approvals can be found in our Service and Support Portal on the Internet at the following link (<http://support.automation.siemens.com/WW/view/en/54137334/134200>).

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

## 2.4.3 Ambient conditions

### Pollution degree

Operation of the 3VA5 and 3VA6 molded case circuit breakers is approved in accordance with IEC / EN 60947-1 and IEC / EN 60664-1 for pollution degree 3.

### Ambient temperature

3VA UL molded case circuit breakers may be used at ambient temperatures from -25 °C to +70 °C.

3VA UL thermal-magnetic circuit breakers are calibrated for use at +40 °C.

There may be reductions in the rated operational current depending on ambient conditions, frame size and accessories used (Derating (Page 454)).

Please contact Siemens concerning operating conditions that are outside the values specified in the derating table.

The permissible storage temperature in original Siemens packaging is between -40 °C and +80 °C.

### Special climatic requirements

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

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

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

This class covers the areas MC3 + CC2 + SC1:

- Ambient temperature
- Humidity
- Vibration environment
- Shock environment

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

2.4 Standards and guidelines

The following standards-related criteria are complied with:

- IEC / EN 60068-2-2 "Bd" and IEC / EN 60068-2-1 "Ab":  
Temperature range: -25 °C ... +70 °C
- IEC / EN 60068-2-30 "Db"  
Humid heat up to +55 °C and air humidity up to 95 %
- IEC / EN 60068-2-6 "Fc"  
Vibration test
- IEC / EN 60068-2-27 "Ea"  
Shock resistance test

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

**Vibration resistance and shock resistance**

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

The circuit breakers resist impacts of up to 10 g without tripping and are tested to withstand without damage their operating conditions with shock impact according to IEC / EN 60068-2 27 "Ea" with 150 m/s<sup>2</sup> / 11 ms.

**Installation altitudes**

When 3VA5 and 3VA6 molded case circuit breakers are used at up to 6562 ft or 2000 m above sea level, the rating data will not change.

An installation altitude above 6562 ft or 2000 m can result in higher temperatures on the switching devices. The lower density of air can significantly reduce heat dissipation, making it necessary to decrease rated operational voltage, the rated uninterrupted current and the short-circuit values.

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

	Altitude			
	6562 ft 2000 m	9843 ft 3000 m	13123 ft 4000 m	16404 ft 5000 m
Breaking capacity	1.00	0.85	0.75	0.65
Operating voltage U <sub>max</sub>	1.00	0.86	0.75	0.67
Operating current I <sub>max</sub>	1.00	0.96	0.93	0.90

## 2.4.4 Permissible mounting positions and mounting positions with accessories

The tested mounting positions for 3VA UL molded case circuit breakers are illustrated below.

Please adhere to local codes and standards for specific application regulations.

	Wall mounting				Ceiling mounting suspended from above	Floor mounting supported from below
	vertical upright	horizontal right	horizontal left	vertical inverted <sup>2)</sup>		
<b>3VA5 molded case circuit breakers</b>						
3VA51 circuit breaker with DIN rail mounting, including installed, internal accessories <sup>1)</sup>	■	■	■	—	—	■
3VA51 circuit breaker with screw connection to mounting plate, including installed, internal accessories	■	■	■	■	■	■
3VA52 circuit breaker including internal accessories	■	■	■	■	■	■
<b>3VA6 molded case circuit breakers</b>						
All circuit breakers with installed internal accessories	■	■	■	■	■	■
<b>3VA5 and 3VA6 molded case circuit breakers with external accessories, 3- and 4-pole circuit breakers</b>						
Connection technology (terminals, covers, etc.)	■	■	■	■	■	■
Interlocking technology	■	■	■	■	■	■
Plug-in technology	■	■	■	—	—	■
Draw-out technology	■	■	■	—	—	■
Motor operator without <sup>1)</sup> /with plug-in or draw-out technology	■/■	■/■	■/■	—/—	■/—	■/■
Front mounted rotary operator without/with plug-in or draw-out technology	■/■	■/■	■/■	■/—	■/—	■/■
Door mounted rotary operator without/with plug-in or draw-out technology	■/■	■/■	■/■	■/—	■/—	■/■
Operator kit with Bowden cable (Max-Flex operator)	■	■	■	—	—	■
Operator kit with linkage	■	—	—	—	—	■
3-pole circuit breaker mounted on adapter for 60 mm busbar system	■	—	—	—	—	—

<sup>1)</sup> 3VA51: A motor operator cannot be used with DIN rail mounting

<sup>2)</sup> Not allowed by NEC

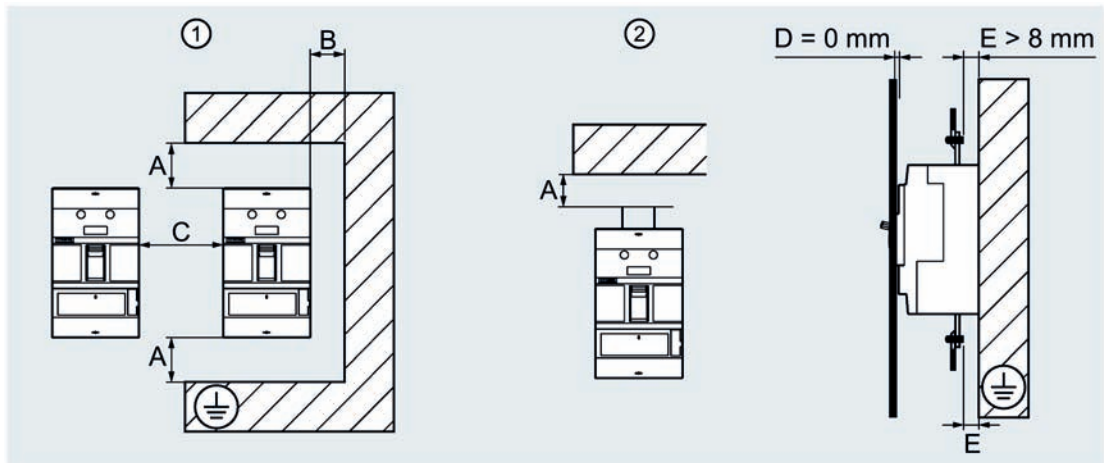
### 2.4.5 Safety clearances (for IEC applications)

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

Safety clearances are required to:

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

The following safety clearances apply to 3VA molded case circuit breakers with UL and IEC approval:



- ① Molded case circuit breaker without additional insulation measures or with short terminal cover
  - ② Molded case circuit breaker with additional insulation measures, phase barrier or long terminal cover
- A Minimum clearance between molded case circuit breaker and current paths (uninsulated and grounded metal), see tables below
- B Minimum clearance between molded case circuit breaker and side walls left / right (uninsulated and grounded metal), see tables below
- C Minimum clearance between two horizontally installed molded case circuit breakers, see tables below;  
applicable to fixed-mounted and plug-in versions (see chapter Plug-in and draw-out technology (Page 221))
- D Minimum clearance between molded case circuit breaker and panel door
- E Minimum clearance between live parts of connection system and grounded mounting plate



Minimum clearance for 3VA5 molded case circuit breakers:

3VA5 molded case circuit breakers Rated operational voltage	between devices	Distances [mm]								
		to grounded plate				to insulating material				
		3VA51 125 A		3VA52 250 A		3VA51 125 A		3VA52 250 A		
	C	A	B	A	B	A	B	A	B	
<b>U ≤ 415 V</b>										
Molded case circuit breaker										
without additional insulation measures or with short terminal covers	0	35	10	40	5	35	10	30	5	
with short phase barriers (1st third) <sup>1)</sup>	0	0	10	5	5	0	10	0	5	
with long phase barriers <sup>2)</sup>	0	0	10	0	5	0	10	0	5	
with long terminal cover	0	35	10	25	5	35	10	25	5	
<b>415 V &lt; U ≤ 690 V</b>										
Molded case circuit breaker										
without additional insulation measures or with short terminal covers	0	35	10	– <sup>3)</sup>	– <sup>3)</sup>	35	10	– <sup>3)</sup>	– <sup>3)</sup>	
with long phase barriers	0	0	10	0	10	0	10	0	5	
with long terminal cover	0	35	10	35	10	35	10	20	5	

- 1) Can be used for connection methods: box terminal, screw-type terminal, internal wire connector, and rear terminals
- 2) Can be used for connection methods: wire connector large, bus connectors extended, and bus connectors offset
- 3) Is not permitted in this voltage range for IEC applications

Minimum clearance for 3VA6 molded case circuit breakers:

3VA6 molded case circuit breakers Rated operational voltage	between devices	Distances [mm]											
		to grounded plate						to insulating material					
		3VA61 3VA62 150 A 250 A		3VA63 250 A 400 A		3VA64 400 A 600 A		3VA61 3VA62 150 A 250 A		3VA63 250 A 400 A		3VA64 400 A 600 A	
	C	A	B	A	B	A	B	A	B	A	B	A	B
<b>U ≤ 525 V</b>													
Molded case circuit breaker													
without additional insulation measures or with short terminal covers	0	40	5	50	10	50	20	30	5	40	5	40	5
with short phase barriers (1st third) <sup>1)</sup>	0	0	5	0	10	0	20	0	5	0	5	0	5
with long phase barriers <sup>2)</sup>	0	0	5	0	10	0	20	0	5	0	5	0	5
with long terminal cover	0	25	5	30	5	30	5	25	5	25	5	25	5
<b>525 V &lt; U ≤ 690 V</b>													
Molded case circuit breaker													
without additional insulation measures or with short terminal covers	is not permitted in this voltage range for IEC applications												
with long phase barriers	0	0	20	33	20	33	20	0	5	5	10	5	10
with long terminal cover	0	35	10	135	20	135	20	20	5	55	10	55	10

- 1) Can be used for connection methods: box terminal, screw-type terminal, internal wire connector, and rear terminals
- 2) Can be used for connection methods: wire connector large, bus connectors extended, and bus connectors offset

---

**Note**

In addition to the clearances stated above, any insulating equipment that might be required must also be considered, see chapter Insulating equipment (Page 203).

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

---

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

Additional insulation measures such as long terminal covers or phase barriers can increase the width or height of the molded case circuit breaker. In this case the minimum clearances apply from the corresponding sides of the overall molded case circuit breaker/insulation measure combination.

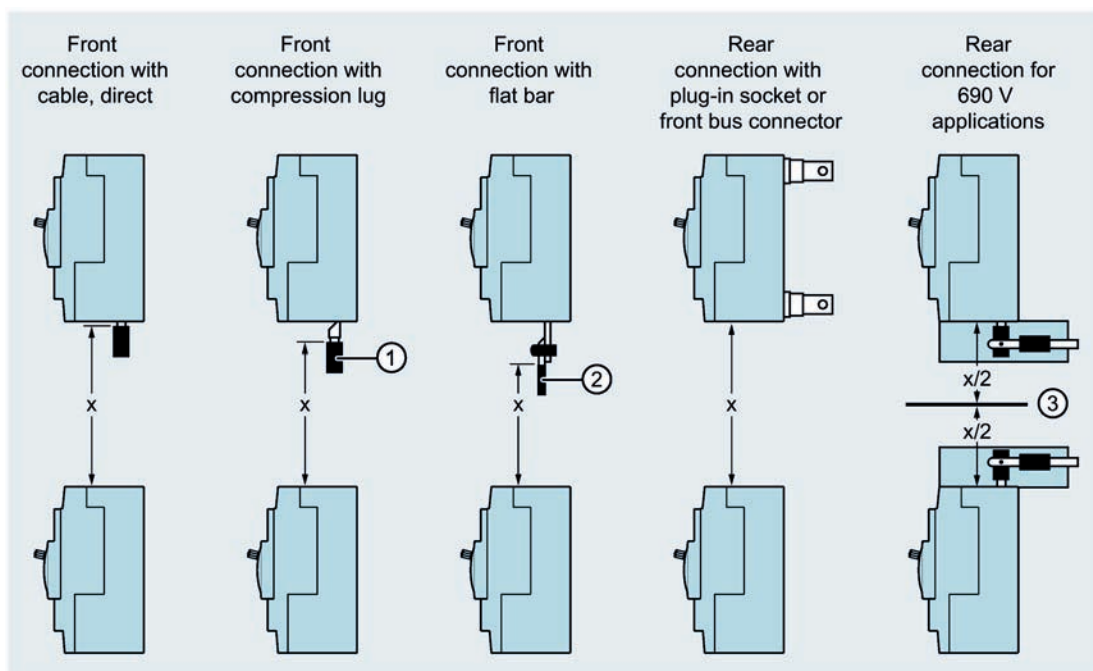
<b>NOTICE</b>
<b>Damage to the molded case circuit breaker and the system</b>
Depending on the application, larger minimum clearances may be necessary.
Note the specifications regarding air and creepage distances in the applicable overriding IEC 61439 standards "Switchgear and controlgear assemblies" as well as the applicable UL standards and local installation and application codes.

### Safety clearances between molded case circuit breakers

Generally, no minimum clearance needs to be observed between the molded case circuit breakers placed side-by-side.

For more details please refer to the relevant operating instructions of the circuit breakers.

The following safety clearances apply to molded case circuit breakers installed directly on top of each other:



x See tables below for minimum clearance

① Insulation of cable

② Insulation of busbar

③ Insulation between the molded case circuit breakers

Minimum clearance for 3VA5 molded case circuit breakers:

3VA5 molded case circuit breakers	125 A x [inch] [mm]	250 A x [inch] [mm]
Rated operational voltage		
$U \leq 415 \text{ V}$	5.91 150	5.91 150
$415 \text{ V} < U \leq 690 \text{ V}$	5.91 150	5.91 150

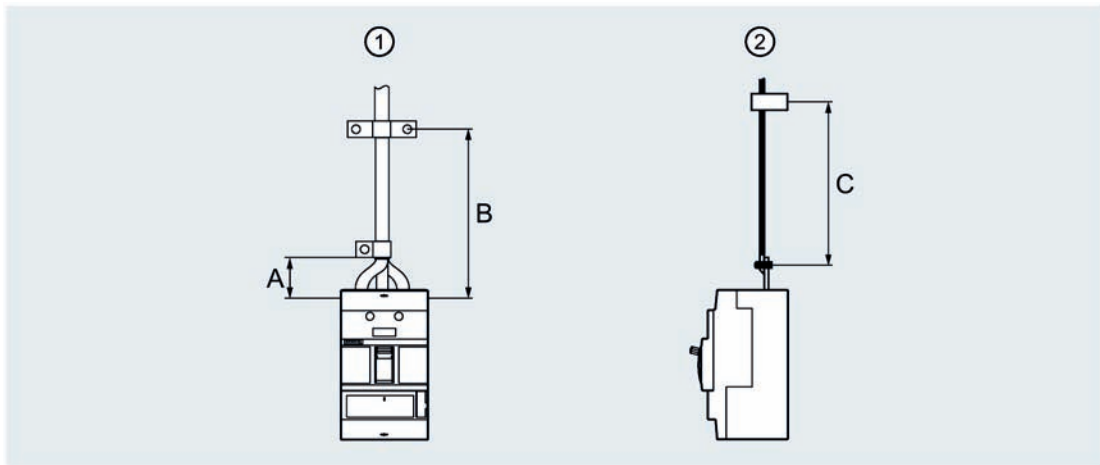
Minimum clearance for 3VA6 molded case circuit breakers:

3VA6 molded case circuit breakers	150 A / 250 A x [inch] [mm]	400 A / 600 A x [inch] [mm]
Rated operational voltage		
$U \leq 500 \text{ V}^{1)}$	5.91 150	5.91 150
$500 \text{ V} < U \leq 690 \text{ V}^{2)}$	7.88 200	15.75 400

- 1) Applies to the following installation variants:
  - Front connection with cable, direct / with compression lug / with flat bar
  - Rear connection with plug-in socket or busbar terminal
- 2) Applies to installation variant: Rear connection for 690 V applications (diagram top right)

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

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



- ① Fixing of cable
- ② Fixing of busbar

**Recommended maximum clearance for 3VA5 molded case circuit breakers**

The values for the 3VA5 molded case circuit breakers are available from Siemens on request.

Recommended maximum clearance for 3VA6 molded case circuit breakers:

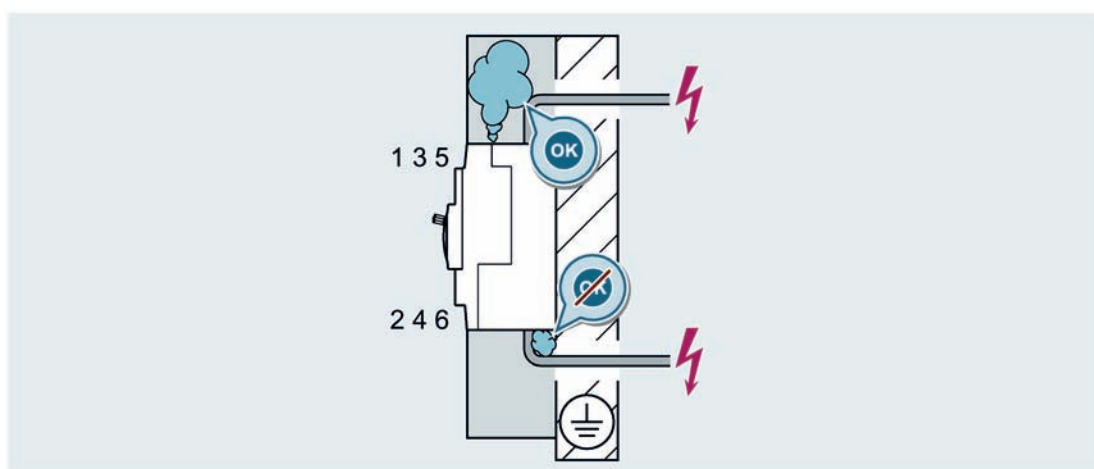
3VA6 molded case circuit breakers	Maximum clearances to first fixing point (recommended)		
	Cable		Busbar
	A [inch] [mm]	B [inch] [mm]	C [inch] [mm]
< 16 mm <sup>2</sup> / 6 AWG	30 kA: 6 150 85 kA / 150 kA: 2 + cable duct 50 + cable duct	10 250	10 250
16 mm <sup>2</sup> < 70 mm <sup>2</sup> / 6 AWG < 2/0	4 100	10 250	10 250
70 mm <sup>2</sup> < 240 mm <sup>2</sup> / 2/0 < 500 kcmil	6 150	10 250	10 250

## 2.4.6 Breaker venting

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

In particular, the following must be observed:

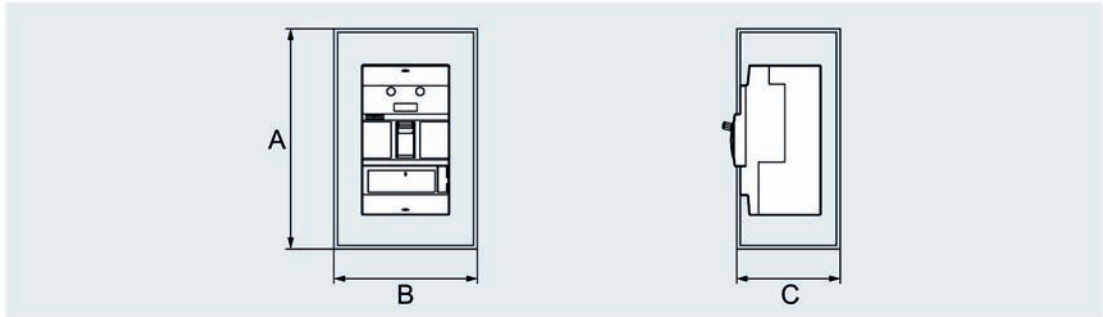
- Ventilation openings must be kept free.
- Ionized gases must not be routed in the direction of connecting terminals or non-insulated busbars.
- Venting spaces must not be blocked by busbars installed too close to one another or by other objects.



### 2.4.7 Minimum enclosure dimensions

The 3VA UL molded case circuit breakers are tested in appropriate steel enclosures as per UL 489.

The minimum enclosure dimensions are summarized in the following tables by size.



- A Minimum enclosure height
- B Minimum enclosure width
- C Minimum enclosure depth

Minimum enclosure dimensions for 3VA5 molded case circuit breakers:

3VA5 molded case circuit breakers		Rated	Breaking capacity	A [inch] [mm]	B [inch] [mm]	C [inch] [mm]
3VA51	125 A	80 %	S / M / H	20 508	8.77 223	4 102
3VA52	250 A	80 %	M / H / C	30.9 785	9.13 232	5.07 129

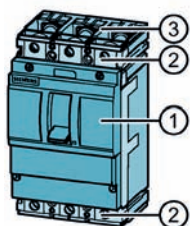
Minimum enclosure dimensions for 3VA6 molded case circuit breakers:

3VA6 molded case circuit breakers		Rated	Breaking capacity	A [inch] [mm]	B [inch] [mm]	C [inch] [mm]
3VA61	150 A	80 % / 100 %	M / H / C / L	25.19 640	12 305	5.11 <sup>1)</sup> 130 <sup>1)</sup>
3VA62	250 A	80 % / 100 %	M / H / C / L	25.19 640	12 305	5.11 <sup>1)</sup> 130 <sup>1)</sup>
3VA63	250 A	80 % / 100 %	M / H / C / L	39.37 1000	14.17 360	14.56 370
3VA63	400 A	80 %	M / H / C / L	39.37 1000	14.17 360	14.56 370
3VA64	400 A	80 % / 100 %	M / H / C / L	39.37 1000	14.17 360	14.56 370
3VA64	600 A	80 %	M / H / C / L	39.37 1000	14.17 360	14.56 370

<sup>1)</sup> with plug-in socket: 7.87" / 200 mm

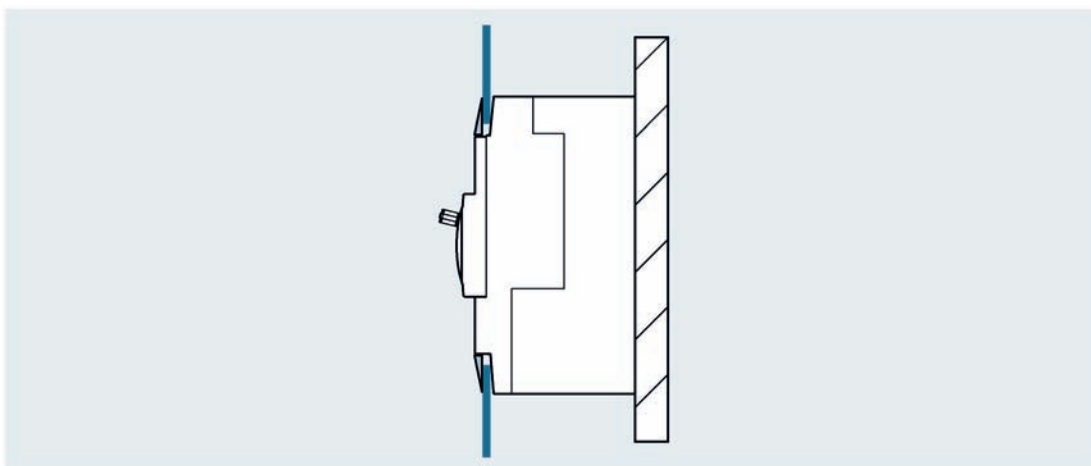
## 2.4.8 IP degrees of protection

The 3VA UL molded case circuit breakers meet the following IP protection classes as defined by IEC 60529 and IEC 60947-1, Annex C:



		Accessories cover		Terminal cover	
		Without	With	Without	With
Front panel without termination area ①	–		IP4x		
Front panel termination area ②				IP2x	IP4x
Infeed/load ends ③				IP3x	IP4x

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



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

You can achieve a higher degree of protection up to IP65 in combination with the door-mounted rotary operator.

The IP protection system according to IEC 60529 is used for devices and enclosures or panels. However, there is not a comparable system for electrical devices themselves in the UL world. According to NEMA 250, there is a "type-rated system" for electrical enclosures and panels. In NFPA79 "Electrical Standard for Industrial Machinery", in which the NEMA 250 ratings for electrical enclosures are provided in detail, requirements for electrical equipment without enclosure can also be found in section 6 "Protection from Electrical Hazards". In essence, it states that the protection from electric shock is to be tested using a jointed test finger with a diameter of 12.5 mm. The test finger described in detail here corresponds pretty closely to the test finger that must be used according to IEC 60529 for testing the finger safety for IP2x degree of protection, except that the IEC finger must have a diameter of 12.0 mm

Thus, devices that meet IP2x degree of protection generally meet the requirements of the U.S. touch-safe standards.

You can find NEMA protection types of the manual operators in chapter NEMA degree of protection (Page 291).

### **2.4.9 Environmental protection**

The 3VA UL molded case circuit breakers already meet the requirements of the European RoHS Directive 2011/65/EU (Restriction of the use of certain hazardous substances in electrical and electronic equipment) even though these products will not fall under this directive until July 22, 2019.



## 2.5 Protection functions










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



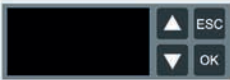



















The topics discussed in this chapter are listed below:

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

### 2.5.1 Description of functions

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

Protection	Thermal-magnetic TM 2-series	Electronic ETU 3-series
Trip units	 <p>Line protection: TM210, TM230 Motor circuit protector: TM120M</p>	 <p>Line protection: ETU320, ETU330, ETU350 Motor circuit protector: ETU310M</p>
Integrated functions		
Parameter assignment	 <p>Setting and reading off parameters in A</p>	 <p>Setting and reading off parameters in A and s</p>
Status display		 <p>Display of ETU status via LEDs</p>
Interface		 <p>Interface for test devices</p>
Metering function		
Optional expansions		 <p>EFB300 external function box for connection to the ETU</p>
		 <p>MMB300 maintenance mode box for connection to the ETU</p>
		 <p>TD300/TD500 test device</p>

Protection	Electronic with display ETU 5-series	Electronic with display and metering function ETU 8-series
Trip units	 Line protection: ETU550, ETU 556, ETU560	 Line protection: ETU 820, ETU 830, ETU850, ETU856, ETU860
Integrated functions		
Parameter assignment	 - Setting and reading off the parameters via display and communication - Fine setting of the parameters - Reading off the measured values	 - Setting and reading off the parameters via display and communication - Fine setting of the parameters - Reading off the measured values
Status display	 Display of ETU status via LEDs	 Display of ETU status via LEDs
Interface	 Interface for test devices	 Interface for test devices
Metering function		Metering function integrated
Optional expansions		
	 24 V module for continuous power supply (also without primary current through the molded case circuit breaker)	 24 V module for continuous power supply (also without primary current through the molded case circuit breaker)
	 EFB300 external function box for connection to the ETU	 EFB300 external function box for connection to the ETU
	 MMB300 maintenance mode box for connection to the ETU	 MMB300 maintenance mode box for connection to the ETU
	 COM060 communication module	 COM060 communication module
	 COM800/COM100 breaker data server Interface to - PROFIBUS - PROFINET - Modbus RTU - Ethernet (Modbus TCP)	 COM800/COM100 breaker data server Interface to - PROFIBUS - PROFINET - Modbus RTU - Ethernet (Modbus TCP)
	 External display DSP800 for installing in the cubicle door	 External display DSP800 for installing in the cubicle door
	 TD300/TD500 test device	 TD300/TD500 test device

### 2.5.2 Characteristic curves

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

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

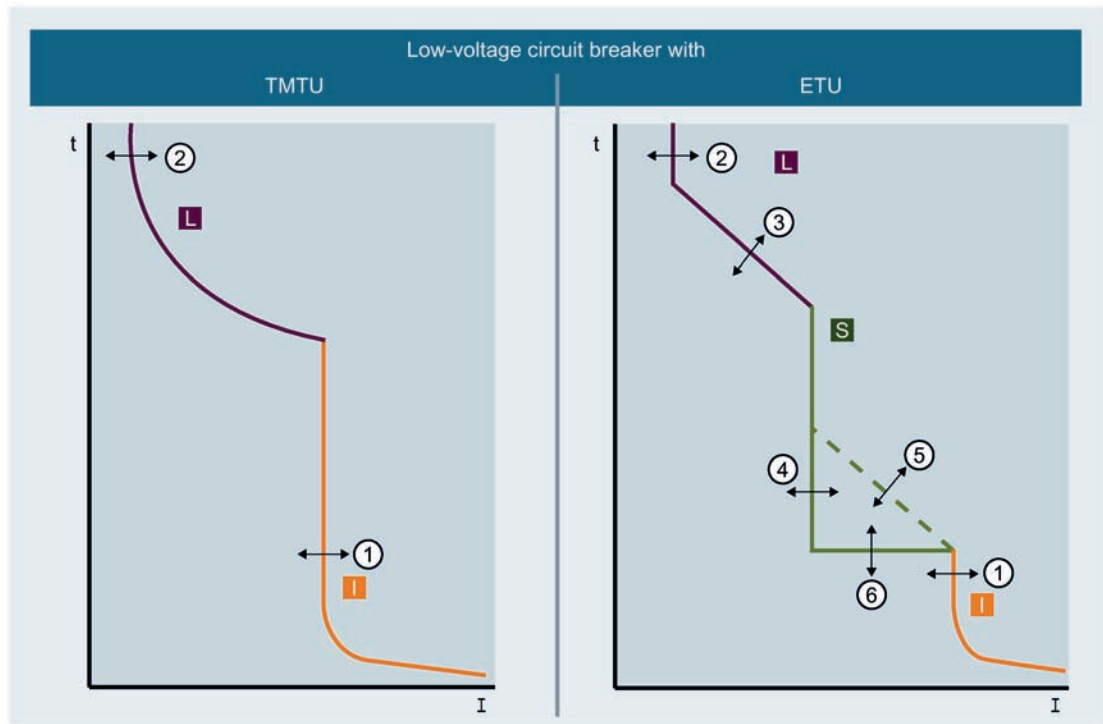
Tripping characteristics are represented graphically. In order to ease the coordination of different protection devices, the current is sometimes specified as a multiple of the current setting value and the time is specified in seconds.

#### Tripping characteristics for thermal-magnetic trip units

The graph is drawn in the log-log coordinate system.

#### Tripping characteristics for electronic trip units

The graph is drawn in the log-log coordinate system.



- ① Response threshold of the instantaneous protection
- ② Response threshold of the long-time delayed protection
- ③ Delay of the long-time-delayed protection
- ④ Response threshold of the short-time delayed protection
- ⑤ Fixed tripping time or  $I^2t$  function of the short-time-delayed protection
- ⑥ Delay of the short-time delayed protection
- L Overload range
- S Short-time delayed short-circuit current range
- I Instantaneous short-circuit current range

## 2.5.3 Guide to setting the tripping characteristic

### Supplementary conditions

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

### Basic rules for setting different trip parameters

Parameter	Knobs	Effect on characteristic curve	Brief description	Reason	Example
L	$I_r$ / A 		Pick-up current of the Breaker rating $I_r$ : ETU $I_r = 0.4 \dots 1 \times I_n$ TMTU $I_r = 1 \times I_n$ Absolute values in A	Optimization of the overload range by setting to the operational current of the circuit to be protected	Overload range from 300 A
	$t_{ld}$ / s 		Delay time in the overload range. In this case, the set tripping time relates to reference point of $6 \times I_r$	Better selectivity in the overload range in switchboards with multiple selective tripping levels	The tripping time of $t_{ld} = 10$ s applies to $6 \times I_r$ in this case $6 \times 300 \text{ A} = 1800 \text{ A}$
S	$I_{sd} = x I_r$ / A 		Pick-up current of the short-time delayed short-circuit protection	Limiting of the short-circuit range in which the current must be disconnected faster but possibly with a small time delay.	When $I_r = 300$ A and $I_{sd} = 5$ : Tripping with 1500 A after delay time $t_{sd}$
	$t_{sd}$ / s 		Delay time of the short-time delayed short-circuit protection	Better selectivity in the overload range in switchboards with multiple selective tripping levels	$t_{sd} = 0.15$ s: Tripping after 0.15 s for current values between $I_r$ and $I_{sd}$
I	$I_i$ / A 		Pick-up current of the instantaneous short-circuit protection	Limiting of the short-circuit range in which the fault current has to be disconnected as quickly as possible.	When $I_r = 2000$ A: Instantaneous tripping with currents $> 2000$ A
N	$I_N = x I_r$ 		Pick-up current of the neutral conductor protection	Protection of the neutral conductor for overcurrent and short-circuit	When $I_N = \text{ON}$ , $I_N = 0.5 \times I_r$ and $I_r = 300$ A, overload from 150 A in neutral conductor, instantaneous tripping with 2000 A
G	$t_g = 0.1$ s $t_g = 0.3$ s 		Pick-up current of the ground fault protection and delay time until disconnection	Line protection	With ground-fault currents starting from $I_g = 50$ A: Tripping after time $t_g = 0.1$ s

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

Trip units of the ETU 5-series and 8-series are equipped with an LCD display and operator buttons. These can be used to change the parameters.

The powerconfig software can also be used to input parameter settings. The TD500 test device and the COM800/COM100 breaker data server combined with the COM060 communication module can be used as the software interface.

#### 2.5.4 Overload protection (L)

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

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

- Bimetal characteristic with thermal-magnetic trip units
- $I^2t$  characteristic with electronic trip units

The setting value of the current (and the breaker rating) is designated with  $I_r$ , and the associated time delay with  $t_r$ .

The time delay with the device-specific reference point defines the current-dependent curve shape of the setpoint characteristic. With 3VA UL molded case circuit breakers, this reference point of the overcurrent trip is 6 times the current setting value  $I_r$ . The following mathematical equation determines the remaining curve of the setpoint characteristic:

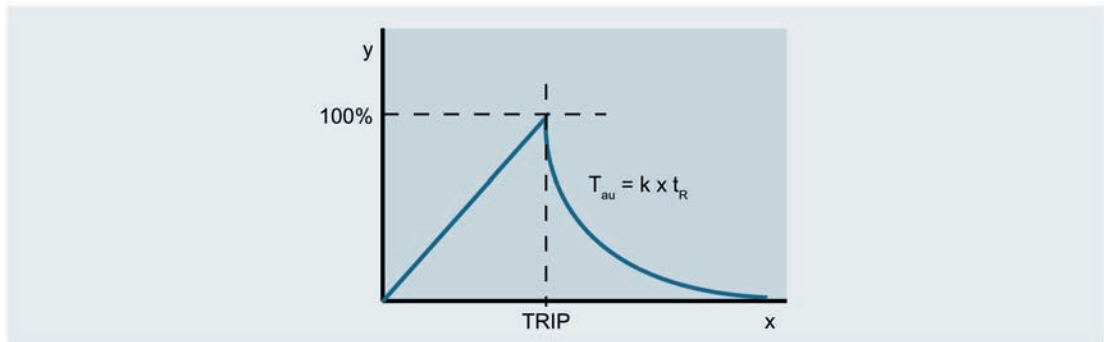
$$I^2t = \text{constant}$$

#### Thermal memory

The electronic trip units have a so-called thermal memory via which temperature rises in the past are taken into account for tripping.

##### Thermal memory activated (ON)

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



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

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

The short-time delayed short-circuit protection refers to the short-circuit protection of phases L1 to L3 (called phases A to C in North America) and the neutral conductor. The protection function responds if the current in at least one phase exceeds the set tripping current  $I_{sd}$  for the set delay period  $t_{sd}$ .

The S release has a characteristic curve with current-dependent characteristic  $I^2t$ , i.e. the delay time is dependent on the energy content of the short-circuit current present. The electronic trip units ETU 5-series and 8-series can be optionally switched over to a current-independent tripping characteristic. In this case, a fixed delay time  $t_{sd}$  applies.

### 2.5.6 Instantaneous short-circuit protection (I)

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

This short-circuit protection function protects phases L1 to L3. The instantaneous short-circuit protection function responds if the instantaneous value equal to the rms of the current in at least one phase exceeds the instantaneous tripping current  $I_i$ .

## 2.5.7 Ground-fault protection

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

The G protection detects residual currents between phases and grounded, electrically conductive parts. The ground-fault protection function responds if the ground fault current exceeds the set tripping current  $I_g$  for the set delay period  $t_g$ .

Like for the short-time delayed short-circuit protection, the delay time of the ground fault protection can be set as either a current-independent or a current-dependent ( $I^2t$ ) value, dependent on the trip unit options.

Special variants with ground-fault alarm-only are available for the 3VA UL molded case circuit breakers. These are the 3VA6 molded case circuit breakers with ETUs 556 and 856. When a ground-fault current is detected, the breaker does not trip.

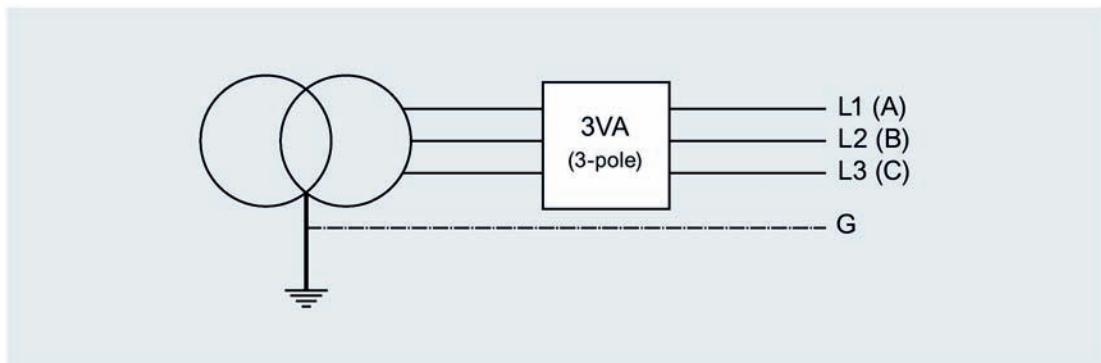
Rather, only an indication is provided via the ETU display and, if desired, via a programmable digital output on the External Function Box (EFB) and/or through communications. This allows the system to remain in operation.

On 4-pole molded case circuit breakers and 3-pole molded case circuit breakers with external current transformer for the N conductor, the G protection calculates the vector sum of the currents of the three phases and the neutral conductor. The G release trips the molded case circuit breaker, or an alarm is issued via the communication system if the trip unit is alarm-only, if the rms value of this vector sum exceeds the set response threshold  $I_g$  for the set delay time  $t_g$ .

### 2.5.7.1 Measurement method 1: Vectorial summation (residual) current

#### Ground-fault detection in balanced systems

3-pole molded case circuit breaker in balanced systems:



Trip unit variants:

- ETUs 3-series: ETU330 (LIG)
- ETUs 5-series: ETU556 (LSIG alarm), ETU560 (LSIG)
- ETUs 8-series: ETU830 (LIG), ETU856 (LSIG alarm), ETU860 (LSIG)



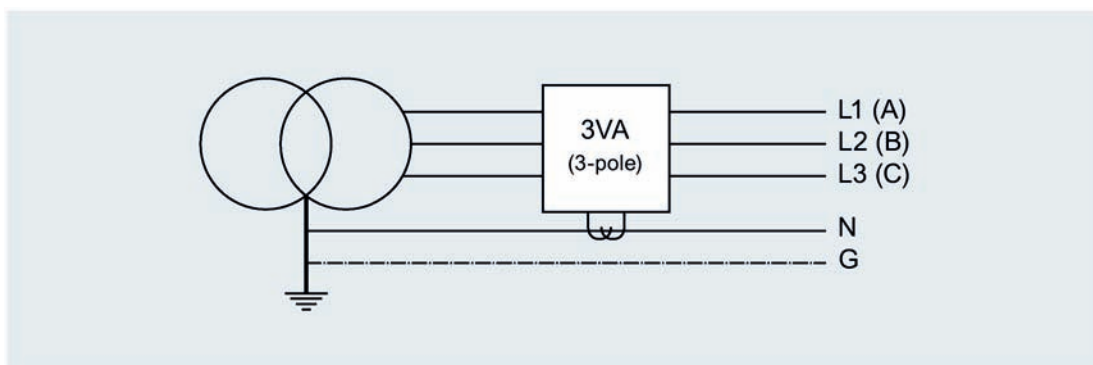
## Ground-fault detection in unbalanced systems

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

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

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

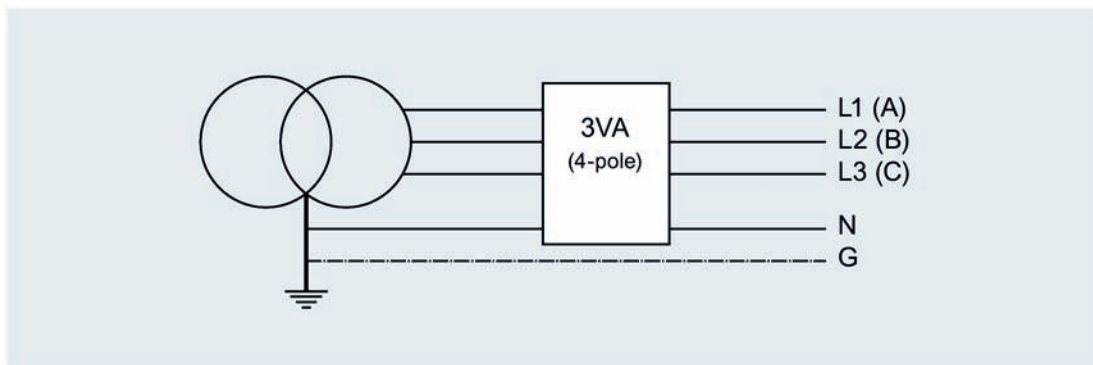
### 3-pole molded case circuit breaker in unbalanced systems, 3-pole 3VA with external N transformer:



Trip unit variants, 3-pole 3VA6 molded case circuit breaker with external N transformer:

- ETUs 5-series: ETU556 (LSIG alarm), ETU560 (LSIG)
- ETUs 8-series: ETU856 (LSIG alarm), ETU860 (LSIG)

### 4-pole molded case circuit breaker in unbalanced systems:



Trip unit variants, 4-pole 3VA6 molded case circuit breaker:

- ETUs 3-series: ETU330 (LIG)
- ETUs 5-series: ETU556 (LSIG alarm), ETU560 (LSIG)
- ETUs 8-series: ETU830 (LIG), ETU856 (LSIG alarm), ETU860 (LSIG)

### 2.5.7.2 Measurement method 2: Direct detection

In this case, an external current transformer is installed directly in the grounded neutral point of the transformer. When the set ground-fault current is reached, a message is directly output (ETU556 and ETU856) or the circuit breaker is tripped (ETU560 and ETU860).

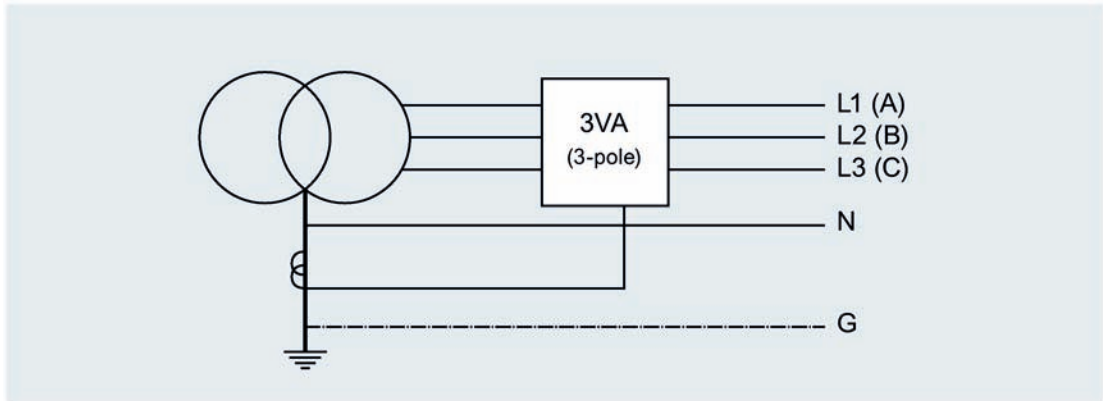
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#### Note

This measuring method must be activated explicitly in the ETU: On the display under menu item "GF M", switch over from "rES" (measurement method 1) to "d Ir" (measurement method 2).

---

**3-pole molded case circuit breaker, external current transformer in the grounded neutral point of the transformer:**



Trip unit variants, 3-pole 3VA6 molded case circuit breaker with external N transformer:

- ETUs 5-series: ETU556 (LSIG alarm), ETU560 (LSIG)
- ETUs 8-series: ETU856 (LSIG alarm), ETU860 (LSIG)

## 2.5.8 Neutral conductor protection (N)

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

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

The setting value of the current is designated with  $I_N$ , the associated setting time is identical to  $t_{ld}$ .

---

### Note

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

---

## Neutral conductor protection

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

- The neutral conductor has a smaller cross section than the phase conductors.
- Higher harmonic components in the system can be expected.
- A large number of loads, or predominantly single-phase loads, will be connected.
- The neutral conductor will be isolated for functional reasons, e.g. because there are several voltage sources.
- The neutral conductor will be isolated for safety reasons, e.g. because work is in progress on disconnected units

### Neutral conductor protection and 3VA6 molded case circuit breakers

The following 3VA6 molded case circuit breakers have neutral conductor protection:

- All 3-pole versions with external current transformer for N conductor (only with ETUs 5-series and 8-series)
- All 4-pole versions

The tripping systems of the ETUs 5-series and 8-series enable an overdimensioned neutral conductor protection. This might be necessary to provide protection against third-order harmonics and multiples thereof.

2.5 Protection functions

3VA	Options	Neutral conductor protection	TMTU	ETU 3-series	ETU 5-series	ETU 8-series
3-pole molded case circuit breaker	3-pole, 3 phases monitored	None	■	■		
3-pole molded case circuit breaker with external transformer for neutral conductor	3-pole, 3 phases monitored	None			■	■
	3-pole, 3 phases monitored + N (20% <sup>1)2)</sup> ... 100% I <sub>n</sub> )	Protection for user-defined cross section of neutral conductor			■	■
	3-pole, 3 phases monitored + N (100% ... 160% I <sub>n</sub> )	Oversized neutral conductor			■	■
4-pole molded case circuit breaker	4-pole, 3 phases monitored, N = OFF	None		■	■	■
	4-pole, 3 phases monitored + N (50% x I <sub>r</sub> )	Protection for half cross section of neutral conductor		■ <sup>3)</sup>		
	4-pole, 3 phases monitored + N (100% x I <sub>r</sub> )	Protection for full cross section of neutral conductor		■		
	4-pole, 3 phases monitored + N (20% <sup>1)2)</sup> ... 100% I <sub>n</sub> )	Protection for user-defined cross section of neutral conductor			■	■
	4-pole, 3 phases monitored + N (100% ... 160% I <sub>n</sub> )	Oversized neutral conductor			■ <sup>4)</sup>	■ <sup>4)</sup>

N Neutral conductor protection

1) With rated current I<sub>n</sub> ≤ 40 A: I<sub>N</sub> = 40 % ... 100 % I<sub>n</sub>

2) With rated current I<sub>n</sub> ≤ 100 A: I<sub>N</sub> = 20% ... 100% I<sub>n</sub>

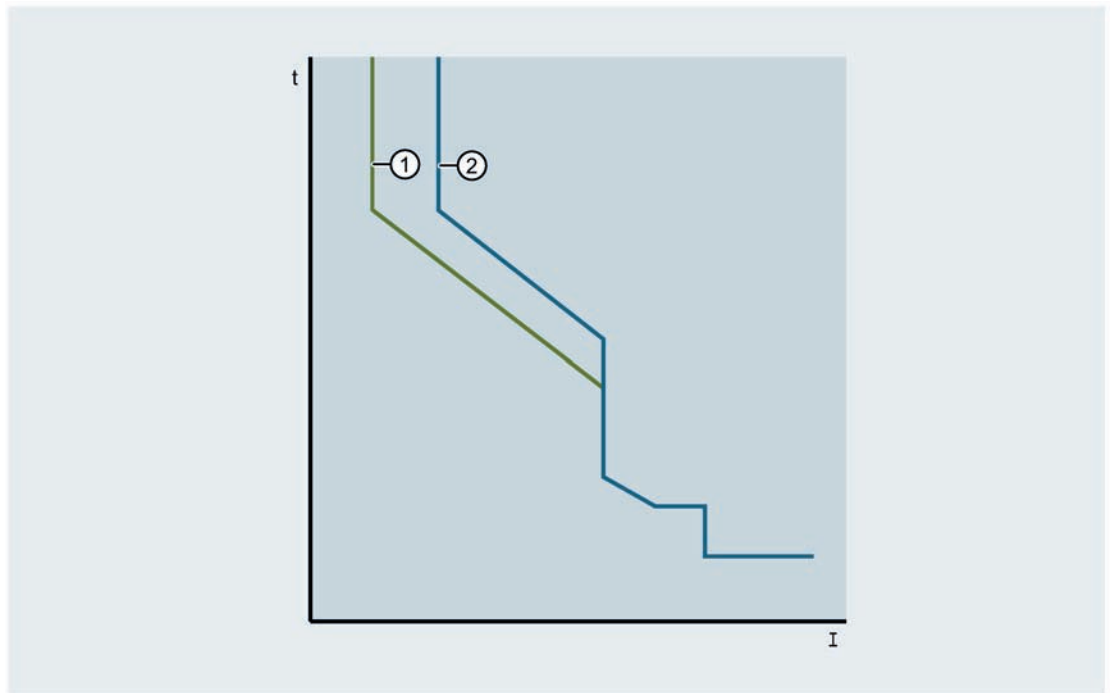
3) Starting from rated current I<sub>n</sub> ≥ 100 A

4) Dependent on circuit breaker frame size and rated current

**Parameters of the neutral conductor protection function**

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

### Example of a neutral conductor protection characteristic



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

### Adjustment of neutral conductor protection settings

The tripping current  $I_N$  can be adjusted:

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

### See also

Use of the 3VA UL molded case circuit breakers in line protection (Page 99)

## **2.5.9 Zone-selective interlocking ZSI**

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

Regardless of the number of series-connected molded case circuit breakers, all short circuits in the network greater than  $I_{st}$  but less than  $I_i$  will have a delay of no more than 50 ms.

---

### **Note**

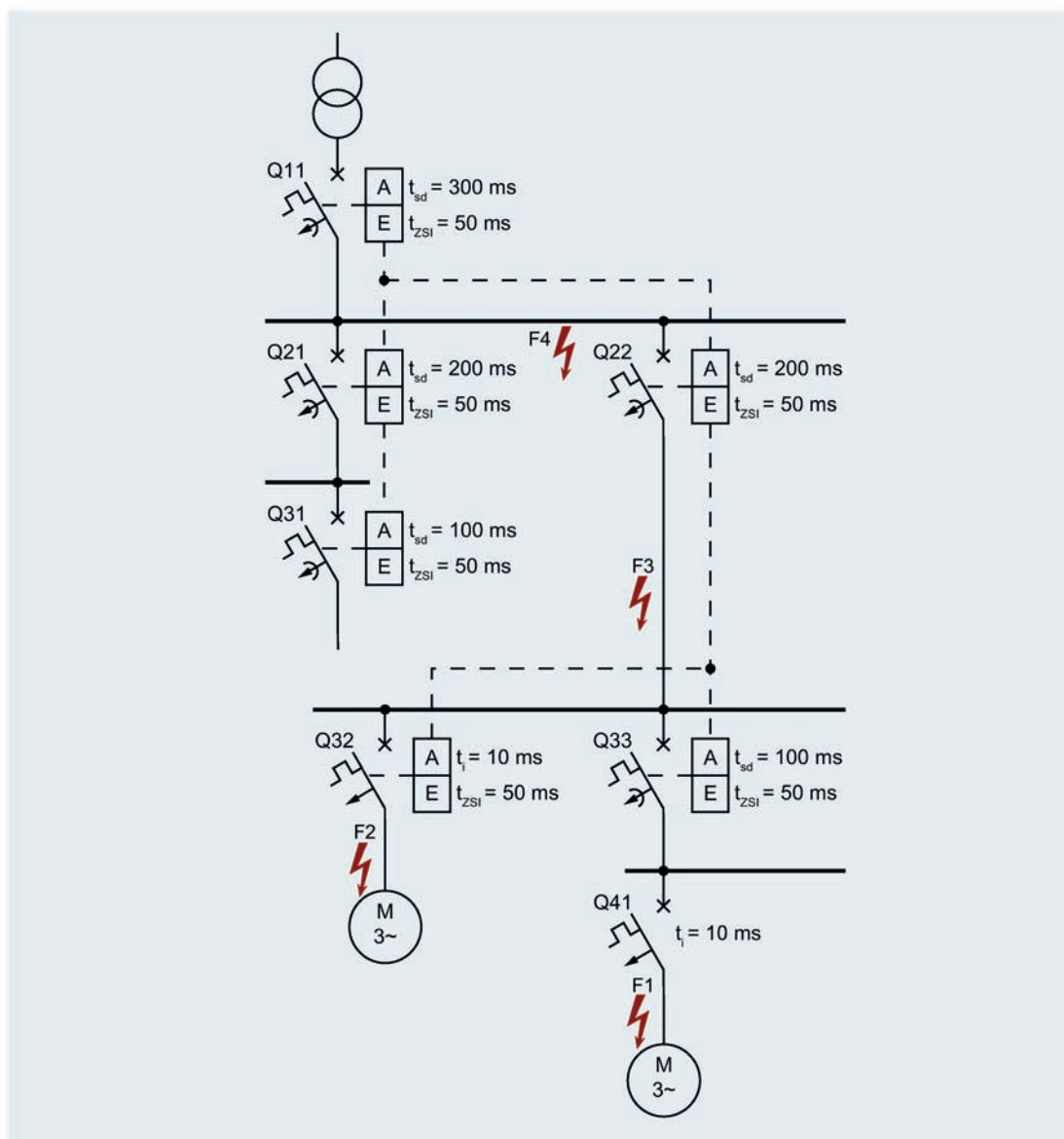
#### **Backward compatibility**

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

---

## Operating principle

The diagram below demonstrates the operating principle of zone-selective interlocking:



--- Communication cable

A Output, transmits the blocking signal

E Input, receives the blocking signal

$t_i$  "Virtual" tripping time of I protection

$t_{SD}$  Delay time setting of S protection

$t_{ZSI}$  Delay time of all molded case circuit breakers which detect the short circuit but do not receive a blocking signal when ZSI is activated

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

2.5 Protection functions

**Fault 1**

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

**Fault 2**

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

**Fault 3**

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

**Fault 4**

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

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



## 2.6 Thermal-magnetic trip unit

### 2.6.1 Thermal-magnetic trip unit (TMTU)

A thermal-magnetic trip unit consists of a thermal trip unit for protecting against overload, and a magnetic trip unit for protecting against short circuits. Both trip units are series-connected. Thermal-magnetic trip units are available with Fixed-Thermal-Fixed-Magnetic (FTFM) or Fixed-Thermal-Adjustable-Magnetic (FTAM) settings.

### 2.6.2 Application cases and trip unit types

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

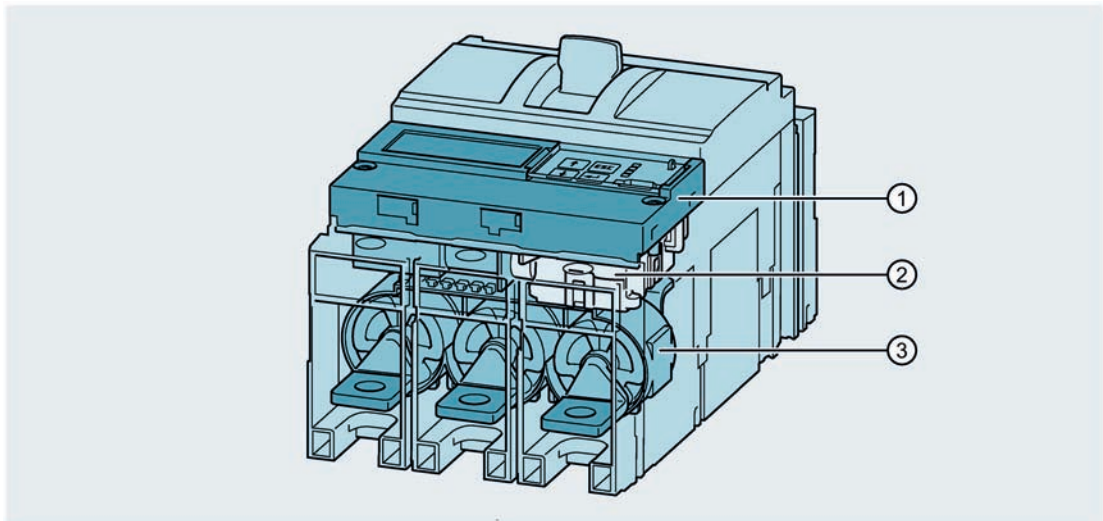
Protection	TM210 FTFM	TM230 FTAM
Line protection	■	■
Version available with		
1-pole breaker	■	
2(3)-pole breaker	■	■
3-pole breaker	■	■
Available protection parameters		
$I_r$ adjustable		
$I_l$ adjustable		■
$I_r$ fixed	■	■
$I_l$ fixed	■	

## 2.7 Electronic trip unit

### 2.7.1 Electronic trip unit (ETU)

An electronic trip unit is based on the following concepts:

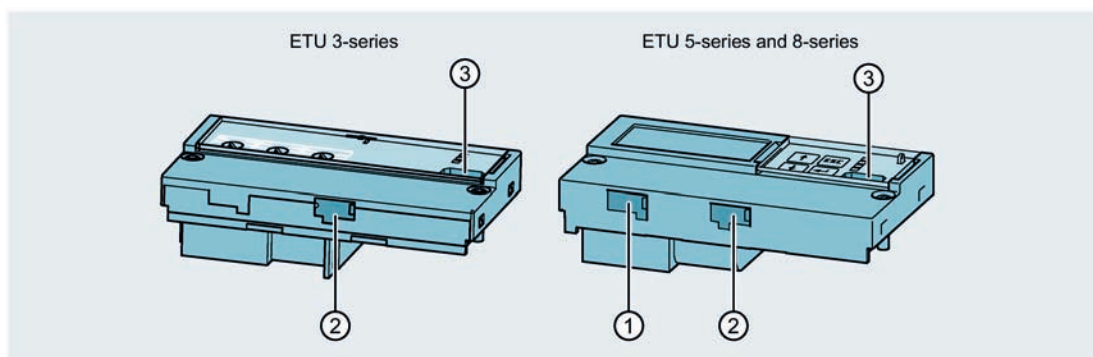
- Complete measurement of the current in the phases L1, L2 and L3, with N and currents to ground optional
- Rogowski coil
  - Very precise measurement of the current
  - Better ground-fault protection because the vectorial summation formation is more exact
- Evaluation of the current measurement values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



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

## 2.7.2 Connections

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



- ① Interface for an external current transformer for N conductor
- ② Interface for connection of an EFB300 external function box and MMB300 maintenance mode box
- ③ Connection for test devices TD300 and TD500

## 2.7.3 Arc energy reduction

The U.S. "National Electrical Code (NFPA 70) Section 240.87" requires special protection measures for circuit breakers where the highest continuous current setting is rated or can be adjusted to 1200 A or higher.

The intent of these protection functions is to reduce the let-through energy under fault conditions (e.g. short-circuit) to the smallest possible amount in order to best protect the worker.

One method to satisfy this requirement is to provide energy-reducing maintenance switching with local status indicator.

The Siemens DAS when used with a remote external switch meets this requirement.

### 3VA6 molded case circuit breakers and Dynamic Arc Sentry

All 3VA6 molded case circuit breakers are equipped with the Dynamic Arc Sentry mode (DAS mode).




When the 3VA6 molded case circuit breakers are in Dynamic Arc Sentry mode, the instantaneous short-circuit current  $I_i$  is automatically reduced to the smallest available value (factory setting). Likewise, the ground-fault current  $I_g$  is reduced to the smallest available value for the ETU variants with ground-fault protection or ground-fault detection. In this way it is ensured that the molded case circuit breaker disconnects as quickly as possible under fault conditions and enhanced personal protection is achieved.

To facilitate optimal adjustment of the molded case circuit breaker in DAS mode to local or system-specific circumstances, it is possible to configure the DAS parameter set ( $I_i$  and  $I_g$ ) using the powerconfig parameterization software.

Protection parameters		Normal operating state	Dynamic Arc Sentry mode DAS parameter set	
Parameter	ETU type		Factory setting	Parameter assignment via powerconfig possible
$I_i$	System protection ETUs (3-series, 5-series and 8-series)	Value can be adjusted or is fixed	$1.5 \times I_n$	■
	ETU310M	Value adjustable	$3.0 \times I_n$	■
$I_g$	ETU variants with ground-fault protection or ground-fault detection	Value adjustable	$0.2 \times I_n$	■
$t_g$	ETU variants with ground-fault protection or ground-fault detection	Time adjustable	$t_g$ and curve characteristic not adapted in DAS mode	

All molded case circuit breakers with electronic trip units (ETUs 3-series, 5-series and 8-series) receive the signal for switchover of the protection parameters to DAS mode via the MMB300 maintenance mode box applied with the appropriate control scheme. You can find more information about the MMB300 maintenance mode box in chapter MMB300 maintenance mode box (Page 351).

Additionally, it is possible to activate DAS mode for the ETUs 5-series and 8-series directly at the molded case circuit breakers via the keys on the LCD display.

Indication on LCD display	Meaning
	DAS mode on molded case circuit breaker deactivated (factory setting)
	DAS mode on molded case circuit breaker activated
	Molded case circuit breaker is in DAS mode <sup>1)</sup>

<sup>1)</sup> For LED displays, see chapter Operator controls (Page 84)

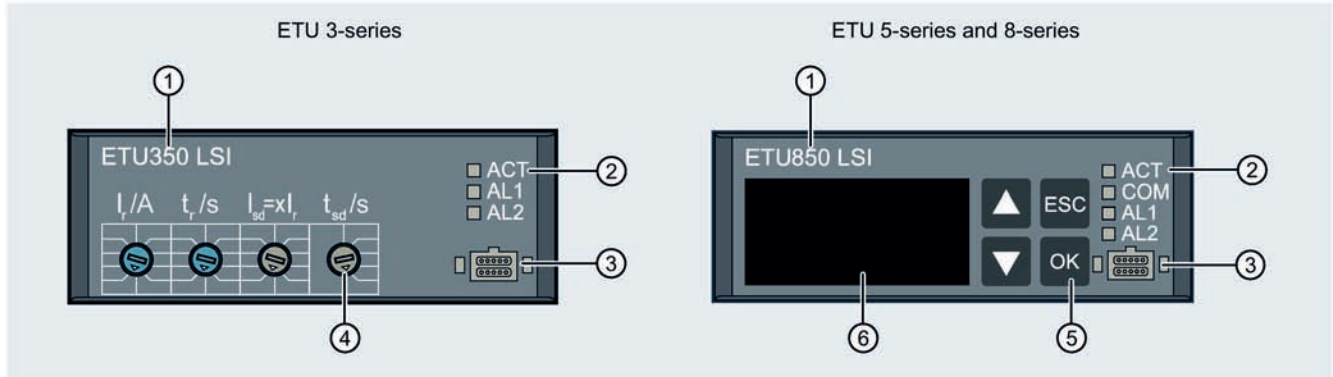
## 2.7.4 Protection functions

Protection	ETU 320 LI	ETU 330 LIG	ETU 350 LSI	ETU 550 LSI	ETU 556 LSI-G	ETU 560 LSIG	ETU 820 LI	ETU 830 LIG	ETU 850 LSI	ETU 856 LSI-G	ETU 860 LSIG
Line protection	■	■	■	■	■	■	■	■	■	■	■
Generator protection	■	■	■	■	■	■	■	■	■	■	■
<b>Version</b>											
3-pole without external neutral conductor transformer	■	■	■								
3-pole with external neutral conductor transformer				■	■	■			■	■	■
4-pole with protected neutral conductor transformer	■	■	■	■	■	■	■	■	■	■	■
<b>Available protection parameters</b>											
$I_r$	■	■	■	■	■	■	■	■	■	■	■
$t_{sd}$ with $6 \times I_r$	■	■	■	■	■	■	■	■	■	■	■
Characteristic in L range: $I^2 t_{sd}$	■	■	■	■	■	■	■	■	■	■	■
Thermal image	■	■	■	■	■	■	■	■	■	■	■
$I_{sd}$			■	■	■	■			■	■	■
$t_{sd}$ with $8 \times I_r$			■	■	■	■			■	■	■
Characteristic in S range: $I^2 t_{sd}$			■	■	■	■			■	■	■
Characteristic in S range: Selectable $I^2 t_{sd} / t_{sd}$				■	■	■			■	■	■
$I_i$	■	■	■	■	■	■	■	■	■	■	■
$I_N$ <sup>1)</sup>	■	■	■	■	■	■	■	■	■	■	■
$I_g$		■			■	■		■		■	■
$t_g$ with $2 \times I_g$		■			■	■		■		■	■
Characteristic in G range: $I^2 t_g$					■	■		■		■	■
Characteristic in G range: selectable $I^2 t_g / t_g$					■	■				■	■
Ground fault alarm-only function					■					■	
Ground fault trip function						■		■			■
ZSI	■	■	■	■	■	■	■	■	■	■	■
Arc fault mitigation mode (DAS)	■	■	■	■	■	■	■	■	■	■	■
<b>Features and options</b>											
Setting with rotary coding switch	■	■	■								
Setting via the operator buttons on the ETU display				■	■	■	■	■	■	■	■
Data shown on ETU display				■	■	■	■	■	■	■	■
Metering function							■	■	■	■	■
Communication option				■	■	■	■	■	■	■	■
Front interface	■	■	■	■	■	■	■	■	■	■	■

<sup>1)</sup> Available in a version with external current transformer for N conductor or 4-pole breaker

### 2.7.5 Operator controls

The following figure shows the available ETU types of the 3VA6 molded case circuit breakers. You can decide which ETU to select according to the area of application.



- ① Name of the ETU
- ② LED display

- ③ Front interface
- ④ Setting buttons

- ⑤ Pushbuttons
- ⑥ LCD

## LED displays

The following table explains what the LED displays mean:

LED	Meaning	Description
<input type="checkbox"/> ACT	Off	Current flow in the main circuit less than 20% $I_n$
 ACT	Flashing	ETUs 8-series: Missing external 24 V DC supply voltage for metering function
 ACT	On	ETU ready for operation, current flow greater than 20 % $I_n$
<input type="checkbox"/> COM	Off	No communication to a COM100/800 via COM060
 COM	Flashing	Communication interrupted. The LED flashes when the communication already existed
 COM	On	Active communication to the COM100/800 breaker data server.
 ACT	On	Current flow between 90 % and 105 % $I_r$
 AL1	On	
<input type="checkbox"/> AL2	Off	
 ACT	On	Current flow greater than 105 % $I_r$
 AL1	On	
 AL2	On	
 ACT	On	Overtemperature alarm AL1 and AL2 flashing alternately
 AL1	Flashing	
 AL2	Flashing	
 ACT	Flashing	Error Internal fault in trip unit All LEDs flash simultaneously with same frequency
 COM	Flashing	
 AL1	Flashing	
 AL2	Flashing	
 ACT	On	ETU is in Dynamic Arc Sentry mode (DAS mode)
 COM	On	
<input type="checkbox"/> AL1	Off	
 AL2	Flashing	

**ETU 3-series units**

3-series electronic trip units are equipped with rotary selector switches. A description of the operating principle of the rotary selector switches and operating instructions can be found in chapter Guide to setting the tripping characteristic (Page 67).

**Displays on ETU 5-series and 8-series units**

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



**Note**





The backlighting of the LED display is only active with an external voltage supply (e.g. by the COM060 communication module, by the 24 V module or by the EFB300 External Function Box).

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

Symbol	Meaning
	If this symbol is activated, the indicated value is a measured value.
	This symbol is shown when the first alarm threshold for this measured value was exceeded.
	This symbol is shown when the second alarm threshold for this measured value was exceeded.
	Display in parameter edit mode. The value can be changed with the <UP> and <DOWN> arrow keys.
	If TRIP is shown, the display indicates the information from the previous tripping operation.
	Name of the displayed value. Here, current I phase "a" or "1".



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

Symbol	Meaning
	Goes back to the previous screen page. Increases a parameter in parameter edit mode.
	Goes to the next screen page. Decreases a parameter in parameter edit mode.
	Goes to parameter edit mode when a parameter is displayed. Confirms a parameter in parameter edit mode.
	Goes to the standard display. Discards a parameter in parameter edit mode.


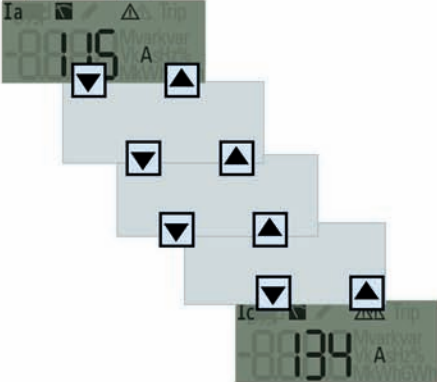
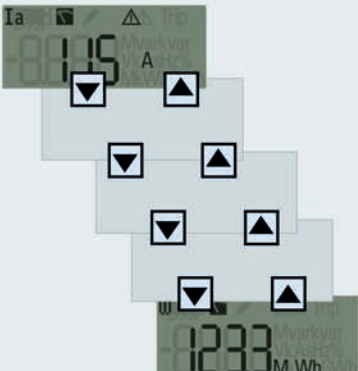
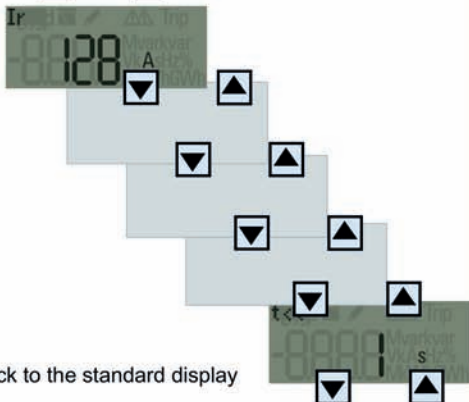
### Displays on ETU 5-series and 8-series units

The basic structure comprises the following displays:

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

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

2.7 Electronic trip unit

<p>Standard display</p> <p>Shows the highest current in one of the three phases. After timeout or ESC</p>	<p>Default</p> 
<p>Alarm display</p> <p>Up to five alarm displays are available. They are only displayed if an alarm is active, otherwise, they are skipped.</p>	
<p>Measured value display</p> <p>Depending on the ETU type, the measured values available are displayed.</p>	
<p>Parameter display</p> <p>Displays the available parameters in succession. Click (OK) in display mode to change to Edit mode.</p>	 <p>Back to the standard display</p>

**Standard display****Alarm display**

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



## Measured value display

The table below explains the measured value display:

Number	Screen	Measured value	Description	ETU 550	ETU 556	ETU 560	ETU 820	ETU 830	ETU 850	ETU 856	ETU 860
MV 1		$I_a$	Instantaneous current $I_a$ in phase A	■	■	■	■	■	■	■	■
MV 2		$I_b$	Instantaneous current $I_b$ in phase B	■	■	■	■	■	■	■	■
MV 3		$I_c$	Instantaneous current $I_c$ in phase C	■	■	■	■	■	■	■	■
MV 4		$I_N$	Instantaneous current in neutral conductor	■	■	■	■	■	■	■	■
MV 5		$I_g$	Instantaneous residual current to ground		■	■				■	■
MV 6		$U_{ab}$	Instantaneous voltage $U_a - U_b$				■	■	■	■	■
MV 7		$U_{bc}$	Instantaneous voltage $U_b - U_c$				■	■	■	■	■
MV 8		$U_{ca}$	Instantaneous voltage $U_c - U_a$				■	■	■	■	■
MV 9		f	Instantaneous frequency				■	■	■	■	■
MV 10		P	Instantaneous active power (total)				■	■	■	■	■
MV 11		Q	Instantaneous reactive power (total)				■	■	■	■	■
MV 12		PF	Instantaneous power factor				■	■	■	■	■
MV 13		W	Active energy				■	■	■	■	■

### Parameter display

The table below explains the parameter display:

Number	Screen	Parameter	Description	ETU 550	ETU 556	ETU 560	ETU 820	ETU 830	ETU 850	ETU 856	ETU 860
PV 1		$I_r$	Overload protection current	■	■	■	■	■	■	■	■
PV 2		$t_d$	Overload protection delay time	■	■	■	■	■	■	■	■
PV 5		$I_{sd}$	Short-time delayed short-circuit current	■	■	■	■	■	■	■	■
PV 6		$t_{sd}$	Short-time delayed short-circuit current delay time	■	■	■	■	■	■	■	■
PV 7		$I^2t_{sd}$	Characteristic curve in S range	■	■	■	■	■	■	■	■
PV 8a		ZSI S	Zone Selective Interlocking	■	■	■	■	■	■	■	■
PV 8b		ZSI G	Zone Selective Interlocking in the event of a ground fault		■	■				■	■
PV9		$I_i$	Instantaneous short-circuit protection current	■	■	■	■	■	■	■	■
PV 10		$I_N$	Overload protection in the neutral conductor	■ <sup>1)</sup>	■ <sup>1)</sup>	■ <sup>1)</sup>	■ <sup>1)</sup>	■ <sup>1)</sup>	■ <sup>1)</sup>	■ <sup>1)</sup>	■ <sup>1)</sup>
PV 11		$I_g$	Ground-fault protection current		■	■				■	■
PV 12		$t_g$	Ground-fault protection delay time		■	■				■	■
PV 13		$I^2t_g$	Characteristic curve for ground-fault protection		■	■				■	■
PV 14		$I_{gA}$	Ground fault alarm current		■	■				■	■

<sup>1)</sup> Dependent on the rated current of the molded case circuit breaker and the ETU version

**Setting and changing parameters**

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



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

**"Tripped" display**

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



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

Press <ESC> to exit the display.

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

Number	Display in the title	Meaning	Unit
TV1	LT	Tripped by long-time (overload) protection	A
TV2	ST	Tripped by short-time delayed short-circuit protection	A
TV3	Inst	Tripped by instantaneous short-circuit protection	A, kA
TV4	N	Tripped by overload in the neutral conductor	A
TV5	GF	Tripped by ground-fault protection	A
TV6	Temp	Tripped by overheating	%

### Diagnostics display

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



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

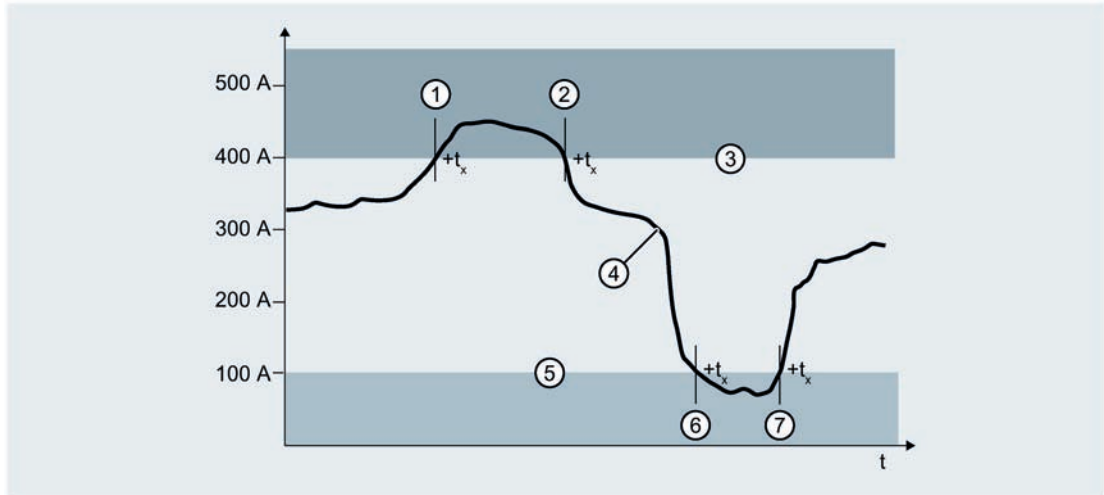
### Activation limits

The table below shows the activation limits for the different types of ETU, when not powered by an auxiliary control voltage:

Current in one of the three phases	Meaning for the ETU
0 ... 20 % $I_n$	The ETU is not active.
> 20 % $I_n$	The protection of the ETU is active, and the display is active.

### 2.7.6 Load acceptance and load shedding - load management

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



- |                                  |                                    |
|----------------------------------|------------------------------------|
| ① Incoming alarm "load shedding" | ⑤ Parameter load acceptance 100 A  |
| ② Outgoing alarm "load shedding" | ⑥ Incoming alarm "load acceptance" |
| ③ Parameter load shedding 400 A  | ⑦ Outgoing alarm "load acceptance" |
| ④ Current in one phase           |                                    |

**Note**

**No trip**

Tripping is not initiated as a result of the current value crossing the upper or lower thresholds.

If the current in one phase exceeds the parameter setting for "load shedding", an incoming alarm "load shedding" is generated. Only when the current in all three phases drops below this threshold is an outgoing alarm "load shedding" generated.

The incoming and outgoing alarms can be output via the EFB300 external function box and transferred via the communication function. Parameterization can also take place via the "powerconfig" software.

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

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



## 2.7.7 Measuring with a Rogowski coil

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

Advantages of the current sensor:

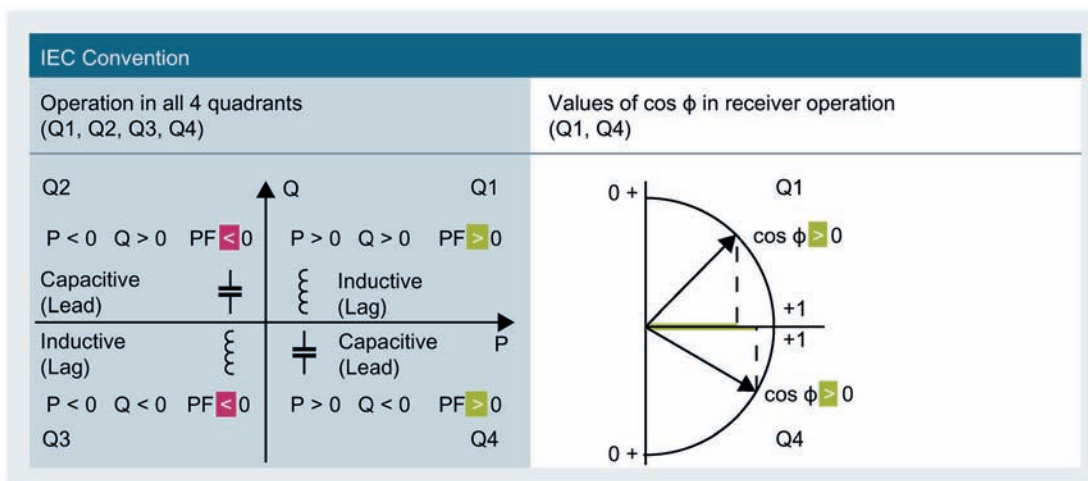
- Each transformer can be optimized for its task and operating points
  - Transformers for power generation
  - Transformers for measurement
- Higher accuracy of current measurement and therefore higher accuracy for ground-fault currents

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

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

Measured value	Accuracy
Current	1 % in the range from 0.2 ... 1.2 x I <sub>n</sub>
Voltage	1 % in the range from 80 ... 800 V
Active power, active energy	Class 2 acc. to IEC 61557-12

### Interpretation of measured values



PF Power factor

Measured current and voltage values are always positive.

The "normal" direction of energy flow of the 3VA UL molded case circuit breaker is from top (terminals 1, 3, 5) to bottom (terminals 2, 4, 6), which corresponds to operation in quadrants Q1 and Q4. If the molded case circuit breaker is supplied from below (terminals 2, 4, 6), it operates in quadrants Q2 and Q3, and the measurement direction can be adjusted using the powerconfig software.

The following table provides an overview of the setting values:

Setting values <sup>1)</sup>				ETUs of the		Display		Communication COM100/800 via COM060	
				5-series	8-series	Display in ETU	DSP800		
Overload protection	Current	$I_r$	A	■	■				
	Delay time	$t_{ld}$	s	■	■				
	Thermal memory	ThM		■	■				
Short-time delayed short-circuit protection	Current	$I_{sd}$	A	■	■				
	Delay time	$t_{sd}$	s	■	■				
	Characteristic curve in S range	$I^2t_{sd}$		■	■				
	Zone selective interlocking	ZSI		■	■				
Instantaneous short-circuit protection	Current	$I_l$	A	■	■				
Overload protection in the neutral conductor	Current	$I_N$	A	■	■				
Ground-fault protection	Current	$I_g$	A	■	■				
	Delay time	$t_g$	s	■	■				
	Characteristic curve	$I^2t_g$		■	■				
	Alarm current	$I_{gA}$	A	■	■				

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

Metering function <sup>1)</sup>				ETUs		Display		Communication
				5-series	8-series	Display in ETU	DSP800	COM100/800 via COM060
Current	Phase and neutral conductor currents	$I_1, I_2, I_3, I_N$	A	■	■	👁️	👁️	👁️
	Residual current to ground	$I_g$	A	■	■	👁️	👁️	👁️
	Phase with highest load		A	■	■	👁️	👁️	👁️
	Mean value over the three phase currents	$I_{LAVG}(I_1 + I_2 + I_3)/3$	A	■	■		👁️	👁️
	Asymmetry of the phase currents	$I_{nba}$	%	■	■		👁️	👁️
	THD of the 3 phases	$THDI_1, THDI_2, THDI_3$	%		■		👁️	👁️
Voltage	Phase voltages incl. mean value	$U_1, U_2, U_3, U_{phavg}$	V		■	👁️	👁️	👁️
	Voltages to N conductor incl. mean value	$U_{1N}, U_{2N}, U_{3N}, U_{Navg}$	V		■		👁️	👁️
	Asymmetry of the voltages		%		■		👁️	👁️
	THD phase/phase and phase/N	$THDI_1, THDI_2, THDI_3$	%		■		👁️	👁️
Power	Active power, total and per phase	$P_1, P_2, P_3, P_{tot}$	kW		■	👁️ ( $P_{tot}$ )	👁️	👁️
	Apparent power, total and per phase	$S_1, S_2, S_3, S_{tot}$	kVA		■		👁️	👁️
	Reactive power, total and per phase	$Q_1, Q_2, Q_3, Q_{tot}$	kVAr		■	👁️ ( $Q_{tot}$ )	👁️	👁️
	Fundamental power factor	$PF_1, PF_2, PF_3, PF_{avg}$			■	👁️ ( $PF_{avg}$ )	👁️	👁️
Energy	Active energy, infeed and feedback	$E_p$	kWh		■	👁️	👁️	👁️
	Reactive energy, infeed and feedback	$E_q$	kVArh		■		👁️	👁️
	Apparent energy	$E_s$	kVAh		■		👁️	👁️
Frequency	Present frequency	$f$	Hz		■	👁️	👁️	👁️
Maximum pointer function	Min/max current, voltage, power	with time stamp						👁️

1) Depending on ETU version

👁️ Value can be displayed/read

Description

2.7 Electronic trip unit

		ETUs of the		Display		Communication
		5-series	8-series	Display in ETU	DSP800	COM100/800 via COM060
<b>Status, diagnostics and maintenance<sup>1)</sup></b>						
Breaker status	On, Off, TRIP	■	■		👁	👁
Currently pending alarm messages		■	■	👁	👁	👁
Reason for last trip		■	■	👁	👁	👁
Event Log	of the last 100 events	■	■			👁
	of the last 10 trips	■	■			👁
	of the last 100 switching operations	■	■			👁
Maintenance information	Trip counter after LSIG trips	■	■		👁	👁
	Operating hours counter	■	■		👁	👁
	Switching cycle counter	■	■		👁	👁
Position in the draw-out unit		■	■			👁
<b>Identification</b>						
Identification data of the breaker	Order No.	■	■		👁	👁
	Rated operational current, number of poles, $I_{cu}$	■	■		👁	👁
HW/FW version		■	■			👁
<b>Power management functions</b>						
Power demand values of the last demand period	Active, reactive and apparent power in fixed block or rolling block		■		👁	👁
Energy pulse output	S0 signal at EFB output		■			
Load monitoring	Load shedding/load pick-up, output via EFB	■	■		👁	👁
Threshold value parameters	10 freely adjustable monitoring parameters	■	■		👁	👁

1) Depending on ETU version  
 👁 Value can be displayed/read

# Applications

## 3.1 Use of the 3VA UL molded case circuit breakers in line protection

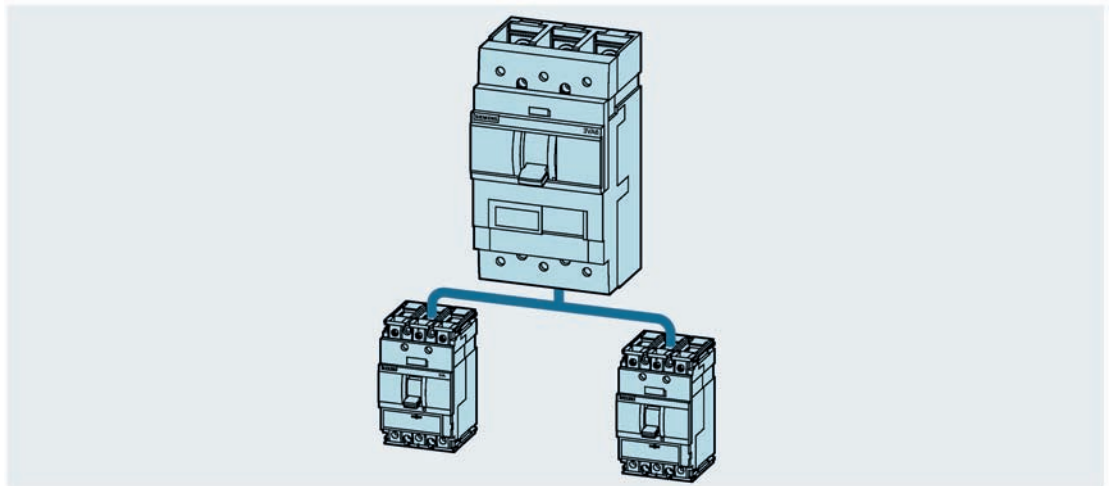
### 3.1.1 Applications in line protection

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

- Feeder circuit breaker of machines
- Branch circuit breaker for predominantly resistive loads
- Group switch for loads that are jointly protected
- In main switchboards to provide protection for cables to subdistribution boards
- In subdistribution boards to provide protection for cables to small distribution boards
- Protection for mixed load (e.g. machine, lighting system, heating system, etc.)

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

- Cables
- Conductors
- Non-motor loads



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

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

- 3VA5 with thermal-magnetic trip units
  - TM 2-series (Page 102)
- 3VA6 with electronic trip units
  - ETU 3-series (Page 105)
  - ETU 5-series (Page 117)
  - ETU 8-series (Page 117)
- Sealable, transparent protective cover of trip units  
All trip units for the 3VA UL molded case circuit breakers have a sealable protective cover. Sealing this protective cover is intended to prevent unauthorized changes of the setting values.

## 3.1 Use of the 3VA UL molded case circuit breakers in line protection

## Overview of the trip units

	Article No. supplement <sup>1)</sup>	Trip units	Line protection	Generator protection	Starter protection	Communication capability	Metering function	Function	Number of poles	Setting options						
										L	S		I	G	N	
										Overload protection $I_r = x I_n$	Short-circuit protection (short-time delayed) $I_{sd} = x I_n$ $t_{sd}$ [s]		Short-circuit protection (instantaneous) $I_l = x I_n$	Ground-fault protection $I_g = x I_n$	Neutral conductor protection $I_N = x I_n$	
3VA5	BB	MSC110			■			I	3	–	–	–	3)	–	–	
	ED	TM210	■					LI	1 ... 3	1	–	–	10	–	–	
	EC	TM230	■					LI	2 ... 3	1	–	–	5 ... 10	–	–	
	MH	TM120M			■			I	3	–	–	–	5 ... 12 3VA51 6 ... 12 3VA52	–	–	
	MU	TM120M			■			I	3	–	–	–	3 ... 6 3VA51 6 ... 12 3VA52	–	–	
3VA6	BB	MCS110			■			I	3	–	–	–	Dependent on size 3 ... 6	–	–	
	MS	ETU310M			■			I	3	–	–	–	3 ... 15	–	–	
	HL	ETU320	■						LI	3	0.4 ... 1	–	–	1.5 ... 12	–	–
									LIN	4	0.4 ... 1	–	–	1.5 ... 12	–	0.5 <sup>4)</sup> / 1 / OFF
	HM	ETU330	■						LIG	3	0.4 ... 1	–	–	1.5 ... 12	0.2 ... 1	–
									LIGN	4	0.4 ... 1	–	–	1.5 ... 12	0.2 ... 1	0.5 <sup>4)</sup> / 1 / OFF
	HN	ETU350	■	■					LSI	3	0.4 ... 1	1.5 ... 10	0 ... 0.4	12	–	–
									LSIN	4	0.4 ... 1	1.5 ... 10	0 ... 0.4	12	–	0.5 <sup>4)</sup> / 1 / OFF
	JP	ETU550	■	■		■			LSI	3 + N <sup>2)</sup>	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	–	0.2 <sup>5)</sup> ... 1.6 / OFF
									LSIN	4	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	–	0.2 <sup>5)</sup> ... 1.6 / OFF
	JT	ETU556	■	■		■			LSI G (alarm)	3 + N <sup>2)</sup>	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF
									LSIN G (alarm)	4	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF
	JQ	ETU560	■	■		■			LSIG	3 + N <sup>2)</sup>	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF
									LSING	4	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF
	KL	ETU820	■			■	■		LI	3	0.4 ... 1	–	–	1.5 ... 12	–	–
LIN									4	0.4 ... 1	–	–	1.5 ... 12	–	0.2 <sup>5)</sup> ... 1.6 / OFF	
KM	ETU830	■			■	■		LIG	3	0.4 ... 1	–	–	1.5 ... 12	0.2 ... 1	–	
								LIGN	4	0.4 ... 1	–	–	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF	
KP	ETU850	■	■		■	■		LSI	3 + N <sup>2)</sup>	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	–	–	0.2 <sup>5)</sup> ... 1.6 / OFF	
								LSIN	4	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	–	–	0.2 <sup>5)</sup> ... 1.6 / OFF	
KT	ETU856	■	■		■	■		LSI G (alarm)	3 + N <sup>2)</sup>	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF	
								LSIN G (alarm)	4	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF	
KQ	ETU860	■	■		■	■		LSIG	3 + N <sup>2)</sup>	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF	
								LSING	4	0.4 ... 1	0.6 ... 10	0.05 ... 0.5	1.5 ... 12	0.2 ... 1	0.2 <sup>5)</sup> ... 1.6 / OFF	

1) 9th and 10th digit of article number, e.g. 3VA6115-5JP31-0AA0

2) Neutral conductor protection

3) See Use of the 3VA UL molded case circuit breaker as a molded case switch (MCS) (Page 138)

4) 0.5 (50%) cannot be set for molded case circuit breakers with rated operational current 40 A

5) 0.2 (20%) cannot be set for molded case circuit breakers with rated operational current 40 A

### 3.1.2 Versions of the trip units

#### 3.1.2.1 Thermal-magnetic trip units

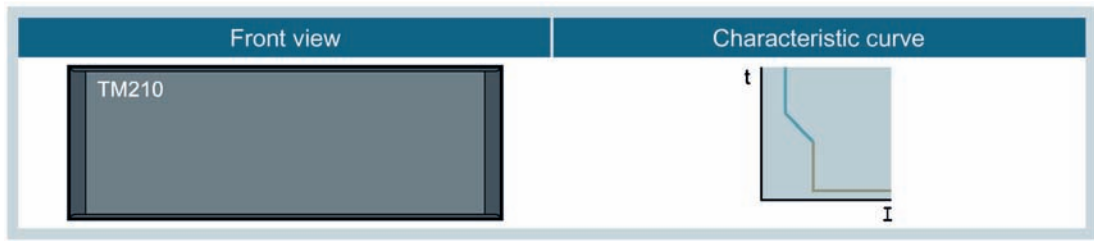
##### TMTUs for line protection applications

###### Derating

Thermal-magnetic trip units employ a temperature-dependent bimetal to provide overload protection. The setting values are calibrated at an ambient temperature of +40 °C. Compensation factors must be applied for ambient temperatures greater than +50 °C.

You will find more information and derating factors in chapter Derating (Page 454).

##### Thermal-magnetic trip unit TM210 LI



###### Line protection FTFM - function LI

The thermal-magnetic trip unit TM210 has:

- Fixed parameter setting  $I_r$  for overload protection (L)
- Fixed parameter setting  $I_i$  for instantaneous short-circuit protection (I)



## 3.1 Use of the 3VA UL molded case circuit breakers in line protection

TM210 parameters:

	Rated current $I_n$ [A]	Values $I_r$ [A]	Values $I_i$ [A]
3VA51	15	15	300
	20	20	300
	25	25	300
	30	30	300
	35	35	350
	40	40	400
	45	45	450
	50	50	500
	60	60	600
	70	70	700
	80	80	800
	90	90	900
	100	100	1000
	110	110	1100
125	125	1250	
3VA52	100	100	1000
	110	110	1100
	125	125	1250
	150	150	1500
	175	175	1750
	200	200	2000
	225	225	2250
250	250	2500	

Thermal-magnetic trip unit TM230 LI



Line protection FTAM - function LI

The thermal-magnetic trip unit TM230 has:

- Fixed parameter setting  $I_r$  for overload protection (L)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)

TM230 parameters:

	Rated current $I_n$	Values $I_r$	Setting values $I_i$					
	[A]	[A]	[A]					
3VA51	15, 20, 25, 30	15, 20, 25, 30	150	180	210	240	270	300
	35	35	175	210	245	280	315	350
	40	40	200	240	280	320	360	400
	45	45	225	270	315	360	405	450
	50	50	250	300	350	400	450	500
	60	60	300	360	420	480	540	600
	70	70	350	420	490	560	630	700
	80	80	400	480	560	640	720	800
	90	90	450	540	630	720	810	900
	100	100	500	600	700	800	900	1000
	110	110	550	660	770	880	990	1100
	125	125	625	750	875	1000	1125	1250
3VA52	100	100	500	600	700	800	900	1000
	110	110	550	660	770	880	990	1100
	125	125	625	750	875	1000	1125	1250
	150	150	750	900	1050	1200	1350	1500
	175	175	875	1050	1225	1400	1575	1750
	200	200	1000	1200	1400	1600	1800	2000
	225	225	1125	1350	1575	1800	2025	2250
	250	250	1250	1500	1750	2000	2250	2500

### 3.1.2.2 Electronic trip units

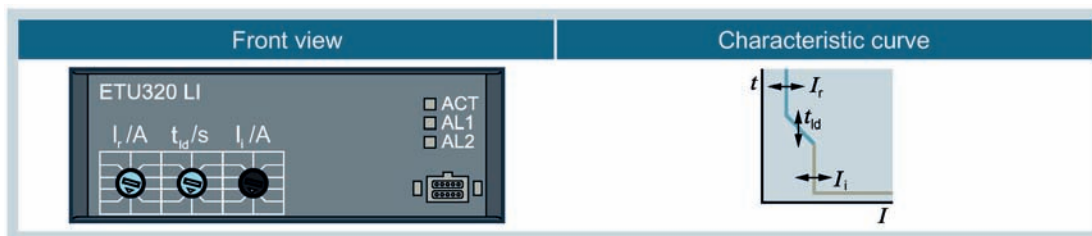
#### ETUs for line protection applications

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

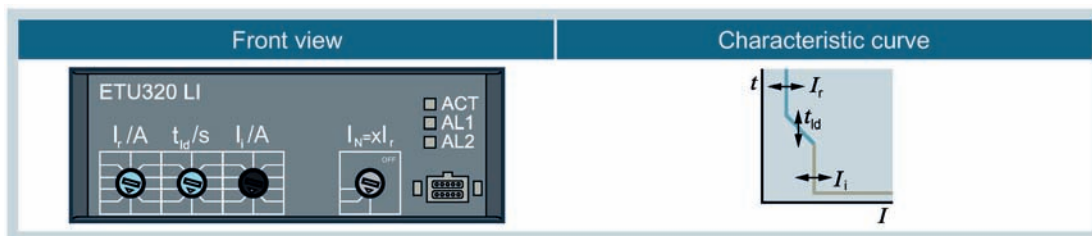
- ETU320 LI
- ETU330 LIG
- ETU350 LSI
- ETU550 LSI
- ETU556 LSI-G (alarm-only)
- ETU560 LSIG
- ETU820 LI
- ETU830 LIG
- ETU850 LSI
- ETU856 LSI-G (alarm-only)
- ETU860 LSIG

#### Electronic trip unit ETU320 LI

ETU320 LI 3-pole:



ETU320 LI 4-pole:



3.1 Use of the 3VA UL molded case circuit breakers in line protection

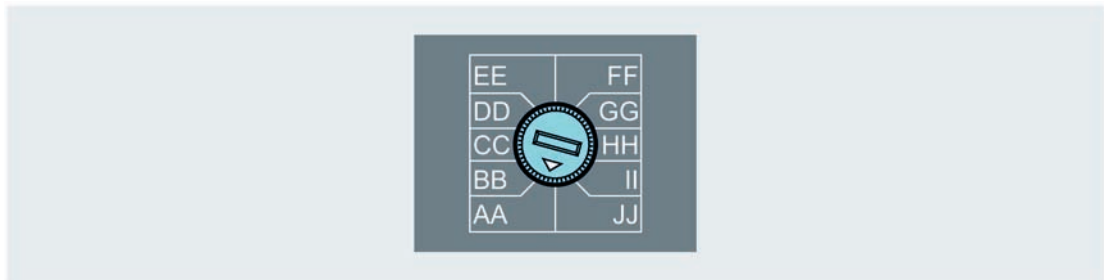
**Line protection - function LI**

The electronic trip unit ETU320 has:

- Adjustable parameter settings  $I_r$  and  $t_{td}$  for overload protection (L)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- With 4-pole versions only: Neutral conductor protection (N) which can be deactivated

**ETU320 parameters:**

The parameters are selected with the setting knob. The diagram below shows an example of the possible selections with setting knob  $I_r$ .



The values for the respective setting are listed in the following tables.

**Current setting values -  $I_r$**

	Rated current $I_n$ [A]	Setting values $I_r$ [A]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	15	20	25	28	30	32	35	37	39	40
3VA6110	100	40	50	60	70	75	80	85	90	95	100
3VA6115	150	60	70	80	90	100	110	125	135	145	150
3VA6210	100	40	50	60	70	75	80	85	90	95	100
3VA6225	250	100	125	150	175	200	210	220	230	240	250
3VA6325	250	100	125	150	175	200	210	220	230	240	250
3VA6340	400	150	200	240	280	300	320	340	360	380	400
3VA6440	400	150	200	240	280	300	320	340	360	380	400
3VA6460	600	250	300	350	400	450	500	525	550	575	600

## 3.1 Use of the 3VA UL molded case circuit breakers in line protection

Long-time delay setting values -  $t_{ld}$ 

	Rated current $I_n$ [A]	Setting values $t_{ld}$ [s]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	0,5	0,75	1	2	3	5	8	10	14	17
3VA6110	100	0,5	0,75	1	2	3	5	8	10	14	17
3VA6115	150	0,5	0,75	1	2	3	5	8	10	14	17
3VA6210	100	0,5	0,75	1	2	3	5	8	10	14	17
3VA6225	250	0,5	0,75	1	2	3	5	8	10	12	13
3VA6325	250	0,5	0,75	1	2	3	5	8	10	14	17
3VA6340	400	0,5	0,75	1	2	3	5	8	10	14	17
3VA6440	400	0,5	0,75	1	2	3	5	8	10	14	17
3VA6460	600	0,5	0,75	1	2	3	5	8	10	14	15

Instantaneous pickup setting values -  $I_i$ 

	Rated current $I_n$ [A]	Setting values $I_i$ [A]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	60	80	100	120	160	200	240	320	400	480
3VA6110	100	150	200	250	300	400	500	600	800	1000	1200
3VA6115	150	225	300	375	450	600	750	900	1200	1350	1500
3VA6210	100	150	200	250	300	400	500	600	800	1000	1200
3VA6225	250	375	500	625	750	1000	1250	1500	2000	2250	2500
3VA6325	250	375	500	625	750	1000	1250	1500	2000	2500	3000
3VA6340	400	600	800	1000	1200	1600	2000	2400	3200	3600	4000
3VA6440	400	600	800	1000	1200	1600	2000	2400	3200	4000	4800
3VA6460	600	900	1200	1500	1800	2400	3000	3600	4800	5100	5400

Neutral current setting values -  $I_N$ 

	Rated current $I_n$ [A]	Setting values $I_N$ $I_N = x I_r$									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6110	100	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6115	150	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6210	100	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6225	250	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6325	250	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6340	400	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6440	400	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6460	600	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

3.1 Use of the 3VA UL molded case circuit breakers in line protection

**Overload protection L:**

- $I_r$  Adjustable in 10 steps from 0.4 to  $1.0 \times I_n$ :  
0.4 / 0.5 / 0.6 / 0.7 / 0.75 / 0.8 / 0.85 / 0.9 / 0.95 / 1.0
- $t_{td}$  Adjustable in 10 steps from 0.5 to 12 / 15 s or 17 s:  
 $t_{td}$  is the tripping time with  $6 \times I_r$

The ETU320 LI has a permanently active thermal memory.

**Instantaneous short-circuit protection I:**

- $I_i$  Adjustable in 10 steps from 1.5 to 9 / 10 / 11 / 12  $\times I_n$  (dependent on the frame size)

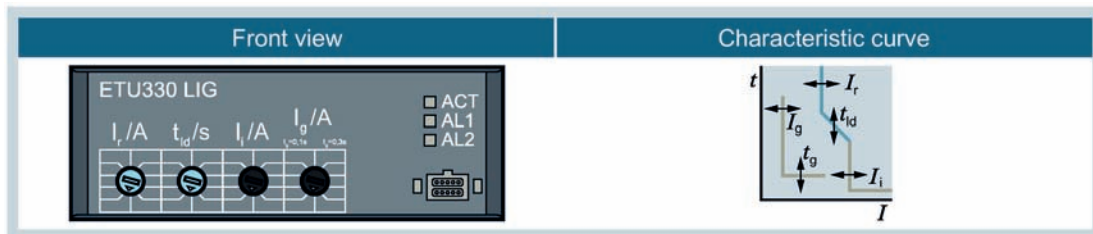
**Neutral conductor protection N:**

The neutral conductor protection function is available for 4-pole molded case circuit breakers only.

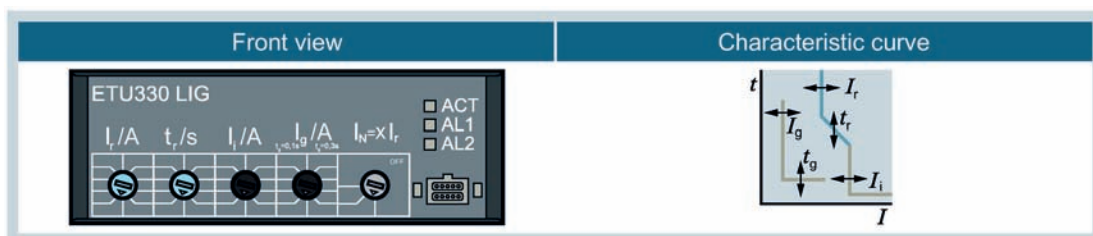
- $I_N$   $I_n < 100$  A:  $1.0 \times I_r$  or OFF  
 $I_n \geq 100$  A: 0.5 /  $1.0 \times I_r$  or OFF

## Electronic trip unit ETU330 LIG

ETU330 LIG 3-pole:



ETU330 LIG 4-pole:



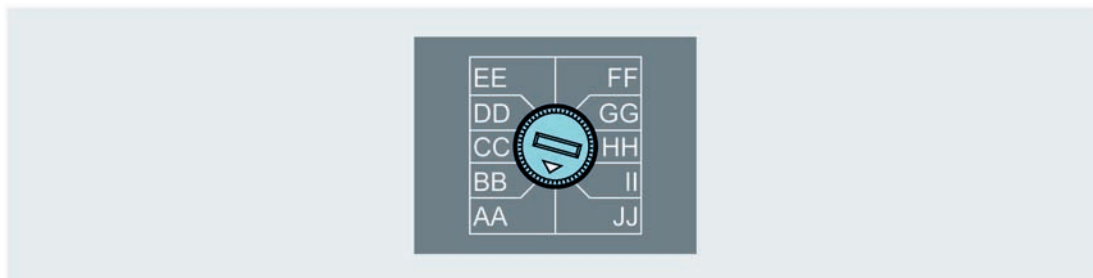
### Line protection - function LIG

The electronic trip unit ETU330 has:

- Adjustable parameter settings  $I_r$  and  $t_{td}$  for overload protection (L)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- Adjustable parameter settings  $I_g$  and  $t_g$  for ground-fault protection (G)
- With 4-pole versions only: Neutral conductor protection (N) which can be deactivated

### ETU330 parameters:

The parameters are selected with the setting knob. The diagram below shows an example of the possible selections with setting knob  $I_r$ .



The values for the respective setting are listed in the following tables.

3.1 Use of the 3VA UL molded case circuit breakers in line protection

Current setting values -  $I_r$

	Rated current $I_n$ [A]	Setting values $I_r$ [A]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	15	20	25	28	30	32	35	37	39	40
3VA6110	100	40	50	60	70	75	80	85	90	95	100
3VA6115	150	60	70	80	90	100	110	125	135	145	150
3VA6210	100	40	50	60	70	75	80	85	90	95	100
3VA6225	250	100	125	150	175	200	210	220	230	240	250
3VA6325	250	100	125	150	175	200	210	220	230	240	250
3VA6340	400	150	200	240	280	300	320	340	360	380	400
3VA6440	400	150	200	240	280	300	320	340	360	380	400
3VA6460	600	250	300	350	400	450	500	525	550	575	600

Long-time delay setting values -  $t_{ld}$

	Rated current $I_n$ [A]	Setting values $t_{ld}$ [s]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	0,5	0,75	1	2	3	5	8	10	14	17
3VA6110	100	0,5	0,75	1	2	3	5	8	10	14	17
3VA6115	150	0,5	0,75	1	2	3	5	8	10	14	17
3VA6210	100	0,5	0,75	1	2	3	5	8	10	14	17
3VA6225	250	0,5	0,75	1	2	3	5	8	10	12	13
3VA6325	250	0,5	0,75	1	2	3	5	8	10	14	17
3VA6340	400	0,5	0,75	1	2	3	5	8	10	14	17
3VA6440	400	0,5	0,75	1	2	3	5	8	10	14	17
3VA6460	600	0,5	0,75	1	2	3	5	8	10	14	15

Instantaneous pickup setting values -  $I_i$

	Rated current $I_n$ [A]	Setting values $I_i$ [A]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	60	80	100	120	160	200	240	320	400	480
3VA6110	100	150	200	250	300	400	500	600	800	1000	1200
3VA6115	150	225	300	375	450	600	750	900	1200	1350	1500
3VA6210	100	150	200	250	300	400	500	600	800	1000	1200
3VA6225	250	375	500	625	750	1000	1250	1500	2000	2250	2500
3VA6325	250	375	500	625	750	1000	1250	1500	2000	2500	3000
3VA6340	400	600	800	1000	1200	1600	2000	2400	3200	3600	4000
3VA6440	400	600	800	1000	1200	1600	2000	2400	3200	4000	4800
3VA6460	600	900	1200	1500	1800	2400	3000	3600	4800	5100	5400



## 3.1 Use of the 3VA UL molded case circuit breakers in line protection

Ground fault pickup setting values -  $I_g$ 

	Rated current $I_n$ [A]	Setting values $I_g$ [A]									
		$t_g = 0,1$ s					$t_g = 0,3$ s				
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	15	24	28	32	40	15	24	28	32	40
3VA6110	100	20	40	60	80	100	20	40	60	80	100
3VA6115	150	30	60	90	120	150	30	60	90	120	150
3VA6210	100	20	40	60	80	100	20	40	60	80	100
3VA6225	250	50	100	150	200	250	50	100	150	200	250
3VA6325	250	50	100	150	200	250	50	100	150	200	250
3VA6340	400	80	160	240	320	400	80	160	240	320	400
3VA6440	400	80	160	240	320	400	80	160	240	320	400
3VA6460	600	120	240	360	480	600	120	240	360	480	600

Neutral current setting values -  $I_N$ 

	Rated current $I_n$ [A]	Setting values $I_N$ $I_N = x I_r$									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6110	100	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6115	150	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6210	100	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6225	250	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6325	250	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6340	400	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6440	400	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6460	600	0,5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

**Overload protection L:**

- $I_r$  Adjustable in 10 steps from 0.4 to 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
- $t_{td}$  Adjustable in 10 steps from 0.5 to 12 / 15 s or 17 s:  
 $t_{td}$  is the tripping time with 6 x  $I_r$

The ETU330 LIG has a permanently active thermal memory.

3.1 Use of the 3VA UL molded case circuit breakers in line protection

**Instantaneous short-circuit protection I:**

- $I_i$  Adjustable in 10 steps from 1.5 to 9 / 10 / 11 / 12 x  $I_n$  (dependent on the frame size)

**Ground-fault protection G:**

- $I_g$  Adjustable in 5 steps of 0.2 / 0.25 / 0.4 / 0.6 to 1.0 x  $I_n$  (depending on size)
- $t_g$  Adjustable to 100 ms or 300 ms, at 2 x  $I_g$  in each case

The ground-fault protection cannot be deactivated.

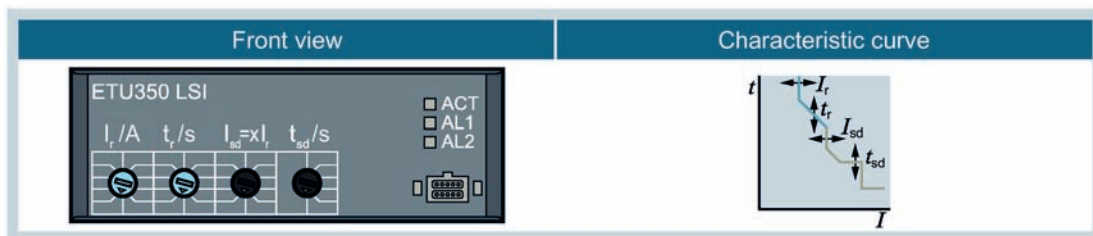
**Neutral conductor protection N:**

The neutral conductor protection function is available for 4-pole molded case circuit breakers only.

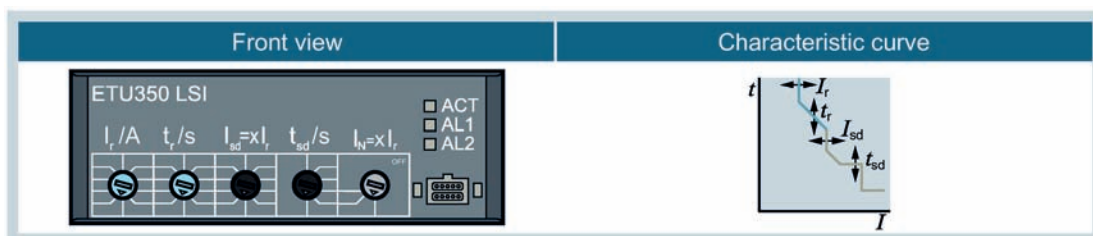
- $I_N$   $I_n < 100$  A: 1.0 x  $I_r$  or OFF  
 $I_n \geq 100$  A: 0.5 / 1.0 x  $I_r$  or OFF

## Electronic trip unit ETU350 LSI

ETU350 LSI 3-pole:



ETU350 LSI 4-pole:



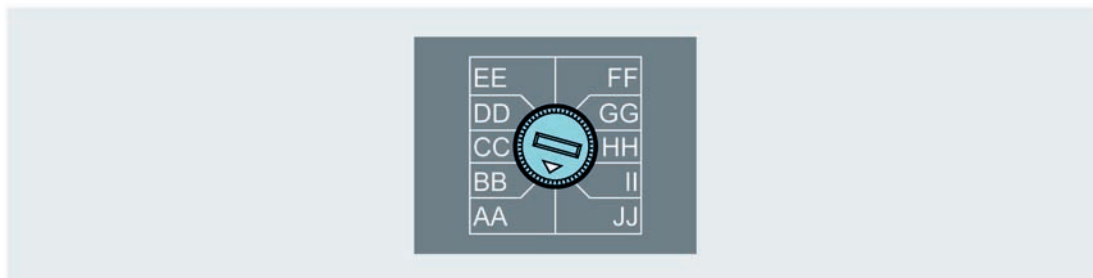
### Line protection - function LSI

The electronic trip unit ETU350 has:

- Adjustable parameter settings  $I_r$  and  $t_{td}$  for overload protection (L)
- Adjustable parameter settings  $I_{sd}$  and  $t_{sd}$  for short-time delayed short circuit protection (S)
- Fixed parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- With 4-pole versions only: Neutral conductor protection (N) which can be deactivated

### ETU350 parameters:

The parameters are selected with the setting knob. The diagram below shows an example of the possible selections with setting knob  $I_r$ .



The values for the respective setting are listed in the following tables.

3.1 Use of the 3VA UL molded case circuit breakers in line protection

Current setting values - I<sub>r</sub>

	Rated current I <sub>n</sub> [A]	Setting values I <sub>r</sub> [A]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	15	20	25	28	30	32	35	37	39	40
3VA6110	100	40	50	60	70	75	80	85	90	95	100
3VA6115	150	60	70	80	90	100	110	125	135	145	150
3VA6210	100	40	50	60	70	75	80	85	90	95	100
3VA6225	250	100	125	150	175	200	210	220	230	240	250
3VA6325	250	100	125	150	175	200	210	220	230	240	250
3VA6340	400	150	200	240	280	300	320	340	360	380	400
3VA6440	400	150	200	240	280	300	320	340	360	380	400
3VA6460	600	250	300	350	400	450	500	525	550	575	600

Long-time delay setting values - t<sub>ld</sub>

	Rated current I <sub>n</sub> [A]	Setting values t <sub>ld</sub> [s]									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	0.5	0.75	1	2	3	5	8	10	14	17
3VA6110	100	0.5	0.75	1	2	3	5	8	10	14	17
3VA6115	150	0.5	0.75	1	2	3	5	8	10	14	17
3VA6210	100	0.5	0.75	1	2	3	5	8	10	14	17
3VA6225	250	0.5	0.75	1	2	3	5	8	10	12	13
3VA6325	250	0.5	0.75	1	2	3	5	8	10	14	17
3VA6340	400	0.5	0.75	1	2	3	5	8	10	14	17
3VA6440	400	0.5	0.75	1	2	3	5	8	10	14	17
3VA6460	600	0.5	0.75	1	2	3	5	8	10	14	15

Instantaneous pickup setting values - I<sub>i</sub>

	Rated current I <sub>n</sub> [A]	Fixed setting values I <sub>i</sub>	
		x I <sub>n</sub>	[A]
3VA6140	40	12	480
3VA6110	100	12	1200
3VA6115	150	10	1500
3VA6210	100	12	1200
3VA6225	250	10	2500
3VA6325	250	12	3000
3VA6340	400	12	4800
3VA6440	400	12	4800
3VA6460	600	9	5400

## 3.1 Use of the 3VA UL molded case circuit breakers in line protection

Short-time pickup setting values -  $I_{sd}$ 

	Rated current $I_n$ [A]	Setting values $I_{sd}$ $I_{sd} = x I_r$									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6110	100	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6115	150	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6210	100	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6225	250	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6325	250	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6340	400	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6440	400	1.5	2	2.5	3	3.5	4	5	6	8	10
3VA6460	600	1.5	2	2.5	3	3.5	4	5	6	8	9

Short-time delay setting values -  $t_{sd}$ 

	Rated current $I_n$ [A]	Setting values $t_{sd}$ [s]									
		Fixed delay					I <sup>2</sup> t function				
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6110	100	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6115	150	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6210	100	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6225	250	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6325	250	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6340	400	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6440	400	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4
3VA6460	600	0	0	0	0	0	0.08	0.15	0.22	0.3	0.4

Neutral current setting values -  $I_N$ 

	Rated current $I_n$ [A]	Setting values $I_N$ $I_N = x I_r$									
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ
3VA6140	40	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6110	100	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6115	150	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6210	100	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6225	250	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6325	250	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6340	400	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6440	400	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
3VA6460	600	0.5	1	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

3.1 Use of the 3VA UL molded case circuit breakers in line protection

**Overload protection L:**

- $I_r$  Adjustable in 10 steps from 0.4 to  $1.0 \times I_n$ :  
0.4 / 0.5 / 0.6 / 0.7 / 0.75 / 0.8 / 0.85 / 0.9 / 0.95 / 1.0
- $t_{td}$  Adjustable in 10 steps from 0.5 to 12 / 15 s or 17 s:  
 $t_{td}$  is the tripping time with  $6 \times I_r$

The ETU350 LSI has a permanently active thermal memory.

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

- $I_{sd}$  Adjustable in 10 steps from 1.5 to  $9 / 10 \times I_r$ .
- $t_{sd}$  Adjustable in 6 steps from 0 to 0.4 s  
with the reference point at  $I_{sd} = 8 \times I_r$

The curve shape is  $I^2t = \text{constant}$ .

**Instantaneous short-circuit protection I:**

- $I_i$  Not adjustable: Permanently set to 9 / 10 / 11 / 12  $\times I_n$   
(depending on rated operational current and breaker frame size)

**Neutral conductor protection N:**

The neutral conductor protection function is available for 4-pole molded case circuit breakers only.

- $I_N$   $I_n < 100$  A:  $1.0 \times I_r$  or OFF  
 $I_n \geq 100$  A:  $0.5 / 1.0 \times I_r$  or OFF

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

### Parameter input via display unit

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

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

Potential alternatives for this power supply:

- 24 V supplied externally via:
  - EFB300 external function box
  - MMB300 maintenance mode box
  - temporarily connected TD300 or TD500 test device
  - internal 24 V module
  - internal COM060 communication module
- Current flow  $> 20\% I_n$  in one of the 3 phases

A description of the parameter display can be found in chapter "Operator controls (Page 84)".

### Additional features of 8-series units

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

- An integrated voltage tap, plus an external voltage tap in the case of 3-pole molded case circuit breakers
- Additional sensing of power measurements (function requires an external 24 V supply)

Electronic trip unit ETU820 LI

ETU820 LI 3-pole and 4-pole:



Line protection - function LI

The electronic trip unit ETU820 has:

- Adjustable parameter settings  $I_r$  and  $t_{id}$  for overload protection (L)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- With 4-pole versions only: Adjustable parameter setting  $I_N$  for protection of neutral conductor (N)

ETU820 parameters, 3-pole

Size		$I_n$ [A]	$I_r$ [A]	$t_{id}$ [s]	$I_i$ [A]	
3VA6 M/H/C/L	150 A	40	16 ... 40	0.5 ... 25	60 ... 480	
		100	40 ... 100	0.5 ... 25	150 ... 1200	
		150	60 ... 150	0.5 ... 20	225 ... 1500	
	250 A	100	40 ... 100	0.5 ... 25	150 ... 1200	
		250	100 ... 250	0.5 ... 13	375 ... 2500	
	400 A	250	100 ... 250	0.5 ... 25	375 ... 3000	
		400	160 ... 400	0.5 ... 17	600 ... 4000	
		600 A	400	160 ... 400	0.5 ... 25	600 ... 4800
			600	250 ... 600	0.5 ... 15	900 ... 5400



ETU820 parameters, 4-pole

Size		$I_n$ [A]	$I_r$ [A]	$t_{td}$ [s]	$I_i$ [A]	$I_N$ [A]
3VA6 M/H/C/L	150 A	40	16 ... 40	0.5 ... 25	60 ... 480	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	150 ... 1200	20 ... 150 / OFF
		150	60 ... 150	0.5 ... 20	225 ... 1500	30 ... 150 / OFF
	250 A	100	40 ... 100	0.5 ... 25	150 ... 1200	20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	375 ... 2500	50 ... 250 / OFF
	400 A	250	100 ... 250	0.5 ... 25	375 ... 3000	50 ... 400 / OFF
		400	160 ... 400	0.5 ... 17	600 ... 4000	80 ... 400 / OFF
	600 A	400	160 ... 400	0.5 ... 25	600 ... 4800	80 ... 600 / OFF
		600	250 ... 600	0.5 ... 15	900 ... 5400	120 ... 600 / OFF

#### Overload protection L:

- $I_r$  Adjustable from 0.4 to 1.0 x  $I_n$  in absolute current values  
 $I_r = 40$  A: In steps of 0.5 A  
 $I_r \geq 100$  A: In steps of 1 A
- $t_{td}$  Adjustable from 0.5 to 13 / 15 / 17 / 20 / 25 s (dependent on rated operational current and frame size)  
with a reference point of 6 x  $I_r$ .  
In steps of 0.1 s

The ETU820 LI has a permanently active thermal memory.

#### Instantaneous short-circuit protection I:

- $I_i$  Adjustable from 1.5 to 9 / 10 / 11 / 12 x  $I_n$  (dependent on the frame size):  
In steps of 1 A

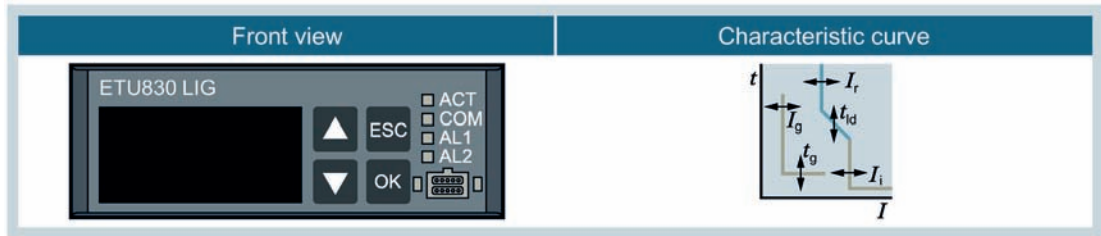
#### Neutral conductor protection N:

Protection of the neutral conductor is available only for 4-pole molded case circuit breakers.

- $I_N$   $I_n = 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.0 or 1.5 / 1.6 x  $I_n$

**Electronic trip unit ETU830 LIG**

ETU830 LIG 3-pole and 4-pole



**Line protection - function LIG**

The electronic trip unit ETU830 has:

- Adjustable parameter settings  $I_r$  and  $t_{id}$  for overload protection (L)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- Adjustable parameter settings  $I_g$  and  $t_g$  for ground-fault protection (G)
- With 4-pole versions only: adjustable parameter setting  $I_N$  for protection of neutral conductor (N)

ETU830 parameters, 3-pole

Size		$I_n$ [A]	$I_r$ [A]	$t_{id}$ [s]	$I_i$ [A]	$I_g$ [A]	$t_g$ [s]			
3VA6 M/H/C/L	150 A	40	15 ... 40	0.5 ... 25	60 ... 480	15 ... 40	0.05 ... 0.8			
		100	40 ... 100	0.5 ... 25	150 ... 1200	20 ... 100				
		150	60 ... 150	0.5 ... 20	225 ... 1500	30 ... 150				
	250 A	100	40 ... 100	0.5 ... 25	150 ... 1200	20 ... 100		0.05 ... 0.8		
		250	100 ... 250	0.5 ... 13	375 ... 2500	50 ... 250				
	400 A	250	100 ... 250	0.5 ... 25	375 ... 3000	50 ... 250			0.05 ... 0.8	
		400	150 ... 400	0.5 ... 17	600 ... 4000	80 ... 400				
	600 A	400	150 ... 400	0.5 ... 25	600 ... 4800	80 ... 400				0.05 ... 0.8
		600	250 ... 600	0.5 ... 15	900 ... 5400	120 ... 600				

## ETU830 parameters, 4-pole

Size		$I_n$ [A]	$I_r$ [A]	$t_{td}$ [s]	$I_i$ [A]	$I_g$ [A]	$t_g$ [s]	$I_N$ [A]
3VA6 M/H/C/L	150 A	40	15 ... 40	0.5 ... 25	60 ... 480	15 ... 40	0.05 ... 0.8	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	150 ... 1200	20 ... 100		20 ... 150 / OFF
		150	60 ... 150	0.5 ... 20	225 ... 1500	30 ... 150		30 ... 150 / OFF
	250 A	100	40 ... 100	0.5 ... 25	150 ... 1200	20 ... 100		20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	375 ... 2500	50 ... 250		50 ... 250 / OFF
	400 A	250	100 ... 250	0.5 ... 25	375 ... 3000	50 ... 250		50 ... 400 / OFF
		400	150 ... 400	0.5 ... 17	600 ... 4000	80 ... 400		80 ... 400 / OFF
	600 A	400	150 ... 400	0.5 ... 25	600 ... 4800	80 ... 400		80 ... 600 / OFF
		600	250 ... 600	0.5 ... 15	900 ... 5400	120 ... 600		120 ... 600 / OFF

**Overload protection L:**

- $I_r$  Adjustable from 0.4 to 1.0 x  $I_n$  in absolute current values  
 $I_r = 40$  A: In steps of 0.5 A  
 $I_r \geq 100$  A: In steps of 1 A
- $t_{td}$  Adjustable from 0.5 to 13 / 15 / 17 / 20 / 25 s (dependent on rated operational current and frame size)  
with a reference point of 6 x  $I_r$ .  
In steps of 0.1 s

The ETU830 LI has a permanently active thermal memory.

**Instantaneous short-circuit protection I:**

- $I_i$  Adjustable from 1.5 to 9 / 10 / 11 / 12 x  $I_n$  (dependent on the rated operational current and the frame size):  
In steps of 1 A

**Ground-fault protection G:**

- $I_g$  Adjustable from 0.2 / 0.4 to 1.0 x  $I_n$  in absolute current values  
In steps of 1 A
- $t_g$  Adjustable from 0.05 to 0.8 s  
with a reference point of 2 x  $I_g$   
In steps of 0.01 s

An alarm threshold  $I_{gA}$  of 0.2 / 0.4 to 1 x  $I_n$  can also be set. In steps of 1 A

The ground-fault protection can **not** be deactivated.

**Neutral conductor protection N:**

Protection of the neutral conductor is available only for 4-pole molded case circuit breakers.

- $I_N$   $I_n = 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.0 or 1.6 x  $I_n$

### Electronic trip units ETU550 LSI and ETU850 LSI

ETU550 LSI 3-pole and 4-pole units:



ETU850 LSI 3-pole and 4-pole units:



### Line protection - function LSI

The electronic trip units ETU550 and ETU850 have:

- Adjustable parameter settings  $I_r$  and  $t_{id}$  for overload protection (L)
- Adjustable parameter settings  $I_{sd}$  and  $t_{sd}$  for short-time delayed short circuit protection (S)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- With 4-pole versions: adjustable parameter setting  $I_N$  for neutral conductor protection (N) can be activated optionally for 3-pole versions

ETU550 / ETU850 parameters (3-pole version):

Size		$I_n$ [A]	$I_r$ [A]	$t_{id}$ [s]	$I_{sd}$ [A]	$t_{sd}$ [s]	$I_i$ [A]	$I_N^{(1)}$ [A]
3VA6 M/H/C/L	150 A	40	16 ... 40	0.5 ... 25	24 ... 400	0.05 ... 0.5	60 ... 480	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 160 / OFF
		150	60 ... 150	0.5 ... 20	90 ... 1500		225 ... 1500	30 ... 240 / OFF
	250 A	100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	150 ... 2500		375 ... 2500	50 ... 400 / OFF
	400 A	250	100 ... 250	0.5 ... 25	150 ... 2500		375 ... 3000	50 ... 400 / OFF
		400	160 ... 400	0.5 ... 17	240 ... 4000		600 ... 4000	80 ... 640 / OFF
	600 A	400	160 ... 400	0.5 ... 25	240 ... 4000		600 ... 4800	80 ... 640 / OFF
		600	250 ... 600	0.5 ... 15	360 ... 5400		900 ... 5400	120 ... 960 / OFF

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

ETU550 / ETU850 parameters (4-pole version):

Size		$I_n$ [A]	$I_r$ [A]	$t_{id}$ [s]	$I_{sd}$ [A]	$t_{sd}$ [s]	$I_i$ [A]	$I_N$ [A]
3VA6 M/H/C/L	150 A	40	16 ... 40	0.5 ... 25	24 ... 400	0.05 ... 0.5	60 ... 480	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 150 / OFF
		150	60 ... 150	0.5 ... 20	90 ... 1500		225 ... 1500	30 ... 150 / OFF
	250 A	100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	150 ... 2500		375 ... 2500	50 ... 250 / OFF
	400 A	250	100 ... 250	0.5 ... 25	150 ... 2500		375 ... 3000	50 ... 400 / OFF
		400	160 ... 400	0.5 ... 17	240 ... 4000		600 ... 4000	80 ... 400 / OFF
	600 A	400	160 ... 400	0.5 ... 25	240 ... 4000		600 ... 4800	80 ... 600 / OFF
		600	250 ... 600	0.5 ... 15	360 ... 5400		900 ... 5400	120 ... 600 / OFF

#### Overload protection L:

- $I_r$  Adjustable from 0.4 to 1.0 x  $I_n$  in absolute current values  
 $I_r < 40$  A: In steps of 0.5 A  
 $I_r \geq 100$  A: In steps of 1 A
- $t_{id}$  Adjustable from 0.5 to 13 / 15 / 17 / 20 / 25 s (dependent on rated operational current and frame size):  
in steps of 0.1 s  
with a reference point of 6 x  $I_r$

The ETU550 LSI and ETU850 LSI have a permanently active thermal memory.

3.1 Use of the 3VA UL molded case circuit breakers in line protection

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

- $I_{sd}$  Adjustable from 0.6 to 9 / 10 x  $I_n$   
 $I_{sd} < 40$  A:  $I_n$  steps of 0.5 A  
 $I_{sd} \geq 100$  A:  $I_n$  steps of 1 A
- $t_{sd}$  Adjustable from 0.05 to 0.5 s:  
in steps of 0.01 s  
with a reference point of  $I_{sd} = 8 \times I_r$

The curve shape  $I^2t = \text{constant}$  can be deactivated.

**Instantaneous short-circuit protection I:**

- $I_i$  Adjustable from 1.5 to 9 / 10 / 12 x  $I_n$  (dependent on rated operational current and frame size)  
 $I_n$  steps of 1 A

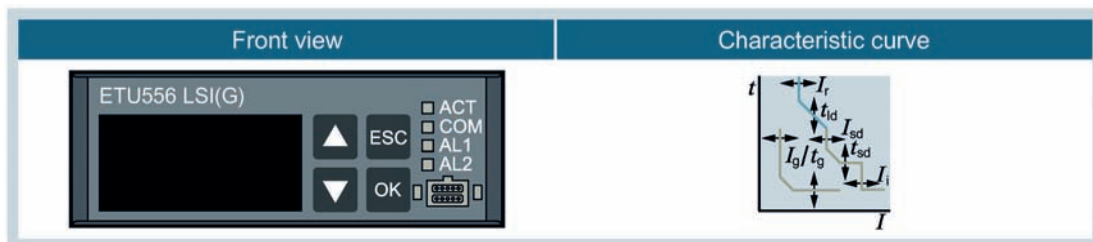
**Neutral conductor protection N:**

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

- $I_N$  Adjustable in steps of 1 A  
**3-pole** circuit breakers with external current transformer for N conductor:  
 $I_n < 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.6 x  $I_n$   
**4-pole** circuit breakers:  
 $I_n < 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.0 or 1.5 / 1.6 x  $I_n$

## Electronic trip units ETU556 LSI G (alarm-only) and ETU856 LSI G (alarm-only)

ETU556 LSI(G) 3-pole and 4-pole:



ETU856 LSI(G) 3-pole and 4-pole:



### Line protection - function LSI(G)

The electronic trip units ETU556 and ETU856 have:

- Adjustable parameter settings  $I_r$  and  $t_{id}$  for overload protection (L)
- Adjustable parameter settings  $I_{sd}$  and  $t_{sd}$  for short-time delayed short circuit protection (S)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- Adjustable parameter settings  $I_g$  and  $t_g$  for ground-fault alarm (G)
- With 4-pole versions: adjustable parameter setting  $I_N$  for neutral conductor protection (N) optionally available for 3-pole versions

ETU556 / ETU856 parameters, 3-pole:

Size		$I_n$ [A]	$I_r$ [A]	$t_{td}$ [s]	$I_{sd}$ [A]	$t_{sd}$ [s]	$I_l$ [A]	$I_g$ [A]	$t_g$ [s]	$I_N^{1)}$ [A]
3VA6 M/H/C/L	150 A	40	15 ... 40	0.5 ... 25	24 ... 400	0.05 ... 0.5	60 ... 480	15 ... 40	0.05 ... 0.8	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 160 / OFF
		150	60 ... 150	0.5 ... 20	90 ... 1500		225 ... 1500	30 ... 150		30 ... 240 / OFF
	250 A	100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	150 ... 2500		375 ... 2500	50 ... 250		50 ... 400 / OFF
	400 A	250	100 ... 250	0.5 ... 25	150 ... 2500		375 ... 3000	50 ... 250		50 ... 400 / OFF
		400	150 ... 400	0.5 ... 17	240 ... 4000		600 ... 4000	80 ... 400		80 ... 640 / OFF
	600 A	400	150 ... 400	0.5 ... 25	240 ... 4000		600 ... 4800	80 ... 400		80 ... 640 / OFF
		600	250 ... 600	0.5 ... 15	360 ... 5400		900 ... 5400	120 ... 600		120 ... 960 / OFF

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

ETU556 / ETU856 parameters, 4-pole:

Size		$I_n$ [A]	$I_r$ [A]	$t_{td}$ [s]	$I_{sd}$ [A]	$t_{sd}$ [s]	$I_l$ [A]	$I_g$ [A]	$t_g$ [s]	$I_N$ [A]
3VA6 M/H/C/L	150 A	40	15 ... 40	0.5 ... 25	24 ... 400	0.05 ... 0.5	60 ... 480	15 ... 40	0.05 ... 0.8	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 150 / OFF
		150	60 ... 150	0.5 ... 20	90 ... 1500		225 ... 1500	30 ... 150		30 ... 150 / OFF
	250 A	100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	150 ... 2500		375 ... 2500	50 ... 250		50 ... 250 / OFF
	400 A	250	100 ... 250	0.5 ... 25	150 ... 2500		375 ... 3000	50 ... 250		50 ... 400 / OFF
		400	150 ... 400	0.5 ... 17	240 ... 4000		600 ... 4000	80 ... 400		80 ... 400 / OFF
	600 A	400	150 ... 400	0.5 ... 25	240 ... 4000		600 ... 4800	80 ... 400		80 ... 600 / OFF
		600	250 ... 600	0.5 ... 15	360 ... 5400		900 ... 5400	120 ... 600		120 ... 600 / OFF

**Overload protection L:**

- $I_r$  Adjustable from 0.4 to 1.0 x  $I_n$  in absolute current values  
 $I_r = 40$  A: In steps of 0.5 A  
 $I_r \geq 100$  A: In steps of 1 A
- $t_{td}$  Adjustable from 0.5 to 13 / 15 / 17 / 20 / 25 s (dependent on rated operational current and frame size)  
with a reference point of 6 x  $I_r$ .  
In steps of 0.1 s

The ETU556 LSI(G) and ETU856 LSI(G) have a permanently active thermal memory.



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

- $I_{sd}$  Adjustable from 0.6 to 9 / 10 x  $I_n$   
 $I_{sd} = 40$  A: In steps of 0.5 A  
 $I_{sd} \geq 100$  A: In steps of 1 A
- $t_{sd}$  Adjustable from 0.05 to 0.5 s  
with a reference point of  $I_{sd} = 8 \times I_r$   
in steps of 0.01 s

The curve shape  $I^2t = \text{constant}$  can be deactivated.

**Instantaneous short-circuit protection I:**

- $I_i$  Adjustable from 1.5 to 9 / 10 / 12 x  $I_n$  (dependent on rated operational current and frame size)  
In steps of 1 A

**Ground-fault alarm (G):**

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

- $I_g$  Adjustable from 0.2 / 0.4 to 1.0 x  $I_n$  in absolute current values  
In steps of 1 A
- $t_g$  Adjustable from 0.05 to 0.8 s  
with a reference point of  $2 \times I_g$   
In steps of 0.01 s

An alarm threshold  $I_{gA}$  from 0.2 / 0.4 to 1 x  $I_n$  can also be set. In steps of 1 A

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

If a ground fault is detected, the ETU556 or ETU856 only issues an alarm without tripping the circuit breaker. This alarm is displayed directly on the LCD display and/or communicated to higher-level systems via the communication connection, the EFB external function box and the maintenance mode box.

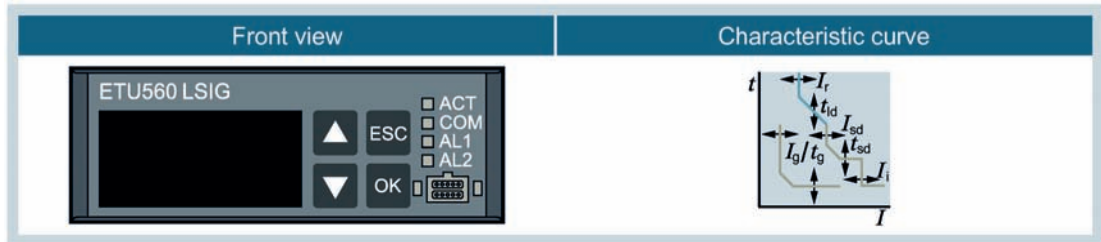
**Neutral conductor protection N:**

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

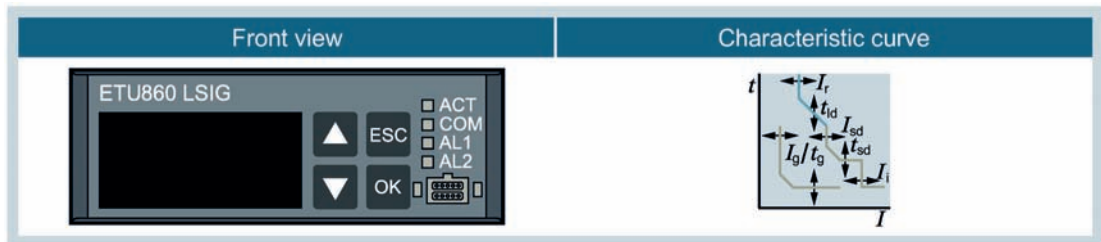
- $I_N$  Adjustable in steps of 1 A  
**3-pole** circuit breakers with external current transformer for N conductor:  
 $I_n = 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.6  $I_n$   
**4-pole** circuit breakers:  
 $I_n = 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.0 or 1.5 / 1.6 x  $I_n$

**Electronic trip units ETU560 LSIG and ETU860 LSIG**

ETU560 LSIG 3-pole and 4-pole units:



ETU860 LSIG 3-pole and 4-pole units:



**Line protection - function LSIG**

The electronic trip units ETU560 and ETU860 have:

- Adjustable parameter settings  $I_r$  and  $t_{id}$  for overload protection (L)
- Adjustable parameter settings  $I_{sd}$  and  $t_{sd}$  for short-time delayed short circuit protection (S)
- Adjustable parameter setting  $I_i$  for instantaneous short-circuit protection (I)
- Adjustable parameter settings  $I_g$  and  $t_g$  for ground-fault protection (G)
- With 4-pole versions: adjustable parameter setting  $I_N$  for neutral conductor protection (N) optionally available for 3-pole versions

## 3.1 Use of the 3VA UL molded case circuit breakers in line protection

ETU560 / ETU860 parameters (3-pole version):

Size		$I_n$ [A]	$I_r$ [A]	$t_{id}$ [s]	$I_{sd}$ [A]	$t_{sd}$ [s]	$I_l$ [A]	$I_g$ [A]	$t_g$ [s]	$I_N^{(1)}$ [A]
3VA6 M/H/C/L	150 A	40	15 ... 40	0.5 ... 25	24 ... 400	0.05 ... 0.5	60 ... 480	15 ... 40	0.05 ... 0.8	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 160 / OFF
		150	60 ... 150	0.5 ... 20	90 ... 1500		225 ... 1500	30 ... 150		30 ... 240 / OFF
	250 A	100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	150 ... 2500		375 ... 2500	50 ... 250		50 ... 400 / OFF
	400 A	250	100 ... 250	0.5 ... 25	150 ... 2500		375 ... 3000	50 ... 250		50 ... 400 / OFF
		400	150 ... 400	0.5 ... 17	240 ... 4000		600 ... 4000	80 ... 400		80 ... 640 / OFF
	600 A	400	150 ... 400	0.5 ... 25	240 ... 4000		600 ... 4800	80 ... 400		80 ... 640 / OFF
		600	250 ... 600	0.5 ... 15	360 ... 5400		900 ... 5400	120 ... 600		120 ... 960 / OFF

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

ETU560 / ETU860 parameters (4-pole version):

Size		$I_n$ [A]	$I_r$ [A]	$t_{id}$ [s]	$I_{sd}$ [A]	$t_{sd}$ [s]	$I_l$ [A]	$I_g$ [A]	$t_g$ [s]	$I_N$ [A]
3VA6 M/H/C/L	150 A	40	15 ... 40	0.5 ... 25	24 ... 400	0.05 ... 0.5	60 ... 480	15 ... 40	0.05 ... 0.8	15 ... 64 / OFF
		100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 150 / OFF
		150	60 ... 150	0.5 ... 20	90 ... 1500		225 ... 1500	30 ... 150		30 ... 150 / OFF
	250 A	100	40 ... 100	0.5 ... 25	60 ... 1000		150 ... 1200	20 ... 100		20 ... 160 / OFF
		250	100 ... 250	0.5 ... 13	150 ... 2500		375 ... 2500	50 ... 250		50 ... 250 / OFF
	400 A	250	100 ... 250	0.5 ... 25	150 ... 2500		375 ... 3000	50 ... 250		50 ... 400 / OFF
		400	150 ... 400	0.5 ... 17	240 ... 4000		600 ... 4000	80 ... 400		80 ... 400 / OFF
	600 A	400	150 ... 400	0.5 ... 25	240 ... 4000		600 ... 4800	80 ... 400		80 ... 600 / OFF
		600	250 ... 600	0.5 ... 15	360 ... 5400		900 ... 5400	120 ... 600		120 ... 600 / OFF

**Overload protection L:**

- $I_r$  Adjustable from 0.4 to 1.0 x  $I_n$  in absolute current values  
 $I_r = 40$  A: In steps of 0.5 A  
 $I_r \geq 100$  A: In steps of 1 A
- $t_{id}$  Adjustable from 0.5 to 13 / 15 / 17 / 20 / 25 s (dependent on rated operational current and frame size)  
with a reference point of 6 x  $I_r$ .  
In steps of 0.1 s

The ETU560 LSIG and ETU860 LSIG have a permanently active thermal memory.

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

- $I_{sd}$  Adjustable from 0.6 to 9 / 10 x  $I_n$   
 $I_{sd} = 40$  A: In steps of 0.5 A  
 $I_{sd} \geq 100$  A: In steps of 1 A
- $t_{sd}$  Adjustable from 0.05 to 0.5 s  
with a reference point of  $I_{sd} = 8 \times I_r$   
in steps of 0.01 s

The curve shape  $I^2t = \text{constant}$  can be deactivated.

**Instantaneous short-circuit protection I:**

- $I_i$  Adjustable from 1.5 to 9 / 10 / 12 x  $I_n$  (dependent on rated operational current and frame size)  
In steps of 1 A

**Ground-fault protection G:**

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

- $I_g$  Adjustable from 0.2 / 0.4 to 1.0 x  $I_n$   
In steps of 1 A
- $t_g$  Adjustable from 0.05 to 0.8 s  
with a reference point of 2 x  $I_g$   
In steps of 0.01 s
- Changeover of measurement method from "rES" (measurement method 1) to "d Ir" (measurement method 2), for details see chapter Ground-fault protection (Page 70)

An alarm threshold  $I_{gA}$  between 0.2 to 1 x  $I_n$  can also be set. In steps of 1 A

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

Ground-fault protection G can **not** be deactivated.

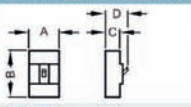
**Neutral conductor protection N:**

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

- $I_N$  Adjustable in steps of 1 A  
**3-pole** circuit breakers with external current transformer for N conductor:  
 $I_n = 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.6  $I_n$   
**4-pole** circuit breakers:  
 $I_n = 40$  A: 0.4 to 1.6 x  $I_n$   
 $I_n \geq 100$  A: 0.2 to 1.0 or 1.5 / 1.6 x  $I_n$

3.1 Use of the 3VA UL molded case circuit breakers in line protection

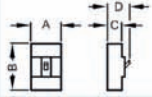
3.1.3 Overview of 3VA UL molded case circuit breakers in line protection

3VA UL molded case circuit breakers for line protection				3VA5 molded case circuit breakers								
				125 A 3VA51			125 A 3VA51			250 A 3VA52		
Number of poles				1			3			2- in 3-pole, 3		
Rated operational current I <sub>n</sub>	A			15 ... 125			15 ... 125			100 ... 250		
Frequency	Hz			0 ... 400			0 ... 400			0 ... 400		
<b>Electrical characteristics according to UL 489</b>												
Rated operational voltage U <sub>e</sub> 50/60 Hz AC	V			347			600			600		
Rated operational voltage U <sub>e</sub> DC	V			125			500			600		
<b>Electrical characteristics according to IEC 60947-2</b>												
Rated operational voltage U <sub>e</sub>	V			415			690			690		
Rated insulation voltage U <sub>i</sub>	V			500			800			800		
Rated impulse withstand voltage U <sub>imp</sub>	kV			8			8			8		
Use in IT systems				■			■			■		
<b>Service life (make-break operations)</b>												
Mechanical				15000			15000			15000		
Electrical with U <sub>e</sub> UL 489 480 V / IEC 60947 415 V				8000			8000			8000		
Switching frequency	Switching cycles/hour			120			120			120		
<b>Short-circuit breaking capacity according to UL 489</b>												
Rated ultimate short-circuit breaking capacity				S	M	H	S	M	H	M	H	C
120 V	kA			65	85	100						
240 V AC	kA						65	85	100	85	100	200
227 V AC	kA			25	35	50						
347 V AC	kA			14	14	14						
480Y/277 V AC	kA						25	35	65	35	65	100
480 V AC	kA						25 <sup>1)</sup>	35 <sup>1)</sup>	65 <sup>1)</sup>	35	65	100
600Y/347 V AC	kA						14	18 <sup>2)</sup>	25 <sup>3)</sup>	18	25	35
600 V AC	kA									18	25	35
125 V DC	kA			14	25	30						
250 V DC	kA						50	85	100	50	85	100
500 V DC	kA						50	85	100	50	85	100
600 V DC (3-pole only)	kA									50	85	100
<b>Short-circuit breaking capacity according to IEC 60947-2</b>												
Rated ultimate short-circuit breaking capacity I <sub>cs</sub> /I <sub>cs</sub>				S	M	H	S	M	H	M	H	C
240 V AC	kA			25/25	36/36	55/55	55/55	85/85	150/150	85/85	100/100	200/200
415 V AC	kA			5/5	5/5	5/5	36/36	55/55	70/70	55/55	70/70	110/110
690 V AC	kA						5/5	7/5	10/5	7/7	10/10	10/10
125 V DC	kA			14	25	30						
250 V DC	kA						50	85	100	50	85	100
500 V DC	kA						50	85	100	50	85	100
750 V DC (3-pole only)	kA									50	85	100
<b>Trip units</b>												
Trip units	FTFM	TM210		■			■			■		
	FTAM	TM230					■			■		
	LI	ETU320										
	LIG	ETU330										
	LSI	ETU350										
	LSI	ETU550/ETU850										
	LSI (G)	ETU556/ETU856										
	LSIG	ETU560/ETU860										
<b>Dimensions / miscellaneous</b>												
				A	inch	mm	1	25.4	3	76.2	4.13	105
	B	inch	mm	5.51	140	5.51	140	7.28	185			
	C	inch	mm	3	76.5	3	76.5	3.27	83			
	D	inch	mm	3.72	94.5	3.72	94.5	4.21	107			
Weight		kg		0.4			1.01			1.53/1.77		
Standards				UL 489 / CSA22.2 / IEC 60947-2			UL 489 / CSA22.2 / IEC 60947-2			UL 489 / CSA22.2 / IEC 60947-2		
Versions				Fixed			Fixed			Fixed		
Utilization category acc. to IEC 60947-2				A			A			A		
Overvoltage category				IV			IV			IV		
Pollution degree acc. to IEC 60947-2				3			3			3		
Power and infeed direction				Top and bottom			Top and bottom			Top and bottom		
Standard connection technology <sup>4)</sup>				No connection technology			No connection technology			No connection technology		

- 1) Applies to I<sub>n</sub> 15 A to 90 A
- 2) I<sub>n</sub> 100 A to 125 A 14 kA
- 3) I<sub>n</sub> 40 A to 90 A 18 kA; 100 A to 125 A 14 kA
- 4) The 3VA5/3VA6 molded circuit breakers are supplied without connectors by default. These must be ordered separately.

3.1 Use of the 3VA UL molded case circuit breakers in line protection

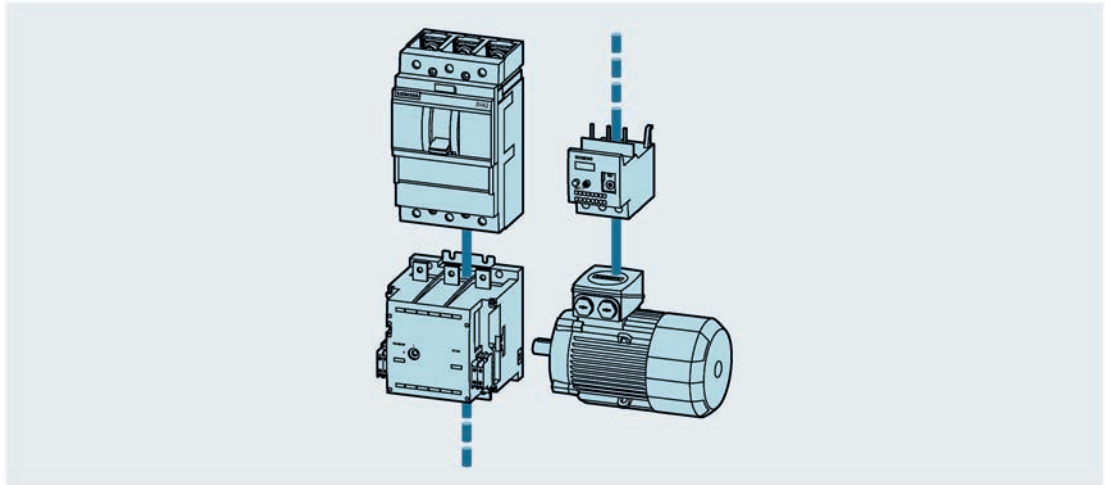
For the rated ultimate short-circuit breaking capacity and rated service short-circuit breaking capacity with direct current, see chapter Use of 3VA UL molded case circuit breaker in DC systems (Page 141) .

3VA UL molded case circuit breakers for line protection			3VA6 molded case circuit breakers																			
			150 A 3VA61				250 A 3VA62				400 A 3VA63				600 A 3VA64							
Number of poles			3, 4				3, 4				3, 4				3, 4							
Rated operational current I <sub>n</sub>			A				100, 250				250, 400				400, 600							
Frequency			Hz				50 ... 60				50 ... 60				50 ... 60							
<b>Electrical characteristics according to UL 489</b>																						
Rated operational voltage U <sub>n</sub> 50/60 Hz AC			V				600				600				600							
Rated operational voltage U <sub>n</sub> DC			V																			
<b>Electrical characteristics according to IEC 60947-2</b>																						
Rated operational voltage U <sub>n</sub>			V				690				690				690							
Rated insulation voltage U <sub>i</sub>			V				800				800				800							
Rated impulse withstand voltage U <sub>imp</sub>			kV				8				8				8							
Use in IT systems			■				■				■				■							
<b>Service life (make-break operations)</b>																						
Mechanical			20000				20000				15000				15000							
Electrical with U <sub>n</sub> UL 489 480 V / IEC 60947 415 V			9000				6000				6000				4000							
Switching frequency			Switching cycles/hour				120				120				120							
<b>Short-circuit breaking capacity according to UL 489</b>																						
Rated ultimate short-circuit breaking capacity																						
120 V			kA																			
240 V AC			kA				100 100 200 200				100 100 200 200				100 100 200 200							
227 V AC			kA																			
347 V AC			kA																			
480Y/277 V AC			kA				35 65 100 150				35 65 100 150				35 65 100 150							
480 V AC			kA				35 65 100 150				35 65 100 150				35 65 100 150							
600Y/347 V AC			kA				18 22 35 50				18 22 35 50				18 22 35 50							
600 V AC			kA				18 22 35 50				18 22 35 50				18 22 35 50							
125 V DC			kA																			
250 V DC			kA																			
500 V DC			kA																			
600 V DC (3-pole only)			kA																			
<b>Short-circuit breaking capacity according to IEC 60947-2</b>																						
Rated ultimate short-circuit breaking capacity I <sub>cs</sub> /I <sub>cm</sub>																						
240 V AC			kA				85/85 110/110 150/150 200/200				3/3 3/3 3/3 3/3				5/5 5/5 5/5 5/5				6/6 6/6 6/6 6/6			
415 V AC			kA				55/55 85/85 110/110 150/150				3/3 3/3 3/3 3/3				5/5 5/5 5/5 5/5				6/6 6/6 6/6 6/6			
690 V AC			kA				2.5/2.5 2.5/2.5 2.5/2.5 2.5/2.5				3/3 3/3 3/3 3/3				5/5 5/5 5/5 5/5				6/6 6/6 6/6 6/6			
125 V DC			kA																			
250 V DC			kA																			
500 V DC			kA																			
750 V DC (3-pole only)			kA																			
<b>Trip units</b>																						
Trip units			FTFM TM210																			
			FTAM TM230																			
			LI ETU320																			
			LIG ETU330																			
			LSI ETU350																			
			LSI ETU550/ETU850																			
			LSI (G) <sup>5)</sup> ETU556/ETU856																			
			LSIG ETU560/ETU860																			
<b>Dimensions / miscellaneous</b>																						
			A		inch mm		4.13/5.51		105/140		4.13/5.51		105/140		5.43/7.24		138/184		5.43/7.24		138/184	
			B		inch mm		7.8		198		7.8		198		9.76		248		9.76		248	
			C		inch mm		3.27		83		3.27		83		4.33		110		4.33		110	
			D		inch mm		4.21		107		4.21		107		5.39		137		5.39		137	
Weight			kg		2.3/2.9		2.3/2.9		2.3/2.9		5.3/6.9		5.3/6.9		5.3/6.9		5.3/6.9		5.3/6.9		5.3/6.9	
Standards			UL 489 / CSA22.2 / IEC 60947-2				UL 489 / CSA22.2 / IEC 60947-2				UL 489 / CSA22.2 / IEC 60947-2				UL 489 / CSA22.2 / IEC 60947-2							
Versions			Fixed / Plug-in / Draw-out				Fixed / Plug-in / Draw-out				Fixed				Fixed							
Utilization category acc. to IEC 60947-2			A				A				A				A							
Overvoltage category			IV				IV				IV				IV							
Pollution degree acc. to IEC 60947-2			3				3				3				3							
Power and infeed direction			Top and bottom				Top and bottom				Top and bottom				Top and bottom							
Standard connection technology <sup>4)</sup>			No connection technology				No connection technology				No connection technology				No connection technology							

4) The 3VA5/3VA6 molded circuit breakers are supplied without connectors by default. These must be ordered separately.

5) G alarm, no G protection

## 3.2 Use as Motor Circuit Protector (MCP) for starter combinations



Molded circuit protectors for starter protection are used to protect three-phase asynchronous motors.

Starter combinations consist of:

- Motor circuit protectors (MCP) for starter protection
- Contactor
- Overload relay

In this case, the motor circuit protector provides the short-circuit protection and the disconnecter function. It is therefore equipped with an adjustable and instantaneous short-circuit release. The contactor is responsible for operational switching of the feeder. The overload relay provides the overload protection. These can be specially matched to the motor.

Siemens offers two versions of the 3VA UL motor circuit protectors:

- Magnetic trip units from the 3VA5 series in sizes 125 A and 250 A with a magnetic setting range from 3 to 12 x  $I_n$
- Electronic trip units with instantaneous short-circuit protection in sizes 150 A, 250 A, 400 A and 600 A with a setting range from 3 to 15 x  $I_n$



## 3.2 Use as Motor Circuit Protector (MCP) for starter combinations

## 3VA UL motor circuit protectors for starter combinations

3VA UL motor circuit protector for starter combinations (MCPs)			3VA5 motor circuit protector			3VA6 motor circuit protector											
			125 A 3VA51	250 A 3VA52		150 A 3VA61	250 A 3VA62	400 A 3VA63	600 A 3VA64								
Number of poles			3			3			3								
Rated operational current $I_n$ [A]			15 ... 125			150 ... 200			25 ... 100		110 ... 200		200 ... 250		400 ... 500		
			H			H		C		C		C		C			
Breaking capacity according to UL 489 without contactor			240 V AC [kA]			100		100		200		200		200		200	
			480/277 V AC [kA]			65		65		100		100		100		100	
			480 V AC [kA]			65 <sup>1)</sup>		65		100		100		100		100	
			600/347 V AC [kA]			25 <sup>2)</sup>		25		35		35		35		35	
			600 V AC [kA]			25		35		35		35		35		35	
Breaking capacity according to IEC 60947			240 V AC $I_{cs}/I_{cs}$ [kA]			150/150		100/100		200/200		200/200		200/200		200/200	
			415 V AC $I_{cs}/I_{cs}$ [kA]			70/70		70/70		110/110		110/110		110/110		110/110	
			690 V AC $I_{cs}/I_{cs}$ [kA]			5/5		10/5		10/5		2.5/2.5		3/3		5/5	
Trip units			Magnetic adjustable			TM120M		■		■		■		■		■	
			Electronic			ETU310M		■		■		■		■		■	

1) Applies to  $I_n$  15 A to 90 A

2)  $I_n$  40 A to 90 A: 18 kA  
 $I_n$  100 to 125 A: 14 kA:

## Trip units for starter combinations

Rated operational current $I_n$		15 A	25 A	30 A	40 A	50 A	70 A	80 A	90 A	100 A	110 A	125 A	150 A	200 A	250 A	400 A	500 A
Size	Trip units	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]	[x 1]
125 A 3VA51	Magnetic adjustable TM120M	MU <sup>1)</sup>	3 ... 7	3 ... 7	3 ... 7	3 ... 7	3 ... 7	3 ... 7	3 ... 7	3 ... 7	3 ... 7	3 ... 7					
		MH <sup>1)</sup>	5 ... 12	5 ... 12	5 ... 12	5 ... 12	5 ... 12	5 ... 12	5 ... 12	5 ... 12	5 ... 12	5 ... 12					
250 A 3VA52	Magnetic adjustable TM120M	MU <sup>1)</sup>											3 ... 6	3 ... 6			
		MH <sup>1)</sup>											6 ... 12	6 ... 12			
150 A 3VA61	Electronic ETU310M		3 ... 15	3 ... 15	3 ... 15	3 ... 15	3 ... 15	3 ... 15	3 ... 15	3 ... 15							
250 A 3VA62											3 ... 15	3 ... 15	3 ... 15	3 ... 12			
400 A 3VA63														3 ... 15	3 ... 15		
600 A 3VA64																3 ... 13	3 ... 12

1) 9th and 10th digit of article number, e.g. 3VA6115-5MH31-0AA0

## Note

For the relevant short-circuit current ratings (SCCR ratings) of the combination of contactor and overload relay, please refer to the corresponding UL certificates for contactor and overload relay. These can be found in the Service and Support Portal (<https://support.industry.siemens.com/cs/ww/en/view/29755649>).

**TM120M magnetic trip unit**



Starter protection (motor circuit protector) AM - function I

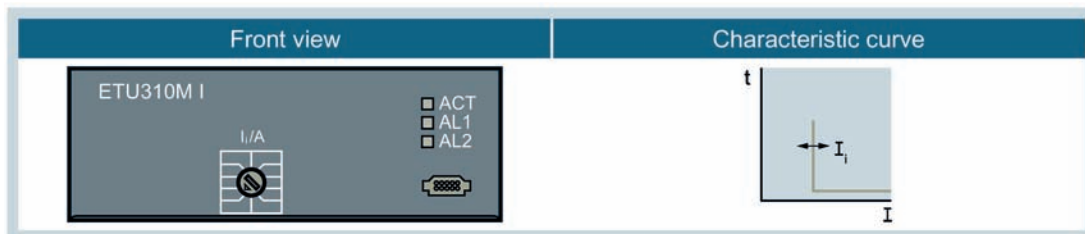
The TM120M magnetic trip unit has an adjustable short circuit release  $I_i$ .

TM120M parameters:

Size	$I_n$ [A]	$I_i$ [A]													
		TM120M MU						TM120M MH							
3VA51 125 A	15	45	60	75	90	105	75	90	105	120	135	150	165	180	
	25	75	100	125	150	175	125	150	175	200	225	250	275	300	
	30	90	120	150	180	210	150	180	210	240	270	300	330	360	
	40	120	160	200	240	280	200	240	280	320	360	400	440	480	
	50	150	200	250	300	350	250	300	350	400	450	500	550	600	
	70	210	280	350	420	490	350	420	490	560	630	700	770	840	
	80	240	320	400	480	560	400	480	560	640	720	800	880	960	
	90	270	360	450	540	630	450	540	630	720	810	900	990	1080	
	100	300	400	500	600	700	500	600	700	800	900	1000	1100	1200	
	110	330	440	550	660	770	550	660	770	880	990	1100	1210	1320	
3VA52 250 A	150	450	600	750	900	–	–	900	1050	1200	1350	1500	1650	1800	
	200	600	800	1000	1200	–	–	1200	1400	1600	1800	2000	2200	2400	

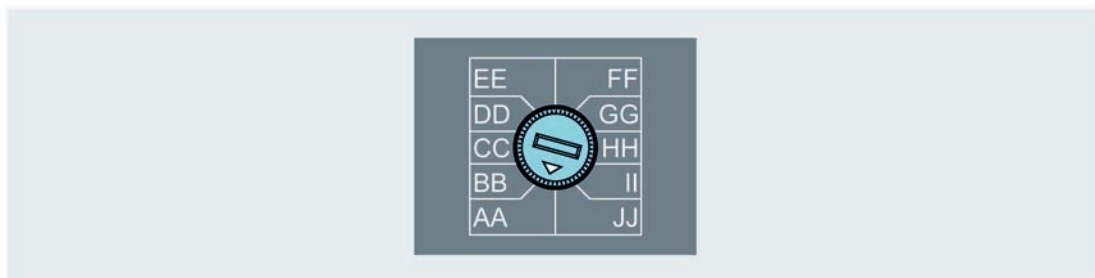
## ETU310M electronic trip unit

ETU310M 3-pole



ETU310M parameters:

The parameters are selected with the setting knob. The diagram below shows the possible selections.



The values for the respective setting are listed in the following table.

Size	$I_n$ [A]	$I_i$ [A]											$I_{i \min}$ [ $\times I_n$ ]	$I_{i \max}$ [ $\times I_n$ ]
		AA	BB	CC	DD	EE	FF	GG	HH	II	JJ			
3VA61 150 A	25	75 ... 375	75	100	125	150	200	250	300	325	350	375	3	15
	30	90 ... 450	90	120	150	180	240	300	360	390	420	450	3	15
	40	120 ... 600	120	160	200	240	320	400	480	520	560	600	3	15
	50	150 ... 750	150	200	250	300	400	500	600	650	700	750	3	15
	70	210 ... 1050	210	280	350	420	560	700	840	910	980	1050	3	15
	80	240 ... 1200	240	320	400	480	640	800	960	1040	1120	1200	3	15
	90	270 ... 1350	270	360	450	540	720	900	1080	1170	1260	1350	3	15
3VA62 250 A	100	300 ... 1500	300	400	500	600	800	1000	1200	1300	1400	1500	3	15
	110	330 ... 1650	330	440	550	660	880	1100	1320	1430	1540	1650	3	15
	125	375 ... 1875	375	500	625	750	1000	1250	1500	1625	1750	1875	3	15
	150	450 ... 2250	450	600	750	1000	1200	1400	1600	1800	2000	2250	3	15
3VA63 400 A	200	600 ... 3000	600	800	1000	1200	1600	2000	2400	2600	2800	3000	3	15
	250	750 ... 3750	750	1000	1250	1500	2000	2500	3000	3250	3500	3750	3	15
3VA64 600 A	400	1200 ... 5200	1200	1700	2100	2600	3100	3600	4000	4400	4800	5200	3	13
	500	1500 ... 6000	1500	2000	2500	3000	3500	4000	4500	5000	5500	6000	3	12

Instantaneous short-circuit protection I:

- $I_i$  adjustable in 10 steps from 3 to 12 / 13 / 15  $\times I_n$  (dependent on the frame size)

### 3.3 Use of the 3VA UL molded case circuit breaker as a molded case switch (MCS)

Molded case switches are used as:

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

Molded case switches can be used to switch equipment and parts of electrical installations up to their rated current and rated voltage.

In contrast to the switch disconnector according to IEC 60947-3, the molded case switch has a short-circuit release for self-protection up to a specified maximum short-circuit current and is certified to UL 489. The special advantage of the molded case switch is that the type of protective device in the upstream panelboard up to the specified short-circuit current of the molded case switch is insignificant.

So that the molded case switches of the 3VA UL series can also be used globally in IEC applications, they are also approved as CBI-X according to IEC 60947-2 Annex L.

Depending on the requirement, the range of 3VA UL molded case switches includes devices for a short-circuit current of 65 kA as well as 100 kA at 480 V according to UL 489.

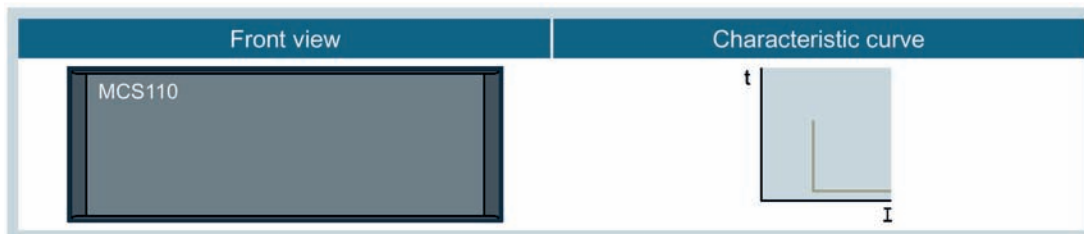
## 3.3 Use of the 3VA UL molded case circuit breaker as a molded case switch (MCS)

## Technical specifications of molded case switch

3VA UL molded case switch (MCS)		125 A 3VA51	250 A 3VA52	400 A 3VA63	600 A 3VA64
Number of poles		3	2(3)-pole <sup>1)</sup> / 3	3	3
Electrical characteristics according to UL 489					
Short-circuit current rating (SCCR) up to 65 kA with 480 V <sup>2)</sup>					
Rated uninterrupted current $I_n$ at 40 °C ambient temperature [A]		100	150, 250	–	–
Short-circuit current rating (SCCR) up to 100 kA with 480 V <sup>2)</sup>					
Rated uninterrupted current $I_n$ at 40 °C ambient temperature [A]		–	100, 150, 250	400	600
Approval according to IEC 60947-2 Annex L BI-X		■	■	■	■
Trip units <sup>3)</sup> FM MCS110		■	■	■	■
Dimensions					
	A [inch]	3	4.13	5.43/7.24	5.43/7.24
	[mm]	76.2	105	138/184	138/184
	B [inch]	5.51	7.28	9.76	9.76
	[mm]	140	185	248	248
	C [inch]	3	3.27	4.33	4.33
[mm]	76.5	83	110	110	
D [inch]	3.67	4.21	5.39	5.39	
[mm]	93.4	107	137	137	
General information					
Power and infeed direction		Top and bottom	Top and bottom	Top and bottom	Top and bottom
Standard connection technology		No connection technology	No connection technology	No connection technology	No connection technology

- 1) 2-pole circuit breaker in 3-pole frame
- 2) The short-circuit current rating (SCCR rating) is the maximum permissible short-circuit current at the installation location of the molded case switch when a corresponding overload protection device is used
- 3) Integrated instantaneous short-circuit release for self-protection

## MCS110 magnetic trip unit



## Molded case switch FM - function I for self-protection

The MCS110 magnetic trip unit has a fixed short circuit release  $I_i$ .

MCS110 parameters:

Size	$I_n$ [A]	$I_i$ [ $\times I_n$ ]	$I_i$ [A]
3VA51	100	16	1600
	100	25	2500
3VA52	150	16	2400
	250	10	2500
3VA63	400	14	5400
3VA64	600	9	5600

### **3.3.1 Compatibility of 3VA UL molded case switch and accessories**

The 3VA UL molded case switches are derived from the molded case circuit breakers and share the following:

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

This means that, for example, a shunt trip can trip the molded case switches via remote control or the molded case switch can be opened or closed with a door mounted rotary operator.

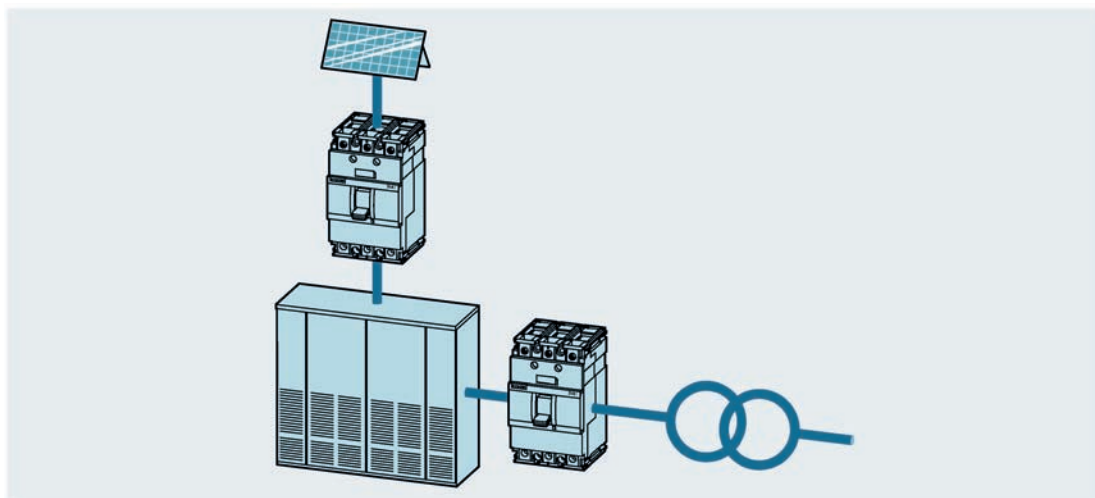
## 3.4 Use of 3VA UL molded case circuit breaker in DC systems

### 3.4.1 Introduction

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

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

The 3VA5 molded case circuit breakers for line protection with thermal overload and magnetic short-circuit releases are suitable for use in DC systems.



### Features specific to direct current

Short-circuits are interrupted in DC networks by a method similar to the one applied to high alternating currents, i.e. by current limiting. A high arc voltage builds up in molded case circuit breakers, which forces the current to zero when the source voltage (supply system voltage) is exceeded.

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

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

With DC applications, the breaking capacity depends only on:

- The arc extinction method used
- The line voltage

### 3.4.2 Variants

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

However, a correction factor must be applied to the magnetic trip unit, relative to the actual current rating.

Correction factor for the magnetic trip unit for DC systems	
3VA51 125 A	3VA52 250 A
0,7	0,85

Example:

3VA51 100 A, TM230 FTAM:

If the switching device is to trip instantaneously on an overcurrent of 1000 A, the parameter  $I_i$  for instantaneous short-circuit current protection (I) is set to:

$$I_i = 1000 \text{ A} \times 0.7 = 700 \text{ A.}$$

For further information on trip units and details about the setting parameters, please refer to chapter Applications in line protection (Page 99).

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

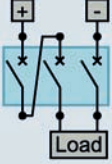
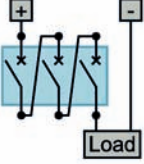
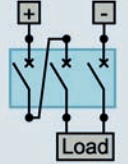
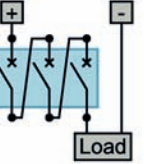


## 3.4.3 Breaking capacity with direct current

DC breaking capacity			3VA5 molded case circuit breakers				
			125 A / 3VA51		250 A / 3VA52		
			1-pole	3-pole	2(3)-pole	3-pole	
DC UL	at 125 V DC	S [kA]	14				
		M [kA]	25				
		H [kA]	30				
		C [kA]					
	at 250 V DC	S [kA]			50		
		M [kA]			85	50	50
		H [kA]			100	85	85
		C [kA]				100	100
	at 500 V DC	S [kA]			50		
		M [kA]			85	50	50
		H [kA]			100	85	85
		C [kA]				100	100
	at 600 V DC	S [kA]					
		M [kA]					50
		H [kA]					85
		C [kA]					100
DC IEC (100 % I <sub>cs</sub> )	at 125 V DC	S [kA]	14				
		M [kA]	15				
		H [kA]	30				
		C [kA]					
	at 250 V DC	S [kA]			50		
		M [kA]			85	50	50
		H [kA]			100	85	85
		C [kA]				100	100
	at 500 V DC	S [kA]			50		
		M [kA]			85	50	50
		H [kA]			100	85	85
		C [kA]				100	100
	at 750 V DC	S [kA]					
		M [kA]					50
		H [kA]					85
		C [kA]					100

3.4.4 Recommended circuits for DC systems UL

Max. permissible direct voltage $U_e$	3VA51	3VA52
125 V DC		
250 V DC		
500 V DC		
600 V DC		

Max. permissible direct voltage $U_e$	3VA51	3VA52
Isolated UPS (per UL 489 SUB SC)	Level 1 384 V nominal 500 V maximum 	
		
Level 2 500 V nominal 600 V maximum		
		

**Note**

**2-pole version in 3-pole frame (2(3)-pole)**

Only the outer poles may be used (pole 1/2 and pole 5/6).

3.4.5 Recommended circuits for DC systems IEC

Max. permissible direct voltage $U_e$		DC 1-pole disconnection		DC 2-pole (all-pole) disconnection	
		3VA51	3VA52	Grounded system	Grounded system
125 V DC	250 V DC				
250 V DC	500 V DC				
500 V DC	600 V DC 750 V DC <sup>1)</sup>				

GF Ground-fault monitoring

<sup>1)</sup> 750 V DC is not a listed voltage according to UL 489

**Note**

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

The grounded pole must always be assigned to the individual conducting path, so that in the event of a ground fault there are always 2 conducting paths in series in a circuit with 3-pole molded case circuit breakers, and 3 conducting paths in series in a circuit with 4-pole molded case circuit breakers.

**Note**

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

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

---

**Note**

**2-pole version in 3-pole frame (2(3)-pole)**

Only the outer poles may be used (pole 1/2 and pole 5/6).

---

Further circuits are available on request.

**See also**

Insulating equipment (Page 203)

## 3.5 Use of 3VA UL molded case circuit breakers in IT systems according to IEC 60947-2

### 3.5.1 Introduction

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

Preferred applications for IT systems are therefore:

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

The IT system is a low-voltage power supply network with increased failure-safety in the event of ground faults. In an IT system, live phases are not connected to ground. A ground fault does not cause system shutdown. DIN EN 60204-1 (VE 0113) therefore stipulates that an insulation monitoring device must be installed in order to indicate ground faults. In the unusual event that a fault on the load side coincides with a second fault on the line side, the full phase-to-phase voltage is connected across one contact of the breaker. The Siemens 3VA UL molded case circuit breakers for line protection, with thermal-magnetic and electronic trip units, are suitable for use in IT systems.

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

### 3.5.2 Selection criteria for 3VA UL molded case circuit breakers

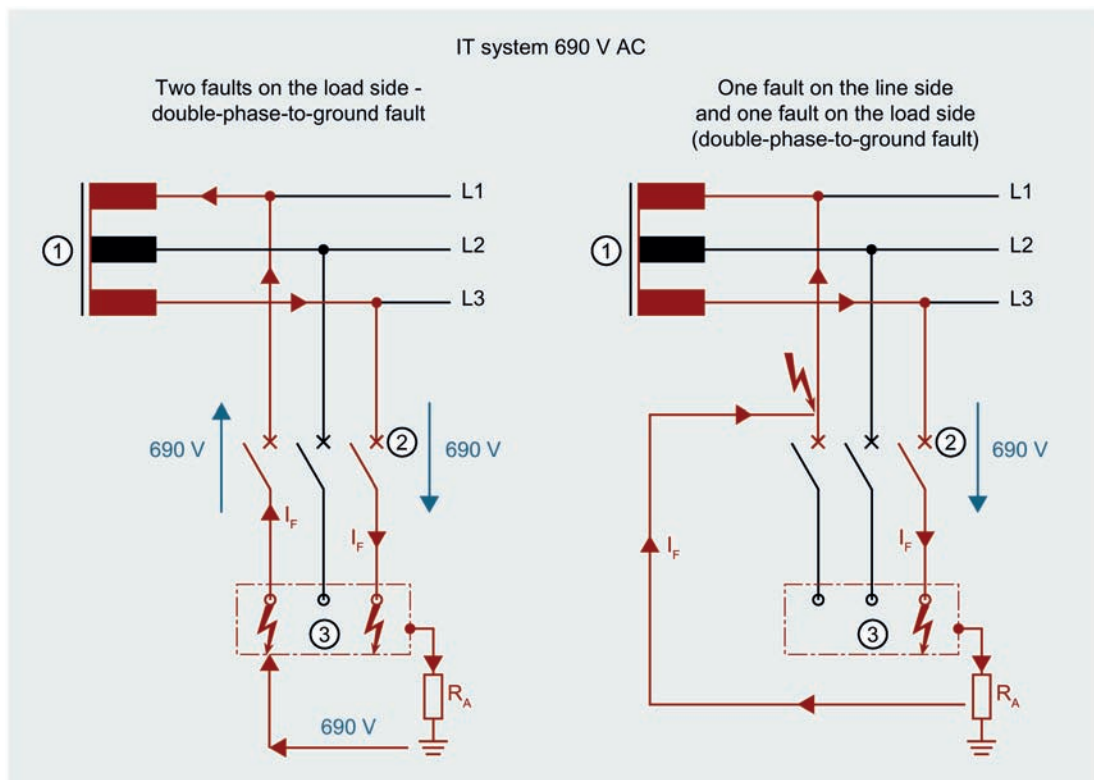
The circuit breakers are always dimensioned and selected irrespective of the system type in which they will be deployed.

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

If the system operator takes measures to ensure that a double-phase-to-ground fault cannot develop on the line side or load side of the circuit breaker, the breaking capacity  $I_{cu} / I_{cs}$  remains unchanged in IT systems. If this cannot be ensured, the values in accordance with the standard IEC 60947-2 Annex H apply for single-pole short circuits.

### 3.5.3 Fault situation

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



- ① Ungrounded transformer
- ② Molded case circuit breaker
- ③ Exposed conductive part
- $R_A$  Contact resistance of exposed conductive part ground

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

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

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

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







## 4.2 Internal accessories

### 4.2.1 Mounting locations of 3VA UL molded case circuit breakers

The portfolio of internal accessories includes:

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

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

3VA5 molded case circuit breakers:

Internal accessories Optional equipment		3VA5 125 A 3-pole		3VA5 250 A 3-pole	
		Slot No.:	23 22 21 11 12 13	Slot No.:	24 23 22 21 11 12 13 14
<b>Auxiliary switch</b>	<b>Type</b>				
Auxiliary switch	AUX_HQ	x x x	x x x	x x x x	x x x x
	AUX_HQ_el	x x x	x x x	x x x x	x x x x
	AUX_HP	x	x	x x	x x
Leading changeover switch	LCS_HQ		x		x
	LCS_HQ_el		x		x
	LCS_HP		x		x
<b>Alarm switch</b>	<b>Type</b>				
Trip alarm switch	TAS_HQ	x x	x x	x x	x x
	TAS_HQ_el	x x	x x	x x	x x
	TAS_HP	x	x	x	x
<b>Auxiliary release</b>	<b>Type</b>				
Shunt trip flexible	STF	x		x	
Shunt trip left	STL	x		x	
Undervoltage release	UVR	x		x	
Universal release	UNI	x		x	
<b>Other</b>					
Cylinder lock (type Ronis)			x		x

4.2 Internal accessories

3VA6 molded case circuit breakers:

<b>Internal accessories</b>		<b>3VA6</b>	<b>3VA6</b>
<b>Optional equipment</b>		<b>150/250 A</b>	<b>150/250 A</b>
		<b>3-pole</b>	<b>4-pole</b>
		24 23 22 21 11 12 13 14	34 33 32 31 24 23 22 21 11 12 13 14
<b>Slot No.:</b>			
<b>Auxiliary switch</b>			
	<b>Type</b>		
Auxiliary switch	AUX_HQ	x x x x x x x x	x x x x x x x x
	AUX_HQ_el	x x x x x x x x	x x x x x x x x
	AUX_HP	x x x x x x x x	x x x x x x x x
Leading changeover switch	LCS_HQ	x	x
	LCS_HQ_el	x	x
	LCS_HP	x	x
<b>Alarm switch</b>			
	<b>Type</b>		
Trip alarm switch	TAS_HQ	x x x x	x x x x
	TAS_HQ_el	x x x x	x x x x
	TAS_HP	x x x x	x x x x
Electrical alarm switch	EAS_HQ	x	x
	EAS_HQ_el	x	x
<b>Auxiliary release</b>			
	<b>Type</b>		
Shunt trip flexible	STF	x x	x x
Shunt trip left	STL	x	x
Undervoltage release	UVR	x	x
Universal release	UNI	x	x
<b>ETU/communication</b>			
	<b>Type</b>		
Communication module	COM060	x	x
Breaker data server		x	x
24 V module		x	x
<b>Other</b>			
Cylinder lock (type Ronis)		x	x

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Internal accessories Optional equipment		3VA6 400/600 A 3-pole										3VA6 400/600 A 4-pole																	
		25	24	23	22	21	11	12	13	14	15	35	34	33	32	31	25	24	23	22	21	11	12	13	14	15			
<b>Auxiliary switch</b>	<b>Type</b>																												
Auxiliary switch	AUX_HQ	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x		x	x	x	x	x		x	x	x	x
	AUX_HQ_el	x	x	x	x	x		x	x	x	x	x		x	x	x	x	x		x	x	x	x	x		x	x	x	x
	AUX_HP			x		x				x		x				x		x						x				x	
Leading changeover switch	LCS_HQ																												
	LCS_HQ_el																												
	LCS_HP																												
<b>Alarm switch</b>	<b>Type</b>																												
Trip alarm switch	TAS_HQ			x	x			x	x									x	x										
	TAS_HQ_el			x	x			x	x									x	x										
	TAS_HP			x				x										x											
Electrical alarm switch	EAS_HQ																												
	EAS_HQ_el																												
<b>Auxiliary release</b>	<b>Type</b>																												
Shunt trip flexible	STF			x						x																			
Shunt trip left	STL			x																									
Undervoltage release	UVR			x																									
Universal release	UNI			x																									
<b>ETU/communication</b>	<b>Type</b>																												
Communication module Breaker data server	COM060																												
24 V module																													
<b>Other</b>																													
Cylinder lock (type Ronis)																													

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### 4.2.2 Auxiliary and alarm switches

The auxiliary and alarm switches for the 3VA UL molded case circuit breaker form a single family. They can be installed in all sizes of all circuit breakers up to 600 A.

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

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

### HQ and HP switches

The switches are available in two versions: High Quantity (HQ) and High Power (HP). HQ switches are 7 mm wide, and HP switches 14 mm wide.



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

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

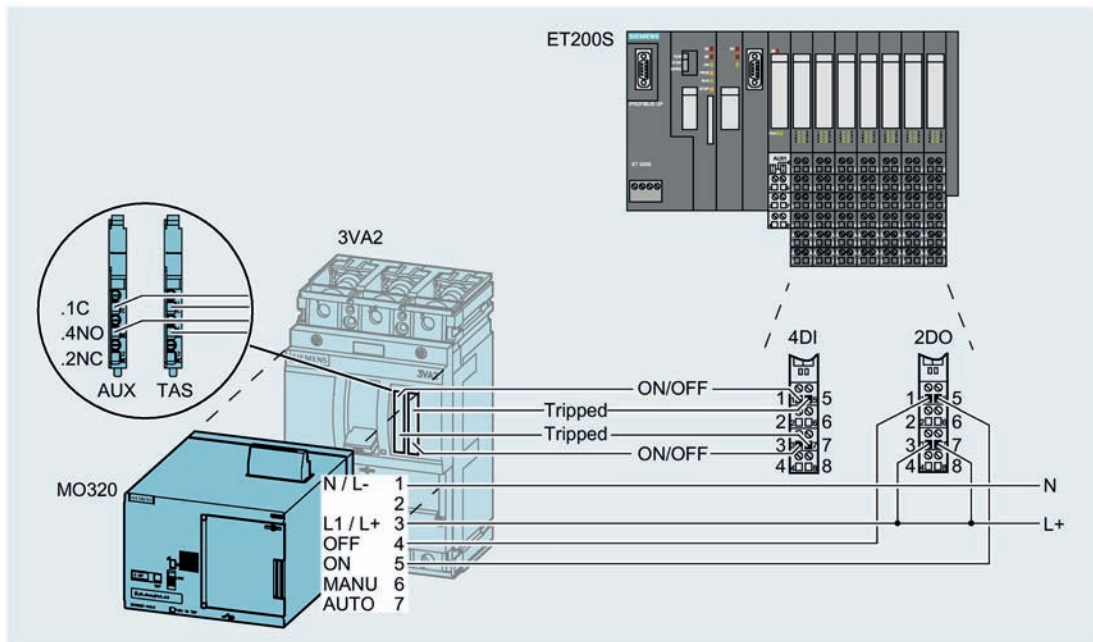
- Connection technology
  - HQ: One conductor per contact point
  - HP: Two conductors per contact point possible (two screw terminals support one internal contact point)
- Key electrical data
  - HQ: max. 300 V AC, max. 6 A
  - HP: max. 600 V; max. 10 A

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

All HQ switches are also available in a version suitable for lower-level electronic signals (HP\_el).

The auxiliary switches suitable for electronics (HQ\_el) are specially optimized for switching small voltages and currents. They are thus especially well suited to digital inputs and outputs in the environment of PLC controllers.

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



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

### Auxiliary switches AUX



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

### Leading changeover switches LCS



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

### Trip alarm switches TAS



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

### Electrical alarm switches EAS



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

- Overload L and neutral conductor overload
- Short-circuit S, I
- Ground-fault tripping G

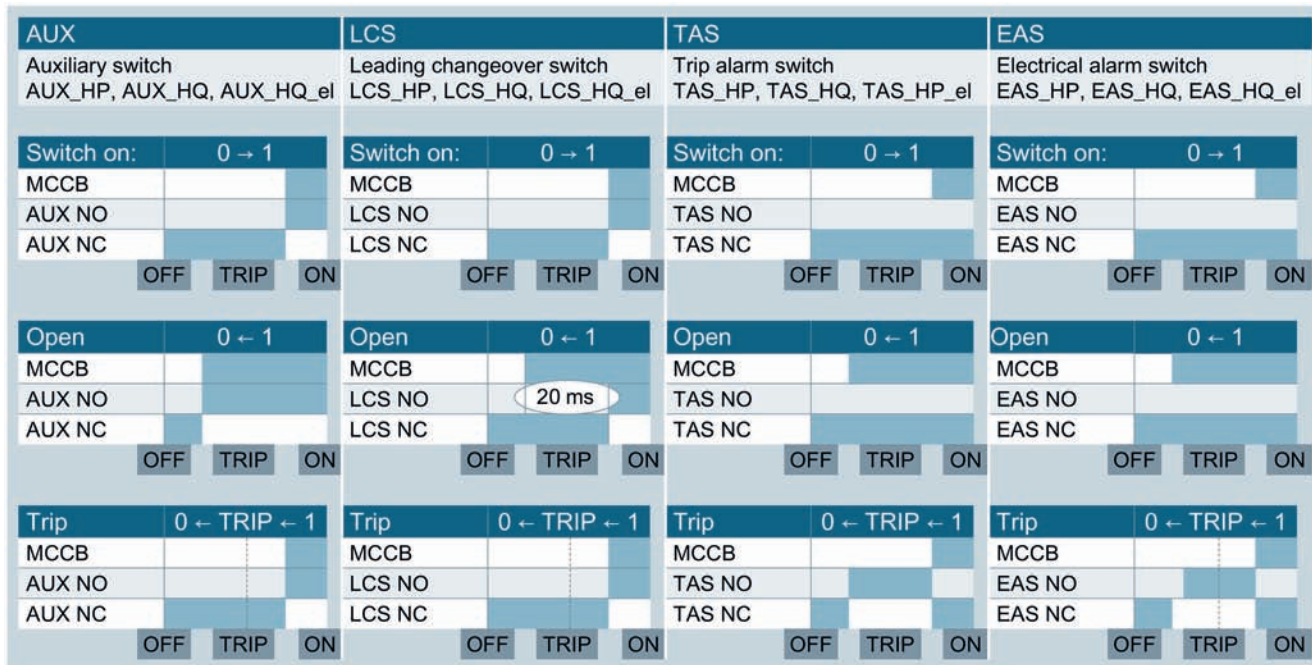
The electrical alarm switch is not operated:

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

You can use electrical alarm switches only with the 3VA6 molded case circuit breakers with electronic trip units (ETU).



### 4.2.3 Contact sequence diagrams



- Main contacts open
- Auxiliary contacts open
- Contacts closed

4.2.4 Technical specifications of auxiliary and alarm switches

Technical specifications Auxiliary and alarm switches			HQ				HQ_el				HP			
			AUX	LCS	TAS	EAS	AUX	LCS	TAS	EAS	AUX	LCS	TAS	
Width			mm				7				14			
Graphic symbol														
Wire range		Screw connection (per contact)	1 x (0.5 mm <sup>2</sup> - 1.5 mm <sup>2</sup> )				2 x (0.75 mm <sup>2</sup> - 2.5 mm <sup>2</sup> )							
		Screw connection (per contact)	1 x (AWG20 - AWG16)				2 x (AWG18 - AWG14)							
		Screw connection (per contact)	1 x (0.5 mm <sup>2</sup> - 1.0 mm <sup>2</sup> )				2 x (0.75 mm <sup>2</sup> - 1.0 mm <sup>2</sup> )							
		Screw connection (per contact)	1 x (AWG20 - AWG16)				2 x (AWG18 - AWG16)							
Tightening torque (connecting cables)		lb-in Nm	3.54 <sup>+0.88</sup> 0.4 <sup>+0.1</sup>											
Stripped length		inch mm					0.59 15							
Rated insulation voltage		$I_i$ V AC	690 Overtoltage category III Pollution degree 3											
Rated impulse withstand voltage		$U_{imp}$ kV	4				6							
Rated operational voltage		IEC 60947												
		$U_e$	V AC 50 Hz	240				24				600		
			V DC	250				24				250		
		UL / CSA												
$U_e$	V AC 60 Hz	300				24				600				
	V DC	250				24				250				
Safety separation IEC 60947-1			Safety separation of auxiliary circuits is provided up to 500 V <sup>1) 2)</sup>											

- 1) Safe separation in the case of side-by-side construction of auxiliary switches and auxiliary releases only up to 440 V and in systems up to an impulse voltage withstand level of 4 kV
- 2) HP switches without adjacent switches; not in mounting locations 11 and 21 up to 690 V

Technical specifications Auxiliary and alarm switches			HQ				HQ_el				HP		
			AUX	LCS	TAS	EAS	AUX	LCS	TAS	EAS	AUX	LCS	TAS
Conventional free-air thermal current			$I_{th} = I_e$	A	6				0.3			10	
Rated making capacity				A	6				0.3			10	
Rated operational current	AC-12	12 V	A	6				0.3				10	
		24 V	A	6				0.3				10	
		48 V	A	6								10	
		125 V	A	6								10	
		220/240 V	A	6								10	
		280/440 V	A									6	
		600 V	A									2	
	AC-15	12 V	A	3					0.3				6
		24 V	A	3					0.3				6
		48 V	A	3									6
		125 V	A	3									6
		220/240 V	A	3									6
		280/440 V	A										2
	DC-12	12 V	A	6					0.1				6
		24 V	A	4					0.1				6
		48 V	A	2									2
		110 V	A	0.5									0.6
		250 V	A	0.25									0.3
	DC-13	12 V	A	1					0.07				3
		24 V	A	0.8					0.07				3
		48 V	A	0.4									0.8
110 V		A	0.2									0.2	
250 V		A	0.1									0.1	
Short-circuit protection	Fuses	Type gG/gL	Corresponding to the specifications under rated operational current										
	Miniature circuit breakers	Characteristic type B	Corresponding to the specifications under rated operational current										
Lead time compared with main contacts <sup>1)</sup>	LCS	ms	> 20										
Switching frequency	Switching operations per hour		240										
Degree of protection	Lid of accessories compartment closed		IP40										
	Lid of accessories compartment open		IP20										
Minimum load	with 24 V DC		mA	70				0.5				70	
	with 5 V DC		mA					1					

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

4.2 Internal accessories

Maximum rated current UL/CSA			HQ				HQ_el				HP		
			AUX	LCS	TAS	EAS	AUX	LCS	TAS	EAS	AUX	LCS	TAS
Inductive load (0.75 – 0.8 AC)	24 V	A	3				0.3				6		
	300 V	A	3								6		
	600 V	A									6		
Maximum rated current (AC)	24 V	A	3								6		
	127 V	A	3								6		
	240 V	A	3								3		
	480 V	A									1.5		
	600 V	A									1.2		
Resistive load (DC)	24 V	A	0.25				0.1				0.3		
	250 V	A	0.25								0.3		
Resistive load	125 V	A	0.6								0.9		
Maximum rated current (DC)	250 V	A	0.3								0.55		

4.2.5 Auxiliary releases

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

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

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

The shunt trips are suitable for use in electrical interlocks. An attempt to switch on a circuit breaker while the interlock voltage is applied to the shunt trip leads to a so-called "no-load switching operation", i.e. the basic breaker always returns to the TRIP position and the main contacts never close.

**Note**

All auxiliary releases are reverse-polarity-protected.

### Shunt Trip Left (STL)



Shunt trips of type STL can be fitted in the left-hand accessory compartment as an alternative to an undervoltage release. The units are available with six rated voltages in the following range:

- 24 to 600 V AC 50/60 Hz
- 12 to 250 V DC

They have a maximum power consumption of 58 VA which is significantly lower than the power consumption of the flexible shunt trip versions.

Switches (permanent signal) or momentary push-buttons (minimum signal duration 40 ms) may be used to control shunt trips.

### Shunt Trip Flexible (STF)



Shunt trips of type STF can be installed in the left and right (3VA6 only) accessory compartment. They are therefore suitable for combining different auxiliary releases in one switch.

The following rated voltage is available:

- 24 to 600 V AC 50/60 Hz

Due to their design, their power consumption ranges up to maximum 750 VA and is therefore higher than the power consumption of STL versions.

### Undervoltage Release (UVR)



Undervoltage releases trip the molded case circuit breaker in the event that the rated voltage fails or drops to between 70% and 35% of its normal value (in compliance with the relevant standard).

The main contacts of the breaker cannot be closed until the voltage applied to the UVR reaches 85% of its rated value.

The units are available with rated voltages in the following range:

- 24 to 480 V AC 50/60 Hz
- 12 to 250 V DC

### Universal Release (UNI)







A universal release is a single, 21 mm wide component in which a shunt trip and an undervoltage release are combined. These are subject to the same tripping conditions as the individual devices. A single component with minimal footprint can therefore perform both functions.

The three available rated voltages are identical in each case for both the shunt trip and the undervoltage release. These rated voltages are:

- 12 V DC
- 24 V DC
- 48 V DC

Technical specifications of shunt trips and releases

Technical specifications Auxiliary releases				STL	STF	UVR	UNI	
Width				mm				21
Graphic symbol								
Wire range	 Solid/stranded/finely stranded with ferrule	Screw connection (per contact)	Number x mm <sup>2</sup>	1 x (0.5 mm <sup>2</sup> - 1.5 mm <sup>2</sup> )				
		Screw connection (per contact)	Number x AWG	1 x (AWG20 - AWG16)				
	 Flexible with insulated ferrule	Screw connection (per contact)	Number x mm <sup>2</sup>	1 x (0.5 mm <sup>2</sup> - 1.0 mm <sup>2</sup> )				
		Screw connection (per contact)	Number x AWG	1 x (AWG20 - AWG16)				
	Tightening torque (connecting cables)		lb-in		3.54 <sup>+0.88</sup>			
Stripped length		Nm		0.4 <sup>+0.1</sup>				
Rated insulation voltage				690				
				Overvoltage category III				
				Pollution degree 3				
Power consumption U <sub>e</sub>	12 - 30	V DC	W	7.0 - 50	-	-	< 2.5	
	48 - 60	V DC	W	20.0 - 30	-	-	< 2.5	
	110 - 127	V DC	W	30.0 - 40	-	-	< 2.5	
	220 - 250	V DC	W	28.0 - 35.0	-	-	< 2.5	
	24	V AC 50/60 Hz	VA	20	-	-	< 2.0	
	48 - 60	V AC 50/60 Hz	VA	20.0 - 30	-	-	< 2.0	
	110 - 127	V AC 50/60 Hz	VA	30.0 - 40	-	-	< 2.0	
	208 - 277	V AC 50/60 Hz	VA	16.0 - 35	-	-	See table below	
	380 - 600	V AC 50/60 Hz	VA	10.0 - 30	-	-	See table below	
	24	V AC 50/60 Hz	VA	-	300	-		
	48 - 60	V AC 50/60 Hz	VA	-	340 - 600	-		
	110 127	V AC 50/60 Hz	VA	-	500 - 650	-		
	208 - 277	V AC 50/60 Hz	VA	-	360 - 650	-		
	380 - 500	V AC 50/60 Hz	VA	-	330 - 600	-		
600	V AC 50/60 Hz	VA	-	300	-			

Technical specifications				STL	STF	UVR	UNI
Auxiliary releases							
Power consumption $U_e$	12	V DC	W			< 2.5	
	24	V DC	W			< 2.5	
	48	V DC	W			< 2.5	
	60	V DC	W			< 2.5	
	125 - 127	V DC	W			< 2.5	
	220 - 230	V DC	W			< 2.5	
	250	V DC	W			< 2.5	
	24	V AC 50/60 Hz	VA			< 2.0	
	48	V AC 50/60 Hz	VA			< 2.0	
	60	V AC 50/60 Hz	VA			< 2.0	
	110	V AC 50/60 Hz	VA			< 2.0	
	120 - 127	V AC 50/60 Hz	VA			< 2.0	
	208 - 230	V AC 50/60 Hz	VA			< 2.0	
	380 - 400	V AC 50/60 Hz	VA			< 2.5	
	440 - 480	V AC 50/60 Hz	VA			< 2.5	
		12	V DC (Cat II; PELV/SELV)	W			
	24	V DC (Cat II; PELV/SELV)	W				UVR: < 2.5 SHT: 20
	48	V DC (Cat II; PELV/SELV)	W				UVR: < 2.5 SHT: 20
Rated impulse withstand voltage	$U_{imp}$	kV		6		4	0.5
Making current	$I_{max}$	with V		1.5 A / 24 V AC	18 A / 24 V AC	5 mA / 480 V	1.5 A / 24 V AC
Maximum tripping time		ms				< 10	
Service life	Electrical trips					8500	
	Mechanical switching cycles of the switch					25000	
Takes precedence over other control signals						Yes	
Degree of protection	Lid of accessories compartment closed					IP 40	
	Lid of accessories compartment open					IP 20	
Minimum signal duration		ms		40	40		40
Operating voltage of shunt trip: pick-up (breaker trips)		Us/V %		70 ... 110			70 ... 110
Operating voltage of undervoltage release:	Pick-up (circuit breaker can be closed)	Us/V %				85 ... 110	
	Drop (breaker trips)	Us/V %				35 ... 70	
Tripping frequency		Trips per hour		Unlimited	120		Unlimited
Can be used for electrical interlocking of MCCBs				No	No		Yes

### 4.2.6 Time-delay devices for undervoltage releases

Undervoltage releases can also be equipped with external, electronic time-delay control devices which prevent unintentional tripping in response to brief voltage dips during periods of disrupted operation.

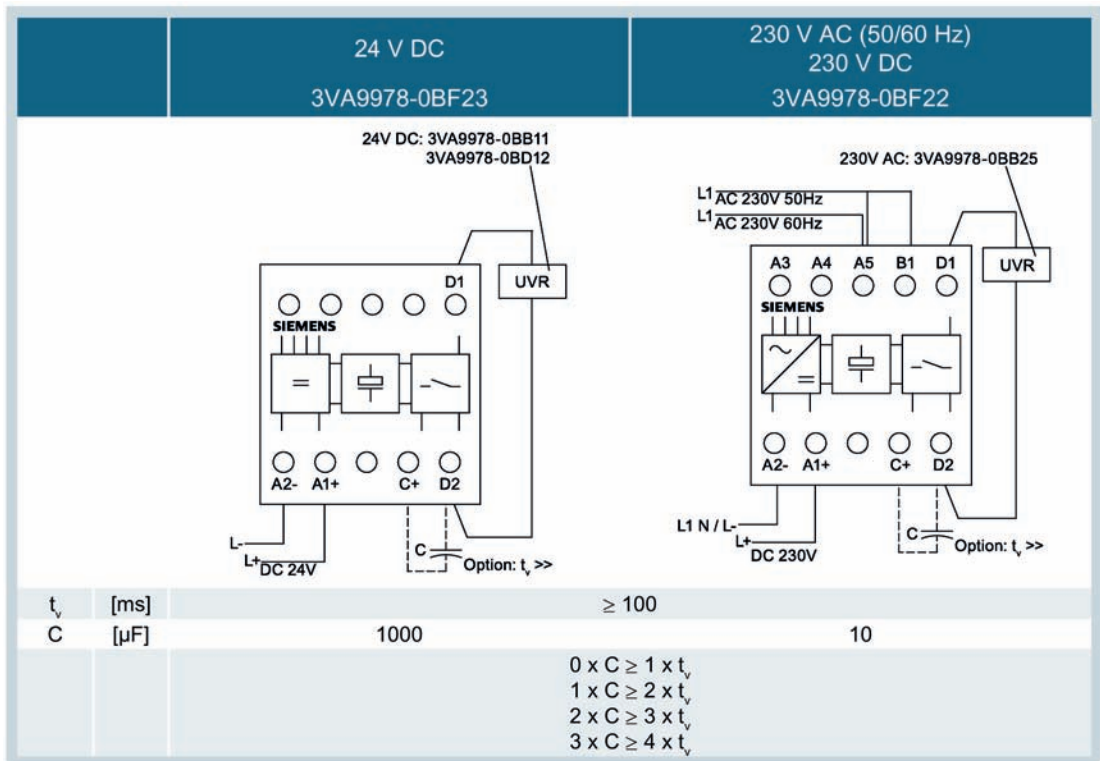
#### Time-delay device for UVR with fixed delay setting



The simple time-delay device with fixed delay setting is available for the following voltages:

- 230 V AC and 230 V DC
- 24 V DC

The default delay time is >100 ms, as supplied, but can be extended by the customer with the addition of customer-supplied supplementary capacitors:



As an alternative to screw mounting, the device can also be mounted on a 35 mm DIN rail.

You can find a circuit diagram for the time-delay device in chapter Circuit diagrams (Page 385) or in the operating instructions.

### 4.2.7 COM060 communication module

You can find information about the COM060 communication module in chapter Communication and system integration (Page 327).



## 4.2.8 24 V module



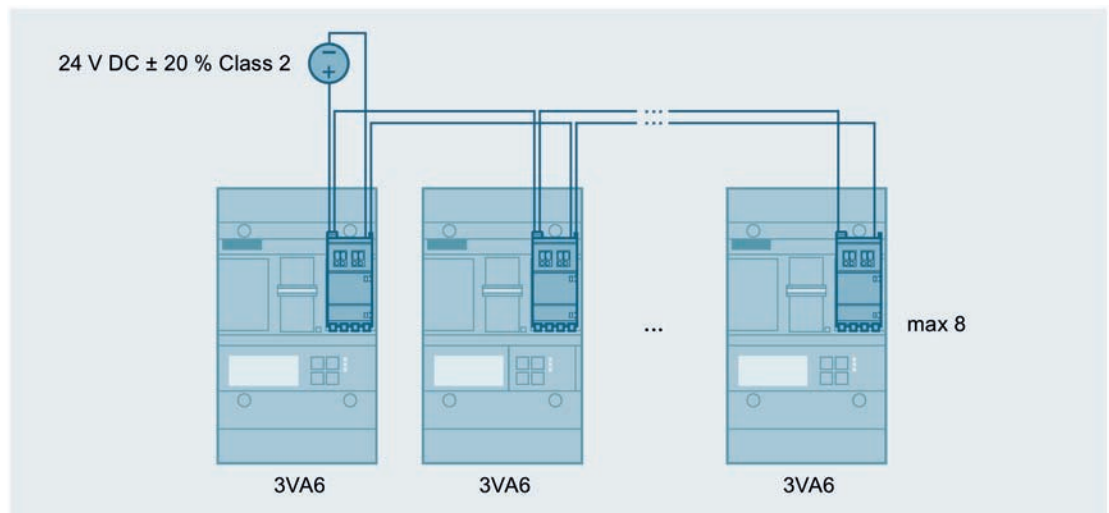
With the aid of the 24 volt module, the ETU electronic trip unit of the 3VA6 molded case circuit breakers can be permanently activated.

The module is installed in the right-hand accessory compartment and has 4 slots.

The following advantages arise from the use of the 24 V module:

- Activated display even when the circuit breaker is switched off or no current is flowing through the main circuit.
- Backlighting permanently activated
- Through activation of the ETUs, it is possible to test and change setting parameters (ETUs 5-series and 8-series)
- Faster tripping of the 3VA6 molded case circuit breaker on connecting to a short-circuit by an already active ETU.

There are two connection points available for ground and 24 V DC so that looping through of the voltage can be done very easily.



### Mechanical design

Width	inch	1.13
	mm	28.8
Height	inch	2.53
	mm	64.1
Depth	inch	1.32
	mm	33.5
Number of slots		4
Net weight	g	80

### General technical specifications

Pollution degree		3
Overvoltage category		1

## 4.3 Connection system

### 4.3.1 Introduction

The chapter "Connection technology" contains useful information and provides an overview of the 3VA UL connection technology. It provides a helpful guide to connecting cables or busbars to a molded case circuit breaker and so helps to ensure the safety of personnel and material assets. Mistakes which affect the operational safety of electrical installations can be avoided.

#### Contents

The chapter discusses the following topics:

- General information about cables and busbars
- 3VA UL molded case circuit breakers with
  - Front cable connection
  - Front busbar connector / compression lug connection
  - Rear busbar connector / compression lug connection
- Further connection accessories

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#### Note

##### UL connectors

3VA UL connectors are not UL Listed for use with fine-stranded or sector-shaped conductors.

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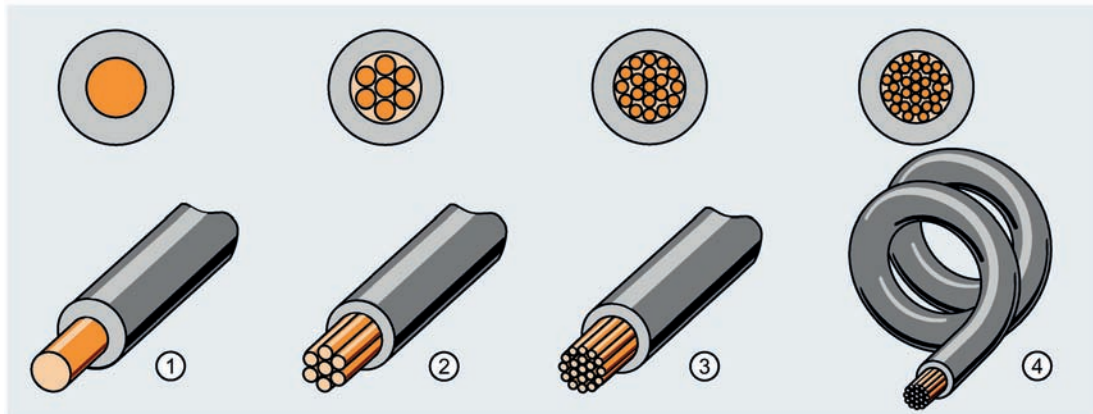
### 4.3.2 General information about cables and busbars

#### Cables and busbars: Cables

##### Cable designation and cable classes

A key design feature of a cable is its flexibility. This is primarily determined by the number of cores inside the cable.

**Cable classes according to UL 486 and IEC 60228:**



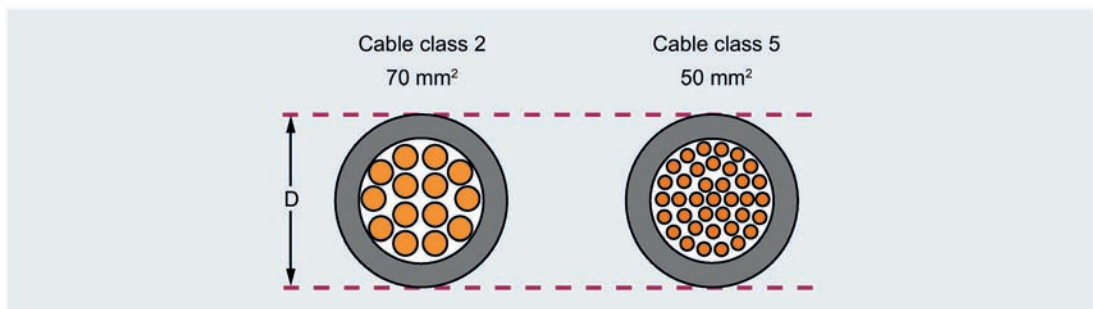
	<b>UL 486</b>	<b>IEC 60228</b>
① Cable with solid wire in core	Solid	Class 1
② Cable with stranded wires in core	Class B	Class 2
③ Cable with stranded wires in core	Class C	Class 5
④ Cable with a large number of extra finely stranded conductors		Class 6

The conductors of class 1 / solid and class 2 / B refer to rigid conductors, solid and stranded. These are used predominantly in applications with low-curvature cable bending radii and in fixed or inflexible installations.

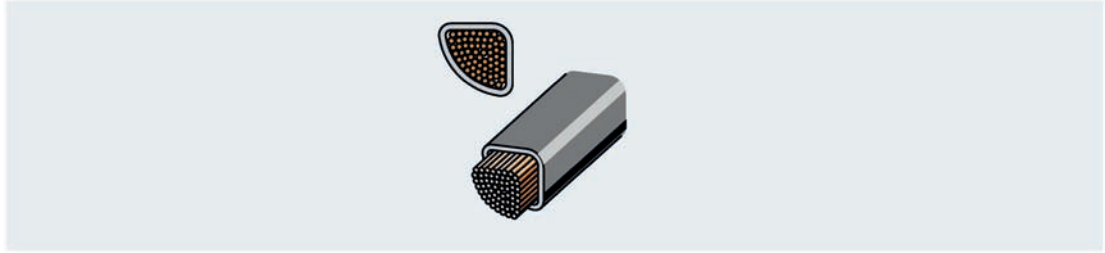
Flexible conductors of class 5 / C and class 6 permit higher-curvature cable bending radii.

Solid cables of class 1 / solid are normally used only up to a cross section of 16 mm<sup>2</sup> (IEC) / AWG 10 (UL).

Please note: Solid-conductor cables in classes 1 / solid and 2 / B are smaller in diameter than cables in classes 5 / C and 6 even when their cross sectional area is the same. As a result, cables with the same diameter from different classes may have different connection cross sections.



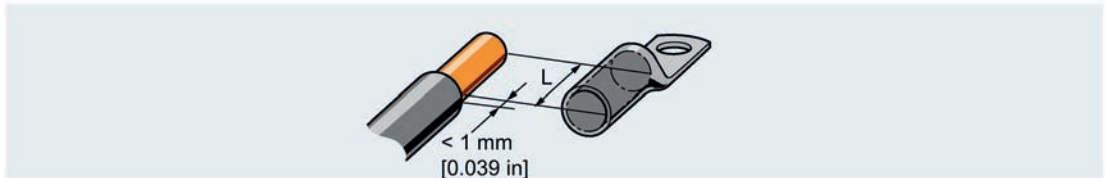
Solid and stranded sector-shaped conductors are also used.



### Compression lugs

For stable and reliable connecting of cables to molded case circuit breakers, compression lugs are also used. These elements help to make solid connections at the breaker.

Insulation is first stripped from the end of the cable (by amount of length L) before the compression lug is attached to the cable.



The cable must be stripped carefully to ensure that the correct amount of insulating material is removed. In this way, a reliable connection of the cable to the compression lug is ensured. A total of 1 mm more insulation can be stripped than is specified by length L.

Compression lugs compliant with DIN 46235 have ideal heat transfer characteristics for connecting busbar connectors. By contrast, "Tubular compression lugs with narrow palm for switching devices" (designation "SG" for example) must be used to make direct cable connections in the termination area of the molded case circuit breaker. These compression lugs vary in design depending on make. All compression lugs of this kind with the dimensions stipulated in standard IEC 609437-1, Annex P are basically suitable.

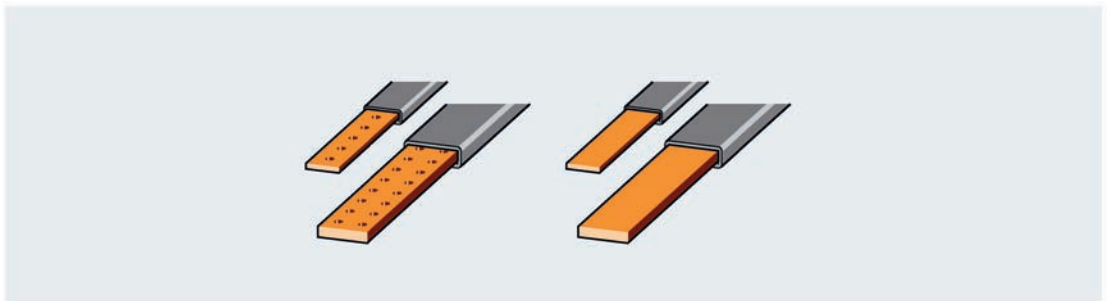
## Cables and busbars: Busbars

In addition to cables, the busbar is also widely used in electrical connections, especially in panels.

Some of the reasons for using busbars include:

- High-curvature bending radii which are unsuitable for cables of large cross section
- Lack of space
- Heat dissipation, air circulation
- ...

Rigid busbars are used in the examples of applications listed above.



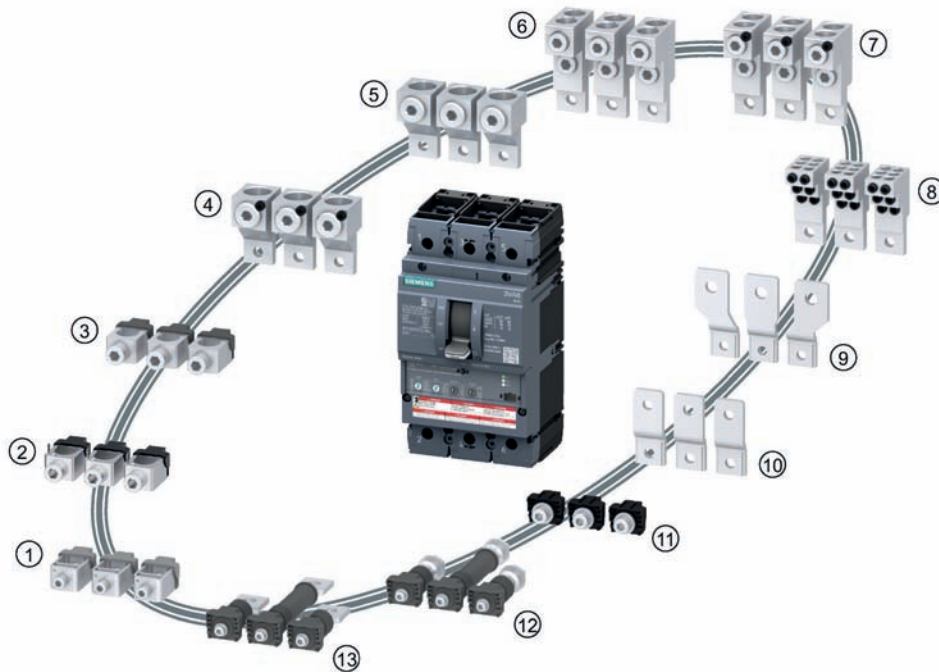
Rigid busbars are made of copper or aluminum. Pre-punched aluminum busbars, some of which are threaded, are often used.

### 4.3.3 Connection portfolio for 3VA UL molded case circuit breakers

#### 4.3.3.1 General overview

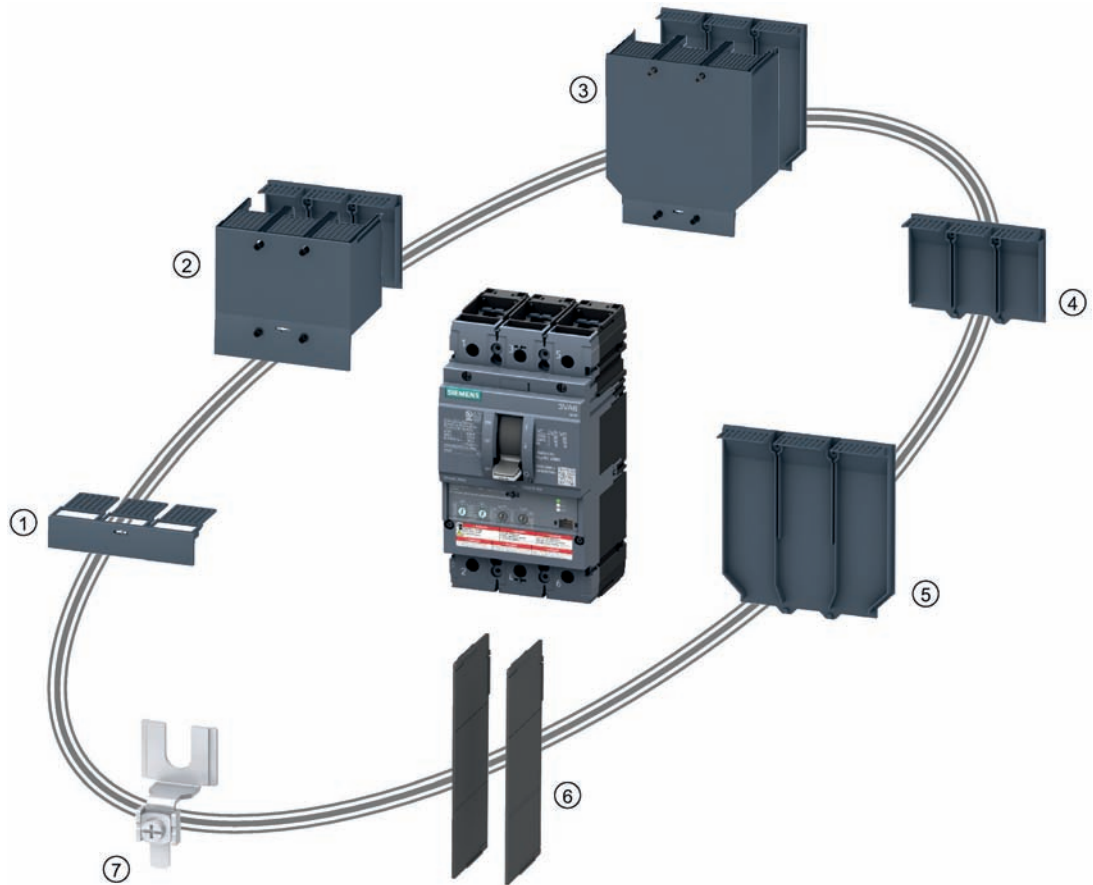
The connection technology of the 3VA UL molded case circuit breakers provides a straightforward and convenient way to commission the molded case circuit breakers in compliance with all installation requirements.

To meet this objective, an extensive portfolio of connection components is available.



- ① Box terminal
  - ② Wire connector with control wire tap
  - ③ Wire connector
  - ④ Wire connector, large, with control wire tap
  - ⑤ Wire connector, large
  - ⑥ Wire connector, 2 cables
  - ⑦ Wire connector, 2 cables, with control wire tap
  - ⑧ Distribution wire connector, 6 cables
  - ⑨ Front bus connectors offset <sup>1)</sup>
  - ⑩ Front bus connectors extended
  - ⑪ Nut keeper kit
  - ⑫ Rear connection stud round
  - ⑬ Rear connection stud flat
- <sup>1)</sup> Only available for 3VA63 and 3VA64

The connection technology accessories (see chapter Further connection accessories (Page 203)) also provide the option of insulating the termination area of the 3VA UL molded case circuit breaker and protecting it from accidental contact. A control wire tap can be implemented quickly using accessory components which are available separately.



- |                                       |  |
|---------------------------------------|--|
| ① Terminal cover                      | ⑤ Rear insulating plate offset <sup>1)</sup>     |
| ② Terminal cover extended             | ⑥ Phase barriers                                 |
| ③ Terminal cover offset <sup>1)</sup> | ⑦ Control wire tap for busbars                   |
| ④ Rear insulating plate               | <sup>1)</sup> Only available for 3VA63 and 3VA64 |

The table below lists all the main conductor connection systems available for 3VA UL molded case circuit breakers and also indicates which type of cables or busbars are compatible with each connection system. A basic distinction is made between front and rear connections.

The illustration in the table shows the 3-piece pack for the 3-pole molded case circuit breaker. All connection systems are also available in 4-piece packs for 4-pole molded case circuit breakers.

4.3 Connection system

Connection technology		Cables and busbars		
Front connections	Illustration			
Box terminal for copper cable		■		
Circular conductor terminal <sup>1)</sup>		■		
Circular conductor terminal with auxiliary conductor terminal <sup>1)</sup>		■		
Circular conductor terminal, large		■		
Circular conductor terminal, large, with auxiliary conductor terminal		■		
Circular conductor terminal, 2 cables <sup>1)</sup>		■		
Circular conductor terminal, 2 cables, with auxiliary conductor terminal <sup>1)</sup>		■		
Circular conductor terminal, large, 6 cables		■		
Lug terminal			■	■
Front connection bars extended			■	■
Front connection bars broadened <sup>2)</sup>			■	■
<b>Rear connections</b>				
Rear terminal flat			■	■
Rear connecting studs			■	■

<sup>1)</sup> Copper terminal available

<sup>2)</sup> Only available for 3VA63 and 3VA64



**Note**

Wire connectors are generally made of aluminum. For special wire connectors, there are copper versions.

Exact cross-section and torque information for these can be found in chapter Front cable connection (Page 176).

For designs and applications for 100% rated line protection, copper wire connectors without control wire tap must be used.

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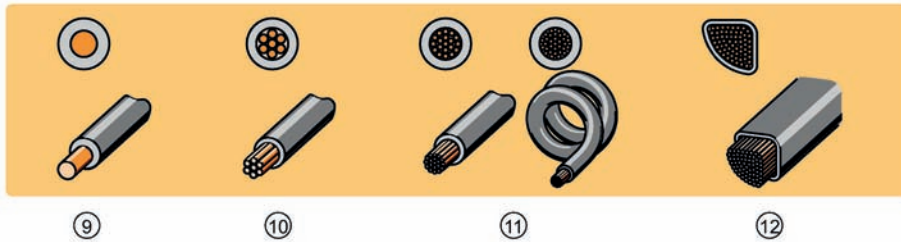
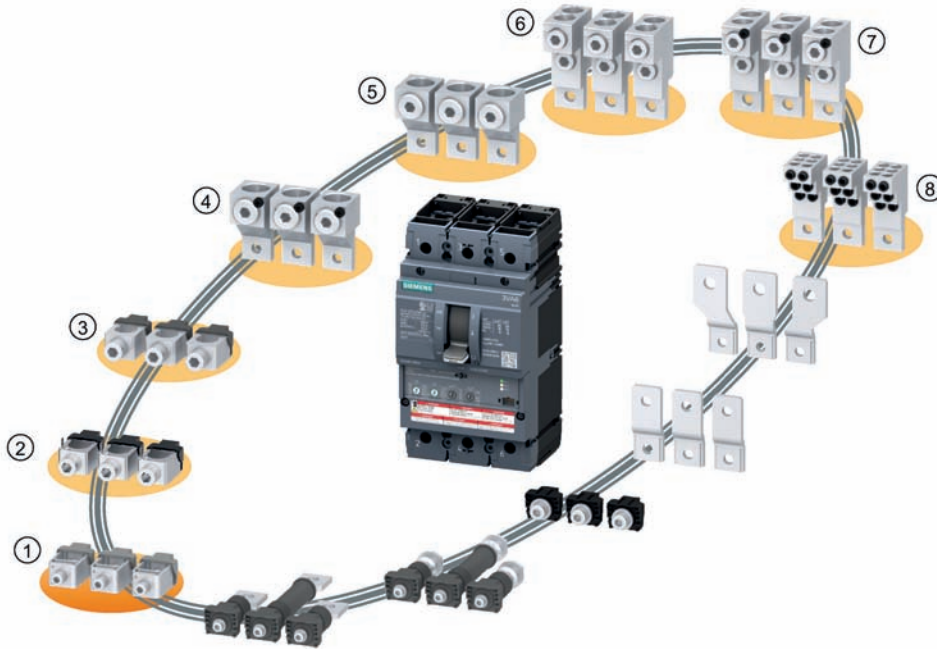
The entire portfolio of connection technology for the 3VA UL molded case circuit breakers can be used without modifications in the following applications:

- On all fixed-mounted versions of molded case circuit breaker
- On all molded case circuit breakers equipped with plug-in technology
- On all molded case circuit breakers equipped with draw-out technology

The connection components described above are identical for fixed-mounted breakers, for plug-in and for draw-out versions.

4.3.3.2 Front cable connection

The diagram below illustrates all the components available for implementing a direct cable connection at the molded case circuit breaker. The only exception is the box terminal as this can be used to connect busbars as well as cables.



Connection technology

- ① Box terminal
- ② Wire connector with control wire tap
- ③ Wire connector
- ④ Wire connector, large, with control wire tap
- ⑤ Wire connector, large
- ⑥ Wire connector, 2 cables
- ⑦ Wire connector, 2 cables, with control wire tap
- ⑧ Distribution wire connector, 6 cables

Cables and busbars

- ⑨ Solid conductor, class 1
- ⑩ Stranded conductor, class 2
- ⑪ Flexible conductors, classes 5 and 6
- ⑫ Sector-shaped conductor

## Box terminal



The tables below show all the types and sizes of cable and flexible busbar that can be connected to a box terminal.

3VA5 molded case circuit breakers:

Designation		Box terminal			
		3VA913.-0JA11	3VA923.-0JA11	3VA923.-0JA12	
Connection technology	Article No.	3VA913.-0JA11	3VA923.-0JA11	3VA923.-0JA12	
	Can be installed in 3VA5	3VA51	3VA52	3VA52	
	Terminal marking	TS1.1	TS1.2	TS1.4	
Cables and busbars	Cross-section specifications in AWG				
	Copper cable (number of cables x wire range)	Stranded (Class C)	1 x 14 AWG ... 3/0 AWG	1 x 10 AWG ... 3/0 AWG	1 x 4 AWG ... 350 kcmil
		Stranded (Class B)	1 x 14 AWG ... 3/0 AWG	1 x 10 AWG ... 3/0 AWG	1 x 4 AWG ... 350 kcmil
		Solid (Class A)	1 x 14 AWG ... 10 AWG	1 x 10 AWG	-
	Aluminum cable	-	-	-	
	Stripped length of cable L	0.50 in	0.75 in	0.80 in	
	Tightening torque	Stranded (Class C)	≤ 6 AWG: 45 lb-in ≥ 4 AWG: 70 lb-in	≤ 4 AWG: 105 lb-in ≥ 3 AWG: 140 lb-in	≤ 1 AWG: 70 lb-in ≥ 1/0: 140 lb-in
		Stranded (Class B)			
		Solid (Class A)			
	Cross-section specifications in mm <sup>2</sup>				
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	1 x 1.5 ... 50 mm <sup>2</sup>	1 x 10 ... 95 mm <sup>2</sup>	1 x 35 ... 150 mm <sup>2</sup>
		Finely stranded (Class 5/6) with ferrule	1 x 1.5 ... 50 mm <sup>2</sup>	1 x 10 ... 95 mm <sup>2</sup>	1 x 35 ... 150 mm <sup>2</sup>
		Stranded (Class 2)	1 x 1.5 ... 70 mm <sup>2</sup>	1 x 6 ... 120 mm <sup>2</sup>	1 x 25 ... 185 mm <sup>2</sup>
		Solid (Class 1)	1 x 1.5 ... 16 mm <sup>2</sup>	1 x 6 ... 16 mm <sup>2</sup>	-
	Aluminum cable	-	-	-	
	Stripped length of cable L	12 mm	19 mm	20 mm	
	Tightening torque	Finely stranded (Class 5/6)	≤ 16 mm <sup>2</sup> : 5 Nm ≥ 25 mm <sup>2</sup> : 8 Nm	≤ 25 mm <sup>2</sup> : 6 Nm ≥ 35 mm <sup>2</sup> : 10 Nm	≤ 35 mm <sup>2</sup> : 6 Nm ≥ 50 mm <sup>2</sup> : 12 Nm
Stranded (Class 2)					
Solid (Class 1)					

4.3 Connection system

3VA6 molded case circuit breakers:

Designation		Box terminal			
		3VA914.-0JA12	3VA924.-0JA12	3VA947.-0JA13	
Connection technology	Article No.	3VA61 3VA62	3VA61 3VA62	3VA63 3VA64	
	Can be installed in 3VA6				
	Terminal marking	TS1.2	TS1.4	TS1.5 <sup>1)</sup>	
Cables and busbars	Cross-section specifications in AWG				
	Copper cable (number of cables x wire range)	Stranded (Class C)	1 x 10 AWG ... 3/0 AWG	1 x 4 AWG ... 350 kcmil	1 x 1/0 AWG ... 500 kcmil
		Stranded (Class B)	1 x 10 AWG ... 3/0 AWG	1 x 4 AWG ... 350 kcmil	1 x 1/0 AWG ... 500 kcmil
		Solid (Class A)	1 x 10 AWG	-	-
	Aluminum cable	-	-	-	
	Stripped length of cable L	0.75 in	0.80 in	1.05 in	
	Tightening torque	Stranded (Class C)	≤ 4 AWG: 105 lb-in ≥ 3 AWG: 140 lb-in	≤ 1 AWG: 70 lb-in ≥ 1/0: 140 lb-in	≤ 4/0 AWG: 140 lb-in ≥ 250 kcmil: 248 lb-in
		Stranded (Class B)			
		Solid (Class A)			
	Cross-section specifications in mm <sup>2</sup>				
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	1 x 10 ... 95 mm <sup>2</sup>	1 x 35 ... 150 mm <sup>2</sup>	1 x 35 ... 240 mm <sup>2</sup>
		Finely stranded (Class 5/6) with ferrule	1 x 10 ... 95 mm <sup>2</sup>	1 x 35 ... 150 mm <sup>2</sup>	1 x 35 ... 240 mm <sup>2</sup>
		Stranded (Class 2)	1 x 6 ... 120 mm <sup>2</sup>	1 x 25 ... 185 mm <sup>2</sup>	1 x 35 ... 300 mm <sup>2</sup>
		Solid (Class 1)	1 x 6 ... 16 mm <sup>2</sup>	-	-
	Aluminum cable	-	-	-	
Stripped length of cable L	19 mm	20 mm	26.5 mm		
Tightening torque	Finely stranded (Class 5/6)	≤ 25 mm <sup>2</sup> : 6 Nm ≥ 35 mm <sup>2</sup> : 10 Nm	≤ 35 mm <sup>2</sup> : 6 Nm ≥ 50 mm <sup>2</sup> : 12 Nm	≤ 95 mm <sup>2</sup> : 16 Nm ≥ 120 mm <sup>2</sup> : 28 Nm	
	Stranded (Class 2)				
	Solid (Class 1)				



1) Maximum current carrying capacity 380 A

Box terminals can be ordered

- as a pack of 3
- as a pack of 4

### Wire connector with and without control wire tap



The wire connector is available under separate article numbers depending on whether it is ordered with or without a control wire tap. With the exception of the hole for the control wire tap, both wire connectors are technically identical, i.e. the same cable cross sections can be connected to both variants. Both variants are available in aluminum and copper versions.

---

#### Note

A maximum current limit of 15 A applies to all control wire taps for 3VA UL molded case circuit breakers. Control wire overcurrent protection must be applied separately.

Suitable cable cross-sections: Cables up to maximum AWG 12 / 2.5 mm<sup>2</sup> can be connected.

---

The wire connector is an internal component, i.e. it is contained within the external contour of the molded case circuit breaker. As a result, the size of cable cross section which can be connected is limited by the geometry of the breaker's termination area.

The tables below show all the types and sizes of cable which can be connected to a wire connector.

4.3 Connection system

**3VA5 molded case circuit breakers:**

Aluminum version:

Designation		Aluminum wire connector, without/with control wire tap	
		Article No.	Without control wire tap
	With control wire tap	3VA913.-0JG11	3VA923.-0JG12
Can be installed in 3VA5		3VA51	3VA52
Terminal marking		TA1.1	TA1.4
<b>Connection technology</b>			
Cross-section specifications in AWG			
Copper cable (number of cables x wire range)	Stranded (Class C)	1 x 8 AWG ... 3/0 AWG	1 x 6 AWG ... 350 kcmil
	Stranded (Class B)	1 x 8 AWG ... 3/0 AWG	1 x 6 AWG ... 350 kcmil
	Solid (Class A)	-	-
Aluminum cable (number of cables x wire range)	Stranded (Class B)	1 x 8 AWG ... 3/0 AWG	1 x 6 AWG ... 350 kcmil
	Solid (Class A)	-	-
Stripped length of cable L		0.50 in	0.80 in
Tightening torque	Stranded (Class C)		
	Stranded (Class B)	8 AWG: 55 lb-in > 8 AWG: 100 lb-in	≤ 2 AWG: 140 lb-in > 2 AWG: 275 lb-in
	Solid (Class A)		
<b>Cables and busbars</b>			
Cable connection	Cross-section specifications in mm <sup>2</sup>		
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	1 x 10 ... 35 mm <sup>2</sup>
Finely stranded (Class 5/6) with ferrule		1 x 10 ... 35 mm <sup>2</sup>	1 x 16 ... 120 mm <sup>2</sup>
Stranded (Class 2)		1 x 10 ... 95 mm <sup>2</sup>	1 x 16 ... 185 mm <sup>2</sup>
Solid (Class 1)		1 x 10 ... 16 mm <sup>2</sup>	1 x 16 mm <sup>2</sup>
Aluminum cable (number of cables x wire range)	Stranded (Class 2)	1 x 10 ... 95 mm <sup>2</sup>	1 x 16 ... 185 mm <sup>2</sup>
	Solid (Class 1)	1 x 10 ... 16 mm <sup>2</sup>	1 x 16 mm <sup>2</sup>
Stripped length of cable L		12.7 mm	20 mm
Tightening torque	Finely stranded (Class 5/6)		
	Stranded (Class 2)	10 mm <sup>2</sup> : 6.2 Nm > 10 mm <sup>2</sup> : 11.3 Nm	≤ 35 mm <sup>2</sup> : 15.8 Nm ≥ 50 mm <sup>2</sup> : 31.1 Nm
	Solid (Class 1)		

Copper version:

Designation		Copper wire connector, without/with control wire tap		
Connection technology	Article No.	Without control wire tap	3VA913.-0JD11	3VA923.-0JD12
		With control wire tap	3VA913.-0JK11	3VA923.-0JK12
	Can be installed in 3VA5		3VA51	3VA52
	Terminal marking		TC1.1	TC1.4
Cables and busbars	Cross-section specifications in AWG			
	Copper cable (number of cables x wire range)	Stranded (Class C)	1 x 14 AWG ... 2/0 AWG	1 x 6 AWG ... 350 kcmil
		Stranded (Class B)	1 x 14 AWG ... 2/0 AWG	1 x 6 AWG ... 350 kcmil
		Solid (Class A)	1 x 14 AWG ... 10 AWG	-
	Stripped length of cable L		0.50 in	0.80 in
	Tightening torque	Stranded (Class C)	≤ 14 AWG: 25 lb-in ≤ 12 AWG: 35 lb-in ≤ 10 AWG - 2/0: 55 lb-in	≤ 2 AWG: 140 lb-in > 2 AWG: 275 lb-in
		Stranded (Class B)		
		Solid (Class A)		
	Cross-section specifications in mm <sup>2</sup>			
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	-	-
		Finely stranded (Class 5/6) with ferrule	-	-
		Stranded (Class 2)	-	-
		Solid (Class 1)	-	-
Stripped length of cable L		-	-	
Tightening torque	Finely stranded (Class 5/6)	-	-	
	Stranded (Class 2)			
	Solid (Class 1)			



4.3 Connection system

**3VA6 molded case circuit breakers:**


Aluminum version:

Designation		Aluminum wire connector, without/with control wire tap			
Connection technology	Article No.	Without control wire tap	3VA914.-0JB11	3VA924.-0JB12	3VA937.-0JB13
		With control wire tap	3VA914.-0JG11	3VA924.-0JG12	3VA937.-0JG13
	Can be installed in 3VA6		3VA61 3VA62	3VA61 3VA62	3VA63 3VA64
	Terminal marking		TA1.3	TA1.4	TA1.5 <sup>1)</sup>
Cables and busbars	Cross-section specifications in AWG				
	Copper cable (number of cables x wire range)	Stranded (Class C)	1 x 14 AWG ... 1/0 AWG	1 x 6 AWG ... 350 kcmil	1 x 1 AWG ... 600 kcmil
		Stranded (Class B)	1 x 14 AWG ... 1/0 AWG	1 x 6 AWG ... 350 kcmil	1 x 1 AWG ... 600 kcmil
		Solid (Class A)	1 x 14 AWG ... 10 AWG	-	-
	Aluminum cable (number of cables x wire range)	Stranded (Class B)	1 x 12 AWG ... 1/0 AWG	1 x 6 AWG ... 350 kcmil	1 x 1 AWG ... 600 kcmil
		Solid (Class A)	1 x 12 AWG ... 10 AWG	-	-
	Stripped length of cable L		0.70 in	0.80 in	1.10 in
	Tightening torque	Stranded (Class C)			
		Stranded (Class B)	≤ 8 AWG: 55 lb-in ≤ 2 AWG: 75 lb-in > 2 AWG: 120 lb-in	≤ 2 AWG: 140 lb-in > 2 AWG: 275 lb-in	375 lb-in
		Solid (Class A)			
	Cross-section specifications in mm <sup>2</sup>				
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	1 x 1.5 ... 35 mm <sup>2</sup>	1 x 25 ... 150 mm <sup>2</sup>	1 x 50 ... 240 mm <sup>2</sup>
		Finely stranded (Class 5/6) with ferrule	1 x 1.5 ... 35 mm <sup>2</sup>	1 x 16 ... 120 mm <sup>2</sup>	1 x 50 ... 240 mm <sup>2</sup>
		Stranded (Class 2)	1 x 1.5 ... 50 mm <sup>2</sup>	1 x 16 ... 185 mm <sup>2</sup>	1 x 50 ... 300 mm <sup>2</sup>
		Solid (Class 1)	1 x 1.5 ... 16 mm <sup>2</sup>	1 x 16 mm <sup>2</sup>	-
	Aluminum cable (number of cables x wire range)	Stranded (Class 2)	1 x 4 ... 50 mm <sup>2</sup>	1 x 16 ... 185 mm <sup>2</sup>	1 x 50 ... 300 mm <sup>2</sup>
Solid (Class 1)		1 x 4 ... 16 mm <sup>2</sup>	1 x 16 mm <sup>2</sup>	-	
Stripped length of cable L		18 mm	20 mm	28 mm	
Tightening torque	Finely stranded (Class 5/6)				
	Stranded (Class 2)	≤ 10 mm <sup>2</sup> : 6.2 Nm ≤ 35 mm <sup>2</sup> : 8.5 Nm > 35 mm <sup>2</sup> : 13.6 Nm	≤ 35 mm <sup>2</sup> : 15.8 Nm ≥ 50 mm <sup>2</sup> : 31.1 Nm	42.4 Nm	
	Solid (Class 1)				

<sup>1)</sup> Maximum current carrying capacity 400 A



Copper version:

Designation		Copper wire connector, without/with control wire tap				
Connection technology	Article No.	Without control wire tap	3VA914.-0JD11	3VA924.-0JD12	3VA937.-0JD13	
		With control wire tap	3VA914.-0JK11	3VA924.-0JK12	3VA937.-0JK13	
	Can be installed in 3VA6		3VA61 3VA62	3VA61 3VA62	3VA63 3VA64	
	Terminal marking		TC1.3	TC1.4	TC1.5	
Cables and busbars 	Cross-section specifications in AWG					
	Copper cable (number of cables x wire range)	Stranded (Class C)	1 x 14 AWG ... 1/0 AWG	1 x 6 AWG ... 350 kcmil	1 x 1 AWG ... 600 kcmil	
		Stranded (Class B)	1 x 14 AWG ... 1/0 AWG	1 x 6 AWG ... 350 kcmil	1 x 1 AWG ... 600 kcmil	
		Solid (Class A)	1 x 14 AWG ... 10 AWG	-	-	
	Stripped length of cable L		0.70 in	0.80 in	1.10 in	
	Tightening torque	Stranded (Class C)				
		Stranded (Class B)	≤ 8 AWG: 55 lb-in ≤ 2 AWG: 75 lb-in > 2 AWG: 120 lb-in	≤ 2 AWG: 140 lb-in > 2 AWG: 275 lb-in		500 lb-in
		Solid (Class A)				
	Cross-section specifications in mm <sup>2</sup>					
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	-	-	-	
		Finely stranded (Class 5/6) with ferrule	-	-	-	
		Stranded (Class 2)	-	-	-	
		Solid (Class 1)	-	-	-	
Stripped length of cable L		-	-	-		
Tightening torque	Finely stranded (Class 5/6)					
	Stranded (Class 2)	-	-	-		
	Solid (Class 1)					

Wire connector with and without control wire tap can be ordered:

- as a pack of 3
- as a pack of 4

### Wire connector, large, with and without control wire tap



The wire connector, large, is available under separate article numbers depending on whether it is ordered with or without a control wire tap. With the exception of the hole for the control wire tap, both wire connectors are technically identical, i.e. the same cable cross sections can be connected to both variants.

---

#### Note

A maximum current limit of 15 A applies to all control wire taps for 3VA UL molded case circuit breakers. Control wire overcurrent protection must be applied separately.

Suitable cable cross-sections: Cables up to maximum AWG 12 / 2.5 mm<sup>2</sup> can be connected.

---

The wire connector, large is an external terminal, i.e. it projects beyond the external contour of the breaker's termination area. This means that cables with a larger cross section can be connected.

The extended terminal cover plus the required assembly materials are supplied as standard with all wire connectors, large. This is used for insulation and provides degree of protection IP4x at the front of the molded case circuit breaker and degree of protection IP2x at the infeed side and load side (see chapter Insulating equipment (Page 203)).

The table below shows all the types and sizes of cable which can be connected to a wire connector, large.

Designation		Aluminum wire connector, large, without/with control wire tap			
Connection technology	Article No.	Without control wire tap	3VA913.-0JJ12	3VA923.-0JJ13	3VA924.-0JJ13
		With control wire tap	3VA913.-0JC12	3VA923.-0JC13	3VA924.-0JC13
	Can be installed in	3VA5	3VA51	3VA52	-
		3VA6	-	-	3VA61 3VA62
	Terminal marking	TA2.1	TA2.2	TA2.2	
Cables and busbars	Cross-section specifications in AWG				
	Copper cable (number of cables x wire range)	Stranded (Class C)	1 x 4 AWG ... 300 kcmil	1 x 2 AWG ... 350 kcmil	1 x 2 AWG ... 350 kcmil
		Stranded (Class B)	1 x 4 AWG ... 300 kcmil	1 x 2 AWG ... 350 kcmil	1 x 2 AWG ... 350 kcmil
		Solid (Class A)	-	-	-
	Aluminum cable (number of cables x wire range)	Stranded (Class B)	1 x 4 AWG ... 300 kcmil	1 x 2 AWG ... 350 kcmil	1 x 2 AWG ... 350 kcmil
		Solid (Class A)	-	-	-
		Stripped length of cable L	1.20 in	1.20 in	1.20 in
		Tightening torque	252 lb-in	275 lb-in	275 lb-in
	Cross-section specifications in mm <sup>2</sup>				
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	1 x 25 ... 120 mm <sup>2</sup>	1 x 50 ... 185 mm <sup>2</sup>	1 x 50 ... 185 mm <sup>2</sup>
		Finely stranded (Class 5/6) with ferrule	1 x 25 ... 95 mm <sup>2</sup>	1 x 50 ... 185 mm <sup>2</sup>	1 x 50 ... 185 mm <sup>2</sup>
		Stranded (Class 2)	1 x 25 ... 150 mm <sup>2</sup>	1 x 50 ... 240 mm <sup>2</sup>	1 x 50 ... 240 mm <sup>2</sup>
		Solid (Class 1)	-	-	-
	Aluminum cable (number of cables x wire range)	Stranded (Class 2)	1 x 25 ... 150 mm <sup>2</sup>	1 x 25 ... 240 mm <sup>2</sup>	1 x 25 ... 240 mm <sup>2</sup>
Solid (Class 1)		-	-	-	
	Stripped length of cable L	30.5 mm	30.5 mm	30.5 mm	
	Tightening torque	28.5 Nm	31.1 Nm	31.1 Nm	

Wire connector, large with or without control wire tap can be ordered:

- as a pack of 3
- as a pack of 4

### Wire connector, 2 cables, with and without control wire tap



The wire connector, 2 cables, is available under separate article numbers depending on whether it is ordered with or without a control wire tap. With the exception of the hole for the control wire tap, both wire connectors are technically identical, i.e. the same cable cross sections can be connected to both variants. Both variants are available in aluminum and copper versions.

---

#### Note

A maximum current limit of 15 A applies to all control wire taps for 3VA UL molded case circuit breakers. Control wire overcurrent protection must be applied separately.

Suitable cable cross-sections: Cables up to maximum AWG 12 / 2.5 mm<sup>2</sup> can be connected.


---

The wire connector, 2 cables is an external terminal, i.e. it projects beyond the external contour of the breaker's termination area. The 2-cable capacity of the terminal allows cables with large cross sectional area to be connected.

The extended terminal cover plus the required assembly materials are supplied as standard with all wire connectors, 2 cables. This is used for insulation and provides degree of protection IP4x at the front of the molded case circuit breaker and degree of protection IP2x at the infeed side and load side (see chapter Insulating equipment (Page 203)).


The following tables show all the possible cable connections of the wire connector, 2 cables.

Aluminum version:

Designation		Aluminum wire connector, 2 cables, without/with control wire tap				
Connection technology	Article No.	Without control wire tap	3VA923.-0JJ22	3VA924.-0JJ22	3VA947.-0JJ23	
		With control wire tap	3VA923.-0JC22	3VA924.-0JC22	3VA947.-0JC23	
	Can be installed in	3VA5	3VA52	-	-	
		3VA6	-	3VA61 3VA62	3VA63 3VA64	
	Terminal marking	TA2.3	TA2.3	TA2.4		
Cables and busbars	Cross-section specifications in AWG					
	Copper cable (number of cables x wire range)	Stranded (Class C)	2 x 4 AWG ... 300 kcmil	2 x 4 AWG ... 300 kcmil	2 x 2/0 AWG ... 600 kcmil	
		Stranded (Class B)	2 x 4 AWG ... 300 kcmil	2 x 4 AWG ... 300 kcmil	2 x 2/0 AWG ... 600 kcmil	
		Solid (Class A)	-	-	-	
	Aluminum cable (number of cables x wire range)	Stranded (Class B)	2 x 4 AWG ... 300 kcmil	2 x 4 AWG ... 300 kcmil	2 x 2/0 AWG ... 600 kcmil	
		Solid (Class A)	-	-	-	
		Stripped length of cable L	1.00 in / 2.00 in	1.00 in / 2.00 in	1.20 in / 2.30 in	
		Tightening torque	275 lb-in	275 lb-in	450 lb-in	
	Cable connection 	Cross-section specifications in mm <sup>2</sup>				
		Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	2 x 25 ... 150 mm <sup>2</sup>	2 x 25 ... 150 mm <sup>2</sup>	2 x 70 ... 240 mm <sup>2</sup>
			Finely stranded (Class 5/6) with ferrule	2 x 25 ... 70 mm <sup>2</sup>	2 x 25 ... 70 mm <sup>2</sup>	2 x 70 ... 185 mm <sup>2</sup>
			Stranded (Class 2)	2 x 25 ... 150 mm <sup>2</sup>	2 x 25 ... 150 mm <sup>2</sup>	2 x 70 ... 300 mm <sup>2</sup>
			Solid (Class 1)	-	-	-
		Aluminum cable (number of cables x wire range)	Stranded (Class 2)	2 x 25 ... 150 mm <sup>2</sup>	2 x 25 ... 150 mm <sup>2</sup>	2 x 70 ... 300 mm <sup>2</sup>
			Solid (Class 1)	-	-	-
		Stripped length of cable L	26 mm / 51 mm	26 mm / 51 mm	31 mm / 58.5 mm	
		Tightening torque	31.1 Nm	31.1 Nm	50.8 Nm	

4.3 Connection system

Copper version:

Designation		Copper wire connector, 2 cables, without/with control wire tap		
Connection technology	Article No.	Without control wire tap	3VA947.-0JE23	
		With control wire tap	3VA947.-0JL23	
	Can be installed in	3VA5	-	
		3VA6	3VA63 3VA64	
	Terminal marking	TC2.4		
Cables and busbars	Cross-section specifications in AWG			
	Copper cable (number of cables x wire range)	Stranded (Class C)	2 x 2/0 AWG ... 600 kcmil	
		Stranded (Class B)	2 x 2/0 AWG ... 600 kcmil	
		Solid (Class A)	-	
	Stripped length of cable L	1.20 in / 2.30 in		
	Tightening torque	375 lb-in		
	Cable connection 	Cross-section specifications in mm²		
		Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	-
			Finely stranded (Class 5/6) with ferrule	-
			Stranded (Class 2)	-
			Solid (Class 1)	-
			Stripped length of cable L	-
		Tightening torque	-	

Wire connector, 2 cables with or without control wire tap can be ordered

- as a pack of 3
- as a pack of 4

### Distribution wire connector, 6 cables




The distribution wire connector, 6 cables, is an external terminal that projects beyond the molded case circuit breaker contour of the termination area. It can hold up to 6 cables. One of the six holes in the terminal can be used to implement a control wire tap.

For all distribution wire connectors, 6 cables, the extended terminal cover and the required installation materials are included in the scope of delivery. This is used for insulation and provides degree of protection IP4x at the front of the molded case circuit breaker and degree of protection IP2x at the infeed side and load side (see chapter Insulating equipment (Page 203)).


The following table shows all the possible cable connections of the distribution wire connector, 6 cables.

3VA5 molded case circuit breakers:

Designation		Aluminum distribution wire connector, 6 cables		
Connection technology	Article No.	3VA913.-0JF60	3VA923.-0JF60	
	Can be installed in 3VA5	3VA51	3VA52	
	Terminal marking	TA2.5	TA2.6	
	Cross-section specifications in AWG			
Cables and busbars 	Copper cable (number of cables x wire range)	Stranded (Class C)	6 x 14 AWG ... 2 AWG	6 x 14 AWG ... 2 AWG
		Stranded (Class B)	6 x 14 AWG ... 2 AWG	6 x 14 AWG ... 2 AWG
		Solid (Class A)	6 x 14 AWG ... 10 AWG	6 x 14 AWG ... 10 AWG
	Aluminum cable (number of cables x wire range)	Stranded (Class B)	6 x 8 AWG ... 2 AWG	6 x 8 AWG ... 2 AWG
		Solid (Class A)	-	-
	Stripped length of cable L		0.50 in / 0.90 in / 1.50 in	0.50 in / 0.90 in / 1.50 in
	Tightening torque		≤ 8 AWG: 55 lb-in > 8 AWG: 62 lb-in	≤ 8 AWG: 55 lb-in > 8 AWG: 62 lb-in
	Cross-section specifications in mm <sup>2</sup>			
	Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	6 x 1.5 ... 25 mm <sup>2</sup>	6 x 1.5 ... 25 mm <sup>2</sup>
		Finely stranded (Class 5/6) with ferrule	6 x 1.5 ... 25 mm <sup>2</sup>	6 x 1.5 ... 25 mm <sup>2</sup>
		Stranded (Class 2)	6 x 1.5 ... 35 mm <sup>2</sup>	6 x 1.5 ... 35 mm <sup>2</sup>
		Solid (Class 1)	6 x 1.5 ... 16 mm <sup>2</sup>	6 x 1.5 ... 16 mm <sup>2</sup>
	Aluminum cable (number of cables x wire range)	Stranded (Class 2)	6 x 4 ... 35 mm <sup>2</sup>	6 x 4 ... 35 mm <sup>2</sup>
		Solid (Class 1)	6 x 4 ... 16 mm <sup>2</sup>	6 x 4 ... 16 mm <sup>2</sup>
Stripped length of cable L		12 mm / 24 mm / 38.5 mm	12 mm / 24 mm / 38.5 mm	
Tightening torque		1.5 mm <sup>2</sup> : 2.8 Nm ≤ 10 mm <sup>2</sup> : 6.2 Nm > 10 mm <sup>2</sup> : 7 Nm	1.5 mm <sup>2</sup> : 2.8 Nm ≤ 10 mm <sup>2</sup> : 6.2 Nm > 10 mm <sup>2</sup> : 7 Nm	

4.3 Connection system

3VA6 molded case circuit breakers:

Designation		Aluminum distribution wire connector, 6 cables			
Connection technology	Article No.	3VA924.-0JF60	3VA937.-JF60		
	Can be installed in 3VA6	3VA61 3VA62	3VA63 3VA64		
	Terminal marking	TA2.6	TA2.7		
	Cross-section specifications in AWG				
Copper cable (number of cables x wire range)	Stranded (Class C)	6 x 14 AWG ... 2 AWG	6 x 14 AWG ... 2 AWG		
	Stranded (Class B)	6 x 14 AWG ... 2 AWG	6 x 14 AWG ... 2 AWG		
	Solid (Class A)	6 x 14 AWG ... 10 AWG	6 x 14 AWG ... 10 AWG		
Aluminum cable (number of cables x wire range)	Stranded (Class B)	6 x 8 AWG ... 2 AWG	6 x 8 AWG ... 2 AWG		
	Solid (Class A)	-	-		
Stripped length of cable L		0.50 in / 0.90 in / 1.50 in	0.70 in / 1.40 in		
Tightening torque		≤ 8 AWG: 55 lb-in > 8 AWG: 62 lb-in	≤ 8 AWG: 55 lb-in > 8 AWG: 62 lb-in		
Cables and busbars	Cable connection 	Cross-section specifications in mm²			
		Copper cable (number of cables x wire range)	Finely stranded (Class 5/6)	6 x 1.5 ... 25 mm²	6 x 1.5 ... 25 mm²
			Finely stranded (Class 5/6) with ferrule	6 x 1.5 ... 25 mm²	6 x 1.5 ... 25 mm²
			Stranded (Class 2)	6 x 1.5 ... 35 mm²	6 x 1.5 ... 35 mm²
			Solid (Class 1)	6 x 1.5 ... 16 mm²	6 x 1.5 ... 16 mm²
		Aluminum cable (number of cables x wire range)	Stranded (Class 2)	6 x 4 ... 35 mm²	6 x 4 ... 35 mm²
			Solid (Class 1)	6 x 4 ... 16 mm²	6 x 4 ... 16 mm²
		Stripped length of cable L		12 mm / 24 mm / 38.5 mm	18 mm / 34.5 mm
		Tightening torque		1.5 mm²: 2.8 Nm ≤ 10 mm²: 6.2 Nm > 10 mm²: 7 Nm	1.5 mm²: 2.8 Nm ≤ 10 mm²: 6.2 Nm > 10 mm²: 7 Nm

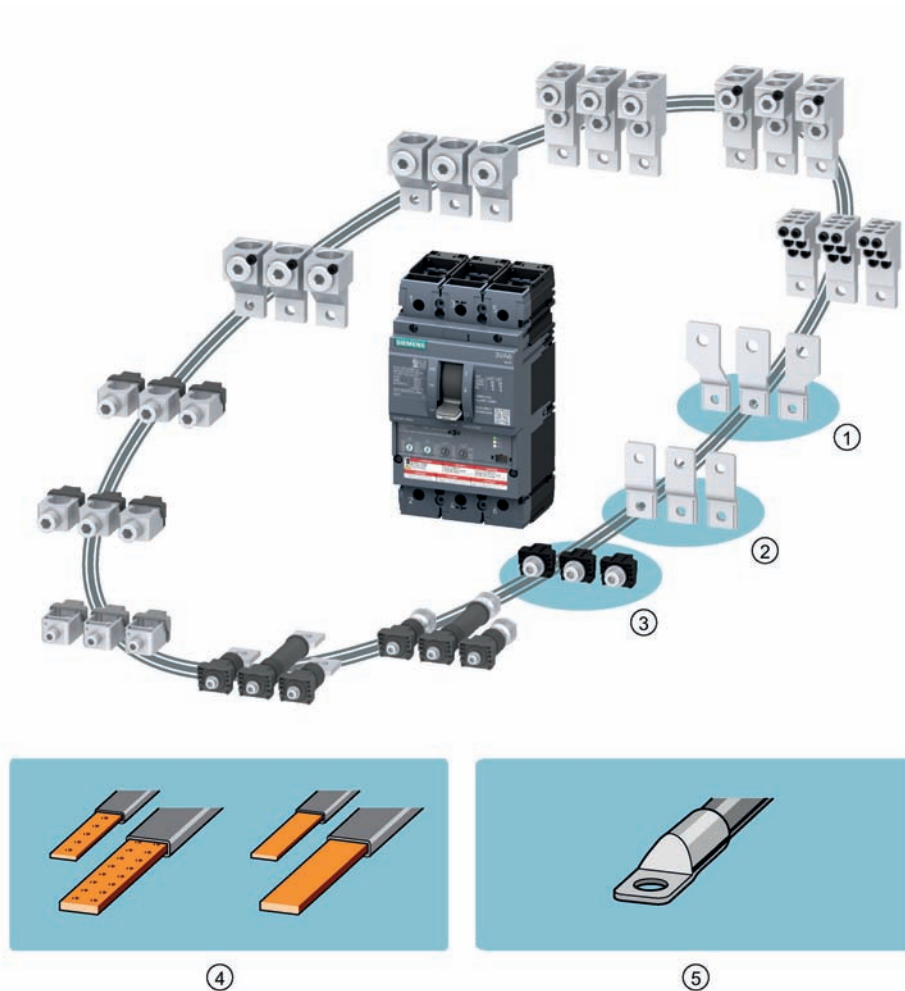
The distribution wire connector, 6 cables, can be ordered:

- as a pack of 3
- as a pack of 4



### 4.3.3.3 Front busbar and compression lug connections

The diagram below illustrates all the components available for implementing a busbar or compression lug connection on the front panel of the 3VA UL molded case circuit breaker.



#### Connection technology

- ① Front bus connectors offset <sup>1)</sup>
- ② Front bus connectors extended
- ③ Nut keeper kit

<sup>1)</sup> Only available for 3VA63 and 3VA64

#### Cables and busbars

- ④ Busbars
- ⑤ Compression lugs



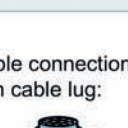
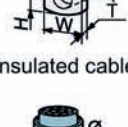
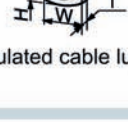
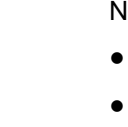
### Nut keeper kit



With the nut keeper kit, it is possible to connect busbars and compression lugs directly to the terminal of the 3VA UL molded case circuit breaker.

An auxiliary connection can be implemented using a special control wire tap. You can find more detailed information about this in chapter Control wire tap (Page 219).

The table below provides an overview of the minimum and maximum sizes of cables and busbars which can be connected by a nut keeper kit.

Designation		Nut keeper kit						
		3VA913.-0QA00	3VA923.-0QA00	3VA924.-0QA00	3VA947.-0QA00			
Connection technology	Article No.	3VA5	3VA51	3VA52	-	-		
	Can be installed in	3VA6	-	-	3VA61 3VA62	3VA63 3VA64		
Cables and busbars	Busbar connection (rigid & flexible): 	Maximum width	$W_{max}$	[inch] [mm]	0.66 17	0.98 25	0.98 25	1.37 35
		Thickness	T	[inch] [mm]	< 0.25 ≤ 6.5	< 0.31 ≤ 8	< 0.31 ≤ 8	0.04 ... 0.39 1 ... 10
	Insulated busbar 	Length L	L	[inch] [mm]	0.32 ... 0.39 8 ... 10	0.40... 0.47 10 ... 12	0.40... 0.47 10 ... 12	0.67 ... 0.78 17 ... 20
		Length H	H	[inch] [mm]	0.31 8	0.39 10	0.39 10	0.57 14.5
	Insulated flexible busbar 	Hole diameter	Ø	[inch] [mm]	1/4 6.5	5/16 8.5	5/16 8.5	3/8 11
		Tightening torque		[lb-in] [Nm]	70 8	177 20	177 20	354 40
		Tool: Hexagon socket wrench		[inch]	5/32	1/4	1/4	5/16
		Cable connection with cable lug: 	Maximum width	$W_{max}$	[inch] [mm]	0.66 17	0.98 25	0.98 25
	Uninsulated cable lug 	Thickness	T	[inch] [mm]	< 0.25 ≤ 6.5	< 0.31 ≤ 8	< 0.31 ≤ 8	0.04 ... 0.39 1 ... 10
		Length $C_{min}$	$C_{min}$	[inch] [mm]	0.32 8	0.40 10	0.40 10	0.59 15
	Insulated cable lug 	Length H	H	[inch] [mm]	0.31 8	0.39 10	0.39 10	0.57 14.5
		Hole diameter	Ø	[inch] [mm]	1/4 6.5	5/16 8.5	5/16 8.5	3/8 11
		Tightening torque		[lb-in] [Nm]	70 8	177 20	177 20	354 40
		Tool: Hexagon socket wrench		[inch]	5/32	1/4	1/4	5/16

Nut keeper kits can be ordered:

- as a pack of 3
- as a pack of 4

### Front bus connectors extended

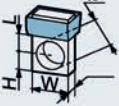
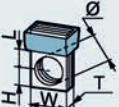
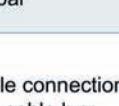
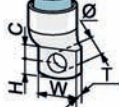
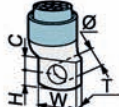



The front bus connectors extended enable larger busbars and compression lugs to be connected outside the termination area of a 3VA UL molded case circuit breaker. The front bus connectors therefore extend the terminal of the breaker.

You can find information on the required insulation measures in chapter Insulating equipment (Page 203).

An auxiliary connection can be implemented using a special control wire tap. You can find more detailed information about this in chapter Control wire tap (Page 219).

The table below provides an overview of the minimum and maximum sizes of cables and busbars which can be connected by front bus connectors extended.

Designation		Front bus connectors extended						
Article No.		3VA913.-0QB00	3VA927.-0QB00	3VA927.-0QB00	3VA947.-0QB00			
Connection technology	Can be installed in	3VA5	3VA51	3VA52	-	-		
		3VA6	-	-	3VA61 3VA62	3VA63 3VA64		
Cables and busbars	Busbar connection (rigid & flexible): 	Maximum width	$W_{max}$	[inch]	0.86	1.25	1.25	1.57
				[mm]	22	32	32	40
	Thickness	T	[inch]	≤ 0.31	≤ 0.39	≤ 0.39	≤ 0.49	
			[mm]	≤ 8	≤ 10	≤ 10	≤ 12.5	
	Length L	L	[inch]	0.39	0.49	0.49	0.59	
			[mm]	10	12.5	12.5	15	
	Length H	H	[inch]	0.47	0.78	0.78	0.78	
			[mm]	12	20	20	20	
	Insulated busbar 	Hole diameter	∅	[inch]	1/4	3/8	3/8	3/8
				[mm]	6.6	11	11	11
	Insulated flexible busbar 	Tightening torque		[lb-in]	70	132.8	132.8	177
				[Nm]	8	15	15	20
		Tool: Hexagon socket wrench		[inch]	3/16	5/16	5/16	5/16
	Cable connection with cable lug: 	Maximum width	$W_{max}$	[inch]	0.86	1.25	1.25	1.57
			[mm]	22	32	32	40	
Thickness		T	[inch]	≤ 0.31	≤ 0.39	≤ 0.39	≤ 0.49	
			[mm]	≤ 8	≤ 10	≤ 10	≤ 12.5	
Length $C_{min}$		$C_{min}$	[inch]	0.39	0.49	0.49	0.59	
			[mm]	10	12.5	12.5	15	
Length H		H	[inch]	0.47	0.78	0.78	0.78	
			[mm]	12	20	20	20	
Uninsulated cable lug 		Hole diameter	∅	[inch]	1/4	3/8	3/8	3/8
				[mm]	6.6	11	11	11
Insulated cable lug 	Tightening torque		[lb-in]	70	132.8	132.8	177	
			[Nm]	8	15	15	20	
	Tool: Hexagon socket wrench		[inch]	3/16	5/16	5/16	5/16	

The front bus connectors extended can be ordered:

- as a pack of 3
- as a pack of 4

### Front bus connectors offset (only available for 3VA63 and 3VA64)


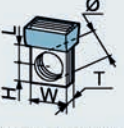
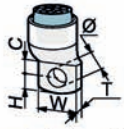



The front bus connectors offset enable very large busbars and compression lugs to be connected outside the termination area of a 3VA UL molded case circuit breaker. The front bus connector offset increases the distance between pole centers (3VA63 and 3VA64 with offset = 70 mm / 2.76 inch) of the terminals of the molded case circuit breaker.

You can find information on the required insulation measures in chapter Insulating equipment (Page 203).

An auxiliary connection can be implemented using a special control wire tap. You can find more detailed information about this in chapter Control wire tap (Page 219).

The table below provides an overview of the minimum and maximum sizes of cables and busbars which can be connected by front bus connectors offset.

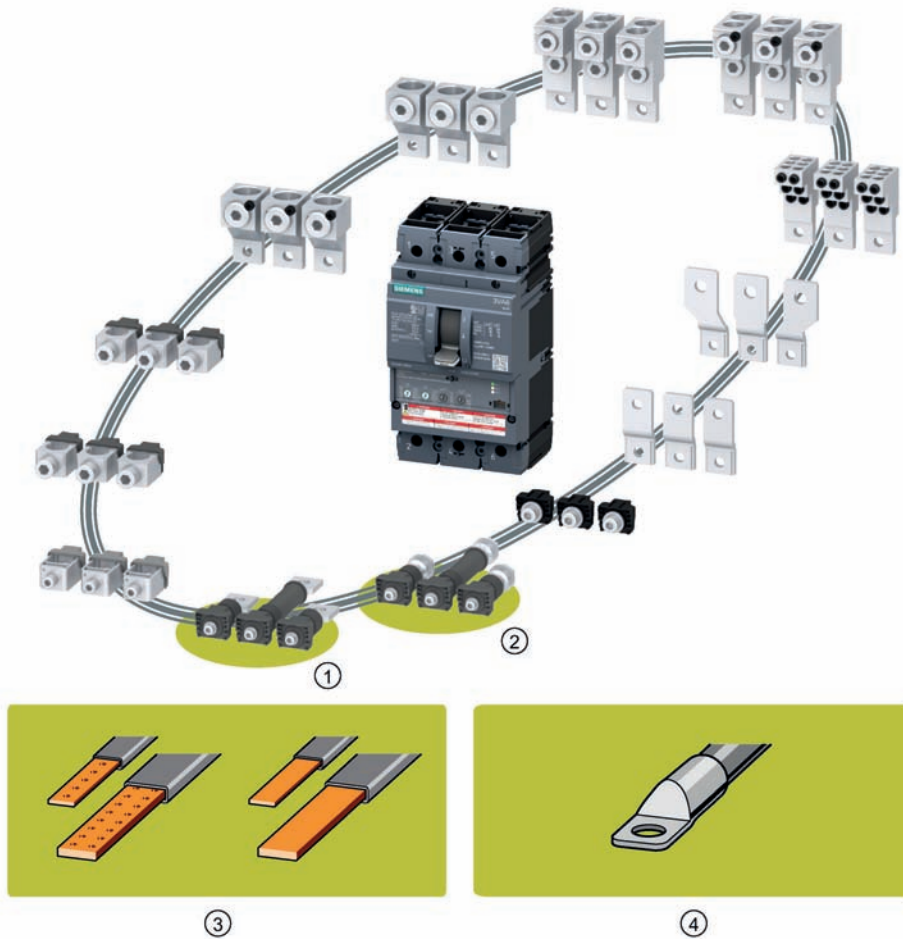
Designation		Front bus connectors offset				
Connection technology	Article No.	3VA947.-0QC00				
	Can be installed in	3VA5	-			
		3VA6	3VA63 3VA64			
Cables and busbars	Busbar connection (rigid & flexible): 	Maximum width	$W_{max}$	[inch] [mm]	2.40 60	
		Thickness	T	[inch] [mm]	< 0.49 < 12.5	
		Length L	L	[inch] [mm]	0.79 20	
		Length H	H	[inch] [mm]	0.78 20	
		Insulated busbar 	Hole diameter	$\varnothing$	[inch] [mm]	1/2 14
			Tightening torque		[lb-in] [Nm]	265 30
	Insulated flexible busbar	Tool: Hexagon socket wrench		[inch]	3/8	
	Cable connection with cable lug: 	Maximum width	$W_{max}$	[inch] [mm]	2.40 60	
		Thickness	T	[inch] [mm]	< 0.49 < 12.5	
		Length $C_{min}$	$C_{min}$	[inch] [mm]	0.79 20	
		Uninsulated cable lug 	Length H	H	[inch] [mm]	0.78 20
			Hole diameter	$\varnothing$	[inch] [mm]	1/2 14
Insulated cable lug		Tightening torque		[lb-in] [Nm]	265 30	
	Tool: Hexagon socket wrench		[inch]	3/8		

Front bus connectors offset can be ordered:

- as a pack of 3
- as a pack of 4

4.3.3.4 Rear busbar and compression lug connections

The diagram below illustrates all the components available for implementing a busbar or compression lug connection on the rear panel of the 3VA UL molded case circuit breaker.



Connection technology

- ① Rear connection stud round
- ② Rear connection stud flat

Cables and busbars

- ③ Busbars
- ④ Compression lugs

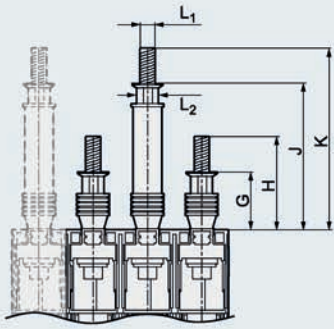
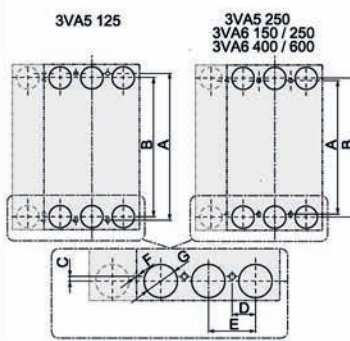
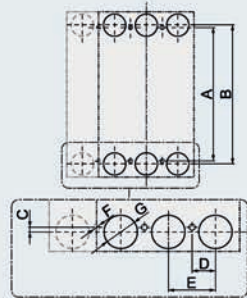
Rear connection stud round



The rear connection stud round enables busbars and compression lugs to be connected to the rear of the 3VA UL molded case circuit breaker.

The dimensions of rear connecting studs are given in the table below:



Designation		Rear connection stud round						
Connection technology	Article No.	3VA913.-0QF.0	3VA923.-0QF.0	3VA924.-0QF.0	3VA947.-0QF.0			
	Can be installed in	3VA5 3VA6	3VA51 -	3VA52 -	- 3VA61 3VA62 3VA63 3VA64			
Dimensions of rear connection stud round	Dimensional drawing 	G	[inch] [mm]	0.85 21.5	1.42 36	1.42 36	1.77 45	
		H	[inch] [mm]	2.34 59.5	2.32 59	2.32 59	3.29 83.5	
		J	[inch] [mm]	3.09 78.5	3.66 93	3.66 93	4.13 105	
		K	[inch] [mm]	4.59 116.5	4.57 116	4.57 116	5.65 143.5	
		L <sub>1</sub>	Hexagon nut Hexagon nut width across flats	M8 11/16	3/8 9/16	3/8 9/16	1/2 3/4	
			Hexagon nut tightening torque	105	88	88	177	
		L <sub>2</sub>	Round connection stud width across flats	11/16 <sup>1)</sup>	9/16	9/16	11/16	
		Drilling pattern for fixed-mounted circuit breaker 	A	[inch] [mm]	4.51 114.5	5.24 133	5.75 146	7.09 180
			B	[inch] [mm]	4.24 107.8	5.67 144	6.18 157	7.87 200
			C	[inch] [mm]	0.14 3.5	0.22 5.5	0.22 5.5	0.39 10
	D		[inch] [mm]	0.50 12.7	0.69 17.5	0.69 17.5	0.91 23	
	E		[inch] [mm]	1 25.4	1.38 35	1.38 35	1.81 46	
	F		[inch] [mm]	0.16 4	0.18 4.5	0.18 4.5	0.22 5.5	
	G		[inch] [mm]	0.67 17	0.96 24.5	0.96 24.5	1.34 34	
	Drilling pattern for socket plug-in/draw-out technology 	A	[inch] [mm]	- -	- -	8.23 209	- <sup>2)</sup> -	
		B	[inch] [mm]	- -	- -	8.66 220	- <sup>2)</sup> -	
		C	[inch] [mm]	- -	- -	0.22 5.5	- <sup>2)</sup> -	
D		[inch] [mm]	- -	- -	0.69 17.5	- <sup>2)</sup> -		
E		[inch] [mm]	- -	- -	1.38 35	- <sup>2)</sup> -		
F		[inch] [mm]	- -	- -	0.18 4.5	- <sup>2)</sup> -		
G		[inch] [mm]	- -	- -	0.96 24.5	- <sup>2)</sup> -		

1) Width across flats of the supplied lock nut

2) Plug-in and draw-out technology **only** possible in combination with bus connector offset and associated terminal cover

Rear connection studs round can be ordered

- as a pack of 3 (2 short studs and 1 long stud)
- as a pack of 4 (2 short studs and 2 long studs)
- as a pack of 1 (1 short stud)
- as a pack of 1 (1 long stud)

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**Note**

In order to achieve degree of protection IP40, terminal covers (short version) must also be attached when a rear connection stud is installed.

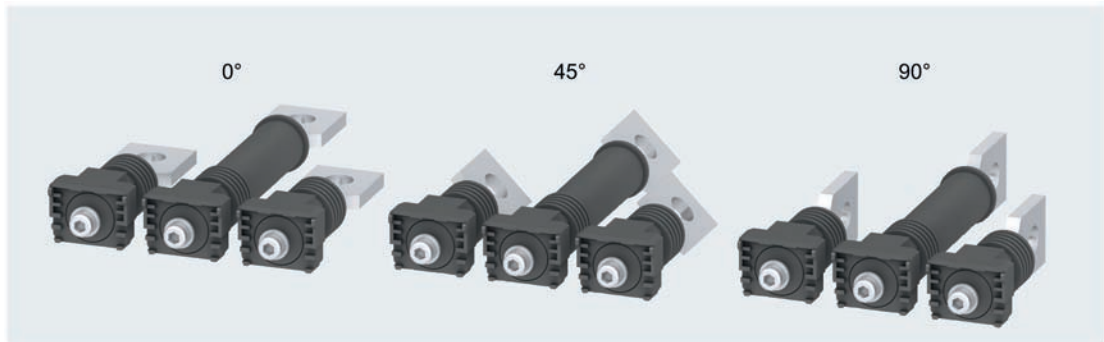
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**Rear connection stud flat**

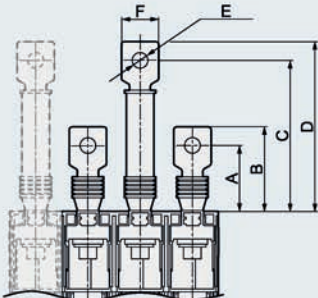
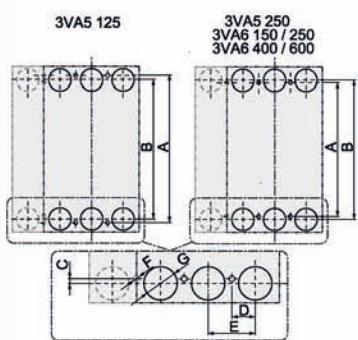
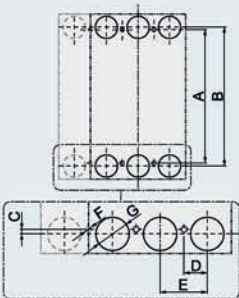


The rear connection stud flat enables busbars and compression lugs to be connected to the rear of the 3VA UL molded case circuit breaker.

The rear connection stud flat can be rotated in steps of 45°, i.e. it can be installed at an angle of 0°, 45° or 90°:



The dimensions of rear connection studs flat are stated in the table below:

Designation		Rear connection stud flat				
Connection technology	Article No.	3VA913.-0QE.0	3VA923.-0QE.0	3VA924.-0QE.0	3VA947.-0QE.0	
		3VA5	3VA51	3VA52	-	
	Can be installed in	3VA6	-	-	3VA61 3VA62	3VA63 3VA64
Dimensions of rear connection stud flat	Dimensional drawing 	A	[inch] 1.75 [mm] 44.5	1.69 43	1.69 43	2 50
		B	[inch] 2.22 [mm] 56.5	2.19 55.5	2.19 55.5	2.6 65
		C	[inch] 4 [mm] 101.5	3.94 100	3.94 100	4.5 115
		D	[inch] 4.49 [mm] 114	4.43 112.5	4.43 112.5	5.2 130
		E	[inch] 5/16 [mm] 8.40	3/8 10.50	3/8 10.50	1/2 13.20
		F	[inch] 0.6 [mm] 16	0.87 22	0.87 22	1.2 29.4
		Drilling pattern for fixed-mounted circuit breaker 	A	[mm] 4.51 [mm] 114.5	5.24 133	5.75 146
	B	[inch] 4.24 [mm] 107.8	5.67 144	6.18 157	7.87 200	
	C	[inch] 0.14 [mm] 3.5	0.22 5.5	0.22 5.5	0.39 10	
	D	[inch] 0.50 [mm] 12.7	0.69 17.5	0.69 17.5	0.91 23	
	E	[inch] 1 [mm] 25.4	1.38 35	1.38 35	1.81 46	
	F	[inch] 0.16 [mm] 4	0.18 4.5	0.18 4.5	0.22 5.5	
	G	[inch] 0.67 [mm] 17	0.96 24.5	0.96 24.5	1.34 34	
	Drilling pattern for socket plug-in/draw-out technology 	A	[inch] - [mm] -	-	8.23 209	- <sup>1)</sup> - <sup>1)</sup>
	B	[inch] - [mm] -	-	8.66 220	- <sup>1)</sup> - <sup>1)</sup>	
	C	[inch] - [mm] -	-	0.22 5.5	- <sup>1)</sup> - <sup>1)</sup>	
	D	[inch] - [mm] -	-	0.69 17.5	- <sup>1)</sup> - <sup>1)</sup>	
	E	[inch] - [mm] -	-	1.38 35	- <sup>1)</sup> - <sup>1)</sup>	
	F	[inch] - [mm] -	-	0.18 4.5	- <sup>1)</sup> - <sup>1)</sup>	
	G	[inch] - [mm] -	-	0.96 24.5	- <sup>1)</sup> - <sup>1)</sup>	

<sup>1)</sup> Plug-in and draw-out technology **only** possible in combination with bus connector offset and associated terminal cover

4.3 Connection system

Rear connection studs flat can be ordered:

- as a pack of 3 (2 short connection studs flat and 1 long connection stud flat)
- as a pack of 4 (2 short connection studs flat and 2 long connection studs flat)
- as a pack of 1 (1 short connection stud flat)
- as a pack of 1 (1 long connection stud flat)

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**Note**

In order to achieve degree of protection IP40, terminal covers (short version) must also be attached when a rear connection stud is installed.

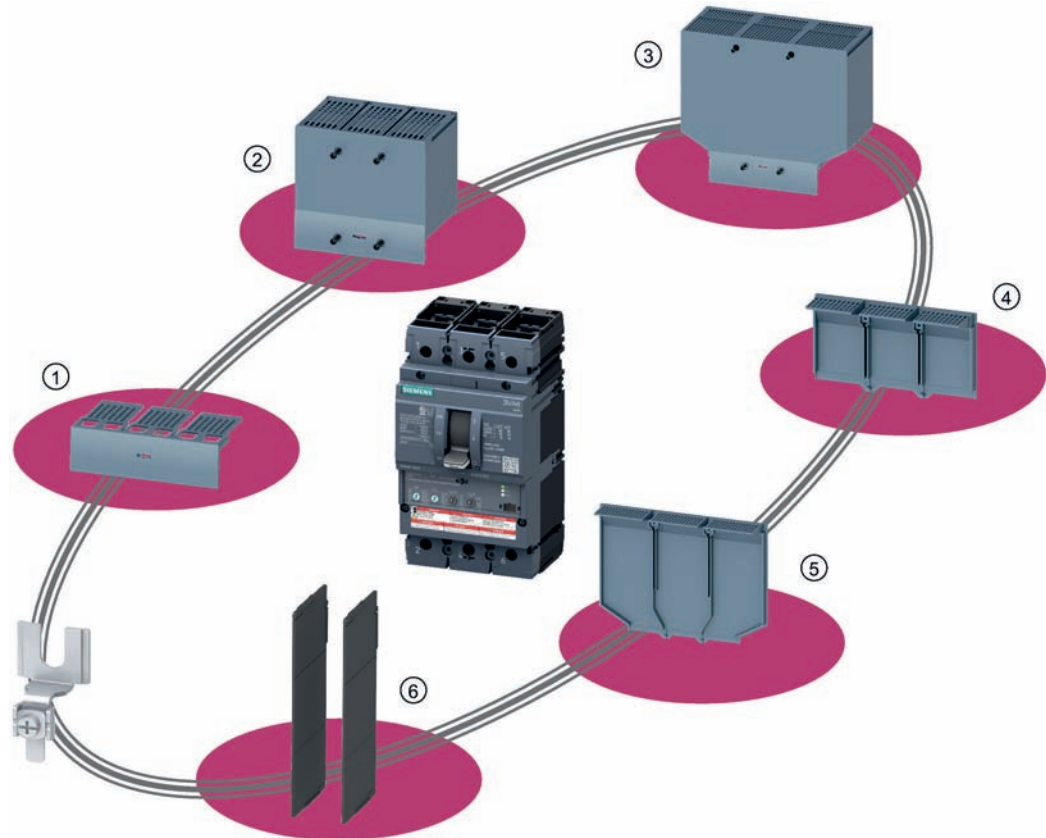
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## 4.3.4 Further connection accessories

### 4.3.4.1 Insulating equipment

The connection technology accessories provide a comprehensive range of insulation measures.

The following overview shows the insulation accessories available for the 3VA UL molded case circuit breakers.



- ① Terminal cover
- ② Terminal cover extended
- ③ Terminal cover offset <sup>1)</sup>
- ④ Insulating plate
- ⑤ Insulating plate, offset <sup>1)</sup>
- ⑥ Phase barriers

<sup>1)</sup> Only available for 3VA63 and 3VA64

### Phase barriers



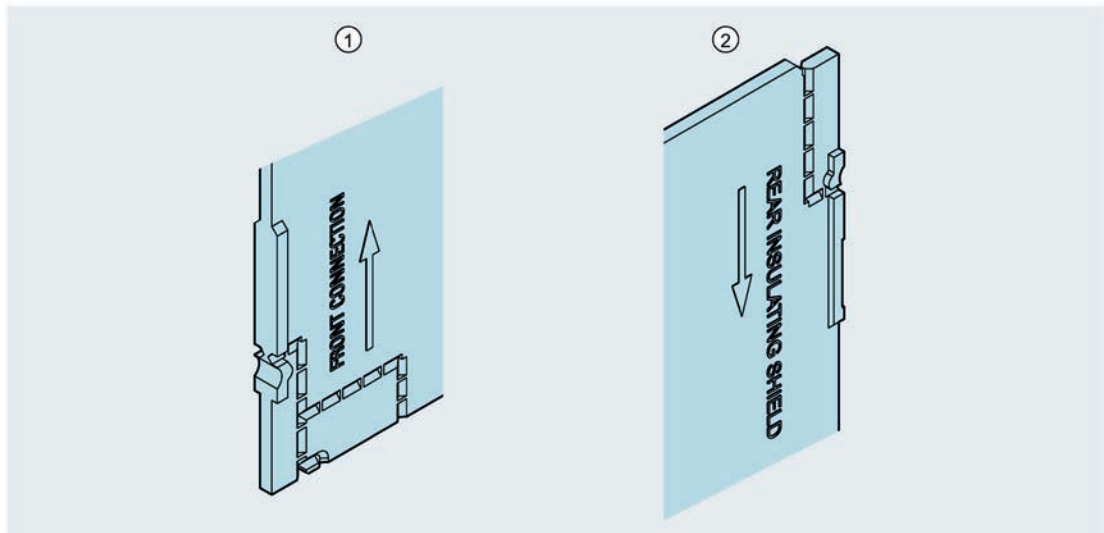
Phase barriers provide insulation between the individual phases of the molded case circuit breaker. They are simply snapped into place on the 3VA UL molded case circuit breaker.

Phase barriers can be used in combination with the insulating plate and the insulating plate offset, in order to provide additional insulation from the mounting plate.

Phase barriers are compatible with:

- Box terminal
- Wire connector
- Front bus connectors extended (included in scope of supply)
- Front bus connectors offset (included in scope of supply)
- Other insulation accessories: Insulating plate or insulating plate, offset

Depending on the intended purpose of the phase barriers, they must be snapped into position in the direction indicated by the arrows below:



- ① Front connection
- ② In combination with insulating plate

## Terminal cover, extended terminal cover, and offset terminal cover

### Note

The offset terminal cover is only available for the 3VA63 and 3VA64 molded case circuit breakers.

All terminal covers provide IP40 protection at the front of the breaker and IP20 protection at the infeed and load ends provided that they are correctly installed (cutting of grille structure). The requirements of NFPA 79 "Protection against electric shock" for UL applications are met with IP20 protection.

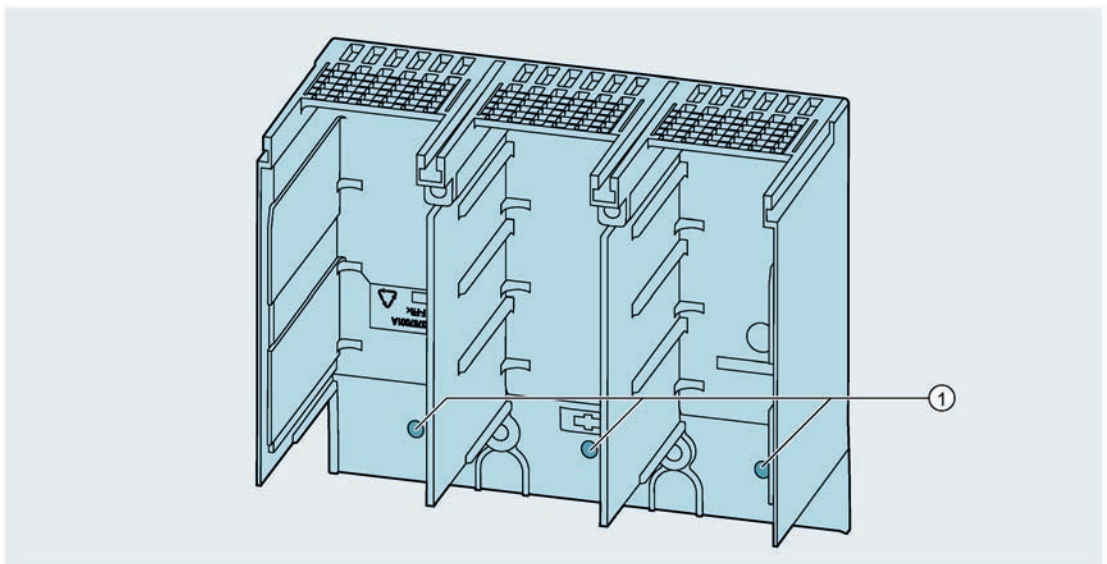
All terminal covers have a marking on the inside face which can be drilled through before the cover is installed. A voltage detector can be inserted through this hole to test for safe isolation.

### WARNING

#### Reduced degree of barrier protection

IP40 is not maintained at the front of the breaker if a hole is drilled through the terminal cover.

Suitable precautions must be taken to safeguard against any hazards posed by this loss of protection.



① Marking for holes

Phase barriers can also be installed on all terminal covers to increase clearances and creepage distances which might be impacted by ionized gas following a short circuit.

4.3 Connection system



**Terminal cover**

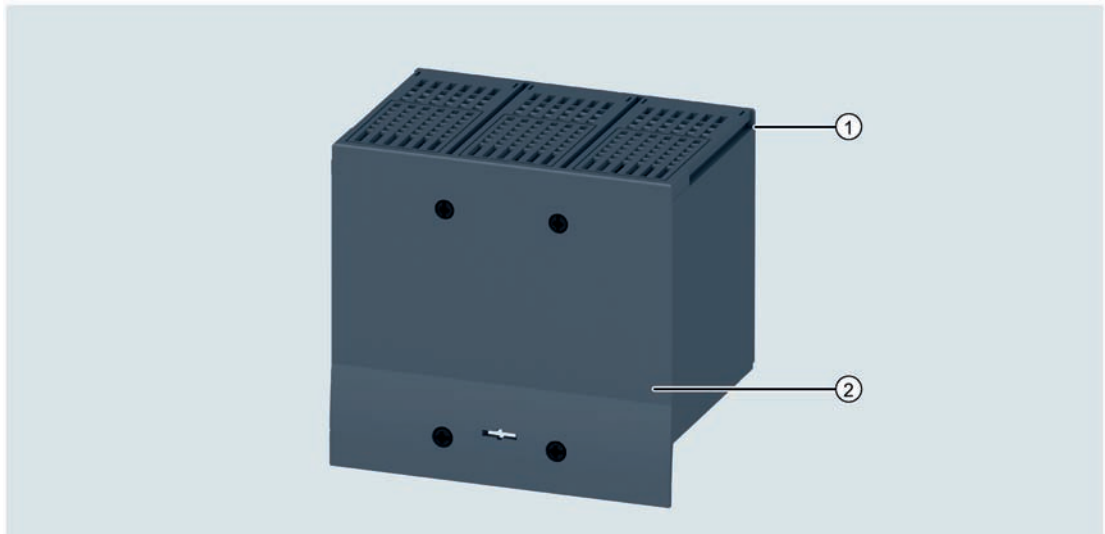
The terminal cover is compatible with:

- Box terminals
- Wire connectors
- Nut keeper kits

The terminal cover is simply snapped into place on the 3VA UL molded case circuit breaker (3VA5 125 A) or snapped into place and secured with 2 screws (3VA5 250 A and 3VA6).



**Terminal cover extended**



- ① Rear insulating plate, provides insulation from the panel mounting plate
- ② Front half, pushed over the molded case circuit breaker from the front

The insulating plate is fitted to the rear panel of the molded case circuit breaker and then secured by 2 screws to the front half of the terminal cover. The terminal cover extended is also secured by 2 additional screws to the molded case circuit breaker itself.

The terminal cover extended is compatible with:

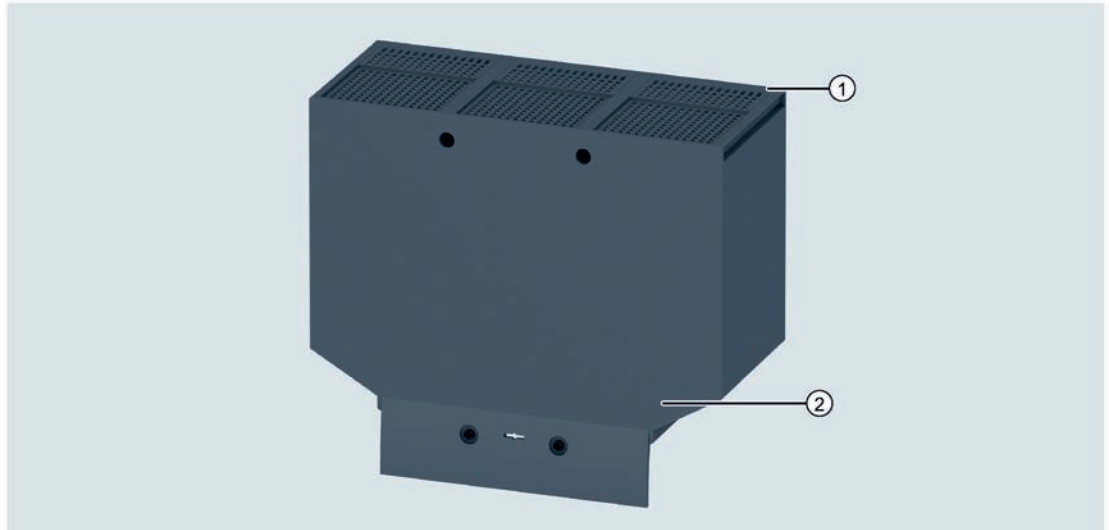
- Wire connectors, large (terminal cover extended included in scope of supply)
- Wire connectors, 2 cables (terminal cover extended included in scope of supply)
- Distribution wire connector, 6 cables (terminal cover extended included in scope of supply)
- Front bus connectors extended





### Terminal cover offset

The terminal cover offset always consists of two parts:



- ① Rear insulating plate, provides insulation from the panel mounting plate
- ② Front half, pushed over the molded case circuit breaker from the front

The insulating plate is fitted to the rear panel of the molded case circuit breaker and then secured by 2 screws to the front half of the terminal cover. The terminal cover offset is also secured by 2 additional screws to the molded case circuit breaker itself.

The terminal cover offset is compatible with:

- Front bus connectors offset

### Insulating plate and insulating plate offset



If insulation for the mounting plate is needed, this can be ensured by an insulating plate.

The insulating plate is fitted to the rear panel of the molded case circuit breaker and can be installed in combination with phase barriers.

Potential applications:

- Insulating plate:
  - Bus connectors, extended
  - Non-insulated, straight conductors / terminals
- Insulating plate, offset:
  - Bus connectors, offset

General insulating measures

Voltage level [V AC]		Insulated cables and busbars e.g. insulated cable, insulated cable lug, insulated busbar, rear round connection stud, rear flat connection stud	Non-insulated cables and busbars e.g. bare cable, bare cable lug, bare busbar, bus connector extended, external wire connector
3VA51	≤ 480	No additional insulating measures are required.	If the insulation extends inside the termination area, no additional insulating measures are required.
	≥ 480		Additional insulating measures are always required: 1. Phase to phase: Phase barriers or terminal cover extended 2. Phase to mounting plate: Insulating plates or terminal cover extended
3VA5	≤ 480	Only the short terminal cover is required as an additional insulating measure.	If the insulation extends inside the termination area, no additional insulating measures are required.
	≥ 480	In addition to the short terminal cover, phase barriers are also required.	Additional insulating measures are always required: 1. Phase to phase: Phase barriers or terminal cover extended 2. Phase to mounting plate: Insulating plates or terminal cover extended with infeed from below (terminals 2/4/6)
3VA6	≤ 480	Only the short terminal cover is required as an additional insulating measure.	If the insulation extends inside the termination area, no additional insulating measures are required.
	≥ 480	In addition to the short terminal cover, phase barriers are also required.	Additional insulating measures are always required: Phase to phase: Phase barriers or terminal cover extended
3VA63/64	≤ 480	Only the short terminal cover is required as an additional insulating measure.	If the insulation extends inside the termination area, no additional insulating measures are required.
	≥ 480	In addition to the short terminal cover, phase barriers are also required.	Additional insulating measures are always required: Phase to phase: Phase barriers or terminal cover extended

## Insulating measures - UL

The insulation accessories for UL applications are presented by identification letters in the following tables.

Installation requirements for all terminals						
	A	B	C	D	E	F
	 3VA9272-0WA00 3VA9472-0WA00	 3VA9272-0WA00 3VA9472-0WA00	 3VA9271-0WD.0 3VA9471-0WD.0	 3VA9271-0WD.0 3VA9471-0WF.0	 3VA9272-0WA00 3VA9271-0WJ.0 3VA9472-0WA00 3VA9471-0WJ.0	 3VA9272-0WA00 3VA9271-0WJ.0 3VA9472-0WA00 3VA9471-0WJ.0
G	H	K	L			
 3VA9272-0WA00 3VA9271-0WD.0 3VA9472-0WA00 3VA9471-0WD.0	 3VA9272-0WA00 3VA9271-0WD.0 3VA9472-0WA00 3VA9471-0WD.0	 3VA9471-0WG.0	 3VA9472-0WA00 3VA9471-0WK.0			
Installation requirements only for terminals 2 / 4 / 6						
	I	J				
	 3VA9272-0WA00 3VA9271-0WJ.0	 3VA9272-0WA00 3VA9271-0WJ.0				


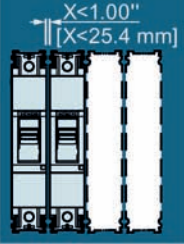





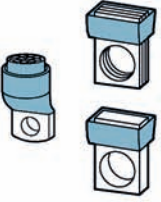

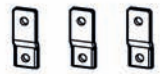






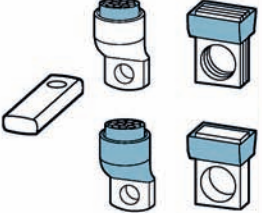


### Note

All the presented insulation measures represent minimum requirements.

Covers can be replaced with more substantial covers:





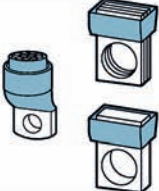




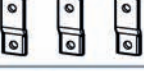


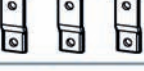
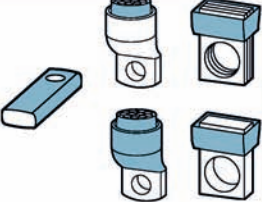


- Insulating measure A can be replaced with D and E
- Insulating measure B can be replaced with D and F
- Insulating measure E can be replaced with D
- Insulating measure L can be replaced with K

Insulating measures for 3VA51 molded case circuit breakers for UL use




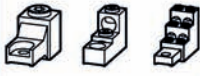
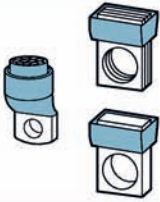











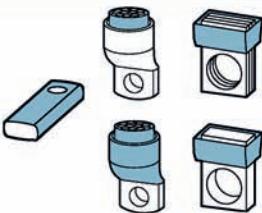


Connection	Order number	3VA51...	3VA51...-ED1.	
				
			≤ 600 V AC ≤ 500 V DC	≤ 347 V AC 125 V DC
	 3VA913.-0JB10 3VA913.-0JG10 3VA913.-0JD10 3VA913.-0JK10	—	—	—
	 3VA913.-0JB11 3VA913.-0JG11 3VA913.-0JD11 3VA913.-0JK11	—	—	—
	 3VA913.-0JA11	—	—	—
	 3VA913.-0JJ12 3VA913.-0JC12 3VA913.-0JF60	D	1)	1)
	 3VA913.-0QA00	—	—	—
	 3VA913.-0QB00	D / F	—	
	 3VA913.-0QA00	D / F	—	
	 3VA913.-0QB00	D / F	—	
	 3VA913.-0QE.0	—	1)	1)
	 3VA913.-0QF.0	—	1)	1)

1) Not applicable for 3VA51...-ED1.

Insulating measures for 3VA52 molded case circuit breakers for UL use



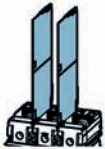



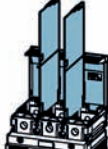

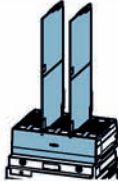

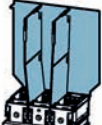
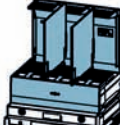
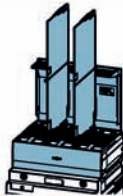
Connection	Order number	≤ 480 V AC ≤ 500 V DC	Line	Load
			1 3 5 2 4 6 Load	1 3 5 2 4 6 Line
	 3VA923.-0JB12 3VA923.-0JG12 3VA923.-0JD12 3VA923.-0JK12	—	A/B/D	D/I/J
	 3VA923.-0JA1.	—	A/B/D	D/I/J
	 3VA923.-0JJ13 3VA923.-0JC13 3VA923.-0JJ22 3VA923.-0JC22 3VA923.-0JF60	D	D	D
	 3VA923.-0QA00	—	A/B/D	D/I/J
	 3VA927.-0QB00	D/F	D	D
	 3VA923.-0QA00	D/F	D	D
	 3VA927.-0QB00	D/F	D	D
	 3VA923.-0QA00	A/B/D	D/E/F	D/E/F
	 3VA927.-0QB00	D/F	D	D
	 3VA923.-0QE.0	C/G/H	G/H	G/H
	 3VA923.-0QF.0	C/G/H	G/H	G/H

Insulating measures for 3VA61/62/63/64 molded case circuit breakers for UL use

Connection		Order number	≤ 240 V AC ≤ 480 V AC	≤ 600 V AC
		3VA9...-0JB1. 3VA9...-0JG1. 3VA9...-0JD1. 3VA9...-0JK1.	—	A / B / D
		3VA9...-0JA12	—	A / B / D
		3VA9...-0JJ.3 3VA9...-0JC.3 3VA9...-0JJ2. 3VA9...-0JC2. 3VA9...-0JF60	D	D
		3VA9...-0QA00	—	A / B / D
		3VA9...-0QB00	D / F	D
		3VA947...-0QC00 <sup>1)</sup>	K / L	K
		3VA9...-0QA00	D / F	D
		3VA9...-0QB00	D / F	D
		3VA947...-0QC00 <sup>1)</sup>	K / L	K
		3VA9...-0QA00	E / F	D / E / F
		3VA9...-0QB00	D / F	D
		3VA947...-0QC00 <sup>1)</sup>	K / L	K
		3VA9...-0QE.0	C	G / H
		3VA9...-0QF.0	C	G / H

<sup>1)</sup> For 3VA63/64 only

The insulating measures for IEC applications are presented in the following. The insulating measures are identified with letters in the tables. These letters stand for the following insulation accessories:

Installation requirements for all terminals						
	A	B	C	D	E	F
	 3VA9272-0WA00 3VA9472-0WA00	 3VA9272-0WA00 3VA9472-0WA00	 3VA9271-0WD.0 3VA9471-0WD.0	 3VA9271-0WD.0	 3VA9272-0WA00 3VA9271-0WJ.0 3VA9472-0WA00 3VA9471-0WJ.0	 3VA9272-0WA00 3VA9271-0WJ.0 3VA9472-0WA00 3VA9471-0WJ.0
G	H	K	L	M	N	
 3VA9272-0WA00 3VA9271-0WD.0 3VA9472-0WA00 3VA9471-0WD.0	 3VA9272-0WA00 3VA9271-0WD.0 3VA9472-0WA00 3VA9471-0WD.0	 3VA9471-0WG.0	 3VA9472-0WA00 3VA9471-0WK.0	 3VA9472-0WA00 3VA9471-WJ.0 3VA9471-0WD.0	 3VA9472-0WA00 3VA9471-WJ.0 3VA9471-0WD.0	















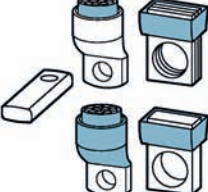


### Note

All the presented insulation measures represent minimum requirements.

Covers can be replaced with higher-quality covers:

- Insulating measure A can be replaced with D and E
- Insulating measure B can be replaced with D and F
- Insulating measure E can be replaced with D
- Insulating measure L can be replaced with K

Insulating measures for 3VA51 molded case circuit breakers for IEC use

Connection	Order number	3VA51...	3VA51...-ED1.		3VA51...-ED1.	
			≤ 415 V AC	≤ 250 V DC	690 V AC 500 V DC	≤ 415 V AC 125 V DC
	 3VA913.-0JB10 3VA913.-0JG10 3VA913.-0JD10 3VA913.-0JK10	—	—	—	—	—
	 3VA913.-0JB11 3VA913.-0JG11 3VA913.-0JD11 3VA913.-0JK11	—	—	—	—	—
	 3VA913.-0JA11	—	—	—	—	—
	 3VA913.-0JJ12 3VA913.-0JC12 3VA913.-0JF60	D	D	D	1)	1)
	 3VA913.-0QA00	—	—	—	—	—
	 3VA913.-0QB00	A / B	A / B	D / E / F	—	
	 3VA913.-0QA00	A / B	A / B	D / E / F	—	
	 3VA913.-0QB00	B	B	D / E / F	—	
	 3VA913.-0QE.0	C	C	C	1)	1)
	 3VA913.-0QF.0	C	C	C	1)	1)

1) Not applicable for 3VA51...-ED1.



Insulating measures for 3VA52 molded case circuit breakers for IEC use

Connection	Order number	≤ 415 V AC ≤ 415 V DC	Line	Load
			1 3 5 2 4 6 Load	1 3 5 2 4 6 Line
		≤ 415 V AC ≤ 415 V DC	≤ 690 V AC ≤ 750 V DC	≤ 690 V AC ≤ 750 V DC
	 3VA923.-0JB12 3VA923.-0JG12 3VA923.-0JD12 3VA923.-0JK12	—	D/E/F	D/E/F
	 3VA923.-0JA1.	—	D/E/F	D/E/F
	 3VA923.-0JJ13 3VA923.-0JC13 3VA923.-0JJ22 3VA923.-0JC22 3VA923.-0JF60	D	D	D
	 3VA923.-0QA00	—	D/E/F	D/E/F
	 3VA927.-0QB00	A/B	D/E/F	D/E/F
	 3VA923.-0QA00	D/F		
	 3VA927.-0QB00	D/F		
	 3VA923.-0QA00	A/B/D	D/E/F	D/E/F
	 3VA927.-0QB00	D/F	D	D
	 3VA923.-0QE.0	C/G/H	G/H	G/H
	 3VA923.-0QF.0	C/G/H	G/H	G/H

Insulating measures for 3VA61 and 3VA62 molded case circuit breakers for IEC use

Connection		Order number	≤ 500 V AC	≤ 690 V AC
		3VA9.4.-0JB1. 3VA9.4.-0JG1. 3VA9.4.-0JD1. 3VA9.4.-0JK1.	—	D / E / F
		3VA9.4.-0JA12	—	D / E / F
		3VA924.-0JJ13 3VA924.-0JC13 3VA924.-0JJ22 3VA924.-0JC22 3VA924.-0JF60	D	D
		3VA924.-0QA00	—	D / E / F
		3VA927.-0QB00	A / B	D / E / F
		3VA924.-0QA00	A / B	
		3VA927.-0QB00	A / B	
		3VA924.-0QA00	A / B	D / E / F
		3VA927.-0QB00	A / B	D / F
		3VA924.-0QE.0	C	M / N
		3VA924.-0QF.0	C	M / N

Insulating measures for 3VA63 and 3VA64 molded case circuit breakers for IEC use

Connection	Order number	≤ 500 V AC	≤ 690 V AC
	 3VA937.-0JB13 3VA937.-0JG13 3VA937.-0JD13 3VA937.-0JK13	—	D / E / F
	 3VA947.-0JA13	—	D / E / F
	 3VA947.-0JJ23 3VA947.-0JC23 3VA947.-0JE23 3VA947.-0JL23 3VA937.-0JF60	D	D
	 3VA924.-0QA00	—	D / E / F
	 3VA927.-0QB00	A / B	D / E / F
	 3VA947.-0QF.0	A / B	K / L
	 3VA947.-0QA00	A / B	
	 3VA947.-0QB00	A / B	
	 3VA947.-0QF.0	B / K / L	
	 3VA947.-0QA00	A / B	D / E / F
	 3VA947.-0QB00	K / L	D / F
	 3VA947.-0QF.0	K / L	K / L
	 3VA947.-0QE.0	C	M / N
	 3VA947.-0QF.0	C	M / N

### Touch protection

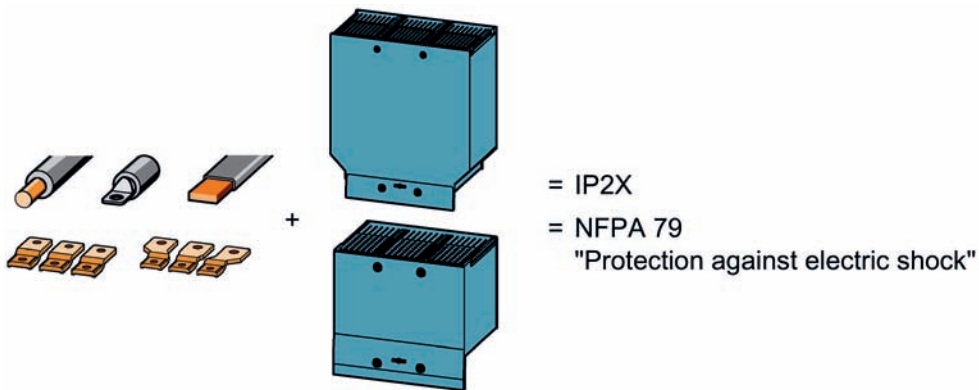
#### Insulated cables and busbars

With insulated cables and busbars whose insulation extends inside the termination area of the 3VA molded case circuit breaker, finger safety according to IP2X degree of protection is achieved in IEC applications with the terminal cover. The requirements of NFPA 79 "Protection against electric shock" for UL applications are met with degree of protection IP20. A basic precondition for this is proper installation.



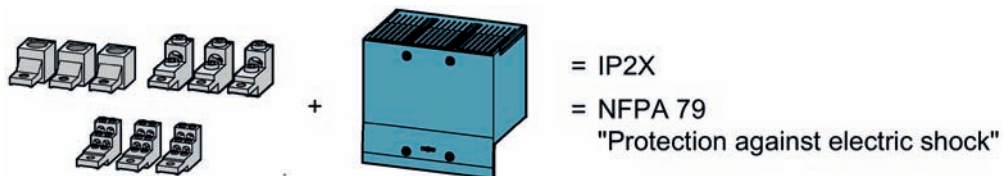
#### Non-insulated cables and busbars

With non-insulated cables and busbars and bus connectors extended or bus connectors offset, finger safety according to IP2X degree of protection is achieved in IEC applications with terminal covers extended or offset. The requirements of NFPA 79 "Protection against electric shock" for UL applications are met with degree of protection IP20. A basic precondition for this is proper installation.





#### External wire connectors

External wire connectors are supplied as standard with a terminal cover extended. When a terminal cover extended is used and properly installed, the external wire connectors achieve finger safety according to IP2X degree of protection in IEC applications. The requirements of NFPA 79 "Protection against electric shock" for UL applications are met with degree of protection IP20.



#### 4.3.4.2 Control wire tap

The portfolio of the 3VA UL molded case circuit breaker enables easy implementation of a control wire tap.

Designation		Control wire tap			
Connection technology	Variant				
	Usage			Control wire tap on wire connectors	Control wire tap for front bus connector
	Suitable cables and busbars			Ring lug Plug connection	Ring lug Plug connection Bare cable
Cables and busbars	Cross-section specifications in AWG				
	Copper cable (number of cables x wire range)	Stranded	(Class C)	2 x 18 AWG ... 14 AWG	2 x 18 AWG ... 14 AWG
		Stranded	(Class B)	2 x 18 AWG ... 14 AWG	2 x 18 AWG ... 14 AWG
		Solid	(Class A)	2 x 18 AWG ... 14 AWG	2 x 18 AWG ... 14 AWG
	Stripped length of cable L			0.2 in ... 0.3 in	0.2 in ... 0.3 in
	Tightening torque	Stranded	(Class C)	4.4 lb-in	17.7 lb-in
		Stranded	(Class B)		
		Solid	(Class A)		
	Cross-section specifications in mm <sup>2</sup>				
	Copper cable (number of cables x wire range)	Finely stranded	(Class 5/6)	2 x 0.75 ... 2.5 mm <sup>2</sup>	2 x 0.75 ... 2.5 mm <sup>2</sup>
		Finely stranded with ferrule	(Class 5/6)	2 x 0.75 ... 2.5 mm <sup>2</sup>	2 x 0.75 ... 2.5 mm <sup>2</sup>
		Stranded	(Class 2)	-	-
		Solid	(Class 1)	2 x 0.75 ... 2.5 mm <sup>2</sup>	2 x 0.75 ... 2.5 mm <sup>2</sup>
Stripped length of cable L			5 ... 8 mm	5 ... 8 mm	
Tightening torque	Finely stranded	(Class 5/6)	0.5 Nm	2 Nm	
	Stranded	(Class 2)			
	Solid	(Class 1)			

#### Note

A maximum current limit of 15 A applies to all control wire taps for 3VA UL molded case circuit breakers. Control wire overcurrent protection must be applied separately. The control wire tap must be taken into account when configuring the molded case circuit breaker. Suitable cable cross-sections: Cables up to maximum AWG 14 / 2.5 mm<sup>2</sup> can be connected.

4.3 Connection system

All wire connectors can be ordered with control wire tap under a separate article number. The wire connector is then supplied with a hole for the control wire tap. A ring terminal can be applied using this hole and, in some cases, a spade plug-in connector. The required screw is supplied.



Control wire tap for front busbar connector

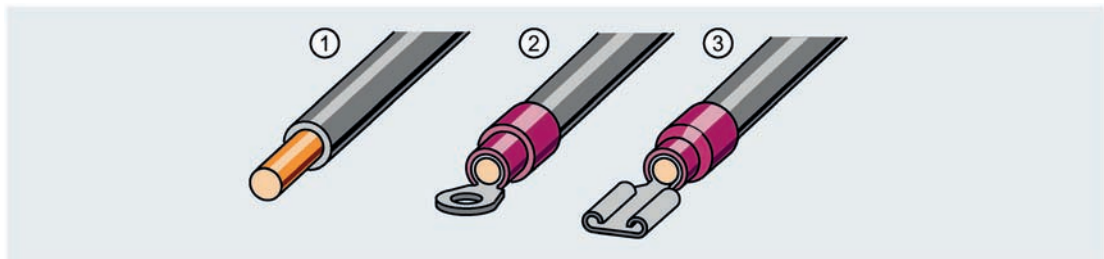


This control wire tap is installed on the 3VA UL molded case circuit breaker with the busbar to be installed.

It can also be installed using:

- Front bus connectors extended
- Front bus connectors offset

The following connections can be selected for the control wire tap:



- ① Bare conductor
- ② Ring connector

- ③ Spade connector

## 4.4 Plug-in and draw-out technology

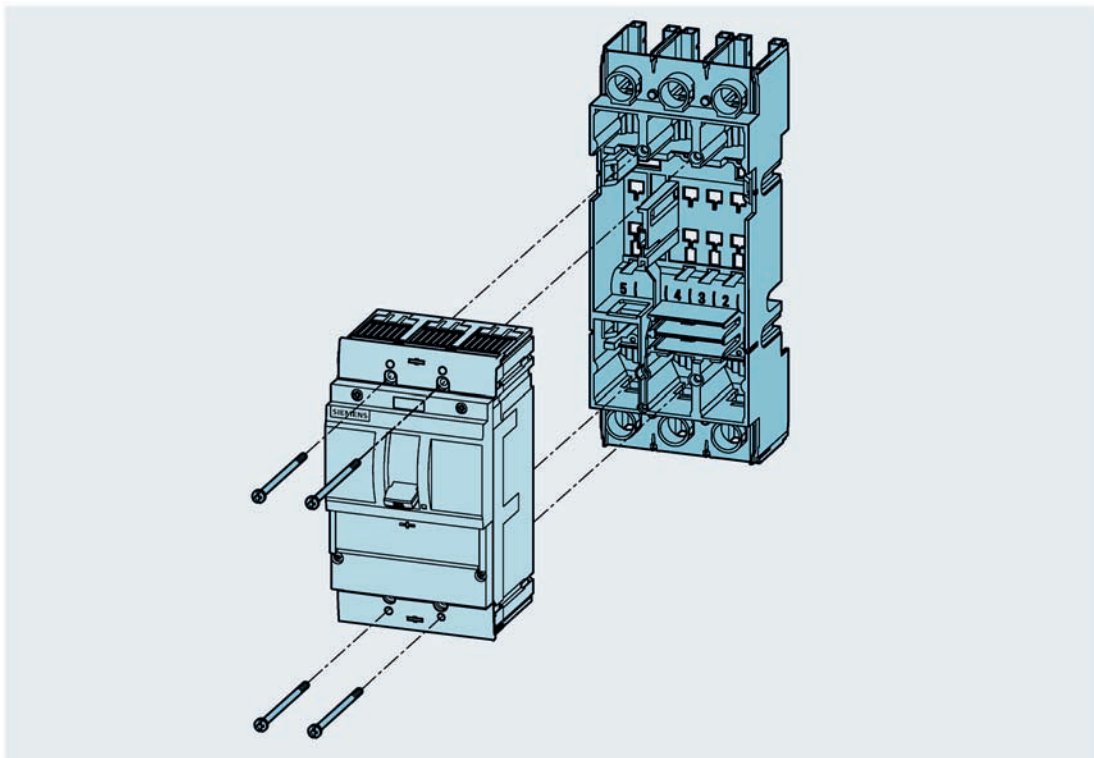
### 4.4.1 Introduction

In most applications, 3VA UL molded case circuit breakers are fixed-mounted in switchboards or distribution panels. The breaker is normally secured by mounting screws directly to the mounting plate or other suitable supports inside the panel. The cables or busbars of the main circuits are connected directly to the 3VA UL molded case circuit breaker with various terminals or connectors. The molded case circuit breaker thus has a fixed and rigid connection to the control panel.

For certain applications, such as for cyclic inspections or service, it must be possible to replace the 3VA UL molded case circuit breakers quickly. To meet this requirement, the molded case circuit breakers can be retrofitted for plug-in and draw-out technology.

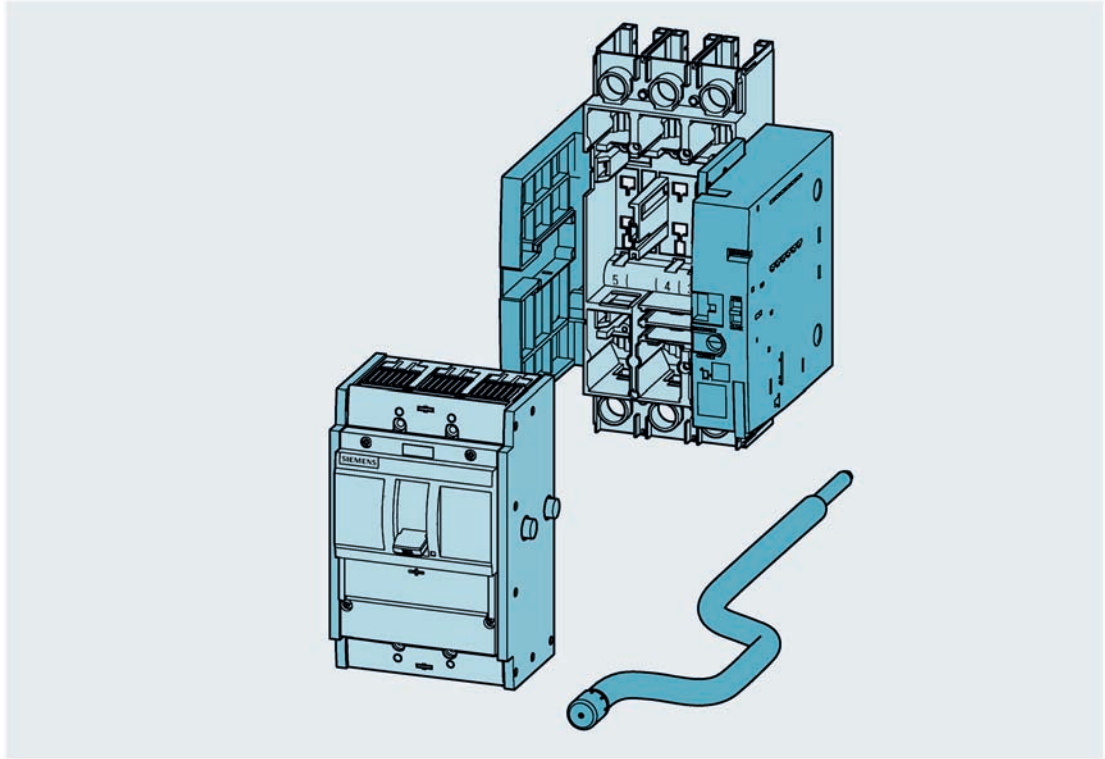
The main differences between plug-in units and draw-out units are convenience of operation and the potential for functional expansion.

#### Plug-in technology



Plug-in technology is the less expensive and more space-saving of the two solutions. Here, the molded case circuit breaker is inserted into the corresponding socket and equipped with plug-in contacts that establish a force- and form-fitted connection with the mating contacts in the plug-in socket – the tulip contacts. In this case, the device is plugged in and withdrawn manually.

### Draw-out technology



As with plug-in technology, with draw-out technology, the 3VA UL molded case circuit breaker is equipped with plug-in contacts for the main circuits. In addition, side walls including guide and retaining studs are screwed onto the side of the molded case circuit breakers.

In this case, the mating contacts are in the draw-out socket. This is also equipped with a guide mechanism via which the molded case circuit breaker is moved into the draw-out socket by means of a crank handle in order to connect the breaker to the main circuits. The operator can clearly read from a position indicator whether the breaker is properly connected to the main circuits or is 100% safely isolated from them (so that it can be withdrawn).

#### Cable connection

With plug-in and draw-out circuit breakers, the cables or busbars are connected to the plug-in socket or the draw-out socket. Here, the termination areas are implemented in the same way as for the molded case circuit breaker. That is, all the connection technology available for the 3VA UL molded case circuit breaker is also available in a similar way for the plug-in and draw-out sockets.



### Plug-in and draw-out technology for 3VA UL

The following describes the interplay of plug-in and draw-out technology and 3VA UL molded case circuit breakers. However, the 3VA UL molded case switch (MCS) and motor circuit protector (MCP) types can also be implemented with plug-in or draw-out technology. The information given below also applies analogously to these device types.

#### WARNING

##### Arcing hazard

Insertion and withdrawal of the 3VA UL molded case circuit breaker in switched-on state (circuit breaker position ON) leads to formation of arcs between contacts and can result in irreparable damage to the molded case circuit breaker and electrical installation as well as bodily injuries.

Install an auto-trip plunger in all 3VA UL molded case circuit breakers before inserting into a plug-in or draw-out base. Always turn the circuit breaker OFF before removing from a plug-in or draw-out base.

Note the color coding and labels for the autotrip plunger:

- Plug-in technology: Black, labeled "Plug-in"
- Draw-out technology: Grey, labeled "Draw-out"

The autotrip plunger cannot be removed from the circuit breaker after installation.

Before inserting or withdrawing the molded case circuit breaker into or from the socket, use the handle to switch it to the OFF position. In order to prevent operating errors, 3VA UL molded case circuit breakers are equipped with an autotrip plunger when they are converted to plug-in or draw-out technology. This plunger immediately trips the molded case circuit breaker (circuit breaker position TRIP) and thus opens the main contacts whenever an attempt is made to withdraw a switched-on molded case circuit breaker (circuit breaker position ON) or turn ON a breaker which is not properly engaged with a base.

### 4.4.2 Overview of variants / products

#### Installation overview

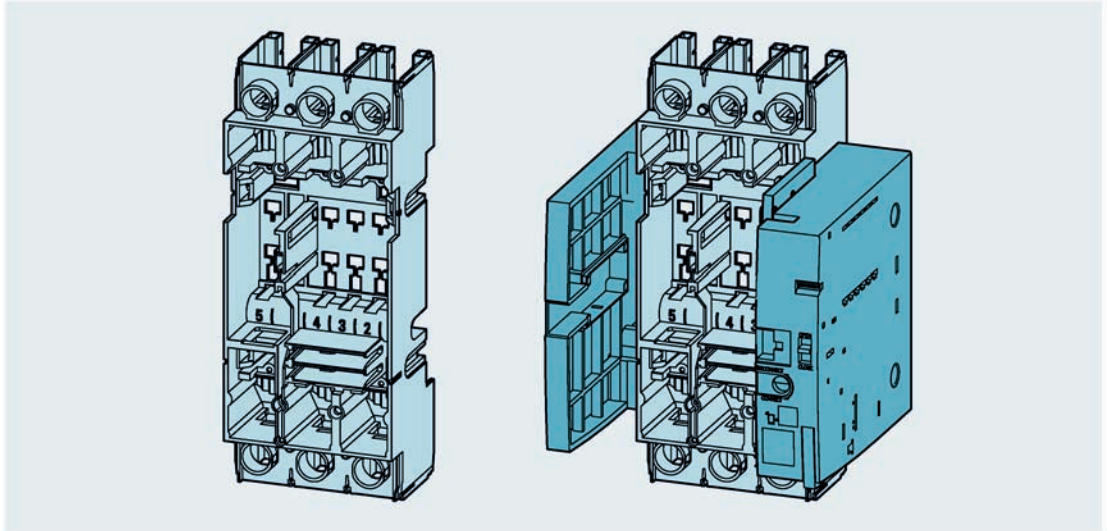
3-pole and 4-pole 3VA UL molded case circuit breaker versions are available for fixed mounting as well as for plug-in or draw-out technology according to the following table:

	Size	Fixed-mounted	Plug-in	Draw-out
3VA5	125 A, 1-pole	■		
	125 A, 3-pole	■		
	250 A, 2(3)-pole	■		
	250 A, 3-pole	■		
3VA6	150 A, 3-pole	■	■	■
	150 A, 4-pole	■	■	■
	250 A, 3-pole	■	■	■
	250 A, 4-pole	■	■	■
	400 A, 3-pole	■	■	■
	400 A, 4-pole	■	■	■
	600 A, 3-pole	■	■	■
	600 A, 4-pole	■	■	■

Besides the complete kit for plug-in or draw-out technology, a "conversion kit" for the 3VA UL molded case circuit breaker alone can be ordered. These conversion kits are used to prepare 3VA UL molded case circuit breakers so that completely assembled molded case circuit breakers are available at short notice if a replacement is required. They include all components that are installed on the molded case circuit breakers.

### 4.4.3 General information

With plug-in and draw-out circuit breakers, the cables or busbars are connected to the plug-in socket or the draw-out socket. The same socket unit is used for the same sizes of both variants.



The termination area of the incoming and outgoing side of the socket unit is implemented the same as the associated 3VA UL molded case circuit breakers. The major benefit of this is that all terminal and connection variants including terminal covers of the 3VA UL molded case circuit breaker can be used with the corresponding plug-in or draw-out unit without limitation.

Which connection technology is available for a 3VA UL size and which cable or busbar cross-sections can be used here is described in detail in chapter Connection system (Page 168).

#### 4.4.4 Information about installation, built-on and built-in components

##### Securing plug-in and draw-out units to the mounting plate

###### **Bolts supplied with complete kit**

Supplied with each complete kit for plug-in or draw-out technology:

- 4 fastening bolts, metric thread, Phillips pan head

The fastening bolts are used to attach the relevant socket unit to a mounting plate or supports. Fastening bolts with an inch thread are also available.

##### Mounting positions

The permissible mounting positions are described in Chapter Permissible mounting positions and mounting positions with accessories (Page 53).

##### See also

Connection system (Page 168)

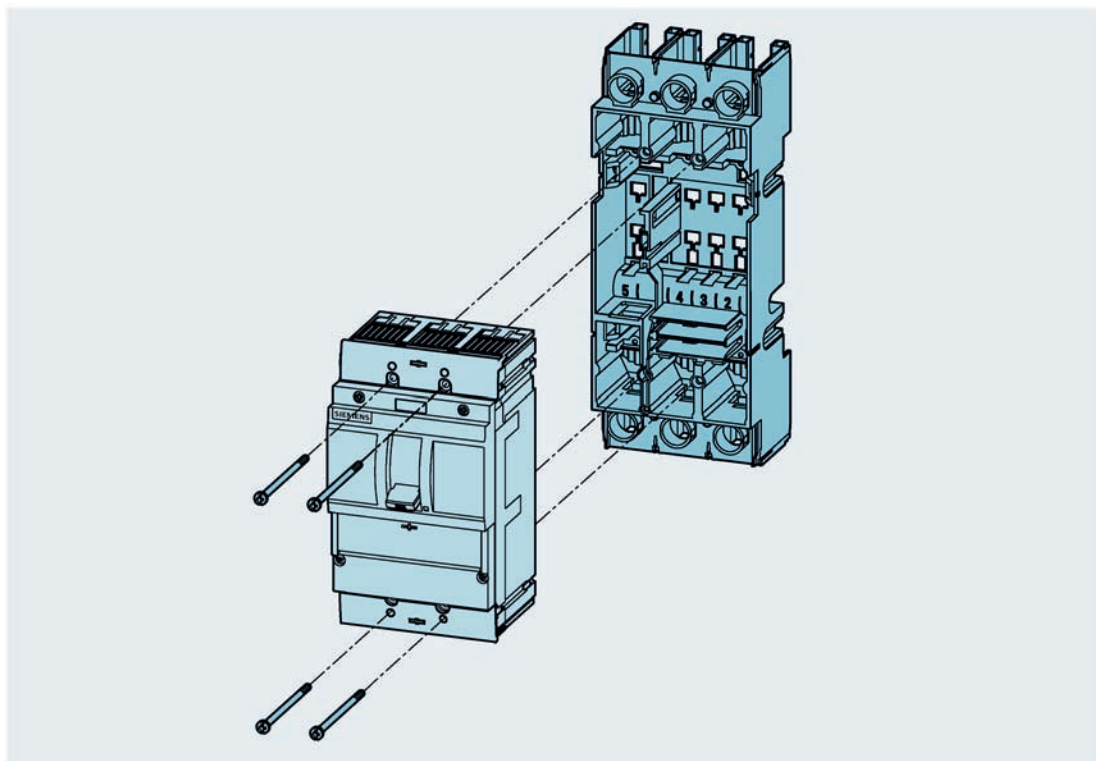
## 4.4.5 Plug-in technology

### 4.4.5.1 Product description

#### Applications

The plug-in units for the 3VA UL molded case circuit breakers are designed for complex applications in which fast replacement of the molded case circuit breaker is needed. Plug-in technology can be used, for example, when clear visual evidence of safe electrical isolation of circuits is essential, e.g. when inspection work is in progress.

#### Description



With a plug-in system, the molded case circuit breaker is moved into and out of the plug-in socket manually.

#### **⚠ WARNING**

##### **Projectile hazard.**

The molded case circuit breaker can be ejected from its socket by the resulting magnetic forces of a short-circuit event if not properly secured to its base.

Screw the 3VA UL molded case circuit breakers to the plug-in socket in inserted state. The complete kit for plug-in technology contains assembly screws for this purpose.

4.4 Plug-in and draw-out technology

A complete kit for plug-in technology contains all the components for conversion of a fixed-mounted molded case circuit breaker type to a plug-in technology type.

A complete kit for plug-in technology contains:

- Plug-in socket
- 4 mounting screws for installing the socket in the panel
- Mounting screws for fixing the molded case circuit breaker in the plug-in socket:
  - 3-pole version:  
2 mounting screws from the scope of delivery of the plug-in unit and  
2 mounting screws from the scope of delivery of the molded case circuit breaker
  - 4-pole version:  
No additional mounting screws in the scope of delivery of the plug-in unit  
4 mounting screws from the scope of delivery of the molded case circuit breaker
- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 plug-in contacts
- Autotrip plunger, labeled with "Plug-in"
- 2 screw-mounted terminal covers for the molded case circuit breaker
- Cable cages (see chapter Cable cage (Page 255))
- Size 3VA6 600 (3VA944.-0KP00) only: Bus connectors offset and corresponding terminal covers

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**Note**

The complete plug-in technology kits for circuit breaker sizes 3VA6 600 (3VA944.-0KP00) additionally come with bus connectors offset and corresponding terminal covers. For temperature reasons, molded case circuit breakers of size 3VA6 600 are installed and operated only with plug-in sockets with bus connectors offset.

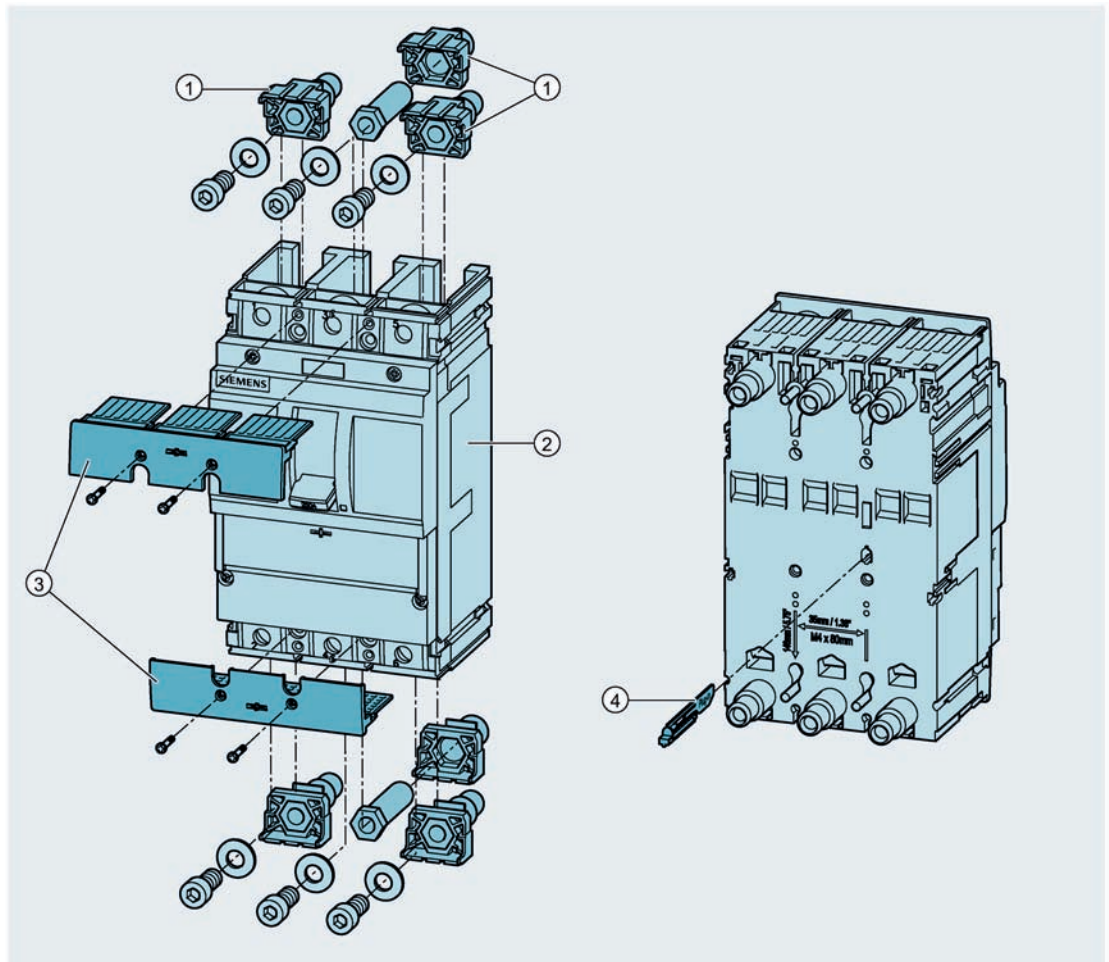
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A conversion kit for plug-in technology contains:

- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 plug-in contacts
- Autotrip plunger, labeled with "Plug-in"
- 2 screw-mounted terminal covers for the molded case circuit breaker
- Cable cages (see chapter Cable cage (Page 255))

Scope of delivery of the 3VA UL molded case circuit breaker, 3VA UL molded case switch (MCS) and motor circuit protector (MCP):

- For 3-pole version up to 250 A: 2 assembly bolts
- For 4-pole version 4 assembly bolts



- ① Plug-in contacts for attachment to the main terminals of the 3VA UL molded case circuit breaker
- ② 3VA UL molded case circuit breaker
- ③ Screw-mounted terminal covers for the molded case circuit breaker
- ④ Autotrip plunger

4.4 Plug-in and draw-out technology

**Terminal covers**


As described above, two screw-mounted terminal covers are included in the plug-in socket complete kit and the plug-in socket conversion kit. These feature molded grips to ease withdrawal of the molded case circuit breaker from its socket. Since more force is needed to remove a molded case circuit breaker from its socket, the plug-in technology terminal covers are screwed to the molded case circuit breaker.

If the terminal area of the plug-in socket needs to be protected by terminal covers, a variety of terminal covers are available to order as options for this purpose. The circuit breaker terminal covers and insulation materials can be used because direct mounting on the plug-in base is also possible.

**Autotrip plunger**

An autotrip plunger comes with every plug-in technology complete kit and every plug-in technology conversion kit for the 3VA UL molded case circuit breaker. The plunger performs safety functions in operation.

When a molded case circuit breaker is converted to a molded case circuit breaker for plug-in technology, this plunger is installed from the rear of the device and latched. The plunger performs safety functions in operation. It prevents the molded case circuit breaker from being switched to the ON position if the breaker is not correctly bolted to the socket. For further information, see also section "Signal 'Plug-in unit - MCCB correctly bolted to plug-in socket'" in chapter Position signaling switches (Page 244).

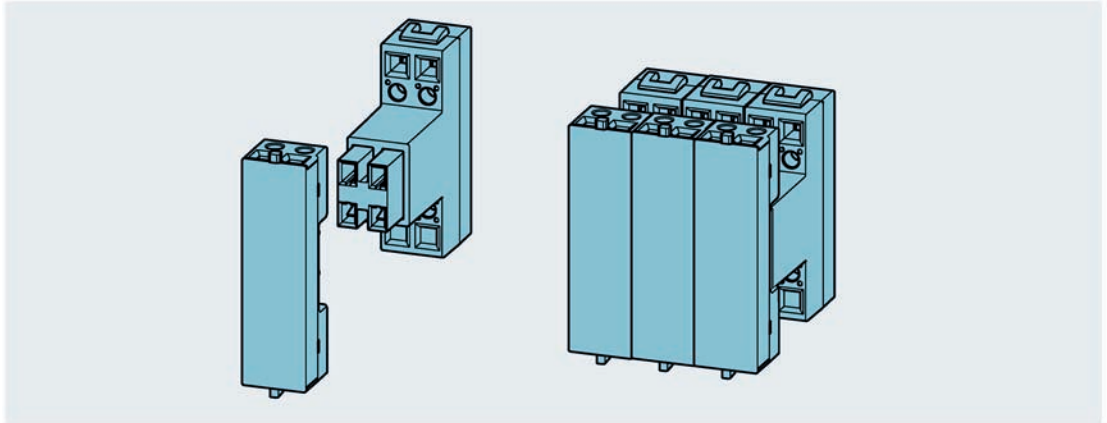
 <b>WARNING</b>
<b>Arcing hazard</b> Insertion and withdrawal of the 3VA UL molded case circuit breaker in switched-on state (circuit breaker position ON) leads to formation of arcs between contacts and can result in irreparable damage to the molded case circuit breaker and electrical installation as well as bodily injuries. Install an auto-trip plunger in all 3VA UL molded case circuit breakers before inserting into a plug-in or draw-out base. Always turn the circuit breaker OFF before removing from a plug-in or draw-out base. Note the color coding and labels for the autotrip plunger: <ul style="list-style-type: none"><li>• Plug-in technology: Black, labeled "Plug-in"</li><li>• Draw-out technology: Grey, labeled "Draw-out"</li></ul> The autotrip plunger cannot be removed from the circuit breaker after installation.



## Auxiliary circuit connectors

Molded case circuit breakers are frequently equipped with internal accessories, e.g. auxiliary switches, auxiliary releases, etc. A broad range of components is also available for the 3VA UL molded case circuit breaker. For further information, please refer to chapter Internal accessories (Page 152).

To ensure that the electrical connections required by plug-in units can be quickly and safely disconnected, auxiliary circuit connectors can be installed.



The part of the auxiliary circuit connectors on the circuit breaker side is mounted on the underside of the molded case circuit breaker using the cable cage and is electrically connected to the internal accessories. Appropriate openings and cable ducts are provided in the molded case circuit breaker for routing stranded wires. The plug-in socket half of the auxiliary circuit connector is inserted in the socket and electrically connected to the customer's installation.

When the molded case circuit breaker is inserted into the plug-in socket, the internal accessories in the breaker are quickly connected to the customer's installation without the use of tools.

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### Note

Plug-in and draw-out units use different versions of the auxiliary circuit connector. The draw-out version has a longer, movable telescopic rail because the distance to be bridged in the draw-out socket is longer.

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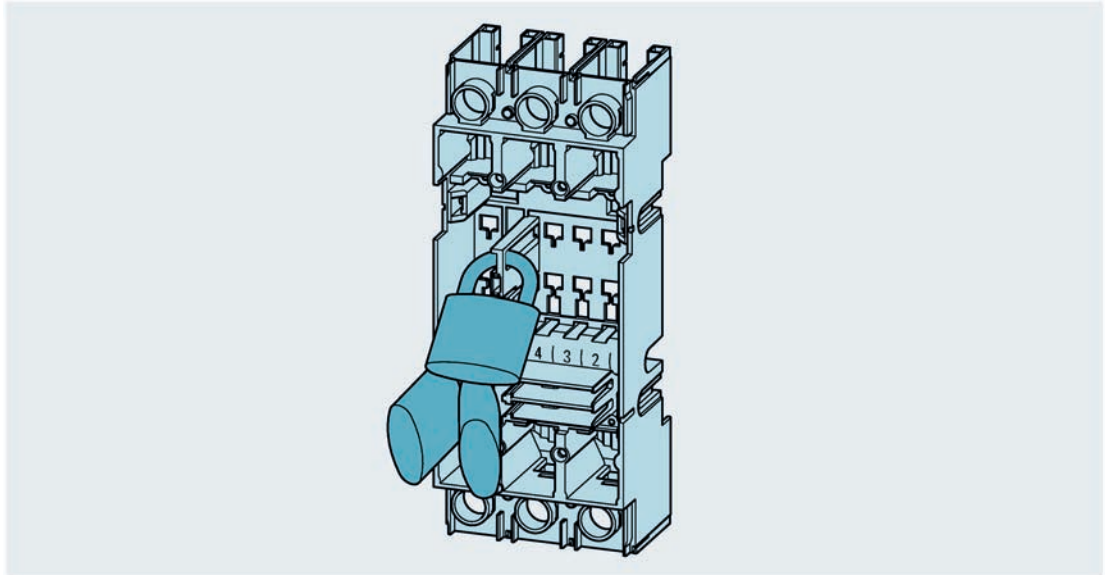
Further details about auxiliary circuit connectors can be found in chapter Auxiliary circuit connector (Page 250).

### Position signaling in the plug-in socket

Several position signaling switches (number depends on socket size) can be fitted in the plug-in socket. Auxiliary switches are capable of signaling "Plug-in unit - MCCB correctly bolted to plug-in socket" via electrical connections.

For further information, please refer to chapter Position signaling switches (Page 244).

### Padlocks for preventing insertion of a molded case circuit breaker



The socket unit can be locked with padlocks to prevent unauthorized insertion of a molded case circuit breaker during service calls and inspections. Using these locks to prevent insertion and operation of a molded case circuit breaker helps to protect personnel and the installation itself. The socket unit of the plug-in socket is equipped with three openings for padlocks.

Openings for padlocks:

- Up to 3 padlocks
- Shackle diameter 1/4" to 5/16" / 6 mm to 8 mm

### Benefits of plug-in technology

- Defective molded case circuit breakers can be replaced quickly and easily
- Clear visual evidence of safe electrical isolation of main circuits with removal of the circuit breaker
- Remote signaling of molded case circuit breaker positions:
  - "INSERTED": The 3VA UL molded case circuit breaker is properly inserted and screwed into place
  - "WITHDRAWN": Screws have been removed, the 3VA UL molded case circuit breaker has been removed
- Plug-in socket can be locked by padlocks to prevent insertion of a molded case circuit breaker
- IP20 degree of protection / this meets NFPA 79 "Protection against electric shock" requirements
- No grounding required

### See also

Locking and interlocking (Page 302)

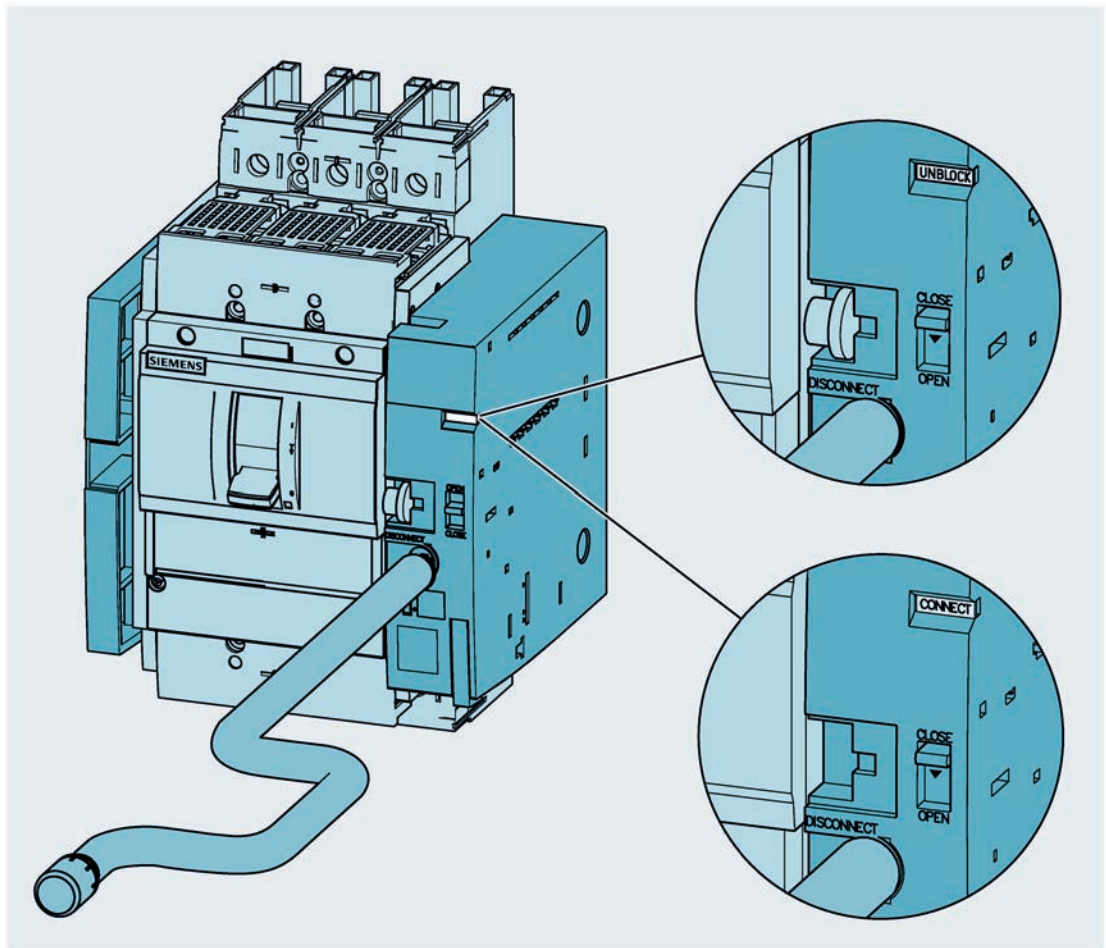
#### 4.4.5.2 Combination with other accessories

Accessory group	Component
Manual operators	Front mounted rotary operator
	Door mounted rotary operator
Remote operator	Motor operator MO320
Interlocks	Rear interlock module
	Bowden cable interlock for sliding bar
Sliding bar	

### 4.4.6 Draw-out technology

#### 4.4.6.1 Product description

Typical applications for draw-out units for the 3VA UL molded case circuit breaker range are installations in which inspections need to be carried out at regular intervals and a visible electrical isolation is required by removal of the circuit breaker, which must be implemented quickly. In addition, draw-out units for the 3VA UL molded case circuit breaker range are used when a very fast replacement of molded case circuit breakers or molded case switches is required.



In the case of draw-out technology, the 3VA UL molded case circuit breaker is mounted on the side walls and can be moved into three defined positions by turning the crank handle. The current breaker position is indicated by the breaker status indicator.

### Defined positions

- **CONNECT position:** The molded case circuit breaker is connected to the main circuits. The auxiliary circuits are also electrically connected to the installation via the auxiliary circuit connectors.  
This is the normal operating position of the molded case circuit breaker.
- **TEST position:** The main circuits are not connected to the installation. The auxiliary circuits are connected to the installation via auxiliary circuit connectors.  
The auxiliary circuits can be function-tested with the breaker in the TEST position even when the installation itself is not live.
- **DISCON position:** Neither the main circuits nor the auxiliary circuits are connected to the installation.  
The molded case circuit breaker is electrically isolated.

If the molded case circuit breaker is not in any of these defined positions, the breaker status indicator displays the word UNBLOCK on a white background. When the breaker is in this position, its main contacts cannot be closed if the autotrip plunger is correctly installed (see below).

### Move the molded case circuit breaker into a defined position

#### NOTICE

#### Irreparable damage to the racking mechanism when rotated in wrong direction

The following operations will lead to irreparable damage of the draw-out socket gear:

- Molded case circuit breaker is in DISCONNECT position:  
Insertion of the crank handle (position indicator changes to UNBLOCK) and counterclockwise turning of the crank handle toward DISCONNECT.
- Molded case circuit breaker is in CONNECT position:  
Insertion of the crank handle (position indicator changes to UNBLOCK) and clockwise turning of the crank handle toward CONNECT.

In the situations described above, pay attention **not** to turn the crank handle in the indicated direction.

#### Note

Once the circuit breaker has been moved into the position CONNECT, TEST or DISCON, the sliding clutch of the crank gear is disengaged and additional rotation of the crank handle has no effect.

By removing and reinserting the crank handle, it is possible to reengage the gear. The breaker status indicator will then show UNBLOCK. The molded case circuit breaker can now be moved to a new position.

1. If the crank handle is inserted in the crankcase, pull it out.
2. Insert the crank handle into the crankcase again.  
By removing and reinserting the crank handle, it is possible to reengage the gear.
3. Turn the crank handle until the breaker status indication shows the required position.

**Remove the molded case circuit breaker****NOTICE****Irreparable damage to the racking mechanism when rotated in wrong direction**

The following operations will lead to irreparable damage of the draw-out socket gear:

- Molded case circuit breaker is in DISCONNECT position:  
Insertion of the crank handle (position indicator changes to UNBLOCK) and counterclockwise turning of the crank handle toward DISCONNECT.
- Molded case circuit breaker is in CONNECT position:  
Insertion of the crank handle (position indicator changes to UNBLOCK) and clockwise turning of the crank handle toward CONNECT.

In the situations described above, pay attention **not** to turn the crank handle in the indicated direction.

1. Move the molded case circuit breaker into the DISCON position.  
The molded case circuit breaker is electrically isolated.
2. To disengage the lock, press the safety lock slide underneath the breaker status indication downwards as indicated by the arrow.
3. Remove the molded case circuit breaker.

**Components of a complete kit for draw-out technology**

A complete kit for draw-out technology contains all the components for conversion of a fixed-mounted molded case circuit breaker type to a draw-out technology type.

- Draw-out socket including side walls with the mechanical components required to guide the molded case circuit breaker into and out of the socket under the control of a crank handle
- 4 mounting screws for installing the socket in the panel
- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 plug-in contacts
- Side walls with guide bolts for mounting on the molded case circuit breaker
- Autotrip plunger, labeled with "Draw-out"
- 2 screw-mounted terminal covers for the molded case circuit breaker
- Cable cage (see chapter Cable cage (Page 255))
- Size 3VA6 600 (3VA944.-0KP00) only: Bus connectors offset and corresponding terminal covers

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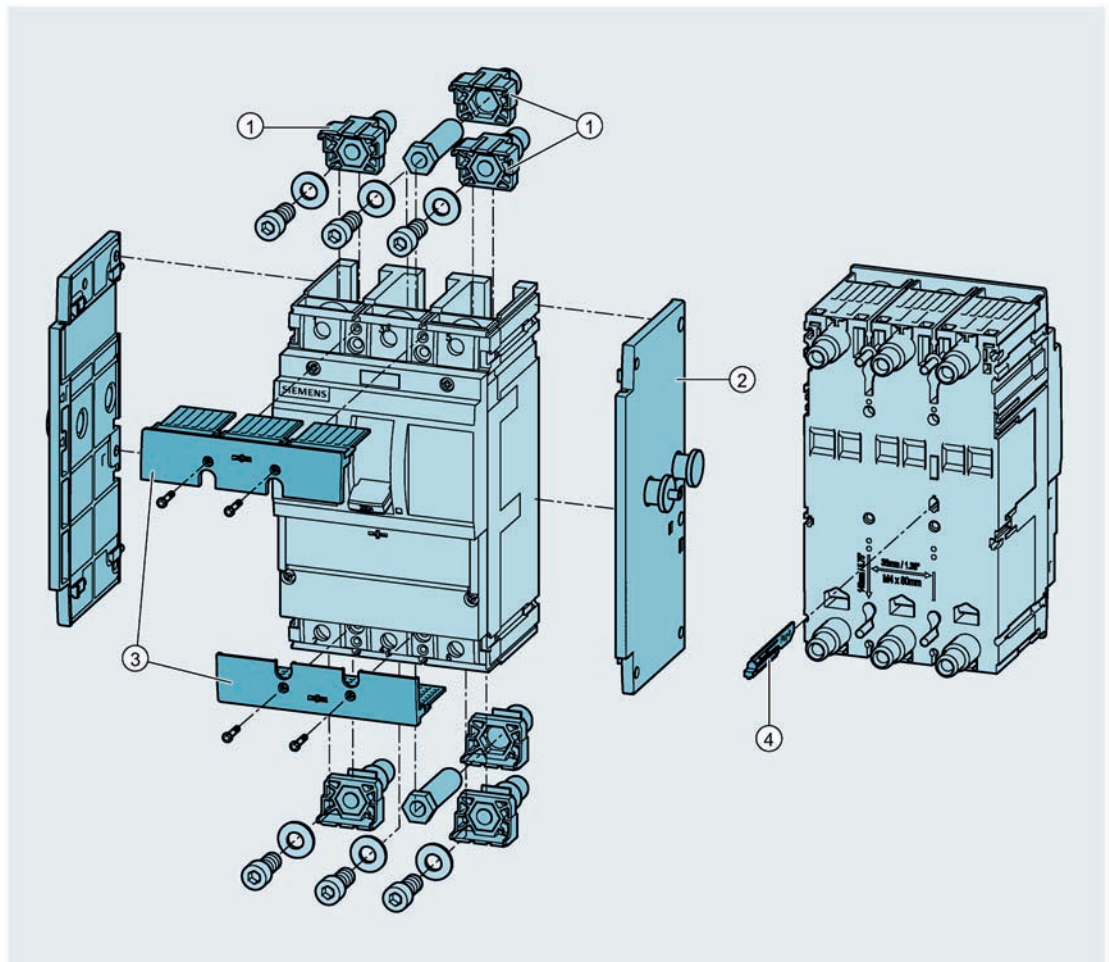
**Note****Information about the crank handle**

The crank handle is not supplied as part of the complete kit and must be ordered separately.

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### Components of a conversion kit for draw-out technology

- Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
  - 3-pole: 6 plug-in contacts
  - 4-pole: 8 plug-in contacts
- Side walls with guide bolts for mounting on the molded case circuit breaker
- Autotrip plunger, labeled with "Draw-out"
- 2 screw-mounted terminal covers for the molded case circuit breaker



- ① Plug-in contacts for attachment to the main terminals of the molded case circuit breaker
- ② Side walls with guide bolts for mounting on the molded case circuit breaker
- ③ Screw-mounted terminal covers for the molded case circuit breaker
- ④ Autotrip plunger

4.4 Plug-in and draw-out technology

**Installation instructions**

The draw-out socket is permanently mounted in the panel by means of the mounting screws included in the complete kit for draw-out technology.

The molded case circuit breaker / molded case switch comes with two assembly screws (3-pole version) or four assembly screws (4-pole version). These screws are not required if the device is to be converted to a draw-out unit.

**Note**


The draw-out technology complete kits for circuit breaker sizes 3VA6 600 (3VA944.-0KD00) additionally come with offset bus connectors extended and corresponding terminal covers extended and corresponding terminal covers. For temperature reasons, molded case circuit breakers of size 3VA6 600 are installed and operated only with draw-out sockets with offset bus connectors extended.

**Terminal cover**

Two terminal covers are included in the scope of supply of the complete kit for draw-out technology and the conversion kit for draw-out technology for the molded case circuit breaker. These two terminal covers are intended for the molded case circuit breaker. If terminal covers are to be attached to the busbars of the draw-out socket, they must be ordered separately, see chapter Insulating equipment (Page 203).

**Autotrip plunger**

An autotrip plunger is supplied as standard with every complete kit and every conversion kit for converting a molded case circuit breaker to draw-out technology.

 <b>WARNING</b>
<b>Arcing hazard</b> Insertion and withdrawal of the 3VA UL molded case circuit breaker in switched-on state (circuit breaker position ON) leads to formation of arcs between contacts and can result in irreparable damage to the molded case circuit breaker and electrical installation as well as bodily injuries. Install an auto-trip plunger in all 3VA UL molded case circuit breakers before inserting into a plug-in or draw-out base. Always turn the circuit breaker OFF before removing from a plug-in or draw-out base. Note the color coding and labels for the autotrip plunger: <ul style="list-style-type: none"><li>• Plug-in technology: Black, labeled "Plug-in"</li><li>• Draw-out technology: Grey, labeled "Draw-out"</li></ul> The autotrip plunger cannot be removed from the circuit breaker after installation.

When a molded case circuit breaker is converted to a molded case circuit breaker for draw-out technology, the autotrip plunger is installed from the rear of the device and latched.



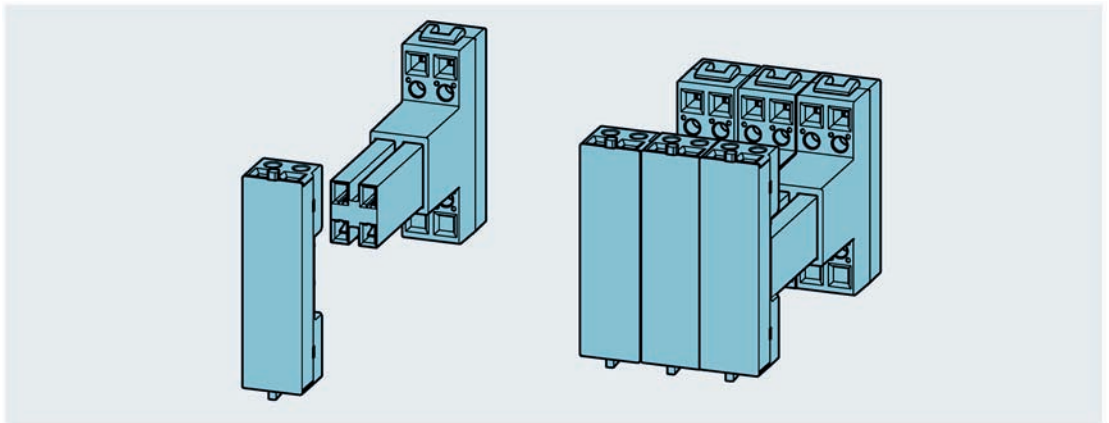
The plunger performs various safety functions in operation:

- It prevents closure of the main contacts of the molded case circuit breaker when the breaker is inserted in the draw-out socket and in an undefined position (breaker status indication is UNBLOCK).
- It allows the breaker to be closed in the defined positions TEST and CONNECT.
- It trips the molded case circuit breaker (TRIP) when the breaker's main contacts are closed (switching position ON) and an attempt is made to move the breaker out of one of the three defined positions CONNECT, TEST or DISCON using the crank handle.

### Auxiliary circuit connectors

Molded case circuit breakers are frequently equipped with internal accessories, e.g. auxiliary switches, auxiliary releases, etc. A broad range of components is also available for the 3VA UL molded case circuit breaker. For further information, please refer to chapter Internal accessories (Page 152).

To ensure that the electrical connections required by draw-out units can be quickly and safely disconnected, auxiliary circuit connectors can be installed.



The part of the auxiliary circuit connectors on the circuit breaker side is mounted on the underside of the molded case circuit breaker using the cable cage and is electrically connected to the internal accessories. Appropriate openings and cable ducts are provided in the 3VA UL molded case circuit breaker for routing stranded wires. The socket-end half of the auxiliary circuit connector with the movable telescopic rail is inserted in the socket and electrically connected to the customer's installation.

When the molded case circuit breaker is inserted into the draw-out unit, an electrical connection between the internal accessories in the breaker and the customer's installation is quickly established.

---

#### Note

**Plug-in and draw-out units use different versions of the auxiliary circuit connector.**

The draw-out version has a longer, movable telescopic rail because the distance to be bridged in the draw-out socket is longer.

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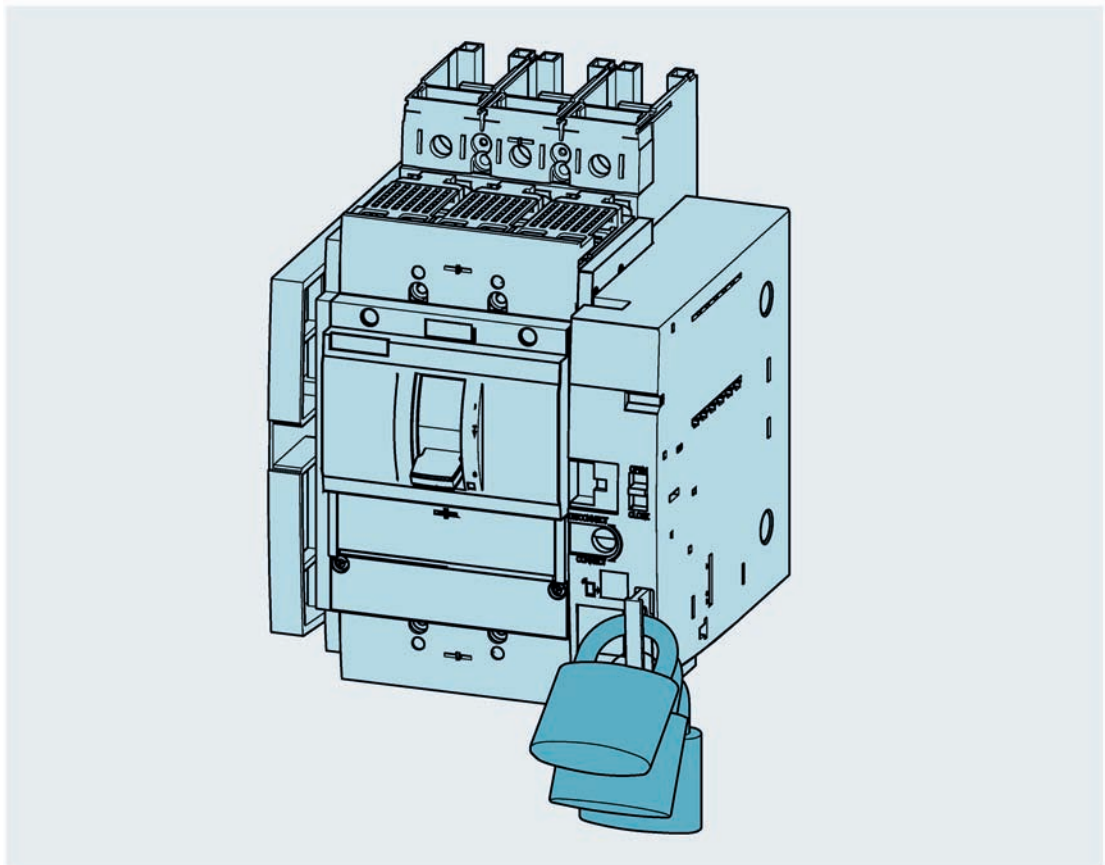
Further details about auxiliary circuit connectors can be found in chapter Auxiliary circuit connector (Page 250).

### Position signaling in the draw-out socket

Several position signaling switches can be inserted in the right side wall of the draw-out socket. These auxiliary switches are capable of signaling breaker positions DISCON, TEST and CONNECT. The auxiliary switches also output a position indication signal if the molded case circuit breaker in the draw-out socket is not in one of the positions specified above. For information, please refer to chapter Position signaling switches (Page 244).

### Protection against unauthorized operation of molded case circuit breaker

#### Padlocks for protection against unauthorized operation



To provide protection against unauthorized operation of the molded case circuit breaker, padlocks can be inserted through the plastic frame opening of the padlock locking unit on the right side wall of the draw-out socket. The plastic frame is simple to pull out. The crank handle opening is mechanically sealed when the plastic frame is in the OUT position.

Openings for padlocks:

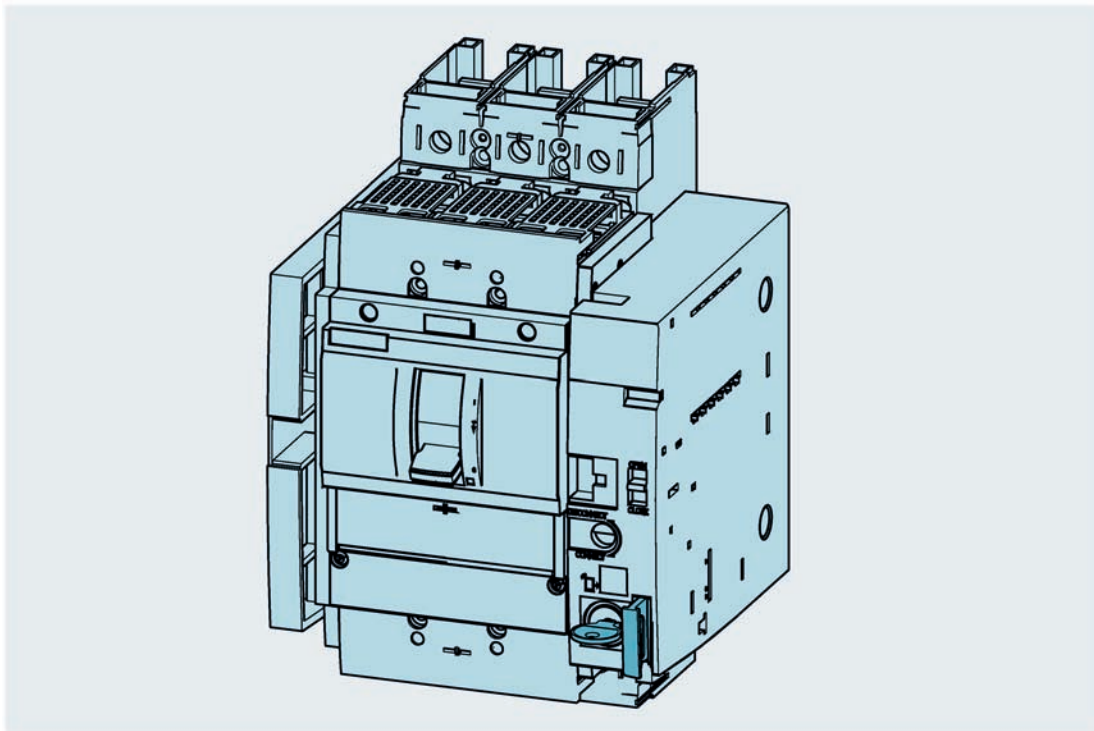
- Up to 3 padlocks
- Shackle diameter 1/4" to 5/16" / 6 mm to 8 mm

### Attaching padlocks

1. Move the molded case circuit breaker into the CONNECT, TEST or DISCON position.  
The breaker must be in one of these positions before the plastic frame can be pulled out.
2. Pull out the plastic frame.  
The crank handle opening is sealed off.
3. Insert padlock shackles through the plastic frame and lock padlocks as illustrated above.

### Cylinder lock for protection against unauthorized operation

A cylinder lock can be retrofitted in the right-hand side wall of the draw-out socket. Like with the padlocks, it can be used to lock a molded case circuit breaker in the CONNECT, TEST and DISCON positions. The cylinder lock utilizes the locking mechanism of the plastic frame. This is evident from the way the plastic frame moves into or out of the socket as the cylinder lock is turned.



### Signaling of locked/unlocked status

The locked or unlocked status of a draw-out unit can be signaled electrically. An additional position signaling switch (3VA9977-0KB00) is inserted in the right side wall of the draw-out socket for this. This switch signals whether the plastic frame described above is in the "IN" or "OUT" position. For further details, refer to chapter Position signaling switches (Page 244).

### Integration of molded case circuit breaker position signal into a communication network

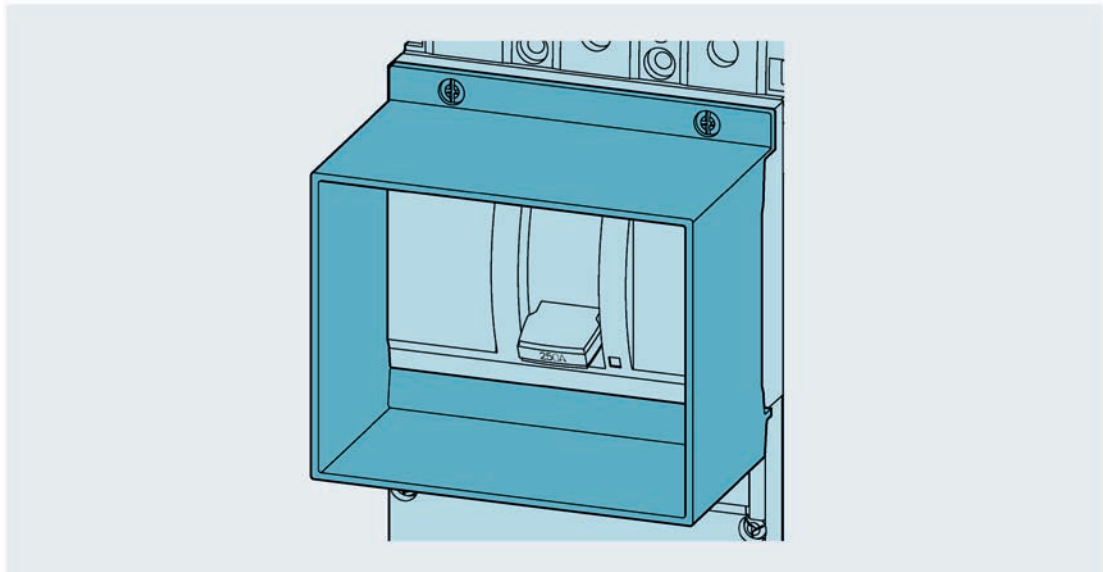
By means of the COM100 and COM800 breaker data servers, various statuses of multiple molded case circuit breakers can be queried and passed on by bus systems. This includes messages such as "Breaker tripped", "Breaker on", "Breaker off", reason for tripping, etc. Depending on the version of the 3VA UL molded case circuit breaker, actual current and voltage measurements can also be passed on. To provide this communications capability, the molded case circuit breaker itself is equipped with a COM060 communication module which functions as the breaker's actual communication link.

In addition to the status information listed above, the position of the molded case circuit breaker in the draw-out unit can also be transferred. For this purpose, the molded case circuit breaker and draw-out frame must be equipped with the "Communication link for draw-out unit" (3VA9977-0KC00). This kit allows the position of the molded case circuit breaker in the draw-out unit to be picked up and transferred to the COM060 communication module and from there to the higher-level communication network. For further information about the communication kit for draw-out units, please refer to chapter Communications interface for draw-out unit (Page 249).

### Operation through the panel door

The molded case circuit breaker can be optionally installed in the panel in such a way that the breaker can be operated even when the panel door is closed. Draw-out versions of molded case circuit breakers can then be switched on or off when the panel door is not open. This is made possible by a cutout in the panel door which allows access to the main control elements, i.e the handle and the <PUSH TO TRIP> button of the molded case circuit breaker, but prohibits access to other live components inside the panel. This solution is referred to as a "door feedthrough".

Door feedthroughs are mounted on the front of the molded case circuit breaker and securely attached to the breaker by means of two bolts and a latch.



The door cutout must be positioned such that it is flush with the door feedthrough. It must also be positioned in such a way as to minimize the size of the gap between the feedthrough

walls and the cutout. Optimum results are achieved here by additionally attaching a cover frame (Page 378).

An opening in the panel through which the crank handle can be inserted must be provided in addition to the cutout for the door feedthrough.

With its straight sides, the door feedthrough is designed to allow the molded case circuit breaker to be moved through positions DISCON, TEST and CONNECT, while at the same time providing a permanently tight seal around the feedthrough area (degree of protection IP30) and preventing access to live components inside the panel.

Markings are visible on the door feedthrough to help the user identify the current position of the molded case circuit breaker as it is moved into or out of the panel. Since mounting dimensions may vary slightly, however, these markings should be regarded as a rough guide only. The crank handle mechanism provides the user with feedback information about the molded case circuit breaker position, e.g. whether it has been correctly inserted.

### Benefits of draw-out technology

- Defective molded case circuit breakers can be replaced quickly and easily
- Clear visual evidence of safe electrical isolation of main circuits with the circuit breaker removed
- Molded case circuit breaker and accessories can be function-tested in the TEST position
- Remote signaling of molded case circuit breaker positions CONNECT, TEST and DISCON
- Padlocks and / or cylinder locks can be used to lock draw-out unit so that the molded case circuit breaker cannot be inserted or removed by unauthorized persons
- Molded case circuit breaker can be operated through the panel door
- IP20 degree of protection / this meets NFPA 79 "Protection against electric shock" requirements
- No grounding required

### See also

Locking and interlocking (Page 302)

#### 4.4.6.2 Combination with other accessories

Accessory group	Component
Manual operators	Front mounted rotary operator
	Door mounted rotary operator
Remote operator	Motor operator MO320
Interlocks	Rear interlock
	Bowden cable interlock for sliding bar
Sliding bar	

## 4.4.7 Accessories for plug-in and draw-out units

### 4.4.7.1 Description of individual product variants

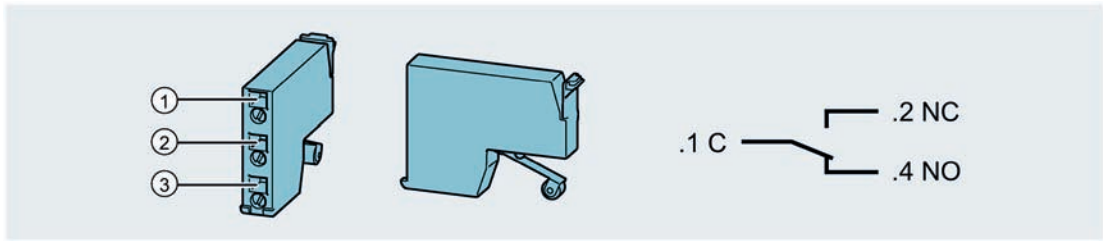
#### Position signaling switches

These auxiliary switches are capable of signaling a variety of states via electrical connections. The position signaling switch is available in only one version.

Applications:

- Signal "Position of breaker in the draw-out unit"
- Signal "Draw-out unit locked / open"
- Signal "Plug-in unit - MCCB correctly bolted to plug-in socket"

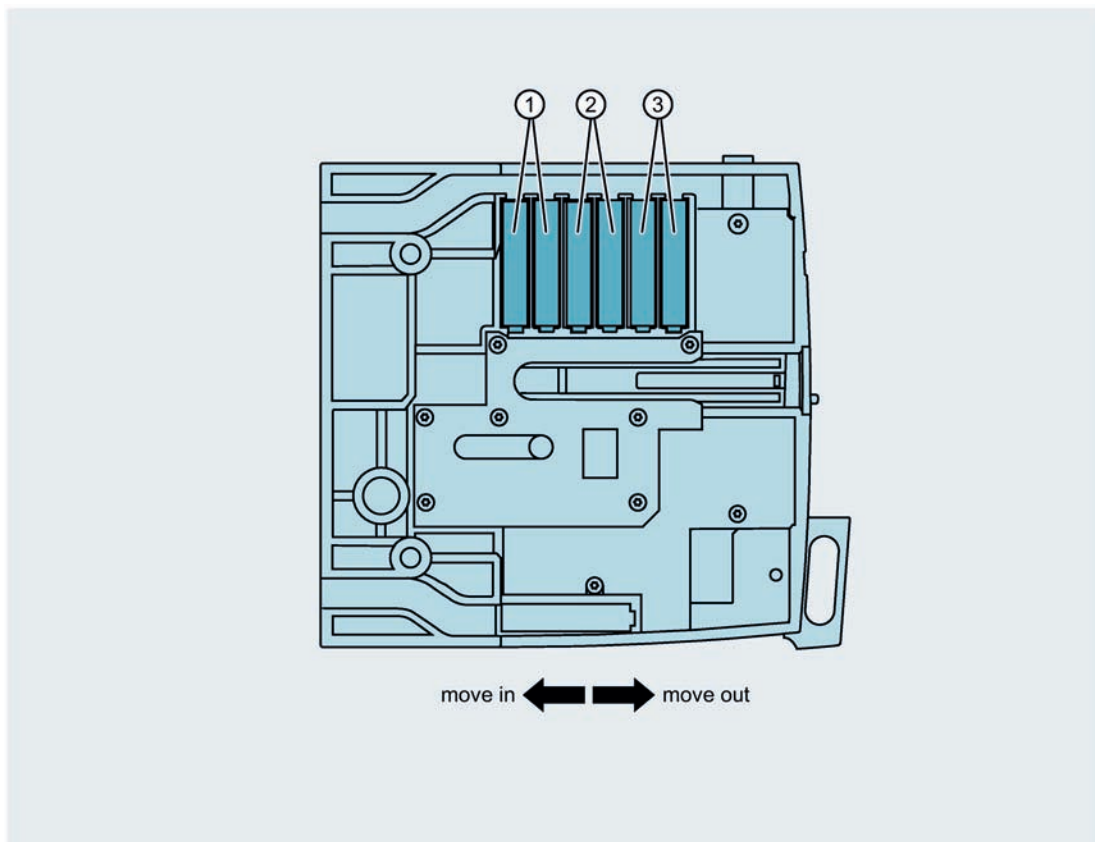
The position signaling switches are changeover switches, i.e. they have three connections:



- ① NO contact
- ② NC contact
- ③ Common potential contact

### Signal "Position of molded case circuit breaker in the draw-out unit"

So that the position of the molded case circuit breaker within the draw-out socket can be passed on electrically to the monitoring and control systems, up to six position signaling switches can be inserted in the right side wall of the draw-out unit at the following positions:



- ① Slot No. 41a or 41b: Detects position CONNECT
- ② Slot No. 42a or 42b: Detects position TEST
- ③ Slot No. 43a or 43b: Detects position DISCON

### Signal "Position of molded case circuit breaker in the draw-out unit"

It is irrelevant whether the position signaling switch is inserted in slot a or b. Only one position signaling switch per position is usually installed. The remaining free slots can be used for the signaling switches of the communication link kit. Alternatively, another position signaling switch can also be inserted, however.

If the molded case circuit breaker in the draw-out unit is moved into a defined position with the crank handle, the corresponding position signaling switch outputs a signal that can be further used electrically, such as for visual or acoustic alarm indications.

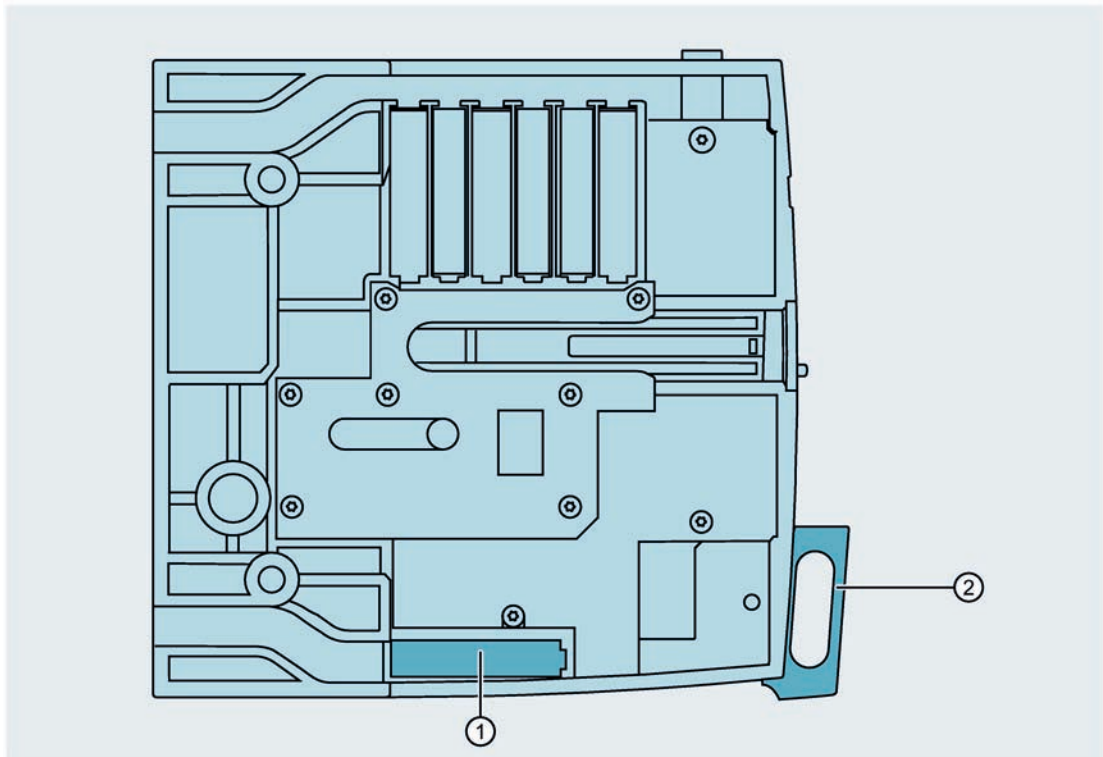
If the molded case circuit breaker is not in any of the defined positions, the breaker status indicator displays the word UNBLOCK on a white background. In this position, the molded case circuit breaker is either off (position OFF, contacts open) or tripped (position TRIP, contacts open). The breaker main contacts cannot be closed with the breaker in the UNBLOCK state.

4.4 Plug-in and draw-out technology

Depending on the position of the molded case circuit breaker in the draw-out unit, the outputs of the position signaling switches assume one of the following states:

Position signaling switch		Position of circuit breaker			
		DISCON	TEST	CONNECT	UNBLOCK
DISCON	NC	Open	Closed	Closed	Closed
	NO	Closed	Open	Open	Open
TEST	NC	Closed	Open	Closed	Closed
	NO	Open	Closed	Open	Open
CONNECT	NC	Closed	Closed	Open	Closed
	NO	Open	Open	Closed	Open

Signal "Draw-out unit locked / open"



- ① Slot for position signaling switch for signal "Draw-out unit locked / open"
- ② Plastic frame for padlock locking unit



**Signal "Draw-out unit locked / open"**

A position signaling switch to transmit this signal is installed in position 44 of the right-hand side wall of the draw-out unit.

A position signaling switch in position 44 outputs a signal which indicates whether the padlock locking unit is in the OUT position, thereby locking the draw-out unit.

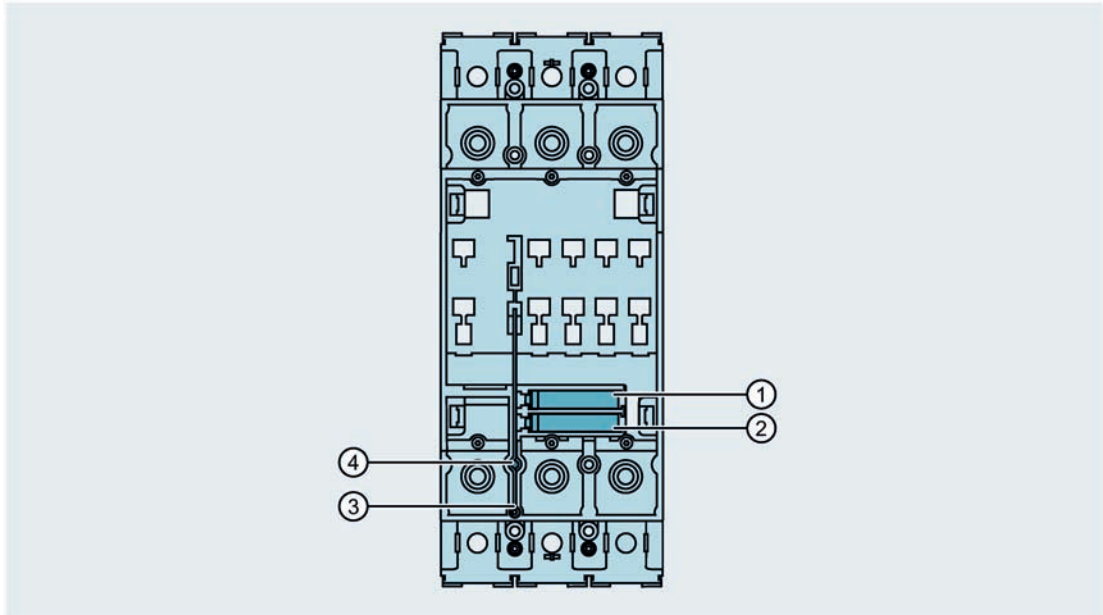
The draw-out unit can be locked in the defined breaker positions CONNECT, TEST and DISCON by padlocks or a cylinder lock (available as retrofit component). The position of the molded case circuit breaker cannot be changed when the draw-out is locked. In the locked state, the opening for the crank handle is mechanically sealed and the handle cannot be inserted.

To lock the unit using padlocks, the padlock locking unit on the draw-out unit must be pulled out manually so that the shackles of the padlocks can be inserted through the opening. When the draw-out unit is locked by the cylinder lock, the padlock locking unit moves out automatically as the cylinder lock is turned because it is mechanically coupled with the cylinder lock in the draw-out unit. The position of the padlock locking unit ultimately determines the position of the contacts of the position signaling switch.

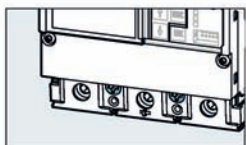
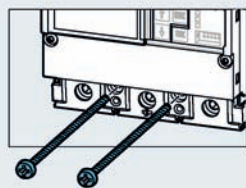
	NO	NC
	Closed	Open
	Open	Closed

**Signal "Plug-in unit - MCCB correctly bolted to plug-in socket"**

This option is provided for plug-in units only. Depending on the socket size, up to two position signaling switches can be installed in slot No. 46.



- ① Slot 46 for position signaling switch of the plug-in socket
- ② Slot 46 for position signaling switch of the plug-in socket
- ③ Mechanical system for actuation of position signaling switches when the bolt is tightened
- ④ Bolt hole which determines the signal output by the position signaling switches

	NO	NC
	Closed	Open
	Open	Closed

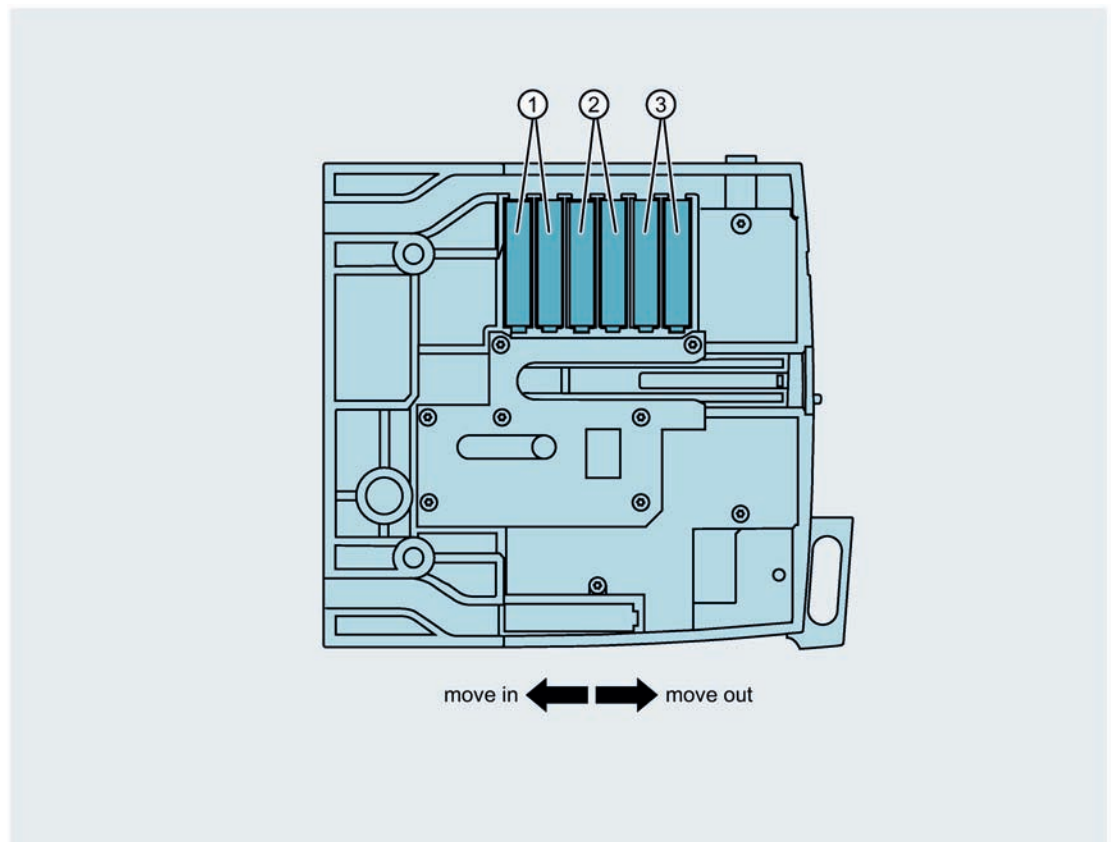
With this application, the position signaling switches indicate whether the molded case circuit breaker is inserted in the plug-in socket and secured by at least one screw. The reason for this application is that the molded case circuit breaker needs to be secured in position by mounting screws in the plug-in socket. All four mounting screws of the complete kit for draw-out technology must be used for this purpose.

## Communications interface for draw-out unit

The cable set for the communication link for the draw-out unit consists of a preassembled cable with a mini USB port at one end and three special position signaling switches at the other. It is also supplied with another cable with mini USB connector and tab connector.

### Attaching the cable set

1. Insert the 3 position signaling switches of the cable set in the right-hand side wall according to the color coding of the cables, see diagram below. It is irrelevant whether the switches are inserted in slots a or b.



- ① CONNECT: Position signaling switch with green cables
- ② TEST: Position signaling switch with blue cables
- ③ DISCON: Position signaling switch with red cables

The remaining slots are normally used to install standard position signaling switches.

2. Remove the seal over the opening for the micro USB port on the right-hand side wall.
3. Insert the USB connector attached to the cable set into the micro USB port in the right-hand side wall.
4. Store the cable in the space available behind the side wall.
5. Connect the position signaling switches and the COM060 communication module to the USB connector and tab connector of the second cable.

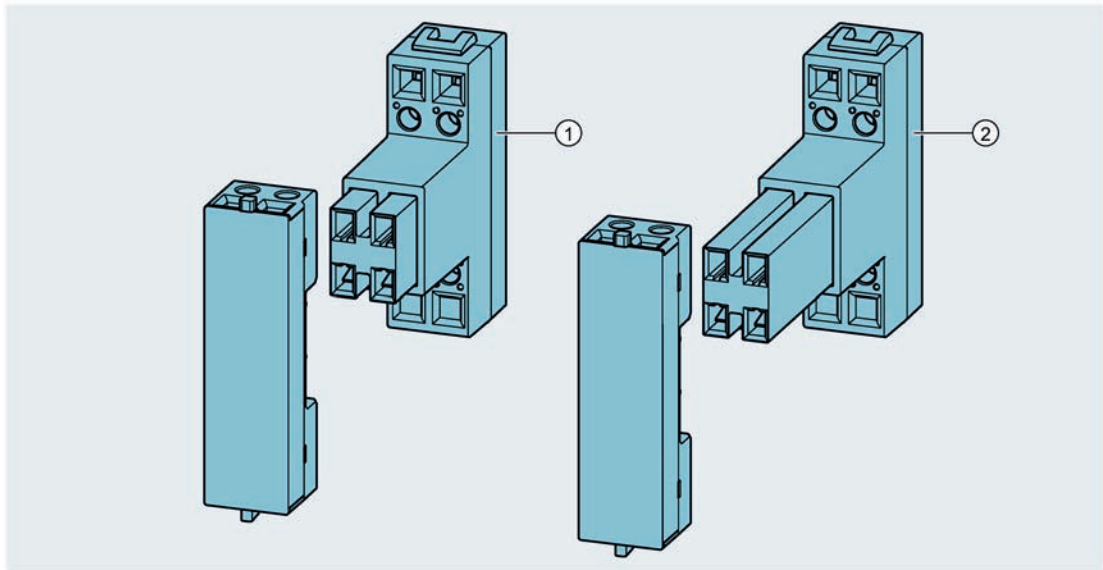
4.4 Plug-in and draw-out technology

The cable with pre-assembled USB and tab connectors can also be ordered as an individual item for installation on molded case circuit breakers prepared for use as draw-out units.

For detailed instructions on how to install the communication link for the draw-out unit, please refer to the relevant Operating Instructions (<https://support.industry.siemens.com/cs/ww/en/view/109741015>).

For instructions on how to read out data via remote data transfer, refer to the operating instructions for the COM100/COM800 breaker data server.

Auxiliary circuit connector

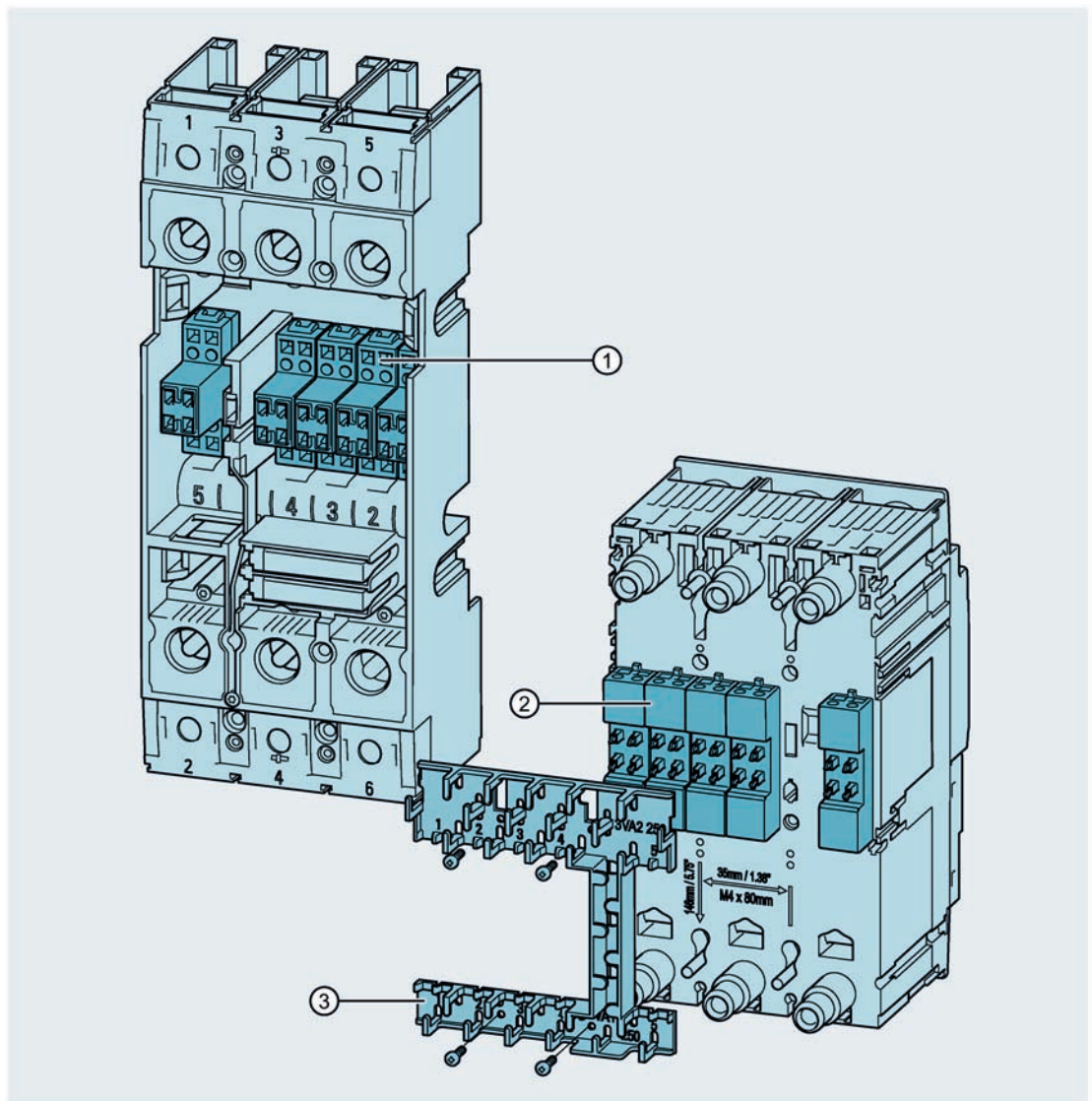


- ① Plug-in technology
- ② Draw-out technology

Auxiliary circuit connectors are required only if the molded case circuit breaker to be converted to plug-in or draw-out technology is equipped with internal accessories. Plug-in units use a different design of auxiliary circuit connector than draw-out units.

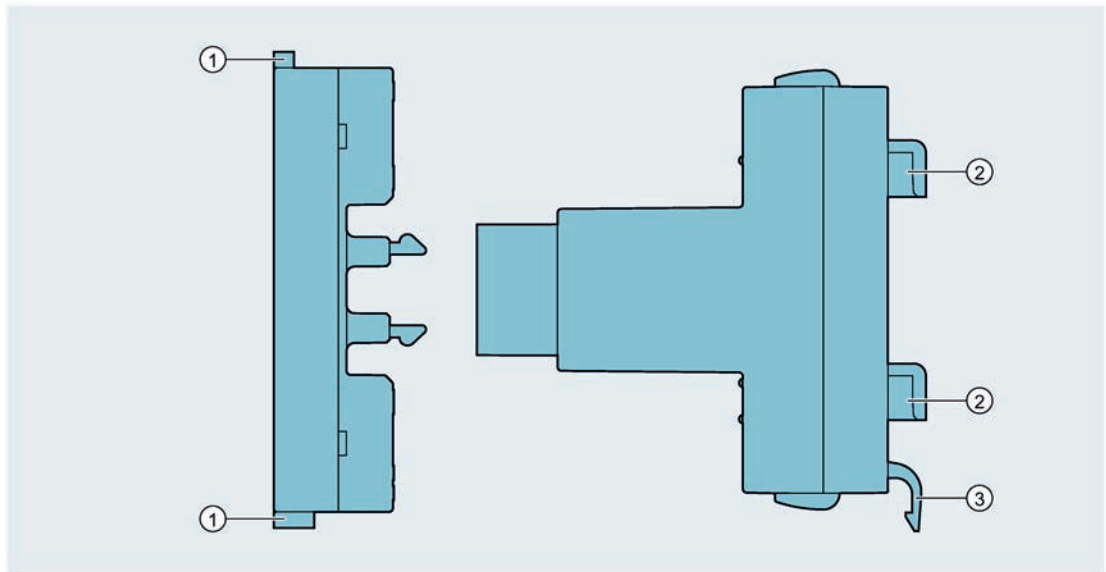
The number of auxiliary circuit connectors required depends on the accessories to be installed in the molded case circuit breaker and ultimately on the number of electrical connections which need to be brought out of the molded case circuit breaker. Each auxiliary circuit connector can be used to connect up to four cables. Accordingly, the breaker-end and socket-end halves of the auxiliary circuit connectors have four screw-type terminals which are labeled ".1" to ".4".

A total of nine auxiliary circuit connectors can be installed depending on the size of the molded case circuit breaker and the size of the plug-in or draw-out socket. The slots for auxiliary circuit connectors are labeled from right to left in the socket, starting at 1.



- ① Socket-end auxiliary circuit connector
- ② Breaker-end auxiliary circuit connector
- ③ Cable cage

Cable cages are used to attach the breaker-end half of the auxiliary circuit connector to the underside of the molded case circuit breaker. Slot numbers are also printed on the cable cages. The design of the cable cages for the top and bottom halves of the molded case circuit breaker is different so that the cages cannot be mixed up or installed in the wrong position. The positioning tongues of the breaker-end half of the auxiliary circuit connectors latch into small recesses in the cable cages which are screw-mounted to the rear panel of the circuit breaker. The auxiliary circuit connectors are securely fixed once the cable cages have been installed.



- ① Positioning tongue (breaker end)
- ② Positioning hook (socket end)
- ③ Latching element (socket end)

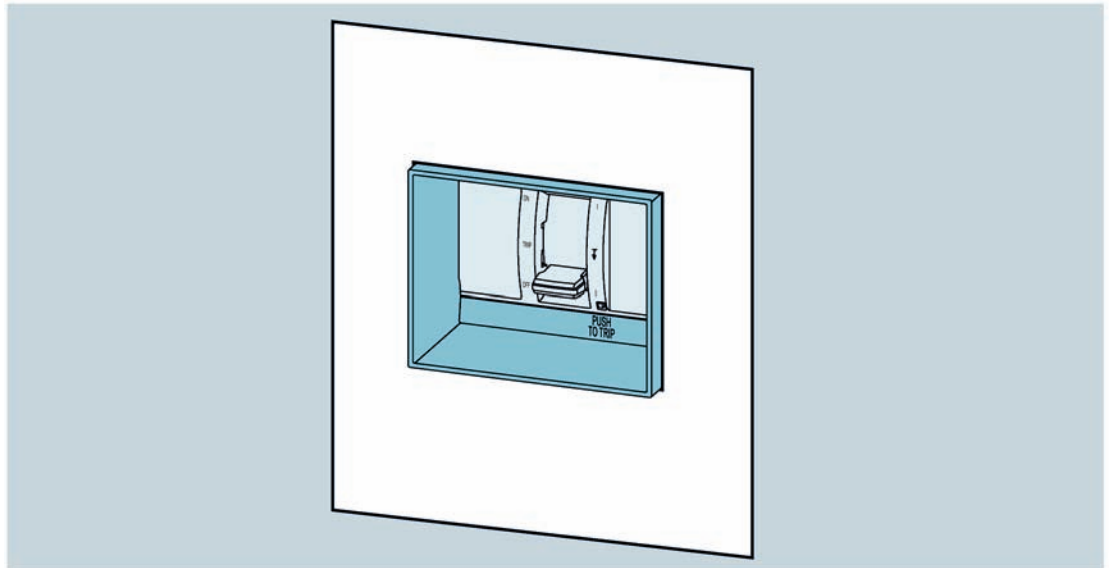
The socket-end half of the auxiliary circuit connectors is simply snapped into the socket.

Various cable routing openings and ducts are provided in the socket and the molded case circuit breaker. For further details, please refer to the operating instructions for the complete kits for plug-in or draw-out technology.

**See also**

Cable cage (Page 255)

## Door feedthrough

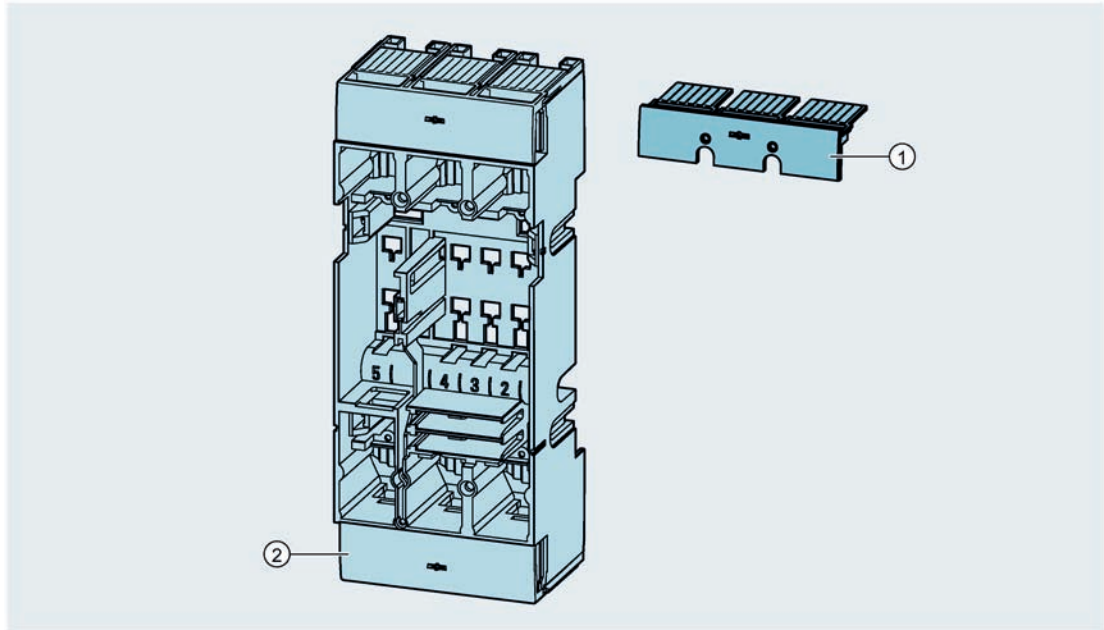


Door feedthroughs must be installed for applications which require

- direct operation of a molded case circuit breaker even when the panel door is closed,
- the draw-out version of a molded case circuit breaker to be electrically isolated from or connected to the installation while the panel door is closed,
- prevention of access to live components inside the panel.

Door feedthroughs are mounted over the front of the molded case circuit breaker and securely attached to the breaker by means of two bolts and a latch.

Terminal cover for a molded case circuit breaker converted to plug-in or draw-out technology



- ① Terminal cover with molded grips, can be screwed to contact unit
- ② Terminal cover for covering the terminal area

Two screw-mounted terminal covers ① are included in the scope of supply of the complete kits and the conversion kits for plug-in and draw-out technology. These feature molded grips to ease withdrawal of the molded case circuit breaker from its socket. Since it requires significant force to remove a molded case circuit breaker from its socket, the plug-in terminal covers are bolted to the contact unit.

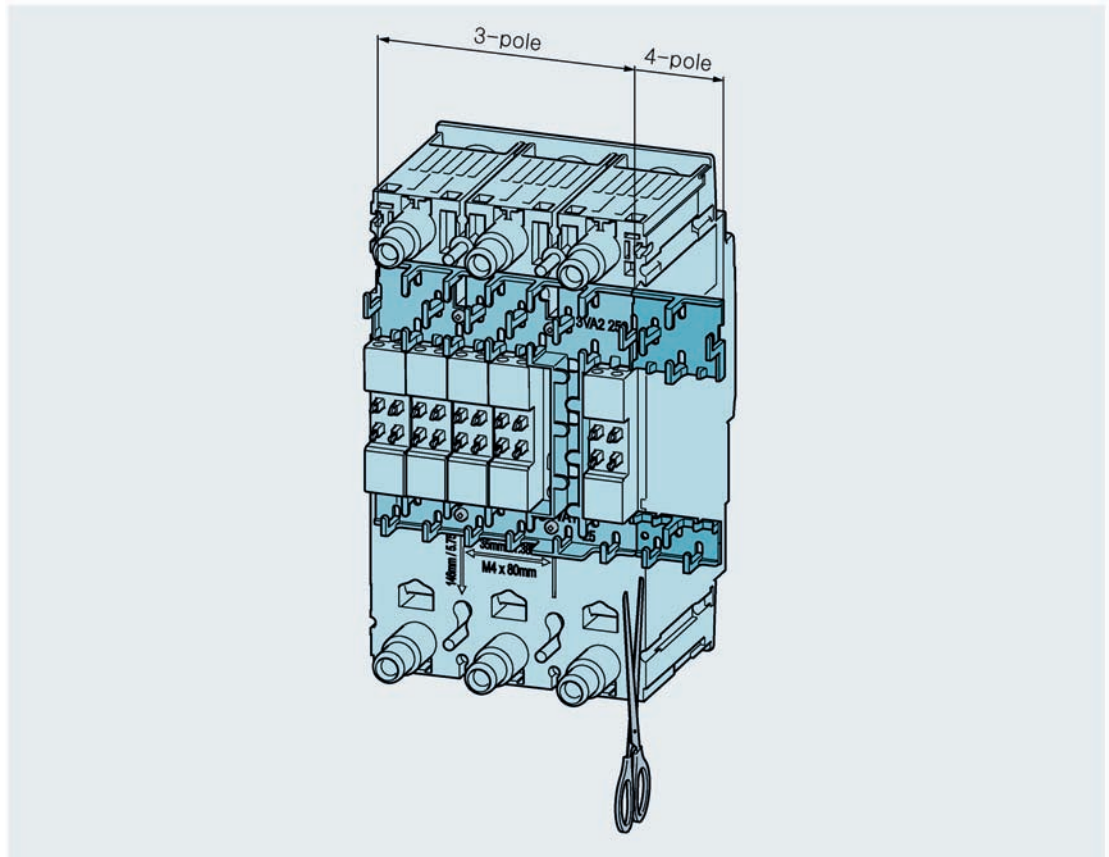
These terminal covers can be ordered separately as a spare part.

The additionally available terminal covers ② are used for the plug-in technology as well as the draw-out technology for covering the terminal area.



## Cable cage

Cable cages are used to attach the breaker-end half of auxiliary circuit connectors to the molded case circuit breaker. They are also designed to act as cable ducts for installing wires from internal accessories to the auxiliary circuit connector. For further information about cable cages, please refer to chapter Auxiliary circuit connector (Page 250).



Cable cages consist of a top half and a bottom half. These parts are designed such that they cannot be mounted in the wrong position at the rear of the molded case circuit breaker.

Cable cages are included in the scope of supply of the conversion kits and complete kits for converting molded case circuit breakers to plug-in or draw-out units and are therefore also supplied with complete kits. They are available as standard only in the offset version for 4-pole units. For use on 3-pole units, part of the cable cage need only be cut away (at the required breaking point).

## 4.4.7.2 Overview of technical specifications

Technical specifications of the accessories for internal components of molded case circuit breakers in plug-in and draw-out technology:

Position signaling switch			
Article No.			3VA9977-0KB00
Rated operating voltage $U_e$	V		AC 250
	V		AC 250
Rated insulation voltage $U_i$	V		AC 250
Rated frequency $f_n$	Hz		50 / 60
Rated operating current $I_e / U_e$	AC-13	12 V	A 6
		24 V	A 6
		48 V	A 6
		110 V	A 6
		230 V	A 6
	DC-15	12 V	A 6
		24 V	A 3
		48 V	A 1
		110 V	A 0.5
		230 V	A 0.25
Thermal current $I_{th}$	A		6
Contact switching			001
Conductor cross section S	mm <sup>2</sup>		0.5 ... 1.5
Degree of protection of terminals (when breaker is connected)			IP20 <sup>1)</sup>

1) This meets NFPA 79 "Protection against electric shock" requirements

Auxiliary circuit connector			
Article No.			3VA9977-0KP80
			3VA9977-0KD80
Rated operating voltage $U_e$	V		AC 250
	V		DC 250
Rated insulation voltage $U_i$	V		AC 500
Rated frequency $f_n$	Hz		50 / 60
Rated operating current $I_e / U_e$	AC-13		3 A / 400 V
	DC-15		0.15 A / 250 V; 3 A / 125 V
Thermal current $I_{th}$	A		10
Conductor cross section S	mm <sup>2</sup>		0.5 ... 1.5
Degree of protection of terminals (when breaker is connected)			IP20 <sup>1)</sup>

1) This meets NFPA 79 "Protection against electric shock" requirements

### 4.4.7.3 Combination with other accessories

- The communication link for the draw-out unit and the switches for signaling the position of the molded case circuit breaker in the draw-out unit are mutually compatible. For further information, please refer to the following chapters:  
Position signaling switches (Page 244)  
Communications interface for draw-out unit (Page 249)
- The switches for signaling whether or not the molded case circuit breaker is locked have no influence on other accessories described in chapter Position signaling switches (Page 244)

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#### Note

#### No transfer of "locked / not locked" signals

The information "locked / not locked" cannot be transferred via the COM060 communication module.

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- A molded case circuit breaker which requires a communication link to transfer signals must be equipped with a COM060 communication module.
- When internal accessories are integrated in a molded case circuit breaker, auxiliary circuit connectors and cable cages for plug-in and draw-out technology must also be installed.
- Door feedthroughs are required only if the molded case circuit breaker needs to be operated when the panel door is closed. The door feedthrough is compatible with position signaling switches, communication link and auxiliary circuit connectors with cable cages.
- The terminal cover for plug-in technology can be installed in combination with any other internal accessories. It does not have any effect on other accessories.
- A variable depth adapter (see section Door mounted rotary operator (Page 271)) can be used in conjunction with the door mounted rotary operator in order to compensate the racking distance and so allow the molded case circuit breaker to be moved out when the panel door is closed.

## 4.5 Manual operators

### 4.5.1 Introduction

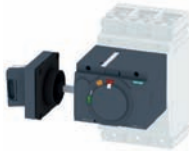
The manual operators for the 3VA UL molded case circuit breaker are described in this chapter.

#### Overview of manual operators



The following manual operators are available for the 3VA UL molded case circuit breaker:

- Front mounted rotary operator (optionally with door interlock and door open function)
  - Illumination kit
- Door mounted rotary operator
  - Fixing bracket for long shafts
  - Variable depth adapter for draw-out units
  - Supplementary handle for door mounted rotary operator
  - Illumination kit
- Side wall mounted rotary operator
  - Illumination kit
- Operator kit with Bowden cable (Max-Flex operator)
  - Auxiliary switches
  - Bowden cables



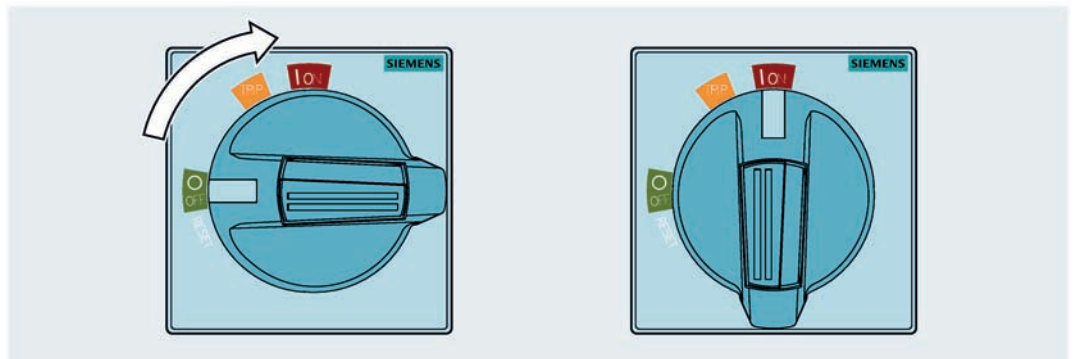
Padlock devices are available for all manual operators.

## 4.5.2 Operator control of the 3VA UL molded case circuit breakers with manual operators

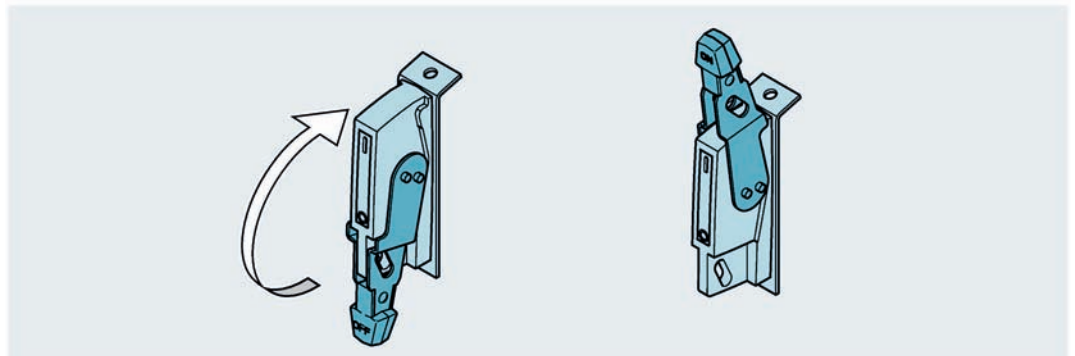
### Opening and closing

- To close the 3VA UL molded case circuit breaker:  
Turn the manual operator to the ON (I) position.

Front mounted rotary operator, door mounted rotary operator, side wall mounted rotary operator:



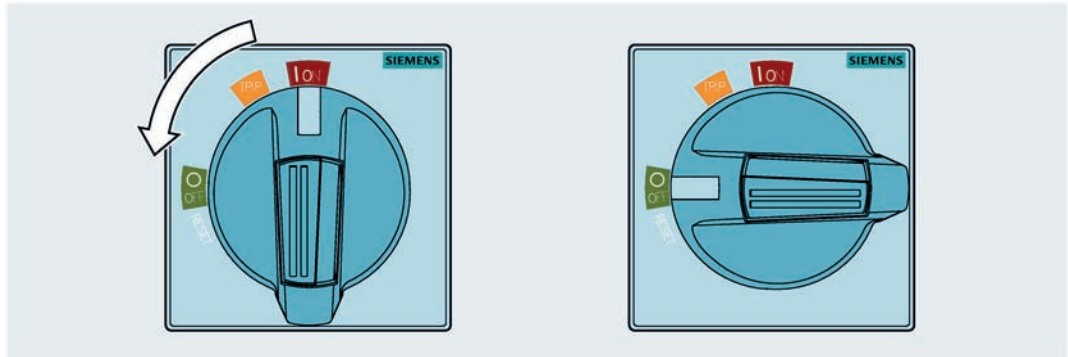
Handle of the operator kit with Bowden cable:



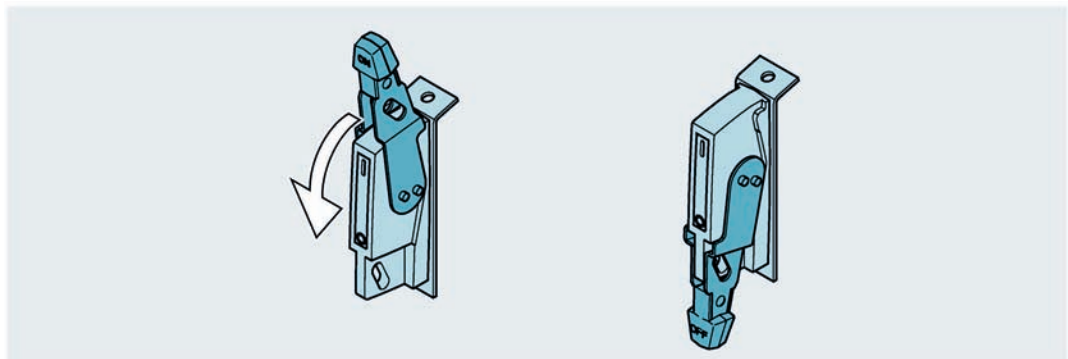
4.5 Manual operators

- To open the 3VA UL molded case circuit breaker:  
Turn the manual operator to the OFF (O) position.

Front mounted rotary operator, door mounted rotary operator, side wall mounted rotary operator:



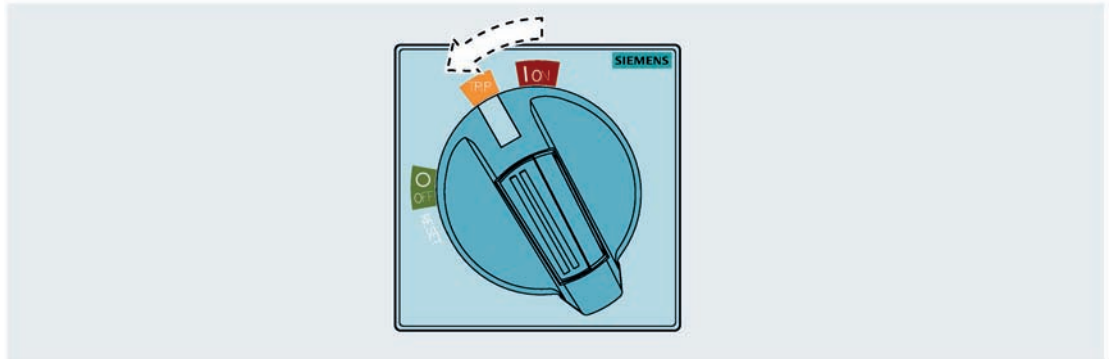
Handle of the operator kit with Bowden cable:



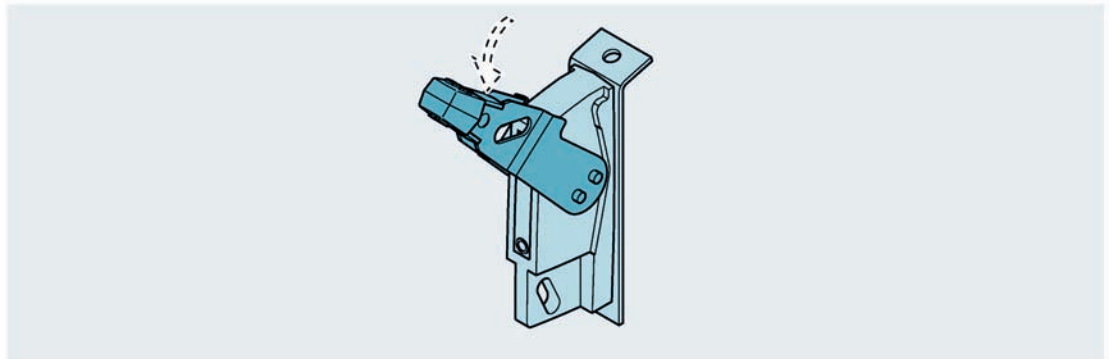
## Resetting the manual operator after the molded case circuit breaker has tripped

When the molded case circuit breaker trips, the manual operator moves automatically from the ON (I) to the TRIP position.

Front mounted rotary operator, door mounted rotary operator, side wall mounted rotary operator:



Handle of the operator kit with Bowden cable:

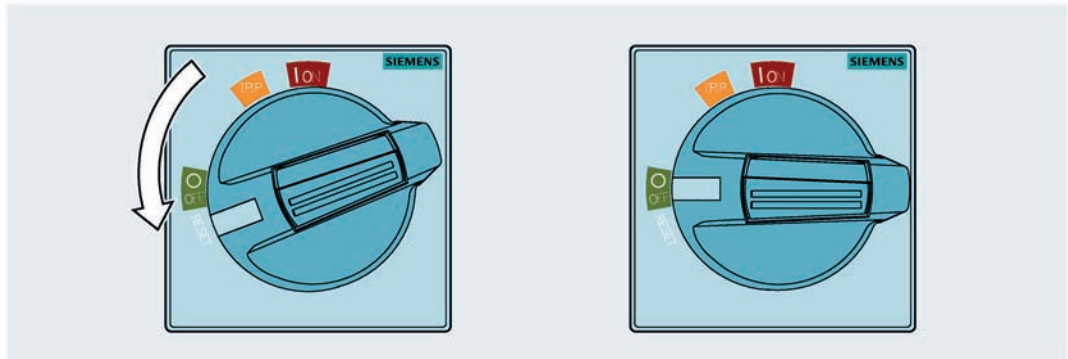


The molded case circuit breaker remains in the tripped state until the manual operator is reset:

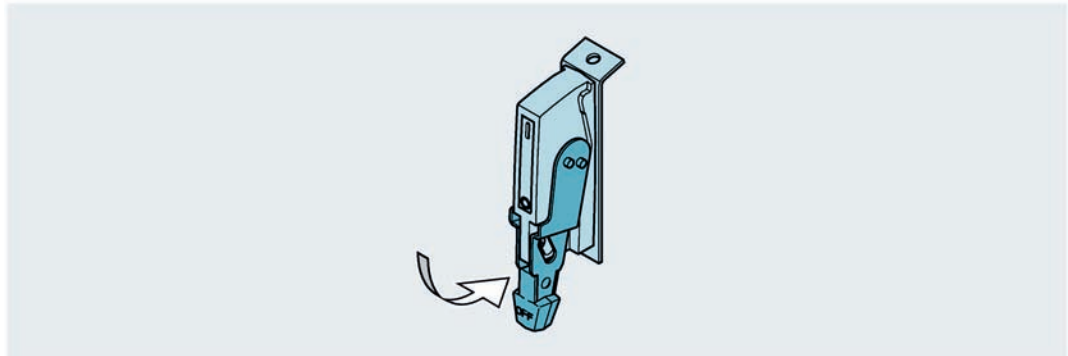
1. Clear the fault which has caused the molded case circuit breaker to trip.
2. Turn the manual operator counter-clockwise to the RESET position (just beyond OFF (O)).

Pull the Max-Flex operator downwards as far as it will go.  
The manual operator remains in the OFF (O) position.

Front mounted rotary operator, door mounted rotary operator, side wall mounted rotary operator:



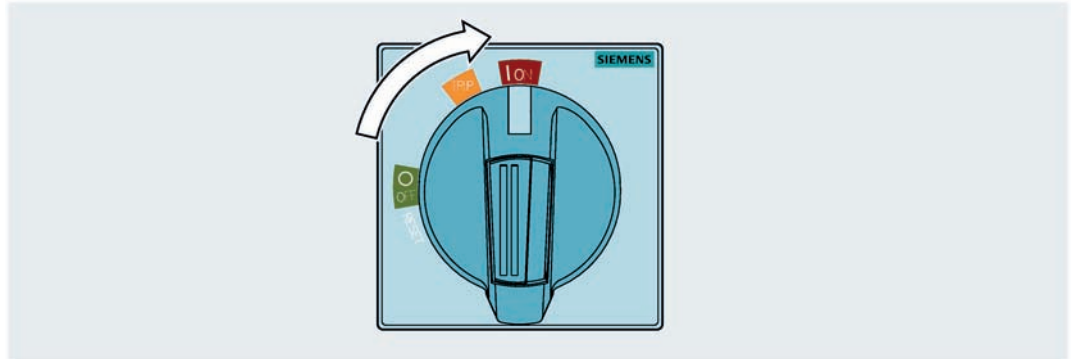
Handle of the operator kit with Bowden cable:



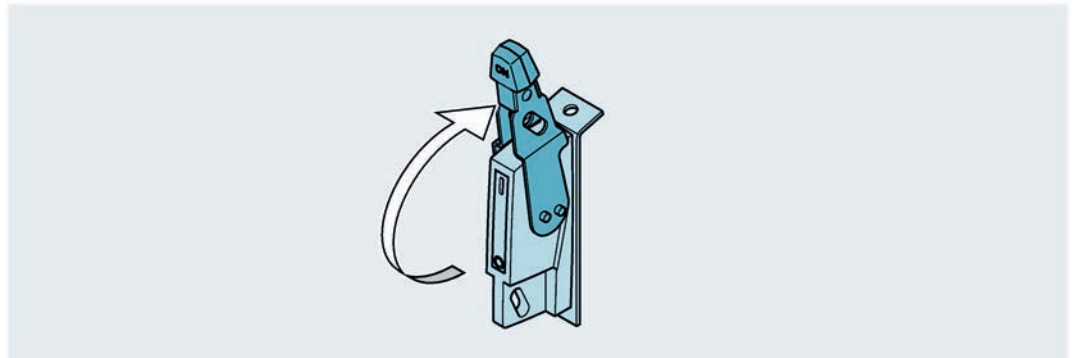


3. Turn the manual operator to the ON (I) position.

Front mounted rotary operator, door mounted rotary operator, side wall mounted rotary operator:



Handle of the operator kit with Bowden cable:



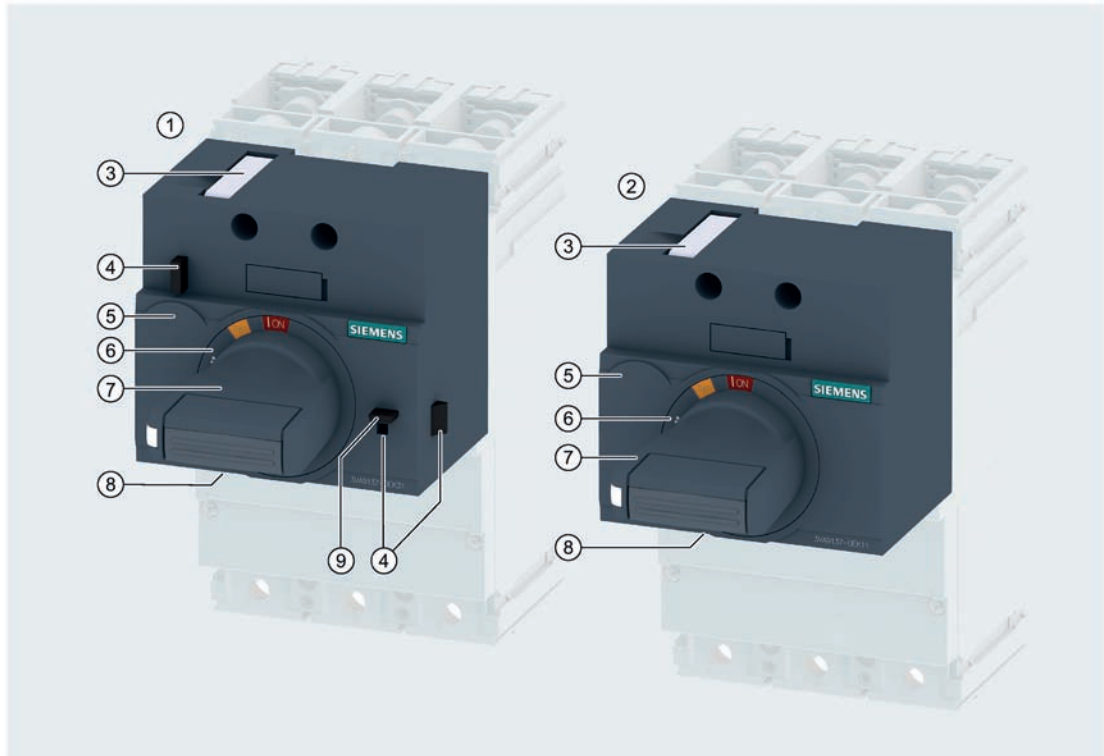
The molded case circuit breaker is closed again.

### 4.5.3 Front mounted rotary operator

#### 4.5.3.1 Elements of the front mounted rotary operator

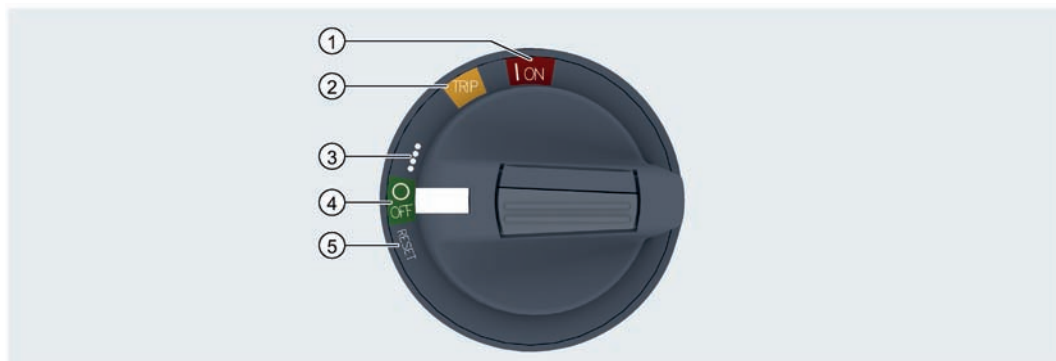
The front mounted rotary operator is available in two versions:

- With door interlock
- Without door interlock



- |  |   |
|--|---|
| <p>① Front mounted rotary operator with door interlock</p> <p>② Front mounted rotary operator without door interlock</p> <p>③ Locking mechanism for up to 3 padlocks</p> <p>④ Door interlocking elements (door position switch, defeat function, interlock)</p> <p>⑤ Position for a cylinder lock (optional)</p> | <p>⑥ Indication of the breaker status (on, off, trip) (see below)</p> <p>⑦ Handle with mechanism for up to 3 padlocks</p> <p>⑧ Manual trip button &lt;PUSH TO TRIP&gt;</p> <p>⑨ Door open function (optional)</p> |
|--|---|

### Indication of the breaker status on front mounted rotary operator



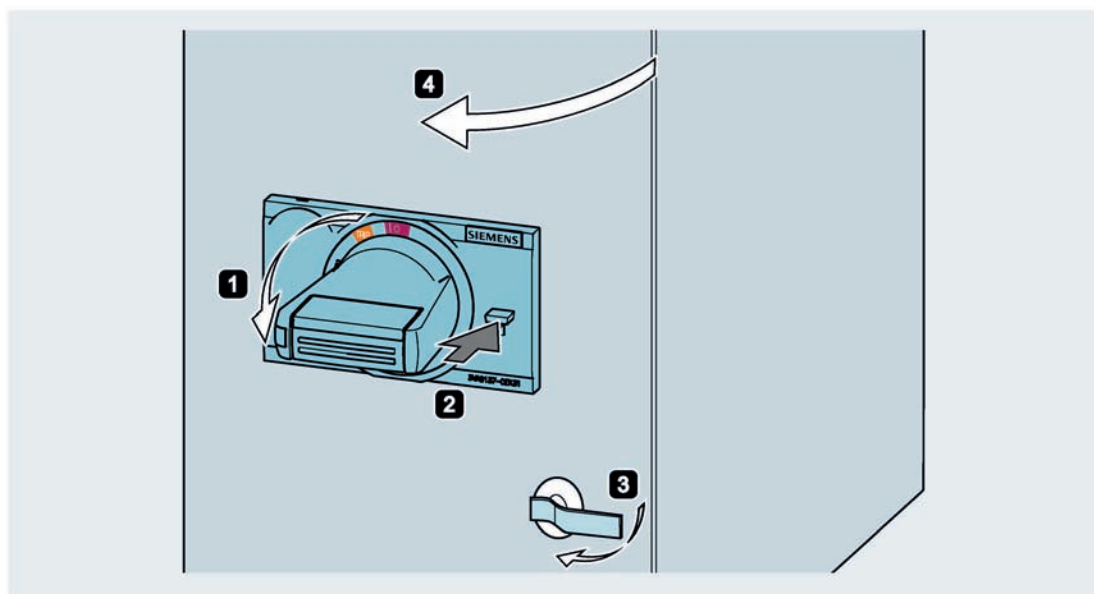
- |                         |                                 |
|-------------------------|---------------------------------|
| ① ON: Breaker closed    | ④ OFF: Breaker open             |
| ② TRIP: Breaker tripped | ⑤ RESET: Reset following a trip |
| ③ Mounting position     |                                 |

#### 4.5.3.2 Front mounted rotary operator with door interlock

The front mounted rotary operator with door interlock projects through the panel door. This arrangement ensures that the molded case circuit breaker can be switched on only when the panel door is closed. The door is locked automatically when the front mounted rotary operator is turned to position ON (I).

For front mounted rotary operators with door open function, this function must be additionally operated in order to open the door in position OFF (0).

#### Opening panel door with door open function.

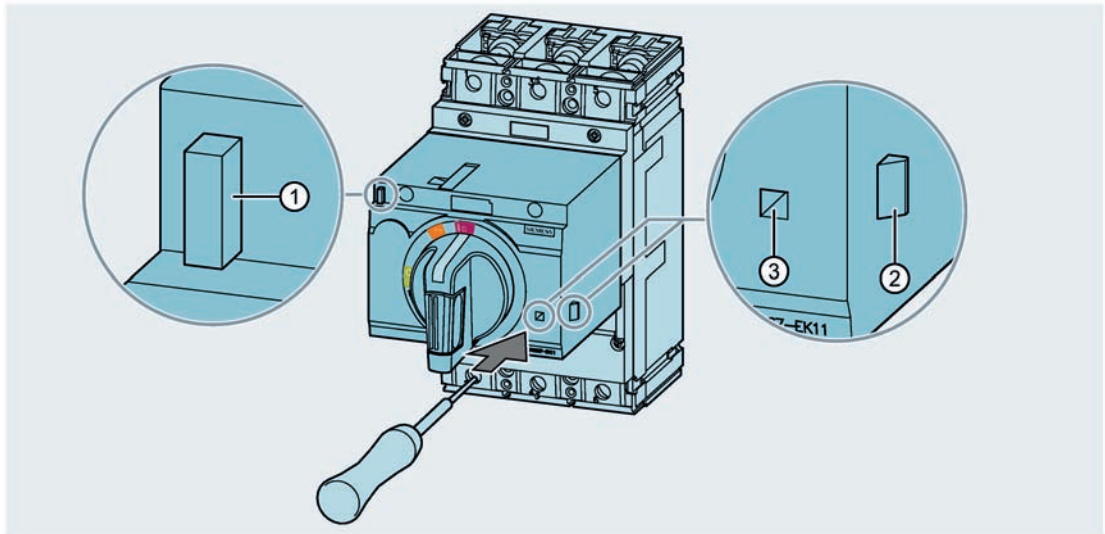


**Procedure**

1. Turn the front mounted rotary operator to position OFF (0) in order to open the molded case circuit breaker.
2. Press the button of the door open function
3. Actuate the NC contact of the panel door and open the panel door.

**Overriding the door interlock**

The door interlock can be overridden by a deliberate action. This means that the door can be opened with the operator in position ON (I) so that maintenance can be carried out, for example.



- 1) Door position switch
- 2) Door interlock
- 3) Defeat function

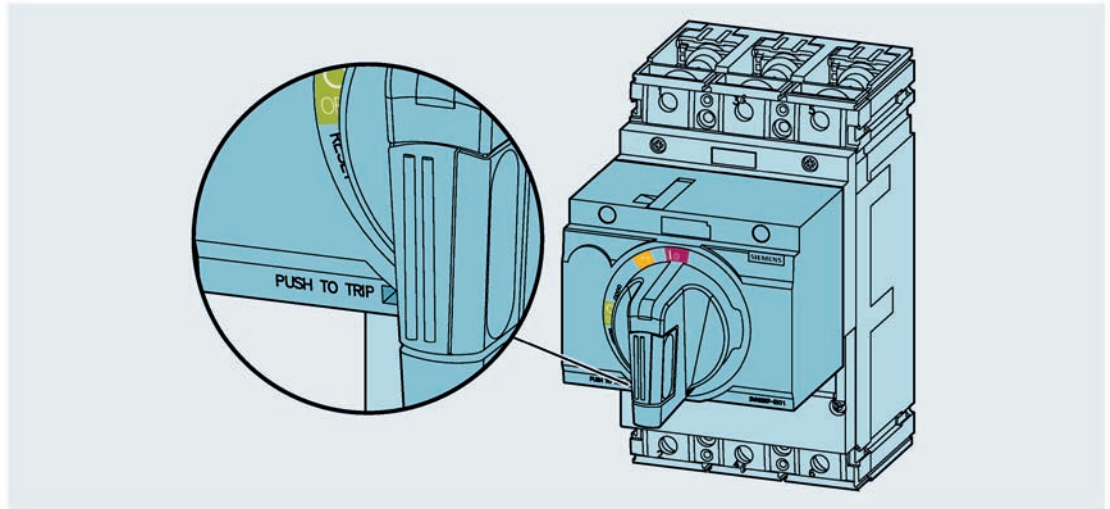
**Procedure (overriding the door interlock)**

- Use a slotted screwdriver 0.3 x 2.0 mm to press into the opening for the defeat function of the door interlock and simultaneously open the door.

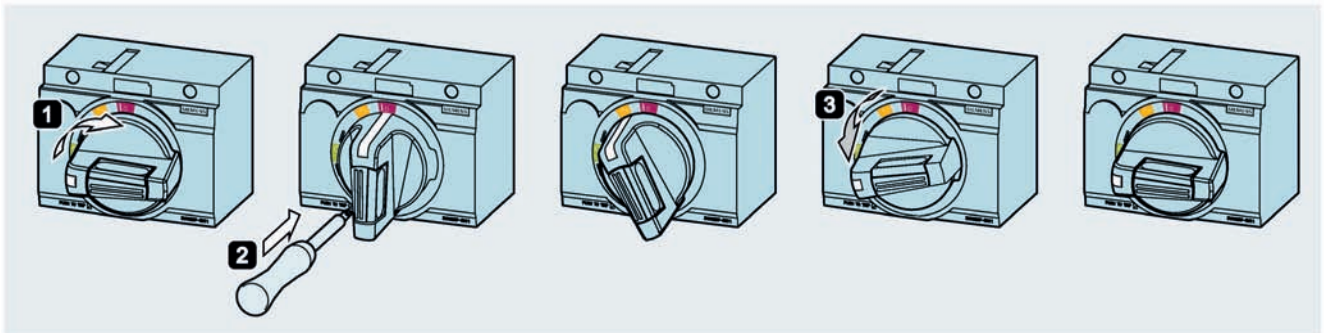
### 4.5.3.3 Testing the tripping mechanism

#### Testing the tripping mechanism

The button <PUSH TO TRIP> can be pressed to perform a function test on the tripping mechanism.



#### Procedure



1. Turn the front mounted rotary operator to position ON (I) in order to close the molded case circuit breaker.
2. Press the button <PUSH TO TRIP> with a tool such as a screwdriver.  
The front mounted rotary operator moves from position ON (I) to position TRIP. The molded case circuit breaker is now in the tripped state.
3. Turn the front mounted rotary operator counter-clockwise to the RESET position (just beyond OFF (O)).  
The front mounted rotary operator remains in the OFF (O) position, the molded case circuit breaker can now be closed again.

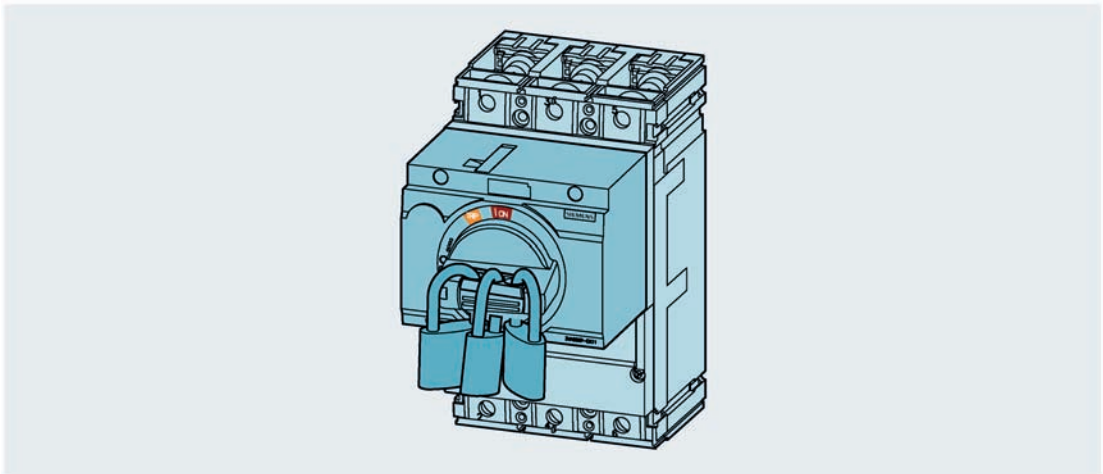
#### 4.5.3.4 Locking, blocking and interlocking

The following accessories for locking, blocking and interlocking are used:

- Locking at the handle
- Locking, blocking and interlocking at the rotary operator

#### Locking at the handle

The rotary operator can be locked at the handle with up to three padlocks with a diameter of 3/16" to 5/16" / 5 mm to 8 mm. Padlocks are not included in the scope of supply.



Lockable positions:

- Position OFF (O)
- Position ON (I)  
Possible only if the front mounted rotary operator has been modified according to the operating instructions.

---

#### Note

##### No impairment of protection function

Locking the rotary operators in the ON (I) position does not impair the protection function of the molded case circuit breakers. In the event of a fault, the molded case circuit breaker trips in the normal way.

When the rotary operator is unlocked, the position changes to TRIP.

---

### Locking, blocking and interlocking at the rotary operator

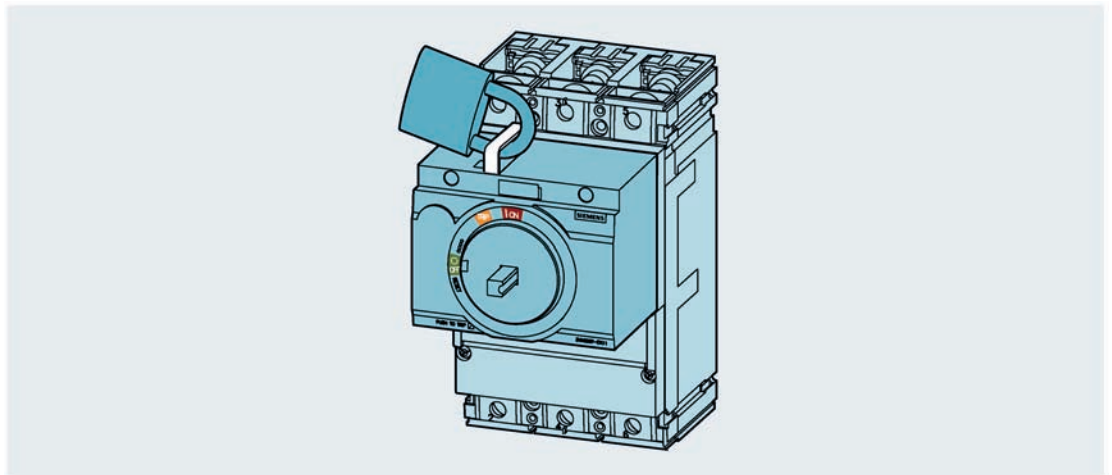
Locking at the rotary operator is possible with up to three padlocks with a diameter of 3/16" - 5/16" / 5 - 8 mm and with a cylinder lock (type Ronis). Interlocking is only possible with a cylinder lock (type Ronis).

Padlocks and cylinder locks are not included in the scope of supply of manual rotary operators.

#### Locking with padlocks

All rotary operators have a mechanism for padlocks. This can be pulled out from the rotary operator.

Example of rotary operator with shaft stub:

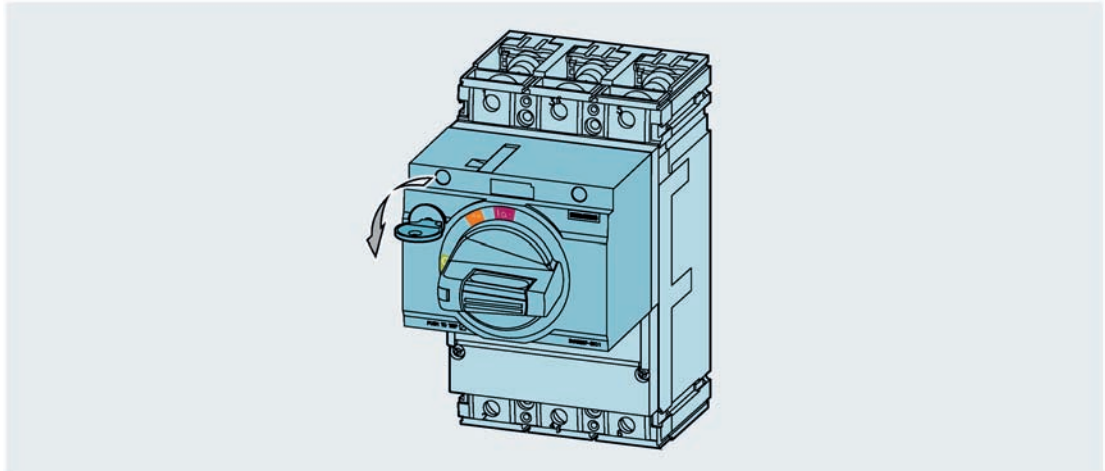


Lockable positions:

- Position OFF (O)

### Locking, blocking or interlocking with cylinder lock (type Ronis)

The cylinder lock (type Ronis) is used, depending on the installation of the cylinder lock holder, for locking, blocking and interlocking the rotary operators.



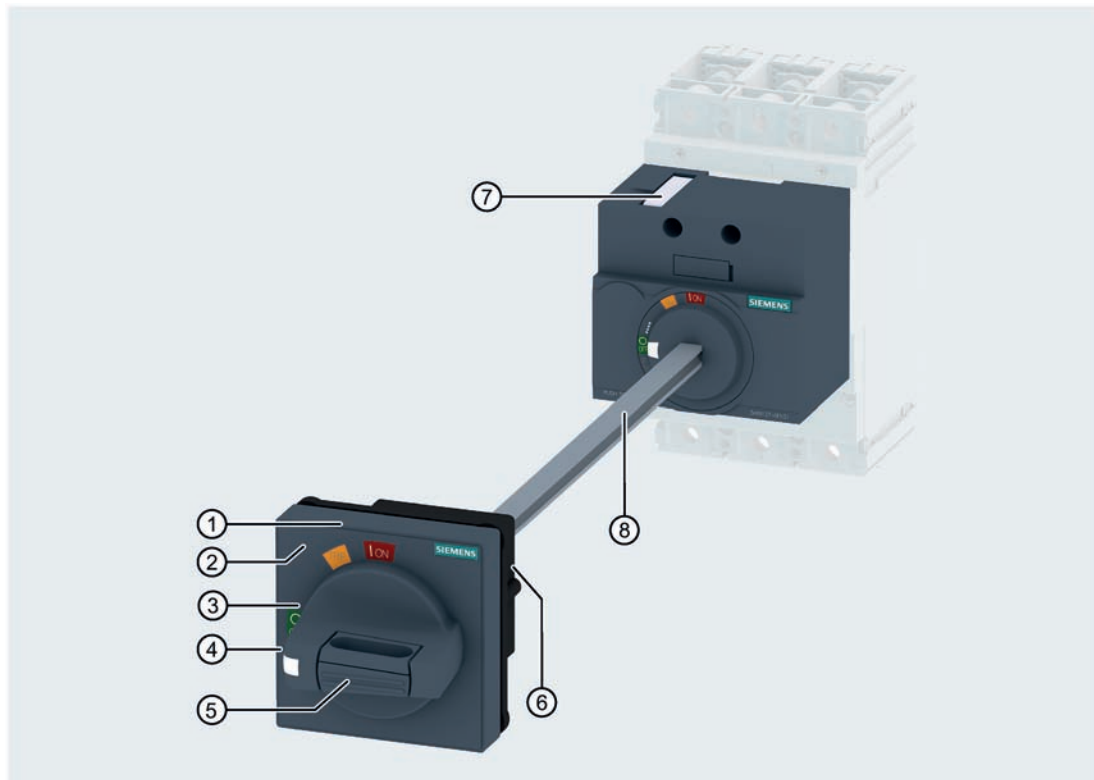
- Locking with cylinder lock (type Ronis):  
The cylinder lock (type Ronis) locks the rotary operators in the OFF (O) position.
- Mutual interlocking with cylinder lock (type Ronis):  
Through use of the cylinder lock insert for interlocking, any number of rotary operators can be mutually interlocked.  
This requires that the keys of all opened and locked molded case circuit breakers be removed and securely stored. Only the key of the rotary operator which is in the ON (I) position is left in the cylinder lock. This key cannot be removed in the ON (I) position. This key can only be removed if the rotary operator has been turned to the OFF (O) position, the cylinder lock has been locked and the molded case circuit breaker has thus been interlocked. See also chapter Cylinder locks for interlocking multiple 3VA UL molded case circuit breakers (Page 311).



## 4.5.4 Door mounted rotary operator

### 4.5.4.1 Elements of the door mounted rotary operator

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



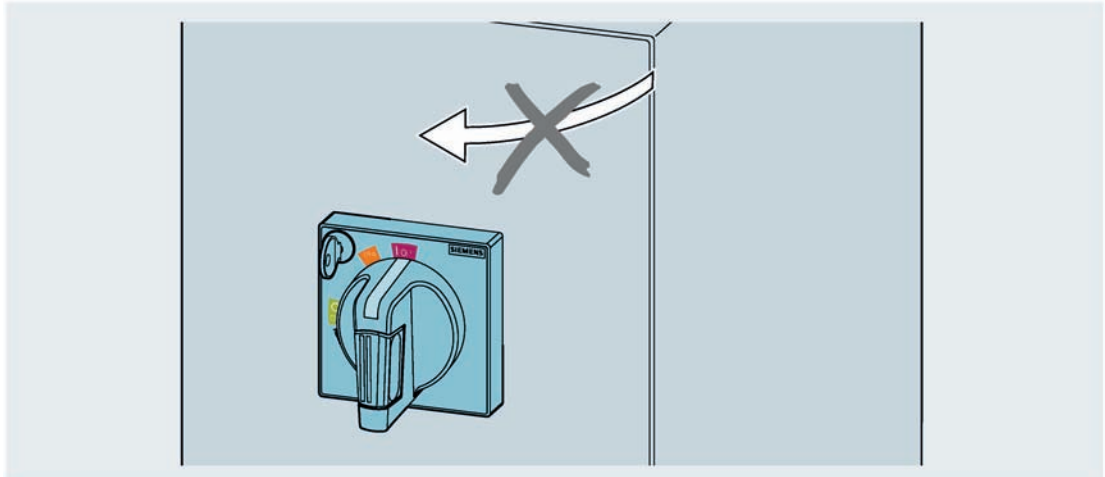
- ① Door mounted rotary operator
- ② Position for a cylinder lock
- ③ Indication of the breaker status ON, TRIP, mounting position, OFF, RESET  
For mounting position, see chapter Front mounted rotary operator (Page 264)
- ④ Door open function (Door-Open) (optional)
- ⑤ Handle with mechanism for up to 3 padlocks
- ⑥ Tolerance compensator
- ⑦ Interlock mechanism for up to 3 padlocks
- ⑧ Shaft

### 4.5.4.2 Door interlock with door mounted rotary operator

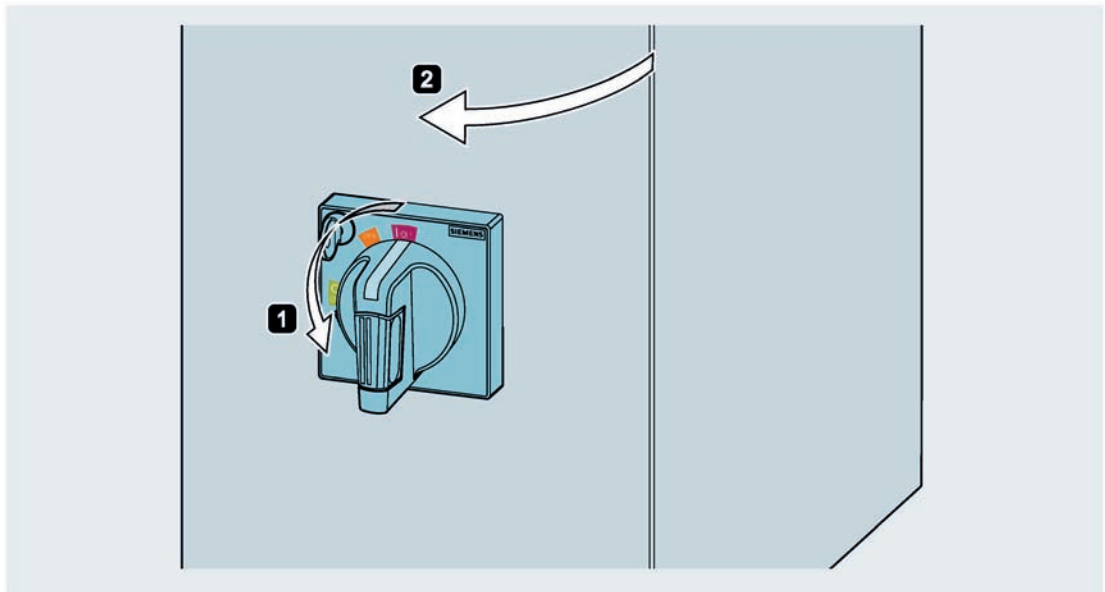
#### Door interlock with door mounted rotary operator

In the case of door mounted rotary operators with door interlock, the door is interlocked as soon as the switch is in ON (I) position.

In the case of door mounted rotary operators with door open function, the door is interlocked starting from the closing of the door (OFF (0)).



Opening panel door with door open function.

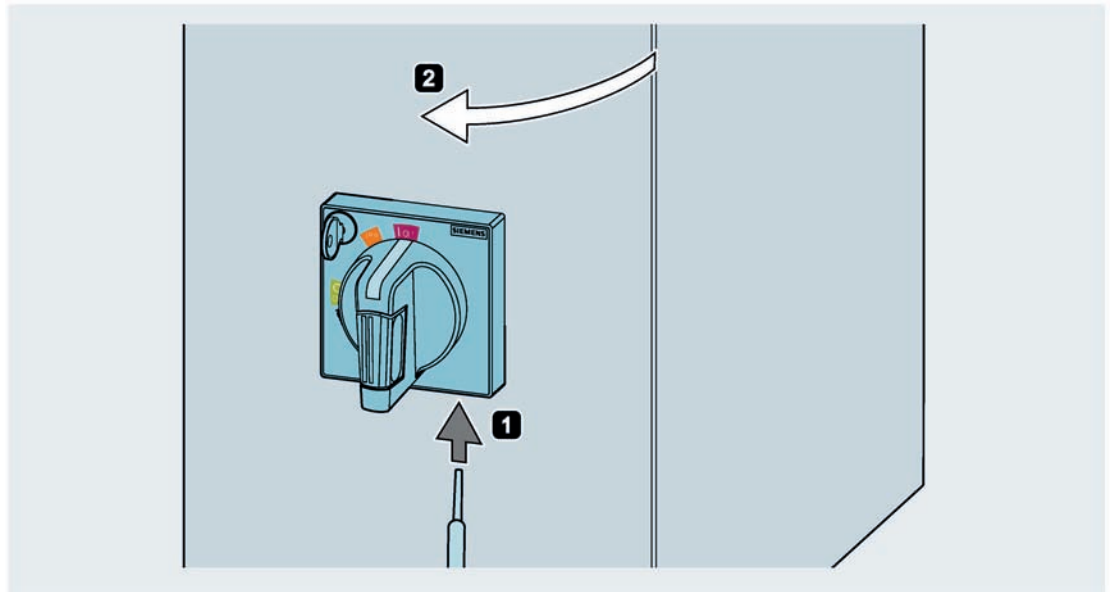


### Procedure

1. Turn the door mounted rotary operator the RESET / DOOR-OPEN position in order to activate the door open function.
2. Hold the handle in RESET / DOOR-OPEN position while the door is opened.

### Overriding the door interlock

The door interlock can be overridden by a deliberate action. This means that the door can be opened with the operator in position ON (I) so that maintenance can be carried out, for example.



### Procedure (overriding the door interlock)

- Use a slotted screwdriver 0.3 x 2.0 mm to press into the opening for the defeat function of the door interlock and simultaneously open the door.

### Deactivation of the door interlock function

The door interlock can be completely deactivated by a small modification on the inside of the handle. The panel door can then also be opened at any time without additional measures if the circuit breaker is switched on (position ON). This applies to all door mounted rotary operators with article numbers 3VA9...-0FK2...

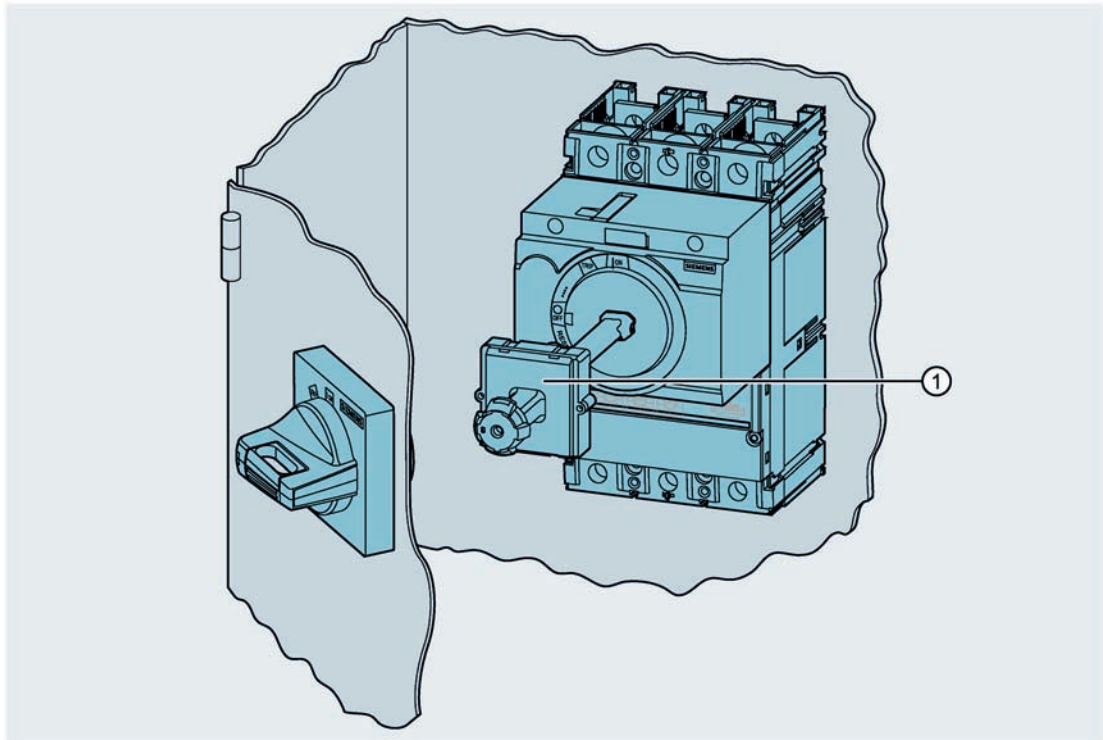
For details, see operating instructions

(<https://support.industry.siemens.com/cs/ww/en/view/109741016>).

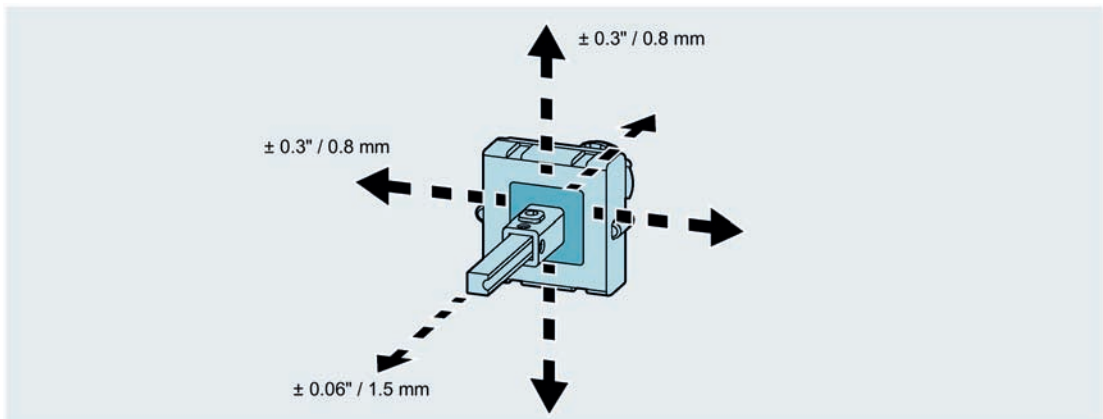
### 4.5.4.3 Tolerance compensator

#### Tolerance compensator

Door mounted rotary operators are supplied as standard with a tolerance compensator. This tolerance compensator compensates for a possible small misalignment between the handle in the panel door and the shaft of the door mounted rotary operator.



① Tolerance compensator

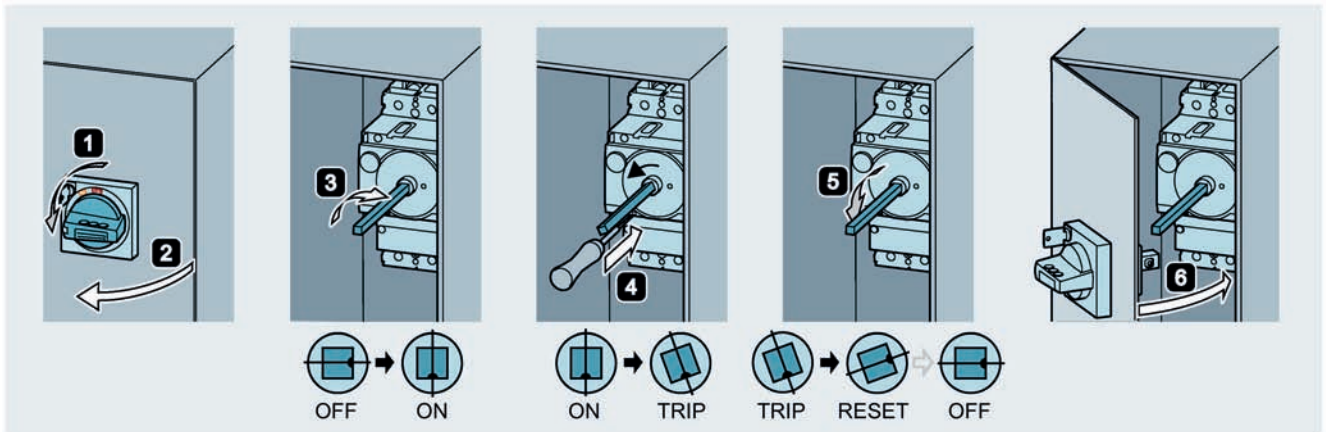


#### 4.5.4.4 Testing the tripping mechanism

##### Testing the tripping mechanism

The <PUSH TO TRIP> button can be used to check whether the tripping mechanism is working properly.

##### Procedure



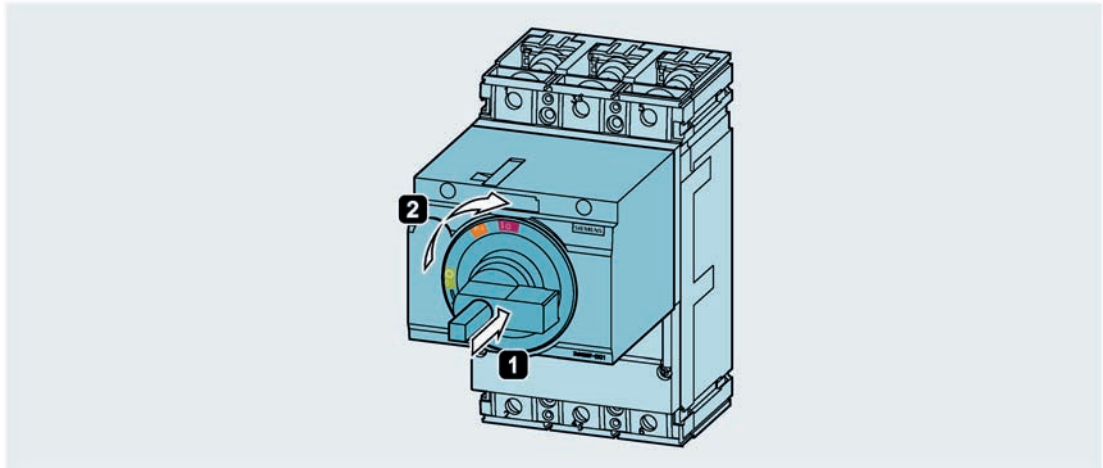
1. Turn the door mounted rotary operator to the OFF (O) position.
2. Open the panel door.
3. Use a tool to turn the shaft to the ON (I) position in order to close the molded case circuit breaker.  
Alternatively, you can use the supplementary handle for the door mounted rotary operator to close the molded case circuit breaker, see Supplementary handle for door mounted rotary operator (Page 276).
4. Press the button <PUSH TO TRIP> with a tool such as a screwdriver.  
The door mounted rotary operator moves from position ON (I) to position TRIP. The molded case circuit breaker is now in the tripped state.
5. Turn the door mounted rotary operator counter-clockwise to the limit stop (RESET position, just beyond OFF (O)).  
The manual operator remains in the OFF (O) position.
6. Close the panel door.  
The molded case circuit breaker can now be closed again.

#### 4.5.4.5 Supplementary handle for door mounted rotary operator

##### Supplementary handle for door mounted rotary operator

The supplementary handle can be used to operate the molded case circuit breaker when the panel door is open. The supplementary handle is mandatory for applications requiring NFPA 79-compliant door mounted rotary operators.

The supplementary handle is not included in the scope of delivery of the door mounted rotary operator and must be ordered separately.



##### Use the supplementary handle to close the molded case circuit breaker:

In accordance with NFPA 79, a deliberate action is required to reach the ON (I) position:

1. Push in the supplementary handle.
2. Turn the supplementary handle to the ON (I) position in order to close the molded case circuit breaker.

---

##### Note

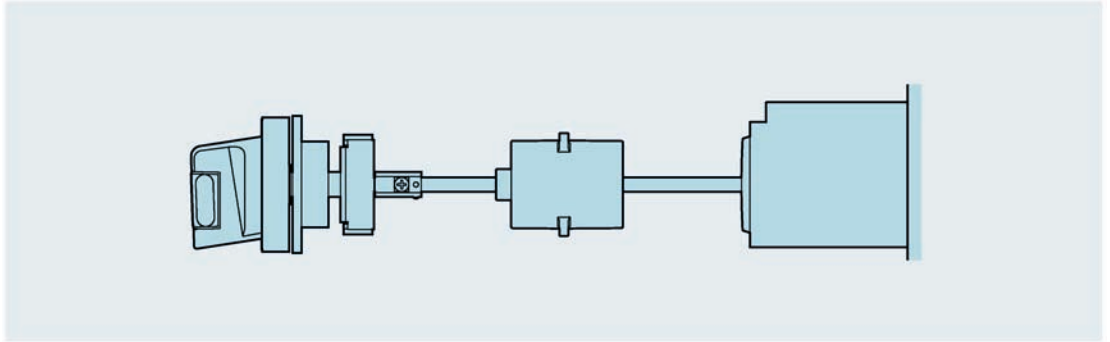
The supplementary handle is mandatory for applications requiring NFPA 79-compliant door mounted rotary operators.

---

#### 4.5.4.6 Variable depth adapter

##### Variable depth adapter

The variable depth adapter enables adjustment of the travel distance CONNECT, TEST and DISCONNECT when using draw-out technology. As a result, the panel door does not have to be opened to move the switch to the CONNECT, TEST and DISCONNECT positions. See also chapter Draw-out technology (Page 234).



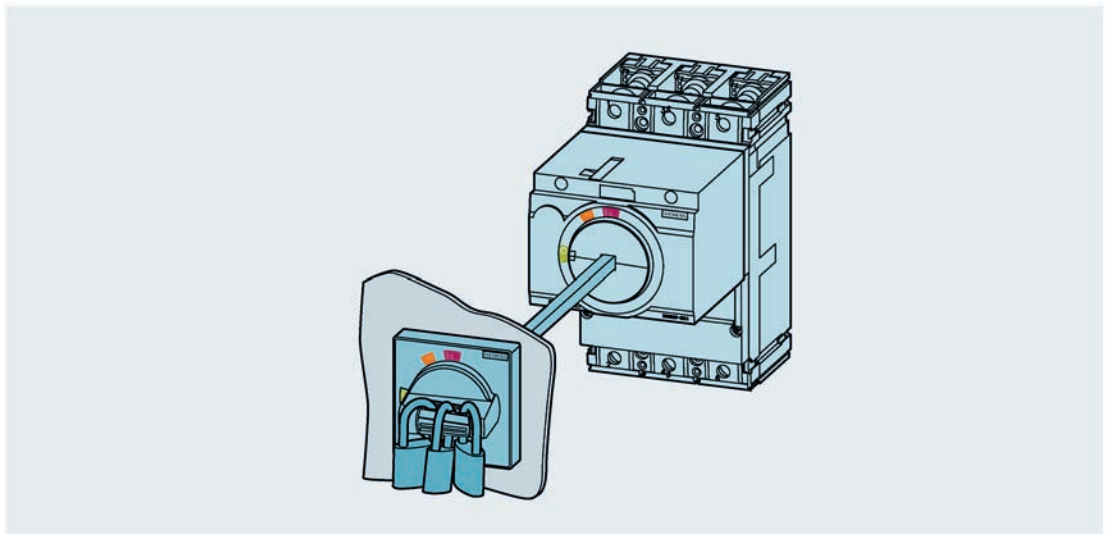
#### 4.5.4.7 Locking, blocking and interlocking

The following accessories for locking, blocking and interlocking are used:

- Locking at the handle
- Locking at the masking plate of the panel door
- Locking, blocking and interlocking at the rotary operator

##### Locking at the handle

The rotary operator can be locked at the handle with up to three padlocks with a diameter of 3/16" to 5/16" / 5 mm to 8 mm. Padlocks are not included in the scope of supply.



Lockable positions:

- Position OFF (O)  
Locking the door mounted rotary operator in OFF (O) position prevents the molded case circuit breaker from being switched on and the panel door from being opened. The door interlock cannot be overridden.
- Position ON (I)  
Possible only if the front mounted rotary operator has been modified according to the operating instructions.

---

##### Note

##### No impairment of protection function

Locking the rotary operators in the ON (I) position does not impair the protection function of the molded case circuit breakers. In the event of a fault, the molded case circuit breaker trips in the normal way.

When the rotary operator is unlocked, the position changes to TRIP.

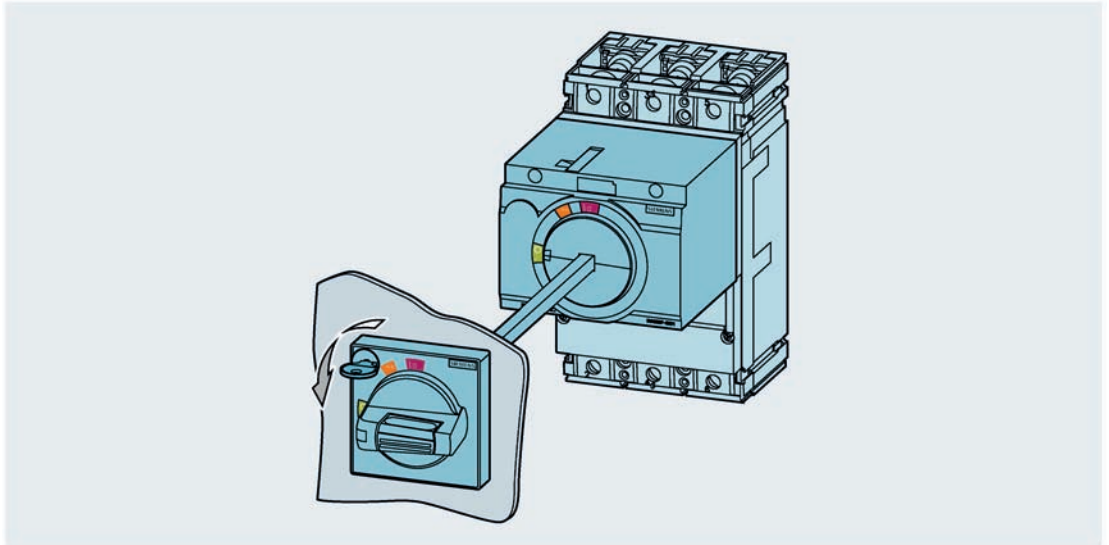
---



### Locking at the masking plate of the panel door with cylinder lock (Kaba)

The door mounted rotary operator can be locked at the panel door with a cylinder lock (type Kaba).

The cylinder lock can **not** be used for locking in the ON (I) position.



---

#### Note

The cylinder lock (type Kaba) for the masking plate must be ordered separately.

---

### Locking, blocking and interlocking at the rotary operator

Locking at the rotary operator is possible with up to three padlocks with a diameter of 3/16" - 5/16" / 5 - 8 mm and with a cylinder lock (type Ronis). Interlocking is only possible with cylinder locks (type Ronis).

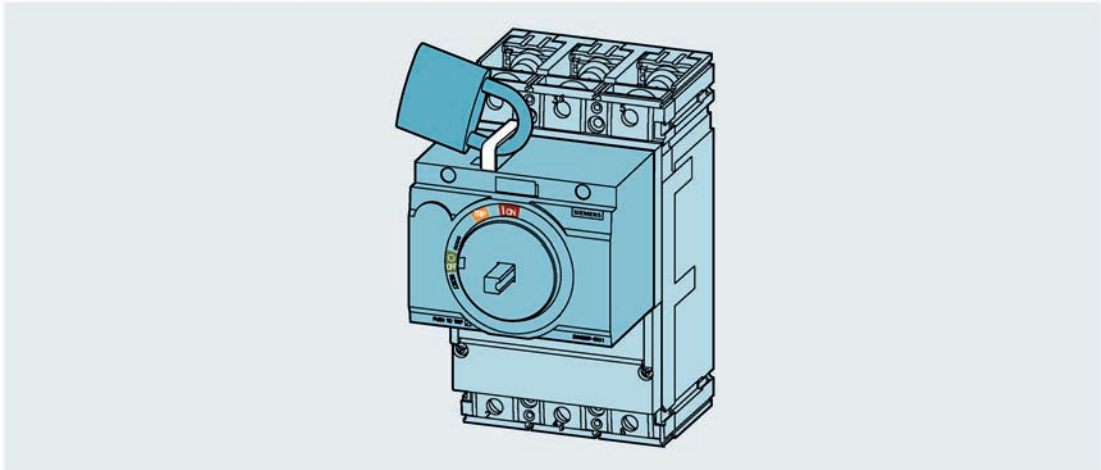
In addition, the door mounted rotary drive can be locked at the masking plate in the panel door additionally with cylinder locks (type Kaba).

Padlocks and cylinder locks are not included in the scope of supply of manual rotary operators.

#### Locking with padlocks

All rotary operators have a mechanism for padlocks. This can be pulled out from the rotary operator.

Example of rotary operator with shaft stub:

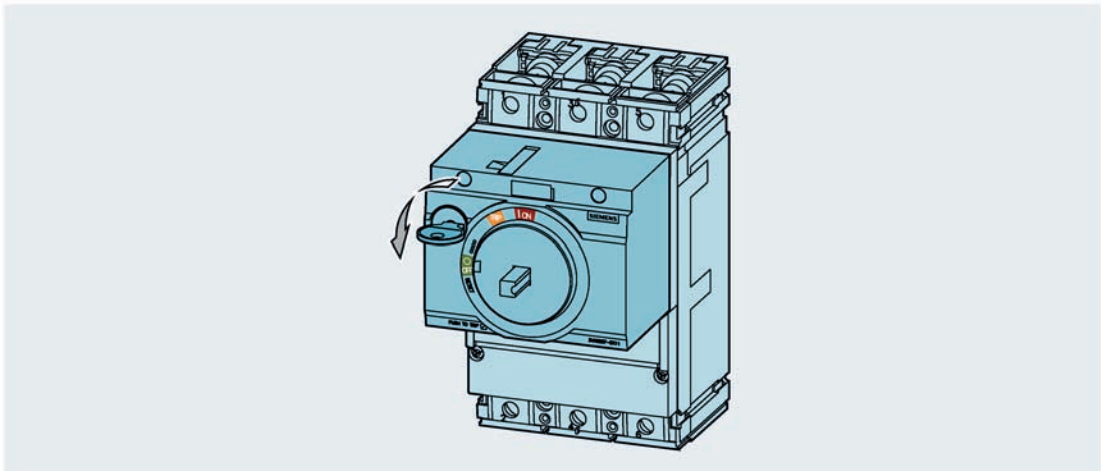


Lockable positions:

- Position OFF (O)

**Locking, blocking or interlocking with cylinder lock (type Ronis)**

The cylinder lock (type Ronis) is used, depending on the installation of the cylinder lock holder, for locking, blocking and interlocking the rotary operators.



- Locking with cylinder lock (type Ronis):

The cylinder lock (type Ronis) locks the rotary operators in the OFF (O) position.

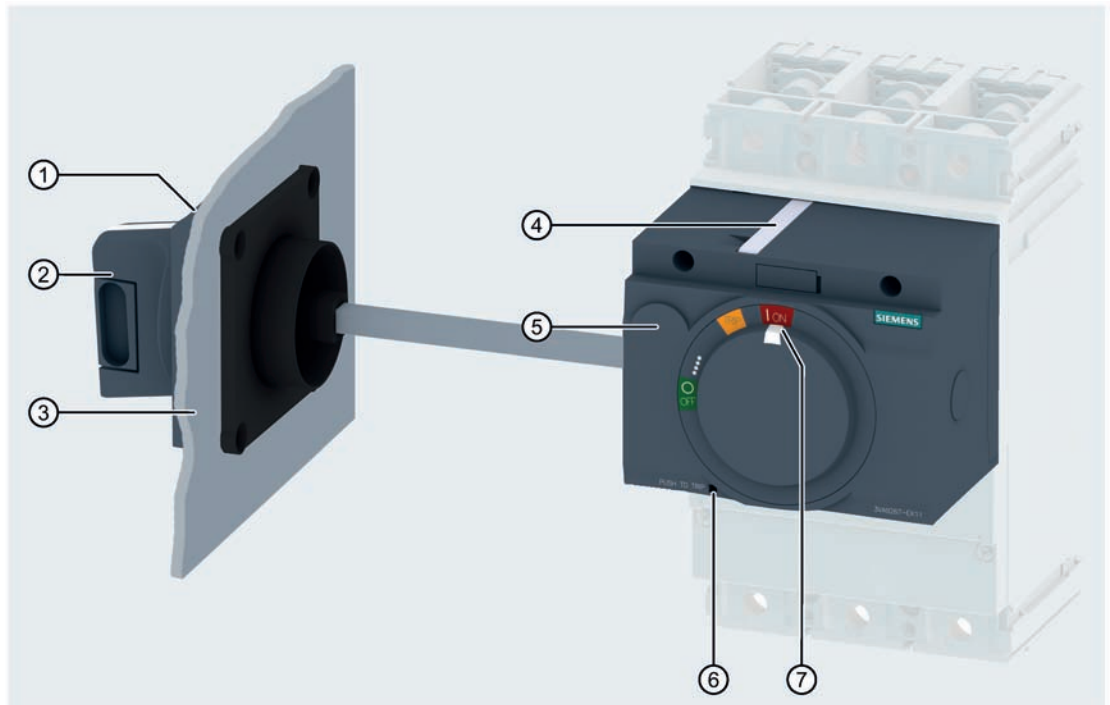
- Mutual interlocking with cylinder lock (type Ronis):

Through use of the cylinder lock insert for interlocking, any number of rotary operators can be mutually interlocked. This requires that the keys of all opened and locked molded case circuit breakers be removed and securely stored. Only the key of the rotary operator which is in the ON (I) position is left in the cylinder lock. This key cannot be removed in the ON (I) position. This key can only be removed if the rotary operator has been turned to the OFF (O) position, the cylinder lock has been locked and the molded case circuit breaker has thus been interlocked. See also chapter Cylinder locks for interlocking multiple 3VA UL molded case circuit breakers (Page 311).

## 4.5.5 Side wall mounted rotary operator

### 4.5.5.1 Elements of the side wall mounted rotary operator

The side wall mounted rotary operator allows the molded case circuit breaker to be operated through the right-hand or left-hand side wall of the panel.

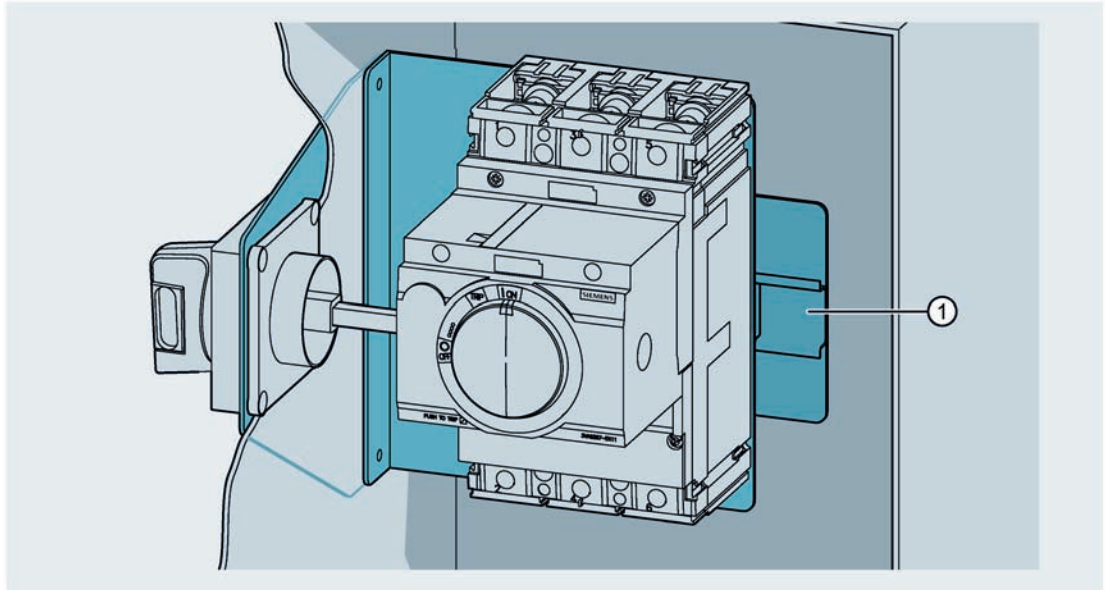


- ① Side wall mounted rotary operator
- ② Handle with mechanism for up to 3 padlocks
- ③ Side wall of panel
- ④ Device for up to 3 padlocks
- ⑤ Device for cylinder lock
- ⑥ Trip unit button <PUSH TO TRIP>
- ⑦ Indication of the breaker status ON, TRIP, mounting position, OFF, RESET  
For mounting position, see chapter Front mounted rotary operator (Page 264)

### 4.5.5.2 Side wall mounted rotary operator with mounting plate

#### Side wall mounted rotary operator with mounting plate

The side wall mounted rotary operator is available in a version with mounting plate for molded case circuit breakers up to 250 A. The mounting plate can be installed on the right-hand or left-hand side panel. The space on the mounting plate can be used to install other components.



If there is insufficient space available on the mounting plate to install terminals, a terminal plate ① can be bolted to the panel.

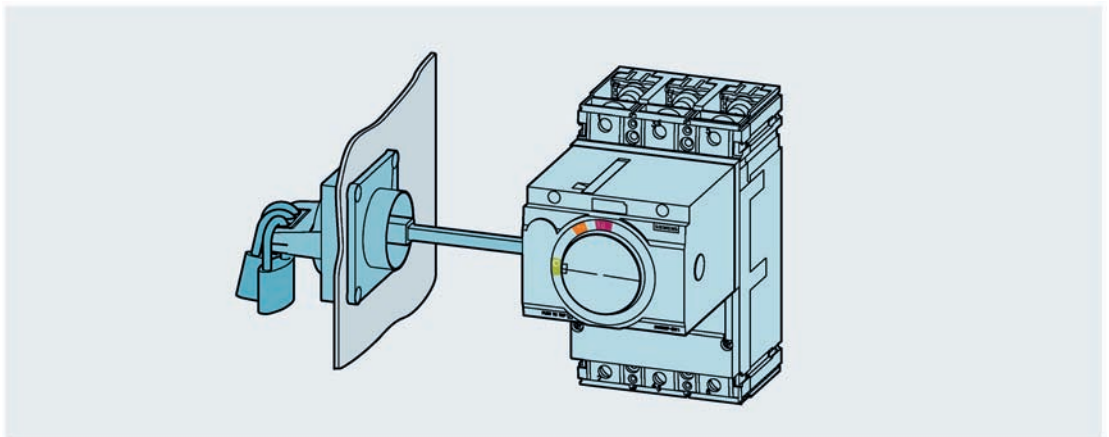
### 4.5.5.3 Locking, blocking and interlocking

The following accessories for locking, blocking and interlocking are used:

- Locking at the handle
- Locking at the masking plate of the side wall
- Locking, blocking and interlocking at the rotary operator

#### Locking at the handle

The rotary operator can be locked at the handle with up to three padlocks with a diameter of 3/16" to 5/16" / 5 mm to 8 mm. Padlocks are not included in the scope of supply.



Lockable positions:

- Position OFF (O)  
Locking the side wall mounted rotary operator in the OFF (O) position prevents the molded case circuit breaker from being closed.
- Position ON (I)  
Possible only if the side wall mounted rotary operator has been modified according to the operating instructions.

---

#### Note

##### No impairment of protection function

Locking the rotary operators in the ON (I) position does not impair the protection function of the molded case circuit breakers. In the event of a fault, the molded case circuit breaker trips in the normal way.

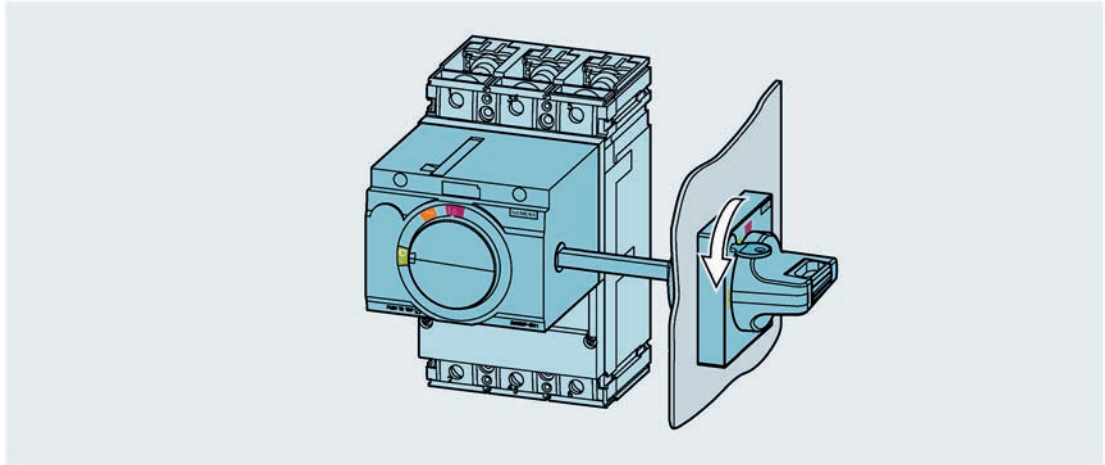
When the rotary operator is unlocked, the position changes to TRIP.

---

### Locking at the masking plate of the side wall with cylinder lock (Kaba)

The side wall mounted rotary operator can be locked at the side wall with a cylinder lock (type Kaba).

The cylinder lock can **not** be used for locking in the ON (I) position.



---

#### Note

The cylinder lock (type Kaba) for the masking plate must be ordered separately.

---

### Locking, blocking and interlocking at the rotary operator

Locking at the rotary operator is possible with up to three padlocks with a diameter of 3/16" - 5/16" / 5 - 8 mm and with a cylinder lock (type Ronis). Interlocking is only possible with cylinder locks (type Ronis).

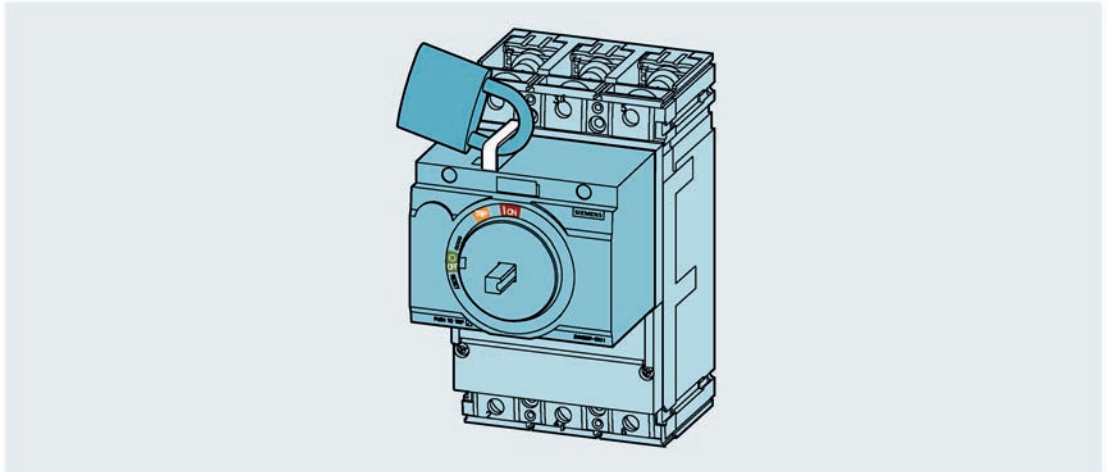
In addition, the side wall mounted rotary drive can be locked at the masking plate of the side wall additionally with cylinder locks (type Kaba).

Padlocks and cylinder locks are not included in the scope of supply of manual rotary operators.

#### Locking with padlocks

All rotary operators have a mechanism for padlocks. This can be pulled out from the rotary operator.

Example of rotary operator with shaft stub:

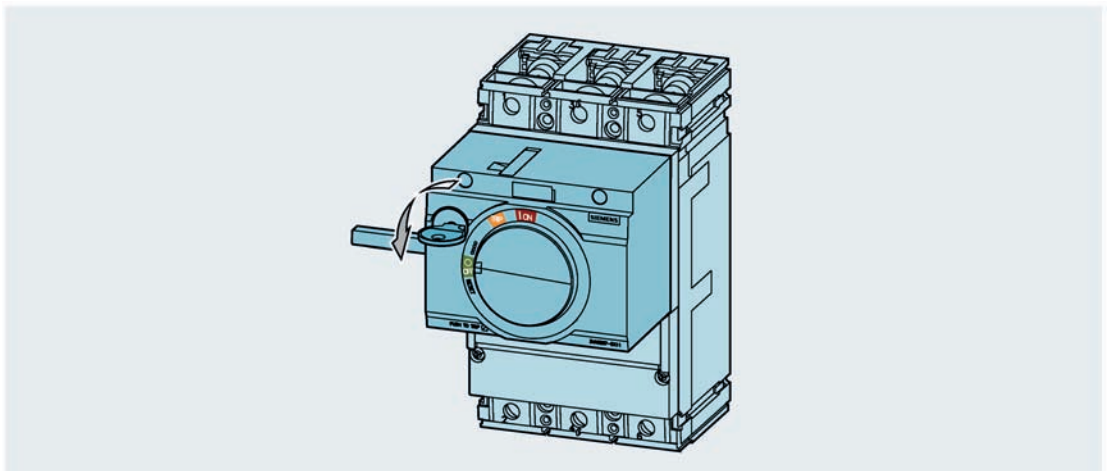


Lockable positions:

- Position OFF (O)

#### Locking, blocking or interlocking with cylinder lock (type Ronis)

The cylinder lock (type Ronis) is used, depending on the installation of the cylinder lock holder, for locking, blocking and interlocking the rotary operators.



- Locking with cylinder lock (type Ronis):

The cylinder lock (type Ronis) locks the rotary operators in the OFF (O) position.

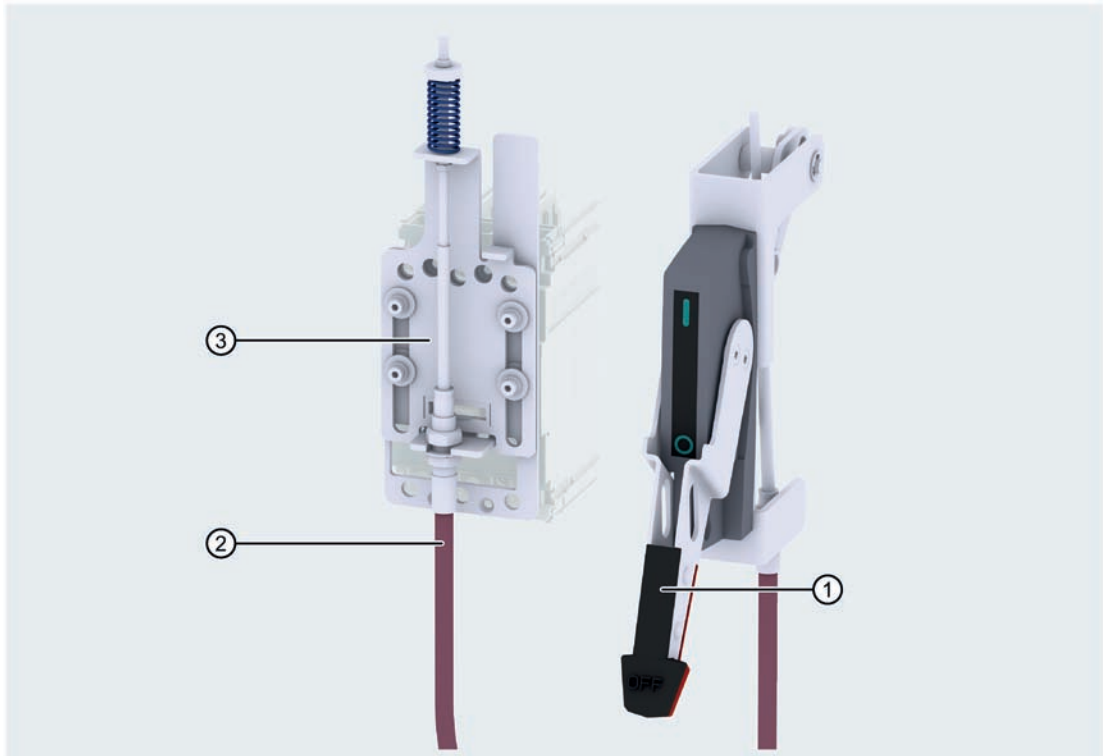
- Mutual interlocking with cylinder lock (type Ronis):

Through use of the cylinder lock insert for interlocking, any number of rotary operators can be mutually interlocked. This requires that the keys of all opened and locked molded case circuit breakers be removed and securely stored. Only the key of the rotary operator which is in the ON (I) position is left in the cylinder lock. This key cannot be removed in the ON (I) position. This key can only be removed if the rotary operator has been turned to the OFF (O) position, the cylinder lock has been locked and the molded case circuit breaker has thus been interlocked. See also chapter Front interlocking (Page 311).

## 4.5.6 Operator kit with Bowden cable (Max-Flex operator)

### 4.5.6.1 Elements of the operator kit with Bowden cable

The Max-Flex operator is installed for switching a 3VA UL molded case circuit breaker using a handle and Bowden cable through the panel door. The switching mechanism and handle are connected to one another with a flexible Bowden cable.



- ① Handle
- ② Bowden cable
- ③ Switching mechanism

A variety of Bowden cable lengths are available.

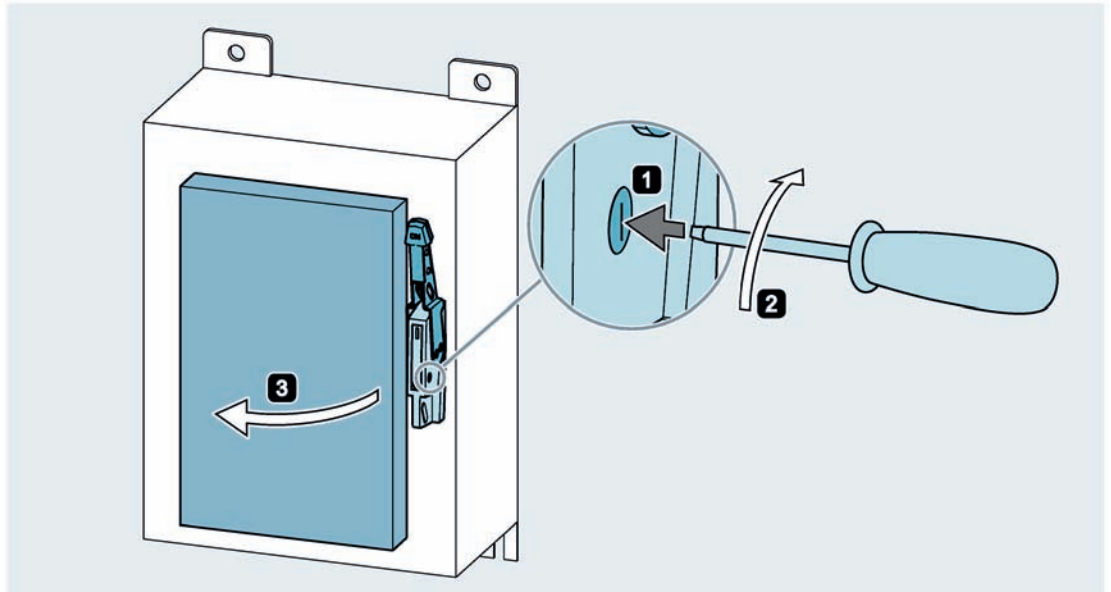


#### 4.5.6.2 Door interlocking with the operator kit with Bowden cable

The handle of the operator kit with Bowden cable interlocks the panel door as soon as the handle is in position ON (I).

##### Defeat function of the door interlock

In order to open the panel door even when the molded case circuit breaker is closed, the door interlock can be defeated. This is done using the screw on the side of the handle.

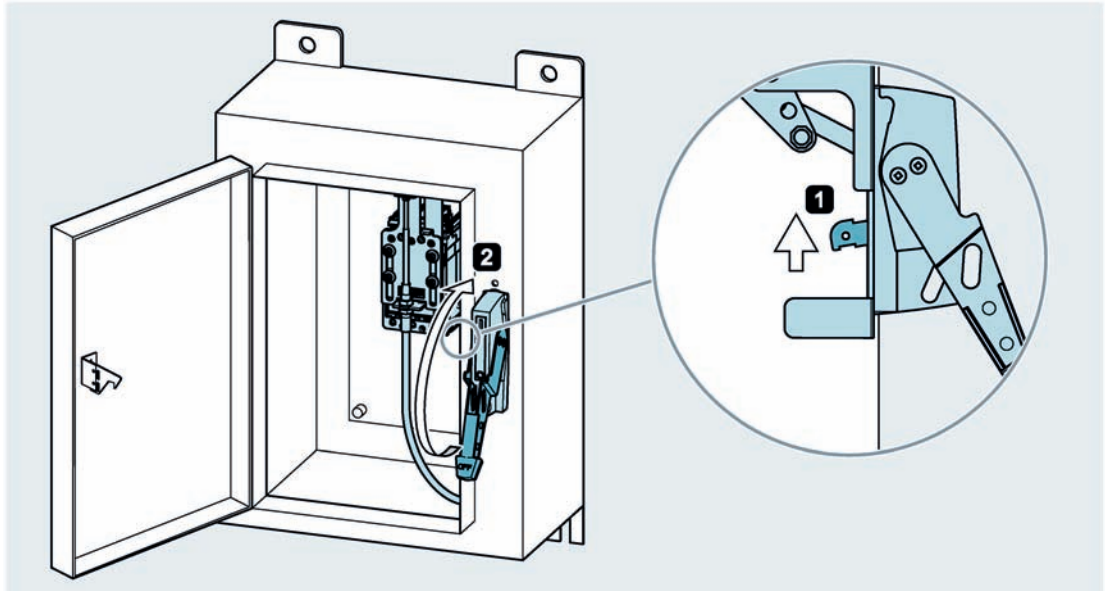


##### Procedure

1. Use a screwdriver to turn the screw clockwise by 90°.
2. Keep the screw turned while the door is opened.

**Switching on the molded case circuit breaker when panel door is open**

When the panel door is open, the 3VA UL molded case circuit breaker can be switched using the Max-Flex operator with a deliberate action only.



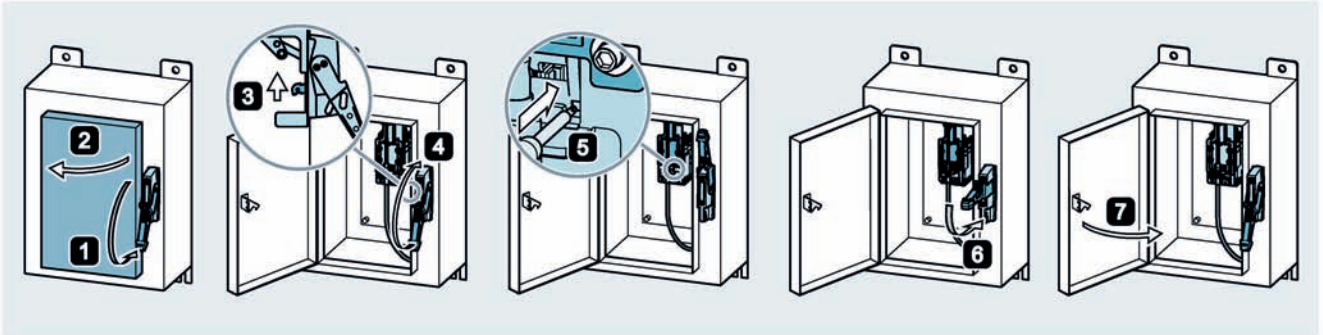
**Procedure**

1. Press interlock pin upward.
2. Keep interlock pin pressed while the molded case circuit breaker is closed.

### 4.5.6.3 Testing the tripping mechanism

The <PUSH TO TRIP> button can be used to check whether the tripping mechanism is working properly.

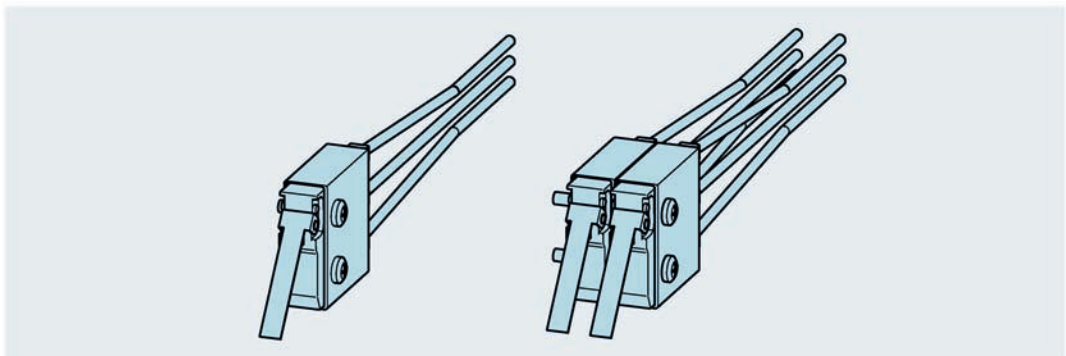
#### Procedure



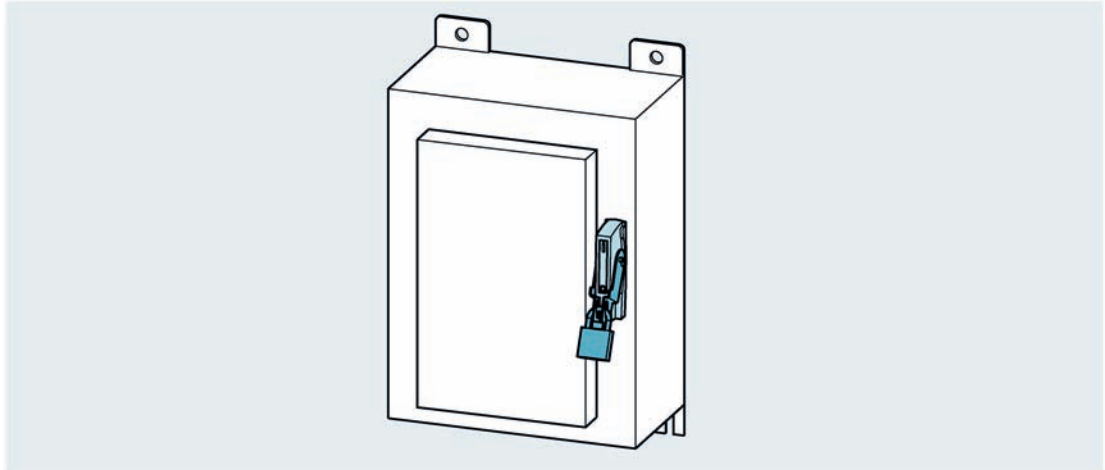
1. Turn the Max-Flex handle to the OFF (O) position.
2. Open the panel door.
3. Keep the interlock pin pressed as described above.
4. Bring the molded case circuit breaker to the ON (I) position using the handle.
5. Press the <PUSH TO TRIP> button with a tool such as a screwdriver.  
The Max-Flex operator moves from the ON (I) position to the TRIP position. The molded case circuit breaker is now in the tripped state.
6. Move the handle for resetting the molded case circuit breaker to the OFF (O) position.
7. Close the panel door.  
The molded case circuit breaker can now be closed again.

### 4.5.6.4 Auxiliary switches for the operator kit with Bowden cable

For the operator kit with Bowden cable, auxiliary switches are available with one or two changeover contacts. These are screwed to the switching mechanism and signal the switching state.



#### 4.5.6.5 Locking, blocking and interlocking



Lockable positions:

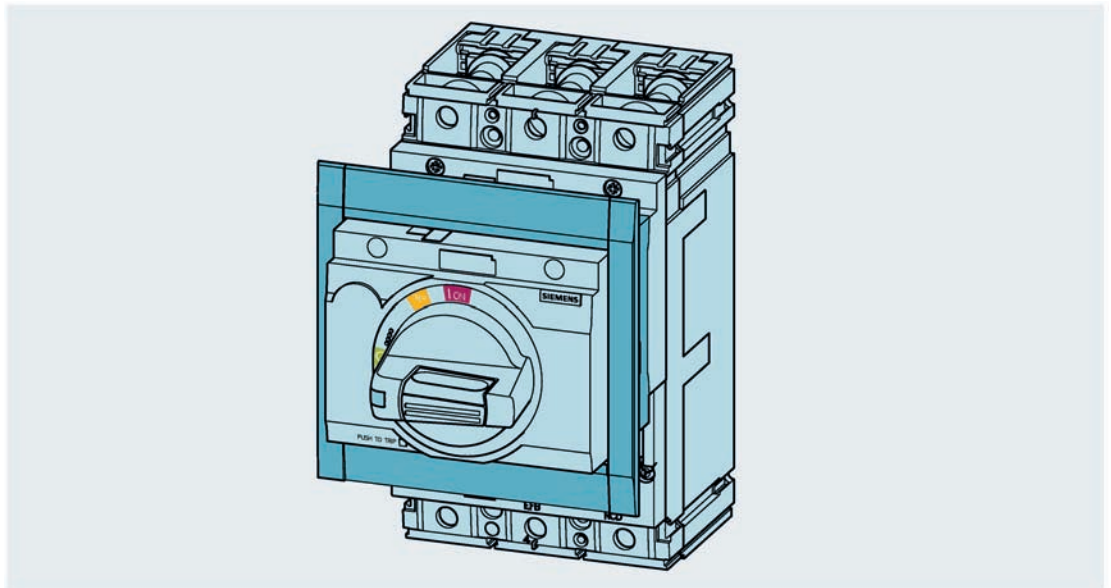
- Position OFF (O)  
Locking the handle of the operator kit with Bowden cable in the OFF (O) position prevents the molded case circuit breaker from being closed.
- Position ON (I)  
The handle of the operator kit with Bowden cable can **not** be locked in the ON position.

## 4.5.7 Degree of protection

### 4.5.7.1 IP degree of protection

Operator	IP degree of protection
Front mounted rotary operator	IP30
Front mounted rotary operator with cover frame	IP30
Door mounted rotary operator	IP65
Side wall mounted rotary operator	IP65
Operating unit with Bowden cable	IP65

When fitted with a cover frame (see illustration below), a front mounted rotary operator installed in the panel door has degree of protection IP30.



#### Note

To ensure that the panel door can still be opened, the front mounted rotary operator must not project over the cover frame by more than 5 mm when the door is closed.

### 4.5.7.2 NEMA degree of protection

All 3VA UL rotary operators are designed in such a way that the NEMA degrees of protection 1, 12, 3R and 4 or 4X for enclosures can be met.

The handle of the operator kit with Bowden cable is also available in variants with NEMA degrees of protection 1, 12 and 3R or NEMA degrees of protection 4/4X.

## 4.5.8 Accessories

### 4.5.8.1 Illumination kit

#### Illumination kit



The illumination kit illuminates the indication of the breaker status of the front mounted rotary operator or the door mounted rotary operator or the masking plate of the door mounted or side wall mounted rotary operator. The illumination kit can be ordered with the operator as a pre-assembled accessory, or individually as a retrofit component.

The illumination kit operates on a 24 V DC supply.

Its power consumption is 0.16 W.

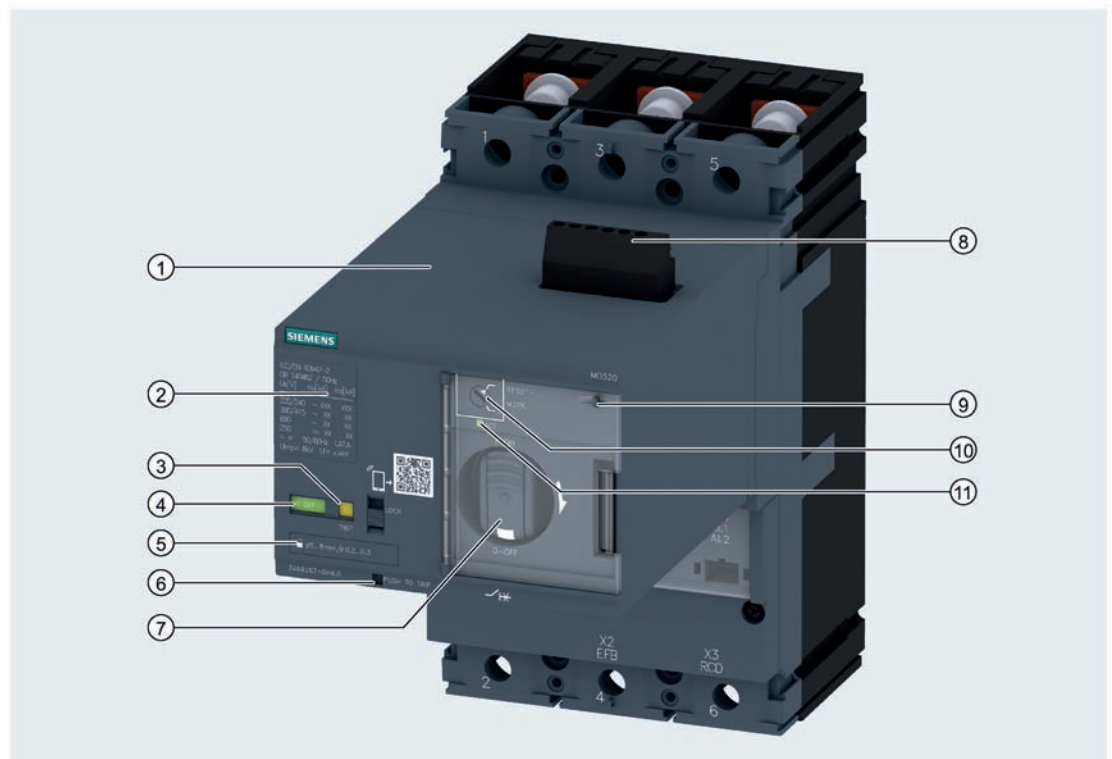
## 4.6 Motor operator

### 4.6.1 Elements of the motor operator MO320



The motor operator MO320 transmits commands via electrical control cables to open and close the molded case circuit breaker. The source of commands transmitted via electrical control cables can be a pushbutton or a PLC, for example.

Motor operators must also be used in conjunction with automatic transfer control devices.






- |   |  |   |  |
|---|--|---|--|
| ① | Motor operator MO320                                   | ⑦ | Handle for manual operation  |
| ② | Characteristic data of the molded case circuit breaker | ⑧ | Connecting terminals for power supply (AC/DC depending on version) |
| ③ | LED "TRIP"   | ⑨ | Seal   |
| ④ | Indication of the breaker status ON/OFF                | ⑩ | Reset mode setting   |
| ⑤ | Mechanism for padlocks                                 | ⑪ | LED "Active"   |
| ⑥ | Button for trip unit <PUSH TO TRIP>                    |   |  |

### 4.6.2 Description of front panel






The front panel of the motor operator MO320 features an indication of the breaker status and an LED labeled "TRIP". The indication directly reflects the status of the actuating shaft. With its clear breaker status indication, the motor operator MO320 meets the requirements pertaining to isolating features stipulated by IEC / EN 60947-1.

#### Indication of the breaker status on the front panel

	ON	The main contacts of the molded case circuit breaker are closed.
	OFF	The main contacts of the molded case circuit breaker are open.
	Off and LED TRIP lit	The molded case circuit breaker is in TRIP position.

#### LED status displays



ACT	TRIP	Status
<input type="checkbox"/>	<input type="checkbox"/>	No power supply
	<input type="checkbox"/>	Internal error
	<input type="checkbox"/>	Normal operating status
		Tripped if TRIP LED is illuminated
		Device defective

See also chapter Faults, causes of faults and rectification of faults (Page 300).



### 4.6.3 MANUAL, AUTO and LOCK modes

The motor operator MO320 is switched to MANUAL or AUTO mode when the plastic window is opened (MANUAL) or closed (AUTO).



#### MANUAL:

When the plastic window is open, the motor operator MO320 is in MANUAL mode. The motor operator is moved to position ON (I) or OFF (O) by manual operation of the handle.

#### AUTO:

When the plastic window is closed, the motor operator MO320 is in AUTO mode. The motor operator can be operated via control cables, e.g. in response to signals issued by a pushbutton or by control commands output by a PLC.

#### LOCK:

The motor operator can be locked in the OFF (O) position to prevent reclosing of the breaker. The padlock device snaps out if the slide above it is moved to the "LOCK" position.

4.6 Motor operator

The padlock device can be locked with up to three padlocks with a diameter of 3/16" - 5/16" / 5 - 8 mm. Padlocks are not included in the scope of supply.

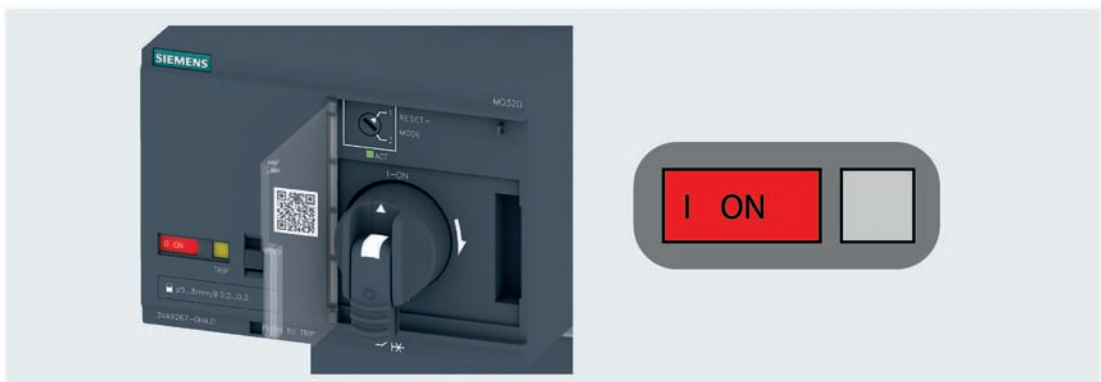


4.6.4 Operating the molded case circuit breaker with motor operator

Opening and closing in MANUAL mode

The plastic window is open, the motor operator is in MANUAL mode. The supply to the LEDs is also disconnected, but the motor operator remains fully operational.

- Closing the 3VA UL molded case circuit breaker:  
Turn the handle clockwise until the breaker status indication indicates ON (I).  
The molded case circuit breaker is now closed ON (I). The main contacts are closed.



- Opening the 3VA UL molded case circuit breaker:  
Turn the handle clockwise until the breaker status indication indicates OFF (O).  
The molded case circuit breaker is now OFF (O). The main contacts are open.



### Opening and closing in AUTO mode

The plastic window is closed, the motor operator is in AUTO mode. The 3VA UL molded case circuit breaker can be closed or opened with electrical signals.



- Close the 3VA UL molded case circuit breaker with an electrical ON signal at the terminal block:  
The molded case circuit breaker is closed - ON (I). The main contacts are closed. The indicator on the front panel of the motor operator indicates ON (I).
- Open the 3VA UL molded case circuit breaker with an electrical OFF signal at the terminal block:  
The molded case circuit breaker is opened - OFF (O). The main contacts are separated. The indicator on the front panel of the motor operator indicates OFF (O).

### Resetting the molded case circuit breaker

If the 3VA UL molded case circuit breaker is tripped, the "TRIP" LED lights up





① Reset mode setting

The resetting of the 3VA UL molded case circuit breaker by the motor operator depends on the selected reset mode.

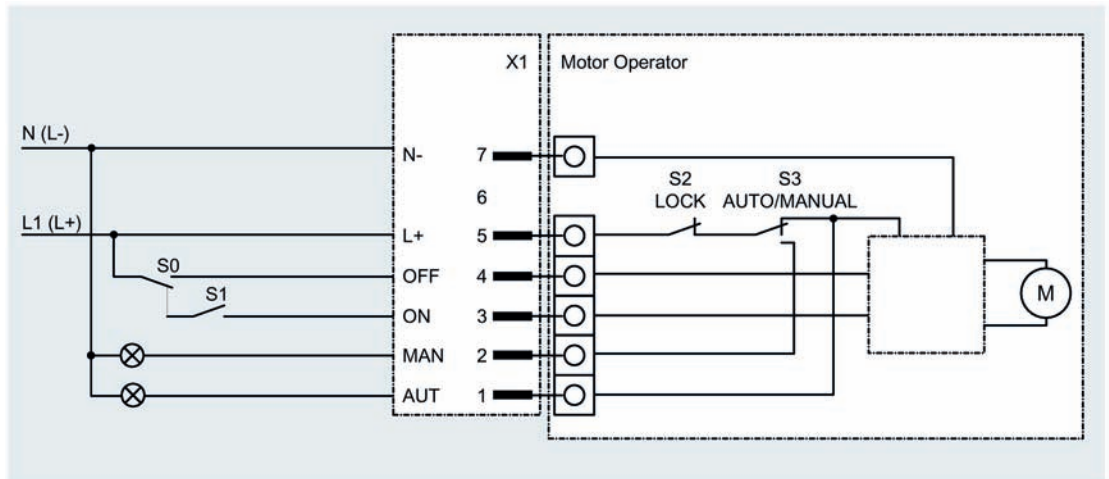
#### Reset modes

The reset mode can be selected. After the molded case circuit breaker has tripped, the selected reset mode determines the response of the motor operator in the TRIP position.

Response of the motor operator to tripping of the 3VA UL molded case circuit breaker, depending on the reset mode:

Reset mode	Requirements	Operating mode	Setting Rotary button	Description
Operating mode 1: Automatic reset	Plastic window closed, motor operator is in AUTO position.	AUTO		If the molded case circuit breaker has tripped, the motor operator moves it automatically from position TRIP to position OFF.
Operating mode 2: Manual reset or reset by remote control	Plastic window open or closed, motor operator is in the MANUAL or AUTO position.	MANUAL / AUTO		MANUAL operating mode: The motor operator must be reset locally by means of the handle (switching position OFF (O)).  AUTO operating mode: The motor operator must be reset with an OFF signal transferred via control cables (e.g. pushbutton, PLC).

### Connection diagram for control of the motor operator MO320



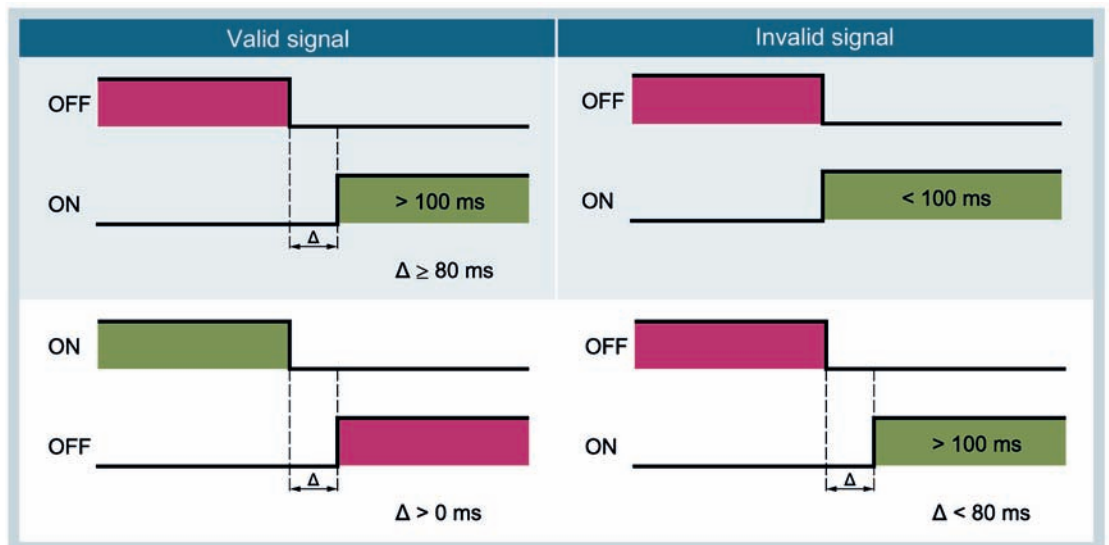
#### Note

An EMERGENCY OFF circuit may be implemented by means of a shunt trip or UVR (Page 162).

For further circuit diagrams, see chapter "Circuit diagrams" (Page 385).

The motor operator MO320 is edge-controlled, i.e. it reacts only to the positive edge of an ON or OFF command at the relevant terminals 3 and 4. In this case, the OFF signal is dominant, i.e. the motor operator will be switched off in response to an OFF edge even if an ON signal is applied.

The MO320 requires a pause period of 80 ms between the end of an OFF signal and the edge of an ON signal. Since the OFF signal is dominant, it does not require a pause period.



4.6.5 Faults, causes of faults and rectification of faults

Causes of faults	LED display		Remedy
	ACT	TRIP	
<b>Defects</b>			
Unit is defective (e.g. defective microswitch)			Cannot be repaired, replace the unit
<b>Faults</b>			
Excessively long switching time (e.g. blocked motor)		<input type="checkbox"/>	Reset fault by 2 x OFF signal (< 1 s)
Incorrect switching position after command (e.g. OFF position after ON signal)		<input type="checkbox"/>	Reset fault by 2 x OFF signal (< 1 s) or manual correction of switching position
Undefined switching position		<input type="checkbox"/>	Reset fault by 2 x OFF signal (< 1 s) or manual correction of switching position
Fault during automatic reset		<input type="checkbox"/>	Reset fault by 2 x OFF signal (< 1 s)
Undefined reset mode (e.g. rotary button not in position 1 or 2)		<input type="checkbox"/>	Set the reset mode correctly, reset fault by 2 x OFF signal (< 1 s) or manual actuation

## 4.6.6 Technical specifications

### Motor operator MO320

		MO320 motor operator			
		125 A	3VA5 250 A	250 A	3VA6 400 A / 600 A
Ambient temperature (operation)	°C	-25 ... +70			
Ambient temperature (storage)	°C	-40 ... +80			
Rated control supply voltage (control supply voltage range)		24 ... 60 V DC (0.85 ... 1.26) 110 ... 240 V AC / 110 ... 250 V DC (0.85 ... 1.1)			
Rating	W/VA	250, max. 500 (60 ms)			
Breaking capacity (outputs)	24 ... 60 V DC	A			
	110 ... 230 V AC	A			
	110 ... 250 V DC	A			
Input impedance	24 ... 60 V DC	kΩ			
	110 ... 230 V AC	kΩ			
	110 ... 250 V DC	kΩ			
Make time, typical	ms	< 800	< 1000	< 1700	
Break time, typical	ms	< 800	< 1000	< 1400	
Pulse duration, minimum	ms	100			
Maximum switching frequency	1/h	120			
Degree of protection		IP20, with escutcheon IP30			
Connectable conductor cross sections	mm <sup>2</sup>	1.5 ... 2.5			
	AWG	16 ... 14			
Tightening torque	Nm	0.4 ±0.04			
	lb-in	3.5 ±0.4			
Stripped length	mm	7			
	in	0.28			
DIAZED fuse	A	4			
		Operational class gG Characteristic: slow			
Miniature circuit breakers		C characteristic to DIN VDE 0641			

## 4.7 Locking and interlocking

### 4.7.1 General information

#### 4.7.1.1 General information

For all 3VA UL molded case circuit breakers, a basic distinction is made between:

- Locking of molded case circuit breakers
- Interlocking of molded case circuit breakers

#### 4.7.1.2 Locking

The padlock devices can be used to lock the 3VA UL molded case circuit breaker in the OFF (O) position or ON (I) position. A molded case circuit breaker cannot be operated when it is locked.

##### Locking a molded case circuit breaker in the OFF (O) position



In order to prevent the 3VA UL molded case circuit breaker from being closed, the position OFF (O) can be secured with a padlock device. As a result of this locking, the 3VA UL molded case circuit breaker is in the secure OFF (O) position. It can be unlocked again only by an authorized person.

The padlock devices of the 3VA UL molded case circuit breaker in the OFF (O) position ensure safe separation of the main contacts as defined by IEC 60947-2.



### Locking a molded case circuit breaker in the ON (I) position



Like the OFF (O) position, the ON (I) positions can also be secured with a padlock device in order to secure the 3VA UL molded case circuit breaker against being opened. Only an authorized person can remove the locking of the 3VA UL molded case circuit breaker in the ON position again.

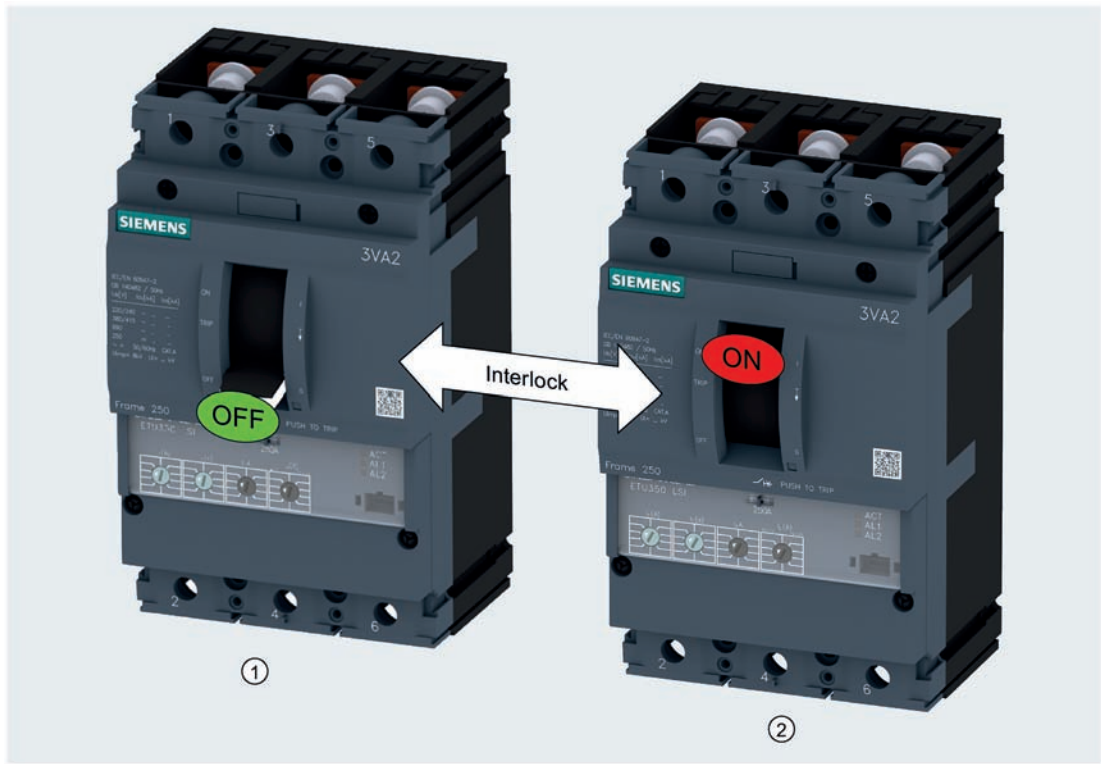
The TRIP function and thus the protection function of the 3VA UL molded case circuit breaker is not impaired by locking in the ON (I) position. In the event of a fault, the 3VA UL molded case circuit breaker trips in the normal way.

#### 4.7.1.3 Interlocking

Two or more 3VA UL molded case circuit breakers can be mutually interlocked with the padlock devices.

The padlock device releases only one 3VA UL molded case circuit breaker at a time, thereby ensuring that only the released circuit breaker can be actuated. All other 3VA UL molded case circuit breakers are in the safe OFF (O) position and are blocked by the interlocking technology.

Principle of two interlocked 3VA UL molded case circuit breakers:



- ① Molded case circuit breaker blocked/locked in the safe switching state OFF (O)
- ② Molded case circuit breaker released for operation

The 3VA UL molded case circuit breakers provide the following interlocking options:

- Front interlock
- Rear interlock

#### Front interlock

All front interlocks are installed on the front panel of the 3VA UL molded case circuit breaker. Front interlocks make it impossible to install some other external accessories such as motor operator, rotary operators, etc. They also partially restrict access to internal accessory compartments.

#### Rear interlock

The rear interlock does not affect the front panel of the 3VA UL molded case circuit breaker. All components of the interlocking system are concealed behind the molded case circuit breaker or the mounting plate.

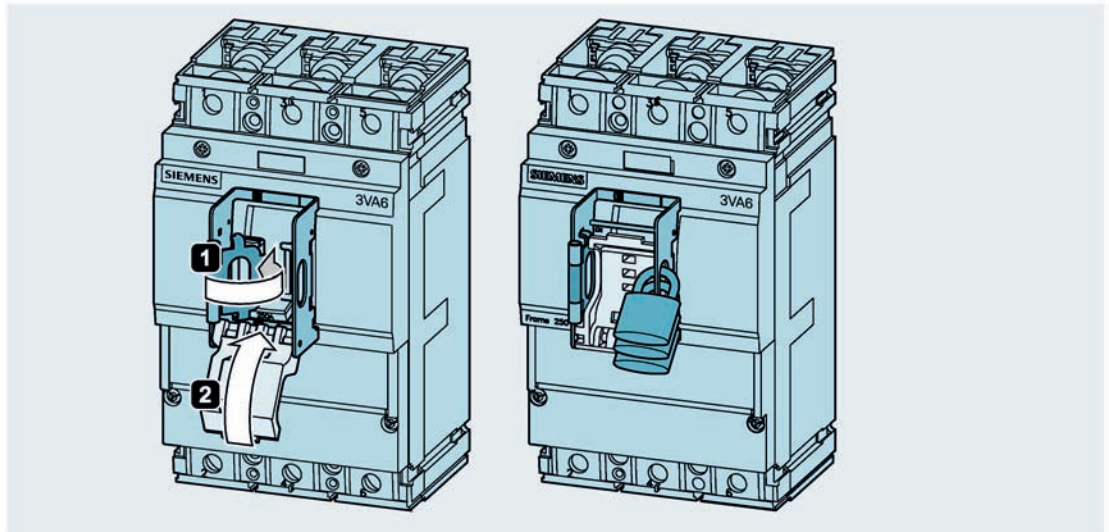
## 4.7.2 Blocking and locking

The following locking methods are available for the 3VA UL molded case circuit breaker:

- Handle blocking device including padlocks
- Cylinder locks for locking the 3VA UL molded case circuit breaker

### 4.7.2.1 Handle blocking device

The handle blocking device is attached directly to the handle of the 3VA UL molded case circuit breaker to be locked and latched in place.



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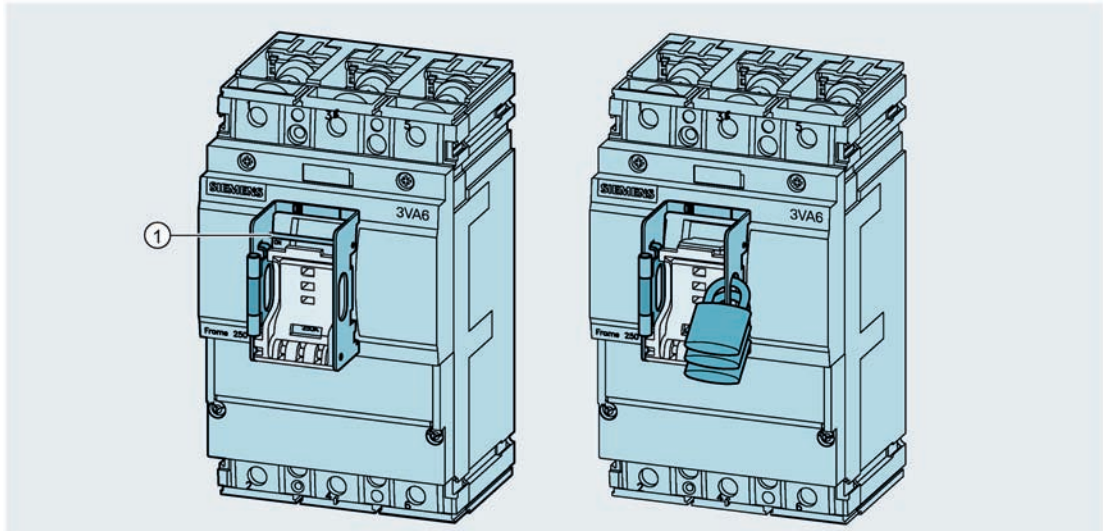
#### Note

You can find information on installation in the operating instructions "Handle blocking device" (<https://support.industry.siemens.com/cs/ww/en/view/109742929>).

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With the help of the handle blocking device, the 3VA UL molded case circuit breaker can be locked in the OFF (O) position with up to three padlocks (shackle diameter 3/16" - 5/16" / 4.5 - 8.5 mm).

If the 3VA UL molded case circuit breaker also needs to be lockable in the ON (I) position, the metal pin ① on the sliding bar must be removed with pliers, see diagram below. This deliberate action is a safety precaution and prevents accidental locking of the breaker in the ON position.



① Metal pin

#### Installation of other accessories

The installed handle blocking device partly excludes the installation of other accessory components, e.g. front mounted accessories such as manual and motor operators as well as front interlocks. In addition, the handle blocking device must be removed to gain access to the accessory compartment for the internal accessories.

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#### Note

The handle blocking device must be removed from the circuit breaker to change the state of the breaker from OFF to ON or from ON to OFF.

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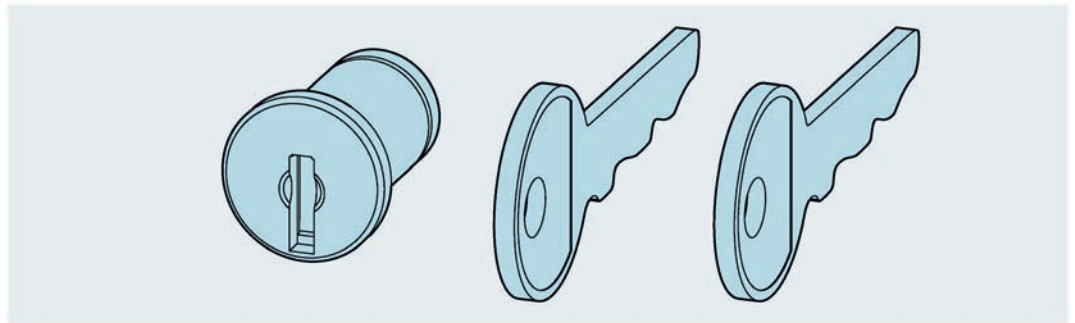
#### 4.7.2.2 Cylinder locks for locking the 3VA molded case circuit breaker

The OFF (O) or ON (I) position of the 3VA UL molded case circuit breaker can also be locked with a cylinder lock (type Ronis). After the locking, the 3VA UL molded case circuit breaker is protected from further actuation.

Locking with cylinder locks (type Ronis) is possible on all 3VA UL molded case circuit breakers. The cylinder lock is installed in an accessory compartment of the 3VA UL molded case circuit breaker.

To provide a cylinder lock, the following 2 components need to be ordered:

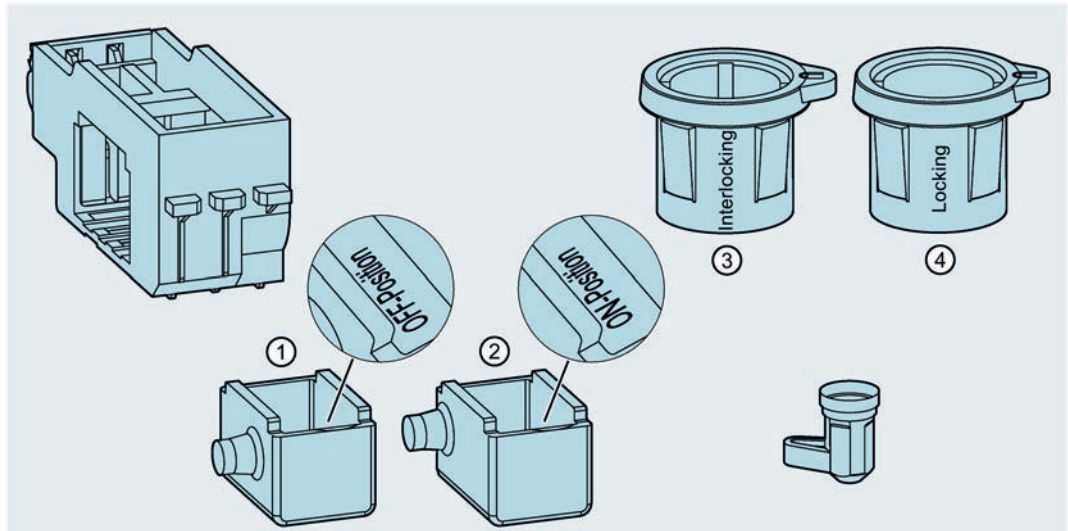
- One cylinder lock (type Ronis)  
1 lock and 2 keys are always included in the order.



Selection of the lock number is highly flexible, i.e. it can be selected from a choice of four different lock numbers. If different cylinder lock numbers are required for multiple locks, they can be selected from the predefined article numbers stated in the catalog.

4.7 Locking and interlocking

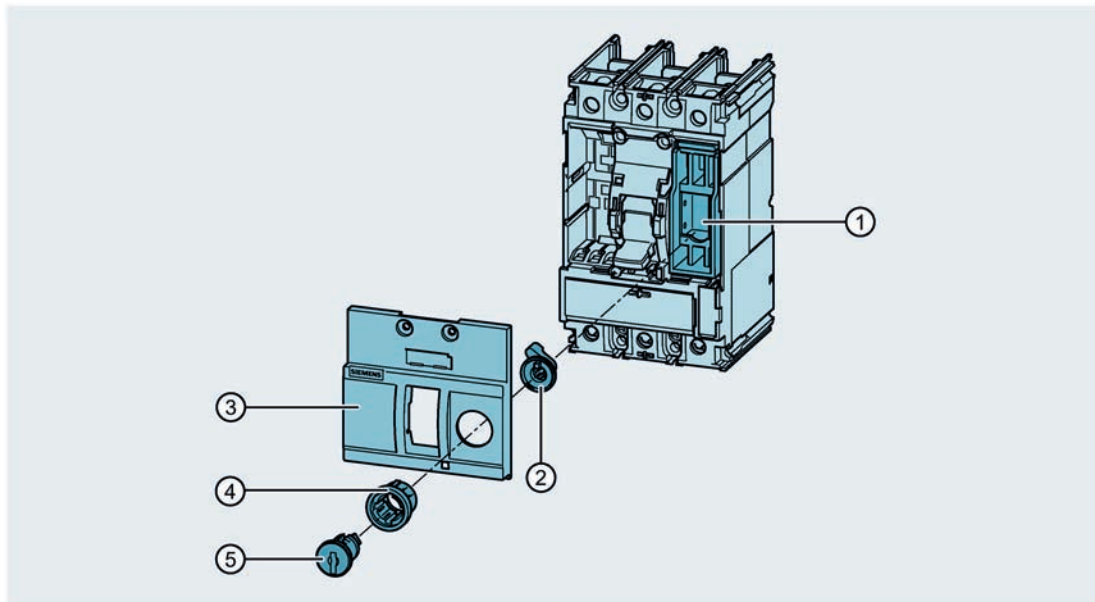
- One adapter kit  
The adapter kit transfers the motion of the lock to the switching mechanism.  
The article number includes the adapter kit and two cylinder lock housings. One cylinder lock housing (locking) is used for locking applications and the other housing (interlocking) for interlocking applications.



- ① Slide for locking in the OFF position
- ② Slide for locking in the ON position
- ③ Cylinder lock housing for locking
- ④ Cylinder lock housing for interlocking

### Locking in the OFF (O) position

In order to lock the 3VA UL molded case circuit breaker in the OFF (O) position, the cylinder lock (type Ronis) is installed with the adapter kit and the cylinder lock housing for locking in the right-hand accessory compartment of the molded case circuit breaker. The slide for locking in the OFF position is fitted for this purpose.



- |                                       |                                     |
|---------------------------------------|-------------------------------------|
| ① Adapter kit with OFF position slide | ④ Cylinder lock housing for locking |
| ② Actuating lever                     | ⑤ Cylinder lock (type Ronis)        |
| ③ Accessory cover                     |                                     |

1. Remove the accessory cover ③ from the 3VA UL molded case circuit breaker.
2. From the rear of the lid of the accessory cover, drill a hole through the lid at the position designated for the cylinder lock housing and remove burrs with a file.  
In addition, introduce as precise a gap as possible for anti-rotation protection of the cylinder lock housing.
3. Insert a cylinder lock (type Ronis) ⑤ and the locking version of the cylinder lock housing ④ in the drilled hole and connect it securely to the accessory cover ② via the actuating lever.
4. Install the adapter kit ① in the right-hand accessory compartment of the 3VA UL molded case circuit breaker.
5. Reattach the accessory cover to the 3VA UL molded case circuit breaker.

To lock the 3VA UL molded case circuit breaker in the OFF (O) position, the key must be turned to the vertical "locked" position.



#### Locking in the ON (I) position

For safety reasons, a deliberate action is required to lock the breaker in the ON (I) position. The slide for locking in the ON position must be used for this purpose. Further information can be found in the relevant operating instructions.

#### Use of cylinder locks (type Ronis) for other applications

Cylinder locks (type Ronis) can also be used in the following applications:

- For locking the travel of draw-out technology, see chapter Draw-out technology (Page 234)
- For locking in the manual operators of the 3VA UL molded case circuit breaker, see chapter Manual operators (Page 258)

#### Installation of other accessories

The installation of the cylinder lock in the accessory compartment of the molded case circuit breaker partly excludes the installation of other accessory components, e.g. front mounted accessories such as manual and motor operators as well as front interlocks. Likewise the cylinder lock blocks slots for internal accessories, for overview see chapter Mounting locations of 3VA UL molded case circuit breakers (Page 152).



### 4.7.3 Front interlocking

Front interlocks are installed on the front panel of the 3VA UL molded case circuit breaker.

The following interlocking methods are available for the 3VA UL molded case circuit breaker:

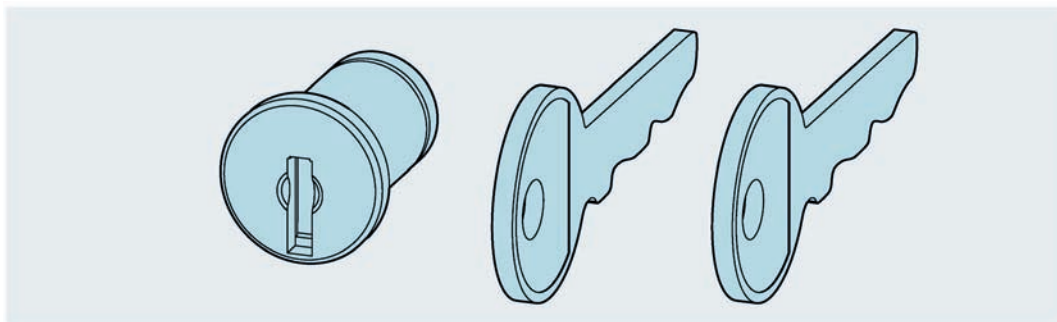
- Cylinder locks for implementing interlocks between an unlimited number of molded case circuit breakers
- Cable interlock module using a Bowden cable
- Sliding bar

#### 4.7.3.1 Cylinder locks for interlocking multiple 3VA UL molded case circuit breakers

With cylinder locks (type Ronis) in the accessory compartments, molded case circuit breakers cannot only be locked (see chapter Cylinder locks for locking the 3VA molded case circuit breaker (Page 307)), but it is also possible to mutually interlock any number of 3VA UL molded case circuit breakers. This ensures that only one 3VA UL molded case circuit breaker at a time in the interlock application can be in position ON (I).

In order to implement an interlock application on multiple 3VA UL molded case circuit breakers, the following two components must be ordered for each 3VA UL molded case circuit breaker to be interlocked:

- One cylinder lock (type Ronis)  
1 lock and 2 keys are always included in the order



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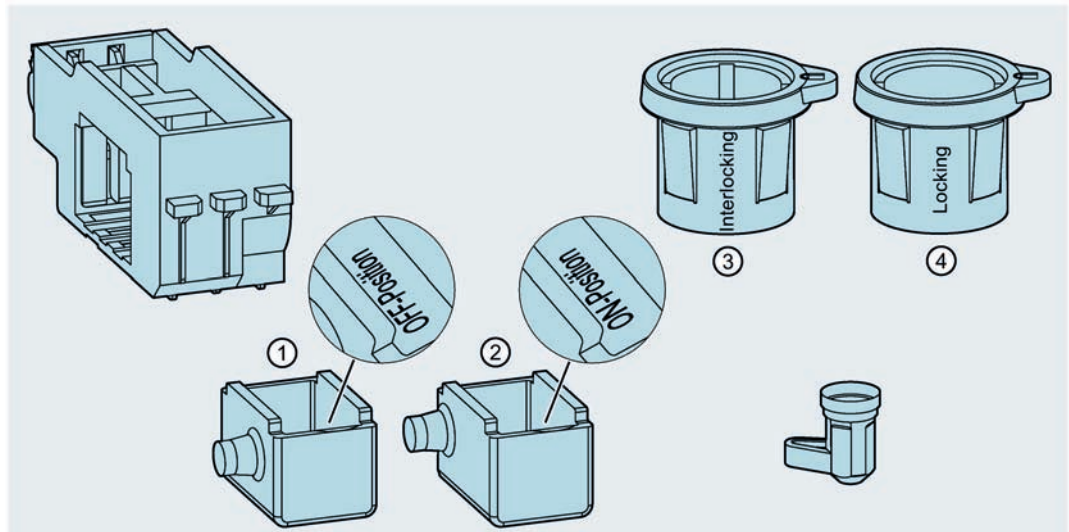
**Note**

It is important to order the same lock number for all circuit breakers to be included in the interlock arrangement.

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4.7 Locking and interlocking

- One adapter kit  
The adapter kit transfers the motion of the lock to the switching mechanism.  
The article number includes the adapter kit and two cylinder lock housings.

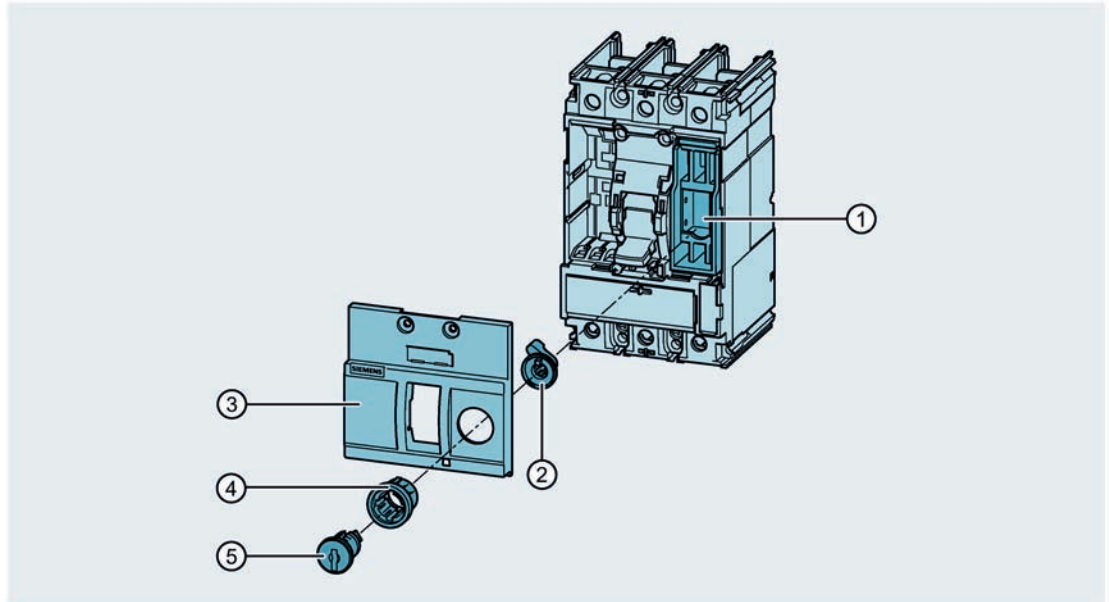


- ① Slide for locking in the OFF position
- ② Slide for locking in the ON position
- ③ Locking version of cylinder lock housing
- ④ Interlocking version of cylinder lock housing

If, for example, three 3VA UL molded case circuit breakers are to be interlocked, three cylinder locks (type Ronis) with the same lock number and 3 adapter kits suitable for the respective 3VA UL molded case circuit breaker must be ordered.

### Installing the cylinder lock in the accessory compartment

The cylinder lock (type Ronis) is installed with the adapter kit and the "Interlocking" cylinder lock housing in the right-hand accessory compartment of the molded case circuit breaker.




- |   |                 |   |  |
|---|-----------------|---|--|
| ① | Adapter kit     | ④ | Cylinder lock housing for interlocking |
| ② | Actuating lever | ⑤ | Cylinder lock (type Ronis)             |
| ③ | Accessory cover |   |  |

1. Remove the accessory cover ③ from the 3VA UL molded case circuit breaker.
2. From the rear of the lid of the accessory cover, drill a hole through the lid at the position designated for the cylinder lock housing and remove burrs with a file.  
In addition, introduce as precise a gap as possible for anti-rotation protection of the cylinder lock housing.
3. Insert a cylinder lock (type Ronis) ⑤ and the locking version of the cylinder lock housing ④ in the drilled hole and connect it securely to the accessory cover ② via the actuating lever.
4. Install the adapter kit ① in the right-hand accessory compartment of the 3VA UL molded case circuit breaker.
5. Reattach the accessory cover to the 3VA UL molded case circuit breaker.

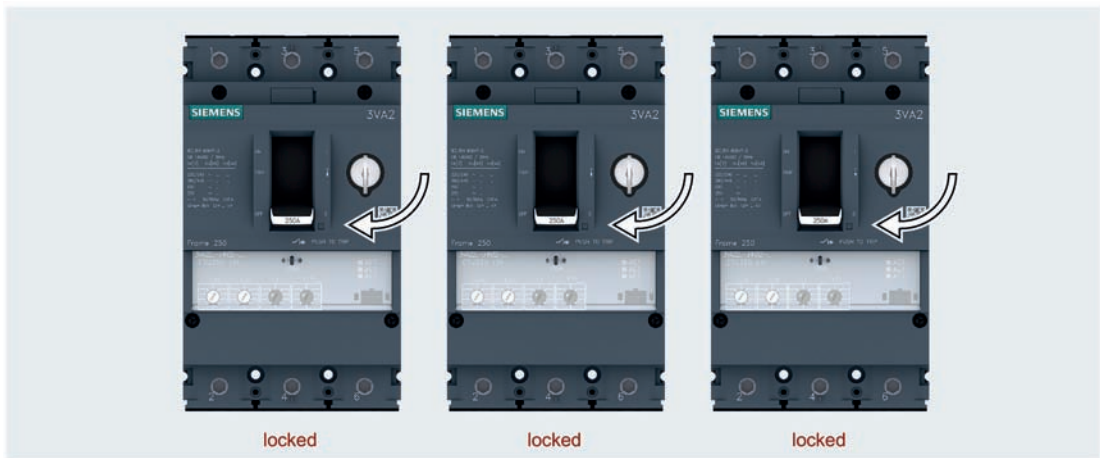
A cylinder lock (type Ronis) is installed for each 3VA UL molded case circuit breaker to be interlocked.

Interlocking of molded case circuit breakers

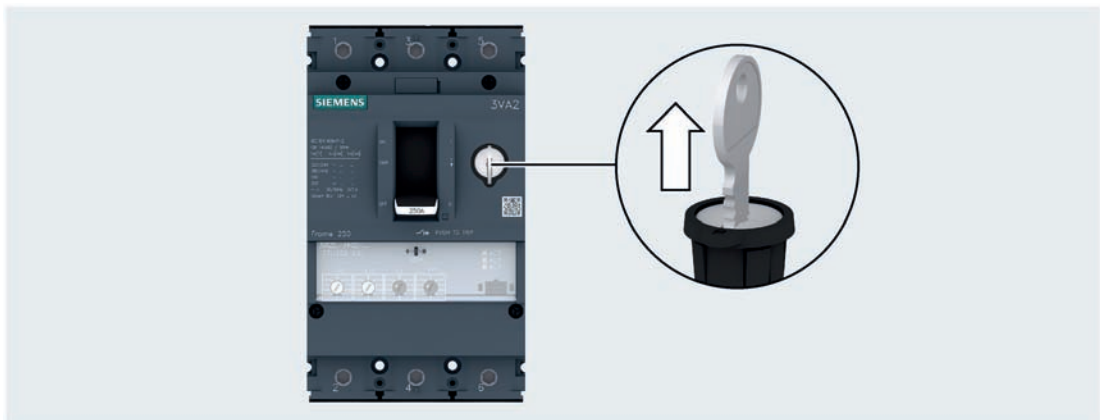
 <b>WARNING</b>
<b>Risk of interlock defeat. Use of more than one key poses safety hazard.</b>
Leave a key inserted in only one of the circuit breakers in the interlock arrangement.
Store all other keys in a safe place or lock them away.

In order to ensure reliable functioning of the interlock, only 1 key is left in one circuit breaker included in the interlock arrangement. This one key serves as the release instrument for only one molded case circuit breaker at a time.

1. Bring all 3VA UL molded case circuit breakers of the interlock arrangement to the OFF position and lock them (cylinder lock in vertical "locked" position).

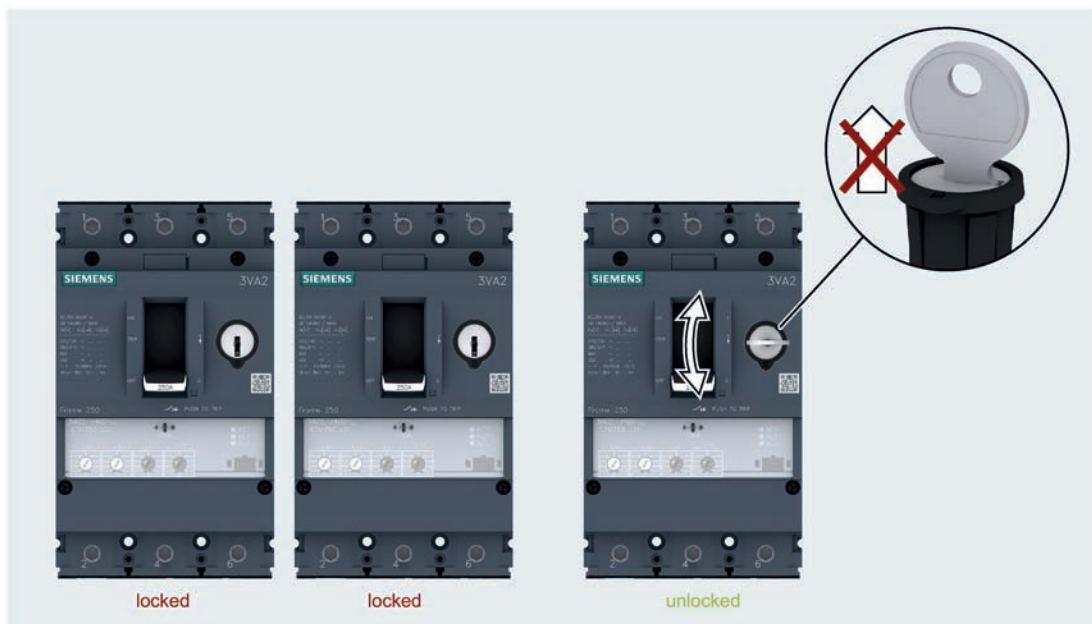


2. Remove all keys.



All 3VA UL molded case circuit breakers of the interlock arrangement are now securely locked in the OFF (O) position and cannot be actuated.

3. Insert **one single** key in one circuit breaker included in the interlock; store or lock away **all other** keys.
4. Use the single key to turn the cylinder lock of the 3VA UL molded case circuit breaker to be released to the "unlocked" position.  
In "unlocked" position, the key can no longer be removed and must remain in the cylinder lock.



5. Move the handle of the released 3VA UL molded case circuit breaker to the ON (I) position.

#### Releasing a different molded case circuit breaker

1. Move the handle of the currently released molded case circuit breaker to the OFF (O) position.
2. Turn the cylinder lock to the vertical "locked" position and remove the key.  
The 3VA UL molded case circuit breaker released up to then is now securely locked in the OFF (O) position and cannot be actuated.
3. Use the removed key to turn the cylinder lock of the 3VA UL molded case circuit breaker to be newly released to the horizontal "unlocked" position.
4. Move the handle of the released 3VA UL molded case circuit breaker to the ON (I) position.

#### Interlock combinations

The following interlock combinations can be implemented with cylinder locks:

- All 3VA5 and 3VA6 molded case circuit breakers can be interlocked.
- Interlocks can be implemented between all sizes of breakers.
- Mutual interlocks can be implemented between all 2-pole, 3-pole and 4-pole molded case circuit breakers.

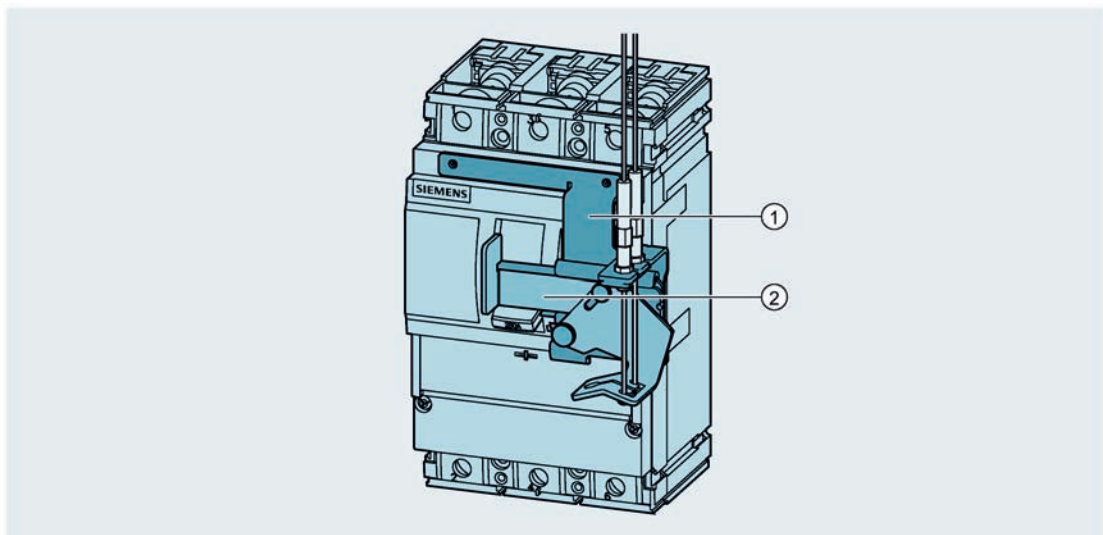
### Installation of other accessories

The installation of the cylinder lock in the accessory compartment of the molded case circuit breaker partly excludes the installation of other accessory components, e.g. front mounted accessories such as manual and motor operators as well as front interlocks. Likewise the cylinder lock blocks slots for internal accessories (for overview see chapter Mounting locations of 3VA UL molded case circuit breakers (Page 152)).

#### 4.7.3.2 Cable interlock module using a Bowden cable

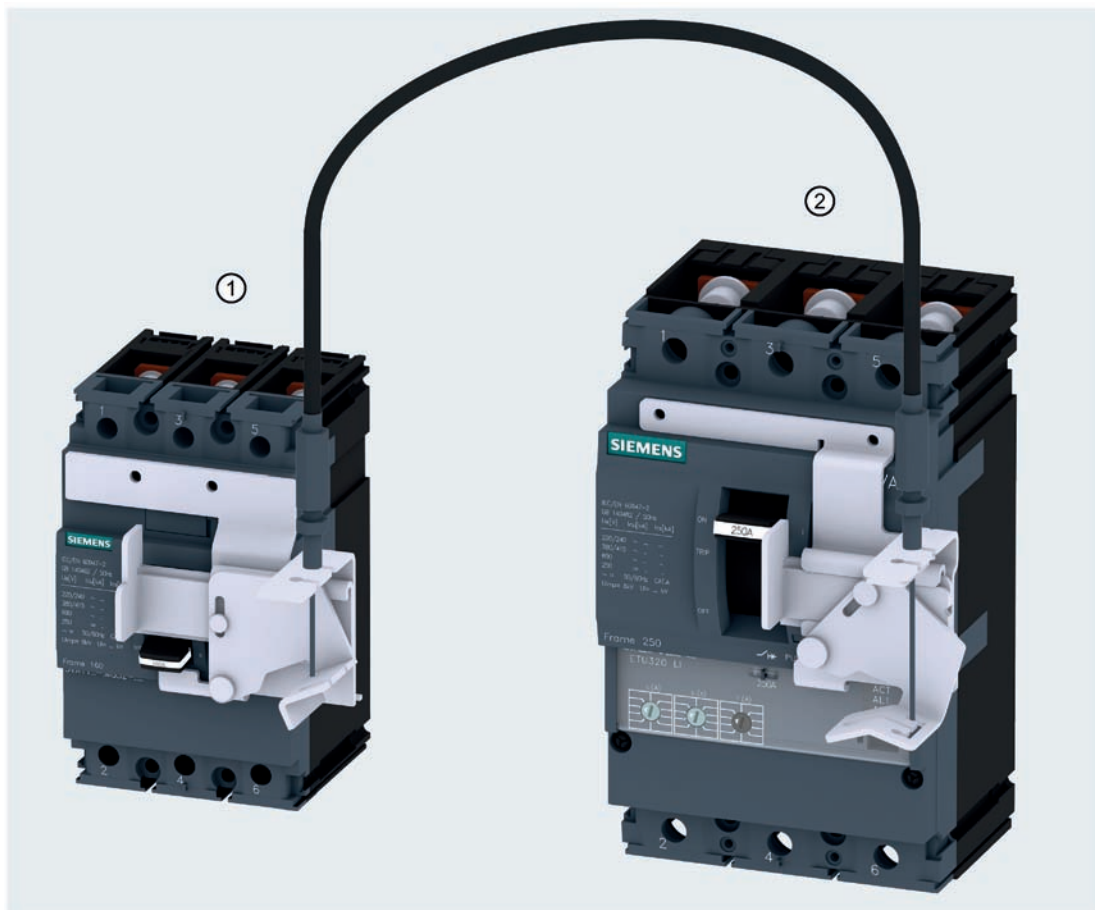
A mutual interlock between up to three molded case circuit breakers can be implemented by means of the front Bowden cable interlock module. This interlock functions according to the blocking principle: If one of the circuit breakers included in the interlock is unlocked, the Bowden cables move in such a way as to ensure that the other molded case circuit breakers are locked in the OFF (O) position.

In order to implement a front Bowden cable interlock, sliding bar modules must be mounted on the 3VA UL molded case circuit breakers involved. Each of these modules is equipped with a slide which blocks or releases operation of the handle.



- ① Sliding bar module
- ② Slide

A Bowden cable must be installed in addition to the sliding bar modules. This cable prevents the slides from releasing more than one molded case circuit breaker at any one time. This ensures that only one 3VA UL molded case circuit breaker at a time can be actuated and only **one** molded case circuit breaker can be in the ON (I) position.



- ① 3VA5 125 molded case circuit breaker, blocked by slide
- ② 3VA6 250 molded case circuit breaker, released by slide

### Note

For installation instructions, please refer to operating instructions "Sliding bar modules".

### Bowden cable lengths



The following lengths of Bowden cable can be ordered:

- 23.62" / 0.6 m
- 39.37" / 1.0 m
- 59.05" / 1.5 m

4.7 Locking and interlocking

**Interlock combinations**

The following 3VA UL molded case circuit breakers can be interlocked:

						
			3VA5		3VA6	
			125 A 3- and 4-pole	250 A 3- and 4-pole	150 A / 250 A 3- and 4-pole	400 A / 600 A 3- and 4-pole
	3VA5	125 A 3- and 4-pole	■	■	■	■
		250 A 3- and 4-pole	■	■	■	■
	3VA6	150 A / 250 A 3- and 4-pole	■	■	■	■
		400 A / 600 A 3- and 4-pole	■	■	■	■

**Possible combinations of handle positions**

When a sliding bar using a Bowden cable is installed for **two** 3VA UL molded case circuit breakers, the following handle positions are possible:

Molded case circuit breaker 1	Molded case circuit breaker 2
ON / TRIP	OFF
OFF	ON / TRIP
OFF	OFF

When a sliding bar using a Bowden cable is installed for **three** 3VA UL molded case circuit breakers, the following handle positions are possible:

Molded case circuit breaker 1	Molded case circuit breaker 2	Molded case circuit breaker 3
ON / TRIP	OFF	OFF
OFF	ON / TRIP	OFF
OFF	OFF	ON / TRIP
OFF	OFF	OFF

**Installation of other accessories**

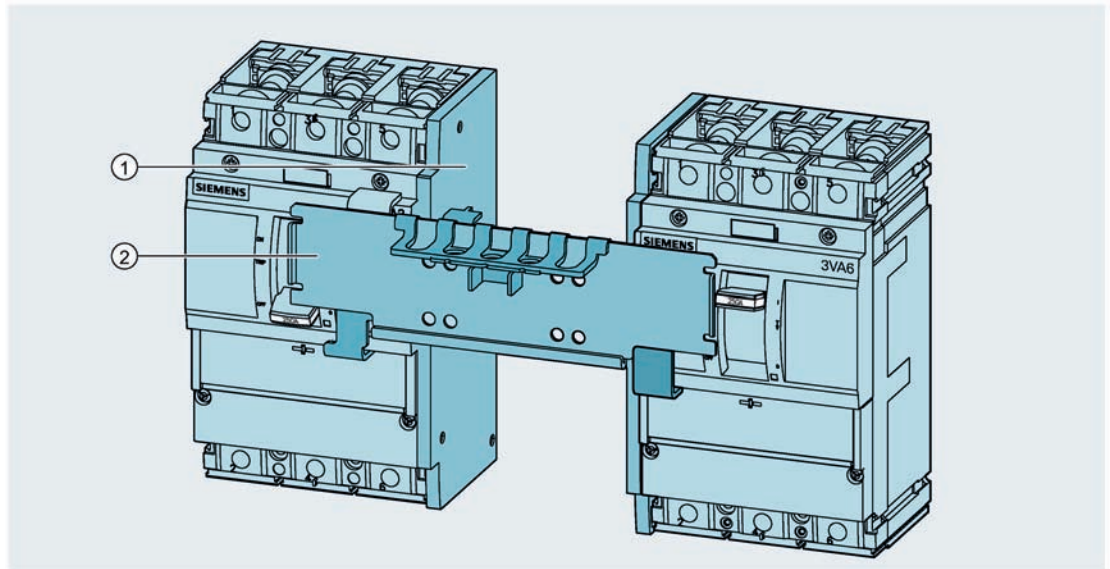
The installation of the front sliding bar with Bowden cable partly excludes the installation of other accessory components, e.g. front mounted accessories such as manual and motor operators as well as cylinder locks. In addition, the front interlock must be removed to gain access to the accessory compartment for the internal accessories.



### 4.7.3.3 Sliding bar

With the front sliding bar, up to three 3VA UL molded case circuit breakers of the same size can be mutually interlocked with a bar device. The sliding bar can be locked with up to three padlocks (shackle diameter 1/4" to 5/16" / 6 mm to 8 mm).

#### Installing the sliding bar



- ① Side plate
- ② Locking slide

1. Attach two side plates ① to the side of the 3VA UL molded case circuit breaker.
2. Attach the locking slide ② securely to the two side plates.

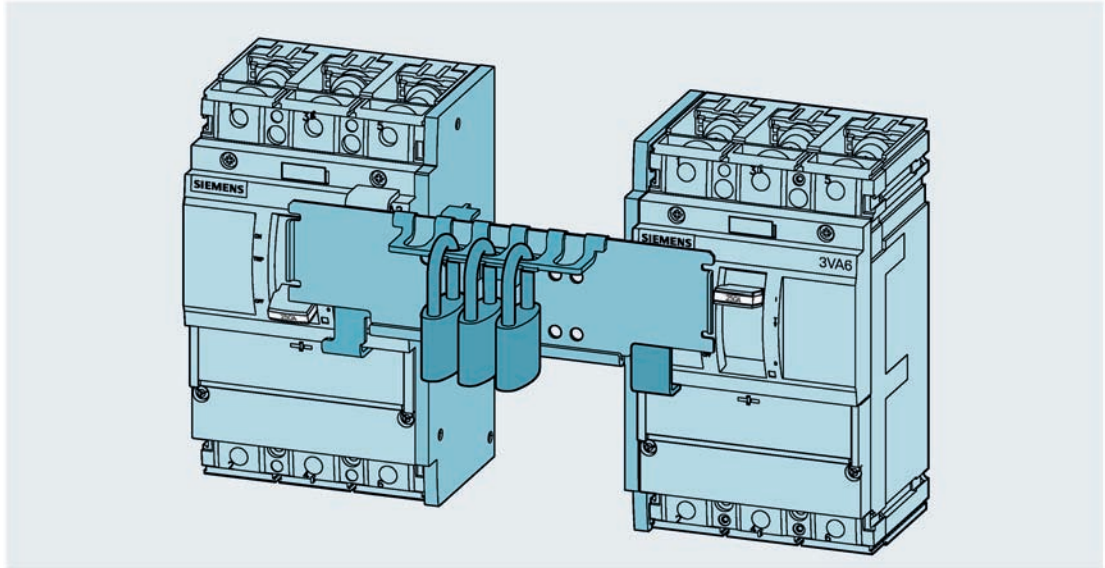
#### Locking the handle

The handle of the 3VA UL molded case circuit breaker to be interlocked is blocked by sliding the locking slide.

Up to three commercially available padlocks (shackle diameter 1/4" to 5/16" / 6 mm to 8 mm) can be fitted to lock the slide in position and prevent operation of the blocked handle. The blocked 3VA UL molded case circuit breaker is thus always locked in the safe and locked OFF (O) position, while the released 3VA UL molded case circuit breaker can be actuated.

If the locking slide is in the midway position and locked there with padlocks, two or all three of the molded case circuit breakers can also be blocked or secured in the OFF (O) position.

Example of an interlock based on two 3VA UL molded case circuit breakers:



#### Scope of delivery

The order number includes the following items:

- 2 side plates
- 1 locking slide

#### Interlock combinations

The following interlock combinations can be implemented with the sliding bar:

- Interlocks can be implemented between the same rated current versions of molded case circuit breakers:
  - 3VA5 125 A with 3VA5 125 A
  - 3VA5 250 A with 3VA5 250 A and 3VA6 150/250 A
  - 3VA6 150/250 A with 3VA5 250 A and 3VA6 150/250 A
  - 3VA6 400/600 A with 3VA6 400/600 A
- All 3-pole and 4-pole molded case circuit breakers of the same size can be interlocked.

### Possible combinations of handle positions

In the case of a sliding bar for **two** 3VA UL molded case circuit breakers locked with padlocks, the following handle positions are possible:

Molded case circuit breaker 1	Molded case circuit breaker 2
ON / TRIP	OFF
OFF	ON / TRIP
OFF	OFF

In the case of a sliding bar for **three** 3VA UL molded case circuit breakers locked with padlocks, the following handle positions are possible:

Molded case circuit breaker 1	Molded case circuit breaker 2	Molded case circuit breaker 3
ON / TRIP	OFF	OFF
OFF	ON / TRIP	OFF
OFF	OFF	ON / TRIP
OFF	OFF	OFF

### Installation of other accessories

The installation of the front sliding bar partly excludes the installation of other accessory components, e.g. front mounted accessories such as manual and motor operators as well as cylinder locks. In addition, the front interlock must be removed to gain access to the accessory compartment for the internal accessories.

## 4.7.4 Rear interlock

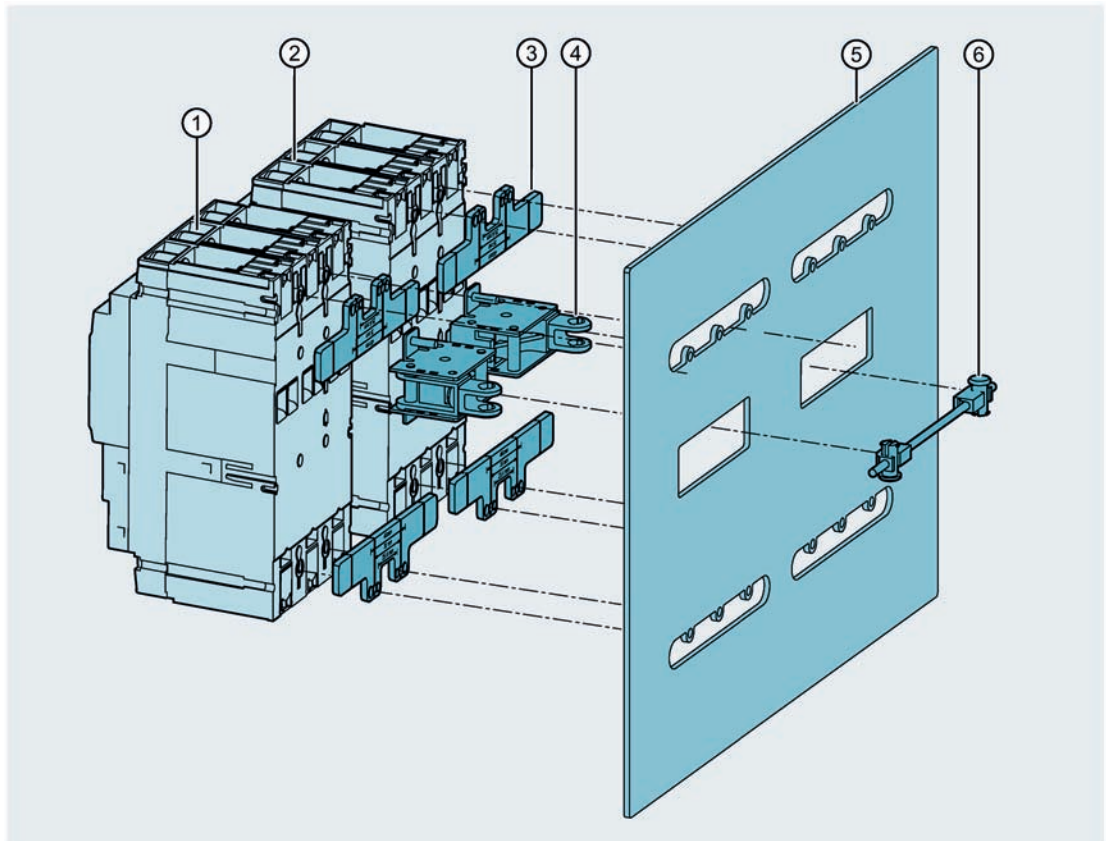
### Rear interlock

The rear interlock allows an interlock of two 3VA UL molded case circuit breakers without restricting the installation of accessories on the front panel of the molded case circuit breaker.

The rear interlock operates according to the following principle: When one molded case circuit breaker is closed, the other circuit breaker is prevented from closing by a tappet which engages in the breaker mechanism directly from the rear panel of the molded case circuit breaker.

The rear interlock is provided by two interlocking modules which are attached at the rear of the molded case circuit breakers and behind the mounting plate. The two interlocking modules are interconnected by means of the interlocking rod.

Modification of the panel mounting plate may be required.



- |   |                               |   |                      |
|---|-------------------------------|---|----------------------|
| ① | Molded case circuit breaker 1 | ④ | Interlocking modules |
| ② | Molded case circuit breaker 2 | ⑤ | Panel mounting plate |
| ③ | Mounting accessories          | ⑥ | Interlocking rod     |

**Note**

You can find installation information in the operating instructions of the rear interlock (<https://support.industry.siemens.com/cs/ww/en/view/109742930>).

**Scope of delivery**

The order number includes the following items:

- Two interlocking modules
- Mounting accessories
- Interlocking rod

**Interlock combinations**

The following interlock combinations are possible:

- All 3VA5 and 3VA6 molded case circuit breakers can be interlocked.
- All sizes up to 600 A can be interlocked.
- All 3-pole and 4-pole molded case circuit breakers can be interlocked.

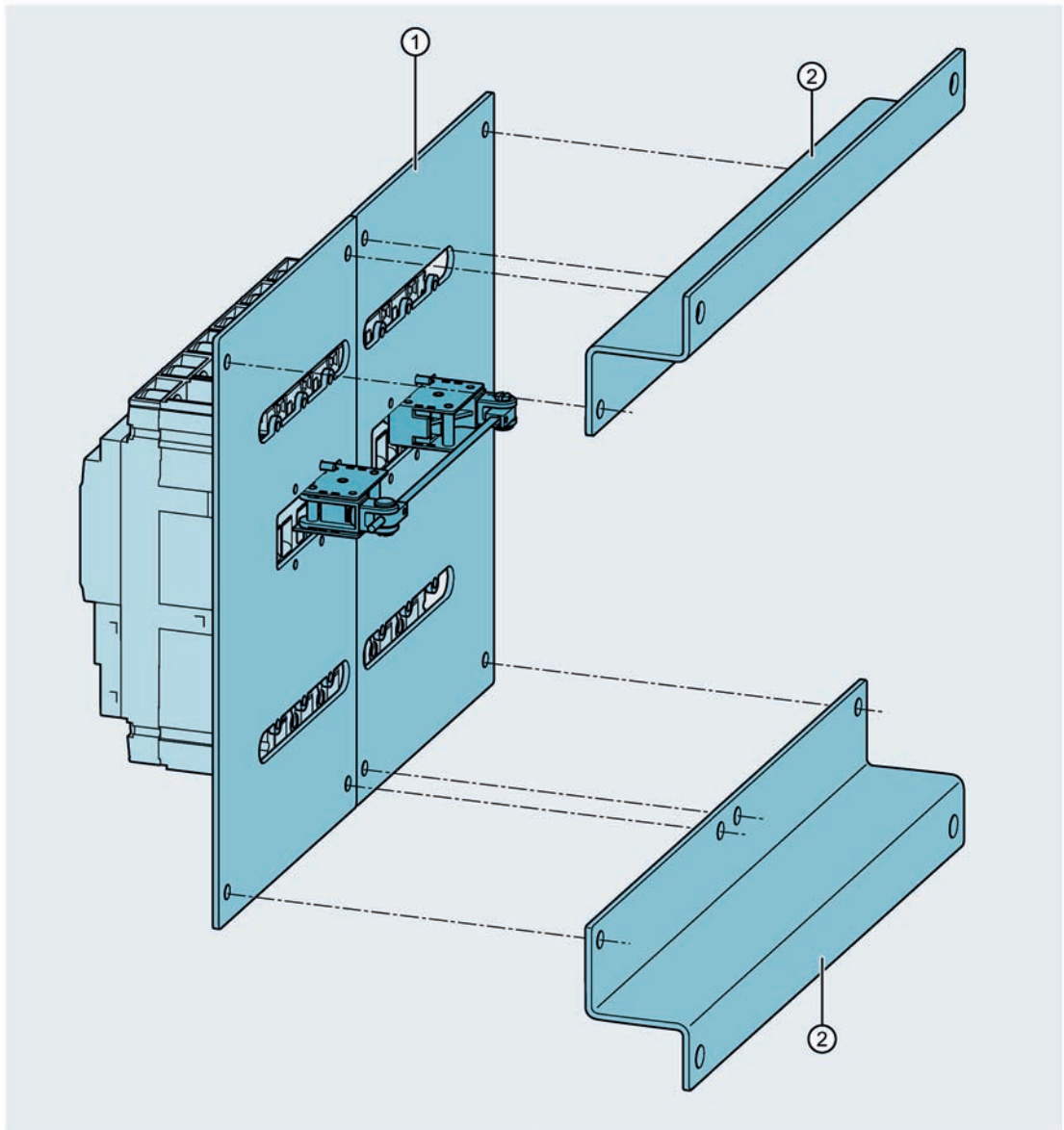
**Handle positions**

When a rear interlock is installed for two 3VA UL molded case circuit breakers, the following handle positions are possible:

Molded case circuit breaker 1	Molded case circuit breaker 2
ON / TRIP	OFF
OFF	ON / TRIP
OFF	OFF

**Assembling aid to facilitate installation of rear interlock**

An assembling aid is available for all 3VA UL molded case circuit breakers. It facilitates installation of the rear interlock and reduces the amount of work required to the panel mounting plate.



- ① Mounting plates (specific to molded case circuit breaker)
- ② Profile rail

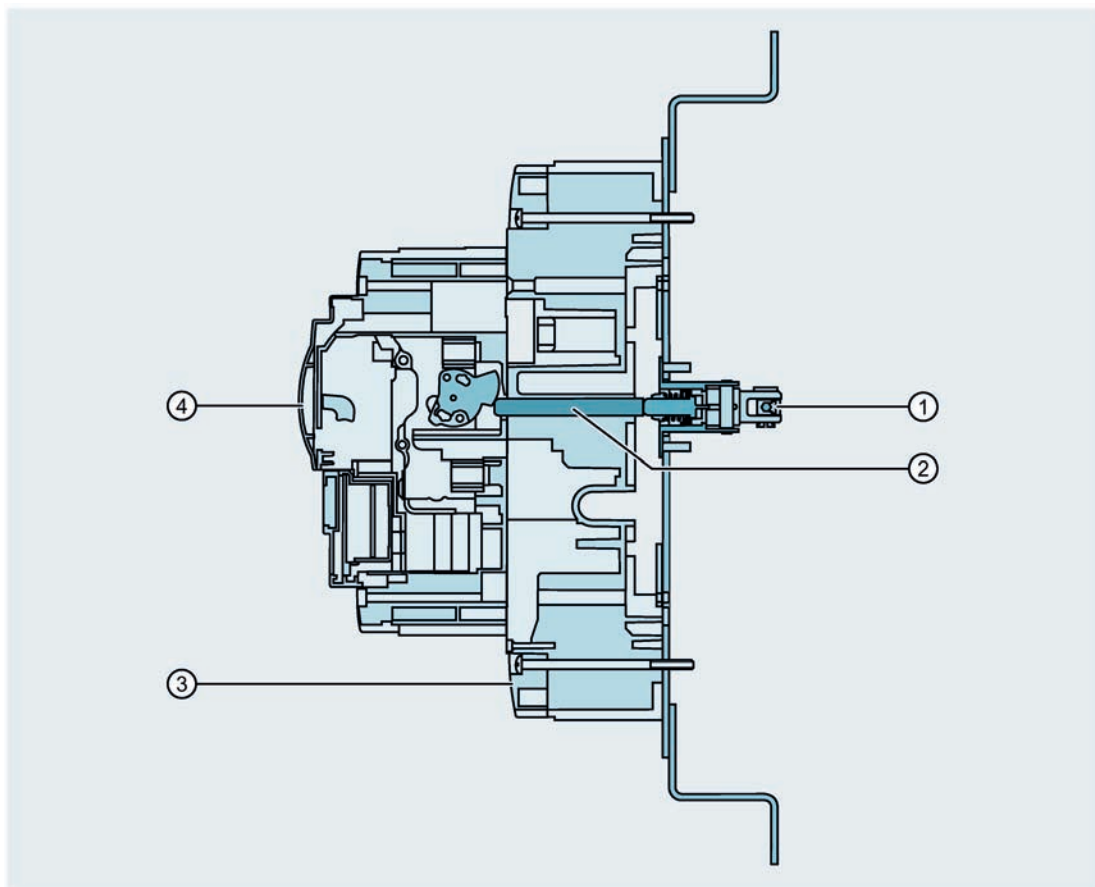
1. Assemble installation frame:
  - Place mounting plates ① on the molded case circuit breaker.
  - Bolt the profile rails ② to the adapter plates.
  - Install rear interlock.
2. Bolt the assembled installation frame to the panel mounting plate.

No further work to the panel mounting plate is required.

The same rear interlock combinations can be implemented regardless of whether or not the assembling aid is used.

### Rear interlock for plug-in and draw-out units

In order to use a rear interlock for plug-in or draw-out versions of the molded case circuit breakers, the tappet needs to be lengthened. The tappet extension transfers the interlocking motion of the modules through the plug-in socket or the draw-out socket.



- |   |                     |   |                             |
|---|---------------------|---|-----------------------------|
| ① | Interlocking module | ③ | Plug-in or draw-out socket  |
| ② | Tappet extension    | ④ | Molded case circuit breaker |

#### 4.7 Locking and interlocking

The rear interlock for plug-in or draw-out units is available as a complete kit containing all the required components:

- Two interlocking modules
- Mounting accessories
- Interlocking rod
- All the required tappet extensions

#### **Interlock combinations**

The same rear interlock combinations can be implemented for plug-in and draw-out versions as for fixed-mounted versions.

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#### **Note**

The draw-out technology cannot be installed together with the mounting plates and the profile rails.

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## 4.8 Communication and system integration

### 4.8.1 System description

Communication-capable 3VA UL molded case circuit breakers are presented in this chapter. You will learn which components the 3VA UL molded case circuit breakers need for communication, how these components are assembled and what properties they have.

Optimum integration of the 3VA UL molded case circuit breakers in a software and communication system yields the following advantages:

- Acquisition of breaker status
- Remote parameterization
- Monitoring of capacity utilization
- Acquisition of consumption and performance data
- Local signaling via the EFB300 external function box
- Local visualization of the 3VA UL molded case circuit breakers

To make use of all these functions, a COM060 communication module must be installed in the respective 3VA UL molded case circuit breaker and connected to a COM800 breaker data server for up to eight 3VA UL molded case circuit breakers or a COM100 breaker data server for a single 3VA UL molded case circuit breaker.

You can find detailed information on the communication module and breaker data server and the communication link of the molded case circuit breaker in the 3VA Communication System Manual (<https://support.industry.siemens.com/cs/ww/en/view/98746267>).

### 4.8.2 Communication system of the 3VA UL molded case circuit breaker

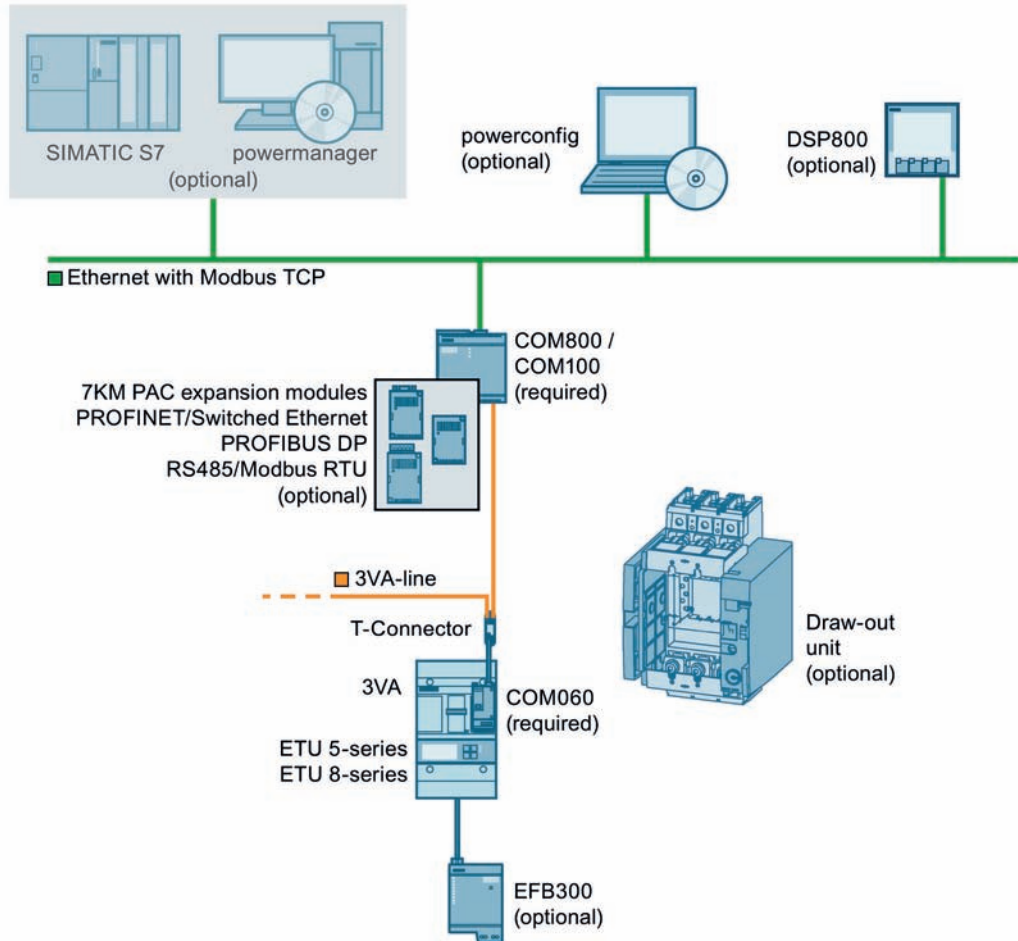
The following components combine with the 3VA UL molded case circuit breaker to form the communication system:

- Electronic trip unit (ETU)
- COM800 / COM100 breaker data server
- Optional expansion modules for three other communication networks
- COM060 communication module
- Draw-out unit with communication link
- EFB300 external function box (EFB)
- DSP800 display
- Commissioning and service software: powerconfig

4.8 Communication and system integration

The diagram below presents the components which render a 3VA UL molded case circuit breaker capable of communication.

System architecture of 3VA UL communication



The central components of communication-capable 3VA UL molded case circuit breakers are the ETUs 5-series and 8-series.

You can find additional information in the 3VA Communication System Manual (Page 11). There the components are regarded only as suppliers of information or receivers of commands.

Typical communication partners are:

- SIMATIC S7
- powermanager

These are named multiple times but are not an integral part of the 3VA UL communication system.

### 4.8.3 COM800 / COM100 breaker data server

The COM800/COM100 breaker data servers can be used to integrate communication-capable 3VA UL molded case circuit breakers, with 5-series and 8-series trip units, into various communication networks.

- The COM800 breaker data server supports a maximum of eight 3VA UL molded case circuit breakers
- The COM100 breaker data server supports one 3VA UL molded case circuit breaker

3VA molded case circuit breakers can be connected to higher-level communication networks by the following methods:

- Direct Ethernet connection to Modbus TCP
- 7KM PAC PROFIBUS DP expansion module to PROFIBUS DPV1 / V2
- 7KM PAC Switched Ethernet PROFINET expansion module to PROFINET IO and PROFlenergy, as well as Modbus TCP
- 7KM PAC RS 485 expansion module for Modbus RTU

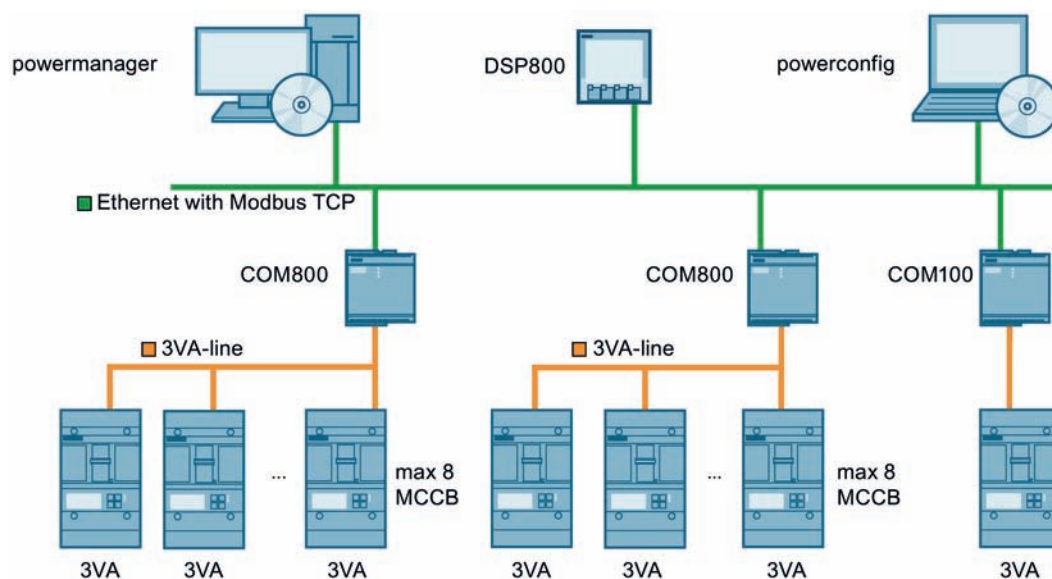
The 3VA UL molded case circuit breakers are typically integrated in the power monitoring software powermanager or the TIA (Totally Integrated Automation) automation concept via a communication network.

The 3VA UL molded case circuit breakers can also be connected to the commissioning and service software powerconfig.

The 3VA UL molded case circuit breakers can also be connected to many non-Siemens systems via these communication networks.

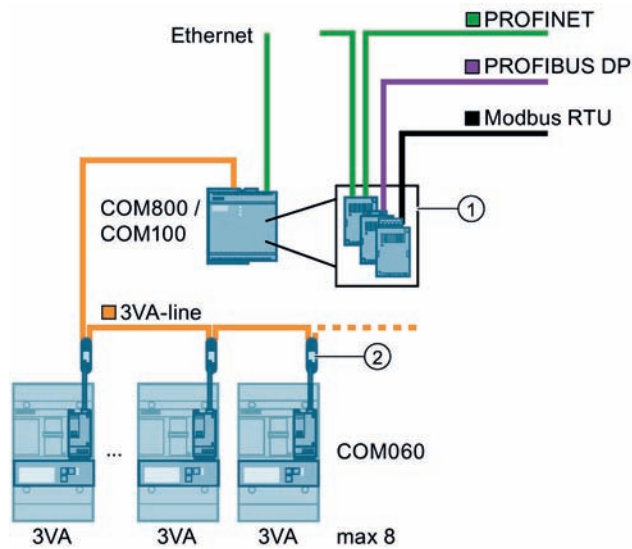
Furthermore, local visualization on the DSP800 display can be implemented with the COM800/COM100 breaker data server.

Example: Configuration of the COM800/COM100 breaker data server with a 3VA-line of three 3VA UL molded case circuit breakers and with connection to the power monitoring software powermanager (left), to the DSP800 (center) and to the commissioning and service software powerconfig (right).



4.8 Communication and system integration

To establish a communication link, the COM800 or COM100 breaker data server is connected via the 3VA-line to the COM060 communication module of the relevant circuit breaker.



- ① 7KM PAC expansion modules
- ② T-connector

From a UL Class 2, 24 V DC power supply, the COM800/COM100 breaker data server supplies power to all the 3VA UL molded case circuit breakers involved and the following components:

- COM060 communication module
- ETUs 5-series and 8-series
- Position signaling switch for draw-out socket
- 7KM PAC PROFIBUS DP expansion module
- 7KM PAC Switched Ethernet PROFINET expansion module
- 7KM PAC RS 485 expansion module
- Direct Ethernet connection to Modbus TCP

#### 4.8.3.1 Area of application

The COM800/COM100 breaker data server enables the integration of the 3VA UL molded case circuit breakers in:

- Power monitoring software powermanager
- Industrial automation systems
- Building automation systems
- Parameterization and breaker condition evaluation via communication link
- Maintenance systems

#### 4.8.3.2 Features

The COM800/COM100 breaker data server together with the connected 3VA UL molded case circuit breakers with the ETUs 5-series and 8-series provides the following information about the power distribution system:

- Condition of the 3VA UL molded case circuit breaker
- Tripping history with time stamp, cause of trip and number of trip events for breakers with ETUs 5-series and 8-series
- Minimum and maximum values of measured variables
- Limit-value monitoring for measured variables in the 3VA UL molded case circuit breakers
- Load curves with power demands, e.g. 15-minute demands
- Energy values such as active energy (kWh) and reactive energy (kvarh)
- Power supply to connected 3VA UL molded case circuit breakers
- Three simultaneous communication connections via the integrated Ethernet interface

#### 4.8.4 Communication with ETUs

Electronic trip units allow detailed setting of protection parameters from a central location. They record measured variables and maintenance information in order to support power and installation monitoring.

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

- Overload protection L ("L" = Long time)
- Short-time delayed short-circuit release S ("S" = Short time) for time-selective response in case of a short-circuit
- Instantaneous short-circuit release I ("I" = Instantaneous)
- Protection of the neutral conductor against overload and short-circuit ("N" = neutral)
- Protection from fault currents to ground ("G" = Ground fault).

#### 4.8.4.1 Area of application

Communication-capable ETUs are deployed for any application which requires the following functions:

- Diverse protection functions
- Fine adjustment of protection functions
- Metering functions
- For 50 Hz and 60 Hz systems (45 ... 65 Hz)
- Communication of the actual condition and history of the molded case circuit breaker

#### 4.8.5 DSP800 display

The DSP800 display is designed for mounting in the panel door and can be optionally connected to the Ethernet (Modbus TCP) interface integrated in the COM800 / COM100 breaker data server. The DSP800 display shows the data of the breaker data server and thus the data of up to eight connected 3VA6 molded case circuit breakers.

The start page of the DSP800 displays the status and maximum current of all the 3VA6 molded case circuit breakers. All the detailed information about individual molded case circuit breakers can be selected via the efficiently structured menu. This includes

- Measured values of ETU 5-series and 8-series
- ETU setting parameters
- Status
- Diagnostics



## 4.8.6 Commissioning and testing of electronic trip units using powerconfig

### **powerconfig**

powerconfig has the following functions in relation to 3VA UL molded case circuit breakers:

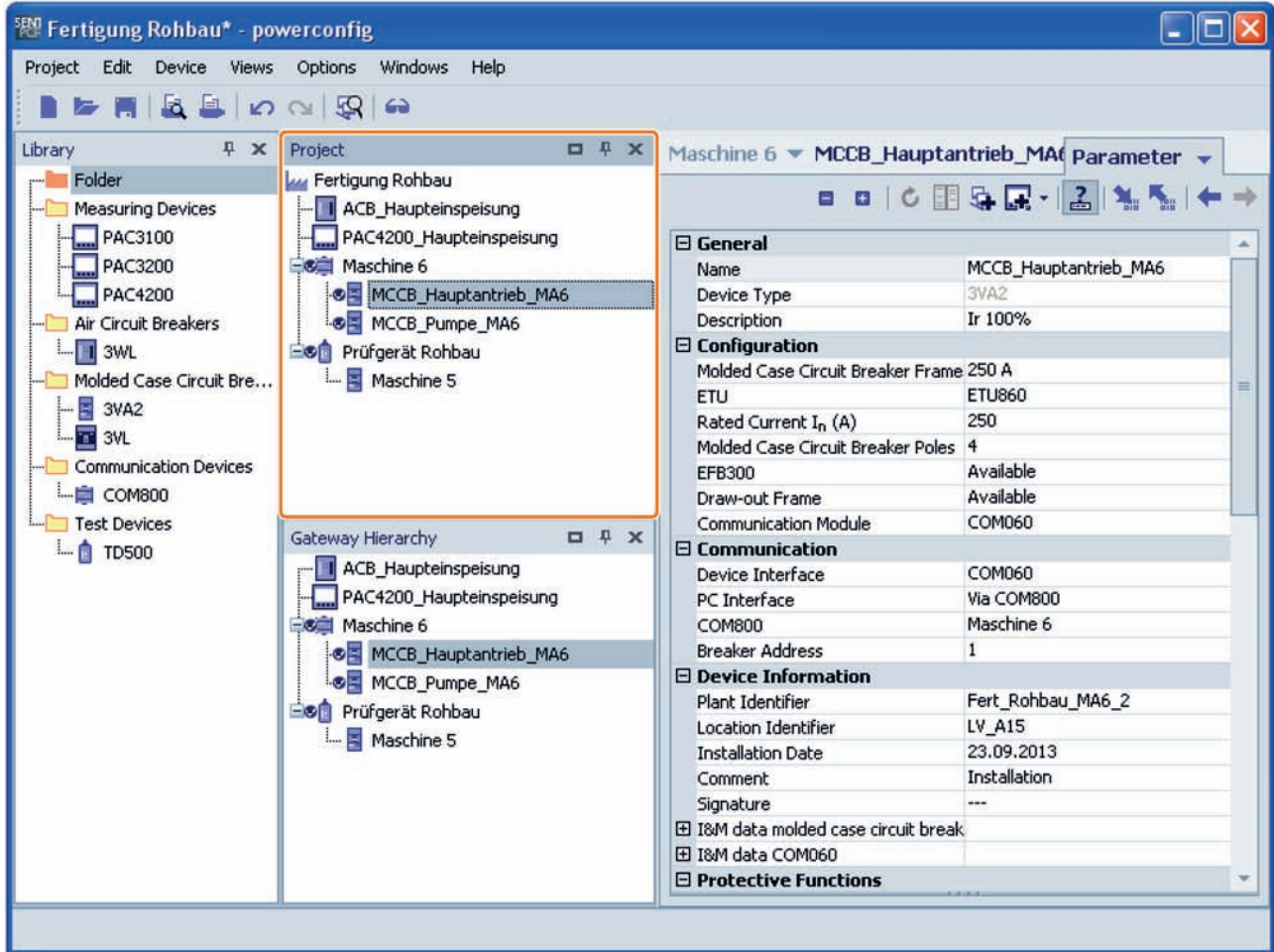
- Parameterization of 3VA UL ETUs and other 3VA UL components
- Testing of 3VA UL
- Commissioning of 3VA UL
- Statistical analysis of 3VA UL
- Readout of measured variables such as energy, current, voltage and power from the 3VA UL molded case circuit breakers
- Readout of minimum and maximum values from 3VA UL molded case circuit breakers
- Diagnostics of 3VA UL

The PC on which powerconfig runs is connected to the 3VA UL molded case circuit breaker by means of the COM800/COM100 breaker data server, optionally with modules or the TD500 test device.

The TD500 test device is required in order to perform function tests. You can find information on the TD500 test device in chapter The TD500 test device (Page 364).

4.8 Communication and system integration

The 3VA UL molded case circuit breakers and, if applicable, other devices supported by powerconfig, are combined in powerconfig to form a project if they have a technical, organizational or other connection.



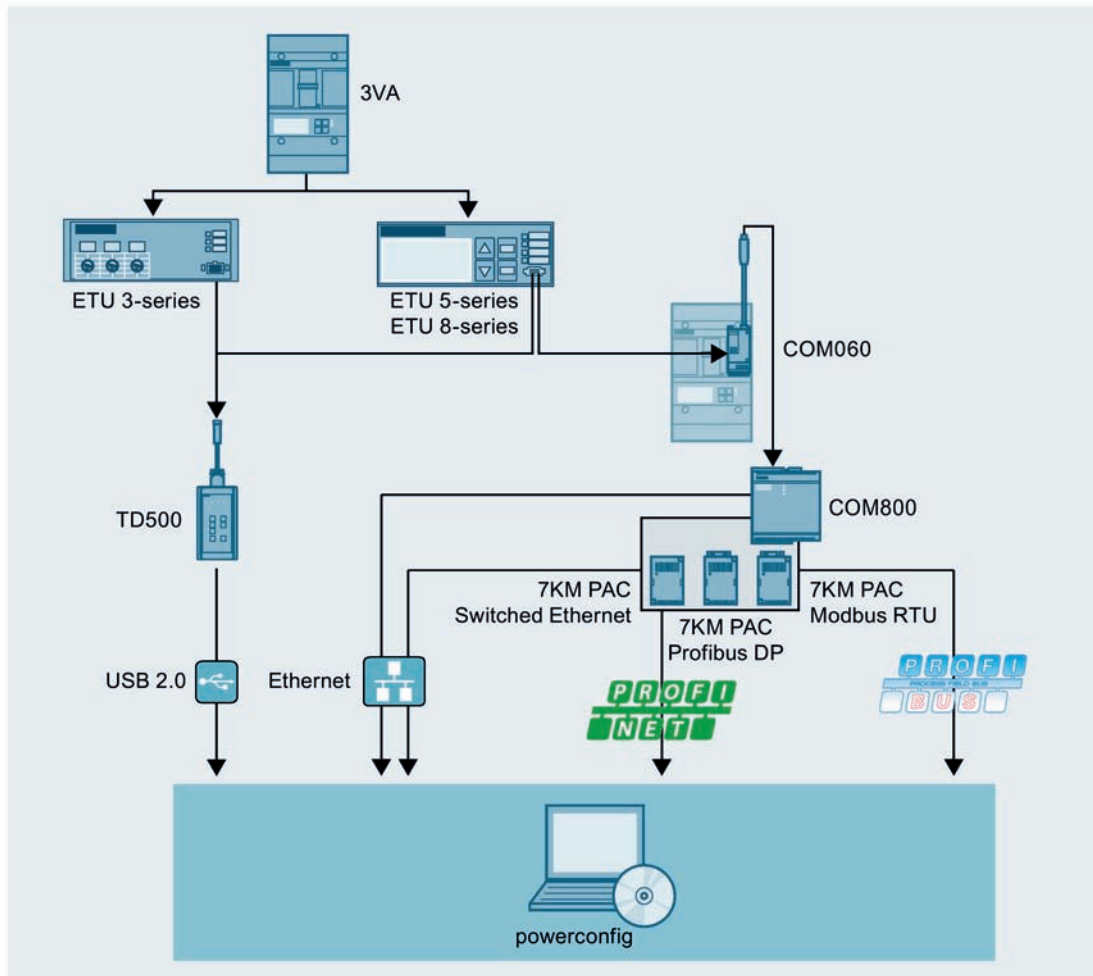
Electronic trip units (ETU), the EFB300 external function box and the communication structure can be commissioned easily by means of the powerconfig software. On completion of the commissioning process, the ETU settings can be stored as a project on the PC and printed out.

powerconfig can also be used to perform ETU trip tests. A test report is generated automatically and stored in the project every time a test is carried out.



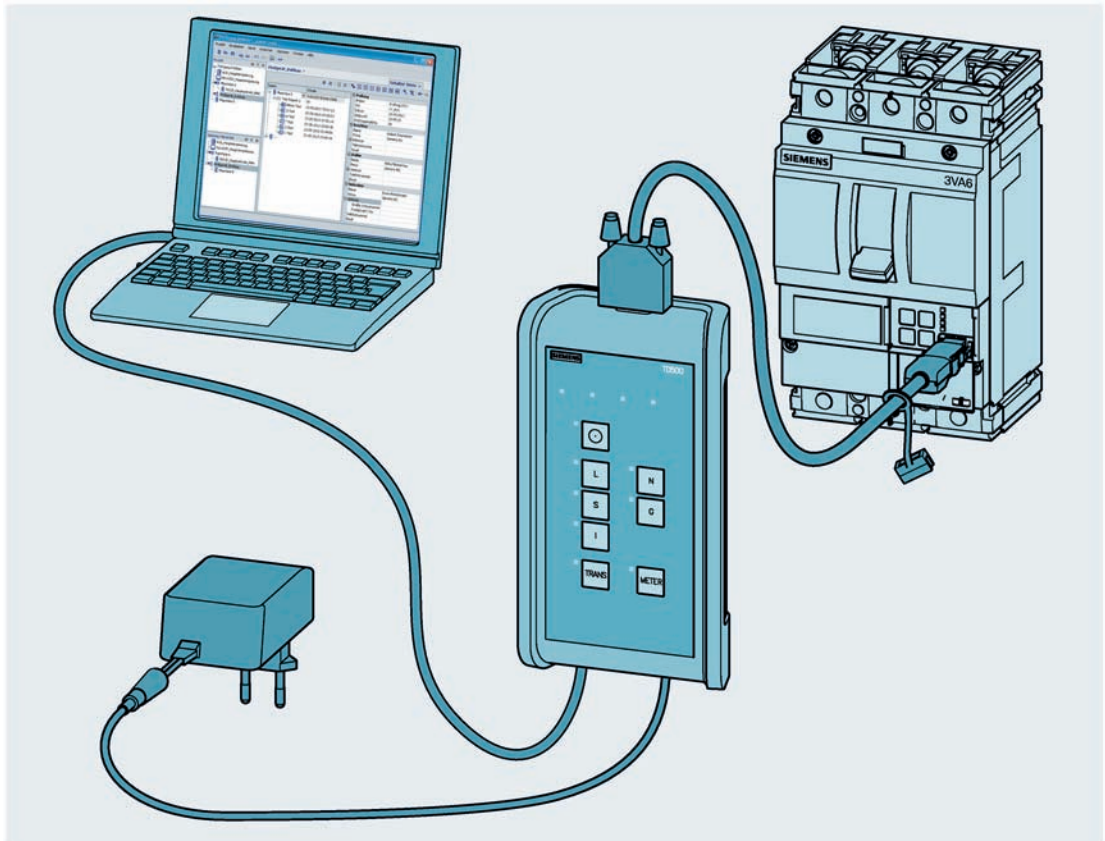
powerconfig supports a variety of different device communication links depending on the SENTRON device used:

- USB
- Ethernet (Modbus TCP)
- PROFINET
- PROFIBUS
- MODBUS RTU



The possible means of connection of the COM800 / COM100 breaker data server are described in detail in the 3VA Communication system manual (see Reference documents (Page 11)).

With 3VA6 molded case circuit breakers and ETUs 3-series, powerconfig is linked to the ETU interface via the USB interface on the PC and the interface on the TD500 test device.



### 4.8.7 Power management with powermanager

For power and plant monitoring, Siemens offers the powermanager software. Together with SENTRON protection devices such as 3VA UL, 3WL, 3VL and PAC measuring devices as well as non-Siemens devices, powermanager provides a power monitoring system for reducing energy costs and increasing energy availability.

powermanager acquires the measured variables that are needed to optimize power consumption and so reduce costs. These variables not only include energy and power values, but also electrical parameters such as current, voltage, or power factor. Not only is this system able to display values, but also to monitor and archive them for later analysis. In addition, the load monitoring function is capable of monitoring a specified setpoint and making recommendations as to which loads should be connected and disconnected.

#### Identifying savings potential

The power monitoring software has been tested by the TÜV Rheinland for its suitability to support a power management system in accordance with ISO 50001.

#### Functionality and user-friendliness

The salient features and functions of the power monitoring software are as follows:

- Good scalability
- Enhanced report templates
- Response plans
- Mass parameterization
- Virtual measuring points for computing customer-specific parameters
- Load monitoring function for monitoring specified power limits for freely definable time periods
- Switching recommendations in the event of limit violations
- Remote control of circuit breakers

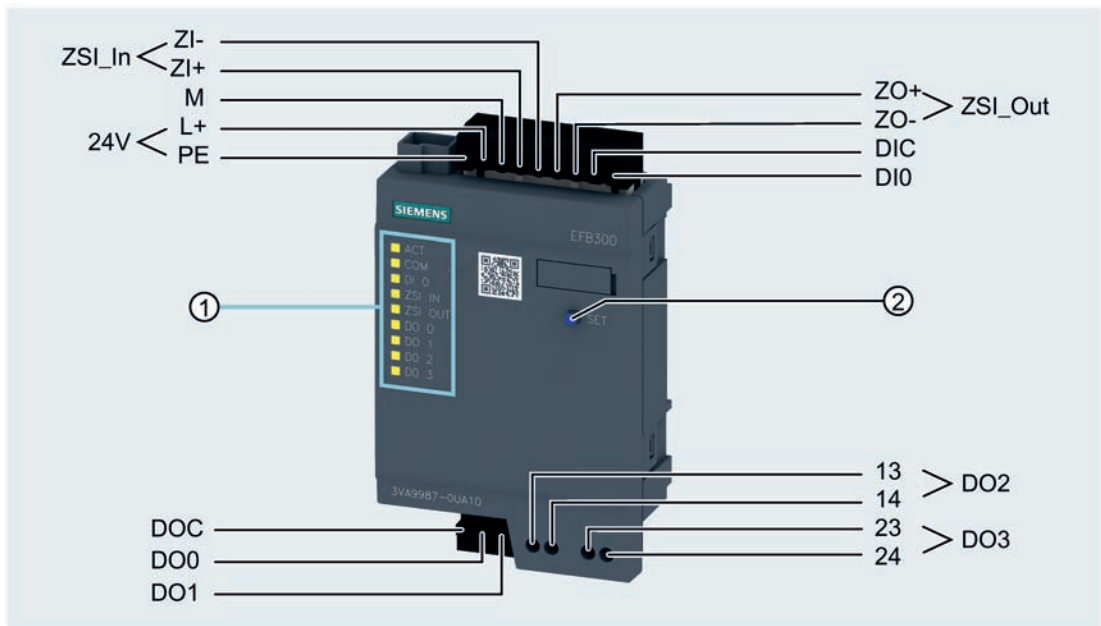
## 4.9 EFB300 external function box

### 4.9.1 General information

The 3VA UL molded case circuit breakers with the electronic trip systems ETUs 3-series, 5-series and 8-series can be functionally expanded with the EFB300 external function box.

The EFB300 external function box receives information from the ETU via a cable connection. This information (warnings, reason for last trip, energy meter) can be output via the four digital outputs.

Zone selective interlocking functionality (ZSI, see chapter Zone Selective Interlocking (Page 76)) can also be implemented via the EFB300. The EFB300 also supplies the ETU with power which means that the ETU can be parameterized via the display even when a 3VA UL molded case circuit breaker is in the de-energized state.



- ① LED display
- ② <SET> button
- ZSI Zone Selective Interlocking
- DI Digital input
- DO 0 ... 3 Digital output

## 4.9.2 Power supply

The EFB300 external function box requires a UL Class 2, 24 V DC power supply and acts as a power supply for the connected ETU. This allows the ETU to remain operational even after a 3VA UL molded case circuit breaker has tripped.

## 4.9.3 Functions of the digital input and digital outputs

### Functions of the digital input

Active alarms transmitted by the ETU can be acknowledged via the digital input.

### Functions of the digital outputs

With the powerconfig software application, it is possible to selectively assign signals transmitted by the connected ETU to the four digital outputs of the EFB300. powerconfig can be accessed via the TD500 test device or by means of the COM800 or COM100 breaker data server through the link to the communication system.

The following signals (dependent on the ETU) can be assigned:

- **All reasons for ETU tripping** (L, S, I, N and G)
- **Overload alarms AL 1 and AL 2**
- **Pre-trip alarm for overload protection**  
An alarm is output in advance of a trip event, allowing time for a load to be disconnected before the main voltage ceases as a result of the trip.
- **Load shedding/load pick up**  
By means of the load shedding and load pick up signals, a load can be disconnected or connected automatically depending on the capacity utilization of the 3VA UL molded case circuit breaker.
- **Energy pulse** (ETUs 8-series only)  
An energy pulse (S0 signal pulse) contains information that a certain amount of energy has flowed through the molded case circuit breaker. The data are transmitted by weighted pulses, i.e. a specific number of pulses are transferred to represent one kWh unit.  
Settings for the energy pulse, see table on next page.

Example of energy pulse:

Energy meter source:	Active energy kWh
Pulses per unit:	10
Unit:	1 kWh
Pulse length:	100 ms
For a flow of 50 kWh:	500 pulses with a length of 100 ms each

4.9 EFB300 external function box

Overview of functions available with EFB300 external function box

Version available with		ETU320	ETU330	ETU350	ETU550	ETU560	ETU560	ETU820	ETU830	ETU850	ETU860	ETU860
		LI	LIG	LSI	LSI	LSI	LSIG	LI	LIG	LSI	LSI	LSIG
3-pole breaker without external neutral conductor transformer		■	■	■				■	■			
3-pole breaker with external neutral conductor transformer					■	■	■			■	■	■
4-pole breaker with protected neutral conductor transformer		■	■	■	■	■	■	■	■	■	■	■
<b>Configurable trip alarms and output signals</b>												
Trip reason overload		■	■	■	■	■	■	■	■	■	■	■
Trip reason short-time delayed short-circuit				■	■	■	■			■	■	■
Trip reason instantaneous short circuit		■	■	■	■	■	■	■	■	■	■	■
Trip reason overload at neutral conductor			■	■	■	■	■			■	■	■
Trip reason ground fault protection			■	■		■	■	■	■		■	■
Trip reason overtemperature		■	■	■	■	■	■	■	■	■	■	■
Alarm level 1 for overload		■	■	■	■	■	■	■	■	■	■	■
Alarm level 2 for overload		■	■	■	■	■	■	■	■	■	■	■
Pre-trip alarm for overload		■	■	■	■	■	■	■	■	■	■	■
Temperature alarm		■	■	■	■	■	■	■	■	■	■	■
Alarm ground-fault protection			■	■		■	■	■	■		■	■
Alarm to indicate internal ETU fault		■	■	■	■	■	■	■	■	■	■	■
Undershooting of threshold for load reconnection		■	■	■	■	■	■	■	■	■	■	■
Overshooting of threshold for load shedding		■	■	■	■	■	■	■	■	■	■	■
Energy pulse								■	■	■	■	■
Energy source	Apparent energy (kVAh)							■	■	■	■	■
	Active energy (kWh) import							■	■	■	■	■
	Active energy (kWh) export							■	■	■	■	■
	Reactive energy (kvarh) inductive							■	■	■	■	■
	Reactive energy (kvarh) capacitive							■	■	■	■	■
Weighted pulse	1 ... 1000 (in steps of 1 in kWh or kVAh)							■	■	■	■	
Pulse width	30 ... 500 ms (in steps of 10 ms)							■	■	■	■	
Time-delayed Zone Selective Interlocking ZSI			■	■	■	■	■	■	■	■	■	■
Load monitoring		■	■	■	■	■	■	■	■	■	■	■

4.9.4 Zone-selective interlocking ZSI

Description

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

**Advantage of ZSI:**

Regardless of the number of series-connected molded case circuit breakers, all short circuits in the network greater than  $I_{st}$  but less than  $I_i$  will have a delay of no more than 50 ms. Short-circuit clearance times should be minimized, particularly in the case of system short circuits of very large magnitude.

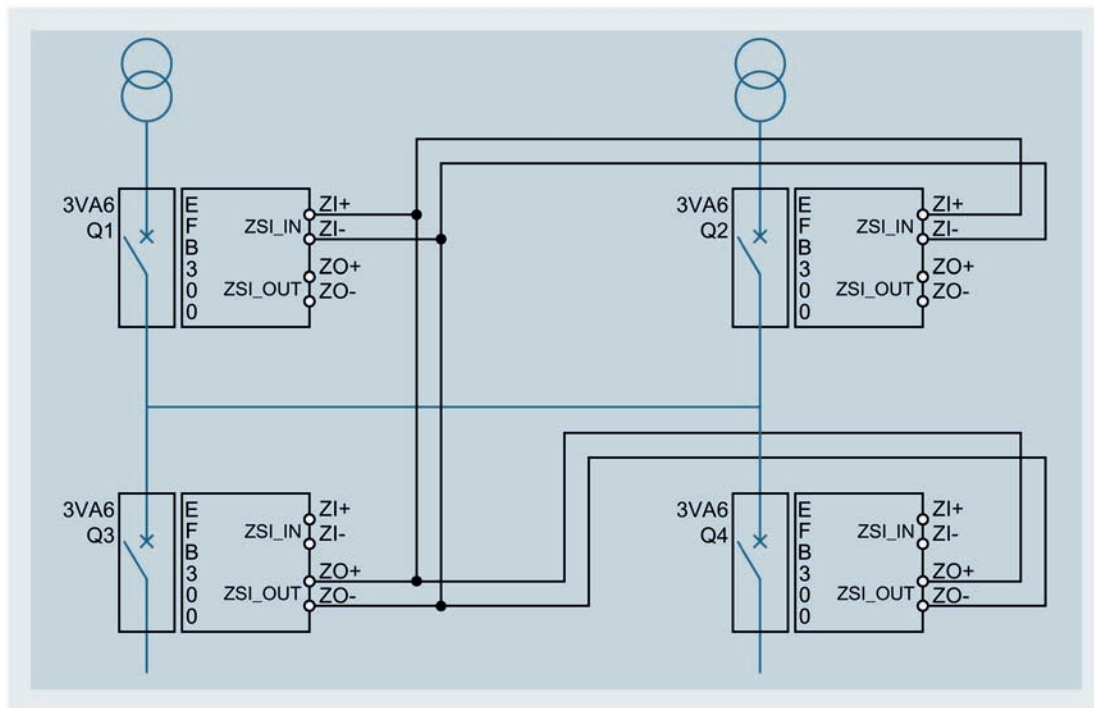
**Note****Backward compatibility**

The ZSI function is compatible with the ZSI function of the 3VL and 3WL molded case circuit breakers.

**Connection**

Use of the ZSI function is conditional upon the connection of a dedicated EFB300 external function box to each 3VA6 molded case circuit breaker. The EFB300 allows molded case circuit breakers to communicate with one another, a capability which is a basic requirement for the ZSI function.

To permit utilization of the ZSI function, EFB300 external function boxes must be interconnected as illustrated below:



### 4.9.5 <SET> button

The <SET> button performs the following functions depending on mode:

- Operating mode: Acknowledgment of signals
- Test mode: Execution of a test function

#### Operating mode


The EFB300 external function box is in operating mode during operation. Operation of the EFB300 is indicated by steady illumination of the LED labeled "ACT".


If a tripped signal is present at an output (output is activated), the user can acknowledge the signal or reset the output. This can be done by various methods:

- By application of a signal to the digital input of the EFB300
- By brief actuation of the <SET> button on the EFB300
- By actuation of the <ESC> button on the ETU



## LED states in operating mode

LED	Meaning	Description
<input type="checkbox"/> ACT	Off	EFB300 not active
 ACT	On	EFB300 ready
<input type="checkbox"/> COM	Off	No communication link with ETU
 COM	Flashing (2 Hz)	Establishing communication link with ETU
 COM	On	Communication link with ETU established
<input type="checkbox"/> DI 0	Off	Input not activated
 DI 0	On	Input activated
<input type="checkbox"/> ZSI IN	Off	ZSI function not activated
 ZSI IN	On	ZSI function activated
<input type="checkbox"/> ZSI OUT	Off	No ZSI Out signal transmitted
 ZSI OUT	On	ZSI Out signal transmitted
<input type="checkbox"/> DO 0	Off	No valid reason for trip signal
 DO 0	On	Active trip signal
<input type="checkbox"/> DO 1	Off	No valid reason for trip signal
 DO 1	On	Active trip signal
<input type="checkbox"/> DO 2	Off	No valid reason for trip signal
 DO 2	On	Active trip signal
<input type="checkbox"/> DO 3	Off	No valid reason for trip signal
 DO 3	On	Active trip signal

 Steady illumination

 Flashing

Off

Simultaneous flashing of all LEDs indicates that the EFB300 is defective.

ACT	COM	DI 0	ZSI IN	ZSI OUT	DO 0	DO 1	DO 2	DO 3	
									EFB300 defective

 Flashing

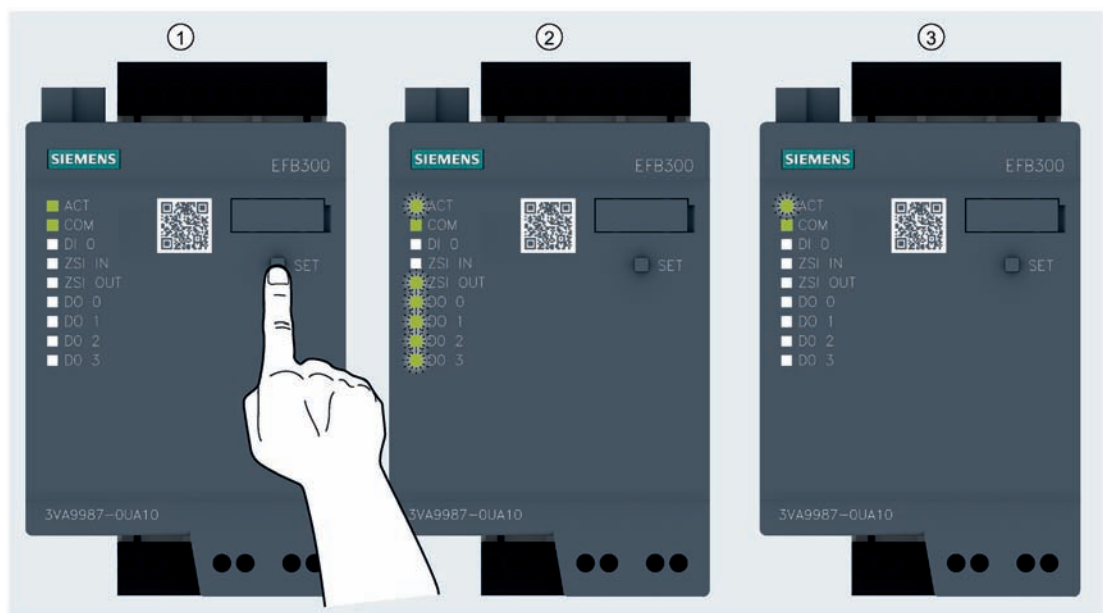
## Test mode

All inputs and outputs can be activated or deactivated manually in test mode. This can be done to determine whether the digital outputs and the ZSI bus are functioning properly and wired correctly.

The LED labeled "ACT" flashes to indicate that test mode is active. The powerconfig software can also be used to test outputs.

### Activating test mode and performing tests

1. In order to activate test mode, press the <SET> button for at least 2 seconds ① until all the LEDs for the outputs light up briefly ②. Test mode is activated when the LED labeled "ACT" starts to flash ③.



2. Press the <SET> button briefly.  
LED "ZSI\_OUT" flashes, the ZSI output is selected.



3. In order to activate the selected output, press the <SET> button for longer than 2 seconds.  
The LED of the selected output changes from flashing to steady illumination to indicate activation of the selected output.

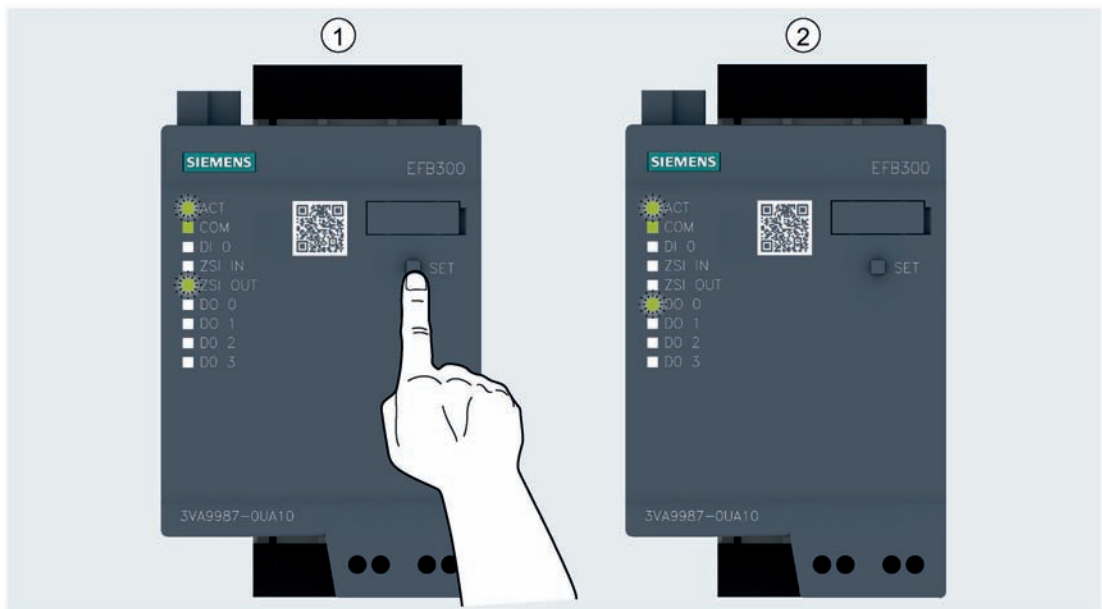


4.9 EFB300 external function box

4. In order to deactivate the output again, press the <SET> button again for longer than 2 seconds.  
The LED of the activated output will change from steady illumination to flashing. The output is deactivated, but still selected.



5. In order to select the next output, press the <SET> button briefly ①.  
The LED of the next output starts to flash ②, the output is selected.



6. Repeat steps 3 to 5 in order to check the wiring of all digital outputs in succession.















**Terminating test mode**



If the <SET> button is not pressed for a period of three minutes after selection of an output, test mode is terminated automatically and the EFB300 reverts to operating mode.

Alternative method:

After working through the entire menu structure (only the LED labeled "ACT" flashes), press the <SET> button for longer than 2 seconds.

LED states in test mode

LED	Meaning	Description
<input type="checkbox"/> ACT	Off	EFB300 not active
 ACT	Flashing (2 Hz)	Test mode active
<input type="checkbox"/> COM	Off	No communication link with ETU
 COM	Flashing (2 Hz)	Establishing communication link with ETU
 COM	On	Communication link with ETU established
<input type="checkbox"/> DI 0	Off	Input not activated
 DI 0	On	Input activated
<input type="checkbox"/> ZSI IN	Off	ZSI function not activated
 ZSI IN	On	ZSI function activated
<input type="checkbox"/> ZSI OUT	Off	No ZSI Out signal transmitted
 ZSI OUT	On	ZSI Out signal transmitted
<input type="checkbox"/> DO 0	Off	Output not selected
 DO 0	Flashing (2 Hz)	Output selected
 DO 0	On	Output selected and activated
<input type="checkbox"/> DO 1	Off	Output not selected
 DO 1	Flashing (2 Hz)	Output selected
 DO 1	On	Output selected and activated
<input type="checkbox"/> DO 2	Off	Output not selected
 DO 2	Flashing (2 Hz)	Output selected
 DO 2	On	Output selected and activated
<input type="checkbox"/> DO 3	Off	Output not selected
 DO 3	Flashing (2 Hz)	Output selected
 DO 3	On	Output selected and activated

-  Steady illumination
-  Flashing
- Off

## 4.9.6 Technical specifications

Dimensions and weights		
Suitability for application		Installation in fixed switchboard inside enclosed rooms
Type of mounting		
DIN rail (35 mm)		Yes
Flat mounting		Yes
Mounting position		Vertical
Width	inch	2,75
	mm	70
Height	inch	4,52
	mm	115
Depth	inch	1,33
	mm	34
Weight (net)	g	145
Functions		
ETU power supply		Yes
Data exchange with ETU		Yes
Digital input and output module		Yes
Supply		
Rated power dissipation $P_v$	VA	4
Rated control supply voltage $U_c$	V DC	24
Operating range	x $U_c$	$\pm 20\%$
Power consumption	A	$\leq 0.16$
Communication with molded case circuit breakers		
Number of 3VA-line interfaces		1
Length of cable	inch	59,05
	m	1,5
ZSI		
Number of breakers which can be connected to ZSI IN		$\leq 20$
Number of breakers which can be connected to ZSI OUT		$\leq 8$
Cable for ZSI		Flexible, shielded (min. 85 % coverage), twisted cable, max. capacitance: 200 nF/km (cable/shield), 160 nF/km (cable/cable), inductance 0.65 H/km, total cable resistance: max. 28 ohms
Cable length for ZSI		< 600 m / 0.75 mm <sup>2</sup> (AWG 18) < 1200 m / 1.5 mm <sup>2</sup> (AWG 16) < 2000 m / 2.5 mm <sup>2</sup> (AWG 14)

## 4.9 EFB300 external function box

Digital input		
Number of digital inputs		1
Rated operational voltage	V DC	24
Operating range		+ 20 % IEC: SELV/PELV
Voltage value for reliable detection of a "1" signal	V	15
Voltage value for reliable detection of a "0" signal	V	≤ 5
Digital outputs		
Number of relays		2
Voltage		IEC: ≤ 250 V AC/DC UL: LVLE
Rated uninterrupted current		6 A
Rated breaking capacity	AC-12 / 250 V AC-15 / 250 V DC-12 / 250 V DC-13 / 250 V	A 6 A 3 A 0.2 A 0.1
Output current for signal <1>	mA	10 ... 27
Output current for signal <0>	mA	≤ 0.2
Design of fuse link for short-circuit protection of auxiliary contacts of output relay	A	6
Specified fuse for auxiliary contact elements		Fuse links operating class gL/gG 6A
Overvoltage category		III (relays) I (all others)
Number of static semiconductor outputs		2
Rated voltage		24 V DC ± 20 % IEC: SELV/PELV UL: LVLE
Rated operational current	mA	100
Connection elements and terminals		
Design of electrical connection		
- Inputs for supply voltage		Removable / plug-in
- At the inputs for supply voltage		Screw-type terminals
Type of connectable conductor cross sections		
- Solid	mm <sup>2</sup>	0.5 ... 2.5
- Finely stranded / with end sleeve	mm <sup>2</sup>	0.5 ... 2.5
- With AWG cables / solid		1 x 21 ... 14; 2 x 21 ... 16
Tightening torque	Nm	0.4 ... 0.5
Electromagnetic compatibility		
Conducted or radiated emissions		EN 61000-6-3 / FCC Class A and marine application requirements
Immunity in industrial environments		EN 61000-6-2 and marine application requirements
Ambient conditions		
Ambient temperature		
- during operation	°C	-25 ... +60
- during operation with derating of rated operational current of digital outputs to 80 mA	°C	-25 ... +70
- during storage and transportation	°C	-25 ... +70
Pollution degree		3
Degree of protection and safety class		
Degree of protection (acc. to IEC 60529)		IP20



## 4.10 MMB300 maintenance mode box

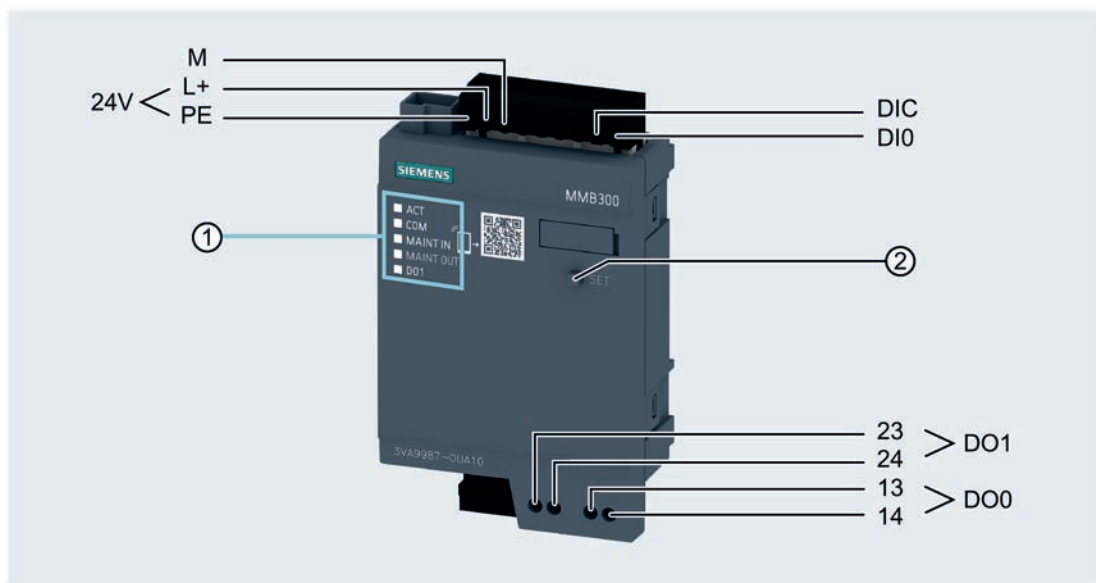
### 4.10.1 Operating principle of the MMB300 maintenance mode box

The 3VA6 molded case circuit breakers with the electronic trip system ETUs 3-series, 5-series and 8-series can be functionally expanded with an MMB300 **maintenance mode box**.

With the MMB300 maintenance mode box, the Dynamic Arc Sentry mode (DAS mode, chapter Arc energy reduction (Page 81)) of the molded case circuit breaker is activated and the setting parameters for the instantaneous short circuit current  $I_i$  and the ground-fault current  $I_g$  are set to the lowest setting values of the circuit breaker. This reduces the let-through energy of the molded case circuit breaker under fault conditions. This results in improved protection when personnel is in the vicinity of the installation and the installation is in maintenance mode.

This parameter changeover can occur, for example, through a door contact at the switchboard or an externally actuated switch. In addition, a signal lamp or horn, for example, signals when the circuit breaker is in maintenance mode.







A series connection of up to eight 3VA6 molded case circuit breakers with the associated MMB300 maintenance mode box is possible.





- ① LED display
- ② <SET> button

- DI Digital input
- DO Digital output

**LED states of the MMB300 maintenance mode box**

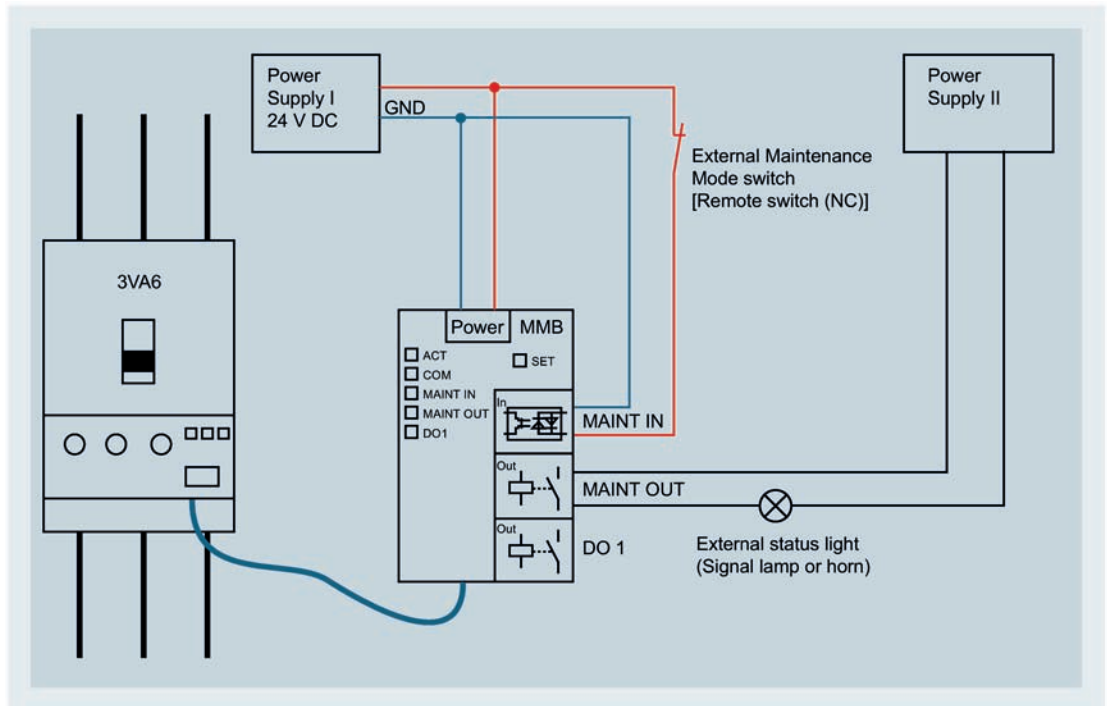
LED	Meaning	Description
<input type="checkbox"/> ACT	Off	MMB300 not active
 ACT	On	MMB300 ready for use
<input type="checkbox"/> COM	Off	No communication with ETU
 COM	Flashing (2 Hz)	Establishing communication with ETU
 COM	On	Communication connection with ETU established
<input type="checkbox"/> MAINT IN	Off	No input signal
 MAINT IN	On	Input signal active
<input type="checkbox"/> MAINT OUT	Off	No output signal
 MAINT OUT	On	Output signal active
<input type="checkbox"/> DO 1	Off	No output signal
 DO 1	On	Output signal active

-  Steady illumination
-  Flashing
- Off

Simultaneous flashing of all LEDs indicates that the MMB300 is defective.

### 4.10.2 Configuration of MMB300 with a 3VA6 molded case circuit breaker

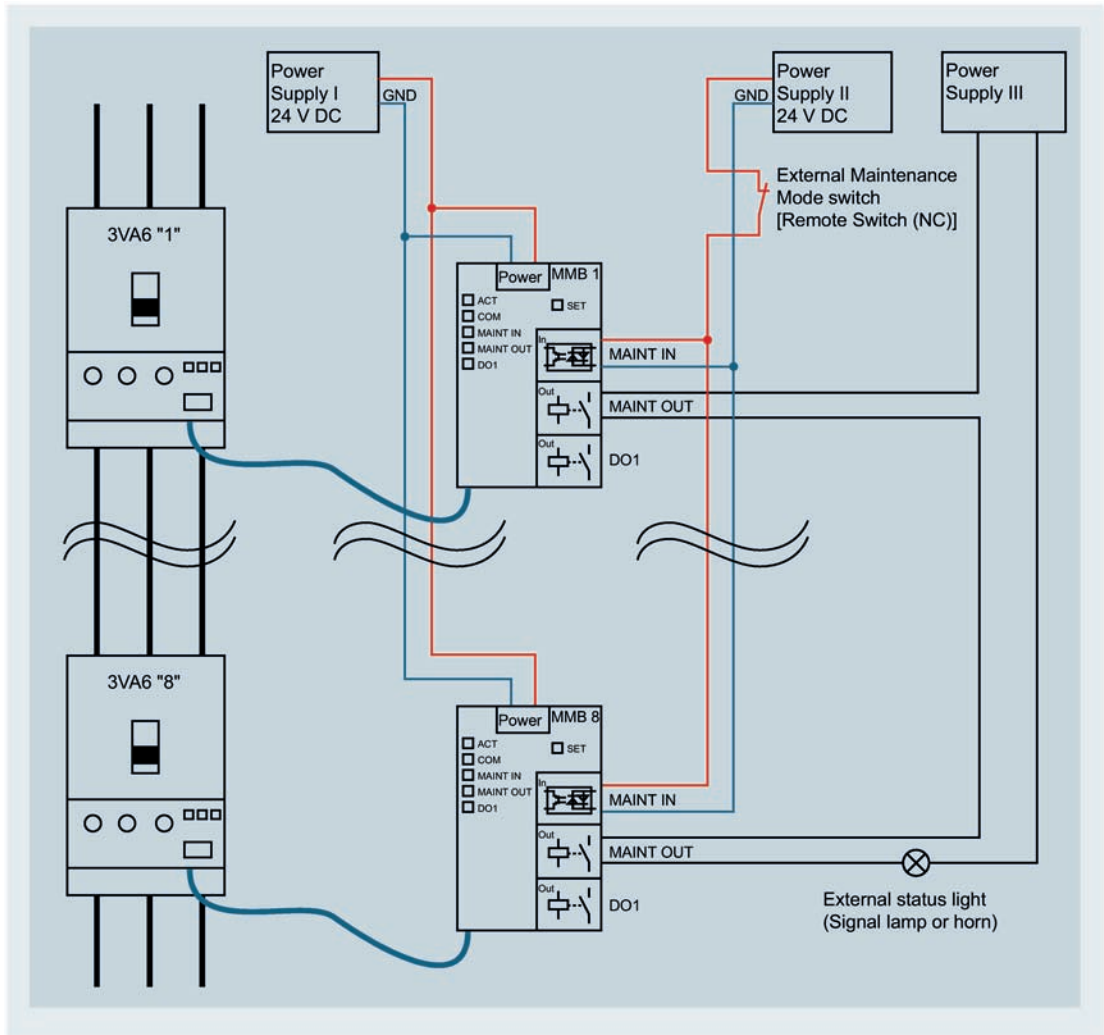
The possible configuration of the MMB300 maintenance mode box with the associated molded case circuit breaker is shown in the following.



4.10 MMB300 maintenance mode box

Alternatively, up to eight 3VA6 molded case circuit breakers can be connected in series with an MMB300 maintenance mode box.
















This ensures that the external status display only signals that maintenance mode is activated when all series-connected molded case circuit breakers are in DAS mode.





It is also possible to combine the power supplies.

















**LED states for the 3VA6 molded case circuit breaker and MMB300 maintenance mode box in different applications**



The LED states shown in the following tables relate to the circuit diagram of the multiple series-connected 3VA6 molded case circuit breakers (see above).

Application	Description	Status LEDs	
		3VA6	MMB300
1	1. All power supplies "On" 2. Maintenance mode box closed - 3VA6 "1" to 3VA6 "8" → normal operation - <b>External status display → Off</b>	 ACT (all) <input type="checkbox"/> AL 2 (all)	 ACT  COM  MAINT IN <input type="checkbox"/> MAINT OUT
2	1. All power supplies "On" 2. Maintenance mode box open - 3VA6 "1" to 3VA6 "8" → maintenance mode - <b>External status display → On</b>	 ACT (all)  AL 2 (all)	 ACT  COM <input type="checkbox"/> MAINT IN  MAINT OUT
3	1. Power supply I is "Off" (before ETU is activated) 2. Maintenance mode box open 3. 3VA6 circuit breakers are switched on → ETUs are active - 3VA6 circuit breakers do not detect the MMBs - 3VA6 "1" to 3VA6 "8" → normal operation - <b>External status display → Off</b>	 ACT (all) <input type="checkbox"/> AL 2 (all)	<input type="checkbox"/> ACT <input type="checkbox"/> COM <input type="checkbox"/> MAINT IN <input type="checkbox"/> MAINT OUT
4	1. Power supply II is "Off" 2. Maintenance mode box closed - 3VA6 "1" to 3VA6 "8" → maintenance mode - <b>External status display → On</b>	 ACT (all)  AL 2 (all)	 ACT  COM <input type="checkbox"/> MAINT IN  MAINT OUT

-  Steady illumination
-  Flashing
- Off

4.10 MMB300 maintenance mode box

Applic- ation	Description	Status LEDs	
		3VA6	MMB300
5	1. Power supply III is "Off" 2. Maintenance mode box closed - 3VA6 "1" to 3VA6 "8" → normal operation - <b>External status display → Off</b>	 ACT (all) <input type="checkbox"/> AL 2 (all)	 ACT  COM  MAINT IN <input type="checkbox"/> MAINT OUT
6	1. Power supply III is "Off" 2. Maintenance mode box open - 3VA6 "1" to 3VA6 "8" → maintenance mode - <b>External status display → Off</b> (no power supply III)	 ACT (all)  AL 2 (all)	 ACT  COM <input type="checkbox"/> MAINT IN  MAINT OUT
7	1. All power supplies "On" 2. The connection between 3VA6 "1" and MMB I is faulty (before ETU is activated) 3. Maintenance mode box open - 3VA6 "1" → normal operation (MMB not detected) - 3VA6 "8" → maintenance mode - <b>External status display → Off</b>	 ACT (3VA6 "1") <input type="checkbox"/> AL 2 (3VA6 "1")  ACT (3VA6 "8")  AL 2 (3VA6 "8")	 ACT  COM (MMB 1)  COM (MMB 8) <input type="checkbox"/> MAINT IN <input type="checkbox"/> MAINT OUT "1"  MAINT OUT "8"










-  Steady illumination
-  Flashing
- Off



If the external status display is "On", this guarantees that all 3VA6 molded case circuit breakers are in maintenance mode.

### 4.10.3 <SET> button

The SET button on the MMB300 maintenance mode box functions exactly like on the EFB300 external function box.

The SET button can be used to activate test mode of the MMB300 maintenance mode box. This means that the "MAINT Out" and "DO1" outputs can be manually activated or deactivated. This allows you to check whether the outputs are functioning correctly and the wiring is correct.

LED	Meaning	Description
<input type="checkbox"/> ACT	Off	MMB300 not active
 ACT	On	MMB300 ready for use
 ACT	Flashing (2 Hz)	MMB300 in test mode
<input type="checkbox"/> COM	Off	No communication with ETU
 COM	Flashing (2 Hz)	Establishing communication with ETU
 COM	On	Communication connection with ETU established
<input type="checkbox"/> MAINT IN	Off	No input signal
 MAINT IN	On	Input signal active
<input type="checkbox"/> MAINT OUT	Off	No output signal
 MAINT OUT	Flashing (2 Hz)	Output selected
 MAINT OUT	On	Output signal active
<input type="checkbox"/> DO 1	Off	No output signal
 DO 1	Flashing (2 Hz)	Output selected
 DO 1	On	Output signal active

-  Steady illumination
-  Flashing
- Off

#### 4.10.4 Power supply

The MMB300 maintenance mode box requires a UL Class 2, 24 V DC power supply and also serves as the power supply for the connected ETUs. This allows the ETU to remain operational even after the 3VA6 molded case circuit breaker has tripped or is in the Off position.

#### 4.10.5 Technical specifications

Dimensions and weights		
Suitability for use		Installation in stationary switchboards within closed rooms
Type of mounting		
DIN rail (35 mm)		Yes
Flat mounting		Yes
Mounting position		Vertical
Width	inch	2.75
	mm	70
Height	inch	4.52
	mm	115
Depth	inch	1.33
	mm	34
Weight (net)	g	145
Functions		
Power supply ETU		Yes
Data exchange with ETU		Yes
Digital input and output module		Yes
Supply		
Rated power loss $P_v$	VA	4
Rated control supply voltage $U_c$	V DC	24
Operating range	x $U_c$	$\pm 20\%$
Current consumption	A	$\leq 0.16$
Communication with the molded case circuit breakers		
Number of interfaces 3VA-line		1
Length of cable	inch	59.05
	m	1.5



Digital input MAINT IN		
Number of digital inputs		1
Rated operational voltage	V DC	24
Operating range		+ 20% IEC: SELV/PELV
Voltage value for reliable detection of a "1" signal	V	15
Voltage value for reliable detection of a "0" signal	V	≤ 5
Digital outputs MAINT OUT and D		
Number of relays		2
Voltage		IEC/UL: ≤ 250 V AC/DC
Rated uninterrupted current		6 A
Rated breaking capacity	UL 250 Vac	A 6
	UL 30 Vdc	A 5
	AC-12 / 250 V	A 6
	AC-15 / 250 V	A 3
	DC-12 / 250 V	A 0.2
	DC-13 / 250 V	A 0.1
Design of fuse link for short-circuit protection of auxiliary contacts of the output relay	A	6
Specified fuse for auxiliary contacts		Fuse links, operating class gL/gG 6A
Overvoltage category		III (relay) I (all others)
Number of static semiconductor outputs		2
Rated voltage		24 V DC ± 20% IEC: SELV/PELV UL: LVLE
Rated operational current	mA	100

Connection elements and terminals		
Design of electrical connection		
- Inputs for supply voltage		removable / plug-in
- at inputs for supply voltage		Screw connection
Type of connectable wire ranges		
- Solid	mm <sup>2</sup>	0.5 ... 2.5
- Finely stranded / with ferrule	mm <sup>2</sup>	0.5 ... 2.5
- AWG cables / solid		1 x 21 ... 14; 2 x 21 ... 16
Tightening torque	Nm	0.4 ... 0.5
Electromagnetic compatibility		
Conducted or radiated emissions		EN 61000-6-3 / FCC Class A and marine engineering requirements
Immunity in industrial environment		EN 61000-6-2 and marine engineering requirements
Ambient conditions		
Ambient temperature		
- During operation	°C	-25 ... +70
- During storage and transport	°C	-25 ... +70
Pollution degree		3
Degree of protection and protection class		
Degree of protection (according to IEC 60529)		IP20
NEMA protection class		1

## 4.11 Test devices

### 4.11.1 Introduction

Test devices are required in order to perform local tests of the 3VA6 molded case circuit breakers with electronic trip units (ETUs).

Two versions of the test devices are available:

- TD300 activation and trip box
- TD500 test device

#### Functional scope of test devices

ETU	TD300 activation and trip box			TD500 test device		
	3-series	5-series	8-series	3-series	5-series	8-series
Activation of ETUs		■	■	■	■	■
Mechanical trip tests	■	■	■	■	■	■
Testing of trip functions				■	■	■
Testing of metering function				■	■	■
Testing of transformers <sup>1)</sup>				■	■	■
Connection to a PC with powerconfig				■	■	■
ETU parameterization					■ <sup>2)</sup>	■ <sup>2)</sup>
Saving test results				■	■	■

<sup>1)</sup> One energy transformer, one Rogowski coil

<sup>2)</sup> Via powerconfig

### 4.11.2 The TD300 activation and trip box

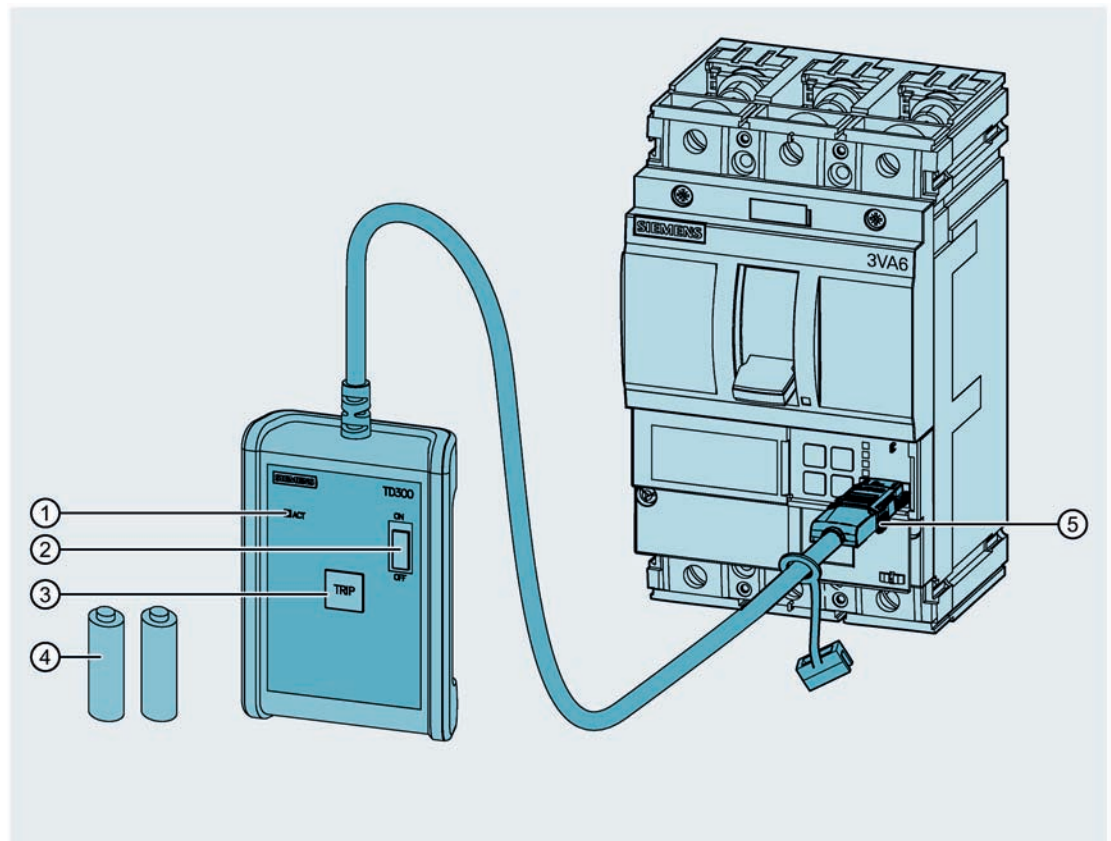
The TD300 activation and trip box is a mobile, battery-operated local test device. Its purpose is:

- To supply the ETU with power so that the ETU can be parameterized when the molded case circuit breaker is switched off and de-energized.
- To test and service the electronic trip unit (ETU).

The power supply is provided by two AA batteries included in the scope of supply.


The TD300 activation and trip box has a compact size of 3 x 4.21 x 1" / 76 x 107 x 25 mm (W x H x D).

#### Description of the TD300 activation and trip box



- ① LED "ACT" for indicating the battery status
- ② Slide switch ON/OFF
- ③ <TRIP> pushbutton for testing the molded case circuit breaker
- ④ 2 1.5 V AA batteries
- ⑤ Plug-in connector for insertion in the test socket on the ETU

### 4.11.2.1 Operation and execution of the tripping function

 <b>CAUTION</b>
<b>Personal injury, unintentional tripping and irreparable damage to the TD300</b>
Use of the TD300 when the molded case circuit breaker is not de-energized can result in personal injury, unintentional tripping of the circuit breaker and irreparable damage to the TD300.
Disconnect the molded case circuit breaker from the power supply before using the TD300 activation and trip box.

#### TD300: Connect, switch on and off, disconnect

##### Connect the TD300 to the 3VA6 molded case circuit breaker

1. Disconnect the molded case circuit breaker from the power supply.
2. Insert the connecting cable in the test socket of the ETU.

##### Switch the TD300 on and off

1. Check whether the molded case circuit breaker is disconnected from the power supply. If it is not, disconnect it.
2. Push the slide switch to ON.  
The LED labeled "ACT" on the TD300 lights up and the ETU display is activated. The TD300 is ready.

If the "ACT" LED does not light up:


















- Push the slide switch to OFF.
- Detach the connecting cable from the molded case circuit breaker.
- Replace the batteries.
- Follow the correct sequence of steps to connect the unit to the molded case circuit breaker again.
- Push the slide switch to ON.

3. Push the slide switch to OFF.  
The LED labeled "ACT" on the TD300 goes out to indicate that the unit is switched off.

##### Disconnect the TD300 from the 3VA6 molded case circuit breaker

1. Switch off the molded case circuit breaker (OFF position).
2. Detach the connecting cable from the molded case circuit breaker.

### LED states when the TD300 and the molded case circuit breaker are switched on

TD300	ETU					Description
ACT	ACT	COM	AL1	AL2		
						
						TD300 and ETU are ready
						The batteries on the TD300 need to be replaced
						TD300 is ready ETU is not ready

### Test the molded case circuit breaker (mechanical trip test)

1. Connect the TD300 to the molded case circuit breaker in the correct sequence and switch on.
2. Switch on the molded case circuit breaker (ON position).
3. Press the pushbutton labeled <TRIP> on the TD300.


#### The molded case circuit breaker trips:

The molded case circuit breaker is functioning correctly.

#### The molded case circuit breaker does not trip:

- Switch off the TD300.
- Switch off the molded case circuit breaker (OFF position).
- Detach the connecting cable from the molded case circuit breaker.
- Connect the TD300 correctly to the molded case circuit breaker again and switch on.
- Repeat the trip test (by pressing the pushbutton labeled <TRIP> on the TD300).
- If the molded case circuit breaker fails to trip again, contact Technical Support (Page 10) .

4.11.2.2 Technical specifications of TD300

Mechanical characteristics		
Height	inch	4.21
	mm	107
Width	inch	3
	mm	76
Depth	inch	1
	mm	25
IP degree of protection		IP30
Ambient temperature		
- in operation	°C	-10 ... +40
- in storage	°C	-40 ... +50
- with installed battery		
- in storage	°C	0 ... +25
Mounting position		Any
Interface to circuit breaker		
Number of circuit breakers / directly connectable		1
Length / of connecting cable	m	1
Power supply		
Type of batteries		AA, alkaline, 1.5 V
Approvals / certificates:		
Declaration of conformity		
 <small>EG-Konf.</small>		

4.11.3 The TD500 test device

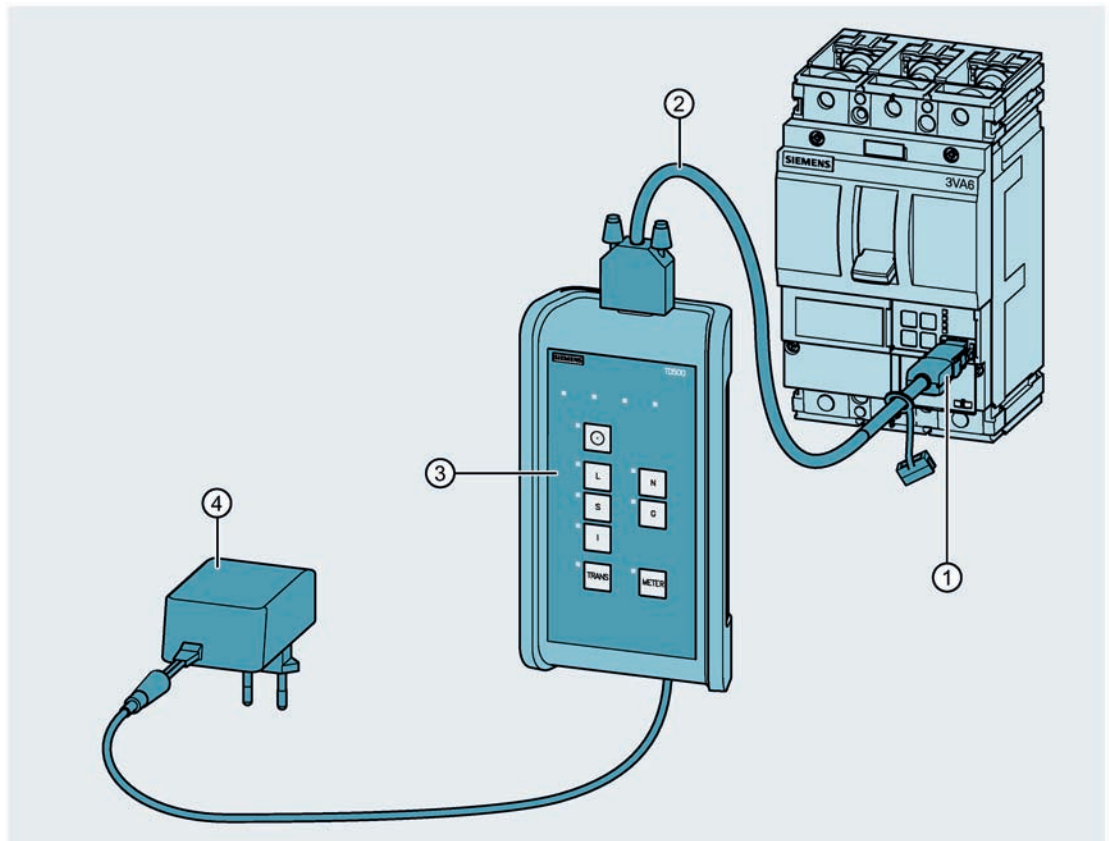
4.11.3.1 General information, preparations

The TD500 mobile test device can be used to test the different causes of ETU trips. This enables testing of the functioning and wiring of all connected system components before the 3VA6 molded case circuit breaker is commissioned. The system behaves as it would in the case of a real trip event. The molded case circuit breaker trips when the set delay times expire and signals all alarms and tripped signals from connected components.

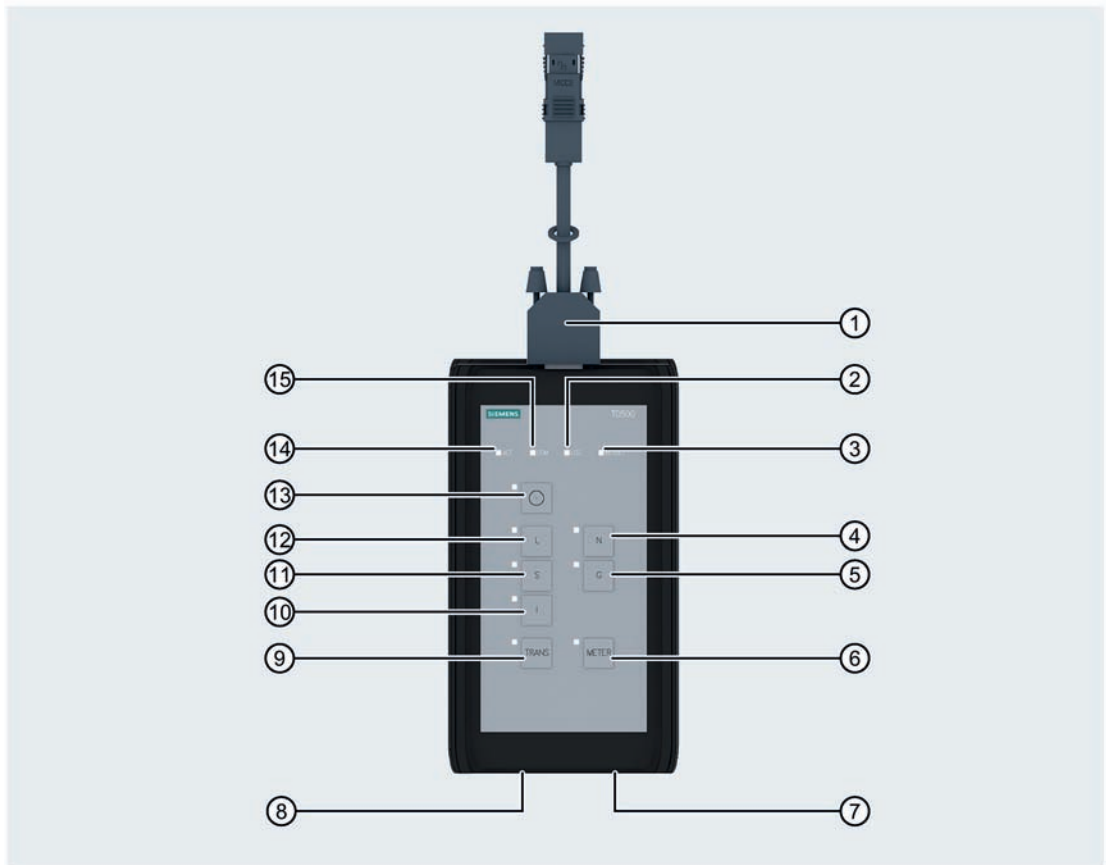
### Benefits of the TD500 test device

- With a TD500 test device, all 3VA6 molded case circuit breakers can be configured one after the other directly at the installation via powerconfig
- The device can store up to 100 test results.
- With the TD500 test device and the powerconfig software, all diagnostic data of the 3VA6 molded case circuit breaker can be archived electronically or as a printed document.
- In addition, test functions can be performed directly on the PC with the powerconfig software.

### Description of the TD500










- ① Plug-in connector for insertion in the test socket on the ETU
- ② TD500-to-ETU connecting cable
- ③ TD500 test device
- ④ Power supply unit



- |   |  |
|---|--|
| ① Connecting cable for ETU                                | ⑨ Pushbutton for transformer test                        |
| ② LED "LOG" (available memory status)                     | ⑩ Pushbutton for instantaneous short-circuit trip test I |
| ③ LED "RESULT"  | ⑪ Pushbutton for short-time delayed short-circuit test S |
| ④ Pushbutton for neutral trip test N                      | ⑫ Pushbutton for overload trip test L                    |
| ⑤ Pushbutton for ground fault trip test G                 | ⑬ Pushbutton for ETU Power ON/OFF                        |
| ⑥ Pushbutton for meter test (current measurement display) | ⑭ LED "ACT" (status)                                     |
| ⑦ PC connection   | ⑮ LED "COM" (communication status)                       |
| ⑧ Mains cable connection                                  |  |

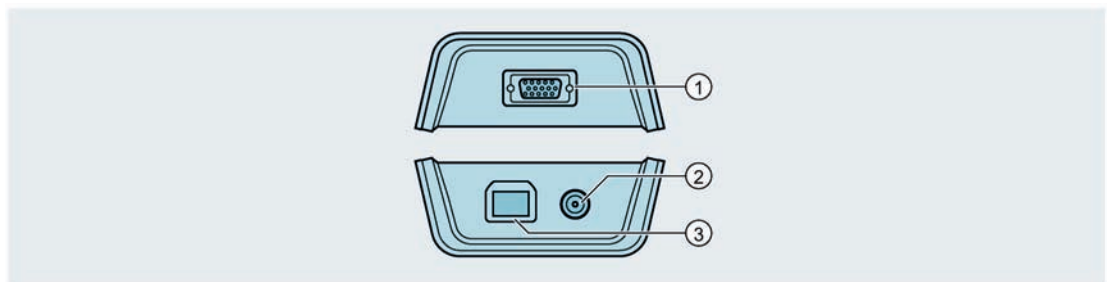


## LED display

LED	Meaning	Description
<input type="checkbox"/> ACT	Off	TD500 switched off
 ACT	On	TD500 ready
<input type="checkbox"/> COM	Off	No communication link with ETU
 COM	Flashing (2 Hz)	- Establishing communication link with ETU - Communications error - TD500 not ready
 COM	On	Communication link established with ETU
<input type="checkbox"/> LOG	Off	No free memory space The TD500 device can continue to be used, but the results of the trip tests will no longer be stored on the TD500. The device is still capable of executing all test functions.
 LOG	Flashing (2 Hz)	Available memory space < 25 % The TD500 device can continue to be used without restriction, but there is only enough memory space available to store a few test results. In order to ensure safe storage of test results, save the existing results to a PC and delete the contents of the TD500 memory using powerconfig.
 LOG	On	Free memory space ≥ 25 % The TD500 device can continue to be used without restriction.
<input type="checkbox"/> RESULT	Off	No test has been carried out and no test result has been recorded.
 RESULT	Flashing red (2 Hz)	It has not been possible to establish whether or not the molded case circuit breaker is functioning correctly.
 RESULT	On	No faults have been detected.

## Interfaces of the TD500 test device

The diagram below shows the physical interfaces of the TD500 test device.



- ① Top of unit: Connection to 3VA UL molded case circuit breaker
- ② Bottom of unit on right: 24 V DC supply
- ③ Bottom of unit on left: Connection to PC

## Compatibility with molded case circuit breakers

The TD500 test device can be connected to all 3VA6 molded case circuit breakers with the ETUs 3-series, 5-series and 8-series. The connecting cable from the test device is inserted in the test socket of the ETU.

**Data stored in the TD500**

The following data are stored in the TD500:

- Article number
- ETU parameter settings
- Causes of ETU trips

---

**Note**

**Readout of data and clearing of the internal memory of the TD500**

Using a PC and the powerconfig software, you can read these data out of the TD500 and clear its internal memory.

---

**Test functions of the TD500**

The relevant pushbutton must be pressed in order to start a specific test. The molded case circuit breaker is tripped electronically when the pushbutton is actuated. This is essential to allow effectual testing of the electronic and mechanical control elements of the circuit breaker.

Test	Description
L test	Overload function test The circuit breaker trips when the time setting $t_l$ elapses
S test	Function test on the short-time delayed short-circuit protection system The circuit breaker trips when the time $t_{sd}$ set on the ETU elapses
I test	Function test on the instantaneous short-circuit protection system The circuit breaker trips instantaneously
N test	Function test on neutral conductor protection system The circuit breaker trips when the time $t_n$ set on the ETU elapses
G test	Function test on ground fault protection system The circuit breaker trips when the time $t_g$ set on the ETU elapses
TRANS test	Function test on transformers (energy and Rogowski transformers) One energy transformer and one Rogowski transformer is tested The circuit breaker trips after a delay of several seconds
METER test	Function test on the measured value display In order to test the displayed current measurement The circuit breaker does <b>not</b> trip during this test

### 4.11.3.2 Operation and execution of test functions

#### Connecting and disconnecting the TD500

#### CAUTION


##### Personal injury, malfunctions and false test results

Failure to connect the TD500 test device to the molded case circuit breaker according to the sequence of steps specified below can result in personal injury, malfunctions and false test results.

Disconnect the molded case circuit breaker from the power supply before connecting the TD500.

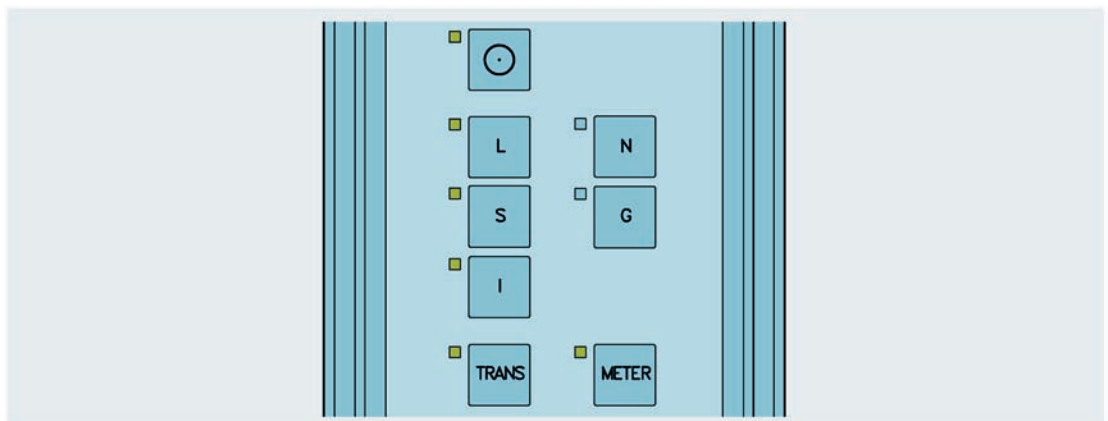
Strictly adhere to the sequence of steps described below for connecting the two devices.

#### Connect the TD500 to the 3VA6 molded case circuit breaker


1. Disconnect the molded case circuit breaker from the power supply.
2. Insert the connecting cable in the socket on top of the TD500 test device.
3. Insert the connecting cable in the test socket of the ETU.
4. Insert the cable of the power supply unit in the socket on the bottom of the TD500 test device.
5. Connect the power supply unit to a socket.  
The TD500 test device is now switched on and ready.
6. Press the pushbutton labeled <ETU Power ON/OFF>  on the TD500 test device.  
The ETU is now powered via the TD500 and activated. Successful communication between the TD500 and ETU is indicated by illumination of the LED labeled "COM" on the TD500.

All test functions available for the connected ETU are indicated by illumination of the appropriately labeled LEDs.

Example: In this example, the L, S and I releases, the transformers (TRANS) and the current meter (METER) can be tested on the connected ETU:

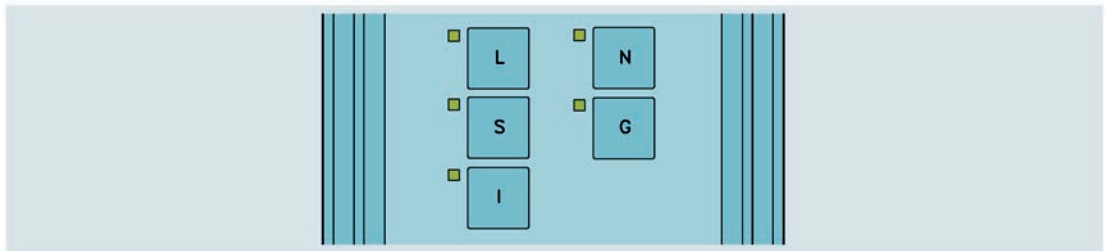


**Disconnect the TD500 from the 3VA6 molded case circuit breaker**

1. Switch off the 3VA6 molded case circuit breaker.
2. Press the pushbutton labeled <ETU Power ON/OFF>  on the TD500 test device. The LED labeled "COM" on the TD500 goes out. The ETU is now no longer powered via the TD500 and is deactivated.
3. Disconnect the power supply unit from the socket.
4. Detach the power supply unit cable from the TD500.
5. Detach the connecting cable between the TD500 and the ETU.

**Test tripping functions L, S, I, N and G**

1. Connect the TD500 test device to the 3VA6 molded case circuit breaker, see above.
2. Switch on the 3VA6 molded case circuit breaker.
3. To test the tripping function, press one of the pushbuttons <L>, <S>, <I>, <N> or <G> on the TD500 test device.

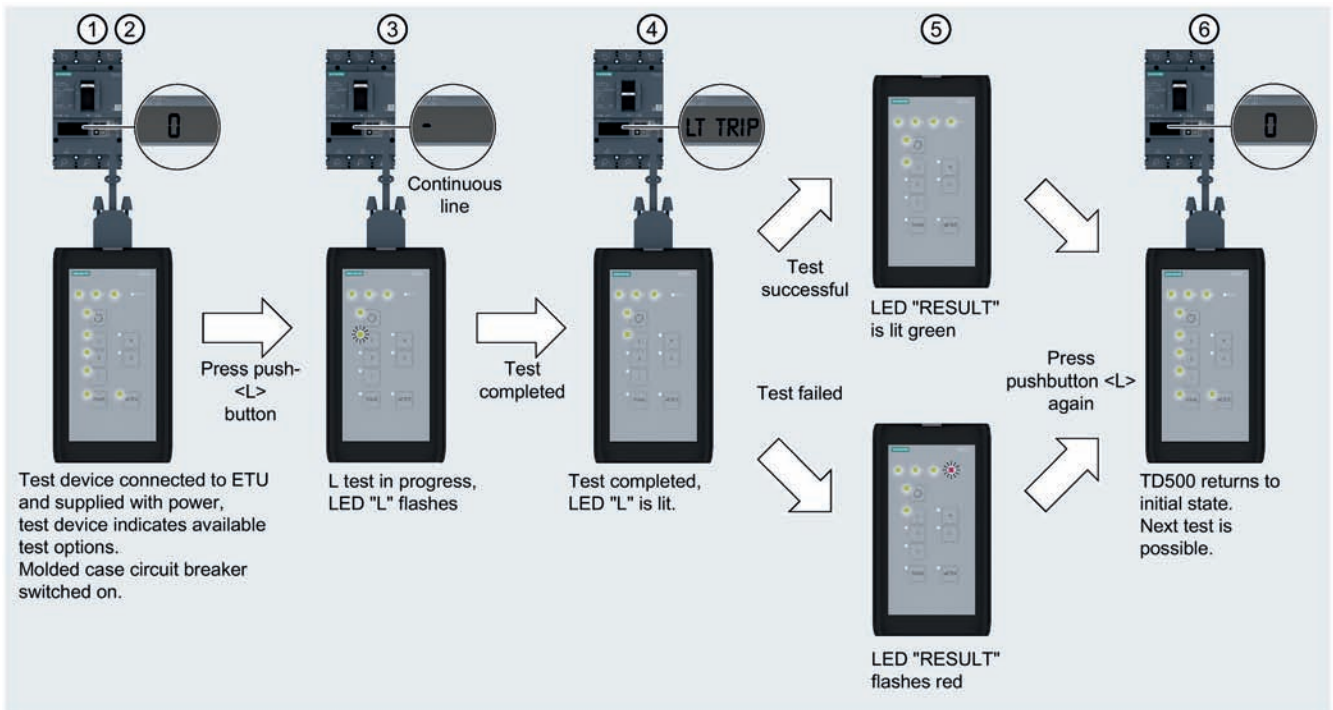


- When a pushbutton is pressed, its LED flashes while the test is in progress.
  - The ETU trips when the set trip times expire and the molded case circuit breaker switches from "ON" to "TRIP".
  - On completion of the test, the LED of the selected pushbutton changes from flashing to steady illumination.
4. Wait for the test to end and evaluate the test result by the status of the LED labeled "RESULT":
 

**Test was successful:**  
The LED "RESULT" lights up green.

**Test was unsuccessful:**  
The LED "RESULT" flashes red.  
Repeat the test. If the test fails again, contact Technical Support (Page 10) .
  5. Press the pushbutton for the same tripping function again in order to confirm the test result and restore the TD500 to its initial state.
  6. Switch on the molded case circuit breaker again (ON position) in order to carry out further tripping function tests.

### Example: Testing the tripping function L on an ETU550 LSI



1. Connect the TD500 test device to the 3VA6 molded case circuit breaker.
2. Switch on the 3VA6 molded case circuit breaker.
3. Press pushbutton <L> on the TD500 test device.  
The LED in the pushbutton <L> starts to flash.
4. Wait until the LED in the pushbutton <L> changes from flashing to steady illumination.  
The test is completed.
5. Evaluate the test result by the status of the LED labeled "RESULT":
  - LED "RESULT" is **illuminated steadily in green**: **The test was successful.**
  - LED "RESULT" flashes **red**: **The test was unsuccessful** and must be repeated. If the test fails again, contact Technical Support (Page 10) .
6. Press the pushbutton <L> again in order to confirm the test result and restore the TD500 to its initial state.

### Carry out a meter test

The purpose of the meter test is to determine whether the ETU is measuring and displaying current correctly. A test current of  $0.4 \times I_{rated}$  is fed into the ETU. The current value measured by the ETU is then checked to confirm that it matches the test current.

---

#### Note

The molded case circuit breaker does **not** need to be switched to position "ON" for this test.

---

#### Execute the test

1. Connect the TD500 test device to the 3VA6 molded case circuit breaker.
2. Press the pushbutton labeled <METER> ①.



The LED in the <METER> pushbutton begins to flash. The test takes approximately 30 seconds.

3. Wait until the LED in the pushbutton <METER> changes from flashing to steady illumination.  
The test is completed.

4. Evaluate the test result by the status of the LED labeled "RESULT":

LED "RESULT" is **illuminated steadily in green**: **The test was successful.**

LED "RESULT" flashes **red**: **The test was unsuccessful** and must be repeated. If the test fails again, contact Technical Support (Page 10) .

5. Press the pushbutton <METER> again in order to confirm the test result and restore the TD500 to its initial state.

### Test transformers

This procedure tests the transformers (energy transformer or Rogowski coil) to determine the following:

- Are transformers installed in the ETU?
- Are transformers correctly installed in the ETU?
- Are the installed transformers functioning correctly?

---

#### Note

In order to carry out this test, it is absolutely essential to disconnect all external power supplies (e.g. EFB300, COM800, COM100, 24 V module) to the electronics.

---

### Execute the test

1. Disconnect all external power supplies to the electronics.
2. Connect the TD500 test device to the 3VA6 molded case circuit breaker.
3. Switch on the 3VA6 molded case circuit breaker.
4. Press the pushbutton labeled <TRANS> ①.



The LED in the <TRANS> pushbutton begins to flash. The test takes several seconds.

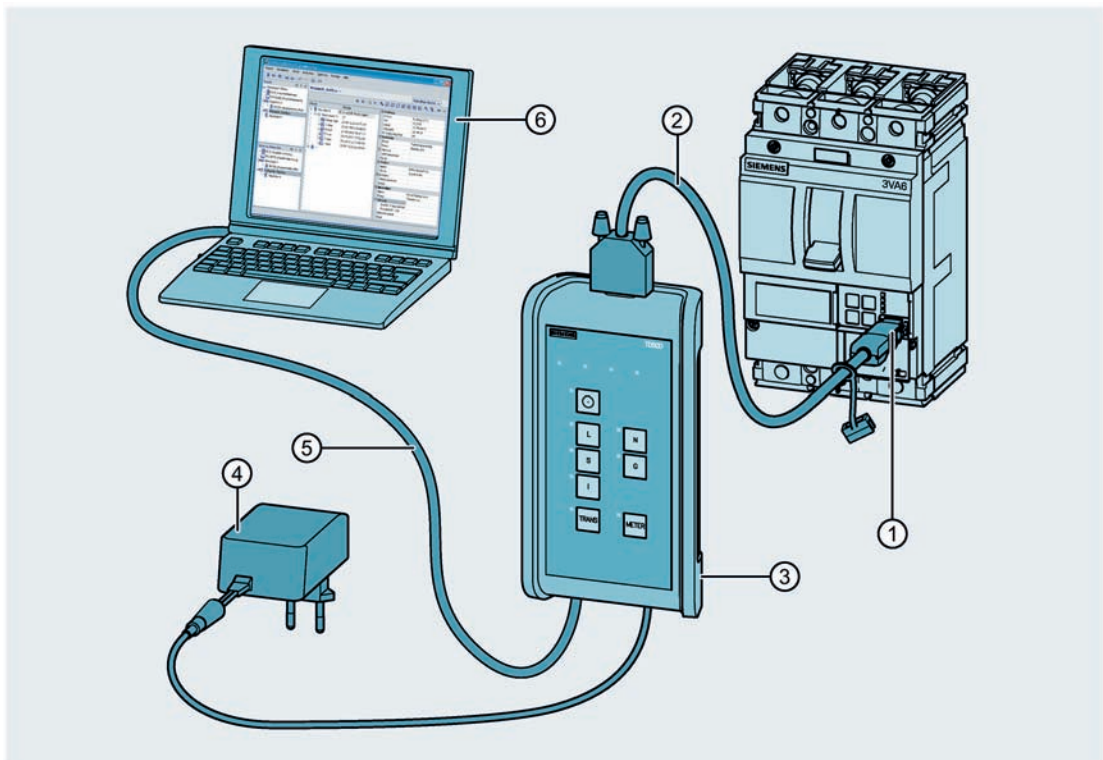
5. Wait until the LED in the pushbutton <TRANS> changes from flashing to steady illumination.  
The test is completed.
6. Evaluate the test result by the status of the LED labeled "RESULT":  
LED "RESULT" is **illuminated steadily in green: The test was successful.**  
LED "RESULT" flashes **red: The test was unsuccessful** and must be repeated. If the test fails again, contact Technical Support (Page 10) .
7. Press the pushbutton <TRANS> again in order to confirm the test result and restore the TD500 to its initial state.

### 4.11.3.3 Executing the test functions using a PC and powerconfig

In addition to its capabilities as a stand-alone test device, the TD500 can also act as a PC interface to the ETU.

If the TD500 test device is connected both to the ETU and a PC, the protective functions can be triggered from a PC on which the powerconfig software is installed. A test log for the molded case circuit breaker is generated and stored in the powerconfig project. The test log can be printed out.

#### Connections between ETU - TD500 - PC



- ① Plug-in connector for insertion in the test socket on the ETU
- ② TD500-to-ETU connecting cable
- ③ TD500 test device
- ④ Power supply unit
- ⑤ USB connecting cable
- ⑥ PC with powerconfig installed

### 4.11.3.4 Parameterizing using the powerconfig software


In addition to test functions, the powerconfig software package also provides tools for assigning parameters to ETU 5-series and 8-series.

These tools allow you to:

- assign parameters to ETU 5-series and 8-series
- store parameter settings for ETU 5-series and 8-series in the powerconfig project and print them out

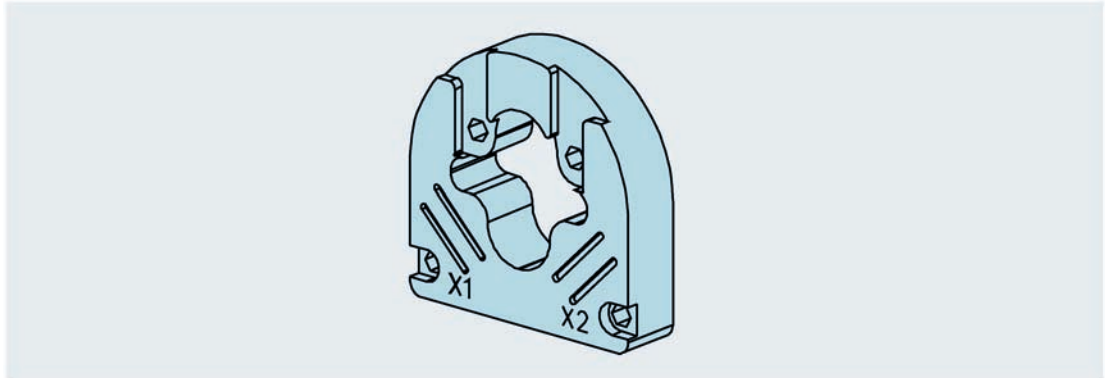


### 4.11.3.5 Technical specifications

Mechanical characteristics		
Dimensions		
Length	inch	7.5
	mm	190
Width	inch	4.13
	mm	105
Depth	inch	4.65
	mm	42
Degree of protection		IP30
Ambient conditions		
Ambient operating temperature	°C	-10 ... +40
Storage temperature	°C	-40 ... +80
Normal position of use		Any
Interface to molded case circuit breakers		
Number of directly connectable molded case circuit breakers		1
Length of cable	inch	59.05
	m	1.5
Power supply		
Number of electrical connections / for external network		1
External power supply unit		
Input voltage	V AC	100 ... 240
Output voltage	V DC	12
Interface to PC		
Number of interfaces / acc. to USB		1
Approvals / certificates		
Declaration of conformity		
 <small>EG-Konf.</small>		

## 4.12 External current transformer for N conductor

The external current transformer for N conductor is a current transformer for 3-pole 3VA6 molded case circuit breakers with ETUs 5-series and 8-series. It is used when 3-pole circuit breakers are to be used in 4-wire systems but monitoring of the N conductor is still desired. The N conductor is thereby protected against short-circuit and overload.




Available external current transformers for N conductor

3VA	Options	Neutral conductor protection	TMTU	ETU		
				3-series	5-series	8-series
Molded case circuit breaker 3-pole	3 phases monitored	None	■	■		
Molded case circuit breaker 3-pole with external neutral conductor transformer	3 phases monitored	None			■	■
	3 phases monitored + N (20% <sup>1)2)</sup> ... 100%)	Neutral conductor, user-defined cross-section protected			■	■
	3 phases monitored + N (100% ... 160%)	Neutral conductor oversized			■	■
Molded case circuit breaker 4-pole	3 phases monitored	None	■	■	■	■
	3 phases monitored + N (50% x I <sub>n</sub> )	Neutral conductor, half cross-section protected		■ <sup>3)</sup>		
	3 phases monitored + N (100% x I <sub>n</sub> )	Neutral conductor, full cross-section protected	■	■		
	3 phases monitored + N (20% <sup>1)2)</sup> ... 100%)	Neutral conductor, user-defined cross-section protected			■	■
	3 phases monitored + N (100% ... 160%)	Neutral conductor oversized			■ <sup>4)</sup>	■ <sup>4)</sup>

N Neutral conductor protection

- 1) With rated current  $I_n = 40\text{ A}$ :  $I_N = 40\% \dots 100\% I_n$
- 2) With rated current  $I_n \geq 100\text{ A}$ :  $I_N = 20\% \dots 100\% I_n$
- 3) Starting from rated current  $I_n \geq 100\text{ A}$
- 4) Dependent on circuit breaker frame size and rated operational current

## Technical specifications

	Rated current $I_n$		
	25 ... 150 A	200 ... 250 A	400 ... 600 A
Rated frequency	50/60 Hz		
Rated operational voltage $U_o$	Max. 690 V		
Rated impulse strength $U_{imp}$	8 kV		
Rated insulation voltage $U_i$	0.8 kV		
IP degree of protection	IP00		
Ambient temperature	-25 °C ... 50 °C		
> 50 °C: Derating	7.5 % / 10 K		
Max. bar temperature	115 °C at 50 °C ambient temperature		
Approvals / certificates			
			

## 4.13 Cover frame

Molded case circuit breakers or supplementary motor operators or front mounted rotary operators for molded case circuit breakers are often installed in panels or distribution boards in such a way that only the operating device is directly accessible. Busbars, cables and the termination area of the molded case circuit breaker are covered by metal or plastic plates in order to prevent direct contact with live components. The panel door itself is often designed as a protective cover.

Cutouts must be made in these covers

- in order to allow access to control elements,
- which are designed to prevent direct contact with cables, and
- which are large enough in size that the cover can be closed easily.

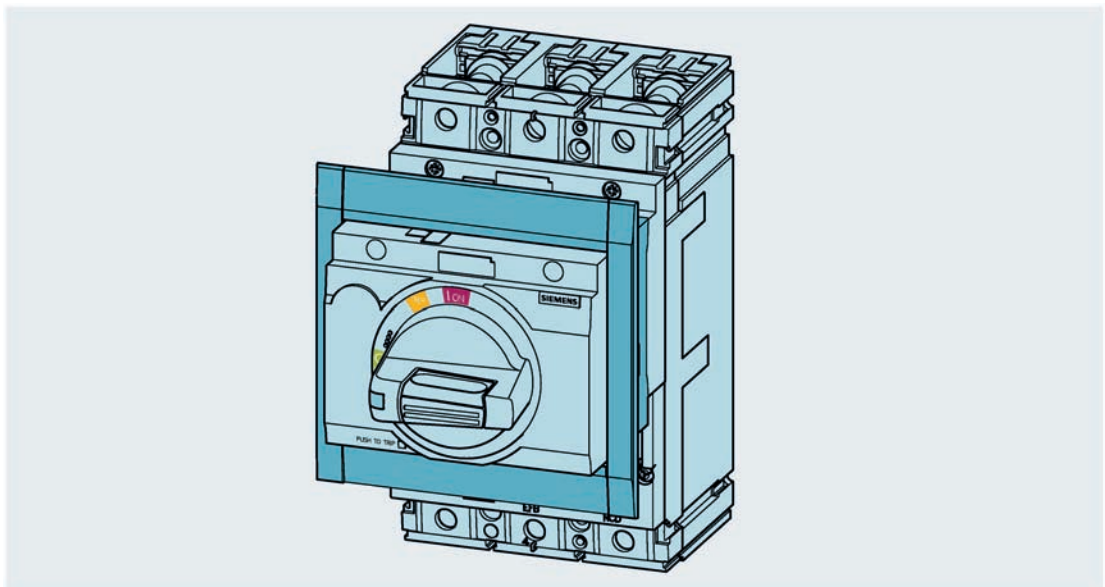
All these requirements necessitate gap dimensions of a few millimeters between the cutout and the unit.

Door cover frames are used when the gap is to be covered and as small as possible. With cover frames you achieve a clean, attractive panel appearance in the front view as well as a higher degree of protection of IP30 in IEC applications.

### 4.13.1 Product description

Cover frames are generally available for the following devices of the 3VA UL product range:

- 3VA5 / 3VA6 molded case circuit breakers, 3- or 4-pole: Handle area only
- 3VA5 / 3VA6 molded case circuit breakers, 3- or 4-pole: Area around handle and trip unit
- Front mounted rotary operator
- Motor operators
- Door feedthroughs



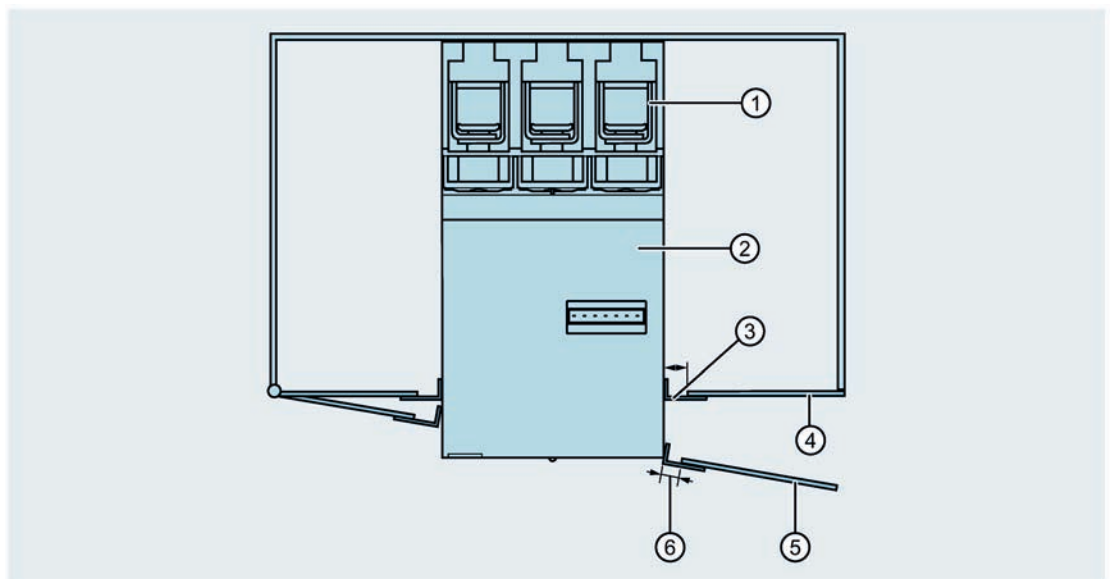
### Installation

1. Cut out an opening in the cover plate.  
Refer to the operating instructions for the correct cutout dimensions.
2. Insert the cover frame into the cutout from the front and fasten by means of small spring steel sheets at the rear of the cover plate.

The fastening system is designed such that the the cover frame can move in the cutout. In other words, the cover frame is "float-mounted". Tolerance compensation in the range  $\pm 0.12'' / \pm 3 \text{ mm}$  is thus possible in the horizontal direction and in the range  $\pm 0.24'' / \pm 6 \text{ mm}$  in the vertical direction. On the one hand, this tolerance compensation is required to achieve the small gap dimension of max.  $\pm 0.19'' / \pm 0.5 \text{ mm}$  between the cover frame and device. On the other hand, it is needed to compensate for tolerances, for example, in the panel, which are always present due to the construction.

Typical tolerance compensation examples are:

- Tolerance compensation of the door angle with right-hinged or left-hinged doors
- Tilting of devices under their own weight when they are fastened to thin mounting plates



- ① Molded case circuit breaker
- ② Motor operator
- ③ Cover frame
- ④ Panel door (closed)
- ⑤ Panel door (open)
- ⑥ Tolerance compensator

### Note

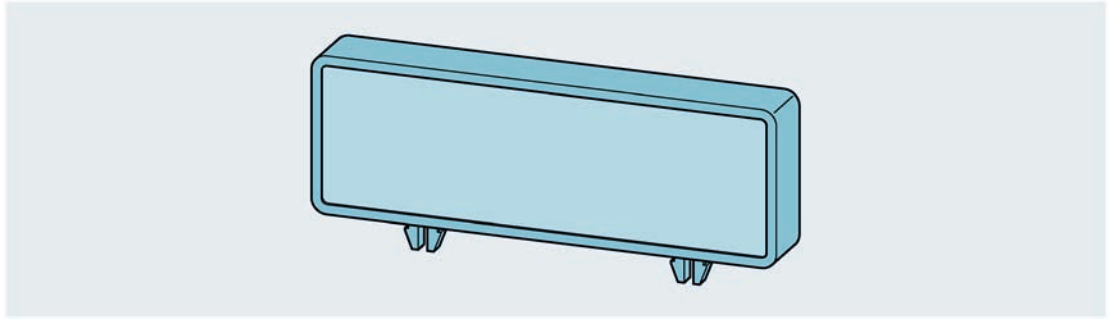
To ensure that the panel door can still be opened, a mounted accessory component must not project beyond the cover frame by more than 5 mm (0.19") when the door is closed.

### 4.13.2 Labeling plate

A supplementary labeling plate (3VA9077-0SX10) is available for the cover frames.

It can be latched in position in the center of any of the four sides of the cover frame. Paper or plastic labels displaying plant-specific information are attached by adhesive to the labeling plate.

The scope of supply includes 10 labeling plates and 10 aluminum-colored labels.



## Service and maintenance

### 5.1 Notes

#### Qualified personnel

It is essential to refer to this documentation when setting up and operating the relevant equipment / system. The equipment / system may only be serviced and maintained by qualified personnel. For the purpose of the safety information in these operating instructions, a "qualified person" is someone who is authorized to energize, ground, and tag equipment, systems, and circuits in accordance with established safety procedures.

#### Maintenance category

Maintenance category	Maintenance interval
Inspection	Annually
Maintenance	As required; 10 years after delivery at the latest
Corrective maintenance	As required; 20 years after delivery or after 1000 switching cycles at the latest

## 5.2 Regular maintenance

### Recommended maintenance/inspection intervals

Following initial commissioning, the equipment/system must be inspected at least once per year.

In addition, an inspection should be carried out after 1000 cycles at rated operational current.

If the molded case circuit breaker or molded case switch (MCS) is operated in a dusty environment or an environment with corrosive vapors, gases or salt spray, it is recommended that the inspection intervals be adjusted, e.g. to twice per year.

### Recommended inspection of the 3VA UL molded case circuit breaker / molded case switch (MCS)

Schedule of inspections/tests	Inspection/test procedures
<b>3VA molded case circuit breakers / molded case switches</b>	
Check that connections are tight	<ul style="list-style-type: none"> <li>- Check the tightening torque of the connecting screws (80% of the tightening torque is recommended)</li> <li>- Visually inspect the incoming and outgoing cables</li> <li>- Visually inspect the connection accessories</li> <li>- Replace any damaged connection accessories after cleaning the termination area</li> </ul>
Inspect the exterior surfaces of the molded case circuit breaker / molded case switch	<ul style="list-style-type: none"> <li>- Examine all visible surfaces for oxidation, residues or other adverse effects</li> <li>- Remove residues with a lint-free, dry and clean cloth. Never use chemical cleaning agents or water!</li> </ul>
Check the protection parameters	Check that the trip unit is correctly set for the prevailing conditions in the installation and adjust the settings if necessary.
Test the electrical and mechanical functions of the molded case circuit breaker / molded case switch	Move the handle from OFF to ON, and from ON to OFF, in order to check the mechanical function of the molded case circuit breaker contacts
Test the tripping function with the <PUSH TO TRIP> button	Press the <PUSH TO TRIP> button. The molded case circuit breaker / molded case switch must trip and move to the "TRIP" position.
<b>Undervoltage release</b>	
Test the tripping function	<ol style="list-style-type: none"> <li>1. Open the molded case circuit breaker.</li> <li>2. Set the operational voltage (terminals D1 and D2) to 0 V.</li> <li>3. Close the molded case circuit breaker (move handle to ON). The molded case circuit breaker must trip and move to the "TRIP" position.</li> </ol>

### Optional inspection possibilities for the ETU of the 3VA6 molded case circuit breaker

What needs to be tested/inspected?	What is the correct test/inspection procedure?
The various protective trip functions of the ETU need to be tested	Test the individual protective functions LSING in the ETU using the TD500 test device. The circuit breaker must trip at the end of each test. The current transformer and the metering function can also be tested for proper functioning. Refer to section "Test devices".



## **5.3 Maintenance following tripping of a molded case circuit breaker**

If a 3VA UL molded case circuit breaker trips because of an overcurrent (overload, short circuit) or fault current (ground fault), the cause of the trip must be identified and eliminated before the molded case circuit breaker may be switched on again.

In the case of 3VA6 molded case circuit breakers, the cause of the trip can be output via the EFB300 external function box. With electronic trip units ETU 5-series and 8-series, the cause of tripping can be indicated on the LCD display and optionally transferred via communication modules.

An inspection as described in chapter Regular maintenance (Page 382) should be carried out after each trip by the trip unit. In addition, any black residue on the molded case circuit breaker must be removed as it may contain conductive particles. The molded case circuit breaker should then be switched on and off without load at least five times.

## 5.4 Fault diagnostics

Description of problem	Possible fault cause	Remedial action
Repeated tripping	The protection settings of the ETU are not correct	Check whether the current setting of the ETU matches the rated current of the supply system.
	Fluctuations in the voltage of the undervoltage release	Check the voltage at the undervoltage release. The connection of other high-consumption loads (such as motor operators) to the same power source may cause the voltage to dip briefly in some cases.
	Ambient temperature too high	The protection settings are specified for a particular reference point. Erroneous tripping can occur if the ambient temperature is higher than the specified reference or if other ambient conditions have not been given due consideration (e.g. derating for draw-out technology when installation location is above 2000 m). Pay due attention to ambient conditions and appropriate derating.
	Shunt trip is activated	The trip is initiated by the shunt trip STL or STF. Check the causes of unintentional shunt trip activation.
Molded case circuit breaker cannot be switched on by the handle or manual operators	Tripping by ground fault	Check the insulation in the low-voltage network and at the loads.
	No voltage supply to the undervoltage release	Check the voltage supply UVR to the undervoltage release.
	Shunt trip STL or STF is connected to voltage	Check the voltage.
	Molded case circuit breaker is locked, e.g. by sliding bar or cylinder locks in the manual operators	Unlock the circuit breaker.
Molded case circuit breaker cannot be switched on via motor operator	Molded case circuit breaker is interlocked, e.g. by a front interlock	Release the circuit breaker.
	No voltage supply to the undervoltage release	Check the voltage supply UVR to the undervoltage release.
	Shunt trip STL or STF is connected to voltage	Check the voltage.
	Molded case circuit breaker is locked, e.g. by cylinder lock in the motor operator	Unlock the circuit breaker.
	Molded case circuit breaker cannot be switched on or off via the communication interface if the write protection slide switch on the COM800 is set to OFF	Check the position of the write protection slide switch on the COM800.

### See also

Technical Support (Page 10)

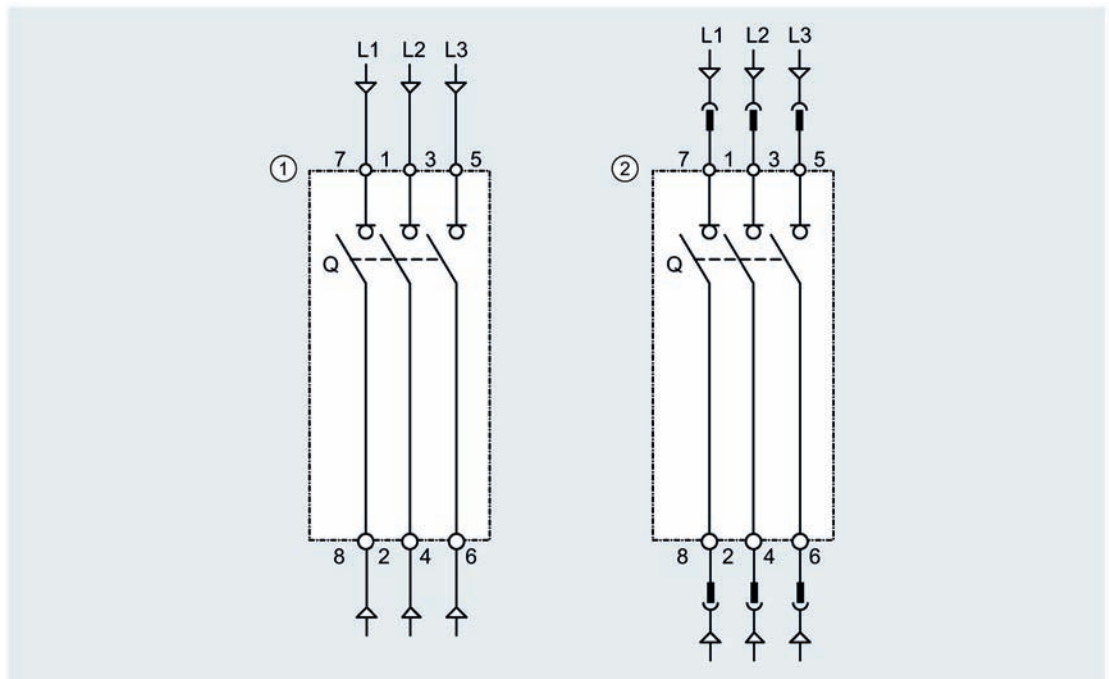
## Technical specifications

### 6.1 Circuit diagrams

#### 6.1.1 3VA5 molded case circuit breakers

##### 6.1.1.1 Basic units

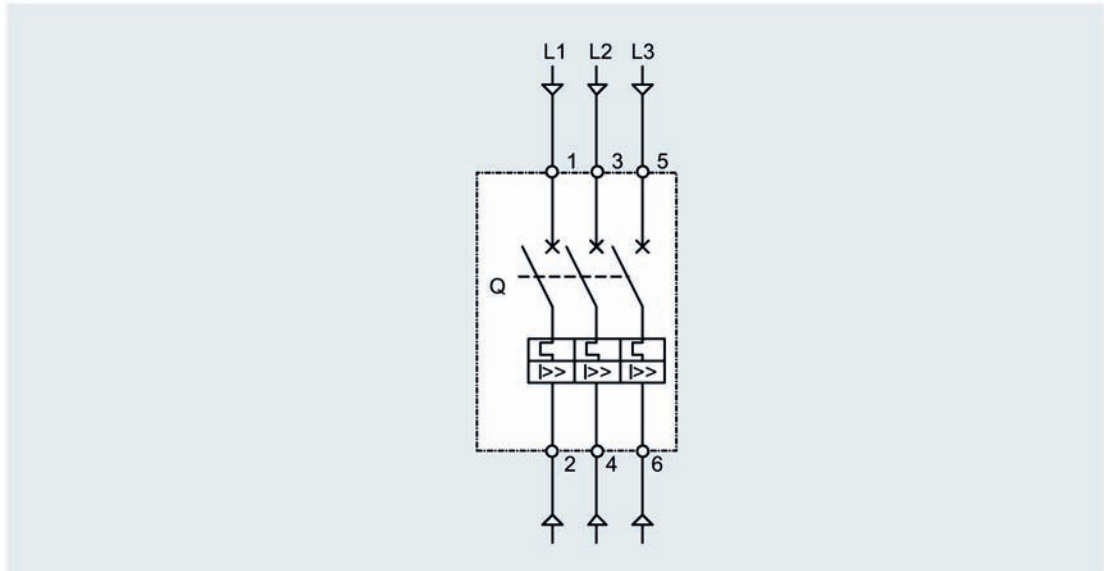
#### Molded case switch / motor circuit protector



- ① Fixed mounting
- ② Plug-in/draw-out technology

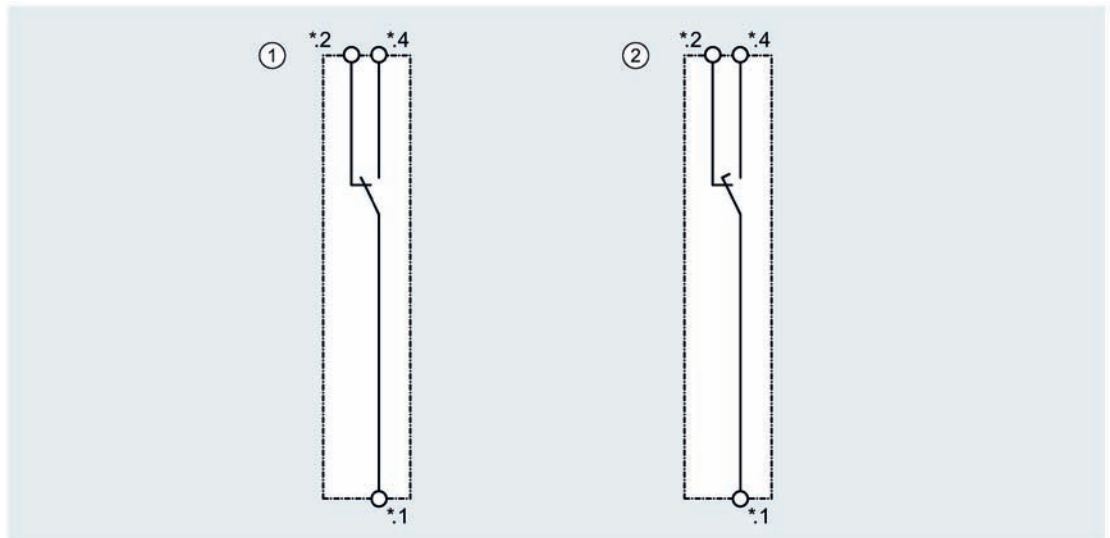
3VA5 molded case circuit breakers with thermal-magnetic trip unit

Fixed mounted, 3-pole



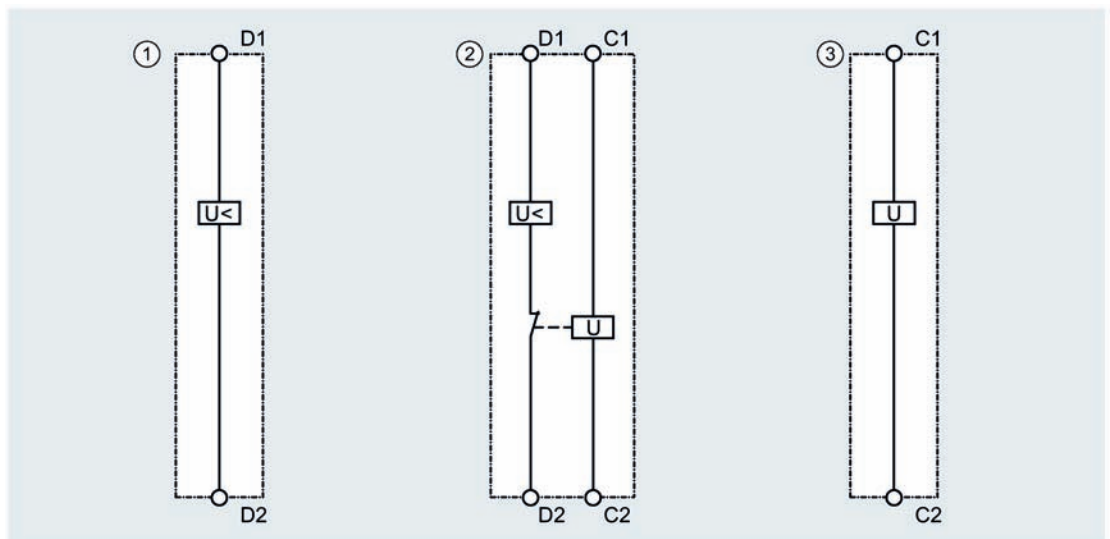
### 6.1.1.2 Accessories

#### Auxiliary switches, alarm switches and position signaling contacts



- ① Changeover contacts for auxiliary switches AUX, trip alarm switches TAS and electrical alarm switches EAS, position signaling switches for plug-in and draw-out units
- ② Leading changeover contacts for leading changeover switch LCS

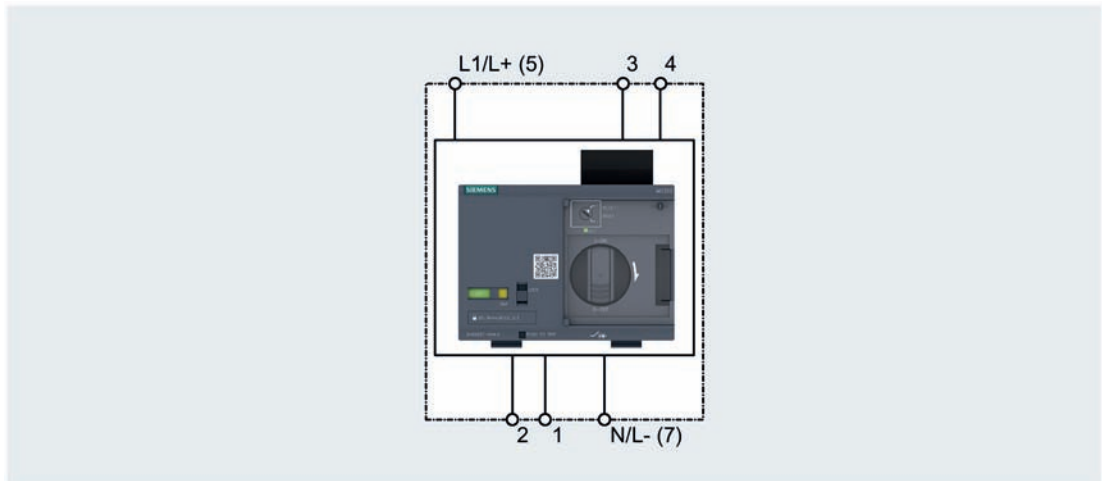
#### Auxiliary releases



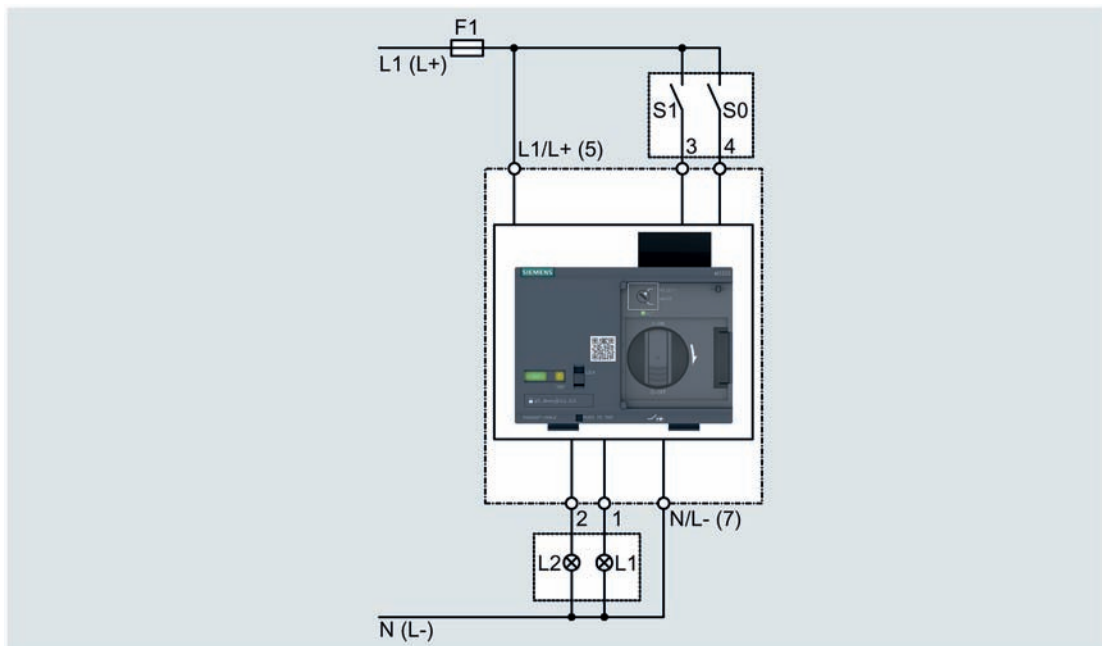
- ① Undervoltage release UVR
- ② Universal release UNI
- ③ Shunt trip

### Motor operators

#### Front mounted motor operator

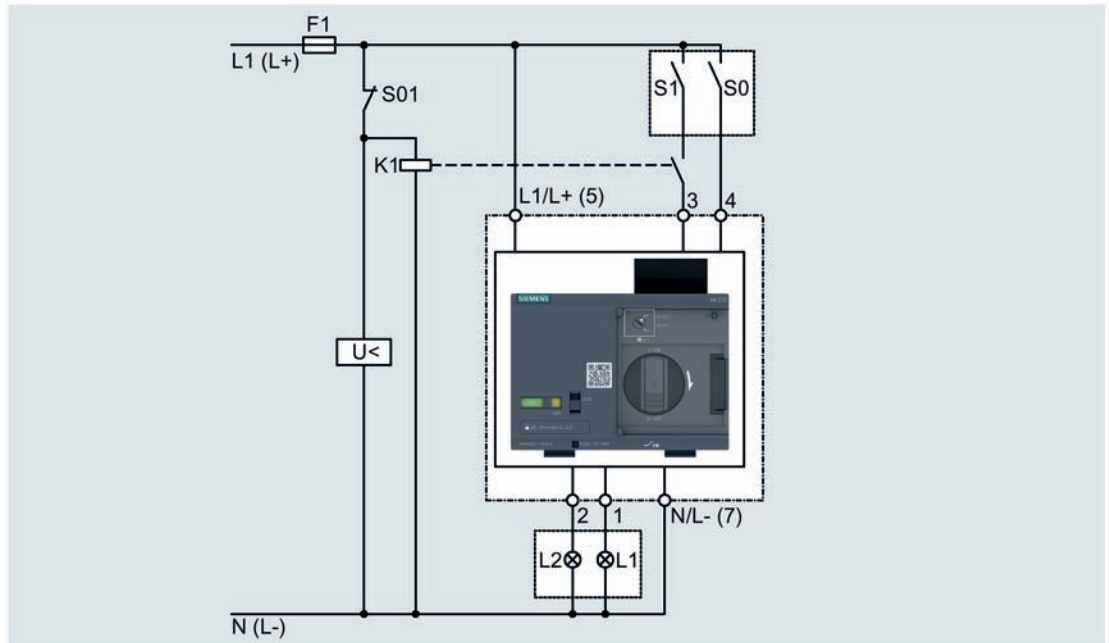


#### Motor operator actuation controlled via control cable



- S0 OFF (to be provided by customer)
- S1 ON (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

Motor operator actuation controlled via control cable and undervoltage release



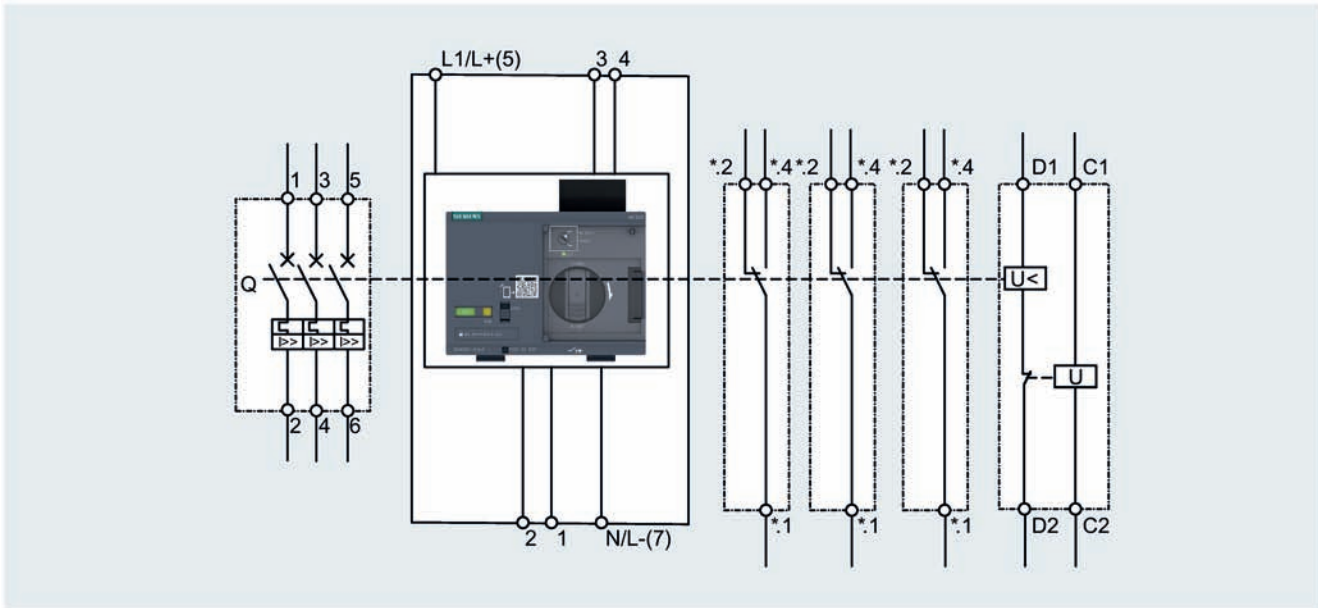
- S0 OFF (to be provided by customer)
- S1 ON (to be provided by customer)
- S01 Remote command (to be provided by customer)
- K1 Auxiliary contactor (to be provided by customer)
- U< Undervoltage release (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

This circuit is deployed in order to prevent no-load operation of the molded case circuit breaker. The contact of auxiliary contactor K1 prevents no-load operation when the undervoltage release "U<" is de-energized.

No-load operations subject the molded case circuit breaker to high stresses. If the undervoltage release is de-energized, auxiliary contactor K1 has not picked up. The contact in the ON circuit (control circuit) of the motor operator is thus not closed, that is, the molded case circuit breaker cannot be switched.

This auxiliary contactor is not necessary when the undervoltage release is supplied uninterrupted (e.g. pushbutton S01) from the same source as the motor operator itself (e.g. contact 3).

6.1.1.3 Example: 3VA5 molded case circuit breakers with accessories (external/internal)

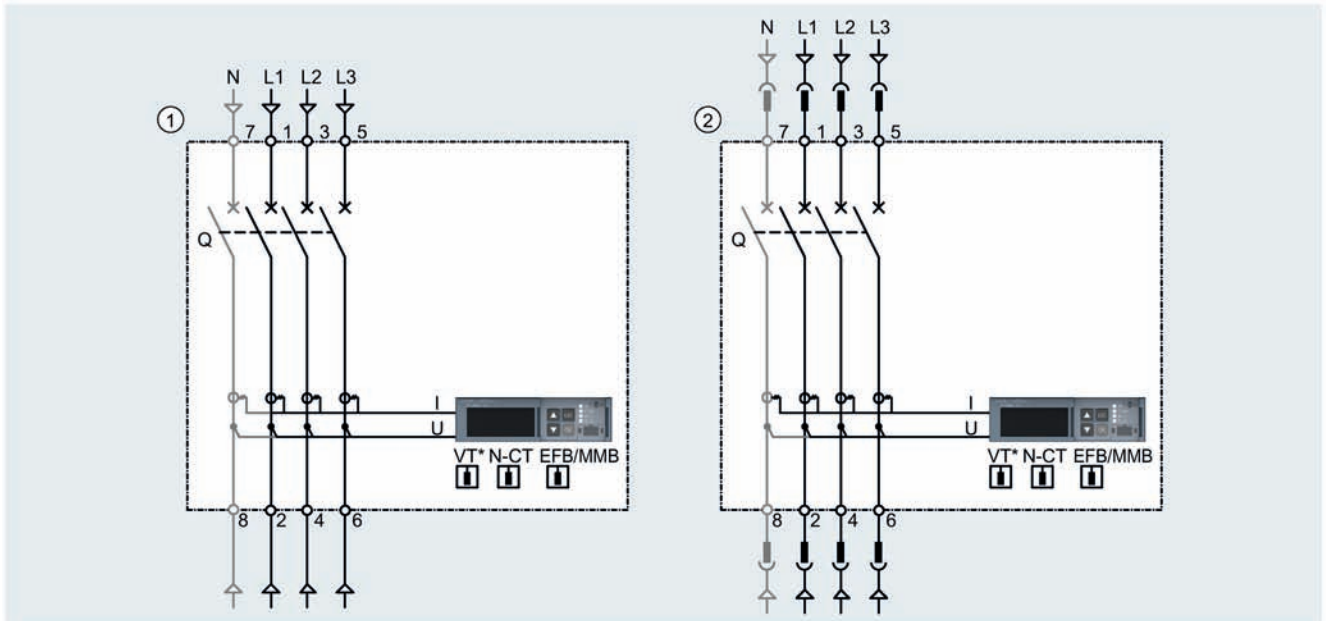




## 6.1.2 3VA6 molded case circuit breakers

### 6.1.2.1 Basic units

Fixed-mounted and plug-in/draw-out units, 3-pole and 4-pole

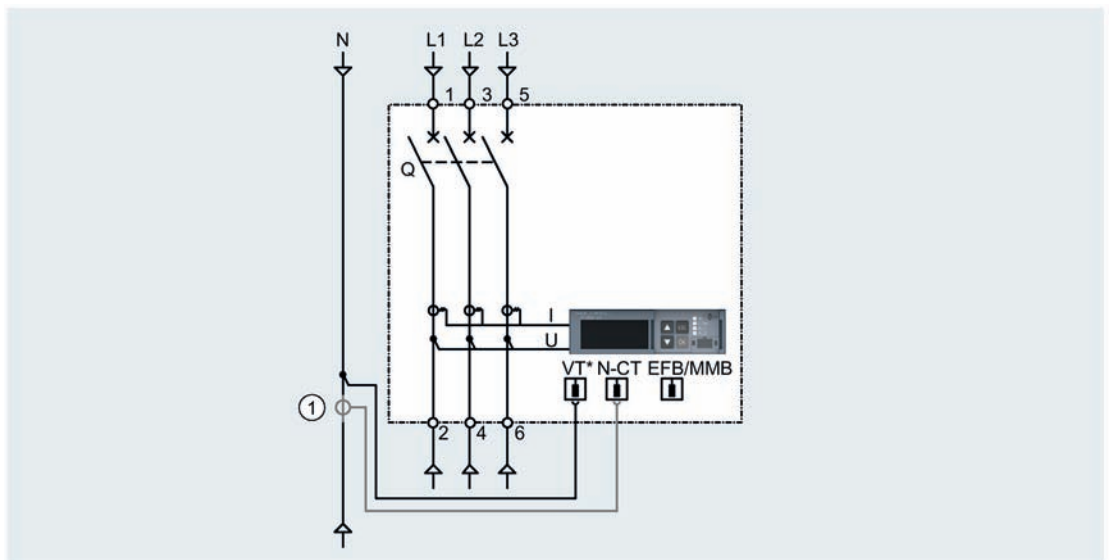


① Fixed-mounted, 3-pole and 4-pole

② Plug-in/draw-out units, 3-pole and 4-pole

\* Voltage tap

Fixed-mounted, 3-pole 3VA6 molded case circuit breaker in 5-wire system

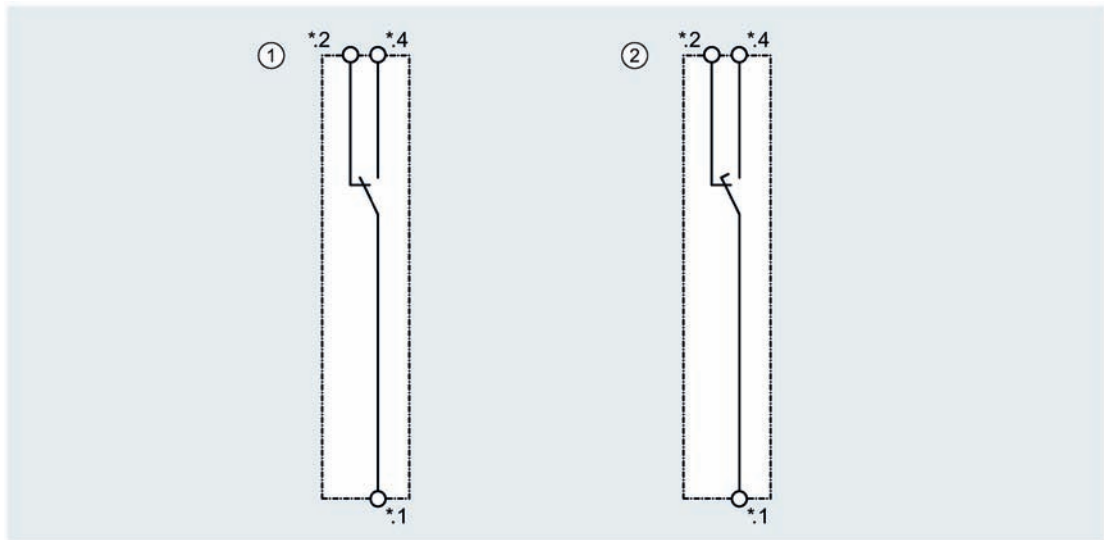


① Optional external current transformer for N conductor (gray line)

\* Voltage tap

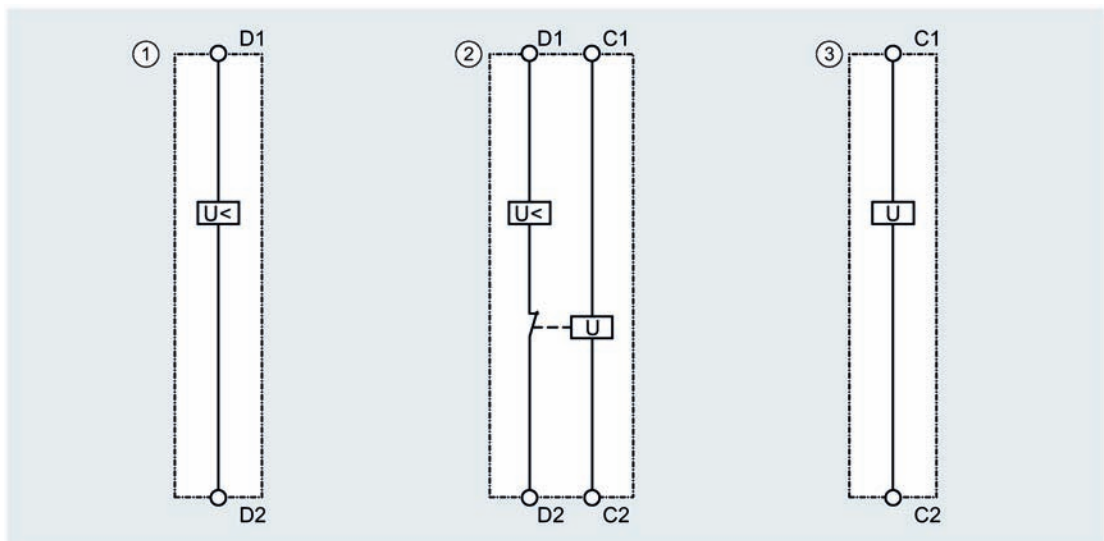
6.1.2.2 Accessories

Auxiliary switches, alarm switches and position signaling contacts



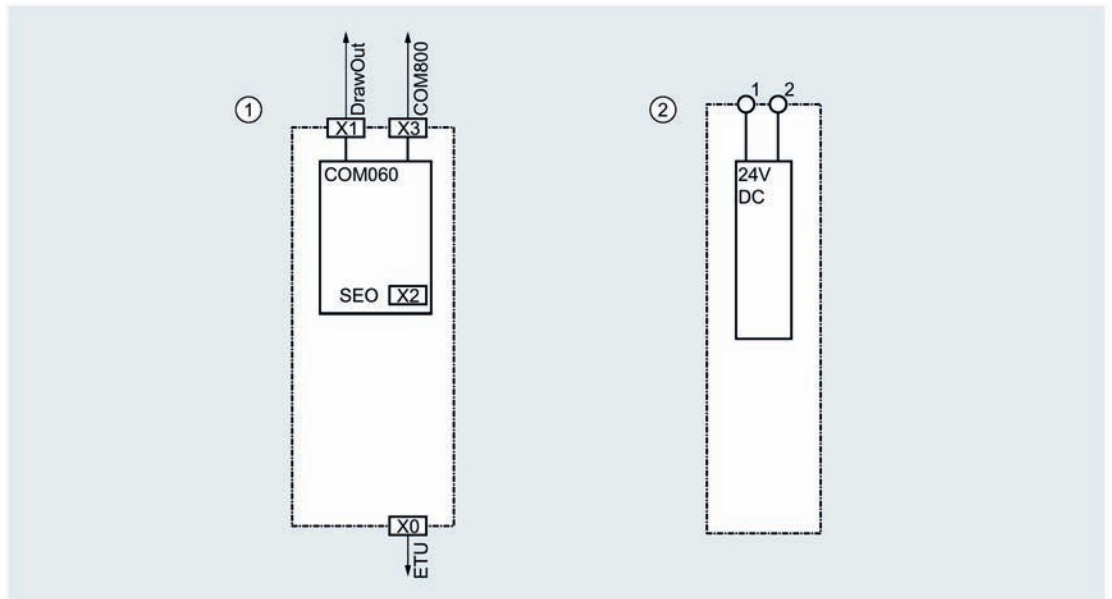
- ① Changeover contacts for auxiliary switches AUX, trip alarm switches TAS and electrical alarm switches EAS, position signaling switches for plug-in and draw-out units
- ② Leading changeover contacts for leading changeover switch LCS

Auxiliary releases



- ① Undervoltage release UVR
- ② Universal release UNI
- ③ Shunt trip

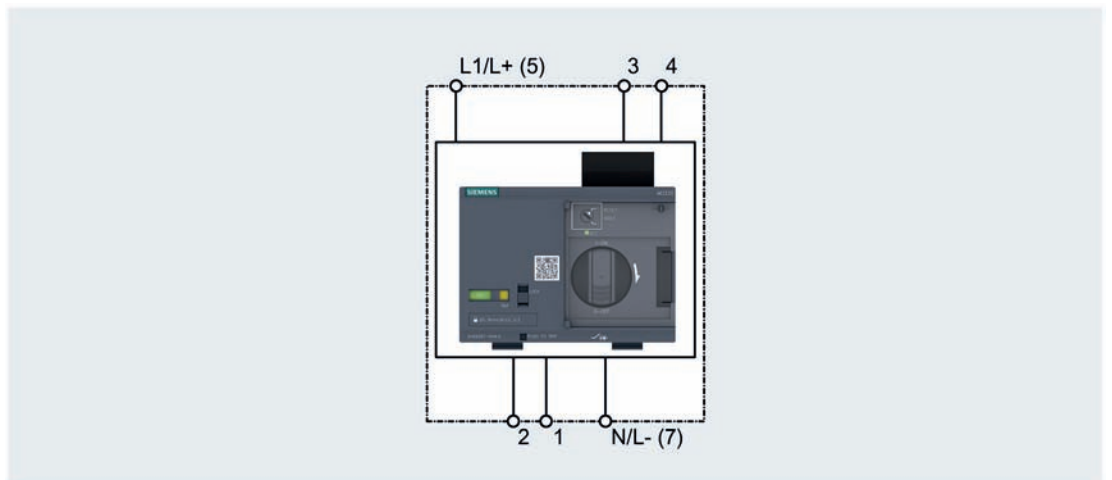
### Other internal accessories



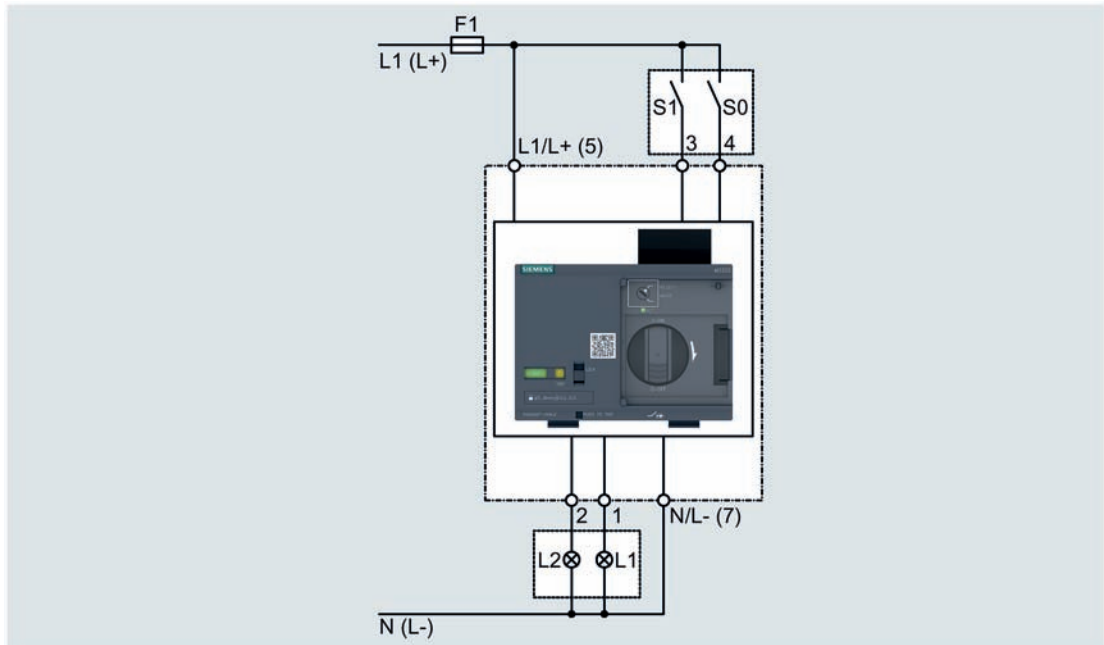
- ① COM060 communication module
- ② 24 V module

### Motor operators

#### Front mounted motor operator

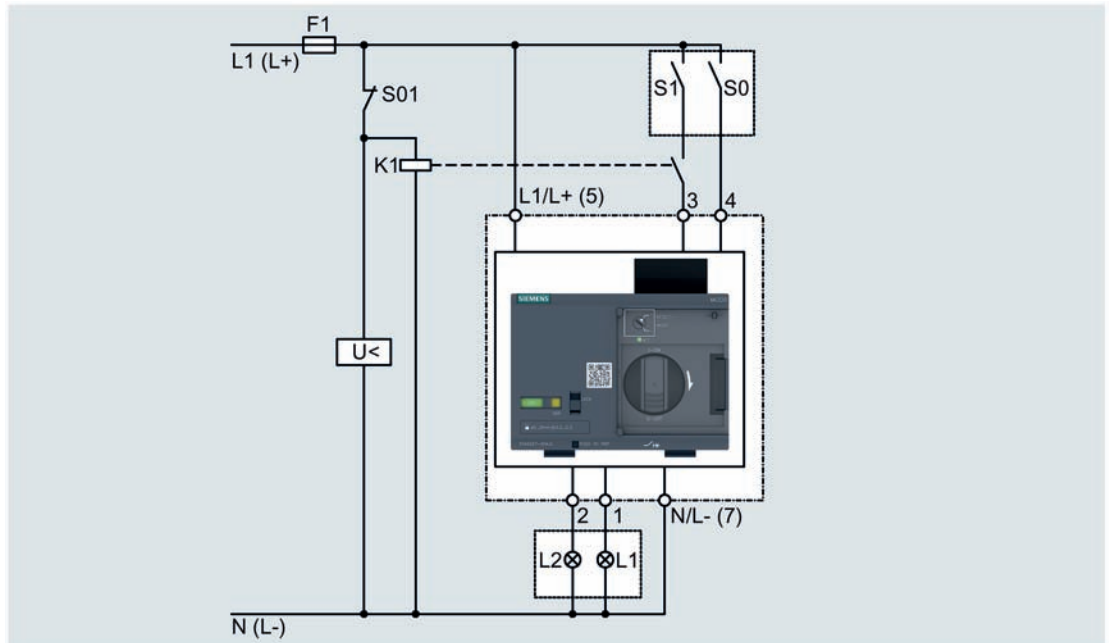


Motor operator actuation controlled via control cable



- S0 OFF (to be provided by customer)
- S1 ON (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

Motor operator actuation controlled via control cable and undervoltage release



- S0 OFF (to be provided by customer)
- S1 ON (to be provided by customer)
- S01 Remote command (to be provided by customer)
- K1 Auxiliary contactor (to be provided by customer)
- U< Undervoltage release (to be provided by customer)
- F1 Fuse in the control circuit (to be provided by customer)
- L1 Indicator light AUTO mode (to be provided by customer)
- L2 Indicator light MAN mode (to be provided by customer)

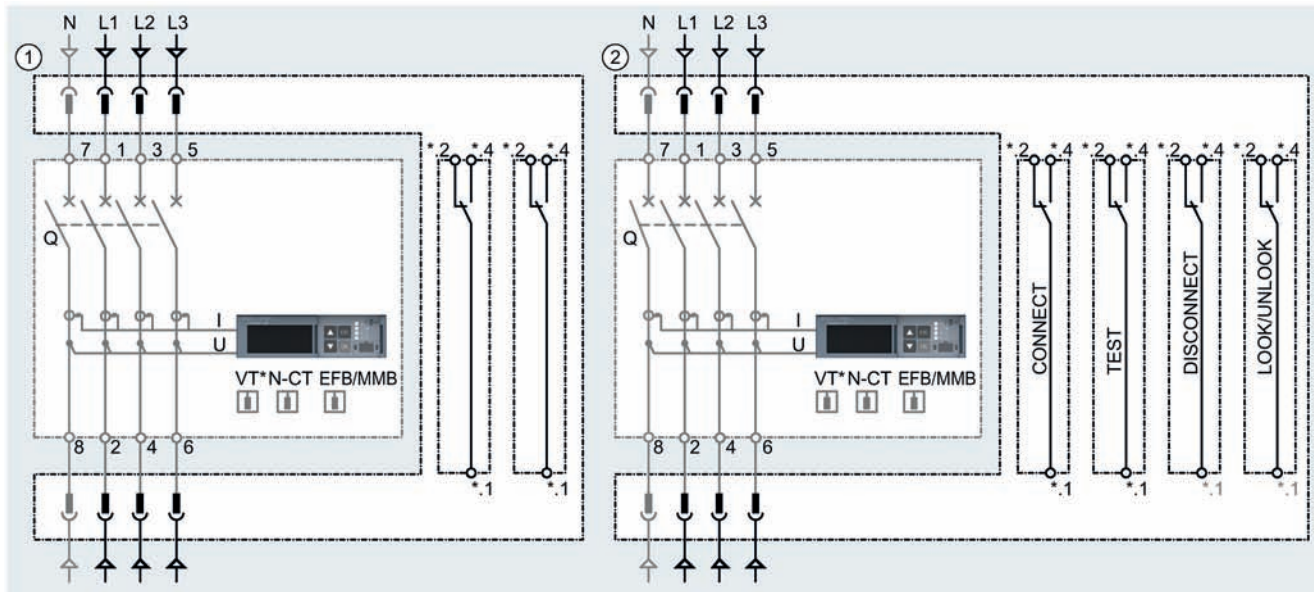
This circuit is deployed in order to prevent no-load operation of the molded case circuit breaker. The contact of auxiliary contactor K1 prevents no-load operation when the undervoltage release "U<" is de-energized.

No-load operations subject the molded case circuit breaker to high stresses. If the undervoltage release is de-energized, auxiliary contactor K1 has not picked up. The contact in the ON circuit (control circuit) of the motor operator is thus not closed, that is, the molded case circuit breaker cannot be switched.

This auxiliary contactor is not necessary when the undervoltage release is supplied uninterrupted (e.g. pushbutton S01) from the same source as the motor operator itself (e.g. contact 3).

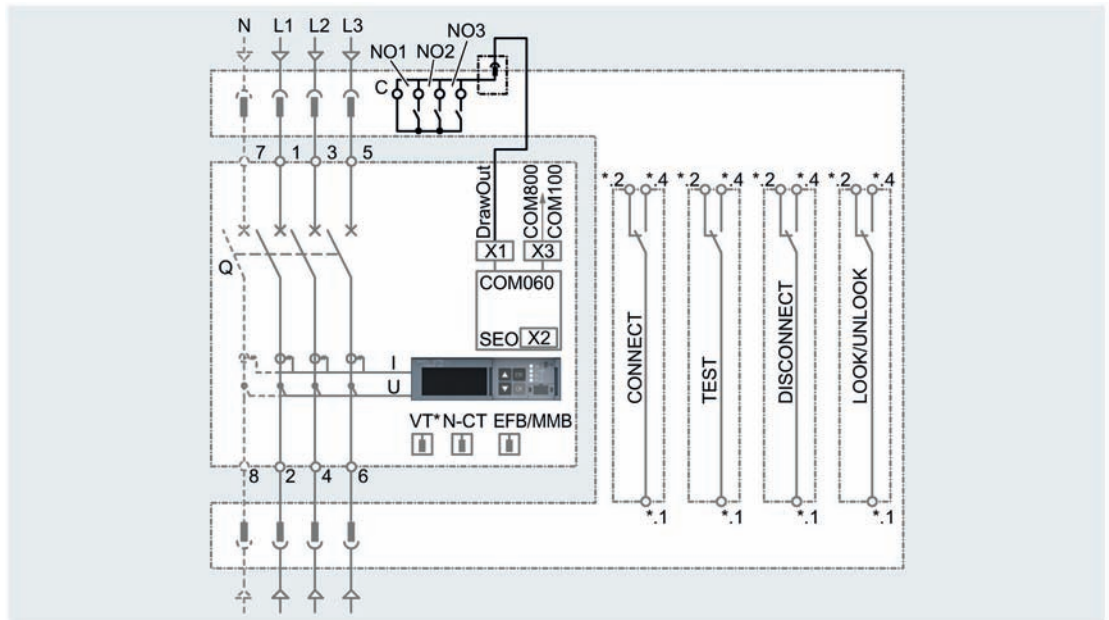
Plug-in and draw-out technology

Plug-in and draw-out technology



- ① Plug-in units, 3-pole and 4-pole, with two optionally integrated position signaling switches for signaling "Plug-in unit - MCCB correctly bolted to plug-in socket".
  - ② Draw-out units, 3-pole and 4-pole, with an optional switch for signaling the condition "Draw-out unit locked / open" and six optionally integrated position signaling switches for signaling "Position of breaker in the draw-out unit".
- \* Voltage tap

Draw-out units with communication interface

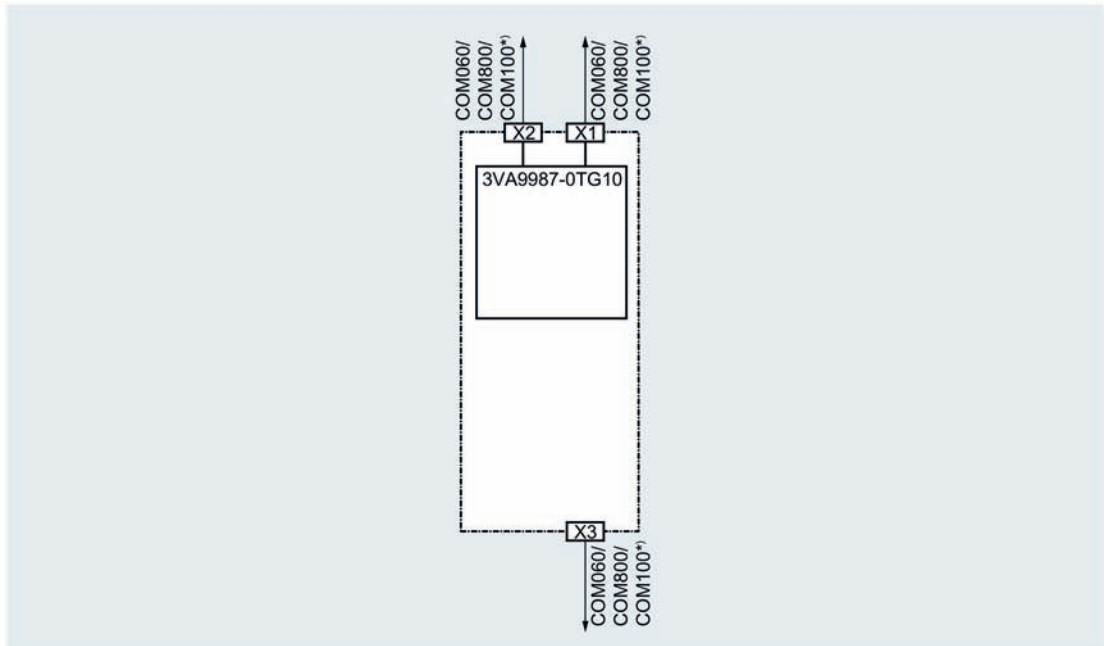


\* Voltage tap

Draw-out units, 3-pole and 4-pole, with an optional switch for signaling the condition "Draw-out unit locked / open" and three optionally integrated position signaling switches for signaling "Position of breaker in the draw-out unit".

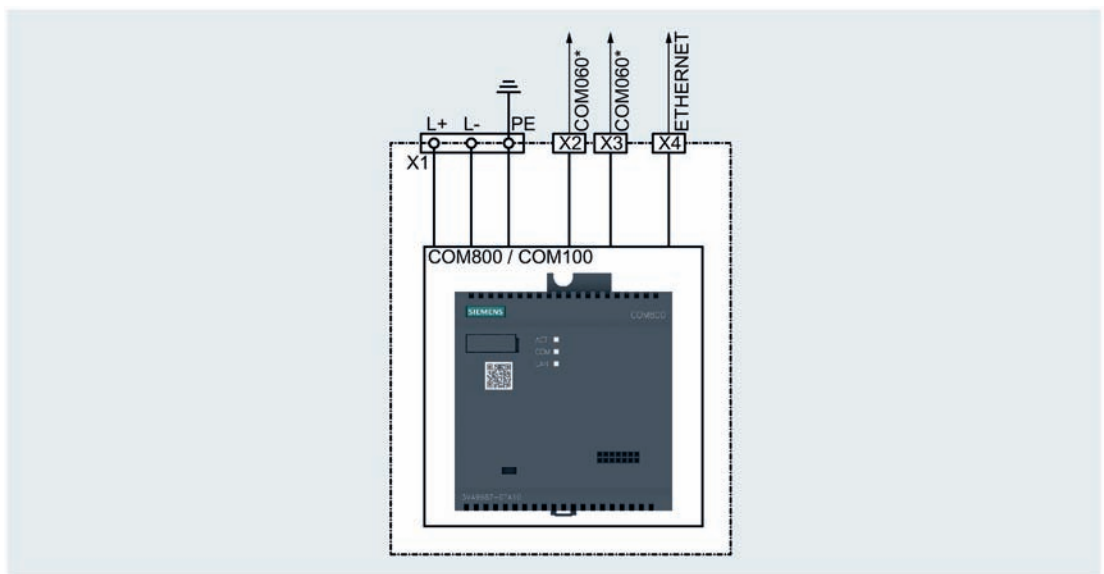
Other external accessories

T-connector



\* A connection can also be optionally equipped with a bus terminating resistor.  
The T-Connector is included in the scope of supply of the COM060 communication module.

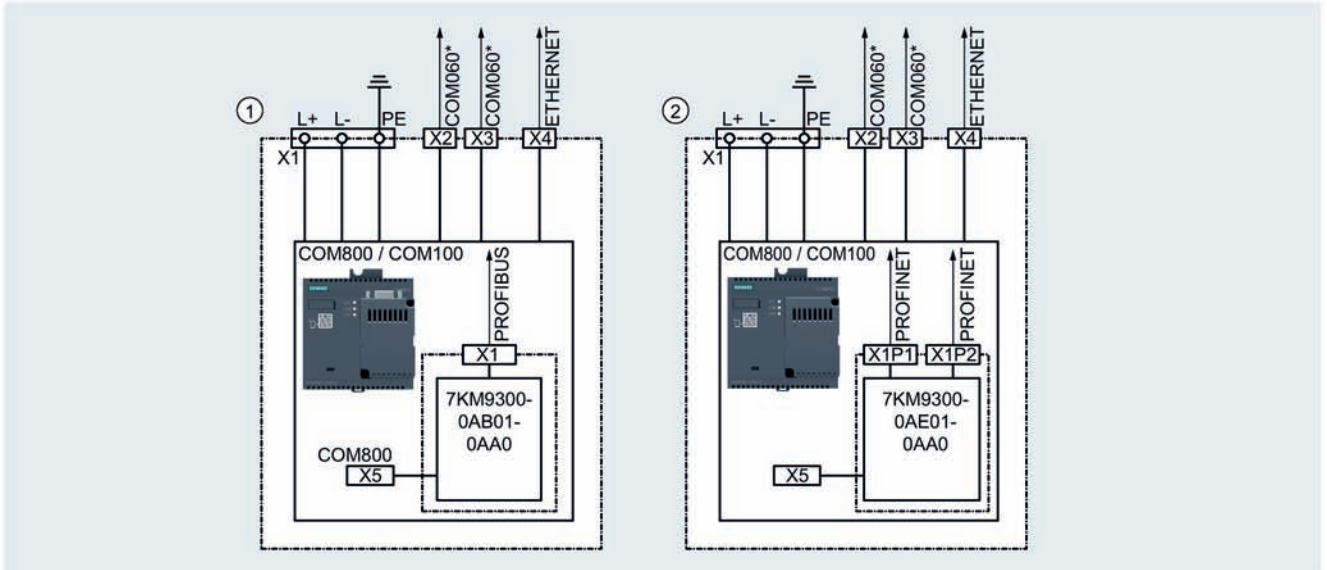
COM800 / COM100 breaker data server



\* A connection can also be optionally equipped with a bus terminating resistor.



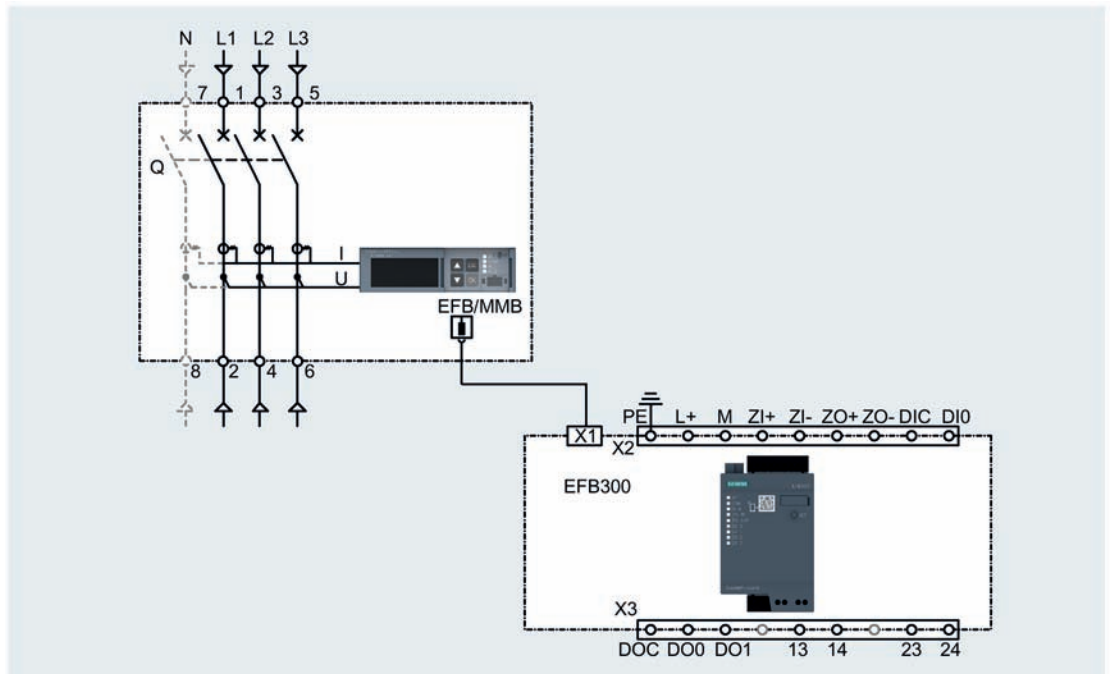
COM800 / COM100 breaker data server with expansion modules



- ① COM800 / COM100 breaker data server with 7KM PAC PROFIBUS DP expansion module
- ② COM800 / COM100 breaker data server with 7KM PAC Switched Ethernet PROFINET expansion module

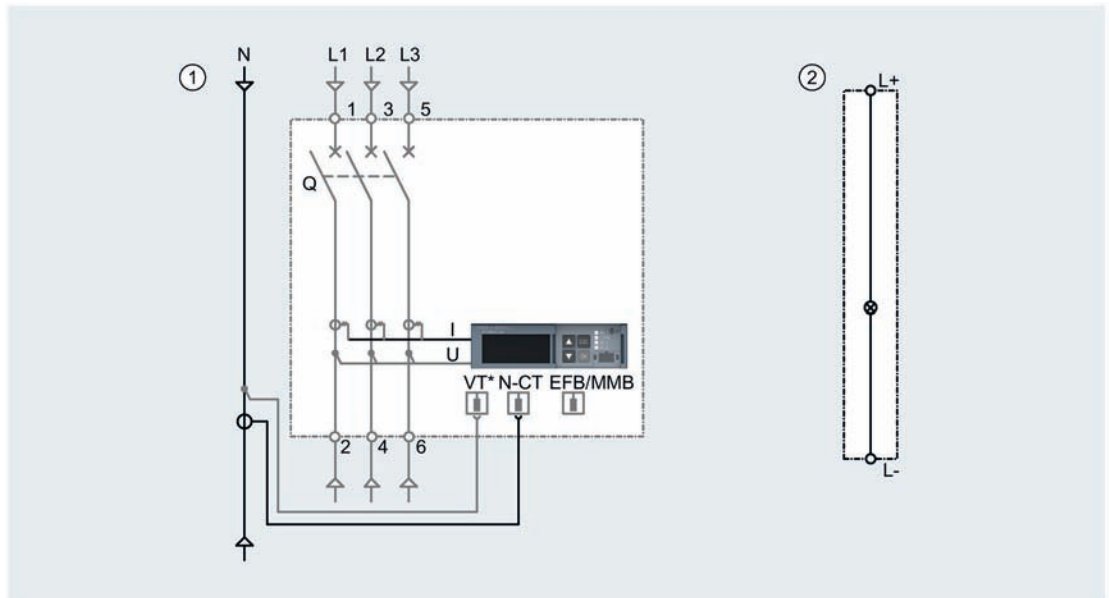
\* A connection can also be optionally equipped with a bus terminating resistor.

EFB300 external function box





**External current transformer for N conductor and illumination kit (24 V DC) for manual handle**

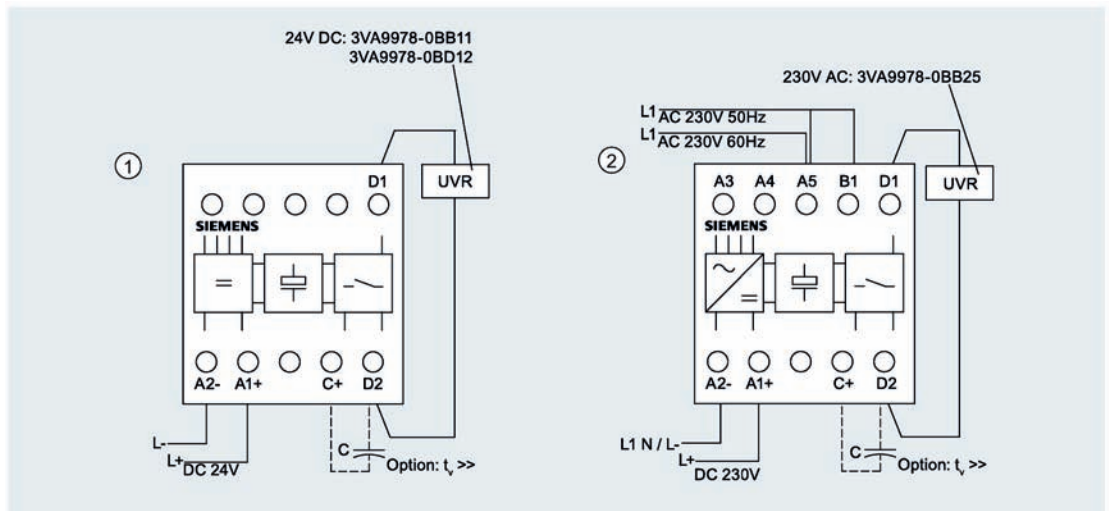


① Connection for external current transformer for N conductor

② Illumination kit (24 V DC) for manual handle

\* Voltage tap

**Time-delay device for undervoltage releases**

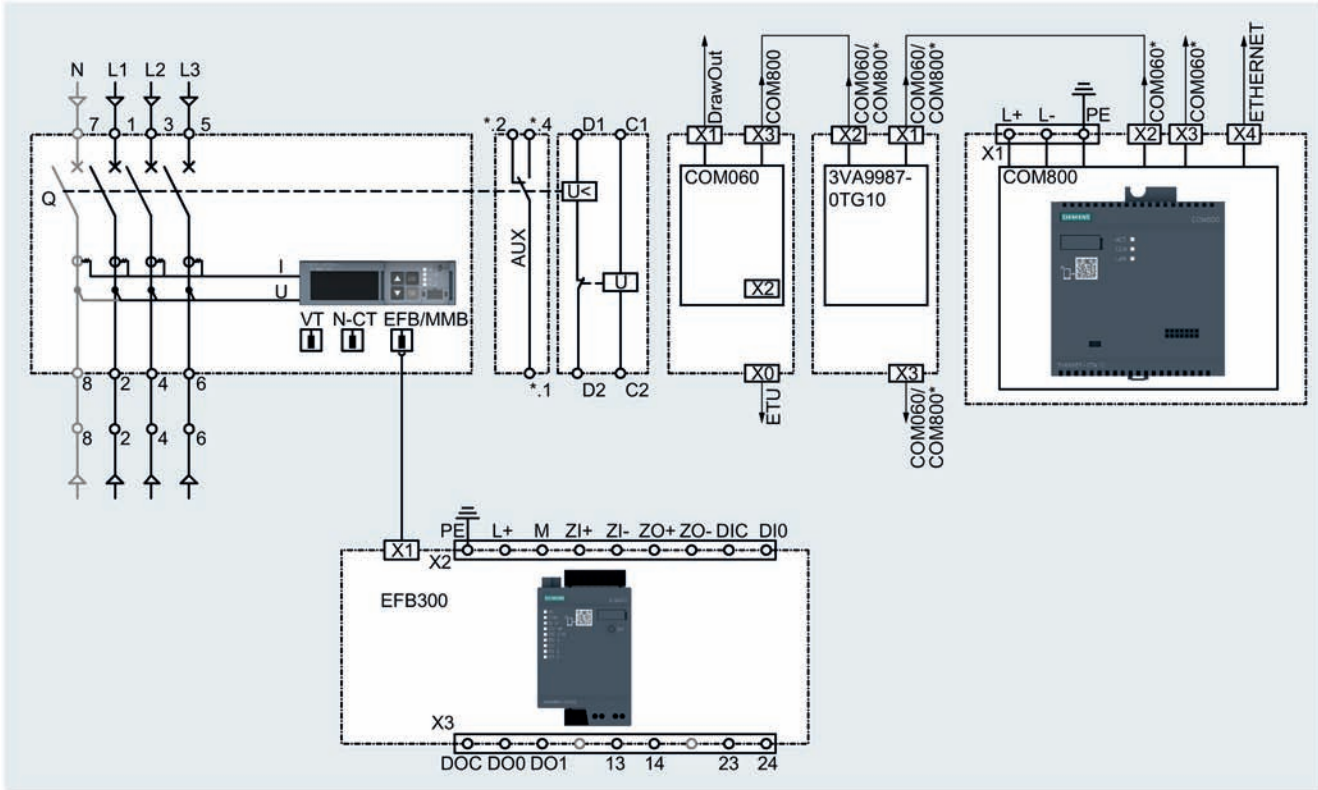


① 24 V DC

② 230 V AC (50/60 Hz), 230 V DC

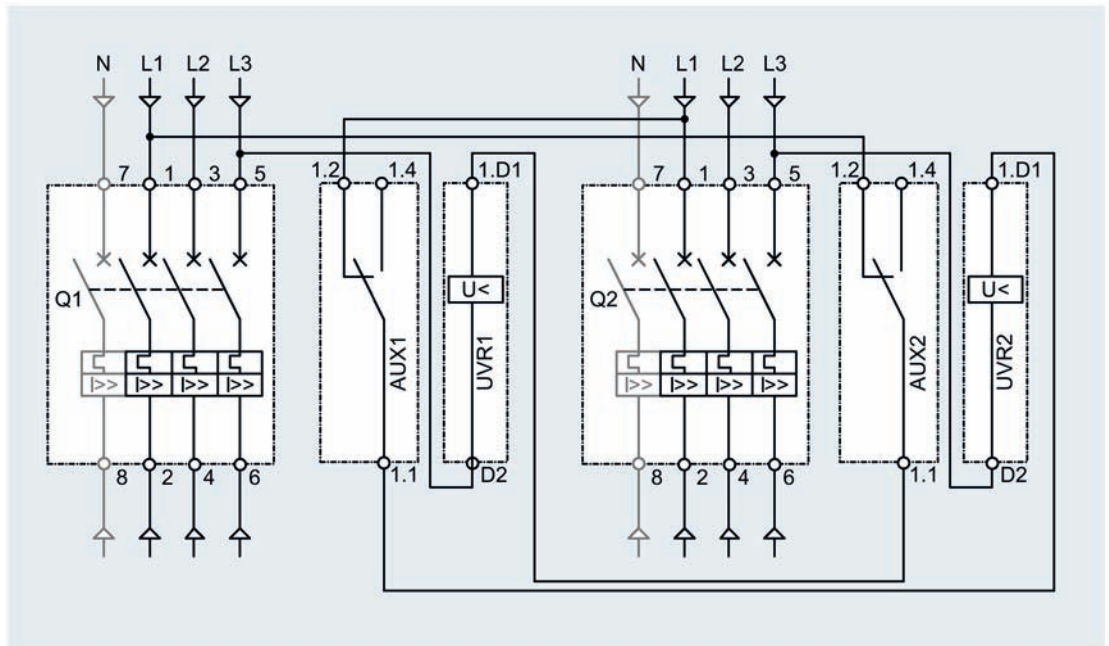
Dashed lines represent optional connections. For the detailed wiring, refer to the operating instructions.

6.1.2.3 Example: 3VA6 molded case circuit breakers with accessories (external/internal)



\* A connection can also be optionally equipped with a bus terminating resistor.

**6.1.3 Application example: Electrical interlocking of two 3VA UL molded case circuit breakers with undervoltage releases**



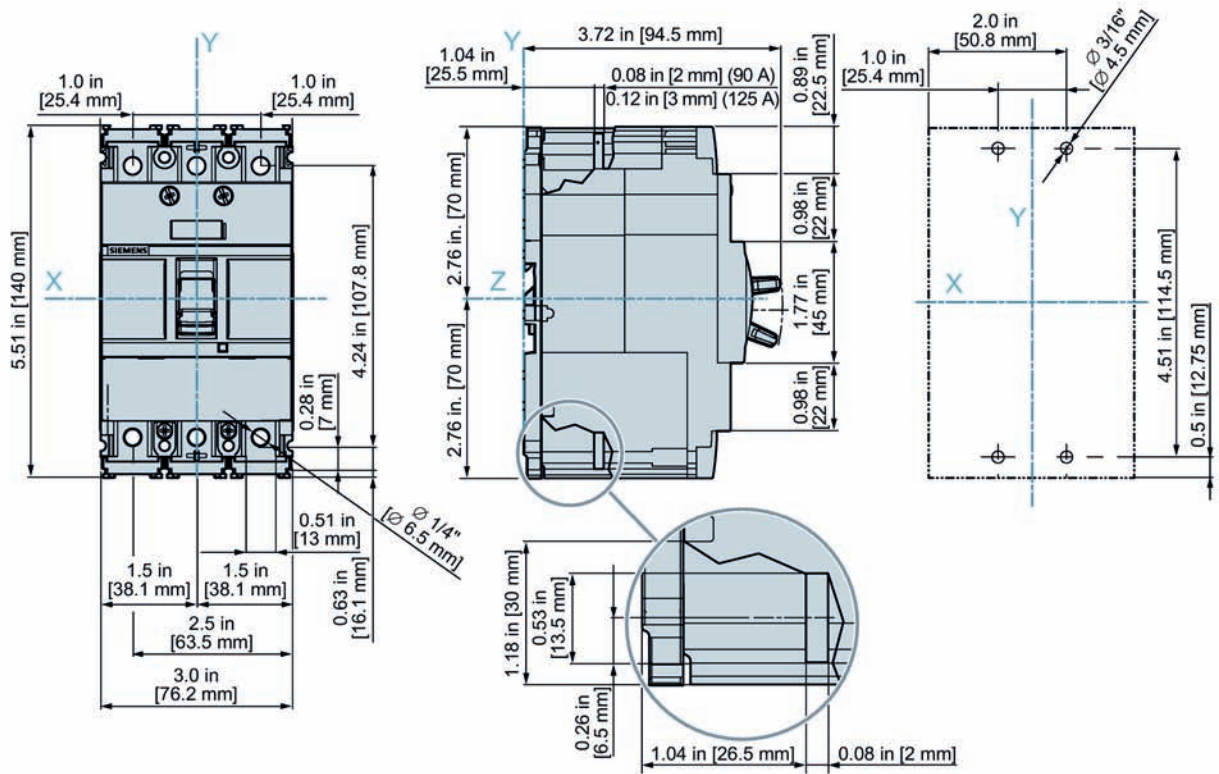
- Q 1      Molded case circuit breaker 1
- UVR 1    Undervoltage release in molded case circuit breaker 1
- AUX 1    Auxiliary switch in molded case circuit breaker 1
- Q 2      Molded case circuit breaker 2
- UVR 2    Undervoltage release in molded case circuit breaker 2
- AUX 2    Auxiliary switch in molded case circuit breaker 2

**Note**

In the case of supply system voltage > 480 V AC, the undervoltage release UVR must not be connected to phases L1 and L3. In this case, it is connected to phase L1 and the N conductor or to a control voltage supply up to maximum 480 V AC.

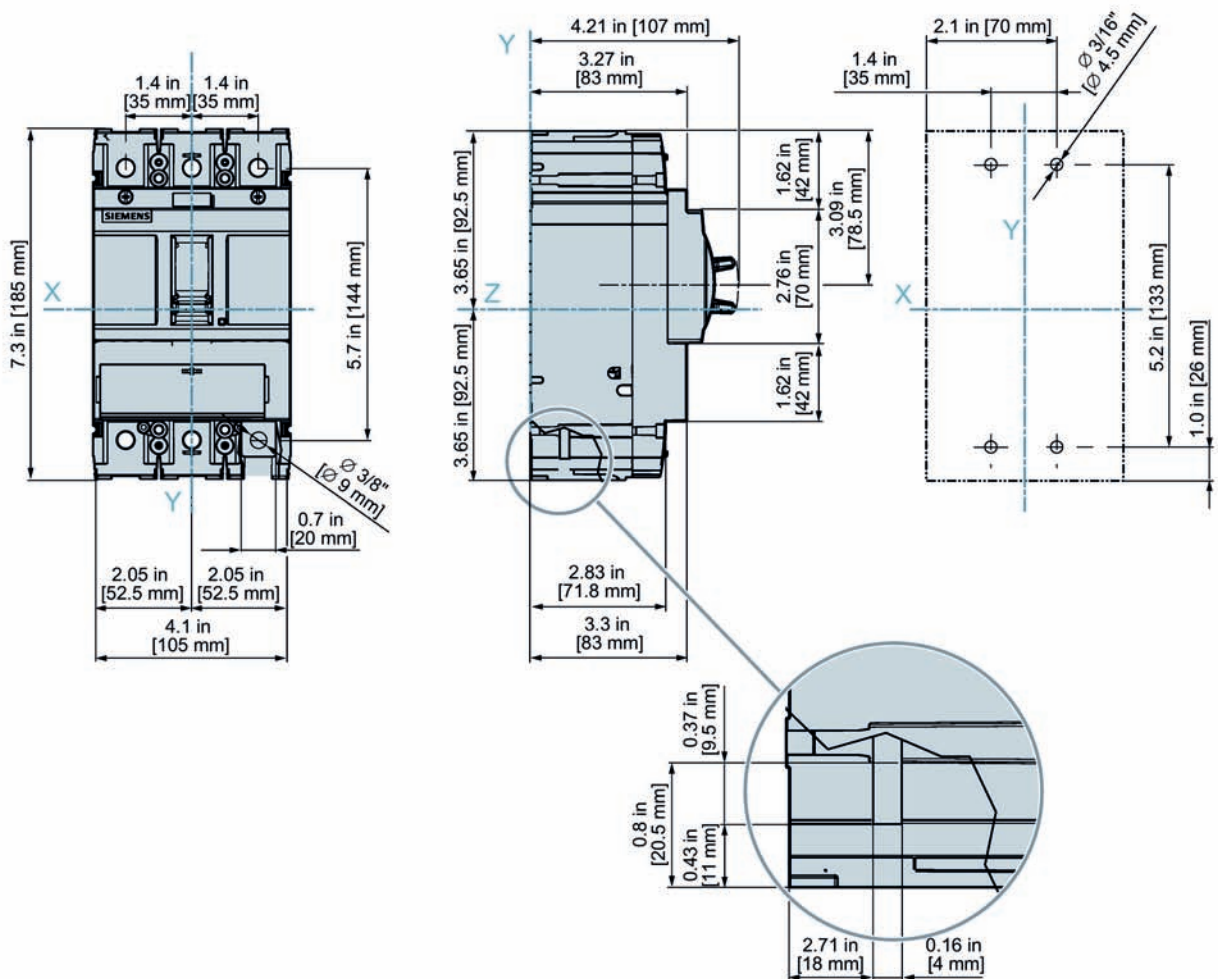


3VA51 125 A 3-pole



6.2.1.2 3VA52

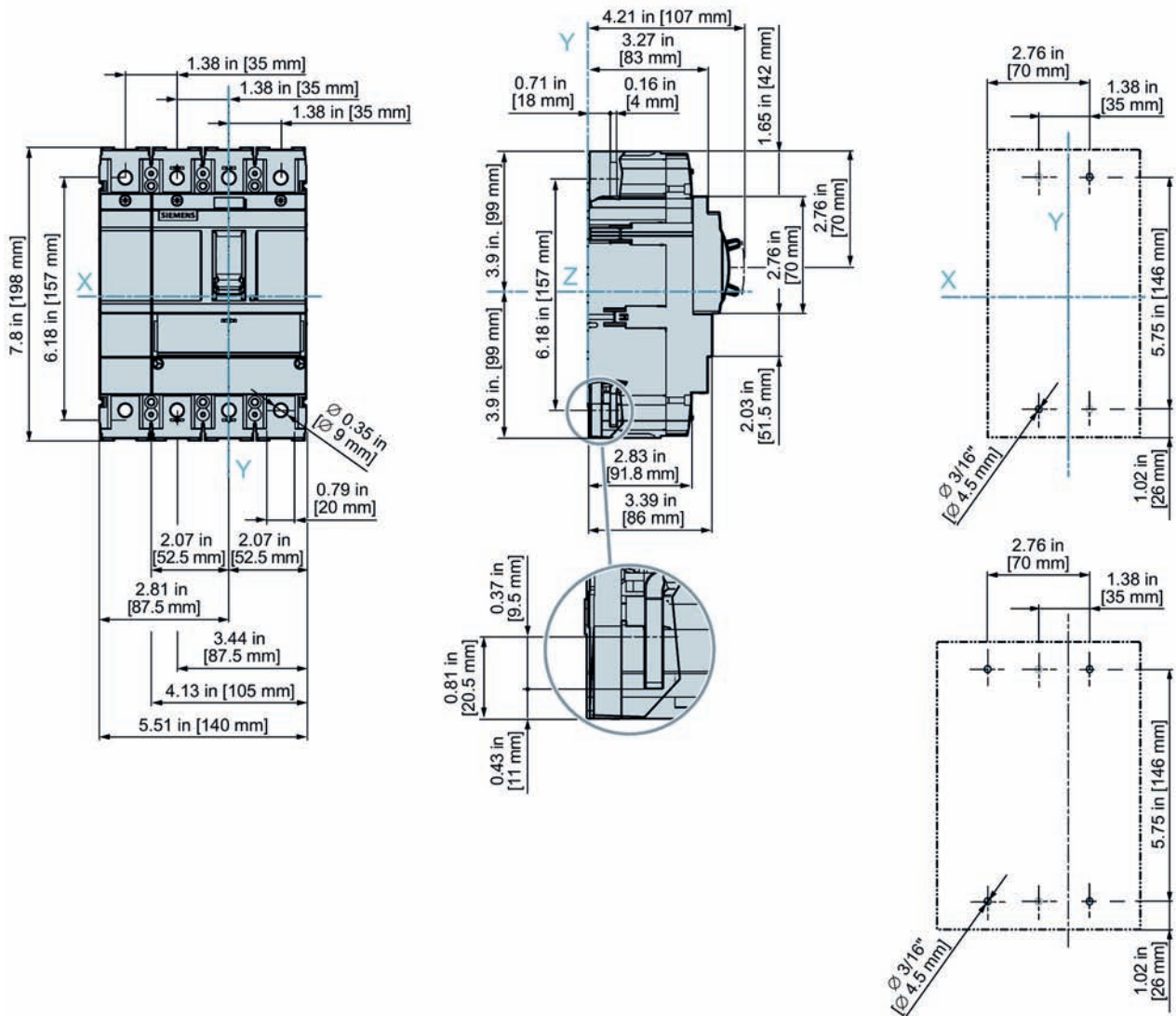
3VA52 250 A 3-pole





6.2.1.3 3VA61 / 3VA62

3VA61 150 A / 3VA62 250 A, 3- and 4-pole



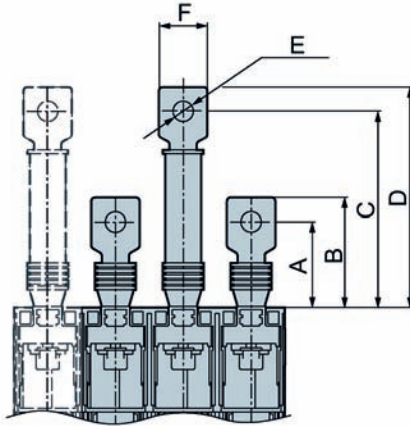


## 6.2.2 Dimensions of accessories

### 6.2.2.1 Connection technology

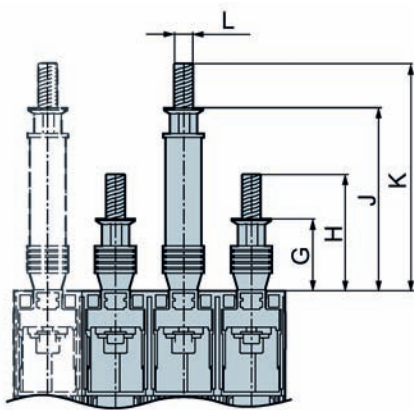
#### Rear busbar and compression lug connections for plug-in and draw-out molded case circuit breakers

##### Rear connection stud flat



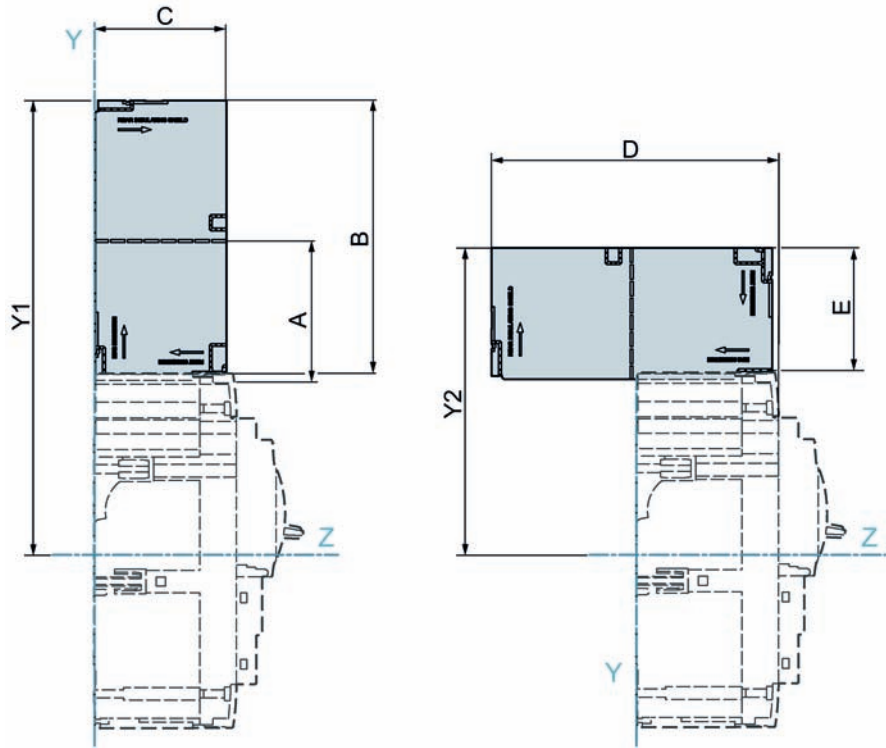
	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	1.75 in [44.5 mm]	1.7 in [43 mm]	2.0 in [50 mm]	2.0 in [50 mm]
B	2.22 in [56.5 mm]	2.2 in [55.5 mm]	2.6 in [65 mm]	2.6 in [65 mm]
C	4 in [101.5 mm]	3.9 in [100 mm]	4.5 in [115 mm]	4.5 in [115 mm]
D	4.49 in [114 mm]	4.4 in [112.5 mm]	5.2 in [130 mm]	5.2 in [130 mm]
E	0.3 in [8.4 mm]	0.41 in [10.5 mm]	0.52 in [13.2 mm]	0.52 in [13.2 mm]
F	0.6 in [16 mm]	0.9 in [22 mm]	1.2 in [29.4 mm]	1.2 in [29.4 mm]

Rear connection stud round



	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
G	0.85 in [21.5 mm]	1.4 in [36 mm]	1.8 in [45 mm]	
H	2.34 in [59.5 mm]	2.3 in [59 mm ]	3.3 in [83.5 mm]	
J	3.09 in [78.5 mm]	3.7 in [93 mm]	4.1 in [105 mm]	
K	4.59 in [116.5 mm]	4.6 in [116 mm]	5.7 in [143.5 mm]	
L	M8	3/8"	1/2"	

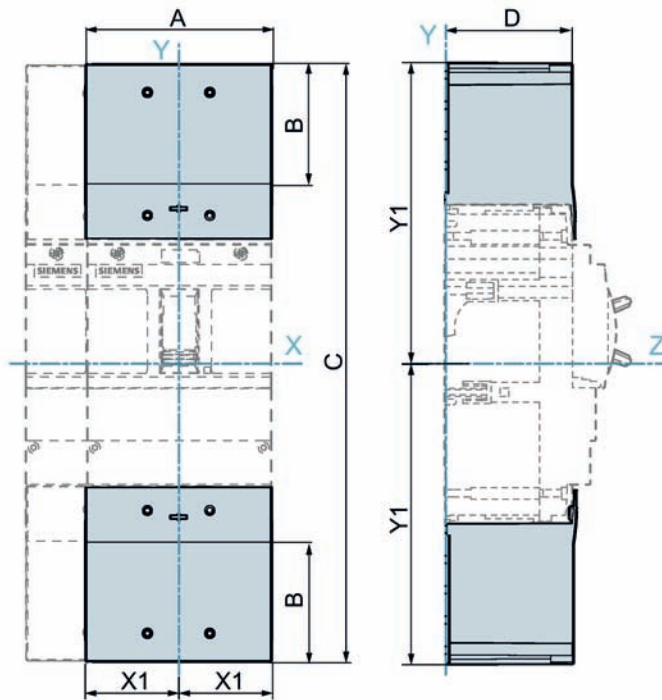
Phase barrier



	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	1.5/2.7 in [38.5/68.5 mm]		3.15 in [79.9 mm]	3.4 in [87.2 mm]
B	3.8 in [96.6 mm]		5.8 in [148.1 mm]	6.6 in [166.5 mm]
C	2.4 in [61.2 mm]		2.7 in [68.4 mm]	3.4 in [87.2 mm]
D	3.9 in [100.2 mm]		6.5 in [164.1 mm]	6.9 in [174.4 mm]
E	2.3 in [57.8 mm]		2.3 in [57 mm]	3.1 in [79.3 mm]
Y1	6.6 in [166.6 mm]	9.5 in [240.6 mm]	9.7 in [247.1 mm]	11.4 in [290.5 mm]
Y2	5.0 in [127.8 mm]	5.9 in [149.5 mm]	6.1 in [156.0 mm]	8.0 in [203.3 mm]

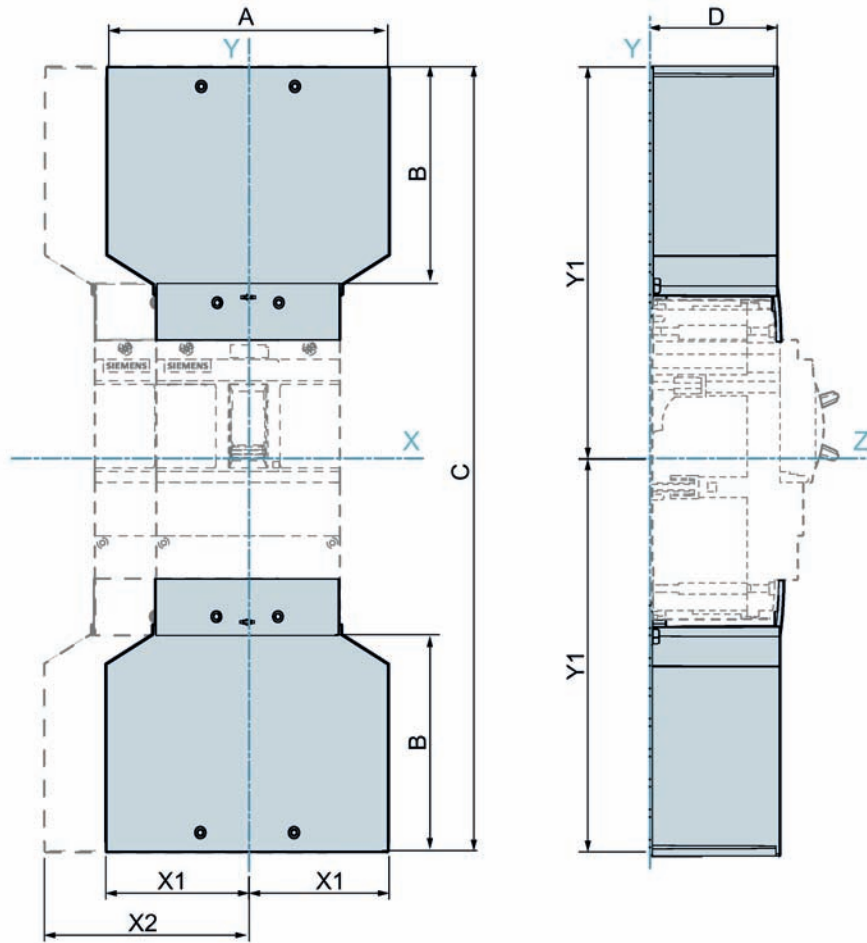
Terminal cover

Extended terminal cover



	3VA5			3VA6			
	125 A 3-pole	250 A 3-pole	250 A 4-pole	150 / 250 A 3-pole	150 / 250 A 4-pole	400 / 600 A 3-pole	400 / 600 A 4-pole
A	3.0 in [76.2 mm]	4.1 in [105 mm]	5.5 in [140 mm]	4.1 in [105 mm]	5.5 in [140 mm]	5.4 in [138 mm]	7.2 in [182.2 mm]
B	1.97 in [50 mm]	2.65 in [67.4 mm]		2.65 in [67.4 mm]		2.6 in [64.9 mm]	
C	9.45 in [240 mm]	12.59 in [319.8 mm]		13.11 in [333 mm]		14.9 in [377.8 mm]	
D	2.64 in [67 mm]	2.8 in [71 mm]		2.8 in [71 mm]		3.6 in [91.5 mm]	
X1	1.5 in [38.1 mm]	2.05 in [52.5 mm]	2.05 in [52.5 mm]	2.05 in [52.5 mm]	2.05 in [52.5 mm]	2.7 in [69 mm]	2.7 in [69 mm]
X2		3.45 in [87.5 mm]		3.45 in [87.5 mm]		4.5 in [113.2 mm]	
Y1	4.73 in [120 mm]	6.3 in [159.9 mm]		6.56 in [166.5 mm]		7.45 in [188.9 mm]	

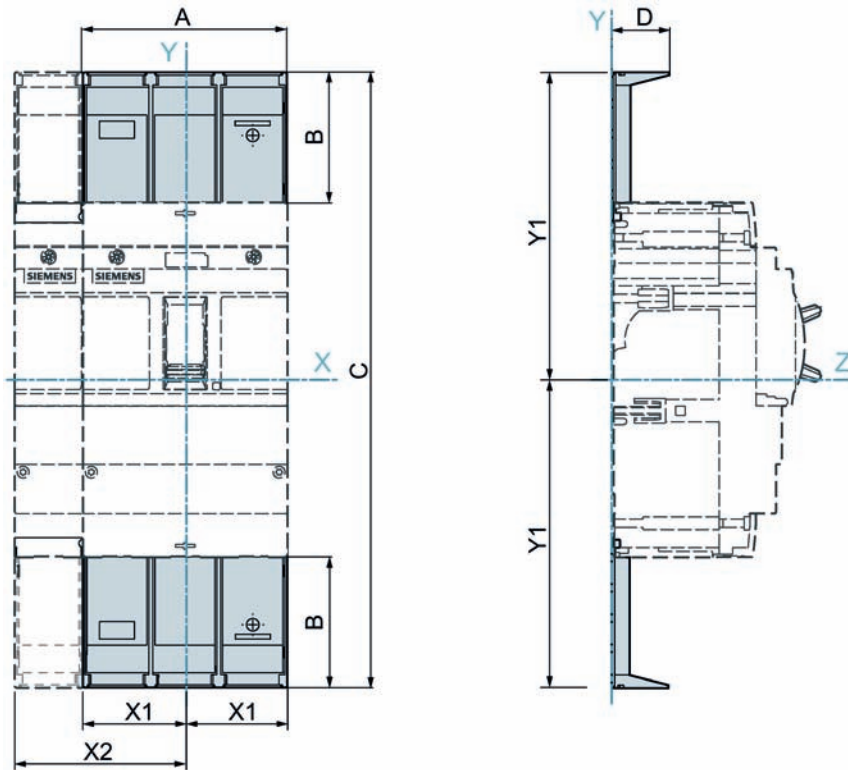
Terminal cover offset



	3VA6 400 / 600 A	
	3-pole	4-pole
A	8.3 in [212 mm]	11.1 in [282 mm]
B	5.8 in [147.5 mm]	
C	21.4 in [543 mm]	
D	3.6 in [91.5 mm]	
X1	4.15 in [106 mm]	4.15 in [106 mm]
X2	6.95 in [176 mm]	
Y1	10.7 in [271.5 mm]	

Insulating plate

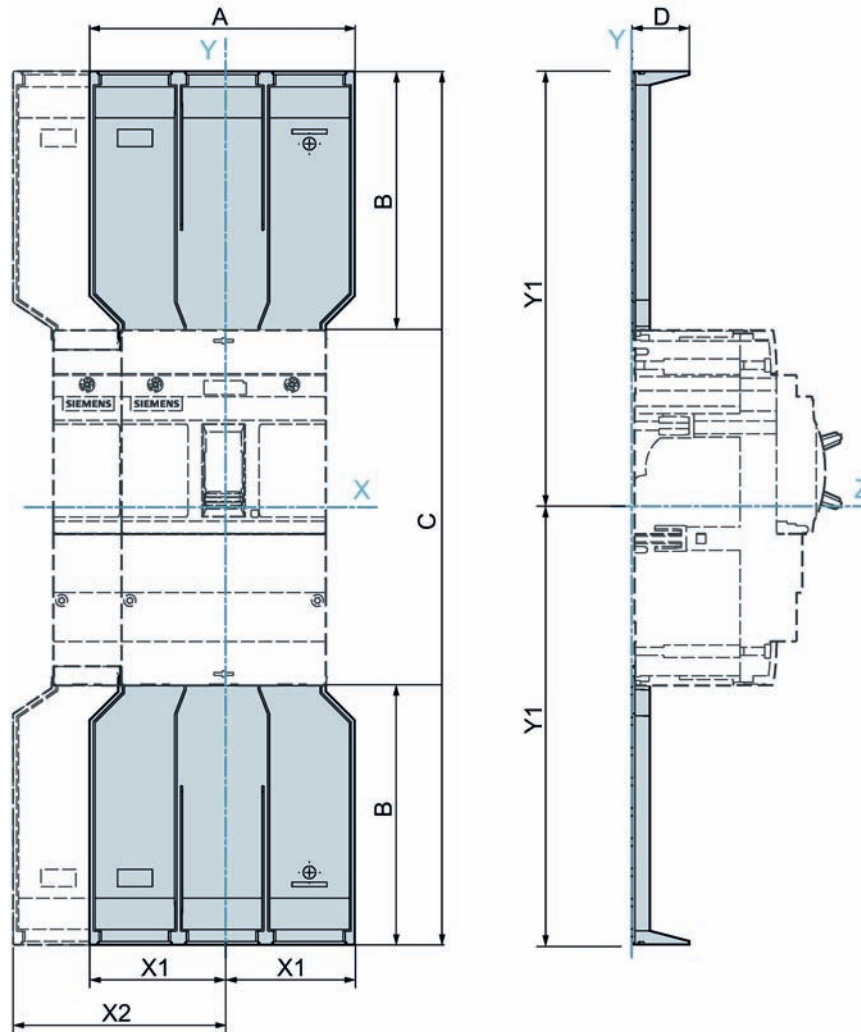
Insulating plate



	3VA5			3VA6			
	125 A 3-pole	250 A 3-pole	250 A 4-pole	150 / 250 A 3-pole	150 / 250 A 4-pole	400 / 600 A 3-pole	400 / 600 A 4-pole
A	3.0 in [76.2 mm]	4.1 in [105 mm]	5.5 in [140 mm]	4.1 in [105 mm]	5.5 in [140 mm]	5.4 in [138 mm]	7.2 in [182.2 mm]
B	1.97 in [50 mm]	2.65 in [67.4 mm]		2.65 in [67.4 mm]		2.6 in [64.9 mm]	
C	9.45 in [240 mm]	12.59 in [319.8 mm]		13.11 in [333 mm]		14.9 in [377.8 mm]	
D	0.52 in [13.2 mm]	1.15 in [29.2 mm]		1.15 in [29.2 mm]		1.3 in [33.2 mm]	
X1	1.5 in [38.1 mm]	2.05 in [52.5 mm]	2.05 in [52.5 mm]	2.05 in [52.5 mm]	2.05 in [52.5 mm]	2.7 in [69 mm]	2.7 in [69 mm]
X2	3.45 in [87.5 mm]			3.45 in [87.5 mm]		4.5 in [113 mm]	
Y1	4.73 in [120 mm]	6.3 in [159.9 mm]		6.56 in [166.5 mm]		7.45 in [188.9 mm]	



Broadened insulating plate

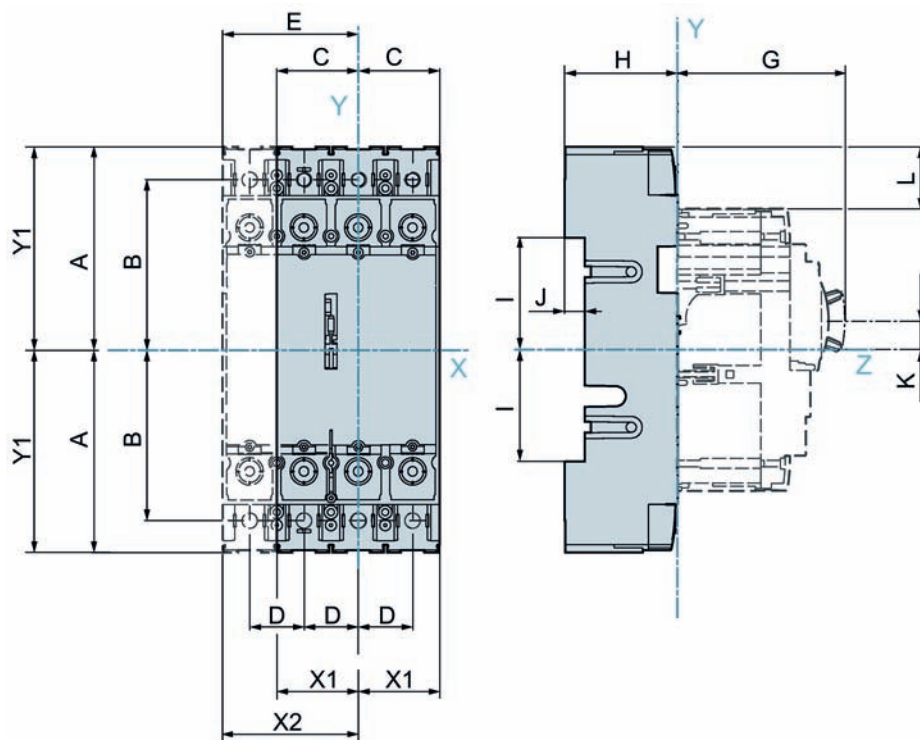


	3VA6 400 / 600 A	
	3-pole	4-pole
A	8.3 in [212 mm]	11.1 in [282 mm]
B	5.8 in [147.5 mm]	
C	21.4 in [543 mm]	
D	1.5 in [37.3 mm]	
X1	4.15 in [106 mm]	4.15 in [106 mm]
X2	6.95 in [176 mm]	
Y1	10.7 in [271.5 mm]	

6.2.2.2 Plug-in and draw-out units

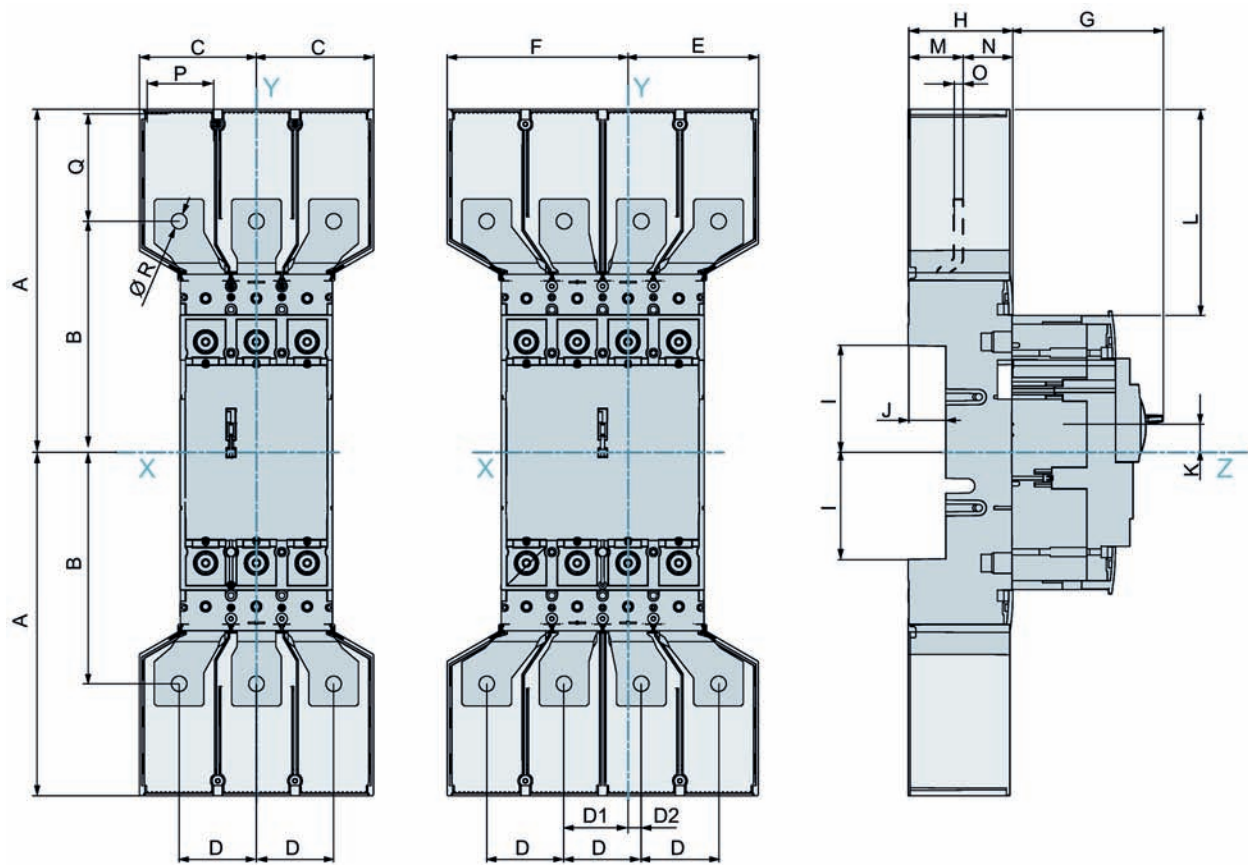
Plug-in socket

3VA6 150 / 250 A and 400 A



	3VA6	
	150 / 250 A	400 A
A	5.14 in [130.5 mm]	6.44 in [163.5 mm]
B	4.33 in [110 mm]	5.49 in [139.5 mm]
C	2.06 in [52.2 mm]	2.72 in [69 mm]
D	1.38 in [35 mm]	1.81 in [46 mm]
E	3.44 in [87.5 mm]	4.53 in [115 mm]
F	4.21 in [107 mm]	5.41 in [137.5 mm]
G	2.87 in [73 mm]	3.70 in [94 mm]
H	2.83 in [72 mm]	3.78 in [96.1 mm]
I	0.51 in [13 mm]	1.34 in [34 mm]
J	0.81 in [20.5 mm]	1.02 in [26 mm]
K	1.57 in [40 mm]	1.56 in [39.5 mm]
X1	2.06 in [52.2 mm]	2.72 in [69 mm]
X2	3.44 in [87.5 mm]	4.53 in [115 mm]
Y1	5.14 in [130.5 mm]	6.44 in [163.5 mm]

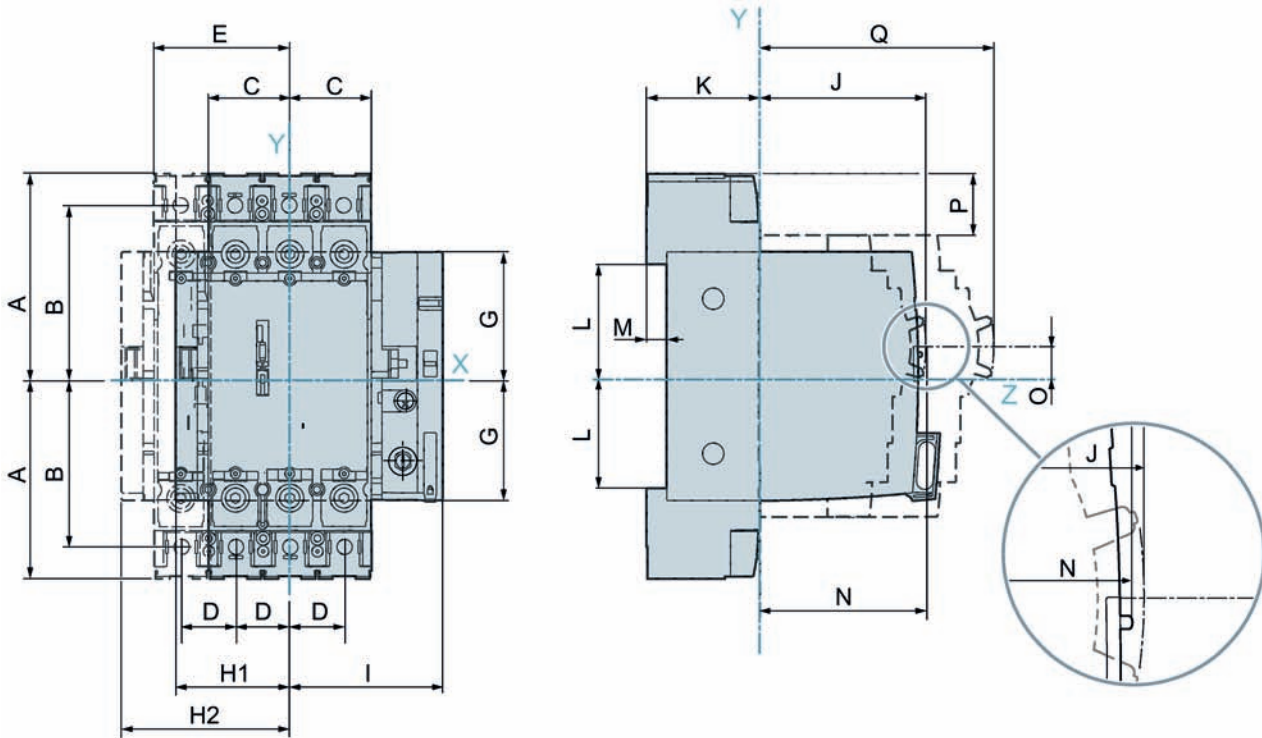
3VA6 600 A



	3VA6 600 A
A	12.25 in [311.1 mm]
B	11.44 in [290.5 mm]
C	4.17 in [106 mm]
D	2.76 in [70 mm]
D1	2.28 in [58 mm]
D2	0.47 in [12 mm]
E	4.65 in [118 mm]
F	6.46 in [164 mm]
G	5.41 in [137.5 mm]
H	3.70 in [94 mm]
I	3.78 in [96.1 mm]
J	1.34 in [34 mm]
K	1.02 in [26 mm]
L	7.37 in [187.1 mm]
M	1.93 in [49 mm]
N	1.77 in [45 mm]
O	0.31 in [8 mm]
P	2.48 in [63 mm]
Q	3.91 in [99.4 mm]
R	0.55 in [14 mm]

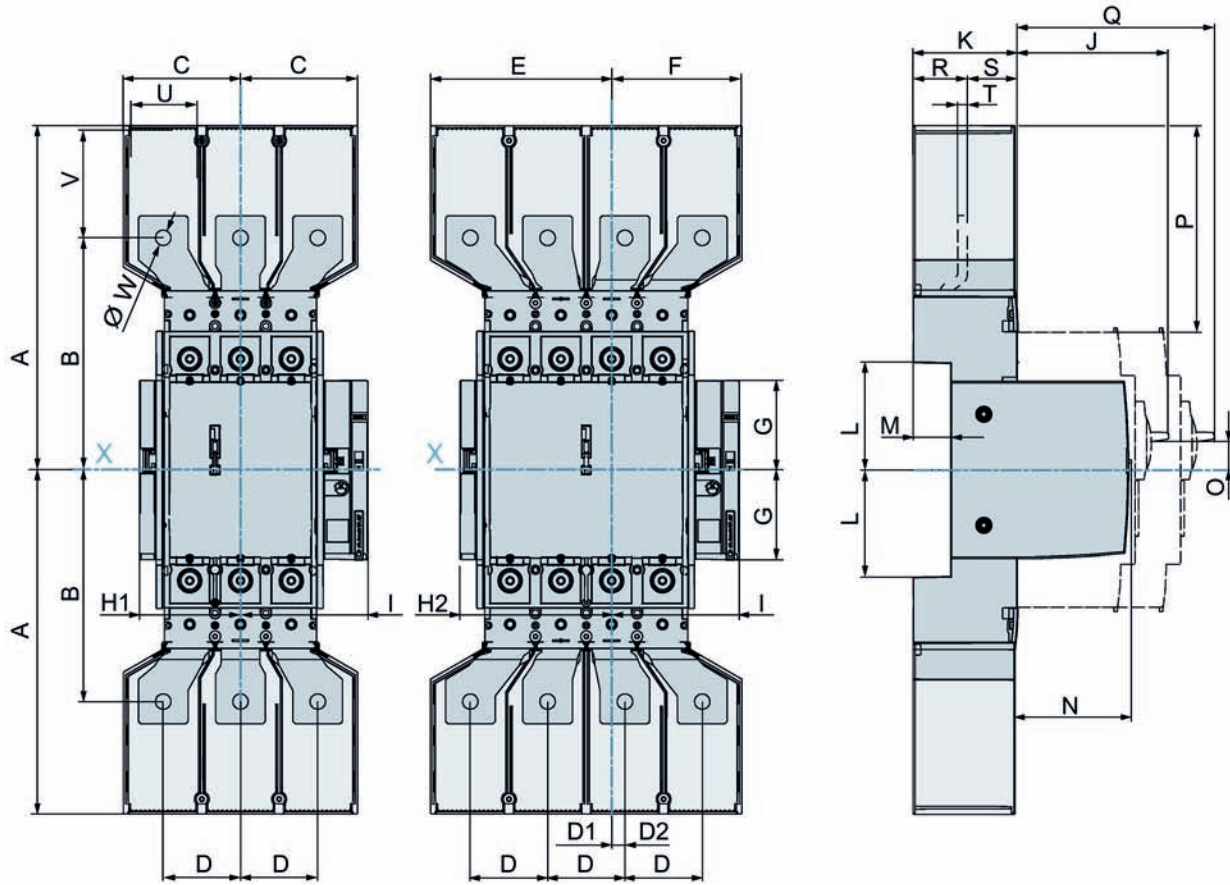
Draw-out unit

3VA6 150 / 250 A and 400 A



	3VA6	
	150 / 250 A	400 A
A	5.14 in [130.5 mm]	6.44 in [163.5 mm]
B	4.33 in [110 mm]	5.49 in [139.5 mm]
C	2.06 in [52.5 mm]	2.72 in [69 mm]
D	1.38 in [35 mm]	1.81 in [46 mm]
E	3.44 in [87.5 mm]	4.53 in [115 mm]
G	3.15 in [80 mm]	3.15 in [80 mm]
H1	2.91 in [73.8 mm]	3.54 in [90 mm]
H2	4.27 in [108.5 mm]	5.35 in [136 mm]
I	3.88 in [98.5 mm]	4.53 in [115 mm]
J	4.21 in [107 mm]	5.41 in [137.5 mm]
K	2.87 in [73 mm]	3.70 in [94 mm]
L	2.83 in [72 mm]	3.78 in [96.1 mm]
M	0.51 in [13 mm]	1.34 in [34 mm]
N	4.11 in [104.5 mm]	4.11 in [104.5 mm]
O	0.81 in [20.5 mm]	1.02 in [26 mm]
P	1.24 in [31.5 mm]	1.56 in [39.5 mm]
Q	5.87 in [149 mm]	7.07 in [179.5 mm]

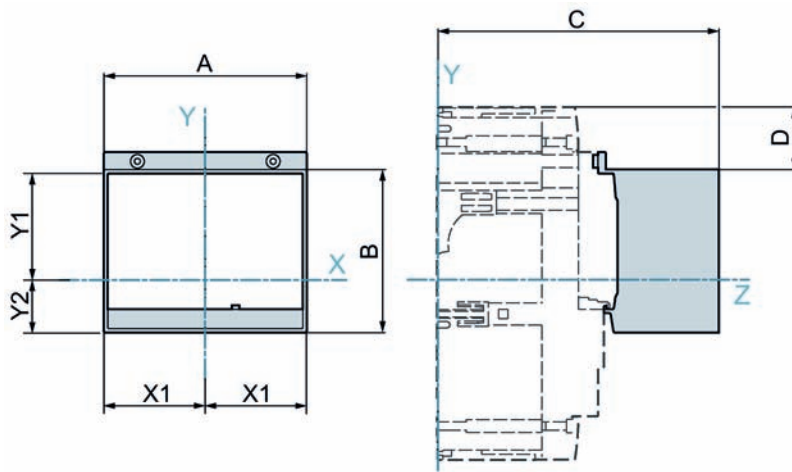
3VA6 600 A





3VA6 600 A	
A	12.25 in [311.1 mm]
B	8.25 in [209.5 mm]
C	4.17 in [106 mm]
D	2.76 in [70 mm]
D1	2.28 in [58 mm]
D2	0.47 in [12 mm]
E	6.46 in [164 mm]
F	4.65 in [118 mm]
G	3.15 in [80 mm]
H1	5.35 in [136 mm]
H2	7.17 in [182 mm]
I	4.53 in [115 mm]
J	5.41 in [137.5 mm]
K	3.70 in [94 mm]
L	3.78 in [96.1 mm]
M	1.34 in [34 mm]
N	4.11 in [104.5 mm]
O	1.02 in [26 mm]
P	7.37 in [187.1 mm]
Q	7.07 in [179.5 mm]
R	1.93 in [49 mm]
S	1.77 in [45 mm]
T	0.31 in [8 mm]
U	2.48 in [63 mm]
V	3.91 in [99.4 mm]
W	0.55 in [14 mm]

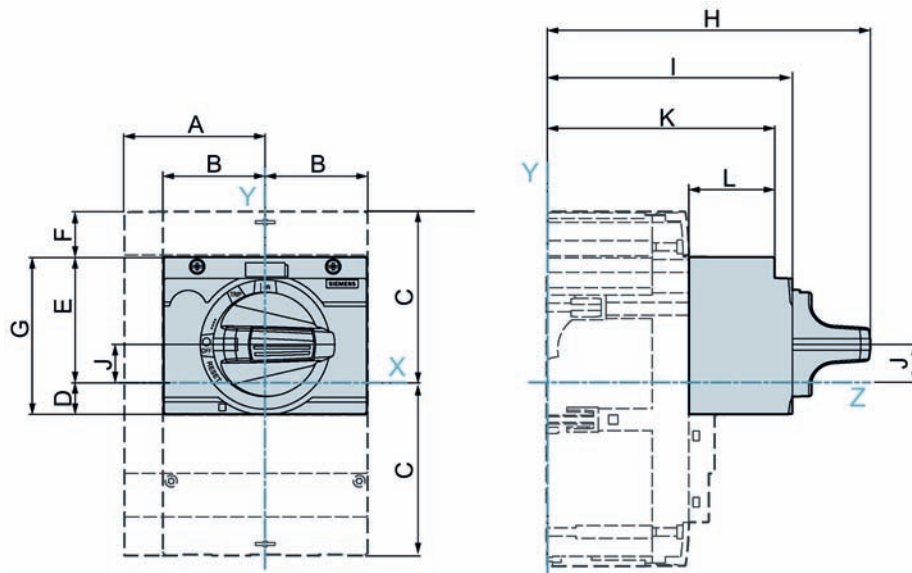
Door feedthrough



	3VA6	
	150 / 250 A	400 / 600 A
A	4.12 in [104.6 mm]	5.42 in [137.6 mm]
B	3.31 in [84 mm]	4.27 in [108.5 mm]
C	5.72 in [145.3 mm]	6.77 in [172 mm]
D	1.24 in [31.5 mm]	2.01 in [51 mm]
X1	2.06 in [52.3 mm]	2.71 in [68.8 mm]
Y1	2.66 in [67.5 mm]	2.87 in [73 mm]
Y2	0.65 in [16.5 mm]	0.87 in [22 mm]

### 6.2.2.3 Manual operators

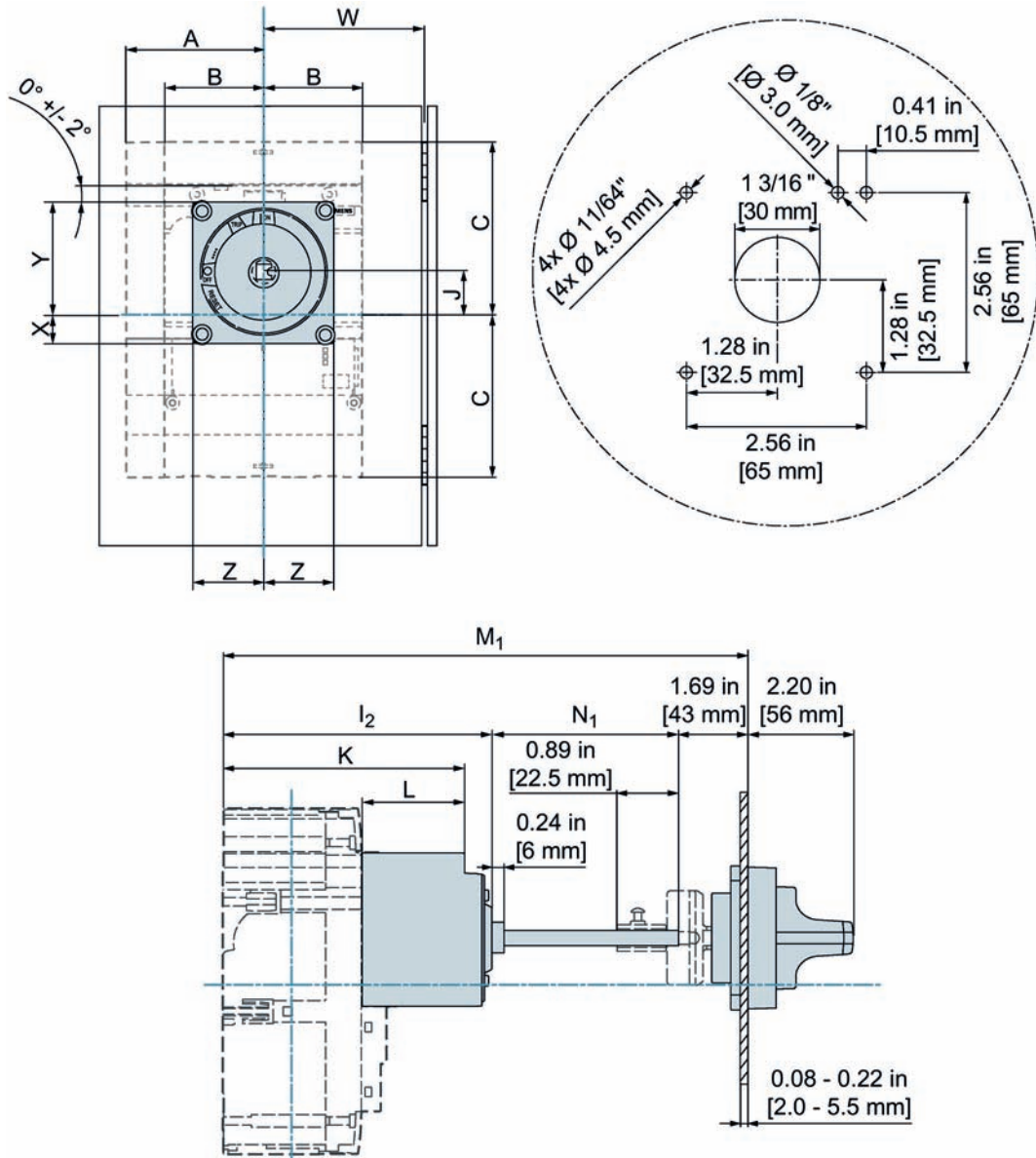
#### Front mounted rotary operator




	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	2.50 in [63.5 mm]	3.44 in [87.5 mm]		4.53 in [115 mm]
B	1.50 in [38.1 mm]	2.07 in [45 mm]		2.72 in [69 mm]
C	2.76 in [70 mm]	3.64 in [92.5 mm]	3.90 in [99 mm]	4.88 in [124 mm]
D	0.89 in [22.6 mm]	0.77 in [19.6 mm]	0.52 in [13.1 mm]	0.33 in [8.5 mm]
E	1.87 in [47.4 mm]	2.42 in [61.4 mm]	2.67 in [67.9 mm]	3.34 in [84.9 mm]
F	0.89 in [22.6 mm]	1.22 in [31.1 mm]		1.54 in [39 mm]
G	1.77 in [45 mm]	2.76 in [70 mm]		2.76 in [70 mm]
H	6.52 in [165.5 mm]	7.13 in [181 mm]		7.87 in [200 mm]
I	4.85 in [123.1 mm]	5.36 in [136.1 mm]		6.30 in [160 mm]
J	0.00 in [0 mm]	0.65 in [16.4 mm]	0.90 in [22.9 mm]	1.08 in [27.5 mm]
K	4.63 in [117.5 mm]	5.00 in [127 mm]		5.94 in [151 mm]
L	1.81 in [46 mm]	2.13 in [54 mm]		2.24 in [57 mm]

Door mounted rotary operator

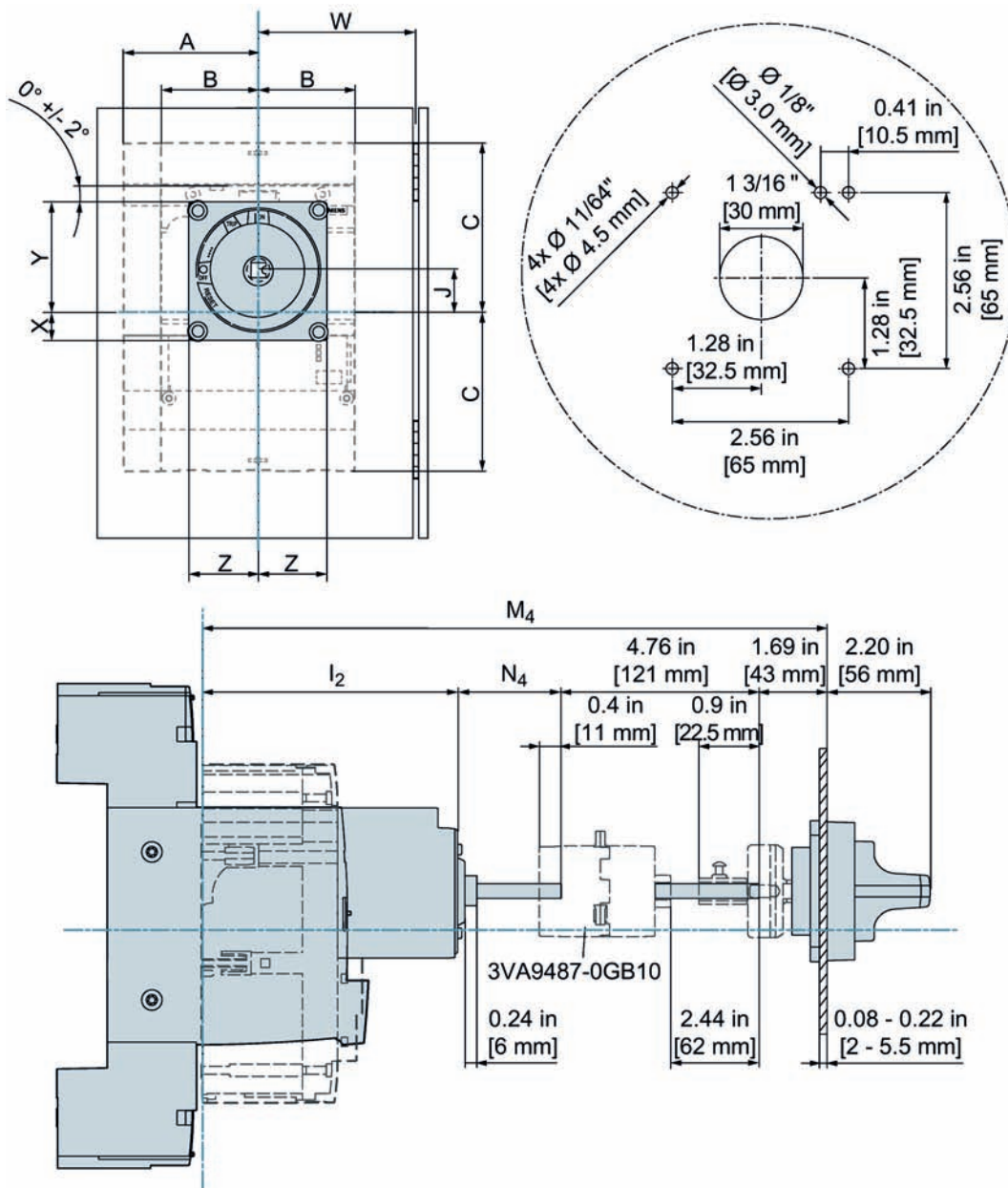
Door mounted rotary operator



	3VA5		3VA6		 3VA6 + 3VA9487-0GB10 <sup>1)</sup>
	125 A	250 A	150 / 250 A	400 / 600 A	
A	2.50 in [63.5 mm]	3.44 in [87,5 mm]		4.53 in [115 mm]	
B	1.50 in [38.1mm]	2.07 in [52.5 mm]		2.72 in [69 mm]	
C	2.76 in [70 mm]	23.64 in [92.5 mm]	3.90 in [99 mm]	4.88 in [124 mm]	
I <sub>2</sub>	4.94 in [125.6 mm]	5.56 in [141.1 mm]		6.50 in [165 mm]	
J	0.00 in [0 mm]	0.65 in [16.4 mm]	0.90 in [22.9 mm]	1.08 in [27.5 mm]	
K	4.63 in [117.5 mm]	5.00 in [127 mm]		5.94 in [151 mm]	
L	1.81 in [46 mm]	2.13 in [54 mm]		2.24 in [57 mm]	
M <sub>1 min</sub>	9.15 in [232.5 mm]	9.69 in [246 mm]		10.63 in [270 mm]	
M <sub>1 max</sub>	17.58 in [446.5 mm]	18.11 in [460 mm]		19.02 in [483 mm]	
N <sub>1</sub>	M <sub>1</sub> – I <sub>2</sub> – 1.69 in [43 mm]				
W	≥ 3.15 in [80 mm]				≥ 9.84 in [250 mm]
X	1.5 in [38 mm]	0.85 in [21.6 mm]	0.59 in [15.1 mm]	0.41 in [10.5 mm]	
Y	1.5 in [38 mm]	2.14 in [54.4 mm]	2.40 in [60.9 mm]	2.58 in [65.5 mm]	
Z	1.5 in [38 mm]				

1) Variable depth adapter

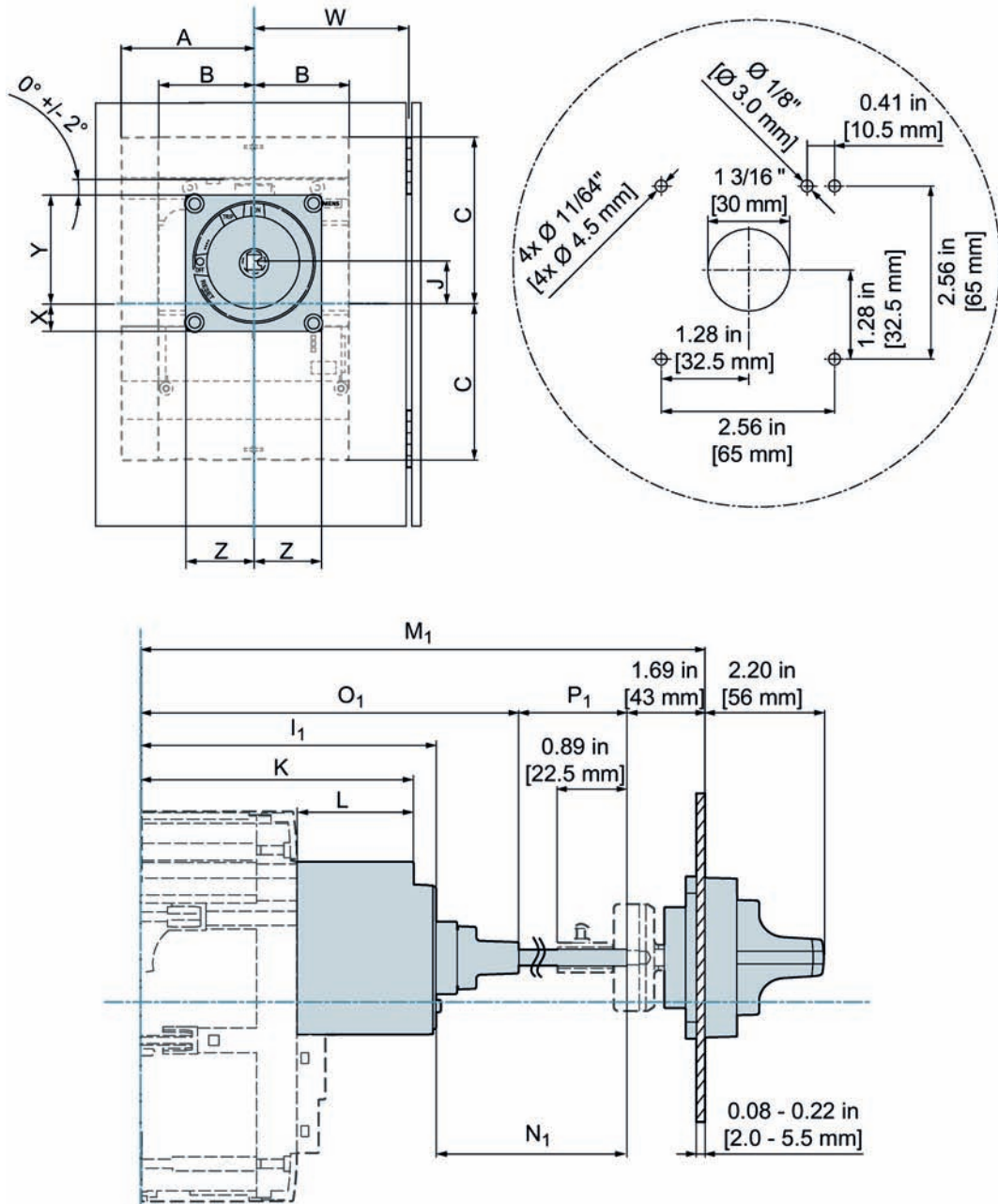
Door mounted rotary operator with variable depth adapter (3VA9487 - 0GB10)



	3VA6	
	150 / 250 A	400 / 600 A
A	3.44 in [87,5 mm]	4.53 in [115 mm]
B	2.07 in [52.5 mm]	2.72 in [69 mm]
C	3.90 in [99 mm]	4.88 in [124 mm]
$I_2$	5.56 in [141.1 mm]	6.50 in [165 mm]
J	0.90 in [22.9 mm]	1.08 in [27.5 mm]
$M_{4 \min}$	13.35 in [334.1 mm]	14.09 in [358 mm]
$M_{4 \max}$	22.95 in [583 mm]	23.82 in [605 mm]
$N_4$	$M_4 - I_2 - 6.46$ in [164 mm]	
W	$\geq 9.84$ in [250 mm]	
X	0.59 in [15.1 mm]	0.41 in [10.5 mm]
Y	2.40 in [60.9 mm]	2.58 in [65.5 mm]
Z	1.5 in [38 mm]	

Supplementary handle for door mounted rotary operator

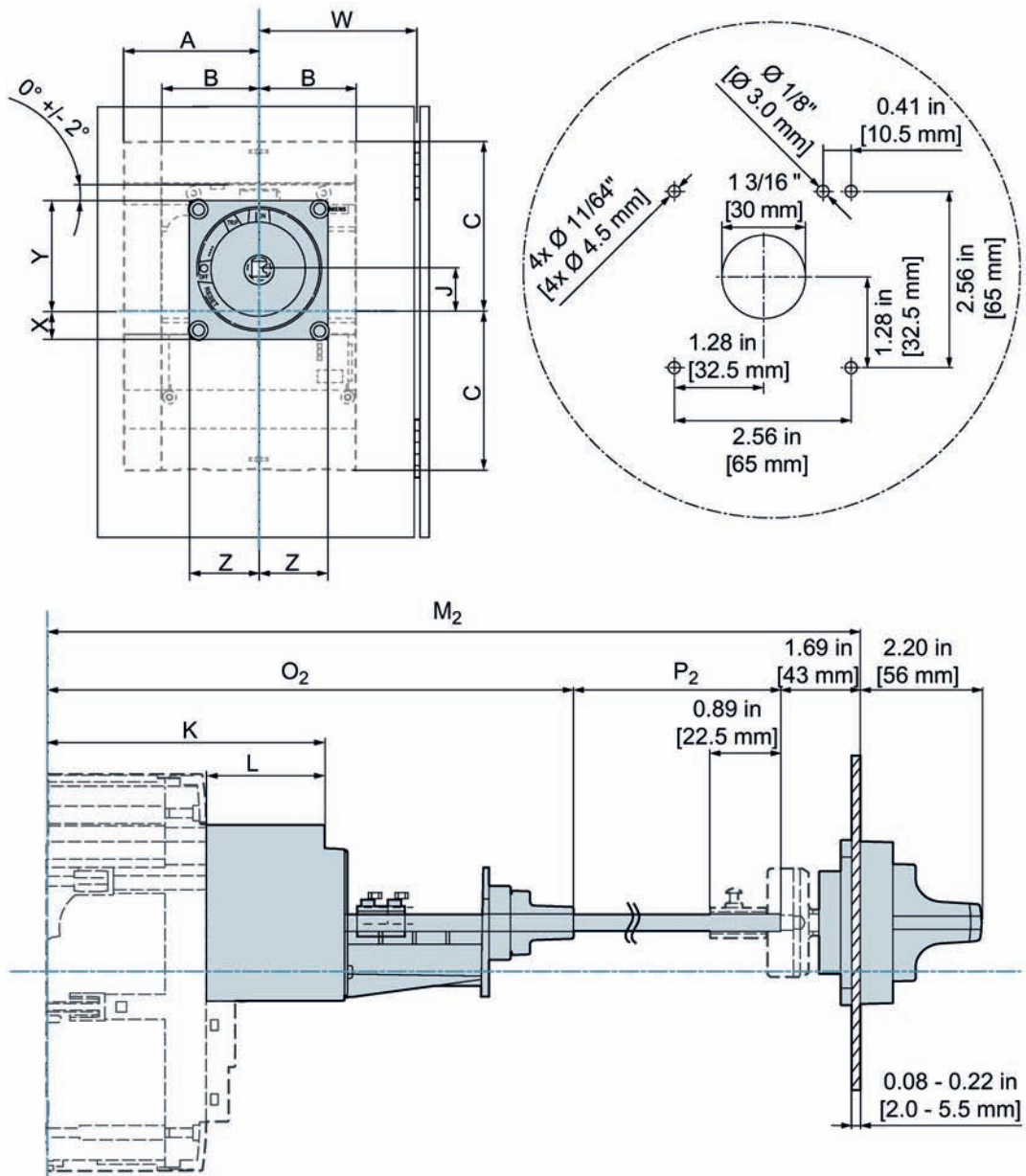
3VA9.87 - 0GC...





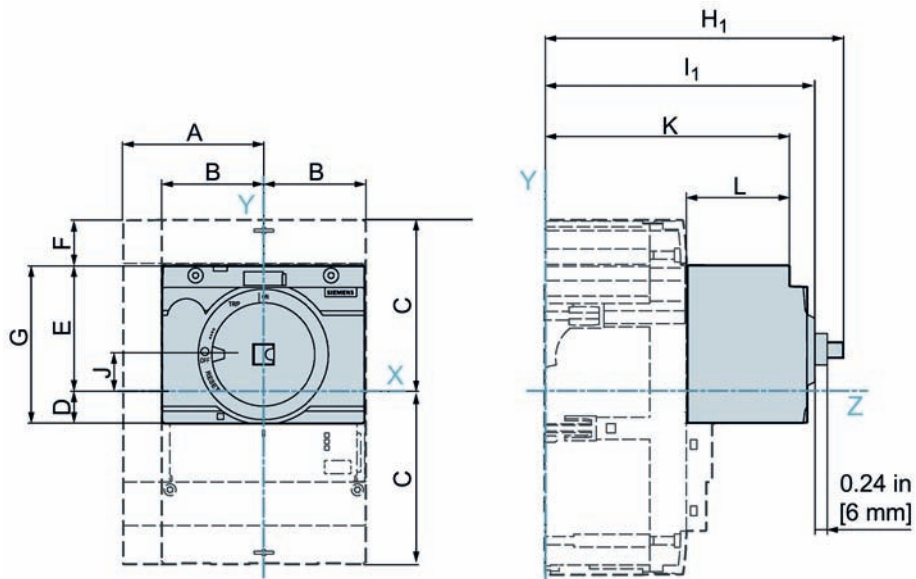
	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	2.50 in [63.5 mm]	3.44 in [87,5 mm]		4.53 in [115 mm]
B	1.50 in [38.1 mm]	2.07 in [52.5 mm]		2.72 in [69 mm]
C	2.76 in [70 mm]	3.64 in [92.5 mm]	3.90 in [99 mm]	4.88 in [124 mm]
I <sub>1</sub>	4.85 in [123.1 mm]	5.36 in [136.1 mm]		6.30 in [160 mm]
J	0.00 in [0 mm]	0.65 in [16.4 mm]	0.90 in [22.9 mm]	1.08 in [27.5 mm]
K	4.63 in [117.5 mm]	5.00 in [127 mm]		5.94 in [151 mm]
L	1.81 in [46 mm]	2.13 in [54 mm]		2.24 in [57 mm]
M <sub>1 min</sub>	7.78 in [197.6 mm]	8.39 in [213.1 mm]		9.33 in [237 mm]
M <sub>1 max</sub>	17.58 in [446.5 mm]	18.11 in [460 mm]		19.02 in [483 mm]
O <sub>1</sub>	6.48 in [164.5 mm]	6.97 in [177 mm]		7.91 in [201 mm]
P <sub>1 min</sub>		0.91 in [23 mm]		
P <sub>1 max</sub>	9.33 in [237 mm]	9.37 in [238 mm]		9.37 in [238 mm]
N <sub>1</sub>		M <sub>1</sub> – I <sub>1</sub> – 1.69 in [43 mm]		
W		≥ 3.15 in [80 mm]		
X	1.5 in [38 mm]	0.85 in [21.6 mm]	0.59 in [15.1 mm]	0.41 in [10.5 mm]
Y	1.5 in [38 mm]	2.14 in [54.4 mm]	2.40 in [60.9 mm]	2.58 in [65.5 mm]
Z		1.5 in [38 mm]		

3VA9.87 - 0GA80



	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	2.50 in [63.5 mm]	3.44 in [87,5 mm]		4.53 in [115 mm]
B	1.50 in [38.1 mm]	2.07 in [52.5 mm]		2.72 in [69 mm]
C	2.76 in [70 mm]	3.64 in [92.5 mm]	3.90 in [99 mm]	4.88 in [124 mm]
I <sub>1</sub>	4.85 in [123.1 mm]	5.36 in [136.1 mm]		6.30 in [160 mm]
J	0.00 in [0 mm]	0.65 in [16.4 mm]	0.90 in [22.9 mm]	1.08 in [27.5 mm]
K	4.63 in [117.5 mm]	5.00 in [127 mm]		5.94 in [151 mm]
L	1.81 in [46 mm]	2.13 in [54 mm]		2.24 in [57 mm]
M <sub>2 min</sub>	11.83 in [300.5 mm]	12.32 in [803 mm]		13.27 in [337 mm]
M <sub>2 max</sub>	31.12 in [790.5 mm]	31.61 in [803 mm]		32.60 in [828 mm]
O <sub>2</sub>	9.11 in [231.5 mm]	9.61 in [244 mm]		10.55 in [268 mm]
P <sub>2 min</sub>		0.91 in [23 mm]		
P <sub>2 max</sub>		20.31 in [516 mm]		
W		≥ 3.15 in [80 mm]		
X	1.5 in [38 mm]	0.85 in [21.6 mm]	0.59 in [15.1 mm]	0.41 in [10.5 mm]
Y	1.5 in [38 mm]	2.14 in [54.4 mm]	2.40 in [60.9 mm]	2.58 in [65.5 mm]
Z		1.5 in [38 mm]		

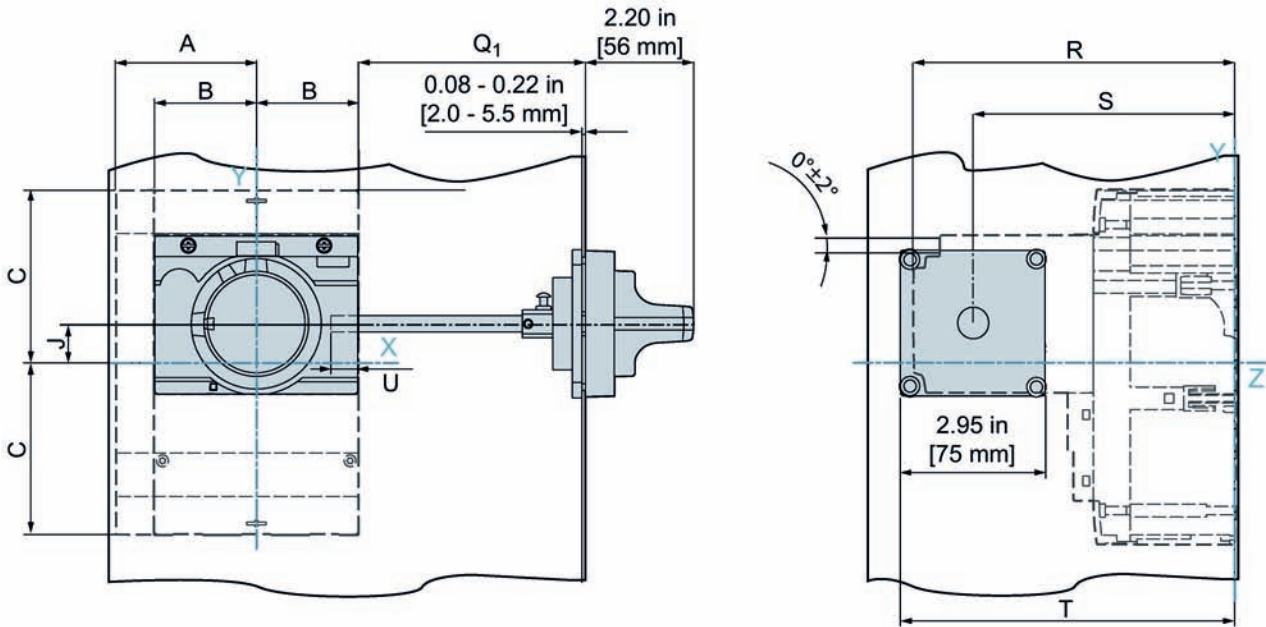
Articulated shaft operator



	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	2.50 in [63.5 mm]	3.44 in [87.5 mm]		4.53 in [115 mm]
B	1.50 in [38.1 mm]	2.07 in [52.5 mm]		2.72 in [69 mm]
C	2.76 in [70 mm]	3.64 in [92.5 mm]	3.90 in [99 mm]	4.88 in [124 mm]
D	0.89 in [22.6 mm]	0.77 in [19.6 mm]	0.52 in [13.1 mm]	0.33 in [8.5 mm]
E	1.87 in [47.4 mm]	2.42 in [61.4 mm]	2.67 in [67.9 mm]	3.34 in [84.9 mm]
F	0.89 in [22.6 mm]	1.22 in [31.1 mm]		1.54 in [39 mm]
G	1.77 in [45 mm]	2.76 in [70 mm]		2.76 in [70 mm]
H <sub>1</sub>	5.81 in [147.5 mm]	6.30 in [160 mm]		7.28 in [185 mm]
I <sub>1</sub>	4.85 in [123.1 mm]	5.36 in [136.1 mm]		6.30 in [160 mm]
J	0.00 in [0 mm]	0.65 in [16.4 mm]	0.90 in [22.9 mm]	1.08 in [27.5 mm]
K	4.63 in [117.5 mm]	5.00 in [127 mm]		5.94 in [151 mm]
L	1.81 in [46 mm]	2.13 in [54 mm]		2.24 in [57 mm]

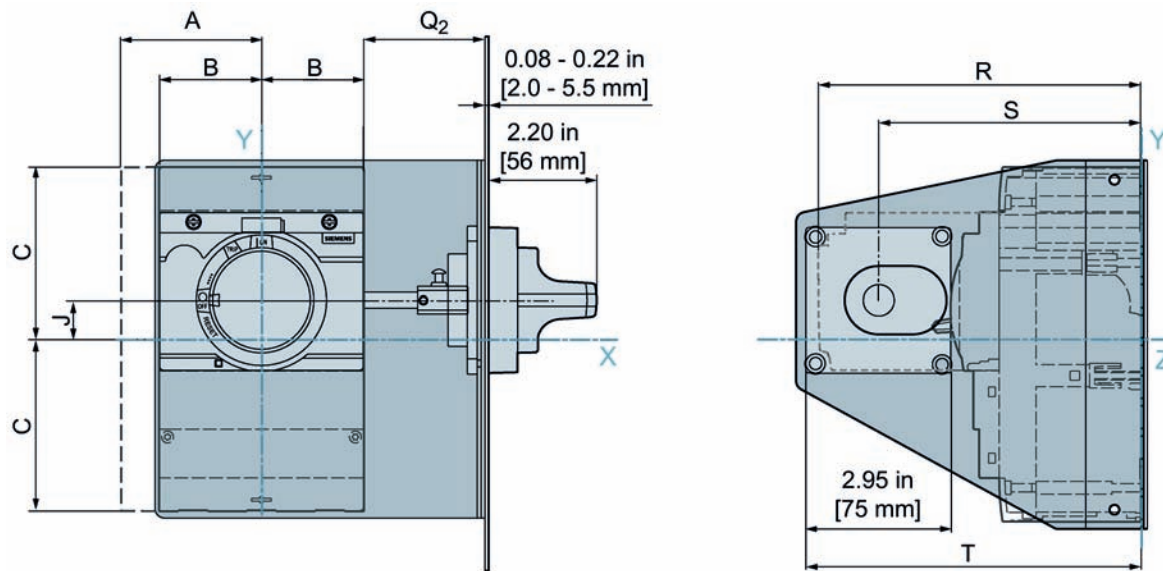
### Side wall mounted rotary operator

Side wall mounted rotary operator



	3VA5		3VA6
	125 A	250 A	150 / 250 A
A	2.50 in [63.5 mm]		3.44 in [87.5 mm]
B	1.50 in [38.1 mm]		2.07 in [52.5 mm]
C	2.76 in [70 mm]	3.64 in [92.5 mm]	3.90 in [99 mm]
J	0.00 in [0 mm]	0.65 in [16.4 mm]	0.90 in [22.9 mm]
Q <sub>1 min</sub>	1.10 in [28 mm]		1.10 in [28 mm]
Q <sub>1 max</sub>	11.26 in [286 mm]		10.75 in [273 mm]
R	6.04 in [153.5 mm]		6.57 in [167 mm]
S	4.94 in [125.5 mm]		5.31 in [135 mm]
T	6.44 in [163.5 mm]		6.81 in [173 mm]
U	0.59 in [15 mm]		1.16 in [29.5 mm]

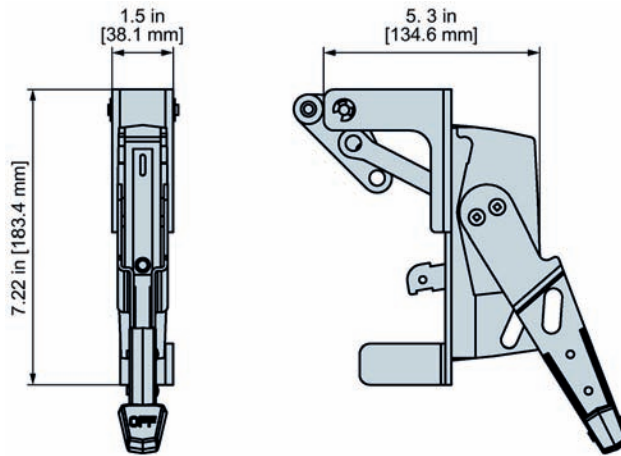
Side wall mounted rotary operator with mounting plate



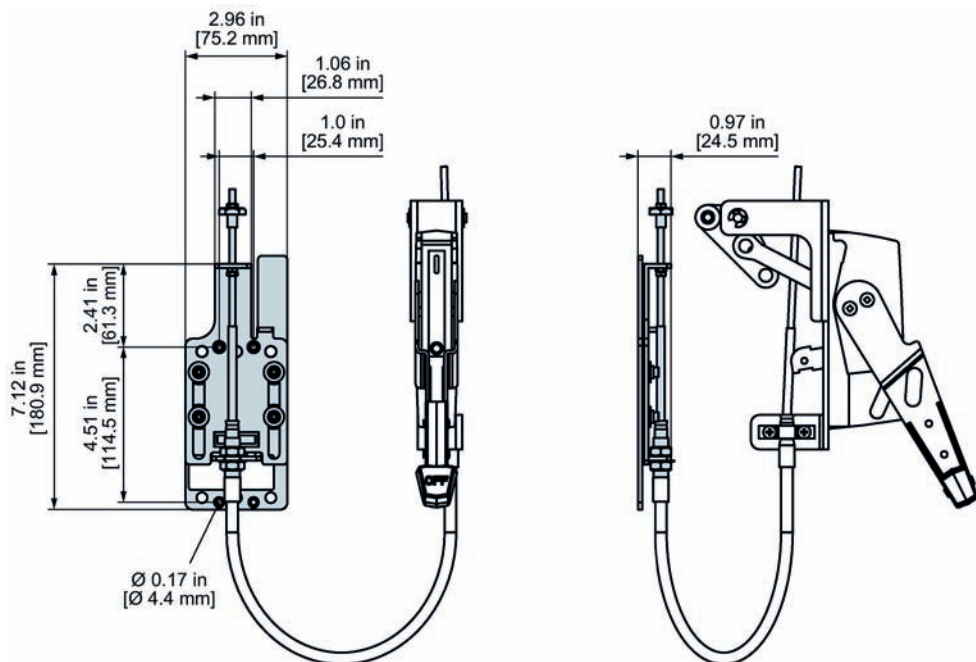
	3VA5		3VA6
	125 A	250 A	150 / 250 A
A	2.50 in [63.5 mm]		3.44 in [87.5 mm]
B	1.50 in [38.1 mm]		2.07 in [52.5 mm]
C	2.76 in [70 mm]	3.64 in [92.5 mm]	3.90 in [99 mm]
J	0.00 in [0 mm]	0.65 in [16.4 mm]	0.90 in [22.9 mm]
Q <sub>2</sub>	1.65 in [42 mm]		1.77 in [45 mm]
R	6.04 in [153.5 mm]		6.57 in [167 mm]
S	4.94 in [125.5 mm]		5.31 in [135 mm]
T	6.44 in [163.5 mm]		6.81 in [173 mm]

### Operator kit with Bowden cable (Max-Flex operator)

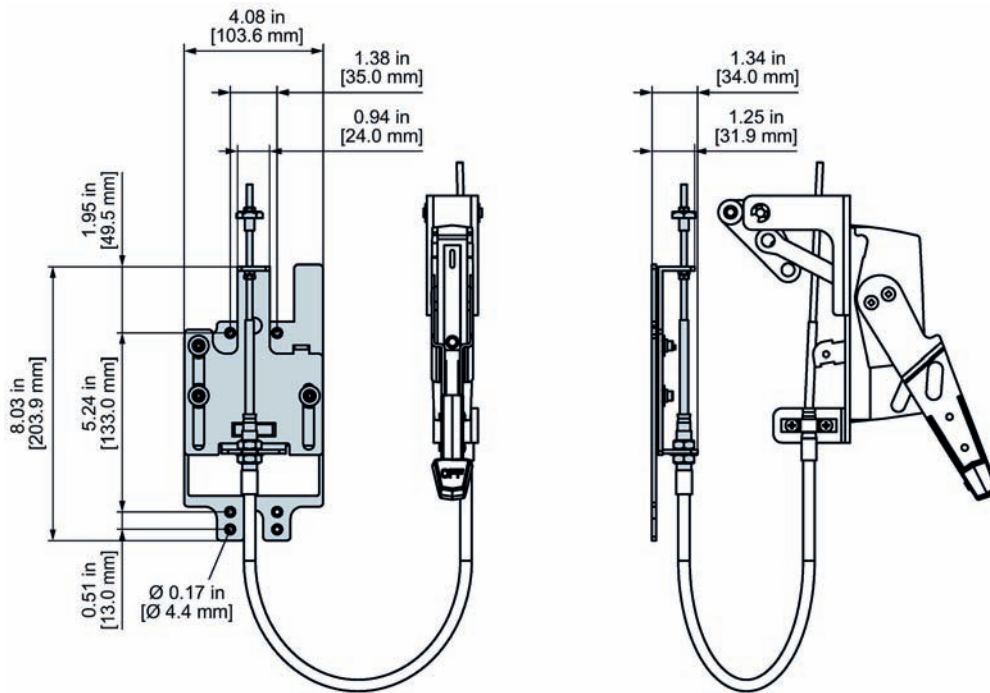
Handle



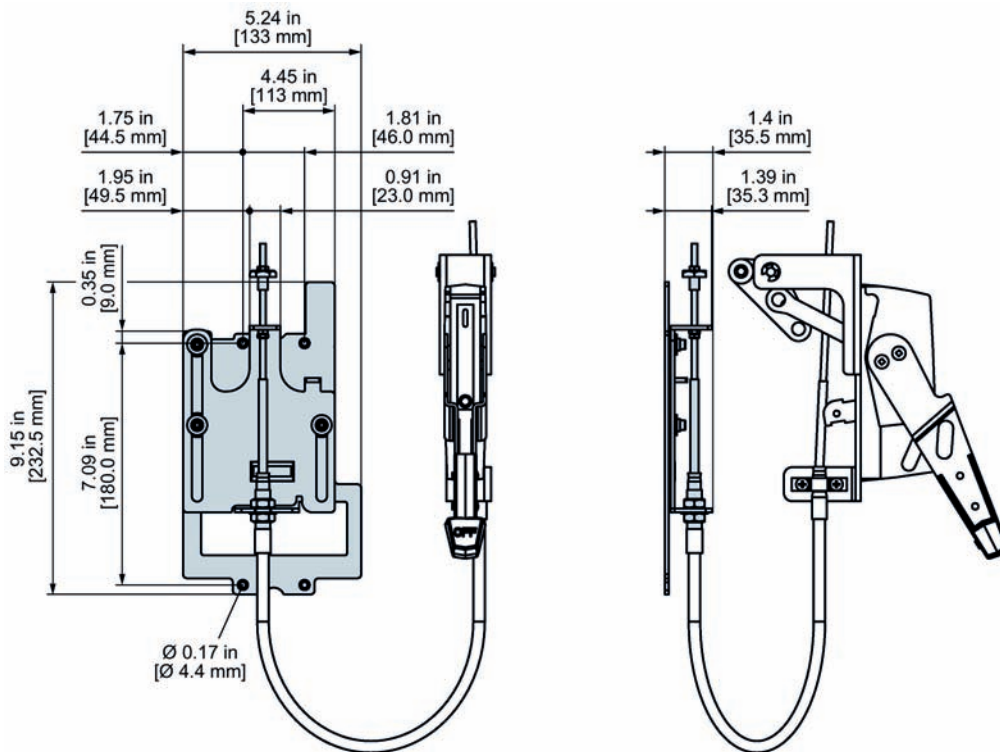
Switching mechanism for 3VA5 125 A



Switching mechanism for 3VA5 250 A and 3VA6 150 / 250 A



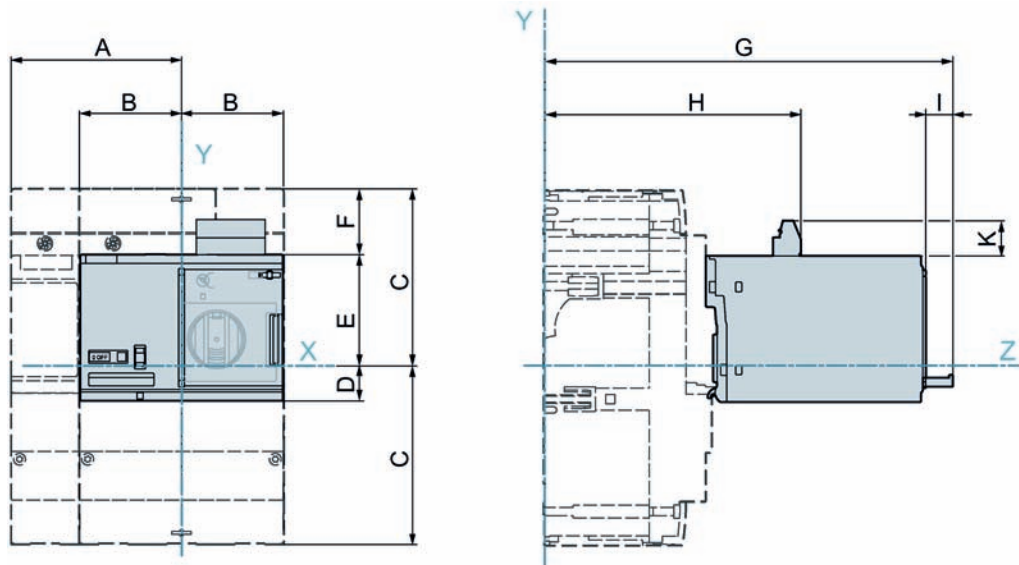
Switching mechanism for 3VA6 400 / 600 A





### 6.2.2.4 Motor operators

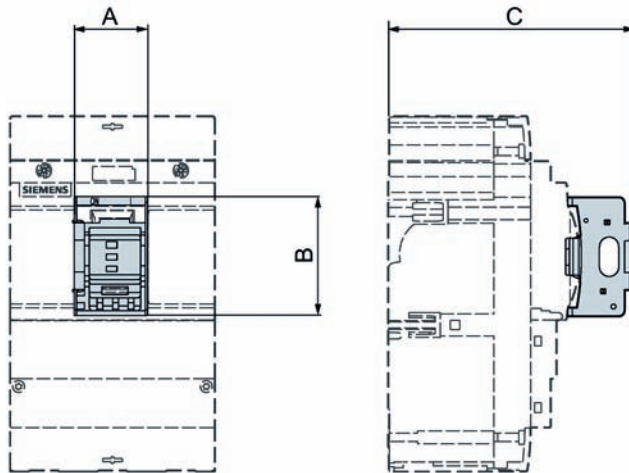
#### MO320 motor operator



	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	2.50 in [63.5 mm]	3.44 in [87.5 mm]	4.53 in [115 mm]	
B	1.5 in [38.1 mm]	2.07 in [52.5 mm]	2.72 in [69 mm]	
C	2.76 in [70 mm]	3.64 in [92.5 mm]	3.90 in [99 mm]	4.88 in [124 mm]
D	0.89 in [22.6 mm]	0.54 in [13.6 mm]	0.28 in [7.1 mm]	0.33 in [8.5 mm]
E	1.87 in [47.4 mm]	2.42 in [61.4 mm]	2.67 in [67.9 mm]	3.29 in [83.5 mm]
F	0.89 in [22.6 mm]	1.22 in [31.1 mm]	1.59 in [40.5 mm]	
G	7.38 in [187.5 mm]	8.58 in [217.9 mm]	9.49 in [241 mm]	
H	5.02 in [127.6 mm]	5.63 in [143.1 mm]	6.70 in [170.2 mm]	
I		0.59 in [15 mm]		
K		0.68 in [17.2 mm]		

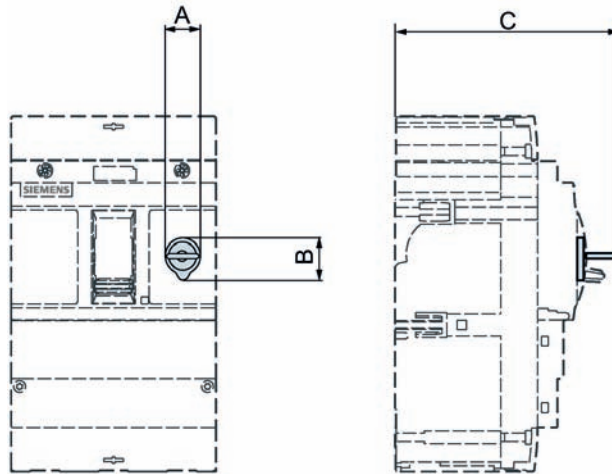
6.2.2.5 Locking and interlocking

Handle blocking device



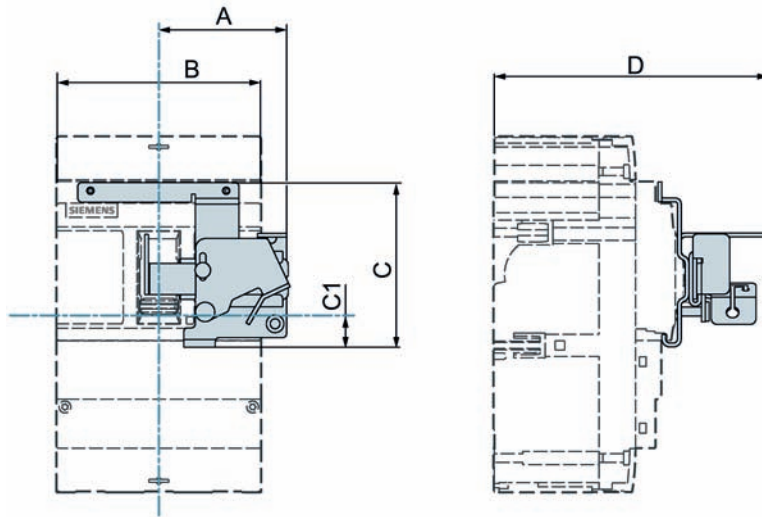
	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	1.1 in [29 mm]	1.5 in [39 mm]	1.5 in [39 mm]	1.5 in [39 mm]
B	1.8 in [45 mm]	2.4 in [61 mm]	2.4 in [61 mm]	2.4 in [61 mm]
C	4.5 in [114.5 mm]	5.0 in [127 mm]	5.0 in [127 mm]	5.9 in [151 mm]

Locking, blocking or interlocking with cylinder lock



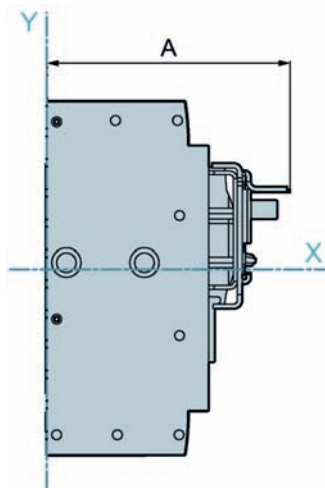
	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	0.8 in [20 mm]			
B	0.9 in [23 mm]			
C	4.4 in [104.8 mm]	4.8 in [122 mm]	5.8 in [146 mm]	

Module for sliding bar with Bowden cable



	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	2.4 in [59.7 mm]	2.5 in [63.5 mm]	2.6 in [66.7 mm]	2.7 in [69.7 mm]
B	3.0 in [76.5 mm]	4.1 in [105 mm]	4.1 in [104.6 mm]	5.4 in [137.6 mm]
C	2.9 in [73.5 mm]	3.2 in [80 mm]	3.3 in [85 mm]	3.8 in [97.5 mm]
C1	1.0 in [26 mm]	0.8 in [21 mm]	0.7 in [17 mm]	0.5 in [12.9 mm]
D	4.5 in [114 mm]		5.5 in [140.5 mm]	6.5 in [164.5 mm]

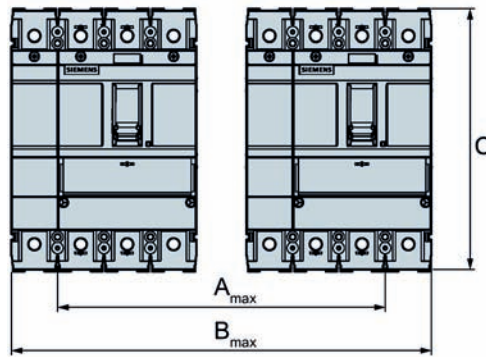
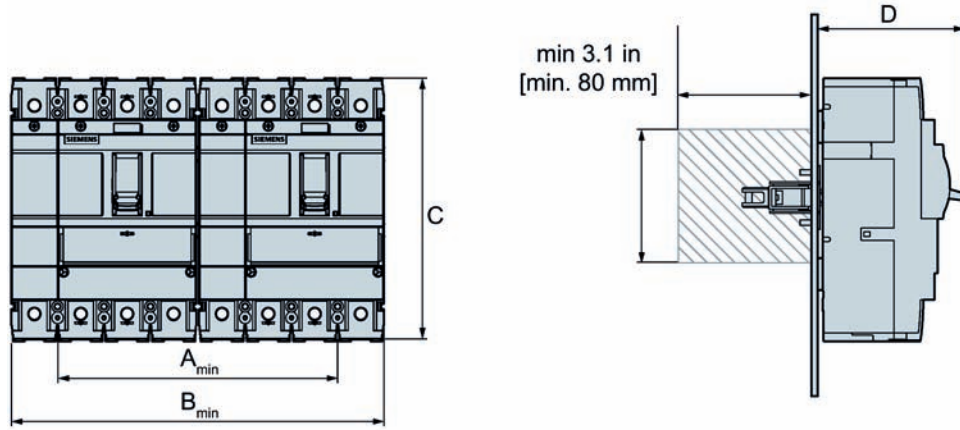
Sliding bar



	3VA5		3VA6	
	125 A	250 A	150 / 250 A	400 / 600 A
A	4.1 in [105 mm]	4.9 in [125 mm]	5.9 in [150 mm]	

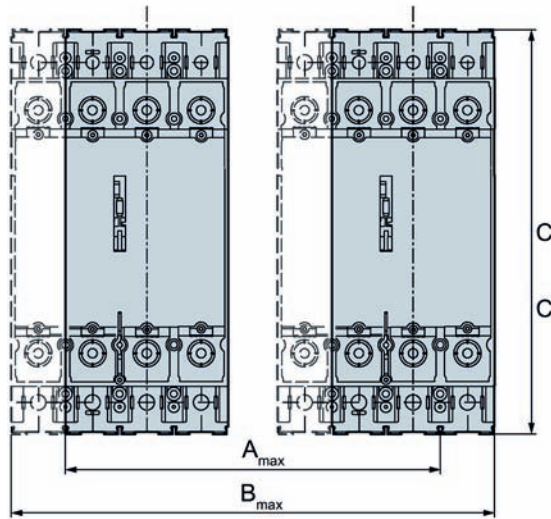
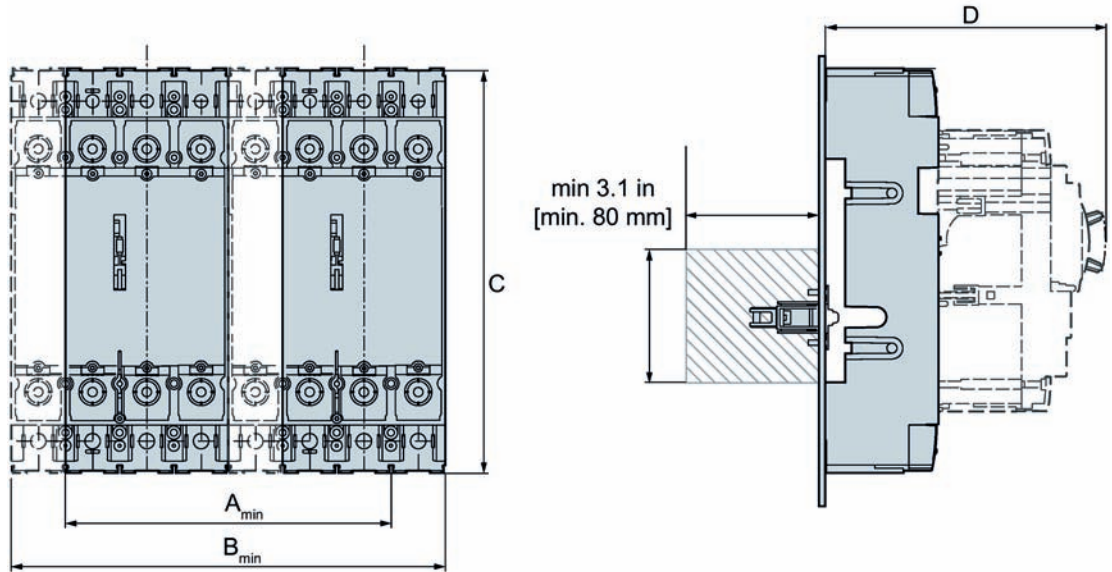
## Rear interlock

### Mounting on rear wall of panel, fixed-mounted



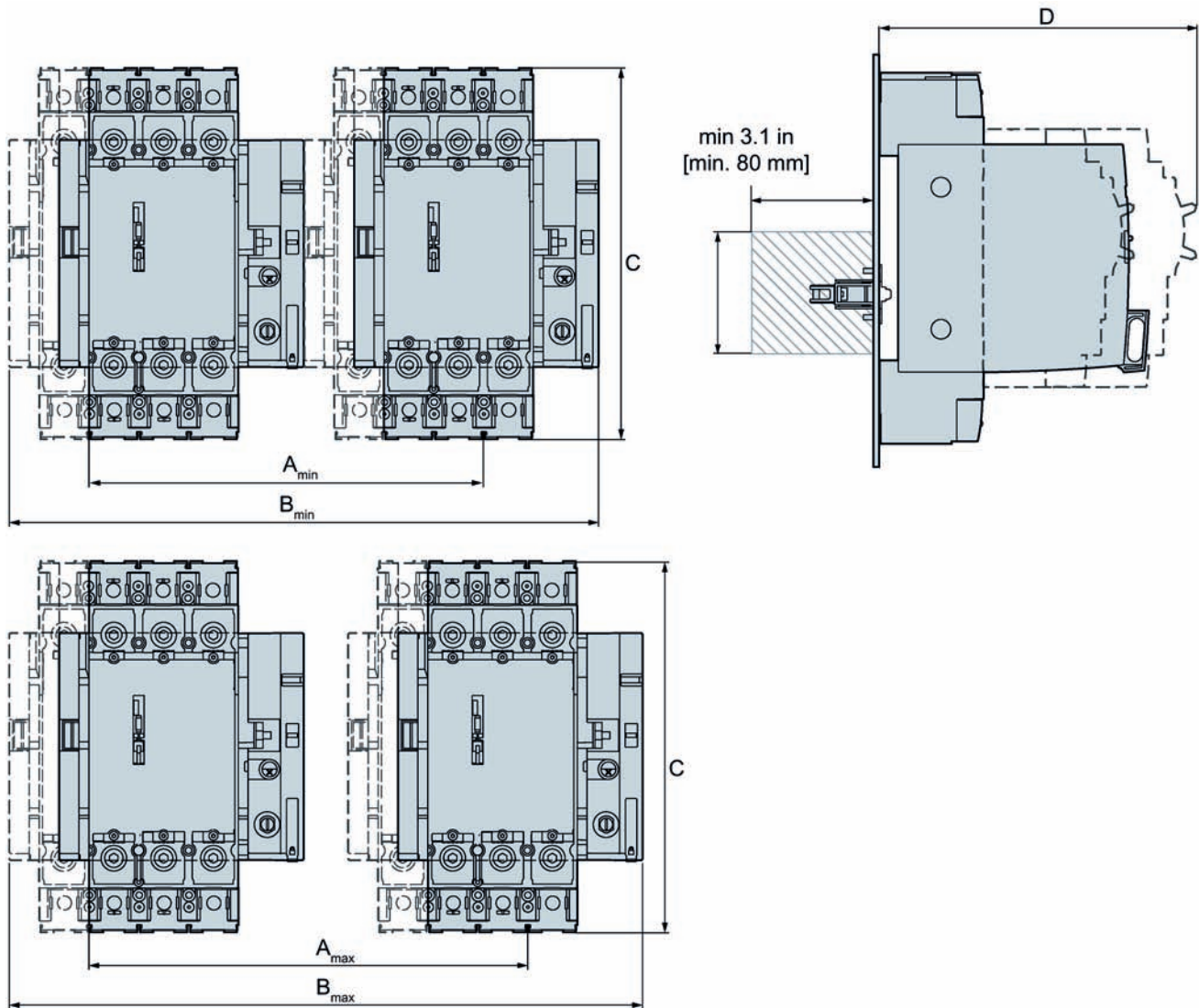
		3VA5		3VA6	
		125 A	250 A	150 / 250 A	400 / 600 A
A <sub>min</sub>	3-pole	6 in [152.4 mm]	8.27 in [210 mm]	8.27 in [210 mm]	10.87 in [276 mm]
A <sub>max</sub>	3-pole	11.72 in [297.6 mm]	13.21 in [335.6 mm]	13.21 in [335.6 mm]	14.94 in [379.6 mm]
B <sub>min</sub>	4-pole			11.02 in [280 mm]	14.49 in [368 mm]
B <sub>max</sub>	4-pole			15.97 in [405.6 mm]	18.57 in [471.6 mm]
C		4.24 in [107.8 mm]	7.3 in [185 mm]	7.8 in [198 mm]	9.8 in [248 mm]
D		3.72 in [94.5 mm]	4.21 in [107 mm]	4.21 in [107 mm]	6.8 in [172.9 mm]

Mounting on rear wall of panel, plug-in technology



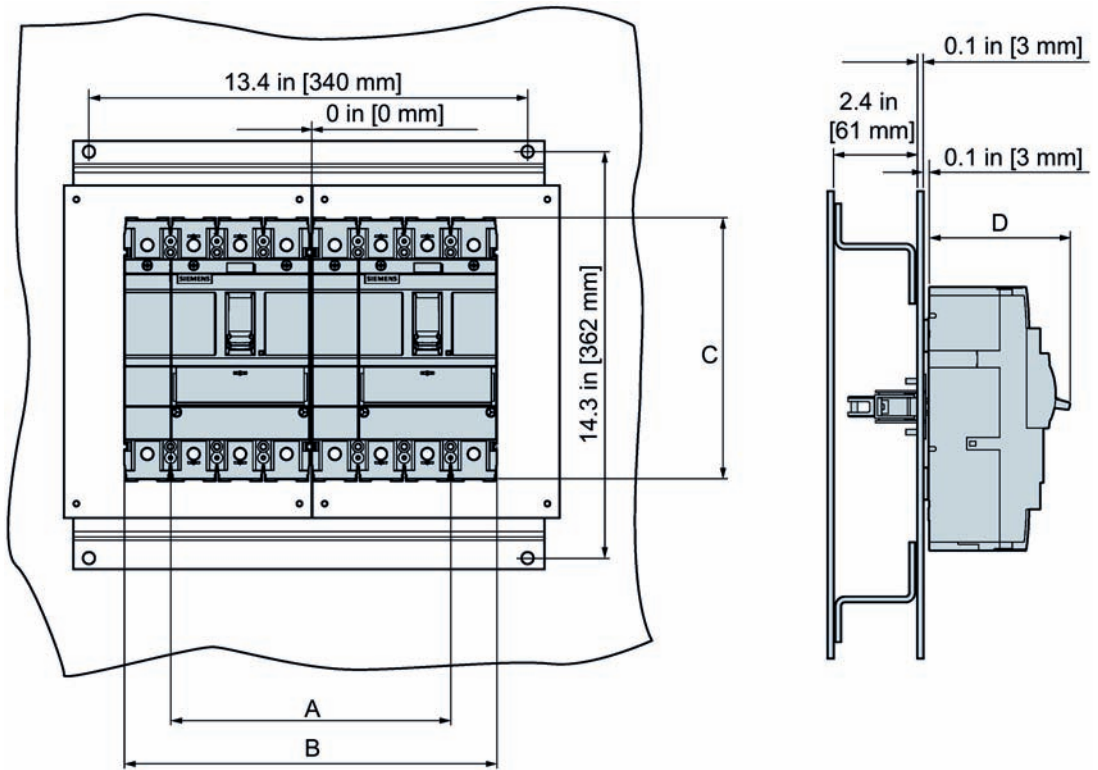
		3VA6	
		150 / 250 A	400 / 600 A
$A_{min}$	3-pole	9.63 in [244.6 mm]	12.55 in [321.6 mm]
$A_{max}$	3-pole	14.59 in [370.6 mm]	16.76 in [425.6 mm]
$B_{min}$	4-pole	12.39 in [314.6 mm]	16.28 in [413.6 mm]
$B_{max}$	4-pole	17.35 in [440.6 mm]	20.38 in [517.6 mm]
$C$		10.3 in [261 mm]	12.87 in [327 mm]
$D$		7.1 in [180 mm]	9.11 in [231.5 mm]

Mounting on rear wall of panel, draw-out technology



		3VA6	
		150 / 250 A	400 / 600 A
A <sub>min</sub>	3-pole	27.08 in [687.8 mm]	32.25 in [819.2 mm]
A <sub>max</sub>	3-pole	26.45 in [671.8 mm]	29.89 in [759.2 mm]
B <sub>min</sub>	4-pole	31.78 in [807.2 mm]	39.5 in [1003.2 mm]
B <sub>max</sub>	4-pole	31.15 in [791.2 mm]	37.13 in [943.2 mm]
C		10.3 in [261 mm]	12.87 in [327 mm]
D		8.74 in [222 mm]	10.77 in [273.5 mm]

Mounting with mounting plate and profile rail

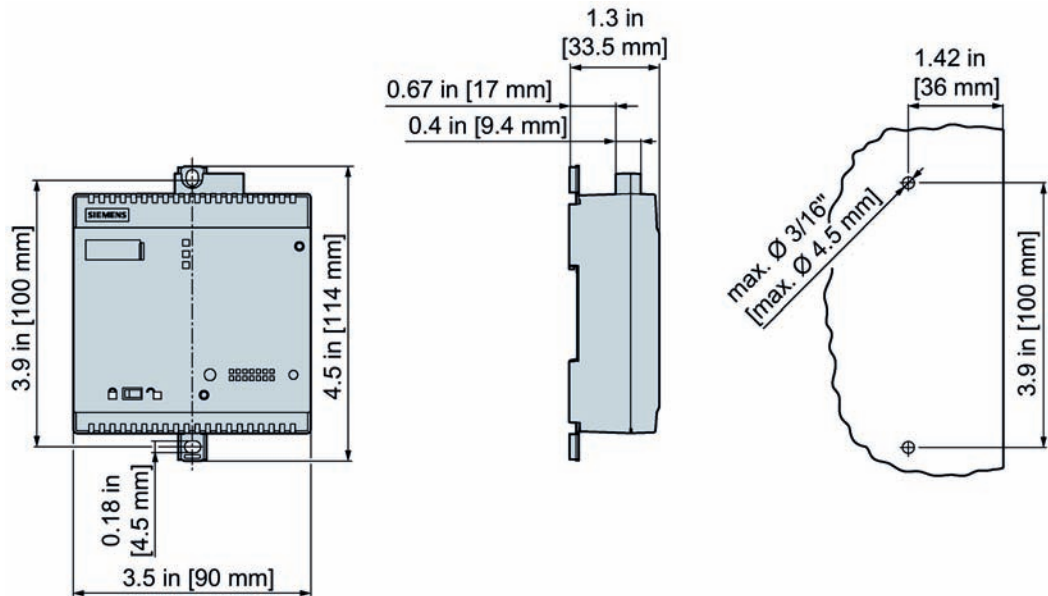


		3VA5		3VA6	
		125 A	250 A	150 / 250 A	400 / 600 A
A	3-pole	6 in [152.4 mm]	8.27 in [210 mm]	8.27 in [210 mm]	10.87 in [276 mm]
B	4-pole			11.02 in [280 mm]	14.49 in [368 mm]
C		4.24 in [107.8 mm]	7.3 in [185 mm]	7.8 in [198 mm]	9.8 in [248 mm]
D		3.72 in [94.5 mm]	4.21 in [107 mm]	4.21 in [107 mm]	6.8 in [172.9 mm]

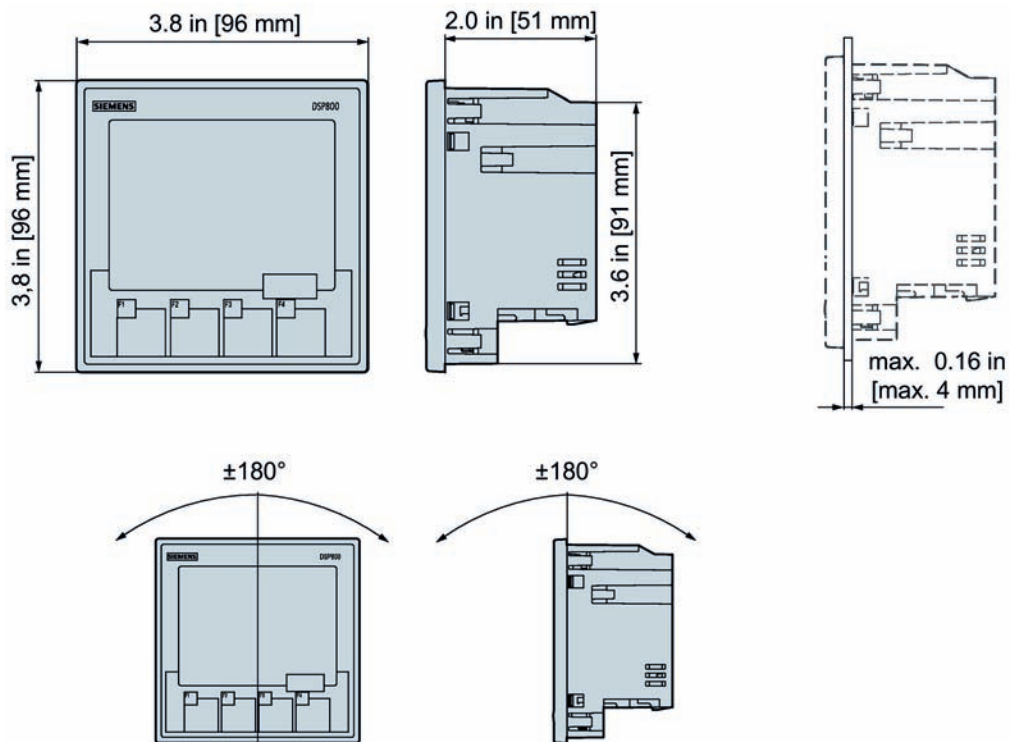


### 6.2.2.6 Communication and system integration

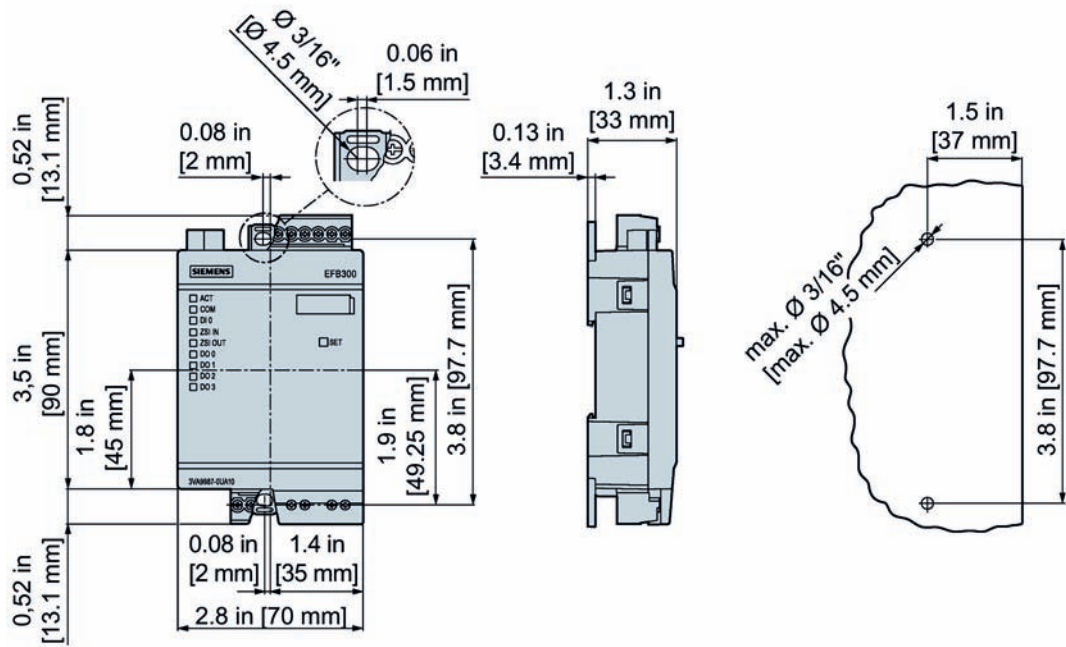
#### COM800 and COM100 breaker data server



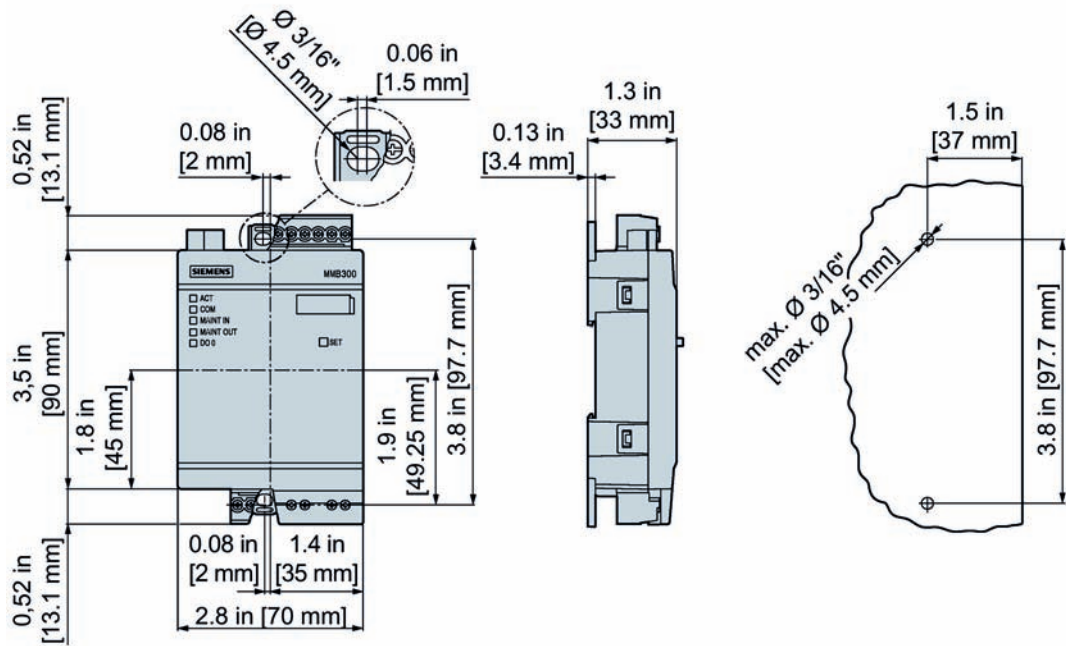
#### DSP800 display



6.2.2.7 EFB300 external function box



6.2.2.8 MMB300 maintenance mode box



### 6.2.2.9 Test devices

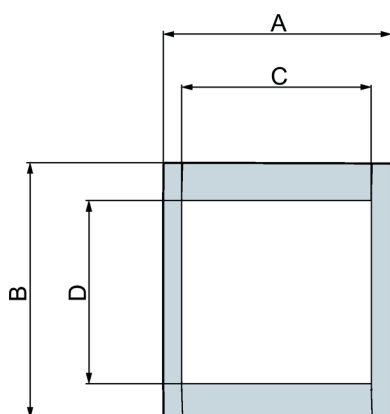
#### TD300 activation and trip box

Refer to chapter Technical specifications of TD300 (Page 364).

#### TD500 test device

Refer to chapter Technical specifications (Page 375).

### 6.2.2.10 Door cover frame



	A in [mm]	B in [mm]	C in [mm]	D in [mm]
3VA9033 - 0SB10	3.9 [98.2]	3.4 [85.65]	3 [76.2]	1.8 [45.65]
3VA9033 - 0SB20	3.9 [98.2]	4.4 [110.7]	3 [76.2]	2.8 [70.7]
3VA9034 - 0SB10	4.9 [123.6]	3.4 [85.65]	4 [101.6]	1.8 [45.65]
3VA9034 - 0SB20	4.9 [123.6]	4.4 [110.7]	4 [101.6]	2.8 [70.7]
3VA9143 - 0SB10	5 [126.6]	4.4 [110.7]	4.1 [104.6]	2.8 [70.7]
3VA9143 - 0SB20	5 [126.6]	5.5 [140.8]	4.1 [104.6]	4 [100.8]
3VA9144 - 0SB10	6.4 [161.6]	4.4 [110.7]	5.5 [139.6]	2.8 [70.7]
3VA9144 - 0SB20	6.4 [161.6]	5.5 [140.8]	5.5 [139.6]	4 [100.8]
3VA9147 - 0SB30	5 [126.6]	4.8 [120.8]	4.1 [104.6]	3.2 [80.8]
3VA9233 - 0SB20	5 [126.6]	6 [152.8]	4.1 [104.6]	4.4 [112.8]
3VA9233 - 0SB30	5 [126.6]	4.9 [124.7]	4.1 [104.6]	3.3 [84.7]
3VA9234 - 0SB20	5 [161.6]	6.0 [152.8]	5.5 [139.6]	4.4 [112.8]
3VA9237 - 0SB30	5 [126.6]	4.6 [115.8]	4.1 [104.6]	3 [75.8]
3VA9333 - 0SB20	6.3 [159.6]	5.9 [149.3]	5.4 [137.6]	4.3 [109.3]
3VA9334 - 0SB20	8.1 [205.6]	5.9 [149.3]	7.2 [183.6]	4.3 [109.3]
3VA9343 - 0SB20	6.3 [159.6]	6.4 [162.3]	5.4 [137.6]	4.8 [122.3]
3VA9344 - 0SB20	8.1 [205.6]	6.4 [162.3]	7.2 [183.6]]	4.8 [122.3]
3VA9373 - 0SB10	6.3 [159.6]	4.4 [110.7]	5.4 [137.6]	2.8 [70.7]
3VA9374 - 0SB10	8.1 [205.6]	4.4 [110.7]	7.2 [183.6]	2.8 [70.7]
3VA9377 - 0SB30	6.3 [159.6]	5.2 [132.8]	5.4 [137.6]	3.65 [92.8]

## 6.3 Power losses

### 6.3.1 Power losses of 3VA5 molded case circuit breakers

**Note**

For 3-pole devices, the specified power loss applies in the case of 3-phase symmetrical loading.

**3VA5 molded case circuit breakers for line protection**

	$I_n$ [A]	3VA5 Breaker Power loss $P_v$			3VA5 Breaker with UVR Power loss $P_v$		3VA5 Breaker external accessories Additional Power loss $P_v$ Rear terminals	
		1-pole [W]	2-pole [W]	3-pole [W]	2-pole [W]	3-pole [W]	2-pole [W]	3-pole [W]
3VA51	15	–	–	10.6	–	13.1	–	0.1
	20	4.1	–	12.2	–	14.7	–	0.1
	25	2.9	–	8.6	–	11.1	–	0.2
	30	3.2	–	9.6	–	12.1	–	0.2
	35	3.8	–	11.4	–	13.9	–	0.3
	40	3.7	–	11.2	–	13.7	–	0.4
	45	3.8	–	11.4	–	13.9	–	0.5
	50	4.0	–	12.0	–	14.5	–	0.6
	60	5.1	–	15.4	–	17.9	–	0.9
	70	6.1	–	18.3	–	20.8	–	1.2
	80	6.4	–	19.3	–	21.8	–	1.6
	90	7.1	–	21.4	–	23.9	–	2.0
	100	7.6	–	22.8	–	25.3	–	2.5
110	8.6	–	25.8	–	28.3	–	3.0	
125	10.0	–	30.1	–	32.6	–	3.8	
3VA52	100	–	21.1	31.6	23.6	34.1	1.1	1.7
	110	–	15.1	22.6	17.6	25.1	1.4	2.1
	125	–	15.1	22.6	17.6	25.1	1.8	2.7
	150	–	19.9	29.9	22.4	32.4	2.5	3.8
	175	–	23.4	35.1	25.9	37.6	3.5	5.2
	200	–	28.3	42.5	30.8	45.0	4.5	6.8
	225	–	34.1	51.2	36.6	53.7	5.8	8.7
	250	–	38.7	58.0	41.2	60.5	7.1	10.7

3VA5 molded case circuit breakers for starter protection

	$I_n$ [A]	3VA5 MCP Power loss $P_v$		3VA5 MCP with UVR Power loss $P_v$		3VA5 MCP external accessories <u>Additional</u> Power loss $P_v$
		"MU" 3-pole [W]	"MH" 3-pole [W]	"MU" 3-pole [W]	"MH" 3-pole [W]	Rear terminals 3-pole [W]
3VA51	15	2.2	2.2	4.7	4.7	0.1
	25	6.1	2.1	8.6	4.6	0.2
	30	8.8	3.1	11.3	5.6	0.2
	40	5.0	3.6	7.5	6.1	0.4
	50	7.7	5.6	10.2	8.1	0.6
	70	10.9	10.9	13.4	13.4	1.2
	80	14.2	14.2	16.7	16.7	1.6
	90	18.0	18.0	20.5	20.5	2.0
	100	19.2	19.2	21.7	21.7	2.5
	110	23.2	23.2	25.7	25.7	3.0
	125	30.0	30.0	32.5	32.5	3.8
3VA52	150	19.6	19.6	22.1	22.1	3.8
	200	34.8	34.8	37.3	37.3	6.8

### 6.3.2 Power losses of 3VA6 molded case circuit breakers

**Note**

The specified power loss applies to 3-pole and 4-pole devices in the case of 3-phase, symmetrical loading.

If the 4th pole is not de-energized (e.g. DC applications; unbalanced loading, many 1-pole loads), the 4th pole has one-third the power loss of the 3-pole power loss.

**3VA6 molded case circuit breakers for line protection**

	$I_n$ [A]	3VA6 Breaker	3VA6 Breaker with UVR	3VA6 Breaker external accessories	
		Power loss $P_v$	Power loss $P_v$	Additional Power loss $P_v$	
		3- / 4-pole [W]	3- / 4-pole [W]	Rear terminals 3- / 4-pole [W]	Plug-In / Draw-Out unit 3- / 4-pole [W]
3VA61	40	2.4	4.9	0.3	0.4
	100	13.0	15.5	1.0	2.0
	150	29.0	31.5	3.0	5.0
3VA62	100	6.7	9.2	1.8	2.4
	250	42.0	44.5	11.0	15.0
3VA63	250	27.0	29.5	11.0	15.0
	400	70.0	72.5	26.0	38.0
3VA64	400	70.0	72.5	26.0	38.0
	600	151.0	153.5	59.0	64.0

## 3VA6 molded case circuit breakers for starter protection

		3VA6 MCP		3VA6 MCP with UVR		3VA6 MCP external accessories		
		Power loss $P_v$		Power loss $P_v$		Additional Power loss $P_v$		
		$I_n$ [A]	3-pole [W]	3-pole [W]	Rear terminals 3-pole [W]	Plug-In / Draw-Out unit 3-pole [W]		
3VA61	25	0.9	3.4	0.1	0.2			
	30	1.4	3.9	0.1	0.2			
	40	2.4	4.9	0.3	0.4			
	50	3.8	6.3	0.4	0.6			
	70	7.4	9.9	0.8	1.1			
	80	9.6	12.1	1.1	1.5			
	90	12.2	14.7	1.4	1.9			
3VA62	100	13.0	15.5	1.0	2.0			
	110	8.1	10.6	2.1	2.9			
	125	10.5	13.0	2.7	3.8			
	150	15.0	17.5	4.0	6.0			
3VA63	200	26.9	29.4	5.1	7.1			
	200	18.0	20.5	6.0	–			
3VA64	250	27.0	29.5	11.0	–			
	400	70.0	72.5	26.0	–			
	500	105.0	107.5	41.0	–			

## 6.3.3 Power losses of 3VA UL molded case switches

**Note**

For 3-pole devices, the specified power loss applies in the case of 3-phase symmetrical loading.

		3VA MCS		3VA MCS with UVR		3VA MCS external accessories		
		Power loss $P_v$		Power loss $P_v$		Additional Power loss $P_v$		
		$I_n$ [A]	2-pole [W]	3-pole [W]	2-pole [W]	3-pole [W]	Rear terminals 2-pole [W]	3-pole [W]
3VA51	100	–	19.2	–	21.7	–	2.5	–
3VA52	100	5.8	8.7	8.3	11.2	1.1	1.7	–
	150	13.1	19.6	15.6	22.1	2.5	3.8	–
	250	36.3	54.4	38.8	56.9	7.1	10.7	–
3VA63	400	–	70.0	–	72.5	–	26.0	–
3VA64	600	–	151.0	–	153.5	–	59.0	–

## 6.4 Derating

### 6.4.1 Derating of 3VA5 molded case circuit breakers

The temperature inside the molded case circuit breaker is influenced by the ambient temperature and the current-dependent power loss generated inside the unit. To prevent overloading of 3VA5 molded case circuit breakers under difficult thermal conditions, the maximum rated continuous operational current must be limited as a function of the ambient temperature.

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#### Note

The values do not apply to all installation situations of the molded case circuit breaker and may deviate depending upon factors such as cables and busbars, packing density, ventilation, etc.

---

The extensive range of accessories of the 3VA5 molded case circuit breaker has no effect on the thermal response thresholds of the switching devices.



3VA5 molded case circuit breakers for line protection

Line protection	Rated operational current $I_n$	Max. rated continuous operational current									
		86 °F 30 °C	95 °F 35 °C	104 °F 40 °C	113 °F 45 °C	122 °F 50 °C	131 °F 55 °C	140 °F 60 °C	149 °F 65 °C	158 °F 70 °C	
		[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	
3VA51	15					14	14	14	14	14	
	20					19	19	19	18	18	
	25				24	24	23	23	23	22	
	30				29	29	28	28	28	27	
	35				34	34	33	33	32	32	
	40				39	39	38	37	37	36	
	45				44	44	43	42	42	41	
	50				49	48	47	46	45	44	
	60				59	58	57	56	55	54	
	70				69	68	67	66	65	64	
	80				78	77	76	74	73	72	
	90				88	86	84	82	80	79	
	100				98	95	93	91	89	87	
	110				107	105	103	100	98	96	
	125				122	119	117	114	112	109	
3VA52	100					97	95	92	89	87	84
	110					107	104	100	97	94	91
	125					121	116	112	108	103	99
	150					146	141	137	132	128	123
	175					171	166	162	158	153	149
	200					194	189	183	178	172	167
	225					220	216	211	206	201	197
250					244	239	233	227	222	216	

No derating up to the rated operational current  $I_n$  of the molded case circuit breaker

3VA5 molded case circuit breakers for starter protection MCP

	Rated operational current $I_n$	Max. rated continuous operational current														
		86 °F 30 °C	95 °F 35 °C	104 °F 40 °C	113 °F 45 °C	122 °F 50 °C	131 °F 55 °C	140 °F 60 °C	149 °F 65 °C	158 °F 70 °C						
	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]						
Motor circuit protection (MCP) 3VA51	15															
	25															
	30															
	40															
	50															
	70															
	80															
	90										88	86	84	82	80	79
	100										98	95	93	91	89	87
	110										107	105	103	100	98	96
125	122	119	117	114	112	109										
3VA52	150															
	200															

No derating up to the rated operational current  $I_n$  of the molded case circuit breaker

3VA UL molded case switches

	Rated operational current $I_n$	Max. rated continuous operational current										
		86 °F 30 °C	95 °F 35 °C	104 °F 40 °C	113 °F 45 °C	122 °F 50 °C	131 °F 55 °C	140 °F 60 °C	149 °F 65 °C	158 °F 70 °C		
	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]		
MCS	3VA51	100							97	94		
		100										
	3VA52	150										
	200				244	239	233	227	222	216		

No derating up to the rated operational current  $I_n$  of the molded case circuit breaker

6.4.2 Use of terminals with control wire tap

When connecting terminals with control wire tap are used, the total current from the main circuit and control wire must not exceed the maximum rated operational current of the molded case circuit breaker.

### 6.4.3 Additional correction factors with frequencies other than 50/60 Hz for 3VA5 molded case circuit breakers

The temperature rise in the bimetal is greater at frequencies above 50/60 Hz. This is due to eddy-current losses and the reduction in the available conductor cross section as a result of the skin effect.

The rated operational current must therefore be reduced from the value used in 50/60 Hz applications.

3VA51 Frequencies	Correction factor for the thermal trip unit
< 150 Hz	1.0
150 Hz ... 400 Hz	0.9

3VA52 Frequencies	Correction factor for the thermal trip unit
< 100 Hz	1.0
100 Hz ... 250 Hz	0.95
250 Hz ... 400 Hz	0.90

In an application with 400 Hz, this means the following for the example from chapter Derating of 3VA5 molded case circuit breakers (Page 454) with a 3VA5 molded case circuit breaker and a desired current  $I_r = 90$  A:

- Setting value  $I_{r(400\text{ Hz})} = 90\text{ A} \cdot 0.9 = 86\text{ A}$

Where ambient temperatures differ from the calibration temperature, temperature compensation as described in chapter Derating of 3VA5 molded case circuit breakers (Page 454) must be performed.

In addition, a correction factor for setting the magnetic trip unit as a function of frequency must be applied.

	DC	Correction factor for the magnetic trip unit at frequency f [Hz]								
		20	50/60	100	150	200	250	300	350	400
3VA51	0.7	1.05	1	1	0.95	0.9	0.85	0.8	0.75	0.7
3VA52	0.8	1.0	1	1	0.9	0.8	0.75	0.7	0.65	0.6

**Example**

Starting point:

A 3VA5 200 A molded case circuit breaker with a TM230 trip unit is used in a 400 Hz application. The molded case circuit breaker is to trip instantaneously at an overcurrent of 2000 A.

The maximum permissible rated continuous operational current is calculated first:

$$200 \text{ A} \cdot 0.9 = 180 \text{ A}$$

The setting value for instantaneous short-circuit protection ( $I_i$ ) is then determined on the basis of the correction factor from the table above:

$$I_i = 2000 \text{ A} \cdot 0.6 = 1200 \text{ A}$$

#### 6.4.4 Derating for the electronic trip units of 3VA6 molded case circuit breakers

The ambient temperature has no effect on the current measurement of the electronic trip units of 3VA6 molded case circuit breakers. The Rogowski coils integrated in the trip unit measure the current and compare it to the set tripping threshold. Higher or lower ambient temperatures do not influence the tripping threshold, which means that it is not necessary to apply correction factors.

##### Limitation of the rated operational current

The temperature inside the molded case circuit breaker is nonetheless influenced by the ambient temperature and the current-dependent power loss generated inside the unit. To prevent overloading of molded case circuit breakers under difficult thermal conditions, the maximum rated continuous operational current must therefore be limited as a function of the ambient temperature in some cases:

The tables below contain the maximum rated uninterrupted operational current as a function of the accessories to be taken into account and the ambient temperature. The operational current must never exceed the maximum rated operational current of the molded case circuit breaker.

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##### Note

The values do not apply to all installation situations of the molded case circuit breaker and may deviate depending upon factors such as cables and busbars, packing density, ventilation, etc.

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

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When connecting terminals with control wire tap are used, the total current from the main circuit and control wire must not exceed the maximum rated operational current of the molded case circuit breaker.

3VA6 molded case circuit breakers for line protection

Fixed-mounted:

Internal accessories	ETU electronic trip units	Size [A]	Rated operational current $I_n$ [A]	Maximum rated uninterrupted operational current												
				86 °F 30 °C	95 °F 35 °C	104 °F 40 °C	113 °F 45 °C	122 °F 50 °C	131 °F 55 °C	140 °F 60 °C	149 °F 65 °C	158 °F 70 °C				
				[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]				
Line protection fixed mounted version	Basic circuit breaker	150	40													
			100													
			150										145	139	133	128
		250	100													
			250										241	232	222	213
			400										385	370	355	340
		600	400													
			600										593	575	557	538
		5-series and 8-series	150	40												
				100												
	150			143										135	128	120
	250		100													
			250										238	225	213	200
	400		250													
400			375										350	325	300	
600	400															
	600	570										540	510	480	450	
COM060	5-series and 8-series	150	40													
			100													
			150										139	129	119	108
		250	100													
			250										232	215	198	180
		400	250													
			400										368	335	303	270
		600	400													
600	588		548										507	467	426	385

COM060 COM060 communication module

 No derating up to the rated operational current  $I_n$  of the molded case circuit breaker

Plug-in and draw-out technology:

Internal access ories	ETU electronic trip units	Size [A]	Rated operational current I <sub>n</sub> [A]	Maximum rated uninterrupted operational current								
				86 °F 30 °C	95 °F 35 °C	104 °F 40 °C	113 °F 45 °C	122 °F 50 °C	131 °F 55 °C	140 °F 60 °C	149 °F 65 °C	158 °F 70 °C
				[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]
Line protection plug-in and draw-out technology	Basic circuit breaker	150	40									
			100									
		150	150	147	143	138	132	126	122	117		
			250	100								
		250	250	245								
			400	250								
	400	390		375								
	600	400										
		600										585
	5-series and 8-series	150	40									
			100									
		150	150	143	136	129	122	116	109	102		
250			100									
250		250	238									
		400	250									
400	380		360									
600	400											
	600										585	562
COM060	5-series and 8-series	150	40									
			100									
		150	150	143	136	128	121	113	106	99		
			250	100								
		250	250	238								
			400	250								
400	355	320		285								
600	400											
	600										514	487

COM060 COM060 communication module


No derating up to the rated operational current I<sub>n</sub> of the molded case circuit breaker

3VA6 molded case circuit breakers for starter protection

Fixed-mounted:

Internal accessories	ETU electronic trip units	Size [A]	Rated operational current $I_n$ [A]	Maximum rated uninterrupted operational current										
				86 °F 30 °C [A]	95 °F 35 °C [A]	104 °F 40 °C [A]	113 °F 45 °C [A]	122 °F 50 °C [A]	131 °F 55 °C [A]	140 °F 60 °C [A]	149 °F 65 °C [A]	158 °F 70 °C [A]		
Motor circuit protector (MCP) fixed mounted version	Basic circuit breaker	3-series	150	25 ... 100										
			250	110 ... 150										
			400	200										
				250										
			600	400										
		500							495	490	485	480		
		5-series and 8-series	150	25 ... 100										
			250	110 ... 150										
			400	200										
				250										
600	400													
500								477	455	432	410			
COM060	5-series and 8-series	150	25 ... 100											
		250	110 ... 150											
		400	200											
			250											
		600	400											
500								462	425	387	350			

COM060 COM060 communication module

 No derating up to the rated operational current  $I_n$  of the molded case circuit breaker





3VA6 molded case switches

Molded case switch (MCS)	Accessories	Trip units	Size [A]	Rated operational current $I_n$ [A]	Maximum rated uninterrupted operational current								
					86 °F 30 °C [A]	95 °F 35 °C [A]	104 °F 40 °C [A]	113 °F 45 °C [A]	122 °F 50 °C [A]	131 °F 55 °C [A]	140 °F 60 °C [A]	149 °F 65 °C [A]	158 °F 70 °C [A]
Fixed mounted		MCS110	400	400	593 575 557 538 520								
			600	600									

COM060 COM060 communication module

No derating up to the rated operational current  $I_n$  of the molded case circuit breaker

Molded case switch (MCS)	Accessories	Trip units	Size [A]	Rated operational current $I_n$ [A]	Maximum rated uninterrupted operational current								
					86 °F 30 °C [A]	95 °F 35 °C [A]	104 °F 40 °C [A]	113 °F 45 °C [A]	122 °F 50 °C [A]	131 °F 55 °C [A]	140 °F 60 °C [A]	149 °F 65 °C [A]	158 °F 70 °C [A]
Plug-in technology		MCS110	400	400					390	375	360	345	330
			600	600	585	562	540	525	510	495	480	465	450

COM060 COM060 communication module

No derating up to the rated operational current  $I_n$  of the molded case circuit breaker

**Example 1**

Starting point:

A 3VA61 100 A molded case circuit breaker with an ETU350 LSI trip unit is to be operated at 70 °C with plug-in technology:

$$I_{r(\max 70^\circ C)} = 100 \text{ A}$$

No derating is required.

**Example 2**

Starting point:

A 3VA62 250 A molded case circuit breaker with an ETU850 LSI trip unit is to be operated at 60 °C with plug-in technology and the COM060 communication module:

$$I_{r(\max 60^\circ C)} = 189 \text{ A}$$



# Appendix

## A.1 Standards and approvals

### Description

Table A- 1 International standards that the molded case circuit breakers of the 3VA5 and 3VA6 ranges meet

Standard		Title
CISPR11	Class A	Limits and methods of measurement of radio interference suppression of equipment in industrial environments.
	Class B	Limits and methods of measurement of radio interference suppression of equipment in domestic environments.
IEC 60664-1		Insulation coordination for equipment within low-voltage systems.
IEC 60068-2-1 "Ab"		Environmental testing - Part 2-1: Tests - Test A: Cold
IEC 60068-2-2 "Bd"		Environmental testing - Part 2-2: Tests - Test B: Dry heat
IEC 60068-2-27 "Ea"		Environmental testing - Part 2-27: Tests - Test Ea and guidance Shock
IEC 60068-2-30 "Db"		Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 + 12 hours)
IEC 60068-2-52		Environmental testing - Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution)
IEC 60068-2-6 "Fc"		Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)
IEC 60228 Class 1		Solid conductors
IEC 60228 Class 2		Stranded conductors
IEC 60228 Class 5		Flexible conductors
IEC 60228 Class 6		Very flexible conductors (more flexibility than Class 5)
IEC 60364-4-41		Electrical installations of buildings - Part 4-41: Protection for safety - Protection against electric shock
VDE 0100-410		
IEC 60529		Degrees of protection provided by enclosures (IP code)
IEC 60947-1 / DIN EN 60947-1 (VDE 0600-100)		Low-voltage switchgear and controlgear – General rules
IEC / EN 60947-1		Low-voltage switchgear and controlgear – General rules
IEC / EN 60947-1, Annex S		Digital inputs and/or digital outputs contained in switchgear and controlgear
IEC / EN 60947-2 Edition 4.1, 05.2009		Low-voltage switchgear and controlgear - Part 2: Circuit-Breakers
IEC / EN 60947-2 A1		
IEC / EN 60947-2, Annex B		Circuit-breakers incorporating residual current protection

Standard	Title
IEC / EN 60947-2, Annex H	"Test sequence for circuit-breakers for IT systems" "Circuit-breakers for IT systems"
IEC / EN 60947-3 / DIN EN 60947-3 (VDE 0660-107)	Low-voltage switchgear and controlgear – Switches, disconnectors, switch-disconnectors and fuse-combination units
IEC 60947-4-1 / DIN EN 60947-4-1 (VDE 0660-102)	Low-voltage switchgear and controlgear: Contactors and motor-starters
IEC / EN 61000-4-2	Electrostatic discharge immunity test
IEC / EN 61000-4-3	Radiated, radio-frequency, electromagnetic field immunity test
IEC / EN 61000-4-4	Electrical fast transient/burst immunity test
IEC / EN 61000-4-5	Surge immunity test
IEC / EN 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields
IEC 61557-12	Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 12: Performance measuring and monitoring devices (PMD)
UL 489	UL Standard for Safety for Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 1053	Standard For Safety For Ground-Fault Sensing and Relaying Equipment
	RoHS Directive 2002/95/EC (Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment).

#### National standards that the 3VA UL molded case circuit breakers meet

You will find the national standards that the 3VA UL molded case circuit breakers meet at (<http://www.siemens.com/3VA-Documentation>)

#### Certification by marine classification societies

You will find the marine approvals that the 3VA UL molded case circuit breakers meet at (<http://www.siemens.com/3VA-Documentation>)

#### Disposal of waste electronic equipment



Waste electronic equipment must not be disposed of as unsorted municipal waste, e.g. household waste. When disposing of waste electronic equipment, the current local national/international regulations must be observed.

## ESD guidelines

### B.1 Electrostatic sensitive devices (ESD)

ESD components are destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged. ESD components which have been subject to such voltage are usually not recognized immediately as being defective, because the malfunction does not occur until after a longer period of operation.

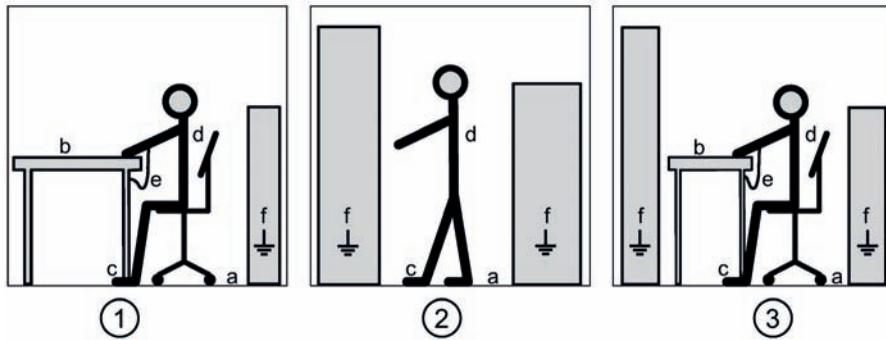
#### ESD Guidelines

<b>NOTICE</b>
<b>Electrostatic sensitive devices</b> Electronic modules contain components that can be destroyed by electrostatic discharge. These modules can be easily destroyed or damaged by improper handling. <ul style="list-style-type: none"><li>• You must discharge your body electrostatically immediately before touching an electronic component. To do this, touch a conductive, grounded object, e.g., a bare metal part of a switch cabinet or the water pipe.</li><li>• Always hold the component by the plastic enclosure.</li><li>• 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.</li><li>• Always place electrostatic sensitive devices on conductive bases.</li><li>• Always store and transport electronic modules or components in ESD-safe conductive packaging, e.g. metallized plastic or metal containers. Leave the component in its packaging until installation.</li></ul>

<b>NOTICE</b>
<b>Storage and transport</b> If you have to store or transport the component in non-conductive packaging, you must first pack the component in ESD-safe, conductive material, e.g., conductive foam rubber, ESD bag.

B.1 Electrostatic sensitive devices (ESD)

The diagrams below illustrate the required ESD protective measures for electrostatic sensitive devices.



- (1) ESD seat
- (2) ESD standing position
- (3) ESD seat and ESD standing position

Protective measures

- a Conductive floor
- b ESD table
- c ESD footwear
- d ESD smock
- e ESD bracelet
- f Panel ground connection

Figure B-1 ESD work center

# List of abbreviations

## C.1 Table of abbreviations

### Summary

Table C- 1 Meaning of abbreviations used in this document

<b>Abbreviation</b>	<b>Meaning</b>
AC	AC voltage
ACT	ACTIVE (ready signal)
AL	ALARM (pre-alarm)
ASCII [Modbus interface]	American Standard Code for Information Interchange
ATAM	Adjustable Thermal Adjustable Magnetic Trip Unit (adjustable thermal overload release, adjustable magnetic trip unit with short-circuit protection)
ATFM	Adjustable Thermal Fixed Magnetic Trip Unit (adjustable thermal overload release, permanently set magnetic trip unit with short-circuit protection)
ATSE	Automatic Transfer Switching Equipment
AUX	Auxiliary switch
C	Common
CB-S	Circuit Breaker Switch (standard auxiliary switch (NO contact))
CD	Compact Disk
COM-DO	COM-Draw-out-Kit
DAS	Dynamic Arc Sentry
DC	Direct voltage
DIN	Deutsches Institut für Normierung e. V. (German Institute for Standardization)
DISCON	DISCONNECT
DO	Draw out
EFB	External Function Box
ESD	Electrostatic sensitive devices
EMC	Electromagnetic compatibility
EN	European Standard
ETU	Electronic trip unit
FTAM	Fixed thermal adjustable magnetic trip unit (permanently set thermal overload release, adjustable magnetic trip unit with short-circuit protection)
FTFM	Fixed thermal fixed magnetic trip unit (permanently set thermal overload release, permanently set magnetic trip unit with short-circuit protection)
G	Ground fault (ground fault protection)
GF [tripping characteristic]	Ground fault

Abbreviation	Meaning
HH-fuse	High-voltage fuses
HID	High-intensity discharge
I	Instantaneous (short-circuit protection)
I	Isolated
I- / O-	Input / Output
IEC	International Electrotechnical Commission
INST [tripping characteristic]	INST [tripping characteristic]
INSTA	Final distribution area
IP	International Protection
IT	Injection Tester
IT	Isolated ground, French: "Isolé Terre"
L	Long-time delay (overload protection)
L	Overload protection
LBS	Load Break Switch (switch disconnecter)
LCS	Leading changeover switch
LI	Overload protection (L) and instantaneous short-circuit protection (I)
LIG	Overload protection (L), instantaneous short-circuit protection (I) and ground-fault protection (G)
LIN	Overload protection (L), instantaneous short-circuit protection (I) and neutral-conductor protection (N)
LSI	Overload protection (L), short-time delayed short-circuit protection (S) and instantaneous short-circuit protection (I)
LSIN	Overload protection (L), short-time delayed short-circuit protection (S), instantaneous short-circuit protection (I) and neutral-conductor protection (N)
LSING	Overload protection (L), short-time delayed short-circuit protection (S), instantaneous short-circuit protection (I) and ground-fault protection (N)
LT [tripping characteristic]	Partial overload range of the characteristic curve of a switching device
MCCB	Molded case circuit breaker
MCP	Motor circuit protector
MCS	Molded case switch
MMB	Maintenance mode box
MO	Motor operator
N	Neutral conductor
NC	Normally closed contact
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association.
NO	Normally open contact
LV	Low voltage
LV fuse	Low-voltage fuse
PAC	Power Analysis & Control
PI	Plug-in (unit)
R	RESET



<b>Abbreviation</b>	<b>Meaning</b>
RCR	Residual Current Release
REC	Reclose (automatic reset)
RJ [connector]	Registered Jack
RMS	Root Mean Square
RS [interface]	Formerly: Radio Selector; now usually: Recommended Standard
RTU [Modbus interface]	Remote Terminal Unit
SAS	Short circuit alarm switch
PLC	Programmable logic controller
ST	Shunt trip
STF	Shunt trip flexible
STL	Shunt trip left
SWD	Switching duty
T	Test
T [IT systems]	French: Terre (ground)
TC	Test device for molded case circuit breaker or MRCD, suitable for systems with grounded phase
TCP	Transmission Control Protocol
TD	Test Device
TM	Thermal Magnetic
TMTU	Thermal Magnetic Trip Unit
TRIP-IND	TRIP INDICATOR (trip alarm switch)
TRUE RMS	TRUE root-mean-square
TU	Trip Unit
UAR	Universal release
UL	Underwriters Laboratories Inc.
UR	Undervoltage release
USB	Universal Serial Bus
UPS	Uninterruptible power supply
UVR	Undervoltage release
VDE	Verein Deutscher Ingenieure (Association of German Electrical Engineers)
VDI	Verein Deutscher Ingenieure (Association of German Engineers)
ZSI	Zone Selective Interlocking
ZSS	Zone Selective Interlocking

Table C- 2 Meaning of symbols and abbreviations

Symbol/ abbreviation	Meaning
$\Delta t$	Delay time
$I_{\Delta n}$	Residual current; rated residual current; response current
$I_1$	Inrush current
$I'_{KG}$	Initial balanced short-circuit current
$I_t$	Let-through energy
$I_B$	Take-over current
$I_b$	Pickup value blocking protection
$I_{cm}$	Making capacity; rated short-circuit making capacity
$I_{cn}$	Rated short-circuit breaking capacity
$I_{cs}$	Maximum rated service short-circuit breaking capacity
$I_{cu}$	Maximum rated ultimate short-circuit breaking capacity
$I_{cw}$	Rated short-time withstand current; rated short-time current
$I_d$	Prospective current; residual current; response residual current
$I_D$	Let-through current
$I_g$	Ground-fault protection; ground-fault release; ground-fault current setting value
$I_i$	Instantaneous tripping current; instantaneous short-circuit protection; instantaneous magnetic protection; rated tripping current of instantaneous trip
$I_k$	Short-circuit current
$I_{KD}$	Uninterrupted short-circuit current
$I_{K MAX}$	Maximum short-circuit current
$I_{Kmaxline}$	Uninterrupted short-circuit current of system
$I_n$	Rated operational current
$I_{nG}$	Rated operational current (generator)
$I_p$	Rated peak withstand current, impulse short-circuit current
$I_r$	Thermal protection; setting current; response value; current setting value of adjustable overload protection (pickup value overload protection)
$I_s$	Limit current with selectivity; maximum short-circuit current for selectivity limit
$I_{sc}$	Prospective current
$I_{sd}$	Short-time delayed tripping current; response current of S protection; short-time delayed short-circuit release; short-time delayed short-circuit protection; delay time of S protection
$I_{th}$	Conventional free-air thermal current
$I_U$	Rated uninterrupted current
$R_A$	Contact resistance of exposed conductive part ground
$t_1$	Time of inrush current
$t_2$	Ramp up time
$t_A$	Safety clearance
$t_b$	Delay time (delay of blocking time)
$t_d$	Response time
$t_g$	Delay time associated with the adjustable response current; trip time associated with ground-fault current setting value

<b>Symbol/ abbreviation</b>	<b>Meaning</b>
$t_i$	"Virtual" trip time of I protection; highest trip time associated with rated tripping current of instantaneous trip
$t_d$	Trip time associated with current setting value of adjustable overload release
$T_p$	Trip time; delay time; time-lag class
$t_{sd}$	Trip time associated with short-time delayed tripping current; delay time of S protection
$t_s$	Fuse operating time
$t_{zSI}$	Delay time of all molded case circuit breakers which detect the short circuit but do not receive a blocking signal when ZSI is activated.
$U$	Voltage across main contacts of the molded case circuit breaker
$U_e$	Maximum voltage; rated operating voltage
$U_{Nn}$	System rated voltage



## Conversion tables

### D.1 Conversion tables

The U.S. units can be converted to the corresponding European/metric units using the conversion tables listed.

---

#### Note

**No liability assumed for completeness or accuracy**

No liability can be assumed for the completeness or accuracy of the values listed in this section of the manual.

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#### Conversion of North American cross section dimensions into metric cross section dimensions

Metric cross-sections in accordance with VDE (Verband Deutscher Elektroingenieure (Association of German Electrical Engineers)) (mm<sup>2</sup>) ↔ conductor cross-sections in accordance with AWG (American Wire Gauge) or kcmil (Thousand Circular Mills)

##### AWG ↔ mm<sup>2</sup> conversion table

	AWG / kcmil	Diameter d/mm	mm <sup>2</sup>	Metric equivalent [mm <sup>2</sup> ]
AWG	20	0.81 <sup>1)</sup>	0.52	0.75
	18	1.02 <sup>1)</sup>	0.82	1
	16	1.29 <sup>1)</sup>	1.3	1.5
	14	1.63 <sup>1)</sup>	2.08	2.5
	12	2.05 <sup>1)</sup>	3.31	4
	10	2.59 <sup>1)</sup>	5.26	6
	8	3.26 <sup>1)</sup>	8.4	10
	6	4.12 <sup>1)</sup>	13.3	16
	4	5.19 <sup>1)</sup>	21.2	25
	2	6.54 <sup>1)</sup>	33.6	35
	1	7.34 <sup>1)</sup>	42.4	50
	1 / 0	8.25 <sup>1)</sup>	53.5	—
	2 / 0	9.27 <sup>1)</sup>	67.4	70
	3 / 0	10.4 <sup>1)</sup>	85.0	95
4 / 0	11.68 <sup>1)</sup>	107	120	

1) Diameters over Solid Conductors and Cross-Sectional Area for All Solid and Stranded Conductors  
Source: Standard UL 83

kcmil ↔ mm<sup>2</sup> conversion table

	AWG / kcmil	Diameter d/mm	mm <sup>2</sup>
kcmil	250	14.6 <sup>1)</sup>	126
	300	16 <sup>1)</sup>	152
	350	17.3 <sup>1)</sup>	177
	400	18.49 <sup>1)</sup>	203
	500	20.65 <sup>1)</sup>	253
	600	22.68 <sup>1)</sup>	304
	800	26.16 <sup>1)</sup>	405
	1000	29.26 <sup>1)</sup>	507
	1500	35.86 <sup>1)</sup>	760
	2000	41.45 <sup>1)</sup>	1010

1) Diameter over Round Concentric-Lay-Stranded Conductors for Classes B, C and D  
Source: Standard UL83

## Other conversions

### Conversion factors for units of length

Length	Conversion factor
1 inch (")	25.4 millimeters (mm)
1 centimeter	0.3937 inches (")

### Conversion factors for units of weight

Weight	Conversion factor
1 ounce (Oz.)	28.35 grams (g)
1 pound (lb.)	0.454 kilograms (kg)
1 kilogram (kg)	2.205 pounds (lb.)

Pound (lb.)

### Conversion for units of temperature

Temperature	
100 degrees Centigrade (°C)	212 degrees Fahrenheit (°F)
80 °C	176 °F
60 °C	140 °F
40 °C	104 °F
20 °C	68 °F
0 °C	32 °F
- 5 °C	23 °F
- 10 °C	14 °F
- 15 °C	5 °F
- 20 °C	- 4 °F
- 25 °C	- 13 °F
- 30 °C	- 22 °F

### Conversion factors for tightening torques

Tightening torque	Conversion factor
1 Newton meter (Nm)	8.85 lbF in, 8.85 lb-in (inch-pound)
1.36 Newton meter (Nm)	1 lbF ft, 1 lb-ft (food-pound)
0.113 Newton meter (Nm)	1 lbF in, 1 lb-in (inch-pound); 1 / 12 lb-ft





# Glossary

## AUTO

Method of remote operation of the motor operators via control cables, e.g. PLC.

## Breaking capacity

The breaking capacity is the rms value of the current at a specific  $\cos \phi$  (power factor) and a specific voltage which can be safely interrupted by a switching device or fuse under prescribed conditions. The rms value of the symmetrical component applies in the case of alternating current.

## $I^2t$ characteristic

The  $I^2t$  characteristic is a curve that represents the minimum or maximum values of  $I^2t$  in relation to break times as a function of the prospective current under defined operating conditions.

## $I^2t$ value

The  $I^2t$  value is the thermal value of a prospective or limited short-circuit current (let-through current).

## Let-through current

The let-through current  $I_b$  is the maximum instantaneous current value during the breaking time of a switching device or fuse. Limited short-circuit currents occur if the switching device reduces the amplitude of the short-circuit current due to, for example, resistance, switching delay and peak arc voltage. The let-through current of a device such as a current-limiting fuse or a current-limiting molded case circuit breaker determines the thermal load ( $I^2t$  value) imposed on equipment connected downstream of the device (current limiting).

## LOCK

Operating mode of motor operators; the operator is locked and cannot be operated.

## Making capacity

The making capacity is the value of the prospective making current which the switching device can safely conduct at the instant of closing under prescribed conditions for a specific circuit.

For molded case circuit breakers, the making capacity is expressed as the maximum possible instantaneous value of the potential prospective current at the input terminals for the specified voltage.

## MANUAL

Local, manual operating mode of motor operators.

### Protective characteristic

The protective characteristic is determined by the rated operational current and the setting and tripping values of the circuit breaker.

### Rated breaking capacity

The circuit breaker must disconnect this current **three times** without damage. This is followed by, among other things, a check of the operating characteristics. That is, the switch must **subsequently** be able to conduct the **operational current** and to still switch at least once.

### Rated frequency

Design frequency for a switching device and reference value for other characteristics of the device.

### Rated making capacity

The rated making capacity is the maximum current that a switching device can conduct at the instant of closing in accordance with the utilization category at the relevant rated operational voltage.

### Rated operational current

The rated operational current  $I_n$  for molded case circuit breakers is equivalent to the rated uninterrupted current  $I_U$  and to the conventional free-air thermal current  $I_{th}$ .

### Rated operational voltage

The rated operational voltage  $U_e$  of a switching device, e.g. a molded case circuit breaker, is the voltage which serves as a reference to state other characteristics of the device. The maximum rated operational voltage must never be higher than the rated insulation voltage.

With multi-phase circuits, the specified voltage is generally the phase-to-phase voltage.

### Rated peak withstand current, impulse short-circuit current

Maximum permissible instantaneous (peak) value of the prospective short-circuit current in the current path under the highest load. It characterizes the dynamic short-circuit strength of a switching device.

### Rated residual current

The rated residual current  $I_{\Delta n}$  is the fault (residual) current for which residual current-operated circuit breakers are designed. The residual current rating is declared on the rating plate of the device.

### Rated service short-circuit breaking capacity

The rated service short-circuit breaking capacity  $I_{cs}$  is the short-circuit current determined by the operational voltage that a molded case circuit breaker is capable of interrupting repeatedly (test O - CO - CO, formerly test sequence P II). After a molded case circuit breaker has interrupted a short circuit, it can continue to carry the rated operational current despite increased self-heating and will trip again in the event of a short circuit.

### Rated short-circuit breaking capacity

The rated short-circuit breaking capacity  $I_{cn}$  of a molded case circuit breaker is the maximum current that the circuit breaker can safely interrupt at a specific rated operational voltage and rated frequency. It is specified as an rms value.

With AC molded case circuit breakers, the rated short-circuit breaking capacity must be independent of the magnitude of the DC component. The rated short-circuit breaking capacity also ensures that the molded case circuit breaker can interrupt every current up to the rated short-circuit breaking capacity in the event of a line-frequency recovery voltage with 110% of the rated operational voltage.

This applies:

- To alternating current at every value of the power factor, but not lower than the value defined in the relevant test specification.
- To direct current (unless otherwise specified by the manufacturer) with every time constant, but not greater than the value defined in the relevant test specification.

The short-circuit breaking capacity does not apply in the event of a recovery voltage at line frequency above 110% of the rated operational voltage.

### Rated short-circuit making capacity

The rated short-circuit making capacity  $I_{cm}$  of a molded case circuit breaker is the maximum current that the circuit breaker can safely interrupt at a specific rated operational voltage and rated frequency. Unlike other characteristic data, this is specified as a peak value.

With AC molded case circuit breakers, the rated short-circuit making capacity must be at least equal to the rated short-circuit breaking capacity multiplied by a factor  $n$ .

The rated short-circuit making capacity is calculated to allow the molded case circuit breaker to conduct the current during closing at a voltage of up to 110% inclusive of the rated operational voltage.

### Rated short-time current

Permissible rms value of the AC component of the prospective short-circuit current which the switching device is capable of conducting for a specific time period, e.g. from 0.05 s to 1 s (thermal short-circuit strength).

### Rated short-time withstand current

The rated short-time withstand current  $I_{cw}$  is specified as an rms value of the short-circuit current and characterizes the thermal strength of a circuit of a switchgear assembly under brief load conditions. The rated short-time withstand current calculation normally refers to a period of 1 s. The reference time must be specified if it deviates from the above. The rated short-time withstand current is specified for the distribution and/or main busbars of a switchgear assembly.

### Rated ultimate short-circuit breaking capacity

The rated ultimate short-circuit breaking capacity  $I_{cu}$  is the maximum short-circuit current that a molded case circuit breaker is capable of interrupting (test O - CO, formerly test sequence P III). After the molded case circuit breaker has cleared the short circuit, it is capable of tripping with increased tolerances under overload conditions.

Limit value of rated ultimate short-circuit breaking capacity  $I_{cu}$ .

### Rated uninterrupted current

The rated uninterrupted current  $I_U$  of a switching device, e.g. a molded case circuit breaker, is a current that the device can conduct in uninterrupted operation (for weeks, months or years). This current is specified by the manufacturer.

### Rating

The rating is the power that a switching device is capable of switching at the associated rated operational voltage in accordance with the utilization category, e.g. power contactor utilization category AC-3:37 kW at 400 V.

### Remote control

Or AUTO; method of remote operation of the motor operators via control cables, e.g. PLC.

### Short circuit

Connection with a negligibly low impedance between two points of different potential in an electric circuit. The short-circuit current is a multiple of the rated operating current. Short circuits can cause thermal or mechanical damage to switching devices and other parts of an electrical installation.

**Short-circuit strength**

This is the resistivity of a switching device in the closed state, along with its components (e.g. trip units), or a complete switchboard to the electrodynamic and thermal stresses which arise in the event of a short circuit.

The characteristic for the dynamic stress is the rated peak withstand current, which is the maximum instantaneous value of the short-circuit current.

The characteristic for the thermal stress of the short-circuit current is the root-mean-square value of the short-circuit current throughout its duration.

**Tripping current of overload release**

The current value at which a trip unit trips within a specified time.

**Tripping current, ground fault**

When the ground fault current reaches or exceeds this limit value, the ground-fault protection, for example, of a molded case circuit breaker, is tripped.

**Tripping current, instantaneous**

When this current limit is exceeded, the circuit breaker trips instantaneously.

**Tripping current, overload**

When this uninterrupted current limit is exceeded within a predefined time period, the circuit breaker trips (inverse-time delayed tripping).

**Tripping current, short-time delayed**

When this current limit is exceeded, the circuit breaker trips after a predefined time delay.

**Tripping time**

Period of time from the instant of commencement of trip command output to the moment at which the command becomes irrevocable (timing concept for the tripping of circuit breakers).



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