# Sustainability@SI

#### Smart infrastructure is sustainable infrastructure.



Siemens as a company takes an all-round view of environmental, social and governance criteria (ESG) with its DEGREE rulebook (decarbonization, ethics, governance, resource efficiency, equity and employability). Not only are we committed to reducing the carbon footprint in our own plants to net zero by 2030, but also to helping our customers achieve their decarbonization and sustainability objectives. The main areas in which smart infrastructure contributes to the DEGREE rulebook are decarbonization, resource efficiency and employability.

#### Mission & strategy

As a focused technology company, Siemens is committed to tackling the world's most profound challenges by leveraging the synergies of digitalization and sustainability.

#### Technology with a purpose

We develop technologies that interconnect the real world and the digital world and enable our customers to make positive changes to their industries, which form the backbone of our economy: industry, infrastructure, transportation and healthcare.

#### Our contribution

Siemens makes a difference every single day by providing innovative solutions for challenges in environmental protection, decarbonization, health and safety. Innovative solutions that have a clear purpose: to make the world more sustainable, more integrative and a better place to live.

#### Facts about sustainability

For almost 175 years, Siemens has been driven by the desire to improve the lives of people around the world with our technologies.

Further information at: www.siemens.com/sustainability

## New products

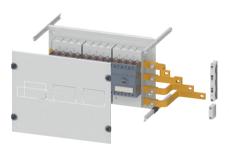
#### SENTRON COM – Version 1.1



- Stability and system improvements
- Additional signals for devices
  - Restart
  - Manual tripping
  - Confirmation of tripping
  - Deactivation of an alarm, etc.
- 5SL6 COM miniature circuit breakers & AFDD/LS 5SV6 COM
  - Additional information about the switching state
- 5ST3 COM auxiliary switches and fault signal contacts
  - Additional device information about the mounted device (name, type)
- 7KN Powercenter 1000
  - Additional temperature measurement and Bluetooth improvements
- Update function of the entire system via SENTRON powerconfig software

See chapter 10 Page 10/20

### SIVACON S4 - 3VA Integration

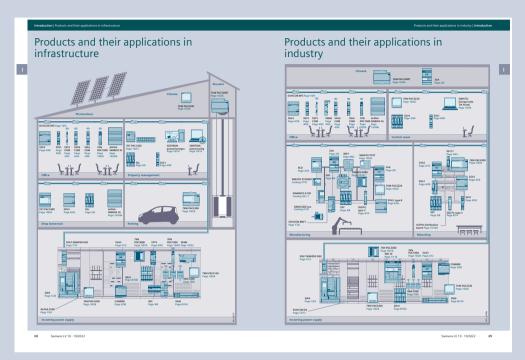


- Extensions in the outgoing feeder panel
  - 3VA integration up to 1600 A with rear terminals
  - 8US multiple feeders in 4-pole version up to 630 A

See chapter 15 Page 15/66

## The fast route to the product

Overviews and matrix tables for better orientation within the catalog



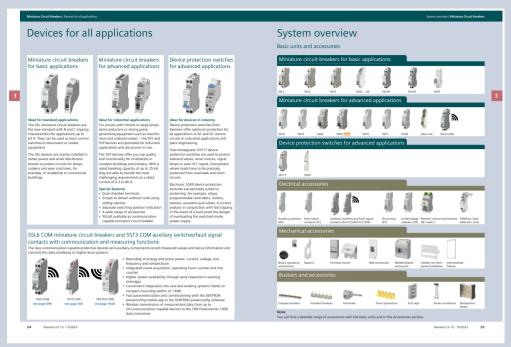
### Overview of products and their applications

On pages I/8 to I/9 you can find an overview of the diverse portfolio of catalog LV 10.



# Protection, switching, measuring and monitoring tasks

From page 1/28 onwards, the catalog LV 10 portfolio is dedicated to the most important protection, switching, measuring and monitoring tasks.



#### System overview

An overview of the basic units and accessories can be found in the system overview at the beginning of the chapters or sections. The color helps you recognize the accessory at a glance.



#### Overview of basic units

The overviews at the beginning of the chapters and sections help you make a quick advance selection of the basic units. You can use the important technical specifications to compare the basic units. Page references quickly take you to the suitable devices.

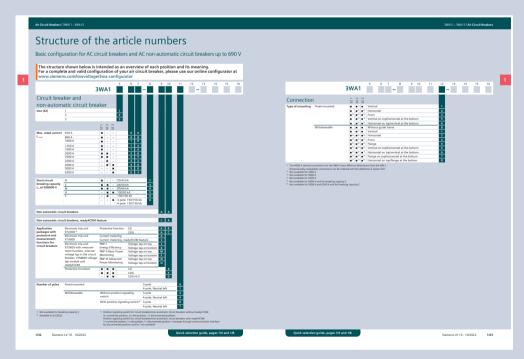
## The fast route to the product

#### Overviews and matrix tables for better orientation within the catalog



#### **Product page**

The article number matrix shows you on the spot which product variants are available. The matching accessories are clearly dedicated to each basic unit – often directly on the same page.



#### Configurable products

For products which are conveniently configurable online, the structure of the article numbers is clearly displayed. A link takes you directly to the configurator which permits complete and valid configuration.

#### Clickable article numbers

Direct forwarding to the individual products in the Industry Mall by clicking on the article number in the catalog



or by entering this web address incl. article number www.siemens.com/product?Article No.

#### **new Search function**

Search for new products by entering "new" in the text field of the search function



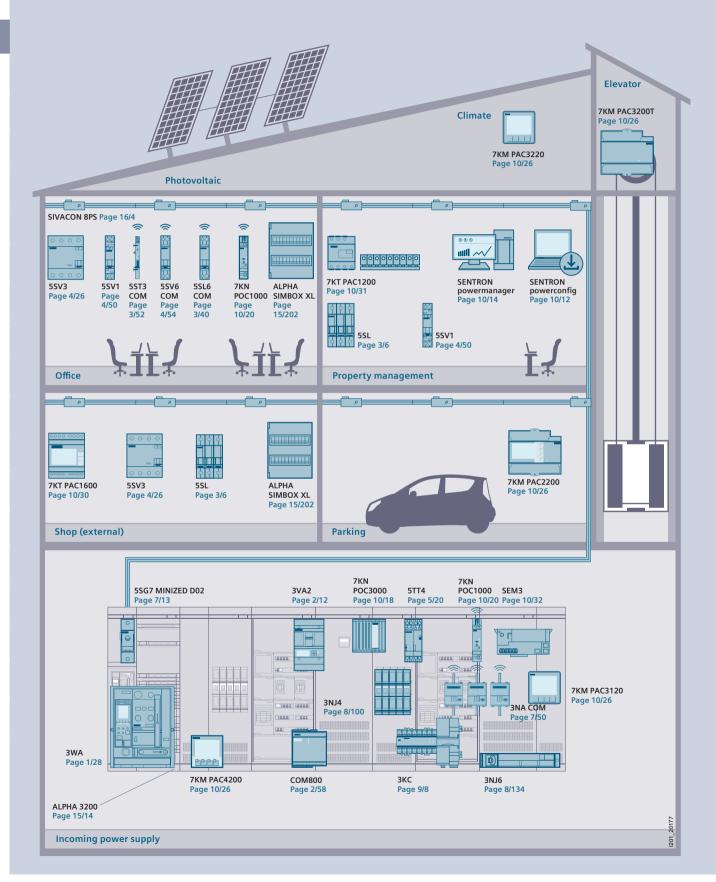
#### Clickable images new

Direct forwarding to the individual motif types in the Industry image database by clicking on the images in the catalog

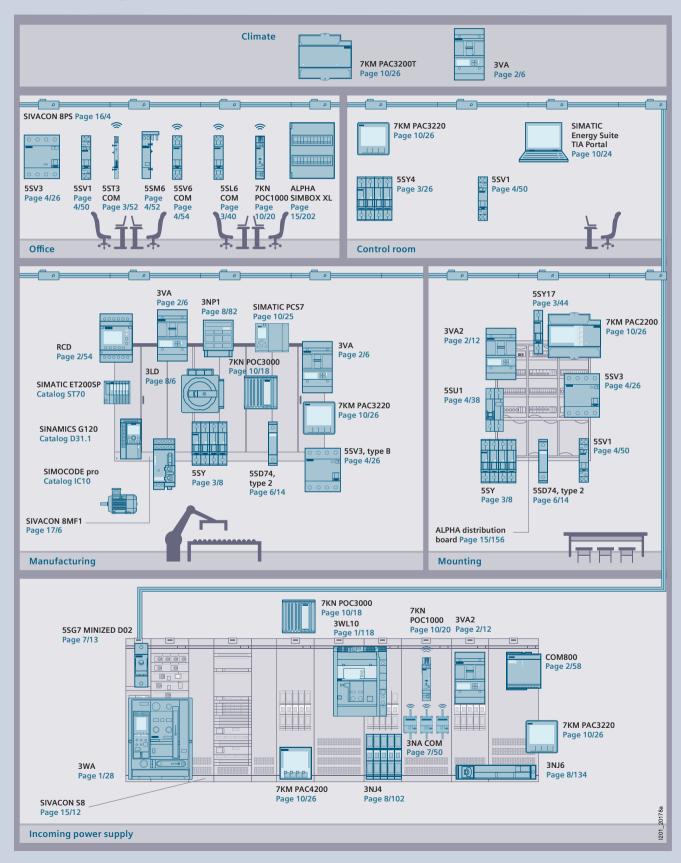


Industry image database: www.siemens.com/lowvoltage/picturedb

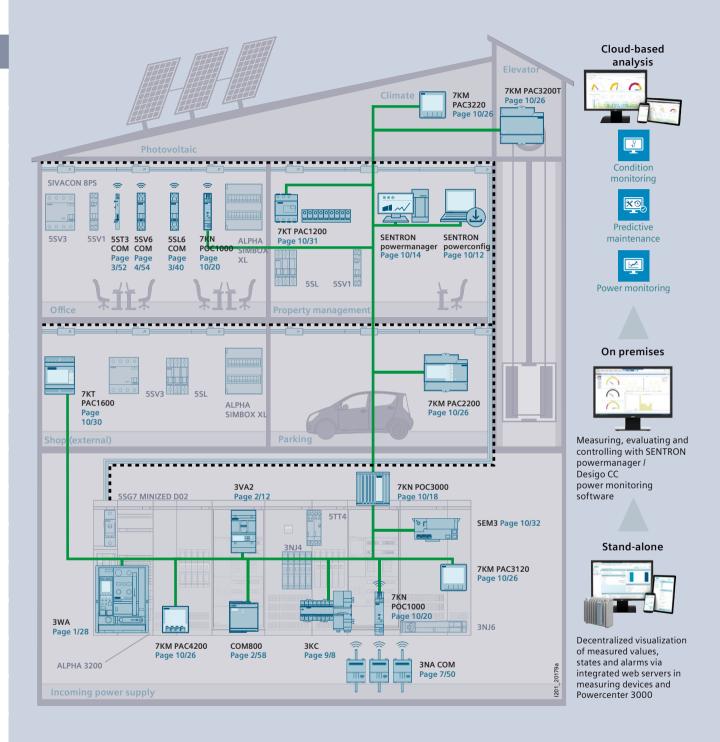
# Products and their applications in infrastructure



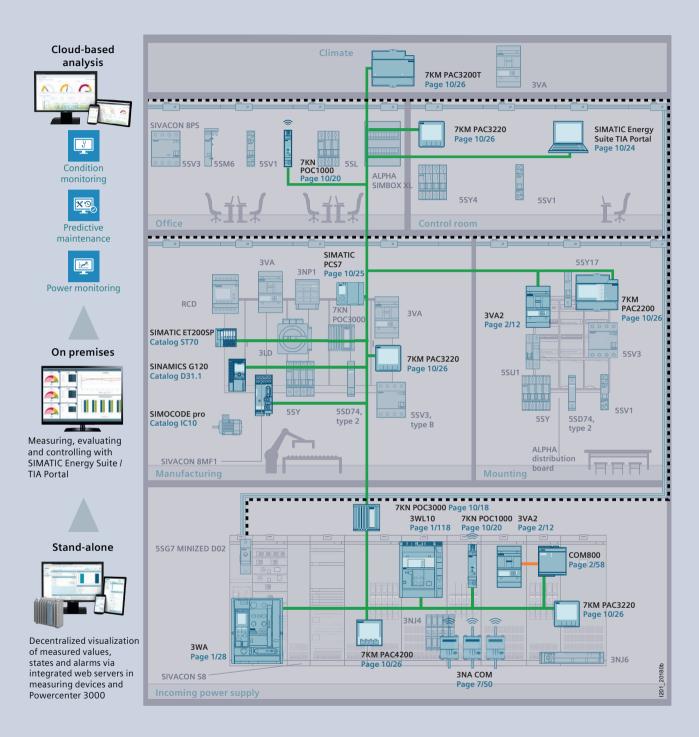
# Products and their applications in industry

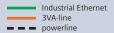


# Examples of digitalization in infrastructure



# Examples of digitalization in industry





# Introduction to the topic of digitalization and Industry 4.0

In industrial automation, the demand for communication capability, data transparency and flexibility is growing constantly. To enable industrial switchgear technology to meet this demand, the use of bus systems and intelligent switching devices is unavoidable.

#### Digitalization

Protection, switching and measuring devices in power distribution systems can display important information on local visualization via integrated communication, e.g. in Powercenter, or transmit it to energy data management systems (EDMS), e.g. SENTRON powermanager, as well as to cloud systems and applications.

- Diagnostics management
- Fault management Email alarm
- Maintenance management predictive maintenance
- Cost center management

#### 1. Visualization and plant transparency



- Greater operational reliability thanks to remote access to the plant.
- Plant visualization for central and simple access to all device information.

#### 2. Digital documentation



- Uniform access to digital data and documentation.
- Provision of extensive CAx data for systems and components during planning and operation.
- Support in planning and process creation using SIMARIS planning tools, product and system configurators.

#### 3. Power monitoring



• Fulfilling the ISO 50001 by detecting and transparently presenting the energy flows within energy distribution.

#### 4. Optimization and retrofit



- Retrofitting solutions such as SEM3 offer a simple option for integrating energy monitoring into existing systems.
- Energy monitoring and plant transparency help you efficiently plan plant expansion.

#### 5. Maintenance management



 Maintenance support, even remotely, by transparently presenting the status of a switchgear and controlgear assembly.

#### 6. Emergency management

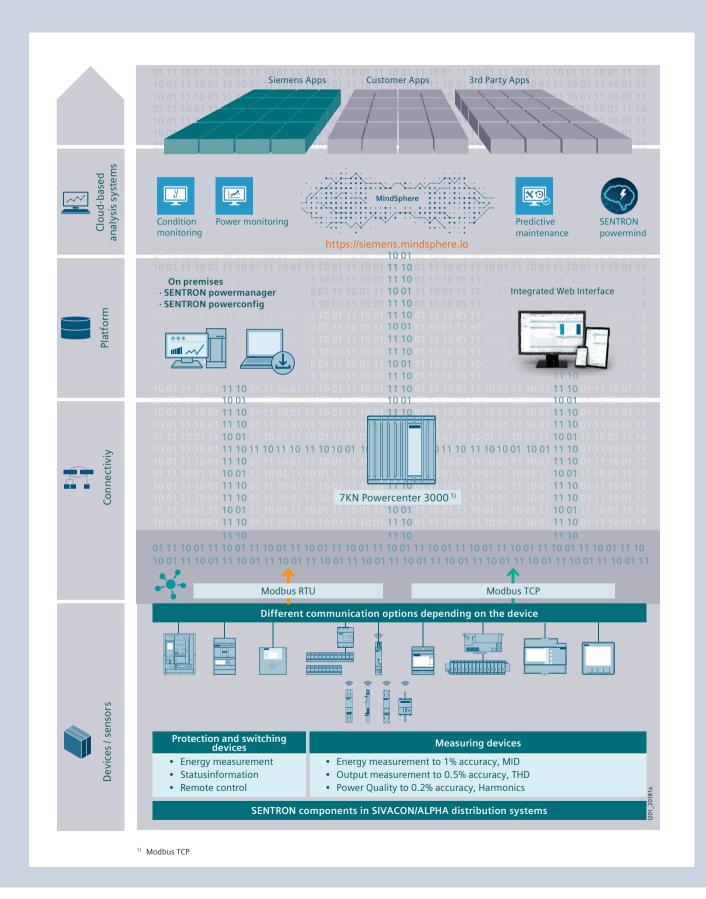


• Quick error localization which therefore leads to a minimization of outage times.

#### 7. Cybersecurity



• Protection from unauthorized access and manipulation to switchgear and controlgear assemblies and devices ensures integrity, availability and confidentiality.



# Overview of protection, switching, measuring and monitoring tasks

The functions presented here are available in combination or individually. Details can be found in the respective chapter.

				Line protection	Motor protection	Generator protection	Starter protection	Isolating function
Device class	Туре	Rated current	Page					
Air circuit breakers	3WA/ 3WL	630 6300 A	1/28	•	•	•		•
Molded case circuit breakers	3VA	16 1600 A	2/6	•	•	•	•	•
Miniature circuit breakers (automatic circuit breakers)	5SY/ 5SL	0 80 A	3/6					•
RCCB	5SV3/ 5SM3	16 125 A	4/6	•				•
RCBOs	5SU1/ 5SV1	0 40 A	4/10	•				•
AFD units	5SM6	0 40 A	4/12					
AFDD/MCBs	5SV6	0 40 A	4/12	•				•
On/Off switches	5TL1	32 125 A	5/14					
Overvoltage protection devices	5SD7	-	6/6					•
Fuses NEOZED, DIAZED, Cylindrical fuses	5SE, 5SA, 5SB, 3NW6, 3NW8	-	7/30	•	<b>■</b> 1)		•	
Photovoltaic fuses	_	_	7/79					
LV HRC fuses	3NA/ 3ND	-	7/36	•	•		•	
SITOR semiconductor fuses	_	_	7/54			•		
Switch disconnectors	3LD	16 250 A	8/6					
	3KD	16 1600 A	8/8					
Fuse switch disconnectors	3NP	0 630 A	8/82	With suitable			With suitable	•
Switch disconnector with fuse	3NJ	0 630 A	8/134	fuse links			fuse links	•
	3KF	0 630 A	8/118					
Transfer switching equipment	3KC	16 3200 A	9/4					
PAC measuring devices	7KM/ 7KT	Any	10/26					
Motor starter protectors	3RV	-	Catalog IC 10		-			•
Contactor	3RT	_	Catalog IC 10					•

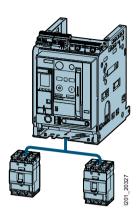
<sup>1)</sup> Only applies to 3NW8

<sup>2)</sup> Only applies to street

Current limitation (Short-circuit)	Overload protection LT	Short-circuit protection, delayed ST	Short-circuit protection, instantaneous INST	Ground-fault protection GF	Measurement function	Personnel safety/ fault current protection	Overvoltage protection	Preventive fire protection	Switching function
		•			_			•	
•	:	•		•	■ ■ 2)	<b>=</b> / <b>=</b>		•	
						<b>=</b> /=			
•			•			<b>=</b> / <b>=</b>			
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•	•		•		<b>2</b> )			•	
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•	•		•						
With suitable fuse links	With suitable fuse links		With suitable fuse links						
					•				
•	•		•						

# Overview of protection, switching, measuring and monitoring tasks

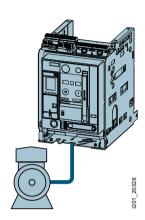
#### Line protection



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

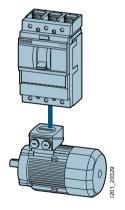
- Cables
- Leads
- · Non-motor loads

#### **Generator protection**



The setting values of the trip units are matched to protecting generators.

#### **Motor protection**

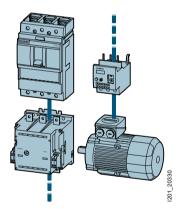


The overload and short-circuit releases are designed for optimal protection and direct starting of three-phase AC squirrel-cage motors.

The molded case circuit breakers for motor protection have phase-failure sensitivity and a thermal image that protects the motor against overheating.

The adjustable time lag class enables users to adjust the overload release to the startup conditions of the motor to be protected.

#### **Starter protection**



Starter combinations consist of:

Molded case circuit breaker + contactor + overload relay.

The molded case circuit breaker handles short-circuit protection and the isolating function. The task of the contactor is the 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.

#### Isolating function

Switching devices are described that meet the requirements defined for the isolating function when in the open position.

 Load switches, disconnectors, switch disconnectors according to IEC 60947-3

Switching operational currents up to the maximum rated current of the switching devices is part of the tasks performed by these devices (See chapter 8).



 Non-automatic circuit breakers according to IEC 60947-2 Annex L

Non-automatic circuit breakers can disconnect operational currents up to the maximum rated current, including fault currents up to the specified  $I_{\rm cc}$  value.





#### Measurement function

There are two possibilities for selecting the measurement function in low-voltage power distribution (See chapter 10):

 Measuring devices (stand-alone) combined with protection and switching devices



 Protection and switching devices with integrated measurement function (all-in-one), measurement function equivalent to a measuring device



#### **Current limitation (Short-circuit)**

Current limitation means that the peak value of the prospective peak short-circuit current is limited to a smaller let-through current.

 Current-limiting devices include molded case circuit breakers (MCCBs), motor starter protectors (MSPs), miniature circuit breakers (MCBs) and fuses









• Air circuit breakers (ACBs) are non-current-limiting devices





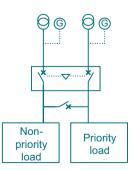
#### **Transfer switching function**

In the selection of transfer switch equipment, the following functions are distinguished (See chapter 9):

- Transfer control
- · Load transfer

The following possibilities for transfer switching are available:

- MTSE = manual transfer switch equipment
- RTSE = remote transfer switch equipment
- ATSE = automatic transfer switch equipment



# **Tripping characteristics**

The protective function of protection and switching devices in low-voltage power distribution systems is determined by the correct selection of the respective tripping characteristic (fuses, miniature circuit breakers) or TMTU/ETU trip units (air circuit breakers, molded case circuit breakers).

All current-limiting protection devices, such as MCCBs, MSPs, MCBs and fuses, can be described in terms of three characteristic curves:

- Tripping curve (time/current)
- · Let-through current curve
- · Let-through energy curve

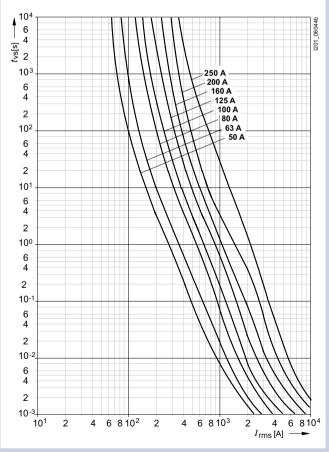
In the following, the functions of the tripping curves are presented as an example.

#### **Fuses**

The time-current characteristic curve of fuses denotes the virtual melting time as a function of the overload or short-circuit current.

Different characteristics must be considered in dimensioning depending on the protection requirement and operational class (e.g. gG, gR, aR, etc.).

See Configuration Manual – Fuse systems www.siemens.com/lowvoltage/manuals (45314810)

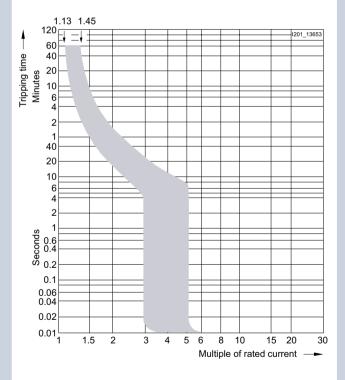


#### Miniature circuit breakers (MCBs)

The characteristic curve is chosen based on the application and is classified, for example, as tripping characteristic A, B, C or D.

Tripping curve = tripping characteristics according to IEC/EN 60898-1

See Configuration Manual – Miniature circuit breakers www.siemens.com/lowvoltage/manuals (45302792)



#### Molded case circuit breakers (MCCBs)

The choice of electronic trip unit is based on the protective function required in power distribution.

The trip units are classified as:

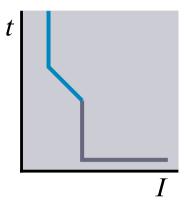
- thermal-magnetic trip units (TMTU; previously known as electromechanical trip units)
- electronic trip units (ETU).

Depending on the application and requirements, TMTUs are available with different protection setting options for both overload and short-circuit.

See Equipment Manual – 3VA molded case circuit breakers with IEC certificate

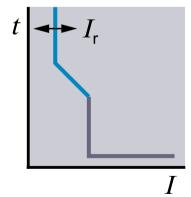
www.siemens.com/lowvoltage/manuals (90318775)

### FTFM (Fixed Thermal Fixed Magnetic)



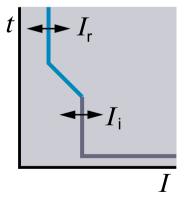
Permanently set thermal overload trip unit, permanently set magnetic trip unit with short-circuit protection

### ATFM (Adjustable Thermal Fixed Magnetic)



Adjustable thermal overload trip unit, permanently set magnetic trip unit with short-circuit protection

### ATAM (Adjustable Thermal Adjustable Magnetic)



Adjustable thermal overload trip unit, adjustable magnetic trip unit with short-circuit protection

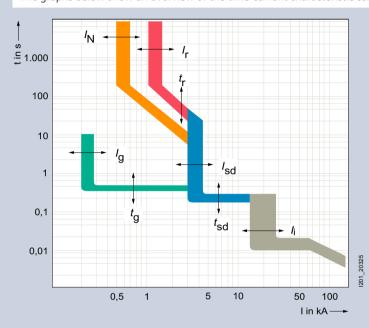
# **Tripping characteristics**

#### Molded case circuit breakers (MCCBs)/air circuit breakers (ACBs) with ETU

Selection of the electronic trip unit determines the protective function in power distribution. Electronic trip units offer the most extensive and variable protection settings of all protection and switching devices for low-voltage power distribution.

- See Equipment Manual 3VA molded case circuit breakers with IEC certificate www.siemens.com/lowvoltage/manuals (90318775)
- See Equipment Manual 3WA air circuit breakers www.siemens.com/lowvoltage/manuals (109763061)

The graphs below show an overview of the time-current characteristic curve.



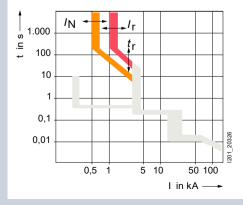


#### Overload protection LT

The ID letter for overload protection is LT (stands for "Long-time delay"). 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<sup>2</sup>t characteristics for molded case circuit breakers MCCBs and I<sup>2</sup>t and I<sup>4</sup>t characteristics for ACBs
- Depending on the electronic trip units, only I<sup>2</sup>t characteristic or I<sup>2</sup>t and I<sup>4</sup>t characteristic

The letters  $I_r$  refer to the current setting value; the associated tripping time is identical to  $t_r$ .



#### Neutral conductor overload protection N

The ID letter for neutral conductor overload protection is N. The letters  $I_{\rm N}$  refer to the current setting value for the overload protection; the associated tripping time is identical to  $t_{\rm r}$ .

The short-circuit protection of the circuit breaker also protects the neutral conductor.

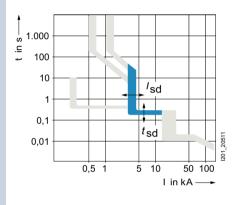
Possible reasons for implementing overload protection in the neutral conductor include:

- 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 1-phase loads, are connected.

#### Short-circuit protection, delayed ST

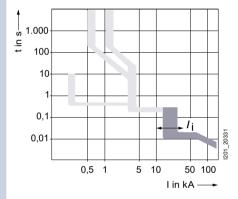
The ID letter for short-time delayed short-circuit protection is ST (stands for "Short-time"). The ST function of the electronic trip unit can be used to implement time-selective short-circuit tripping in low-voltage networks in which multiple circuit breakers are installed in series.

The short-time delayed short-circuit protection function protects phases L1 to L3 and the neutral conductor. The protective function responds if the current in at least one phase exceeds the set tripping current  $I_{\rm sd}$  for the set delay period  $t_{\rm sd}$ .



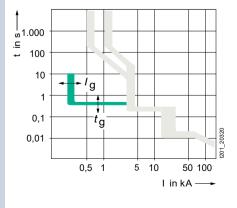
#### Short-circuit protection, instantaneous INST

The ID letter for instantaneous short-circuit protection is INST (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<sub>i</sub>*.



#### **Ground-fault protection GF**

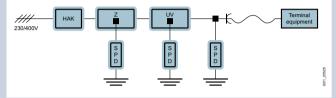
The ID letter for ground-fault protection is GF (ground fault). The G release measures fault currents between phases and grounded, electrically conductive parts. Ground-fault protection protects against the flow of current to ground in the rated current range. As ground-fault currents can produce arcing, ground-fault protection consequently offers extended fire protection.



# Overview of protection, switching, measuring and monitoring tasks

#### Overvoltage protection

Overvoltage protection refers to the protection of electrical and electronic devices against excessively high electrical voltages. Overvoltage can be caused by switching operations or electrostatic discharging (ESD).



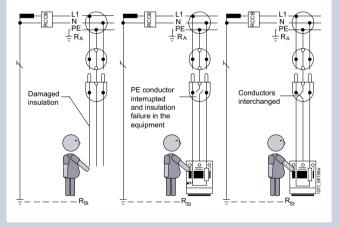
#### Personnel safety/fault current protection

Protection in the event of direct contact:

Additional protection contact refers to direct contact with a part that is live under operating conditions.

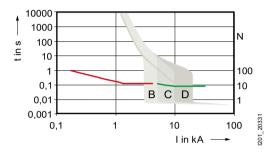
Protection against indirect contact:

Fault protection refers to contact with an electrically conductive part which is not live under operating conditions.



#### Preventive fire protection

Arc fault detection devices evaluate occurring faults in the current and voltage wave using an electronic switch and shutting off the current when it recognizes a contact fault. This prevents overheating at poor contact points which can prevent fires.

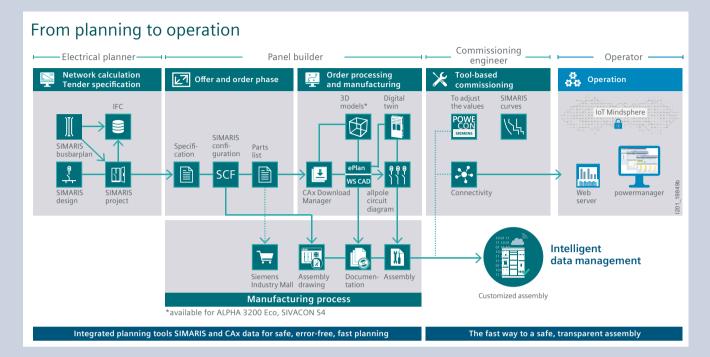


Potential failure causes

- Damaged cable insulation, e.g. by nails, screws or brackets
- The risk of a cable break exists for cables with a too-tight bending radius
- Cables which are laid through open doors and windows can be crushed when doors or windows are closed resulting in damaged insulation and arcing faults
- Environmental influences such as UV rays, temperature, humidity, gases can damage or age the insulation
- Damage caused by rodents
- Loose contact, e.g. caused by too low torque
- · Conductor damaged by claw fixing

# SIMARIS planning tools

For planning and visualizing the power distribution system



#### **Highlights**

- Thorough support of the engineering process with interlinked software tools
- Provision of extensive CAx data for systems and components
- Reduction of cost and time aspects during planning

# Distribution systems

#### For industrial plants or in infrastructure

### SIVACON S8 power distribution boards and motor control centers

- Reliable, economical, flexible and communication-capable
- For all applications in infrastructure and process industry



Overview, see page 15/12

### ALPHA 3200 power distribution boards (DIN technology)

- Safe investment, enhances productivity and performance
- Optimized for applications in modern building infrastructures
- Integrated system for all SENTRON components



Overview, see page 15/14

#### ALPHA distribution boards (DIN technology)

Comprehensive portfolio with wall-mounted and floor-mounted distribution boards for currents between 160 A to 1250 A



Overview, see page 15/160

#### SIVACON 8PS busbar trunking systems

- For economic and reliable power supply
- Space-saving and simple to install
- Low fire load, good electromagnetic compatibility



Overview, see page 16/4

### ALPHA 3200 Eco power distribution boards (DIN technology)

- Saves resources: lower use of copper with centrally positioned busbar
- **Practical:** optimized performance from the transformer connection via the busbar to the outgoing feeders
- Modular: a high packing density in a compact space due to flexible use of ALPHA assembly kits
- Innovative: 3D processor generates a digital twin of the configured system at the press of a button



Overview, see page 15/14

### SIVACON S4 power distribution boards (NF technology)

- Consistent portfolio for applications from 800 A to 6300 A
- High flexibility in system planning thanks to a modular platform structure
- Simple reproduction of type-tested solutions thanks to software-assisted configuration
- Increased planning accuracy due to the provision of 3D data
- Safe to use thanks to independent VDE approval





Overview, see page 15/22

### ALPHA UNIVERSAL distribution boards (NF technology)

- Comprehensive portfolio with wall-mounted and floormounted distribution boards for currents between 125 A to 800 A
- Simple planning thanks to the modular platform structure



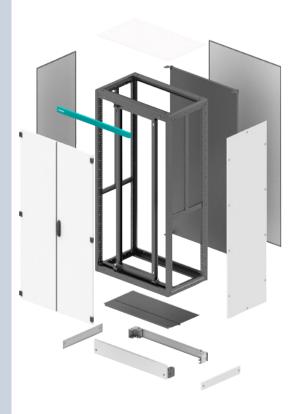
Overview, see page 15/130

# Control cabinets/System cubicles

For plant engineering, process control, network technology, secondary systems/energy automation

#### SIVACON 8MF1 system cubicles

- Modular system
- Fully assembled, adapted according to your specifications, or entirely customized



Overview, see page 17/6

### SIVACON 8MF/8MR system lighting – LED lights

The LED lights offer optimum lighting conditions for installation and maintenance. The LED technology is energy-efficient and maintenance-free.



Overview, see page 17/32

### SIVACON 8MF/8MR system lighting – Slimline lights

The Slimline lights are an alternative with an energy-saving lamp and are also available as a version with an integrated socket.





Overview, see page 17/33

#### SIVACON 8MR system air-conditioning

Ensures fault-free operation of the electrical and electronic built-in units installed in the cubicle, even under the harshest ambient conditions.



Overview, see page 17/36

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