Planning Manual

sivacon 8PV

SIEMENS

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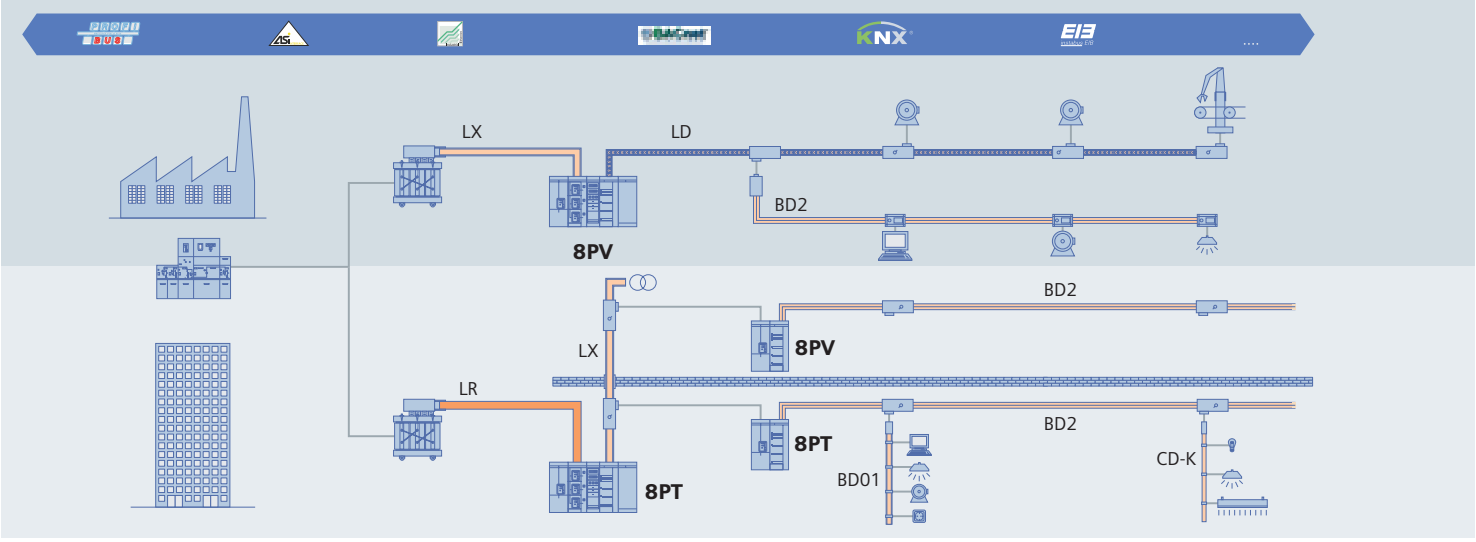
Contents

The development of a power distribution concept which includes the dimensioning of systems and plant components necessitates a coordination of the requirements and feasibilities of both the end user and the manufacturer. We have therefore prepared this planning manual for the SIVACON® 8PV low-voltage switchboard to support you with this task.

sivacon

Everything. Perfect. SIVACON.

The Basis for Optimal Power Distribution



- Safety – integrated
- Economic efficiency – right from the start
- Flexibility – thanks to modularity

All components of the SIVACON range are bound by these three principles. Consequently, all products of the range are optimally matched to each other.

SIVACON 8PV – for the process industry

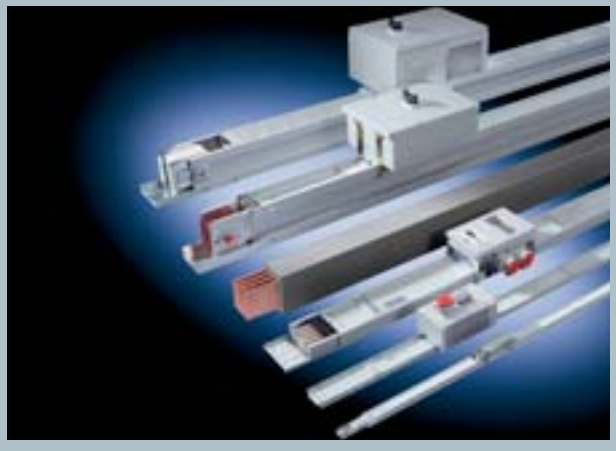
The type-tested SIVACON 8PV switchgear and controlgear assembly is, for example, employed in the power, chemical and mineral oil as well as in the capital goods industries. This assembly is characterized by a high degree of availability combined with a high level of personnel and plant safety and can be used for all applications up to 6,300 A.

SIVACON 8PT – for the infrastructure

The type-tested SIVACON 8PT switchgear and controlgear assembly is not only employed for the infrastructural supply in industrial and building applications (administration, functional as well as industrial and commercial buildings), but is also used in the process industry. Matched to the global market requirements, SIVACON both meets the demand for standard solutions from a single source, as well as that for local production. This assembly can be used for all applications up to 7,400 A.

SIVACON 8PS – for power distribution

With the SIVACON 8PS busbar trunking system, all load requirements can be reliably and safely satisfied – from transformers to main distribution boards and small loads – by a total of six available type-tested systems. These busbar trunking systems are characterized by their high short-circuit strength and minimum combustive energy and can be used for all applications up to 6,300 A.



Selection Criteria
SIVACON 8PV – SIVACON 8PT

Selection criteria	SIVACON 8PV	
Busbar position	Top	Rear
Rated busbar currents up to	2,500 A	6,300 A
Rated currents ingoing feeder up to	2,500 A	6,300 A
Short-circuit strength I_{cw} (1s)	50 kA	100 kA
Busbars up to I_{pk}	110 kA	220 kA (250 kA)
Mounting designs		
Circuit-breaker design (fixed-mounted / withdrawable)	● (1 breaker per cubicle)	● (1 breaker per cubicle)
Fixed-mounted design	●	●
In-line design	● LV HRC in-line design	● LV HRC in-line design
Plug-in design	● Motor & power feeders (fuseless)	● Motor & power feeders (fuseless)
Withdrawable design	●	●
Mounting options	Stand-alone/wall mounting/ back-to-back	Stand-alone/wall mounting/ back-to-back double front
Application	Motor control centers	Motor control centers
	Power distribution boards	Power distribution boards
Production	Siemens	Siemens

Safety characteristics	
Safety proof for each specifically developed system	TTA-tested standard modules in acc. with IEC 60439-1
Cubicle-to-cubicle safety	Solid-wall design
Safety with test and disconnected position	The systems' degree of protection is maintained up to IP54: ■ Increased protection of the operating personnel ■ Avoidance of harmful deposits in the system
Uniform operation of withdrawable units	Uniform user interface for small and standard withdrawable units, with integr. operator error protection: ■ Avoidance of maloperations ■ Reduction of instruction times
Resistance to internal arcs (IEC 61641)	Stepped concept with additive modules for the active and passive limitation of arcing faults: ■ 690 V, 65 kA, 300 ms ■ Insulated busbars as additive
Seismic withstand capability (IEC 60068-3-3, IEC 60068-2-57, IEC 60980, KTA 2201.4)	Acceleration on the system's mounting level: ■ Function during earthquakes 0.6 *g* ■ Function after earthquakes 0.9 *g*
And of course	Switchgear and controlgear made by Siemens: ■ No premature failures ■ Minimum downtimes ■ Short delivery periods

● Available

	SIVACON 8PT	
	Top	Rear
	7,400 A	3,200 A
	6,300 A	3,200 A
	150 kA	85 kA
	375 kA	187 kA
	● (1, 2 or 3 breakers per cubicle)	● (1 breaker per cubicle)
	●	●
	● LV HRC in-line design	● LV HRC in-line design
	● Motor & power feeders (fuseless/fused)	–
	●	–
	Stand-alone/wall mounting/ back-to-back –	Stand-alone/wall mounting/ back-to-back –
	Motor control centers	–
	Power distribution boards	Power distribution boards
	Siemens/SIVACON technology partners	Siemens/SIVACON technology partners
	TTA-tested standard modules in acc. with IEC 60439-1	
	Additive partition walls	–
	The systems' degree of protection is maintained up to IP54 with circuit-breaker design and up to IP30 with withdrawable design: ■ Increased protection of the operating personnel ■ Avoidance of harmful deposits in the system	
	Uniform user interface for all withdrawable units: ■ Avoidance of maloperations ■ Reduction of instruction times	
	Stepped concept with additive modules for the active and passive limitation of arcing faults: ■ 690 V, 50 kA, 300 ms ■ Insulated busbars as additive	■ 440 V, 50 kA, 300 ms
		–

SIVACON 8PV

The Variable Low-Voltage Switchboard

Introduction

Economical, demand-oriented and type-tested (TTA) – those are the characteristics of the low-voltage switchboard made by Siemens. SIVACON 8PV is applicable on all performance levels: From 6,300 A power centers to main and sub-distribution boards, down to motor control centers – both in fixed-mounted and plug-in, as well as in withdrawable design. Thanks to the central Siemens-internal production, this type-tested switchgear and controlgear assembly offers the excellent quality and short delivery periods of a mature series product.

Modular design

Every SIVACON 8PV switchboard is exclusively manufactured from demand-oriented and series-produced modules, all of which are type-tested and of high quality. Due to the modules' vast combination options, each and every requirement can be met.

Adaptations to new performance requirements can be easily and rapidly implemented by the replacement or supplementation of modules. The advantages offered by this modular concept are obvious:

- Safety and quality proof for all switchboards thanks to type test
- Compliance with any requirement profile with the high quality of series production
- Easy placement of repeat orders and short delivery periods

The advantages offered by SIVACON set new standards:

- Safety and quality proof for all switchboards thanks to type test
- Compliance with any requirement profile with the high quality of series production
- Easy placement of repeat orders and short delivery periods
- 3- and 4-pole busbar system up to 6,300 A
- Short-circuit strength I_{cw} (1s) up to 100 kA; I_{pk} up to 250 kA
- Type-tested standard modules (TTA)
- Space-saving mounting surface from 400 x 400 mm
- Maximum packing density with up to 40 feeders per cubicle
- Test and disconnected position with closed door and maintenance of the degree of protection (up to IP54)
- Visible isolating distances and contact points
- Uniform user interface for all withdrawable units
- Solid-wall design for safe cubicle-to-cubicle separation
- Variable busbar positions at the top or rear
- Cable/busbar connection from the top or bottom

Application areas

Chemical & mineral oil industry

Power industry: Power plants and auxiliaries systems

Capital goods industry: Production-related systems

Infrastructure: Building complexes

Motor control centers

Power distribution from the power center down to main and sub-distribution

Basics

Standards & regulations	
Type-tested low-voltage controlgear and switchgear assembly (TTA)	IEC 60439-1 DIN EN 60439-1 (VDE 0660 Part 500)
Testing of response to internal faults (internal arcs)	IEC 61641, VDE 0660 Part 500, Supplement 2 (U_e bis 690 V, I_{cw} (1s) bis 65 kA, t bis 300 ms)
Induced vibrations	IEC 60068-2-57, IEC 60068-3-3, IEC 60980

Technical data			
Mounting conditions	Indoor mounting		
Ambient temperature	24-h average	+ 35°C (-5°C to +40°C)	
Degree of protection	In acc. with IEC 60529, EN 60529	IP20, IP21, IP40, IP41, IP54	
Internal separation	IEC 60439-1, Section 7.7, VDE 0660 Part 500, 7.7	Type 1 to type 4	
Rated insulation voltage (U_i)	Main circuit	1000 V	
Main circuit (U_e)	Main circuit	Up to 690 V	
Creepage distances and clearances	Rated impulse withstand voltage U_{imp}	8 kV	
	Overvoltage category	III	
	Pollution degree	3	

Main busbars horizontal (3- and 4-pole), busbar position top										
Rated operational current (ventilated)	[A]	660	860	1,070	1,280	1,590	1,990	2,250		
Rated operational current (non-ventilated)	[A]	590	770	950	1,150	1,300	1,630	1,965		
Rated peak withstand current I_{pk}	[kA]	60	85	110	110	110	110	110		
Rated short-time withstand current I_{cw} (1s)	[kA]	29	40	50	50	50	50	50		

Main busbars horizontal (3- and 4-pole), busbar position rear										
Rated operational current (ventilated)	[A]	1,255	1,645	1,990	2,380	2,665	3,300	3,500/3,700	4,000	6,300
Rated operational current (non-ventilated)	[A]	1,165	1,525	1,840	2,200	2,470	3,050	3,250	3,250	4,850
Rated peak withstand current I_{pk}	[kA]	110	165	220	220	220	220	250	220	220
Rated short-time withstand current I_{cw} (1s)	[kA]	50	75	100	100	100	100	100	100	100

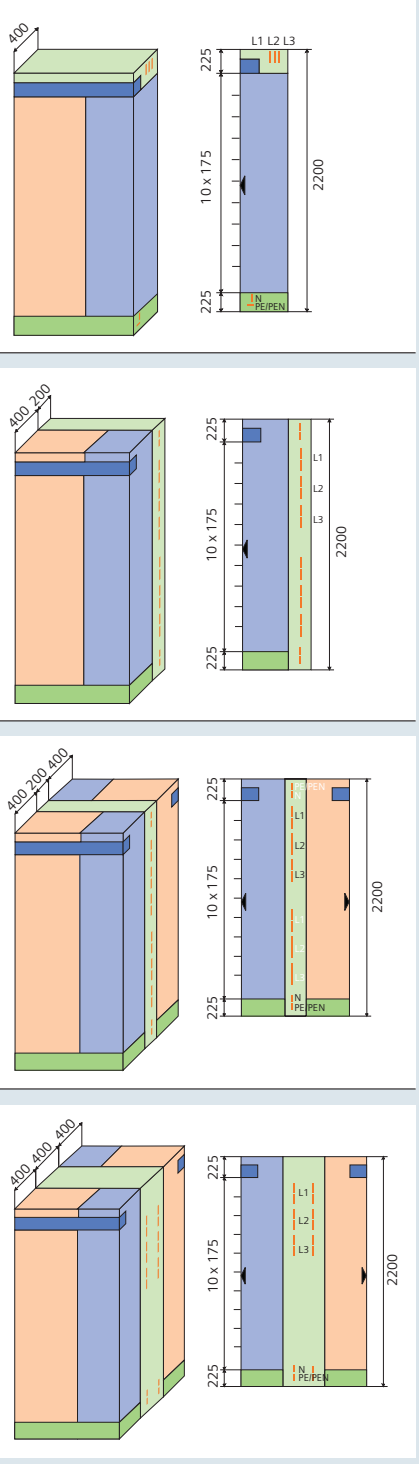
Busbars vertical for circuit-breaker design (3- and 4-pole)			
Nominal current	Refer to main busbars horizontal		
Rated peak withstand current I_{pk}	Refer to main busbars horizontal		
Rated short-time withstand current I_{cw} (1s)	Refer to main busbars horizontal		
Busbars vertical (3- and 4-pole)		For fixed-mounted design, in-line design & plug-in design	For withdrawable design
Rated operational current	[A]	Up to 2,000	Up to 1,000
Rated peak withstand current I_{pk}	[kA]	Up to 110	Up to 110
Rated short-time withstand current I_{cw} (1s)	[kA]	Up to 50*	Up to 65*

Surface treatment	
Rack components	Sendzimir-galvanized
Casing	Sendzimir-galvanized/powder-coated
Doors	Powder-coated
Color of powder-coated components (layer thickness 100 ± 25 µm)	RAL 7035, light gray (in acc. with DIN 43656)

* Rated conditional short-circuit current I_{cc} up to 100 kA

Cubicle Structure & Busbar Systems

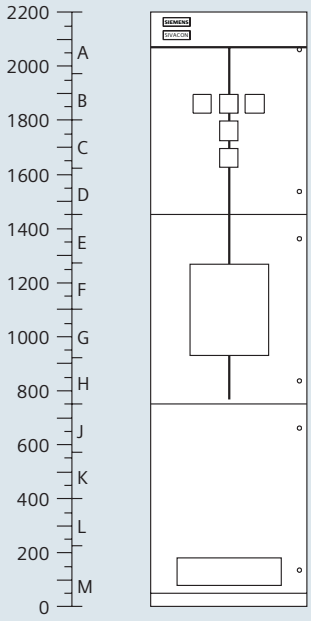
Mounting	Busbar system	Cubicle structure
Single-front **Wall assembly,** **Stand-alone assembly,** **back-to-back assembly**	Busbar position: Rated current: Cable/busbar entry: Busbar system:	top Up to 2,500 A From the bottom 3-/4-pole
Single-front **Wall assembly,** **stand-alone assembly,** **back-to-back assembly**	Busbar position: Rated current: Cable/busbar entry: Busbar system:	Rear top, Bottom, Top & bottom Up to 4,000 A From the bottom From the top 3-/4-pole
Double-front **Stand-alone as-** **sembly**	Busbar position: Rated current: Cable/busbar entry: Busbar system:	Center top, Bottom, Top & bottom Up to 4,000 A From the bottom From the top 3-/4-pole
Power center **Stand-alone assembly**	Busbar position: Rated current: Cable/busbar entry: Busbar system:	Center top Up to 6,300 A From the bottom From the top 3-/4-pole



Cable compartment
Busbar compartment
Socket compartment
Device/function compartment
Cross-wiring compartment
Operating panels

Mounting Designs

Overview



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Circuit-breaker design from 630 A to 6,300 A

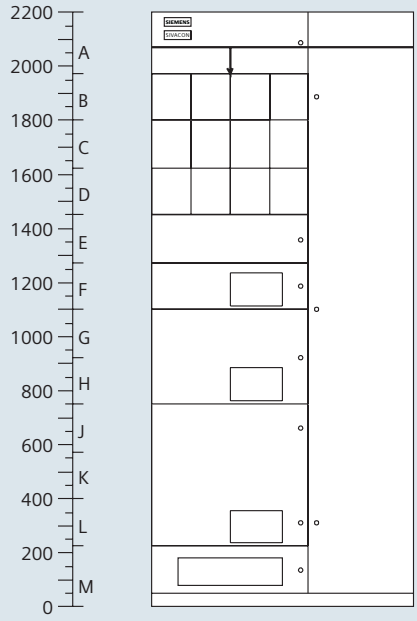
- Incoming feeders
- Couplings (longitudinal and tranverse coupling)
- Outgoing feeder bays

- Circuit-breakers in fixed-mounted design; or
- Circuit-breakers in withdrawable design

- Cubicle width matched to breaker sizes (e.g. cubicle width of 400 mm with I_n = 1,600 A)
- Clearly separated function compartments
- Test and disconnected position with closed door

- Type-tested connection with cable or LD/LX busbar trunking system
- Large cable/busbar compartment
- High degree of safety for the mounting personnel thanks to double-sides cubicle separation

- Separate auxiliary device compartment for each circuit-breaker
- Space for comprehensive controls and interlockings
- Withdrawable auxiliary device module which can be separated from the power unit



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Withdrawable design up to 630 A

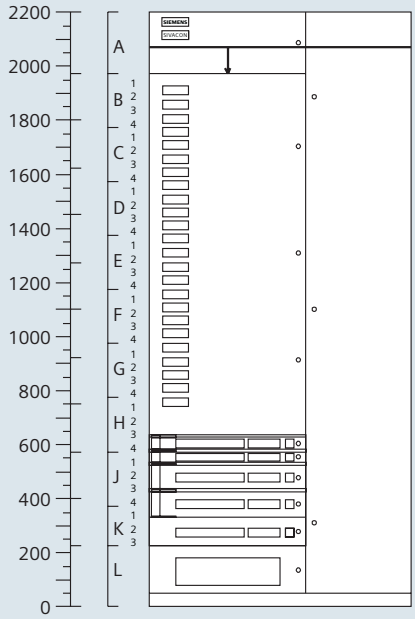
- Outgoing motor feeders up to 355 kW (400 V) and 500 kW (690 V)
- Outgoing cable feeders up to 630 A
- Incoming feeders up to 630 A

- Maximum packing density with up to 40 withdrawable units per cubicle
- Test and disconnected position with closed door and maintenance of degree of protection
- Visible isolating distances on the incoming and outgoing side
- Uniform user interface for all withdrawable units
- Large cable compartment with a width of 400 mm

- Connections for the power and control unit in the cable compartment

- Replacement of withdrawable units while energized
- Change of cubicle panel sizes possible during operation

- Plug-in busbar system
  - Embedded with resistance to internal arcs
  - Test-finger proof (IP20B)
  - Phase separation
  - 3- and 4-pole
  - Pick-off openings in a modular grid of 175 mm



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Plug-in design up to 100 A

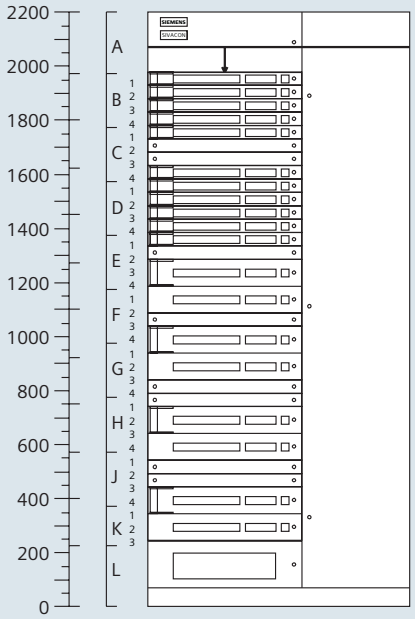
- Outgoing motor feeders in fuseless design up to 45 kW
- Outgoing cable feeders in fuseless design up to 100 A
- Combinable with in-line design for fused outgoing cable feeders up to 630 A

- High packing density with up to 35 withdrawable units per cubicle
- Plug-in contacts on the supply line side
- Individual equipping with devices or device combinations
- Free combination of modules within the cubicle
- Lateral guide for a safe plug connection
- Instrument panel for measuring and command devices directly at the plug-in unit

- Large cable compartment with a width of 400 mm or 600 mm
- Connections for the power and control unit in the cable compartment

- Replacement without system shutdown

- Plug-in busbar system
  - Integrated touch guard
  - Test-finger proof (IP20B)
  - 3- and 4-pole
  - Pick-off openings in a modular grid of 50 mm



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In-line design up to 630 A

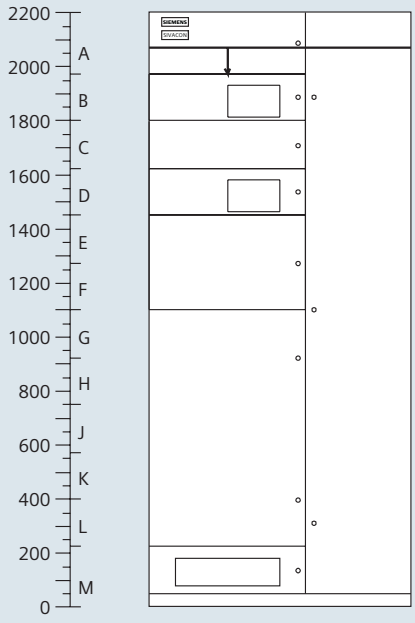
- Fuse switch-disconnector with single-break
- Fuse switch-disconnector with double-break

- High packing density with up to 35 in-line units per cubicle
- In-line units with/without auxiliary switch
- In-line units with/without fuse monitoring as group or individual fault message
- Plug-in contact on the supply line side
- Dead-state fuse replacement

- Large cable compartment with a width of 400 mm or 600 mm
- Connections for the power and control unit in the cable compartment
- Good accessibility

- Replacement without system shutdown

- Plug-in busbar system
  - Integrated touch guard
  - Test-finger proof (IP20B)
  - 3- and 4-pole
  - Pick-off openings in a modular grid of 50 mm



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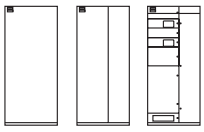
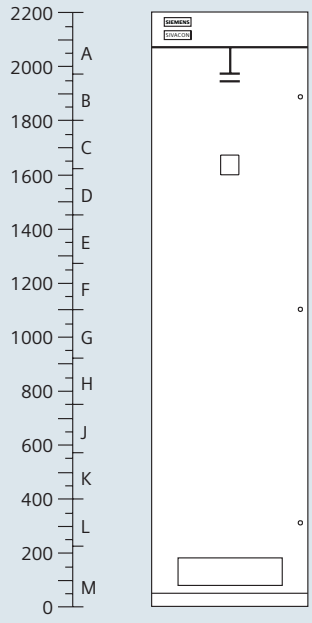
Fixed-mounted design up to 1,250 A

- Incoming feeders, outgoing feeders & couplings with MCCB circuit-breakers up to 1,250 A
- Universal installation of low-voltage switchgear and controlgear
- Switch-disconnectors
- Fuse switch-disconnectors
- Fuse switch-disconnectors in in-line design
- Automation devices (SIMATIC)
- Outgoing installation feeders

- Free combination of the equipped modular installation sheets within the cubicle
- Five different module sizes
- Attachment system for “one-man mounting”
- Horizontal partition of device compartment possible
- Cubicle-high or individual doors
- Cable compartment available with a width of 200 mm and 400 mm
- Good accessibility



- Universal vertical busbar
  - Fast conversion thanks to connections accessible from the front
  - Device connection without boring or punching
  - Connections visible and checkable from the front



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Fixed-mounted design for reactive power compensation

- 500 kvar per cubicle non-throttled
- 250 kvar per cubicle throttled (5.67% oder 7%)

- Capacitor modules up to 100 kvar with
  - Fuse switch-disconnector
  - Capacitor contactor
  - MKK capacitors
  - Discharge devices
  - Optional filter reactors (throttled)

- Controller assembly with electronic reactive power controller for door installation
  - Self-adaptation of the C/k value
  - Adjustable setpoint cos phi from 0.7 ind to 0.9 cap
  - Manual control
  - Integrated fan assembly with higher ambient temperatures

- Optional application of switch-disconnector and/or audio-frequency parallel trap circuit (AF trap)
- Available as basic unit with controller assembly or as expansion unit without controller assembly
- The reactive power compensation cubicles can be integrated in the switchboard’s system and busbar assemblies as a standard

8PV Space Requirements

Circuit-Breaker Design

Circuit-breaker 630 A to 6,300 A, fixed-mounted and withdrawable design

Application area

For incoming feeders,
couplings (longitudinal and tranverse coupling),
outgoing feeders

Degrees of protection (in acc. with IEC 60529, EN 60529)

IP20 ventilated
IP21 ventilated, IP21 non-ventilated
IP40 ventilated, IP40 non-ventilated
IP41 ventilated, IP41 non-ventilated
IP54 non-ventilated

Cubicle dimensions

Height: 2,200 mm
Width: According to table
Depth: 400, 600, 1,000, 1,200 mm

Type of internal separation

Type 1 (cubicle-high door)
Type 2b, 4a (cubicle-high door)
Type 2a, 3a/3b, 4b (3-partitions door)

Design options

- Air circuit-breaker (ACB)
- Molded-case circuit-breaker (MCCB)
- Fuse switch-disconnector
- Switch disconnector

Cable / busbar connection direction

Busbar position top Cubicle depth 400 mm:	Bottom cable/busbar compartment
Busbar position rear Cubicle depth 600/1,000/ 1,200 mm:	Optional top or bottom cable/busbar compartment

Cubicle widths for incoming/outgoing feeder with 3WL circuit-breakers/non-automatic circuit-breakers (ACB)

Rated breaker-current [A]	Min. cubicle width 3-pole [mm]	Min. cubicle width 4-pole [mm]	Cubicle depth* 400 TopBBpos [mm]	600 RearBBpos [mm]	1000 DF [mm]	1200 PC [mm]	Short-circuit breaking capacity I_{cu} [kA]
630 – 1600	400	–	●	–	–	–	65
630[1] – 2500	600	–	●	–	–	–	100
630 – 1600	400	600	–	●	●	●	65
630[1] – 3200	600	800	–	●	●	●	100
4,000	800	1,000	–	●	●	●	100
5,000 – 6,300	1,000	–	–	–	–	●	100

[1] 630 A with rated current module (rating plug)

* Abbreviations: TopBBpos – Top busbar position
RearBBpos – Rear busbar position
DF – Double-front
PC – Power center

The cubicle depths and structures depend on the busbar position, refer to page 8.

Cubicle widths for longitudinal/tranverse couplings with 3WL circuit-breakers/non-automatic circuit-breakers (ACB)

Rated breaker current [A]	Min. cubicle width 3-pole Longitudinal coupling [mm]	Transverse coupling [mm]	Min. cubicle width 4-pole Longitudinal coupling [mm]	Transverse coupling [mm]	Cubicle depth* 400 TopBBpos [mm]	600 RearBBpos [mm]	1,000 DF [mm]	1,200 PC [mm]	Short-circuit breaking capacity I_{cu} [kA]
630 – 1,600	600	–	–	–	●	–	–	–	65
630[1] – 2,500	800	–	–	–	●	–	–	–	100
630 – 1,600	500	400	600	–	–	●	●	–	65
630[1] – 2,500	600	600	800	–	–	●	●	–	100
3,200	800	600	800	–	–	●	●	–	100
4,000	1,000	800	1,000	–	–	●	●	–	100
5,000	1,000 + 500	–	–	–	–	–	–	●	100

[1] 630 A with rated current module (rating plug)

The cubicle widths for fuse switch-disconnectors and molded-case circuit-breakers (MCCB) are available upon request.

Type-tested busbar connection for 3WL circuit-breakers / non-automatic circuit-breakers (ACB)

Rated breaker current [A]	Circuit-breaker size	Connectable SIVACON 8PS busbar trunking system	Min. cubicle width 3-pole [mm]
1,600	Size I	LD / LX	400
2,000	Size II	LD / LX	600
2,500	Size II	LD / LX	600
3,200	Size II	LD / LX	600
4,000	Size III	LD / LX	800

Cubicle widths for fuse switch-disconnectors and molded-case circuit breakers (MCCB) are available upon request.

Cable connection for 3WL circuit-breakers/non-automatic circuit-breakers (ACB)

Rated breaker current [A]	Circuit-breaker size	Connectable cables per connection rail for L1; L2; L3 (N with 4-pole version) [mm²]	PE; PEN; N [mm²]
630 – 1,000	Size I	4 x 240	4 x 240
1,250 – 1,600	Size I	6 x 240	6 x 240
2,000 – 2,500	Size II	9 x 300	9 x 300
3,200	Size II	11 x 300	11 x 300
4,000	Size III	14 x 300	14 x 300
5,000	Size III	Realization with busbar connection	
6,300	Size III		

Derating factors circuit-breaker design

Derating factors I_e/I_n with incoming or outgoing feeder function at an average ambient temperature of 35°C

Rated breaker current [A]	Circuit-breaker size	Cubicle depth 400 mm Top busbar position		600/1,000 mm Rear busbar position/ double-front		1,200 mm Power center	
		Non-ventilated (e.g. IP54)	Ventilated (e.g. IP20)	Non-ventilated (e.g. IP54)	Ventilated (e.g. IP20)	Non-ventilated (e.g. IP54)	Ventilated (e.g. IP20)
630 – 800	Size I	1	1	1.00	1.00	1.00	1.00
1,000	Size I	0.94	1	1.00	1.00	1.00	1.00
1,250	Size I	1	1	0.95	1.00	0.95	1.00
1,600	Size I	0.91	0.99	0.85	0.93	0.85	0.93
2,000	Size II	0.86	0.95	0.95	1.00	0.95	1.00
2,500	Size II	0.75	0.84	0.81	0.95	0.81	0.95
3,200	Size II	–	–	0.77	0.86	0.77	0.86
4,000	Size III	–	–	0.72	0.87	0.72	0.87
5,000	Size III	–	–	–	–	0.82	1.00
6,300	Size III	–	–	–	–	0.65	0.84

Derating factors I_e/I_n with longitudinal coupling function at an average ambient temperature of 35°C

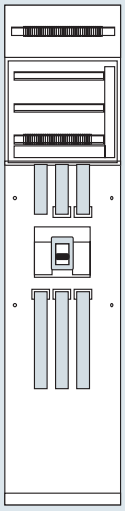
Rated breaker current [A]	Circuit-breaker size	Cubicle depth 400 mm Top busbar position		600/1,000 mm Rear busbar position/ double-front		1,200 mm Power center	
		Non-ventilated (e.g. IP54)	Ventilated (e.g. IP20)	Non-ventilated (e.g. IP54)	Ventilated (e.g. IP20)	Non-ventilated (e.g. IP54)	Ventilated (e.g. IP20)
630 – 800	Size I	1	1	1	1	–	–
1000	Size I	0.9	1	1	1	–	–
1250	Size I	0.96	1	1	1	–	–
1600	Size I	0.87	1	0.96	1	–	–
2000	Size II	0.8	0.94	0.96	1	–	–
2500	Size II	0.7	0.83	0.82	0.94	–	–
3200	Size II	–	–	0.72	0.85	–	–
4000	Size III	–	–	0.77	0.94	–	–
5000	Size III	–	–	–	–	0.84	1.00
6300	Size III	–	–	–	–	0.66	0.86

Derating factors I_e/I_n with transverse coupling function at an average ambient temperature of 35°C

Rated breaker current [A]	Circuit-breaker size	Cubicle depth 600/1,000 mm Rear busbar position/double-front	
		Non-ventilated (e.g. IP54)	Ventilated (e.g. IP20)
630 – 1,250	Size I	1	1
1,600	Size I	0.91	1
2,000	Size II	0.94	1
2,500	Size II	0.84	1
3,200	Size II	0.87	0.97
4,000	Size III	0.73	0.92

The derating factors are rounded values, which serve as a basis for rough planning. The exact rated currents for the circuit-breaker design cubicles as well as factors for deviating ambient temperatures have to be requested.

Layout



* Optionally with MCCB circuit-breaker, DUMECO switch disconnector or EFEN LV HRC switch disconnector size 4a

The circuit-breaker cubicle's layout in universal mounting design is analog to that of circuit-breaker cubicles with ACB breakers, i.e. it is divided into a cross-wiring, an auxiliary device, a device and a cable compartment.

Universal mounting design selection table

Devices	**Rated breaker current** [A]	**Derating factors I_e/I_n** Ambient temperature of 35°C		**Cubicle width** [mm]
		Non-ventilated	Ventilated	
EFEN LV HRC switch-disconnector size 4a	1,250	0.84	0.89	500
DUMECO switch-disconnector	800	1.00	1.00	400
DUMECO switch-disconnector	1,250	0.85	0.95	500
DUMECO switch-disconnector	1,600	0.75	0.90	500
Circuit-breaker (MCCB)	630	0.81	0.94	400
Circuit-breaker (MCCB)	800	0.79	0.83	400
Circuit-breaker (MCCB)	1,250	0.78	0.80	400
Circuit-breaker (MCCB)	1,600	0.61	0.63	400

Withdrawable Design

Withdrawable units up to 630 A

Application area

Motive power loads
Outgoing cable feeders
Incoming feeders

Degrees of protection (in acc. with IEC 60529, EN 60529)

IP20 ventilated
IP21 ventilated, IP21 non-ventilated
IP40 ventilated, IP40 non-ventilated
IP41 ventilated, IP41 non-ventilated
IP54 non-ventilated

Cubicle dimensions

Height: 2,200 mm
Width: 1,000 mm
1,200 mm upon request
Depth: 400, 600, 1000, 1200 mm

Type of internal separation

Type 3b, 4b

Design options

- Fuseless load feeders
- Fused load feeders
- Outgoing motor feeders with and without overload relay
- Withdrawable units with and without communication connection

Cubicle structure:
Height device compartment: 1,750 mm
(10 modules á 175 mm)
Width device compartment: 600 mm
Width cable compartment: 400 mm
(600 mm upon request)

Cubicle structure (1 M = 1 module = 175 mm)

Withdrawable unit size: 4 x $^1/_4$ M = module
2 x $^1/_2$ M = 1 module
1 x 1 M = 1 module
1 x 2 M = 2 module up to
1 x 8 M = 8 module

Size 1 M

Size $^1/_2$ M

Size $^1/_4$ M

Cable connection

Busbar position top
Cubicle depth 400 mm: Bottom cable connection

Busbar position rear
Cubicle depth 600/1000/1,200 mm: Optional top or bottom connection

Summation current of all feeders: Refer to table.

Individual feeder utilization

- Motor starters: $I \leq 0{,}8$
- Cable feeders: $I \leq 0{,}8$

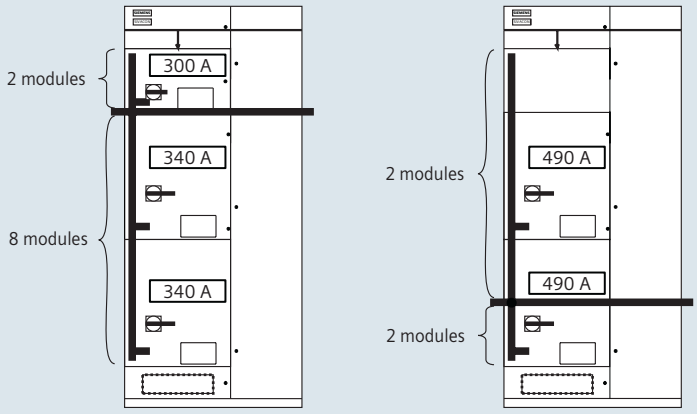
Rated currents for the vertical distribution busbar

400 mm cubicle depth Top busbar position		**600/1,000/1,200 mm cubicle depth** Rear busbar position/double-front/power center	
Ventilated 35°C (e.g. IP20)	Non-ventilated 35°C (e.g. IP54)	Ventilated 35°C (e.g. IP20)	Non-ventilated 35°C (e.g. IP54)
680 A	**560 A**	**980 A** [1]	**770 A** [2]

With rear busbar positions, the current division can be used in an 8M to 2M relation.

[1] 980 A = 680 A + 300 A
[2] 770 A = 560 A + 210 A

Examples of current division



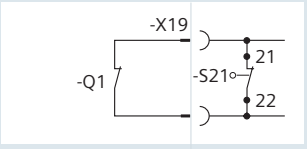
Display and signaling

The position at which a withdrawable unit is located is clearly indicated by a display on the instrument panel. Furthermore, messages such as “Feeder not available” (AZNV), “Test” and “AZNV and test” can be received via additional signaling switches.

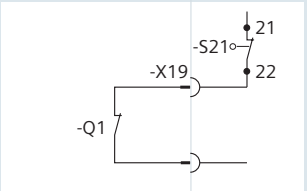
The signaling switch in the compartment (S21) is an end switch designed as an NC contact and that in the withdrawable unit (S20) is an end switch designed as an NO contact. Both switches are operated via the withdrawable unit’s main isolating contacts.

Circuit principle and position of the main and auxiliary contacts

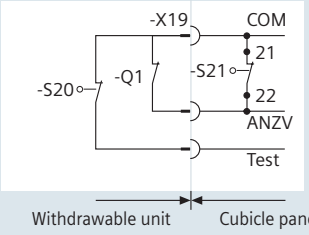
AZNV



Test



AZNV / Test



X19 = Auxiliary isolating contact
S20 = Signaling switch in withdrawable unit*
S21 = Signaling switch in compartment*

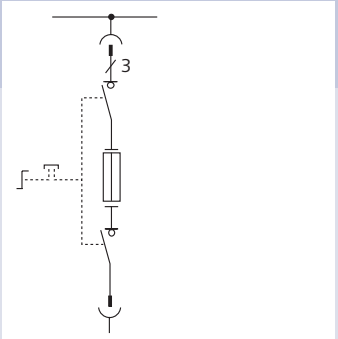
*Operated via main isolating contact

	Main isolating contact	Auxiliary isolating contact	In withdrawable unit - S 20 1 NO contact	In compartment - S 21 1 NC contact
Operation				
Disconnection			*	
Test				

*No message as auxiliary isolating contact is open

Withdrawable design selection table

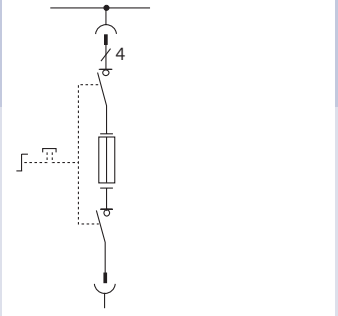
Outgoing cable feeders (3-pole)



Rated currents and withdrawable unit sizes of fused outgoing cable feeders

Rated breaker current [A]	Derating factors I_e/I_n at an ambient temperature of 35 °C		Withdrawable unit size
	Non-ventilated	Ventilated	
35	0.91	0.91	1/4 / 1/2 M
63	0.72	0.8	1 M
125	0.76	0.88	1 M
160	0.78	0.88	2 M
250	0.78	0.94	2 M
400	0.69	0.82	2 M
630	0.70	0.81	3 M

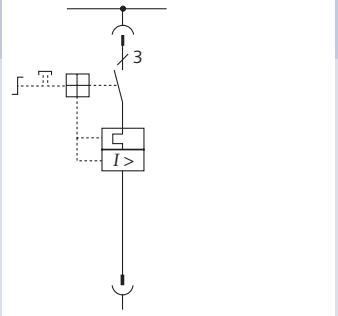
Outgoing cable feeders (4-pole)



Rated currents and withdrawable unit sizes of fused outgoing cable feeders (N-conductor circuit)

Rated breaker current [A]	Derating factors I_e/I_n at an ambient temperature of 35 °C		Withdrawable unit size
	Non-ventilated	Ventilated	
35	0.91	0.91	1/4 / 1/2 M
125	0.76	0.88	1 M
250	0.78	0.94	2 M
400	0.69	0.82	2 M
630	0.70	0.81	3 M

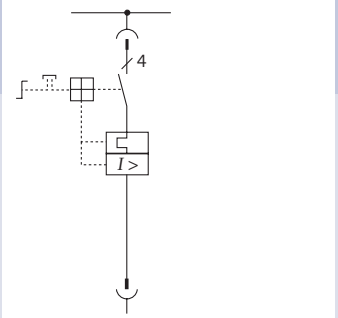
Outgoing cable feeders (3-pole)



Rated currents and withdrawable unit sizes of fuseless outgoing cable feeders

Rated breaker current [A]	Derating factors I_e/I_n at an ambient temperature of 35 °C		Withdrawable unit size
	Non-ventilated	Ventilated	
12	1.00	1.00	1/4 / 1/2 M
25	0.72	0.8	1/4 / 1/2 / 1 M
32/50	0.81/0.78	0.94/0.86	1/2 / 1 M
100	0.77	0.86	1 M
125	0.74	0.81	1 M
160	0.72	0.76	1 M
250	0.75	0.77	2 M
400	0.79	0.85	2 M
630	0.64	0.70	4 M

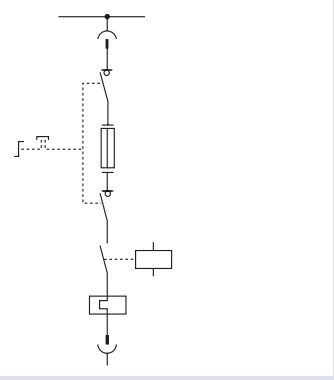
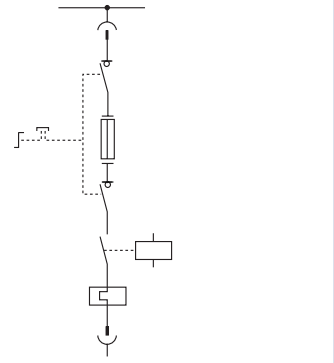
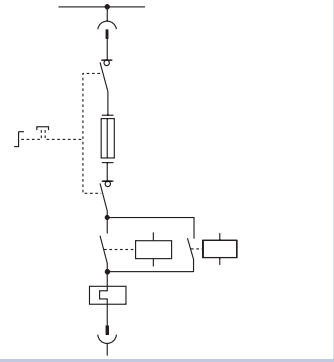
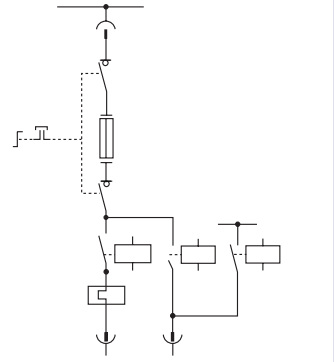
Outgoing cable feeders (4-pole)



Rated currents and withdrawable unit sizes of fuseless outgoing cable feeders (with and without overload and short-circuit releases in the 4th pole (N))

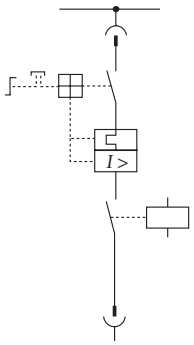
Rated breaker current [A]	Derating factors I_e/I_n at an ambient temperature of 35 °C		Withdrawable unit size
	Non-ventilated	Ventilated	
32	0.81	0.94	1/2 M
125	0.74	0.81	2 M
160	0.72	0.76	2 M
250	0.75	0.77	2 M
400	0.79	0.85	2 M
630	0.64	0.70	4 M

Fused outgoing motor feeders 400 V

Direct contactor normal start-up	Rated data (AC-2 / AC-3) P_n [kW]	I_e [A]	Withdrawable unit size
	5.5	12	1/4 M
	11	21	1/4 M
	18.5	36	1/2 M
	11	21	1 M
	22	43	1 M
	37	68	1 M
	45	83	2 M
	75	133	2 M
	90	157	3 M
	132	233	3 M
	160	280	3 M
	200	340	4 M
	250	420	4 M
Direct contactor heavy-duty start-up Class 30			
	4	8,8	1/4 M
	7.5	15	1/4 M
	15	28	1/2 M
	7.5	15	1 M
	11	21	1 M
	22	43	1 M
	37	68	2 M
	55	99	2 M
	90	157	3 M
	132	233	3 M
	160	280	3 M
Reversing circuit			
	5.5	12	1/4 M
	11	21	1/4 M
	18.5	36	1/2 M
	11	21	1 M
	22	43	1 M
	45	83	2 M
	90	157	3 M
	132	233	4 M
	160	280	4 M
	200	340	4 M
	250	420	4 M
Star-delta circuit			
	15	28	1 M
	30	57	1 M
	37	68	2 M
	55	99	2 M
	75	133	2 M
	90	157	3 M
	132	233	3 M
	160	280	3 M
	250	420	6 M
	355	610	8 M

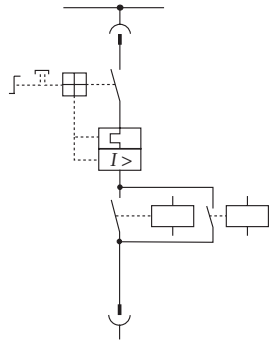
Fuseless outgoing motor feeders 400 V, type 2 with 50 kA overload protection CB without SIMOCODE

Direct contactor normal start-up, type 2 (comfortable solution)



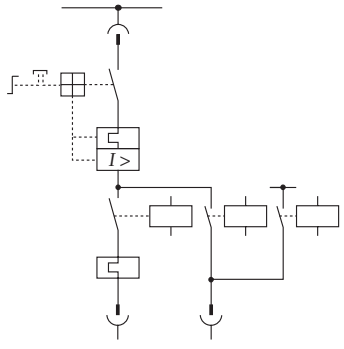
Rated data (AC-2 / AC-3) P_n [kW]	I_e [A]	Withdrawable unit size
0.55	1.5	1/4 M
7.5	15	1/4 M
18.5	36	1/2 M
7.5	15	1 M
22	43	1 M
45	83	2 M
55	99	2 M
75	133	2 M
90	157	3 M
110	195	3 M
160	280	3 M
250	420	4 M

Reversing circuit, type 2 (comfortable solution)



0.55	1.5	1/4 M
7.5	15	1/4 M
18.5	36	1/2 M
7.5	15	1 M
22	43	1 M
45	83	2 M
55	99	2 M
75	133	2 M
90	157	3 M
110	195	3 M
160	280	3 M
250	420	4 M

Star-delta circuit



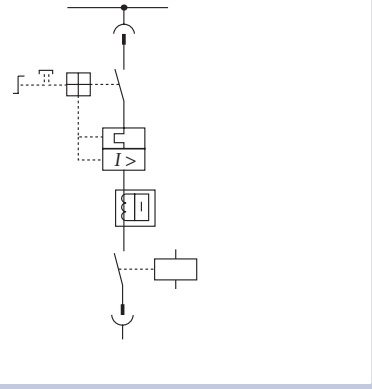
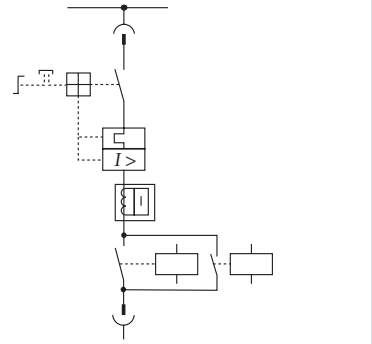
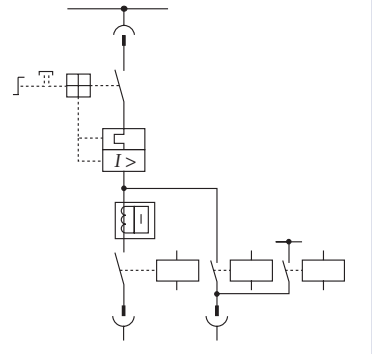
7.5	15	1 M
22	43	1 M
45	83	2 M
55	99	2 M
75	133	3M
90	157	3 M
110	195	3 M
160	280	4 M
250	420	5 M

In case of a short-circuit, the employed short-circuit protection device must safely and successfully disconnect the applied overcurrent. Persons as well as system components must not be subjected to any risks.

Coordination type 2 (for motor starters): The overload relay or other parts must not be damaged, with the exception of contactor contact welding, if the contacts can be easily separated

Previously used term: Type of protection "Class C" (IEC 60292-1, replaced by IEC 60947-4)

Fuseless outgoing motor feeders 400 V, type 2 with 50 kA overload protection CB with SIMOCODE pro

Direct contactor normal start-up, type 2 (with SIMOCODE pro C)	Rated data (AC-2/AC-3) P_n [kW]	I_e [A]	Withdrawable unit size
	0.75	1.9	1/4 M
	5.5	12	1/4 M
	11	21	1/2 M
	18.5	36	1/2 M
	22	43	1 M
	37	68	1 M
	45	83	2 M
	75	133	2 M
	90	157	3 M
	110	195	3 M
	160	280	3 M
	250	420	4 M
Reversing circuit, type 2 (with SIMOCODE pro C)			
	0.75	1.9	1/2 M
	5.5	12	1/2 M
	11	21	1 M
	22	43	1 M
	37	68	2 M
	45	83	2 M
	75	133	2 M
	90	157	3 M
	110	195	3 M
	160	280	3 M
	250	420	4 M
Star-delta circuit, type 2 (with SIMOCODE pro C)			
	0.75	1.9	1/2 M
	5.5	12	1/2 M
	11	21	1 M
	22	43	1 M
	37	68	2 M
	45	83	2 M
	75	133	3 M
	90	157	3 M
	110	195	3 M
	160	280	4 M
	250	420	5 M

- Motor feeders for 500 V and 690 V are available upon request
- Further outgoing motor feeders with the SIMOCODE pro motor management system are available upon request

Plug-In Design

Cubicle structure and equipping

Fuseless outgoing motor feeders up to 45 kW with motor protection switch
Fuseless outgoing cable feeders up to 100 A with circuit-breaker
Combinable with in-line design

Application area

Price-favorable alternative to the comfortable in-line design for outgoing cable and motor feeders

Degrees of protection (in acc. with IEC 60529, EN 60529)

IP20/IP21 ventilated
IP40 ventilated
IP41 ventilated

Cubicle dimensions

Height: 2,200 mm
Width: 1,000 mm (1,200 mm auf Anfr.)
Depth: 400, 600, 1,000, 1,200 mm

Type of internal separation

Type 2b

Design options

- Fuseless load feeders
- Fuseless outgoing motor feeders
- Overload protection with CB, overload relays or the SIMOCODE-DP/SIMOCODE pro C motor management system

Cubicle structure

Height device compartment: 1,750 mm
Width device compartment: 600 mm
Max. number of modules per cubicle (also refer to table):
Module height 50 mm = 35 items
Module height 100 mm = 17 items

Installation plates for special installations:
100 mm to 450 mm height in a 50 mm grid

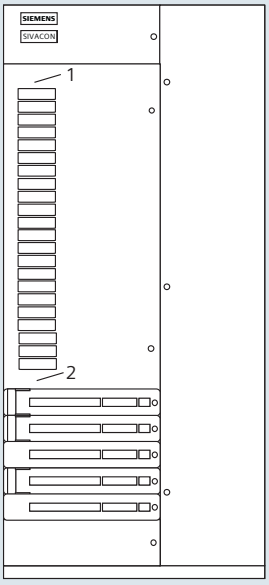
Cable connection

Busbar position top
Cubicle depth 400 mm: Bottom cable connection

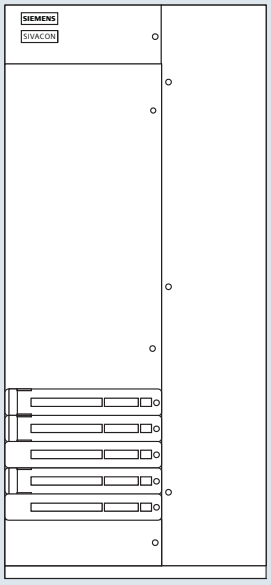
Busbar position rear
Cubicle depth 600/1,000/1,200 mm: Optional top or bottom connection

- Connections for the power unit directly at the switchgear or controlgear
- Control unit connected via plug connector in the cable compartment
- Instrument panel for measuring and command devices directly at the plug-in unit

Equipping of ventilated cubicles



1,000 mm
with door cutout
for instrument panel



1,000 mm
without door cutout
for instrument panel

1) The topmost module cannot be equipped with an instrument panel.

2) Between in-line units and in-line module, a distance of 1 M = 50 mm must be provided for.

Summation current of all feeders: ≤ 1000 A

Individual feeder utilization:

- Motor starters: $I \leq 0{,}8\ I_{\text{n Motor}}$
- Cable feeders: $I \leq 0{,}7\ I_{\text{n Circuit-breaker}}$

Distance rule:
Above and below each motor starter with devices of size 3 (30 to 45 kW), one module (50 mm) distance to the next plug-in module.

When adhering to the above rules, the cubicle can be equipped arbitrarily. All feeders may be operated simultaneously.

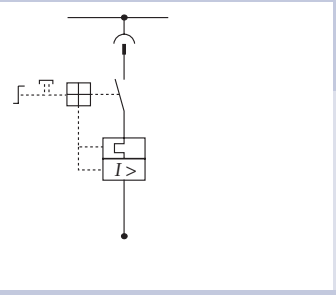
Plug-in busbar system

(Separation possible in 1,000 mm + 750 mm ratio)

Rated operational current ventilated 35°C	Short-circuit strength I_{cw}/I_{pk}
1,000 A	50 kA/110 kA

Plug-in design selection table

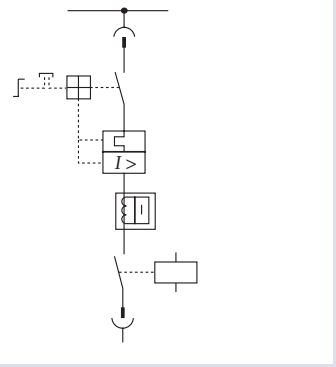
Fuseless outgoing cable feeders (3-pole)



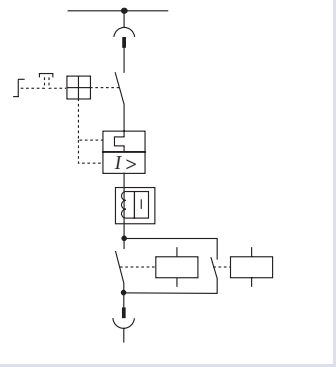
Rated device current [A]	Derating factors I_e/I_n ventilated, 35°C	Module height [mm]
12	0.71	50*
25	0.70	50*
50	0.70	100
100	0.70	100

* With 1-phase current measuring = 100 mm module height

Fuseless outgoing motor feeders 400 V, type 1



Direct contactor normal start-up (Class 10), type 1, 50 kA Rated data P_n [kW]	I_e [A]	With SIMOCODE	Module height [mm]
5.5	12	–	50*
11	21	–	50*
22	43	–	100
45	83	–	100
5.5	12	-DP	100
11	21	-DP	100
22	43	-DP	100
45	83	-DP	100
0.75	1.9	pro C	50
5.5	12	pro C	50
11	21	pro C	100
22	43	pro C	100
37	68	pro C	100
45	83	pro C	100

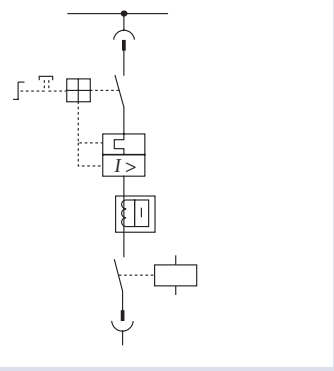


Reversing circuit type 1, 50 kA Rated data P_n [kW]	I_e [A]	With SIMOCODE	Module height [mm]
5.5	12	–	100
11	21	–	100
22	43	–	150
45	83	–	200
5.5	12	-DP	100
11	21	-DP	100
22	43	-DP	150
45	83	-DP	200
0.75	1.9	pro C	100
5.5	12	pro C	100
11	21	pro C	150
22	43	pro C	150
37	68	pro C	200
45	83	pro C	200

* With 1-phase current measuring = 100 mm module height

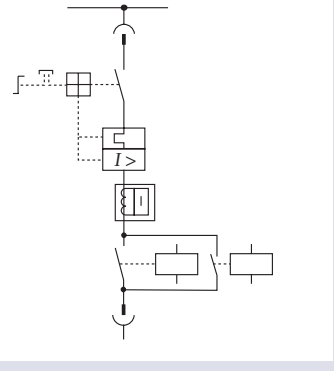
Fuseless outgoing motor feeders 400 V, type 2

Direct contactor normal start-up (Class 10), type 2, 50 kA



Rated data P_n [kW]	Rated data I_e [A]	With SIMOCODE	Module height [mm]
0.55	1.5	–	50 *
7.5	15	–	50 *
22	43	–	100
45	83	–	100
0.55	1.5	-DP	100
7.5	15	-DP	100
22	43	-DP	100
45	83	-DP	100
0.75	1.9	pro C	50
5.5	12	pro C	50
11	21	pro C	100
22	43	pro C	100
37	68	pro C	100
45	83	pro C	100

Reversing circuit type 2, 50 kA



Rated data P_n [kW]	Rated data I_e [A]	With SIMOCODE	Module height [mm]
0.55	1.5	–	100
7.5	15	–	100
22	43	–	150
45	83	–	200
0.55	1.5	-DP	100
7.5	15	-DP	100
22	43	-DP	150
45	83	-DP	200
0.75	1.9	pro C	100
5.5	12	pro C	100
11	21	pro C	150
22	43	pro C	150
37	68	pro C	200
45	83	pro C	200

* With 1-phase current measuring = 100 mm module height

Terms	Explanation	Previously used terms
The following applies to both types of coordination: In case of a short-circuit, the employed short-circuit protection device must safely and successfully disconnect the applied overcurrent. Persons as well as system components must not be subjected to any risks.		
Coordination type 1 (for motor starters)	After a short-circuit disconnection, the starter may be inoperative as a damage to the contactor and the overload relay is permissible.	Type of protection “Class a” (IEC 60292-1, replaced by IEC 60947-4)
Coordination type 2 (for motor starters)	The overload relay or other parts must not be damaged, with the exception of contactor contact welding, if the contacts can be easily separated.	Type of protection “Class c” (IEC 60292-1, replaced by IEC 60947-4)

In-Line Design

Cubicle structure and equipping

Outgoing cable feeders up to 630 A with pluggable in-line fuse switch-disconnectors

Design options

In-line units for outgoing cable feeders up to 630 A alternatively as

- Fuse switch-disconnectors with single break
- Fuse switch-disconnectors with double break
- In both of the above cases with or without electronic fuse monitoring

Cubicle dimensions

Height: 2,200 mm
Width: 1,000 mm (1,200 mm on request)
Depth: 400, 600, 1,000, 1,200 mm

Application area

Price-favorable alternative to the withdrawable design for outgoing cable feeders.

Easy and fast conversion or replacement under operating conditions.

Degrees of protection (in acc. with IEC 60529, EN 60529)

IP20/IP21 ventilated
IP40 ventilated
IP41 ventilated

Type of internal separation

Typ 3b
Typ 4b

Cubicle structure

Height device compartment: 1750 mm
Width device compartment: 600 mm

Max. number of modules per cubicle (also refer to table):
Module height 50 mm = 35 items
Module height 100 mm = 17 items
Module height 200 mm = 8 items

Device compartment for auxiliary devices and instruments with a height between 100 mm and 400 mm, consisting of:

- Door with and without instrument panel
- Mounting plate
- With and without connection module 100 A at the plug-in busbar system

Cable connection

Busbar position top
Cubicle depth 400 mm: Bottom cable connection

Busbar position rear
Cubicle depth 600/1,000/1,200 mm: Optional top or bottom connection

Size	Nominal current [A]	Max. number and cross-sections of the cables to be connected [mm²]
00	160	1 x 95
1	250	1 x 240
2	400	2 x 240
3	630	2 x 240

In-line design selection table

Installation data of ventilated cubicles with 3-pole in-line units (4-pole in-line units upon request)

Installation data of in-line units, 3-pole

Rated Current [A]	Size	Derating factors I_e/I_n ventilated 35°C	Max. number of items per cubicle	Height requirement of in-line units [mm]
160	00	0.78	35	50
250	1	0.80	17	100
400	2	0.80	8	200
630	3	0.79	8	200

Further installations

Designation	Height requirement [mm]
Blanking covers for empty compartments / connection module	50
Device compartment	100 *
Device compartment	200 *
Device compartment	300 *
Device compartment	400 *
Connection module 400 A for device compartment	+ 50
Group fault indicator 1 – 10 in-line units	–
Group fault indicator 1 – 100 in-line units	–

*) Max. utilizable device installation depth 185 mm

Equipping rules for ventilated cubicles with 3-pole in-line units (4-pole in-line units upon request)

1. Equipping in the cubicle from bottom to top, decreasing from size 3 to size 00
2. Recommended maximum equipping, including reserve, per cubicle 1,250 mm (approx. $^2/_3$)
3. Distribution of in-line units of sizes 2 and 3 to different cubicles if possible
4. Summation operational current per cubicle max. 2,000 A
5. Rated currents of the device sizes = 0.8 x I_N of the largest fuse link
6. Rated currents of smaller fuse links of one size = 0.8 x I_N of the fuse link

Plug-in busbar system

(Separation possible in 1,000 mm + 750 mm ratio)

Rated operational current ventilated 35°C [A]	Short-circuit strength I_{cw}/I_{pk} [kA]
2010	50/110

Fixed-Mounted Design

Cubicle structure and equipping

Fuseless outgoing cable feeders up to 630 A
Fused outgoing cable feeders up to 630 A
Outgoing motor feeders up to 250 kW

Application area

Realization of outgoing cable and motor feeders

Degrees of protection (in acc. with IEC 60529, EN 60529)

IP20 ventilated
IP21 ventilated, IP21 non-ventilated
IP40 ventilated, IP40 non-ventilated
IP41 ventilated, IP41 non-ventilated
IP54 non-ventilated

Cubicle structure

Height device compartment:	1,750 mm (10 modules à 175 mm)
Width device compartment:	600 mm
Width cable compartment:	200 mm, 400 mm

Cubicle dimensions

Width: 800, 1,000 mm
Height: 2,200 mm
Depth: 400, 600, 1,000, 1,200 mm

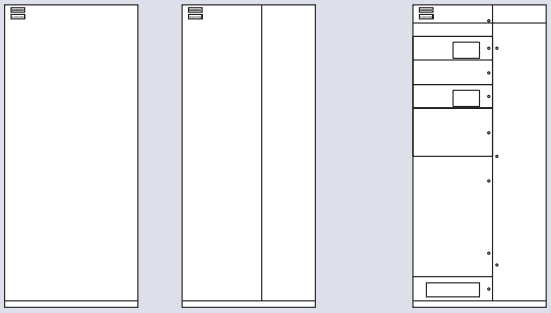
Type of internal separation

Typ 2b, 4a

Design options

- Molded-case circuit-breakers
- Fuse switch-disconnectors
- Switch-disconnectors with fuses
- In-line fuse switch-disconnectors

Illustration of door variants



Cubicle-high door

Cubicle-high door divided for separate cable compartment

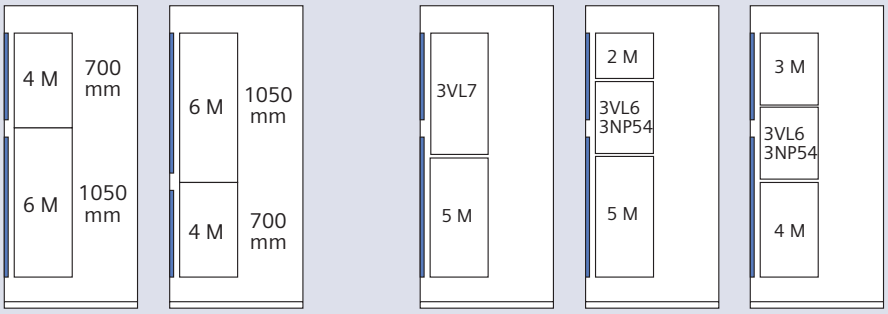
Plain doors in front of module plates

Cable connection

Busbar position top Cubicle depth 400 mm:	Bottom cable connection
Busbar position rear Cubicle depth 600/1,000/1,200 mm:	Optional top or bottom cable connection

Vertical busbar system

Separation possible in 4:6 or 5:5 ratio with or without coupling switch



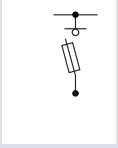
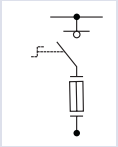
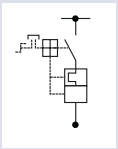
Vertical busbar separation

Vertical busbar coupling

	Ventilated (e.g. IP20)	Non-ventilated (e.g.. IP54)
Rated operational current at 35°C I_n:	1,360 A	1,060 A
Rated short-time current I_{cw}:	50 kA	50 kA
Rated peak withstand current I_{pk}:	110 kA	110 kA
Circuit-breaker coupling I_n:	983 A	841 A

Fixed-mounted design selection table

Outgoing cable feeders, 3-pole

Type	Outgoing feeder	Rated values	Derating factors I_e/I_n [2]		Height requirement [1]	Module height
	Circuit diagram		Ventilated	Non-ventilated	[Modul]	[mm]
Fuse switch-disconnector		NH00/160 A	0.94	0.72	1 M	175
		NH1/250 A	0.98	0.72	2 M	350
		NH2/400 A	0.99	0.78	2 M	350
		NH3/630 A	0.93	0.78	2 M	350
Switch-disconnector with fuses		NH00/125 A	0.84	0.76	1 M	175
		NH00/160 A	0.84	0.72	2 M	350
		NH1/250 A	0.94	0.72	2 M	350
		NH2/400 A	0.79	0.63	2 M	350
		NH3/630 A	0.88	0.70	3 M	525
Circuit-breaker		160 A	0.76	0.72	1 M	175
		250 A	0.77	0.74	1 M	175
		400 A	0.77	0.74	1 M	175
		630 A	0.70	0.64	2 M	350

[1] 1 M = 1 module height = 175 mm
[2] At an ambient temperature of 35°C

Outgoing motor feeders

Nominal motor power [kW]													
Fused design Coordination type 2						Fuseless design Coordination type 1			Coordination type 2			Height requirement [1]	
Fuse switch-disconnector			Switch-disconnector with fuse										
Direct	Reversing	Star-delta	Direct	Reversing	Star-delta	Direct	Reversing	Star-delta	Direct	Reversing	Star-delta	Module	Height [mm]
45	11	18.5	37	11	18.5	45	11	18.5	18.5	15	11	1M	175
75	45	75	90	37	55	110	45	110	110	–	–	2M	350
250	90	132	160	160	132	250	132	–	250	132	110	3M	525
–	250	–	–	–	–	–	200	200	–	200	160	4M	700
–	–	160	–	–	250	–	250	250	–	250	250	5M	875

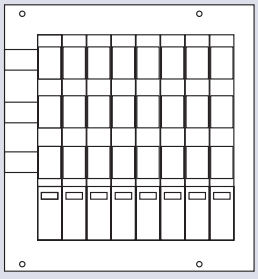
1 M = 1 module height = 175 mm

Fused in-line design

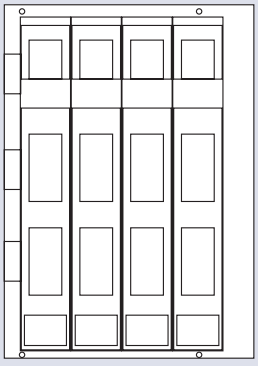
The installation of LV HRC in-line fuse switch-disconnectors in vertical mounting position is realized on modular plates. Per cubicle, two assemblies of LV HRC in-line fuse switch-disconnectors are possible.

Type	Space requirement [mm]	Max. number per module plate	Height requ. [1] [Module] Installation		Derating factors I_e/I_n [2]		Cable connection
			Top	Bottom	Ventilated	Non-ventilated	
NH00/160 A	50	8	3 M	4 M	0.68	0.56	Top/bottom
NH1/250 A	100	4	4 M	5 M	0.68	0.56	Bottom
NH2/400 A	100	4	4 M	5 M	0.72	0.61	Bottom
NH3/630 A	100	4	4 M	5 M	0.64	0.63	Bottom

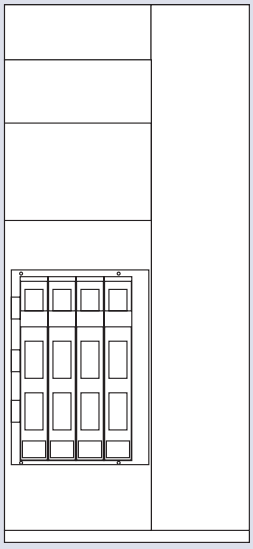
[1] 1 M = 1 module height = 175 mm
[2] At an ambient temperature of 35°C

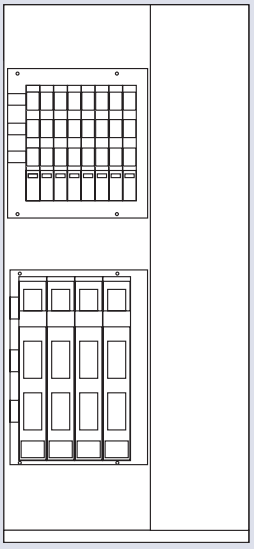


3 M module plate with max. 8 in-line units Size 00



4 M module plate with max. 4 LV HRC in-line units Size 1 – 3





Reactive Power Compensation

Cubicle structure and equipping

Application area

Controlled reactive power compensation system with connection to the main busbar or external installation up to 500 kvar

Degrees of protection (in acc. with IEC 60529, EN 60529)

IP20 ventilated
IP21 ventilated, IP21 non-ventilated
IP40 ventilated, IP40 non-ventilated
IP41 ventilated, IP41 non-ventilated

Cubicle dimensions

Height: 2,200 mm
Width: 800 mm
Dept: 400, 600, 1,000, 1,200 mm

Design options

- Throttled/non-throttled: 5.67%, 7%, 8%,
- With/without audio-frequency trap circuit
- With/without upstream circuit-breaker as disconnector between main and distribution busbar

Reactive power compensation selection tables

Selection table for direct connection to the main busbar

Reactive power per cubicle [kvar]	**Throttling**	**Steps** [kvar]	**Audio-frequency trap or breaker**
100	●	4 x 25	●
125	●	5 x 25	●
150	●	6 x 25	●
175	●	7 x 25	●
200	●	4 x 50	●
250	●	5 x 50	–
300	–	6 x 50	–
400	–	8 x 50	–
500	–	10 x 50	–

Further step variants available upon request

Selection table for back-up fuse and connection cable with external installation

Reactive power per cubicle [kvar]	**Throttling**	**Back-up fuse** (with external installation) [A]	**Cable cross-section** (with external installation) [mm²]
100	●	250	120
125	●	300	150
150	●	355	2 x 70
175	●	400	2 x 95
200	●	500	2 x 120
250	●	630	2 x 150
300	●	2 x 355	2 x 185
400	●	2 x 500	4 x 120
500	●	2 x 630	4 x 150

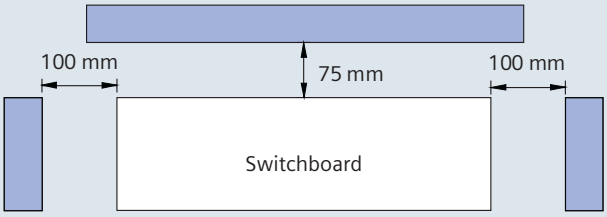
Planning Notes

Mounting Options

Cubicle depth 400 mm and 600 mm: Wall or stand-alone mounting

Cubicle depth 1,000 and 1,200 mm: Stand-alone Mounting

The following minimum distances from the switchboard to the obstacles must be maintained:



The dimensions refer to the rack dimensions. Above the cubicles, a min. space of 400 mm to obstacles must be kept.

Mounting heights higher than 2,000 m above sea level

Reduction factors for mounting heights of cubicles higher than 2,000 m above sea level

Altitude of the mounting site [m]	Reduction factor for the load
Up to 2,200	0.88
2,400	0.87
2,500	0.86
2,700	0.85
2,900	0.84
Up to 3,000	0.83
3,300	0.82
3,500	0.81
Up to 4,000	0.78
4,500	0.76
Up to 5,000	0.74

Combination options with double-front switchboards

1. General

Identical cubicle widths for front cubicle and rear cubicle, longitudinal couplings only combinable with empty cubicle as rear cubicle.

2. Combination options of mounting designs

Combinations are not restricted by the cubicles' installation as front or rear cubicle.

Mounting design		Reactive power compensation		Fixed-mounted design		Withdrawable design		Plug-in design		Neutral/special cubicles
Mounting design	**Cubicle width** [mm] (cubicle + cubicle expansion)	600	800	800	1,000	800	1,000	800	1,000	
3WL Size 1	400									●
	500									●
	600	●								●
	500 + 300		●	●		●		●		●
	500 + 500				●		●		●	●
	600 + 200		●	●		●		●		●
	600 + 400				●		●		●	●
3WL Size 2	600	● 2)								●
	800			● 3)		● 3)				●
	600 + 200		● 2)	● 2)		● 2)		● 2)		● 2)
	600 + 400				● 2)		● 2)		● 2)	● 2)
	800 + 200				●		●		● 4)	● 2)
3WL Size 3	800	●		●						●
Reactive power compensation	600		●		●					●
	800		●	●		●		●		●
Fixed-mounted design	800				●		●		●	●
	1,000			●		●		●		●
Withdrawable design	800				●		●		●	●
	1,000			●		●		●		●
Plug-in design	800				●		●		●	●
	1,000	●	●	●	●	●	●	●	●	●
Neutral/special cubicle		●	●	●	●	●	●	●	●	●

● Combination possible

1) Only combinable with empty cubicles

2) Not combinable with 3WL1232 with the main busbar at the rear top and external connection from the top or the main busbar at the rear bottom and external connection from the bottom

3) Not combinable with main busbar at the rear top and external connection from the top or the busbar at the rear bottom and external connection from the bottom

4) Not combinable with main busbar at the rear top and external connection from the top and main busbar at the rear bottom

3. Combination options of the circuit-breaker design

Busbar position rear (**bottom**), customer connection from the **top**
Busbar position rear (**top**), customer connection from the **bottom**

		Installation rear side 3WL Size 1 Cubicle width [mm]						3WL Size 2 Cubicle width [mm]					3WL Size 3 [1] Cubicle width [mm]	
Installation front side	Cubicle width [mm] Cubicle + cubicle extension	400	500	600	500 + 300	600 + 200	600 + 400	600	800	600 + 200	600 + 400	800 + 200	800	1,000
3WL Size 1	400	●												
	500		●											
	600			●				●						
	500 + 300				●	●			●					
	600 + 200				●				●	●				
	600 + 400						●				●	●		
3WL Size 2	600			●				●						
	800				●	●			●					
	600 + 200					●				● [2]				
	600 + 400						●				●	●		
	800 + 200						●				●			
3WL Size 3 [1]	800													

● Combination possible
[1] Only combinable with empty cubicles
[2] Not combinable with 3WL1220, 3WL1225, 3WL1232

4. Combination options of the double-front switchboards

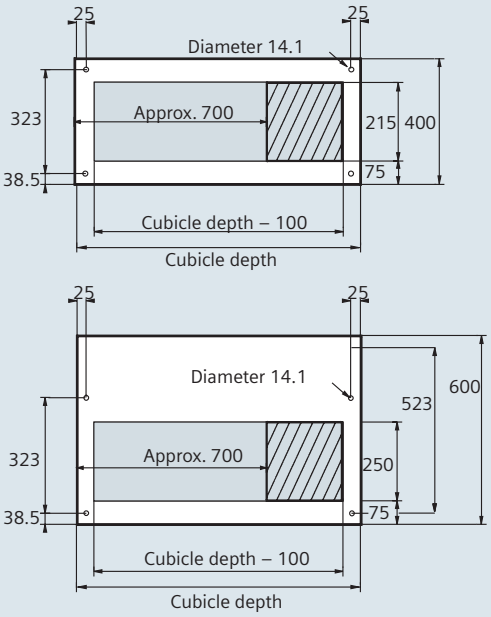
Busbar positions rear (**bottom**), customer connection from the **top**
Busbar positions rear (**top**), customer connection from the **bottom**

		Installation rear side 3WL Size 1 Cubicle width [mm]						3WL Size 2 Cubicle width [mm]					3WL Size 3 [1] Cubicle width [mm]	
Installation front side	Cubicle width [mm] Cubicle + cubicle extension	400	500	600	500 +300	600 +200	600 +400	600	800	600 +200	600 +400	800 +200	800	1,000
3WL Size 1	400	●												
	500		●											
	600			●				● [2]						
	500 + 300				●	●								
	600 + 200				●									
	600 + 400						●			● [3]				
3WL Size 2	600			● [2]				● [5]						
	800													
	600 + 200					● [4]				● [6]				
	600 + 400						● [3]				● [3]			
	800 + 200													
3WL Size 3 [1]	800													

● Combination possible
[1] Only combinable with empty cubicles
[2] Not combinable with 3WL1220, 3WL1225, 3WL1232
[3] Not combinable with 3WL1232
[4] Not combinable with 3WL1208, 3WL1210, 3WL1212, 3WL1216, 3WL1232
[5] Combinable 3WL1210 – 3WL1216 with 3WL1210 – 3WL1216
Combinable 3WL1220 – 3WL1225 with 3WL1220 – 3WL1225
Not combinable with 3WL1232
[6] Combinable 3WL1210 – 3WL1216 with 3WL1210 – 3WL1225
Not combinable 3WL1220 – 3WL1225 with 3WL1220 – 3WL1225
Not combinable with 3WL1232

Floor openings

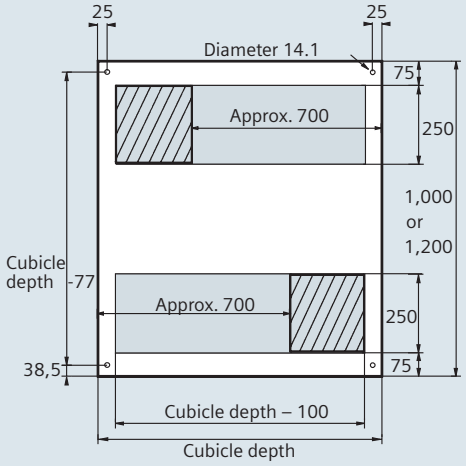
Cubicle depth 400 mm, 600 mm



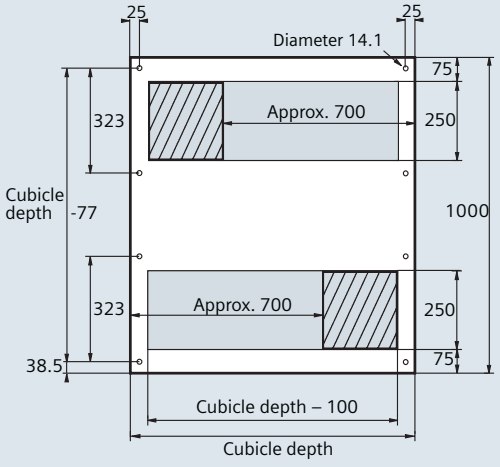
Free spaces for cable and busbar glands

Free spaces for cable entry in cubicles with cubicle compartment at the right

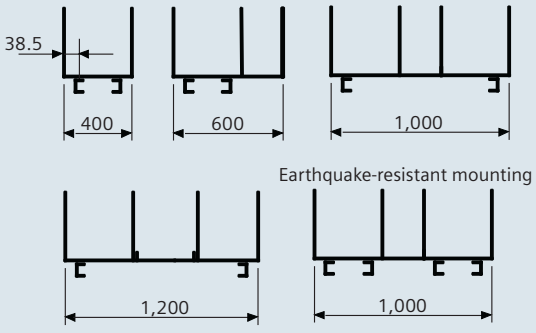
Cubicle depth 1,000 mm 1,200 m (standard version)

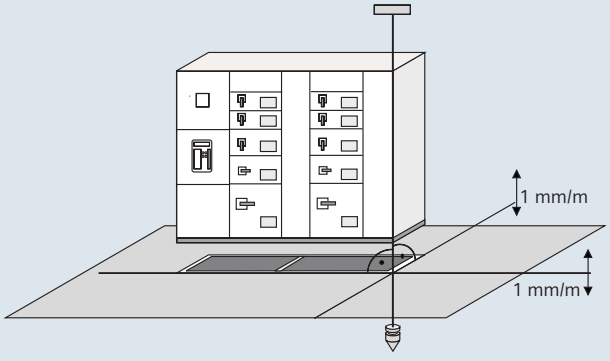


Cubicle depth 1,000 mm (earthquake-resistant version)



Mounting on raised floors / tolerance data





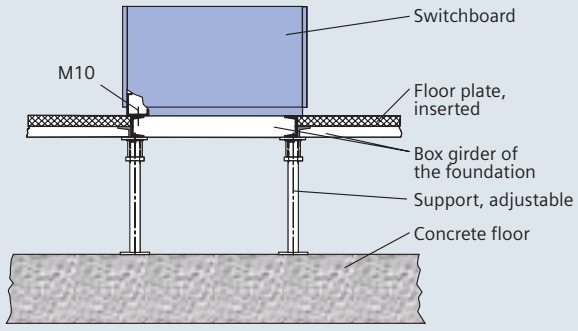
The foundation generally consists of concrete and a breakthrough for cables.
The switch panels are mounted onto a foundation frame, which is made of steel girders.
The dimensions refer to the rack dimensions.

Permissible deviations of the mounting surface
It must be assured that:

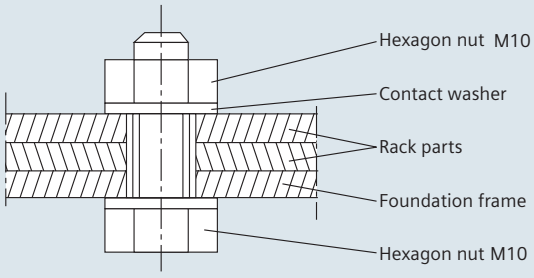
- The foundation is accurately adjusted
- The joints of several foundations are smooth
- The surface of the frame lies on one level with the surface of the completed floor

Installation examples

Installation on false floors (not permissible for earthquake-resistant version)

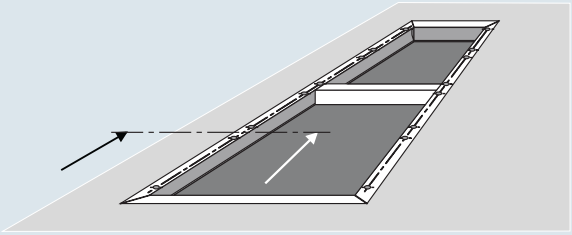


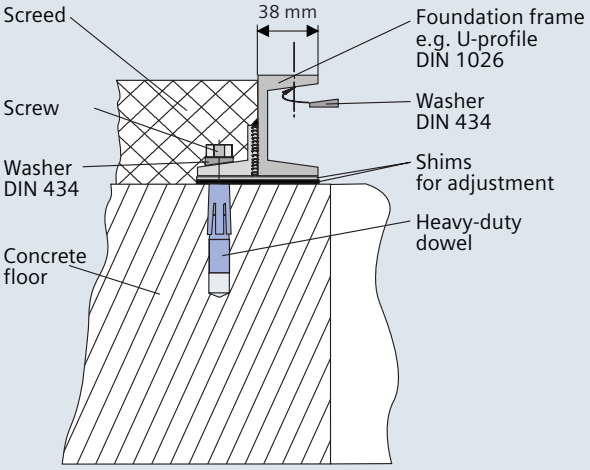
Fixation of the switchboard to the foundation



Tightening torque: approx. 60 Nm

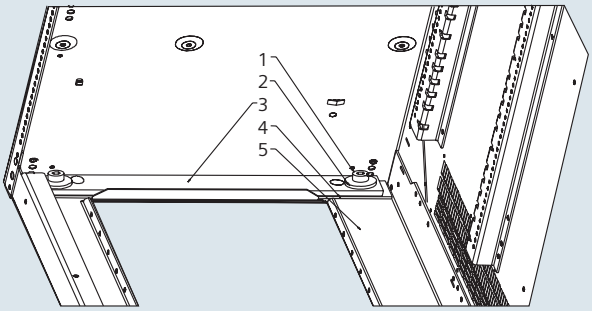
Foundation frame fixation on concrete





The fixation with M10 on U-steels in accordance with DIN 1026 is realized by means of washers in accordance with DIN 434. For these U-steels, a minimum leg width of w = 38 mm is recommended for the foundation frame. For sections with equal legs, a support width for washers DIN 125 of 22 mm is sufficient.

Earthquake-resistant installation



1 Rack floor
2 Shim plate 4 mm thick (steel)
3 Floor edging 40 x 10 mm (steel)
4 Clamping washer DIN 6796-12-FST-MECH ZN
5 Cylinder-head screw M12x...-12.9-A3L
(... = length depending on the construction of the foundation frame)

Inlet and connection to the SIVACON 8PS busbar-trunking system

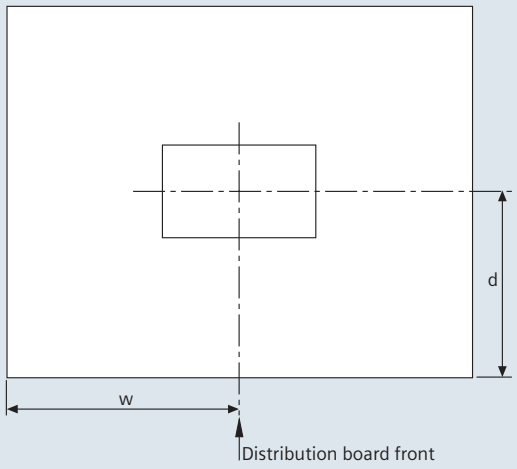
Busbar trunking connection for Siemens power distribution boards

Connection to the Siemens SIVACON 8PV power distribution board system as a type-tested low-voltage switchgear and controlgear assembly (TTA) in accordance with IEC / EN 60439-1 and -2

The connection of SIVACON 8PV and SIVACON 8PS busbar trunking systems of the LD and LX series is realized via an installed busbar trunking connector for rated currents up to 5,000 A.
The busbar connection can both be routed from the top as well as from the bottom and facilitates flexible wiring options.
The factory-fitted copper plating between the point-to-point and line trunking system guarantees a high short-circuit strengths which is assured by means of a type test and offers an enormous degree of safety for power transmission.

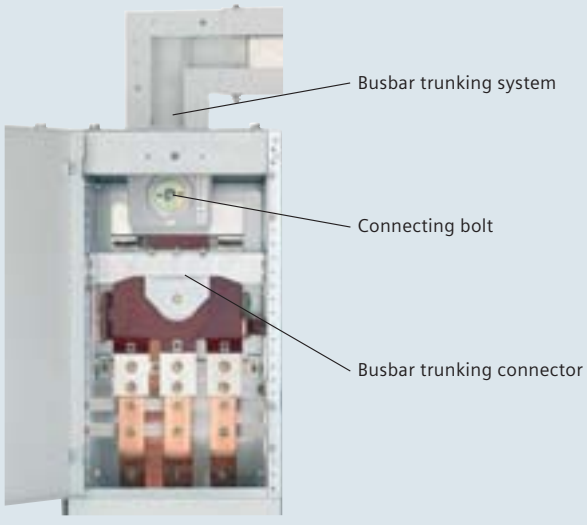
Connection options

The connection system of the SIVACON 8PV is completely accommodated in the distribution board.
For connection, special distribution terminal boxes with a circumferential sheet collar of type LD/LX...-VEU-... are required.
Straight, angular and offset distribution terminal boxes are available.
The connection system is flat-mounted in the distribution board, seen from the distribution board's front.



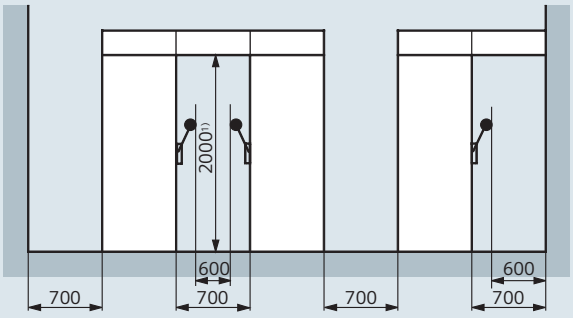
SIVACON distribution board, top view

(The exact dimensions depend on the used busbar trunking system and circuit-breakers are available upon request; for contact partners, please consult the back of this manual)



Operating and maintenance gangways

(In accordance with DIN VDE 0100 Part 729)



1) Minimum passage height beneath covers or casings

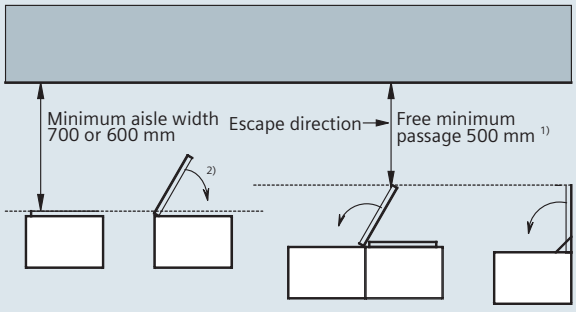
Caution!

When using an elevating truck for the installation of circuit-breakers, the minimum aisle widths must be matched to the elevating truck!

Manufacturer: e.g. Kaiser+Kraft

Elevating truck dimensions:	Height	2,000 mm
	Width	680 mm
	Depth	920 mm
Minimum aisle width:	Approx. 1,500 mm	

Reduced aisle widths in the area of open doors



1) With opposing switchboard fronts, constriction by open doors (i.e. doors which do not close towards the escape direction) is only accounted for on one side

2) Door widths must be observed, i.e. a minimum door opening angle of 90° is required

Door opening angle = 120°

Door width [mm]	Reduction of aisle width [mm]
400	350
500	440
600	520
800	700
1,000	870

With SIVACON, a reduction of the aisle width is not required if all doors can be arranged in a manner which assures that they close towards the escape direction.

Maximum door widths depending on design	[mm]
Circuit-breaker design	1,000
Withdrawable design	600
Fixed-mounted design	1,000
Plug-in design	600

Transport units/transport packings

The maximum length of a transport unit amounts to:

- 2,400 mm for cubicles with top or rear busbar position
- 1,500 mm for power centers in general and 3WL as longitudinal coupling
- 1,000 mm for power centers with 3WL as incoming (or outgoing) feeder
- The transport unit length + 200 mm (230 mm*) amounts to the transport packing length (at least 1,400 mm (1,430 mm*)).
- The transport height amounts to 190 mm (350 mm).

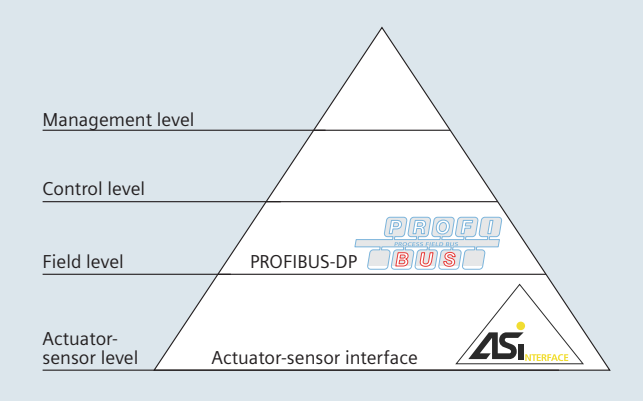
The transport packing depth amounts to the following With cubicle depth [mm]	Transport packing depth [mm]
400	900 (930*)
600	1,050 (1,060*)
1,000	1,460 (1,490*)
1,200	1,660 (1,690*)

* Bracket values = seaworthy packing

Communication in Switchboards

Continuously increasing requirements placed upon switchgear and controlgear in state-of-the-art, high-performance automation concepts:

- More sensors and actuators
- Improved functionality within the switchgear and controlgear
- High degree of information demand
- Minimum response times
- Parameter settings – E.g. for remote parameterization
- Signaling information – ON, OFF, FAULT ...
- Power management – Demand rate minimization
  – Operating data recording
  – Fault data evaluation



Cost reductions thanks to distributed plant structures

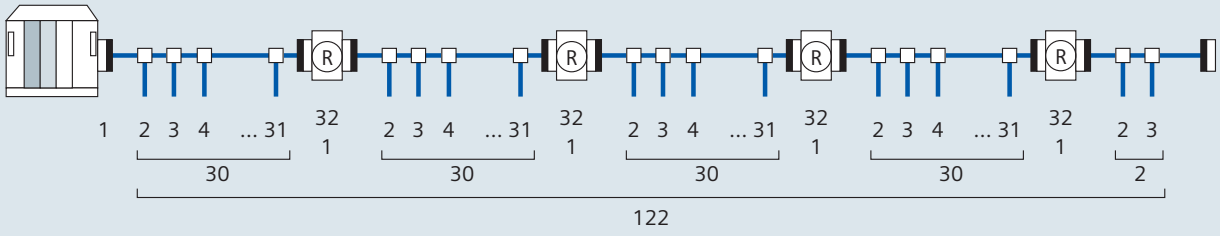
- Planning – Clear project structures
  – Reduced space requirements
- Configuration – Fewer clamping points
  – Device-integrated functions
- Mounting – Reduced wiring
  – No terminal blocks
- Commissioning – Pre-commissioning
  – "Change wiring" via software
  – Fewer fault sources
- Maintenance/service – Clear plant structure
  – Faster fault diagnostics
- Visualization – Illustration of operating states

Modules for the application of SIVACON

- SIMOCODE pro motor management
- SENTRON 3WL and 3VL circuit-breakers
- MICRO, MIDI and MASTER drives
- ET 200 modules
- PROFIMESS universal measuring device
- AS-Interface components

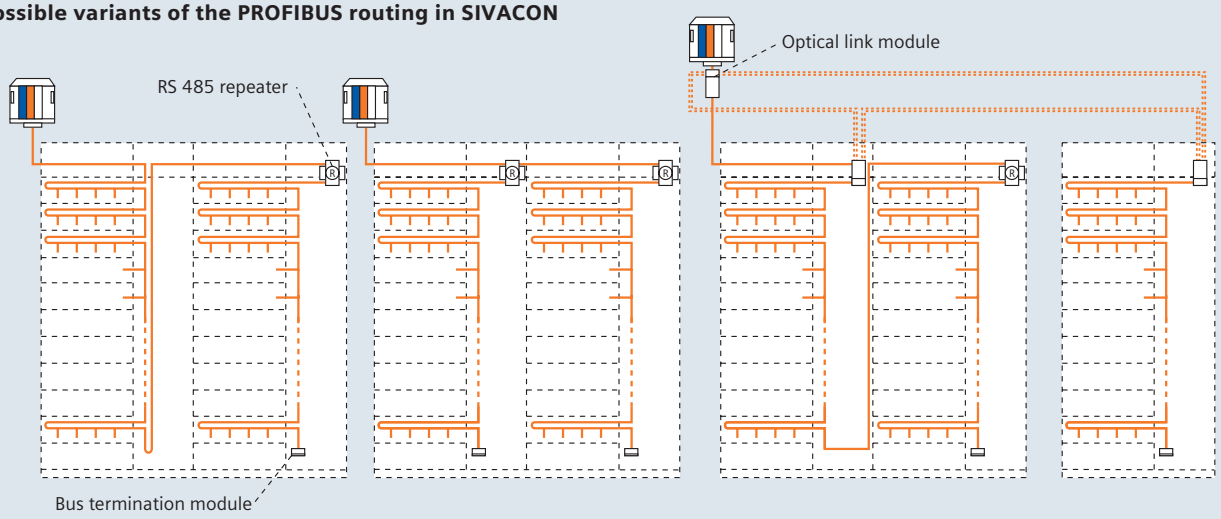
Number of stations

PROFIBUS-DP	Up to 127 addressable bus slaves (5 of which are reserved)
SIMOCODE pro	30 stations per segment
AS-i	Max. 31 slaves with maximally 4 inputs/4 outputs



Note:
One bus segment may contain up to 32 stations. Repeaters and bus termination modules are not addressable, are, however, counted as stations of the bus segment in accordance with the illustration.

Possible variants of the PROFIBUS routing in SIVACON



PROFIBUS – Baud rate limitation (500 kBaud)

The total length of the stub lines in the communication network (all bus stub lines inside the withdrawable units) influences the transmission rate for the PROFIBUS communication. The permissible total length of such stub lines is exceeded with a maximum segment utilization (30 stations) and can thus lead to communication faults.

The maximum transmission rate for the PROFIBUS communication is thus limited to **500 kBaud**.

The application of 1.5 Mbaud is permissible in exceptional cases only when complying with the following conditions:

- Restriction of the slave number per segment to 10–15 stations (depending on withdrawable unit size)
- No employment of devices with segment monitoring functions (special OLMs and diagnostics repeaters)
- Coordination of the bus and the communication structure with Siemens A&D CD DM TPM in Leipzig

New – Active stub line modules for connection of MCC in withdrawable design to PROFIBUS-DP with high speed up to 12 Mbit/s – New

High-speed communication

- Low-disturbance connection of the functional units in withdrawable design
- Transmission rate up to 12 Mbit/s
- Application of active stub lines ASLM-4 and ASLM-6

Module

The module is available in 2 variants:

- ASLM-4 for the connection of 4 functional units
- ASLM-6 for the connection of 6 functional units

Advantages

- Transmission rates up to 12 Mbit/s
- Increased bus quality and reliability
- Retrofitting of functional units without bus interruption
- Easy change of the slaves' bus assignments by means of re-plugging
- High degree of cubicle assignment flexibility thanks to the modules' combination

Resistance to Internal Arcs

The testing of low-voltage switchboards under internal arc conditions is considered a special test in accordance with IEC 61641 and VDE 0660 Part 500, Supplement 2.
With this test, the danger to which persons may be subjected in cases of internal arcs are assessed.
Thanks to its testing under internal arc conditions, SIVACON offers the proof of operator safety with the below-stated assessment criteria as a standard.

Assessment criteria

1. Properly secured doors, covers, etc., must not open.
2. Parts which may pose risks must not fly off.
3. No holes must form in the freely accessible outer parts of the enclosure (casing).
4. No vertically attached indicators must inflame.
5. The protective conductor circuit for touchable parts of the enclosure must remain functioning.

Grading for fault limitation

The top priority is the attempt to prevent the formation of internal arcs completely. All quality assurance measures serve this attempt. These measures start with the development of the system components, which is accompanied by numerous type tests, and furthermore comprise the switchboards' correct configuration following order placement as well as routine tests in our production units. A clearly defined module structure and DP-supported configuration, ordering and handling procedures form the basis for configuration.

For SIVACON, a graded concept was developed by Siemens. Step 1 starts with a very high degree of operator safety without an extensive limitation of the internal arc effects within the system. Step 2 furthermore limits the damage to the system's cubicle. In the third and fourth step, the effects on the function compartment or the internal arc's point of origin are limited, for example, to the busbar compartment, device compartment, withdrawable unit or connection compartment.
This facilitates the system's flexible and cost-effective adjustment to the actual requirements of the operator.

Load profile of SIVACON

Rated operational voltage	Up to 690 V + 5%
Impulse current	110 kA / 143 kA
Symmetrical short-circuit current	50 kA / 65 kA
Permissible arcing time	bis 300 ms

SIVACON internal arc concept

Step 1 (standard)

Operator safety without an extensive limitation of the internal arc's effects within the system

- Molded-plastic covers in the termination walls
- Pressure-relief flaps in the roof sheeting with non-ventilated systems
- Spring-loaded locking device

50 kA/300 ms; 65 kA/300 ms with additional measures

Step 2

Operator safety with limitation of the internal arc's effects on a cubicle

- Molded-plastic covers in the termination walls
- Pressure-relief flaps in the roof sheeting with non-ventilated systems
- Spring-loaded locking device
- Light barriers (2 items/cubicle)

50 kA / 300 ms; 65 kA/300 ms with additional measures

Step 3 (fixed-mounted and withdrawable design)

Operator safety with limitation of the internal arc's effects on the function compartment

- Molded-plastic covers in the termination walls
- Pressure-relief flaps in the roof sheeting with non-ventilated systems
- Spring-loaded locking device
- Light barriers (2 items/cubicle)
- Light barriers between the device compartment and the busbar compartment

50 kA/300 ms; 65 kA/300 ms with additional measures

Step 4 (withdrawable design)

Operator safety with limitation of the internal arc's effects on the point of origin

- Molded-plastic covers in the termination walls
- Pressure-relief flaps in the roof sheeting with non-ventilated systems
- Spring-loaded locking device
- Light barriers (2 items / cubicle)
- Light barriers between the device compartment and the busbar compartment
- Plug-in busbar covers
- Withdrawable contact covers (only NFM withdrawable unit)

With the additional measures, an inflammation of the internal arc upstream the protective organ is practically excluded.

- Insulated main busbar
  Busbars wrapped with protective tape, additionally applicable with all above-stated steps

Checklist for Planners

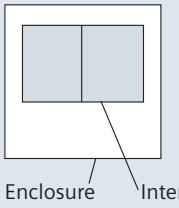
Project name:						
Client:						
Planner:						
Mounting location/altitude:	m (above seal level NN)					
Mounting type:	◯ Single-front	◯ Double-front				
Ambient temperature:	°C					
Degree of protection:	IP	Internal separation: Type				
Maximum possible distribution board dimensions: B x H x T	mm	Room height:	mm			
Maximum transport dimensions: B x H x T	mm					
Network type:	◯ TN-S	◯ TN-C	◯ TN-C-S	◯ TT	◯ IT	
Cross-section PEN/N:	◯ IEC	◯ Half	◯ Full			
Number of transformers:	Items					
Transformer power (per transformer):	kVA					
Rated infeed current:	A					
Frequency:	Hz					
Rated operational voltage:	V					
Rated short-time withstand current of the main busbar	I_{cw} (1 sec) kA_{eff}					
Connection with:	◯ Conductor bars	◯ Cables				
Inlet of bars/cables:	◯ Top	◯ Bottom	◯ Top/bottom			
Internal arc protection (refer to page 36):	◯ Step 1	◯ Step 2	◯ Step 3	◯ Step 4		
Mounting designs: Incoming feeders:	◯ Fixed-mounted design	◯ Withdrawable design				
Outgoing feeders ≥ 630 A:	◯ Fixed-mounted design	◯ Withdrawable design				
Couplings:	◯ Fixed-mounted design	◯ Withdrawable design				
Outgoing feeders < 630 A:	◯ Fixed-mounted design	◯ Plug-in design	◯ Withdrawable design			
Outgoing feeder design < 630 A:	◯ Fuseless	◯ Fused				
Further information:						

Types of Internal Separation (Types 1 to 4)

Protection objectives according to VDE 0660 Part 500, 7.7:

- Protection against contact with hazardous parts in adjacent functional units. The degree of protection must be at least IPXXB.
- Protection against the intrusion of solid alien bodies from one functional unit of the switchgear and controlgear assembly to an adjacent one. The degree of protection must be at least IP2X

Symbol definition:

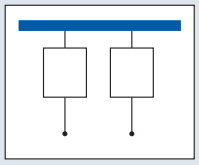


Busbars, including distribution busbars

Functional unit(s), including connection points for the connection of external conductors

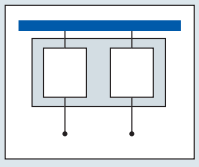
Type 1

No internal separation



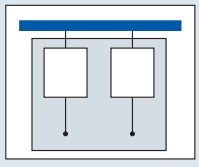
Type 2

Separation between busbars and functional units



Type 2a

No separation between connections and busbars

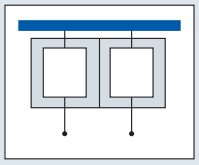


Type 2b

Separation between connections and busbars

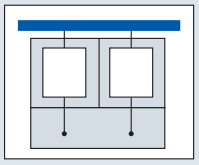
Type 3

Separation between the busbars and the functional units + separation between the functional units themselves + separation between connections and the functional units



Type 3a

No separation between connections and busbars

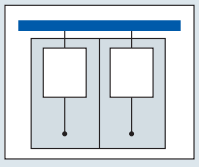


Type 3b

Separation between connections and busbars

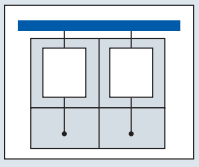
Form 4

Separation between the busbars and the functional units + separation between the functional units themselves + separation between connections of functional units



Form 4a

Connections in the same separation as the connected functional unit



Form 4b

Connections not in the same separation as the connected functional unit

Depending on the respective requirements, the function compartments can be categorized in accordance with the following table:

		Type 1	Type 2a	Type 2b	Type 3a	Type 3b	Type 4a	Type 4b
Circuit-breaker design	ACB	●	●	●	●	●	●	●
	MCCB			●			●	
	DUMECO			●			●	
	EFEN			●			●	
Fixed-mounted design	Modular			●			●	
	Compensation	●						
Plug-in design	In-line					●		●
	Plug-In			●				
Withdrawable design						●		●

TTA – PTTA

The safety standard for low-voltage switchgear and controlgear assemblies

The requirements placed upon low-voltage switchboards with regard to heat dissipation, high packing density, short-circuit current capacity and insulation resistance have increased over the past years.

The safe operation of a low-voltage switchboard can only be assured if the manufacturer complies with the standards applicable to the respective switchgear and controlgear assembly and is able to prove such compliance.

Only switchboards which correspond to the currently applicable standards comply with the present safety regulations.

Applicable standards are:

IEC/EN 60439-1, VDE 0660 Part 500

Low-voltage switchgear and controlgear assemblies

Type-tested and partially type-tested assemblies

These standards have identical contents. They show two possibilities in accordance to which low-voltage switchboards may be manufactured:

- Type-tested switchgear and controlgear assembly (TTA)
- Partially type-tested switchgear and controlgear assembly (PTTA)

Type-tested assembly (TTA)

In these assemblies, all components have been type-tested both individually as well as in the assembled form, including all electrical and mechanical connections.

The application of other switchgear and controlgear and protective devices is only permissible if their technical data are at least identical or better (conclusion by analogy).

Partially type-tested assembly (PTTA)

These assemblies contain both type-tested as well as non-type-tested components. Non-type-tested components must be derived from type-tested components.

With type-tested assemblies, all proofs must be established by means of tests.

With partially type-tested assemblies, two exceptions are permissible (refer to the table):

1. Proof of compliance with the limit overtemperatures. With switchboards with a supply current strength up to max. 3,150 A, the proof can also be provided by means of extrapolation.
2. The short-circuit strength proof is not required for switchboards which are protected by a current-limiting protective organ whose let-through current amounts to ≤ 15 kA.

If an extrapolation or calculation in accordance with DIN VDE 0660 Part 500, is required, this must always be based on a derivation of type-tested systems.

Only if all required proofs could be clearly established, may switchgear and controlgear assemblies be designated as type-tested switchgear and controlgear assemblies (TTA) or partially type-tested switchgear and controlgear assemblies (PTTA). These combinations thus comply with the applicable safety regulations.

Required proofs for compliance with the standards

Requirements	TTA proof established by	PTTA proof established by
1. Limit overtemperature	Test	Test or extrapolation
2. Insulation resistance	Test	Test
3. Short-circuit strength	Test	Test or extrapolation
4. PE conductor effectiveness	Test	Test
5. Creepage distances and clearances	Test	Test
6. Mechanical function	Test	Test
7. IP degree of protection	Test	Test

Checklist for Low-Voltage Switchgear and Controlgear Assemblies

Checklist for TTA

For low-voltage switchgear and controlgear assemblies, IEC/EN 60439-1, IEC/EN 60439-2 and IEC/EN 60439-3, DIN VDE 0660, Parts 500, 502 and 504

Special application conditions in accordance with .....

Routine tests

Seq. No.	Test type	Test		VDE 0660 Part 500 Section	Result Inspector
1	–	Type test		8.2.1 – 8.2.7	Passed
2	P	Mechanical function test (actuating elements, interlockings, etc.)	Routine tests	8.3.1	
3	S	Device installation according to regulations			
4	S	Impeccable line routing			
5	S/P	Degree of protection of enclosure			
6	S/P	Creepage distances, clearances and other distances			
7	P	Connection of construction parts as well as conductors among each other and with devices (random test of tightening torques)			
8.1	P/V	Compliance of the wiring with the circuit documents			
8.2	V	Compliance of identification, inscriptions, completeness of the AWAs, etc., with the circuit documents and other documents			
9	P	Insulation test		8.3.2	
10	S/P	Protective measures and consistent protective conductor connection		8.3.3	
11	P	Electrical function test (if explicitly specified)		8.3.1	

Legend:

S = Visual inspection for compliance with requirements

P = Inspection – manually or with electronic or mechanical measuring devices

V = Comparison with production documents

Checklist for PTTA

For low-voltage switchgear and controlgear assemblies, IEC/EN 60439-1, IEC/EN 60439-2 and IEC 60890 (HD528 S1), DIN VDE 0660, Parts 500, 502 and 507

Special application conditions in accordance with .....

Proofs/tests

Seq. No.	Requirement	VDE 0660 Part 500 Section		Proof	Result	Inspector
1	Limit overtemperature	8.2.1	Proof	Proof of compliance with the limit overtemperature by means of test, extrapolation of TTA or determination in acc. with VDE 0660 Part 507		
2	Insulation resistance	8.2.2		Refer to seq. No. 10		
3	Short-circuit strength	8.2.3		Proof of the short-circuit strength by means of test or extrapolation of similar type-tested arrangements		
4	Effectiveness of the PE conductor circuit	8.2.4		Proof of the impeccable connection between elements of the switchgear and controlgear assembly and the PE conductor		
	Impeccable connection between elements of the switchgear and controlgear assembly and the PE conductor circuit	8.2.4.1 8.2.4.1				
	Short-circuit strength of the PE conductor circuit	8.2.4.2		Proof of the PE conductor's short-circuit strength by means of test or respective design and arrangement of the PE conductor (refer to Section 7.4.3.1.1 of VDE 0660 Part 500)		
5	Creepage distances and clearances	8.2.5		Proof of the creepage distances and clearances		
6	Mechanical function	8.2.6		Proof of the mechanical function		
7	IP degrees of protection	8.2.7		Proof of the IP degree of protection		
8	EMC	8.3.8		Proof of the EMC compatibility by compliance with requirements 7.10.2 a) and b)		

Test list for PTTA (continued)

Seq. No.	Test type	Test		VDE 0660 Part 500 Section	Result	Inspector
9.1	P	Mechanical function test (actuating elements, interlockings, etc.)	Routine tests	8.3.1		
9.2	S	Device installation according to regulations				
9.3	S	Impeccable line routing				
9.4	S/P	Degree of protection of enclosure				
9.5	S/P	Creepage distances, clearances and other distances				
9.6	P	Connection of construction parts as well as conductors among each other and with devices (random test of tightening torques)				
9.7	P/V	Compliance of the wiring with the circuit documents				
9.8	V	Compliance of identification, inscriptions, completeness of the AWAs, etc., with the circuit documents and other documents				
9.9	P	Electronic function test (if explicitly specified) (agreements user/manufacturer, FO322)				
10	P	Insulation test		8.3.2		
		or proof of the insulation resistance's insulation strength		8.3.4		
11	S/P	Protective measures and consistent protective conductor connection		8.3.3		

Legend:

V = Visual inspection for compliance with requirements

I = Inspection – manually or with electronic or mechanical measuring devices

C = Comparison with production documents

Environmental Conditions/ Degrees of Protection

Environmental conditions for switchboards

The outside climate and the external environmental conditions (natural foreign matters, chemical active harmful substances, small animals) may have varyingly strong influences on switchboards. The influence depends on the air-conditioning equipment of the switchboard room. Necessary additional protective measures for the switchboard therefore depend on the resulting indoor room climates, which are divided into three environmental classes:

Environmental class IR 1 (indoor room 1):

Indoor rooms in buildings with a sound heat insulation or a high heat capacity, heated or cooled, normally only subjected to temperature monitoring, e.g. normal residential rooms, offices, shops, transmission and switching centers, storage rooms for sensitive goods.

Environmental class IR 2 (indoor room 2):

Indoor rooms in buildings with minor heat insulation or a low heat capacity, heated or cooled, without temperature monitoring. The heating or cooling may fail for several days, e.g. unattended relay, amplifying and transformer stations, stables, motor vehicle repair shops, fabrication rooms for unfinished goods, hangars.

Environmental class IR 3 (indoor room 3):

Indoor rooms in buildings without noteworthy heat insulation and a low heat capacity, neither heated nor cooled, also in warm and humid areas, e.g. workshops, telephone booths, building entrances, barns, attics, unheated storage rooms, sheds, garages, network stations.

Environmental conditions in switchboard rooms				**Switchboard measures**				
Room climate in acc. with IEC 60721-3-3 with direct influence on the switchboard	Ambient temperature Relative air humidity	Condensation	Natural foreign matters, chemical harmful substances, small animals	Heating	Degree of protection to the operating room	Degree of protection to the cable gallery	Contact treatment Screw connections	 Movable contacts
Environmental class IR1 [3K3]	+5 to +40°C 5% to 85% 24-h average max. 35°C	None	None	–	IP20/40	–	–	–
Environmental class IR2 [3K6]	–25 to +55°C 10% to 98% 24-h average max. 50°C	Occasionally, approx. once per month for 2 hours	None	–	IP20/40	–	–	–
			Airborne sand	–	IP54	–	–	–
			Small animals	–	IP40	IP40	–	–
Environmental class IR3 [3K6]	–25 to +55°C 10% to 98% 24-h average max. 50°C	Frequently, approx. once per day for 2 hours	None	●	IP20/40	–	–	–
			Airborne sand	●	IP54	–	–	–
			Dripping water in acc. with IEC 60529	●	IP41	–	–	–
			Airborne sand, dust and splash water in acc with IEC 60529	●	IP54	–	–	–
			Small animals	●	IP40	IP40	–	–

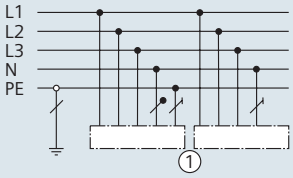
Areas with chemical emission		
Permanently permissible concentration		Measures in cases of higher concentrations:
Sulfur dioxide (SO_2)	< 2 ppm	With higher concentrations, measures to reduce the content of harmful substances must be taken, e.g. ■ Suction of the air for the operating from a point with low exposure ■ Application of slight overpressure to the operating room (e.g. supply of clean air to the switchboard) ■ Switchroom climatization (temperature reduction, relative air humidity < 60%, if required, application of filters for harmful substances) ■ Reduction of temperature rise (overdimensioning of switchgear and controlgear or components such as busbars and distribution busbars)
Hydrogen sulfide (H_2S)	< 1 ppm	
Hydrogen chloride (HCl)	< 3 ppm	
Amonia (NH_3)	< 15 ppm	
Nitrogen oxides (NO_2)	< 2 ppm	
Chloride exposure C1 (salt fog)	< 2 mg/dm²	

Network Systems

Distribution systems (network types) in accordance with 60364-3 (DIN VDE 0100-300)

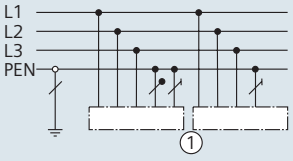
Determination of protective measures and selection of the electrical operating equipment according to the distribution system.

TN Systems



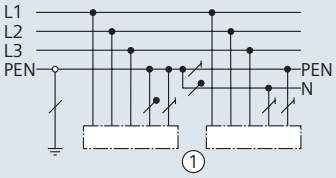
TN-S system

The neutral conductor and protective conductor function are consistently separated in the system.



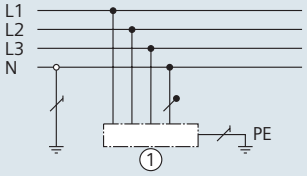
TN-C system

The neutral conductor and protective conductor function go together throughout the entire system.



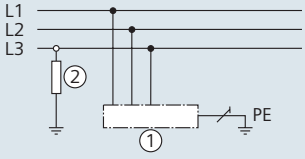
TN-C-S system

Combination between the neutral and the protective conductor function. In one part of the system, they are composite in one conductor, while they are separated in another part.



TT system

In the TT system, one point is directly grounded; the elements of the electrical system are connected to ground electrodes which are separated from the signal ground. The TT system corresponds to the system in which today the protective grounding, current-operated ground fault circuit interrupter system, voltage-operated ground fault circuit interrupter system and protective measures are applied.



IT system

The IT system features no direct connection between active conductors and grounded parts; the elements of the electrical system are grounded. The IT system corresponds to the system in which today the protective conductor system protective measure is applied.

First letter = grounding condition of the supplying current source

T = Direct **grounding** of one point

I = Either **insulation** of all active parts of the ground or connection of one point to the ground via an impedance

Second letter = grounding condition of the elements of the electrical system

T = Elements are **directly grounded**, irrespective of a possible grounding of one point of the current supply

N = Elements are directly connected to the **signal ground**; in AC current networks, the grounded point is generally the star point

Further letters = Arrangement of the neutral and the protective conductor

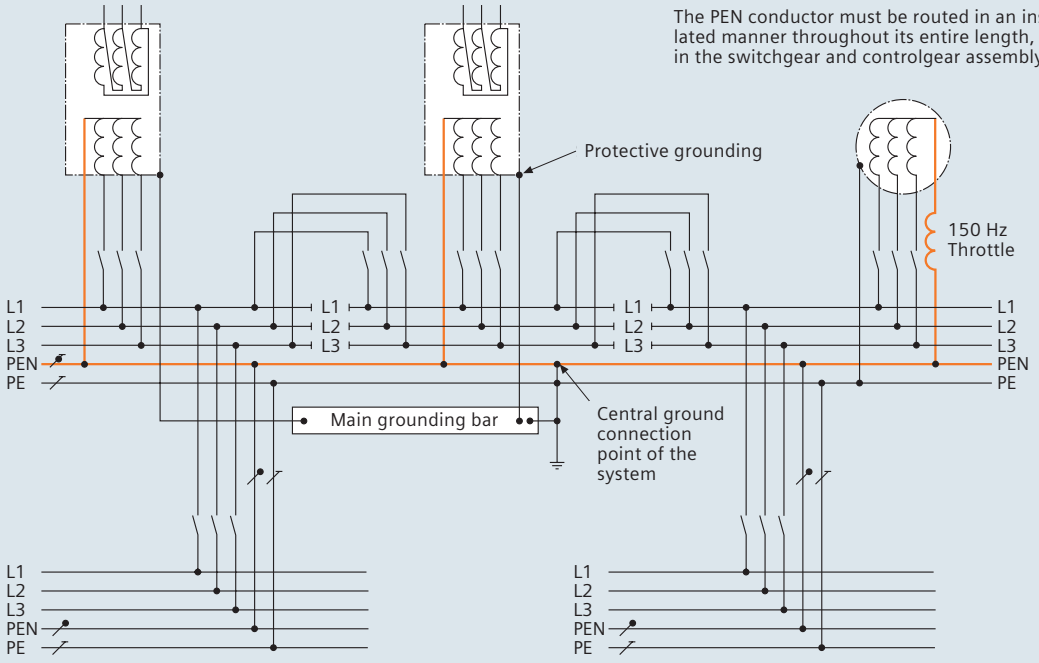
S = Neutral and protective conductor function by means of **separated** conductors

C = Neutral and protective conductor function **combined** in one conductor (PEN)

① Body

② Impedance

Example of an electronically compatible TN-S system



Rated Values / Definitions

Rated values

In accordance with IEC/EN 60439-1, the manufacturers of low-voltage switchgear and controlgear assemblies state rated values. These rated values apply to the specified operating conditions and characterize the usability of switchgear and controlgear assemblies. The coordination of the operating equipment or the configuration of the switchgear and controlgear assemblies must be based on these rated values.

Rated short-time withstand current (I_{cw})

IEC/EN 60439-1; 4.3

As the effective short-circuit current value, the rated short-time withstand current characterizes the thermal strength of switchgear and controlgear assembly circuits during a short-time load. The rated short-time withstand current is normally determined for the duration of 1 s; deviating time values must be stated.
The rated short-time withstand current is stated for the distribution and/or main busbars of switchgear and controlgear assemblies.

Rated peak withstand current (I_{pk})

IEC/EN 60439-1; 4.4

As peak value of the peak current, the rated peak withstand current characterizes the dynamic strength of switchgear and controlgear assembly circuits. The rated peak withstand current is normally stated for the distribution and/or main busbars of switchgear and controlgear assemblies.

Rated conditional short-circuit current (I_{cc})

IEC/EN 60439-1; 4.5

The rated conditional short-circuit current corresponds to the uninfluenced short-circuit current which switchgear and controlgear assembly circuits that are protected by short-circuit protective devices may carry without damage (for a limited time). The rated conditional short-circuit current is therefore stated for outgoing and/or incoming feeders, e.g. with circuit-breakers.

Rated impulse withstand voltage (U_{imp})

IEC/EN 60947-1; 4.3.1.3

Parameter for the resistance of clearances inside switchgear and controlgear to impulse overvoltages. The application of suitable switchgear and controlgear prevents disconnected system parts from transmitting overvoltages from the network in which they are applied.

Rated current (I_n) (of circuit-breakers)

IEC/EN 60947-2; 4.3.2.3

Current which, for circuit-breakers, corresponds to the rated continuous current and the conventional thermal current.

→ Rated continuous current

Rated control voltage (U_c)

IEC/EN 60947-1; 4.5.1

Voltage applied to the actuating NO contact of a control circuit. It may deviate from the rated control supply voltage if transformers or resistors are connected to the control circuit.

Rated ultimate short-circuit breaking capacity (I_{cu})

IEC/EN 60947-2; 4.3.5.2.1

Maximum short-circuit current which can be interrupted by a circuit-breaker (test O – CO). After a short-circuit release, the circuit-breaker is able to trip with increased tolerances in the case of overload.

Rated service short-circuit breaking capacity (I_{cs})

IEC/EN 60947-2; 4.3.5.2.2

The short-circuit current depending on the rated operational voltage which can be repeatedly interrupted by a circuit-breaker (test O – CO – CO).
After the short-circuit breaking, the circuit-breaker is able to continue to carry the rated current in the case of increased self-heating or overload.

→ Rated continuous current
Rated operational voltage

Rated operating capacity

IEC/EN 60947-1; 4.3.2.3

Capacity which can be switched by switchgear and controlgear with the assigned rated operational voltage in accordance with the utilization category, e.g. power contactor of utilization category AC-3: 37 kW at 400 V.

Rated operational voltage (U_e)

IEC/EN 60947-1; 4.3.1.1

Voltage to which the characteristic values of switchgear and controlgear are referred to. The maximum rated operational voltage must, in no case, exceed the rated insulation voltage.

→ Rated insulation voltage

Rated operational current (I_e)

IEC/EN 60947-1; 4.3.2.3

Current which can be carried by switchgear and controlgear in consideration of the rated operational voltage, the operating time, the utilization category and the ambient temperature.

→ Rated operational voltage

Rated continuous current (I_u)

IEC/EN 60947-1; 4.3.2.4

Current which can be carried by switchgear and controlgear in continuous operation (for weeks, months or years).

Rated making capacity

IEC/EN 60947-1; 4.3.5.2

Current which can be switched on by switchgear and controlgear with the respective rated operational voltage in accordance with the utilization category.

→ Rated operational voltage

Rated frequency

IEC/EN 60947-1; 4.3.3

Frequency for which switchgear and controlgear is dimensioned and to which the other characteristic data refer.

→ Rated operational voltage
Rated continuous current

Rated insulation voltage (U_i)

IEC/EN 60947-1; 4.3.1.2

Voltage to which the insulation tests and creepage distances refer. The maximum rated operational voltage must, in no case, exceed the rated insulation voltage.

→ Rated operational voltage

Rated short-circuit breaking capacity (I_{cn})

IEC/EN 60947-1; 4.3.6.3

Maximum current which can be switched off by switchgear and controlgear with the rated operational voltage and frequency without causing damage. The value is stated as effective value.

→ Rated operational voltage

Rated short-circuit making capacity (I_{cm})

IEC/EN 60947-1; 4.3.6.2

Maximum current which can be switched on by switchgear and controlgear with the rated operational voltage and frequency without causing damage. Deviating from the other characteristic data, the value is stated as peak value.

→ Rated operational voltage

Rated short-circuit current, conditional

IEC/EN 60947-1; 2.5.29

→ Rated conditional short-circuit current (I_q)

Definitions

The terms defined below are used in the present catalog in accordance with VDE 0660 Part 500 and IEC 60439-1.

Low-voltage switchgear and controlgear assembly

Assembly of one or more switchgear and controlgear units combined with corresponding operating equipment for control, measuring and signaling tasks and with protective and control devices, etc. The individual devices are completely assembled by the manufacturer, including all internal electrical and mechanical connections and construction components.

Type-tested low-voltage switchgear and controlgear assembly (TTA)

Low-voltage switchgear and controlgear assembly which complies with the original type or system of the type-tested switchgear and controlgear assembly type-tested in accordance with this standard without significant deviations.

Functional unit

Part of a switchgear and controlgear assembly with all electrical and mechanical components which contribute to the execution of the same function.

Removable part

Part which may be removed in whole from the switchgear and controlgear assembly for replacement, even when the connected circuit is energized.

Withdrawable unit

Removable part which can be installed in a position in which an isolating distance is open while it remains mechanically connected to the switchgear and controlgear assembly.
Note: This isolating distance must lie in the main circuits only or in the main and auxiliary circuits.

Non-drawout assembly

Assembly of operating equipment which is assembled and wired on a joint supporting structure for permanent installation.

Operating position

Position of a removable part or withdrawable unit in which such part or unit is fully connected for the intended function.

Test position

Position of a withdrawable unit in which the respective main circuits are open on the supply side, while the requirements placed upon an isolating distance need not be met, and in which the auxiliary circuits are connected in a way which assures that the withdrawable unit undergoes a function test while it remains mechanically connected to the switchgear and controlgear assembly.
Note: The opening may also be established by operating a suitable device without the withdrawable unit being mechanically moved.

Disconnected position

Position of a withdrawable unit in which the isolating distances in the main and auxiliary circuits are open while it remains mechanically connected to the switchgear and controlgear assembly.
Note: The isolating distance may also be established by operating a suitable device without the withdrawable unit being mechanically moved.

Removed position

Position of a removable part or withdrawable unit which has been removed from the switchgear and controlgear assembly and is mechanically and electrically disconnected from the assembly.

Rack

Component of a switchgear and controlgear assembly which serves the carrying of various components of a switchgear and controlgear assembly or of an enclosure.

Enclosure

Part which protects the operating equipment against external influences and offers protection against direct contact from every direction with a minimum degree of protection of IP2X.

Cubicle

Component of a switchgear and controlgear assembly positioned between two successive vertical limiting levels.

Cubicle panel

Component of a switchgear and controlgear assembly positioned between two superimposed horizontal limiting levels inside a cubicle.

Compartment

Cubicle or cubicle panel which is encased with the exception of openings required for connection, control or ventilation.

Transport unit

Part of a switchgear and controlgear assembly or complete switchgear and controlgear assembly which is not disassembled for transportation.

Rated diversity factor

The rated diversity factor of a switchgear and controlgear assembly or of a component of a switchgear and controlgear assembly (e.g. cubicle, cubicle panel) which comprises several main circuits is the ratio of the largest sum of all currents which are to be expected in the respective main circuits at any given time to the sum of the rated currents of all main circuits of the switchgear and controlgear assembly or of the affected part of the switchgear and controlgear assembly. If the manufacturer states a rated diversity factor, this value must be taken as a basis for the temperature-rise test.

Number of main circuits	Rated diversity factor
2 and 3	0.9
4 and 5	0.8
6 up to and including 9	0.7
10 and more	0.6

Rated Currents and Initial Symmetrical Short-Circuit Currents of Three-Phase Distribution Transformers from 50 to 3,150 kVA

Rated voltage U_{rT}	400/230 V, 50 Hz			525 V, 50 Hz			690/400 V, 50 Hz		
Rated value of the short-circuit voltage u_{kr}		4 % [1]	6 % [2]		4 % [1]	6 % [2]		4 % [1]	6 % [2]
Rated power	Rated current I_r	Initial symmetrical short-circuit current I_k [3]		Rated current I_r	Initial symmetrical short-circuit current I_k [3]		Rated current I_r	Initial symmetrical short-circuit current I_k [3]	
[kVA]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]	[A]
50	72	**1,933**	**1,306**	55	**1,473**	**995**	42	**1,116**	**754**
100	144	**3,871**	**2,612**	110	**2,950**	**1,990**	84	**2,235**	**1,508**
160	230	**6,209**	**4,192**	176	**4,731**	**3,194**	133	**3,585**	**2,420**
200	288	**7,749**	**5,239**	220	**5,904**	**3,992**	167	**4,474**	**3,025**
250	360	**9,716**	**6,552**	275	**7,402**	**4,992**	209	**5,609**	**3,783**
315	455	**12,247**	**8,259**	346	**9,331**	**6,292**	262	**7,071**	**4,768**
400	578	**15,506**	**10,492**	440	**11,814**	**7,994**	335	**8,953**	**6,058**
500	722	**19,438**	**12,020**	550	**14,810**	**9,158**	418	**11,223**	**6,939**
630	910	**24,503**	**16,193**	693	**18,669**	**12,338**	525	**14,147**	**9,349**
800	1,154	–	**20,992**	880	–	**15,994**	670	–	**12,120**
1,000	1,444	–	**26,224**	1,100	–	**19,980**	836	–	**15,140**
1,250	1,805	–	**32,791**	1,375	–	**24,984**	1,046	–	**18,932**
1,600	2,310	–	**39,818**	1,760	–	**30,338**	1,330	–	**22,989**
2,000	2,887	–	**52,511**	2,200	–	**40,008**	1,674	–	**30,317**
2,500	3,608	–	**65,547**	2,749	–	**49,941**	2,090	–	**37,844**
3,150	4,550	–	**82,656**	3,470	–	**62,976**	2,640	–	**47,722**

[1] u_{kr} = 4 %, standardized in accordance with DIN 42503 for S_{rT} = 50 ... 630 kVA

[2] u_{kr} = 6 %, standardized in accordance with DIN 42511 for S_{rT} = 100 ... 1600 kVA

[3] I_k Uninfluenced initial symmetrical transformer short-circuit current when connected to a network with unlimited short-circuit power in **consideration of the voltage and correction factor of the transformer impedance in accordance with DIN EN 60909/DIN VDE 0102 (July 2002)**

Approximation formula

Rated transformer current	Transformer short-circuit symmetrical current	
I_N [A] = k x S_{NT} [kVA]	$I''_k = I_N/u_k$ x 100 [A]	400 V: k = 1.45 690 V: k = 0.84

Weights / Power Losses

Average cubicle weight
including busbar (without cable)
Cubicle dimensions

Height [mm]	Width [mm]	Depth [mm]	Remarks Nominal current [A]	Weight approx. kg
Circuit-breaker cubicles				
2,200	400	400	630 – 1,600	287
	500		630 – 1,600	297
	600		2,000 – 2,500	405
	400	600	630 – 1,600	305
	500		630 – 1,600	325
	600		630 – 1,600	335
	800		630 – 1,600	365
	600		2,000 – 2,500	440
	800		2,000 – 2,500	475
	800		3,200	540
	1,000		4,000	700
	1,000	1,200	5,000, 6,300	1,200
Fixed-mounted cubicles				
2,200	800	400	Universal fixed-mounted design	300
	1,000			320
	800	600	Universal fixed-mounted design	360
	1,000			380
	800	1,000	Universal fixed-mounted design	520
	1,000			550
Withdrawable unit cubicles/plug-in design				
2,200	1,000	400		420
		600		480
		1,000		690
Compensation cubicles				
2200	800	600	500 kvar non-throttled	320
2200	800	600	250 kvar throttled	440

Power losses

The power loss data stated below are approximate values for a cubicle with the main circuit of functional units for the determination of the power loss to be dissipated from the switchroom. Power losses of possibly installed additional auxiliary devices must also be taken into consideration.

Circuit-breaker design with 3WL (withdrawable unit) [A]		**Approx. P_v [W] at % of rated current** At 100%	At 80%
630	BG. I	270	180
800	BG. I	440	280
1,000	BG. I	690	440
1,250	BG. I	740	470
1,600	BG. I	830	530
2,000	BG. II	1,080	690
2,500	BG. II	1,700	1,090
3,200	BG. II	2,650	1,690
4,000	BG. III	3,100	1,980
5,000	BG. III	4,630	2,960
6,300	BG. III	7,280	4,660

	Power loss per cubicle [V]
Withdrawable design	Approx. P_v = 600
Fixed-mounted design	Approx. P_v = 600
Plug-in design	Approx. P_v = 600
In-line design	Approx. P_v = 1500
Compensation 500 kvar non-throttled	Approx. P_v = 600
Compensation 250 kvar throttled	Approx. P_v = 1350

Reactive Power Compensation

Calculative determination and specification of the required capacitor power

1. The electricity bill of the power supply company shows the consumption of active power in kWh and of reactive power in kvarh; the power supply company demands a cos φ of 0.9 ... 0.95; the reactive power demand should be compensated to a value approximating cos φ = 1 for cost optimization.

   Determination of $\tan \varphi_1 = \frac{\text{Reactive power}}{\text{Active power}} = \frac{\text{kvarh}}{\text{kWh}}$

2. The table shows conversion factor "F", which must be multiplied with the average power consumption P_m.

   With $\tan \varphi_1$ $\cos \varphi_1$ shows the power factor prior to compensation, while $\cos \varphi_2$ shows the desired power factor for compensation with factor "F".

3. The required compensation power is stated in kvar.

Example:

Reactive power W_r = 19,000 kvar/month

Active power W_a = 16,660 kWh/month

Average power consumption

$$\frac{\text{Active power}}{\text{Operating time}} = \frac{16{,}660 \text{ kWh}}{180 \text{ h}} = 92.6 \text{ kW}$$

$$\tan \varphi_1 = \frac{\text{Active power}}{\text{Operating time}} = \frac{19{,}000 \text{ kWh}}{16{,}660 \text{ kWh}} = 1.14$$

Power factor $\cos \varphi_1$ = 0.66 (with $\tan \varphi_1$ = 1.14)

Power factor $\cos \varphi_2$ = 0.95 (desired)

Conversion factor "F" = 0.81 (from $\tan \varphi_1$ and $\cos \varphi_2$)

Compensation power = Average power x factor "F"
= 92.6 kW x 0.81

Required compensation power: 75 kvar

Table for the determination of the required compensation power

Actual value (to)		Conversion factor "F"										
tan φ_1	cos φ_1	cos φ_2 = 0.70	cos φ_2 = 0.75	cos φ_2 = 0.80	cos φ_2 = 0.82	cos φ_2 = 0.85	cos φ_2 = 0.87	cos φ_2 = 0.90	cos φ_2 = 0.92	cos φ_2 = 0.95	cos φ_2 = 0.97	cos φ_2 = 1.00
4.90	0.20	3.88	4.02	4.15	4.20	4.28	4.33	4.41	4.47	4.57	4.65	4.90
3.87	0.25	2.85	2.99	3.12	3.17	3.25	3.31	3.39	3.45	3.54	3.62	3.87
3.18	0.30	2.16	2.30	2.43	2.48	2.56	2.61	2.70	2.75	2.85	2.93	3.18
2.68	0.35	1.66	1.79	1.93	1.98	2.06	2.11	2.19	2.25	2.35	2.43	2.68
2.29	0.40	1.27	1.41	1.54	1.59	1.67	1.72	1.81	1.87	1.96	2.04	2.29
2.16	0.42	1.14	1.28	1.41	1.46	1.54	1.59	1.68	1.74	1.83	1.91	2.16
2.04	0.44	1.02	1.16	1.29	1.34	1.42	1.47	1.56	1.62	1.71	1.79	2.04
1.93	0.46	0.91	1.05	1.18	1.23	1.31	1.36	1.45	1.50	1.60	1.68	1.93
1.83	0.48	0.81	0.95	1.08	1.13	1.21	1.26	1.34	1.40	1.50	1.58	1.83
1.73	0.50	0.71	0.85	0.98	1.03	1.11	1.17	1.25	1.31	1.40	1.48	1.73
1.64	0.52	0.62	0.76	0.89	0.94	1.02	1.08	1.16	1.22	1.31	1.39	1.64
1.56	0.54	0.54	0.68	0.81	0.86	0.94	0.99	1.07	1.13	1.23	1.31	1.56
1.48	0.56	0.46	0.60	0.73	0.78	0.86	0.91	1.00	1.05	1.15	1.23	1.48
1.40	0.58	0.38	0.52	0.65	0.71	0.78	0.84	0.92	0.98	1.08	1.15	1.40
1.33	0.60	0.31	0.45	0.58	0.64	0.71	0.77	0.85	0.91	1.00	1.08	1.33
1.27	0.62	0.25	0.38	0.52	0.57	0.65	0.70	0.78	0.84	0.94	1.01	1.27
1.20	0.64	0.18	0.32	0.45	0.50	0.58	0.63	0.72	0.77	0.87	0.95	1.20
1.14	0.66	0.12	0.26	0.39	0.44	0.52	0.57	0.65	0.71	0.81	0.89	1.14
1.08	0.68	0.06	0.20	0.33	0.38	0.46	0.51	0.59	0.65	0.75	0.83	1.08
1.02	0.70	–	0.14	0.27	0.32	0.40	0.45	0.54	0.59	0.69	0.77	1.02
0.96	0.72		0.08	0.21	0.27	0.34	0.40	0.48	0.54	0.63	0.71	0.96
0.91	0.74		0.03	0.16	0.21	0.29	0.34	0.42	0.48	0.58	0.66	0.91
0.86	0.76		–	0.11	0.16	0.24	0.29	0.37	0.43	0.53	0.60	0.86
0.80	0.78			0.05	0.10	0.18	0.24	0.32	0.38	0.47	0.55	0.80
0.75	0.80			–	0.05	0.13	0.18	0.27	0.32	0.42	0.50	0.75
0.70	0.82				–	0.08	0.13	0.21	0.27	0.37	0.45	0.70
0.65	0.84					0.03	0.08	0.16	0.22	0.32	0.40	0.65
0.59	0.86					–	0.03	0.11	0.17	0.26	0.34	0.59
0.54	0.88						–	0.06	0.11	0.21	0.29	0.54
0.48	0.90							–	0.06	0.16	0.23	0.48
0.43	0.92								–	0.10	0.18	0.43
0.36	0.94									0.03	0.11	0.36
0.29	0.96									–	0.01	0.29
0.20	0.98										–	0.20

Certificates/Approvals

SIEMENS

EG-Konformitätserklärung
EC-Declaration of Conformity

Siemens AG / A&D CD DM / Nürnberg

Gleiwitzer Straße 555
D-90475 Nürnberg

SIVACON 8PV
Typgeprüfte Niederspannungs-Schaltgerätekombination (TSK)
SIVACON 8PV
Type-tested Low Voltage Switchgear and Controlgear Assembly (TTA)

Niederspannungsrichtlinie Nr.: 73/23/EWG
Low Voltage Directive No.: 73/23/EEC
EMV-Richtlinie Nr.: 89/336/EWG
EMC Directive No.: 89/336/EEC
CE-Kennzeichnung seit / *CE marking since:* 98

IEC 60439-1 Edition 4.1 2004-04
EN 60439-1:1999 + A1:2004
VDE 0660 Teil 500 Januar 2005

Siemens Aktiengesellschaft

Nürnberg, 08.01.06

Lehmann Dr. Dähne

C E R T I F I C A T E

DQS GmbH
Deutsche Gesellschaft zur Zertifizierung von Managementsystemen

Siemens AG
Automation and Drives (A&D)
Division Low Voltage Controls and Distribution (A&D CD DM)
Südstraße 74
D-04178 Leipzig

for the scope

Development, Production and Distribution of Distribution Boards and Motor Control Centers

has implemented and maintains an

Environmental Management System.

An audit, documented in a report, has verified that this environmental management system fulfills the requirements of the following standard:

DIN EN ISO 14001
October 1996 edition

This certificate is valid until: 2006-11-17
Certificate Registration No.: 378247 UM
Frankfurt am Main, Berlin 2003-11-19

ZERTIFIKAT ◆ CERTIFICATE ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

CERTIFICATE

The Certification Body
of TÜV Management Service GmbH

certifies that

SIEMENS

Siemens Aktiengesellschaft
Automation and Drives
Geschäftsgebiet Low-Voltage Controls and Distribution
Gleiwitzer Straße 555
D-90327 Nürnberg
with the organizational sites as listed in the annex

has established and applies
a Quality Management System for

Development, Production, Sales and Marketing
of Low-voltage Control Products, Switchboards and Systems

An audit was performed, Report No. 70029481
Proof has been furnished that the requirements
according to

ISO 9001: 2000

are fulfilled. The certificate is valid until **2009-08-15**
Certificate Registration No. **12 100 16850 TMS**

TÜV Management Service GmbH · TÜV SÜD Gruppe · Zertifizierstelle · Ridlerstrasse 65 · 80339 München · Germany

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