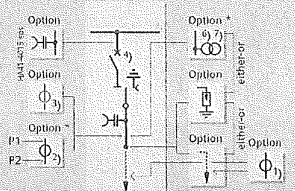


Product Range

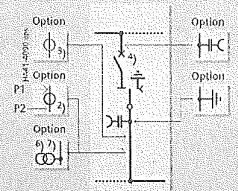
Circuit-breaker panels

Circuit-breaker panels 630 A as feeder panels



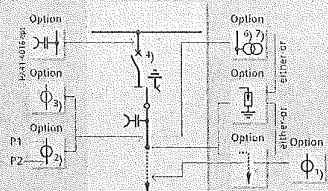
Type L
500 mm wide
With vacuum circuit-breaker, fixed-mounted

as transfer panels for attachment to panel types M or H



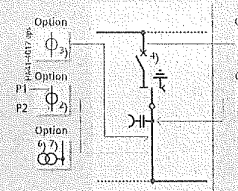
Type L(T)
500 mm wide
With vacuum circuit-breaker, fixed-mounted

Circuit-breaker panels, up to 1250 A ^{Δ)} as feeder panels















Type L1
750 mm wide
With vacuum circuit-breaker, fixed-mounted

as transfer panels for attachment to panel types M or H



Type L1(T)
750 mm wide
With vacuum circuit-breaker, fixed-mounted

-  Vacuum circuit-breaker (type "CB-F")
-  Three-position disconnecter
-  Capacitive voltage detecting system
-  Cable-type current transformer, e.g. 4MC703 ...
-  Block-type current transformer 4MA, cast-resin insulated
-  Three-phase current transformer 4MC63 ...
-  Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated
-  Voltage transformer, e.g. 4MR, 2-pole, cast-resin insulated
-  Cable (not included in the scope of supply)
-  Additional cables (not included in the scope of supply)
-  Surge arrester
-  Fixed earthing point

Δ) In preparation
* On request: Combination CT Φ_3 and VT Φ_3

P1 and P2 are terminal designations of the current transformer

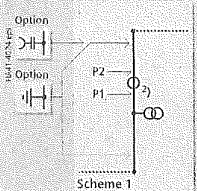
[Handwritten signature]

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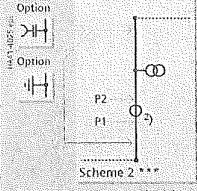
Product Range

Billing metering panels

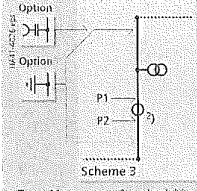
Billing metering panels 630 A, 800 A, 1250 A Standard



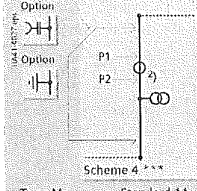
Type M Standard **
750 mm wide Transfer to the right



Type M Standard **
750 mm wide Transfer to the right

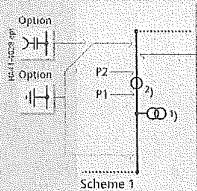


Type M Standard **
750 mm wide Transfer to the right

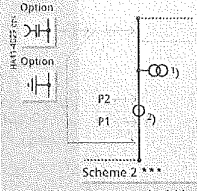


Type M Standard **
750 mm wide Transfer to the right

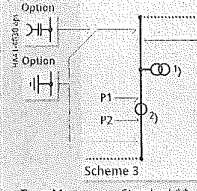
Billing metering panels 630 A, 800 A, 1250 A for additional transformers



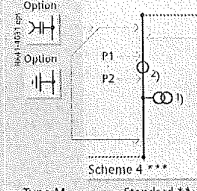
Type M Standard **
750 mm wide Transfer to the right



Type M Standard **
750 mm wide Transfer to the right

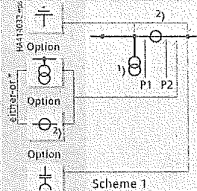


Type M Standard **
750 mm wide Transfer to the right

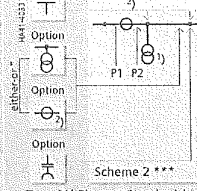


Type M Standard **
750 mm wide Transfer to the right

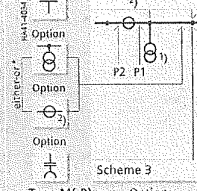
Billing metering panels 630 A, 800 A, 1250 A for busbar connection



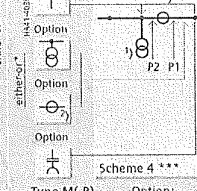
Type M(-B) Standard **
750 mm wide Transfer to the right



Type M(-B) Standard **
750 mm wide Transfer to the right

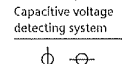
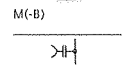
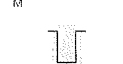


Type M(-B) Option:
750 mm wide Transfer to the left

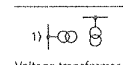


Type M(-B) Option:
750 mm wide Transfer to the left

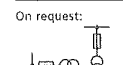
Panel design of M:



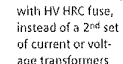
Block-type current transformer 4MA, cast-resin insulated



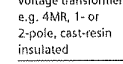
Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated or:



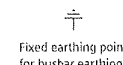
On request:
Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated, with HV HRC fuse, instead of a 2nd set of current or voltage transformers



Voltage transformer, e.g. 4MR, 1- or 2-pole, cast-resin insulated



Fixed earthing point



Fixed earthing point for busbar earthing

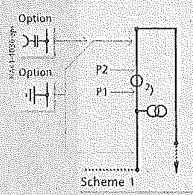
P1 and P2 are terminal designations of the current transformer

* On request

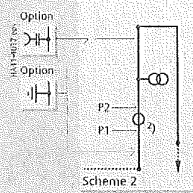
** Option:
Transfer to the left

*** Transformer terminals interchanged

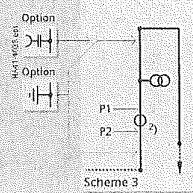
Billing metering panels 630 A, 800 A, 1250 A *) for cable connection 1)



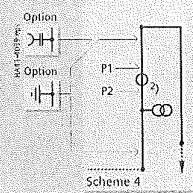
Type M(-K) Standard **:
750 mm wide Transfer to the right



Type M(-K) Standard **:
750 mm wide Transfer to the right

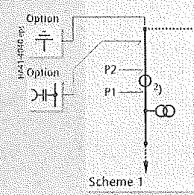


Type M(-K) Standard **:
750 mm wide Transfer to the right

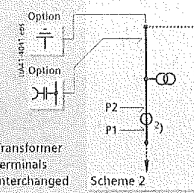


Type M(-K) Standard **:
750 mm wide Transfer to the right

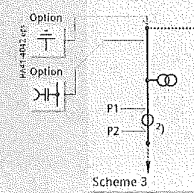
Billing metering panels 630 A, 800 A, 1250 A *) for busbar connection



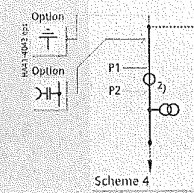
Type M(-BK) as right or left
750 mm wide end panel



Type M(-BK) as right or left
750 mm wide end panel

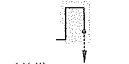


Type M(-BK) as right or left
750 mm wide end panel



Type M(-BK) as right or left
750 mm wide end panel

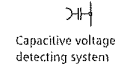
Panel design of M:



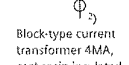
M(-K)



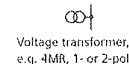
M(-BK)



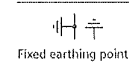
Capacitive voltage
detecting system



Block-type current
transformer 4MA,
cast-resin insulated



Voltage transformer,
e.g. 4MB, 1- or 2-pole,
cast-resin insulated



Fixed earthing point

1) On request:
As single metering
panel type M(KK)
with incoming
and outgoing cable
terminals

* Connection for
2nd cable possible

** Option:
Transfer to the left

P1 and P2 are
terminal designa-
tions of the current
transformer

Product Range

Busbar voltage metering panels and bus riser panels

Busbar voltage metering panels

Type M(VT) **
375 mm wide

Type M1(VT)
500 mm wide

Type M(VT-F) **
375 mm wide

Type M1(VT-F)
500 mm wide

Bus riser panels 630 A, 800 A, 1250 A

Type H *
375 mm wide

Type H *
375 mm wide

Type H *
375 mm wide

Type H *
375 mm wide

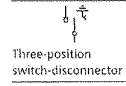
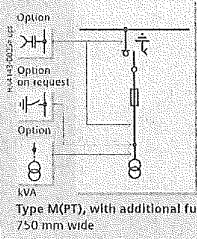
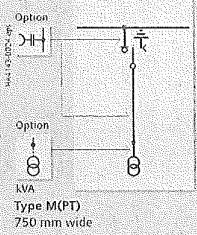
- Three-position switch-disconnector
- HV HRC fuse
- Capacitive voltage detecting system
- Earthing switch
- Block-type current transformer 4MA, cast-resin insulated
- Voltage transformer, e.g. 4MR, 1- or 2-pole, cast-resin insulated
- Voltage transformer, e.g. 4MR, 1-pole cast-resin insulated
- Fixed earthing point

P1 and P2 are terminal designations of the current transformer

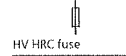
* For attachment to left or right panel types R(T), L(T), L1(T)

** Up to 17.5 kV

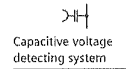
**On request:
Switch-disconnector panels
for auxiliary transformer**



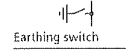
Three-position switch-disconnector



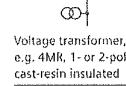
HV HRC fuse



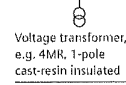
Capacitive voltage detecting system



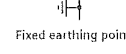
Earthing switch



Voltage transformer, e.g. 4MR, 1- or 2-pole, cast-resin insulated



Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated



Fixed earthing point

Product Range

On request: Circuit-breaker panels

Circuit-breaker panels 630 A, 1250 A as feeder panels

Type L1(r) 750 mm wide
With vacuum circuit-breaker, type 3A, removable

Type L1(w) 750 mm wide
With vacuum circuit-breaker, type 3A, withdrawable

Circuit-breaker panels 630 A, 1250 A as feeder panels

Type L2(r) 875 mm wide
With vacuum circuit-breaker, type 3A, removable

Type L2(w) 875 mm wide
With vacuum circuit-breaker, type 3A, withdrawable

as transfer panel for attachment to panel types M, ...

Type L1(r, T) 750 mm wide
With vacuum circuit-breaker, type 3A, removable

Type L1(w, T) 750 mm wide
With vacuum circuit-breaker, type 3A, withdrawable

Legend:

- Vacuum circuit-breaker (type 3A)
- Three-position disconnecter
- Cable-type current transformer, e.g. 4MC703 ...
- Block-type current transformer 4MC, cast-resin insulated
- Three-phase current transformer 4MC63 ...
- Voltage transformer, e.g. 4MR, 1-pole, cast-resin insulated
- Cable (not included in the scope of supply)
- Surge arrester
- Capacitive voltage deterring system
- Make-proof earthing switch
- Fixed earthing point

* On request

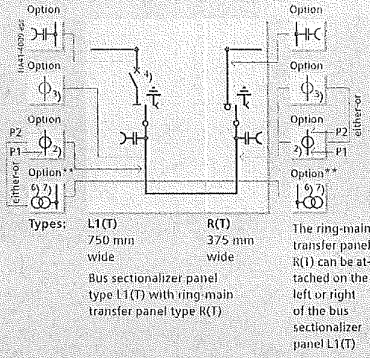
** Standard: Feeder earthing via the vacuum circuit-breaker type 3A, with interlocks (without earthing switch)

Panel combinations of L1(r)	Design	Rated current
L1(r, T) + H	standard	630 A, 1250 A
H + L1(r, T)	on request	-
L1(r, T) + R(T)	standard	630 A
R(T) + L1(r, T)	on request	-
L1(r, T) + D(T)	standard	630 A, 1250 A

Panel combinations of L1(w)	Design	Rated current
L1(w, T) + H	standard	630 A, 1250 A
H + L1(w, T)	on request	-
L1(w, T) + R(T)	standard	630 A
R(T) + L1(w, T)	on request	-
L1(w, T) + D(T)	standard	630 A, 1250 A


Δ Mounting position of the current transformer with terminal P1 at the top only
P1 and P2 are terminal designations of the CT


Panel combinations 630 A





With vacuum circuit-breaker, fixed-mounted


Further panel combinations available:		Rated current
For example:	Total width	I_r (A)
L(T) + R(T)	875 mm	up to 630 A
L(T) + H	875 mm	up to 630 A
L1(T) + D1(T)	1250 mm	up to 1250 A



Vacuum circuit-breaker
(type "CB-F")



Three-position
switch-disconnector



Three-position
disconnector


Capacitive voltage
detecting system


Block-type current
transformer 4MA,
cast-resin insulated


Three-phase current
transformer 4MC63 ...
On request:
For panel type: R(T)

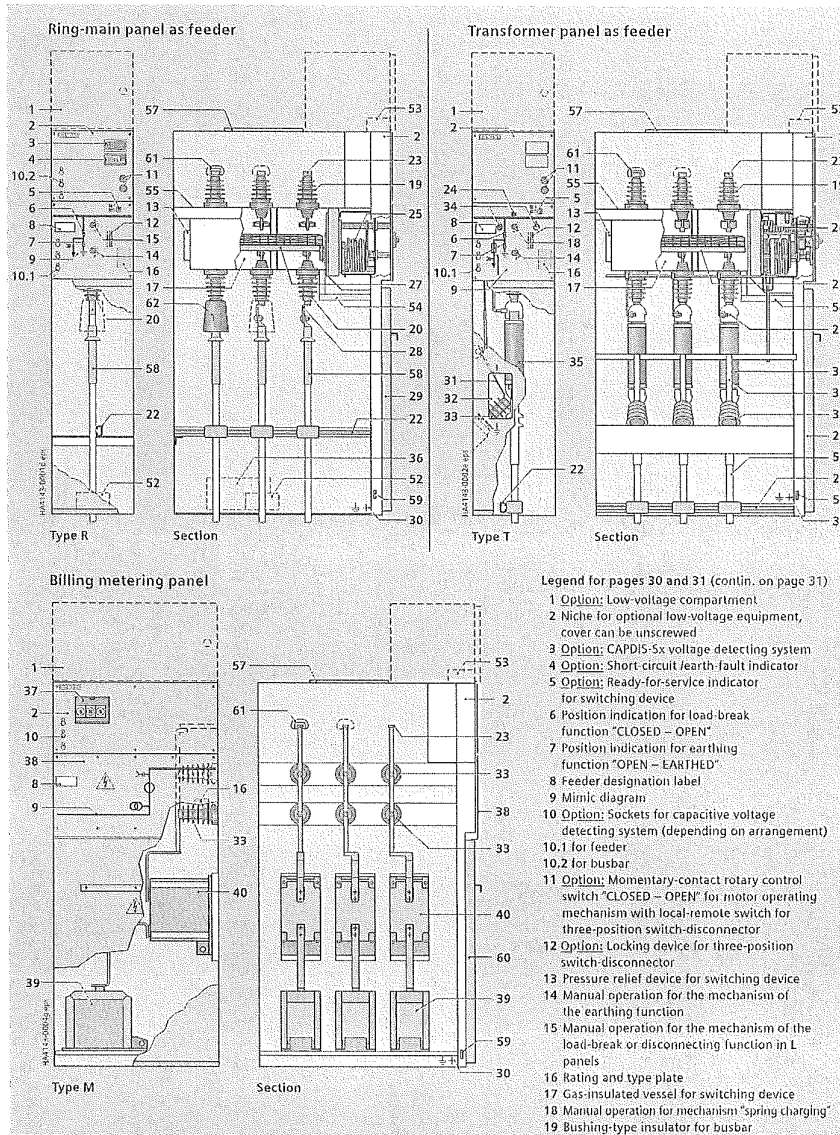

Voltage transformer,
e.g. 4MR, 1-pole,
cast-resin insulated


Voltage transformer,
e.g. 4MR, 2-pole,
cast-resin insulated

P1 and P2 are
terminal designa-
tions of the current
transformer

Design

Panel design (examples)



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Circuit-breaker panel (with vacuum circuit-breaker type CB-f NAR)

Type L (500 mm) Section

Legend for pages 30 and 31

- 20 Bushing-type insulator for feeder
- 21 Terminal for HV HRC fuse assembly (with tripping)
- 22 Cable bracket with cable clamps (option) for fastening cables
- 23 Busbar
- 24 Spring charged indicator for stored-energy "OPEN"
- 25 Spring-operated mechanism for three-position switch-disconnector
- 26 Spring-operated/stored-energy mechanism for three-position switch-disconnector
- 27 Three-position switch-disconnector
- 28 Cable connection
- 29 Cable compartment cover
- 30 Earthing connection (for location, see dimension drawings)
- 31 Earthing switch for cable connection
- 32 Inspection window
- 33 Post insulator
- 34 Operation for stored-energy mechanism
 - stored-energy "OPEN" (red)
 - stored-energy "CLOSED" (black)
- 35 Option: HV HRC fuse-link (e = 292 mm or 442 mm)
- 36 Option: Heating in the panel
- 37 Option: Secondary protection for voltage transformer
- 38 Cover, screwed on
- 39 4MR voltage transformer
- 40 4MA7 block type current transformer

Vacuum circuit-breaker:

- 41 Vacuum circuit-breaker, (VCB) fixed-mounted
- 42 Operating mechanism box
- 43 Manual operation for "spring charging"
 - for closing with manual operating mechanism
 - for emergency operation with motor operating mechanism
- 44 Mechanical "OFF" pushbutton
- 45 Mechanical "ON" pushbutton (not supplied with spring-operated mechanism)
- 46 "Spring charged" indicator
- 47 Operations counter (option for VCB type: CB-f NAR)
- 48 Position indicator

- 49 Option: Three-phase current transformer 4MC63
- 50 Option: Overcurrent-time protection relay
 - SIPROTEC easy 7S145
- 51 Option: Multifunction protection relay
 - SIPROTEC 4 7S162
- 52 Cable-type current transformer
- 53 Option: On request, wiring duct, removable, for control cables and for bus wires
- 54 Option: Additional earthing busbar for switching-device vessel
- 55 Metallic partition of busbar compartment
- 57 Busbar compartment cover for panel extension
- 58 Cable sealing end (not included in scope of supply)
- 59 Earthing busbar
- 60 Cover for transformer connection compartment
- 61 Insulating cap on the busbar (for $U_i > 17.5$ kV)
- 62 Insulating cap for cable connection (for $U_i > 17.5$ kV)

Circuit-breaker panel (with vacuum circuit-breaker type CB-f NAR)

Type L1 (750 mm) Section

Legend for pages 30 and 31

- 20 Bushing-type insulator for feeder
- 21 Terminal for HV HRC fuse assembly (with tripping)
- 22 Cable bracket with cable clamps (option) for fastening cables
- 23 Busbar
- 24 Spring charged indicator for stored-energy "OPEN"
- 25 Spring-operated mechanism for three-position switch-disconnector
- 26 Spring-operated/stored-energy mechanism for three-position switch-disconnector
- 27 Three-position switch-disconnector
- 28 Cable connection
- 29 Cable compartment cover
- 30 Earthing connection (for location, see dimension drawings)
- 31 Earthing switch for cable connection
- 32 Inspection window
- 33 Post insulator
- 34 Operation for stored-energy mechanism
 - stored-energy "OPEN" (red)
 - stored-energy "CLOSED" (black)
- 35 Option: HV HRC fuse-link (e = 292 mm or 442 mm)
- 36 Option: Heating in the panel
- 37 Option: Secondary protection for voltage transformer
- 38 Cover, screwed on
- 39 4MR voltage transformer
- 40 4MA7 block type current transformer

Vacuum circuit-breaker:

- 41 Vacuum circuit-breaker, (VCB) fixed-mounted
- 42 Operating mechanism box
- 43 Manual operation for "spring charging"
 - for closing with manual operating mechanism
 - for emergency operation with motor operating mechanism
- 44 Mechanical "OFF" pushbutton
- 45 Mechanical "ON" pushbutton (not supplied with spring-operated mechanism)
- 46 "Spring charged" indicator
- 47 Operations counter (option for VCB type: CB-f NAR)
- 48 Position indicator

- 49 Option: Three-phase current transformer 4MC63
- 50 Option: Overcurrent-time protection relay
 - SIPROTEC easy 7S145
- 51 Option: Multifunction protection relay
 - SIPROTEC 4 7S162
- 52 Cable-type current transformer
- 53 Option: On request, wiring duct, removable, for control cables and for bus wires
- 54 Option: Additional earthing busbar for switching-device vessel
- 55 Metallic partition of busbar compartment
- 57 Busbar compartment cover for panel extension
- 58 Cable sealing end (not included in scope of supply)
- 59 Earthing busbar
- 60 Cover for transformer connection compartment
- 61 Insulating cap on the busbar (for $U_i > 17.5$ kV)
- 62 Insulating cap for cable connection (for $U_i > 17.5$ kV)

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Design

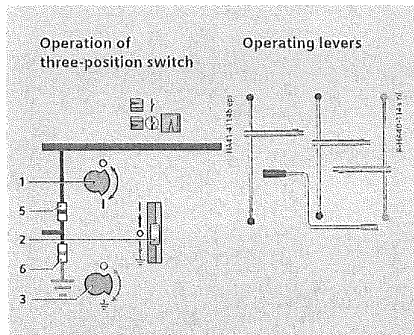
Operation (examples)

Control board

The control boards are function-related. They integrate operation, mimic diagram and position indication. Furthermore, the respective indicating, measuring and monitoring equipment as well as locking devices and control elements (e.g. local-remote switch) are arranged there according to the panel type and version. The ready-for-service indicator and rating plates are also located at the operating front.

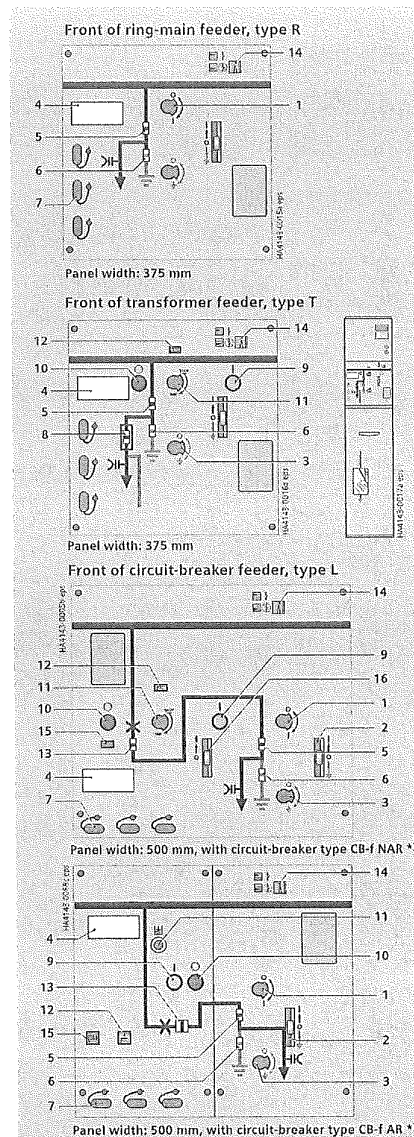
Operation is identical for transformer and circuit-breaker feeders. First, the operating mechanism must be charged; then, closing/opening is done through separate pushbuttons. The condition of the energy store is indicated.

All actuating openings are functionally interlocked against each other, and are optionally lockable. The operating lever carries two plug inserts, separately for the disconnecting and earthing function.



- 1 Manual operation of load-break function (R, T) or disconnecting function (L)
- 2 Locking function (option for ring-main feeders)
- 3 Manual operation of earthing function
- 4 Panel designation label
- 5 Position indicator for switch-disconnector
- 6 Position indicator for earthing switch
- 7 Sockets of capacitive voltage detecting system
- 8 "Fuse tripped" indicator
- 9 ON pushbutton for transformer or circuit-breaker function
- 10 OFF pushbutton for transformer or circuit-breaker function
- 11 Manual operation for "spring charging"
- 12 "Spring charged" indicator
- 13 Position indicator for circuit-breaker
- 14 Ready-for-service indicator
- 15 Operations counter
- 16 Preselection for manual charging of circuit-breaker panels

*) **AR** = Automatic reclosing
NAR = Non automatic reclosing



Components

Three-position switch

Features

- Switch positions: CLOSED – OPEN – EARTHED
- Switching functions as general-purpose switch-disconnector (class E3) according to
 - IEC/EN 62271-103/VDE 0671-103 *)
 - IEC/EN 62271-102/VDE 0671-102 *)
- Designed as a three-position switch with the functions
 - Switch-disconnector and
 - Make-proof earthing switch
- Operation via rotary bushing welded gas-tight into the front of the switching-device vessel
- Climate-independent contact in the gas-filled switching-device vessel
- Maintenance-free according to IEC/EN 62271-1/VDE 0671-1
- Individual secondary equipment
- No cross insulation between phases.

Mode of operation

The operating shaft forms one unit together with the three contact blades. Due to the arrangement of the fixed contacts (earth – busbar), it is not necessary to interlock the CLOSE and EARTHING functions.

Closing operation

During the closing operation, the operating shaft with the moving contact blades changes from the "OPEN" to the "CLOSED" position.

The force of the spring-operated mechanism ensures a high closing speed and a reliable connection of the main circuit.

Opening operation

During the opening operation, the arc is caused to rotate by the arc-suppression system. This rotation movement prevents the development of a fixed root.

The isolating distance in gas established after breaking fulfills the conditions applicable to isolating distances in accordance with

- IEC/EN 62271-102/VDE 0671-102 *)

and

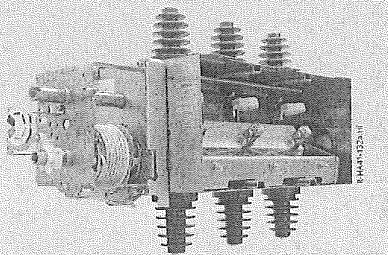
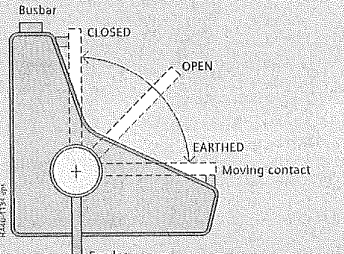
- IEC/EN 62271-1/VDE 0671-1 *).

Due to the arc rotation caused by the arc-suppression system, both load currents and minor no-load currents are safely interrupted.

Earthing operation

The EARTHING operation is implemented by changing from the "OPEN" to the "EARTHED" position.

Three-position switch-disconnector

OPEN/CLOSE 0	CLOSE 0	OPEN 0	
OPEN/EARTH 0		OPEN 0	EARTH 0

Switch positions:	CLOSED	OPEN	Feeder EARTHED
as three-position switch-disconnector up to 630 A			
as three-position switch-disconnector up to 1250 A			

*) For standards, see page 84



Components

Operating mechanisms for the three-position switch

Features

- Mechanical endurance of more than 1000 operating cycles
- Parts subjected to mechanical stress are made of non-rusting materials
- Manual operation with the help of a slip-on operating lever
- **Option:** Motor operation
- Control board with accordingly cut-out switching gate prevents the three-position switch-disconnector from being switched directly from the "CLOSED" via the "OPEN" to the "EARTHED" position
- Two separate actuating openings are provided for unambiguous selection of the DISCONNECTING and EARTHING functions
- Operation via rotary movement, operating direction according to IEC/EN 60447/VDE 0196 (recommendation of FNN.*)

Spring-operated mechanism

The switching movements are performed independently of the operating speed.

Spring-operated / stored-energy mechanism

The switching movements are performed independently of the operating speed.

During the charging process, the closing and opening springs are charged. This ensures that the switch-disconnector/fuse combination can switch off all types of faults reliably even during closing.

Closing and opening is done via pushbuttons, and is therefore identical with the operation of circuit-breaker operating mechanisms.

An energy store is available for tripping by means of an operating HV HRC fuse or via a shunt release (f-release).

After tripping, a red bar appears on the position indicator.

Motor operating mechanism (option)

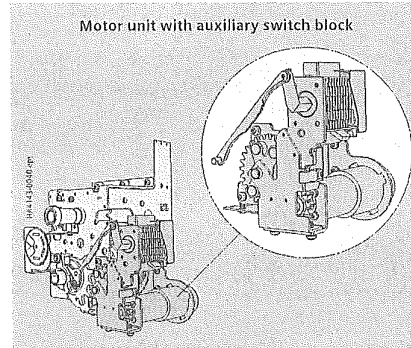
The manual operating mechanisms of SIMOSEC switchgear can be equipped with motor operating mechanisms for the three-position switch-disconnector. Retrofitting is possible.

Operating voltages for motor operating mechanisms:

- 24, 48, 60, 110, 220 V DC
- 110 and 230 V AC, 50/60 Hz.

Operation:

- Local operation by momentary-contact rotary control switch (option)
- Remote operation (standard) applied to terminal.



Shunt release (option) (f-release)

Spring-operated / stored-energy mechanisms can be equipped with a shunt release. Remote electrical tripping of the three-position switch-disconnector is possible via the magnet coil of the shunt release, e.g. transformer overtemperature tripping.

To avoid thermal overloading of the shunt release in the event of a continuous signal that may be applied, the shunt release is switched off via an auxiliary switch which is mechanically coupled with the three-position switch-disconnector.

Assignment of operating mechanism type of three-position switch to panel types

Panel type	R, L, M (PI)	E	T, M(VT-F), M(VT)	
Function	Switch-disconnector (R) Disconnector (L), (D)	Earthing switch	Switch-disconnector	Earthing switch
Type of operating mechanism	Spring-operated	Spring-operated	Stored-energy	Spring-operated
Operation	Manual Motor (option)	Manual	Manual Motor (option)	Manual

Legend

- R = Ring-main feeder
- T = Transformer feeder
- L = Circuit-breaker feeder
- M(VT), M(VT-F) = Busbar voltage metering panel
- D = Disconnector feeder

* FNN: Forum network technology/network operation of the VDE (FNN)

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Auxiliary switch (option)

Each operating mechanism of the three-position switch-disconnector (or three-position disconnector) can be optionally equipped with an auxiliary switch for the position indication:

- Switch-disconnector function: **)
 - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover (manually operated)
- Earthing switch function:
 - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover
- Switch-disconnector function in T typical: **)
 - CLOSED and OPEN: 2 changeover (manually operated, motor-operated)
- Earthing switch function:
 - CLOSED and OPEN: 1 NO + 1 NC + 2 changeover.

Technical data of the auxiliary switch

AC operation 50/60 Hz up to 60 Hz		DC operation		
Operating voltage V	Normal current A	Operating voltage V	Normal current Resistive Inductive, T = 20 ms A A	
up to 230	10	24	10	10
		48	10	9
		60	9	7
		110	5	4
		240	2,5	2

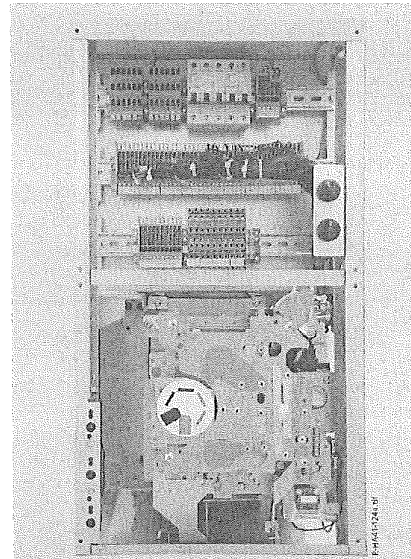
Rated switching capacity

Rated insulation level	250 V AC/DC
Insulation group	C according to VDE 0110
Continuous current	10 A
Making capacity	50 A

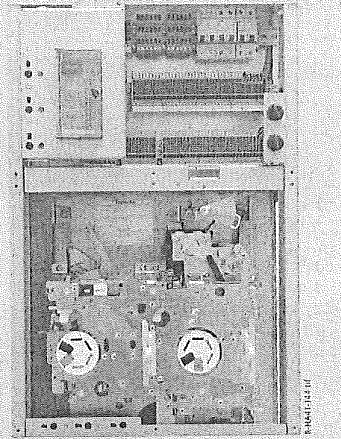
Abbreviations:

NO = Normally open contact
NC = Normally closed contact

** Depending on the secondary equipment of the three-position switch



Panel type R:
Operating mechanism for three-position switch, and low-voltage niche with terminals and MCB's (options)



Panel type L:
Operating mechanism for three-position switch, and circuit-breaker type "CB-f NAR"

Components

Vacuum circuit-breaker

Features

- According to IEC/EN 62271-100/VDE 0671-100/GB 1984 *
- Application in hermetically welded switching-device vessel in conformity with the system
- Climate-independent vacuum interrupter poles in the gas-filled switching-device vessel
- Operating mechanism located outside the switching-device vessel in the front operating mechanism box
- Maintenance-free for indoor installation according to IEC/EN 62271-1/VDE 0671-1 *
- Individual secondary equipment.

Operating mechanism functions

The closing spring is charged by means of the operating lever or the hand crank supplied, or by the motor (option), until the latching of the closing spring is indicated ("spring charged" indicator). Then, the vacuum circuit-breaker can be closed manually or electrically.

In operating mechanisms provided for automatic reclosing (AR), the closing spring can be recharged manually or automatically in case of motor operating mechanism. Thus, the "closing option" is available again.

Operating mechanism

The operating mechanism assigned to a circuit-breaker feeder consists of the following components:

- Operating mechanism for circuit-breaker
- Operating mechanism for three-position disconnecter
- Motor operating mechanism (optional)
- Position indicators
- Pushbuttons for CLOSING and OPENING the circuit-breaker
- Operations counter (optional)
- Interlocking between circuit-breaker and disconnecter.

Assignment of operating mechanism type

Panel type	L, L1, L(T), L1(T)		
Function	Circuit-breaker	Three-position disconnecter	
		Disconnecter	Earthing switch
Type of operating mechanism	Stored-energy	Spring-operated	Spring-operated
Operation	Manual/motor	Manual/motor	Manual

Trip-free mechanism

The vacuum circuit-breaker is fitted with a trip-free mechanism according to IEC/EN 62271-100/VDE 0671-100 *. In the event of an opening command being given after a closing operation has been initiated, the moving contacts return to the open position and remain there even if the closing command is sustained. This means that the contacts are momentarily in the closed position, which is permissible according to the mentioned standard.

* For standards, see page 84

Technical data of the vacuum circuit-breaker

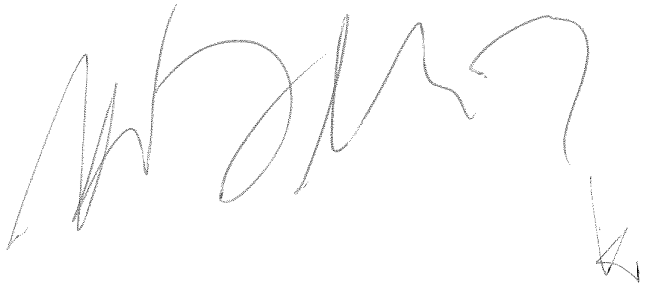
Vacuum circuit-breaker	Type	CB-F AR *)	CB-F NAR *)	On request 3AE *)
Short-circuit breaking current		up to 25 kA	up to 25 kA	up to 25 kA
Rated operating sequence:				
- O - 0.3 s - CO - 3 min - CO		*	-	-
- O - 0.3 s - CO - 15 s - CO		on request	*	*
- O - 0.3 s - CO - 30 s - CO		*	-	*
- O - 3 min - CO - 3 min - CO		-	*	-
Number of breaking operations I _b		10000	2000	10000
Number of short-circuit breaking operations I _{cc}		30	20	30
		Option: 50		Option: 50
Individual panel type L ...	500 mm	L	L	-
Individual panel type L1 ...	750 mm	L1	L1	L1(), L1(w) L2(), L2(w)

Vacuum circuit-breaker type CB-F

The vacuum circuit-breaker consists of a vacuum interrupter unit with integrated three-position disconnecter located in the switching-device vessel, and the associated operating mechanisms.

Explanations:

- Design option
- Not available
- *) AR = Automatic reclosing
- NAR = Non automatic reclosing
- Δ) Design of circuit-breaker:
 - CB-r as removable
 - CB-w as withdrawable



Secondary equipment of the vacuum circuit-breaker

Motor operating mechanism (option)

Operating voltages for motor operating mechanisms:

- 24, 48, 60, 110, 220 V DC
- 110 and 230 V AC, 50/60 Hz.

Further values on request.

Motor rating for circuit-breaker operating mechanism at:

CB-f AR: *

- 24 V to 220 V DC: Maximum 500 W
- 110 V and 230 V AC: Maximum 650 VA

CB-f NAR: *

- 24 V to 220 V DC: Maximum 80 W
- 110 V and 230 V AC: Maximum 80 W.

Secondary components

The scope of the secondary equipment of the vacuum circuit-breaker depends on the type of application and offers a wide range of possible variations, allowing almost every requirement to be satisfied.

Closing solenoid (as option for CB-f NAR)

- For electrical closing.

Shunt release

- Standard: Magnet coil
- Option: Magnet coil with energy store
- Tripping by protection relay or electrical actuation.

C.t.-operated release

- For tripping pulse 0.1 Ws in conjunction with suitable protection systems, e.g. protection system 7SJ45, make Woodward/SEG type WIC; other designs on request
- Used if external auxiliary voltage is missing, tripping via protection relay.

Low-energy magnetic release (for CB-f NAR)

- For tripping pulse 0.02 Ws, tripping via transformer monitor (IKI-30).

Undervoltage release

- Comprising:
 - Energy store and unlatching mechanism
 - Electromagnetic system, which is permanently connected to voltage while the vacuum circuit-breaker is closed; tripping is initiated when this voltage drops
- Connection to voltage transformers possible.

Anti-pumping (standard for CB-f AR) *) (mechanical and electrical)

Function: If constant CLOSE and OPEN commands are present at the vacuum circuit-breaker at the same time, the vacuum circuit-breaker will return to the open position after closing. It remains in this position until a new CLOSE command is given. In this manner, continuous closing and opening (= pumping) is avoided.

Circuit-breaker tripping signal

- For electrical signaling (as pulse > 10 ms), e.g. to remote control systems, in the case of automatic tripping (e.g. protection)
- Via limit switch and cutout switch.

Varistor module

- To limit overvoltages to approx. 500 V for protection devices (when inductive components are mounted in the vacuum circuit-breaker)
- For auxiliary voltages \geq 60 V DC.

Auxiliary switch

- Standard: 6 NO + 6 NC, free contacts thereof **) for:
 - CB-f NAR: 1 NO + 1 NC + 2 changeover
 - CB-f AR: 2 NO + 2 NC + 2 changeover
- Option (for CB-f AR): 11 NO + 11 NC, free contacts thereof: **)
 - 7 NO + 7 NC + 2 changeover.

Position switch

- For signaling "closing spring charged".

Mechanical interlocking

- Dependent on the type of operating mechanism
- Logical mechanical interlock between the three-position disconnecter and the circuit-breaker (option: Closing lock-out for the three-position disconnecter in circuit-breaker panels)
- Option: Operating mechanism with mechanical interlocking as
 - Spring-operated mechanism: Opening for operating crank is blocked
 - Stored-energy mechanism with closing solenoid and pushbutton: The pushbutton operated by the mechanical interlock prevents a continuous command to the closing solenoid
- During operation of the three-position disconnecter from CLOSED to OPEN, the vacuum circuit-breaker cannot be in CLOSED position.

Operations counter

- Standard for circuit-breaker type CB-f AR (with AR \Rightarrow function)
- Option for circuit-breaker type CB-f NAR (without AR function: NAR *).

Abbreviations:

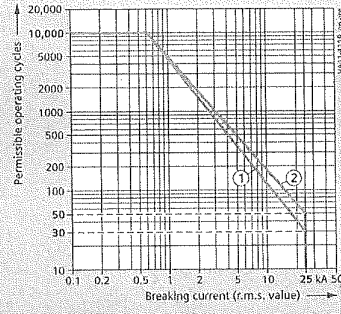
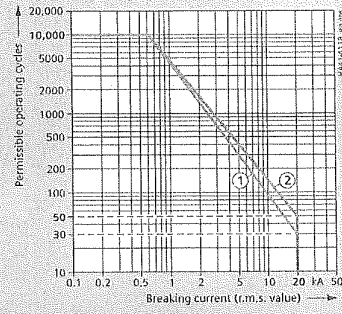
- NO = Normally open contact
- NC = Normally closed contact
- *) AR = Automatic reclosing
- NAR = Non automatic reclosing
- **) Depending on the secondary equipment

Components

Vacuum circuit-breaker

Electrical service life

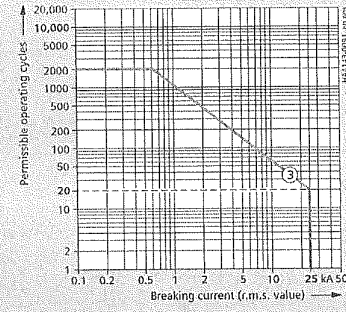
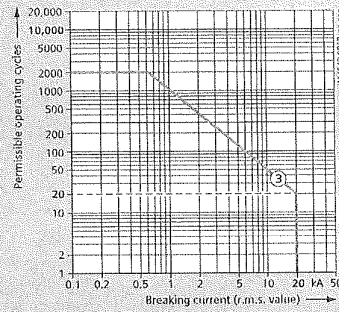
Vacuum circuit-breaker type CB-f AR *)



Max. number of short-circuit breaking operations

n = 30
n = 50

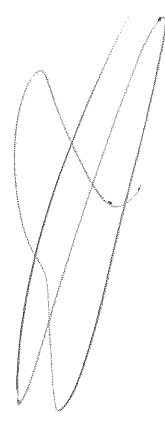
Vacuum circuit-breaker type CB-f NAR *)



Max. number of short-circuit breaking operations

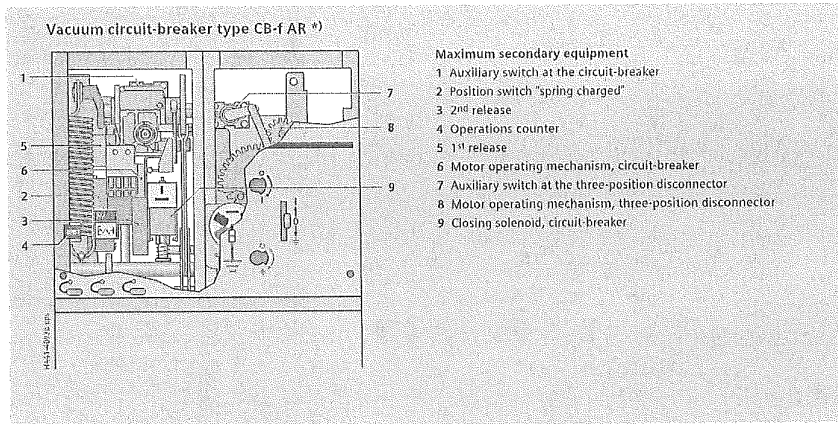
n = 20

*) AR = Automatic reclosing
NAR = Non automatic reclosing



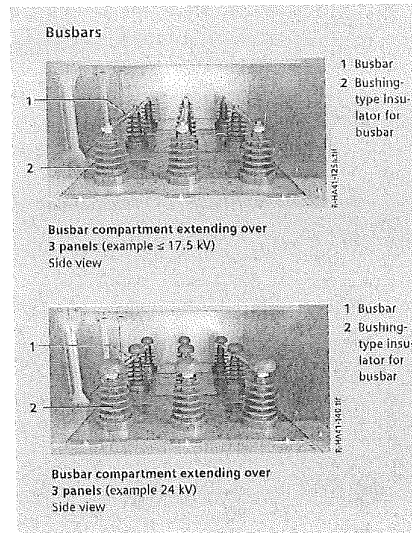
Components

Secondary equipment of the vacuum circuit-breaker, busbars



Busbars

- Safe-to-touch due to metallic enclosure
- Metal-clad busbar compartment
- Three-pole design, bolted from panel to panel
- Easy switchgear extension
- Made of copper: Round E-Cu.



*) AR: Automatic reclosing

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Components

Cable connection

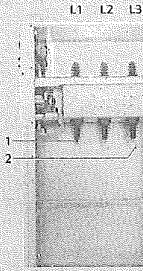
General features

- Connecting lugs for sealing ends arranged one behind the other
- Uniform cable connection height for the respective panel types
- With cable bracket, e.g. type C40 according to DIN EN 50024
- Access to the cable compartment only if feeder has been isolated and earthed.

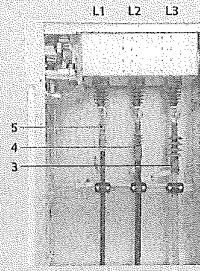
Special features

- In cable panels
- In ring-main panels
- In circuit-breaker panels
- For thermoplastic-insulated cables
- For paper-insulated mass-impregnated cables with adapter systems
- For connection cross-sections up to 300 mm²
- Cable routing downwards.
- In transformer panels
- For thermoplastic-insulated cables
- For connection cross-sections up to 120 mm²: Cable lug max. 32 mm wide
- For rated normal currents of 200 A.

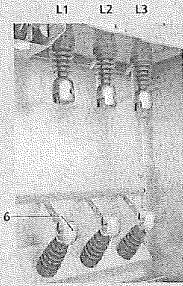
Cable connection (examples)



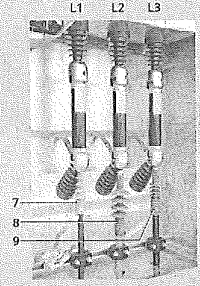
Ring-main panel type R
Cable compartment as delivered



Cable compartment with cable sealing ends (options: A, B, C¹⁾ and D¹⁾, see below)



Transformer panel type T
Cable compartment as delivered



Cable compartment with cable sealing ends (option: A²⁾, see below)

- Options
- | | |
|---------------------------------------|------------------------------------------------------------|
| A Mounted cable clamps ²⁾ | C Double cable connection |
| B Short-circuit/earth-fault indicator | D Suitable for connection of surge arresters ³⁾ |

Cable sealing ends (examples)

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 1 As-delivered condition | 6 As-delivered condition, prepared for cable sealing end |
| 2 Connection for cable | 7 Phase L1:
Make Lovink-Enertech, type IAEM 20, 240 mm ² (20 kV) |
| 3 Phase L1:
Make Lovink-Enertech, type IAEM 20, 240 mm ² (20 kV) | 8 Phase L2:
Make Tyco Electronics Raychem, type TFI1/5131, 95 mm ² (24 kV), as push-on sealing end |
| 4 Phase L2:
Make Prysmian Kabel und Systeme (Pirelli Elektrik) type ELTI mb-1C-2h-C-T3, 240 mm ² (24 kV) | 9 Phase L3:
Make Euromold, type ITK, 95 mm ² (24 kV) |
| 5 Phase L3:
Make Tyco Electronics Raychem, type EPKT 24 CF1X, 185 mm ² (24 kV), as shrink-on sealing end, for severe ambient conditions | |

Note:

- Cable sealing ends and cable clamps are not included in the scope of supply

For options, see figures:

- 1) Only with ring-main panel
- 2) Cable clamps with transformer panels type T... partly mounted underneath the panel in the cable basement
- 3) Make Siemens, type 3EK, other makes on request

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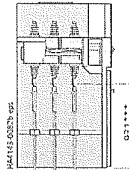
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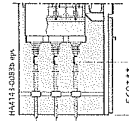
Selection data for various cable sealing ends ¹⁾

Make	Type	Cross-section in mm ²
Single-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); for IEC standard *		
Euromold	AIN 10, AFN 10 *)	25-300 (500 **)
	17 TTGI *)	25-300 (500 **)
	ITK-212 *)	50-300 (400 **)
Prysmian Kabel und Systeme	ELTI mb-1C-12	35-240
	ELTI-1C-12	25-300
Tyco Electronics Raychem	IXSU-F	16-300 (500 **)
	MVTI-31xx-	25-300 (400 **)
	EPKT 2)	16-300
Lovink-Enertech	IAEM 10	25-300
	IAES 10	25-300 (500 **)
3M	92-EB 6x-1	35-300 (400 **)
Südkabel	SEHDI 10.2	35-300 (500 **)
	TI 12	25-240
nkt cables	TO 12	25-300 (500 **)
Three-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); for IEC standard *		
Euromold	AIN 10 *)	25-300 (500 **)
	17 TTGI *)	35-300 (500 **)
Prysmian Kabel und Systeme	ELTI-3C-12	25-300
	IXSU-F33xx	16-300 (500 **)
Lovink-Enertech	IAES 10	25-300
	GHKI	16-300 (400 **)
Single-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV) *)		
Euromold	AIN 20, AFN 20	20-300 (630 **)
	24 TTGI	25-300 (500 **)
	36 MSC 2)	95-300 (800 **)
	36 MSC (Option 1))	95-300 (500 **)
	ITK-224	25-240
Prysmian Kabel und Systeme	ELTI mb-1C-24	35-240
	ELTI-1C-24	25-300
Tyco Electronics	IXSU-F	25-300 (500 **)
	MVTI-51xx-	25-300 (400 **)
	EPKT	16-300 (500 **)
Lovink-Enertech	IAEM 20	25-300
	IAES 20	25-300 (500 **)
3M	93-EB 6x-1	50-300 (400 **)
Südkabel	SEHDI 20.2	35-300 (500 **)
	SEI 24	25-240
nkt cables	TI 24	25-240
	TO 24	25-300 (500 **)
Three-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV) *)		
Euromold	SR-DI 24 2)	35-300 (500 **)
	AFN 10	35-300
Lovink-Enertech	GHKI	25-300 (500 **)
Tyco Electronics Raychem	o.r. IXSU-F53xx	o.r.

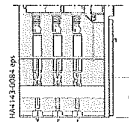
Connection height *** of cables above floor or above lower edge of panel:



Panel type R...



Panel type L...



Panel type T...

Dimension a

- 384 mm: At fuses with e = 442 mm (standard for 24 kV)
- 534 mm: At fuses with e = 292 mm

Note: Depending on make and type, the termination of the cable sealing end (= shield earth) for the 3-core thermoplastic-insulated cable and the fitted cable clamp (option) may be located underneath the panel in the cable basement. This must be taken into account in panels with floor cover (option).

* For standards, see page 84
 **) On request: Max. connection cross-section of cable sealing end types
 ***) Due to the installation of 4MA cast-resin insulated block-type current transformers, the connection height of the cables is reduced in the corresponding panel types [e.g.: L, L1, M (-K), ...]
 1) Note:
 For cable connections, the manufacturer information about the sealing end and the design of the cable must be taken into account (e.g., operating voltage, rated power-frequency withstand voltage, cable type, core material)

2) Transformer panel types T...:
 - Lower edge of sealing end below panel
 - Cable lugs of sealing ends up to 32 mm width
 - Owing to the various sealing end lengths, some of the mounted cable clamps are underneath the panel
 3) Circuit-breaker panel types L...:
 Lower edge of sealing end below panel
 4) Cable sealing end type with insulation shields
 *) Remark concerning applications with requirements according to the GB standard (China): Type suitable for rated short-duration power-frequency withstand voltage $U_{p1} = 42$ kV according to IEC 62271-1 and $U_{p1} = 42$ kV according to EN/HD 629

Components

Cable cross-sections

Cable cross-sections

Panel type	Panel width	Version	Connected cables x connection cross-section number x mm ² for rated voltage			Transformer combination in the connection compartment		
			12 kV	17.5 kV	24 kV	Current transformer		
K	375	Standard	1 x 300	1 x 300	1 x 300	○		
		On request	2 x 300	2 x 300	2 x 300			
		Standard	1 x 300	1 x 300	1 x 300			
K1	500	Standard	1 x 300	1 x 300	1 x 300			
		Option	2 x 400	2 x 300	2 x 300			
		Standard	1 x 300	1 x 300	1 x 300			
R, D	375	Standard	1 x 300	1 x 300	1 x 300	○		
		On request	2 x 300	2 x 300	2 x 300			
		Standard	1 x 300	1 x 300	1 x 300			
R1, D1	500	Standard	1 x 300	1 x 300	1 x 300	○		
		Option	2 x 300	2 x 300	2 x 300			
		Standard	1 x 300	1 x 300	1 x 300			
L	500	Standard	1 x 300	1 x 300	1 x 300	○		
		Option	2 x 240	2 x 240	2 x 240			
		Standard	1 x 300	1 x 300	1 x 300			
L1	750	Standard	1 x 300	1 x 300	1 x 300	○		
		Option	2 x 300	2 x 300	2 x 300			
		Standard	1 x 400	1 x 300	1 x 300		○	○
M(-K) M(+K)	750	Standard	1 x 400	1 x 300	1 x 300		○	○
		Option	3 x 400	3 x 300	3 x 300		○	○
		Standard	1 x 400	1 x 300	1 x 300		○	○
M(KS)	750	Standard	1 x 400	1 x 300	1 x 300		○	○
		Option	2 x 300	2 x 300	2 x 300		○	○
		Standard	1 x 300	1 x 300	1 x 300	○	○	
L1(r) L1(v)	750	Standard	1 x 300	1 x 300	1 x 300	○		
		Option	2 x 300	2 x 300	2 x 300	○		
		Standard	1 x 240	1 x 240	-			

○ possible - not possible

Cable fixing:

Depending on the cable type (1-core cable, 3-core cable) or the associated panel type and its components, the cable may also be fixed in the cable basement (for local installation):

1-core cable

3-core cable

Max. dimension: H _c in mm	Cable version	
	1-core	3-core
Standard	435	425
Option: With additional floor cover	469	459
*) Height of cable clamp (= Option)	60	77

H_{cc} = Available height for cable connection; From the mounted cable clamp *)

Optionally, a deep floor cover is also possible:

- 1) CT as an option (cable-type current transformer)
- 2) CT as an option (zero-sequence current transformer for earth-fault detection)
- 3) Deep floor cover
- 4) Cable fixing bar, additionally movable downwards
- 5) Option: cable clamps

H₀ = Height of cable connection in the panel
*) Extendable up to 600 mm

HV HRC fuse assembly

Features

- Application for
 - Transformer panel types T (375 mm) and T1 (500 mm)
 - Busbar voltage metering panel type M(VT-F), M1(VT-F)
- HV HRC fuse-links acc. to DIN 43625 (main dimensions) with striker; version "medium" acc. to IEC 60282/ VDE 0670-4 *)
- As short-circuit protection before transformers
- With selectivity (depending on correct selection) to upstream and downstream connected equipment
- Requirements according IEC 62271-105 fulfilled as HV alternating current switch-fuse combination
- Selection of HV HRC fuses for transformers
- Fuse replacement possible only when feeder is earthed
- Option: Shunt release on operating mechanism of three-position switch-disconnector
- Option: "Tripped indication" of three-position switch-disconnector in transformer feeder (transformer switch) for remote electrical indication with one normally-open contact (1 NO).

Mode of operation

"HV HRC fuse tripped"

Following the tripping of an HV HRC fuse-link, the mechanism for charging the spring must be set to the "OPEN" position.

Subsequently, earthing can be implemented by means of the three-position switch-disconnector and e.g. the fuse can be replaced.

Replacement of HV HRC fuse-links (without any tools)

- Isolating and earthing of the transformer feeder
- Opening the connection compartment cover
- Subsequent manual replacement of the HV HRC fuse-link.

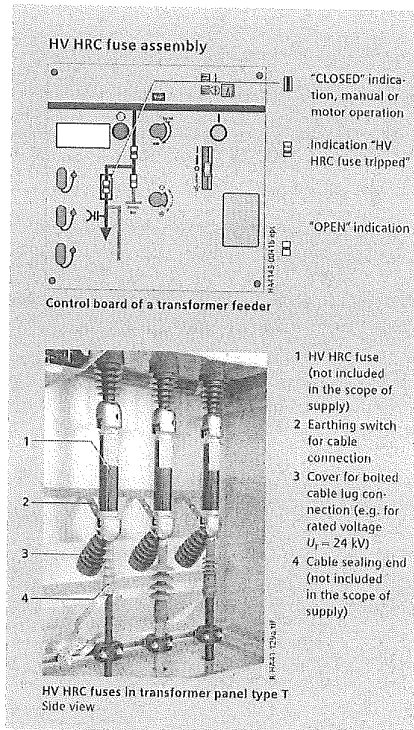
Note to HV HRC fuse-links

According to IEC 60282-1 (2009) Clause 6.6, the breaking capacity of HV HRC fuses is tested within the scope of the type test at 87% of their rated voltage.

In three-phase systems with resonance-earthed or isolated neutral, under double earth fault and other conditions, the full phase-to-phase voltage may be available at the HV HRC fuse during breaking. Depending on the size of the operating voltage of such a system, this applied voltage may then exceed 87% of the rated voltage.

It must therefore already be ensured during configuration of the switching devices and selection of the HV HRC fuse that only such fuse-links are used, which either satisfy the above operating conditions, or whose breaking capacity was tested at least with the maximum system voltage. In case of doubt, a suitable HV HRC fuse must be selected together with the fuse manufacturer.

*) For standards, see page 84



Components

Allocation of HV HRC fuses and transformers Recommended HV HRC fuses make SIBA for switchgear type SIMOSEC

Allocation of HV HRC fuses and transformers

The following table shows the recommended HV HRC fuse-links make SIBA (electrical data valid for ambient air temperatures of up to 40 °C) for fuse protection of transformers.

Standards

HV HRC fuse-links "medium" version with striker and for tripping energy 1 ± 0.5 Joule according to

- IEC/EN 60282-1/VDE 0670-4
- IEC/EN 60787/VDE 0670-402
- DIN 43625 main dimensions.

Fuse protection table

The three-position switch-disconnector in the transformer feeder (transformer switch) was combined and tested with HV HRC fuse-links.

MV system Operating voltage U_n kV	Transformer			HV HRC fuse-link				
	Rated power S_n KVA	Relative impedance voltage $\%z$	Rated current I_n A	Rated current I_n A	Min. operating/ rated voltage U_n kV	Dimension e mm	Outside diameter d	Order No. Make SIBA
3.3 to 3.0	20	4	3.5	6.3	3 to 7.2	292	53	30 098 13.6,3
				10	3 to 7.2	292	53	30 098 13.10
	50	4	8.75	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
	75	4	13.1	20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
	100	4	17.5	31.5	3 to 7.2	292	53	30 098 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
	125	4	21.87	31.5	3 to 7.2	292	53	30 098 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
	160	4	28	40	3 to 7.2	292	53	30 098 13.40
				50	3 to 7.2	292	53	30 098 13.50
	200	4	35	50	3 to 7.2	292	53	30 098 13.50
				63	3 to 7.2	292	67	30 099 13.63
	250	4	43.74	63	3 to 7.2	292	67	30 099 13.63
				80	3 to 7.2	292	67	30 099 13.80
315	4	55.1	80	3 to 7.2	292	67	30 099 13.80	
			100	3 to 7.2	292	67	30 099 13.100	
4.16 to 4.0	20	4	2.78	6.3	3 to 7.2	292	53	30 098 13.6,3
				10	3 to 7.2	292	53	30 098 13.10
	50	4	6.93	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.16
	75	4	10.4	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
	100	4	13.87	20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
	125	4	17.35	25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
	160	4	22.2	31.5	3 to 7.2	292	53	30 098 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
	200	4	27.75	40	3 to 7.2	292	53	30 098 13.40
				50	3 to 7.2	292	53	30 098 13.50
	250	4	34.7	50	3 to 7.2	292	53	30 098 13.50
				63	3 to 7.2	292	67	30 099 13.63
315	4	43.7	63	3 to 7.2	292	67	30 099 13.63	
			80	3 to 7.2	292	67	30 099 13.80	
400	4	55.5	80	3 to 7.2	292	67	30 099 13.80	
			100	3 to 7.2	292	67	30 099 13.100	
5 to 5.5	20	4	2.3	6.3	3 to 7.2	292	53	30 098 13.6,3
				10	3 to 7.2	292	53	30 098 13.10
	30	4	3.2	6.3	3 to 7.2	292	53	30 098 13.6,3
				10	3 to 7.2	292	53	30 098 13.10
	50	4	5.7	10	3 to 7.2	292	53	30 098 13.10
				16	3 to 7.2	292	53	30 098 13.16
	75	4	8.6	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
	100	4	11.5	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
	125	4	14.4	20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
	160	4	18.4	31.5	3 to 7.2	292	53	30 098 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
	200	4	23	40	3 to 7.2	292	53	30 098 13.40
				50	3 to 7.2	292	53	30 098 13.50
250	4	28.8	40	3 to 7.2	292	53	30 098 13.40	
			50	3 to 7.2	292	53	30 098 13.50	
315	4	36.3	50	3 to 7.2	292	53	30 098 13.50	
			63	3 to 7.2	292	67	30 099 13.63	
400	4	46.1	63	3 to 7.2	292	67	30 099 13.63	
			80	3 to 7.2	292	67	30 099 13.80	
500	4	52.5	80	3 to 7.2	292	67	30 099 13.80	
			100	3 to 7.2	292	67	30 099 13.100	
630	4	72.7	100	3 to 7.2	292	67	30 099 13.100	
			125	3 to 7.2	292	67	30 099 13.125	

Components

Allocation of HV HRC fuses and transformers Recommended HV HRC fuses make SIBA for switchgear type SIMOSEC

kV system Operating voltage U_n kV	Transformer		HV HRC fuse (mk)					
	Rated power S, kVA	Relative impedance voltage u_k %	Rated current I_n A	Rated current I_n A	Min. operating/ rated voltage U_n kV	Dimension e mm	Outside diameter d	Order No. Make SIBA
6 to 7.2	20	4	1.9	6.3	6 to 12	292	53	30 004 13.6,3
				6.3	6 to 12	442	53	30 101 13.6,3
	30	4	2.9	6.3	6 to 12	292	53	30 004 13.6,3
				6.3	6 to 12	292	53	30 101 13.6,3
	50	4	4.8	10	6 to 12	292	53	30 004 13.7,0
				10	6 to 12	442	53	30 101 13.7,0
	75	4	7.2	16	6 to 12	292	53	30 004 13.16
				16	6 to 12	442	53	30 101 13.16
	100	4	9.6	16	6 to 12	292	53	30 004 13.16
				16	6 to 12	442	53	30 101 13.16
				20	6 to 12	292	53	30 004 13.20
				20	6 to 12	442	53	30 101 13.20
	125	4	12	20	6 to 12	292	53	30 004 13.20
				20	6 to 12	442	53	30 101 13.20
				25	6 to 12	292	53	30 004 13.25
				25	6 to 12	442	53	30 101 13.25
	160	4	15.4	31.5	6 to 12	292	53	30 004 13.31,5
				31.5	6 to 12	442	53	30 101 13.31,5
	200	4	19.2	31.5	6 to 12	292	53	30 004 13.31,5
				31.5	6 to 12	442	53	30 101 13.31,5
				40	6 to 12	292	53	30 004 13.40
				40	6 to 12	442	53	30 101 13.40
	250	4	24	40	6 to 12	292	53	30 004 13.40
				40	6 to 12	442	53	30 101 13.40
	315	4	30.3	50	6 to 12	292	53	30 004 13.50
				50	6 to 12	442	53	30 101 13.50
				63	6 to 12	292	67	30 012 43.63
	400	4	38.4	63	6 to 12	292	67	30 012 43.63
				80	6 to 12	292	67	30 012 43.80
				80	6 to 12	442	67	30 102 43.80
				63	6 to 12	292	67	30 012 13.63
	500	4	48	80	6 to 12	292	67	30 012 43.80
80				6 to 12	442	67	30 102 43.80	
630	4	61	100	6 to 12	442	67	30 102 13.80	
			100	6 to 12	442	67	30 012 43.100	
			100	6 to 12	442	67	30 102 43.100	
			125	6 to 12	442	67	30 103 43.125	
800	5 (5.5)	77	125	6 to 12	292	85	30 020 43.125	
			125	6 to 12	292	85	30 020 43.125	
			125	6 to 12	442	85	30 103 43.125	
10 to 12	4	1.15	4	6 to 12	292		on request	
			2.9	10	6 to 12	292	53	30 004 13.10
75	4	4.3	10	6 to 12	442	53	30 101 13.10	
			10	10 to 17.5	292	53	30 255 13.10	
			10	10 to 17.5	442	53	30 231 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	6 to 12	292	53	30 004 13.10	
			10	6 to 12	442	53	30 101 13.10	
			10	10 to 17.5	292	53	30 255 13.10	
			10	10 to 17.5	442	53	30 231 13.10	
			10	10 to 24	442	53	30 006 13.10	
			16	6 to 12	292	53	30 004 13.16	
			16	6 to 12	442	53	30 101 13.16	
			100	4	5.8	16	6 to 12	292
16	6 to 12	442				53	30 101 13.16	
16	10 to 17.5	292				53	30 255 13.16	
16	10 to 17.5	442				53	30 231 13.16	
125	4	7.2	16	6 to 12	292	53	30 004 13.16	
			16	6 to 12	442	53	30 101 13.16	
			16	10 to 17.5	292	53	30 255 13.16	
			16	10 to 17.5	442	53	30 231 13.16	
160	4	9.3	20	6 to 12	292	53	30 006 13.16	
			20	6 to 12	442	53	30 004 13.20	
			20	6 to 12	292	53	30 101 13.20	
			20	10 to 17.5	292	67	30 221 13.20	
			20	10 to 17.5	442	53	30 231 13.20	
			20	10 to 24	442	53	30 006 13.20	

Components

Allocation of HV HRC fuses and transformers
 Recommended HV HRC fuses make SIBA for switchgear type SIMOSEC

MV system Operating voltage U_n kV	Transformer		HV HRC fuse-link					
	Rated power S, kVA	Relative impedance voltage u_k %	Rated current I_n A	Rated current I_f A	Min. operating/ rated voltage U_f kV	Dimension e mm	Outside diameter d	Order No. Make SIBA
10 to 12	200	4	11.5	25	6 to 12	292	53	30 004 13.25
				25	6 to 12	442	53	30 101 13.25
				25	10 to 17.5	292	67	30 221 13.25
				25	10 to 17.5	442	53	30 231 13.25
				25	10 to 24	442	53	30 006 13.25
				25	10 to 24	442	53	30 006 13.25
	250	4	14.5	25	6 to 12	292	53	30 004 13.25
				25	6 to 12	442	53	30 101 13.25
				25	10 to 17.5	292	67	30 221 13.25
				25	10 to 17.5	442	53	30 231 13.25
				25	10 to 24	442	53	30 006 13.25
				31.5	6 to 12	292	53	30 004 13.31,5
				31.5	6 to 12	442	53	30 101 13.31,5
				31.5	10 to 17.5	292	67	30 221 13.31,5
				31.5	10 to 17.5	442	53	30 231 13.31,5
				31.5	10 to 24	442	53	30 006 13.31,5
				31.5	10 to 24	442	53	30 006 13.31,5
				315	4	18.3	25	6 to 12
	25	6 to 12	442				53	30 101 13.31,5
	25	10 to 17.5	292				67	30 221 13.31,5
	25	10 to 17.5	442				53	30 231 13.31,5
	25	10 to 24	442				53	30 006 13.31,5
	40	6 to 12	292				53	30 004 13.40
	40	6 to 12	442				53	30 101 13.40
	40	10 to 17.5	292				67	30 221 13.40
	40	10 to 17.5	442				53	30 231 13.40
	40	10 to 24	442				53	30 006 13.40
	40	10 to 24	442				53	30 006 13.40
	400	4	23.1				25	6 to 12
				25	6 to 12	442	53	30 101 13.40
				25	10 to 17.5	292	67	30 221 13.40
				25	10 to 17.5	442	53	30 231 13.40
				25	10 to 24	442	53	30 006 13.40
				29	6 to 12	292	53	30 004 13.50
				29	6 to 12	442	53	30 101 13.50
				29	10 to 17.5	292	67	30 221 13.50
				29	10 to 17.5	442	67	30 232 13.50
				29	10 to 24	442	67	30 014 13.50
				29	10 to 24	442	67	30 012 43.63
				500	4	29	25	6 to 12
	25	6 to 12	442				53	30 101 13.50
	25	10 to 17.5	292				67	30 221 13.50
25	10 to 17.5	442	67				30 232 13.50	
25	10 to 24	442	67				30 014 13.50	
31.5	6 to 12	292	67				30 012 43.63	
31.5	6 to 12	442	67				30 012 43.63	
31.5	6 to 12	292	67				30 012 13.63	
31.5	6 to 12	442	67				30 012 13.63	
31.5	10 to 17.5	442	67				30 102 13.63	
31.5	10 to 17.5	292	85				30 232 13.63	
31.5	10 to 17.5	442	85				30 221 13.63	
630	4	36.4	25	6 to 12	292	67	30 012 13.63	
			25	6 to 12	442	67	30 012 13.63	
			25	10 to 17.5	442	67	30 102 13.63	
			25	10 to 17.5	292	85	30 232 13.63	
			25	10 to 17.5	442	85	30 221 13.63	
			25	10 to 24	442	67	30 014 13.63	
			25	10 to 24	442	67	30 014 13.63	
			25	10 to 24	442	67	30 014 43.80	
			25	10 to 24	442	67	30 012 43.80	
			25	10 to 24	442	67	30 012 43.80	
			25	10 to 24	442	67	30 102 43.80	
			800	5 (5.5)	46.2	25	6 to 12	292
25	6 to 12	442				67	30 012 43.80	
25	6 to 12	292				67	30 102 43.80	
25	6 to 12	442				67	30 012 43.80	
25	6 to 12	442				67	30 012 43.80	
25	6 to 12	442				67	30 012 43.80	
1000	5 (5.5)	58	25	6 to 12	442	67	30 012 43.100	
			25	10 to 24	442	85	30 022 43.100	
1250	5 (5.5)	72.2	125	10 to 24	442	85	30 022 43.125	
1600	5 (to 5.7)	92.3	160	6 to 12	442	85	on request	
13.8	20	4	0.8	3.15	6 to 12	442	53	30 006 13.3,15
				6.3	10 to 17.5	442	53	30 231 13.6,3
				6.3	10 to 17.5	292	53	30 255 13.6,3
				6.3	10 to 24	442	53	30 006 13.6,3
				6.3	10 to 24	442	53	30 331 13.6,3
				6.3	10 to 24	442	53	30 255 13.10
	75	4	3.2	6.3	10 to 17.5	442	53	30 231 13.10
				10	10 to 17.5	292	53	30 255 13.10
				10	10 to 17.5	442	53	30 231 13.10
				10	10 to 24	442	53	30 006 13.10
				10	10 to 17.5	442	53	30 231 13.10
				10	10 to 17.5	442	53	30 231 13.10
	100	4	4.2	10	10 to 17.5	442	53	30 231 13.10
				16	10 to 17.5	442	53	30 231 13.16
				16	10 to 17.5	292	53	30 255 13.16
				16	10 to 24	442	53	30 006 13.16
				16	10 to 24	442	53	30 006 13.16
				16	10 to 24	442	53	30 231 13.16
	125	4	5.3	10	10 to 17.5	442	53	30 231 13.10
				16	10 to 17.5	442	53	30 231 13.10
				16	10 to 17.5	292	53	30 255 13.16
				16	10 to 24	442	53	30 006 13.16
				16	10 to 24	442	53	30 006 13.16
				16	10 to 24	442	53	30 231 13.16
	160	4	6.7	16	10 to 17.5	442	53	30 231 13.16
				16	10 to 17.5	442	53	30 231 13.16
				20	10 to 17.5	442	53	30 231 13.20
				20	10 to 17.5	292	53	30 221 13.20
				20	10 to 24	442	53	30 006 13.20
				20	10 to 24	442	53	30 006 13.20
200	4	8.4	20	10 to 17.5	442	53	30 231 13.20	
			20	10 to 17.5	442	53	30 231 13.20	
			20	10 to 17.5	292	53	30 221 13.20	
			20	10 to 17.5	442	53	30 231 13.25	
			20	10 to 17.5	442	53	30 231 13.25	
			20	10 to 24	442	53	30 006 13.25	

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Components

Allocation of HV HRC fuses and transformers
Recommended HV HRC fuses make SIBA for switchgear type SIMOSEC

MV system Operating voltage U _e kV	Transformer		HV HRC (fuse-link)		Dimension e mm	Outside diameter d	Order No. Make SIBA	
	Rated power S _r kVA	Relative impedance voltage u _k %	Rated current I _n A	Rated current I _n A				
13.8	315	4	13.2	25	10 to 17.5	442	30 231 13.25	
				31.5	10 to 17.5	292	30 221 13.31,5	
				31.5	10 to 17.5	442	30 231 13.31,5	
	400	4	16.8	31.5	10 to 17.5	442	30 006 13.31,5	
				31.5	10 to 17.5	292	30 231 13.31,5	
				31.5	10 to 24	442	30 221 13.31,5	
	500	4	21	40	10 to 17.5	442	30 006 13.31,5	
				40	10 to 17.5	292	30 221 13.40	
				40	10 to 24	442	30 006 13.40	
	630	4	26.4	50	10 to 17.5	442	30 232 13.50	
				50	10 to 17.5	292	30 221 13.50	
				50	10 to 24	442	30 014 13.50	
	15 to 17.5	800	5 to 6	33.5	63	10 to 24	442	30 014 43.63
					63	10 to 24	442	30 014 43.80
1250		5 to 6	41.9	80	10 to 24	442	30 022 43.100	
				80	10 to 24	442	30 022 43.125	
1600		5 to 6	52.3	100	10 to 24	442	30 022 43.125	
15 to 17.5	20	4	0.77	3.15	10 to 24	442	30 006 13.3,15	
				6.3	10 to 17.5	442	30 231 13.6,3	
	50	4	1.9	6.3	10 to 17.5	292	30 255 13.6,3	
				6.3	10 to 17.5	442	30 006 13.6,3	
	75	4	2.9	6.3	10 to 17.5	442	30 231 13.6,3	
				10	10 to 17.5	442	30 231 13.10	
	100	4	3.9	16	10 to 17.5	442	30 231 13.16	
				16	10 to 24	442	30 006 13.16	
	125	3 (3.5)	4.8	16	10 to 17.5	442	30 231 13.16	
				16	10 to 24	442	30 006 13.16	
	160	4	6.2	16	10 to 17.5	442	30 231 13.16	
				20	10 to 17.5	442	30 231 13.20	
	200	3 (3.5)	7.7	20	10 to 17.5	292	30 221 13.20	
				20	10 to 24	442	30 006 13.20	
	250	3 (3.5)	9.7	25	10 to 17.5	292	30 221 13.25	
				25	10 to 24	442	30 221 13.31,5	
	315	3 (3.5)	12.2	31.5	10 to 17.5	292	30 006 13.31,5	
				31.5	10 to 17.5	442	30 231 13.31,5	
	400	4	15.5	31.5	10 to 17.5	292	30 221 13.31,5	
				31.5	10 to 17.5	442	30 006 13.31,5	
500	4	19.3	31.5	10 to 17.5	442	30 231 13.31,5		
			31.5	10 to 24	442	30 006 13.31,5		
20 to 24	630	4	24.3	40	10 to 17.5	292	30 221 13.40	
				40	10 to 17.5	442	30 221 13.40	
	800	5 (5.1)	30.9	40	10 to 17.5	292	30 221 13.40	
				40	10 to 17.5	442	30 006 13.40	
	1000	5 to 6	38.5	40	10 to 17.5	292	30 221 13.40	
				40	10 to 17.5	442	30 221 13.50	
	1250	5 to 6	48.2	50	10 to 17.5	292	30 221 13.50	
				50	10 to 17.5	442	30 014 13.50	
	1600	5 to 6	61.6	50	10 to 17.5	442	30 014 43.63	
				50	10 to 24	442	30 014 43.63	
	20	4	0.57	2.15	10 to 24	442	on request	
				6.3	10 to 24	442	30 006 13.3,15	
	50	4	1.5	6.3	10 to 24	442	30 006 13.6,3	
				6.3	10 to 24	442	30 006 13.6,3	
	75	4	2.2	6.3	10 to 24	442	30 006 13.6,3	
				10	10 to 24	442	30 006 13.6,3	
	100	4	2.9	10	10 to 24	442	30 006 13.10	
				16	10 to 24	442	30 006 13.10	
	125	4	3.6	16	10 to 24	442	30 006 13.16	
				16	10 to 24	442	30 006 13.16	
160	4	4.7	16	10 to 24	442	30 006 13.16		
			20	10 to 24	442	30 006 13.20		
200	4	5.8	20	10 to 24	442	30 006 13.20		
			20	10 to 24	442	30 006 13.20		
250	4	7.3	20	10 to 24	442	30 006 13.25		
			25	10 to 24	442	30 006 13.31,5		
315	4	9.2	25	10 to 24	442	30 006 13.31,5		
			25	10 to 24	442	30 006 13.31,5		
400	4	11.6	31.5	10 to 24	442	30 006 13.31,5		
			31.5	10 to 24	442	30 006 13.31,5		
500	4	14.5	40	10 to 24	442	30 006 13.40		
			40	10 to 24	442	30 006 13.40		
630	4	18.2	40	10 to 24	442	30 006 13.40		
			40	10 to 24	442	30 006 13.40		
800	5 to 6	23.1	40	10 to 24	442	30 006 13.40		
			40	10 to 24	442	30 006 13.40		
1000	5 to 6	29	40	10 to 24	442	30 006 13.40		
			40	10 to 24	442	30 006 13.40		
1250	5 (to 5.9)	36	50	10 to 24	442	30 006 13.40		
			50	10 to 24	442	30 014 13.50		
1600	5 (to 5.5)	46.5	80	10 to 24	442	30 014 43.80		
			80	10 to 24	442	30 014 43.80		
2000	5 to 6	57.8	100	10 to 24	442	30 022 43.100		
			100	10 to 24	442	30 022 43.140		
2500	5 (to 5.7)	72.2	140	10 to 24	442	30 022 43.140		
			140	10 to 24	442	30 022 43.140		

Components

Three-phase current transformer 4MC63

Features

- According to IEC 61869-2 / DIN EN 61869-2 *)
- Designed as a three-pole ring-core current transformer
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Climate-independent
- Secondary connection by means of a terminal strip in the panel.

Installation

- Arranged outside the switching-device vessel on the bushings
- Factory-assembled
- Mounting location:
 - For circuit-breaker panels type L...
 - For bus sectionalizer panels type L(T)
 - Option: On request for ring-main-panels type R...

Other designs (option)

For protection equipment based on the current-transformer operation principle:

Three-phase current transformer type 4MC63 60 for

- Protection relay 7SJ4x as definite-time overcurrent protection

- Definite-time overcurrent protection relay, make Woodward/SEG, type WIP-1.

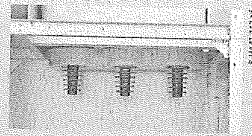
Three-phase current transformer 4MC63 64 for

- Definite-time overcurrent protection relay, make Woodward/SEG, type WIC.

Three-phase current transformer 4MC63 ...



installed on bushing-type insulators



Technical data	Three-phase current transformer 4MC63 (Standard type) 1)								
	for $I_N = 350$ A			for $I_N = 400$ A			for $I_N = 1000$ A		
	for $I_D = 630$ A			for $I_D = 630$ A			for $I_D = 1250$ A		

Primary data

	0.72 kV				0.72 kV			0.72 kV			
Highest voltage for equipment U_{Hn}	0.72 kV				0.72 kV			0.72 kV			
Rated current I_N	150	100	75	50	400	300	200	1000	750	600	500
Rated short-duration power-frequency withstand voltage (winding test)	3 kV				3 kV			3 kV			
Rated short-time thermal current I_{th}	25 kA/1 s, 2 s ¹⁾ or 20 kA/3 s				25 kA/1 s, 2 s ¹⁾ or 20 kA/3 s			25 kA/1 s, 2 s ¹⁾ or 20 kA/3 s			
Rated continuous thermal current I_D	630 A				630 A			1250 A			
Transient overload current	1.5 x I_D /1 h				2 x I_D /0.5 h			1.5 x I_D /1 h			
Rated dynamic current I_{dy}	2.5 x I_{th}				2.5 x I_{th}			unlimited			

Secondary data

Rated current	A	1	0.67	0.5	0.33	1	0.75	0.5	1	0.75	0.6	0.5
Rating	VA	5	3.33	2.5	1.67	5	3.75	2.5	5	3.75	3	2.5
Rated current (option)		5 A				5 A			5 A			
Current at I_D		4.2 A				1.575 A			1.25 A			
Protection class		10 P				10 P			10 P			
Overcurrent factor		10				10			10			

1) Other values on request, e.g. as additional type 4MC63 63 (complementary types)

*) For standards, see page 84

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Features

- According to IEC 61869-2 / DIN EN 61869-2 *)
- Designed as a single-pole ring-core current transformer
- Climate-independent
- Free of dielectrically stressed cast-resin parts (due to design)
- Insulation class E
- Inductive type
- Secondary connection by means of a terminal strip inside the panel.

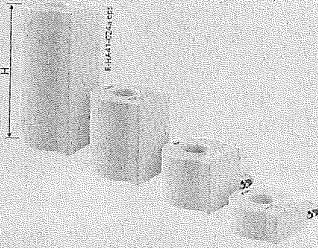
Application

- For circuit-breaker panels type L...
- For ring-main panels type R...
- For transformer panels type T...

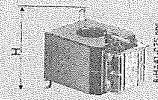
Installation

- Cable-type current transformer 4MC70 33 for panel types: R..., K..., L...
- Cable-type current transformer 4MC70 31: E.g. for panel types R..., K... and T...
- Arranged on the cable at the panel connection
- For shielded cables
- Transformers mounted on a supporting plate at our factory; final assembly on the cables on site.

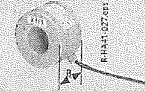
Cable-type current transformer 4MC70 33, 4 overall heights



Cable-type current transformer 4MC70 31



On request:
Cable-type current transformer



Technical data	Cable-type current transformer 4MC70 33	Cable-type current transformer 4MC70 31
Primary data		
Highest voltage for equipment U_m	0.72 kV	0.72 kV
Rated current I_N	20 A to 600 A	50 A to 600 A
Rated short-duration power-frequency withstand voltage (winding test)	3 kV	3 kV
Rated short-time thermal current I_{th}	up to 25 kA/1 s or 25 kA/3 s or 20 kA/3 s	25 kA/1 s or 14.5 kA/3 s
Rated continuous thermal current I_p	$1.0 \times I_N$ option: $1.2 \times I_N$	$1.0 \times I_N$ option: $1.2 \times I_N$
Transient overload current	$1.5 \times I_p / 1$ h or $2 \times I_p / 0.5$ h	$1.5 \times I_p / 1$ h or $2 \times I_p / 0.5$ h
Rated dynamic current I_{dyn}	$2.5 \times I_{th}$	$2.5 \times I_{th}$
Secondary data		
Rated current	1 A or 5 A	
Measuring class	0.2	0.5 1 1
Measuring core	Overcurrent factor	without FS5 FS10 FS5 (option: FS10)
	Rating	2.5 VA to 30 VA 2.5 VA to 10 VA
Protection core	Class	10 P 5 P -
	Overcurrent factor	10 10 -
	Rating	2.5 VA to 10 VA -
Option: Secondary tap	1; 2 (e.g. 150 A - 300 A) 1; 2	
Dimensions		
Overall height $H^{1)}$ mm	65 ¹⁾ 110 ¹⁾ 170 ¹⁾ 285 ¹⁾	89
Outside diameter	150 mm	85 mm x 114 mm
Inside diameter	55 mm	40 mm
For cable diameter	50 mm	36 mm

Other values on request

- *) For standards, see page 84
 1) Depending on the core data
 2) Available installation space for cable-type current transformers inside the panels depends on make, type and cross-section of sealing end.
Example: Panel type R or K:
 Installation space approx. 285 mm

Components

Current transformers 4MA7 and voltage transformers 4MR for air-insulated billing metering panels

Features

Current transformer 4MA7

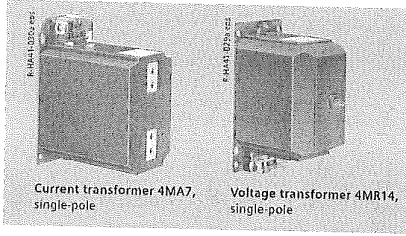
- According to IEC 61869-2 / DIN EN 61869-2 *)
- Dimensions according to DIN 42600-8
- Designed as a single-pole indoor block-type current transformer
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals.

Voltage transformer 4MR

- According to IEC 61869-3 / DIN EN 61869-3 *)
- Dimensions according to DIN 42600-9 (small model)
- Designed as an indoor voltage transformer:
- Type 4MR, single-pole
- Option: Type 4MR, two-pole
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals.

Application

- For panel types:
 - Billing metering panels type M...
 - Bus riser panel type H
 - Busbar voltage transformer panel types M(VT), M(VT-F), L...
- For mounting at the feeder.



Technical data

Current transformer 4MA7, single-pole (other values on request)

Primary data							
Highest voltage for equipment U_M	kV	3.6	7.2	12	12	17.5	24
Rated short-duration power-frequency withstand voltage U_D	kV	10	20	28	42	38	50
Rated lightning impulse withstand voltage U_L	kV	20	60	75	75	95	125
Rated current I_N	A	20 to 1200					
Rated short-time thermal current I_{th}	KA	up to 20 kA/3 s, or up to 25 kA/1 s					
Rated continuous thermal current I_B		up to 1.0 x I_N (option: 1.2 x I_N)					
Rated dynamic current I_{dyn}		max. 2.5 x I_{th}					
Secondary data							
Rated current	A	1 or 5					
Measuring core	Class	0.2 0.5 1					
	Overcurrent factor	without FSS FS10					
	Rating	VA 2.5 to 30					
Protection core	Class	5 P or 10 P					
	Overcurrent factor	10					
	Rating	VA 2.5 to 30					

Voltage transformer 4MR, single-pole (other values on request)

Primary data							
Highest voltage for equipment U_M (- 1.2 x U_D)	kV	3.6	7.2	12	12	17.5	24
Rated short-duration power-frequency withstand voltage U_D	kV	10	20	28	42	38	50
Rated lightning impulse withstand voltage U_L	kV	20	60	75	75	95	125
Rated voltage U_N	kV	3.3/√3	3.6/√3	7.2/√3	10.0/√3	12.8/√3	17.5/√3
		4.2/√3	4.8/√3	10.0/√3	11.0/√3	13.2/√3	20.0/√3
		5.0/√3	6.0/√3	11.6/√3	11.0/√3	13.8/√3	22.0/√3
		6.0/√3	6.3/√3			15.0/√3	23.0/√3
		6.3/√3	6.6/√3			16.0/√3	
		6.6/√3					
Rated voltage factor (8 h)		1.9 x U_N					
Secondary data							
Rated voltage	V	100/√3					
		110/√3 (option)					
		120/√3 (option)					
Rated voltage for auxiliary winding (option)	V	100/3					
		110/3 (option)					
		120/3 (option)					
Rating	VA	20 50 100					
Class		0.2 0.5 1.0					

*) For standards, see page 84

Ready-for-service indicator

Features

- Self-monitoring; easy to read
- Independent of temperature and pressure variations
- Independent of the site altitude
- Only responds to changes in gas density
- Option: Alarm switch "1 NO" for remote electrical indication.

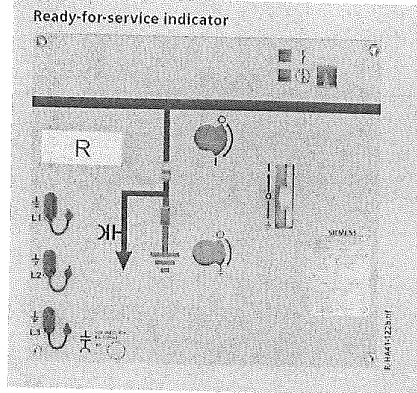
Mode of operation

For the ready-for-service indicator, a gas-tight measurement box is installed inside the switching-device vessel.

A coupling magnet, which is fitted to the bottom end of the measurement box, transmits its position to an outside armature through the non-magnetizable stainless-steel switching-device vessel. This armature moves the ready-for-service indicator of the switchgear.

While changes in the gas density during the loss of gas, which are decisive for the dielectric strength, are displayed, temperature-dependent changes in the gas pressure are not. The gas in the measurement box has the same temperature as that in the switching-device vessel.

The temperature effect is compensated via the same pressure change in both gas volumes.



Gas monitoring

Indicator on control board:
Ready for service

1 Green indication:
Ready for service
(red indication:
Not ready for service)

Stainless-steel vessel
filled with SF₆ gas

Ready-for-service
indicator

2 Measurement box
3 Magnetic coupling

Principle of operation
of gas monitoring with
ready-for-service indicator

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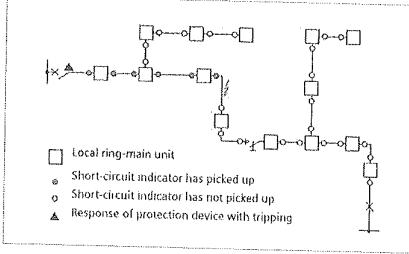
Components

Indicating and measuring equipment

Short-circuit/earth-fault indicators make Horstmann

Short-circuit/earth-fault indicators (option) Ring-main, cable, transformer and circuit-breaker feeders can optionally be equipped with short-circuit or earth-fault indicators in different designs.

The equipment features are shown in the table on page 53. Short-circuit and earth-fault indicators reduce the down-times of a power system by limitation of fault locations in medium-voltage systems.



Short-circuit/earth-fault indicators can be used in radial systems and in openly operated ring systems. In impedance earthed and solidly earthed systems, every short-circuit indicator can also be used as an earth-fault indicator.

Basic functions

- Adjustable pickup values
- Phase-selective fault indication
- Reset of fault indication: manually, automatically, from remote
- Remote indication with relay contacts.

Measuring function with ComPass A

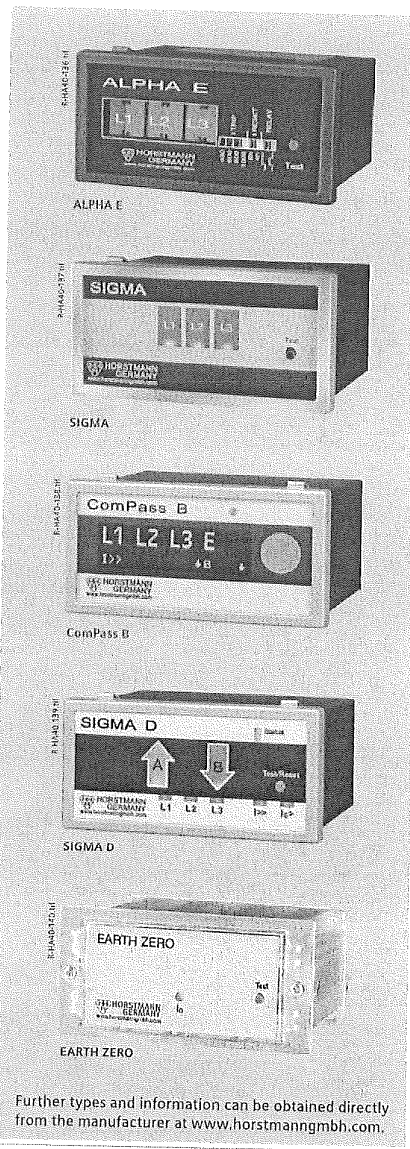
- Measuring and indication of phase and earth currents
- Transfer of measured values, fault indications and events via RS485/Modbus.

ComPass B with further functions

- Short-circuit and earth-fault indication depending on direction
- Voltage detection via voltage detecting system type WEGA. This provides further measured values such as:
 - Phase and displacement voltage
 - Active, reactive and apparent power
 - Power factor $\cos \phi$
 - Load flow direction
- Undervoltage and overvoltage signaling, indication
- Directional/non-directional fault detection for all types of neutral treatment.

SIGMA D, SIGMA D+ universal fault direction indicator

- Current-transformer operated short-circuit direction indicator and earth-fault direction indicator for all systems and neutral point connection types
- Unambiguous signaling of the fault direction
- Simple and flexible configuration via DIP switch and USB
- Event memory for fault evaluation.



Further types and information can be obtained directly from the manufacturer at www.horstmannmbh.com.

Components

Indicating and measuring equipment

Short-circuit/ earth-fault indicators Horstmann	ALPHA M	ALPHA E	SIGMA	SIGMA F+E	SIGMA D	SIGMA D*	CompPass A	CompPass A*	CompPass B	CompPass B*	EARTH/ EARTH ZERO
Function											
Short-circuit indication	x	x	x	x	x	x	x	x	x	x	x
Earth-fault indication				x	x	x	x	x	x	x	x
Indication of direction, short circuit/earth fault					x	x			x	x	
Undervoltage and overvoltage indication									x	x	
Applicable for the following neutral earthing options											
Impedance	x	x	x	x	x	x	x	x	x	x	x
Solid	x	x	x	x	x	x	x	x	x	x	x
Isolated	x	x	x	x	x	x	x	x	x	x	x
Compensated	x	x	x	x	x	x	x	x	x	x	x
Short-circuit pickup values											
I _{sc} > Short-circuit current	400, 600, 800, 1000 A	200, 300, 400, 600, 800, 1000, (2000) ⁵⁾ A, self-adjustment	100, 200, 300, 400, 600, 800, 1000 A, self-adjustment ⁴⁾	50 - 2000 A, self-adjustment	50 ... 2000 A (steps of 1 A)						
t _{sc} > Pickup delay	≤ 100 ms	40, 80 ms	40, 80 ms ⁷⁾ , 40 ms - 60 s	40 ms - 60 s							
Earth-fault pickup values											
I _{EF} > Earth-fault current		20, 40, 60, 80, 100, 120, 160 A	off, 20, 40, 60, 80, 100, 120, 160 A ⁴⁾	20 - 1000 A, steps of 1 A	20 ... 1000 A (steps of 1 A)						25, 50, 75, 100 A ⁷⁾
t _{EF} > Pickup delay		80, 160 ms	80, 160 ms ⁷⁾ , 40 ms - 60 s	40 ms - 60 s							80, 160 ms ⁷⁾
IEP > Transient earth fault				10 - 200 A							
IEP > Active residual current				5 - 200 A	5 - 200 A						5 - 200 A
IEQ > Reactive current				5 - 200 A	5 - 200 A						5 - 200 A
ΔIE > Pulse location (pulse amplitude)				1 - 100 A	1 - 100 A						1 - 100 A
Feedback											
Manual	x	x	x	x	x	x	x	x	x	x	x
Automatic		x	x	x	x	x	x	x	x	x	x
From remote		x	x	x	x	x	x	x	x	x	x
Remote indication											
Passing contact		adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable
Maintained contact		adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable	adjustable
Interface											
RS485/MODBUS							x	x	x	x	
USB 2.0					x	x			x	x	
Power supply											
Current-transformer operated	x	x	x ⁵⁾	y ⁵⁾	x	x					x
Long-duration lithium cell		x	x	y	x	x	x	x	x	x	x
Summation current			x ⁵⁾	x ⁵⁾		possible	x	x	x	x	x ⁵⁾
Current inputs											
Phase current	3	3	3	2 (3) ⁶⁾	3	3	3	3 (2) ⁷⁾	3 (2) ⁷⁾	3 (2) ⁷⁾	3 (2) ⁷⁾
Summation current				1 (0) ⁶⁾	0 ⁷⁾	1 ⁷⁾	0 ⁷⁾	0 (1) ⁷⁾	0 (1) ⁷⁾	0 (1) ⁷⁾	1
Voltage inputs											
Via WEGA 1.2C/WEGA 2.2C					3	3			3	3	
Resistive voltage coupling									x		
Measuring function											
Current							x ²⁾	x ²⁾	x ²⁾	x ²⁾	
Voltage									x	x	
Load flow direction									x	x	
P, Q, S, cos phi									x	x	
Frequency							x	x	x	x	
Relay outputs											
Potential-free	1	1	1	3	4 ³⁾	4 ³⁾	4 ³⁾	4 ³⁾	4 ³⁾	4 ³⁾	1
Binary inputs											
Number		1	2 (Test + Reset)	2 (Test + Reset)	1 ³⁾	1 ³⁾	1 ³⁾	1 ³⁾	1 ³⁾	1 ³⁾	1

1) Measuring sensor 3+0 (summation current is calculated),
measuring sensor 2+1 (phase I2 is calculated)
2) Momentary values: 0.15 min, max 24 h, max. 7 d, max. 365 d, slave-pointer function
3) Freely programmable
4) Alternatively adjustable via DIP switch
5) Optional
6) No calculation of the missing phase or summation current
7) Further settings optionally possible

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Components

Indicating and measuring equipment

Short-circuit / short-circuit-to-earth and earth-fault indicators, make Kries

Ring-main, cable, transformer and circuit-breaker feeders can optionally be equipped with short-circuit or earth-fault indicators in different designs. The equipment features are shown in the opposite table.

The three most common types of faults in medium-voltage systems are earth faults in cables and switchgear, faults and overloads of distribution transformers, as well as short circuits in cables and switchgear. For fast fault location and minimization of downtimes, electronic fault indicators are used:

- Selective fault detection, and thus minimization of downtimes
- Reliable fault detection through electronic measured-value acquisition
- Remote indication of fault events and measured values.

1. Short-circuit and short-circuit-to-earth indicator IKI-20

- Universally adjustable
- Current-transformer supported battery version or auxiliary voltage versions available
- Extended commissioning and testing functions.

2. Short-circuit and earth-fault indicator IKI-20PULS

- Short-circuit detection same as IKI-20
- Earth-fault detection via pulse location in compensated systems.

3. Short-circuit and earth-fault indicator IKI-20C(PULS)

- Current-transformer operated (no battery no auxiliary voltage)
- Optionally with pulse location for earth-fault detection in compensated systems.

4. Directional short-circuit and earth-fault indicator IKI-22

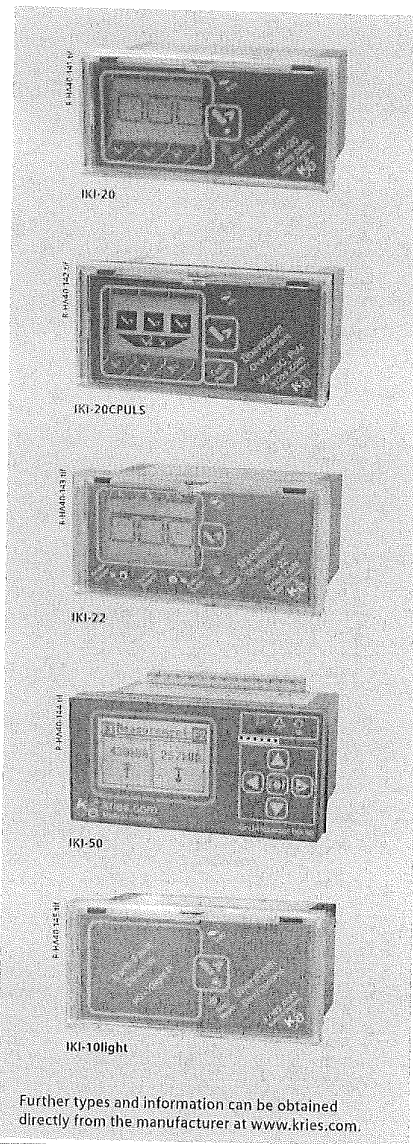
- Directional fault detection for all system types
- Directional detection combined with the voltage detecting system CAPDIS.

5. Substation control and protection device IKI-50

- Directional measured-value acquisition
- Directional fault detection for all system types
- Switchgear control or automation
- One device controls two cable panels plus load flow total
- Directional detection combined with the voltage detecting system CAPDIS.

6. Short-circuit-to-earth indicator

- Short-circuit-to-earth detection in systems with impedance-earthed neutral or temporarily impedance earthed-neutral
- Adjustable.



Components

Indicating and measuring equipment

Short-circuit/earth-fault indicators Kries	IKI-20B	IKI-20T	IKI-20U	IKI-20PULS	IKI-20C	IKI-20CPULS	IKI-22	IKI-50_1F	IKI-50_1F EW_PULS	IKI-50_2F	IKI-50_2F EW_PULS	IKI-10-light-P
Function												
Short-circuit indication	X	X	X	X	X	X	X	X	X	X	X	X
Earth fault indication				X		X		X	X	X	X	
Short-circuit-to-earth indication 5)	X	X	X		X		X	X	X	X	X	X
Direction indication							X	X	X	X	X	X
Applicable for the following neutral earthing options												
Impedance	X	X	X		X		X	X	X	X	X	X
Solid	X	X	X		X		X	X	X	X	X	X
Isolated	X	X	X		X	X	X	X	X	X	X	X
Compensated	X	X	X	X	X		X	X	X	X	X	X
Pickup current												
Short-circuit current	100, 200, 400, 600, 800, 1000, 2000 A				400, 600, 800, 1000 A		100, 200, 300, 400, 600, 800, 1000, 2000 A			100 ... 1000 A (steps of 100 A)		
Earth-fault current							Transient fault detection			4 ... 30 A (steps of 1 A)		
Short-circuit-to-earth current 5)	40, 80, 100, 150 A						40, 80, 100, 200 A			40 ... 200 A (steps of 10 A)		
Pulse location					X		X			X		
Pickup time												
Short-circuit current	60, 80, 150, 200 ms				100 ms		60, 80, 150, 200 ms			60 - 1600 ms		
Short-circuit-to-earth current 5)	60, 80, 150, 200 ms				100 ms		60, 80, 150, 200 ms			60 - 1600 ms		
Earth fault current					Pulse location		Transient fault detection			400 - 3000 ms		
Reset												
Manual	X	X	X	X	X	X	X	X	X	X	X	X
Automatic	X	X	X	X	X	X	X	X	X	X	X	X
From remote	X	X	X	X	X	X	X	X	X	X	X	X
Remote indication												
Passing contact	adjustable				X		X			adjustable		
Maintained contact	adjustable									adjustable		
Interface												
RS485/Modbus										X		
Power supply												
Lithium battery	X						X					X
External auxiliary voltage	X	X	X	X			Only for transient fault detection				Buffered for 6 h by internal capacitor	X
Current inputs												
Phase current	3	3	3	3	3	3	3	3	3	6	6	6
Summation current	1	1	1	1		1		1	0 2)	0 2)	0 2)	1
Voltage inputs												
Via CAPDIS + Y-cable										3		
Measuring function												
Current										x 4)		
Voltage										x 4)		
Load flow direction										x 4)		
Load flow direction cos phi										x 4)		
Frequency										x 4)		
Active power										x 4)		
Apparent power										x 4)		
Reactive power										x 4)		
Release outputs												
Potential-free	1-3	1-3	1-3	1-3	2	2	4	4	4	4	4	1
Supplied by internal capacitor										2 3)		
Binary inputs												
Number	2 (test + reset)						2 (test + reset)			4		

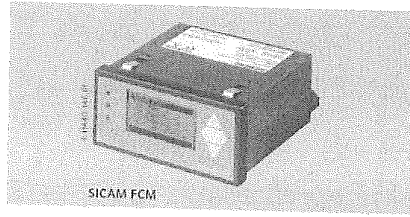
1) Optional for wattmetric detection of earth-fault direction
 2) Creation of sum signal via 3 transformers mounted around the conductor
 3) 0.1 Ws, 24 V DC

4) Momentary value, mean value and min/max value, directional
 5) Short-circuit to earth = Earth fault in impedance-earthed system

Components

On request: Indicating and measuring equipment

Short-circuit/earth-fault indicator Siemens	SICAM FCM
Function	
Short-circuit indication	X
Earth-fault indication	Y
Earth-fault function (impedance-earthed system)	X
Indication of direction, short-circuit/earth fault	X
Undervoltage and overvoltage indication	X
Applicable for the following neutral earthing options	
Impedance	X
Solid	X
Isolated	X
Compensated	X
Pickup current	
Short-circuit current	50 ... 2000 A (steps of 1 A)
Earth-fault current	1 ... 1000 A (steps of 1 A)
Pulse location	-
Pickup time	
Short-circuit current	40 ms < t < 60 s
Earth-fault current	40 ms < t < 60 s
Reset	
Manual	X
Automatic	X
From remote	X
Remote indication	
Passing contact	adjustable
Maintained contact	adjustable
Interface	
RS485/MODBUS	X
Power supply	
Lithium battery	X
External auxiliary voltage	X
Current inputs	
Phase current ¹⁾	3 (2) ¹⁾
Summation current	0 (1) ¹⁾
Voltage inputs	
Via WEGA 1.2C / WEGA 2.2C	3 x
Measuring function	
Current	X
Voltage	X
Load flow direction	X
cos phi	X
Frequency	X
Active power	X
Apparent power	X
Reactive power	X
Relay outputs	
Potential-free	2 ²⁾
Binary inputs	
Number	1



SICAM FCM

Short-circuit and earth-fault indicators, make Siemens
SICAM FCM is a short-circuit and earth-fault indicator with direction indication, operating with protection algorithms and advanced low-power current and voltage sensors according to IEC 60044.

Main features:

- Usable in earthed, isolated and resonance-earthed systems
- Directional short-circuit and earth-fault detection
- Precise and fast fault localization reduces expenses for personnel and traveling costs
- Selective fault information with direction indication as a basis for "self-healing" applications
- Resupply times possible in the range of minutes or seconds (depending on the primary part of the switchgear)
- Minimum loss of power grid and end consumer revenues
- Reliable measured values for operational management and planning
- Targeted application of investment funds during network planning and grid expansion
- Use of low-power sensors and high-quality measuring systems with a measuring accuracy of 99%.

SICAM FCM operates with sensors conforming to the standard IEC 60044-7/8. This enables exact measurements without calibration or adjustment to the primary magnitudes.

1) Measuring sensor 3+0 (summation current is calculated), measuring sensor 2+1 (phase LZ is calculated)

2) Optional

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Indicating and measuring equipment, transformer monitor systems

For circuit-breaker panels (type L, L1 ...)

Protection of distribution transformers with ratings that cannot or should not be protected with HV HRC fuses:

- Tripping of the circuit-breaker in case of overload (delayed)
- Tripping of the circuit-breaker when the short-circuit current arises.

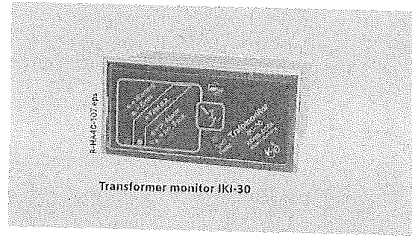
On request: Application with switch-fuse combination (panel type T...)

Monitoring of the overload range of distribution transformers with

- Tripping of the switch in case of overload (current smaller than the rated current of the switch)
- Blocking of the tripping function in the short-circuit range (here, the fuse takes over the disconnecting function).

Features

- Current-transformer operated (cable-type transformer), alternatively auxiliary voltage 24 ... 230 V AC/DC
- Instrument transformer
 - Special cable-type current transformer
 - No direction-dependent installation required
 - No earthing of a transformer pole required
 - No short-circuit terminals required for maintenance
- Low-energy magnetic release (0.02 Ws)
- Mounting location
 - In the low-voltage niche of the feeder panel
 - In the low-voltage compartment (option) of the circuit-breaker feeder
- Response performance
 - Definite-time overcurrent characteristic
 - Definite-time overcurrent characteristic for earth-fault protection (additional sensor required)
 - Inverse-time overcurrent characteristic
 - extremely inverse
 - normal inverse
 - Externally undelayed instantaneous tripping
- Self-test function
 - Display test LED (red)
 - Battery test (under load) LED (green)
 - Primary current test with tripping and with primary current injection into the transformers
- Indication
 - LED indication for tripping (single flash: Starting, double flash: Tripping)
 - Reset after 2 h, 4 h or automatically (after return of power) or manually with reset pushbutton



Example for selection of transformer protection

Operating voltage (kV)	Transformer rating (kVA)		
	Make and type of the device		
	Siemens 7SJ45/7SJ46	Woodward/SEG WHC 1-2P	Kries JKI-30
5	≥ 160	≥ 160	≥ 160
6	≥ 160	≥ 160	≥ 160
6.6	≥ 160	≥ 160	≥ 160
10	≥ 200	≥ 250	≥ 160
11	≥ 200	≥ 250	≥ 160
13.8	≥ 250	≥ 400	≥ 160
15	≥ 315	≥ 400	≥ 160
20	≥ 400	≥ 500	≥ 250

- Outputs
 - Tripping signal: 1 floating relay output (NC contact) for telecommunication as passing contact
 - Starting signal: 1 floating relay output (NC contact) – is activated as long as the starting criterion is reached, e.g. to block an upstream primary protection
 - 1 watchdog (relay)
 - 1 external tripping output for control of an existing release, e.g. via capacitor
 - Tripping output designed as impulse output for direct control of the low-energy release
- Input
 - Remote tripping signal, control via floating external contact
 - Instantaneous tripping.

Components

Indicating and measuring equipment

Voltage detecting systems according to IEC/EN 61243-5 or VDE 0682-415

- To verify safe isolation from supply
- Detecting systems
 - HR or LRM system with plug-in indicator
 - LRM system with integrated indicator, type VOIS+, VOIS R+, WEGA ZERO
 - LRM system with integrated indicator, with integrated repeat test of the interface and function test:
 - type CAPDIS-S1+, WEGA 1.2, WEGA 1.2 Vario; with additional integrated signaling relay
 - type CAPDIS-S2+, WEGA 2.2.

Plug-in voltage indicator

- Verification of safe isolation from supply phase by phase through insertion in each socket pair
- Indicator suitable for continuous operation
- Safe-to-touch
- Routine-tested
- Measuring system and voltage indicator can be tested
- Voltage indicator flashes if high voltage is present.

Voltage Indication
via capacitive voltage divider (principle)

- C₁ Capacitive coupling electrode integrated into bushing
- C₂ Capacity of the coupling unit (as well as connection leads of the voltage detecting system) to earth

$U_{IE} = U_N / \sqrt{3}$ during rated operation in the three-phase system

U₂ Voltage at the interface (for plug-in voltage detecting system) or at the test socket (for integrated voltage detecting system)

Plug-in voltage indicator (as HR or LRM system) per phase at the panel front

Technical data of voltage detecting systems

Version	HR system, LRM system	VOIS	CAPDIS		WEGA		WEGA
		VOIS+	VOIS R+	-S1+	-S2+	ZERO	1.2/1.2 Vario -2.2
Degree of protection	IP54	IP67	IP54	IP54	IP54	IP54	IP54
Temperature range	-40 °C to +55 °C	-25 °C to +55 °C	-25 °C to +55 °C	-25 °C to +55 °C	-25 °C to +55 °C	-25 °C to +55 °C	-25 °C to +55 °C
Integrated signaling relays (auxiliary voltage required)	-	with	-	with	-	with	with

Legend for page 59

VOIS+ and CAPDIS-Sx

- A0 Operating voltage not present. Active zero indication
- A1 Operating voltage present
- A2 Operating voltage not present. For CAPDIS-S2+:
Auxiliary power not present
- A3 Failure in phase L1, e.g. earth fault, operating voltage at L2 and L3
- A4 Voltage present, appears in the range from 0.10...0.45 x U_n

Test button function

- A5 Indication "Display Test" passed (lights up briefly)
- A6 CAPDIS-S2+: ERROR indication, e.g. open circuit or missing auxiliary power
- A7 Overvoltage present (lights up permanently)
- A8 "ERROR" indication, e.g. in case of missing auxiliary voltage

WEGA

- A0 For WEGA 2.2: Operating voltage not present, auxiliary power present, LCD illuminated
- A1 Operating voltage present
For WEGA 2.2: Auxiliary power present, LCD illuminated
- A2 Operating voltage not present
For WEGA 2.2: Auxiliary power not present, LCD not illuminated
- A3 Failure in phase L1, operating voltage at L2 and L3
For WEGA 2.2: Auxiliary power present, LCD illuminated
- A4 Voltage present, current monitoring of coupling section below limit value
For WEGA 2.2: Auxiliary power present, LCD illuminated
- A5 Indication "Display Test" passed
For WEGA 2.2: Auxiliary power present, LCD illuminated
- A6 For WEGA 2.2: LCD for missing auxiliary voltage is not illuminated

Components

Indicating and measuring equipment

VOIS+, VOIS R+

- Integrated display
- With indication "A1" to "A3" (see legend, page 58)
- Maintenance-free, repeat test required
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relays (only VOIS R+).

CAPDIS-Sx+

Common features

- Maintenance-free
- Integrated display
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated repeat test (without auxiliary power) by pressing the "Test" button
- With integrated 3-phase LRM test socket for phase comparison.

CAPDIS-S1+

- With indication "A1" to "A7" (see legend, page 58)
- Without auxiliary power
- Without signaling relay (without auxiliary contacts).

CAPDIS-S2+

- With indication "A0" to "A8" (see legend, page 58)
- Signaling relay (integrated, auxiliary power required).

WEGA 1.2/WEGA 1.2 Vario/WEGA 2.2

Common features

- Integrated display
- Maintenance-free
- Integrated repeat test of the interface (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Display Test" button
- With integrated 3-phase LRM test socket for phase comparison
- Adjustable for different operating voltages (adjustable capacitance C2, only for WEGA 1.2 Vario).

WEGA 1.2

- With indication "A1" to "A5" (see legend, page 58)
- Without auxiliary power
- Without signaling relay.

WEGA 2.2

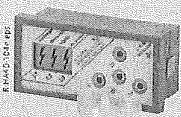
- With indication "A0" to "A6" (see legend, page 58)
- Signaling relay (integrated, auxiliary power required).

Voltage presence indicating system


according to IEC/EN 62271-206 or VDE 0671-206

WEGA ZERO

- With indication "A1" to "A4" (see legend, page 58)
- Maintenance-free
- With integrated 3-phase LRM test socket for phase comparison.



Integrated voltage indicator
VOIS+, VOIS R+




Integrated voltage detecting
system CAPDIS-S2+ (-S1+)


Symbols shown

	VOIS+, VOIS R+			CAPDIS-S1+			CAPDIS-S2+		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
A0							000		
A1	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A2									
A3	⚡	⚡	⚡	⚡	⚡	⚡			
A4		⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A5	000	000	000	000	000	000	000	000	000
A6	000	000	000	000	000	000	000	000	000
A7	000	000	000	000	000	000	000	000	000
A8							000	000	000

For legend, see page 58



Integrated voltage detecting
system WEGA 2.2 (1.2)



Integrated voltage indicator
WEGA ZERO

Symbols shown

	WEGA ZERO			WEGA 1.2			WEGA 2.2		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
A0							←	→	
A1	* * *	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A2	o o o								
A3	o * *	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A4	* * *	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A5		⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A6							⚡	⚡	⚡

For legend, see page 58

LC display gray:
Not illuminated
LC display white,
illuminated (with
auxiliary power)

Components

Indicating and measuring equipment

Verification of correct terminal-phase connections

- Verification of correct terminal-phase connections possible by means of a phase comparison test unit (can be ordered separately)
- Safe-to-touch handling of the phase comparison test unit by inserting it into the capacitive taps (socket pairs) of the switchgear.

Phase comparison test units according to IEC 61243-5 or VDE 0682-415

Phase comparison test unit make Pfisterer, type EPV as combined test unit (HR and LRM) for:

- Voltage detection
- Phase comparison
- Interface test
- Integrated self-test
- Indication via LED

Phase comparison test unit make Horstmann, type ORION 3.1 as combined test unit (HR and LRM) for:

- Phase comparison
- Interface testing at the switchgear
- Voltage detection
- Integrated self-test
- Indication via LED and acoustic alarm
- Phase sequence indicator

Phase comparison test unit make Kries, type CAP-Phase as combined test unit (HR and LRM) for:

- Voltage detection
- Repeat test
- Phase comparison
- Phase sequence test
- Self-test

The unit does not require a battery

Phase comparison test unit make Hachmann, type VisualPhase LCD as combined test unit (HR and LRM) for:

- Voltage detection with measured-value indication
- Interface test
- Low voltage detection
- Documentable repeat test
- Phase comparison with LED signal and measured-value indication
- Phase angle from -180° to $+180^\circ$
- Phase sequence evaluation
- Frequency quality
- Complete self-test

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Simple protection systems

As a simple protection for distribution transformers and circuit-breaker feeders, standard protection systems are available, consisting of:

- Current-transformer operated protection device
 - Siemens: Type 7SJ45
 - Woodward/SEG: Type WIC 1-2P, WIC 1-3P, WIP-1
- Protection device with auxiliary voltage supply
 - Siemens: Type 7SJ46
- Release at the circuit-breaker as
 - Shunt release (f)
- or
- C.t.-operated release (low-energy 0.1 Ws)
- Instrument transformer as
 - Cable-type current transformer (standard)
 - Three-phase current transformer as option for SIMOSEC switchgear panels type L...

Mounting location

- In 350-mm-high top low-voltage compartment of the circuit-breaker feeder, or in the low-voltage niche.

Multifunction protection (selection): SIPROTEC multifunction protection

Common features

- User-friendly operating program DIGSI 4 for parameterizing and analysis
- Freely programmable LEDs for displaying any desired data
- Communications and bus capability
- Functions: Protection, control, signaling, communication and measuring
- Operation and fault indication memory.

7SJ600/7SJ602

- LC text display (2 lines) and keyboard for local operation, configuration and indication
- Control of the circuit-breaker.

7SJ80

- LC text display (6 lines) and keyboard for local operation, parameterizing and indication
- Control of circuit-breaker and disconnecter.

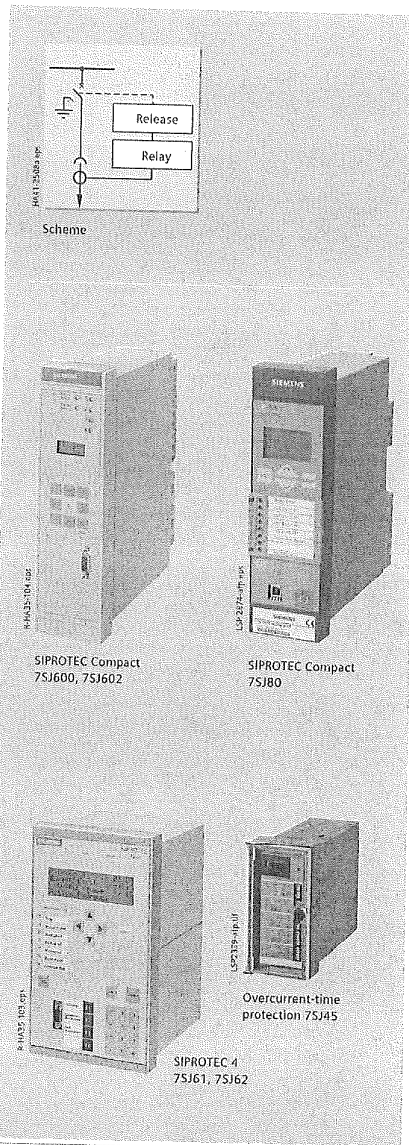
7SJ61/7SJ62

- For stand-alone or master operation
- LC text display (4 lines) for process and equipment data
- Four freely programmable function keys for frequently performed functions
- Keys for navigation in menus and for entering values.

Other types and makes on request

Mounting location

- In the 350-mm or 550-mm-high low-voltage compartment (option) of the circuit-breaker feeder.



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Components

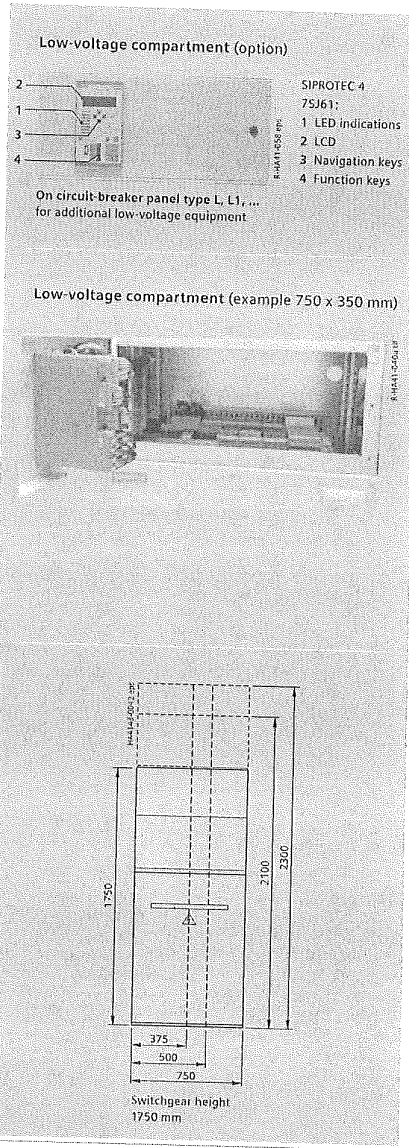
Low-voltage compartment

Features of low-voltage compartment (option)

- Overall heights
 - 350 mm
 - 550 mm
- Partitioned safe-to-touch from the high-voltage part of the panel
- Installation on the panel:
 - Possible per feeder
- Customer-specific equipment
 - For accommodation of protection, control, measuring and metering equipment
- Overall height depends on the panel-specific configuration of primary and secondary equipment
- Door with hinge on the left
 - (standard for heights of 350 and 550 mm)
 - Option: Door with hinge on the right.

Low-voltage cables

- Control cables of the panel to the low-voltage compartment via multi-pole, coded module plug connectors
- Option: Plug-in bus wires from panel to panel inside the low-voltage niche, or optionally in the separate wiring duct on the panel.

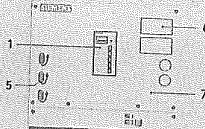


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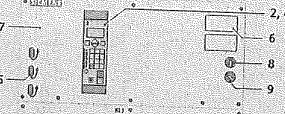
Low-voltage niche (standard)

- Inside the panel
- Cover for low-voltage niche:
 - Standard: Screwed-on cover
 - With door (option)
- For accommodation of terminals and standard protection devices, e.g. in circuit-breaker panels combined with frame cover for panels
 - Protection relays (with max. 75 mm wide mounting frame), e.g.
 - Type 7SJ45, 7SJ46:
 - For type L and L1
 - Make Woodward / SEG, type WIC1: For type L and L1
 - On request:
 - 7SJ60, 7SJ80
 - Make Woodward / SEG, WIP-1
- For bus wires and/or control cables; niche open at the side to the adjacent panel
- Safe-to-touch, separated from high-voltage part of the panel
- Degree of protection IP3X (standard).

Low-voltage niche (examples)



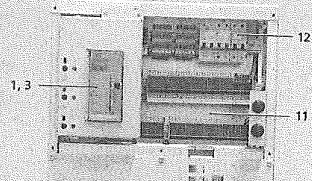
In circuit-breaker panel type L (500 mm) (with CB-f NAR*)



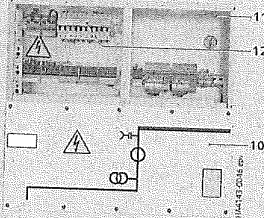
In circuit-breaker panel type L1 (750 mm)

Protection relay as option:

- 1 Protection relay type 7SJ45
- 2 On request: Protection relay type 7SJ80 in LV niche
- 3 Protection relay make Woodward (SEG), type WIC
- 4 On request: Multifunction protection relay SIPROTEC 4 type 7SJ61 on swing-out frame
- 5 Option: Sockets for capacitive voltage detecting system for busbar
- 6 Short-circuit/earth-fault indicator
- 7 Frame cover of low-voltage niche (can be unscrewed)
- 8 Option: Local-remote switch for three-position switch-disconnector
- 9 Option: Momentary-contact rotary control switch ON-OFF for motor operating mechanism of the three-position switch-disconnector
- 10 Panel front
- 11 Low-voltage niche open
- 12 Option: Installed equipment



In circuit-breaker panel type L (500 mm)



In billing metering panel type M (750 mm) (low-voltage niche open)

*) AR = Automatic reclosing
NAR = Non automatic reclosing