

Cable sealing end, e.g. for panel types R, K, K1, D, M(-K), M(-BK), L and L1 (for connection heights of cables, see opposite dimension drawings)

Make	Type	Cross-section in mm <sup>2</sup>
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**Single-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard 2)**

Euromold	AIN 10, AFN 10	25–300 (500 *)
	AIS, AIP	150–300; 50–300
	12 MONOi	25–300 (500 *)
Prysmian Kabel und Systeme	ITK-212 *)	50–300 (400 *)
	ELTI mb-1C-12	35–240
TE Connectivity	ELTI-1C-12	25–300
	IXSU-F	16–300 (500 *)
Lovink-Eneritech	MVTI-31xx-	25–240 (300 *)
	EPKT	16–300
3M	IAEM 10	25–300
	IAES 10	25–300 (500 *)
Südkabel	92-EB 6x-1	35–300 (400 *)
	SEHDI 10.2	35–300 (500 *)
nkt cables	TI 12	25–240
	TO 12	25–300 (500 *)

**Three-core thermoplastic-insulated cables for ≤ 12 kV (6/10 kV); acc. to IEC standard 2)**

Euromold	AIN 10, AFN 10 *)	25–300 (500 *)
	12 MONOi	35–300 (500 *)
Prysmian Kabel und Systeme	ELTI-3C-12	25–300
TE Connectivity	IXSU-F33xx	16–300 (500 *)
Lovink-Eneritech	IAES 10	25–300
	GHKI	16–300 (400 *)

**Single-core thermoplastic-insulated cables for > 12 kV to ≤ 24 kV (12/20 kV) \*) 2)**

Euromold	AIN 20, AFN 20	25–300 (630 *)
	AIS, AIP	70–300; 25–300
	24 MONOi	25–300 (500 *)
	36 MSC 3)	95–300 (500 *)
	36 MSC (Option 4))	95–300 (500 *)
Prysmian Kabel und Systeme	ITK-224	25–240
	ELTI mb-1C-24	35–240
	ELTI-1C-24	25–300
TE Connectivity	IXSU-F	25–300 (500 *)
	MVTI-51xx-	25–300
Lovink-Eneritech	EPKT	16–300 (500 *)
	IAEM 20	25–300
3M	IAES 20	25–300 (500 *)
	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) \*) 2)**

Euromold	24 MONOi	35–300 (500 *)
	AFN 20, AIN 20	35–300
Lovink-Eneritech	GHKI	25–300 (500 *)
TE Connectivity	on request IXSU-F53xx	on request

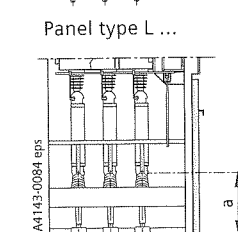
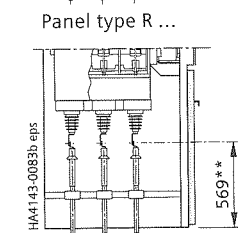
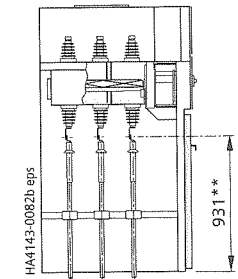
\*) On request: Max. connection cross-section of cable sealing end types

\*\*) 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 panels type T...:  
 - Lower edge of sealing end partly underneath the panel (depending on type of sealing end)  
 - Cable lugs of sealing ends up to 32 mm width  
 - Owing to the various lengths of the sealing ends, mounted cable clamps are partly 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  $U_d = 42$  kV according to IEC 62271-1 and  $U_m = 42$  kV according to EN/HD 629

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



Panel type T ...  
 Dimension a  
 ~ 384 mm:  
 For fuses with e = 442 mm (standard for 24 kV)  
 ~ 534 mm:  
 For fuses with e = 292 mm

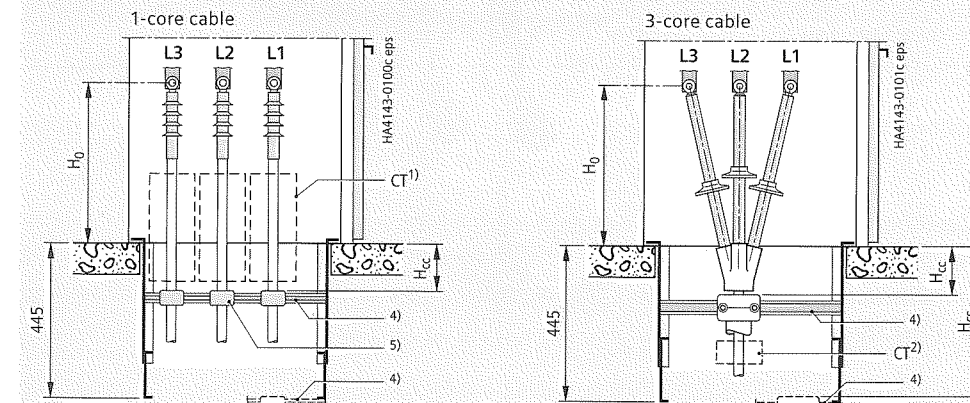
**Note:**  
 Depending on make and type, the termination of the cable sealing end (= shield earth) for the 3-core thermoplastic-insulated cable and the fitted cable clamp (option) may be located underneath the panel in the cable basement. This must be taken into account in panels with floor cover (option).

**Cable cross-sections**

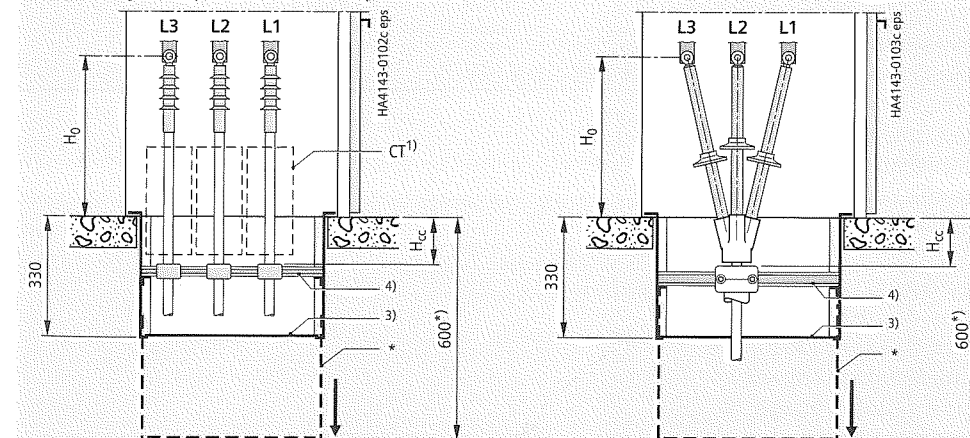
Panel type	Panel width	Version	Connected cables x connection cross-section number x mm <sup>2</sup>			Transformer combination in the connection compartment		
			12 kV	17.5 kV	24 kV	4MC70	4MA	4MR
K	375	Standard	1 x 300	1 x 300	1 x 300	○		
		On request	2 x 300	2 x 300	2 x 300			
K1	500	Standard	1 x 300	1 x 300	1 x 300	○		
		Option	2 x 400	2 x 300	2 x 300			
R	375	Standard	1 x 300	1 x 300	1 x 300	○		
		On request	2 x 300	2 x 300	2 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			
L	500	Standard	1 x 300	1 x 300	1 x 300	○		
		Option	2 x 240	2 x 240	2 x 240			
L1	750	Standard	1 x 300	1 x 300	1 x 300	○		
		Option	2 x 300	2 x 300	2 x 300		○	○
M(-K), M(-BK)	750	Standard	1 x 400	1 x 300	1 x 300		○	○
		Option	3 x 400	3 x 300	3 x 300		○	○
M(KK)	750	Standard	1 x 400	1 x 300	1 x 300		○	○
		Option	2 x 300	2 x 300	2 x 300		○	○
L1(r)	750	Standard	1 x 300	1 x 300	1 x 300	○	○	○
		Option	2 x 300	2 x 300	2 x 300			
L2(r)	875	Standard	2 x 300	2 x 300	2 x 300	○	○	○
		Option	3 x 300	3 x 300	3 x 300			

○ possible – not possible

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



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 clamp
- $H_0$  = Height of cable connection in the panel  
 \*) Extendable up to 600 mm  
 Δ) For panel types T and T1 with a rated voltage of 24 kV: Deeper cable fixing located underneath the panel

Max. dimensions	Cable version	
	1-core	3-core
$H_{cc}$ in mm		
Standard	435	425
Option: With additional floor cover	469	459
5) Height of cable clamp (= Option)	60	77

$H_{cc}$  = Available height for cable connection: From the mounted cable clamp 5)

**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.

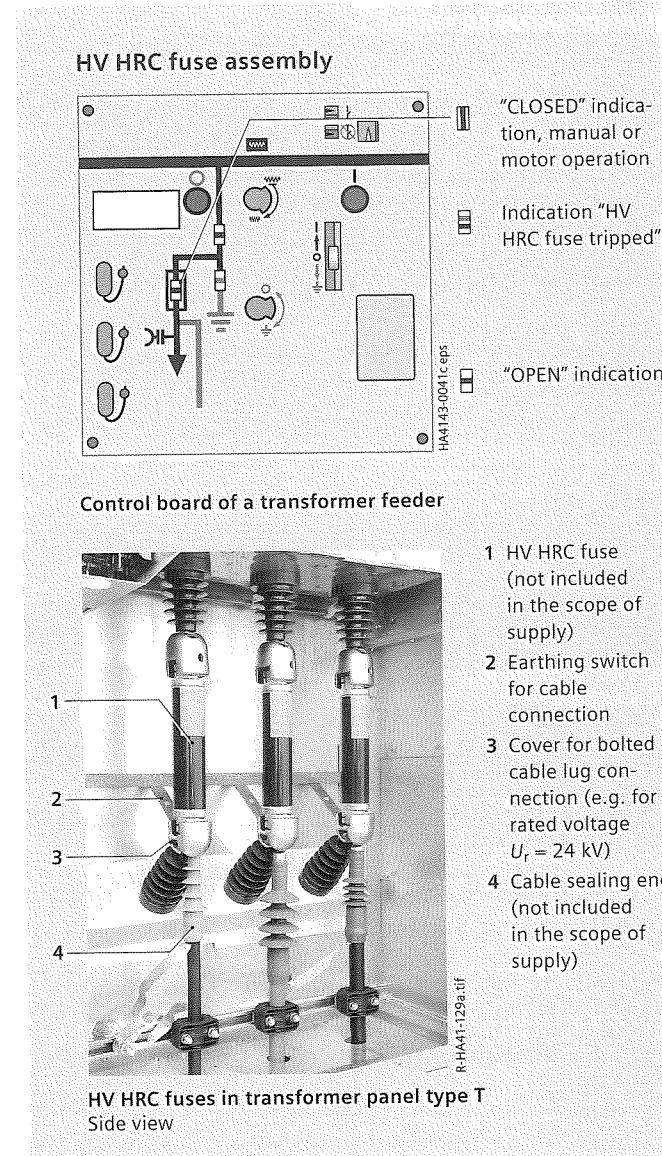
**Note to HV HRC fuse-links**

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 72



**Fuse protection table**

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. The three-position switch-disconnector in the transformer feeder in panel type "T" was combined and tested according to IEC 62271-103.

**Standards**

- HV HRC fuse-links "medium" version with striker and for tripping energy  $1 \pm 0.5$  Joule according to
- IEC/EN 60282-1/VDE 0670-4
  - IEC/EN 60787/VDE 0670-402
  - DIN 43625 main dimensions.

MV system	Transformer	HV HRC fuse-link						
Operating voltage $U_n$	Rated power $S_r$	Relative impedance voltage $u_k$	Rated current $I_r$	Rated current $I_r$	Min. operating/ rated voltage $U_r$	Dimension e	Outside diameter d	Order No. Make SIBA
kV	kVA	%	A	A	kV	mm		
3.3 to 3.6	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
				25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
	100	4	17.5	40	3 to 7.2	292	53	30 098 13.40
				50	3 to 7.2	292	53	30 098 13.50
				63	3 to 7.2	292	67	30 099 13.63
				80	3 to 7.2	292	67	30 099 13.80
	125	4	21.87	100	3 to 7.2	292	67	30 099 13.100
				125	3 to 7.2	292	67	30 099 13.125
				160	3 to 7.2	292	53	30 098 13.40
				200	3 to 7.2	292	53	30 098 13.50
	250	4	43.74	31.5	3 to 7.2	292	67	30 099 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
50				3 to 7.2	292	53	30 098 13.50	
63				3 to 7.2	292	67	30 099 13.63	
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	
			125	3 to 7.2	292	53	30 098 13.25	
			160	3 to 7.2	292	53	30 098 13.40	
4.16 to 4.8	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
	30	4	4.2	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
	50	4	6.93	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
	75	4	10.4	20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
	100	4	13.87	50	3 to 7.2	292	53	30 098 13.50
				63	3 to 7.2	292	67	30 099 13.63
80				3 to 7.2	292	67	30 099 13.80	
100				3 to 7.2	292	67	30 099 13.100	
125	4	17.35	125	3 to 7.2	292	67	30 099 13.125	
			160	3 to 7.2	292	53	30 098 13.40	
			200	3 to 7.2	292	53	30 098 13.50	
			250	3 to 7.2	292	67	30 099 13.63	
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	
			63	3 to 7.2	292	67	30 099 13.63	
			80	3 to 7.2	292	67	30 099 13.80	
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	
			80	3 to 7.2	292	67	30 099 13.80	
			100	3 to 7.2	292	67	30 099 13.100	
315	4	43.7	100	3 to 7.2	292	67	30 099 13.100	
			125	3 to 7.2	292	67	30 099 13.125	
			160	3 to 7.2	292	53	30 098 13.40	
			200	3 to 7.2	292	53	30 098 13.50	
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	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
	50	4	5.7	16	3 to 7.2	292	53	30 098 13.16
				20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
	75	4	8.6	20	3 to 7.2	292	53	30 098 13.20
				25	3 to 7.2	292	53	30 098 13.25
				31.5	3 to 7.2	292	53	30 098 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
	100	4	11.5	31.5	3 to 7.2	292	53	30 098 13.31,5
				40	3 to 7.2	292	53	30 098 13.40
50				3 to 7.2	292	53	30 098 13.50	
63				3 to 7.2	292	67	30 099 13.63	
125	4	14.4	40	3 to 7.2	292	53	30 098 13.40	
			50	3 to 7.2	292	53	30 098 13.50	
			63	3 to 7.2	292	67	30 099 13.63	
			80	3 to 7.2	292	67	30 099 13.80	
160	4	18.4	50	3 to 7.2	292	53	30 098 13.50	
			63	3 to 7.2	292	67	30 099 13.63	
			80	3 to 7.2	292	67	30 099 13.80	
			100	3 to 7.2	292	67	30 099 13.100	
200	4	23	63	3 to 7.2	292	67	30 099 13.63	
			80	3 to 7.2	292	67	30 099 13.80	
			100	3 to 7.2	292	67	30 099 13.100	
			125	3 to 7.2	292	67	30 099 13.125	
250	4	28.8	80	3 to 7.2	292	67	30 099 13.80	
			100	3 to 7.2	292	67	30 099 13.100	
			125	3 to 7.2	292	67	30 099 13.125	
			160	3 to 7.2	292	67	30 099 13.160	
315	4	36.3	100	3 to 7.2	292	67	30 099 13.100	
			125	3 to 7.2	292	67	30 099 13.125	
			160	3 to 7.2	292	67	30 099 13.160	
			200	3 to 7.2	292	67	30 099 13.200	
400	4	46.1	125	3 to 7.2	292	67	30 099 13.125	
			160	3 to 7.2	292	67	30 099 13.160	
			200	3 to 7.2	292	67	30 099 13.200	
			250	3 to 7.2	292	67	30 099 13.250	
500	4	52.5	160	3 to 7.2	292	67	30 099 13.160	
			200	3 to 7.2	292	67	30 099 13.200	
			250	3 to 7.2	292	67	30 099 13.250	
			315	3 to 7.2	292	67	30 099 13.315	
630	4	72.7	315	3 to 7.2	292	67	30 099 13.315	
			400	3 to 7.2	292	67	30 099 13.400	

# Components

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

MV system		Transformer		HV HRC fuse link				
Operating voltage $U_n$	Rated power $S_r$	Relative impedance voltage $u_k$	Rated current $I_r$	Rated current $I_r$	Min. operating / rated voltage $U_r$	Dimension e	Outside diameter $d$	Order No. Make SIBA
kV	kVA	%	A	A	kV	mm		
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 13.10
				10	6 to 12	442	53	30 101 13.10
	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	
20				6 to 12	292	53	30 004 13.25	
25				6 to 12	442	53	30 101 13.25	
125	4	12	20	6 to 12	292	53	30 004 13.20	
			20	6 to 12	442	53	30 101 13.20	
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	
250	4	24	40	6 to 12	292	53	30 004 13.40	
			40	6 to 12	442	53	30 101 13.40	
			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	
			63	6 to 12	442	67	30 102 43.80	
400	4	38.4	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	
			63	6 to 12	442	67	30 102 13.63	
			80	6 to 12	292	67	30 012 43.80	
			80	6 to 12	442	67	30 102 13.80	
500	4	48	100	6 to 12	292	67	30 012 43.100	
			100	6 to 12	442	67	30 102 43.100	
			125	6 to 12	442	67	30 102 43.100	
			125	6 to 12	292	85	30 103 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	20	4	1.15	4	6 to 12	292	53	30 004 13.10
				10	6 to 12	292	53	30 101 13.10
	50	4	2.9	10	6 to 12	442	53	30 255 13.10
				10	10 to 17.5	292	53	30 231 13.10
	75	4	4.3	10	10 to 17.5	442	53	30 006 13.10
				10	10 to 24	292	53	30 004 13.10
	100	4	5.8	10	6 to 12	292	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	
125	4	7.2	16	10 to 17.5	292	53	30 255 13.16	
			16	10 to 17.5	442	53	30 231 13.16	
			16	10 to 24	442	53	30 006 13.16	
			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	
160	4	9.3	16	10 to 17.5	442	53	30 231 13.16	
			16	10 to 24	442	53	30 006 13.16	
			20	6 to 12	292	53	30 004 13.20	
			20	6 to 12	442	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 for switchgear type SIMOSEC

MV system		Transformer		HV HRC fuse link				
Operating voltage $U_n$	Rated power $S_r$	Relative impedance voltage $u_k$	Rated current $I_r$	Rated current $I_r$	Min. operating / rated voltage $U_r$	Dimension e	Outside diameter $d$	Order No. Make SIBA
kV	kVA	%	A	A	kV	mm		
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
	250	4	14.5	25	10 to 17.5	292	67	30 221 13.25
				25	10 to 17.5	442	53	30 231 13.25
	315	4	18.3	25	10 to 24	442	53	30 006 13.25
				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
400	4	23.1	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 24	442	53	30 006 13.31,5	
			31.5	6 to 12	292	53	30 004 13.31,5	
			31.5	6 to 12	442	53	30 101 13.31,5	
500	4	29	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	
			40	6 to 12	442	53	30 101 13.40	
			40	6 to 12	292	53	30 004 13.40	
			40	6 to 12	442	53	30 101 13.40	
630	4	36.4	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	
			50	6 to 12	292	53	30 004 13.50	
			50	6 to 12	442	53	30 101 13.50	
			50	10 to 17.5	292	67	30 221 13.50	
13.8	800	5 (5.5)	46.2	50	10 to 17.5	442	67	30 232 13.50
				50	10 to 24	442	67	30 014 13.50
	1000	5 (5.5)	58	63	6 to 12	292	67	30 012 43.63
				63	6 to 12	442	67	30 102 43.63
				63	6 to 12	292	67	30 012 13.63
				63	6 to 12	442	67	30 102 13.63
				63	10 to 17.5	442	67	30 232 13.63
				63	10 to 17.5	292	85	30 221 13.63
	1250	5 (5.5)	72.2	63	10 to 24	442	67	30 014 13.63
				63	10 to 24	442	67	30 014 43.80
1600	5 (to 5.7)	92.3	80	10 to 24	442	67	30 014 43.80	
			80	6 to 12	292	85	30 012 43.80	
20	4	0.8	63	6 to 12	292	67	30 012 13.63	
			80	6 to 12	292	67	30 012 43.80	
			80	6 to 12	442	67	30 102 43.80	
			100	6 to 12	442	67	30 012 43.100	
			100	10 to 24	442	85	30 022 43.100	
			125	10 to 24	442	85	30 022 43.125	
50	4	2.1	160	6 to 12	442	85	30 103 43.160	
			6.3	10 to 24	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 17.5	442	53	30 231 13.6,3	
75	4	3.2	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 17.5	292	53	30 006 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	4.2	16	10 to 17.5	292	53	30 255 13.16	
			16	10 to 17.5	442	53	30 231 13.16	
			16	10 to 24	442	53	30 006 13.16	
			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	
125	4	5.3	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 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	
160	4	6.7	16	10 to 17.5	442	53	30 231 13.16	
			16	10 to 17.5	292	53	30 255 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 17.5	442	53	30 231 13.20	
200	4	8.4	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 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	

# Components

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

MV system	Transformer	HV HRC fuse-link						
Operating voltage $U_n$	Rated power $S_r$	Relative impedance voltage $u_k$	Rated current $I_r$	Rated current $I_r$	Min. operating / rated voltage $U_r$	Dimension e	Outside diameter d	Order No. Make SIBA
kV	kVA	%	A	A	kV	mm		
13.8	315	4	13.2	25	10 to 17.5	442	53	30 231 13.25
				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 17.5	442	53	30 231 13.31,5
				31.5	10 to 17.5	292	67	30 221 13.31,5
	400	4	16.8	31.5	10 to 17.5	442	53	30 006 13.31,5
				31.5	10 to 17.5	292	67	30 221 13.31,5
				31.5	10 to 24	442	53	30 006 13.31,5
				40	10 to 17.5	442	53	30 231 13.40
				40	10 to 17.5	292	67	30 221 13.40
				40	10 to 24	442	53	30 006 13.40
	500	4	21	40	10 to 17.5	442	53	30 231 13.40
				40	10 to 17.5	292	67	30 221 13.40
				40	10 to 24	442	53	30 006 13.40
				50	10 to 17.5	442	67	30 232 13.50
				50	10 to 17.5	292	67	30 221 13.50
				50	10 to 24	442	67	30 014 13.50
	630	4	26.4	50	10 to 17.5	442	67	30 014 43.63
				50	10 to 24	442	67	30 014 43.80
				63	10 to 24	442	67	30 014 43.80
				80	10 to 24	442	67	30 022 43.100
				100	10 to 24	442	85	30 022 43.125
				125	10 to 24	442	85	30 022 43.125
15 to 17.5	20	4	0.77	3.15	10 to 24	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 17.5	442	53	30 231 13.6,3
				10	10 to 17.5	442	53	30 231 13.10
	50	4	1.9	16	10 to 17.5	442	53	30 231 13.16
				16	10 to 24	442	53	30 006 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	67	30 221 13.20
				20	10 to 24	442	53	30 006 13.20
	75	4	2.9	25	10 to 17.5	292	67	30 221 13.25
				31.5	10 to 17.5	292	67	30 221 13.31,5
				31.5	10 to 24	442	53	30 006 13.31,5
				31.5	10 to 17.5	442	53	30 231 13.31,5
				31.5	10 to 17.5	292	67	30 221 13.31,5
				31.5	10 to 24	442	53	30 006 13.31,5
	100	4	3.9	31.5	10 to 17.5	442	53	30 231 13.31,5
				31.5	10 to 17.5	292	67	30 221 13.31,5
				31.5	10 to 24	442	53	30 006 13.31,5
				40	10 to 17.5	442	53	30 231 13.40
				40	10 to 17.5	292	67	30 221 13.40
				40	10 to 24	442	53	30 006 13.40
125	3 (3.5)	4.8	40	10 to 17.5	442	53	30 231 13.40	
			40	10 to 24	442	53	30 006 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 17.5	292	67	30 221 13.40	
			40	10 to 24	442	53	30 006 13.40	
160	4	6.2	40	10 to 17.5	442	53	30 231 13.40	
			40	10 to 17.5	292	67	30 221 13.40	
			40	10 to 24	442	53	30 006 13.40	
			50	10 to 17.5	292	67	30 221 13.50	
			50	10 to 17.5	442	67	30 232 13.50	
			50	10 to 24	442	67	30 014 13.50	
200	3 (3.5)	7.7	50	10 to 17.5	442	67	30 014 43.63	
			50	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
250	3 (3.5)	9.7	63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
			63	10 to 24	442	67	30 014 43.63	
315	3 (3.5)	12.2	63	10 to 17.5	442	67	30 014 43.63	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
			63	10 to 17.5	442	53	30 231 13.31,5	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
20 to 24	400	4	15.5	63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
				63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
	500	4	19.3	63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
				63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
	630	4	24.3	63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
				63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
	800	5 (5.1)	30.9	63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
				63	10 to 17.5	442	53	30 231 13.31,5
				63	10 to 17.5	292	67	30 221 13.31,5
				63	10 to 24	442	53	30 006 13.31,5
1000	5 to 6	38.5	63	10 to 17.5	442	53	30 231 13.31,5	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
			63	10 to 17.5	442	53	30 231 13.31,5	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
1250	5 to 6	48.2	63	10 to 17.5	442	53	30 231 13.31,5	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
			63	10 to 17.5	442	53	30 231 13.31,5	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
1600	5 to 6	61.6	63	10 to 17.5	442	53	30 231 13.31,5	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
			63	10 to 17.5	442	53	30 231 13.31,5	
			63	10 to 17.5	292	67	30 221 13.31,5	
			63	10 to 24	442	53	30 006 13.31,5	
20	4	0.57	3.15	10 to 24	442	53	30 006 13.3,15	
			6.3	10 to 24	442	53	30 006 13.6,3	
			6.3	10 to 24	442	53	30 006 13.6,3	
			6.3	10 to 24	442	53	30 006 13.6,3	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
75	4	2.2	6.3	10 to 24	442	53	30 006 13.6,3	
			6.3	10 to 24	442	53	30 006 13.6,3	
			6.3	10 to 24	442	53	30 006 13.6,3	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
100	4	2.9	6.3	10 to 24	442	53	30 006 13.6,3	
			6.3	10 to 24	442	53	30 006 13.6,3	
			6.3	10 to 24	442	53	30 006 13.6,3	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
125	4	3.6	10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
160	4	4.7	10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
			10	10 to 24	442	53	30 006 13.10	
200	4	5.8	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	30 006 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	30 006 13.16	
250	4	7.3	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	30 006 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	30 006 13.16	
315	4	9.2	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	30 006 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	30 006 13.16	
400	4	11.6	20	10 to 24	442	53	30 006 13.20	
			20	10 to 24	442	53	30 006 13.20	
			20	10 to 24	442	53	30 006 13.20	

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.

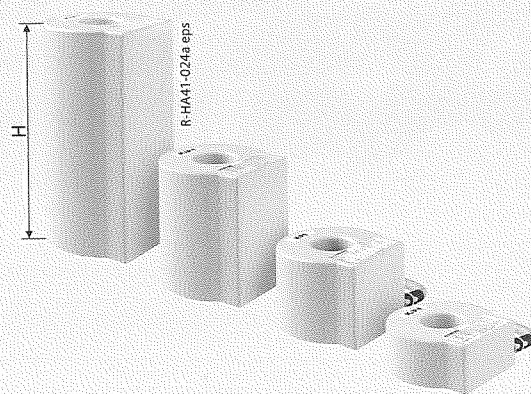
Application

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

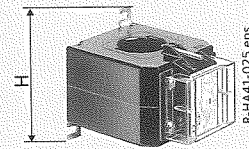
Installation

- 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.

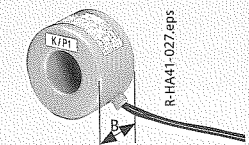
Cable-type current transformer 4MC70 33, 4 overall heights



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
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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	25 kA/1 s, or 14.5 kA/3 s
Rated continuous thermal current $I_D$	$1.0 \times I_N$ option: $1.2 \times I_N$	$1.0 \times I_N$ option: $1.2 \times I_N$
Transient overload current	$1.5 \times I_D/1$ h or $2 \times I_D/0.5$ h	$1.5 \times I_D/1$ h or $2 \times I_D/0.5$ 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	1 A or 5 A
Measuring core	Class: 0.2, 0.5, 1 Overcurrent factor: without, FS5, FS10 Rating: 2.5 VA to 30 VA	Class: 1 Overcurrent factor: FS5 (option: FS10) Rating: 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 $H^{2)}$ mm	65 <sup>1)</sup> 110 <sup>1)</sup> 170 <sup>1)</sup> 285 <sup>1)</sup>	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 72  
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

Features

Current transformer 4MA7

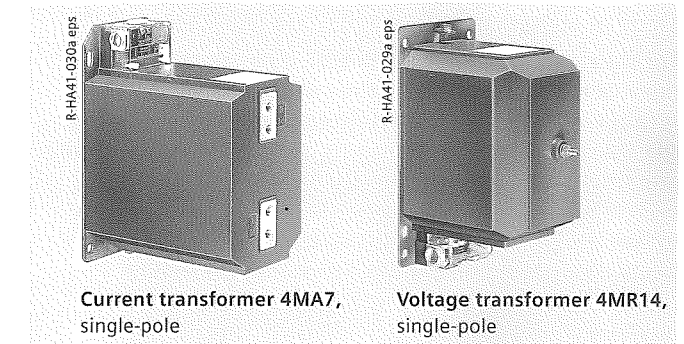
- According to IEC 61869-2/ DIN EN 61869-2 \*)
- Dimensions according to DIN 42600-8
- Designed as a single-pole indoor block-type current transformer
- Cast-resin insulated
- Insulation class E
- Secondary connection by means of screw-type terminals.

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:
  - Metering panel type M...as billing metering panel (750 mm wide)
  - Metering panel/bus riser panel type H and H1
  - 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		3.6	7.2	12	12	17.5	24
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 $U_p$	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 $I_D$		up to $1.0 \times I_N$ (option: $1.2 \times I_N$ )					
Rated dynamic current $I_{dyn}$		max. $2.5 \times I_{th}$					

Secondary data

Rated current	A	1 or 5					
Measuring core	Class	0.2	0.5	1			
	Overcurrent factor	without	FS5	FS10			
	Rating	2.5 to 30					
Protection core	Class	5 P or 10 P					
	Overcurrent factor	10					
	Rating	2.5 to 30					

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

Primary data		3.6	7.2	12	12	17.5	24	
Highest voltage for equipment $U_m (= 1.2 \times U_N)$	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 $U_p$	kV	20	60	75	75	95	125	
Rated voltage $U_N$	kV	$3.3/\sqrt{3}$	$3.6/\sqrt{3}$ $4.2/\sqrt{3}$ $4.8/\sqrt{3}$ $5.0/\sqrt{3}$ $6.0/\sqrt{3}$ $6.3/\sqrt{3}$ $6.6/\sqrt{3}$	$7.2/\sqrt{3}$ $10.0/\sqrt{3}$ $11.0/\sqrt{3}$ $11.6/\sqrt{3}$	$10.0/\sqrt{3}$ $11.0/\sqrt{3}$	$12.8/\sqrt{3}$ $13.2/\sqrt{3}$ $13.8/\sqrt{3}$ $15.0/\sqrt{3}$ $16.0/\sqrt{3}$	$17.5/\sqrt{3}$ $20.0/\sqrt{3}$ $22.0/\sqrt{3}$ $23.0/\sqrt{3}$	
Rated voltage factor (8 h)		$1.9 \times U_N$						

Secondary data

Rated voltage	V	$100/\sqrt{3}$ $110/\sqrt{3}$ (option) $120/\sqrt{3}$ (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 72

**Ready-for-service indicator**

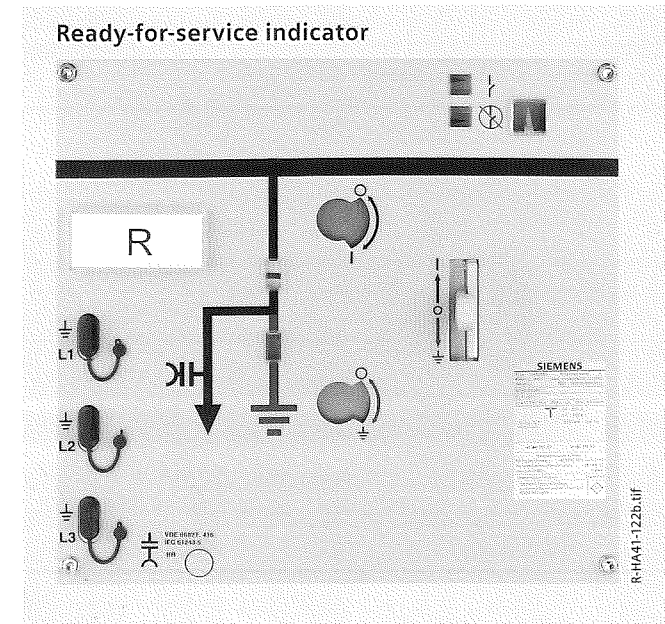
**Features**

- 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.

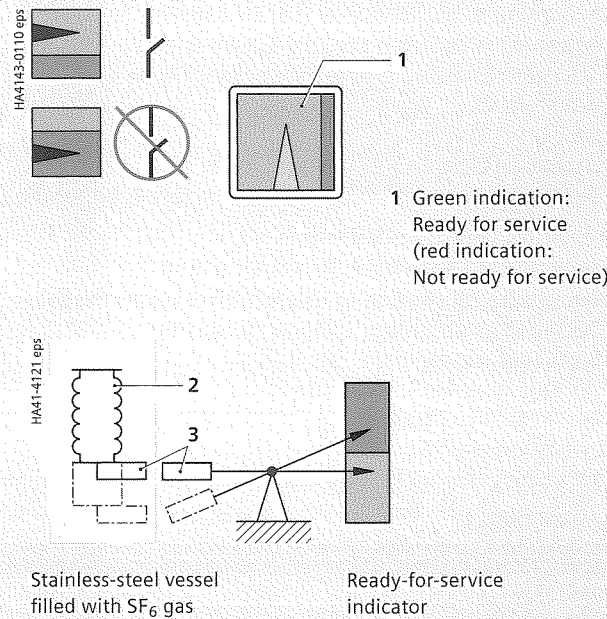
**Mode of operation**

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**

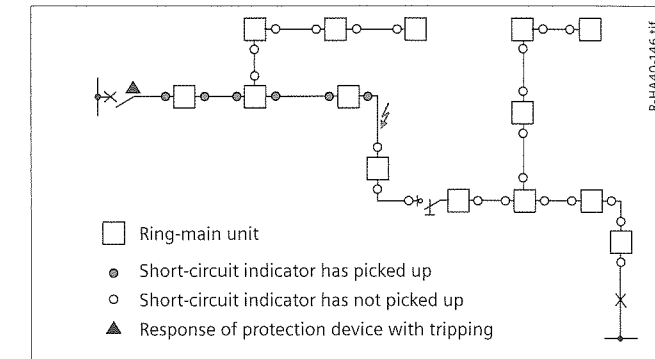


**Principle of operation of gas monitoring with ready-for-service indicator**

- 2 Measurement box
- 3 Magnetic coupling

**Short-circuit/earth-fault indicators make Horstmann**

Short-circuit/earth-fault indicator (option)  
 Ring-main, cable 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 46.  
 Short-circuit and earth-fault indicators reduce the downtimes of a power system by delimiting the fault locations in medium-voltage systems.



Short-circuit/earth-fault indicators can be used in all kinds of power systems. In impedance-earthed and solidly earthed systems, as well as in isolated and compensated (resonant-earthed) systems, earth-fault detection is also possible.

**SIGMA 2.0 with basic functions**

- Adjustable pickup values
- Phase-selective fault indication
- Reset of the fault indication: manually, automatically, from remote
- Earth-fault detection in impedance-earthed or solidly earthed systems
- Remote indication with relay contacts.

**SIGMA D++ with directional function**

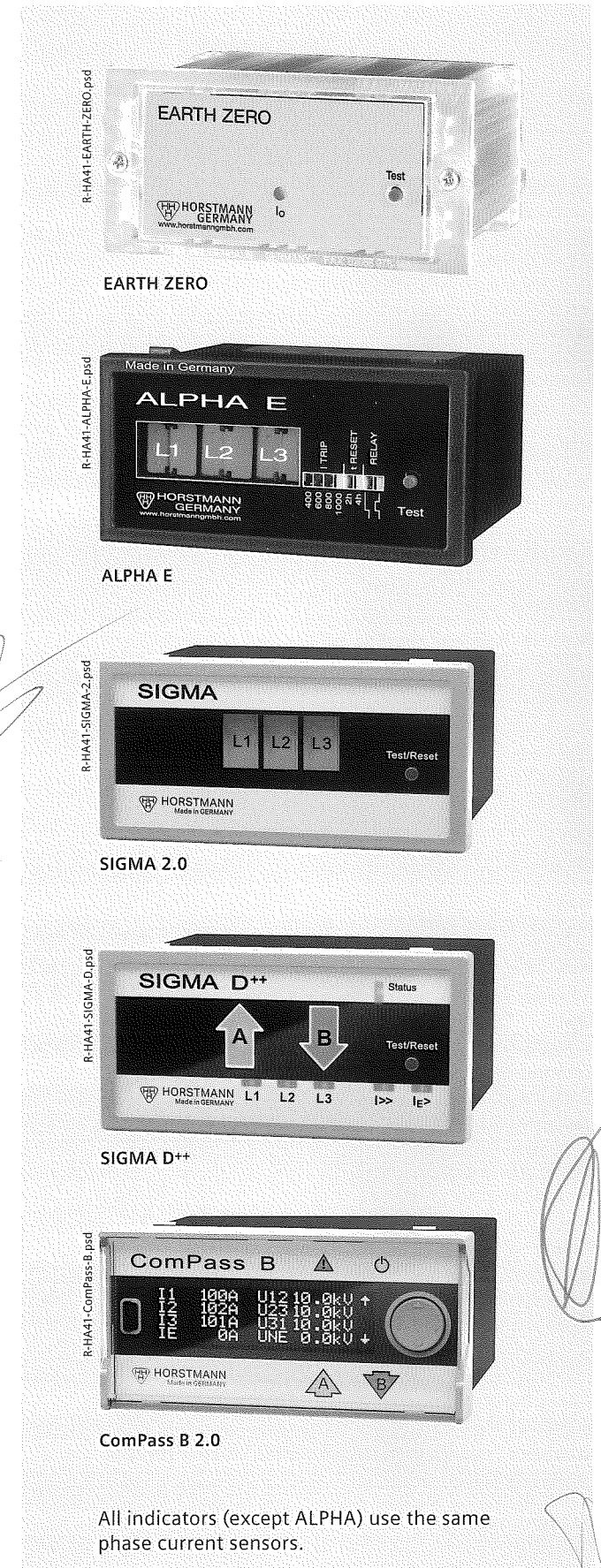
- Directional short-circuit indication
- Directional earth-fault indication for all types of neutral treatment
- Unambiguous indication of the fault direction
- Monitoring with "SIGMA Explorer" software.

**ComPass B 2.0 with monitoring**

- Voltage detection via WEGA voltage detecting system and resistive sensor system for up to 4 devices
- High-precision current and voltage measurement up to 0.5 %
- Monitoring of the values: U, I, f, P, Q, S, E, cos φ, load flow direction, power meter with direction
- Temperature measurement with PT100
- Limit value recording for U, I, P, Q, T
- Transfer of measured values, fault indications and events via RS485/MODBUS.

**ComPass Bs 2.0 with control function**

- Remote control of a switch-disconnector or circuit-breaker
- Freely programmable logic to define the switching conditions
- 6 binary inputs for recording relevant state information from the switchgear/substation.



All indicators (except ALPHA) use the same phase current sensors.

Short-circuit / earth-fault indicators from Horstmann	ALPHA M ALPHA E	SIGMA 2.0 SIGMA 2.0 AC / DC	SIGMA F+E 2.0 SIGMA F+E 2.0 AC / DC	SIGMA F+E 3.0 SIGMA F+E 3.0 AC / DC	SIGMA D	SIGMA D+	SIGMA D++	ComPass A 2.0	ComPass B 2.0	ComPass Bs 2.0	Earth Zero-EarthZeroFlag
<b>Function</b>											
Short circuit/earth fault	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	■/■	-/■
Direction indication	-	-	-	-	■	■	■	-	■	■	-
Monitoring: U, I, f, P, Q, S, E, cos φ, load flow direction	-	-	-	-	-	-	-	■	■	■	-
Control of a CB or SD	-	-	-	-	-	-	-	-	-	■	-
Logic	-	-	-	-	-	-	-	-	-	■	-
<b>Applicable for the following neutral treatments</b>											
Impedance earthed	■	■	■	■	■	■	■	■	■	■	■
Solidly earthed	■	■	■	■	■	■	■	■	■	■	■
Isolated	■	■	■	■	■	■	■	■	■	■	-
Compensated	■	■	■	■	■	■	■	■	■	■	-
<b>Short-circuit pickup values</b>											
I>> Short-circuit current	400, 600, 800, 1000 A	200, 300, 400, 600, 800, 1000, 2000 A, self-adjustment			DIP: 200, 300, 400, 600, 800, 2000 A, self-adjustment Software (SW): 50 – 2000 A			20 – 2000 A			-
tI>> Pickup delay	100 ms	40, 80 ms	40, 80, 200, 300 ms		DIP: 40, 80 ms, Software (SW): 40 ms – 60 s			40 ms – 60 s			-
<b>Earth-fault pickup values</b>											
IES> Short-circuit-to-earth current	-	-	20, 40, 60, 80, 100, 120 or 160 A		DIP: off, 20, 40, 60, 80, 100, 120, 160 A, Software (SW): 20 – 1000 A			20 – 1000 A			25, 50, 75, 100 A
IET> Transient earth fault	-	-	-	-	-	10 – 100 A 10 – 500 A		10 – 500 A			-
IEP> Active residual current cos φ	-	-	-	-	-	5 – 200 A 5 – 200 A		1 – 200 A			-
IEQ> Reactive current sin φ	-	-	-	-	-	5 – 200 A 5 – 200 A		1 – 200 A			-
UNE> Permanent earth fault	-	-	-	-	-	-		1 – 100%			-
ΔIE> Pulse location (pulse amplitude)	-	-	-	■	-	1 – 100 A 1 – 100 A		1 – 200 A			-
Pickup delay	-	-	80, 200 ms	60, 80, 200, 300 ms		DIP: 80, 160 ms, Software (SW): 40 ms – 60 s		40 ms – 60 s			80, 160 ms
<b>Reset</b>											
Manually / from remote	■ / - (M) ■ / ■ (E)	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / -
Auto. time reset	■ (E)	■	■	■	■	■	■	■	■	■	■
Current/voltage recovery	-	-	-	■ / -	■ / ■	■ / ■	■ / ■	■ / -	■ / ■	■ / ■	- / ■
<b>Test</b>											
Manually / from remote	■ / -	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / ■	■ / -
<b>Communication</b>											
Relay contact	1	1	2	3	4	4	4	4	4	4	1
Maintained / passing contact	adjustable		adjustable			adjustable		adjustable		adjustable	adjustable
RS485 / MODBUS-RTU	-	-	-	-	-	-	-	■	■	■	-
USB connection	-	-	-	-	■	■	■	■	■	■	-
<b>Parameterizing</b>											
Manually / from remote	■ / -	■ / -	■ / -	■ / -	■ / -	■ / -	■ / -	■ / ■	■ / ■	■ / ■	■ / -
<b>Supply</b>											
Lithium cell, ≥ 20 years	■ (E)	■ / Capacitor (AC/DC)			■	■	■	■	■	■	■
Current-transformer operated	■	■	■	■	■	■ (not IET>)	-	-	-	-	■
External auxiliary voltage	-	24 – 230 V AC / DC (only AC / DC versions)	24 – 230 V AC / DC (SIGMA F+E3 2.0 optional)		-	24 V AC, 24 – 60 V DC (possible)	24 – 230 V AC / DC (for IET>)	24 – 230 V AC / DC			-
<b>Binary inputs</b>											
Number	2	2	2	2	2	2	2	2	2	6	-
<b>Number of phase current / summation current sensors</b>											
Short circuit / earth fault	3/0	3/0	3/0	3/0	3/0	3/0 or 3/1 for IET>	3/0 or 3/1	3/0	3/0 (opt. 3/1 or 2/1)		0/1
<b>Voltage coupling</b>											
Capacitive	-	-	-	-	■	■	■	-	■	■	-
Resistive	-	-	-	-	-	-	-	-	■	■	-

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

Ring-main, cable 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 48.

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-Sx+.

**5. Grid-Inspector IKI-50**

- Directional measured-value acquisition
- Monitoring of values U, I, f, P, Q, S, E, cos φ, power factor, load flow direction (momentary value, mean value and min/max value, directional)
- Directional fault detection for all system types
- Switchgear control or automation through an integrated, programmable logic component
- Directional detection combined with the voltage detecting system CAPDIS-Sx+.

**Options:**

- One device controls two cable panels and the load flow total
- Directional detection combined with resistor dividers (accuracy 1.0%)
- Early fault detection and detection of intermittent earth faults
- Telecontrol interface according to IEC 60870-5-104.

**6. Short-circuit-to-earth indicator IKI-10light**

- Earth-fault detection in systems with impedance-earthed neutral or temporarily impedance-earthed neutral
- Adjustable.



IKI-20



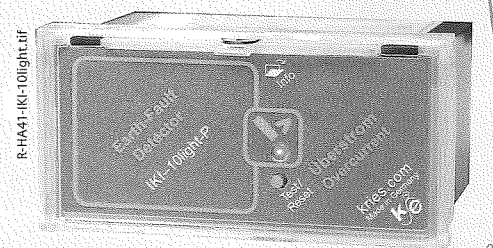
IKI-20PULS



IKI-22



IKI-50



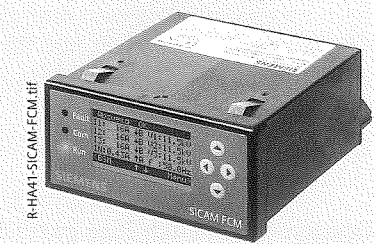
IKI-10light

Short-circuit/earth-fault indicators from Kries	IKI-20B	IKI-20T	IKI-20U	IKI-20PULS	IKI-20C	IKI-22	IKI-50_1F	IKI-50_1F_EW_PULS	IKI-50_2F	IKI-50_2F_EW_PULS	IKI-10-light-P
<b>Function</b>											
Short-circuit indication	■	■	■	■	■	■	■	■	■	■	■
Earth-fault indication				■		■	■	■	■	■	
Short-circuit-to-earth indication <sup>5)</sup>	■	■	■		■	■	■	■	■	■	■
Direction indication						■	■	■	■	■	
<b>Applicable for the following neutral earthing options</b>											
Impedance	■	■	■			■	■	■	■	■	■
Solid	■	■	■		■	■	■	■	■	■	■
Isolated	■	■	■		■	■	■	■	■	■	
Compensated	■	■	■	■	■	■	■	■	■	■	
<b>Pickup current</b>											
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 <sup>5)</sup>	40, 80, 100, 150 A				40, 80, 100, 200 A		40 ... 200 A (steps of 10 A)		20, 40, 60, 80 A		
Pulse location			■		■		■		■		
<b>Pickup time</b>											
Short-circuit current	60, 80, 150, 200 ms		100 ms		60, 80, 150, 200 ms		60 – 1600 ms				
Short-circuit-to-earth current <sup>5)</sup>	60, 80, 150, 200 ms		100 ms		60, 80, 150, 200 ms		60 – 1600 ms				
Earth-fault current			Pulse location		Pulse location		Transient fault detection		400 – 3000 ms		
<b>Reset</b>											
Manual	■	■	■	■	■	■	■	■	■	■	■
Automatic	■	■	■	■	■	■	■	■	■	■	■
From remote	■	■	■	■	■	■	■	■	■	■	■
<b>Remote indication</b>											
Passing contact	adjustable				■				adjustable		
Maintained contact	adjustable								adjustable		
<b>Interface</b>											
RS485/MODBUS							■		■		
IEC 60870-5-104 (option)							■		■		
<b>Power supply</b>											
Lithium battery	■	■	■	■	■	■	Only for transient fault detection		■		
External auxiliary voltage	■		■		■		Buffered for 6 h by internal capacitor		■		
<b>Current inputs</b>											
Phase current	3	3	3	3	3	3	3	3	6	6	–
Summation current	1	1	1	1	1	1	1 <sup>1)</sup>	0 <sup>2)</sup>	0 <sup>2)</sup>	0 <sup>2)</sup>	1
<b>Voltage inputs</b>											
Via CAPDIS					3		3		3		–
Via resistor divider (option)							3		3		–
<b>Release outputs</b>											
Potential-free	1–3	1–3	1–3	1–3	2	2	4	4	4	4	1
Supplied by internal capacitor (option)							2 <sup>3)</sup>		2 <sup>3)</sup>		2 <sup>3)</sup>
<b>Binary inputs</b>											
Number	2 (test + reset)				2 (test + reset)		4		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

Short-circuit/earth-fault indicator from Siemens	SICAM FCM	SICAM FPI
<b>Function</b>		
Short-circuit indication	■	■
Earth-fault indication	■	■
Earth-fault function (impedance-earthed system)	■	■
Indication of direction, short-circuit/earth-fault	■	–
Undervoltage and overvoltage indication	■	–
<b>Applicable for the following neutral earthing options</b>		
Impedance	■	■
Solid	■	■
Isolated	■	■
Compensated	■	■
<b>Pickup current</b>		
Short-circuit current	50 ... 2000 A (steps of 1 A)	Type 1: 200 – 1200 A, type 2: 200 – 800 A (in 7 steps each)
Earth-fault current	1 ... 1000 A (steps of 1 A)	Type 1: 10 – 100 A, type 2: 40 – 300 A (in 7 steps each)
Pulse location	–	–
<b>Pickup time</b>		
Short-circuit current	40 ms < t < 60 s	< 500 ms adjustable
Earth-fault current	40 ms < t < 60 s	< 500 ms adjustable
<b>Reset</b>		
Manual	■	■
Automatic	■	■
From remote	■	■
<b>Remote indication</b>		
Passing contact	adjustable	–
Maintained contact	adjustable	2 binary outputs
<b>Interface</b>		
RS485/MODBUS	■	–
<b>Power supply</b>		
Lithium battery	■	■
External auxiliary voltage	■	–
<b>Current inputs</b>		
Phase current	3 (2) <sup>1)</sup>	3 optical
Summation current	0 (1) <sup>1)</sup>	1 optical
<b>Voltage inputs</b>		
Via resistor divider	3	–
Via integrated capacitive voltage indicator (optional)	3	–
<b>Relay outputs</b>		
Potential-free	2 <sup>2)</sup>	2
<b>Binary inputs</b>		
Number	1	–

1) Measuring sensor 3+0 (summation current is calculated), measuring sensor 2+1 (phase L2 is calculated)  
 2) Optional



SICAM FCM

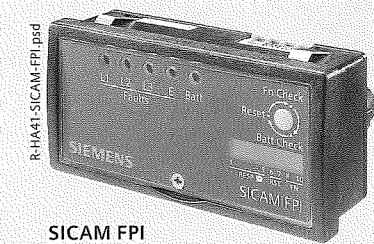
1. SICAM FCM

The short-circuit and earth-fault indicator SICAM FCM (Feeder Condition Monitor) with direction indication enables fast and precise fault location, thus reducing the downtimes in the power system. The possibility to determine and telecommunicate the values U, I, f, P, Q, S, E, cos φ and load flow direction supports efficient operational management and network planning.

- Usable in earthed, isolated and resonance-earthed systems
- Directional short-circuit and earth-fault detection
- Selective fault information with direction indication as a basis for "self-healing" applications
- Usable with current and voltage sensors according to IEC 60044 for precise measurement without calibration and adjustment to the primary values
- Alternatively usable with an integrated capacitive voltage detecting system
- Flexible earth-current detection as from 0.4 A
- Integrated MODBUS-RTU interface:
- Remote parameterization via SICAM A8000 and MODBUS
- Self-test function of the communication connection.

2. SICAM FPI (Fault Passage Indicator)

- Detection of short circuits and earth faults
- Indication of phase and earth faults via 4 separate LEDs
- Enhanced diagnostics, self and sensor cable diagnostics is supported
- Configurable binary outputs, for remote indication to SCADA via RTU for faults and for diagnostics.



SICAM FPI



**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.

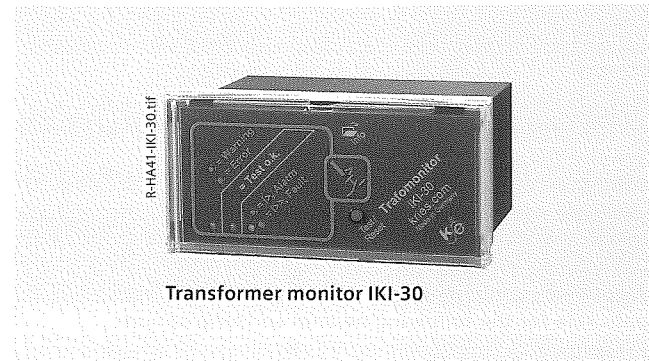
**On request: Application with switch-fuse combination (panel type T...)**

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



Transformer monitor IKI-30

**Example for selection of transformer protection**

Operating voltage (kV)	Transformer rating (kVA)		
	Siemens 7SJ145/7SJ146	Woodward/SEG WIC 1-2P	Kries IKI-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.

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

- For verification of safe isolation from supply
- HR or LRM detecting systems with plug-in indicator
- LRM detecting systems with integrated indicator type VOIS+, VOIS R+, CAPDIS-S1+, CAPDIS-S2+, WEGA 1.2 C, WEGA 2.2 C or WEGA 3.

**Plug-in voltage indicator**

- Verification of safe isolation from supply phase by phase
- Indicator suitable for continuous operation
- Measuring system and voltage indicator can be tested, repeat test according to local specifications and standards
- Voltage indicator flashes if high voltage is present.

**VOIS+, VOIS R+**

- Without auxiliary power
- Display indication "A1" to "A3" (see legend)
- Repeat test according to local specifications and standards
- With integrated 3-phase LRM test socket for phase comparison
- With integrated signaling relay (only VOIS R+).

**Common features of CAPDIS-Sx+**

- Without auxiliary power
- Integrated repeat test of the interfaces (self-monitoring)
- With integrated function test (without auxiliary power) by pressing the "Test" button
- Adjustable for different operating voltages (adjustable capacitance C2)
- With integrated 3-phase LRM test socket for phase comparison
- With connectable signal-lead test
- With overvoltage monitoring and signaling (1.2 times operating voltage).

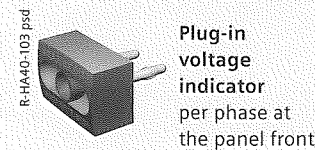
**CAPDIS-S1+**

- Without auxiliary power
- Display indication "A1" to "A7" (see legend)
- Without ready-for-service monitoring
- Without signaling relay (without auxiliary contacts).

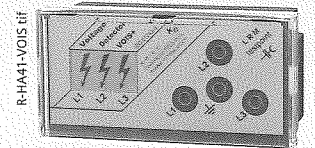
**CAPDIS-S2+**

- Display indication "A0" to "A8" (see legend)
- Only by pressing the "Test" pushbutton: "ERROR" indication (A8), e.g. in case of missing auxiliary voltage
- With ready-for-service monitoring (auxiliary power required)
- With integrated signaling relay for signals (auxiliary power required).

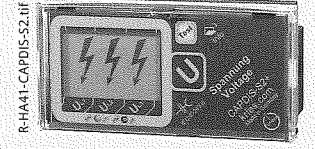
**Indicators and detecting systems**



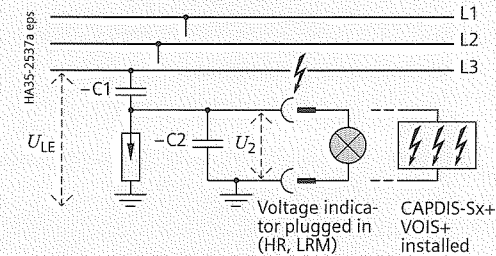
Plug-in voltage indicator per phase at the panel front



Integrated voltage indicator VOIS+, VOIS R+



Integrated voltage detecting system CAPDIS-S1+, -S2+



Voltage indication via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth
- $U_{LE} = U_N / \sqrt{3}$  during rated operation in the three-phase system
- $U_2 = U_A =$  Voltage at the capacitive interface of the switchgear or at the voltage indicator

**Symbols shown**

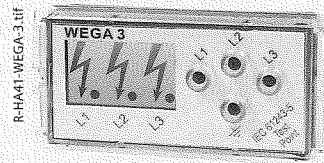
	VOIS+, VOIS R+			CAPDIS-S1+			CAPDIS-S2+		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
A0							000		
A1	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A2									
A3	⚡	⚡		⚡	⚡		⚡	⚡	
A4				⚡	⚡	⚡	⚡	⚡	⚡
A5				000			000		
A6				000			000		
A7				000			000		
A8							000		ERROR

CAPDIS S2+: The red and green LEDs show the state of the relay contacts  
 ○ LED doesn't light up  
 ● LED lights up  
 U = Operating voltage

- A0 CAPDIS-S2+: Operating voltage not present
- A1 Operating voltage present
- A2 – Operating voltage not present
  - For CAPDIS-S2+: Auxiliary power not present
- A3 Failure in phase L1, operating voltage at L2 and L3 (for CAPDIS-Sx+ also earth-fault indication)
- A4 Voltage (not operating voltage) present
- A5 Indication "Test" passed (lights up shortly)
- A6 Indication "Test" not passed (lights up shortly)
- A7 Overvoltage present (lights up permanently)
- A8 "ERROR" indication, e.g. in case of missing auxiliary voltage

WEGA 3

- Display indication "A1" to "A5"
- Integrated repeat test of the interface (self-monitoring)
- With integrated 3-phase LRM test socket for phase comparison.



Integrated voltage indicator WEGA 3

WEGA 1.2 C

- Display indication "A1" to "A6" (see legend)
- 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.



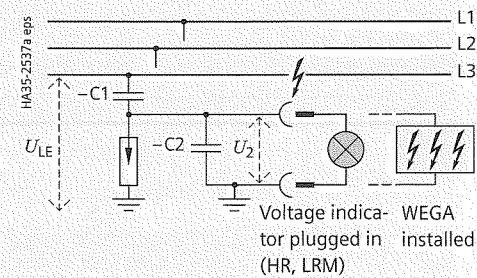
Integrated voltage indicator WEGA 1.2 C

WEGA 2.2 C

- Display indication "A0" to "A7" (see legend)
- 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
- With two integrated signaling relays (auxiliary power required \*)).



Integrated voltage indicator WEGA 2.2 C



Voltage indication via capacitive voltage divider (principle)

- C1 Capacitance integrated into bushing
- C2 Capacitance of the connection leads and the voltage indicator to earth

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

$U_2 = U_A =$  Voltage at the capacitive interface of the switchgear or at the voltage indicator

\*) Shows the function of the relay via the LED indications (U=0, U≠0)

Symbols shown

	WEGA 3			WEGA 1.2 C			WEGA 2.2 C		
	L1	L2	L3	L1	L2	L3	L1	L2	L3
A0									
A1	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A2									
A3	⚡	⚡		⚡	⚡		⚡	⚡	
A4	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A5	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡	⚡
A6				⚡	⚡	⚡	⚡	⚡	⚡
A7							⚡	⚡	⚡

LC display gray: not illuminated  
LC display white: illuminated

WEGA 2.2 C: The red and green LEDs show the state of the relay contacts

○ LED doesn't light up

● LED lights up

U = Operating voltage

A0 For WEGA 2.2 C:

Operating voltage not present, auxiliary power present, LCD illuminated

A1 Operating voltage present  
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A2 Operating voltage not present  
For WEGA 2.2 C: Auxiliary power not present, LCD not illuminated

A3 Failure in phase L1, operating voltage at L2 and L3  
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A4 Voltage present, current monitoring of coupling section below limit value  
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

A5 Indication "Display-Test" passed  
For WEGA 2.2 C: Auxiliary power present, LCD illuminated

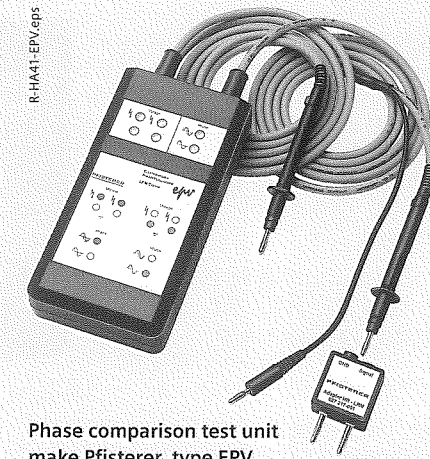
A6 Indication "Display Test" passed  
For WEGA 2.2 C: Auxiliary power present

A7 For WEGA 2.2 C: LCD for missing auxiliary voltage is not illuminated

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:

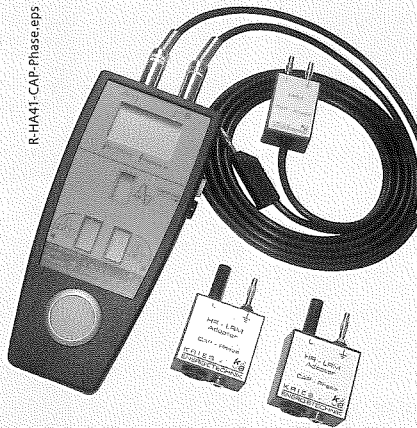
- Voltage detection
- Phase comparison
- Interface test
- Integrated self-test
- Indication via LED.



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 indication.



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 Horstmann, type ORION M1

as combined test unit (HR and LRM) for:

- Voltage detection
- Phase comparison
- Interface testing at the switchgear
- Integrated self-test
- Indication via display and acoustic alarm
- Phase sequence indication and status LED
- Measurement of interface current up to 25 µA
- Measurement of phase angle from -180° to +180°
- Measurement of harmonics up to 40th harmonic
- Securing the measured values via PC software (ORION explorer) and USB.