










- Short-Circuit and Earth Fault Indicators
- Solutions for Remote Monitoring
- Voltage Detectors and Detecting Systems
- Earthing Devices and Accessories



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## Company Profile

Dipl.-Ing. H. Horstmann GmbH is a medium-sized company based in Heiligenhaus near Düsseldorf (Germany). The company was founded in 1946 by Heinrich Horstmann. Since that time it has been a successful family-owned company. Due to its long experience and the ongoing expansion activities in research and development as well as in production facilities Dipl.-Ing. H. Horstmann GmbH is today recognized as the leading manufacturer in medium voltage technology for:

- Short-circuit and earth fault indicators
- Solutions for Remote Monitoring
- Voltage detectors and voltage detecting systems
- Earthing devices and accessories.

The worldwide distribution is covered by both our own highly qualified sales force and trade agents.

Our products meet the highest quality requirements and are developed and manufactured in own production facilities in Germany. In order to respond to these demands, we have a very high vertical depth of production (e. g. own SMD assembly lines) as well as an own research and development department with state-of-the-art testing and measuring equipment. Besides the electronics manufacturing, we have also a mechanical production facility for safety material.

Our company has been certified according to DIN EN ISO 9001 since 1996.



Head office in Heiligenhaus



In-house manufacturing



Component testing



High voltage laboratory

# Short-Circuit and Earth Fault Indicator

## General Information

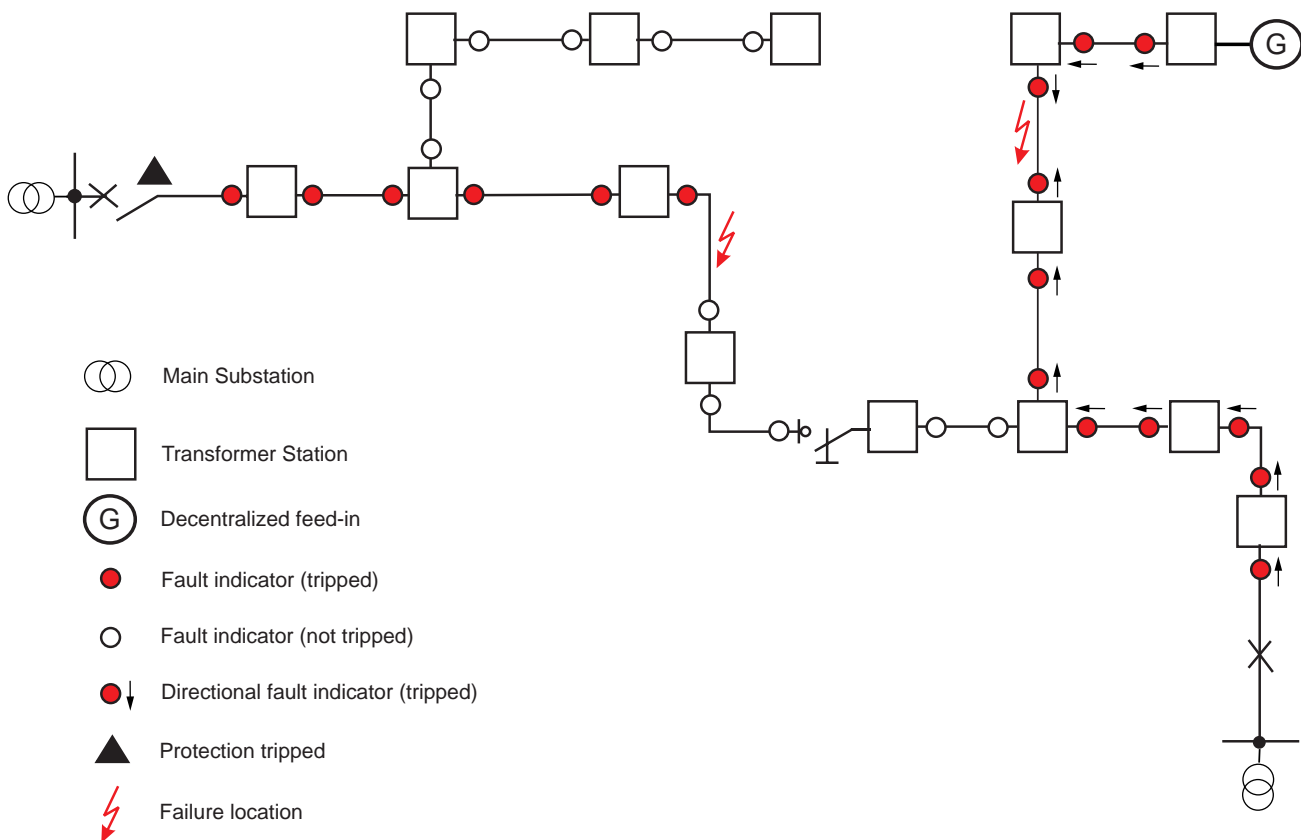
Short-circuit indicators are devices which are tripped by a magnetic field induced by the current flow in a conductor when a short-circuit occurs and indicate that the device has tripped.

Short-circuit indicators are mainly used for an efficient and quick fault location in medium voltage distribution networks (radially fed, open-ring or closed-ring networks). They are mounted on current-carrying busbars, cables or overhead lines. Any fault condition that exceeds pre-set trip currents of the short-circuit indicator produces a trip signal leading to a visual indication without information on the direction of the fault. This signal can also be remotely indicated.

In case of a short-circuit, if additional decentralized power feeders, e. g. from photovoltaics or wind parks, are connected to the existing energy distribution network, both the substation and the decentralized feeding sources feed in from two directions to the fault. In such cases, short-circuit/earth fault indicators with indication of fault direction are required.

Short-circuit indicators can also be used as earth fault indicators provided that a single-phase current fault of sufficiently high level occurs in the faulty line section. In cases where low current faults occur, it is recommended to use short-circuit indicators with additional summation current transformers.

The fault is located between the last tripped short-circuit indicator and the first untripped short-circuit indicator (see the circuit diagram below).



# Rotor Indicator

## Mechanical Short-Circuit Indicator

### Product Features

- Mechanical design
- Installation on cables or busbars
- Fault indication by pivoted rotor
- Retrofit ready

The Rotor Indicator is a mechanical short-circuit indicator. It is designed to detect short-circuit currents in medium voltage distribution networks.

The indicator is tripped by a magnetic field strength "H" which is induced by trip values  $I >>$ . The pivoted rotor with reset pin uses a two-colour indication to inform the user of the state of the Rotor Indicator. "Black" means that the indicator has not been tripped whereas "red" indicates that the indicator has been tripped.

Technical Data	Rotor Indicator
$I >>$ Short-circuit trip current	150–2,000 A (factory setting)
$tI >>$ Response time	100 ms at rated trip value
Accuracy	±10 %
Reset	Manual reset with hot stick
Material	<ul style="list-style-type: none"> <li>▪ Housing and fixing screws made from polyamide</li> <li>▪ Yoke made from ferromagnetic steel</li> </ul>
Temperature range	-40 to +85 °C

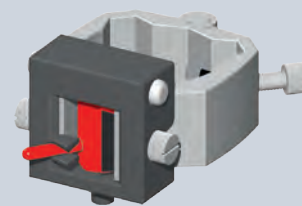
Dimension drawing see on page 49, M1

$I_{min}$ [A]	for $\varnothing$ [mm]	Order No.
150	8–16	20-0101-001 <sup>1)</sup>
200	16–20	20-0102-001
200	20–30	20-0103-001
200	30–40	20-0104-001
200	40–50	20-0105-001
300	50–60	20-0106-001
300	60–80	20-0108-001
$I_{min}$ [A]	for $\square$ [mm]	
150	20 x 4–25 x 6	20-0122-001 <sup>1)</sup>
150	25 x 4–30 x 6	20-0123-001 <sup>1)</sup>
200	30 x 4–40 x 10	20-0120-001 <sup>1)</sup>
300	45 x 4–60 x 12	20-0121-001 <sup>1)</sup>

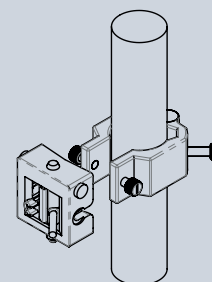
1) Screws for fixing the conductor made of steel

Combined rotor / fluid type short-circuit indicators are available on request.

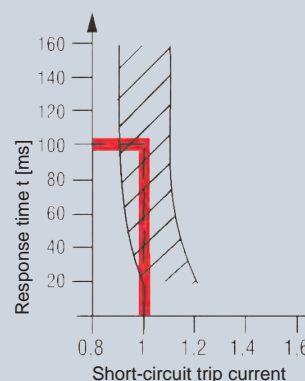
Accessories	
Hot stick	see on page 88



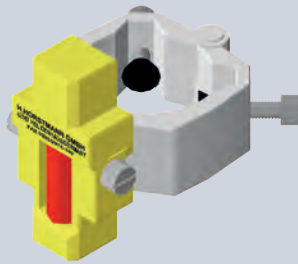
Rotor Indicator



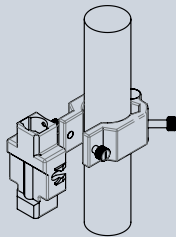
Installation



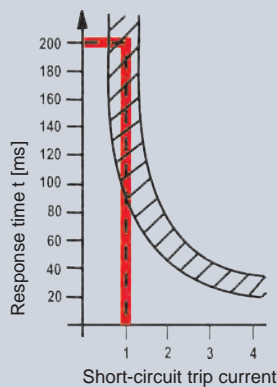
Response characteristic



Fluid Indicator



Installation



Response characteristic

## Fluid Indicator

### Mechanical Short-Circuit Indicator

#### Product Features

- Mechanical design
- Installation on cables or busbars
- Fault indication by fluid with red coloured particles
- Retrofit ready

The Fluid Indicator is a mechanical short-circuit indicator which is designed to detect short-circuit currents in medium voltage distribution networks.

The indicator is tripped by a magnetic field strength “H” which is induced by trip values  $I \gg$ . When a short-circuit occurs, the mixer is pulled up by the magnetic field stirring up red particles in the fluid. The indication resets automatically after 6 to 8 hours once the red particles have set to the bottom of the mixer.

Technical Data	Fluid Indicator
$I \gg$ Short-circuit trip current	400, 600 or 1,000 A (factory setting)
$tI \gg$ Response time	200 ms at rated trip value (100 ms are available on request)
Accuracy	$\pm 20\%$
Reset	Automatic reset by time after: approx. 6–8 h
Material	<ul style="list-style-type: none"> <li>▪ Housing and fixing screws made from polyamide</li> <li>▪ Yoke made from ferromagnetic steel</li> </ul>
Temperature range	-40 to +85 °C

Dimension drawing see on page 49, M2

I min [A]	for $\varnothing$ [mm]	Order No.
400	8–16 <sup>1)</sup>	20-0401-000
400	16–20	20-0402-000
400	20–30	20-0403-000
400	30–40	20-0404-000
600	40–50	20-0405-000
600	50–60	20-0406-000
1,000	60–80	20-0408-000
I min [A]	for $\square$ [mm]	
400	30 x 4–40 x 10 <sup>1)</sup>	20-0420-000
400	20 x 4–25 x 6 <sup>1)</sup>	20-0422-000
400	25 x 4–30 x 6 <sup>1)</sup>	20-0423-000
600	45 x 4–60 x 12 <sup>1)</sup>	20-0421-000
I min [A]	for $\square$ [mm]	
400	30 x 4–40 x 15 <sup>1)</sup>	20-0410-000

1) Screws for fixing the conductor made from steel

Combined rotor/fluid type short-circuit indicators are available on request.

# OPTO-F 3.0/OPTO-F+E 3.0

## Short-Circuit Indicator/Short-Circuit and Earth Fault Indicator

### Product Features

- Fibre optic cables for electrical isolation between indicator and current transformers
- High-intensity LED indication
- Single and double flash mode for operation in radial and ring networks
- Remote indication via relay contact
- Current transformer retrofit ready

The OPTO-F 3.0 device is a short-circuit indicator. It is designed, to detect, display and remotely indicate short-circuit currents in medium voltage distribution networks. The indicator unit can be used in all medium voltage switchgear installations. Fibre optic cables provide electrical isolation between the current transformers, mounted on cable/busbar, and the display unit when transferring signals.

The OPTO-F+E 3.0 device is a combined short-circuit and earth fault indicator. Due to its measuring principle, the earth fault indication is suitable for low-impedance or solidly earthed neutral networks as well as for radial or open ring networks.

In the event of a short-circuit, the current transformers mounted on the conductors emit light signals via fibre optic cables to the evaluation unit in the housing where the events are indicated as a short-circuit. Phase-selectively operated red LEDs start flashing.

After the first tripping incident (e. g. in radial systems) the LEDs begin a phase-selective flash rhythm of: flash/pause/flash.

A second tripping (e. g. ring operated network with auto-reclosing) is indicated by flashing LEDs of the fault-affected phases in a flash-flash/pause/flash-flash rhythm.



OPTO-F 3.0, plug-in housing



OPTO-F 3.0, surface mount housing



OPTO-F+E 3.0, plug-in housing



OPTO-F+E 3.0, surface mount housing



# OPTO-F 3.0/OPTO-F+E 3.0

Short-Circuit Indicator/Short-Circuit and Earth Fault Indicator

Technical Data	OPTO-F 3.0	OPTO-F+E 3.0
Short-circuit indicator	▪	▪
Earth fault indicator	—	▪
I <sub>&gt;&gt;</sub> Short-circuit trip current	400, 600, 800 or 1,000 A (adjustable) <sup>1)</sup>	
tI <sub>&gt;&gt;</sub> Response delay	40, 60, 80, 100, 200, 300 or 500 ms (adjustable)	
I <sub>E&gt;</sub> Earth fault trip current	—	10, 20, 40, 80 A or 40, 80, 120, 160 A (adjustable)
tI <sub>E&gt;</sub> Response delay	—	60, 100 or 200 ms (adjustable)
Accuracy	±15 % (determined by current transformer)	
Indication	Phase-selective short-circuit: 3 red LEDs, flashing period 2 s, double flash sequence 0.3 s with flashing period of 3 s  Optional: external signal lamp	Phase-selective short-circuit: 3 red LEDs, earth fault: 1 yellow LED, flashing period 2 s, double flash sequence 0.3 s with flashing period of 3 s  Optional: external signal lamp
Remote signal	1 Relay contact	2 Relay contacts
Remote contact	Potential-free permanent or momentary contact (adjustable) Contact capacity: 380 V AC/5 A/1250 VA max. 220 V DC/5 A/150 W max.	
Reset	<ul style="list-style-type: none"> <li>▪ Manual reset</li> <li>▪ Automatic time reset: 1, 2, 4 or 8 h (adjustable)</li> <li>▪ Voltage supply restoration or by applied external voltage supply ≥10 s (can be activated via DIP switch)</li> <li>▪ Remote reset</li> </ul>	
Remote reset/remote test	Separate inputs, potential-free NO contact, wiping time ≥0.5 s	
Power supply	Long-life lithium cell, active flashing time >1,000 h, shelf life ≥20 years Auxiliary supply, integrated in the device: 12–110 V DC ±10 % or 24–60 V AC (±10 %), 50–60 Hz Optional accessories: Transformer with cable for top-hat rail or screw mounting (115–230 V AC/24–48 V AC)	
Housing	Polycarbonate, IP40 (plug-in housing), IP65 (surface mount housing)	
Temperature range	-30 to +70 °C	

1) Further trip current levels on request.

Dimension drawing see on page 49, M3 and on page 50, M7

	OPTO-F 3.0	OPTO-F+E 3.0
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit (plug-in/surface mount housing)</li> <li>▪ 3 Short-circuit current transformer</li> <li>▪ 3 Fibre optic cables</li> </ul>	<ul style="list-style-type: none"> <li>▪ 1 Display unit (plug-in/surface mount housing)</li> <li>▪ 3 Short-circuit current transformers</li> <li>▪ 1 Summation current transformer</li> <li>▪ 4 Fibre optic cables</li> </ul>

Article	Order No.	
	OPTO-F 3.0	OPTO-F+E 3.0
Display unit in plug-in housing	33-0513-001	36-0323-001
Display unit in surface mount housing	33-0613-001	36-0313-001
Accessories	see on page 10	
External signal lamp	see on page 10	

# OPTO-F 3.0/OPTO-F+E 3.0

## Short-Circuit Indicator/Short-Circuit and Earth Fault Indicator

### Short-circuit current transformers

Current transformers with integrated trip threshold detection capability. When the pre-set trip current is reached or exceeded, light pulses will be emitted. A fibre optic cable is used to transmit these light pulses from the current transformer to the evaluation unit in the housing.

The current transformer can be mounted either on the medium voltage cable or on the bright copper bar.

Trip Currents <sup>1)</sup> [A]	Conductor Ø [mm]	Order No.
400, 600, 800 or 1,000	22–42	49-0101-202
400, 600, 800 or 1,000	40–60	49-0101-203
Trip Currents <sup>1)</sup> [A]	for □ [mm]	
400, 600, 800 or 1,000	20 x 4–40 x 10	49-0101-206

1) adjustable

### Earth fault current transformers (only for OPTO-F+E 3.0)

Summation current transformer with integrated trip threshold detection capability. When the pre-set trip current is reached or exceeded, light pulses will be emitted. A fibre optic cable is used to transmit light pulses from the current transformer to the evaluation unit in the housing. The mechanical dimension of the current transformer must be large enough to fit around all three phases.

Trip Currents <sup>1)</sup> [A]	Conductor Ø [mm]	Order No.
40, 80, 120 or 160	up to 115	49-6014-009
(10), (20), 40 or 80	up to 115	49-6014-007
80, 120, 160 or 200	280 x 50, oval summation current transformer for SF6 gas-insulated switchgears	49-6014-022
80, 120, 160 or 200	350 x 50, oval summation current transformer for air-insulated switchgears	49-6014-021

1) adjustable

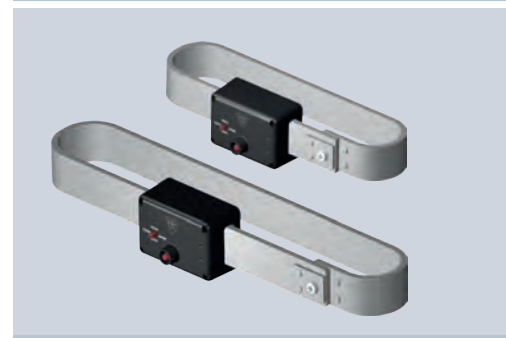
### Fibre optic cables

Fibre optic cables transmit the signals from the current transformer to the evaluation unit in the housing.

Accessories	Order No.
Fibre optic cable 3 m (standard length for short-circuit current transformers)	49-0602-009
Fibre optic cable 4 m (standard length for earth fault current transformers)	49-0602-001
Cutting tool for fibre optic cables	49-0109-003
Transformer with cable for top-hat rail mounting (115 V–230 V AC/24 V–48 V AC)	49-0921-002
External signal lamp for permanent contact, connection cable 5 m	49-0702-005
Optical testing unit to excite the indicator for connection to the FOC plug	49-0109-002
Disassembly clip for retracting plug-in housings	040401-0008
Spring clip suitable for 2 mm front plate thickness (standard)	040804-0009
Spring clip suitable for 3 mm front plate thickness	040804-0010



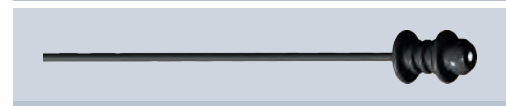
OPTO-F 3.0, incl. current transformer



Summation current transformer



External signal lamp



Fibre optic cable



ALPHA M, plug-in housing



ALPHA E, plug-in housing

## ALPHA M/ALPHA E

### Short-Circuit Indicator

#### Product Features

- Adjustable trip currents
- Flag-type indication (black/red)
- Remote signal
- No external power supply required

The ALPHA device is a short-circuit indicator. It is designed to detect, display and remotely indicate short-circuit faults in medium voltage distribution networks.

The indication is tripped by a short-circuit current and remains active until the device is reset.

Technical Data	ALPHA M	ALPHA E
Short-circuit indicator	▪	▪
I <sub>&gt;&gt;</sub> Short-circuit trip current	400, 600, 800 or 1,000 A, adjustable	
t <sub>l&gt;&gt;</sub> Response time	100 ms, no tripping <20 ms	
Accuracy	±15 %	
Indication	3 Display elements (black/red), bi-stable type, for L1, L2, L3	
Remote signal	1 Relay contact	
Remote contact	Potential-free permanent and momentary contact (>100 ms), adjustable Contact capacity: 230 V AC/1 A/62.5 VA max. 220 V DC/1 A/60 W max.	
Reset	Manual reset via rotary knob	<ul style="list-style-type: none"> <li>▪ Manual reset</li> <li>▪ Remote reset: 12–60 V AC/DC ±10 %</li> <li>▪ Automatic time reset: 2 or 4 h, adjustable</li> </ul>
Power supply	—	Long-life lithium cell, shelf life ≥20 years
Housing	Polycarbonate, IP40 (plug-in housing)	
Temperature range	-30 to +70 °C	

Dimension drawing see on page 49, M3 and M5

	ALPHA M	ALPHA E
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit</li> <li>▪ 3 Short-circuit current transformers</li> </ul>	

Article	Order No.	ALPHA E
Display unit in plug-in housing	ALPHA M 30-1815-001	30-1715-001
Current transformers	see on page 14 and 15	
Accessories	see on page 32 and 33	

# SIGMA *plus*

Short-Circuit and Earth Fault Indicator

## Product Features

- Retrofit solution for old devices without replacing existing current transformers
- Can be adjusted to all common Horstmann current transformers
- Indication by high-intensity LEDs with a viewing angle of 180 degrees
- Load-dependent self-adjustment or fixed setting
- Single and double flash mode for operation in radial and ring networks

The SIGMA *plus* device features all the functions provided by the SIGMA and SIGMA F+E devices thus capable of being used as a short-circuit indicator or as a combined short-circuit and earth fault indicator.

This device is ready for retrofit: Change or replace old indicators with the SIGMA *plus* WITHOUT REPLACING CURRENT TRANSFORMERS ALREADY EXISTING IN THE SWITCHGEAR!

The SIGMA *plus* features a selection switch which is used to adapt the device to all current transformers of the ALPHA, DELTA, GAMMA and SIGMA series.



SIGMA *plus*, plug-in housing



SIGMA *plus*, surface mount housing

# SIGMA *plus*

## Short-Circuit and Earth Fault Indicator

Technical Data	SIGMA <i>plus</i>
Short-circuit indicator	▪
Earth fault indicator	▪
I <sub>&gt;&gt;</sub> Short-circuit trip current	(100), 200, 300, 400, 600, 800 or 1,000 A, fixed setting Self-adjustment to load current (I <sub>L</sub> =load current): I <sub>L</sub> < 100 A → I <sub>&gt;&gt;</sub> = 400 A, I <sub>L</sub> > 100 A → I <sub>&gt;&gt;</sub> = 4 x I <sub>L</sub>
tI <sub>&gt;&gt;</sub> Response delay	40, 80, 200 or 300 ms
I <sub>E&gt;</sub> Earth fault trip current	20, 40, 60, 80, 100, 120 or 160 A
tI <sub>E&gt;</sub> Response delay	80 or 160 ms
Accuracy	±15 %
Indication	Bright LED displays: <ul style="list-style-type: none"> <li>▪ Short-circuit: 3 red phase-selective LEDs (L1, L2, L3)</li> <li>▪ Short-circuit/earth fault: 3 red LEDs (L1, E, L3)</li> </ul>
Reset	<ul style="list-style-type: none"> <li>▪ Manual reset</li> <li>▪ Automatic time reset: 2, 4, 8 or 24 h</li> <li>▪ Remote reset</li> <li>▪ Current restoration</li> </ul>
Remote signal	2 Relay contacts
Remote contact	Potential-free permanent or momentary contact (1 s), adjustable contact capacity: 230 V AC/1 A/62,5 VA max. 220 V DC/1 A/60 W max
Power supply	Long-life lithium cell, shelf life ≥20 years, >1,000 h total flashing time
Housing	Polycarbonate, IP40 (plug-in housing), IP65 (surface mount housing)
Temperature range	-30 to +70 °C

Dimension drawing see on page 49, M3 and on page 50, M7

	SIGMA <i>plus</i>
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit (plug-in/surface mount housing)</li> <li>▪ 3 Short-circuit current transformers or 2 short-circuit current transformers + 1 summation current transformer</li> </ul>

Article	Order No.
Display unit in plug-in housing	37-3110-001
Display unit in surface mount housing	37-3510-001
Display unit in plug-in housing with external power supply (AC/DC)	37-3120-001
Display unit in surface mount housing with external power supply (AC/DC)	37-3520-001
Current transformer	see on page 14 and 15
Accessories	see on page 32 and 33

# Current Transformer

for Short-Circuit and Earth Fault Indicators  
Type ALPHA, SIGMA plus

Short-circuit current transformers for installation on bushings and pole plates



for Switchgear Manufacturer	Type	Dimensions [mm]	Cable Length [m]	Order No.
ABB	SafeRing, RGC, SafePlus cable-type CTs	23 x 3	3.00	49-6012-009
Driescher	MINEX, G.I.S.E.L.A. cable-type CTs	3 pole plate	1.50	49-6012-007
Ormazabal	GA/GAE + GE	96 x 96 □	1.20	49-6010-011
Schneider Electric	RM6	80 ∅	1.10	49-6010-044
	FBA, GLA, GMA	92 ∅	1.26	49-6010-030
	FBX cable-type CTs for pole plate	3 pole plate	1.70	49-6012-005
Siemens	8DJ, 8DH, SIMOSEC	95 ∅	0.80	49-6010-052
	8DJH (module transformer)		1.30	49-6010-060

1 set consisting of 3 short-circuit current transformers

for Switchgear Manufacturer	Type	Dimensions [mm]	Cable Length [m]	Order No.
ABB	SafeRing, RGC, SafePlus cable-type CTs	23 x 3	0.89/0.99/1.09	49-6012-015
EATON/Holec	SVS	44	1.22/1.06/1.06	49-6010-032
	XIRIA	70	1.47/1.36/1.25	49-6010-048

# Current Transformer

for Short-Circuit and Earth Fault Indicators  
Type ALPHA, SIGMA *plus*

Short-circuit current transformers for installation on insulated cables

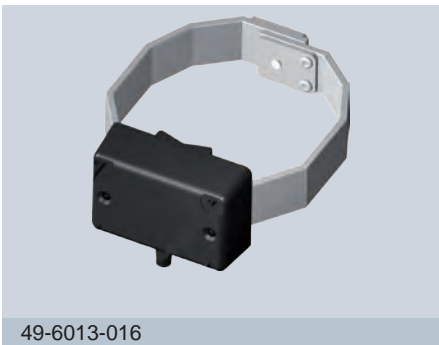


49-6011-040/49-6011-043

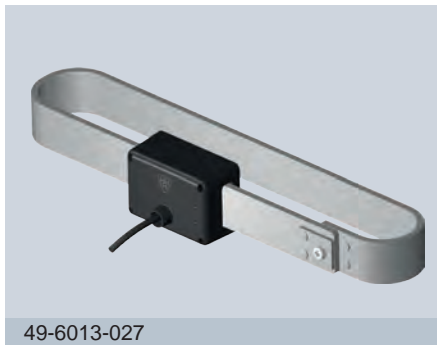
Conductor Ø [mm]	Cable Length [m]	Order No.
15–52	3.00	49-6011-040
15–52	6.00	49-6011-043

## Earth fault current transformers

For short-circuit and earth fault indicator type SIGMA *plus*



49-6013-016



49-6013-027



49-6013-028

Type	Conductor Ø [mm]	Cable Length [m]	Order No.
Summation current transformer for installation on cables	40–115	3	49-6013-016
Summation current transformer for SF6 gas-insulated switchgears	280 x 50, oval	3	49-6013-028
Summation current transformer for air-insulated switchgears	350 x 50, oval	3	49-6013-027

Autumn  
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## SIGMA 2.0/SIGMA F+E 2.0

Short-Circuit Indicator/Short-Circuit and Earth Fault Indicator

### Product Features

- Short-circuit and earth fault detection from only 3 single-phase current sensors
- Phase-selective fault indication and fault signalling
- Retrofitting to SIGMA F+E 3/SIGMA F+E 3 2.0, SIGMA D/D+/D++, ComPass A/A 2.0/B/B 2.0 possible
- Trip current values: load-dependent self-adjustment or fixed settings
- Single and double flash mode for operation in radial and ring networks

The SIGMA 2.0 device is a short-circuit indicator. It is designed to detect, display and remotely indicate short-circuits in medium voltage distribution networks.

The SIGMA F+E 2.0 device is a combined short-circuit and earth fault indicator. Due to the measuring principle the earth fault indication is suitable for low-impedance or solidly earthed neutral networks.

The current is measured via current sensors which deliver high precision current measurement values. By using the new sensors retrofit to more advanced indicator series is possible – without changing the sensors.

When the phase current exceeds the trip current value for the duration of the response delay the fault-affected phase will be indicated by a bright flashing LED. At the same time, the remote signal contact will be activated. A double flashing LED signals a second fault that has occurred within the reset time, e. g. by an automatic reclose attempt. The device provides automatic reset options, either after expiry of a pre-set time, by closing an external input contact or manually by pressing the "Test" button. A function test can also be carried out either by the "Test" button or an external input contact.

The DIP switches on the front face of the device are used to adjust the values for trip current, response delay and time reset, as well as the required remote signal contact type (permanent or momentary contact).



SIGMA 2.0, plug-in housing



SIGMA F+E 2.0, plug-in housing



# SIGMA 2.0/SIGMA F+E 2.0

Short-Circuit Indicator/Short-Circuit and Earth Fault Indicator

Technical Data	SIGMA 2.0	SIGMA F+E 2.0
Short-circuit indicator	▪	▪
Earth fault indicator	—	▪
I <sub>&gt;&gt;</sub> Short-circuit trip current	<ul style="list-style-type: none"> <li>▪ 200, 300, 400, 600, 800 or 2,000 A, fixed setting</li> <li>▪ Self-adjustment to load current (I<sub>L</sub> = load current): I<sub>L</sub> &lt; 100 A → I<sub>&gt;&gt;</sub> = 400 A, I<sub>L</sub> &gt; 100 A → I<sub>&gt;&gt;</sub> = 4 x I<sub>L</sub></li> </ul>	
tI <sub>&gt;&gt;</sub> Response delay	40 ms or 80 ms	
I <sub>E&gt;</sub> Earth fault trip current	—	20, 40, 60, 80, 100, 120 or 160 A
tI <sub>E&gt;</sub> Response delay	—	80 or 160 ms
Accuracy	±10 %	
Indication	Bright LED displays: <ul style="list-style-type: none"> <li>▪ Short-circuit: 3 red LEDs (L1, L2, L3)</li> </ul>	Bright LED displays: <ul style="list-style-type: none"> <li>▪ Short-circuit: 3 red LEDs (L1, L2, L3) or 1 x phase-selective earth fault</li> </ul>
Reset	<ul style="list-style-type: none"> <li>▪ Manual reset</li> <li>▪ Automatic time reset: 1, 2, 4 or 8 h, adjustable</li> <li>▪ Remote reset</li> </ul>	
Remote signal	1 Relay contact	2 Relay contacts
Remote contact	Potential-free permanent or momentary contact (1 s), adjustable Contact capacity: 230 V AC/1 A/62,5 VA max. 220 V DC/1 A/60 W max.	
Power supply	Long-life lithium cell, shelf life ≥20 years, >1.000 h total flashing time, Optional: external power supply, integrated in unit: 12–60 V DC	
Housing	Polycarbonate, IP40 (plug-in housing), IP65 (surface mount housing)	
Temperature range	-30 to +70 °C	

Dimension drawing see on page 49, M3

	SIGMA 2.0	SIGMA F+E 2.0
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit</li> <li>▪ 3 Short-circuit current sensors</li> </ul>	<ul style="list-style-type: none"> <li>▪ 1 Display unit</li> <li>▪ 3 Short-circuit current sensors</li> </ul>

Article	Order No.	SIGMA F+E 2.0
	SIGMA 2.0	
Display unit in plug-in housing	37-1111-101	37-2111-101
Display unit in plug-in housing with external power supply (AC/DC)	37-1121-101	37-2121-101
Current sensors	see on page 30 and 31	
Accessories	see on page 32 and 33	

# SIGMA F+E 3

## Short-Circuit and Earth Fault Indicator

### Product Features

- Short-circuit and earth fault detection from only 3 single-phase current sensors
- Phase-selective fault indication and fault signalling
- Load-dependent self-adjustment or fixed values
- Single and double flashing mode for ring and radial operated distribution networks

The SIGMA F+E 3 2.0 device is a combined short-circuit and earth fault indicator. It is designed to detect, display and remotely indicate short-circuit and earth faults in medium voltage distribution networks.

Only three single-phase current sensors are used for sensing short-circuits and earth faults allowing phase-selective detection, indication and remote signalling (or group signalling) of faults.

The red LED I>> indicates that a short-circuit has occurred whereas the yellow LED I<sub>E</sub>> signals an earth fault. The L1, L2 and L3 indication fields display the fault-affected phase.



SIGMA F+E 3 2.0, plug-in housing



Current sensor 49-6024-001



Current sensor 49-6025-601

# SIGMA F+E 3

## Short-Circuit and Earth Fault Indicator

Technical Data	SIGMA F+E 3
Short-circuit indicator	▪
Earth fault indicator	▪
I <sub>&gt;&gt;</sub> Short-circuit trip current	200, 300, 400, 600, 800, 1,000 or 2,000 A, fixed setting Self-adjustment as a function of the operating current (I <sub>L</sub> = load current): I <sub>L</sub> < 100 A ⇒ I <sub>&gt;&gt;</sub> = 400 A, I <sub>L</sub> > 100 A ⇒ I <sub>&gt;&gt;</sub> = 4 x I <sub>L</sub> , I <sub>&gt;&gt;</sub> max. = 2,000 A
tI <sub>&gt;&gt;</sub> Response delay	40, 80, 200 or 300 ms
I <sub>E&gt;</sub> Earth fault trip current	20, 40, 60, 80, 100, 120 or 160 A
tI <sub>E&gt;</sub> Response delay	60, 80, 200 or 300 ms
Accuracy	5 % (0–630 A) 10 % (>630 A)
Indication	Bright LED displays: <ul style="list-style-type: none"> <li>▪ 3 red LEDs: phase-selective L1, L2, L3</li> <li>▪ 1 red LED: short-circuit I<sub>&gt;&gt;</sub></li> <li>▪ 1 yellow LED: earth fault I<sub>E&gt;</sub></li> </ul>
Reset	<ul style="list-style-type: none"> <li>▪ Manual reset</li> <li>▪ Automatic time reset: 2, 4, 8 or 24 h</li> <li>▪ Remote reset</li> <li>▪ Current restoration</li> </ul>
Remote signal	3 Relay contacts
Remote contact	Permanent or momentary contact (1 s), adjustable Contact capacity: 230 V AC/1 A/62.5 VA max. 220 V DC/1 A/60 W max.
Power supply	Long-life lithium cell, shelf life ≥20 years, total flashing time >1,000 h
Housing	Polycarbonate, IP40 (plug-in housing)
Temperature range	-30 to +70 °C

Dimension drawing see on page 49, M3

	SIGMA F+E 3
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit (plug-in housing)</li> <li>▪ 3 Short-circuit current sensors</li> </ul>

Article	Order No.
Display unit in plug-in housing	37-5113-001
Current sensors	see on page 30 and 31
Accessories	see on page 32 and 33

# SIGMA D++/SIGMA D+/SIGMA D

## Directional Fault Indicator

### Product Features

- CT powered directional short-circuit and directional earth fault indicator for all distribution networks/neutral point treatments
- Earth fault detection with up to 5 different earth fault detection methods, also in combination
- Clear indication and signalling of fault direction
- Fully automatic voltage calibration
- Easy and flexible parameter setting via DIP switch or USB port
- Event memory for fault evaluation
- Multicolour LED status display
- Remote signalling via freely programmable relays
- SIGMA Explorer Software: Commissioning and parameterisation via front accessible USB port

### Special features of SIGMA D++

- Only 3 single-phase current sensors needed for all earth fault detection methods
- Wide-range power supply 24 V to 230 V AC/DC

The SIGMA D series are combined directional short-circuit and directional earth fault indicators for medium voltage distribution networks. The devices are current sensor powered, thus no auxiliary supply is required. For the current measurement single-phase current sensors resp. a summation current sensor are required. The voltage information will be taken from an integrated voltage detecting system, either WEGA 1.2 C, WEGA 2.2 C or WEGA 1.2 C vario. Optionally, the voltage information can be taken from an HR interface or capacitive insulators.

The SIGMA D+ and SIGMA D++ provide additional earth fault detection methods for compensated and isolated neutral networks. The calculation or measurement of the summation current is chosen via DIP switches for all earth fault detection methods.

The variants differ in regard of the transient earth fault method.

### SIGMA D+

For the transient earth fault method with the SIGMA D+ a summation current sensor is mandatory, auxiliary supply is optional.

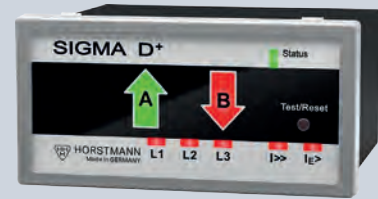
### SIGMA D++

For the transient earth fault method only 3 single-phase current sensors are needed, but auxiliary supply is mandatory. The connection of a summation current sensor is optional.

The auxiliary supply is not needed if only the  $\cos \varphi$  or  $\sin \varphi$  method – without the transient earth fault method – is used for the fault direction indication.



SIGMA D++



SIGMA D+



SIGMA D

# SIGMA D++/SIGMA D+/SIGMA D

## Directional Fault Indicator

Technical Data	SIGMA D	SIGMA D+	SIGMA D++
Detection of short-circuit and earth fault direction	▪	▪	▪
Earth fault detection methods	Earth short-circuit	Transient, earth short-circuit, $\cos \varphi$ or $\sin \varphi$	
$I_{>>}$ Short-circuit trip current	<ul style="list-style-type: none"> <li>DIP: 200, 300, 400, 600, 800, 2,000 A (fixed settings), self-adjustment</li> <li>SW: 50–2,000 A (1 A steps)</li> </ul>		
$t_{l>>}$ Response delay	DIP: 40, 80 ms; SW: 40 ms–60 s		
$I_{E>}$ Earth short-circuit trip current	DIP: off, 20, 40, 60, 80, 100, 120, 160 A; SW: 20–1,000 A (1 A steps)		
$t_{lE>}$ Response delay	DIP: 80, 160 ms; SW: 40 ms–60 s		
Accuracy	3 % (0–630 A, resolution 1 A) 5 % (630–1,500 A) 10 % (1,500–2,000 A)		
$I_{ET>}$ Transient method, trip current	—	10–100 A	10–500 A
$I_{EP>}$ Active current, $\cos \varphi$ trip current	—	5–200 A	
$I_{EQ>}$ Reactive current $\sin \varphi$ , trip current	—	5–200 A	
$t_{lEP>}/t_{lEQ>}$ Response delay	—	40 ms–60 s	
Indication	LED fault direction arrows red/green		
Reset	<ul style="list-style-type: none"> <li>Manual reset</li> <li>Remote reset</li> <li>Automatic time reset: DIP: 2, 4, 8, 24 h; SW: 1 min–24 h</li> <li>Current and voltage restoration</li> </ul>		
Remote signal/Communication	4 potential-free, freely programmable relay contacts		
Parameter setting	<ul style="list-style-type: none"> <li>USB 2.0 interface, connection to software</li> <li>Via DIP switch</li> </ul>		
Remote contact	4 permanent or momentary contacts (1 s), NC or NO (adjustable) Contact capacity: 230 V AC/1 A/62.5 VA max.; 220 V DC/1 A/60 W max.		
Voltage calibration	Manual/automatic		
Current sensor powered	▪	▪	▪
Internal power supply	Long-life lithium cell; shelf life $\geq 20$ years		
External power supply (auxiliary supply)	–	24 V AC/24–60 V DC optional	24–230 V AC/DC optional (required for transient method)
Housing	Polycarbonate, IP40 (plug-in housing)		
Temperature range	-30 to +70 °C		

Dimension drawing see on page 49, M3

	SIGMA D	SIGMA D+	SIGMA D++
Equipment set	<ul style="list-style-type: none"> <li>1 Display unit (plug-in housing)</li> <li>3 Single-phase current sensors</li> </ul>	<ul style="list-style-type: none"> <li>1 Display unit (plug-in housing)</li> <li>3 Single-phase current sensors</li> <li>1 Summation current sensor (required for transient method)</li> </ul>	<ul style="list-style-type: none"> <li>1 Display unit (plug-in housing)</li> <li>3 Single-phase current sensors</li> <li>1 Summation current sensor (optional)</li> </ul>

Article	Order No.		
	SIGMA D	SIGMA D+	SIGMA D++
Display unit in plug-in housing	37-6000-001	37-6100-001	37-6200-001
Current sensors	see on page 30 and 31		
Accessories	see on page 32 and 33		
External signal lamp	see on page 33		

Autumn  
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## ComPass A 2.0

Short-Circuit and Earth Fault Indicator with Control Function

### Product Features

- Short-circuit and earth fault indicator
- Suitable for all types of networks/neutral point treatments
- Earth fault detection with earth short-circuit and pulse detection method
- LED and OLED display: for good visibility
- High-precision current measurement to 0.5 %
- PT-100 temperature sensor for equipment monitoring
- Monitoring of the parameters current (I), temperature (T) and frequency (f)
- Limit monitoring: I, T
- ComPass Explorer Software: Commissioning and parametrisation via front accessible USB port

The ComPass A 2.0 is suitable for use in substations with a remote control connection of the electrical power distribution in a medium voltage network. In addition to the short-circuit and earth fault function, ComPass A 2.0 supplies measured current values from the station for transmission to the control room. The PT-100 sensor measures the temperature, for example of the transformer or the transformer station. For all measured values limits can be defined, which can also be transmitted to the control room.

Phase selectivity and fault (earth fault or short-circuit) are shown in the OLED display. Additionally trip current values and pre trip current values are logged with time stamp.



ComPass A 2.0, plug-in housing

# ComPass A 2.0

Short-Circuit and Earth Fault Indicator with Control Function

Technical Data	ComPass A 2.0
Short-circuit and earth fault indicator	▪
Earth fault detection methods	Earth short-circuit
Measured values/Indication	<ul style="list-style-type: none"> <li>▪ Phase currents I1, I2, I3, IE with phase angle</li> <li>▪ Operating current, I1, I2, I3, IE <math>\varnothing</math>15 min, I1, I2, I3 max. 24 h/7 days/365 days</li> <li>▪ Maximum demand indicator I max. LR (last reset) I1, I2, I3</li> <li>▪ Frequency f</li> <li>▪ Temperature T</li> </ul>
Measurement accuracy phase currents	up to 0.5 %/0.5 A depending on the type of sensor (split-core or closed bushing type)
I>> Short-circuit trip current	20–2,000 A
tl>> Response delay	40 ms–60 s
I $\overline{E}$ > Earth short-circuit trip current	10–1,000 A
tl $\overline{E}$ > Response delay	40 ms–60 s
Limit monitoring I> Overload current T</T<</T>/T>> Temperature	5–1,500 A; tl> Response delay: 40 ms–60 s -40 to +85 °C
Indication	<ul style="list-style-type: none"> <li>▪ LED status display (multicolour)</li> <li>▪ OLED display (multilingual)</li> </ul>
Reset	<ul style="list-style-type: none"> <li>▪ Manual or remote reset</li> <li>▪ Automatic time reset: 1 min–24 h</li> <li>▪ Via RS485/Modbus interface</li> <li>▪ Auxiliary supply restoration, current restoration</li> <li>▪ ComPass Explorer Software</li> </ul>
Remote signal/Communication	<ul style="list-style-type: none"> <li>▪ 4 potential-free relay contacts, freely configurable</li> <li>▪ RS485/Modbus interface</li> </ul>
Parameter setting	USB port with ComPass Explorer Software
Remote contact	4 permanent or momentary contacts, bistable, NC or NO Contact capacity: 230 V AC/1 A/62.5 VA max.; 220 V DC/1 A/60 W max.
Binary inputs	▪ 2, potential-free, 1 s < t < 5 s
Power supply	<ul style="list-style-type: none"> <li>▪ External: 24–230 V AC/DC (<math>\pm</math>10 %)</li> <li>▪ Internal: 3.6 V, long-life lithium cell, shelf life <math>\geq</math>20 years, &gt;1,000 h total flashing time of the LED, &gt;1,000 activations of the display</li> </ul>
Housing	Polycarbonate, IP50 (plug-in housing)
Housing dimensions	96 x 48 x 107 mm (W x H x D), installation depth: 90 mm
Temperature range	-30 to +70 °C

Dimension drawing see on page 49, M4

	ComPass A 2.0
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit</li> <li>▪ 3 Single-phase current sensors</li> </ul>

Article	Order No.
Display unit in plug-in housing	38-0152-001
Current sensors	see on page 30 and 31
Accessories	see on page 32 and 33

# ComPass A

## Short-Circuit and Earth Fault Indicator

### Product Features

- Short-circuit and earth fault detection by 3 single-phase current sensors
- Phase-selective current monitor
- Multilingual OLED display, additional multicolour LED
- Remote indication via RS485/Modbus interface and 4 freely configurable relay contacts
- Simple and intuitive operation, easy-to-read display

The ComPass A device is a combined short-circuit and earth fault indicator for medium voltage distribution networks with solidly or low-impedance earthed neutral system.

The device indicates all measuring results and parameter settings on a menu-controlled display. Via Modbus protocol the device can be parameterised and reports the fault events and measured data to the SCADA. Additionally 4 relay contacts for SCADA application are available.

When the previously set trip values are exceeded, the red LED will start flashing. By operating the rocker switch short-circuits or earth faults will be displayed in plain text format. The device saves the last 20 events along with date, time, and information on fault currents.



ComPass A, plug-in housing



# ComPass A

## Short-Circuit and Earth Fault Indicator

Technical Data	ComPass A
Short-circuit indicator	▪
Earth fault indicator	▪
Measured values/Indication	<ul style="list-style-type: none"> <li>▪ Phase currents I1, I2, I3, IE with phase angle</li> <li>▪ Operating current, I1, I2, I3, IE <math>\varnothing</math>15 min, I1, I2, I3 max. 24 h/7 days/365 days</li> <li>▪ Maximum demand indicator I max. LR (last reset) I1, I2, I3</li> <li>▪ Frequency f</li> </ul>
I>> Short-circuit trip current	10–2,000 A (1 A steps)
tl>> Response delay	40 ms–60 s (10 ms steps)
IE> Earth fault trip current	20–1,000 A
tlE> Response delay	40 ms–60 s
Accuracy	3 % (0–630 A, resolution 1 A) 5 % (630–1,500 A) 10 % (1,500–2,000 A)
Indication	<ul style="list-style-type: none"> <li>▪ LED status display (multicolour)</li> <li>▪ OLED display (multilingual)</li> </ul>
Reset	<ul style="list-style-type: none"> <li>▪ Manual or remote reset</li> <li>▪ Automatic time reset: 1 min–24 h</li> <li>▪ Via RS485/Modbus interface</li> <li>▪ Auxiliary supply restoration</li> <li>▪ Current restoration</li> </ul>
Remote signal/Communication	<ul style="list-style-type: none"> <li>▪ 4 potential-free relay contacts, freely configurable</li> <li>▪ RS485/Modbus interface</li> </ul>
Remote contact	4 permanent or momentary contacts (1 s), NC or NO Contact capacity: 230 V AC/1 A/62.5 VA max.; 220 V DC/1 A/60 W max.
Power supply	<ul style="list-style-type: none"> <li>▪ External: 24 V–230 V AC/DC (<math>\pm</math>10 %)</li> <li>▪ Internal backup supply:                Long-life lithium cell, shelf life <math>\geq</math>20 years,                &gt;1,000 h total flashing time of the LED, &gt;1,000 activations of the display</li> </ul>
Housing	Polycarbonate, IP40 (plug-in housing)
Temperature range	-30 to +70 °C

Dimension drawing see on page 49, M3

	ComPass A
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit (plug-in housing)</li> <li>▪ 3 Single-phase current sensors</li> </ul>

Article	Order No.
Display unit in plug-in housing	38-0102-001
Current sensors	see on page 30 and 31
Accessories	see on page 32 and 33

NEW!

## ComPass B 2.0/ComPass Bs 2.0

Directional Fault Passage Indicator, Monitoring, Control function

### Product Features

- Directional short-circuit and directional earth fault indicator
- Clear fault indication and reading on-site: 2 directional arrow LEDs (A, B) and high contrast OLED display
- Monitoring of the parameters voltage (V), current (I), load flow direction (B↓ or A↑), power factor ( $\cos \varphi$ ), power (P, Q, S), energy (E), temperature (T) and frequency (f)
- Suitable for all types of networks/neutral point treatments
- Earth fault detection with 6 different earth fault detection methods, also in combination
- High-precision current and voltage measurement to 0.5 %
- Voltage monitoring with connection to capacitive and resistive (ohmic) sensors in one indicator
- PT-100 temperature sensor for equipment monitoring
- Limit monitoring: V, I, P, Q, T
- ComPass Explorer Software: Commissioning and parametrisation via front accessible USB port

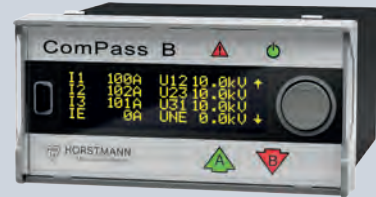
### Additional features of the Control ComPass Bs 2.0:

- Control ComPass Bs 2.0 for remote controlling of a load-break switch or circuit-breaker
- Free assignment of 6 binary inputs for the collection and transmission of relevant switchgear/station data
- Freely programmable logic for flexible definition of switchgear conditions

The ComPass B 2.0 is suitable for use in substations with a remote control connection of the electrical power distribution in a medium voltage network. In addition to the short-circuit and earth fault function, ComPass B 2.0 supplies the collected measured values of current, voltage and power from the station for transmission to the control room. The PT100 sensor measures the temperature, for example of the transformer or the transformer station. For all measured values limits can be defined, which can also be transmitted to the control room.

The voltage coupling/measurement is done via the capacitive VDS system or via resistive (ohmic) voltage sensors. Up to four ComPass can be connected to one set of resistive voltage sensors.

In addition to the functions of the ComPass B 2.0, the Control ComPass Bs 2.0 offers a control function for switching a load-break switch or circuit-breaker. A free assignment of 6 binary inputs in combination with a freely programmable logic (PLC functionality) enables the user to define the switching conditions in a flexible manner. Random information, such as the SF6 gas disruption or HV tripped fuse, can be captured via the binary inputs.



ComPass B 2.0, plug-in housing



Control ComPass Bs 2.0, plug-in housing

# ComPass B 2.0/ComPass Bs 2.0

Directional Fault Passage Indicator, Monitoring, Control function

Technical Data	ComPass B 2.0	ComPass Bs 2.0
Detection of short-circuit and earth fault direction	▪	▪
Earth fault detection methods	Permanent, earth short-circuit, transient, $\cos \varphi$ and $\sin \varphi$	
Control system/freely programmable logic	—	▪
Measured values/Indication	<ul style="list-style-type: none"> <li>▪ Phase currents <math>I_1, I_2, I_3, I_E</math> with phase angle</li> <li>▪ Phase-to-earth voltage <math>V_1, V_2, V_3, V_{NE}</math> and phase-to-phase voltage <math>V_{12}, V_{23}, V_{31}, V_{NE}</math> with phase angle</li> <li>▪ Load flow direction <math>B \downarrow</math> or <math>A \uparrow</math></li> <li>▪ P, Q, S and <math>\cos \varphi</math> (power factor) (<math>P_{1,2,3}, Q_{1,2,3}, S_{1,2,3}, \cos \varphi_{1,2,3}</math> via RS485)</li> <li>▪ Amount of active energy, separate for load flow direction <math>B \downarrow</math> or <math>A \uparrow</math>; additionally per phase</li> <li>▪ Operating current, <math>I_{1,2,3} \varnothing 15 \text{ min}, I_{\text{max. 24 h/7 days/365 days}}</math>, max. demand indicator <math>I_{\text{max. LR}}</math></li> <li>▪ Power frequency <math>f</math></li> <li>▪ Temperature <math>T</math></li> </ul>	
Measurement accuracy phase currents	up to 0.5 %/0.5 A depending on the type of sensor (split-core or closed bushing type)	
Measurement accuracy voltages	up to 0.5 % in the range of 80–120 %/ $V_{\text{nom}}$ , depending on the type of sensor (resistive or capacitive)	
$I_{>>}$ Short-circuit trip current	20–2,000 A; $t_{I_{>>}}$ Response delay: 40 ms–60 s	
$V_{NE>}$ Permanent earth fault trip values	1–100 %; $t_{V_{NE>}}$ Response delay: 40 ms–60 s	
$I_{ES>}/I_{ES>>}$ Earth short-circuit trip current	10–1,000 A; $t_{I_{ES>}}/t_{I_{ES>>}}$ Response delay: 40 ms–60 s	
$I_{ET>}$ Transient method	1–500 A	
$I_{EP>}$ Active current $\cos \varphi$ / $I_{EQ>}$ Reactive current $\sin \varphi$	1–200 A; $t_{I_{EP>}}/t_{I_{EQ>}}$ Response delay: 40 ms–60 s	
Limit monitoring	<ul style="list-style-type: none"> <li><math>I_{&gt;}</math> Overload current 5–1,500 A; <math>t_{I_{&gt;}}</math> Response delay: 40 ms–60 s</li> <li><math>V_{&gt;}</math> Over-voltage 100–200 %; <math>t_{V_{&gt;}}</math> Response delay: 40 ms–60 s</li> <li><math>V_{&lt;}</math> Under-voltage 1–100 %; <math>t_{V_{&lt;}}</math> Response delay: 40 ms–60 s</li> <li><math>P_{&gt;}/P_{&gt;&gt;}</math> Active power 1–30,000 kW; <math>t_{P_{&lt;}}/t_{P_{&gt;&gt;}}</math> Response delay: 40 ms–60 s</li> <li><math>Q_{&gt;}/Q_{&gt;&gt;}</math> Reactive power 1–30,000 kW; <math>t_{Q_{&lt;}}/t_{Q_{&gt;&gt;}}</math> Response delay: 40 ms–60 s</li> <li><math>T_{&lt;}/T_{&lt;&lt;}/T_{&gt;}/T_{&gt;&gt;}</math> Temperature -40 to +85 °C</li> </ul>	
Indication	LED fault direction and status indicators (multicolour); OLED display (multilingual)	
Reset	<ul style="list-style-type: none"> <li>▪ Local, remote, automatic time reset: 1 min–24 h</li> <li>▪ Via RS485/MODBUS interface</li> <li>▪ Auxiliary supply restoration, voltage and current restoration</li> <li>▪ ComPass Explorer Software</li> </ul>	
Remote signal/Communication	<ul style="list-style-type: none"> <li>▪ 4 potential-free, freely programmable relay contacts</li> <li>▪ RS485/MODBUS interface</li> </ul>	
Parameter setting	USB port with ComPass Explorer Software	
Remote contact	4 permanent or momentary contacts, bistable, NC/NO Contact capacity: 230 V AC/1 A/62.5 VA max 220 V DC/1 A/60 W max.	4 permanent or momentary contacts, monostable, NC/NO Contact capacity: 250 V AC/6 A; 30 V DC/6 A, resistive load
Binary inputs	2, potential-free, $1 \text{ s} < t < 5 \text{ s}$	6, freely programmable, max. 30 V DC
Power supply	<ul style="list-style-type: none"> <li>▪ External: 24–230 V AC/DC (<math>\pm 10 \%</math>)</li> <li>▪ Internal: 3.6 V, long-life lithium cell, shelf life <math>\geq 20</math> years, &gt;1,000 h total flashing time of the LED, &gt;1.000 display activations</li> </ul>	
Housing	Polycarbonate, IP50 (plug-in housing)	
Housing dimensions	96 x 48 x 107 mm (W x H x D), installation depth: 90 mm	
Temperature range	-30 to +70 °C	

Dimension drawing see on page 49, M4

	ComPass B 2.0	ComPass Bs 2.0
Equipment set	1 Display unit + 3 single-phase current sensors (combination with summation sensor possible: 3+1 or 2+1)	

Article	Order No.	
	ComPass B 2.0	ComPass Bs 2.0
Display unit in plug-in housing	38-4150-001	38-4153-001
Current sensors	see on page 30 and 31	
Accessories	see on page 32 and 33	

# ComPass B

## Directional Short-Circuit and Directional Earth Fault Indicator

### Product Features

- Directional short-circuit and directional earth fault detection for all distribution networks/neutral point treatments
- Monitoring of V, I, f
- Load monitoring and load flow direction monitoring P, Q, S,  $\cos \varphi$ , E
- Voltage monitoring V<, V>
- Active energy to load flow direction B↓ or A↑
- Multilingual OLED display, additional multicolour LED
- Remote indication using RS485/Modbus interface and 4 freely configurable relay contacts
- User friendly, simple and intuitive operation, easy-to-read display

The ComPass B combines the functions of a directional short-circuit and directional earth fault indicator in one unit for medium voltage distribution networks. The voltage information will be taken from the integrated voltage detecting system, either WEGA 1.2 C, WEGA 2.2 C or WEGA 1.2 C vario. Optional the voltage information can be taken from the HR interface or capacitive insulators.



ComPass B, plug-in housing

# ComPass B

Directional Short-Circuit and Directional Earth Fault Indicator

Technical Data	ComPass B
Short-circuit indicator	▪
Earth fault indicator	▪
Detection of short-circuit current direction	▪
Detection of earth fault current direction	▪
Measured values/Indication	<ul style="list-style-type: none"> <li>▪ Phase currents <math>I_1, I_2, I_3, I_E</math> with phase angle</li> <li>▪ Phase-to-earth voltage <math>V_1, V_2, V_3, V_{NE}</math> and phase-to-phase voltage <math>V_{12}, V_{23}, V_{31}, V_{NE}</math></li> <li>▪ Load flow direction <math>B \downarrow</math> or <math>A \uparrow</math></li> <li>▪ S, P, Q and <math>\cos \varphi</math> (S<sub>1,2,3</sub>, P<sub>1,2,3</sub>, Q<sub>1,2,3</sub>, <math>\cos \varphi_{1,2,3}</math>)</li> <li>▪ Effective energy (E1A, E2A, E3A, EA, E1B, E2B, E3B, EB)</li> <li>▪ Operating current, <math>I_1, I_2, I_3, I_E</math> <math>\varnothing</math>15 min, <math>I_1, I_2, I_3</math> max. 24 h/7 days/365 days, maximum demand indicator I max. LR (last reset) <math>I_1, I_2, I_3</math></li> <li>▪ Frequency f</li> </ul>
V> Overvoltage trip values	100 %–200 %
V< Undervoltage trip values	0 %–100 %
I>> Short-circuit trip current	20–2,000 A (1 A steps)
tI>> Response delay	40 ms–60 s (10 ms steps)
I<E> Earth fault trip current	20–1,000 A (1 A steps) (low-impedance/solidly earthed network) 5–200 A (1 A steps) (isolated/compensated network)
tI<E> Response delay	40 ms–60 s
Accuracy	3 % (0–630 A, resolution 1 A) 5 % (630–1,500 A) 10 % (1,500–2,000 A)
Indication	LED status display (multicolour) and OLED display (multilingual)
Reset	<ul style="list-style-type: none"> <li>▪ Manual or remote reset</li> <li>▪ Automatic time reset: 1 min–24 h</li> <li>▪ Via RS485/MODBUS interface</li> <li>▪ Auxiliary supply restoration</li> <li>▪ Voltage restoration</li> <li>▪ Current restoration</li> </ul>
Remote signal/Communication	<ul style="list-style-type: none"> <li>▪ 4 potential-free relay contacts, freely configurable</li> <li>▪ RS485/MODBUS interface</li> </ul>
Remote contact	4 permanent or momentary contacts (1 s), NC or NO Contact capacity: 230 V AC/1 A/62,5 VA max.; 220 V DC/1 A/60 W max.
Power supply	<ul style="list-style-type: none"> <li>▪ External: 24 V–230 V AC/DC (<math>\pm</math>10 %)</li> <li>▪ Internal: Long-life lithium cell, shelf life <math>\geq</math>20 years, &gt;1,000 h total flashing time of the LED, &gt;1,000 activations of the display</li> </ul>
Housing	Polycarbonate, IP40 (plug-in housing)
Temperature range	-30 to +70 °C

Dimension drawing see on page 49, M3

	ComPass B
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit (plug-in housing)</li> <li>▪ 3 Single-phase current sensors (or 2 + 1 summation current sensors)</li> </ul>

Article	Order No.
Display unit in plug-in housing	38-4102-001
Current sensors	see on page 30 and 31
Accessories	see on page 32 and 33
External signal lamp	see on page 33

# Current Sensors

## Type SIGMA and ComPass

### Single-phase current sensors for new installation on bushings



Switchgear Manufacturer <sup>1)</sup>	Type	Order No.
ABB	SafeLink, SafePlus, SafeRing	3x 49-6025-000 or 3x 49-6025-301
Driescher	MINEX, MINEX C, G.I.S.E.L.A.	3x 49-6025-601*
EATON	XIRIA	3x 49-6025-000 or 3x 49-6025-301
Lucy Electric	AegisPlus	3x 49-6025-601
Ormazabal	GA/GAE + GE	3x 49-6025-311
Schneider Electric	RM6	3x 49-6025-601
Schneider Electric	FBX	3x 49-6025-602*
Siemens	8DJH (module transformer)	2x 49-6025-611, 1x 49-6025-612

1) For screened connectors only. Insulation level: 0.72/3 kV.

\* Without retaining plates. Please contact the manufacturer for retaining plates.

### Single-phase current sensors for retrofit on insulated cables



Article	Conductor $\varnothing$ [mm]	Cable Length [m]	Order No.
Split-core cable-type current sensor	15–55	3	49-6024-001
Split-core cable-type current sensor	15–65	3	49-6024-010

# Current Sensors

Type SIGMA and ComPass

## Earth fault current sensors for installation on insulated cables

for short-circuit and earth fault indicators type SIGMA D+/D++, ComPass B



Article	Inner ø [mm]	Cable Length [m]	Order No.
Split-core summation sensor	150	4	49-6023-005
Split-core summation sensor	220–250	4	49-6023-020

## Voltage sensors for installation in connector sets

for short-circuit and earth fault indicators type ComPass B 2.0, ComPass Bs 2.0



Article	for T connector sets	Order No.
3 voltage sensors, long cone; shielded 2 pole cable with connector, 3.5 m; incl. connecting terminal and termination resistor	Nexans: (K) 400TB Cellpack: CTS Südkabel: SEHDT 13, SEHDT 23	38-9100-013
3 voltage sensors, short cone; shielded 2 pole cable with connector, 3.5 m; incl. connecting terminal and termination resistor	Nkt: CB-24, CC-24 Raychem: RSTI-58xx, RSTI-CC-58xx	38-9100-017

Further cable lengths are available on request.

## Adapter and voltage sensors for direct installation on A cone in the switchgear or on the transformer

for short-circuit and earth fault indicators type ComPass B 2.0, ComPass Bs 2.0



Article	Order No.
3 voltage sensors with adapters for A cones; shielded 2 pole cable with connector, 6 m; incl. connecting terminal and termination resistor	38-9100-026

## Accessories for Short-Circuit and Earth Fault Indicators

### Voltage interface

for directional indicator types ComPass B, ComPass B 2.0, ComPass Bs 2.0, SIGMA D, SIGMA D+, SIGMA D++

Article	Order No.
WEGA 1.2 C	see on page 65
WEGA 2.2 C	see on page 67
WEGA 1.2 C vario	see on page 66
HR interface cable to match specific switchgear types for ComPass B	49-0509-0xx <sup>1)</sup>
HR interface cable to match specific switchgear types for SIGMA D/D+/D++, ComPass B 2.0/Bs 2.0	49-0509-2xx <sup>1)</sup>
Set of connection cables (ComPass–WEGA X.2 C)	49-0509-0xx <sup>2)</sup>
Set of connection cables (SIGMA D/D+/D++–WEGA X.2 C ComPass B 2.0/Bs 2.0–WEGA X.2 C)	49-0509-1xx <sup>2)</sup>

1) For a customised application the following data are required:

- Switchgear type and compartment
- Operating voltage of the installation (Vnom)
- Cable length of the HR interface cable
- Short-circuit current of HR socket
- Current measured via HO-M adapter of HR socket

2) For a customised application the following data are required:

- Cable length of the connection cables
- Connection to WEGA (AMP or flat connector)

### Installation system

for ComPass, SIGMA D, SIGMA D+, SIGMA D++

Article	Order No.
Tablet for parameter setting during installation or monitoring, incl. power supply and USB cable	49-6022-010

### Accessories

for plug-in housings

Article	Order No.
Disassembly clip	040401-0008
Disassembly clip ComPass B 2.0/Bs 2.0	040408-0005
Spring clip suitable for 2 mm front plate thickness (standard)	040804-0009
Spring clip suitable for 3 mm front plate thickness	040804-0010



WEGA 1.2 C



WEGA 2.2 C



WEGA 1.2 C vario



Interface cable (e. g.)



Installation system



Disassembly clip





V49-9001-007-001



V49-9001-004-001



49-9001-001 / 49-9001-002



49-9001-006



49-0702-005



49-0706-001



49-0704-001

# Accessories

## for Short-Circuit and Earth Fault Indicators

### Wall-mounted housings

for the installation of short-circuit and earth fault indicators outside the switch-gear

Article	Order No.
Wall-mounted housing including earthing bar 290 x 74 x 200 mm (W x H x D)	V49-9001-007-001
Wall-mounted housing including earthing bar 125 x 175 x 125 mm (W x H x D)	V49-9001-004-001
Wall-mounted housing 125 x 75 x 125 mm (W x H x D) Bottom cable entry Rear cable entry	49-9001-001 49-9001-002
Wall-mounted housing 125 x 75 x 75 mm (W x H x D)	49-9001-006

### External signal lamp

for installation outside the switchgear

Article	Order No.
External signal lamp with 3 LEDs, 5 m connection cable, for permanent contact, with battery	49-0702-005
External signal lamp with 3 LEDs, 10 m connection cable, for permanent contact, with battery	49-0702-010
External signal lamp „bicolor“ with 3 LEDs (red/green), 3 m connection cable, with battery	49-0706-001
External signal lamp „bicolor“ for connection of fibre optic cables, 1 LED (rot/green), 2 m connection cable, with battery	49-0704-001





EARTH 4.0, surface mount housing



Summation current transformer



External signal lamp

## EARTH 4.0

### Earth Fault Indicator

#### Product Features

- Indication of earth fault currents by LED and mechanical flag
- Remote indication, test and reset via relay contacts
- Battery status indication and remote indication via relay contact

The EARTH 4.0 device is an earth fault indicator. It is designed to detect, locally indicate and remotely report earth fault currents in medium voltage distribution networks. A wired earth fault current transformer monitors the summation current of all three conductors. The electronics of the display unit evaluates the measurements. When the fault sensitivity threshold is exceeded, a red LED will start flashing and a mechanical flag becomes visible. In addition to that, the remote indication contacts are energised. A system-specific external signal lamp is optionally available.

Technical Data	EARTH 4.0
Earth fault indicator	▪
I <sub>E&gt;</sub> Earth fault trip current	25, 50, 60 or 80 A, adjustable <sup>1)</sup>
tI <sub>E&gt;</sub> Response delay	80 or 160 ms <sup>1)</sup>
Accuracy	±10 %
Indication	<ul style="list-style-type: none"> <li>▪ 1 red LED</li> <li>▪ 1 yellow LED (battery status)</li> <li>▪ Mechanical flag</li> </ul>
Test	<ul style="list-style-type: none"> <li>▪ Manual by button located at the side</li> <li>▪ Remote contact</li> </ul>
Reset	<ul style="list-style-type: none"> <li>▪ Manual by button located at the side</li> <li>▪ Remote contact</li> <li>▪ Automatic time reset: after expiry of 1, 2, 4, 8 h</li> <li>▪ Voltage restoration (220–240 V AC, ≥10 %)</li> </ul>
Remote signal	<ul style="list-style-type: none"> <li>▪ 2 relay contacts (change over) for earth fault indication</li> <li>▪ 1 relay contact (change over) for battery status indication</li> </ul>
Remote contact	Permanent or momentary contact (1 s), adjustable Contact capacity: 230 VAC/1 A/62.5 VA max. 220 VDC/1 A/60 W max.
Power supply	Long-life lithium cell, shelf life ≥20 years, total flashing time ≥1,200 h
Housing	Polycarbonate, IP65 (surface mount housing)
Temperature range	-30 to +70 °C

1) Further trip currents on request  
Dimension drawing see on page 50, M7

	EARTH 4.0
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit (plug-in housing)</li> <li>▪ 1 Summation current transformer</li> </ul>

Article	Order No.
Display unit in plug-in housing	32-050x-xxx (Order No. on request)
Summation current transformer, 3 m connection cable	49-6013-029
External signal lamp, 3 LEDs, 10 m cable, with battery	49-0702-010
External signal lamp, 3 LEDs, 15 m cable, with battery	49-0702-015

# EARTH ZERO/EARTH ZERO Flag

## Earth Fault Indicator

### Product Features

- Indication of earth fault currents by LED and mechanical flag
- Remote indication via relay contacts
- Optional: external signal lamp

The EARTH ZERO device is an earth fault indicator. It is designed to detect, locally indicate and remotely report earth fault currents in medium voltage distribution networks. A wired earth fault current transformer monitors the summation current of all three conductors. The electronics of the display unit evaluates the measurements. When the fault sensitivity threshold is exceeded, a red LED will start flashing and a mechanical flag becomes visible (EARTH ZERO Flag). In addition to that, the remote indication contacts are energised. A system-related external signal lamp (optionally available) is also activated.



EARTH ZERO, plug-in housing



EARTH ZERO, surface mount housing



EARTH ZERO Flag, plug-in housing



EARTH ZERO Flag, surface mount housing

# EARTH ZERO/EARTH ZERO Flag

## Earth Fault Indicator

Technical Data	EARTH ZERO	EARTH ZERO Typ Flag
Earth fault indicator	▪	▪
$I_E$ > Earth fault trip current	25, 50, 75 or 100 A <sup>1)</sup>	
$t_{I_E}$ > Response delay	80 or 160 ms <sup>1)</sup>	
Accuracy	±15 %	
Indication	1 red LED, flash rate 2 s	1 red LED + mechanical flag
Reset	<ul style="list-style-type: none"> <li>▪ Manual reset</li> <li>▪ Automatic time reset: 2, 4 or 8 h</li> <li>▪ Voltage restoration (110–240 V AC)</li> </ul>	
Remote signal	1 Relay contact and input for external signal lamp	
Remote contact	Potential-free permanent or momentary contact (1 s), adjustable Contact capacity: 230 V AC / 1 A / 62.5 VA max. 220 V DC / 1 A / 60 W max.	
Power supply	Long-life lithium cell, shelf life ≥20 years, >1,200 h total flashing time (>500 h when using the external signal lamp)	
Housing	Polycarbonate, IP40 (plug-in housing), IP65 (surface mount housing)	
Temperature range	-30 to +70 °C	

1) Further trip currents on request  
Dimension drawing see on page 49, M6 and on page 50, M7

	EARTH ZERO	EARTH ZERO Typ Flag
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit</li> <li>▪ 1 Summation current transformer</li> </ul>	

Article	Order No.	
	EARTH ZERO	EARTH ZERO Typ Flag
Display unit in plug-in housing	32-0513-001	32-0512-002
Display unit in surface mount housing	32-0503-001	32-0502-002
Summation current transformer, 3 m connection cable	49-6013-029	
External signal lamp, 1 LED, 5 m connection cable, excluding battery	49-0701-010	
External signal lamp, 1 LED, 12 m cable, excluding battery	49-0701-012	



Summation current transformer



External signal lamp

# NAVIGATOR-LM/ NAVIGATOR-LM HV

Overhead Faulted Circuit Indicator

## Product Features

- Fault detection; momentary versus permanent
- LED indication with 360 degrees of visibility
- Double-flashing mode upon detection of a second fault
- Battery status indication
- Reset depending on type: manual, current restoration, timed, on restoration of voltage
- Mounting can be performed while overhead line is energised
- NAVIGATOR-LM HV: permissible voltage  $\leq 161$  kV

The NAVIGATOR short-circuit indicator is an electronic device which is designed for medium voltage utility overhead lines.

The indicator is provided with a self-adjusting load-dependent control of the trip current level. This function allows the indicator to continuously sample the load current on overhead lines and electronically set a corresponding trip value for fault detection as a function of the load current. The maximum load current sampled by the indicator, is kept in a memory for a period of at least 72 hours. Thus, the indicator is most favourably adapted to the network to be monitored, even if low load is currently present.

The indicator is provided with a built-in battery control. When the battery capacity decreases from a total indicating time of 500 hours to a residual time of 50 hours, the yellow LED of the display starts flashing for a period of 6 months.

The NAVIGATOR-LM differentiates between two subsequent short-circuit detections. Upon the detection of a first short-circuit, the LED indicator light starts flashing at equal rates. The detection of a second short-circuit (e. g. after ARC) switches the LED to double flashing mode.

Reset options provided by the various versions:

### NAVIGATOR Version A

Faults are indicated by means of 6 high-intensity LEDs. The indication is reset automatically on restoration of current or after expiry of a pre-set time, or can be reset manually, whichever criterion occurs first.

### NAVIGATOR Version B

Faults are indicated by 6 high-intensity LEDs. The indication is reset automatically after expiry of a pre-set time, or manually.

### NAVIGATOR Version C

Faults are indicated by means of 4 red LEDs and 2 yellow high-intensity LEDs. The red LED indicator lights are reset automatically on restoration of current, after expiry of a pre-set time, or manually. The yellow LED indicator lights are reset automatically after expiry of a pre-set time, or manually.

### NAVIGATOR Version E

The indicator samples both the line current and voltage on the line. The device is tripped only if the line has been under voltage for at least 60 seconds. Automatic reset after 60 seconds upon restoration of voltage, after passage of a pre-set time, or manual reset. Its design blocks high inrush currents for indication, even upon reclosure. Both the overbuilt and underbuilt conditions shall be avoided!

## Current/Time Characteristic

Load Current [A]	0 - 50	70	100	170
Trip currents [A]/100 ms	200	294	450	1.000



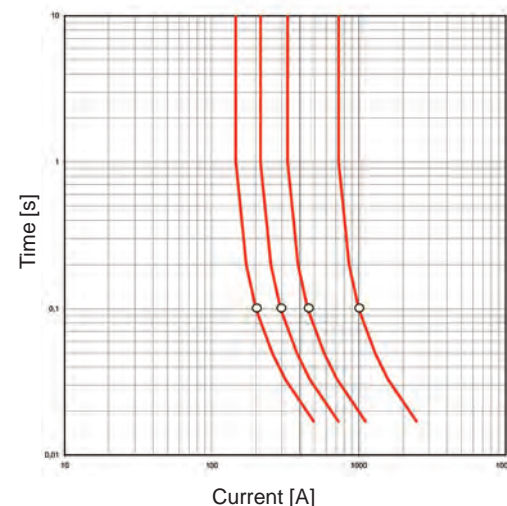
NAVIGATOR-LM ( $\leq 46$  kV)



NAVIGATOR-LM HV ( $\leq 161$  kV)



Test/Reset magnet



# NAVIGATOR-LM/ NAVIGATOR-LM HV

Overhead Faulted Circuit Indicator

Technical Data	NAVIGATOR-LM/LM HV			
	Version A	Version B	Version C	Version E
Trip current range	≥200 A/ 100 ms, load-dependent self-adjustment (see current/time characteristic)			
Accuracy	±10 % at 20 °C			
Self-adjustment	≥50 A load current			
Trip factor	4–6 x load current (see current/time characteristic)			
Adjustment delay	≥50 s load current flow time			
Holding time of self-adjustment	72 h			
Indicators (short-circuit/earth fault)	<ul style="list-style-type: none"> <li>4 red LEDs (&gt;5,000 mcd or 7,000 mLm per piece)</li> <li>2 yellow LEDs</li> </ul>			
Visibility	>50 m/day, >150 m/night/360 degrees of visibility			
Flash rate	30 flashes per minute, total indication time >500 h			
Reset	<ul style="list-style-type: none"> <li>Manual reset by mean of a permanent magnet</li> <li>Automatic time reset: 4 h ±10 % (2 or 8 h)</li> </ul>			
	Current restoration >3 A load current	—	Current restoration >3 A load current	—
	—	—	—	Voltage restoration, line voltage ≥5 kV
Power supply	Lithium cells, replaceable, shelf life ≥20 years			
Battery check	1 yellow LED, flash rate: 6 per minute, 0.5 years			
Max. permissible voltage	<ul style="list-style-type: none"> <li>NAVIGATOR-LM: ≤46 kV/50 Hz or 60 Hz</li> <li>NAVIGATOR-LM HV: ≤161 kV/50 Hz or 60 Hz</li> </ul>			
Withstand current	<ul style="list-style-type: none"> <li>NAVIGATOR-LM: 25 kA/200 ms</li> <li>NAVIGATOR-LM HV: 40 kA/1 s</li> </ul>			
Cable diameter range	<ul style="list-style-type: none"> <li>NAVIGATOR-LM: 8–29 mm</li> <li>NAVIGATOR-LM HV: 13–36 mm</li> </ul>			
Influence	No influence by vicinal power lines with a horizontal distance of at least 250 mm from the indicator			
Housing	UV-resistant polycarbonate/polyamide, IP68 Clamping mechanism: stainless steel			
Temperature range	-30 to +70 °C (IEEE 495 -40 to +85 °C)			

Dimension drawing see on page 50, M8

Article	Order No.			
	Version A	Version B	Version C	Version E
NAVIGATOR-LM	41-2101-111	41-2101-211	41-2101-311	41-2101-511
NAVIGATOR-LM HV	41-2108-111	41-2108-211	41-2108-311	41-2108-511
Magnet (test and reset)	49-6001-002			
Hot stick with hook	see on page 89			

NAVIGATOR PM without self-adjustment facility provided with fixed trip currents (e. g. 800 A/ 100 ms) available ex works after consultation with the manufacturer.

# SMART NAVIGATOR/ SMART NAVIGATOR HV

SMART Overhead Faulted Circuit Indicator

## Product Features

### Event based data reports:

- Fault detection; momentary versus permanent
- Fault current magnitude
- Fault duration
- Last good known load current
- Time stamp

### Continuous data reports:

- Battery status
- Average load current
- Peak and min. load current
- Ambient temperature

The SMART NAVIGATOR overhead faulted circuit indicator is designed for smart grid automation applications. The SMART NAVIGATOR can be installed on overhead transmission and distribution power lines up to 46 kV and provides event based fault status in addition to continuous circuit data.

The SMART NAVIGATOR can be integrated into an existing SCADA or smart grid system and can operate in various communication environments. A pole mounted concentrator receives and manages all NAVIGATOR data as an access point into a communication environment.

The SMART NAVIGATOR detects fault events and provides digital and analog fault data information for intelligent switching and restoration decisions.

The load leveling and load memory features enable the unit to automatically set fault trip current rating in relation to peak load current. Once the unit detects fault current above its trip current rating the FCI sends a signal to the pole mounted concentrator and begins to flash a bright red blinking LED. In addition to event based fault identification, the SMART NAVIGATOR HV also communicates fault data, load current and status data.

The SMART NAVIGATOR HV features all the function provided by the SMART NAVIGATOR. Additionally a conductor temperature sensor is an important diagnostic tool to evaluate line sag and potential hotspots.



SMART NAVIGATOR/SMART NAVIGATOR HV



# SMART NAVIGATOR/ SMART NAVIGATOR HV

SMART Overhead Faulted Circuit Indicator

Technical Data	SMART NAVIGATOR/SMART NAVIGATOR HV
Trip current	50 – 1,200 A
Accuracy	±10 % @ 20 °C
Self adjustment	≥15 A
Trip factor	4 times load current
Peak load memory	72 h
Indication	Bright red LED
Flashing frequency	30 per min., total indicating time >500 h
Reset	<ul style="list-style-type: none"> <li>▪ Manual reset by means of a permanent magnet</li> <li>▪ Automatic reset by time: 4 h ±10 %</li> <li>▪ Current restoration load current &gt;3 A</li> <li>▪ Voltage restoration</li> </ul>
Power supply	Lithium batteries, replaceable, shelf life 20 year
Operating voltage	SMART NAVIGATOR: ≤46 kV L-L SMART NAVIGATOR HV: ≤161 kV L-L
Withstand current	SMART NAVIGATOR: 25 kA/1s SMART NAVIGATOR HV: 40 kA/1s
Adjacent cable immunity	0.25 m (10") @ 10 kA
Conductor temperature measurement range	-40 to +130 °C
Conductor temperature measurement accuracy	±5 °C
Frequency/power/modulation	2.4 GHz/1 mW/MSK
Range	>30 m (>100 ft) line-of-sight
Reporting cycle	15 minutes
Cable diameter range	SMART NAVIGATOR: 8 – 29 mm SMART NAVIGATOR HV: 13 – 36 mm
Housing material	Glass-fibre reinforced plastic/UV stable Clamping mechanism: stainless steel
Temperature range	-40 to +85 °C (IEEE 495 -40 to +85 °C)

Dimension drawing see on page 50, M8

Article	Order No.
SMART NAVIGATOR	43-x0x6-100 (Order No. on request)
SMART NAVIGATOR HV	43-xxx8-xxx (Order No. on request)
SMART RECEIVER	28-6201-002
SMART RECEIVER DNP3	28-6213-103

Accessories	Order No.
Reset magnet	49-6001-002
Hot stick for installation with hook, 30 kV, 2 m length	65-0301-002

# NAVIGATOR LED + Flag

## Overhead Faulted Circuit Indicator

### Product Features

- 72 hour peak load memory
- 4 hours LED automatic reset
- 1, 2 or 7 days flag automatic reset
- Self diagnostic battery circuit
- Replaceable lithium cells
- 360degrees visibility
- Manual test and reset
- Automatic inrush restraint
- Microprocessor controlled

The NAVIGATOR LED + Flag is a faulted circuit indicator for power distribution overhead lines. It consists of a black, UV stable, glass-fibre reinforced plastic housing and a transparent cap with a clamping mechanism of stainless steel, all designed to operate in adverse conditions. The faulted circuit indication is visualised by a large red flag in combination with LEDs. The fault indicator is energised by replaceable lithium cells with a shelf-life of 20 years. The indicator has built-in battery indication. When the batteries run down to 10 % of initial capacity a yellow LED starts blinking for half a year. The NAVIGATOR LED + Flag can be installed and removed on an overhead line using a hot stick.

The NAVIGATOR LED + Flag has a load tracking characteristic. This means it constantly monitors the load current magnitude on the line and electronically adjusts the trip current level for a fault. The highest current sensed for at least 60 seconds will establish a trip point (~4 times load) in memory and holds this value for 72 hours. If the load current reaches or exceeds the stored load current level at any time, a new trip point is registered and the memory time of 72 hours starts again. If load current does not meet or exceed the established level for 72 hours, the NAVIGATOR LED + Flag will sense and reestablish a new lower trip point. When a fault current exceeds the trip point, the indicator activates the red flag and high intensity red LEDs will also flash. The LEDs are reset by current, time or manually whichever comes first. The red flag is reset by either time or manually, giving both an indication on permanent as well as on momentary faults. The reset times for the LED and FLAG can be selected independently to combine the advantages of a blinking indicator (better visibility) at night and a mechanical flag for difficult to reach rural applications.



NAVIGATOR LED + Flag

## NAVIGATOR LED + Flag

### Overhead Faulted Circuit Indicator

Technical Data	NAVIGATOR LED + Flag
Trip current	50 – 1,000 A @ 100 ms
Trip factor	4 times load current
Level adjustment-delay	60 s
Peak load memory	72 h
Indication	Mechanical flag and flashing LED (3 red LEDs for fault indication and 1 yellow LED for low battery indication)
Visibility	>50 m at day time <150 m at night time 360° visibility
Reset	<ul style="list-style-type: none"> <li>▪ Current: By current restoration (&gt;3 A)</li> <li>▪ Manually: By hot stick and magnet</li> <li>▪ LED: Automatic reset by time, after passage of 4 hours</li> <li>▪ Flag: Automatic reset by time, after passage of 4 hours, 1, 2, 3 or 7 days</li> </ul>
Power supply	Lithium batteries, replaceable, shelf life 20 year
Total indication time	>150 faults
LED flashing frequency	Fault indication 30 per minute, low battery indication 6 per minute (only while flag is reset)
Maximum operating voltage	46 kV/50 Hz or 60 Hz
Withstand current	25 kA/1 s sym
Adjacent cable immunity	0.25 m (10") @ 10 kA
Cable diameter range	4 – 29 mm (0.16 – 1.14")
Current transformer	Closed core stainless steel
Housing material	Glass-fibre reinforced plastic/UV stable
Weight	425 g (15 oz.)
Tripping accuracy	+/-10 % @ +20°C +/- 20 % @ -30 to +70 °C
EMC	IEC 61000-4-2 (ESD), IEC 61000-4-3 (HF)
Temperature range	-30 to +70 °C (IEEE 495 -40 to +85 °C)

Dimension drawing see on page 50, M8

Article	Order No.
NAVIGATOR LED + Flag	41-3xxx-xxx (Order No. on request)

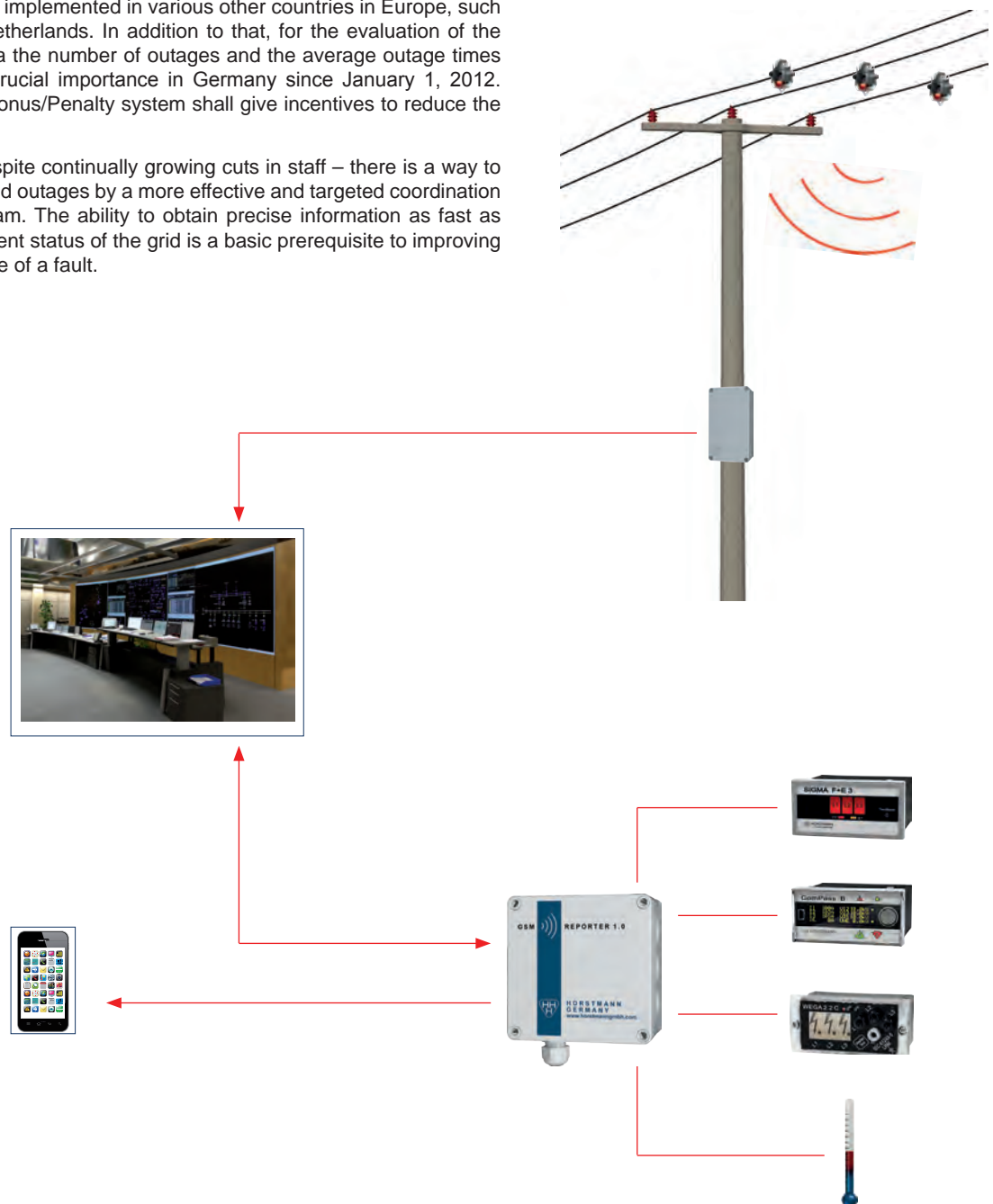
Accessories	Order No.
Reset magnet	49-6001-002
Hot stick for installation with hook, 30 kV, 2 m length	65-0301-002

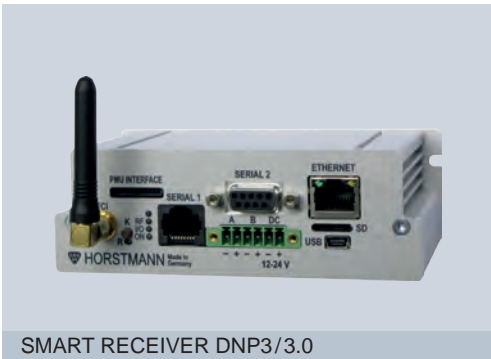
# Solutions for Remote Monitoring

Growing competition and liberalisation of the electricity market is forcing the power supply companies to modernise and automate their grids. In recent years, reports and articles in trade magazines or topics of trade conferences have shown a trend towards „intelligent substations“ along with „Smart Grids“. These discussions are associated with a steadily growing number of decentralised power feed-in facilities leading to changes in existing energy supply systems.

In view of this, it is evident that the penalties introduced in Germany for power failures have also been implemented in various other countries in Europe, such as Sweden and the Netherlands. In addition to that, for the evaluation of the power grid, both criteria the number of outages and the average outage times (ASIDI figure) are of crucial importance in Germany since January 1, 2012. The introduction of a Bonus/Penalty system shall give incentives to reduce the outage times.

It has shown that – despite continually growing cuts in staff – there is a way to gain control over the grid outages by a more effective and targeted coordination of the maintenance team. The ability to obtain precise information as fast as possible about the current status of the grid is a basic prerequisite to improving this coordination in case of a fault.





# SMART RECEIVER DNP3/3.0

Receiver for SMART Overhead Faulted Circuit Indicator

## SMART RECEIVER DNP3/3.0

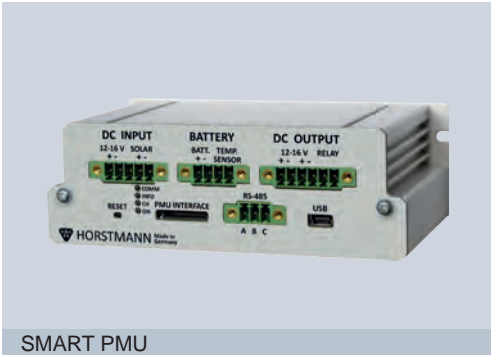
- Controls up to 12 SMART NAVIGATOR FCIs
- DNP3 outstation Level 2+ (IP or Serial)
- Low-power design with intelligent power-down modes
- Local and remote configuration
- Local storage for process and configuration data
- Compact design
- Robust metal enclosure

The SMART RECEIVER DNP3/3.0 is part of a fault indication and monitoring system for overhead lines used for energy distribution. It receives status information about the overhead lines over a wireless link from SMART NAVIGATOR overhead line faulted circuit indicators. The SMART RECEIVER DNP3 converts the status information into the Distributed Network Protocol (DNP3).

Article	Order No.
SMART RECEIVER DNP3/3.0	28-6213-103

# SMART PMU

Power Management Unit



## SMART PMU

- Configurable to operate with various battery types
- Advanced charging algorithm
  - Deep discharge protection
  - Temperature compensation
  - Load drop
  - Battery lifetime calculation
- Optimised algorithms for supply from solar panels
- Support for system power-down modes
- LEDs for local indication
- USB interface for configuration
- Modbus interface for remote data retrieval
- Optimised for systems with Horstmann SMART RECEIVER DNP3

The SMART PMU is an intelligent power management unit (PMU). It contains an advanced battery charger that can work with different battery types. Using state-of-the-art algorithms it maximizes battery service life time and energy available from the battery at the same time. For use in off-grid PV/Solar systems the SMART PMU features an advanced maximum power point tracking (MPPT) system.

Article	Order No.
SMART PMU	26-6213-103

# SMART REPORTER

Solutions for Remote Monitoring

## Product Features

### SMART RECEIVER DNP3

- Controls up to 12 SMART NAVIGATOR FCIs
- DNP3 outstation Level 2+ (IP or Serial)
- Local and remote configuration
- Wide range AC power supply<sup>1)</sup>
- Rechargeable backup battery
- SMART PMU: Intelligent power management unit (option)
  - Advanced charger with rechargeable battery supervision
  - Input of solar panel power supply<sup>2)</sup>
  - Optimised algorithms for supply from solar panels<sup>2)</sup>
  - Power-down modes of connected load for extended battery life
- Mounting space for selected modem/router/gateway
- Tamper detection
- IP66/NEMA 4X rated enclosure, mounting brackets, lockable

### FCI Information (DNP3 data)

#### Alarms/Events:

- Overhead line fault indication (permanent/momentary)
- Fault current magnitude and duration
- Overhead line de-energization (loss of current)

#### Continuous reports:

- Average load current and actual load current
- Peak load current (min & max)
- Counters: permanent faults/momentary faults
- Device temperature, conductor temperature (option)
- Routine call and health check
- Battery status

The SMART REPORTER is a robust, pole mounted solution that works together with the Horstmann line of SMART NAVIGATOR overhead line faulted circuit indicators (FCIs). Together they provide detailed information about fault events, fault locations and load data for distribution and sub-transmission overhead lines.

The SMART REPORTER acts as an access point that relays information from the SMART NAVIGATORS through different WAN environments like Cellular, Licensed/Unlicensed Radio, etc. into SCADA or network management systems. The SMART REPORTER can monitor and manage up to 12 SMART NAVIGATORS. Together the solution forms a DNP3 Level 2+ compliant outstation.

The SMART REPORTER contains the SMART RECEIVER DNP3 that receives and manages data of the overhead line faulted circuit indicators and provides the information in a DNP3 compliant format. The SMART REPORTER includes as option an intelligent power management unit (SMART PMU) that monitors power supply and back-up battery status and enables selective power-down modes. The SMART REPORTER can be fitted with selected 3rd party modems/routers or gateways to enable different WAN connections.

1) for AC solution

2) for Solar solution



SMART REPORTER



# SMART REPORTER

Solution for Remote Monitoring

Technical Data	SMART REPORTER
Features	<ul style="list-style-type: none"> <li>▪ Door contact switch (mapped in DNP3) for tamper detection</li> <li>▪ MicroSD card slot for system and DNP3 logging</li> <li>▪ Internal LEDs to support installation and commissioning</li> <li>▪ Optional internal heater for operation under extreme climate conditions</li> </ul>
FCI radio	Short Range Radio Link Controller for up to 12 NAVIGATOR FCI's
Frequency/modulation/Tx power	2.4 GHz/MSK/0 dBm
Range FCI ↔ SMART REPORTER	30 m (line-of-sight)
Power supply <sup>1)</sup>	85–264 V AC/47–63 Hz/120–370 V DC
Power consumption <sup>1)</sup>	0.9 A @ 115 V/0.5 A @ 230 V (fused: 2A T)
Surge protection (Hot line to ground) <sup>1)</sup>	Rated/maximum voltage: 230/275 V AC, current (8/20 us): 40 kA
Solar power supply; Module (not included) <sup>2)</sup>	Recommended parameters: 12 V/20 W (e. g. ET Solar ETM53920)
Back-up battery	<ul style="list-style-type: none"> <li>▪ 12 V/7.2 Ah, rechargeable</li> <li>▪ Lifetime 8–10 years at 20 °C (&gt;7 days with power saving mode)</li> </ul>
Router/gateway options	Cellular <ul style="list-style-type: none"> <li>▪ Sierra Wireless Raven XE</li> <li>▪ Standard option: 2.5G/3G Cellular; CDMA on request</li> </ul> Other cellular <ul style="list-style-type: none"> <li>▪ On request</li> </ul>
Cellular antenna	N-type connector for external antenna
Interfaces	<ul style="list-style-type: none"> <li>▪ 2 Serial Ports (RJ45, RS232)</li> <li>▪ Ethernet RJ45 10/100 Port for DNP3 IP or local access and configuration</li> <li>▪ Mini-USB for local access and configuration</li> </ul>
Temperature range	-30 to +70 °C
Humidity	0 to 95 % non-condensing
Radiated emissions	FCC Part 15
EMC	EN 61000-4
Degree of protection	NEMA4(X), IP66
Casing material	Fully insulated , fibre-glass reinforced polyester

Article	Order No.
SMART REPORTER	28-31x1-xxx (Order No. on request)
SMART NAVIGATOR	43-x0x6-100 (Order No. on request)
SMART RECEIVER DNP3	28-6213-103

1) for AC solution

2) for Solar solution

# GSM-REPORTER 1.0

## Product Features

- Detection and transmission of digital states, such as those generated by short-circuit and earth-fault indicators
- Transmission via bidirectional data link either by GSM dial-in connection and/or SMS
- Configuration using a WINDOWS-based software programme
- Built-in battery supply
- No auxiliary supply necessary

The GSM-REPORTER serves to remotely indicate short-circuits and earth faults and other states generated in the medium voltage distribution networks.



GSM-REPORTER 1.0

Technical Data	GSM-REPORTER 1.0
Connections	1 – 16 digital inputs for potential-free relay contacts
GSM unit	<ul style="list-style-type: none"> <li>▪ Quad band 850/900/1,700/1,800 MHz GSM modem with integrated antenna</li> <li>▪ Dial-on-demand mobile radio phone connection</li> <li>▪ SIM card with activated data service (provided by the customer)</li> </ul>
Specialties	<ul style="list-style-type: none"> <li>▪ Bidirectional GSM data link</li> <li>▪ Routine call</li> <li>▪ System error messages via SMS</li> <li>▪ Transmission of the GSM network quality</li> </ul>
Power supply	Replaceable lithium cells: 3.6 V/26 Ah
Active time	5 – 10 years, 2,000 calls min.
Housing	Fibreglass-reinforced polycarbonate, degree of protection IP65
Built-in indication	Control LEDs for data reception/GSM connection/fault messages
Installation	Wall-mount
Temperature range	-30 to +75 °C

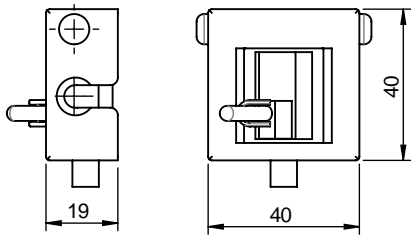
Dimension drawing see on page 50, M9

Article	Order No.
GSM-REPORTER 1.0	28-7200-004

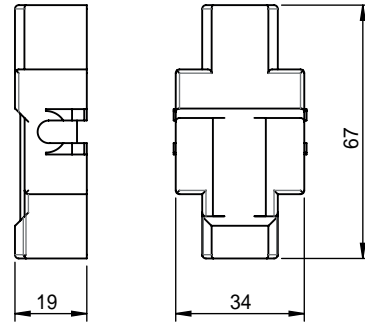


# Dimension Drawings

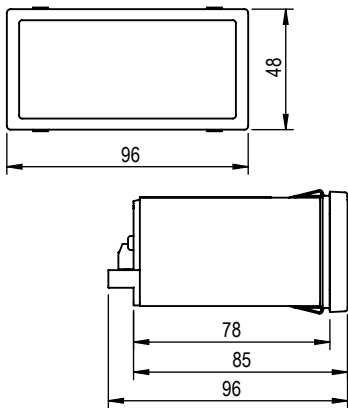
## Short-Circuit and Earth Fault Indicators



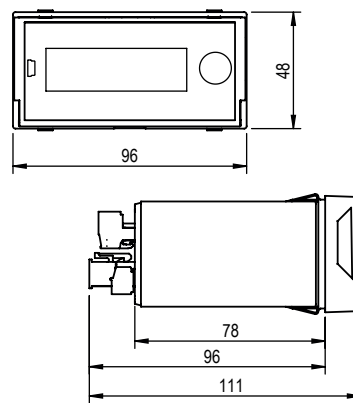
M1: Rotor Indicator



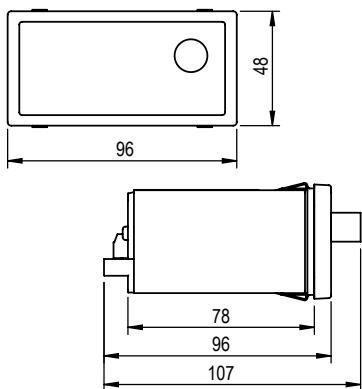
M2: Fluid Indicator



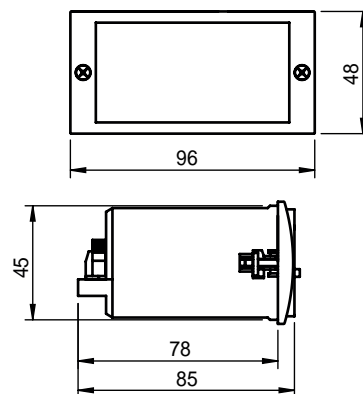
M3: ALPHA E, ComPass, OPTO, SIGMA



M4: ComPass A 2.0/B 2.0/Bs 2.0



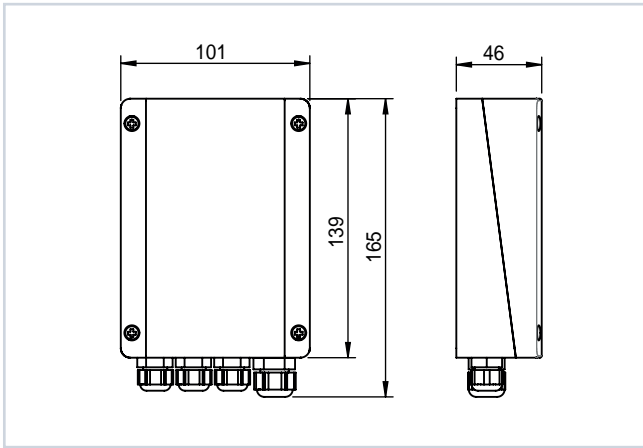
M5: ALPHA M



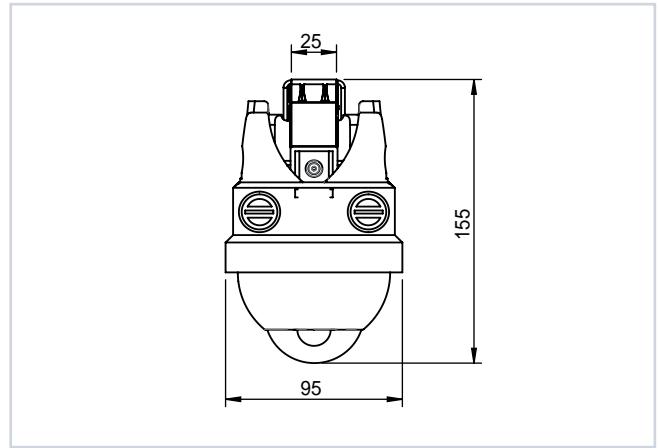
M6: EARTH

# Dimension Drawings

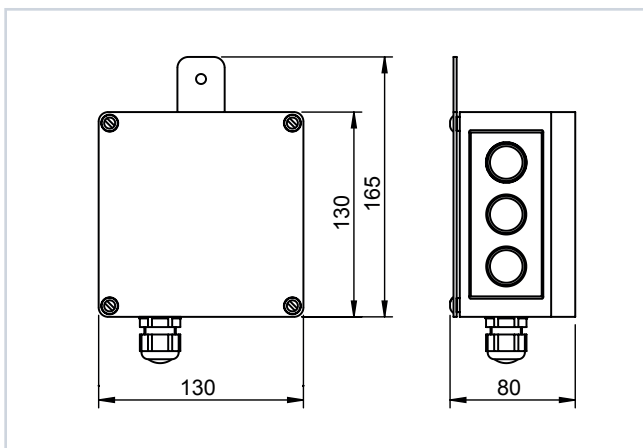
## Short-Circuit and Earth Fault Indicators



M7: EARTH, OPTO, SIGMA plus



M8: NAVIGATOR



M9: GSM-REPORTER 1.0

# Voltage Detectors and Voltage Detecting Systems

## General Information

Voltage detectors and voltage detecting systems are used to verify the presence ("Voltage Present") and absence ("No Voltage Present") condition of voltage in medium voltage switchgears, electrical equipment or of work places when working under voltage.

The absence of voltage on disconnected switchgear parts can be verified by:

- Voltage detector types: FL-I or Comet BL-I/BL-A/BS-I/BS-A
- Capacitive voltage detecting systems (pluggable VDS): HR-ST, LRM-ST, ORION
- Fixed installed capacitive voltage detecting systems (integrated VDS): WEGA models



### Voltage Detectors and Phase Comparators

must only be used at their permitted nominal voltages (phase-phase voltage) and nominal frequency. The corresponding data can be found on the type plate. Voltage detectors for nominal voltage ranges or switchable voltage detectors (e. g. BS-I/BS-A) can be used for systems with different voltage ratings.

According to the IEC 61243-1 (VDE 0682-411) standard it must be ensured that the display of the FL-I type voltage detector (without self-test facility) must be verified on a live conductor before and after each use.

The BL-I/BL-A and BS-I/BS-A voltage detectors are provided with a built-in self-test facility which verifies the display, the evaluation unit and the test probe tip directly after the device has been switched on. Due to this feature it is not strictly necessary to submit the voltage detector to live testing. However, it is recommended to carry out this test if a live conductor is available.

Voltage testers and phase comparators are subject to maintenance tests (see on page 74).



### Capacitive Voltage Detecting Systems (VDS)

Voltage Detecting Systems (VDS) are divided into two groups:

- pluggable systems, to which a portable voltage indicator (e. g. HR-ST) can be connected via an interface with a permanently installed coupling part (e. g. HR-interface). Both the indicator and the coupling part are subject to maintenance tests (see on page 74).
- integrated systems (WEGA) which are incorporated in the electrical equipment constituting an integral part of such equipment. Integrated VDS (WEGA) are additionally provided with either an LRM interface or a measuring point for phase comparison. The integral permanently working current flow monitoring and indication makes a maintenance test superfluous.

The Orion 3.1/M.1 device is a combined indicator for voltage detection, phase comparison and coupling part testing on HR and LRM interfaces.

## FL-I Voltage Detectors

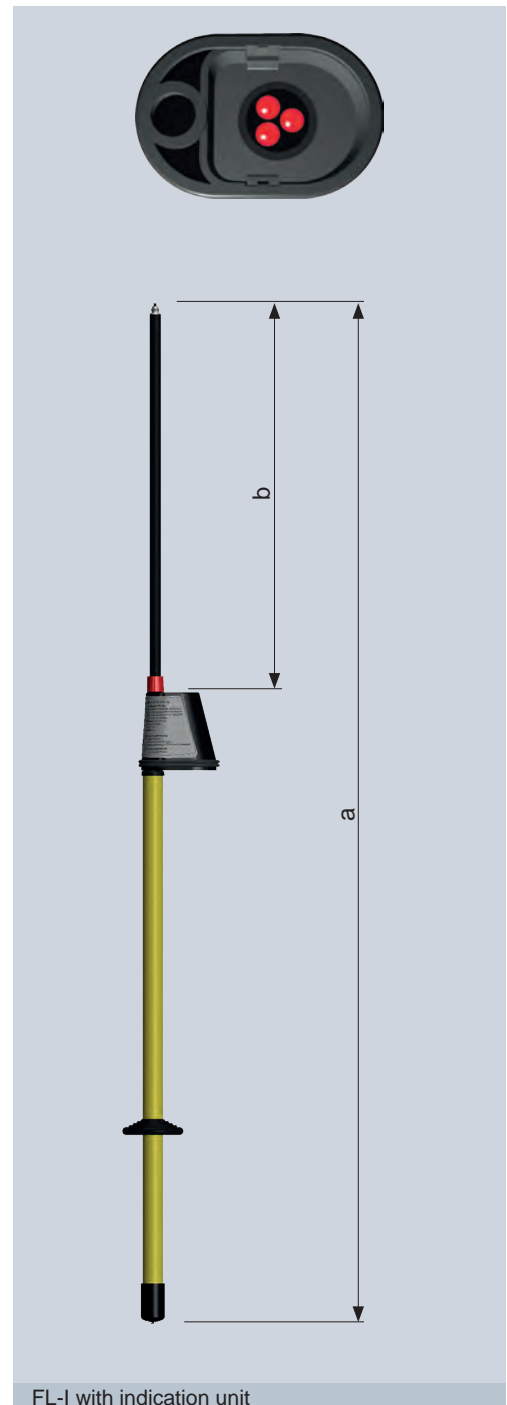
### Product Features

- Designed according to IEC 61243-1 (VDE 0682-411), Category S
- Indoor type 🏠
- Visual voltage indication 👁️
- No battery

The FL-I device is a voltage detector for testing the voltage on one pole. This device is designed to detect operating voltages clearly indicating either the "Voltage Present" or "No Voltage Present" state. This device does not have a built-in power source (battery) and thus no self-test function.

For transportation purposes, the insulating element can be removed from the display unit with the contact electrode.

According to the German accident prevention standard DGUV A3 (Table 1c), the device is subject to maintenance tests with minimum intervals of at least 6 years.



## FL-I Voltage Detectors

Technical Data	FL-I
Use	In dry conditions, normally indoors
Indication	3 red LEDs
Nominal frequency	50 Hz (optional 60 Hz)
Operating temperature	-25 to +70 °C, climatic class N and W

Nominal Voltage [kV]	Total Length a [mm]	Insertion depth b [mm]	Order No.
6	1,270	463	50-1201-001
10	1,270	463	50-1201-002
20	1,370	563	50-1201-003

Accessories	Order No.
Extension rod	see on page 64
Probe tip	
Universal plastic case	

## BL-I/BL-A Voltage Detectors

### Product Features

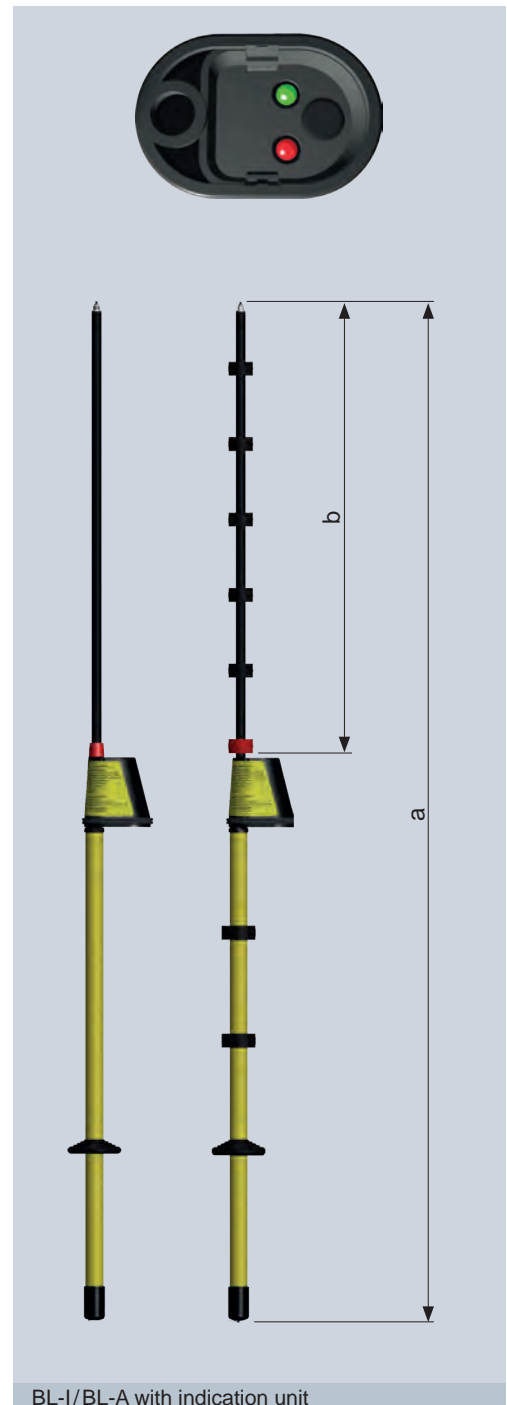
- Designed according to IEC 61243-1 (VDE 0682-411), Category S
- BL-I: indoor type 🏠
- BL-A: outdoor type 🏠 ⚡
- Voltage indication visual 👁️  
or visual/audible 👁️ 🔊
- Built-in self-test function

The BL-I/BL-A devices belong to the Comet series and are capacitive voltage detectors for testing the voltage on one pole. They are intended for the detection of operating voltages clearly indicating either the “Voltage Present” or “No Voltage Present” state.

The voltage detectors are provided with a built-in self-test facility which checks the function of the circuit including the test prod (comprehensive self-test function) before each use.

For transportation purposes, the insulating element can be removed from the display with the contact electrode.








According to the German accident prevention standard DGUV A3 (Table 1c), the device is subject to maintenance tests with minimum intervals of at least 6 years.



# BL-I/BL-A

## Voltage Detectors

Technical Data	BL-I	BL-A
Use	In dry conditions, normally indoors	In dry and wet conditions, either indoors or outdoors
Indication	<ul style="list-style-type: none"> <li>Visual: 1 red LED/1 green LED</li> <li>Visual and audible: 1 red LED/1 green LED/1 signal transmitter</li> </ul>	
Nominal frequency	50 Hz (optional 60 Hz)	
Power supply	2 lithium cells, each 1.5 Ah, 2 x 3 V, Battery service life: 6 years based on 10 ready cycles per day for a total of 230 work days per year	
Operating temperature	-25 to +70 °C, climatic class N and W	

Nominal Voltage [kV]	Total Length a [mm]	Insertion Depth b [mm]	Order No.			
			BL-I 		BL-A  	
						
5	1,270	462	50-0901-011	50-0903-008	50-1001-009	50-1003-009
10	1,270	462	50-0901-012	50-0903-009	50-1001-010	50-1003-010
20	1,420	612	50-0901-013	50-0903-010	50-1001-011	50-1003-011
6–10	1,420	612	50-0901-014	50-0903-011	50-1001-012	50-1003-012
10–20	1,570	762	50-0901-015	50-0903-012	50-1001-013	50-1003-013
20–30	1,570	762	50-0901-022	50-0903-018	50-1001-015	50-1003-018

Accessories	Order No.
Extension rod	see on page 64
Probe tip	
Catch fork	
Universal plastic case	

## BS-I/BS-A Voltage Detectors

### Product Features

- Designed according to IEC 61243-1 (VDE 0682-411), Category S
- Voltage detector for nominal voltages from 5–30 kV, switchable
- BL-I: indoor type 🏠
- BL-A: outdoor type 🏠 ☔
- Voltage indication visual 👁️  
or visual and audible 👁️ 🔊
- Built-in self-test function  
including test of the probe tip for function check before using the device

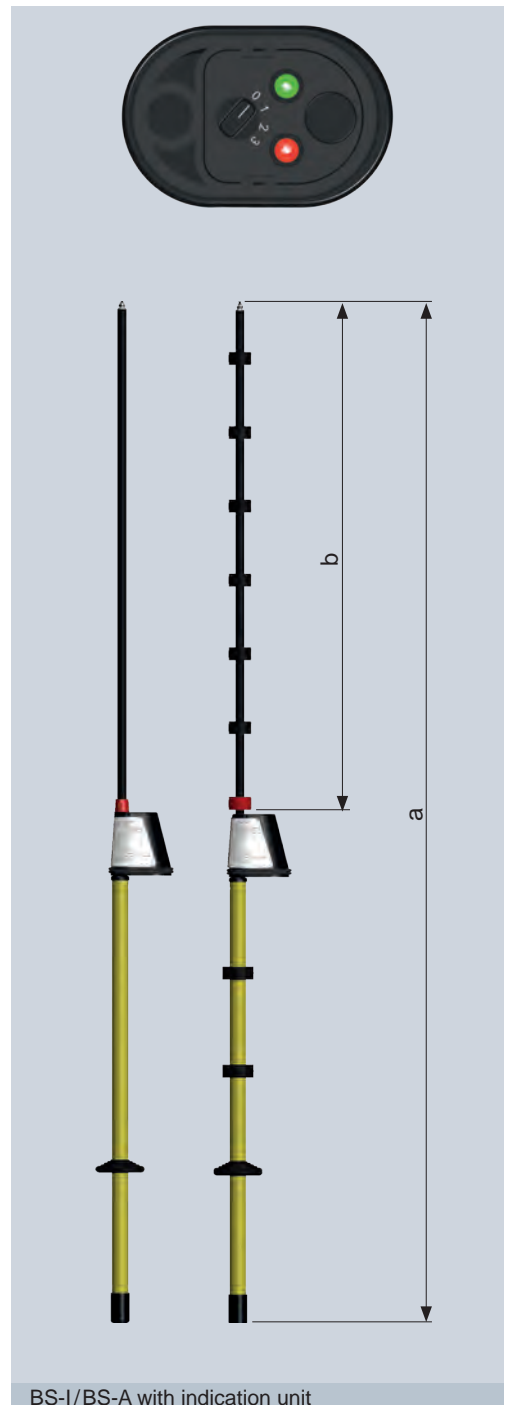
BS-I/BS-A devices are single-pole voltage detectors of the Comet series. They are designed to detect operating voltages clearly indicating the “Voltage Present” or “No Voltage Present” state.

The turning knob is used to either turn the device off or select between three voltage ranges:

0:	OFF
1:	5–10 kV
2:	10–20 kV
3:	20–30 kV

For transportation purposes, the insulating element can be removed from the display unit with the contact electrode.

According to the German accident prevention standard DGUV A3 (Table 1c), the device is subject to maintenance tests with minimum intervals of at least 6 years.










BS-I/BS-A with indication unit



# BS-I/BS-A

## Voltage Detectors

Technical Data	BS-I	BS-A
Use	In dry conditions, normally indoors	In dry and wet conditions, either indoors or outdoors
Indication	<ul style="list-style-type: none"> <li>Visual: 1 red LED/1 green LED</li> <li>Visual and audible: 1 red LED/1 green LED/1 signal transmitter</li> </ul>	
Nominal frequency	50 Hz (optional 60 Hz)	
Power supply	2 lithium cells, each 1.5 Ah, 2 x 3 V, Battery service life: 6 years based on 10 ready cycles per day for a total of 230 work days per year	
Operating temperature	-25 to +70 °C, climatic class N and W	

Nominal Voltage [kV]	Total Length a [mm]	Insertion Depth b [mm]	Order No.			
			BS-I 		BS-A  	
5-30	1,570	758				
			50-0921-001	50-0923-001	50-1021-001	50-1023-001

Accessories	Order No.
Extension rod	see on page 64
Probe tip	
Catch fork	
Universal plastic case	

# COMPARE 2.0

## Phase Comparator, single-pole

### Product Features

- Designed according to IEC 61481 (VDE 0682-431)
- Single-pole, capacitive phase comparator
- Detection of correct phase relationship and incorrect phase relationship between two live conductors
- For indoor and outdoor applications 🏠 ⚡
- Visual indication 👁️
- Built-in self-test function

The phase comparator COMPARE 2.0 is a single-pole, capacitive phase comparator for voltages from 5–36 kV. The device detects "correct phase relationship" or "incorrect phase relationship" conditions between two live conductors of a medium voltage distribution network.

Confirming to IEC 61481 Class B, "incorrect phase relationship" appears at a phase angle between 60° and 300°.

Four bright LEDs indicate various operational conditions.

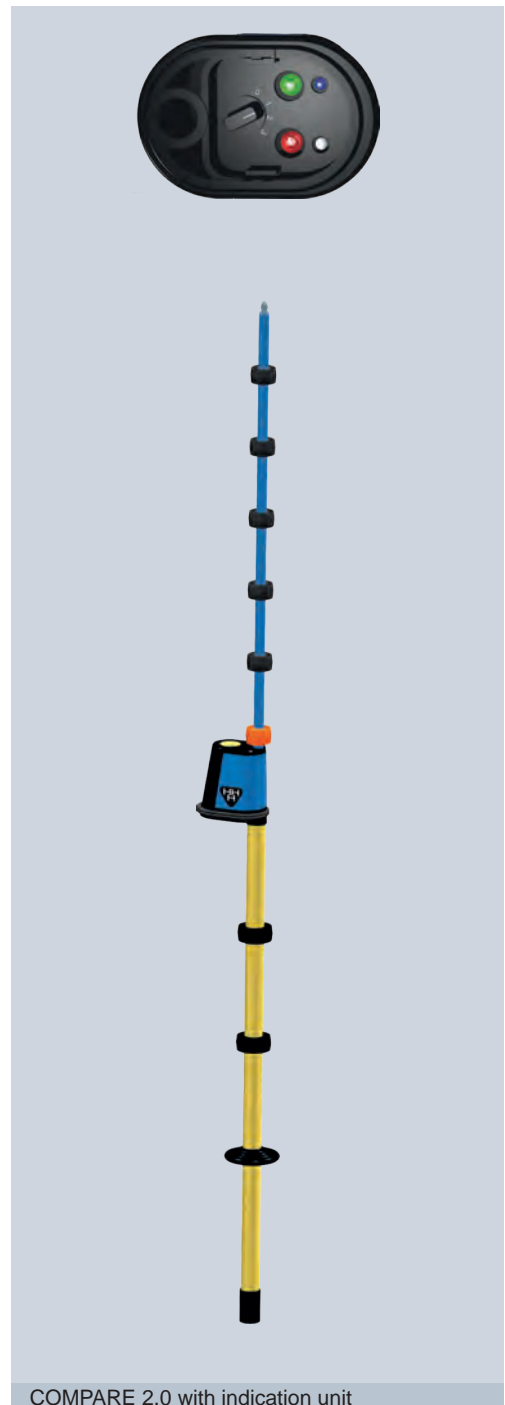
The turning knob is used to either tune the device on/off and select between three voltage ranges:

0:	OFF
1:	5–10 kV
2:	10–20 kV
3:	20–36 kV

The phase comparison is realised by contacting the conductors one after the other.

In medium voltage networks with decentralised renewable energy feed-ins, measurement interruptions may occur. In such cases repeat the phase comparison. It is impossible to get a wrong indication.

According to the German accident prevention standard DGUV A3 (Table 1c), the device is subject to maintenance tests with minimum intervals of at least 6 years.



COMPARE 2.0 with indication unit

# COMPARE 2.0

Phase Comparator, single-pole

Technical Data	COMPARE 2.0
Use	In dry and wet conditions, either indoors or outdoors
Indication	Visual: 1 white LED/1 blue LED/1 green LED/1 red LED
Nominal frequency	50 Hz
Maximum operating period with the pole connected to voltage	60 s
Operating temperature	-25 to +70 °C, climatic class N and W
Operational class	B (indication of phase unbalance in the range of 60° – 300°)

	COMPARE 2.0
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 phase comparator</li> <li>▪ 1 probe tip</li> </ul>

Nominal Voltage [kV]	Total Length a [mm]	Insertion Depth b [mm]	Order No.
5–36	1,420	635	51-0104-001

Accessories	Order No.
Universal plastic case	see on page 64

## PG II Phase Comparator, two-pole

### Product Features

- Designed according to IEC 61481 (VDE 0682-431)
- Two-pole phase comparator
- Detection of correct phase relationship and incorrect phase relationship of two live conductors
- Indoor type 🏠
- Visual indication 👁️

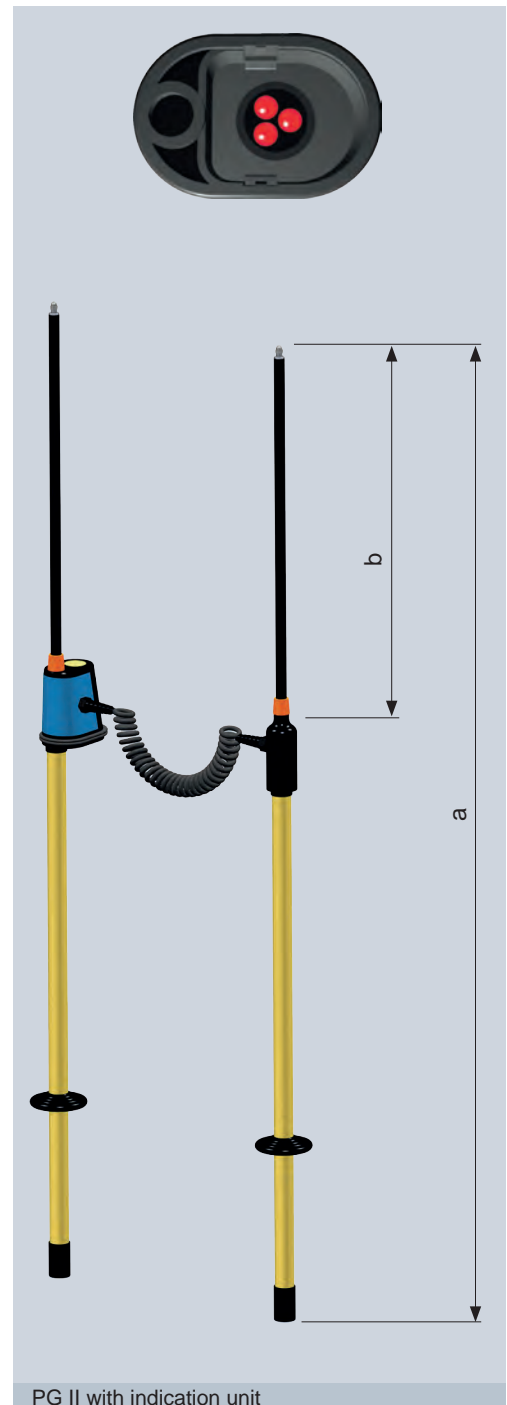
PG II two-pole testing devices detect voltage differences between two live conductors of a medium voltage distribution network.

The device consists of an operating stick with contact electrode and an indication unit (part A) as well as an operating stick with contact electrode (part B) to tap a comparative voltage value.

The insulated stick can be removed from the indication unit with the contact electrode.

Contact electrode A is directly connected with the contact electrode B using a helix cable suitable for high voltages.

According to the German accident prevention standard DGUV A3 (Table 1c), the device is subject to maintenance tests with minimum intervals of at least 6 years.



## PG II

Phase Comparator, two-pole

Technical Data	PG II
Use	In dry conditions, normally indoors
Indication	Visual: 3 red LEDs
Nominal frequency	50 Hz (optional 60 Hz)
Maximum operating period with the pole connected to voltage	60 s
Connection cable	1 m
Operating temperature	-25 to +70 °C
Operational class	B (indication of phase unbalance in the range of 60° – 300°)

Nominal Voltage [kV]	Total Length a (A or B) [mm]	Insertion Depth b [mm]	Order No.
5	1,220	413	51-0102-001
6	1,220	413	51-0102-002
10	1,220	413	51-0102-003
20	1,320	513	51-0102-004
30	1,420	613	51-0102-005

Accessories	Order No.
Probe tip	see on page 64
Universal plastic case	

## BL-M Voltmeter

### Product Features

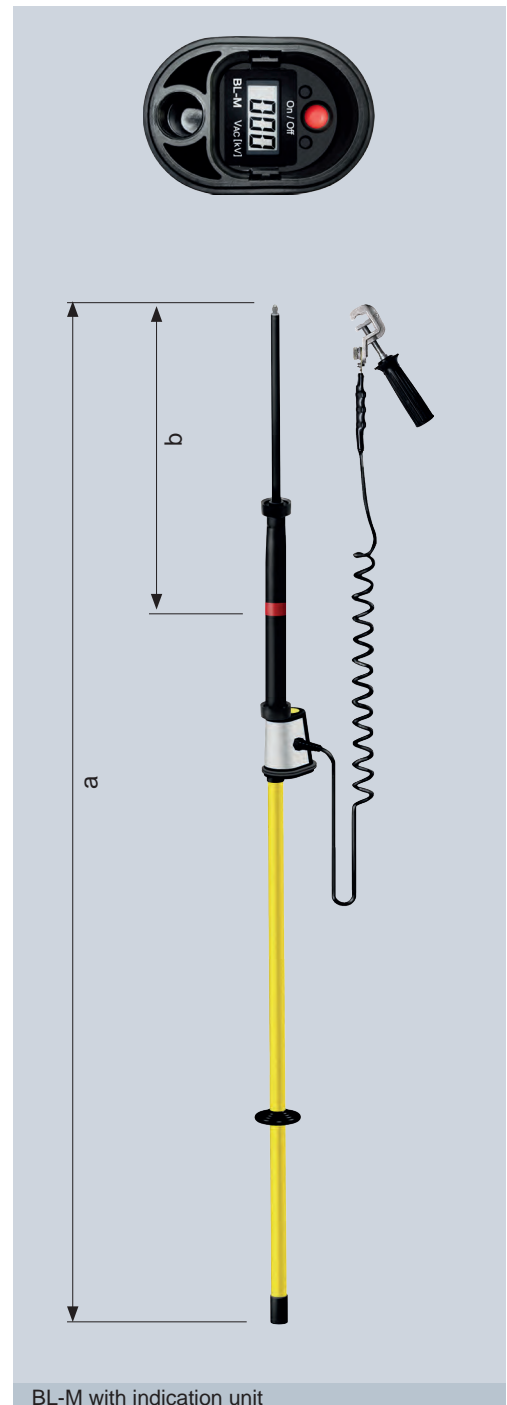
- 2-pole resistive voltmeter
- Designed for direct measurement of alternating voltages in medium voltage distribution networks of 10 – 24 kV/50 Hz
- Accuracy >99 %
- Application on MV switchgears, transformers

The two-pole resistive BL-M type voltmeter is designed to precisely and directly measure phase-to-earth voltages in three-phase medium voltage distribution networks of 10 – 24 kV/50 Hz. Measured voltages are digitally displayed up to >99.99 per cent. Thanks to its accurate measurement feature, the BL-M device can also be used for voltage calibration.

The device is designed and built in accordance to DIN EN 61243-2. It is intended for the use on switchgears, transformers and other medium voltage applications. This device can not be used as voltage detector according to DIN VDE 0105!

The structural design is based on the proven BL series voltage detectors which have been providing many years of reliable service. As with the predecessor model, the BL-M device offers the user easy and advantageous handling, dismounting and transportation capabilities.

According to the German accident prevention standard DGUV A3 (Table 1c), the device is subject to maintenance tests with minimum intervals of at least 6 years.



## BL-M Voltmeter

Technical Data	BL-M
Application	In dry conditions, normally indoors
Indication	Display
Nominal frequency	50–60 Hz (optional 16.7 Hz)
Measuring range	0.01 ... 19.99 kV AC (RMS)
Resolution	0.01 kV
Max. tolerance	±1 %, ±1 digit
Power supply	Block battery 9 V (lithium cell 9 V, 1,200 mAh)
Duty cycle	10 min.
Operating temperature	0 to +50 °C
Total length (a)	2,340 mm
Insertion depth (b)	ca. 570 mm
Earthing connection cable	Length: 3 m
Earthing terminal	Screw-type terminal



Bag set

Article	Order No.
BL-M with connection cable and screw-type terminal, incl. universal plastic case, extension rod, test prod and catch fork	V99-0000-124-001
BL-M with connection cable and screw-type terminal	99-0000-124
Extension rod, 500 mm	52-0108-013
Test prod	52-0306-002
Catch fork	52-0307-003
Universal plastic case	52-0102-005

# Accessories

for Voltage Detectors and Phase Comparators

## Universal plastic case

for products:	Dimensions [mm]			Order No.
	a	b	c	
FL-I, BL-I, BL-A, BS-I, BS-A, COMPARE 2.0, PG II	1,030	240	100	52-0102-001
BL-M	1,030	240	100	52-0102-005

## Extension rod

for extending the handle of voltage detectors and BL-M type voltmeters.

for products:	Length [mm]	Order No.
FL-I, BL-I, BL-A, BS-I, BS-A	250	52-0108-016
FL-I, BL-I, BL-A, BS-I, BS-A, BL-M	500	52-0108-013
FL-I, BL-I, BL-A, BS-I, BS-A	1,000	52-0108-014

## Probe tip

The probe provides improved penetration into oxide and paint layers.

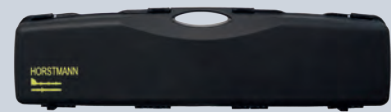
for products:	Order No.
FL-I, BL-I, BL-A, BS-I, BS-A, BL-M, COMPARE 2.0, PG II	52-0306-002

Further probe tips for specific installation on request.

## Catch fork

The catch fork provides improved handling of voltage detectors/voltmeters for contacting surfaces and holding the device.

for	Order No.
Overhead lines	52-0307-001
Switchgear units and overhead lines	52-0307-003



Universal plastic case



Extension rod



Probe tip

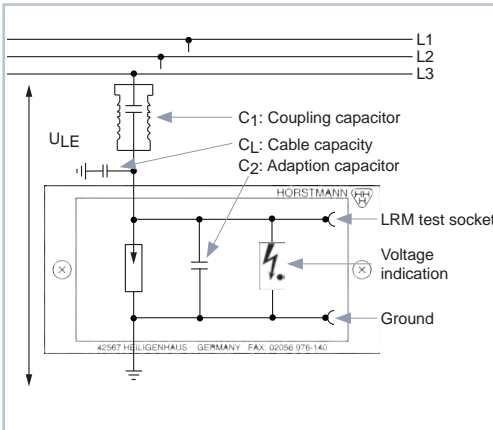


Catch fork





WEGA 1.2 C



Principle of an integrated voltage detecting system





# WEGA 1.2 C

## Integrated Voltage Detecting System

### Product Features

- Designed according to IEC 61243-5 (VDE 0682-415)
- Wide-range WEGA (e. g. 10–20/24 kV): reduction of variants
- Integrated maintenance test: maintenance-free
- Retrofit ready:  
Capacitive connection to ComPass B/B 2.0/Bs 2.0 and SIGMA D/D+
- Front accessible LRM interface: fully featured according to IEC 61243-5
- Fully enclosed electronics: high functional reliability
- Over-voltage indication: phase-selective

WEGA 1.2 C is a 3-phase voltage detecting system, which indicates the following operating voltage states:

-  Voltage present  
Threshold values for voltage presence indication: 0.1–0.45 x Vnom
-  Voltage present  
Integrated maintenance test passed
-  Voltage present  
Integrated maintenance test passed  
Voltage signal too high (overvoltage indication)
-  Voltage not present

The built-in display test function at the front enables verification of the display of the installed and de-energised unit.

For connection, either shielded or unshielded cables with flat connectors or system connectors can be used.

Technical Data	WEGA 1.2 C
Nominal frequency	50–60 Hz
Interface	3 LRM measuring sockets (one per phase) and 1 earth socket LRM system, 14 mm distance between sockets, with captive anti-dust cap
Indication	LCD display with arrow, dot and wrench tool
Power supply	<ul style="list-style-type: none"> <li>▪ No auxiliary supply needed</li> <li>▪ LCD display: fed by measuring voltage</li> </ul>
Housing	Polycarbonate, IP54
Dimensions	96 x 48 x 20 mm (W x H x D), cutout in switchgear: 92 <sup>+0.8</sup> x 45 <sup>+0.6</sup> mm
Temperature range	-25 to +65 °C

Dimension drawing see on page 75, M10

### Required order data:

- Switchgear type
- Switchgear compartment
- Operating voltage of the installation (Vnom)
- Capacity of the coupling electrode (C1)
- Cable type and length of the connection cable

Article	Order No.
WEGA 1.2 C (base type without C2)	51-1250-001





# WEGA 1.2 C vario

## Integrated Voltage Detecting System

### Product Features

- Designed according to IEC 61243-5 (VDE 0682-415)
- Wide-range WEGA (e. g. 10–20/24 kV):  
reduction of variants due to pluggable capacitor cube
- Integrated maintenance test: maintenance-free
- Overvoltage indication: phase-selective
- Retrofit ready:  
Capacitive connection to ComPass B/B 2.0/Bs 2.0 and SIGMA D/D+
- Front accessible LRM interface: fully featured according to IEC 61243-5

WEGA 1.2 C vario is a 3-phase voltage detecting system, which indicates the following operating voltage states:

-  Voltage present  
Threshold values for voltage presence indication:  $0.1 - 0.45 \times V_{nom}$
-  Voltage present  
Integrated maintenance test passed
-  Voltage present  
Integrated maintenance test passed  
Voltage signal too high (overvoltage indication)
-  Voltage not present

WEGA 1.2 C vario can be used to upgrade an HR interface to LRM interface.

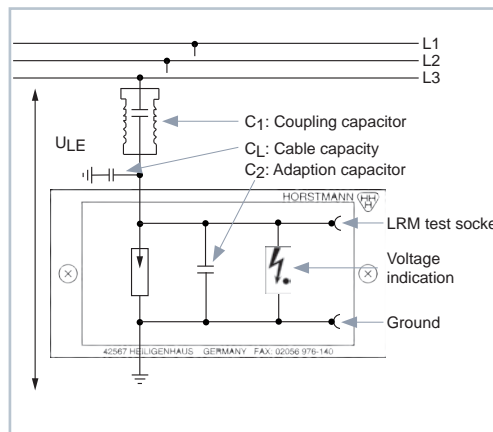
The display test function on the front of the WEGA 1.2 C vario allows to check all settings for conformity with the standards.

To ensure flexibility, an adjustable capacitor cube is plugged in on the back of the device allowing the use of various balancing capacitors. For connection, either shielded or unshielded cables with flat connectors or system connectors can be used.

Optional: Mounting kit consisting of support frame with magnet on the back along with connection cable for HR interface for easy attachment on the front face of switchgear units.



WEGA 1.2 C vario



Principle of an integrated voltage detecting system

Technical Data	WEGA 1.2 C vario
Nominal frequency	50–60 Hz
Interface	3 LRM measuring sockets (one per phase) and 1 earth socket LRM system, 14 mm distance between sockets, with captive anti-dust cap
Indication	LCD display with arrow, dot and wrench tool
Power supply	<ul style="list-style-type: none"> <li>▪ No auxiliary supply needed</li> <li>▪ LCD display: fed by measuring voltage</li> </ul>
Housing	Polycarbonate, IP54
Dimensions	96 x 48 x 38 mm (W x H x D), cutout in switchgear: $92^{+0.8} \times 45^{+0.6}$ mm
Temperature range	-25 to +65 °C

Dimension drawing see on page 75, M11

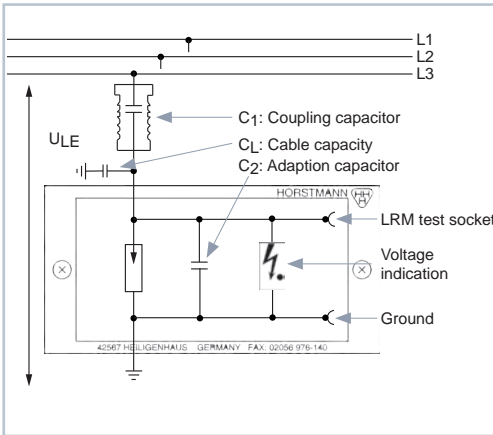
### Required order data:

- Switchgear type
- Switchgear compartment
- Operating voltage of the installation ( $V_{nom}$ )
- Capacity of the coupling electrode (C1)
- Cable type and length of the connection cable

Article	Order No.
WEGA 1.2 C vario (base type without C2)	51-1300-001
Capacitor cube	51-9100-xxx
WEGA mounting kit (housing/magnet/connection cable)	51-1550-900



WEGA 2.2 C



Principle of an integrated voltage detecting system





# WEGA 2.2 C

## Integrated Voltage Detecting System

### Product Features

- Designed according to IEC 61243-5 (VDE 0682-415)
- Remote: 2 relay contacts
- Wide-range WEGA (e. g. 10–20/24 kV): reduction of variants
- Integrated maintenance test: maintenance-free
- Retrofit ready:  
Capacitive connection to ComPass B/B 2.0/Bs 2.0 and SIGMA D/D+
- Front accessible LRM interface: fully featured according to IEC 61243-5
- Fully enclosed electronics: high functional reliability
- Overvoltage indication: phase-selective

WEGA 2.2 C is a 3-phase voltage detecting system, which indicates the following operating voltage states:

-  Voltage present  
Threshold values for voltage presence indication:  $0.1 - 0.45 \times V_{nom}$
-  Voltage present  
Integrated maintenance test passed
-  Voltage present  
Integrated maintenance test passed  
Voltage signal too high (overvoltage indication)
-  Voltage not present

Additional to the LCD display the WEGA 2.2 C has 2 LEDs (green U=0 and red U≠0).

The built-in display test function at the front enables verification of the display of the installed and de-energised WEGA 2.2 C.

For connection, either shielded or unshielded cables with flat connectors or system connectors can be used.

Technical Data	WEGA 2.2 C
Nominal frequency	50–60 Hz
Interface	3 LRM measuring sockets (one per phase) and 1 earth socket LRM system, 14 mm distance between sockets, with captive anti-dust cap
Indication	<ul style="list-style-type: none"> <li>▪ LCD display with arrow, dot and wrench tool</li> <li>▪ LED indication, U=0 and U≠0</li> </ul>
Remote signal	2 relay contacts, alternating contact
Power supply	<ul style="list-style-type: none"> <li>▪ LCD display: fed by measuring voltage</li> <li>▪ Relay via 24–230 V AC/DC power supply</li> </ul>
Housing	Polycarbonate, IP54
Dimensions	96 x 48 x 52 mm (W x H x D), cutout in switchgear: $92^{+0.8} \times 45^{+0.6}$ mm
Temperature range	-25 to +65 °C

Dimension drawing see on page 75, M12

### Required order data:

- Switchgear type
- Switchgear compartment
- Operating voltage of the installation (Vnom)
- Capacity of the coupling electrode (C1)
- Cable type and length of the connection cable

Article	Order No.
WEGA 2.2 C (base type without C2)	51-2250-001

# WEGA 3

## Integrated Voltage Detecting System






WEGA 3

### Product Features

- Designed according to IEC 61243-5 (VDE 0682-415)
- Continuous LCD indication: 3-phase
- Integrated maintenance test: maintenance-free
- Fully enclosed electronics: high functional reliability

WEGA 3 is a 3-phase voltage detecting system, which indicates the following operating voltage states:

-  Voltage present
-  Voltage present  
Integrated maintenance test passed
-  Voltage not present

For connection, either shielded or unshielded cables with flat connectors can be used.

Technical Data	WEGA 3
Nominal frequency	50–60 Hz
Interface	3 LRM measuring sockets (one per phase) and 1 earth socket LRM system, 14 mm distance between sockets, with captive anti-dust cap
Indication	<ul style="list-style-type: none"> <li>▪ LCD display with arrow and dot</li> </ul>
Power supply	<ul style="list-style-type: none"> <li>▪ No auxiliary supply needed</li> <li>▪ LCD display: fed by measuring voltage</li> </ul>
Temperature range	-25 to +65 °C
Housing	Polycarbonate, IP54
Dimensions	96 x 48 x 52 mm (W x H x D), cutout in switchgear: 92 <sup>+0.8</sup> x 45 <sup>+0.6</sup> mm

Dimension drawing see on page 75, M13

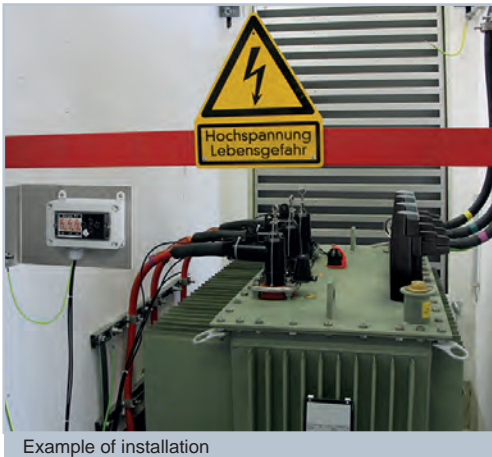
### Required order data:

- Switchgear type
- Switchgear compartment
- Operating voltage of the installation (Vnom)
- Capacity of the coupling electrode (C1)
- Cable type and length of the connection cable

Article	Order No.
WEGA 3	51-1410-001



WEGA T1



Example of installation

# WEGA T1

for Insulated MV Transformers

## Product Features

- Designed according to IEC 61243-5 (VDE 0682-415)
- Continuous LCD indication: 3-phase
- Suitable for Euromold elbow connectors (K) 158 LR, (K) 152 SR and M 400 LR/G with capacitive test points
- Integrated maintenance test: maintenance-free

The WEGA T1 is a 3-phase voltage detector for insulated medium voltage transformers safe for touching. It is installed in a surface mount housing for applications in new and existing transformer stations. Besides conventional medium voltage transformers, these types are in particular ideally suited for remote medium voltage transformers, or in transformer stations/buildings with more than one transformer.

With regard to the response threshold values of the LCD display, the design of the WEGA T1 is a Voltage Detecting System according to IEC 61243-5, with capacitive coupling to live parts. This system is designed for elbow connectors with capacitive voltage taps make Euromold (K) 158 LR, (K) 152 SR, and M 400 LR/G.

The self-monitoring capability of the display does not require periodic maintenance testing. The built-in display test function at the front enables verification of the display of the installed and de-energised unit.

The device is not provided with LRM interfaces or test points for phase comparison due to the weak capacitive coupling which is associated with the specific application of the devices.

Technical Data	WEGA T1
Nominal frequency	50–60 Hz
Interface	Interface or test socket not included
Power supply	<ul style="list-style-type: none"> <li>▪ No auxiliary supply necessary</li> <li>▪ LCD display: fed by measuring voltage</li> </ul>
Temperature range	-25 to +65 °C
Operating time	Suitable for continuous operation
Housing material	Polycarbonate
Dimensions wall-mounted housing	125 x 75 x 75 mm (W x H x D)

Dimension drawing see on page 75, M14

	WEGA T1
Equipment set	<ul style="list-style-type: none"> <li>▪ 1 Display unit</li> <li>▪ 1 Wall-mounted housing</li> <li>▪ 1 Set of coaxial cables: 3 m</li> <li>▪ 1 Earth cable: 30 cm</li> </ul>

Article	Order No.
Set	V51-1200-001-13x <sup>1)</sup> (Order No. on request)
Display unit	51-1200-xxx <sup>1)</sup> (Order No. on request)
Wall-mounted housing incl. earth cable, 3 KOAX cables 3 m, cable tie	050410-0052
Wall-mounted housing	49-9001-006

1) Depends on the voltage level. Please provide data when ordering

# ORION 3.1 / ORION M1

## Combined Voltage Detection and Indication Systems

### Product Features

- Designed according to IEC 61243-5 (VDE 0682-415)
- Voltage detector
- Phase comparator
- Interface detector
- Phase-sequence indicator with status RGB LED
- ORION M1 with additional functions
  - Harmonic voltage and current measurement
  - Phase angle measurement
  - LCD display
  - Measured data storage, readable
  - Data transmission via USB interface

ORION 3.1 and ORION M1 are testing and indication devices for voltage detecting, phase comparison and coupling part testing according to IEC 61243-5. They are used at LRM and HR interfaces in medium voltage switchgears.

The ORION M1 features a large LCD display with backlight. It allows easy reading of the measured values, e. g. current, phase angle and harmonic voltage measurements. The integrated USB interface is used to retrieve the stored data results for further evaluation.

Besides the information on the next maintenance test and the indication of the battery status, the ORION M1 device provides the user with menu language options (German/English).

### Capacitive interface

- Precision current measurement in  $\mu\text{A}$  (2 x CH)
- Voltage testing symbols for both channels
- Maintenance tests on coupling parts
- Phase-sequence indication
- Frequency setting and battery status

### Voltage accuracy

- FFT (Fast Fourier Transformation)
- Total harmonic distortion (THD) [%]
- Up to the 40th harmonic [%]
- Bar graph for harmonic voltage percentage

### Phase comparison

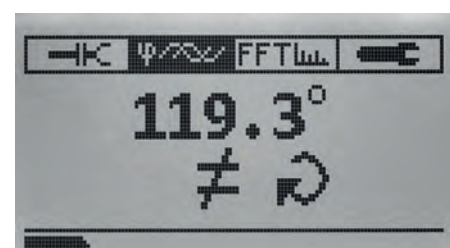
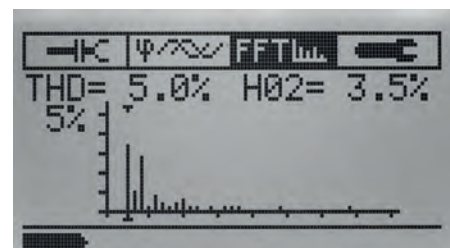
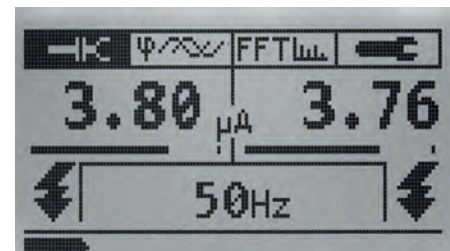
- Phase angle difference
- Phase balance/phase unbalance symbol
- Phase-sequence indication



ORION 3.1



ORION M1



# ORION 3.1/ORION M1

Combined Voltage Detection and Indication Systems

Technical Data	ORION 3.1	ORION M1
Nominal frequency	50 or 60 Hz	16,7, 50, 60 Hz (adjustable)
Current measurement	—	<ul style="list-style-type: none"> <li>Measuring range 1: 0 – 5 <math>\mu</math>A (<math>\pm</math>2 %)</li> <li>Measuring range 2: 0 – 25 <math>\mu</math>A (<math>\pm</math>2 %)</li> </ul>
Phase angle measurement	—	Measuring range: -180 to +180° ( $\pm$ 1°)
Harmonic voltage measurement	—	<ul style="list-style-type: none"> <li>Bar graph: 0 – 5 %/0 – 10 %</li> <li>THD: 0 – 100 % (<math>\pm</math>1 %)</li> <li>Harmonic (2-40): 0 – 100 % (<math>\pm</math>1 %)</li> </ul>
Indication	RGB-LEDs	<ul style="list-style-type: none"> <li>RGB LEDs</li> <li>LCD display</li> </ul>
Power supply	4 mignon cells/LR 6 or AA 1.5 V; replaceable 6 years of service life, 1,000 operating cycles/year	
Operating temperature	-25 to +55 °C	-25 to +55 °C, below -15 °C LED indication only

Dimension drawing see on page 75, M15

	ORION 3.1	ORION M1
Equipment set	ORION, plastic case, set of measuring lines, 2 HR/LRM adapter Only ORION M1: USB cable + CD with application software + magnetic holder	

Article	Order No.	ORION M1
	ORION 3.1	
Set	51-0206-101 (50 Hz) 51-0206-102 (60 Hz)	51-0206-201
LR-LRM adapter (for jack connectors)	52-0206-002	
IVIS adapter	52-0206-003	
WEVA adapter ORION, 104 mm	52-0206-004 (10 kV), 52-0206-005 (20 kV)	
WEVA adapter ORION, 130 mm	52-0206-014 (10 kV), 52-0206-024 (20 kV)	
Special HR adapter (cable length approx. 0.1 m)	52-0206-007	
Magnetic holder	49-6001-010	▪



Set of measuring cables



HR/LRM adapter



IVIS adapter



LR-LRM adapter/WEVA adapter



Special HR adapter



Magnetic holder

# HR-ST/LRM-ST

## Voltage Indicator for Capacitive Measuring Points

### Product Features

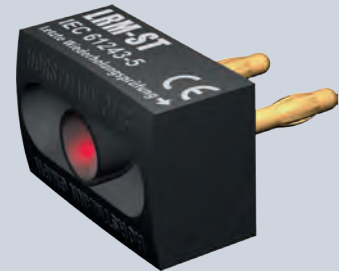
- Designed according to IEC 61243-5 (VDE 0682-415)
- HR-ST: Continuous voltage indicator for high-resistance systems
- LRM-ST: Continuous voltage indicator for low-resistance modified systems
- No battery supply
- Voltage is indicated by a flashing LED

HR-ST and LRM-ST type voltage indicators are mobile components of a voltage detecting system with capacitive single-pole coupling to live parts.

The HR/LRM function tester allows testing of the display and the overall function of the device.



HR-ST



LRM-ST



Function tester HR / LRM

Technical Data	HR-ST	LRM-ST
Response voltage Vt	70 – 90 V	4 – 5 V
Nominal frequency	50 Hz	
Input impedance	36.0 – 43.2 MΩ	2.0 – 2.4 MΩ
Operating temperature	-25 to +55 °C	
Flash frequency	≥1 Hz upon trip voltage	
Housing	Polycarbonate, IP54	
Circuit	Sealed in cast resin, water-proof	

HR-ST: Dimension drawing see on page 76, M16

LRM-ST: Dimension drawing see on page 76, M17

Article	Order No.	
	HR-ST	LRM-ST
Plug	51-0205-010	51-0205-011
HR/LRM function tester	52-0211-007	





Interface adapter converter HR/LRM



Case kit: "Standard type"

## Interface Adapter Converter HR/LRM

### Product Features

- Designed according to IEC 61243-5 (VDE 0682-415)
- Re-establishment of damaged HR interfaces
- Upgrading of interfaces to meet relevant standards
- Conversion from HR to LRM interface

The HR/LRM adapter converter provides a solution that allows to re-establish/upgrade 3-phase HR interfaces on medium voltage switchgears which fail to comply with requirements for interfaces according to IEC 61243-5 standard.

In most cases, it is possible to convert an affected HR interface into an LRM interface by implementing specific adaptation measures so that it complies with IEC 61243-5.

Advantages: Measurement, evaluation and mounting can be performed directly on the switchgear installation during running operation without having to open the switchgear installation or switch off the line voltage.

Should, in the course of time, the HR-interface continue to change, the LRM-interface can be upgraded at any time by repeating the four steps.

Technical Data	Interface Adapter Converter
Entry side	HR interface, two 4 mm plugs, 19 mm distance
Exit side	LRM interface, two 4 mm sockets, 14 mm distance
Over-voltage protection	Surge arrester 90 V, suitable for LRM interface
Adaptation	Balancing capacitor, dielectric strength 200 V
Dimensions	Width x Height: 25 mm x 42 mm
Insertion depth	33 mm This insertion depth must be available in the switchgear installation on the HR interface to allow permanent mounting of the HR/LRM interface converter.

Article	Order No.
Case kit "Standard" type with multimeter	51-0501-001
Case kit "Compact" type with multimeter	51-0501-002
Case kit "Compact" type without multimeter	51-0501-003

Interface Converter	Order No.
68 pF	51-0208-013
100 pF	51-0208-014
150 pF	51-0208-015
680 pF	51-0208-001
1.0 nF	51-0208-002
1.5 nF	51-0208-003
2.2 nF	51-0208-004
3.3 nF	51-0208-005
4.7 nF	51-0208-006
6.8 nF	51-0208-007
10.0 nF	51-0208-008
15.0 nF	51-0208-009

# Maintenance Test

As per German accident prevention regulations for electrical installations and equipment (DGUV regulation 3) of Employers Liability Insurance Association, voltage detectors, phase comparators and pluggable capacitive voltage detecting systems are subject to maintenance tests at intervals not exceeding 6 years. Dipl. Ing. H. Horstmann GmbH offers this maintenance testing for all new but also for some older devices of own production.

Regardless of the duty to perform repeat testing, the following rule is mandatory for devices and equipment including voltage detectors: The user is responsible for the safe and proper condition of the devices. Prior to each use, the user must verify devices and equipment are suitable for proper function as well as checking for externally visible damages and defects.

Integrated capacitive voltage testing devices of the WEGA series including WEGA 1.2, 1.2 C, 2.2, 2.2 C, 1.2 C vario and T1 with self-test facility, are not subject to maintenance tests.

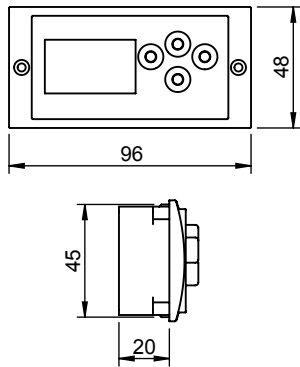
	Testing Requirements according to	Test Interval	Remark	Order No.
<b>Voltage detectors with capacitive coupling a)</b>				
BL-I, BL-A, BK-I, BK-A, BS-I, BS-A	DIN EN 61243-1/VDE 0682 Part 411	6 years	b), c), d)	79-0102-004
BO-A (for railway systems)	DIN VDE 0681 Part 6	6 years	b), c), d)	
FL-I	DIN EN 61243-1/VDE 0682 Part 411	6 years	b), c)	79-0110-001
<b>Phase comparators with capacitive coupling</b>				
PG II	DIN EN 61481/VDE 0682 Part 431	6 years	b), c), d)	79-0105-001
COMPARE 2.0	DIN EN 61481/VDE 0682 Part 431	6 years	b), c), d)	79-0112-001
<b>Interface detectors, voltage detectors, phase comparators</b>				
ORION 3.0, 3.1, M1	DIN EN 61243-5/VDE 0682 Part 415	6 years	c), d)	79-0107-001
<b>Capacitive continuous voltage indicators, pluggable</b>				
HR-ST, LRM-ST	DIN EN 61243-5/VDE 0682 Part 415	6 years	e)	—
<b>Coupling parts of pluggable capacitive voltage detecting systems</b>				
Jack Modules	DIN EN 61243-5/VDE 0682 Part 415 (latest and newer devices)	6 years	f)	—
<b>Voltmeter</b>				
BL-M	Based on DIN EN 61243-2	2 years	g)	79-0107-020

- a.) Maintenance tests on devices belonging to the AC series are no longer carried out.
- b.) All devices, which are sent to us by our customers, must be sent complete i. e. including operating sticks and extension elements.
- c.) We perform maintenance test only on the condition that the devices are not older than 14 years and in a technically acceptable condition.
- d.) For all battery-operated devices, the battery replacement is mandatory during maintenance test (included in the price).
- e.) Due to the disproportionately high testing expenditure, we do not carry out maintenance tests on the HR-ST and LRM-ST devices. We replace these devices on a "new-for-old" basis granting a special discount of 20 % on the new price.
- f.) Can be carried out on own initiative with the ORION 3.0, 3.1, M1. ORION 3.0, 3.1 conclude a good/bad condition. Further quantitative measurements can be carried out using HO-M and NO-M measuring adapters as well as appropriate digital multimeters.
- g.) This test includes a metrological recalibration and maintenance test based on DIN EN 691243-2. We recommend the test every 2 years.

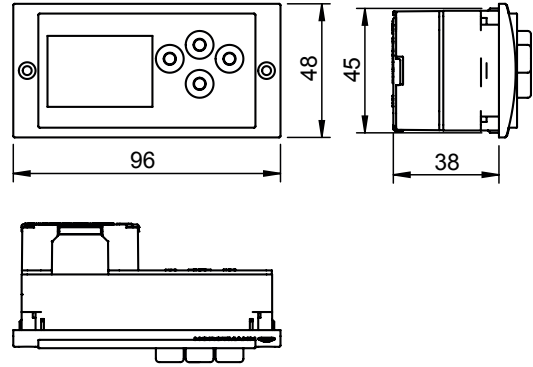
In order to avoid any delay in processing order, we kindly ask you to either attach a copy of your order letter to your consignment, or send us your order letter in due time.

# Dimension Drawings

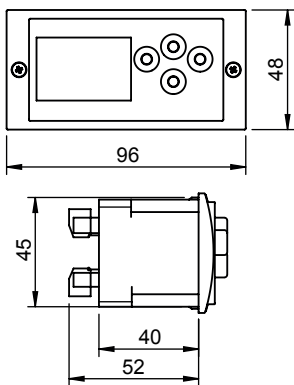
## Voltage Detecting Systems



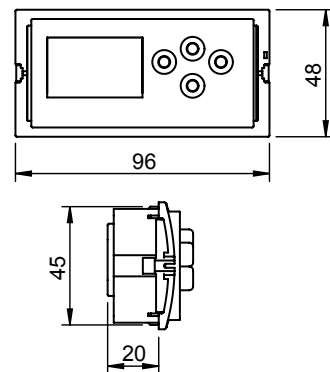
M10: WEGA 1.2 C



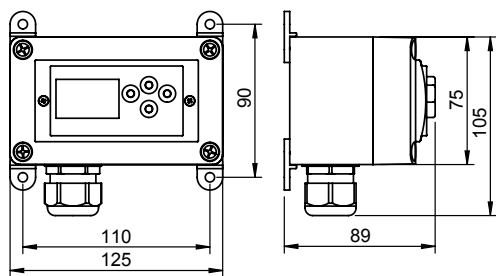
M11: WEGA 1.2 C vario



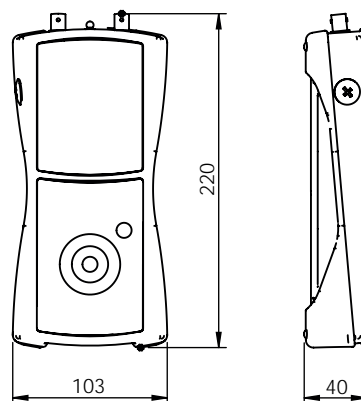
M12: WEGA 2.2 C



M13: WEGA 3



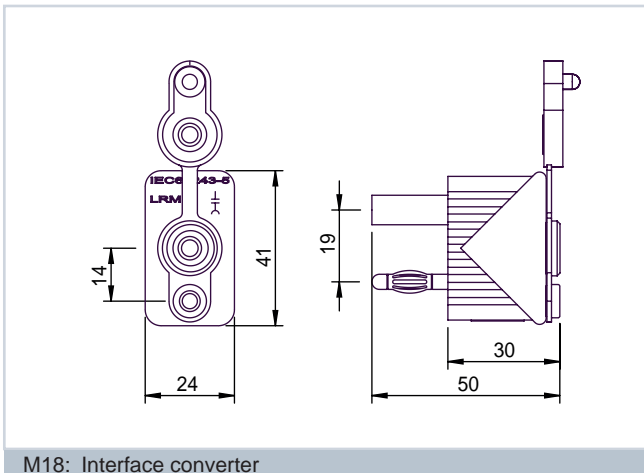
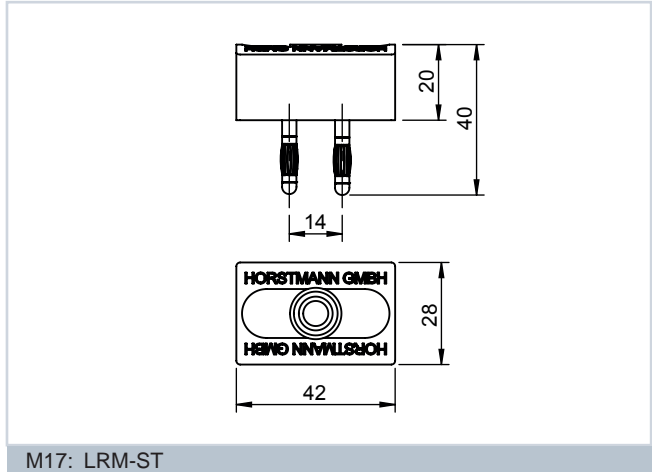
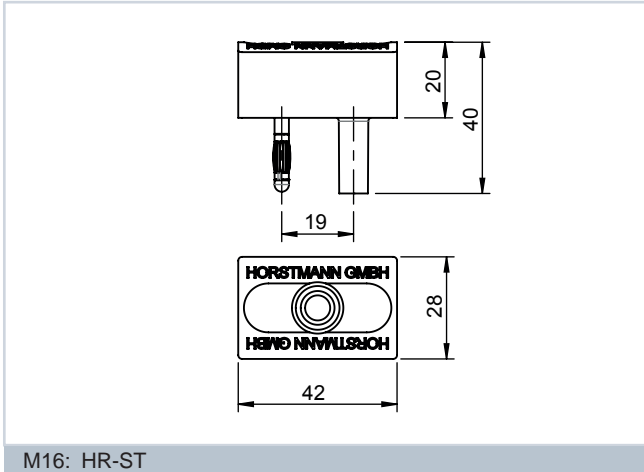
M14: WEGA T1



M15: ORION 3.1/M1

# Dimension Drawings

Voltage Detecting Systems



# Earthing Devices and Accessories

## General Information



Earthing and short-circuiting devices are portable equipment for temporary earthing or earthing and short-circuiting of disconnected or isolated switchgear installations.

The aim of earthing and short-circuiting of disconnected or isolated parts in electrical installations is to prevent voltages and electric arcs in the event of an accidental re-closure or when currents are coupled into the system by adjacent energised installations.

Customers should bear in mind the following aspects:

- Type of switchgear installation(s)
- Length of cables, or distance between phase and earth
- Type of neutral point connection of the installation (whether or not solidly ground)
- Type of connection parts and determination of connection points on conductors
- Rated short-circuit time  $t_r$
- Rated short-circuit current  $I_r$
- Rated short-circuit peak factor

Recommended maintenance intervals for properly treated devices and equipment (according to BG ETEM):

- at least every 5 years for equipment carried in vehicles
- at least every 10 years when installed in stationary equipment

Replacement is required for all devices

- that were exposed at least one full short-circuit fault
- without or with insufficient transparency of cable insulation
- the insulation of which was originally transparent and colourless insulation but has meanwhile discoloured such as to not allow identifying the condition of the copper strand, or
- that are provided with welded or soldered connections.

### Current and time rating for earthing equipment

When selecting the required cable cross section, the maximum short-circuit current of the switchgear installation must be taken into account. Connecting elements that are mounted to earthing and short-circuiting devices shall have at least the same current rating as the cables to which they are connected.

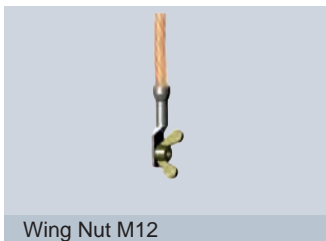
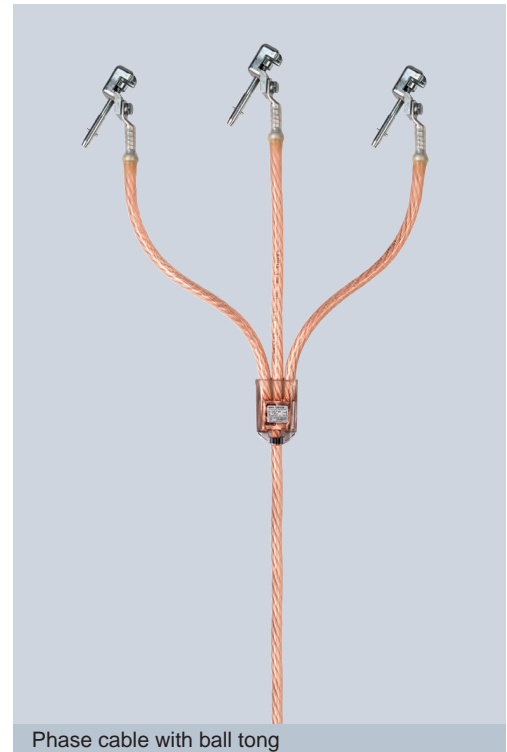
Earthing and short-circuiting devices and their components must be dimensioned in accordance with the short-circuit current rating ( $I_r$ ), the short-circuit time rating ( $t_r$ ) and the corresponding peak factor.

Cable Section [mm <sup>2</sup> ]	Short-Circuit Time $t_r = 0.5$ s		Short-Circuit Time $t_r = 1.0$ s	
	Rated Current $I_r$ [kA]	Peak Factor	Rated Current $I_r$ [kA]	Peak Factor
16	4.5	2.5	3.2	3.5
25	7.0	2.5	4.9	3.5
35	10.0	2.5	6.9	3.5
50	14.0	2.5	9.9	3.5
70	19.5	2.5	13.8	3.5
95	26.5	2.5	18.7	3.5
120	33.5	2.5	23.7	3.5
150	42.0	2.5	29.6	3.5

# Earthing and Short-Circuiting Devices with Ball Tonges

## Product Feature

- Designed according to IEC 61230 (VDE 0683-100)
- Cables assembled from highly flexible copper conductors (with transparent insulation)
- Moulded transparent connection piece allows permanent visual inspection
- Connection elements for phase cable: 3 ball tongs
- Connection elements for earth cable:  
M12 wing nut, M16 wing nut, earth clamp or earthing terminal
- Dimensions:  
Distance between centre line of cable lug hole and entry of the connection piece:  
Phase cable: 600 mm/550 mm/600 mm  
Earth cable: 1,500 mm



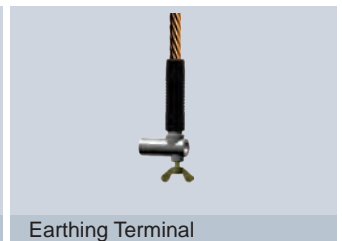
Wing Nut M12



Wing Nut M16



Earth Clamp



Earthing Terminal

Connection to: Fixed Ball Point ø [mm]	Cable Cross Section, Phase/Earth Cable [mm <sup>2</sup> ]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No. of kit			
			Wing nut M12	Wing nut M16	Earth Clamp	Earthing Terminal
20	50/50	9.9	60-0108-002	–	60-0101-001	60-0107-001
20	70/35	13.8	60-0108-004	–	60-0101-003	60-0107-003
20	70/70	13.8	60-0108-003	60-0209-013	60-0101-002	60-0107-002
25	95/35	18.7	60-0208-002	60-0209-004	60-0201-001	60-0207-002
25	95/95	18.7	60-0208-001	60-0209-001	60-0202-001	60-0207-001
25	120/50	23.7	60-0208-003	60-0209-010	60-0201-002	60-0207-003
25	120/120	23.7	–	60-0209-002	60-0202-002	60-0207-007

1) Type testing refers basically to a rated time tr = 0.5 s, see on page 77.

Earthing and short-circuiting devices with other cable lengths and fittings for phase or earth cable ends are available on request (see on page 102).

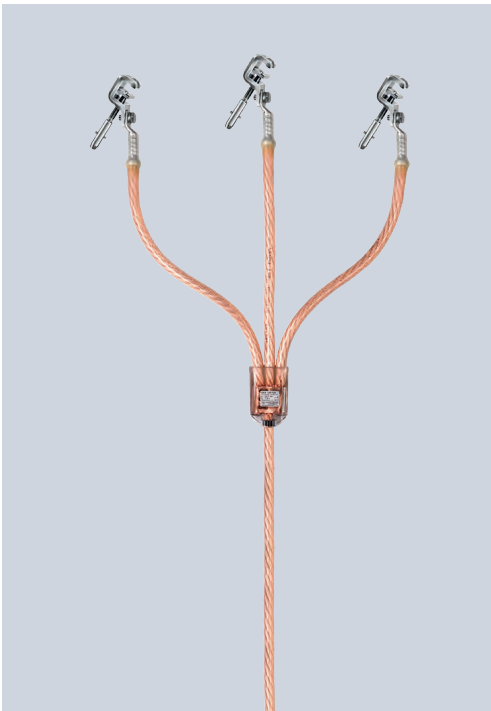
Lengths of earthing and short-circuit cables have to fit to the switchgear and the distances between the connection points (min 1.2 times of the distance). If the cables are too long (>1.5 times of the distance) they must be fixed with an insulating cable to prevent damages and injuries in case of a short-circuit.

Earthing cables used on solidly earthed systems shall have the same cross-section as the associated short-circuiting cables or bars.

Earthing cables used on non-solidly earthed systems may have a cross-section less than the corresponding short-circuiting cables or bars.

Accessories	Order No.
Hot sticks	see on page 88
Earthing sticks	see on page 92
Wall holders	see on page 94

# Earthing and Short-Circuiting Devices with Universal Phase Clamp



Phase cable with Universal Phase Clamp

## Product Features

- Designed according to IEC 61230 (VDE 0683-100)
- Cables assembled from highly flexible copper conductors (with transparent insulation)
- Moulded transparent connection piece allows permanent visual inspection
- Connection elements for phase cable: 3 universal phase clamps
- Connection elements for earth cable:  
M12 wing nut, M16 wing nut, earth clamp or earthing terminal
- Dimensions:  
Distance between centre line of cable lug hole and entry of the connection piece:  
Phase cable: 600 mm / 550 mm / 600 mm  
Earth cable: 1,500 mm



Wing Nut M12



Wing Nut M16



Earth Clamp



Earthing Terminal

Connection to:						Order No. of kit			
Connection to Fixed Ball Point ∅ [mm]	T-Connection Bolt [mm]	Round Conductor [mm]	Flat Conductor [mm]	Cable Cross Section Phase/Earth Cable [mm <sup>2</sup> ]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/t <sub>r</sub> = 1 s	Wing Nut M12	Wing Nut M16	Earth Clamp	Earthing Terminal
20	15	4–15	0–25	50/50	9.9	60-0308-001	–	60-0301-001	60-0307-001
20	15	4–15	0–25	70/35	13.8	60-0308-003	–	60-0301-003	60-0307-003
20	15	4–15	0–25	70/70	13.8	60-0308-002	–	60-0301-002	60-0307-002
25	15	10–25	0–28	95/35	18.7	60-0508-002	–	60-0501-001	60-0507-002
25	15	10–25	0–28	95/95	18.7	60-0508-001	60-0509-001	60-0502-001	60-0507-001
25	15	10–25	0–28	120/50	23.7	60-0508-003	–	60-0501-002	60-0507-003
25	15	10–25	0–28	120/120	23.7	–	60-0509-002	60-0502-002	–

1) Type testing refers basically to a rated time  $t_r = 0.5$  s, see on page 77.

Earthing and short-circuiting devices with other cable lengths and fittings for phase or earth cable ends are available on request (see on page 102).

Lengths of earthing and short-circuit cables have to fit to the switchgear and the distances between the connection points (min 1.2 times of the distance). If the cables are too long (>1.5 times of the distance) they must be fixed with an insulating cable to prevent damages and injuries in case of a short-circuit.

Accessories	Order No.
Hot sticks	see on page 88
Earthing sticks	see on page 92
Wall holders	see on page 94

Earthing cables used on solidly earthed systems shall have the same cross-section as the associated short-circuiting cables or bars.

Earthing cables used on non-solidly earthed systems may have a cross-section less than the corresponding short-circuiting cables or bars.

# Single-Pole Earthing and Short-Circuiting Cables

without connecting elements

## Product Features

- Designed according to IEC 61230 (VDE 0683-1 or -100)
- Cables assembled from highly flexible copper conductors (with transparent insulation)
- Cable lug on each cable end

Each cable lug is provided with a 13 mm dia. hole. Any type of connecting element can be used for the earthing cables (see on page 83 and 86).



Single-pole earthing and short-circuiting cable

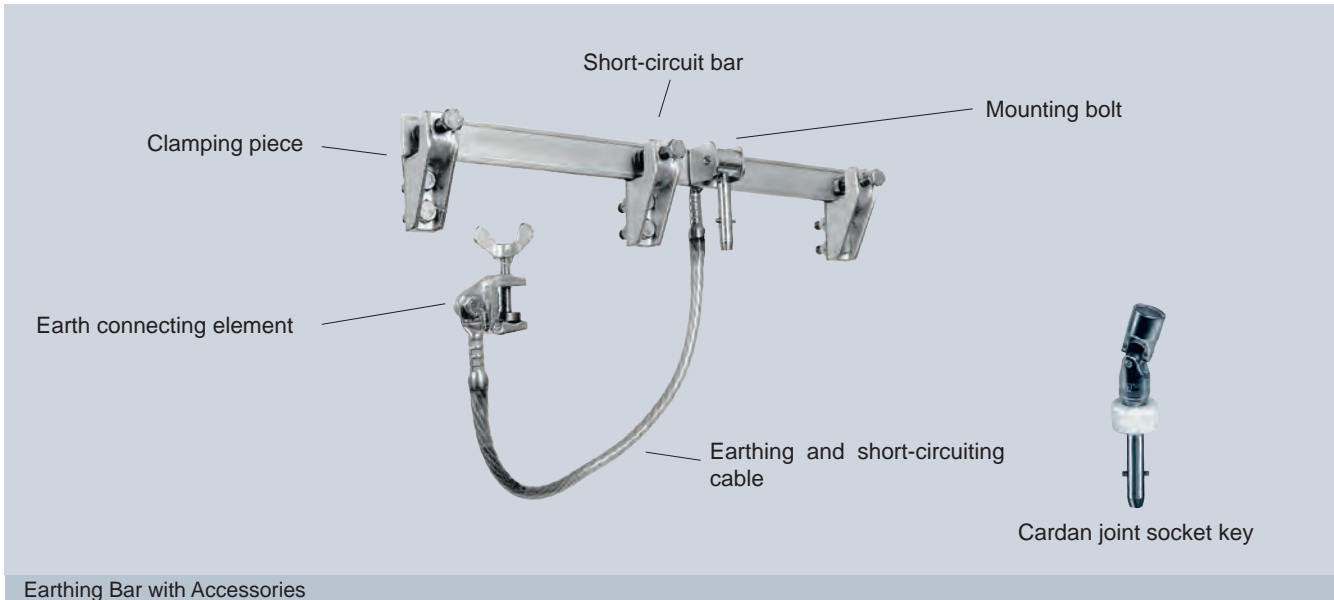
Cross Section of Copper Conductor [mm <sup>2</sup> ]	Rated Values <sup>1)</sup> Ir [kA]/tr = 1s	Cable Length [mm]	Order No.
25	4.9	800	61-0101-015
25	4.9	2,000	61-0101-003
25	4.9	2,500	61-0101-016
35	6.9	2,000	61-0102-003
35	6.9	3,000	61-0102-009
50	9.9	1,200	61-0103-001
50	9.9	1,500	61-0103-002
50	9.9	2,000	61-0103-003
70	13.8	800	61-0104-018
70	13.8	1,200	61-0104-001
70	13.8	1,500	61-0104-002
70	13.8	2,000	61-0104-003
95	18.7	1,200	61-0105-001
95	18.7	1,500	61-0105-002
95	18.7	3,000	61-0105-009
95	18.7	4,000	61-0105-008
95	18.7	5,000	61-0105-010
120	23.7	1,000	61-0106-012
120	23.7	1,200	61-0106-001
120	23.7	1,500	61-0106-002
120	23.7	2,000	61-0106-003
120	23.7	3,000	61-0106-006
150	29.6	1,200	61-0107-001
150	29.6	1,500	61-0107-002
150	29.6	2,000	61-0107-003
150	29.6	2,500	61-0107-009
150	29.6	3,000	61-0107-006

1) Type testing refers basically to a rated time of tr = 1 s and the peak factor of 2.5, see on page 77. Further cable lengths are available on request (see on page 102).

Lengths of earthing and short-circuit cables have to fit to the switchgear and the distances between the connection points (min 1.2 times of the distance). If the cables are too long (>1.5 times of the distance) they must be fixed with an insulating cable to prevent damages and injuries in case of a short-circuit.



# Short-Circuit Bars



Short-Circuit Bar with mounting bolt and centre groove, material: E-Cu 57 F20

Rail Distance	Dimensions [mm]	Rail Length [mm]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/t <sub>r</sub> = 1s	Order No.
210	40 x 10	560	45.9	62-0101-050
250	40 x 10	640	45.9	62-0101-051
210	60 x 8	560	55.9	62-0101-054
450	60 x 8	1,000	55.9	62-0101-057

1) Type testing refers basically to a rated time of t<sub>r</sub> = 1 s and the peak factor of 2.5, see on page 77.

## Clamping piece

For Short-Circuit Bar	Bolts	Material	Order No.
40 x 10	M12, AF19	GTW	62-0103-001
60 x 8/60 x 15	M12, AF19	GK-ALSi 10 MG	62-0103-003

Accessories	Order No.
Earthing and short-circuiting cable	see on page 80
Earth connecting element	see on page 86
Cable lug with wing nut	see on page 86
Cardan joint socket key	67-0301-001

## Set consisting of:

- 1 Short-circuit bar with mounting bolt
- 3 Clamping pieces
- 1 Earthing cable
- 1 Earth connecting element
- 1 Cardan joint socket key

# Phase Connecting Points

## Product Features

- Fixed ball points are suitable for phase connection and current rail bolting
- Connection:  
Female thread: M10, M12 or M16  
Steel pin: M10x30, M12x30 or M16x30

## Fixed ball point with female thread

Material of straight ball pin: E-Cu, zinc-plated

Material of angle ball pin: CrCu, zinc-plated

Ø mm	Thread	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.	
			Straight type	Angle type
20	M10	18.7 (straight)	63-0101-002	—
20	M12	18.7 (straight) 13.8 (angular)	63-0101-001	63-0103-001
25	M12	23.7	63-0101-003	63-0103-002
25	M16	29.6	63-0101-004	63-0103-003

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



Ball point, straight

Ball point, angle type

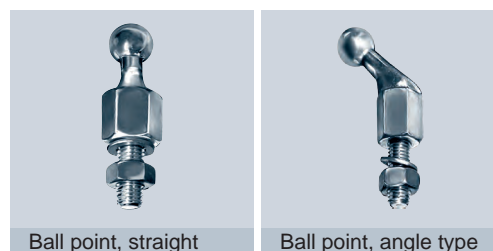
## Ball pin with steel grub screw

Material straight ball pin: E-Cu, zinc-plated

Material angled ball pin: CrCu, zinc-plated

Ø mm	Thread	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.	
			Straight type	Angle type
20	M10 x 30	18.7 (straight)	63-0102-002	—
20	M12 x 30	18.7 (straight) 13.8 (angular)	63-0102-001	63-0104-001
25	M12 x 30	23.7	63-0102-003	63-0104-002
25	M16 x 45	29.6	63-0102-004	63-0104-003

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



Ball point, straight

Ball point, angle type

## T-Connection bolts

Material: zinc-plated

Ø mm	Thread	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
20	M12	13.8	63-0106-001
20	M12 x 30	13.8	63-0106-002

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



T-Connection grub screw

# Phase Connecting Elements

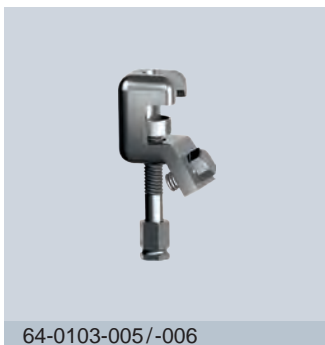
## Phase Clamps with bayonet fitting

Material of universal compact clamp: chromium-copper  
Material of universal line clamp, ball tongs: special brass



Ball Pin Ø [mm]	Connection to:				Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.		
	Round Conductor [mm]	T-Connection Bolt [mm]	Flat Conductor [mm]	Universal Compact Clamp		Universal Phase Clamp	Ball Tong	
20	—	—	—	18.7	—	—	64-0103-001	
25	—	—	—	29.7	—	—	64-0103-002	
20	4–15	15	0–25	13.8	64-0101-001	—	—	
20	10–20	—	0–22	13.8	—	64-0102-001	—	
25	10–25	15	0–28	23.7	—	64-0102-002	—	
20/25	10–25	15	0–28	18.7/23.7	—	64-0102-003	—	
25/30	10–30	15	0–28	23.7	—	64-0102-004	—	

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



## Phase clamps with hexagon spindle

Connection to: Ball pin Ø [mm]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No. Ball Tong
20	18.7	64-0103-005
25	29.7	64-0103-006

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.

# Earth Connecting Points

## Earth connecting bolts with ring groove

for earthing terminal (see on page 86)

Material: brass, zinc-plated



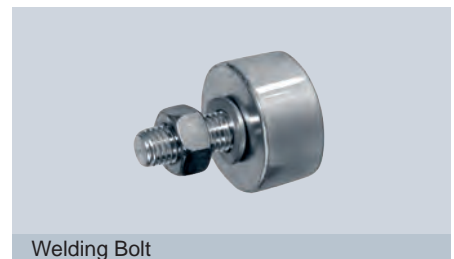
Fixing in switchgears [mm]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.		
		Welding Type	with Steel Pin	with Female Thread
—	18.7	63-0201-001	—	—
M12 x 25	18.7	—	63-0201-007	—
M12 x 40	18.7	—	63-0201-006	—
M12	18.7	—	—	63-0201-003

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.

## Welding earthing nut

for cable lug with captive wing nut or with 13 mm bore hole (see on page 86 and 87).

Material: steel, zinc-plated



Connection point for EKV [mm <sup>2</sup> ]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
M12	18.7	63-0204-001

# Earth Connecting Points



Earthing Screw

## Earthing screw

for cable lug with captive wing nut (see on page 86)  
Material: brass, zinc-plated

Fixing Point for EKV [mm <sup>2</sup> ]	Spanner size	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
M12 x 60	32	13.8	63-0205-001
M16 x 70	32	18.7	63-0205-002

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



Screw for crossed wires

## Earthing screw for converting

for cable lug with captive wing nut (see on page 86)  
Material: brass, zinc-plated

Thread [mm <sup>2</sup> ]	Spanner size	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
M12 to M16	32	9.9	63-0205-003

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



Earthing Nut

## Earthing nut

for cable lug with captive wing bolt (see on page 87)  
Material: brass, zinc plated

Thread [mm <sup>2</sup> ]		Spanner size	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
Female thread	Bolt thread			
M12	M12	32	9.9	63-0206-001
M12	M16 x 30	32	9.9	63-0206-003
M16	M12 x 25	32	9.9	63-0206-002

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.

# Earth Connecting Elements

## Earth clamps

Material: chromium-copper

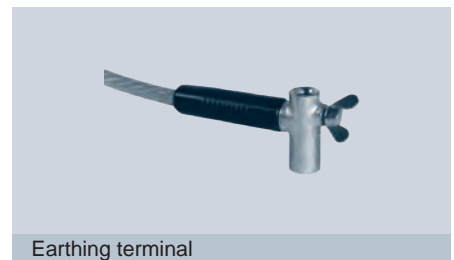


Clamping Range [mm]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.		
		with T-Handle	with Wing Bolt	with Bayonet Connector
23	18.7	64-0201-001	64-0201-003	64-0201-005
38	29.6	64-0201-002	64-0201-004	64-0201-006

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.

## Earthing terminal

Material: brass/handle made of PA 6

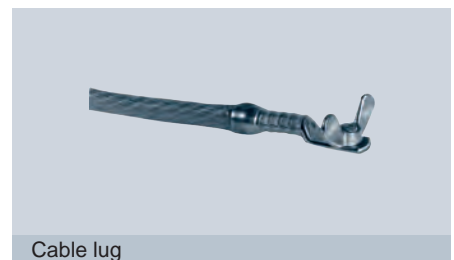


Earthing terminal

Cable Cross Section [mm <sup>2</sup> ]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
50	9.9	64-0202-003
70	13.8	64-0202-004
95	18.7	64-0202-005

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.

## Cable lug with captive wing nut

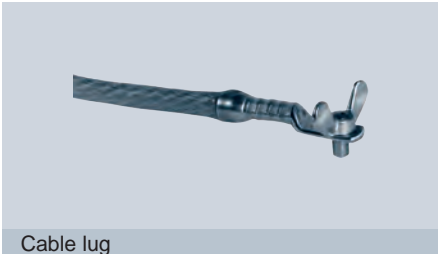


Cable lug

Cable Cross Section [mm <sup>2</sup> ]	Thread	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
50	M12	9.9	64-0203-001
70	M12	13.8	64-0203-002
95	M12	18.7	64-0203-003

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.

# Earth Connecting Elements



Cable lug with captive wing bolt

Cable lug

Cable Cross Section [mm <sup>2</sup> ]	Thread	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
50	M12 x 15	9.9	64-0204-001
70	M12	13.8	64-0204-002
95	M12	18.7	64-0204-003

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



Cable lug with 13 mm ø hole

Cable lug

Cable Cross Section [mm <sup>2</sup> ]	Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
70	13.8	64-0205-004

1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.



Universal earth clamp with insulated handle

Universal earth clamp

Connection to:				Rated Values <sup>1)</sup> I <sub>r</sub> [kA]/tr = 1 s	Order No.
Fixed Ball Point Ø [mm]	Round Conductor [mm]	T-Connection Bolt [mm]	Flat Conductor [mm]		
25	10–25	0–28	0–28	23.7	64-0102-007

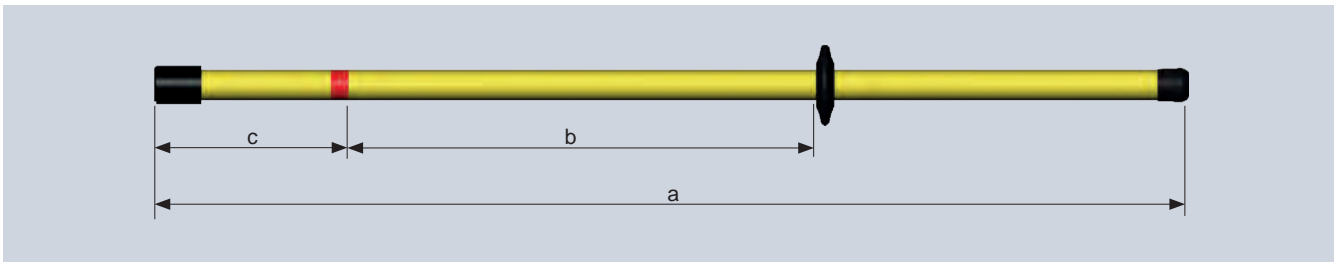
1) Type testing refers basically to a rated time of tr = 0.5 s, see on page 77.

# Hot Sticks

## Product Features

- Designed according to DIN VDE 0681-1
- Manual operation of live parts
- Material: fibreglass reinforced epoxy resin tube
- Types: bayonet or hexagonal fitting
- Applications for indoor 🏠 or outdoor installation 🏠 ☔

## Indoor Applications 🏠

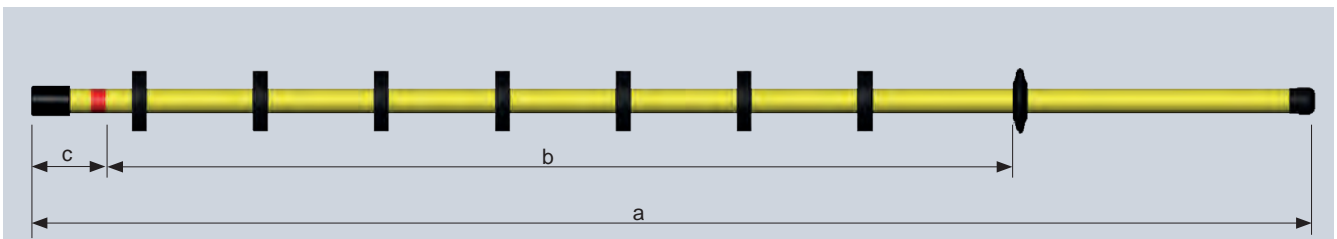


Indoor application hot stick

Nominal Voltage max. [kV]	Dimensions [mm]			Order No.	
	a <sup>1)</sup>	b	c <sup>1)</sup>	Bayonet Fitting	Hexagonal Fitting
20	1,100	500	217	65-0101-001	65-0201-001
30	1,200	525	242	65-0101-002	65-0201-002
45	1,500	720	197	65-0101-003	65-0201-003
60	2,000	905	312	65-0101-004	65-0201-004

1) Dimensions apply to hot sticks with bayonet fitting. Hot sticks with hexagonal end fitting are 12 mm longer.

## Outdoor Applications 🏠 ☔



Outdoor application hot stick

Nominal Voltage max. [kV]	Dimensions [mm]			Order No. Bayonet fitting
	a	b	c	
30	1,707	1,200	107	65-0102-001
60	2,317	1,600	117	65-0102-002

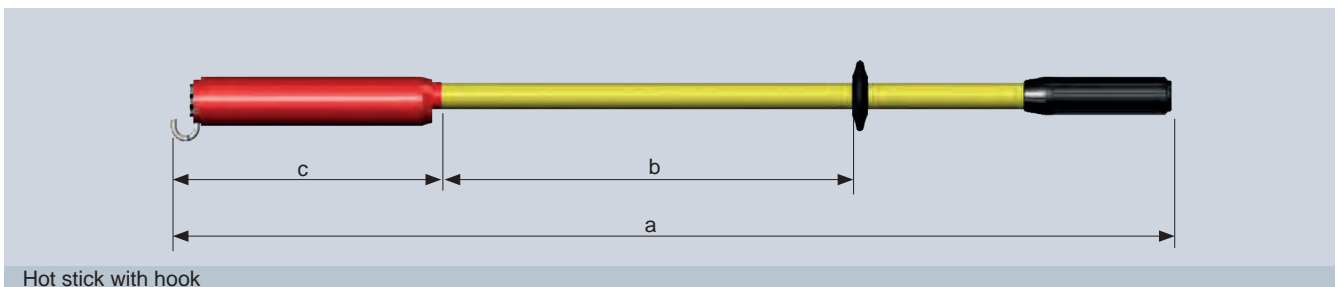


# Hot Sticks

With hook for applications in dry weather conditions 🏠

The hook serves to mount and dismount (Euromold) elbow connectors and NAVIGATOR type overhead line indicators.

Turning the handle will open or close the hook. When closing, the elbow connector bar is pulled into a slot recess of the rod head where it is retained.



Hot stick with hook

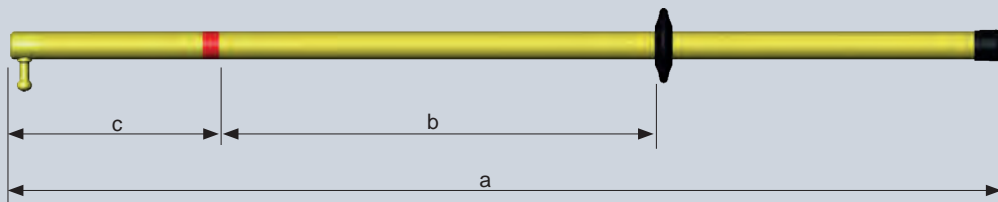
Nominal Voltage max. [kV]	Dimensions [mm]			Order No.
	a	b	c	
20	1,200	500	310	65-0301-001
30	2,000	900	310	65-0301-002
30	3,000	900	1,310	65-0301-003
46	2,000	900	310	65-0301-004

# Operating Rods

## Product Features

- Designed according to VDE 0681-2 (DIN 57681-2)
- Used to switch on and off switches with ring eyes
- Material: fibreglass reinforced epoxy resin tube
- One-part and two-part pluggable design
- Applications for indoor 🏠 and outdoor installation 🏠☔

## Indoor Applications 🏠

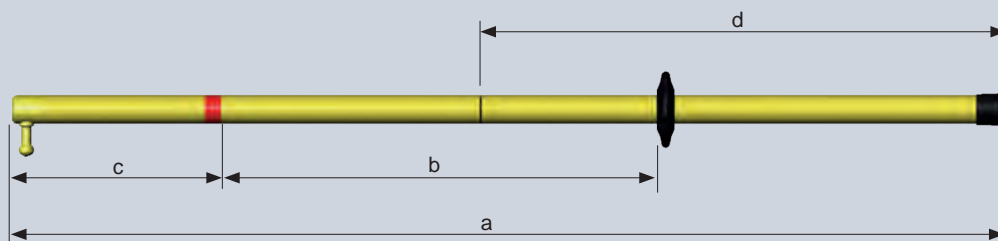


Indoor application operating rod

Nominal Voltage max. [kV]	Dimensions [mm]			Order No.
	a	b	c	
20	1,120	505	215	65-0401-001
30	1,220	525	245	65-0401-002
45	1,520	720	200	65-0401-003
60	2,020	900	320	65-0401-004

## Indoor Applications 🏠 , two-part design

With lock pin.

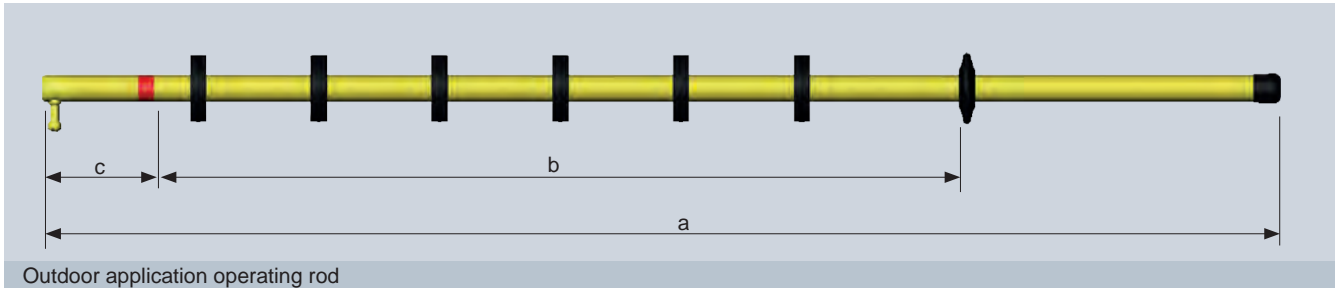


Indoor application operating rod (two-part-design)

Nominal Voltage max. [kV]	Dimensions [mm]				Order No.
	a	b	c	d	
20	1,120	500	220	600	65-0403-001
45	1,520	720	200	800	65-0403-003
60	2,020	900	320	1,050	65-0403-004

# Operating Rods

Outdoor Applications 🏠 ⚡



Nominal Voltage max. [kV]	Dimensions [mm]			Order No.
	a	b	c	
20	1,520	1,000	120	65-0402-001
30	1,720	1,200	120	65-0402-002
45	2,180	1,400	180	65-0402-003
60	2,320	1,600	120	65-0402-004



Switch hook with bayonet fitting

Suitable for all operating rods (bayonet fitting according to DIN 48087)

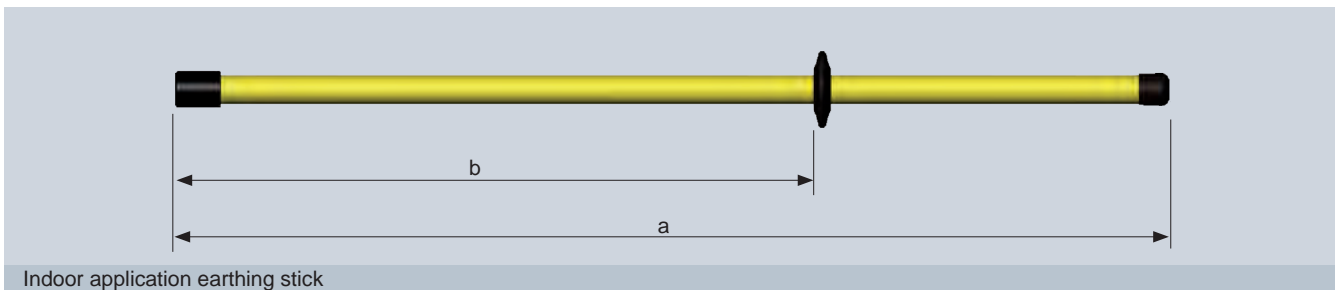
Accessories	Order No.
Switch hook with bayonet fitting	67-0301-003

# Earthing Sticks

## Product Features

- Designed according to VDE 0683-100 (IEC 61230)
- For installation and removal of earthing and short-circuiting devices in high-voltage installations
- Material: fibreglass reinforced epoxy resin tube
- Types with bayonet or hexagon fitting
- Application for indoor installations 🏠

The insulating element of the earthing stick must be of adequate dimension to avoid inadmissible high leakage currents. The minimum length of the insulating element is 500 mm.



Dimensions [mm]		Order No.	
a <sup>1)</sup>	b <sup>1)</sup>	Bayonet Fitting	Hexagon Fitting
1,117	717	66-0101-001	66-0201-001
1,517	917	66-0101-002	66-0201-002
2,017	1,217	66-0101-003	66-0201-003

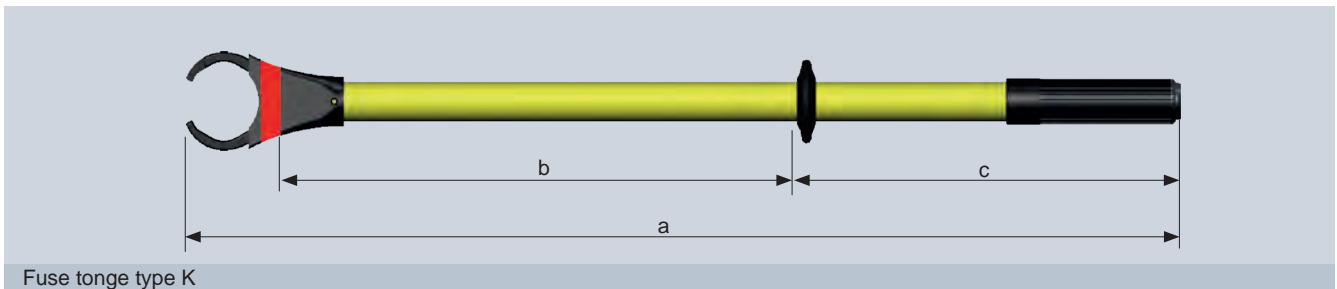
1) Dimensions apply to hot sticks with bayonet fitting. Hot sticks with hexagonal end fitting are 12 mm longer.

# Fuse Tong

## Product Features

- Designed according to VDE 0681-3 (DIN 57681-3)
- For gripping and replacing high-voltage HH fuses

The fuse tongs are guided over the fuses from the front, thus requiring little space to the side. They are ideally suited for use in narrow installations. The clamps are fixed and released by turning the handle.



Fuse tonge type K

Nominal Voltage max. [kV]	Dimensions [mm]			Clamping Range [mm]	Order No.
	a	b	c		
1-30	1,010	525	400	50-90	65-0502-002

## Tools for fuses



Tool

Total Length [mm]	Order No.
305	65-0504-004
385	65-0504-001

# Wall Holders



For holding:									
Earthing and Short-Circuiting Devices	Earthing Sticks	Operating Rods	Hot Sticks	Fuse Tongs	FL-I	BL-I/BL-A	BS-I/BS-A	HH Fuses	Order No.
▪	▪								67-0101-001
		▪	▪	▪					67-0101-002
					▪	▪	▪		52-0105-002
				▪				▪	67-0101-014
								▪	67-0101-015
	▪		▪	▪					67-0101-006
					▪	▪	▪		52-0105-001
				▪					67-0101-007

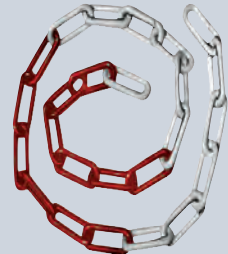
## Accessories



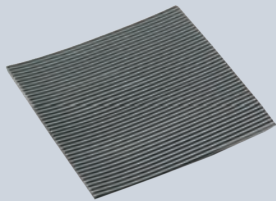
67-0202-003



67-0202-005



67-0202-001



67-0202-003



67-0202-011



67-0202-007

Accessories	Order No.
Safety helmet without face shield	67-0202-002
Safety helmet with face shield	67-0202-003
High-grade protective helmet, without face shield	67-0202-012
High-grade protective helmet, with face shield	67-0202-013
Protective gloves for electricians, 1,000 V according to VDE 0680-1 with certification stamp, length: 350 mm, thickness: 0.7 mm	67-0202-005
Red/white plastic chain with nylon links	67-0202-001
Rubber insulating matting up to 50 kV, max. 1 m wide, 4 mm thick, 10 m long (delivered as a roll – no tailored sizes)	67-0202-004
LED work lamp, incl. wall-mounting charge station 3 W LED lamp with maintenance-free lead-acid battery, charge status display, flashing function and emergency light function	67-0202-010
Handheld fire extinguisher filled with 5 kg of carbon dioxide, with snow pipe and wall holder	67-0202-007

# Insulating Protective Barrier

## Product Features

- Designed according to VDE 0682-552
- Provides partial protection against direct contact

Insulating protective barriers are intended for short-term use in electrical indoor switchgears exceeding voltage ratings from 1 kV bis 30 kV AC.

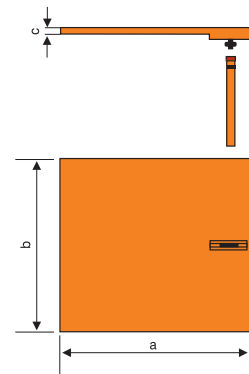
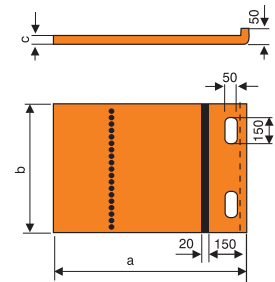
These devices may be used in factory-built, type-tested switchgears only in compliance with the switchgear manufacturer's instructions.

Insulating protective barriers are designed for partial protection against direct touching. These components do not protect against reclosure and must not touch live parts when installed.

According to requirement and application, numerous types of insulating protective barriers are necessary. They are installed manually by hand or using an insulating or operating stick.

Appropriate holders or guide rails shall be provided.

Depending on the size and type of barrier, reinforcements in the form of U-sections are installed at the bottom of the barrier to prevent the component from being bent.

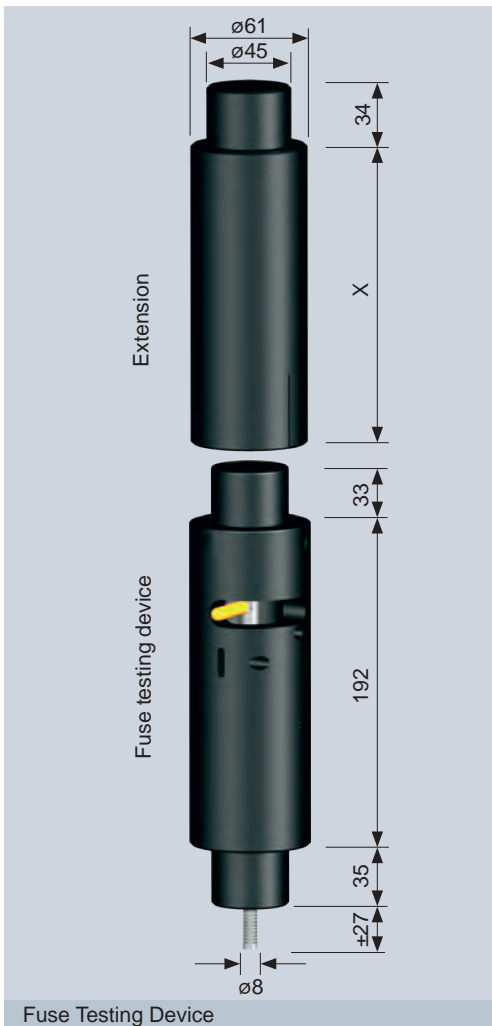


Technical Data	Insulating Protective Barrier
Material	PVC hard DIN 16927
Colour	Red, similar RAL 3000
Plate thickness	<30 kV, 6 mm
Spec. insulation resistance	$10^{15} \Omega \text{ cm}$
Surface resistivity	$10^{11} \Omega$

Article	Order No.
Insulating protective barrier	on request
Hot stick	see on page 88



# Fuse Testing Devices

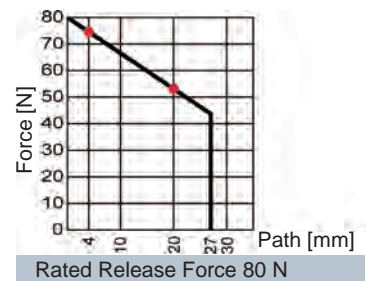
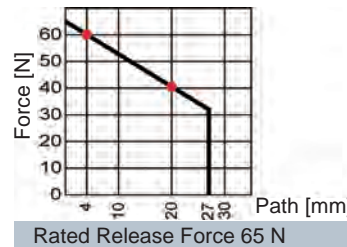
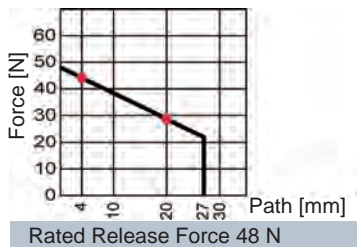
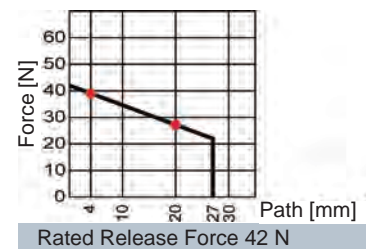
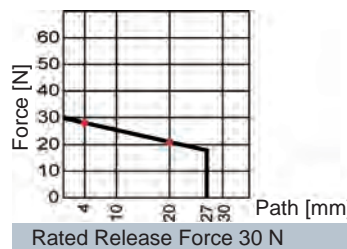


The mechanical HPS fuse testing device is designed to control the trip function of load break switches.

The testing fuse consists of a cylindrical fuse body similar to that of HH fuses and is fitted with a mechanical release device, a timer and a striker pin.

After winding up the timer the striker pin is reset and the testing device is inserted into the fuse cartridge of the switch to be checked.

After about 100 seconds the test fuse is operated whereupon the striker fires out. The size of the fuse corresponds to that of HH fuses with 6 kV nominal voltage. Extension pieces are available for the adaptation to other voltage levels.



Rated Release Force [N]	Free Stroke		Energy [J]	Spring Colour	Order No.
	4 mm [N]	20 mm [N]			
30	28.2	20.8	0.39	white	49-6015-007
42	39.0	27.2	0.53	black	49-6015-001
48	44.1	28.7	0.58	blanc	49-6015-006
65	60.1	40.6	0.81	yellow	49-6015-005
80	74.7	53.3	1.02	silver	49-6015-008

Accessories	X [mm]	U <sub>n</sub> [kV]	Order No.
Extension	100	12.0	49-6015-003
	175	17.5	49-6015-004
	250	24.0	49-6015-002
Bag			52-0102-003

# Weights

Order No.	ges. [kg]	Cu [kg]	Ms [kg]
20-0101-001	0.14	–	–
20-0102-001	0.16	–	–
20-0103-001	0.19	–	–
20-0104-001	0.24	–	–
20-0105-001	0.27	–	–
20-0106-001	0.28	–	–
20-0108-001	0.39	–	–
20-0120-001	0.16	–	–
20-0121-001	0.26	–	–
20-0122-001	0.15	–	–
20-0123-001	0.17	–	–
20-0401-000	0.12	–	–
20-0402-000	0.17	–	–
20-0403-000	0.20	–	–
20-0404-000	0.24	–	–
20-0405-000	0.27	–	–
20-0406-000	0.30	–	–
20-0408-000	0.40	–	–
20-0410-000	0.23	–	–
20-0420-000	0.17	–	–
20-0421-000	0.25	–	–
20-0422-000	0.15	–	–
20-0423-000	0.16	–	–
28-7200-004	0.40	–	–
30-1715-001	0.17	–	–
30-1815-001	0.20	–	–
32-0503-001	0.26	–	–
32-0513-001	0.12	–	–
33-0513-001	0.22	–	–
33-0613-001	0.32	–	–
36-0313-001	0.32	–	–
36-0323-001	0.22	–	–
37-1111-101	0.16	–	–
37-1121-101	0.16	–	–
37-2111-101	0.16	–	–
37-2121-101	0.16	–	–
37-3110-001	0.19	–	–
37-3120-001	0.18	–	–
37-3510-001	0.20	–	–
37-3520-001	0.20	–	–
37-5113-001	0.20	–	–
37-6000-001	0.19	–	–
37-6100-001	0.19	–	–
37-6200-001	0.19	–	–
38-0102-001	0.20	–	–
38-0152-001	0.20	–	–
38-4102-001	0.24	–	–
38-4150-001	0.24	–	–
38-4153-001	0.24	–	–
38-9100-013	3.10	–	–
38-9100-017	2.80	–	–
38-9100-026	7.56	–	–
41-2101-111	0.47	–	–

Order No.	ges. [kg]	Cu [kg]	Ms [kg]
41-2101-211	0.47	–	–
41-2101-311	0.46	–	–
41-2101-511	0.46	–	–
41-2108-111	0.47	–	–
41-2108-211	0.47	–	–
41-2108-311	0.47	–	–
41-2108-511	0.47	–	–
49-0101-202	0.15	–	–
49-0101-203	0.12	–	–
49-0101-206	0.15	–	–
49-0109-002	0.22	–	–
49-0109-003	0.013	–	–
49-0602-001	0.02	–	–
49-0602-009	0.01	–	–
49-0701-010	0.25	–	–
49-0702-005	0.52	–	–
49-0921-002	0.22	–	–
49-6001-002	0.39	–	–
49-6001-010	0.03	–	–
49-6003-218	0.02	–	–
49-6010-011	0.16	–	–
49-6010-030	0.14	–	–
49-6010-032	0.35	–	–
49-6010-044	0.15	–	–
49-6010-048	0.14	–	–
49-6010-052	0.12	–	–
49-6010-060	0.14	–	–
49-6011-040	0.34	–	–
49-6011-043	0.48	–	–
49-6012-004	0.19	–	–
49-6012-005	0.19	–	–
49-6012-007	0.31	–	–
49-6012-009	0.31	–	–
49-6012-015	0.31	–	–
49-6013-016	0.60	–	–
49-6013-027	1.15	–	–
49-6013-028	1.02	–	–
49-6013-029	0.35	–	–
49-6014-007	0.75	–	–
49-6014-009	0.60	–	–
49-6014-021	1.15	–	–
49-6014-022	1.02	–	–
49-6015-001	0.20	–	–
49-6015-005	1.50	–	–
49-6015-006	1.50	–	–
49-6015-007	1.50	–	–
49-6015-008	1.50	–	–
49-6021-001	0.20	–	–
49-6023-010	0.60	–	–
49-6023-020	0.60	–	–
49-6024-001	0.36	–	–
49-6025-000	0.60	–	–
49-9001-006	0.24	–	–

Order No.	ges. [kg]	Cu [kg]	Ms [kg]
50-0901-011	0.75	–	–
50-0901-012	0.75	–	–
50-0901-013	0.80	–	–
50-0901-014	0.80	–	–
50-0901-015	0.85	–	–
50-0901-022	0.85	–	–
50-0903-008	0.75	–	–
50-0903-009	0.75	–	–
50-0903-010	0.80	–	–
50-0903-011	0.80	–	–
50-0903-012	0.85	–	–
50-0903-018	0.85	–	–
50-0921-001	0.85	–	–
50-0923-001	0.85	–	–
50-1001-009	0.85	–	–
50-1001-010	0.85	–	–
50-1001-011	0.95	–	–
50-1001-012	0.95	–	–
50-1001-013	1.00	–	–
50-1001-015	1.00	–	–
50-1003-009	0.85	–	–
50-1003-010	0.85	–	–
50-1003-011	0.95	–	–
50-1003-012	0.95	–	–
50-1003-013	1.00	–	–
50-1003-018	1.00	–	–
50-1021-001	1.00	–	–
50-1023-001	1.00	–	–
50-1201-001	0.80	–	–
50-1201-002	0.80	–	–
50-1201-003	0.80	–	–
51-0102-001	1.60	–	–
51-0102-002	1.60	–	–
51-0102-003	1.60	–	–
51-0102-004	1.60	–	–
51-0102-005	0.70	–	–
51-0104-001	0.95	–	–
51-0205-010	0.03	–	–
51-0205-011	0.03	–	–
51-0206-101	1.04	–	–
51-0206-102	0.91	–	–
51-0206-201	1.13	–	–
51-0208-001	0.07	–	–
51-0208-002	0.07	–	–
51-0208-003	0.07	–	–
51-0208-004	0.07	–	–
51-0208-005	0.07	–	–
51-0208-006	0.07	–	–
51-0501-003	1.50	–	–
51-1200-001	0.15	–	–
51-1220-001	0.15	–	–
51-1300-001	0.15	–	–
51-2200-001	0.15	–	–

# Weights

Order No.	ges. [kg]	Cu [kg]	Ms [kg]
51-2220-001	0.15	–	–
51-9100-201	0.025	–	–
52-0102-001	2.40	–	–
52-0102-005	2.50	–	–
52-0105-001	0.05	–	–
52-0105-002	0.80	–	–
52-0108-013	0.30	–	–
52-0108-014	0.50	–	–
52-0206-003	0.12	–	–
52-0206-004	0.12	–	–
52-0206-007	0.10	–	–
52-0211-007	0.14	–	–
52-0306-002	0.10	–	–
52-0307-001	0.03	–	–
52-0307-003	0.03	–	–
60-0101-001	4.20	2.40	0.80
60-0101-002	5.20	3.30	0.80
60-0101-003	4.50	2.70	0.80
60-0107-001	4.20	2.00	1.10
60-0107-002	5.20	2.70	0.80
60-0107-003	4.60	2.50	1.10
60-0108-002	3.70	2.00	0.80
60-0108-003	4.70	2.90	0.80
60-0108-004	4.00	2.30	0.80
60-0201-001	6.10	3.30	1.60
60-0201-002	7.00	4.20	1.60
60-0202-001	7.70	4.60	1.60
60-0202-002	8.70	5.60	1.60
60-0207-001	7.30	4.10	1.90
60-0207-002	6.20	3.10	1.90
60-0207-003	7.10	3.80	1.90
60-0207-007	7.70	4.80	1.90
60-0208-001	6.80	4.00	1.60
60-0208-002	5.60	3.10	1.60
60-0208-003	6.50	3.80	1.60
60-0209-001	7.00	4.30	1.60
60-0209-002	8.00	5.20	1.60
60-0209-004	6.00	3.40	1.60
60-0209-010	6.70	4.10	1.60
60-0209-013	5.60	3.00	1.60
60-0301-001	4.40	3.50	–
60-0301-002	5.50	4.40	–
60-0301-003	4.80	3.80	–
60-0307-001	4.50	3.30	0.30
60-0307-002	5.50	4.20	0.30
60-0307-003	4.80	3.60	0.30
60-0308-001	3.20	2.40	–
60-0308-002	5.00	4.00	–
60-0308-003	4.30	3.50	–
60-0501-001	6.00	3.40	1.40
60-0501-002	6.90	4.20	1.40
60-0502-001	7.60	4.70	1.40
60-0502-002	8.60	5.70	1.40

Order No.	ges. [kg]	Cu [kg]	Ms [kg]
60-0507-001	7.20	4.10	1.70
60-0507-002	6.10	3.10	1.70
60-0507-003	7.00	4.00	1.70
60-0508-001	6.70	3.80	1.40
60-0508-002	5.50	3.00	1.40
60-0508-003	6.40	3.80	1.40
60-0509-001	7.90	4.20	1.40
60-0509-002	7.90	5.20	1.40
61-0101-003	–	0.52	–
61-0101-015	–	0.24	–
61-0101-016	–	0.64	–
61-0102-003	–	0.73	–
61-0102-009	–	1.07	–
61-0103-001	–	0.78	–
61-0103-002	–	0.92	–
61-0103-003	–	1.16	–
61-0104-001	–	1.01	–
61-0104-002	–	1.21	–
61-0104-003	–	1.54	–
61-0104-018	–	0.68	–
61-0105-001	–	1.47	–
61-0105-002	–	1.75	–
61-0105-008	–	4.10	–
61-0105-009	–	3.11	–
61-0105-010	–	4.94	–
61-0105-011	–	5.85	–
61-0106-001	–	1.80	–
61-0106-002	–	2.15	–
61-0106-003	–	2.72	–
61-0106-006	–	3.88	–
61-0106-012	–	1.57	–
61-0107-001	–	2.25	–
61-0107-002	–	2.68	–
61-0107-003	–	3.40	–
61-0107-006	–	4.84	–
61-0107-009	–	4.12	–
62-0101-050	2.50	2.06	–
62-0101-051	2.70	2.31	–
62-0101-054	2.90	2.46	–
62-0101-057	4.67	4.27	–
62-0103-001	0.56	–	–
62-0103-003	0.40	–	–
63-0101-001	–	0.15	–
63-0101-002	–	0.15	–
63-0101-003	–	0.23	–
63-0101-004	–	0.23	–
63-0102-001	–	0.15	–
63-0102-002	–	0.15	–
63-0102-003	–	0.23	–
63-0102-004	–	0.23	–
63-0103-001	–	0.15	–
63-0103-002	–	0.28	–
63-0103-003	–	0.27	–

Order No.	ges. [kg]	Cu [kg]	Ms [kg]
63-0104-001	–	0.15	–
63-0104-002	–	0.28	–
63-0104-003	–	0.27	–
63-0106-001	–	0.19	–
63-0106-002	0.23	0.19	–
63-0201-001	0.26	0.12	–
63-0201-003	0.50	–	0.34
63-0201-006	0.94	–	0.25
63-0201-007	0.60	–	0.25
63-0204-001	0.23	–	–
63-0205-001	0.14	–	0.10
63-0205-002	0.23	–	0.10
63-0205-003	0.30	–	0.10
63-0206-001	0.34	–	0.25
63-0206-002	0.31	–	0.25
63-0206-003	0.38	–	0.25
64-0101-001	–	0.38	–
64-0102-001	0.62	–	0.42
64-0102-002	0.78	–	0.59
64-0102-003	0.78	–	0.59
64-0102-004	0.77	–	0.59
64-0102-007	0.90	–	0.48
64-0103-001	0.42	–	0.25
64-0103-002	0.70	–	0.52
64-0103-005	0.64	–	0.25
64-0103-006	0.69	–	0.52
64-0201-001	0.52	0.36	–
64-0201-002	0.95	0.68	–
64-0201-003	0.50	0.36	–
64-0201-004	0.95	0.68	–
64-0201-005	0.55	0.36	–
64-0201-006	0.94	0.68	–
64-0202-003	0.52	0.15	0.35
64-0202-004	0.52	0.15	0.35
64-0202-005	0.53	0.15	0.35
64-0203-001	0.11	0.06	–
64-0203-002	0.15	0.09	–
64-0203-003	0.25	0.19	–
64-0204-001	0.13	0.07	–
64-0204-002	0.17	0.10	–
64-0204-003	0.27	0.19	–
64-0205-004	–	0.10	–
65-0101-001	0.54	–	–
65-0101-002	0.58	–	–
65-0101-003	0.68	–	–
65-0101-004	0.83	–	–
65-0102-001	1.32	–	–
65-0102-002	1.65	–	–
65-0201-001	0.55	–	–
65-0201-002	0.58	–	–
65-0201-003	0.68	–	–
65-0201-004	0.83	–	–
65-0301-001	1.51	–	–

# Weights

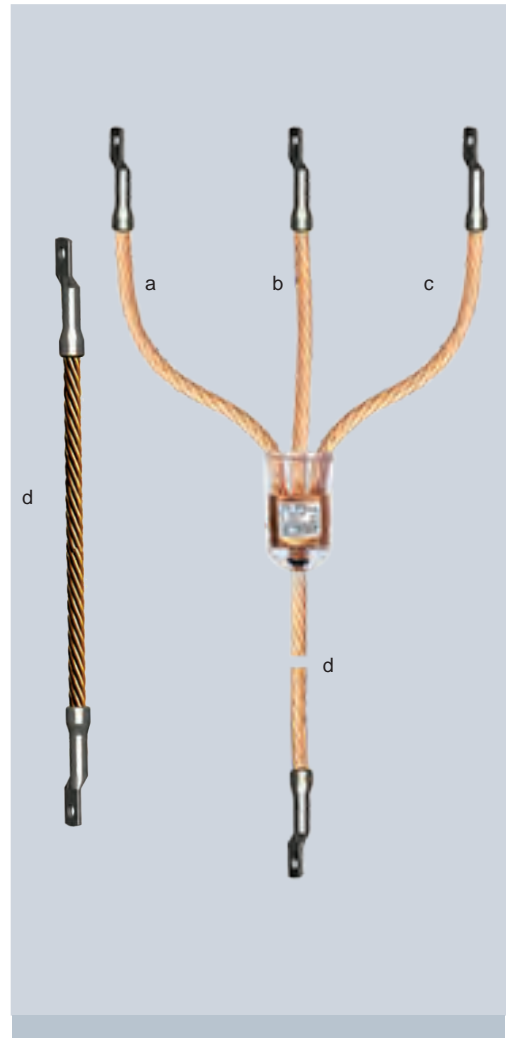
Order No.	ges. [kg]	Cu [kg]	Ms [kg]
65-0301-002	2.22	–	–
65-0301-003	3.12	–	–
65-0401-001	0.81	–	–
65-0401-002	0.86	–	–
65-0401-003	0.99	–	–
65-0401-004	1.21	–	–
65-0402-001	1.35	–	–
65-0402-002	1.45	–	–
65-0402-003	1.70	–	–
65-0402-004	1.70	–	–
65-0403-001	0.90	–	–
65-0403-003	0.90	–	–
65-0403-004	1.05	–	–
65-0502-002	1.70	–	–
65-0504-001	0.75	–	–
65-0504-004	0.82	–	–
66-0101-001	0.54	–	–
66-0101-002	0.77	–	–
66-0101-003	0.95	–	–
66-0201-001	0.50	–	–
66-0201-002	0.60	–	–
66-0201-003	0.78	–	–
67-0101-001	1.10	–	–
67-0101-002	0.80	–	–
67-0101-007	0.03	–	–
67-0101-014	1.50	–	–
67-0101-015	1.30	–	–
67-0301-003	0.20	–	–
99-0000-124	0.10	–	–

# Order/Inquiry

## Earthing and Short-Circuiting Devices

Order No.:		Inquiry No.:	
------------	--	--------------	--

Short-circuiting cable (a/b/c)	
Cable cross section (mm <sup>2</sup> ):	
Length a:	
Length b:	
Length c:	
Mounting:	
Earthing cable (d)	
Cable cross section (mm <sup>2</sup> ):	
Length d:	
Mounting:	
Quantity ordered:	
Date of delivery:	



Lengths of earthing and short-circuit cables have to fit to the switchgear and the distances between the connection points (min 1.2 times of the distance). If the cables are too long (>1.5 times of the distance) they must be fixed with an insulating cable to prevent damages and injuries in case of a short-circuit.

	Company	
	Contact person	
	Department	
	Street	
	Postcode/Place	
Stamp/Date/Signature	Phone/Fax	

An order is made exclusively by the terms and conditions of Dipl.-Ing. H. Horstmann GmbH.





[www.horstmanngbh.com](http://www.horstmanngbh.com)

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