



SENSORS

CURRENT & VOLTAGE MEASUREMENT FOR THE GRID
OF THE FUTURE



GERMANY HAMBURG • WIRGES • KIRCHAICH • DRESDEN
AUSTRIA MARCHTRENK | HUNGARY KECSKEMÉT | CHINA SHANGHAI | USA HARTWELL



RITZ INSTRUMENT TRANSFORMERS GMBH – EXPERIENCE AND SOLUTIONS / TOGETHER!

Experience

RITZ is one of the leading specialists worldwide in the field of instrument transformers, cast resin applications, cast resin insulated busbar systems.

The origins of the company date back to 1904. Today, the RITZ parent company in Hamburg combines the experience of „RITZ Messwandler (RITZ)“, „Messwandlerbau Bamberg (MWB)“, the „Transformatoren- und Röntgenwerk“ in Dresden (TuR and Duromer) and the „Wandler- und Transformatoren-Werk Wirges (WTW)“.

RITZ owns seven production sites, spread across Europe, China and the United States of America. Our customers include well known companies from the energy supply sector and electrical industries throughout the world.

Solutions

RITZ offers a broad portfolio. We develop your standard equipment, but also transform your specific ideas into customised products.

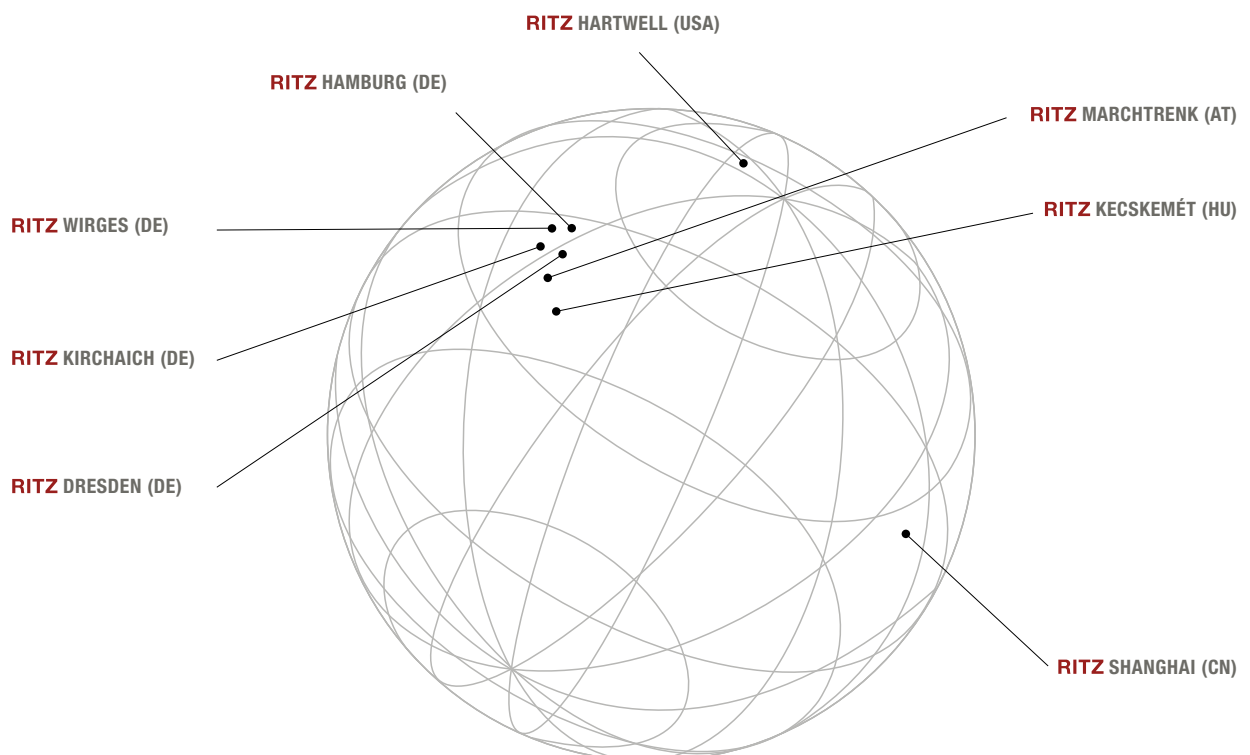
Both small and large quantities can be supplied.

To achieve this, we rely on the knowledge and commitment of our employees at all our locations.

Tell us your requirements and we will develop the solution.

Together!

Our top priority at RITZ is always to find the best solution – together with our customers.



PRODUCT OVERVIEW

CURRENT & VOLTAGE MEASUREMENT



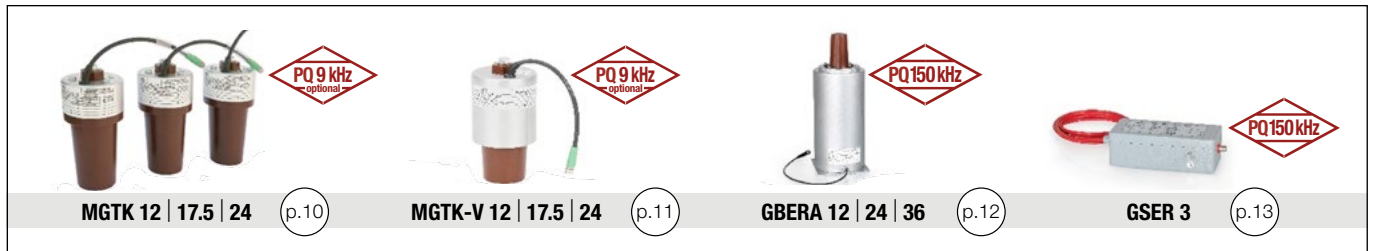
WINDOW TYPE CURRENT SENSORS



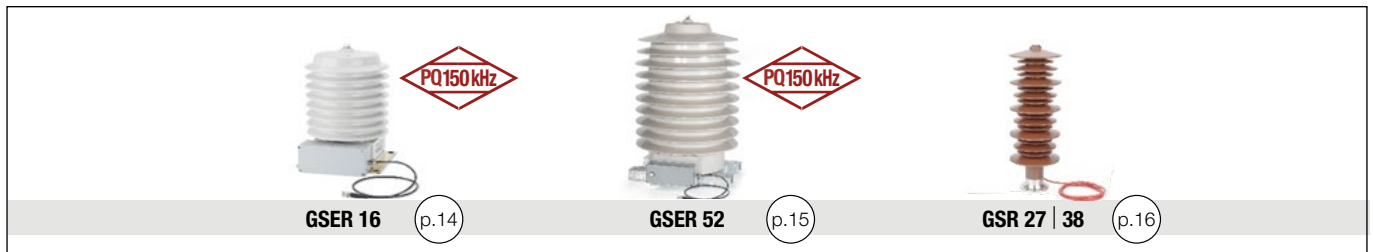
SPLIT CORE CURRENT SENSORS



VOLTAGE SENSORS INDOOR



VOLTAGE SENSORS OUTDOOR



COMBINATION SENSORS

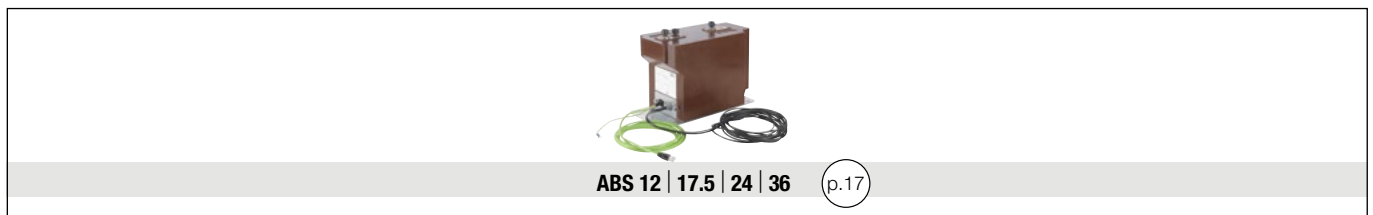


TABLE OF CONTENTS

| | |
|--|-------|
| 1.0 Design and properties of sensors | P. 4 |
| 1.1 Accuracy depending on primary conductor position | P. 4 |
| 1.2 Current transformer or current sensor? | P. 4 |
| 1.3 Voltage transformer or voltage sensor? | P. 4 |
| 1.4 Sensors and power quality | P. 4 |
| 2.0 Window type current sensors | P. 5 |
| 2.1 KSOH-S 1082 | P. 5 |
| 2.2 MKSOH-S 1384 | P. 6 |
| 2.3 KSR-S 60 | P. 7 |
| 3.0 Split core current sensors | P. 8 |
| 3.1 UGSS-S 104 Gr. 1 | P. 8 |
| 3.2 RKU-S 2012 | P. 9 |
| 4.0 Voltage sensors indoor | P. 10 |
| 4.1 MGTK 12 17.5 24 | P. 10 |
| 4.2 MGTK-V 12 17.5 24 | P. 11 |
| 4.4 GBERA 12 24 36 | P. 12 |
| 4.5 GSER 3 | P. 13 |
| 5.0 Voltage sensors outdoor | P. 14 |
| 5.1 GSER(F) 16 | P. 14 |
| 5.2 GSER(F) 52 | P. 15 |
| 5.3 GSR 27 38 | P. 16 |
| 6.0 Combination sensors | P. 17 |
| 6.1 ABS 12 17.5 24 36 | P. 17 |
| 7.0 APPENDIX 1: Secondary terminals | P. 18 |
| 8.0 APPENDIX 2: Accuracy classes according to IEC 61869 | P. 19 |
| 8.1 Limits at rated frequency | P. 19 |
| 8.2 Limits for harmonics | P. 20 |
| 8.3 Accuracy depending on primary conductor position | P. 21 |

1.0 DESIGN AND PROPERTIES OF SENSORS

1.1 WHAT ARE SENSORS?

In power engineering, instrument transformers based on the inductive principle are used to measure current and voltage. In addition to these conventional instrument transformers, there are other, non-conventional instrument transformers, some of which use other operating principles. RITZ generally refers to the passive versions under the umbrella term „sensors“. They are characterised by the following properties:

- Sensors only transfer low power levels, typically ≤ 1 VA.
- Sensors have a voltage output. Standard values are 22.5 mV, 150 mV or 225 mV for current sensors and $3.25/\sqrt{3}$ V for voltage sensors.
- Sensors can exhibit improved linearity characteristics over a wide dynamic range.

1.2 CURRENT TRANSFORMER OR CURRENT SENSOR?

Current sensors are output-matched, inductive current transformers with integrated burden or Rogowski coils. The voltage signal at the output is proportional to the primary current or, in the case of Rogowski coils, proportional to the derivative of the primary current. In this case, an electronic system is required on the secondary side, which integrates the voltage signal. This is important so that the actual mains frequency does not influence the measurement result. As with current transformers, current sensors can only measure alternating currents, in accordance with the principles described above. The small integrated burden of inductive current sensors allows reduced core dimensions and therefore smaller sizes. Saturation effects can occur with these current sensors, as is also the case with current transformers. Rogowski coils cannot saturate since they are wound over an air core as opposed to an iron core. Just like current transformers, current sensors do not require any

auxiliary power and are maintenance-free. All current sensors from RITZ undergo a routine test before delivery.

1.3 VOLTAGE TRANSFORMER OR VOLTAGE SENSOR?

Voltage sensors consist of a resistive, resistive-capacitive or capacitive voltage divider. This divides the primary voltage such that a low voltage proportional to the primary voltage is applied at the output. In this way, not only alternating but also direct voltages can be measured. In contrast to a voltage transformer, a voltage sensor does not have galvanic isolation between the primary and secondary sides, so there are integrated surge arresters to protect the downstream devices. The accuracy of voltage sensors is influenced both by the connected burden and by the type and length of the connecting cable. The stated accuracy therefore only applies to the specified condition. Just like voltage transformers, voltage sensors do not require any auxiliary power and are maintenance-free. All voltage sensors from RITZ undergo a routine test before delivery.



1.4 SENSORS AND POWER QUALITY

The term „power quality“ is generally used to describe the electrical energy quality of electrical networks. In addition to an uninterruptible supply, this includes high current and voltage quality with low flicker, transients and harmonics, as well as a constant mains frequency. Sensors can be used to measure harmonics in order to determine current and voltage quality. These are referred to as „PQ measurements“ and can be carried out with sensors that have transmission characteristics optimised for accurate measurement results even at frequencies in the kHz range. Sensors suitable for PQ measurements are marked in the catalogue with a corresponding symbol. Depending on the sensor, up to three frequency options are available: 3 kHz, 9 kHz und 150 kHz.

| | Transformer | Sensor |
|----------------------|---|--|
| Up to several 100 VA | ≤ 1 VA | |
| Output signal | Current or voltage | Voltage |
| Standard values | 1 A 5 A | 22.5 mV 150 mV 225 mV |
| Output | or $100/\sqrt{3}$ V $110/\sqrt{3}$ V | or $3.25/\sqrt{3}$ V |
| Primary variable | AC | DC and/or AC |
| Electrical isolation | Yes | Partially |
| Frequency | 16.7 Hz 50 Hz 60 Hz + frequency option up to 9 kHz | 0 Hz 16.7 Hz 50 Hz 60 Hz + frequency option up to 150 kHz |

PRODUCT OVERVIEW

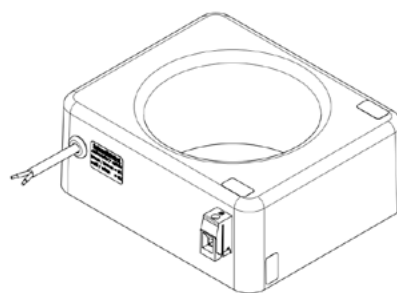
TABLE OF CONTENTS

2.0 WINDOW TYPE CURRENT SENSORS

2.1 KSOH-S 1082

Low power passive current transformer
according to IEC 61869-10

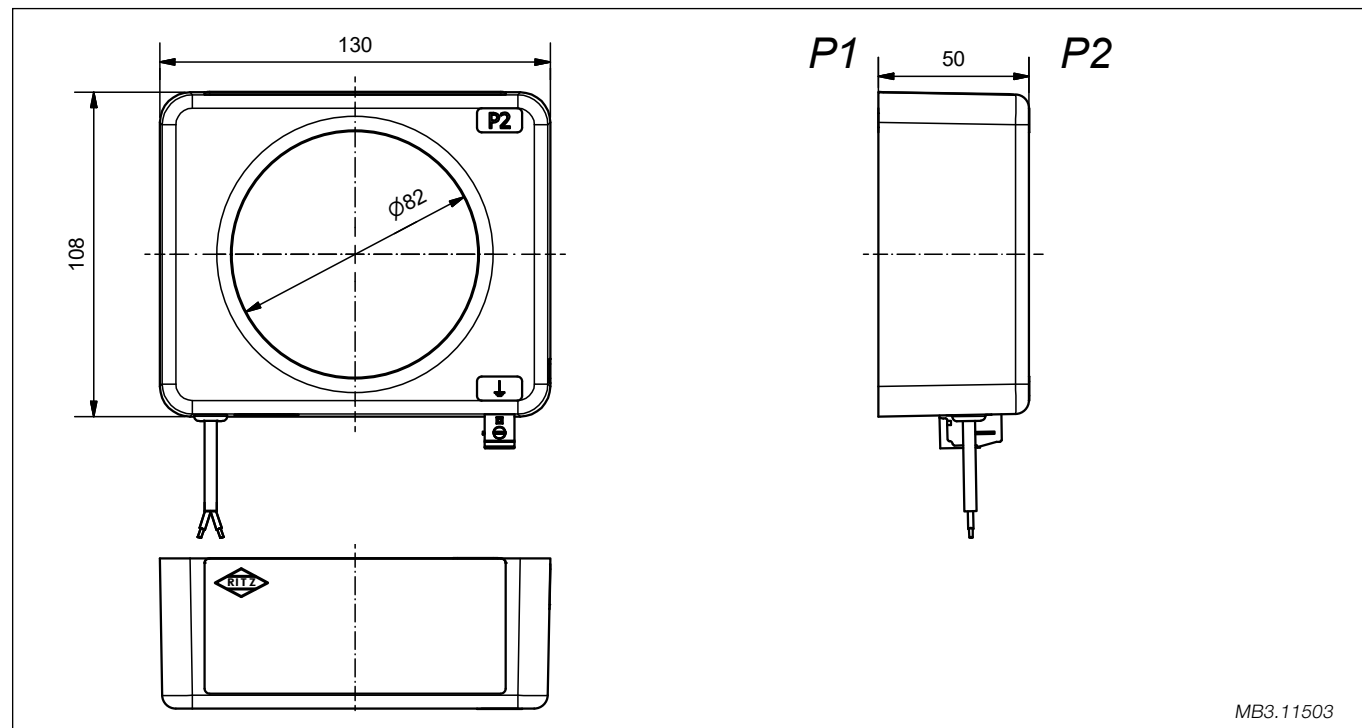
- For installation in local network stations
- Straightforward installation
- With earth terminal



| TYPE | KSOH-S 1082 |
|--|---------------------------------|
| Rated frequency f_r | 50 Hz 60 Hz |
| Rated insulation level | 0,72/3/- kV |
| Temperature category | -5 °C / +40 °C |
| Mass | 1,0 kg |
| Insulating class | A |
| Insulation level at secondary terminalsn | 820/1500 V |
| Rated primary current I_{pr} | 300 A |
| Rated secondary voltage U_{sr} | 225 mV |
| Factor of the extended primary rated current K_{pcr} | 2 |
| Thermal short-time rated current I_{th} | 25 kA 3 s |
| Rated peak current I_{dyn} | 63 kA |
| Rated continuous thermal current I_{cth} | 600 A |
| Accuracy class | 0,2-A3 * 0,5-A3 * / 5P 6000 A |
| Output signal | proportional |
| Rated burden R_{br} | 2 MΩ / 50 pF |
| Rated phase offset φ_{or} | 0° |

* See 8.3 Accuracy depending on primary conductor position

DIMENSIONAL DRAWING



MB3.11503

For more information, please refer to the data sheet. Subject to technical modifications.

NOTE. For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

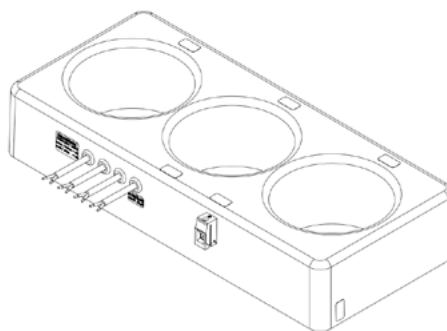
TABLE OF CONTENTS

WINDOW TYPE CURRENT SENSORS

2.2 MKSOH-S 1384

Low power passive current transformer according to IEC 61869-10

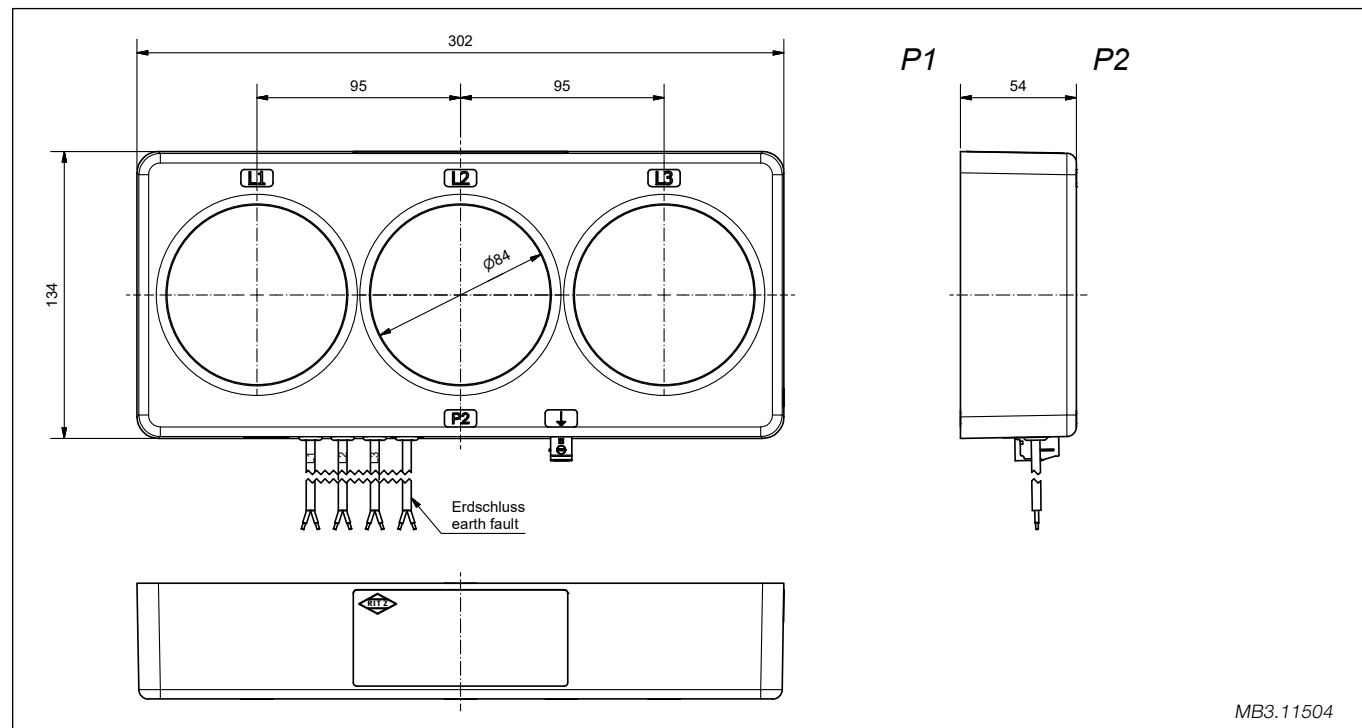
- Compact solution
- 3 phase current sensors
- 1 earth fault detection sensor



| TYPE | PHASE CURRENT | MKSOH-S 1384 | EARTH FAULT |
|--|----------------------|----------------|-------------|
| Rated frequency f_r | | 50 Hz 60 Hz | |
| Rated insulation level | | 0,72/3/- kV | |
| Temperature category | | -5 °C / +40 °C | |
| Mass | | 2,8 kg | |
| Insulating class | | A | |
| Insulation level at secondary terminals | | 820/1500 V | |
| Rated primary current I_{pr} | 300 A | | 60 A |
| Rated secondary voltage U_{sr} | | 225 mV | |
| Factor of the extended primary rated current K_{pcr} | | 2 | |
| Thermal short-time rated current I_{th} | | 25 kA 3 s | |
| Rated peak current I_{dyn} | | 63 kA | |
| Rated continuous thermal current I_{cth} | 600 A | | 120 A |
| Accuracy class | 0,5-A3 * / 5P 3000 A | | 1-A3 * |
| Output signal | | proportional | |
| Rated burden R_{br} | | 2 MΩ / 50 pF | |
| Rated phase offset φ_{or} | | 0° | |

* See 8.3 Accuracy depending on primary conductor position

DIMENSIONAL DRAWING



MB3.11504

For more information, please refer to the data sheet. Subject to technical modifications.

NOTE: For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

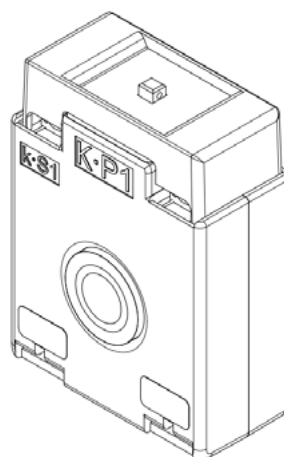
TABLE OF CONTENTS

WINDOW TYPE CURRENT SENSORS

2.3 KSR-S 60 size 1

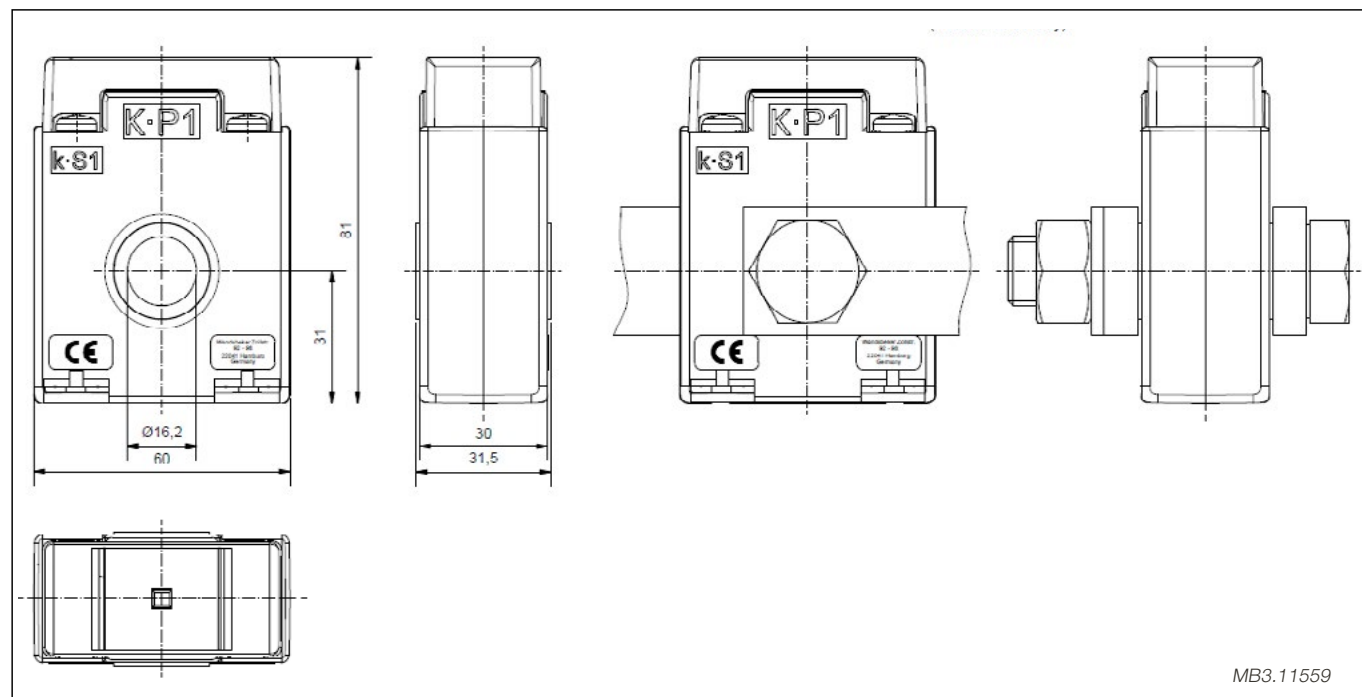
Low power passive current transformer
according to IEC 61869-10

- Removable copper pipe for round conductors 16 mm
- Standard accessories: transparent terminal cover
- The transformer can be installed in any position.

**TYPE****KSR-S 60 size 1**

| | |
|--|---|
| Rated frequency f_r | 50 Hz * |
| Insulation level | 0,72/3/- kV |
| Temperature category | -5 °C / +40 °C |
| Mass | <0,4 kg |
| Insulating class | E |
| Insulation level at secondary terminals | 820/1500 V |
| Rated primary current I_{pr} | 100 A 150 A 200 A 250 A 300 A 400 A * |
| Rated secondary voltage U_{sr} | 330 mV* |
| Factor of the extended primary rated current K_{pcr} | 1 |
| Rated short-time thermal current I_{th} | 60 I_{pr} |
| Rated peak current I_{dyn} | 100 kA |
| Rated short-time thermal current I_{cth} | 100% x I_{pr} * |
| Accuracy class | 0,5-A1 * |
| Output signal | proportional |
| Rated burden R_{br} | 2 MΩ / 50pF |
| Rated phase offset φ_{or} | 0° |

* Other values available on request

DIMENSIONAL DRAWING

MB3.11559

For more information, please refer to the data sheet. Subject to technical modifications.

NOTE: For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

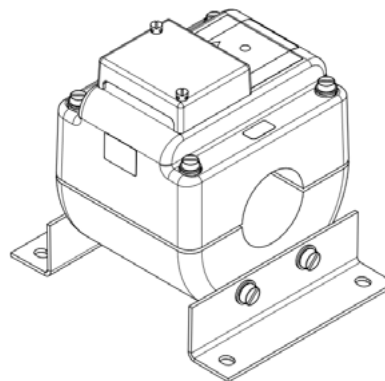
TABLE OF CONTENTS

3.0 SPLIT CORE CURRENT SENSORS

3.1 UGSS-S 104 size 1

Low power passive current transformer
according to IEC 61869-10

- For retrofitting
- Straightforward installation
- Can be split



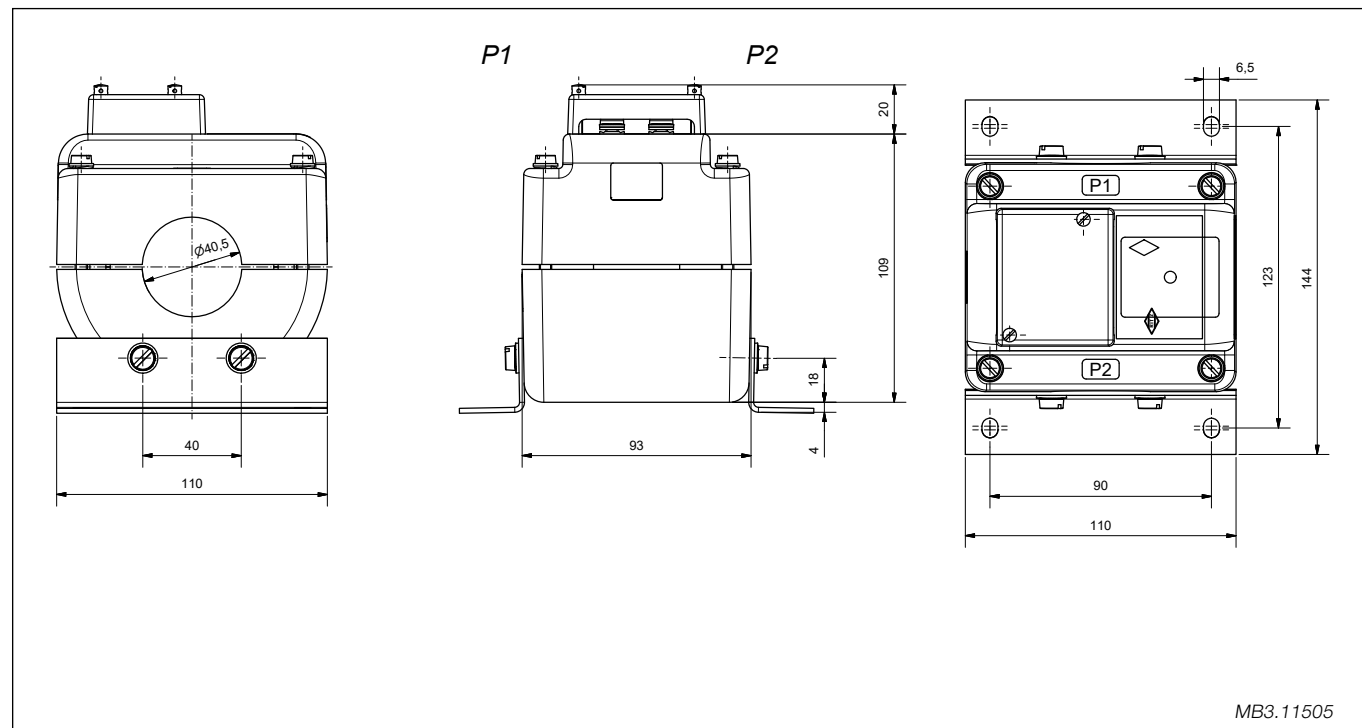
TYPE

UGSS-S 104 size 1

| | |
|--|----------------------|
| Rated frequency f_r | 50 Hz 60 Hz |
| Rated insulation level | 0,72/3/- kV |
| Temperature category | -5 °C / +40 °C |
| Mass | 1,7 kg |
| Insulating class | E |
| Insulation level at secondary terminals | 820/1500 V |
| Rated primary current I_{pr} | 300 A |
| Rated secondary voltage U_{sr} | 225 mV |
| Factor of the extended primary rated current K_{pcr} | 2 |
| Thermal short-time rated current I_{th} | 25 kA 3 s |
| Rated peak current I_{dyn} | 63 kA |
| Rated short-time thermal current I_{cth} | 600 A |
| Accuracy class | 0,5-A2 * / 5P 3000 A |
| Output signal | proportional |
| Rated burden R_{br} | 2 MΩ / 50 pF |
| Rated phase offset φ_{or} | 0° |

* See 8.3 Accuracy depending on primary conductor position

DIMENSIONAL DRAWING



For more information, please refer to the data sheet. Subject to technical modifications.

NOTE. For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

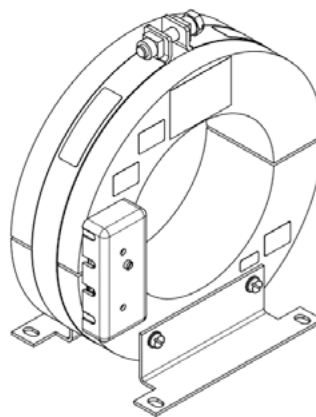
TABLE OF CONTENTS

SPLIT CORE CURRENT SENSORS

3.2 RKU-S 2012

Low power passive current transformer according to IEC 61869-10

- For retrofitting
- Straightforward installation
- Can be split



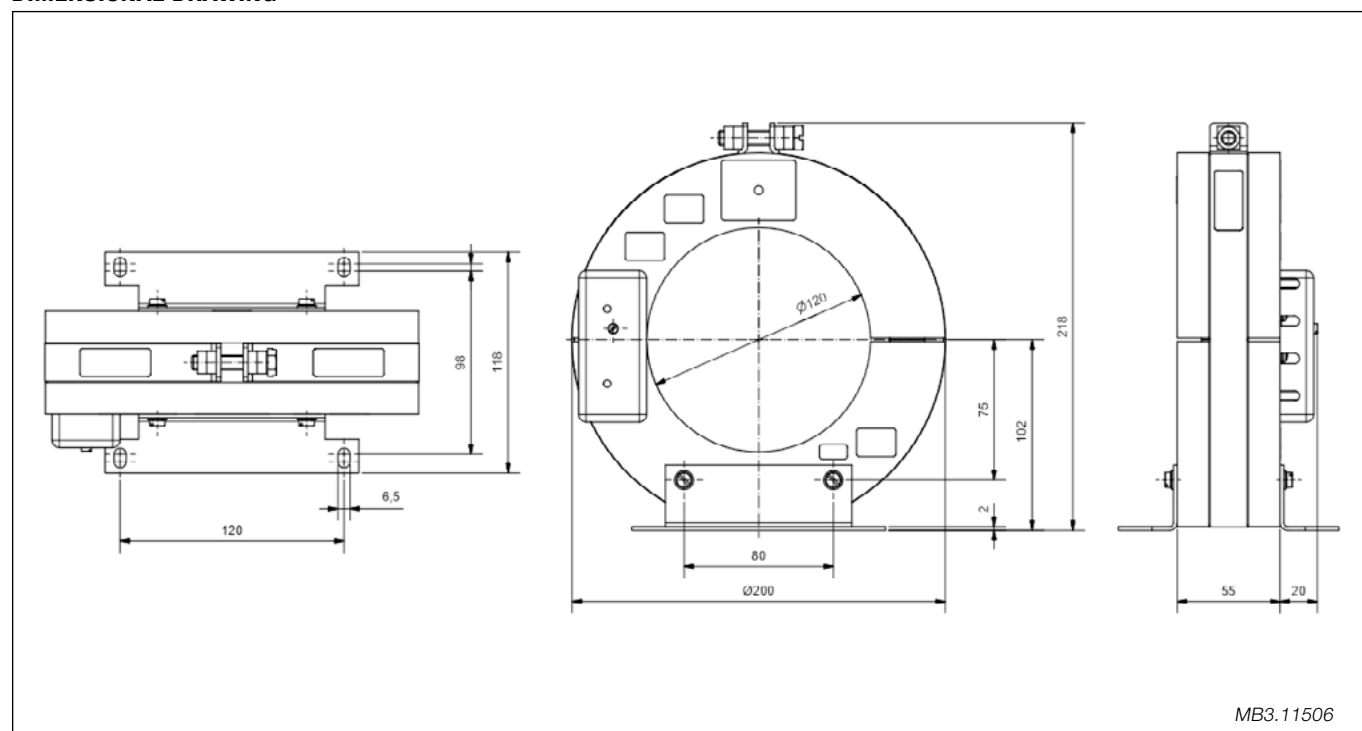
TYPE

RKU-S 2012

| | |
|--|---------------------|
| Rated frequency f_r | 50 Hz 60 Hz |
| Rated insulation level | 0,72/3/- kV |
| Temperature category | -5 °C / +40 °C |
| Mass | 2,7 kg |
| Insulating class | E |
| Insulation level at secondary terminals | 820/1500 V |
| Rated primary current I_{pr} | 60 A |
| Rated secondary voltage U_{sr} | 225 mV |
| Factor of the extended primary rated current K_{pcr} | 2 |
| Rated short-time thermal current I_{th} | 25 kA 3 s |
| Rated peak current I_{dyn} | 63 kA |
| Rated short-time thermal current I_{cth} | 120 A |
| Accuracy class | 0,5-A3 * / 5P 600 A |
| Output signal | proportional |
| Rated burden R_{br} | 2 MΩ / 50 pF |
| Rated phase offset φ_{or} | 0° |

* See 8.3 Accuracy depending on primary conductor position

DIMENSIONAL DRAWING



For more information, please refer to the data sheet. Subject to technical modifications.

NOTE. For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

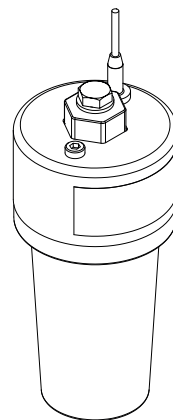
TABLE OF CONTENTS

4.0 VOLTAGE SENSORS – INDOOR

4.1 MGTK 12 | 17.5 | 24

Low power passive voltage transformer according to IEC 61869-11

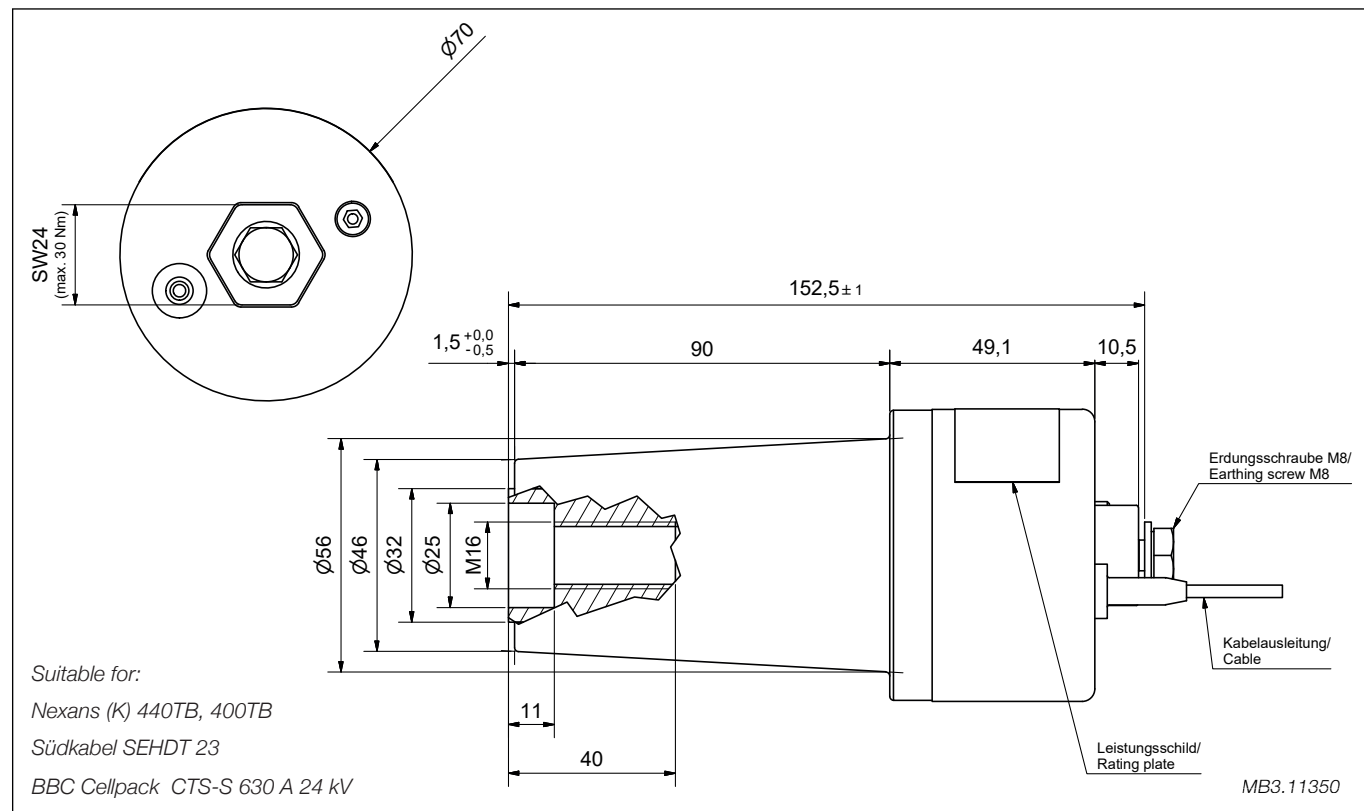
- Primary terminal outer cone type C according to EN 50181
- For installation in symmetrical T-connectors
- Suitable for PQ measurements
- Optionally available for PQ measurements up to 20 kHz



| TYPES | MGTK 12 | MGTK 17.5 | MGTK 24 |
|---|-------------------|----------------------------|-------------------|
| Rated frequency f_r | | 50 Hz 60 Hz | |
| Rated insulation level | 12/28/75 kV | 17,5/38/95 kV | 24/50/125 kV |
| Temperature category | | -5 °C / +40 °C | |
| Mass | | 1 kg | |
| Insulating class | | E | |
| Insulation level at secondary terminals | | n/a | |
| Rated primary voltage U_{pr} | 10/ $\sqrt{3}$ kV | 15/ $\sqrt{3}$ kV | 20/ $\sqrt{3}$ kV |
| Rated secondary voltage U_{sr} | | 3,25/ $\sqrt{3}$ V | |
| Rated voltage factor F_v | | 1,2 / 1,9 8 h | |
| Rated burden R_{br} | | 200 k Ω \pm 1 % * | |
| Accuracy class | | 0,5P | |
| Rated phase offset φ_{or} | | 0° | |

* Other values available on request

DIMENSIONAL DRAWING



For more information, please refer to the data sheet. Subject to technical modifications.
NOTE: For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

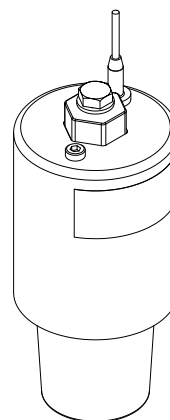
TABLE OF CONTENTS

VOLTAGE SENSORS – INDOOR

4.2 MGTK-V 12 | 17.5 | 24

Low power passive voltage transformer according to IEC 61869-11

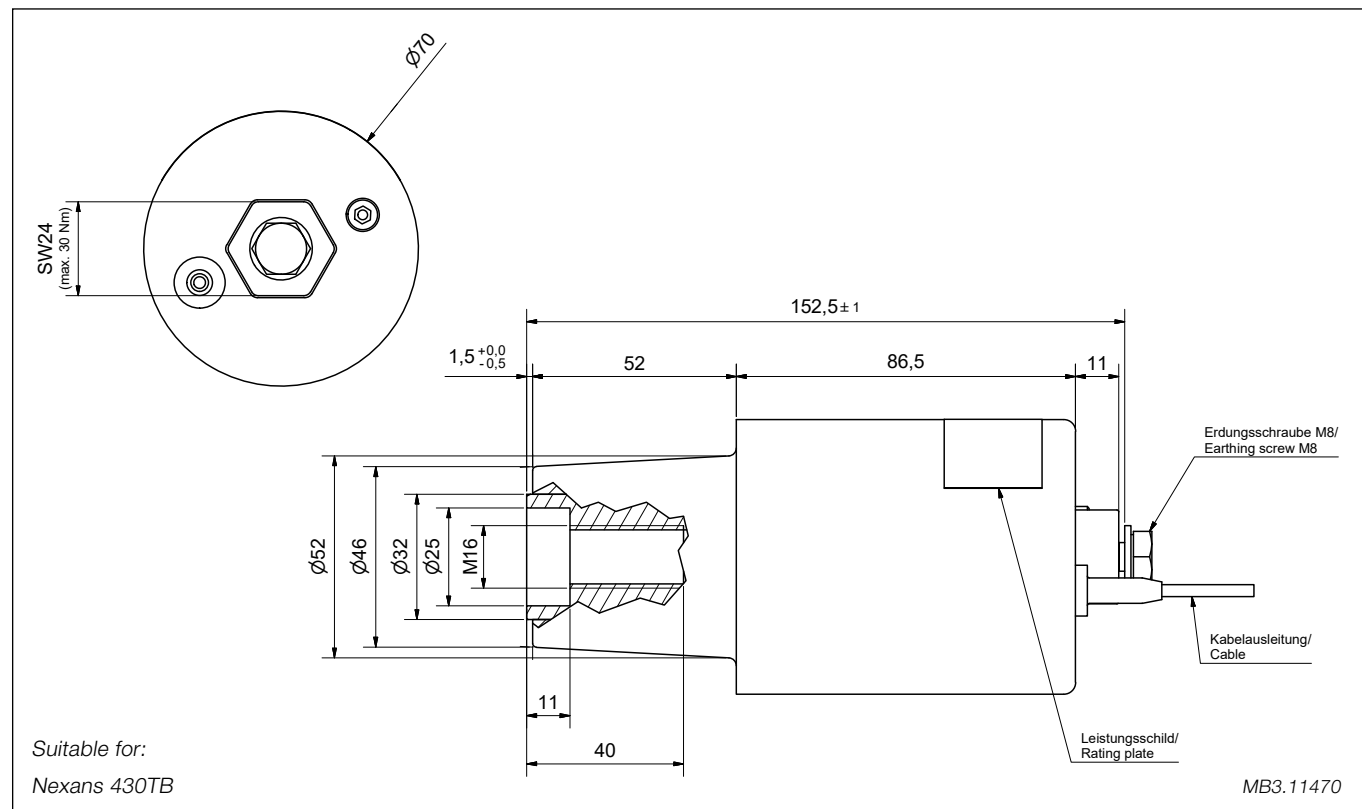
- Primary terminal outer cone shortened
- For installation in asymmetrical T-connectors
- Suitable for PQ measurements
- Optionally available for PQ measurements up to 20 kHz



| TYPES | MGTK-V 12 | MGTK-V 17.5 | MGTK-V 24 |
|---|-------------------|----------------------------|-------------------|
| Rated frequency f_r | | 50 Hz 60 Hz | |
| Rated insulation level | 12/28/75 kV | 17,5/38/95 kV | 24/50/125 kV |
| Temperature category | | -5 °C / +40 °C | |
| Mass | | 1 kg | |
| Insulating class | | E | |
| Insulation level at secondary terminals | | n/a | |
| Rated primary voltage U_{pr} | 10/ $\sqrt{3}$ kV | 15/ $\sqrt{3}$ kV | 20/ $\sqrt{3}$ kV |
| Rated secondary voltage U_{sr} | | 3,25/ $\sqrt{3}$ V | |
| Rated voltage factor F_v | | 1,2 / 1,9 8 h | |
| Rated burden R_{br} | | 200 k Ω \pm 1 % * | |
| Accuracy class | | 0,5P | |
| Rated phase offset φ_{or} | | 0° | |

* Other values available on request

DIMENSIONAL DRAWING



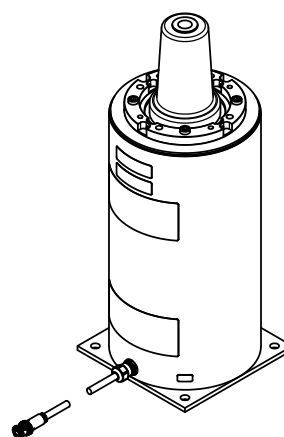
For more information, please refer to the data sheet. Subject to technical modifications.
NOTE: For possible secondary cables refer to Appendix 1

VOLTAGE SENSORS – INDOOR

4.4 GBERA 12 | 24 | 36

Low power passive voltage transformer
according to IEC 61869-11

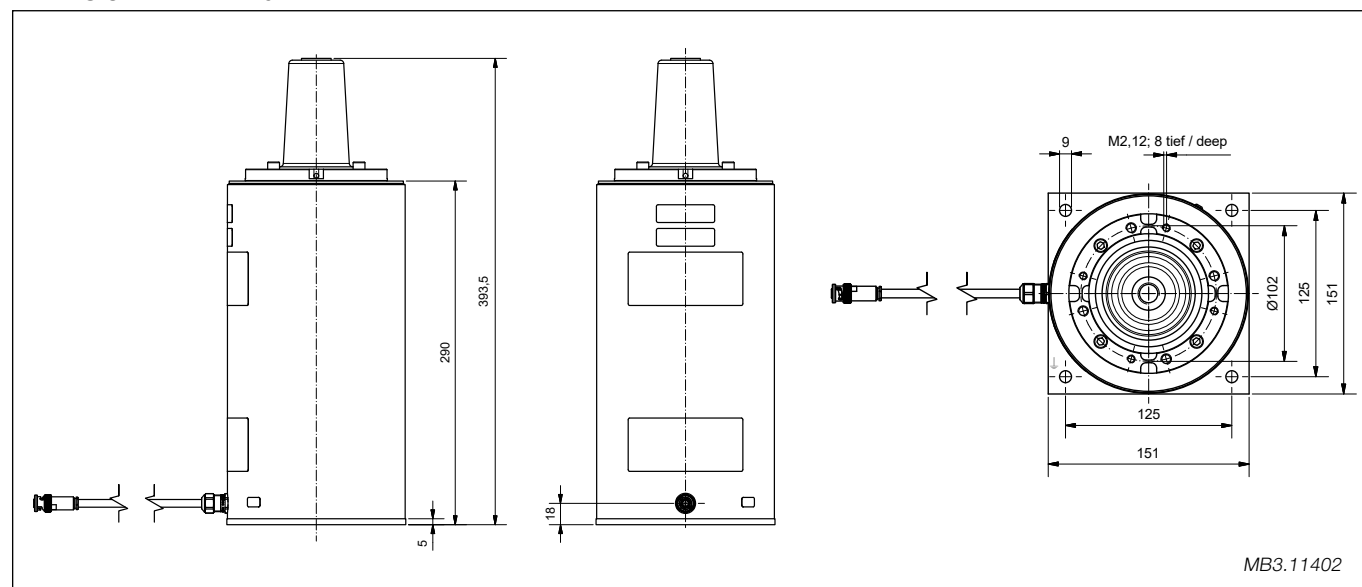
- Primary terminal outer cone type C according to EN 50181
- Metal-clad
- Suitable for PQ measurements



| TYPES | GBERA 12 | GBERA 24 | GBERA 36 |
|---|---------------------|------------------------|---------------------|
| Rated frequency f_r | | 50 Hz 60 Hz * | |
| Rated insulation level | 12/28/75 kV | 24/50/125 kV | 36/70/170 kV |
| Temperature category | | -5 °C / +40 °C | |
| Mass | | 9 kg | |
| Insulating class | | E | |
| Insulation level at secondary terminals | | n/a | |
| Rated primary voltage U_{pr} | 10/ $\sqrt{3}$ kV * | 20/ $\sqrt{3}$ kV * | 30/ $\sqrt{3}$ kV * |
| Rated secondary voltage U_{sr} | | 3,25/ $\sqrt{3}$ V * | |
| Rated voltage factor F_v | | 1,2 / 1,9 8 h | |
| Rated burden R_{br} | | 2 M Ω / 50 pF * | |
| Accuracy class | | 0,5P | |
| Rated phase offset φ_{or} | | 0° | |

* Other values available on request

DIMENSIONAL DRAWING



For more information, please refer to the data sheet. Subject to technical modifications.
NOTE: For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

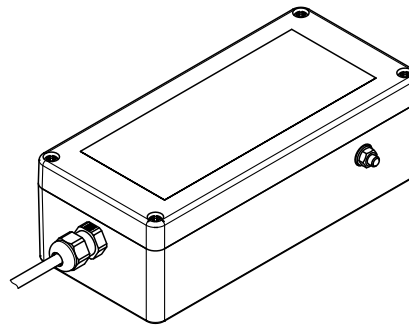
TABLE OF CONTENTS

VOLTAGE SENSORS – INDOOR

4.5 GSER 3

Low power passive voltage transformer according to IEC 61869-11

- For high-precision measurements with class 0.1
- Accessories for power analysers
- Suitable for PQ measurements



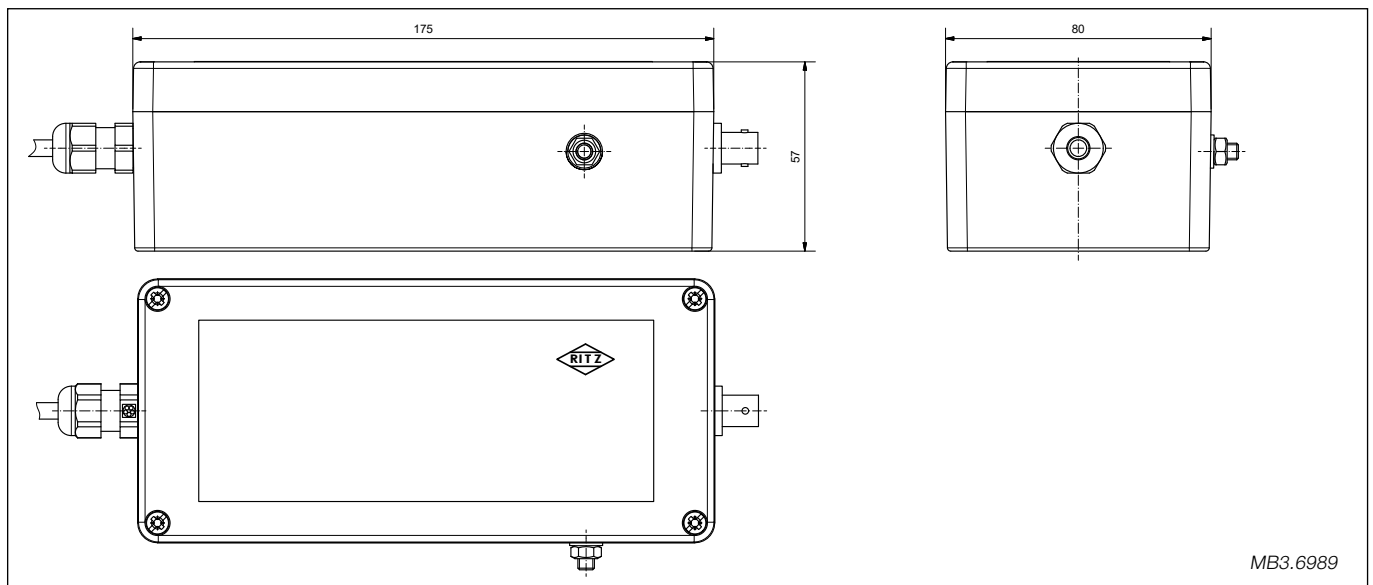
TYPE

GSER 3

| | |
|---|---------------------|
| Rated frequency f_r | 50 Hz 60 Hz * |
| Rated insulation level | 6/10/20 kV |
| Temperature category | -5 °C / +40 °C |
| Mass | 1,2 kg |
| Insulating class | E |
| Insulation level at secondary terminals | n/a |
| Rated primary voltage U_{pr} | $5/\sqrt{3}$ kV * |
| Rated secondary voltage U_{sr} | $3,25/\sqrt{3}$ V * |
| Rated voltage factor F_v | 1,2 / 1,9 8 h |
| Rated burden R_{br} | 2 MΩ / 50 pF * |
| Accuracy class | 0,1P |
| Rated phase offset φ_{or} | 0° |

* Other values available on request

DIMENSIONAL DRAWING



MB3.6989

For more information, please refer to the data sheet. Subject to technical modifications.

NOTE. For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

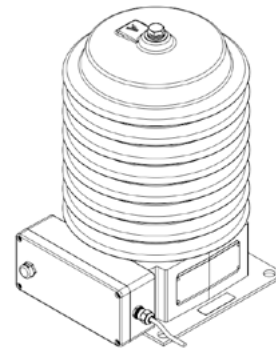
TABLE OF CONTENTS

5.0 VOLTAGE SENSORS – OUTDOOR

5.1 GSER(F) 16

Low power passive voltage transformer according to IEC 61869-11

- Indoor or outdoor version
- Also available as an electronic voltage transformer
- Suitable for PQ measurements



TYPE

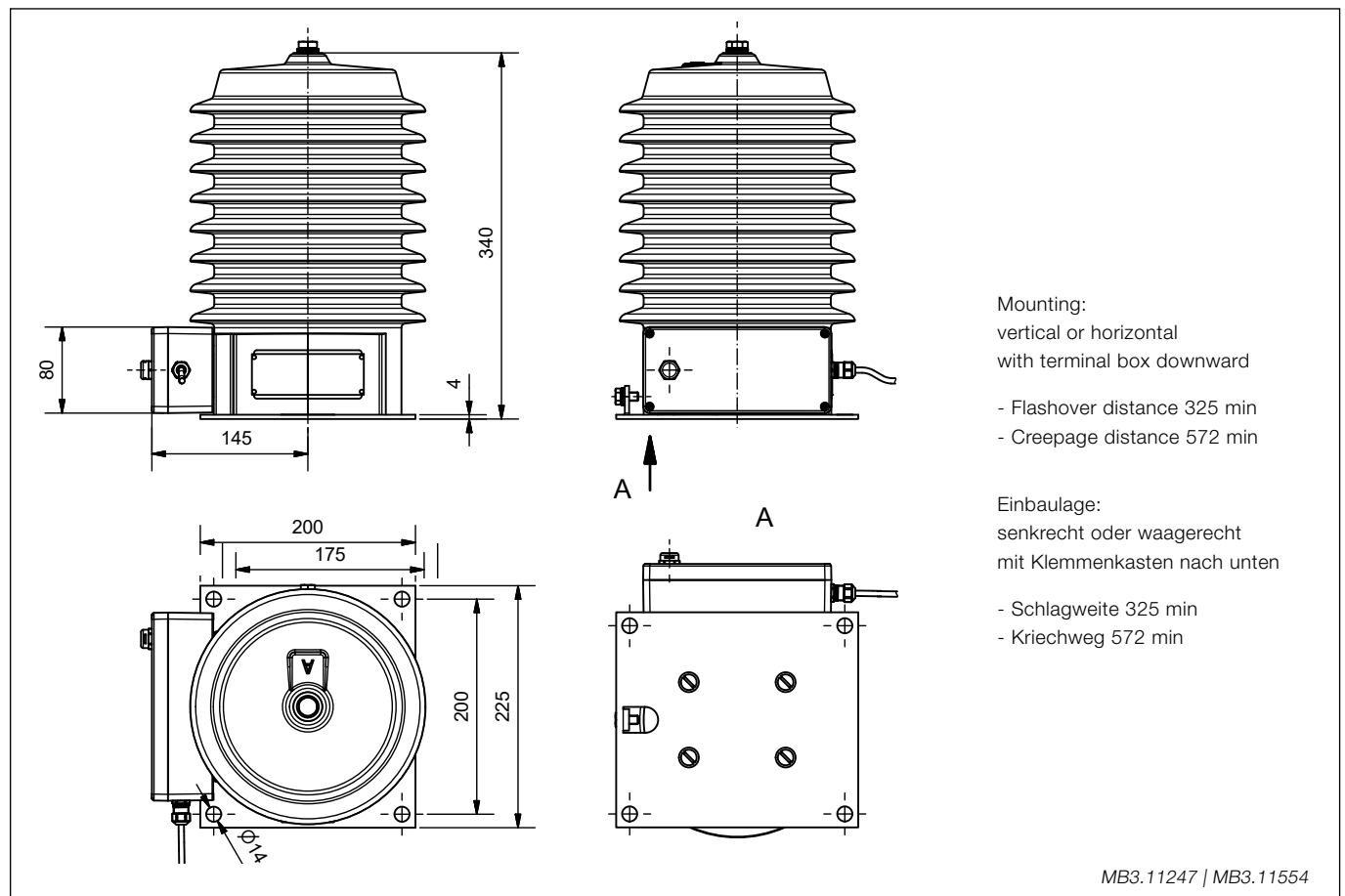
GSER(F) 16

| | |
|---|-----------------|
| Rated frequency f_r | 50 Hz 60 Hz * |
| Rated insulation level | 36/70/170 kV * |
| Temperature category | -25 °C / +40 °C |
| Mass | 20 kg |
| Insulating class | E |
| Insulation level at secondary terminals | n/a |
| Rated primary voltage U_{pr} | 30/√3 kV * |
| Rated secondary voltage U_{sr} | 3,25/√3 V * |
| Rated voltage factor F_v | 1,2 / 1,9 8 h |
| Rated burden R_{br} | 2 MΩ / 50 pF * |
| Accuracy class | 0,2P ** 1P |
| Rated phase offset φ_{or} | 0° |

* Other values available on request

** Temperature category: -5 °C / +40 °C

DIMENSIONAL DRAWING



For more information, please refer to the data sheet. Subject to technical modifications.

NOTE: For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

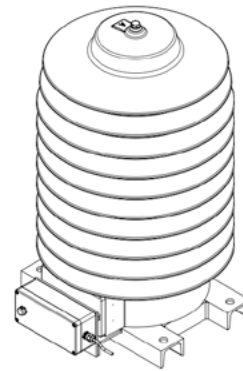
TABLE OF CONTENTS

VOLTAGE SENSORS – OUTDOOR

5.2 GSER(F) 52

Low power passive voltage transformer according to IEC 61869-11

- Indoor or outdoor version
- Also available as an electronic voltage transformer
- Suitable for PQ measurements



TYPE

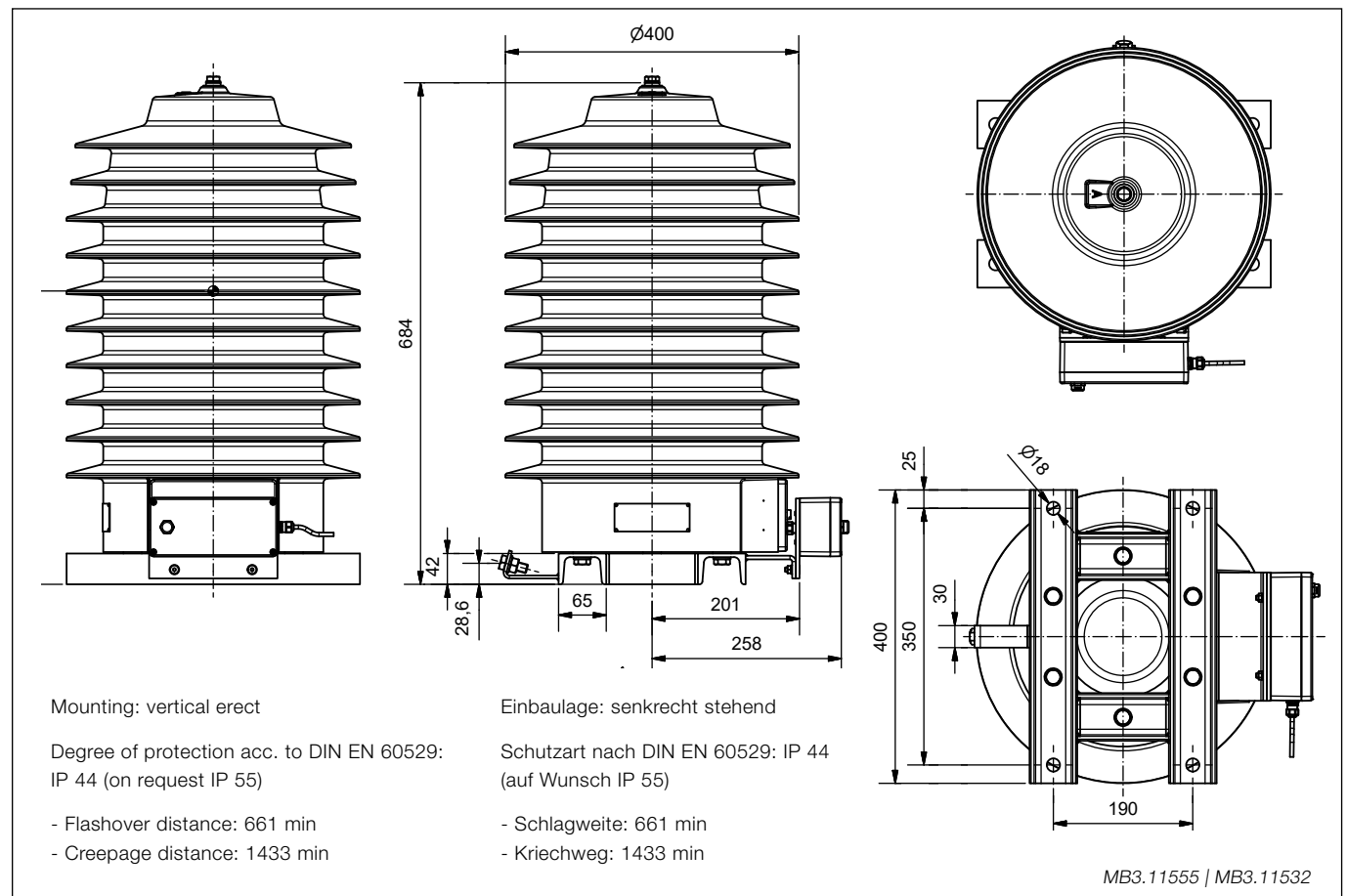
GSER(F) 52

| | |
|---|------------------------|
| Rated frequency f_r | 50 Hz 60 Hz * |
| Rated insulation level | 52/95/250 kV * |
| Temperature category | -25 °C / +40 °C |
| Mass | 100 kg |
| Insulating class | E |
| Insulation level at secondary terminals | n/a |
| Rated primary voltage U_{pr} | 45/ $\sqrt{3}$ kV * |
| Rated secondary voltage U_{sr} | 3,25/ $\sqrt{3}$ V * |
| Rated voltage factor F_v | 1,2 / 1,9 8 h |
| Rated burden R_{br} | 2 M Ω / 50 pF * |
| Accuracy class | 0,2P ** 1P |
| Rated phase offset φ_{or} | 0° |

* Other values available on request

** Temperature category: -5 °C / +40 °C

DIMENSIONAL DRAWING



For more information, please refer to the data sheet. Subject to technical modifications.

NOTE. For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

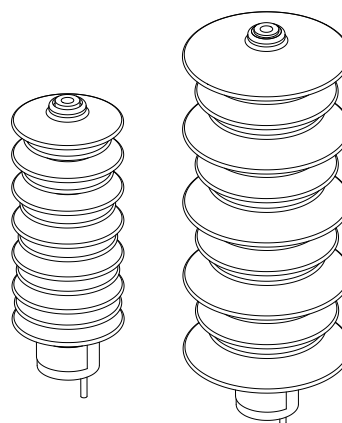
TABLE OF CONTENTS

VOLTAGE SENSORS – OUTDOOR

5.3 GSR 27 | 38

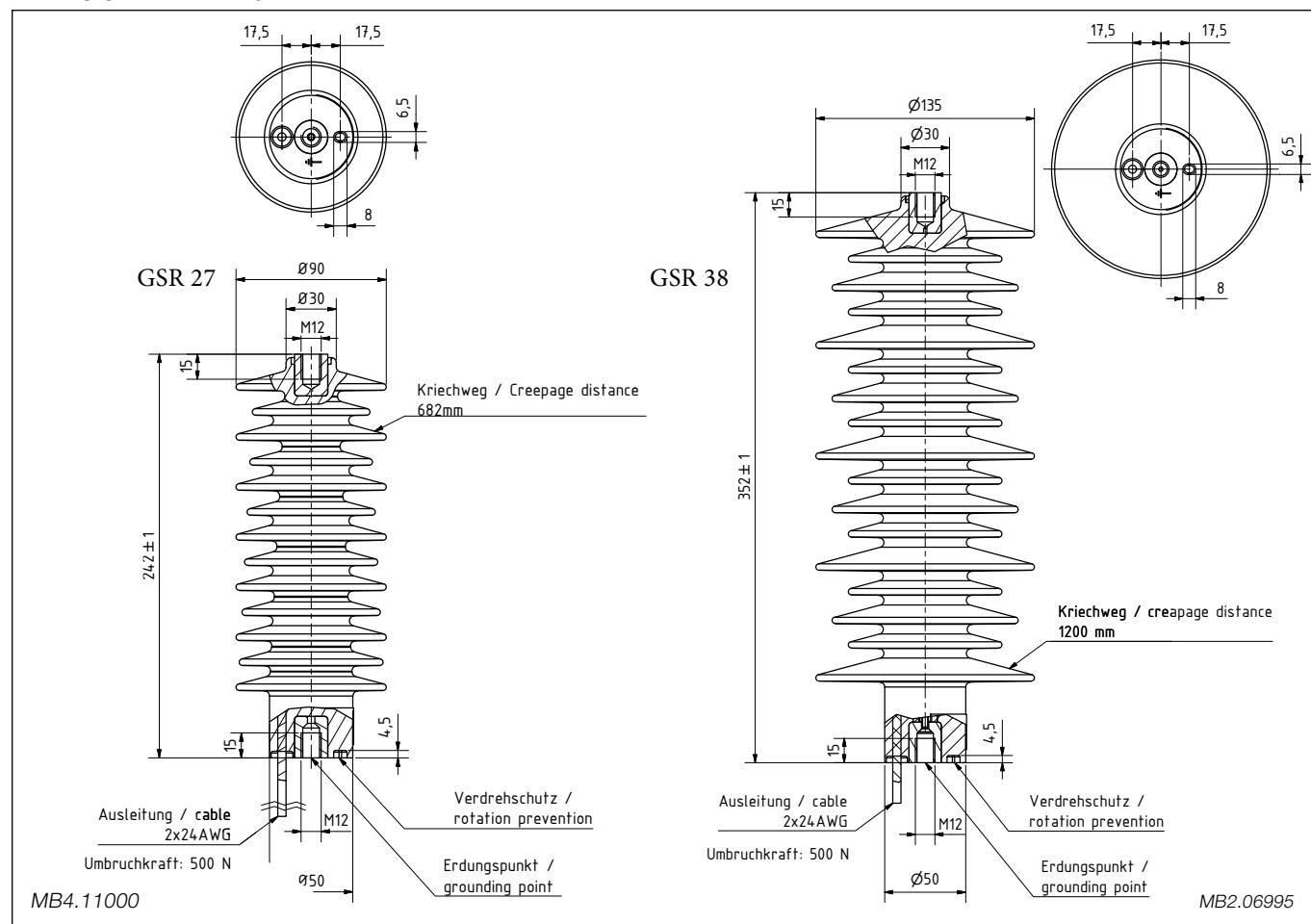
Low power passive voltage transformer
according to IEC 61869-11

- Suitable for Recloser applications



| TYPES | GSR 27 | GSR 38 |
|---|--------------------|-------------------|
| Rated frequency f_r | 50 Hz 60 Hz | |
| Rated insulation level | 27/70/150 kV | 38/95/200 kV |
| Temperature category | -40 °C / +60 °C | |
| Mass | 1,6 kg | 3,5 kg |
| Insulating class | E | |
| Insulation level at secondary terminals | 820/1500 V | |
| Rated primary voltage U_{pr} | 27/ $\sqrt{3}$ kV | 38/ $\sqrt{3}$ kV |
| Rated secondary voltage U_{sr} | 3,25/ $\sqrt{3}$ V | |
| Rated voltage factor F_v | 1,2 / 1,9 8 h | |
| Rated burden R_{br} | > 1 M Ω | |
| Accuracy class | 3 | |
| Rated phase offset φ_{or} | - | |

DIMENSIONAL DRAWING



For more information, please refer to the data sheet. Subject to technical modifications.

NOTE. For possible secondary cables refer to Appendix 1

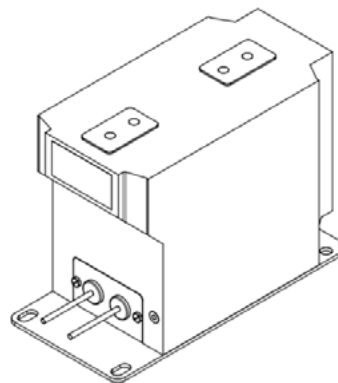
PRODUCT OVERVIEW

TABLE OF CONTENTS

6.0 COMBINED SENSORS

6.1 ABS 12 | 17.5 | 24 | 36

- Rogowski technology
- Non-saturating for current measurement
- Support design according to DIN 42600 and IEC 61869-06
- For installation in air-insulated switchgear
- With coupling electrode for voltage indication



| TYPES | ABS 12 | ABS 17.5 | ABS 24 | ABS 36 |
|--|----------------|---------------|--------------|--------------|
| Rated frequency f_r | 50 Hz 60 Hz | | | |
| Rated insulation level | 12/28/75 kV | 17,5/38/95 kV | 24/50/125 kV | 36/70/170 kV |
| Temperature category | -5 °C / +40 °C | | | |
| Mass | 18...22 kg | | 26...36 kg | 45 kg |
| Insulating class | E | | | |
| Insulation level at secondary terminals | 820/1500 V | | | |
| Rated primary current I_{pr} | 250 A * | | | |
| Rated secondary voltage U_{sr} | 150 mV | | | |
| Factor of the extended primary rated current K_{pcr} | 10 | | | |
| Rated short-time thermal current I_{th} | 31,5 kA 3 s | | | |
| Rated peak current I_{dyn} | 100 kA | | | |
| Rated continuous thermal current I_{cth} | 2500 A | | | |
| Current sensor accuracy class | 0,5 | | | |
| Current sensor output signal | derivative | | | |
| Current sensor rated phase offset | 90° | | | |
| Rated primary voltage U_{pr} | 10/√3 kV | 15/√3 kV | 20/√3 kV | 30/√3 kV |
| Rated secondary voltage U_{sr} | 1/√3 V | 1,5/√3 V | 2/√3 V | 1,5/√3 V |
| Rated voltage factor F_v | 1,2 / 1,9 8 h | | | |
| Voltage sensor accuracy class | 0,5 1 3P | | | |
| Rated burden R_{br} | 2 MΩ / 50 pF * | | | |
| Voltage sensor output signal | proportional | | | |

* Other values available on request

DIMENSIONAL DRAWING

| | | | | | | | |
|---------------|-----------------------------|-------|-------|-------|-------|-----|-----|
| | | | | | | | |
| TYPE | | b_1 | d_1 | e_1 | e_2 | h | l |
| ABS 12 17.5 | Narrow design (DIN 42600-8) | 148 | 11 | 125 | 270 | 220 | 335 |
| ABS 24 | Narrow design (DIN 42600-8) | 178 | 14 | 150 | 280 | 280 | 355 |
| ABS 36 | Large design (DIN 42600-5) | 300 | 14 | 225 | 300 | 390 | 410 |

Example Type: 111048-001 (ABS 12-01)

For more information, please refer to the data sheet. Subject to technical modifications.

NOTE: For possible secondary cables refer to Appendix 1

PRODUCT OVERVIEW

TABLE OF CONTENTS

7.0 APPENDIX 1: SECONDARY TERMINALS

The following table lists the cables, connectors and cable lengths used for the secondary terminals. Other configurations are also possible on request.

| | CABLE | CONNECTION / CONNECTOR | LENGTH |
|--|--------------------------------|------------------------|--------|
| Window type current sensors | | | |
| KSOH-S 1082 | LiYCY 2 x 0,25 mm ² | Open ends | 5 m |
| MKSOH-S 1384 | LiYCY 2 x 0,25 mm ² | Open ends | 5 m |
| KSR-S 60 Gr1 | - | Terminals | - |
| Split core current sensors | | | |
| UGSS-S 104 * | - | Terminals | - |
| RKU-S 2012 * | - | Terminals | - |
| Current sensors in block design | | | |
| ASG 24-63 36-63 | RJ45; CAT6A, green | RJ 45 | 3,6 m |
| ASG 24-36 36-36 | RJ45; CAT6A, green | RJ 45 | 3,6 m |
| Voltage sensors indoor | | | |
| MGTK 12 17.5 24 | LiYCY-OB | M8, 3-pole | 0,2 m |
| MGTK-V 12 17.5 24 | LiYCY-OB | M8, 3-pole | 0,2 m |
| Voltage sensors outdoor | | | |
| GSER(F) 16 | RG 58C/U | BNC | 5 m |
| GSER(F) 52 | RG 58C/U | BNC | 5 m |
| GSR 27 38 | LS9YC11Y 2x24 AWG | Open ends | < 10 m |
| Combination sensors | | | |
| ABS 12 17.5 24 36 | LIYSTCYC11Y / YDDY cat6 | Twin BNC / RJ 45 | 5 m |

* The connecting cable is not included in the scope of delivery. It can be ordered in addition if required.

8.0 APPENDIX 2: ACCURACY CLASSES ACCORDING TO IEC 61869

8.1 LIMITS AT RATED FREQUENCY

CURRENT SENSORS FOR MEASURING PURPOSES

| Accuracy class | RATIO ERROR ε [%] | | | | | PHASE ERROR φ_e ['] | | | | |
|----------------|-------------------------------|---------------|--------------|-----------|-------------------------|-----------------------------|---------------|--------------|----------|-------------------------|
| | 0,01 I_{pr} | 0,05 I_{pr} | 0,2 I_{pr} | I_{pr} | $K_{pcr} \times I_{pr}$ | 0,01 I_{pr} | 0,05 I_{pr} | 0,2 I_{pr} | I_{pr} | $K_{pcr} \times I_{pr}$ |
| 0,1 | - | $\pm 0,4$ | $\pm 0,2$ | $\pm 0,1$ | | - | ± 15 | ± 8 | ± 5 | |
| 0,2 | - | $\pm 0,75$ | $\pm 0,35$ | $\pm 0,2$ | | - | ± 30 | ± 15 | ± 10 | |
| 0,2S | $\pm 0,75$ | $\pm 0,35$ | | $\pm 0,2$ | | ± 30 | ± 15 | | ± 10 | |
| 0,5 | - | $\pm 1,5$ | $\pm 0,75$ | $\pm 0,5$ | | - | ± 90 | ± 45 | ± 30 | |
| 0,5S | $\pm 1,5$ | $\pm 0,75$ | | $\pm 0,5$ | | ± 90 | ± 45 | | ± 30 | |
| 1 | - | $\pm 3,0$ | $\pm 1,5$ | $\pm 1,0$ | | - | ± 180 | ± 90 | ± 60 | |
| 3 | - | - | $\pm 4,5$ | $\pm 3,0$ | | - | - | - | - | - |

Permissible ratio and phase error for current sensors according to IEC 61869-10:2017, Table 1001

CURRENT SENSORS FOR PROTECTION PURPOSES

| Accuracy class | RATIO ERROR ε [%] | PHASE ERROR φ_e ['] | TOTAL ERROR [%] |
|----------------|-------------------------------|-----------------------------|--------------------------------------|
| | I_{pr} | I_{pr} | Rated accuracy limit primary current |
| 5P | 1 | 60 | 5 |
| 10P | 3 | 60 | 10 |

Permissible ratio and phase errors for current sensors according to IEC 61869-10:2017, Table 1002

VOLTAGE SENSORS FOR MEASURING PURPOSES

| Accuracy class | RATIO ERROR ε [%] | | | PHASE ERROR φ_e ['] | | |
|----------------|-------------------------------|-----------|--------------|-----------------------------|----------|--------------|
| | 0,8 U_{pr} | U_{pr} | 1,2 U_{pr} | 0,8 U_{pr} | U_{pr} | 1,2 U_{pr} |
| 0,1 | | $\pm 0,1$ | | | ± 5 | |
| 0,2 | | $\pm 0,2$ | | | ± 10 | |
| 0,5 | | $\pm 0,5$ | | | ± 20 | |
| 1 | | $\pm 1,0$ | | | ± 40 | |
| 3 | | $\pm 3,0$ | | | - | |

Permissible ratio and phase error for voltage sensors according to IEC 61869-11:2017, Table 1101

VOLTAGE SENSORS FOR MEASURING AND/OR PROTECTION PURPOSES

| Accuracy class | RATIO ERROR ε [%] | | | | | PHASE ERROR φ_e ['] | | | | |
|----------------|-------------------------------|--------------|--------------|-----------|---------------------|-----------------------------|--------------|--------------|----------|---------------------|
| | 0,02 U_{pr} | 0,2 U_{pr} | 0,8 U_{pr} | U_{pr} | $F_V \times U_{pr}$ | 0,02 U_{pr} | 0,2 U_{pr} | 0,8 U_{pr} | U_{pr} | $F_V \times U_{pr}$ |
| 0,1P | $\pm 0,5$ | $\pm 0,2$ | | $\pm 0,1$ | | ± 20 | ± 10 | | ± 5 | |
| 0,2P | ± 1 | $\pm 0,4$ | | $\pm 0,2$ | | ± 40 | ± 20 | | ± 10 | |
| 0,5P | ± 2 | ± 1 | | $\pm 0,5$ | | ± 80 | ± 40 | | ± 20 | |
| 1P | ± 4 | ± 2 | | ± 1 | | ± 160 | ± 80 | | ± 40 | |
| 3P | ± 6 | | ± 3 | | | ± 240 | | ± 120 | | |
| 6P | ± 12 | | ± 6 | | | ± 480 | | ± 240 | | |

Permissible ratio and phase error for voltage sensors according to IEC 61869-11:2017, Table 1102

For more information, please refer to the data sheet. Subject to technical modifications.

PRODUCT OVERVIEW

TABLE OF CONTENTS

APPENDIX 2: ACCURACY CLASSES ACCORDING TO IEC 61869

8.2 LIMITS FOR HARMONICS

| Accuracy class | PHASE ERROR ϵ [%] Harmonic | | | | | | | $\Delta\varphi$ [°] | PHASE ERROR φ_e [°] Harmonic | | | | |
|----------------|--|------------|--------|---------|---------|----------|-------------|---------------------|---|--------|---------|--------|----------|
| | 0 Hz | 1 Hz | 2 to 4 | 5 and 6 | 7 bis 9 | 10 to 13 | > 13 | | 1 Hz | 2 to 4 | 5 and 6 | 7 to 9 | 10 to 13 |
| 0,1 | +1 -100 | +1 -30 | ±1 | ±2 | ±4 | ±8 | +8 -100 | | ±45 | ±1 | ±2 | ±4 | ±8 |
| 0,2 0,2S | +2 -100 | +2 -30 | ±2 | ±4 | ±8 | ±16 | +16 -100 | | ±45 | ±2 | ±4 | ±8 | ±16 |
| 0,5 0,5S | +5 -100 | +5 -30 | ±5 | ±10 | ±20 | ±20 | +20 -100 | | ±45 | ±5 | ±10 | ±20 | ±20 |
| 1 | +10 -100 | +10 -30 | ±10 | ±20 | ±20 | ±20 | +20 -100 | | ±45 | ±10 | ±20 | ±20 | ±20 |

Accuracy classes according to IEC 61869-6:2016, Table 6A.2

| | | PHASE ERROR ε [%] | | | PHASE ERROR φ_e [°] | | |
|----------------|------------|-------------------------------|----------------------|----------------------|-----------------------------|----------------------|----------------------|
| Accuracy class | | $0,1 \leq f < 1$ kHz | $1 \leq f < 1,5$ kHz | $1,5 \leq f < 3$ kHz | $0,1 \leq f < 1$ kHz | $1 \leq f < 1,5$ kHz | $1,5 \leq f < 3$ kHz |
| 3 kHz | 0,1 | ±1 | ±2 | ±5 | ±1 | ±2 | ±5 |
| | 0,2 0,2S | ±2 | ±4 | ±5 | ±2 | ±4 | ±5 |
| | 0,5 0,5S | ±5 | ±10 | ±10 | ±5 | ±10 | ±20 |
| | 1 | ±10 | ±20 | ±20 | ±10 | ±20 | ±20 |

Accuracy class extension up to 3 kHz according to IEC 61869-6:2016, Table 6A.3

| | | PHASE ERROR ϵ [%] | | | PHASE ERROR φ_e [°] | | |
|----------------|------------|------------------------------|-----------------------------|------------------------------|------------------------------|-----------------------------|------------------------------|
| Accuracy class | | $0,1 \leq f < 5 \text{ kHz}$ | $5 \leq f < 10 \text{ kHz}$ | $10 \leq f < 20 \text{ kHz}$ | $0,1 \leq f < 5 \text{ kHz}$ | $5 \leq f < 10 \text{ kHz}$ | $10 \leq f < 20 \text{ kHz}$ |
| 20 kHz | 0,1 | ± 1 | ± 2 | ± 5 | ± 1 | ± 2 | ± 5 |
| | 0,2 0,2S | ± 2 | ± 4 | ± 5 | ± 2 | ± 4 | ± 5 |
| | 0,5 0,5S | ± 5 | ± 10 | ± 10 | ± 5 | ± 10 | ± 20 |
| | 1 | ± 10 | ± 20 | ± 20 | ± 10 | ± 20 | ± 20 |

Accuracy class extension up to 20 kHz according to IEC 61869-6:2016, Table 6A.4

| | | PHASE ERROR ϵ [%] | | | PHASE ERROR φ_e [°] | | |
|----------------|------------|------------------------------|-----------------------------|-------------------------------|------------------------------|-----------------------------|-------------------------------|
| Accuracy class | | $0,1 \leq f < 5 \text{ kHz}$ | $5 \leq f < 10 \text{ kHz}$ | $10 \leq f < 150 \text{ kHz}$ | $0,1 \leq f < 5 \text{ kHz}$ | $5 \leq f < 10 \text{ kHz}$ | $10 \leq f < 150 \text{ kHz}$ |
| 150 kHz | 0,1 | ±1 | ±2 | ±5 | ±1 | ±2 | - |
| | 0,2 0,2S | ±2 | ±4 | ±5 | ±2 | ±4 | - |
| | 0,5 0,5S | ±5 | ±10 | ±10 | ±5 | ±10 | - |
| | 1 | ±10 | ±20 | ±20 | ±10 | ±20 | - |

Accuracy class extension up to 150 kHz

For more information, please refer to the data sheet. Subject to technical modifications.

PRODUCT OVERVIEW

TABLE OF CONTENTS

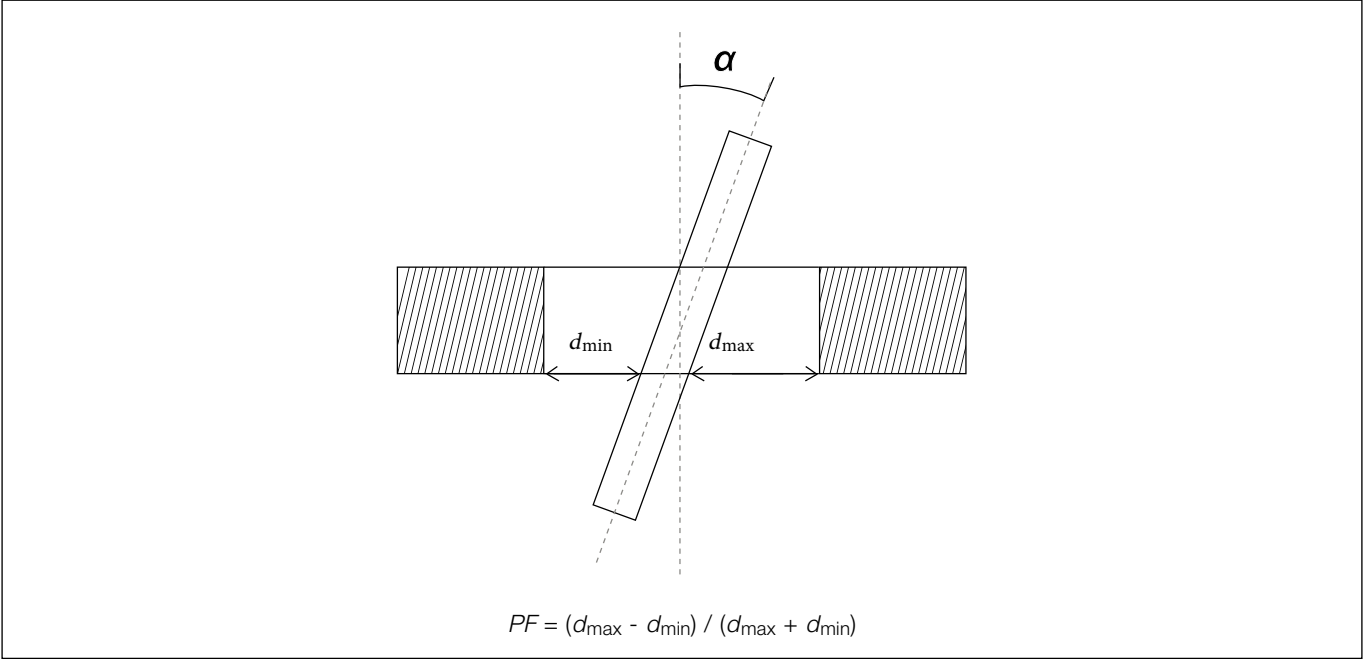
APPENDIX 2: ACCURACY CLASSES ACCORDING TO IEC 61869

8.3 ACCURACY DEPENDING ON PRIMARY CONDUCTOR POSITION

| ADDITION | MAX. POSITION FACTOR PF | MAX. ANGLE α [°] |
|----------|-------------------------|-------------------------|
| A1 | 0 | 0 |
| A2 | 0,5 | 15 |
| A3 | 1 | 45 |

According to IEC 61869-10:2017, Table 10D.1

CALCULATION OF POSITION FACTOR



For more information, please refer to the data sheet. Subject to technical modifications.

PRODUCT OVERVIEW

TABLE OF CONTENTS

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