

# SENSORS

CURRENT & VOLTAGE MEASUREMENT  
FOR THE GRID OF THE FUTURE



# PRODUCT OVERVIEW - CURRENT & VOLTAGE MEASUREMENT

## WINDOW TYPE CURRENT SENSORS



KSOH-S



MKSOH-S



KSR-S 60 Size 1

## SPLIT CORE CURRENT SENSORS

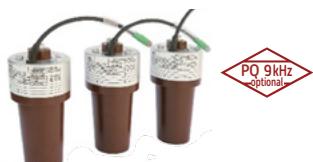


UGSS-S



RKU-S

## VOLTAGE SENSORS INDOOR



MGTK 12 | 17.5 | 24



MGTK-V 12 | 17.5 | 24



GBERA 12 | 24 | 36



GSER 3

## VOLTAGE SENSORS OUTDOOR



GSER 16



GSER 52



GSR 27 | 38

## COMBINED SENSORS



ABS 12 | 17.5 | 24 | 36

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# 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  $\leq 1$  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 auxili-

ary 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 and 150 kHz.

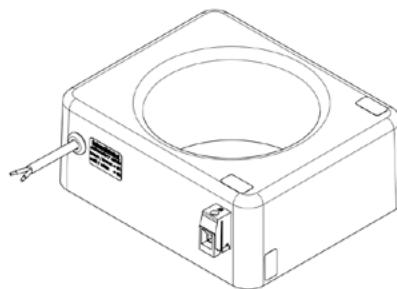
	Transformer	Sensor
Power	Up to several 100 VA	$\leq 1$ VA
Output signal	Current or voltage	Voltage
Standard values	1 A   5 A	22.5 mV   150 mV   225 mV
Output	or $100/\sqrt{3}$ V   $110/\sqrt{3}$ V	or $3.25/\sqrt{3}$ V
Primary variable	AC	DC and/or AC
Electrical isolation	Yes	Partially
Frequency	16.7 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

## 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



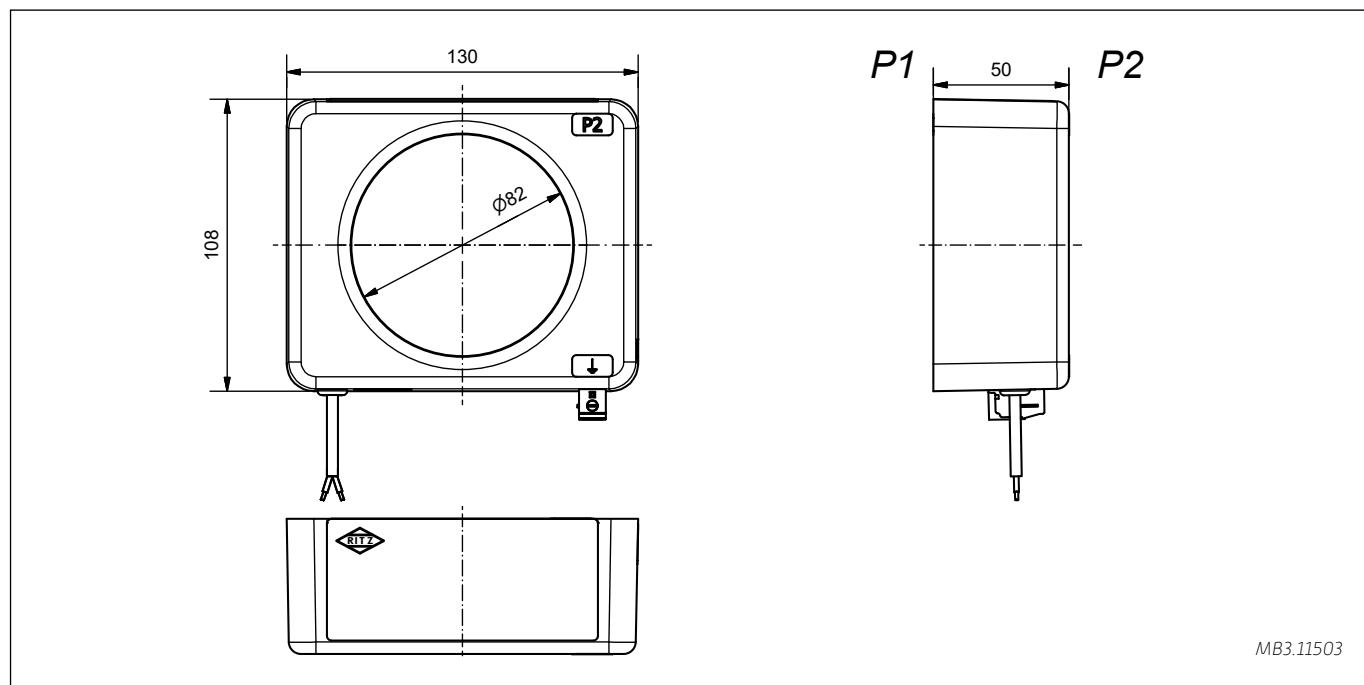
PQ 3 kHz

#### 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 $\varphi_{or}$	0°

\* See 8.3 Accuracy depending on primary conductor position

#### DIMENSIONAL DRAWING



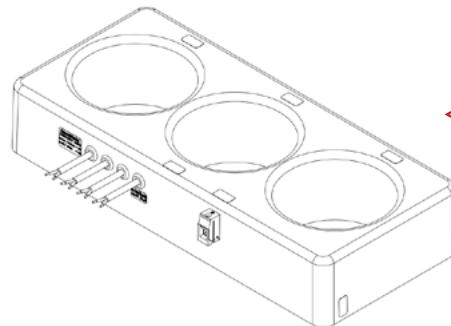
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## 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

## MKSOH-S 1384

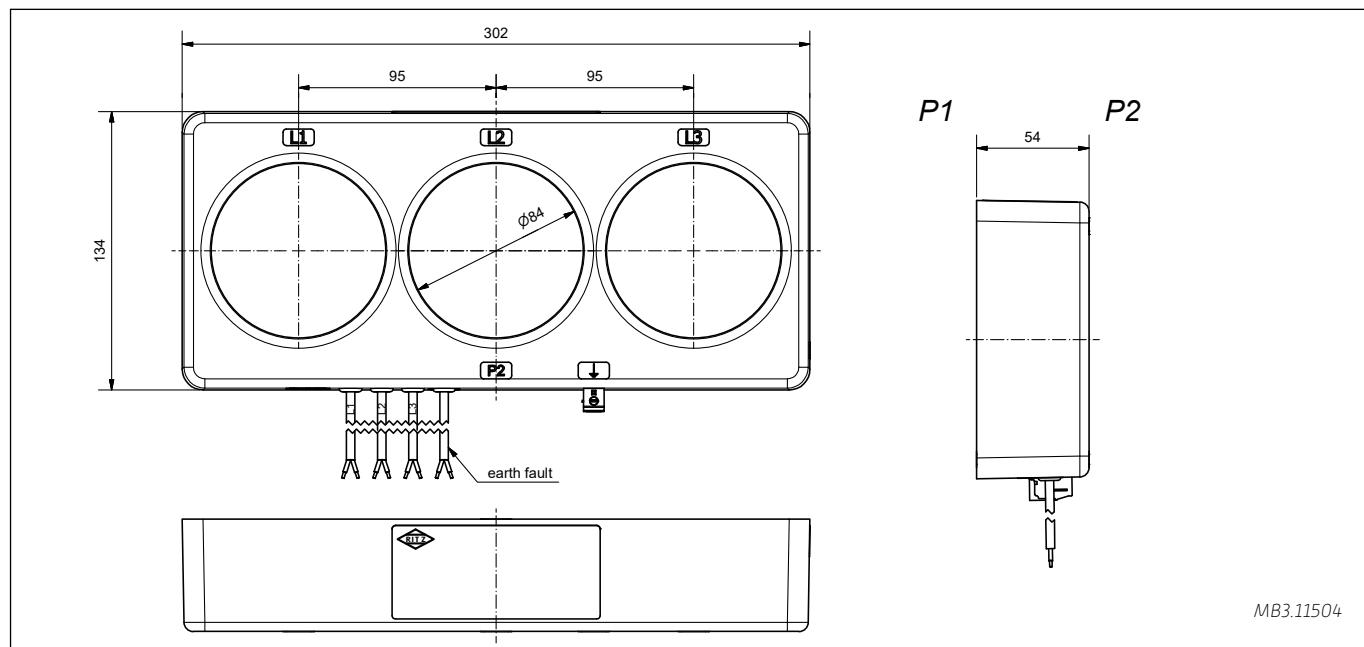
## PHASE CURRENT

## 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 $\varphi_{or}$	0°	

\* See 8.3 Accuracy depending on primary conductor position

## DIMENSIONAL DRAWING



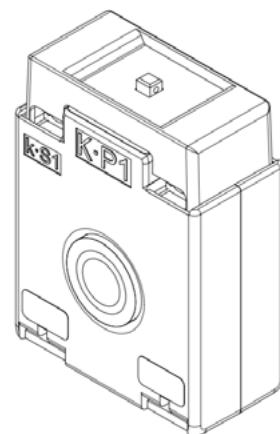
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## 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

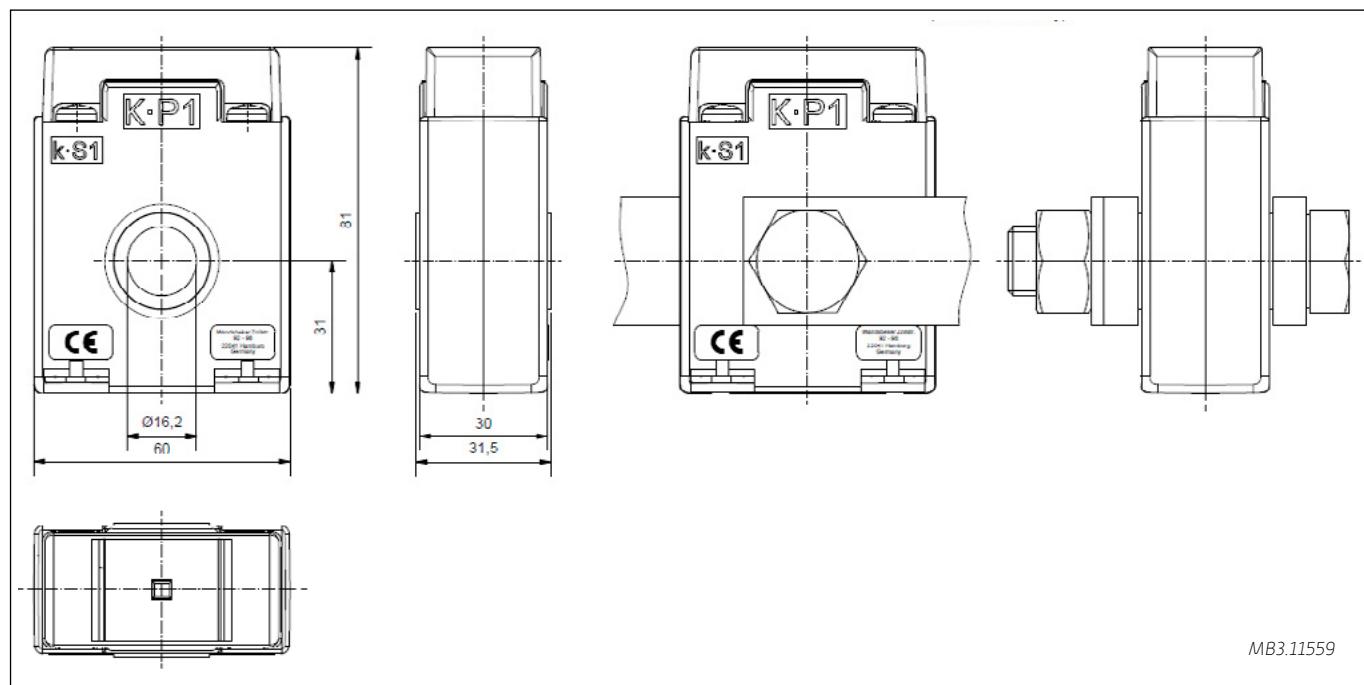


## TYPE

	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 $K_{pr}$	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 $\varphi_{or}$	0°

\* Other values available on request

## DIMENSIONAL DRAWING



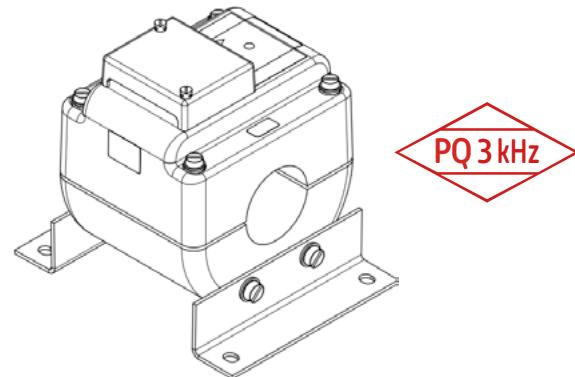
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

### 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

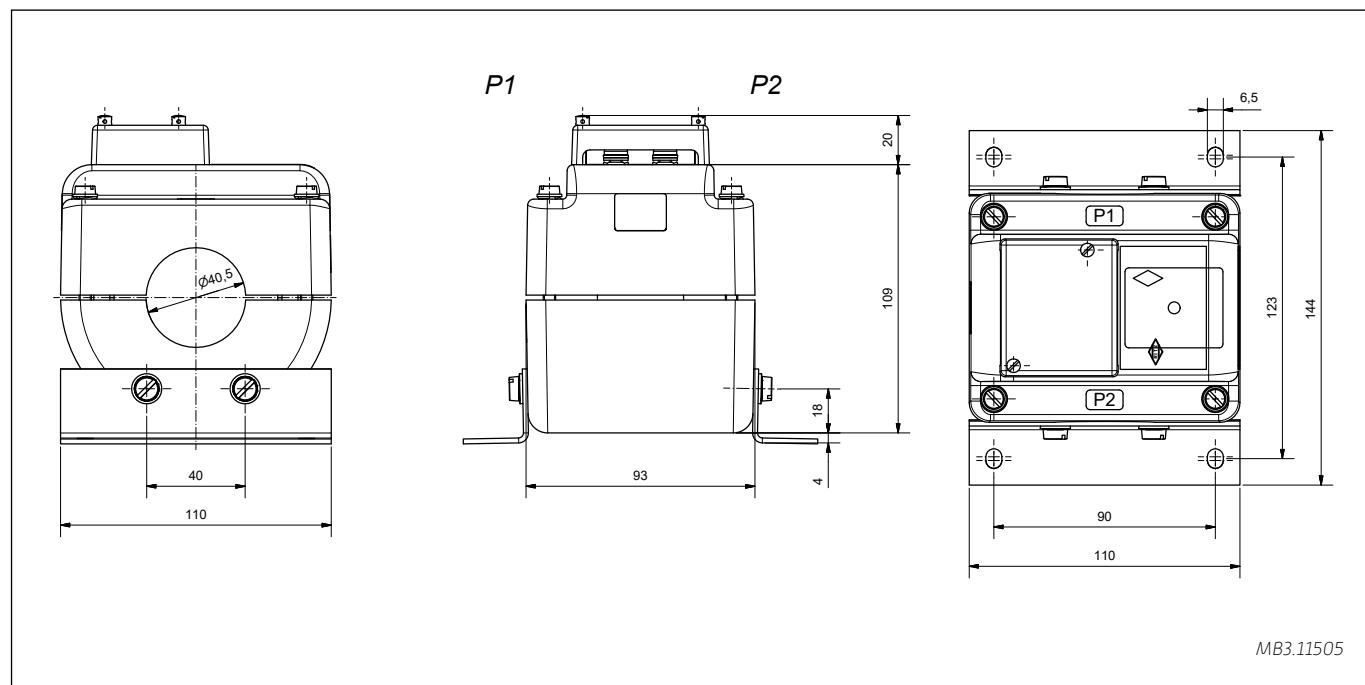


#### TYPE

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 $\varphi_{or}$	0°

\* See 8.3 Accuracy depending on primary conductor position

#### DIMENSIONAL DRAWING



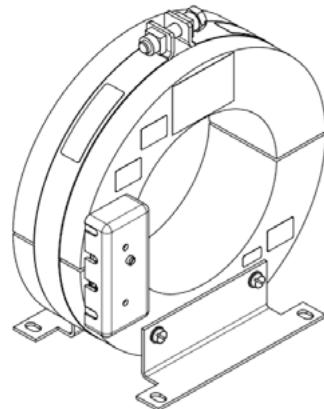
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## 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

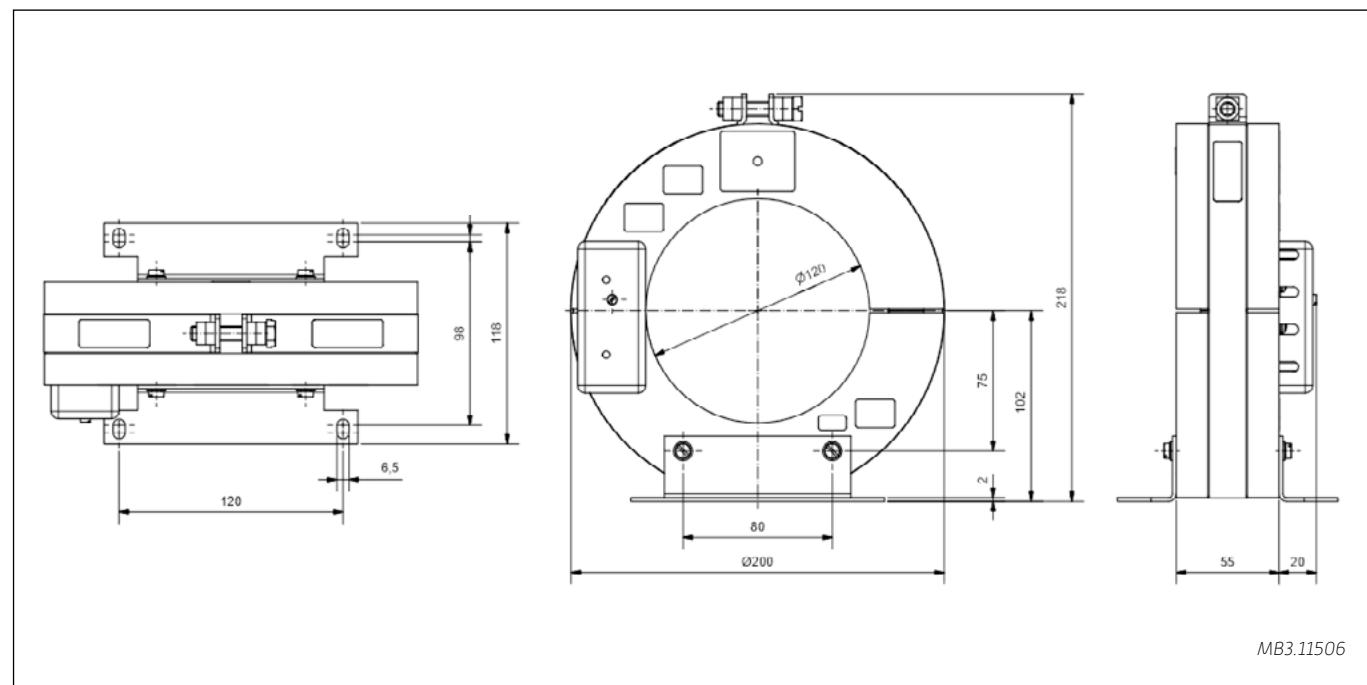


#### TYPE

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	$\epsilon$
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 M $\Omega$ / 50 pF
Rated phase offset $\varphi_{or}$	0°

\* See 8.3 Accuracy depending on primary conductor position

#### DIMENSIONAL DRAWING



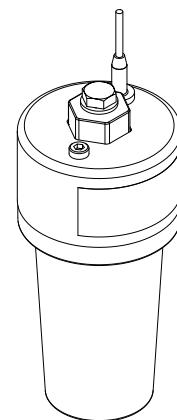
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## 4.0 VOLTAGE SENSORS – INDOOR

### 4.1 MGTK 12 | 17.5 | 24

Low power passive voltage transformer  
according to IEC 61869-11

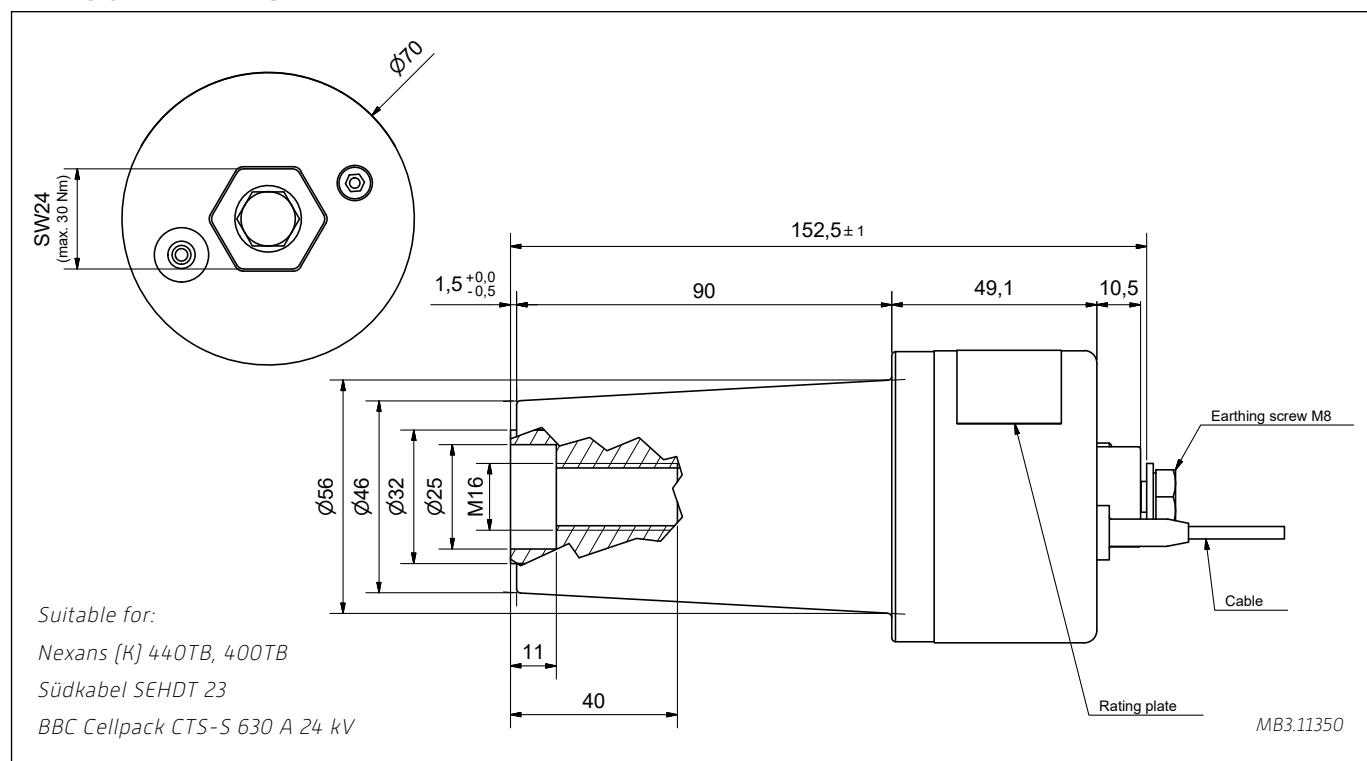
- Primary terminal outer cone type C according to EN 50181
- For installation in symmetrical T-connectors
- Suitable for PQ measurements
- Suitable for BBC Cellpack CTS-S 630 A 24 kV
- Optionally available for PQ measurements up to 20 kHz



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/V3 kV	15/V3 kV	20/V3 kV
Rated secondary voltage $U_{sr}$		3,25/V3 V	
Rated voltage factor $F_V$		1,2 / 1,9 8 h	
Rated burden $R_{br}$		200 kΩ ±1 % *	
Accuracy class		0,5P	
Rated phase offset $\varphi_{or}$		0°	

\* Other values available on request

### DIMENSIONAL DRAWING



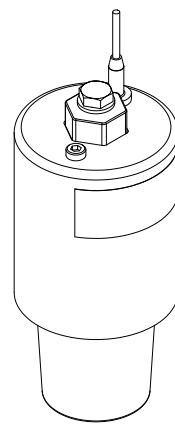
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## VOLTAGE SENSORS – INDOOR

## 4.2 MGT-K-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

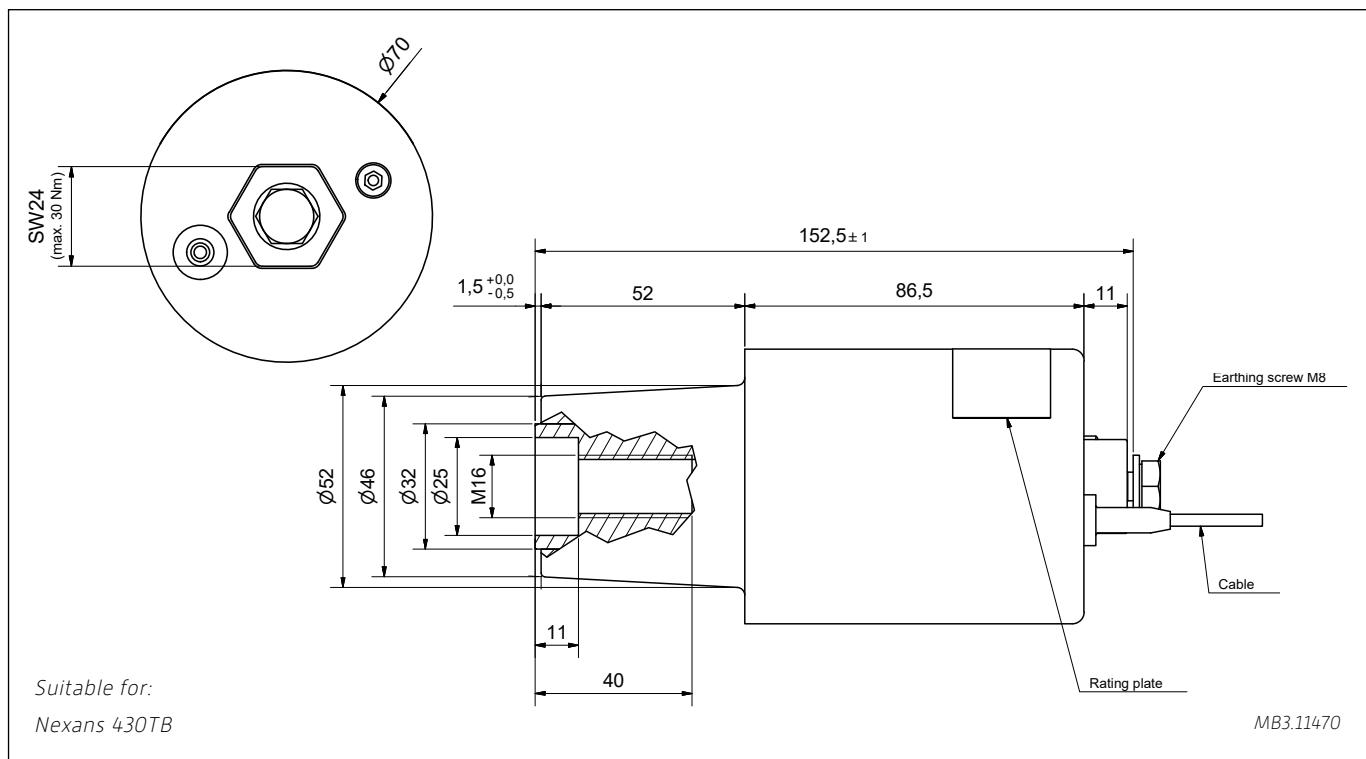


## TYPES

	MGT-K-V 12	MGT-K-V 17.5	MGT-K-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/V3 kV	15/V3 kV	20/V3 kV
Rated secondary voltage $U_{sr}$		3,25/V3 V	
Rated voltage factor $F_V$		1,2 / 1,9 8 h	
Rated burden $R_{br}$		200 kΩ ±1 % *	
Accuracy class		0,5P	
Rated phase offset $\varphi_{or}$		0°	

\* Other values available on request

## DIMENSIONAL DRAWING



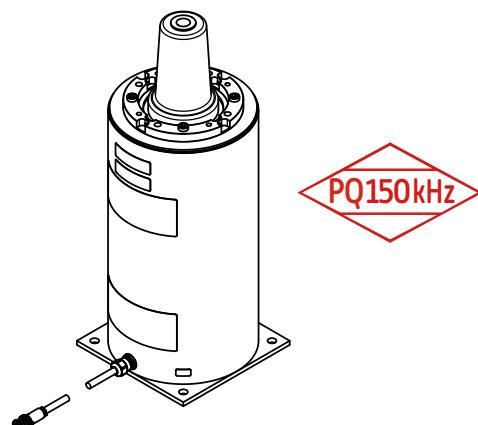
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

# VOLTAGE SENSORS – INDOOR

## 4.3 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

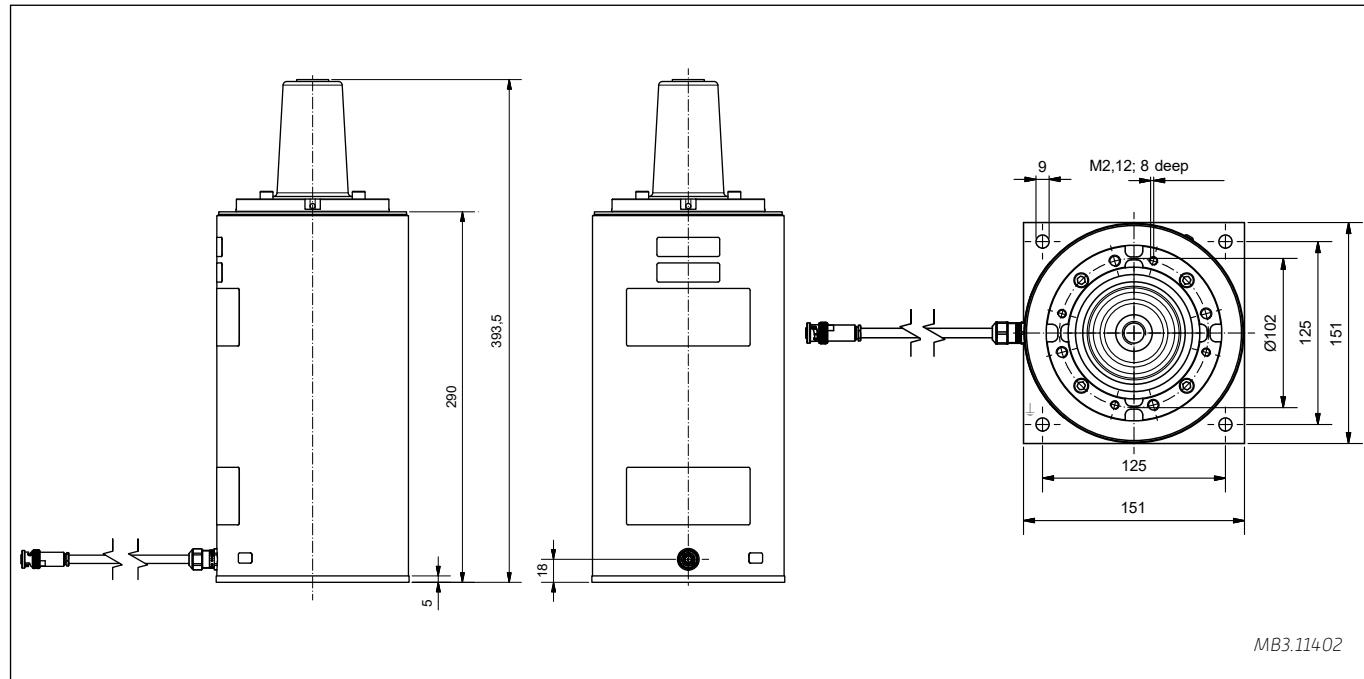


### TYPES

	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/V3 kV *	20/V3 kV *	30/V3 kV *
Rated secondary voltage $U_{sr}$		3,25/V3 V *	
Rated voltage factor $F_V$		1,2 / 1,9 8 h	
Rated burden $R_{br}$		2 MΩ / 50 pF *	
Accuracy class		0,5P	
Rated phase offset $\varphi_{or}$		0°	

\* Other values available on request

### DIMENSIONAL DRAWING



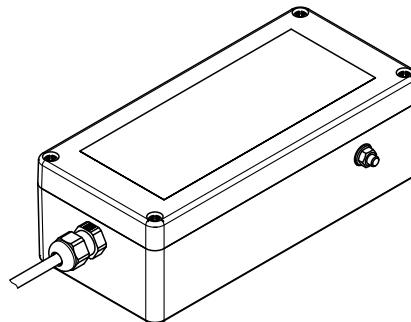
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## VOLTAGE SENSORS – INDOOR

### 4.4 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



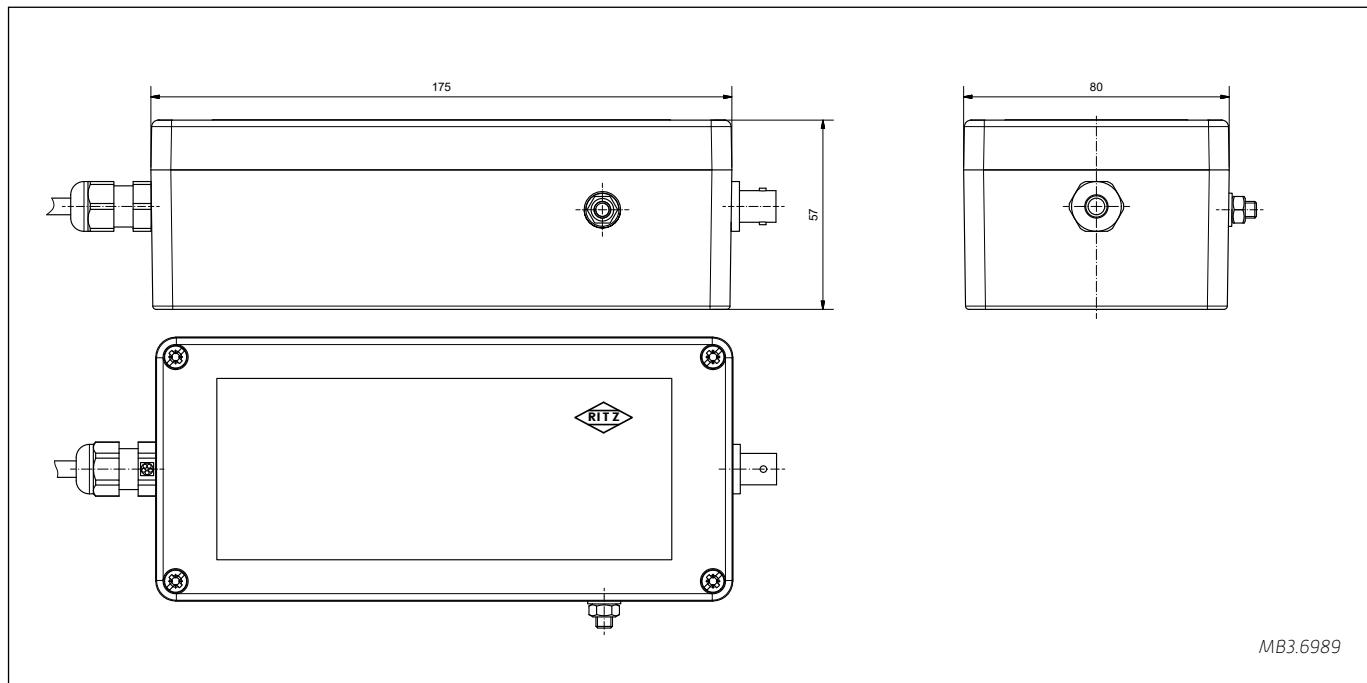
PQ150kHz

#### 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/V3 kV *
Rated secondary voltage $U_{sr}$	3,25/V3 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 $\varphi_{or}$	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

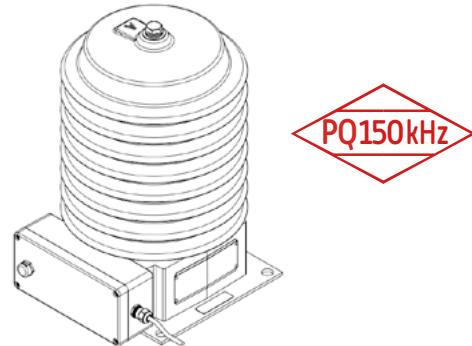
MB3.6989

## 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

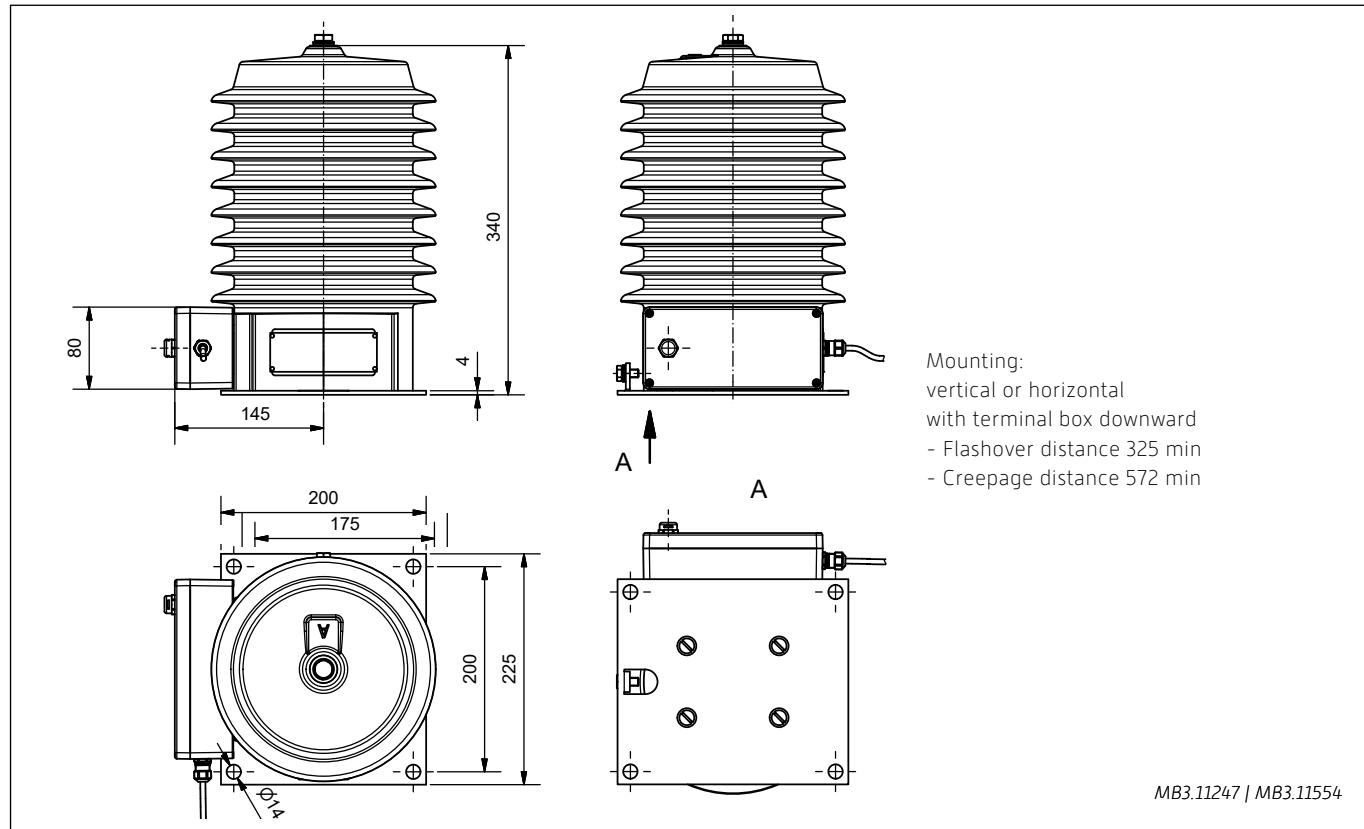


### GSER(F) 16

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/ $\sqrt{3}$ 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 $\Omega$ / 50 pF *
Accuracy class	0,2P **   1P
Rated phase offset $\varphi_{or}$	0°

\* Other values available on request / \*\* Temperature category: -5 °C / +40 °C

### DIMENSIONAL DRAWING



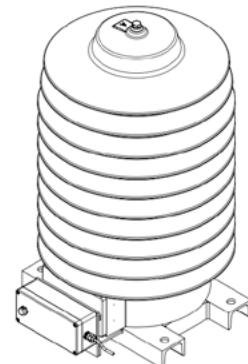
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## 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

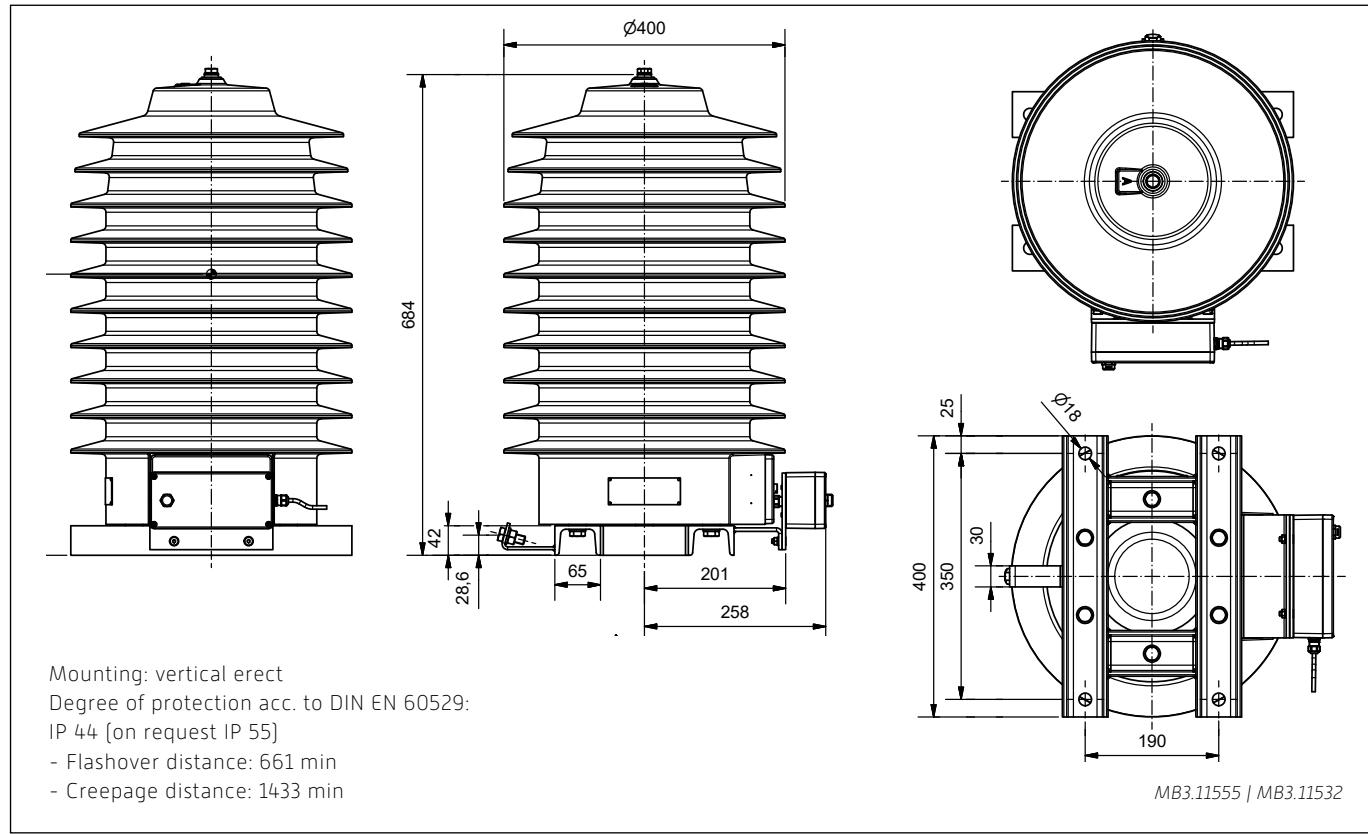


GSER(F) 52

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 MΩ / 50 pF *
Accuracy class	0,2P **   1P
Rated phase offset $\varphi_{or}$	0°

\* Other values available on request / \*\* Temperature category: -5 °C / +40 °C

## DIMENSIONAL DRAWING



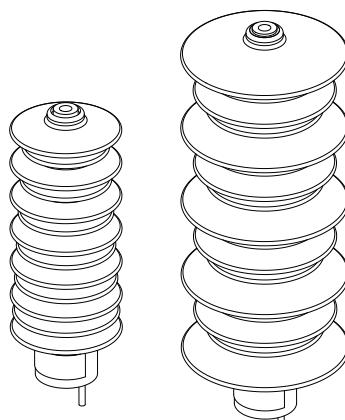
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## VOLTAGE SENSORS – OUTDOOR

### 5.3 GSR 27 | 38

Low power passive voltage transformer  
according to IEC 61869-11

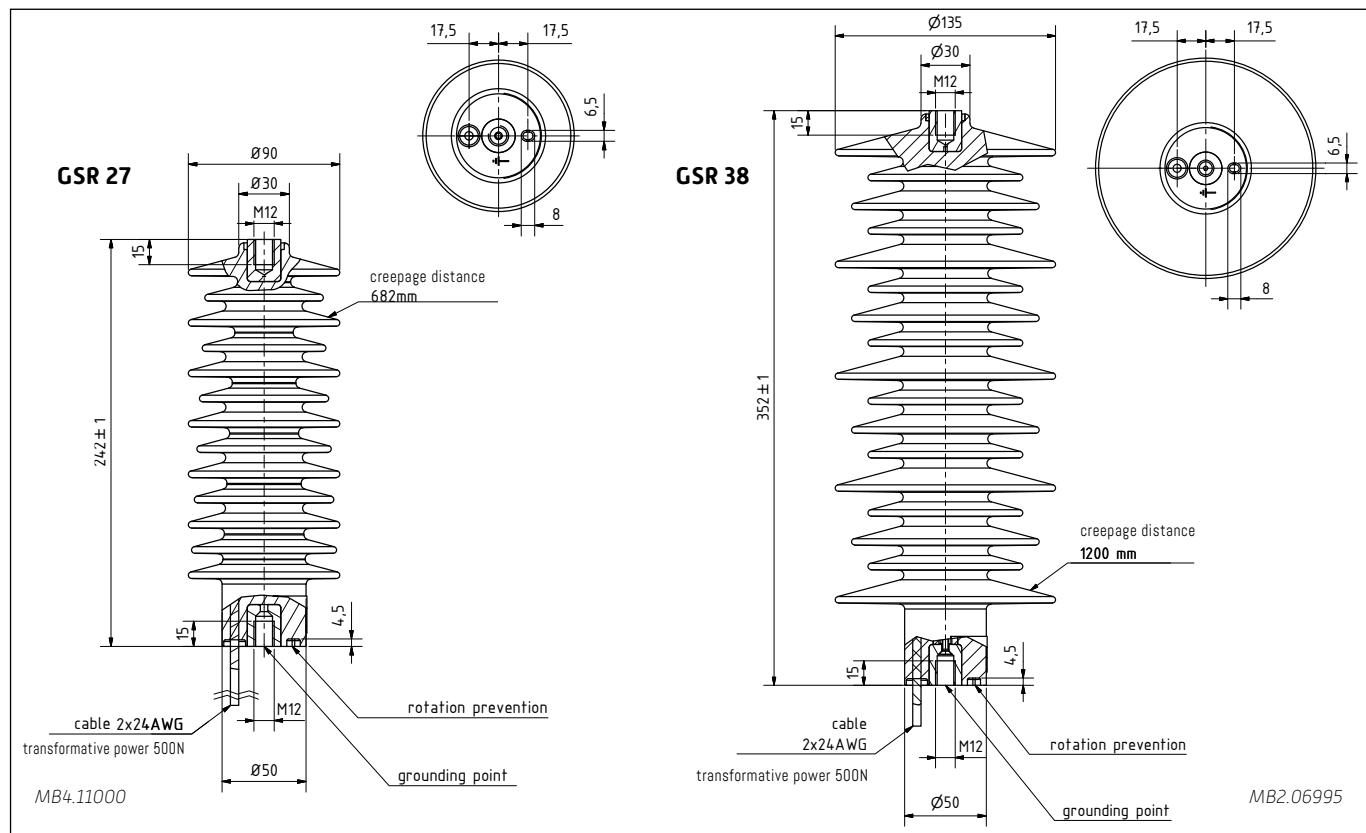
- Suitable for Recloser applications



#### 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 MΩ
Accuracy class		3
Rated phase offset $\varphi_{or}$		-

#### DIMENSIONAL DRAWING



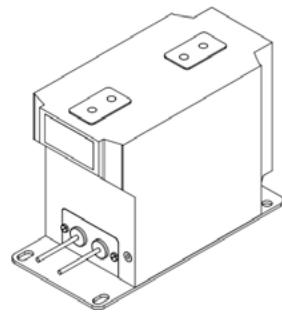
For more information, please refer to the data sheet. Subject to technical modifications. NOTE: For possible secondary cables refer to Appendix 1

## 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/ $\sqrt{3}$ kV	15/ $\sqrt{3}$ kV	20/ $\sqrt{3}$ kV	30/ $\sqrt{3}$ kV
Rated secondary voltage $U_{sr}$	1/ $\sqrt{3}$ V	1,5/ $\sqrt{3}$ V	2/ $\sqrt{3}$ V	1,5/ $\sqrt{3}$ 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

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

TYPE	<b>b<sub>1</sub></b>	<b>d<sub>1</sub></b>	<b>e<sub>1</sub></b>	<b>e<sub>2</sub></b>	<b>h</b>	<b>l</b>
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

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

## 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
<b>Window type current sensors</b>			
KSOH-S 1082	LiYCY 2 x 0,25 mm <sup>2</sup>	Open ends	5 m
MKSOH-S 1384	LiYCY 2 x 0,25 mm <sup>2</sup>	Open ends	5 m
KSR-S 60 size1	-	Terminals	-
<b>Split core current sensors</b>			
UGSS-S 104 *	-	Terminals	-
RKU-S 2012 *	-	Terminals	-
<b>Current sensors in block design</b>			
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
<b>Voltage sensors indoor</b>			
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
<b>Voltage sensors outdoor</b>			
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
<b>Combination sensors</b>			
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 $\epsilon$ [%]					PHASE ERROR $\phi_e$ [']				
	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	-	$\pm 0,4$	$\pm 0,2$	$\pm 0,1$	-	-	$\pm 15$	$\pm 8$	-	$\pm 5$
0,2	-	$\pm 0,75$	$\pm 0,35$	$\pm 0,2$	-	-	$\pm 30$	$\pm 15$	-	$\pm 10$
0,2S	$\pm 0,75$	$\pm 0,35$	-	$\pm 0,2$	$\pm 30$	$\pm 15$	-	-	-	$\pm 10$
0,5	-	$\pm 1,5$	$\pm 0,75$	$\pm 0,5$	-	-	$\pm 90$	$\pm 45$	-	$\pm 30$
0,5S	$\pm 1,5$	$\pm 0,75$	-	$\pm 0,5$	$\pm 90$	$\pm 45$	-	-	-	$\pm 30$
1	-	$\pm 3,0$	$\pm 1,5$	$\pm 1,0$	-	-	$\pm 180$	$\pm 90$	-	$\pm 60$
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 $\epsilon$ [%]		PHASE ERROR $\phi_e$ [']		TOTAL ERROR [%]	
	$I_{pr}$	$I_{pr}$	$I_{pr}$	$I_{pr}$	Rated accuracy limit primary current	
5P	1	1	60	60	5	
10P	3	3	60	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 $\epsilon$ [%]			PHASE ERROR $\phi_e$ [']		
	0,8 $U_{pr}$	$U_{pr}$	1,2 $U_{pr}$	0,8 $U_{pr}$	$U_{pr}$	1,2 $U_{pr}$
0,1	-	$\pm 0,1$	-	-	-	$\pm 5$
0,2	-	$\pm 0,2$	-	-	-	$\pm 10$
0,5	-	$\pm 0,5$	-	-	-	$\pm 20$
1	-	$\pm 1,0$	-	-	-	$\pm 40$
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 $\epsilon$ [%]					PHASE ERROR $\phi_e$ [']				
	0,02 $U_{pr}$	0,2 $U_{pr}$	0,8 $U_{pr}$	$U_{pr}$	$FV \times U_{pr}$	0,02 $U_{pr}$	0,2 $U_{pr}$	0,8 $U_{pr}$	$U_{pr}$	$FV \times U_{pr}$
0,1P	$\pm 0,5$	$\pm 0,2$	-	$\pm 0,1$	-	$\pm 20$	$\pm 10$	-	$\pm 5$	-
0,2P	$\pm 1$	$\pm 0,4$	-	$\pm 0,2$	-	$\pm 40$	$\pm 20$	-	$\pm 10$	-
0,5P	$\pm 2$	$\pm 1$	-	$\pm 0,5$	-	$\pm 80$	$\pm 40$	-	$\pm 20$	-
1P	$\pm 4$	$\pm 2$	-	$\pm 1$	-	$\pm 160$	$\pm 80$	-	$\pm 40$	-
3P	$\pm 6$	-	$\pm 3$	-	$\pm 240$	-	-	$\pm 120$	-	-
6P	$\pm 12$	-	$\pm 6$	-	$\pm 480$	-	-	$\pm 240$	-	-

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.

## ACCURACY CLASSES ACCORDING TO IEC 61869

### 8.2 LIMITS FOR HARMONICS

Accuracy class	PHASE ERROR $\epsilon$ [%]							PHASE ERROR $\varphi_e$ [°]						
	Harmonic							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

3 kHz

Accuracy class	PHASE ERROR $\epsilon$ [%]			PHASE ERROR $\varphi_e$ [°]		
	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
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

20 kHz

Accuracy class	PHASE ERROR $\epsilon$ [%]			PHASE ERROR $\varphi_e$ [°]		
	0,1 $\leq f < 5$ kHz	5 $\leq f < 10$ kHz	10 $\leq f < 20$ kHz	0,1 $\leq f < 5$ kHz	5 $\leq f < 10$ kHz	10 $\leq f < 20$ 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

150 kHz

Accuracy class	PHASE ERROR $\epsilon$ [%]			PHASE ERROR $\varphi_e$ [°]		
	0,1 $\leq f < 5$ kHz	5 $\leq f < 10$ kHz	10 $\leq f < 150$ kHz	0,1 $\leq f < 5$ kHz	5 $\leq f < 10$ kHz	10 $\leq f < 150$ 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.

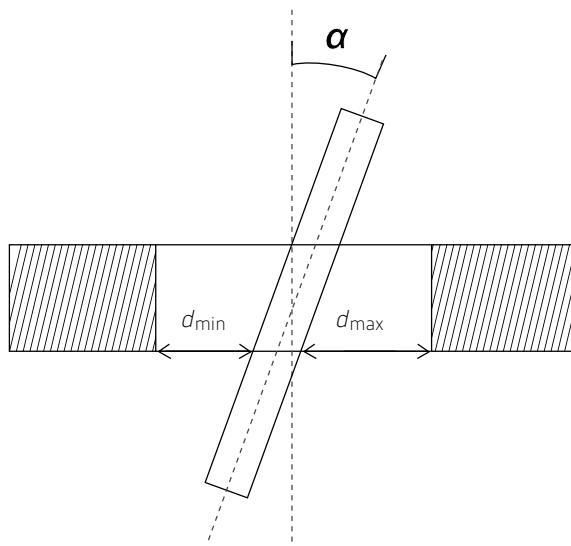
# ACCURACY CLASSES ACCORDING TO IEC 61869

## 8.3 ACCURACY DEPENDING ON PRIMARY CONDUCTOR POSITION

ADDITION	MAX. POSITION FACTOR PF	MAX. ANGLE $\alpha$ [°]
A1	0	0
A2	0,5	15
A3	1	45

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

### CALCULATION OF POSITION FACTOR



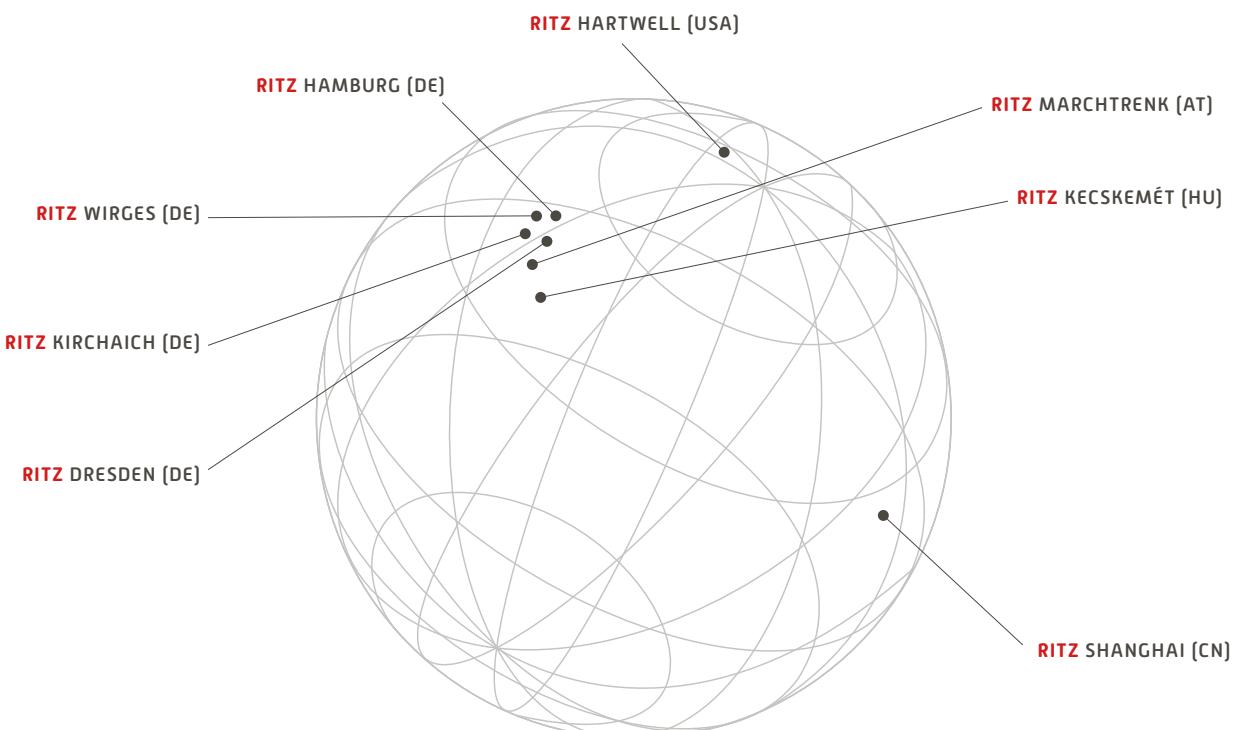
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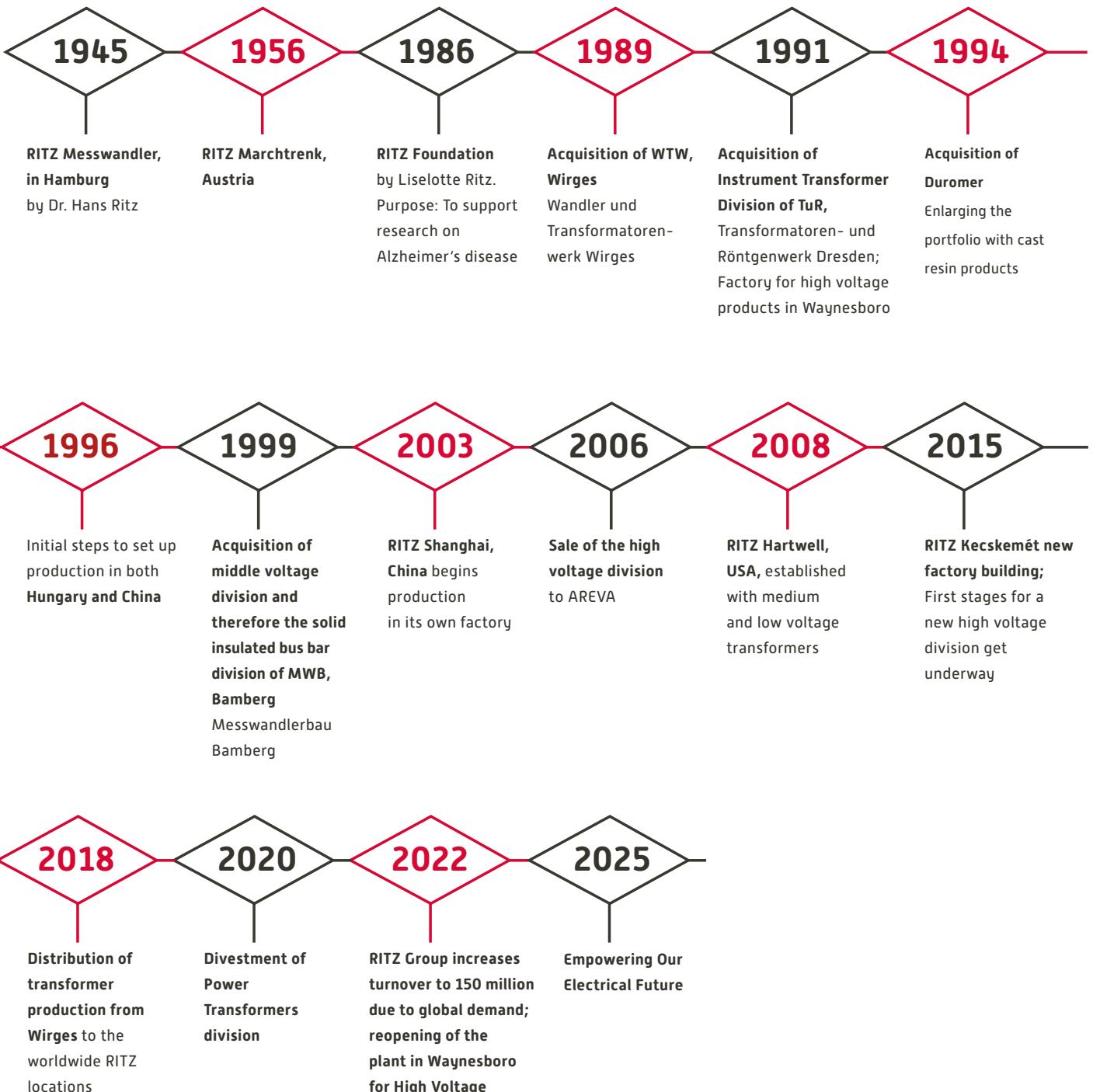
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## GROUP HISTORY



*Disclaimer: Errors and omissions excepted. Subject to technical modifications. Images for reference only.*

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