

MADE IN EUROPE



SENSORS FOR SMART GRID

**Superior innovative
sensor solutions**



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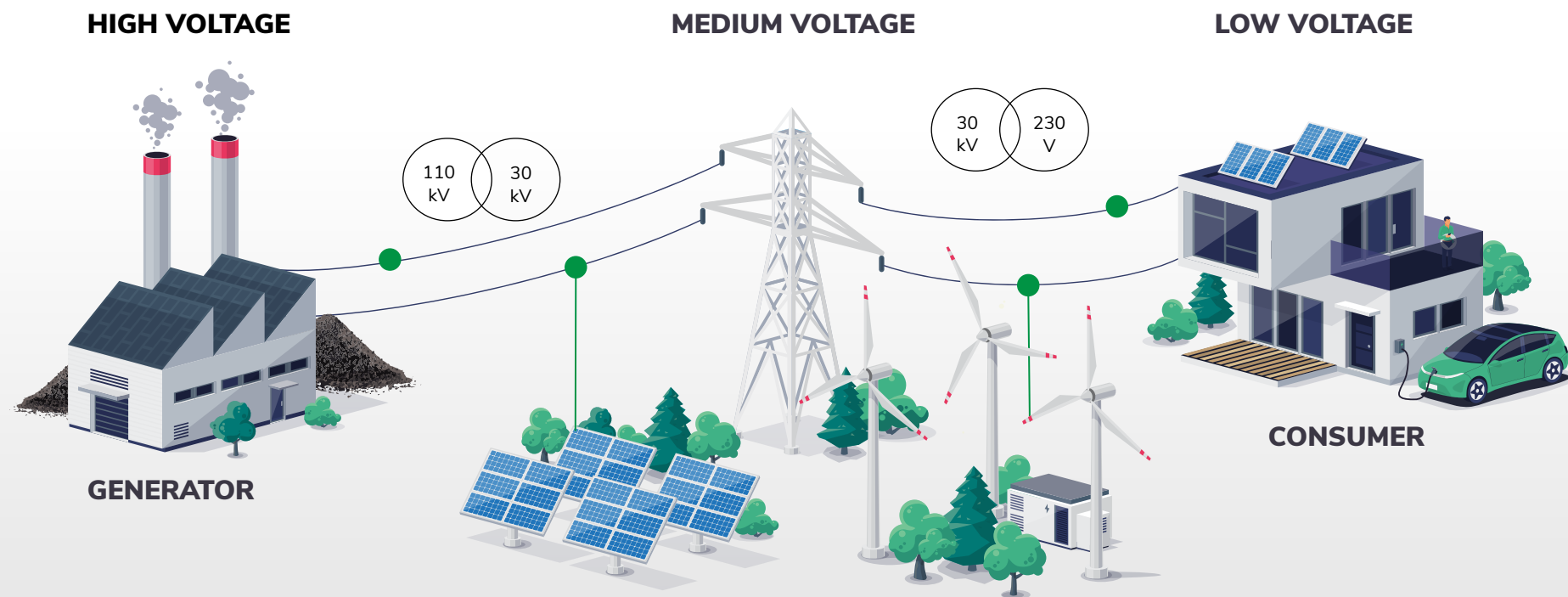


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Background and application

The challenge

Over the years, the power grid has grown larger and more versatile. Today, it includes not only the original equipment but also cables, batteries, and renewable energy sources like wind turbines and solar panels. These decentralized generation units can be placed anywhere on the grid. Customers can generate their own electricity with solar panels and feed it into the grid, causing the electricity to flow in two directions and changing the intended original grid structure. The size of the output can change at any point in the grid. This makes measuring devices that are only installed on the generation side completely useless.



The solution

SMART DEVICES, WHICH CAN REGULATE THE GRID BASED ON THE LAW OF SUPPLY AND DEMAND!

The grid must adapt and improve to fit this new structure. Measuring devices, such as sensors, at medium and low-voltage levels must be installed. These offer a way to transform high voltage and high currents into smaller signals, which electronic smart measuring devices can handle, leading to more effective and reliable smart grids.

Greenwood-Power has the best solutions

With its products, Greenwood-Power supplies a key component for the transformation of existing power grids into efficient smart grids.

The sensors are different from conventional voltage and current transformers because

- ✓ they are smaller, lighter and more flexible
- ✓ usually cost only 1/3 to 2/3 of the price of conventional transformers
- ✓ they also save important resources due to the different design
- ✓ and have 99 % better energy efficiency than conventional transformers

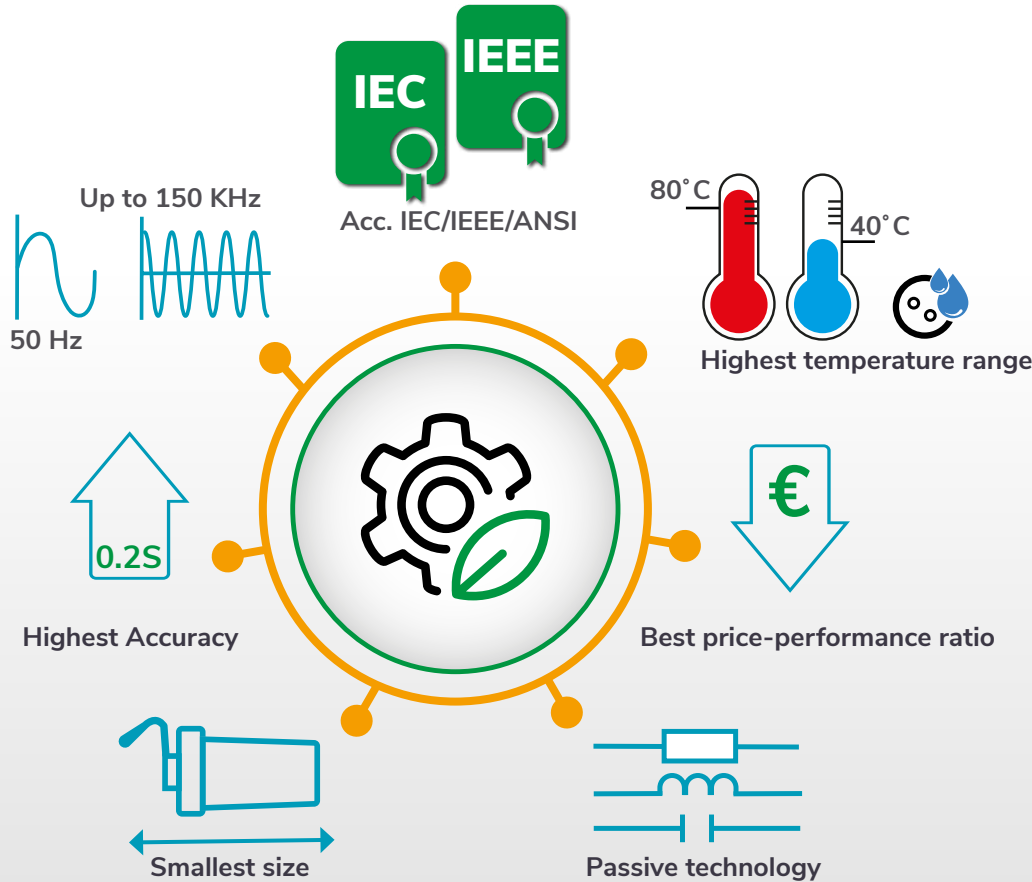
Our company

GWP

The leading innovator for non-conventional transformer

Greenwood-Power is your innovative partner for every design of non-conventional instrument transformers at low and medium voltage level networks.

Our products enable and promote the progressive transformation into smart grids with superior resilience, outstanding sustainability and excellent safety.



WE STAND FOR

- ✓ expertise in delivering tailored solutions for the unique needs of our customers
- ✓ high quality products
- ✓ best price-performance ratio in the market
- ✓ short decision-making processes and extremely fast implementation
- ✓ unique expertise

Application

The main application is in grid stations in urban, rural and industrial areas. The sensors are used for measuring, monitoring, protecting, and detecting short circuits or earth faults, to include determining the direction of current flow during faults. The compact sensors from Greenwood-Power enable quick and easy retrofitting without the need for significant changes to the switchgear.



Medium voltage

Low voltage

VOLTAGE SENSORS OVERVIEW

Voltage sensors Cone type sensors for T-connectors in gas-insulated switchgear		Application	Insul. level	Connector Manufacturer	Type		
					12 kV	24 kV	36 kV
 VxxxC-xx p 11	 Voltage sensor with type C cone, acc. EN 50181	Original equipment/ retrofit	12/28/75kV 24/50/125kV	Südkabel	SEHDT 13.1	SEHDT 23	
				Nexans	400TB/G 440TB/G	K400TB/G K440TB/G	
				Prysmian	FMCT-400		
				3M	93-EE-705		
 V360C-xx p 12	 Voltage sensor with type C cone, acc. EN 50181 for 36kV	Original equipment/ retrofit	36/70/170kV	Südkabel			SEHDT 36
				Nexans			M400TB/G M440TB/G
				Prysmian			FMCT-400
				3M			94-EE-705
 VxxxK-xx p 13	 Voltage sensor with shortened cone	Original equipment/ retrofit	12/28/75kV 24/50/125kV	Südkabel	SET 12 SAT 12	SET 24 SAT 24	
				Nexans	430TB	K430TB	
				Nkt	CB24		
				TE Connectivity/ Raychem Tyco	RSTI-58xx		
				3M	480TB/G	K480TB/G	
 VxxxB-xx p 14	 Voltage sensor for Nexans T-connector 480TB/G	Original equipment/ retrofit	12/28/75kV 24/50/125kV	Nexans	480TB/G	K480TB/G	

VOLTAGE SENSORS OVERVIEW

Voltage sensors Cone type sensors for T-connectors in gas-insulated switchgear		Application	kV	Connector Manufacturer	Type		
					12 kV	24 kV	36 kV
 VxxxJC-xx p 15	 Voltage sensor for Cellpack CTS-S 630, long cone	Original equipment/ retrofit	12/28/75kV 24/50/125kV	Cellpack	CTS-S xxxA 24kV		
 VxxxJK-xx p 16	 Voltage sensor for Cellpack CTS 630, short cone	Original equipment/ retrofit	12/28/75kV 24/50/125kV	Cellpack	CTS xxxA 24kV		
 VxxxAE-xx p 17	 Voltage sensor with IEEE-386, size 11 cone	Original equipment/ retrofit	max. 15/25/28kV 28/45/125kV	15kV25kV			
				Richards	62LCN/62LCT, 92LCN/92LCT		
				ABB Elastimold	K655LR-W0X		
				Eaton Cooper	BT625AB1		
				Prysmian	DBTX25X-X		

Voltage sensors for air insulated switchgears

Support insulator type				VxxxL-xx	Insulator type	VxxxLC-xx	
 12/28/75kV p 18	 V120L-xx	 24/50/125kV	 V240L-xx	 36/70/170kV	 V360L-xx	 12/28/75kV p 19	 V120LC-xx

VOLTAGE SENSORS

Gas-insulated

Cone type sensors for T-connectors in gas-insulated, medium voltage switchgears according to IEC 61869-1, -11

PRODUCT DESCRIPTION

The voltage sensors of Type VxxxC-xx are commonly used together with other shapes in T-connectors of different manufacturers. T-connectors use a blind plug to secure the T-connector in place after installation. Our sensors can be used instead of the blind plug in the T-connector and serve both to secure the T-connector in place and measure voltage. The sensor has a point for common earth connection, and an output cable for connection with an intelligent electronic device (IED).

PRODUCT ADVANTAGES

- ✓ Passive components – No need for power supplies
- ✓ Compact-form-factor – Sensor has the length of a standard blind plug
- ✓ Robust design – Tightening cap made of solid aluminum
- ✓ Compatible to T-connectors acc. IEC50181, Type C connectors (symmetric and asymmetric types)
- ✓ Wide temperature range



Air-insulated

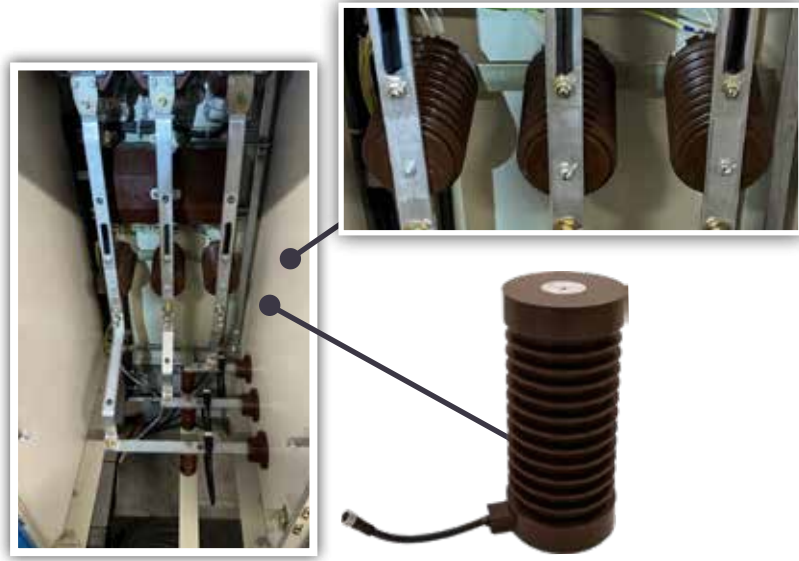
Support insulator sensors for installation in air insulated switchgears according to IEC 61869-1, -11

PRODUCT DESCRIPTION

The voltage sensors of Type VxxxL-xx are for indoor air insulated switchgears. The sensor can resist horizontal forces and can be used as an insulated support for bus bars, from which the voltage is measured. The sensor can be secured in place at the opposite end by a single nut which is also used as a connection to common earth. An output cable on the same end is used for connection with an intelligent electronic device (IED).

PRODUCT ADVANTAGES

- ✓ Bending strength can be specified by customer
- ✓ Passive components – No need for power supplies
- ✓ Easy installation – Single bolt used to secure the sensor on the bottom side
- ✓ Wide temperature range
- ✓ No influence of neighbour electric fields



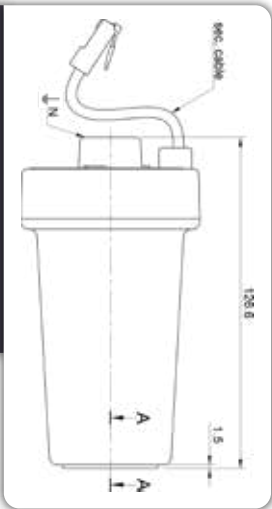
VOLTAGE SENSORS VxxxC-xx

Voltage sensor with type C cone, acc. EN 50181 IEC 61869-1, IEC 61869-11

TECHNICAL DATA

Insulation level	max. 24/50/125kV
Primary / Nominal voltage	max. 20kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Length	< 130mm
*... or customer defined	

TECHNICAL SCHEMATA



TYPES OF CABLE CONNECTION Symmetric T-connector / deadbreak

	Südkabel		Nexans		Prysmian		3M	
12 kV	SEHDT 13.1		400TB/G 440TB/G		FMCT-400		94-EE-705	
24 kV	SEHDT 23		K400TB/G K440TB/G					

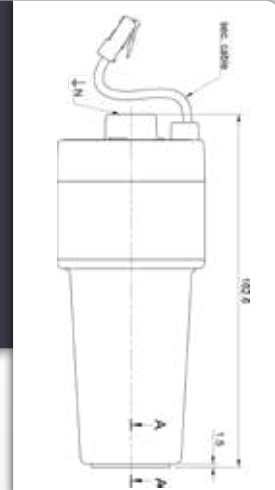
Examples of connection devices: Satec, Siemens, SEL, Fanox, ... See list on pages 50-55
Examples of switchgears: see list on pages 56-57



VOLTAGE SENSORS V360C-XX

Voltage sensor with type C cone, acc. EN 50181 for 36kV
IEC 61869-1, IEC 61869-11

TECHNICAL SCHEMATA



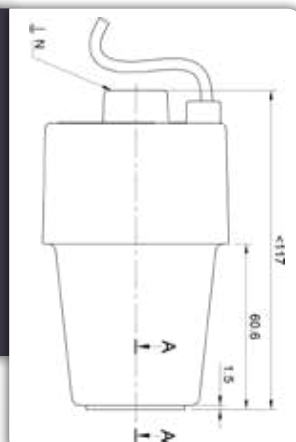
TECHNICAL DATA	
Insulation level	max. 36/70/170kV
Primary / Nominal voltage	max. 30kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Length	< 130mm
*... or customer defined	



VOLTAGE SENSORS VxxxK-xx

Voltage sensor with shorted cone
IEC 61869-1, IEC 61869-11

TECHNICAL SCHEMATA



TECHNICAL DATA	
Insulation level	max. 24/50/125kV
Primary / Nominal voltage	max. 20kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Length	< 130mm
*... or customer defined	

TYPES OF CABLE CONNECTION Symmetric T-connector / deadbreak							
	Südkabel		Nexans		Prysmian		3M
36kV	SEHDT 36		M400TB/G M440TB/G		FMCT-400		94-EE-705 

Examples of connection devices: Satec, Siemens, SEL, Fanox, ... See list on pages 50-55
Examples of switchgears: see list on pages 56-57

TYPES OF CABLE CONNECTION Asymmetric T-connector / deadbreak										
	Südkabel		Nexans		nkt		TE Connectivity/Raychem Tyco		3M	
12 kV	SET 12 SAT 12		430TB		CB24		RSTI-58xx		93-EE	
24 kV	SET 24 SAT 24		K430TB							

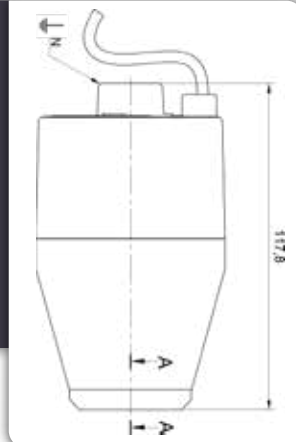
Examples of connection devices: Satec, Siemens, SEL, Fanox, ... See list on pages 50-55
Examples of switchgears: see list on pages 56-57



VOLTAGE SENSORS VxxxB-xx

Voltage sensor for Nexans T-connector
IEC 61869-1, IEC 61869-11

TECHNICAL SCHEMATA



TECHNICAL DATA	
Insulation level	max. 24/50/125kV
Primary / Nominal voltage	max. 20kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Length	< 130mm
*... or customer defined	

TYPES OF CABLE CONNECTION		
Symmetric T-connector / deadbreak with BIPA plug		
	Nexans	
12kV	480TB/G	
24kV	K480TB/G	

Examples of connection devices: Satec, Siemens, SEL, Fanox, ... See list on pages 50-55
Examples of switchgears: see list on pages 56-57

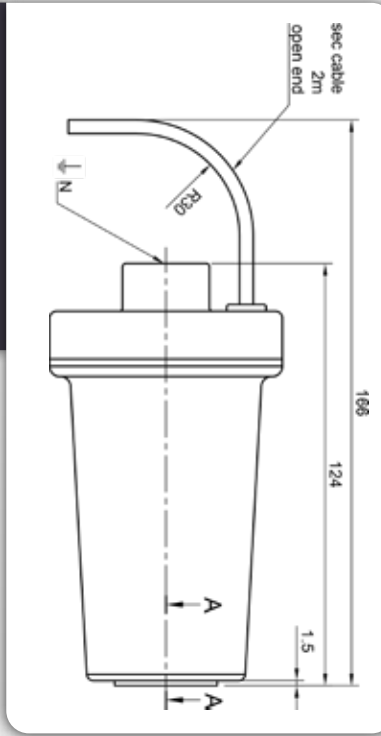


VOLTAGE SENSORS VxxxJC-xx

Voltage sensor for Cellpack CTS-S 630 Type C cone
IEC 61869-1, IEC 61869-11



TECHNICAL SCHEMATA



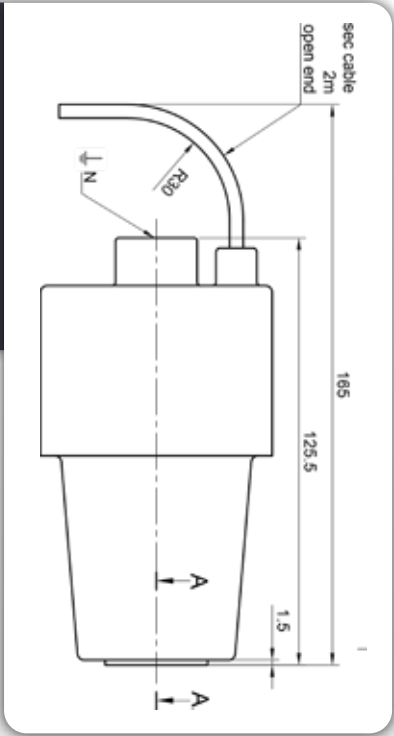
TECHNICAL DATA	
Insulation level	max. 24/50/125kV
Primary / Nominal voltage	max. 20kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Length	< 130mm
*... or customer defined	

TYPES OF CABLE CONNECTION		
	Cellpack	
12kV	CTS-S xxxA 24kV	
24kV		

Examples of connection devices: Satec, Siemens, SEL, Fanox, ... See list on pages 50-55
Examples of switchgears: see list on pages 56-57



TECHNICAL SCHEMATA



VOLTAGE SENSORS VxxxJK-xx

Voltage sensor for Cellpack CTS 630 short cone
IEC 61869-1, IEC 61869-11

TECHNICAL DATA	
Insulation level	max. 24/50/125kV
Primary / Nominal voltage	max. 20kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Length	< 130mm
*... or customer defined	

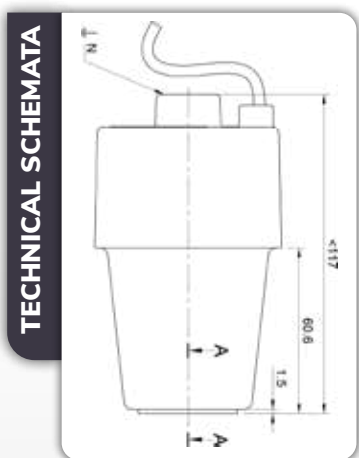
TYPES OF CABLE CONNECTION		
	Cellpack	
12kV	CTS xxxA 24kV	
24kV		

Examples of connection devices: Satec, Siemens, SEL, Fanox, ... See list on pages 50-55
Examples of switchgears: see list on pages 56-57



VOLTAGE SENSORS VxxxAE-xx

Voltage sensor with size 11 cone acc.
IEEE 386-201



TECHNICAL DATA	
Insulation level	max. 28/45/125kV
Primary / Nominal voltage	max. 25kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Length	< 130mm
*... or customer defined	

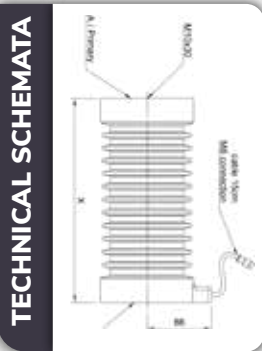
TYPES OF CABLE CONNECTION IEEE 386 size 11 deadbreaks								
	Richards		ABB Elastimold		Eaton Cooper		Prysmian	
15kV	62LCN/62LCT 92LCN/92LCT		K655LR-W0X		BT625AB1		DBTX25X-X	
28kV								

Examples of connection devices: Satec, Siemens, SEL, Fanox, ... See list on pages 50-55
Examples of switchgears: see list on pages 56-57

VOLTAGE SENSORS

VxxxL-xx

Base mounted sensor with supporting function
IEC 61869-1, IEC 61869-11



TECHNICAL DATA

Insulation level	max. 36/70/170kV
Primary / Nominal voltage	max. 30kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Height X	130mm, 210mm, 300mm
*... or customer defined	

VOLTAGE SENSORS

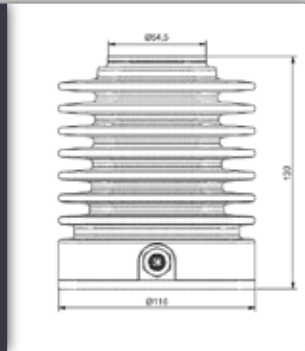
VxxxLC-xx

Base mounted sensor without supporting function
IEC 61869-1, IEC 61869-11



TECHNICAL DATA

Insulation level	max. 12/28/75kV
Primary / Nominal voltage	max. 10kV/ $\sqrt{3}$ *
Secondary output	3.25/ $\sqrt{3}$ V*
Accuracy Class	max. 0.2 & 3P/6P
Burden	$\geq 100\text{k}\Omega$ -10M Ω , < 500pF*
Storage temperature range	-40°C to 80°
Secondary connection	open ends*
Height	130mm
*... or customer defined	



CURRENT SENSORS OVERVIEW

Sensors for retrofit or first installation applications in medium voltage and low voltage switchgears

Current Sensors MEDIUM VOLTAGE RING TYPE SENSORS			Application	Inner diameter	Mounting option / RMU / switchgear / pad mounted transformer
 ExxxR-xx p 27		ONE FOR ALL Ring type for installation on bushings	Indoor	83mm	Siemens, Schneider Electric, Lucy Electric, Ormazabal, ... Switchgear Overview on pages 56-57.
 ExxxRx-xx p 28		Ring type for installation on bushings	Outdoor	90mm	G&W, Hubbel, Eaton ... Switchgear Overview on pages 56-57.
				130mm	
				180mm	
 ExxxRG-xx p 29		Ring type for installation on bushings	Outdoor	84mm	G&W, Hubbel, Eaton, ... Switchgear Overview on pages 56-57.
 ExxxDA-xx p 30		Ring type for installation for 3-phase	Outdoor	85mm Pole distanc: 95mm	Siemens 8DJH-compact, or equivalent

CURRENT SENSORS OVERVIEW

Sensors for retrofit installation applications in medium voltage and low voltage switchgears

FLEXIBLE SPLIT TYPE SENSORS secondary distribution level in every switchgear around screened cables			Application	Inner diameter	Mounting option / RMU / switchgear / pad mounted transformer
 ExxxT-xx p 31		Split-type sensor for 1-phase	Retrofit Indoor	65mm	Siemens, Schneider Electric, Lucy Electric, Ormazabal, ... Switchgear Overview on pages 56-57.
 ExxxSx-xx p 32		Split-type sensor for 1-phase	Retrofit Outdoor	90mm	Siemens, Schneider Electric, Lucy Electric, Ormazabal, ... Switchgear Overview on pages 56-57.
				130mm	
				180mm	
 ExxxE-xx p 33		Residual Split-type sensor around 3-phase	Retrofit Indoor	160mm	Siemens, Schneider Electric, Lucy Electric, Ormazabal, ... Switchgear Overview on pages 56-57.
 ExxxE-9L p 34		Residual Split-type sensor for 3-phase	Retrofit Indoor	65mm	Siemens, Schneider Electric, Lucy Electric, Ormazabal, ... Switchgear Overview on pages 56-57.

CURRENT SENSORS OVERVIEW

Sensors for retrofit or first installation applications in medium voltage and low voltage switchgears

LOW VOLTAGE RING TYPE SENSORS			Application	Inner diameter	Mounting option / RMU / switchgear / pad mounted transformer
 LxxxRA-xx p 35		Low voltage Ring NH-fuse switch	Retrofit Indoor	46(l) x 66(w) x 29(d)mm	Used in low voltage net automation
 LxxxRJ-xx p 36		Low voltage Ring NH-fuse switch	Retrofit Indoor	22mm	Hager/Jean Müller
SPLIT TYPE SENSORS					
 LxxxT-xx p 37		Highly-flexible low voltage current sensor for retrofit installation on low voltage feeders	Retrofit Indoor	40mm	LV Feeder
 LxxxTD-xx p 38		Split Low voltage for retrofit installation on low voltage feeders	Retrofit Indoor	32.5mm	LV Feeder

CURRENT SENSOR

Areas of application: Analysis, Indication, Automation, Control, Protection, Billing

Medium voltage

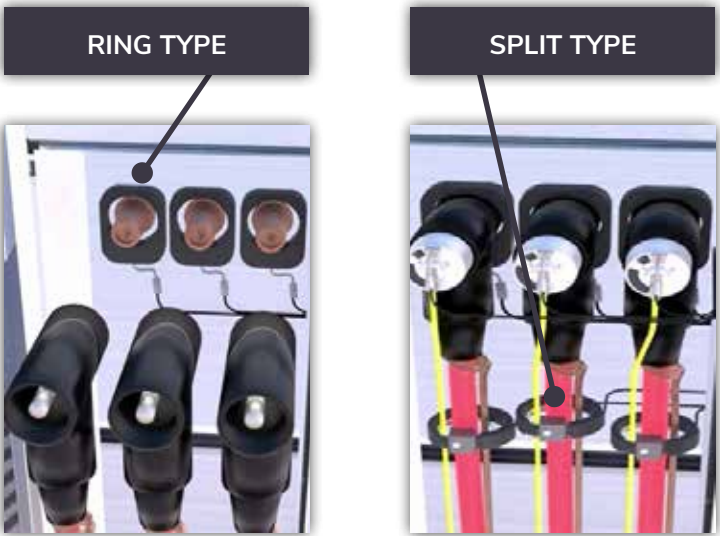
Current sensors for retrofit or first installation applications in medium voltage switchgears according to IEC 61869-1, -10

PRODUCT DESCRIPTION

These sensors are designed for installation on cables on the primary or secondary side of AIS and GIS, as well as on the bushings of a GIS. The split-core design allows for easy installation on existing cables. Its cost-effective construction allows for an optimal price-benefit ratio.

FEATURES

- ✓ Passive components – No need for power supplies
- ✓ Split-core - Allows for retrofit installation
- ✓ Easy installation on bushings and cables



Low voltage

Sensors for low voltage applications according to IEC 61869-1, -10

PRODUCT DESCRIPTION

The LxxxR-series was developed specifically for low voltage applications. The split-core design and small size give these sensors the flexibility of a Rogowski coil with the benefit of solid core accuracy, ease of installation in switchgears on low voltage cables, and cost efficiency for any project in low voltage applications.

FEATURES

- ✓ Passive components – No need for power supplies
- ✓ Split core – Allows for retrofit installation
- ✓ Wide temperature range



SPLIT TYPE



RANGES CURRENT SENSORS – Ring Type ExxxR-xx

225mV Series

Type	Range acc. IEC 61869	Range with given acc.	I primary [A]	U secondary [mV]	max. Ext.	max. Class	FS	P Class
E004R-XXX-O4A	2 - 160A	20 - 160A	40	225	400	0.5	FS40	5P30
E005R-XXX-O4A	2,5 - 200A	25 - 200A	50	225	400	0.5	FS30	5P20
E006R-XXX-O4A	3 - 240A	30 - 240A	60	225	400	0.5	FS30	5P20
E008R-XXX-O4A	4 - 320A	40 - 320A	80	225	400	0.5	FS30	5P20
E010R-XXX-O4A	5 - 400A	50 - 400A	100	225	400	0.5	FS20	5P15
E012R-XXX-O4A	6 - 480A	60 - 480A	120	225	400	0.5	FS25	5P15
E015R-XXX-O4A	7,5 - 600A	75 - 600A	150	225	400	0.5	FS20	5P15
E020R-XXX-O4A	2 - 600A	100 - 600A	200	225	300	0.5s	FS15	5P10
E024R-XXX-O4A	2,4 - 720A	120 - 720A	240	225	300	0.5s	FS15	5P10
E030R-XXX-O4A	3 - 600A	150 - 600A	300	225	200	0.5s/0.2	FS10	5P8
E035R-XXX-O4A	3,5 - 700A	175 - 700A	350	225	200	0.5s/0.2	FS15	5P10
E040R-XXX-O4A	4 - 800A	200 - 800A	400	225	200	0.5s/0.2	FS10	5P5
E048R-XXX-O4A	4,8 - 960A	240 - 960A	480	225	200	0.5s/0.2	FS10	5P5
E060R-XXX-O4A	6 - 1200A	300 - 1200A	600	225	200	0.5s/0.2	FS7	5P5
E070R-XXX-O4A	7 - 1400A	350 - 1400A	700	225	200	0.5s/0.2	FS7	5P5
E080R-XXX-O4A	8 - 1600A	400 - 1600A	800	225	200	0.2s	FS7	5P5
E100R-XXX-O4A	10 - 1200A	500 - 1200A	1000	225	120	0.2s	FS5	none
E120R-XXX-O4A	12 - 1440A	600 - 1440A	1200	225	120	0.2s	FS5	none
E140R-XXX-O4A	14 - 1680A	700 - 1680A	1400	225	120	0.2s	FS5	none

RANGES CURRENT SENSORS – Split Type ExxxT-xx

225mV Series

Type	Range acc. IEC 61869	Range with given acc.	I primary [A]	U secondary [mV]	max. Ext.	max. Class	FS	P Class
E007T-XXX	3.75 - 300A	37.5 - 300A	75	225	400	Cl. 0.5	FS50	5P30
E010T-XXX	5 - 400A	50 - 400A	100	225	400	Cl. 0.5	FS30	5P20
E015T-XXX	7.5 - 600A	75 - 600A	150	225	400	Cl. 0.5	FS15	5P10
E020T-XXX	10 - 400A	100 - 400A	200	225	200	Cl. 0.5	FS30	5P15
E030T-XXX	15 - 600A	150 - 600A	300	225	200	Cl. 0.5	FS10	5P5
E040T-XXX	20 - 800A	200 - 800A	400	225	200	Cl. 0.5	FS15	5P10
E050T-XXX	25 - 1000A	250 - 1000A	500	225	200	Cl. 0.5	FS10	5P5
E060T-XXX	30 - 1200A	300 - 1200A	600	225	200	Cl. 0.5	FS7	5P5
E075T-XXX	37.5 - 1500A	375 - 1500A	750	225	200	Cl. 0.5	FS7	5P5
E080T-XXX	40 - 1600A	400 - 1600A	800	225	200	Cl. 0.5	FS10	5P5
E080T-XXX	45 - 1800A	450 - 1800A	900	225	200	Cl. 0.5	FS5	none
E100T-XXX	50 - 1500A	500 - 1500A	1000	225	150	Cl. 0.5	FS7	5P5
E120T-XXX	60 - 1800A	600 - 1800A	1200	225	150	Cl. 0.5	FS5	none
E150T-XXX	75 - 1800A	750 - 1800A	1500	225	150	Cl. 0.5	FS5	none

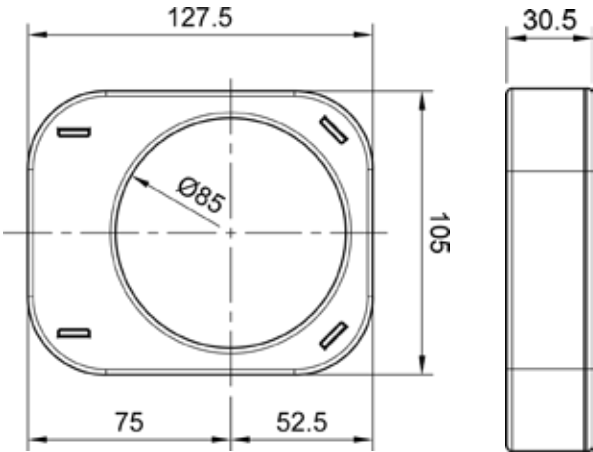
RANGE CURRENT SENSORS – Ring Type IxxxR-xx

1 A Series

Type	Range acc. IEC 61869 (1%, 5%, 20%)	Range with given acc.	I nom	Acc.	FS / FSi (Instrument protection)	Protection Class	Burden (Power)	Output
I020R-xx	10 - 240A	100 - 240A	200A	0.5	FS3		1VA or less	1A
I025R-xx	2.5 - 375A	125 - 375A	250A	0.5s	FS5		1VA or less	1A
I030R-xx	3 - 600A	150 - 600A	300A	0.5s	FS5		1VA or less	1A
I035R-xx	3,5 - 700A	175 - 700A	350A	0.5s	FS5		1VA or less	1A
I040R-xx	4 - 800A	200 - 800A	400A	0.5s	FS5		1VA or less	1A
I045R-xx	4.5 - 900A	225 - 900A	450A	0.5s	FS5		1VA or less	1A
I050R-xx	5 - 1000A	250 - 1000A	500A	0.5s	FS5		1VA or less	1A
I055R-xx	5.5 - 1100A	275 - 1100A	550A	0.5s	FS5		1VA or less	1A
I060R-xx	6/30 - 1200A	300 - 1200A	600A	0.5s/0.2	FS5		1VA or less	1A
I063R-xx	3.15/31.5 - 1260A	315 - 1260A	630A	0.5s/0.2	FS6	5P5/10P5	1VA or less	1A



TECHNICAL SCHEMATA



CURRENT SENSORS

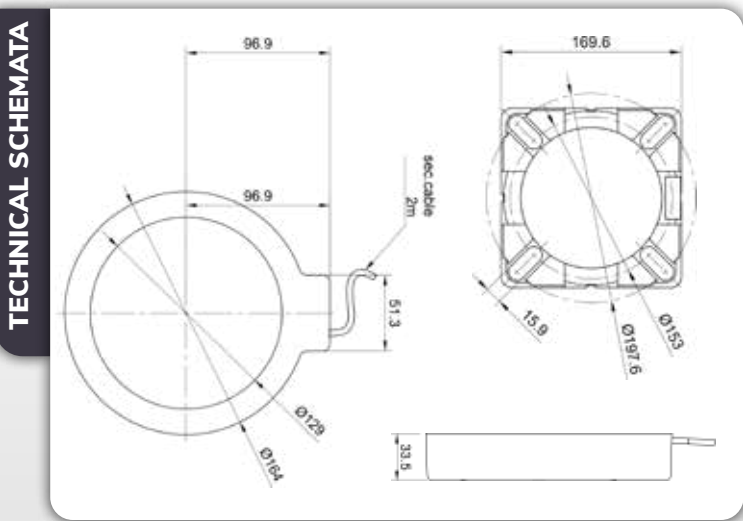
ExxxR-xx

ONE FOR ALL

Ring type sensor
INDOOR
Current sensor for installation on bushings
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Insulation level	0.72/3/-kV
Range Primary current	10A-2500A
Secondary output	225mVAC *
Accuracy Class	max. 0.2S
Over current factor	max. P10
Burden	≥10kΩ-10MΩ, < 1nF
Primary connection	on bushing
Secondary connection	clamps, RJ45, open ends
Inner diameter	83mm
Height	30.5mm
*... or customer defined	

Matching switchgears: see Switchgear Overview on pages 56-57.



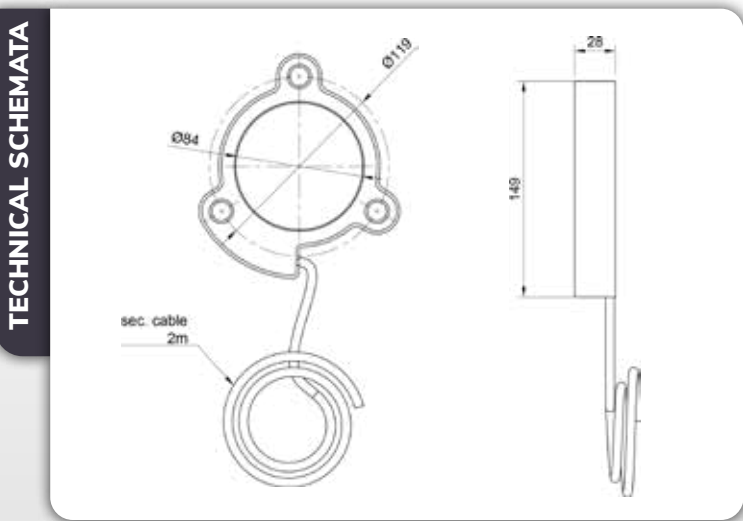
Matching switchgears: see Switchgear Overview on pages 56-57.

CURRENT SENSORS

ExxxRx-xx

Ring type sensor
OUTDOOR
Current sensor for installation on bushings
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Insulation level	0.72/3/-kV
Range Primary current	10A-2500A
Secondary output	22.5 / 150 / 225 / 333mV
Accuracy Class	max. 0.2S
Over current factor	xxPxx (e.g. 5P10)
Burden	≥10kΩ
Primary connection	on bushing
Secondary connection	open ends
Inner diameter	129mm
*... or customer defined	



Matching switchgears: see Switchgear Overview on pages 56-57.

CURRENT SENSORS

ExxxRG-xx

Ring type sensor
OUTDOOR
Current sensor for installation on bushings
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Insulation level	0.72/3/-kV
Range Primary current	100A*
Secondary output	22.5 / 150 / 225 / 333mV
Accuracy Class	max. 0.2S
Over current factor	max. P10
Burden	≥10kΩ
Primary connection	on bushing
Secondary connection	open ends*
Inner diameter	84mm
*... or customer defined	



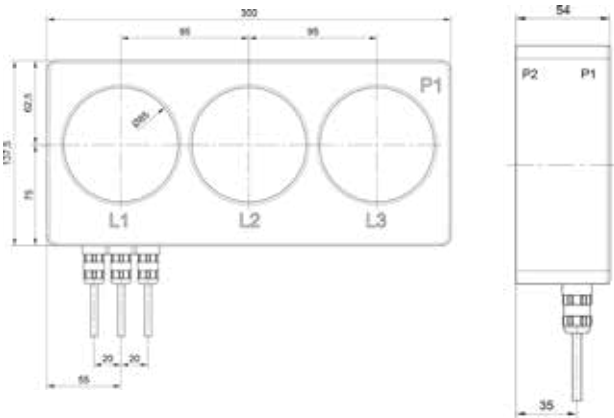
CURRENT SENSORS

ExxxDA-xx

Ring type sensor
OUTDOOR
Current sensor for installation on bushings for 3-phase
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Insulation level	0.72/3-kV
Range Primary current	100A*
Secondary output	22.5 / 150 / 225 / 333mV
Accuracy Class	max. 0.2
Over current factor	max. P10
Burden	≥10kΩ
Primary connection	on bushing
Secondary connection	open ends*
Inner diameter	84mm, Pole distance: 95mm
*... or customer defined	

TECHNICAL SCHEMATA



Matching switchgears: see Switchgear Overview on pages 56-57.



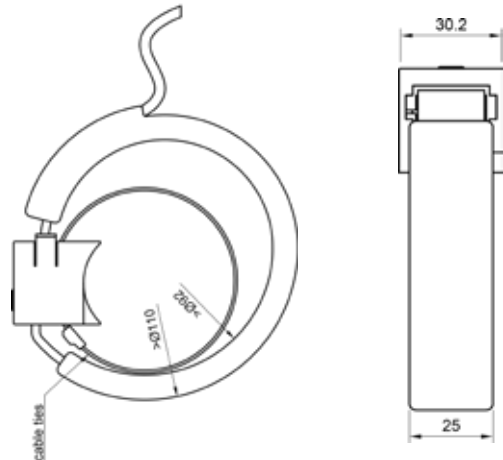
CURRENT SENSORS

ExxxT-xx

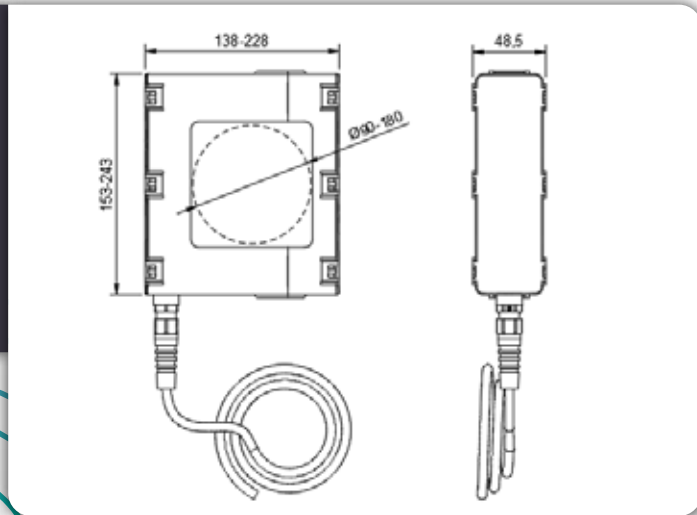
Split-type sensor
INDOOR
Current sensor for 1-phase for retrofit installation
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Insulation level	0.72/3-kV
Range Primary current	3.75-1800A
Secondary output	22.5 / 150 / 225 / 333mV
Accuracy Class	max. 0.5
Over current factor	xxPxx (e.g. 5P10)
Burden	≥10kΩ
Primary connection	on cables
Secondary connection	clamps, RJ45, open ends
Inner diameter	65mm
*... or customer defined	

TECHNICAL SCHEMATA



Matching switchgears: see Switchgear Overview on pages 56-57.



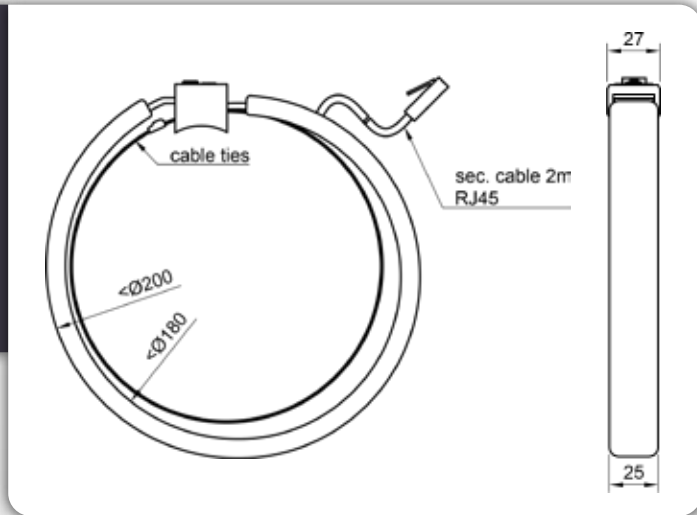
CURRENT SENSORS

ExxxSx-xx

Split type sensor
OUTDOOR (IP67 water protection)
Current sensor for retrofit installation for 1-phase
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Insulation level	0.72/3/-kV
Range Primary current	5-1000A
Secondary output	22.5 / 150 / 225 / 333mV
Accuracy Class	max. 0.5S
Over current factor	xxPxx (e.g. 5P10)
Burden	≥10kΩ
Primary connection	on cables
Secondary connection	clamps, RJ45, open ends
Inner diameter	90mm, 130mm, 180mm
*... or customer defined	

Matching switchgears: see Switchgear Overview on pages 56-57.



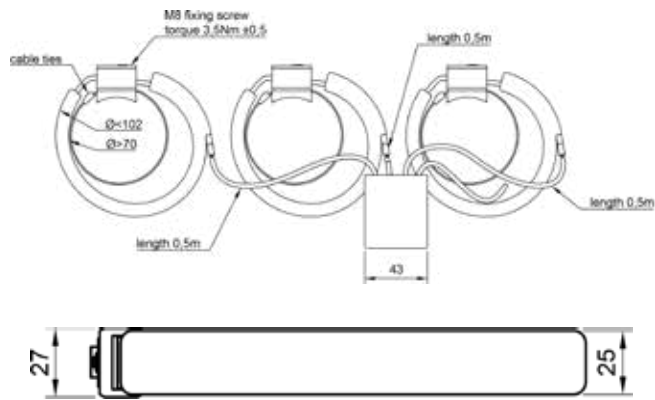
CURRENT SENSORS

ExxxE-xx

Split type sensor
INDOOR
Residual current sensor around 3-phase for
retrofit installation for failure current measurement
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Insulation level	0.72/3/-kV
Range Primary current	60A*
Secondary output	225mVAC *
Accuracy Class	3
Over current factor	max. P50
Burden	≥10kΩ-10MΩ, < 1nF
Primary connection	on cables
Secondary connection	clamps, RJ45, open ends
Inner diameter	160mm
*... or customer defined	

Matching switchgears: see Switchgear Overview on pages 56-57.



CURRENT SENSORS

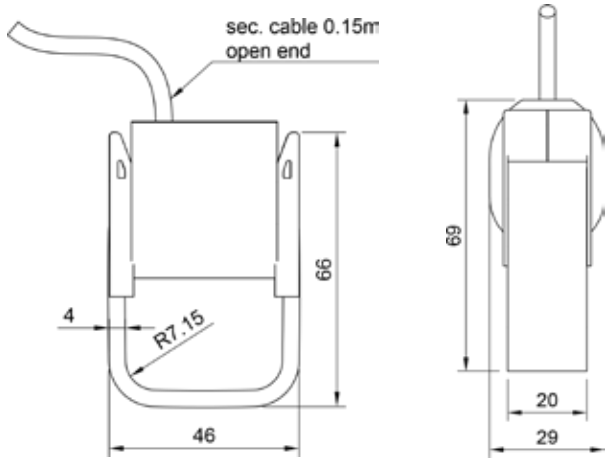
ExxxE-9L

Split type sensor
INDOOR
Residual current sensor for 3-phase for retrofit installation
IEC 61869-1, IEC 61869-10

TECHNICAL DATA

Insulation level	0.72/3/-kV
Range Primary current	60A*
Secondary output	225mVAC *
Accuracy Class	1/3
Over current factor	max. P50
Burden	≥10kΩ-10MΩ, < 1nF
Primary connection	on cables
Secondary connection	clamps, RJ45, open ends
Inner diameter	65mm
*... or customer defined	

Matching switchgears: see Switchgear Overview on pages 56-57.



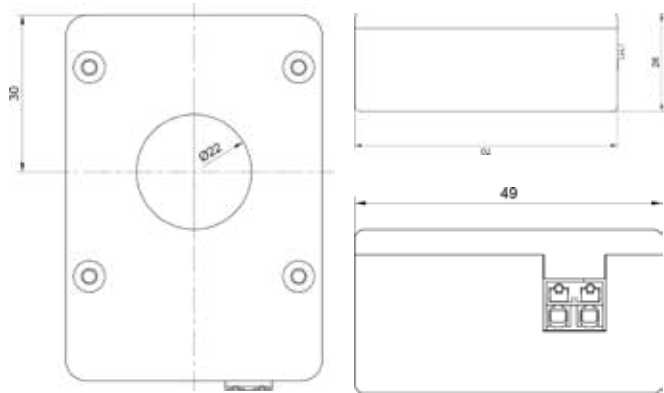
CURRENT SENSORS

LxxxRA-xx

Ring type sensor
INDOOR
Low voltage current sensor for net-automation
IEC 61869-1, IEC 61869-10

TECHNICAL DATA

Insulation level	0.72/3/-kV
Temperature range	-20/70°
Frequency	50Hz
Accuracy Class	max. 0.5S
Rated class	500A
Burden	≥10kΩ
Extension	150%
Secondary output	84.5mV
*... or customer defined	



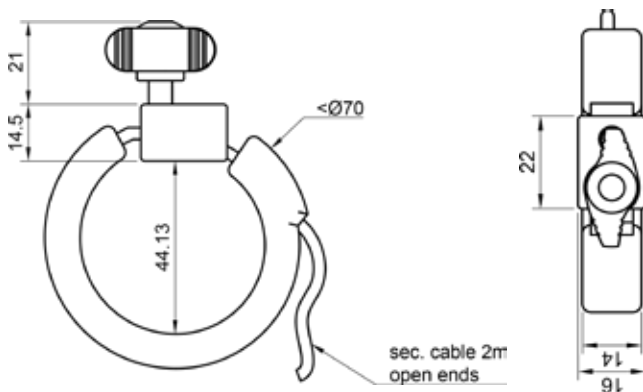
CURRENT SENSORS

LxxxRJ-xx

Ring type sensor
INDOOR
Low voltage current sensor for NH-fuse switch
IEC 61869-1, IEC 61869-10

TECHNICAL DATA

Insulation level	0.72/3/-kV
Primary current	400A*
Secondary output	225mVAC*
Accuracy Class	max. 0.5 & 5P5
Burden	≥10kΩ, < 1nF
*...or customer defined	



CURRENT SENSORS

LxxxT-xx

Split type sensor
INDOOR
Highly-flexible low voltage current sensor for retrofit
installation on low voltage feeders
IEC 61869-1, IEC 61869-10

TECHNICAL DATA

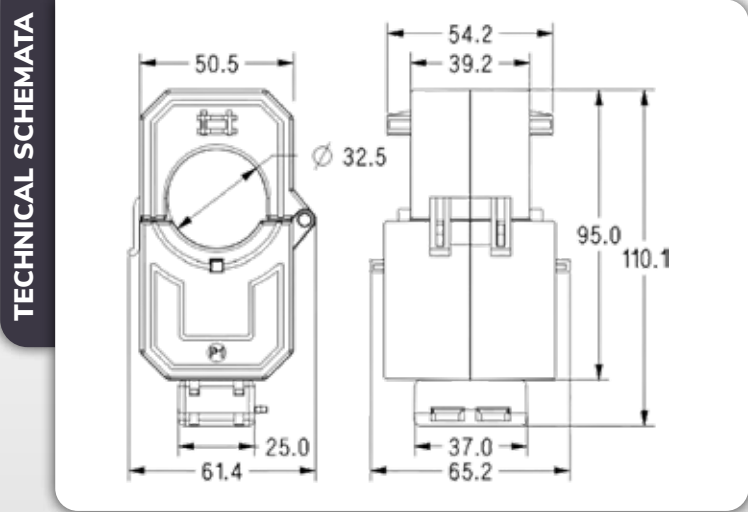
Insulation level	0.72/3/-kV
Range Primary current	100-1000A
Secondary output	225mVAC *
Accuracy Class	0.5/1/3
Over current factor	max. P5 (FS5)
Burden	≥10kΩ, < 1nF
Primary connection	on cables
Secondary connection	Open ends*
Inner diameter	40mm
*... or customer defined	



CURRENT SENSORS
LxxxTD-xx

Split Type Sensor
INDOOR
Low voltage current sensor for retrofit installation
on low voltage feeders
IEC 61869-1, IEC 61869-10

TECHNICAL DATA	
Ratio	400/1A
Power rating	0.2VA
Accuracy	Class 1 acc. IEC61869-2



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OUTDOOR APPLICATIONS

Sensor for outdoor installation on poles and lines acc. IEC & ANSI / IEEE

Voltage sensors		Application		kV
 VxxxFE-xx		Voltage sensor up to 36kV	Rail mounted	24/50/125kV 28/45/125kV 35/50/150kV 36/70/170kV
 VxxxFD-xx		Voltage sensor up to 36kV	Hanging	24/50/125kV 28/45/125kV 35/50/150kV 36/70/170kV
Current sensors		Application		kV
 No Image ExxxFG-xx		Current sensor up to 36kV	Rail mounted	24/50/125kV 28/45/125kV 35/50/150kV 36/70/170kV
 No Image ExxxFF-xx		Current sensor up to 36kV	Hanging	24/50/125kV 28/45/125kV 35/50/150kV 36/70/170kV
Combined sensors		Application		kV
 No Image PxxxFC-xx		Combined voltage and current sensor up to 36kV	Rail mounted	24/50/125kV 28/45/125kV 35/50/150kV 36/70/170kV
 No Image PxxxFB-xx		Combined voltage and current sensor up to 36kV	Hanging retrofit	24/50/125kV 28/45/125kV 35/50/150kV 36/70/170kV



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OUTDOOR APPLICATIONS

VxxxFE-xx + VxxxFD-xx



PRODUCT DESCRIPTION

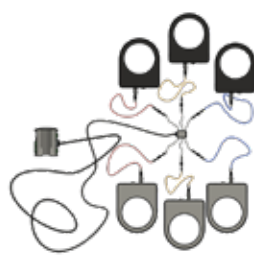
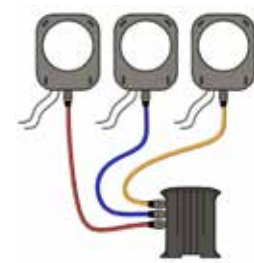
All outdoor sensors are built in a modular fashion, which allows for flexibility of installation as a hanging device on a line, or base mounted on a rail. The modular construction also allows for various solutions as pure current, pure voltage, or a combination of both up to 36kV line voltage. The outside construction is made of cycloaliphatic epoxy resin, which is well known and proven in outdoor applications.

PRODUCT ADVANTAGES

- ✓ Modular system for best price performance ratio
- ✓ Long lifetime, outdoor epoxy resin
- ✓ Available as hanging or base mounted versions
- ✓ Highest stability against harsh environmental conditions due to passive components
- ✓ Flexibility – each sensor can be pure voltage, pure current, or combined

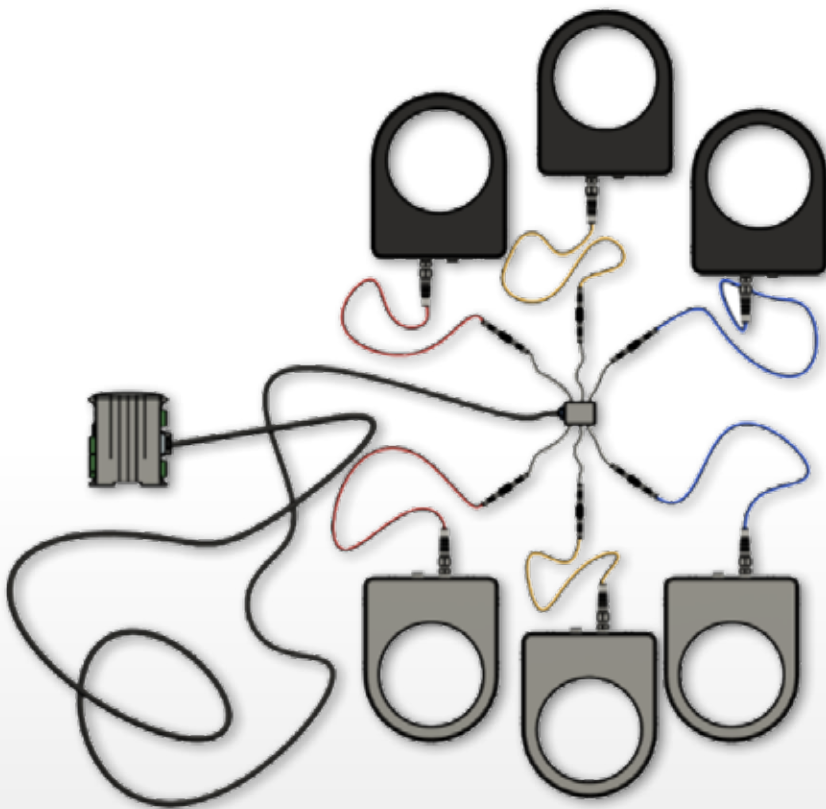
TECHNICAL DATA	VOLTAGE	CURRENT	COMBINED
	VxxxFE-xx (base mounted, clamp installation) VxxxFD-xx (hanging, hot plug installation)	ExxxFG-xx ExxxFF-xx	PxxxFC-xx PxxxFB-xx
Insulation level	24/50/125kV – 28/45/125kV, rated 28kV ULL (=16.2kV ULG) – 35/50/150kV, rated 36.6kV ULL (=21.1kV ULG) – 36/70/170kV		
Nominal voltage & currents	max. 20kV/√3 max. 28kV ULL (=16.2kV ULG) max. 30kV/√3 max. 36.6kV ULL (=21.1kV ULG)	600A*	max. 20kV/√3 max. 28kV ULL (=16.2kV ULG) max. 30kV/√3 max. 36.6kV ULL (=21.1kV ULG) & 600A*
Secondary output	3.25V/√3* 3.25V ULL (=1.876V ULG)*	225mV*	3.25V/√3* 3.25V ULL (=1.876V ULG)* & 225mV*
Accuracy	voltage sensor: max. 0.5 & 3P/6P	max. 0.2 & 5P10/5P20	current sensor: max. 0.2 & 5P10/5P20 voltage sensor: max. 0.5 & 3P/6P
Burden	current sensor: >10kΩ voltage sensor: ≥100kΩ-10MΩ, <500pF*	>10kΩ	current sensor: >10kΩ voltage sensor: ≥100kΩ-10MΩ, <500pF*
Primary connection	hanging or base mounted, directly connected to the overhead line		
Secondary connection	open ends*		
*... or customer defined			

SYSTEM APPLICATION

			Application	Inner diameter	Mounting option / RMU / switchgear / pad mounted transformer
 CxxxFA-xx		Combined outdoor sensor for load break switches	Original equipment/ retrofit	130mm	Load break switches from different manufacturers
 CxxxR-xx		Combined bushing sensor	Original equipment/ retrofit	83mm	Siemens, Schneider Electric, Lucy Electric, Ormazabal, Alfano, ... Switchgear Overview on pages 56-57.

SYSTEM APPLICATIONS LBS

Combined outdoor sensor for load break switches



CxxxFA-xx

Active, combined voltage and current sensor for load break switches

PRODUCT DESCRIPTION

This combined active sensor system comprises of up to 6 six combined voltage and current sensors, or a mix of combined, voltage only, or current only sensors. The capacitive nature of the voltage side of the sensors allows for complete "no contact with carrier" installation. The sensors are mounted on the In- and output bushings of a load break switch or sectionalizer and can be used to monitor both sides. The sensors are IP 54.

PRODUCT ADVANTAGES

- ✓ Combined voltage and current measurement on load break switches - up to 6x voltage and 6x current measurement, or a combination of both
- ✓ Self-calibrating capacitive divider for voltage measurement
- ✓ Complete galvanic separation between LBS and product
- ✓ According to IEC 61869-1, -10, -11
- ✓ Design for easy and fast installation

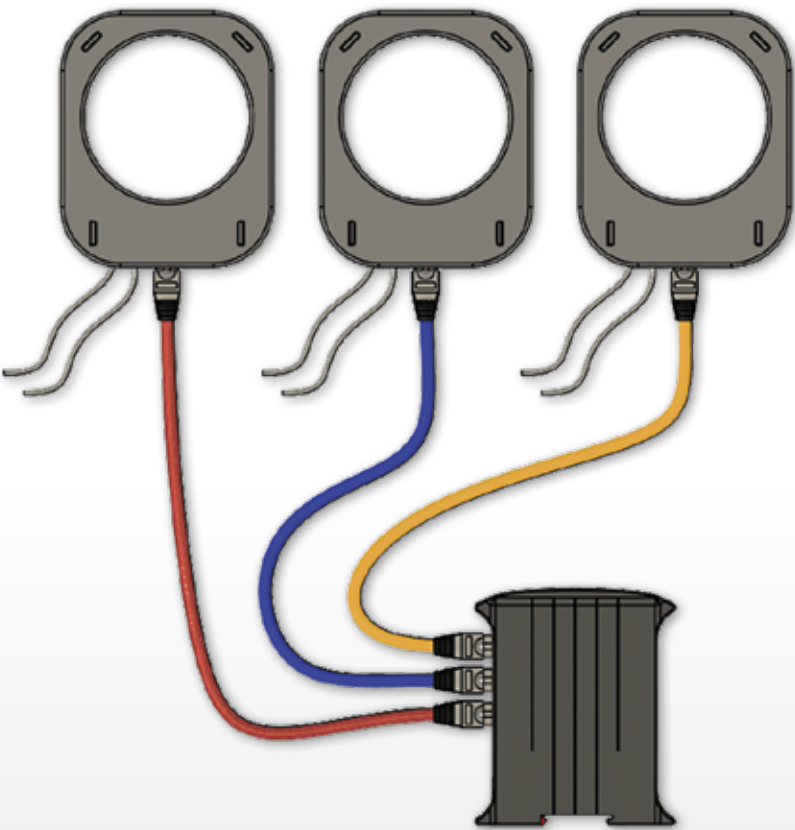
TECHNICAL DATA

Isolation level	max. 36/70/170 kV*
Nominal voltage & current	voltage: 30kV/ $\sqrt{3}$ * current: 300A* Ext. 200%
Merging box output	voltage: 3.25V/ $\sqrt{3}$ * current: 225mV*
Accuracy	voltage: $\pm 3\%$ current: 0.5, max. 5P10
Burden	voltage: $\geq 10M\Omega$, <75pF current: $\geq 10k\Omega$
Installation	outdoor
Secondary connection	open ends*
Power supply	$\pm 24VDC$

* product insulated level: 0,72/3/-kV; System insulation level: max. 36/70/170kV
** or customer defined

SYSTEM APPLICATION BUSHING

Combined sensor on bushings for GIS switchgears



CxxxR-xx

Active, combined voltage and current sensor for GIS switchgears

PRODUCT DESCRIPTION

This combined system utilizes a special additional capacitive tap at the bushing to measure voltage. The GWP sensor system is adaptable to any C-tap value inside the bushing. It sets itself, in an automatic process at the factory of the GIS-switchgear, to a preconfigured ratio and delivers a standard output acc. IEC61869-11 of $3,25V/\sqrt{3}$. During the operation and after installation, no additional calibration is needed. The system actively compensates influences from temperature and neighbour fields, thus makes it possible to reach 0.5 accuracy class acc. IEC standard. The system is combined with 3 current sensors, which allows for a highly cost-efficient design.

PRODUCT ADVANTAGES

- ✓ Combined voltage and current measurement directly at the bushing
- ✓ The system can be installed and connected to IED's at the switchgear manufacturer's site. No installation at site (cone type sensors) needed
- ✓ System calibrates itself during the installation process at the switchgear manufacturer
- ✓ Output of the system is not burden dependent
- ✓ Galvanic separation, through the usage of a capacitive divider
- ✓ Hardware compensation inside the device, no need of correction factors
- ✓ According to IEC 61869-1, -10, -11
- ✓ Active temperature compensation of the C-tap of the bushing

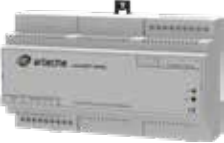
TECHNICAL DATA

Isolation level	max. 36/70/170kV*
Nominal voltage & current	voltage: 30kV/ $\sqrt{3}$ * current: min. 40A* Ext. 200%
Merging box output	voltage: 3.25V/ $\sqrt{3}$ * current: 225mV*
Accuracy	voltage: 0.5, current: 0.5, max. 5P10
Burden	voltage: $\geq 10M\Omega$, <75pF current: $\geq 10k\Omega$
Installation	indoor
Secondary connection	clamp terminals
Power supply	$\pm 24VDC$

* product insulated level: 0,72/3/-kV; System insulation level: max. 36/70/170kV
** or customer defined

FOR THE
FUTURE
greenwood-power

SPECIAL APPLICATIONS ADD ONS

Amplifier		Manufacturer		Output	Burden (Power)	Accuracy
V-Mate		Voltage Amplifier	Orion	100-120V	0.5V	0.2
Capdis-4o + Capdis 4o HF		Voltage Amplifier	Kries	100-120V	0.5VA	0.5
sensART VMAC		Voltage Amplifier	Arteche	100-120V	0.4VA	0.5
Devices		Manufacturer		Output	Burden (Power)	Accuracy
H667AG-xx		Temperature and humidity monitoring system via Modbus	GWP	Modbus-RTU		0.2
Burden Converter		Automatic burden adjustment acc. IED	Elseta	3x3.25V√3	1 MΩ II < 170pF	

SPECIAL APPLICATIONS ADD ONS

Adapter			Manufacturer
Merging Box		Device that consolidates current and voltage measurements from each phase of a 3-phase system into an RJ45 connector (acc. IEC61869-6), allowing easy data transmission or monitoring. RJ45-Pinning: Voltage: a=7, n=8 Current: S1=1, S2=2	GWP
Y-Adapter		Y-Adapter cable combines two separate low-power signals or data connections into a single input. RJ45-Pinning: Voltage: a=7, n=8 Current: S1=1, S2=2	GWP
Y-Adapter		LAN splitter (2 to 1) combines two Ethernet connections into a single output, allowing data from two sensors to share one RJ45 cable.	GWP
KAA4 Adapter		The KAA4 adapter, enables an easy installation of an voltage sensor direct at the distribution transformer bushing. This adapter is used between the bushing and the elbow connector. The GWP VxxxC type sensor can be used together with the adapter.	Nexans

AMPLIFIER



V-Mate
Features Amplifier Orion
Combines sensor technology with IEDs 100-120V input

- ✓ Low power consumption
- ✓ Combined accuracy class sensor and amplifier up to 0.2 acc. IEC 61869

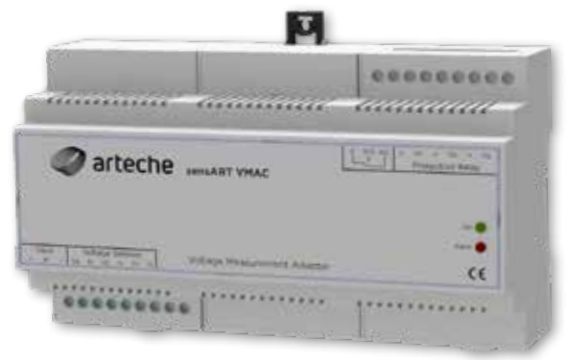
TECHNICAL DATA	
Aux. Voltage	24-230V AC/DC
Input Voltage	3.25V/√3
Output Voltage	100V/√3, 110V/√3, or 120V/√3
Standard Accuracy	0.2
Accuracy with matched sensors	0.2
Load	0.5VA per channel



Capdis-4o + Capdis 4o HF
Features Amplifier Kries
Combines sensor technology with IEDs 100-120V input

- ✓ Low power consumption
- ✓ Combined accuracy class sensor and amplifier up to 0.5 acc. IEC 61869

TECHNICAL DATA	
Aux. Voltage	24-230V AC/DC
Input Voltage	3.25V/√3
Output Voltage	100V/√3
Accuracy	0.5
Load	0.5VA per channel



sensART VMAC
Features Amplifier Artech
Combines sensor technology with IEDs 100-120V input

- ✓ Low power consumption
- ✓ Combined accuracy class sensor and amplifier up to 0.5 acc. IEC 61869

TECHNICAL DATA	
Aux. Voltage	48-125Vdc
Input Voltage	3.25V/√3
Output Voltage	100V/√3, 110V/√3, or 120V/√3
Accuracy	0.5-1P
Load	0.4VA per channel

DEVICES



Temperature & humidity monitoring system
Features

- ✓ RTU Mod. only
- ✓ Baud rate from 4800 to 115200
- ✓ Data packet format configurable from the master
- ✓ Byte register swap possible
- ✓ Big or little endian
- ✓ Factory default settings customer-defined

TECHNICAL DATA	
Insulation level	0.72/3/-kV
Temperature sensors	7 (6 satellites + 1 base station)
Humidity sensors	1
Accuracy temperatur	+/-0,2%
Accuracy humidity	+/-2%rel
Basestation connection	Modbus-RTU
Power consumption	50mA
Power supply	24VDC



Burden Converter
Features

- ✓ Very simple installation
- ✓ Not affect amplitude and phase correction
- ✓ Isolated power circuit
- ✓ Wide operating range

TECHNICAL DATA	
Input Voltage	3x3.25V/√3
Output Voltage	3x3.25V/√3
Device Burden	up to 15mA output
Power consumption	<200mA @12VDC
Basestation connection	Open end cables
Power supply	9-33VDC (full range)

CONFIGURATIONS AND CONNECTIONS

Sensor		Plug	Cable length
Voltage		Open End RJ45 M8 BNC Miscellaneous	• 1m • 1.5m • 2m • 3m • 3.7m • 5m • 10m
Current			
Adapter	Merging Box		
	Different Y-Adapter		
KAA4 Adapter (A to C)			

DEVICES FOR VOLTAGE AND CURRENT SENSORS



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
ABB		Rio600			✓



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
A.Eberle	EOR	3DS	✓	✓	✓
	PQI	DE	✓	✓	



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
ComAp		InteliPro			✓

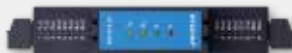


Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
FANOX		SIR-C			✓
		SIL-S			✓

DEVICES FOR VOLTAGE AND CURRENT SENSORS



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Horstmann	Compass	B 2.0	✓	✓	✓
		Bs 2.0	✓	✓	✓
		D	✓	✓	✓



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Janitza		UMG 801	✓		
		UMG96 PQ-L-LP	✓	✓	
		800-CT8-LP	✓		



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Kries	IKI	50		✓	

DEVICES FOR VOLTAGE AND CURRENT SENSORS



Types of measuring devices				Areas of application	
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Powerside	PQube	50	✓	✓	✓



Types of measuring devices				Areas of application	
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
PQ Plus	UMD	98	✓		



Types of measuring devices				Areas of application	
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Satec	PM	335/Pro	✓	✓	
	EM	235/Pro	✓	✓	



Types of measuring devices				Areas of application	
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Schneider Electric	Power Logic	P3U30			✓
		P3F/L/M/G30			✓

DEVICES FOR VOLTAGE AND CURRENT SENSORS



Types of measuring devices				Areas of application	
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
SEG/Woodward		XU2-AC			✓
		MRA4			✓



Types of measuring devices				Areas of application	
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
SEL	SEL-	451			✓
		751			✓
		787L			✓
		700G			✓

DEVICES FOR VOLTAGE AND CURRENT SENSORS



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
SEL	SEL-	487E			✓
		710-5			✓
		651R			✓
		787-2.3.4			✓

Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Siemens	SIPROTEC 5	7SJ81/80			✓
		7SY82			✓
	SIPROTEC Compact	7SC80			✓
	SICAM	FCM	✓	✓	

DEVICES FOR VOLTAGE AND CURRENT SENSORS



Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Sprecher Automation	SPRECON	EDIR	✓	✓	
		E-C			✓

Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
Wago		750-495			✓

Types of measuring devices			Areas of application		
Manufacturer	Series	Type	Analysis	Indication	Automation, Control and Protection
ZIV		TCA	✓	✓	✓

OVERVIEW SWITCHGEARS

SIEMENS



8DJH 8DJH-COMPACT 8DJH36

SCHNEIDER ELECTRIC



RM6 FBX RINGMASTER

LUCY ELECTRIC



AEGIS PLUS AEGIS 36KV

ALFANAR



ALFA-R SF6 RMU
UP TO 17.5KV ALFA-R SF6 RMU
UP TO 36KV

OVERVIEW SWITCHGEARS

ABB



SAFERING SAFEPLUS

EATON



XIRIA

DRIESCHER



MINEX MINEX C G.I.S.E.L.A

ORMAZABAL



GA/GAE + GE

NOTES

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