BENDER
The Power in Electrical Safety©

The Power in Electrical Safety

Main Catalogue Edition 2020/2021

BENDER Group

Main Catalogue
Edition 2020/2021

Quality System Certified
DET NORSKE VERITAS ESTABLISHED 1864
ISO 9001

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Insulation monitoring devices
ISOMETER®



7



Equipment for insulation fault location
ISOSCAN®



151



Residual current monitoring systems
LINETRAXX®



177



Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®



219



Power Quality and Energy Measurement
LINETRAXX®



243

Measuring and monitoring relaxs
LINETRAXX®

270



System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation



317



Switching equipment
ATICS® transfer switching and monitoring devices



415

Test systems
UNIMET® Safety analyser

427



Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service

449











The Power in Electrical Safety






In the past 70 years we have learnt thinking ahead in a strategic and forward-looking way and to consider today what customers are going to need tomorrow. Innovative solutions and service activities, excellent know-how global expertise when it comes to electrical safety provide answers to the challenges of various application areas. With over 800 employees we are globally present in over 70 countries.

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Overview insulation monitoring devices ISOMETER®

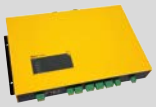
		 ISOMETER® iso685-…	 ISOMETER® iso685-…-B	 ISOMETER® iso685-…-P	 ISOMETER® isoNAV685-D	 ISOMETER® isoNAV685-D-B
Page		32	36	40	46	51
Special applications					Quick response to combined resistance and offset voltage measurement	De-energised loads/ frequency converters
Circuits	Control circuits	■	■	■	■	■
	Auxiliary circuits	■	■	■	■	■
	Main circuits	■	■	■	■	■
Voltage system	3(N)AC	■	■	■	■	■
	AC	■	■	■	■	■
	AC/DC	■	■	■	■	■
	DC	■	■	■		■
Nominal system voltage U_n		AC, 3(N)AC 0…690 V, DC 0…1000 V	AC, 3(N)AC 0…690 V, DC 0…1000 V	AC, 3(N)AC 0…690 V, DC 0…1000 V	AC, 3(N)AC 0…690 V (60 Hz)	offline
Tolerance of U_n		+ 15 %	+ 15 %	+ 15 %	+ 15 %	
System leakage capacitance C_e µF		≤ 1000	≤ 1000	≤ 1000	≤ 1000	≤ 1000
Response value R_{an} kΩ		1…10000	1…10000	1…10000	1…10000	10…1000
Coupled systems			■	■		
Locating current injector for insulation fault location				■		
Installation	DIN rail	■	■	■	■	■
	Screw mounting	■	■	■	■	■
	Panel mounting/ wall fastening	■	■	■		
Interfaces	Web server	■	■	■	■	■
	Modbus	TCP/RTU	TCP/RTU	TCP/RTU	TCP	TCP
	BCOM	■	■	■	■	■
	BS	■	■	■	■	■
	BMS					
	isoData	■	■	■		

	Type	P.	Suitable system components				
	FP200	65	■	■	■		
Coupling devices	AGH150W-4	326	■	■			
	AGH204S-4	328	■	■			
	AGH520S	329	■	■			
	AGH675S-7	330					
	AGH676S-4	332	■	■			

					
ISOMETER® isoHR685W-…-B	**ISOMETER® isoRW685W-D**	**ISOMETER® IRDH275**	**ISOMETER® IRDH275BM-7**	**ISOMETER® IRDH375**	**ISOMETER® IRDH575**
56	61	67	70	74	77
Oil & Gas	Railway		AC, DC or AC/DC medium voltage systems		Equipment for insulation fault location
■	■				■
■	■				
■	■	■	■	■	■
■	■	■	■	■	■
■	■	■		■	■
■	■	■	■	■	■
■	■	■	■	■	■
AC 0…1000 V, 3AC 0…690 V, DC 0…1300 V	AC, 3(N)AC 0…690 V, DC 0…1000 V	AC, 3(N)AC 0…690 V DC 0…565 V	AC, 3(N)AC, DC 0…15,5 kV (absolute)	AC, 3(N)AC 0…690 V DC 0…565 V	dependent on type
+ 15 %	+ 15 %	+ 15 %	+ 15 %	+ 15 %	+ 15 %
≤ 1000	≤ 1000	≤ 500	≤ 5	≤ 500	≤ 500 (150)
1…3000000	1…10000	1…10000	100…10000	1…10000	1…10000
■		■		■	■
					■
■	■	■	■		
■	■	■	■	■	
■				■	■
■	■				
TCP	TCP/RTU				
■	■				
■	■				
		■	■	■	■
■	■				

Suitable system components					
■					
■	■	■		■	
■	■	■		■	
■	■	■		■	
			■		
■	■	■		■	

Overview insulation monitoring devices ISOMETER®

	ISOMETER® IR420-D4	ISOMETER® IR425	ISOMETER® iso1685P	ISOMETER® iso1685DP	ISOMETER® isoHV1685D
					
Page	16	19	22	25	25
Special applications					
Circuits – Control circuits	■	■			
Circuits – Auxiliary circuits	■	■			
Circuits – Main circuits			■	■	■
Voltage system – 3(N)AC					
Voltage system – AC	■	■	■	■	■
Voltage system – AC/DC		■	■	■	■
Voltage system – DC		■	■	■	■
Nominal system voltage U_n	AC 0…250 V	AC/DC 0… 300 V	AC 0…1000 V, DC 0…1500 V	AC 0…1000 V, DC 0…1500 V	AC 0…2000 V, DC 0…3000 V
Tolerance of U_n	+ 20 %	+ 20 %	+10 %, +6 %	+10 %, +5%	+10 %, +5%
System leakage capacitance C_e µF	≤ 20	≤ 20	≤ 500	≤ 2000	≤ 2000
Response value R_{an} kΩ	1…200	1…200	200…1000	200…1000	200…1000
Coupled systems			■	■	■
Locating current injector for insulation fault location					
Installation – DIN rail	■	■			
Installation – Screw mounting	■	■	■	■	■
Installation – Panel mounting/ wall fastening					
Interfaces – Web server					
Interfaces – Modbus				RTU	RTU
Interfaces – BCOM					
Interfaces – BS					
Interfaces – BMS			■	■	■
Interfaces – isoData					

	Type	P.	Suitable system components				
	FP200	65					
Coupling devices	AGH150W-4	326			■		
Coupling devices	AGH204S-4	328			■		
Coupling devices	AGH520S	329			■		
Coupling devices	AGH675S-7	330					
Coupling devices	AGH676S-4	332					

					
ISOMETER® isoLR1685DP	**ISOMETER® isoHR1685DW**	**ISOMETER® IR1575**	**ISOMETER® IR427**	**ISOMETER® isoMED427P**	**ISOMETER® isoLR275**
25	29	81	84	88	102
	insulated elevating work platforms		Medical locations	Medical locations	Installations with a low level of insulation
				■	
■	■	■	■	■	■
		■			■
■	■	■	■	■	■
■	■	■			■
■	■	■			■
AC 0…690 V, DC 0…690 V	AC 0…1000 V, DC 0…1500 V	AC, 3(N) AC 0…400 V DC 0…400 V	AC 70…330 V	AC 70…230 V	via AGH-LR 3(N)AC 0…690 V DC 0…1000 V
+10 % +5%	+10 %, +5%	+ 20 %	+ 15 %	+ 15 %	+ 15 % + 10 %
≤ 2000	≤ 1	≤ 60	≤ 5	≤ 5	≤ 500
20…100	100…1000	2…1000	50…500	50…500 kΩ	0.2…100
■	■				
				■	
			■	■	■
■	■		■	■	■
		■			
RTU	RTU				
■	■	■		■	■

Suitable system components					
			■	■	
			■	■	
			■	■	
			■	■	

Overview insulation monitoring devices ISOMETER®

	ISOMETER® isoPV	ISOMETER® isoPV425	ISOMETER® isoPV1685 isoPV1685PFR	ISOMETER® IR420-D6	ISOMETER® IR423
Page	91	95	99	105	108
Special applications	Photovoltaic	Photovoltaic	Photovoltaic	Disconnected loads	Mobile generators
Circuits – Control circuits					
Circuits – Auxiliary circuits					
Circuits – Main circuits	■	■	■	■	■
Voltage system – 3(N)AC	■			■	
Voltage system – AC	■	■		■	■
Voltage system – AC/DC	■	■			
Voltage system – DC	■	■	■	■	
Nominal system voltage U_n	via AGH-PV 3(N)AC 0…793 V DC 0…1000 V	DC 0…1000 V, AC 0…690 V, 15…460 Hz	DC 0…1500 V	offline	AC 0…250 V
Tolerance of U_n	+ 10 %	+ 15 %	+ 6 %		+ 20 %
System leakage capacitance C_e µF	≤ 2000	≤ 500	≤ 2000	≤ 10	≤ 5
Response value R_{an} kΩ	0.2…100	1…990	0.2…990	100…10000	1…200
Coupled systems					
Locating current injector for insulation fault location			■ (only isoPV1685PFR)		
Installation – DIN rail	■	■		■	■
Installation – Screw mounting	■	■	■	■	■
Installation – Panel mounting/ wall fastening					
Interfaces – Web server					
Interfaces – Modbus		RTU			
Interfaces – BCOM					
Interfaces – BS					
Interfaces – BMS	■	■	■		
Interfaces – isoData		■			

	Type	P.	Suitable system components				
	FP200	65					
Coupling devices	AGH150W-4	326					
Coupling devices	AGH204S-4	328					
Coupling devices	AGH520S	329				■	
Coupling devices	AGH675S-7	330					
Coupling devices	AGH676S-4	332				■	

					
ISOMETER® IR123	**ISOMETER® IR155**	**ISOMETER® isoEV425**	**ISOMETER® isoCHA425**	**ISOMETER® iso165C**	**ISOMETER® isoRW425**
111	114	118	122	125	128
Mobile generators	Electric mobility	Electric mobility	Electric mobility	Electric mobility	Railway
■	■	■	■	■	■
					■
■					■
					■
	■	■	■	■	■
AC 100…250 V	DC 0…1000 V	DC 0…1000 V AC 0…690 V, 15…460 Hz	DC 0…400 V	DC 0…600 V	AC/DC 0…400 V
+ 20 %	+ 0 %	+ 10 % + 15 %		+ 15 %	+ 25 %
≤ 1	≤ 1	≤ 5	≤ 2	≤ 1	≤ 300
46/23	100…10000	10…990	23 kΩ 46 kΩ	30 kΩ…1 MΩ; 40 kΩ…2 MΩ	1…990
		■	■		■
■	■	■		■	■
		RTU	RTU		RTU
		■	■		■
		■	■		■

Suitable system components					

Overview insulation monitoring devices ISOMETER®

		 ISOMETER® isoUG425	 ISOMETER® isoES425	 ISOMETER® isoGEN423	 ISOMETER® isoGEN523	 ISOMETER® isoHV425
Page		131	134	137	140	143
Special applications		Unearthed DC systems	Energy storage	Generators acc. to standard DIN VDE 0100-551	Generators acc. to standard DIN VDE 0100-551	
Circuits	Control circuits					
	Auxiliary circuits					
	Main circuits	■	■	■	■	■
Voltage system	3(N)AC			■	■	■
	AC		■	■	■	■
	AC/DC		■	■	■	■
	DC	■	■	■	■	■
Nominal system voltage U_n		DC 12…120 V	3 (N)AC, AC 0…400 V, DC 0…400 V	3(N)AC, AC 0…400 V, DC 0…400 V	3(N)AC, AC 0…400 V, DC 0…400 V	with AGH422 AC 0…1000 V, DC 0…1000 V
Tolerance of U_n		+20 %	+25 %	+25 %	+25 %	+10 %
System leakage capacitance C_e µF		≤ 50	≤ 100	≤ 5	≤ 5	≤ 150
Response value R_{an} kΩ		2…100	2…990	R_{an2}…200	R_{an2}…200	11…500
Coupled systems						
Locating current injector for insulation fault location						
Installation	DIN rail	■	■	■	■	■
	Screw mounting	■	■	■	■	■
	Panel mounting/ wall fastening					
Interfaces	Web server					
	Modbus	RTU		RTU	RTU	RTU
	BCOM					
	BS					
	BMS	■	■	■	■	■
	isoData	■	■	■	■	■

	Type	P.	Suitable system components				
	FP200	65					
Coupling devices	AGH150W-4	326					
	AGH204S-4	328					
	AGH520S	329					
	AGH675S-7	330					
	AGH676S-4	332					



ISOMETER®
isoHV525

147
■
■
■
■
■
AC 0…1000 V, DC 0…1000 V
+10 %
≤ 150
11…500
■
■
RTU
■
■

ISOMETER® IR420-D4

Insulation monitoring device for unearthed AC control circuits (IT systems)

AC



Typical applications

- AC control circuits in the industrial sector, mechanical engineering, power plants, elevators, automation systems etc.
- AC control and auxiliary circuits in accordance with DIN EN 60204-1 "Electrical equipment of machines", IEC 60204-1, EN 60204-1
- AC auxiliary circuits in accordance with DIN VDE 0100-725
- Smaller AC IT systems such as lighting systems, mobile generators

Approvals

Device features

- Insulation monitoring for IT control circuits AC 0…300 V
- Two separately adjustable response values
- Preset function (automatic setting of basic parameters)
- Connection monitoring system/earth
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation, selectable
- Fault memory behaviour, selectable
- Self monitoring with automatic alarm
- Multi-functional LC display
- Adjustable response delay
- Two-module enclosure (36 mm)
- RoHS compliant
- Push-wire terminal (two terminals per connection)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- ASTM F 1207M-96 (2007)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 42…460 Hz	9.6…94 V	IR420-D4-1	B91016409	B71016409
70…300 V, 42…460 Hz	70…300 V	IR420-D4-2	B91016405	B71016405

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Protective separation (reinforced insulation) between	(A1, A2) -(L1, L2, E, KE, T/R) -(11, 12, 14) -(21, 22, 24)
Voltage test acc. to IEC 61010-1	2.2 kV

Supply voltage

IR420-D4-1:

Supply voltage U_s	AC 16…72 V / DC 9.6…94 V
Frequency range U_s	42…460 Hz / DC

IR420-D4-2:

Supply voltage U_s	AC/DC 70…300 V
Frequency range U_s	42…460 Hz, DC
Power consumption	≤ 4 VA

IT system being monitored

Nominal system voltage U_n	AC 0…300 V
Nominal frequency f_n	42…460 Hz

Response values

Response value R_{an1} (Alarm 1)	1…200 kΩ
Response value R_{an2} (Alarm 2)	1…200 kΩ
Preset mode	
U_n ≤ 72 V R_{an1} (ALARM 1)/R_{an2} (ALARM 2)	20 kΩ/10 kΩ
U_n > 72 V R_{an1} (ALARM 1)/R_{an2} (ALARM 2)	46 kΩ/23 kΩ
Relative uncertainty 1…5 kΩ/5…200 kΩ	±0.5 kΩ/±15 %
Hysteresis 1…5 kΩ/5…200 kΩ	+1 kΩ/+25 %

Time response

Response time t_{an} at R_F = 0.5 x R_{an} and C_e = 1 µF	≤ 1 s
Start-up delay (start time) t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m (at R_F = 0 Ω)	≤ 200 µA
Internal DC resistance R_i	≥ 62 kΩ
Impedance Z_i at 50 Hz	≥ 60 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 300 V
Permissible system leakage capacitance C_e	≤ 20 µF

Displays, memory

Display	LC display, multi-functional, non-illuminated
Display range, measured value	1 kΩ…1 MΩ
Operating uncertainty (1…5 kΩ)	±0.5 kΩ
Operating uncertainty (5 kΩ…1 MΩ)	±15 %
Password	off/0…999 (off)*
Fault memory, alarm relay	on/off*

Inputs

Cable length test and reset button	≤ 10 m

Switching elements

Number of switching elements	2 x 1 changeover contact
Operating principle	NC/N/O operation (N/O operation)*
Electrical service life, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	220 V	110 V	24 V
Rated operational current	5 A	3 A	0.1 A	0.2 A	1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

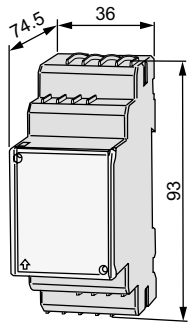
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

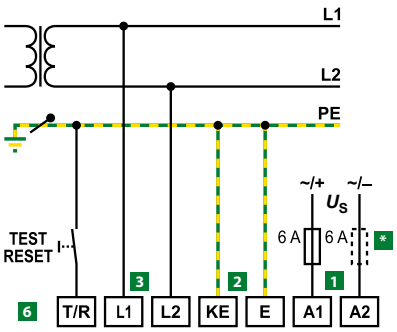
Other

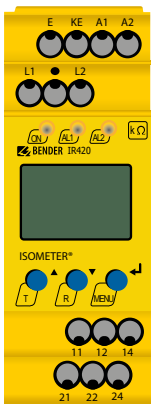
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00037
Weight	≤ 150 g

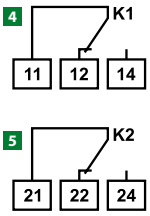
( )* = factory setting

Dimension diagram (dimensions in mm)









1	A1, A2	Supply voltage U_S (see ordering details) via fuse
2	E, KE	Separate connection of E, KE to PE
3	L1, L2	Connection of the AC system to be monitored: AC: connect terminals L1, L2 to conductor L1, L2.
4	11, 12, 14	Alarm relay K1: Alarm 1
5	21, 22, 23	Alarm relay K2: Alarm 2
6	T/R	Combined test and reset button "T/R": short-time pressing (< 1.5 s) = RESET, long-time pressing (> 1.5 s) = TEST

* Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.

ISOMETER® IR425

Insulation monitoring device for unearthed AC/DC control circuits (IT systems)

AC/DC



Typical applications

- AC/DC control circuits in the industrial sector, mechanical engineering, power plants, elevators, automation systems etc.
- AC/DC control and auxiliary circuits in accordance with DIN EN 60204-1 "Electrical equipment of machines", IEC 60204-1, EN 60204-1
- AC/DC auxiliary circuits in accordance with DIN VDE 0100-725 (VDE 0100-725)
- Smaller AC/DC IT systems such as lighting systems

Approvals

Device features

- Insulation monitoring for AC/DC control circuits 0…300 V
- Two separately adjustable response values
- Preset function (automatic setting of basic parameters)
- Connection monitoring system/earth
- LEDs: Power On, Alarm 1, Alarm 2
- Information about the point of fault L+/L-via display
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation, selectable
- Fault memory behaviour, selectable
- Self monitoring with automatic alarm
- Multi-functional LC display
- Adjustable response delay
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- ASTM F 1669M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 15…460 Hz	9.6…94 V	IR425-D4-1	B91036403	B71036403
		IR425-D4W-1	B91036403W	B71036403W
70…300 V, 15…460 Hz	70…300 V	IR425-D4-2	B91036402	B71036402
		IR425-D4W-2	B91036402W	B71036402W

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Protective separation (reinforced insulation) between	(A1, A2) -(L1, L2, E, KE, T/R) -(11, 12, 14) -(21, 22, 24)
Voltage test acc. to IEC 61010-1	2.2 kV

Supply voltage

IR425-D4-1, IR425-D4W-1:

Supply voltage U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	15…460 Hz / DC

IR425-D4-2, IR425-D4W-2:

Supply voltage U_S	AC/DC 70…300 V
Frequency range U_S	15…460 Hz, DC
Power consumption	≤ 4 VA

IT system being monitored

Nominal system voltage U_n	AC/DC 0…300 V
Nominal frequency f_n	DC 15…460 Hz

Response values

Response value R_{an1} (ALARM 1)	1…200 kΩ
Response value R_{an2} (ALARM 2)	1…200 kΩ

Preset mode

$U_n \leq 72$ V R_{an1} (ALARM 1)/R_{an2} (ALARM 2)	20 kΩ/10 kΩ
$U_n > 72$ V R_{an1} (ALARM 1)/R_{an2} (ALARM 2)	46 kΩ/23 kΩ
Relative uncertainty (1…5 kΩ)/(5…200 kΩ)	±0.5 kΩ/±15 %
Hysteresis (1…5 kΩ)/(5…200 kΩ)	+1 kΩ/+25 %

Time response

Response time t_{an} at $R_F = 0.5$ x R_{an} and $C_e = 1$ µF	≤ 2 s
Start-up delay (start time) t	0…10 s
Response delay t_{on}	0…99 s

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m (at $R_F = 0$ Ω)	≤ 200 µA
Internal DC resistance R_i	≥ 62 kΩ
Impedance Z_i at 50 Hz	≥ 60 kΩ
Admissible extraneous d.c. voltage U_{fg}	≤ DC 300 V
Permissible system leakage capacitance	≤ 20 µF

Displays, memory

Display	LC display, multi-functional, non-illuminated
Display range, measured value	1 kΩ…1 MΩ
Operating error (1…5 kΩ)	±0.5 kΩ
Percentage operating error (5 kΩ…1 MΩ)	±15 %
Password	off/0…999
Fault memory, alarm relay	on/off

Inputs

Cable length test and reset button	≤ 10 m

Switching elements

Number of switching elements	2 x 1 changeover contact
Operating principle	NC/N/O operation
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	220 V	110 V	24 V
Rated operational current	5 A	3 A	0.1 A	0.2 A	1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions IEC 60721

Stationary use (IEC 60721-3-3)	3M4
for option W	3M7
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

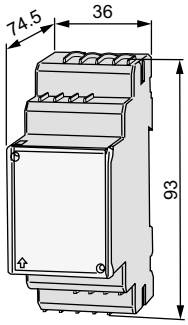
Push-wire terminals

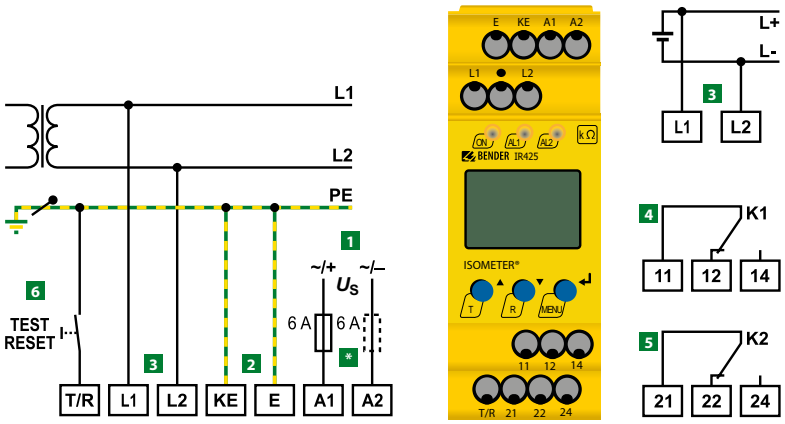
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00039
Weight	≤ 150 g

Dimension diagram (dimensions in mm)





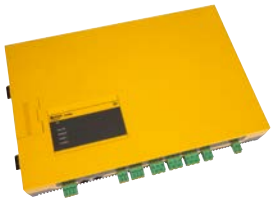
1	A1, A2	Supply voltage U_S (see ordering details) via fuse
2	KE, E	Separate connection of E, KE to PE
3	L1, L2	Connection to the IT system to be monitored
4	11, 12, 14	Alarm relay K1: Alarm 1
5	21, 22, 24	Alarm relay K2: Alarm 2
6	T/R	Combined test and reset button: short-time pressing (< 1.5 s) = RESET long-time pressing (> 1.5 s) = TEST

* Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.

ISOMETER® iso1685P

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to AC 1000 V/DC 1500 V

AC/DC



Typical applications

- Extensive systems up to AC 1000 V/DC 1500 V which are designed as IT systems

Approvals

CE

Device features

- Insulation monitoring in extensive unearthed power supply systems up to AC 1000 V/DC 1500 V
- Measurement of low-resistance insulation faults
- Separately adjustable response values R_{an1} (Alarm 1) and R_{an2} (Alarm 2) (both 200 Ω…1 MΩ) for prewarning and alarm
- Automatic adaptation to high system leakage capacitances up to 2000 µF, selectable range
- Integrated locating current injector up to 50 mA
- Device self test with automatic fault message in the event of a fault
- Alarm relays separately adjustable for insulation fault 1, insulation fault 2 and device error
- RS-485 interface (BMS bus), e.g. to control insulation fault location
- µSD card with data logger and history memory for alarms

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- DIN EN 61557-9 (VDE 0413-9)
- IEC 61557-9
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Response value range	Nominal voltage		Supply voltage [1]	Type	Art. No.
	AC	DC	DC		
200 Ω…1 MΩ	0…1000 V	0…1500 V	18…30 V	iso1685P-425	B91065801
				iso1685PW-425	B91065801W

[1] Absolute values

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Insulation coordination according to IEC 60664-1	
Rated voltage	DC 1500 V
Overvoltage category (OVC)	III
Rated impulse withstand voltage	8 kV
Rated insulation voltage	1500 V
Pollution degree exterior	3
Voltage test, routine test (IEC 61010-1)	2.2 kV

Voltage ranges

Nominal system voltage range U_n	AC 0…1000 V/DC 0…1500 V
Tolerance of U_n	AC +10 %/DC +6 %
Frequency range of U_n	DC, 1…460 Hz
Supply voltage U_s (see also device nameplate)	DC 18…30 V
Frequency range of U_S	DC
Power consumption	≤ 7 W

Measuring circuit for insulation monitoring

Measuring voltage U_m (peak value)	±50 V
Measuring current I_m (at $R_F = 0\ \Omega$)	≤ 1.5 mA
Internal DC resistance R_i	≥ 70 kΩ
Impedance Z_i at 50 Hz	≥ 70 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1500 V
Permissible system leakage capacitance C_e	≤ 500 µF (150 µF)*
Measuring range leakage capacitance	20…500 µF
Tolerance measurement of C_e	±10 % ±10 µF
Frequency range measurement of C_e	DC, 30…460 Hz

Response values for insulation monitoring

Response value R_{an1} (alarm 1)	200 Ω…1 MΩ (40 kΩ)*
Response value R_{an2} (alarm 2)	200 Ω…1 MΩ (10 kΩ)*
Condition response value	$R_{an1} \geq R_{an2}$
Upper limit of the measuring range when set to $C_{emax} = 500$ µF	200 kΩ
Relative uncertainty (10 kΩ…1 MΩ) (acc. to IEC 61557-8)	±15 %
Relative uncertainty (0.2 kΩ…< 10 kΩ)	±200 Ω ±15 %
Hysteresis	25%

Time response

Response time t_{an} at $R_F = 0.5 \times R_{an}$ ($R_{an} = 10$ kΩ) and $C_e = 1$ µF acc. to IEC 61557-8	profile dependent, typ. 10 s

Measuring circuit for insulation fault location (EDS)

Locating current I_L DC	≤ 50 mA
Test cycle/pause	2 s/4 s
Nominal system voltage range U_n:	
AC ≥ 25 Hz, DC	AC 0…1000 V/DC 0…1500 V
AC < 25 Hz	AC 0…690 V

Memory

µSD card for history memory and log files	≤ 32 GB

LEDs

ON (operation LED)	green
PGH ON	yellow
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

Digital inputs

Operating mode, adjustable	active high, active low
Functions	
digital input 1	test (< 1 s)/standby (> 2 s)
digital input 2	reset
High level	10…30 V
Low level	0…0.5 V

Serial interface

Interface/protocol	RS-485/BMS
Connection	terminals A/B
Cable length	≤ 1200 m
Shielded cable (shield to functional earth on one end)	2-core, ≥ 0.6 mm², e.g. J-Y(St)Y 2x0.6
Shield	terminal S
Terminating resistor, can be connected (Term. RS-485)	120 Ω (0.5 W)
Device address, BMS bus	2…33 (2)*

Switching elements

Switching elements	3 changeover contacts: K1 (insulation fault alarm 1), K2 (insulation fault alarm 2), K3 (device error)
Operating principle K1, K2	N/C operation or N/O operation (N/C operation)*
Operating principle K3	N/C operation, cannot be changed
Electrical endurance under rated operating conditions, number of cycles	100.000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC13	AC14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage					250 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Connection (except system coupling)

Connection type	pluggable push-wire terminals
Connection	
rigid/flexible	0.2…2.5 mm²/0.2…2.5 mm²
flexible with ferrule, without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Connection of the system coupling

Connection type	pluggable push-wire terminals
Connection	
rigid/flexible	0.²…10 mm²/0.2…6 mm²
flexible with ferrule, without/with plastic sleeve	0.25…6 mm²0.25…4 mm²
Conductor sizes (AWG)	24…8
Stripping length	15 mm
Opening force	90…120 N

Environment/EMC

EMC	IEC 61326-2-4

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	
iso1685P	3M4
iso1685PW	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Deviation from the classification of climatic conditions:

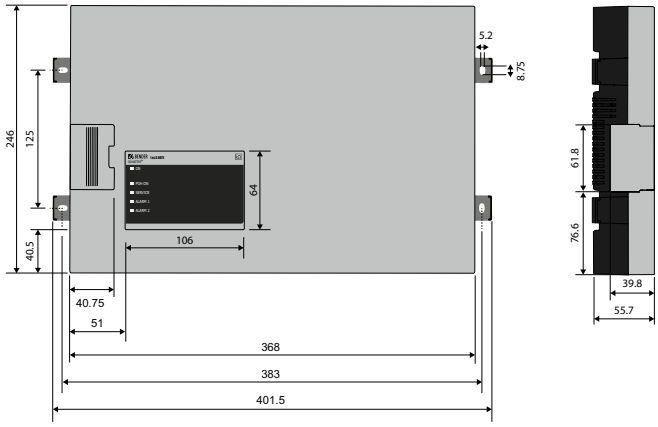
Ambient temperature during operation	-40 …+70 °C
Ambient temperature for transport	-40 …+80 °C
Ambient temperature for long-term storage	-25 …+80 °C
Area of application	≤ 3000 m AMSL

Other

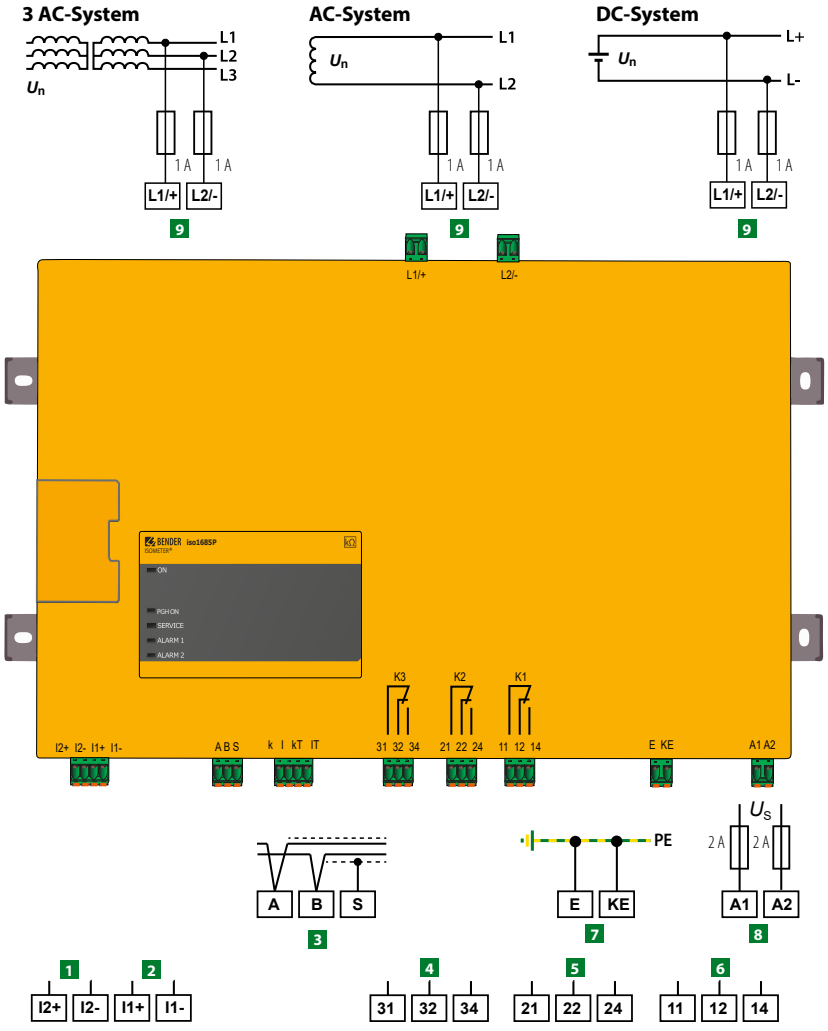
Operating mode	continuous operation
Position of normal use	vertical, system coupling on top
PCB fixation	lens head screw DIN7985TX
Tightening torque of the screws for enclosure mounting	1.0…1.5 Nm
Degree of protection, internal components	IP30
Degree of protection, terminals	IP30
Enclosure material	polycarbonate
Flammability class	V-0
Weight	≤ 1600 g

( )* = Factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	I2+, I2–	Currently has no function, digital input
2	I1+, I1–	Digital input
3	A, B, S	Connection to BMS bus, RS-485, S = shield (connect one end to PE), can be terminated with S700
4	31, 32, 34	Alarm relay K3 for internal device errors
5	21, 22, 24	Alarm relay K2 for insulation faults alarm 2
6	11, 12, 14	Alarm relay K1 for insulation faults alarm 1
7	E,KE	Separate connections of E and KE to PE
8	A1, A2	Connection to Us = DC 24 V via fuses, 2 A each
9	L1/+, L2/-	Connection to the IT system to be monitored

ISOMETER® iso1685DP/isoHV1685D/isoLR1685DP

Insulation monitoring device for unearthed AC, AC/DC and DC power supplies (IT systems)

AC/DC



Typical applications

- Extensive systems up to AC 1000 V/ DC 1500 V which are designed as IT systems

Approvals

CE

Device features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ for Alarm 1 and Alarm 2
- High-resolution graphical LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485 interface for data exchange to other Bender devices

iso1685DP-425

- measuring insulation faults 200Ω …1MΩ

isoLR1685DP-325

- measuring insulation faults 20 Ω…100 kΩ

isoHV1685DP-425

- measuring insulation faults 200Ω …1MΩ at mains voltages AC 2000 V, DC 3000 V

iso1685DP-425 and isoLR1685DP-325

- Locating current injection for selective insulation fault location
- Indication of the insulation faults selectively located by the EDS system
- Parameter setting of EDS systems
- Customer-specific texts for each measuring channel

Standards

The ISOMETER® has been developed in compliance with the following standards::

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61557-8 Appendix C (only applies to profile Fast 2000 µF)
- DIN EN 61557-9 (VDE 0413-9)
- IEC 61557-9
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1]	Response value range	Nominal voltage		Type	Art. No.
DC		AC	DC		
18…30 V	20 Ω…100 kΩ	0…690 V	0…690 V	isoLR1685DP-325	B91065803
	200 Ω…1 MΩ	0…2000 V	0…3000 V	isoHV1685D-425	B91065805
		0…1000 V	0…1500 V	iso1685DP-425	B91065802

[1] Absolute values

Isolationskoordination nach IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	(L1/+, L2/-), (E, KE)
Supply circuit (IC2)	A1, A2
Outputcircuit 1 (IC3)	11, 12, 14
Outputcircuit 2 (IC4)	21, 22, 24
Outputcircuit 3 (IC4)	31, 32, 34
Controlcircuit (IC6)	(A, B), (I1+, I1-, I2+, I2-)
Rated Voltage [for isoHV1685D]	1500V [3000 V]
Overvoltagecategory	III
Rated impulse voltage:	
IC1/(IC2-5) [for isoHV1685D]	10 kV [16,670 kV]
IC2/(IC3-5)	4 kV
IC2/IC1+IC6	800 V
IC3/(IC4-6)	4 kV
IC4/(IC5-6)	4 kV
IC5/IC6	4 kV
Rated insulation voltage:	
IC1/(IC2-6) [für isoHV1685D]	1500 V [3000 V]
IC2/(IC3-5)	250 V
IC2/IC6	50 V
IC3/(IC4-6)	250 V
IC4/(IC5-6)	250 V
IC5/IC6	250 V
Pollutiondegree	3
Safe insulation (reinforced insulation)between:	
IC1/(IC2-5) [für isoHV1685D]	Überspannungskategorie III, 1500 V [3000 V]
IC2/(IC3-5)	Überspannungskategorie III, 300 V
IC2/IC6	Überspannungskategorie III, 50 V
IC3/(IC4-6)	Überspannungskategorie III, 300 V
IC4/(IC5-6)	Überspannungskategorie III, 300 V
IC5/IC6	Überspannungskategorie III, 300 V
Voltage test (routine test) acc. to IEC 61010-1:	
IC2/(IC3-5)	AC 2,2 kV
IC2/IC6	DC ±0,50 kV
IC3/(IC4-6)	AC 2,2 kV
IC4/(IC5-6)	AC 2,2 kV
IC5/IC6	AC 2,2 kV

Voltage ranges

Nominal system voltage range U_n	
iso1685DP	AC 0…1000 V; DC 0…1500 V
isoHV1685D	AC 0…2000 V; DC 0…3000 V
isoLR1685DP	AC 0…690 V; DC 0…690 V
Tolerance of U_n	AC +10 %/DC +5%
Frequency range of U_n	DC, 1…460 Hz
Supply voltage U_s (see also device nameplate)	DC 18…30 V
Frequency range of U_s	DC
Power consumption	≤ 9 W

Measuring circuit for insulation monitoring

Measuring voltage U_m (peak value)	±50 V
Measuring current I_m (bei $R_F = 0\ \Omega$)	
iso1685DP, isoHV1685D	≤ 1,5 mA
isoLR1685DP	≤ 3,5 mA
Internal DC resistance R_i	
iso1685DP, isoHV1685D	≥ 70 kΩ
isoLR1685DP	≥ 15kΩ*1)
Impedance Z_i at 50 Hz	
iso1685DP, isoHV1685D	≥ 70 kΩ
isoLR1685DP	≥ 15 kΩ*1)
Permissible extraneous DC voltage U_{fg}	
iso1685DP	≤ DC 1600 V
isoHV1685D	≤ DC 3150 V
isoLR1685DP	≤ DC 720 V
Permissible system leakage capacitance C_e	profile dependent, 0…2000 µF

Response values for insulation monitoring

Response value R_{an1} (alarm 1) and (alarm 2)	
iso1685DP, isoHV1685D	200 Ω…1 MΩ (40 kΩ/10 kΩ) *2)
isoLR1685DP	20 Ω…100 kΩ (4 kΩ /1 kΩ) *2)
Condition response value	$R_{an1} \geq R_{an2}$
Upper limit of the measuring range when set to C_{emax} = 2000 µF	50 kΩ
Upper limit of the measuring range when set to C_{emax} = 500 µF	200 kΩ
Relative uncertainty (iso1685DP; isoHV1685D)	
(10 kΩ…1 MΩ) (acc. to IEC 61557-8)	±15 %
(0.2 kΩ…< 10 kΩ)	±200 Ω ±15 %
Relative uncertainty (isoLR1685DP)	
(1 kΩ…100 kΩ) (acc. to IEC 61557-8)	±15 %
(20 Ω…< 1 kΩ)	±200 Ω ±15 %
Hysteresis	25 %

Time response

Response time t_{an} at $R_F = 0.5 \times R_{an}$ (R_{an} = 10 kΩ) and C_e= 1 µF acc. to IEC 61557-8	profile dependent, typ. 10 s

Measuring circuit for insulation fault location (EDS) (only iso1685DP)

Locating current IL DC	≤ 50 mA (1/2,5/5/10/25/50 mA)
Test cycle/pause	2 s/4 s

Indication

Display	graphic display 127 x 127 pixel, 40 x 40 mm
Display range measured value	
iso1685DP, isoHV1685D	200 Ω…50 MΩ
isoLR1685DP	20 Ω…1 MΩ

LEDs

ON (operation LED)	green
PGH ON	yellow
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

Digital inputs

Operating mode, adjustable	active high, active low
Functions	none, test, reset, deactivate device, insulation fault location
High level	10…30 V
Low level	0…0.5 V

Serial interface

Interface/protocol	RS-485/BMS/Modbus/RTU
Connection	terminals A/B
Cable length	≤ 1200 m
Shielded cable (shield to functional earth on one end)	2-core, ^{3}0.6 mm², e.g. J-Y(St)Y 2x0.6
Shield	terminal S
Terminating resistor, can be connected (Term. RS-485)	120 Ω (0.5 W)
Device address, BMS bus	(1) 2…90 (2)*
Device adress Modbus/RTU	1…247
Baudrate	9,6/19,2/38,4/57,6/115 kB
Parity	even/odd
Stop Bits	1/2/auto

Switching elements

Switching elements	
3 changeover contacts: K1 (insulation fault alarm 1), K2 (insulation fault alarm 2), K3 (device error)	
Operating principle K1, K2	N/C operation or N/O operation (N/C operation)*
Operating principle K3	N/C operation, cannot be changed
Electrical endurance under rated operating conditions, number of cycles	100,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage					250 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Connection (except system coupling)

Connection type	pluggable push-wire terminals
Connection, rigid/flexible	0.2…2.5 mm²/0.2…2.5 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Connection of the system coupling

Connection type	pluggable push-wire terminals
Connection, rigid/flexible	0.2…10 mm²/0.2…6 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…6 mm²/0.25…4 mm²
Conductor sizes (AWG)	24…8
Stripping length	15 mm
Opening force	90…120 N

Environment/EMC

EMC	IEC 61326-2-4

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3) for iso1685DP	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Deviation from the classification of climatic conditions:

Ambient temperature during operation	-40…+70 °C
Ambient temperature transport	-40…+80 °C
Ambient temperature long-term storage	-25 …+80 °C
Area of application	≤ 3000 m AMSL

Other

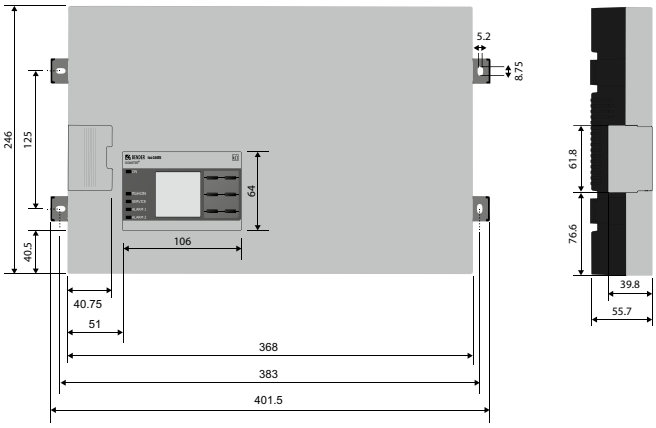
Operating mode	continuous operation
Position of normal use	vertical, system coupling on top
Tightening torque of the screws for enclosure mounting	1.0…1.5 Nm
Degree of protection, internal components	IP30
Degree of protection, terminals	IP30
Enclosure material	polycarbonate
Flammability class	V-0
Documentation number	D00272
Weight	≤ 1600 g

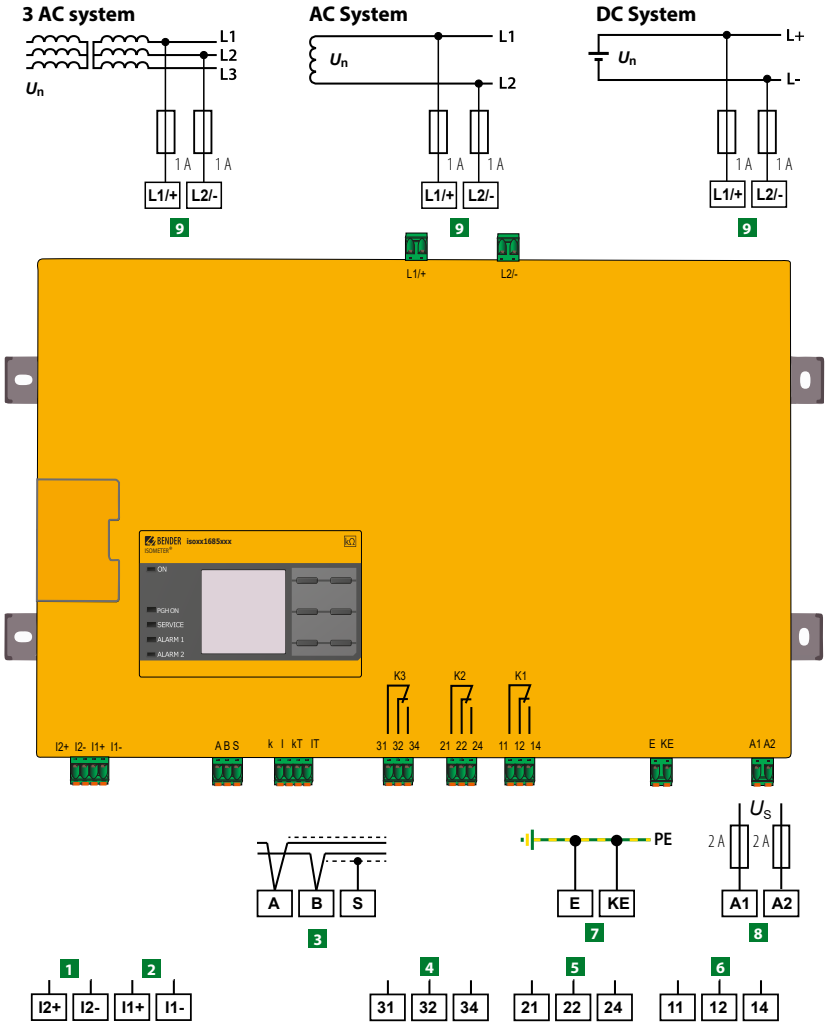
( )* = Factory settings

[1] for U_n > 500 V not acc. to IEC61557-8

[2] Values in brackets are factory settings

Dimension diagram (dimensions in mm)





1	I2+, I2–	Standby, digital input
2	I1+, I1–	Test, digital input
3	A, B, S	Connection to BMS bus, RS-485, S = shield (connect one end to PE), can be terminated with S700
4	31, 32, 34	Alarm relay K3 for internal device errors
5	21, 22, 24	Alarm relay K2 for insulation faults alarm 2
6	11, 12, 14	Alarm relay K1 for insulation faults alarm 1
7	E,KE	Separate connections of E and KE to PE
8	A1, A2	Connection to Us = DC 24 V via fuses, 2 A each
9	L1/+, L2/-	Connection to the IT system to be monitored

ISOMETER® isoHR1685DW–925

Insulation monitoring device for mobile, insulated elevating work platforms

AC/DC



Typical applications

- Isolationsüberwachung von Hubarbeitsbühnen/Oberleitungs-fahrzeugen.

Approvals

CE

Device features

ISOMETER® for mobile, insulated elevating work platforms

- Continuous monitoring of both insulation levels on elevating work platforms, also during operation
- Storage of data for verification of insulation condition. Where necessary, provision of documentary verification following a electrical accident
- Graphical representation of the insulation resistance over time (isoGraph)
- RS-485 interface with BMS protocol and Modbus RTU for forwarding data, alarms and acknowledgements via existing communication to work platform
- History memory with real-time clock (13-day buffer) for storing 1023 alarm messages with date and timestamp
- Freely programmable digital inputs
- Automatic device self-test with automatic message in the event of a fault
- Connection monitoring
- Separately adjustable response values R_{an1} (alarm 1) and R_{an2} (alarm 2) for prewarning and alarm
- High-resolution graphic LC display, for excellent readability and recording of the device status
- Measurement of high-resistance insulation faults 100 kΩ…20 GΩ
- Automatic adjustment to high system leakage capacitances

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1]	Response value range	Nominal system voltage		Type	Art. No.
DC		AC	DC		
18…30 V	100 kΩ…100 MΩ	0…1000 V	0…1500 V	isoHR1685DW-925	B91065806W

[1] Absolute values

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	(L1/+, L2/-), (E, KE)
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Output circuit 3 (IC4)	31, 32, 34
Control circuit(IC6)	(A, B), (I1+, I1-, I2+, I2-)
Rated voltage	1500 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-5)	10 kV
IC2/(IC3-5)	4 kV
IC2/IC1+IC6	800 V
IC3/(IC4-6)	4 kV
IC4/(IC5-6)	4 kV
IC5/IC6	4 kV
Rated insulation voltage:	
IC1/(IC2-6)	1500 V
IC2/(IC3-5)	250 V
IC2/IC6	50 V
IC3/(IC4-6)	250 V
IC4/(IC5-6)	250 V
IC5/IC6	250 V
Pollution degree	3
Protective separation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1500 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC2/IC6	Overvoltage category III, 50 V
IC3/(IC4-6)	Overvoltage category III, 300 V
IC4/(IC5-6)	Overvoltage category III, 300 V
IC5/IC6	Overvoltage category III, 300 V
Voltage test (routine test) as per IEC 61010-1:	
IC2/(IC3-5)	AC 2.2 kV
IC2/IC6	DC ±0.50 kV
IC3/(IC4-6)	AC 2.2 kV
IC4/(IC5-6)	AC 2.2 kV
IC5/IC6	AC 2.2 kV

Voltage ranges

Nominal system voltage range U_n	AC 0…1000 V DC 0…1500 V
Tolerance of U_n	AC +10 %/DC +5 %
Frequency range of U_n	DC 0.1…460 Hz
Supply voltage U_s (also see device name plate)	DC 18…30 V
Frequency range of U_s	DC
Power consumption	≤ 9 W

Measuring circuit for insulation monitoring

Measuring voltage U_m (peak value)	± 50 V
Measuring current I_m (at $R_F = 0\ \Omega$)	≤ 1 µA
Internal resistance DC R_i	≥ 50 MΩ
Impedance Z_i at 50 Hz	≥ 50 MΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1600 V
Permissible system leakage capacitance C_e isoHR1685DW-925	profile-dependent, 0…1 µF

Response values for insulation monitoring

Response value R_{an1} (alarm 1) and R_{an2} (alarm 2)	100 kΩ…100 MΩ
Response value condition	$R_{an1} \geq R_{an2}$
Upper limit of the measuring range when setting measuring profile to "high capacity" C_{emax} = 5 µF	24 MΩ
Relative uncertainty (acc. to IEC 61557-8)	±15 %
100 kΩ…10 MΩ	±200 kΩ ±15 %
Hysteresis	25 %

Time response

Response time t_{an} at $R_F = 0.5 \times R_{an}$ (R_{an}= 100 kΩ) and C_e= 1 µF acc. to IEC 61557-8	profile-dependent, typ. 10 s

Display

Display	graphic display 127 x 127 pixels, 40 x 40 mm
Display range, measured value	100 kΩ…50 GΩ

LEDs

ON (operation LED)	green
PGH ON (no function)	yellow
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

Digital inputs

Operating mode, variable	active high, active low
Functions	off, test, reset, disable device, insulation fault location
High level	10…30 V
Low level	0…0.5 V

Serial interface

Interface/Protocol	RS-485/BMS/Modbus RTU
Connection	Terminals A/B
Cable length	≤ 1200 m
Shielded cable (shield to functional earth on one side)	2-core, ≥ 0.6 mm², e.g. J-Y(St)Y 2x0.6
Shield	Terminal S
Terminating resistance, engageable (term. RS-485)	120 Ω (0.5 W)
Device address, BMS bus	(1) 2…90 (2)*
Device address, Modbus RTU	1 – 247
Baud rate	9.6/19.2/38.4/57.6/115 kB
Parity	even/uneven
Stop bits	1/2/auto

Connection (except mains coupling)

Type of connection	Pluggable push-wire terminals
Connection, rigid/flexible	0.2…2.5 mm²/0.2…2.5 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Connection of the mains coupling

Type of connection	Pluggable push-wire terminals
Connection, rigid/flexible	0.2…10 mm²/0.2…6 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…6 mm²/0.25…4 mm²
Conductor sizes (AWG)	24…8
Stripping length	15 mm
Opening force	90…120 N

Switching elements

Switching elements

3 changeover contacts: K1 (insulation fault alarm 1), K2 (insulation fault alarm 2), K3 (device fault)

Operating mode K1, K2	N/C operation / N/O operation (N/C operation)*
Operating mode K3	N/C operation, not modifiable
Electrical endurance under rated operating conditions	100,000 cycles

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage					250 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 61326-2-4

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Deviation from climate classes:

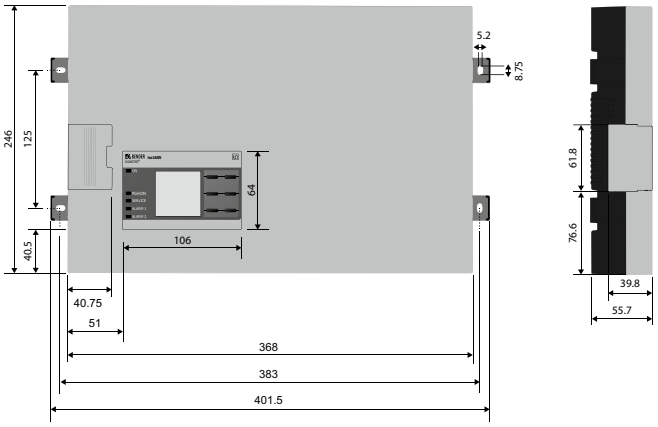
Ambient temperature during operation	-40…+70 °C
Ambient temperature during transport	-40…+80 °C
Ambient temperature during long-term storage	-25…+80 °C
Application range	≤ 3000 m AMSL

Other

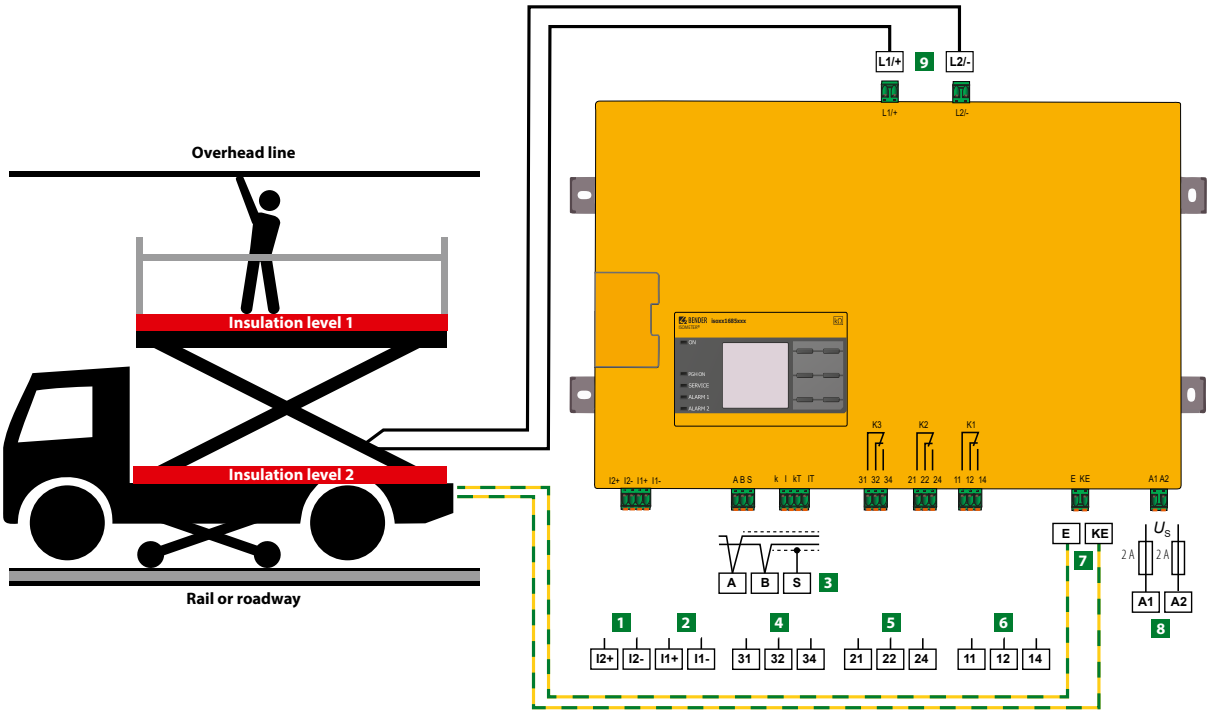
Operating mode	Continuous operation
Position of normal use	Vertical, mains coupling at top
Tightening torque for screws (4x M5) to fasten enclosure	1.0…1.5 Nm
Degree of protection, internal components	IP30
Degree of protection, terminals	IP30
Enclosure material	Polycarbonate
Flammability class	V-0
Documentation number	D00369
Weight	≤ 1600 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	I2+, I2–	Initial measurement, digital input
2	I1+, I1–	Test, digital input
3	A, B, S	Connection to RS-485 with BMS bus, Modbus RTU, S = shield (connect to PE on one side), can be terminated with S700
4	31, 32, 34	Alarm relay K3 for internal device faults
5	21, 22, 24	Alarm relay K2 for insulation faults, alarm 2
6	11, 12, 14	Alarm relay K1 for insulation faults, alarm 1
7	E, KE	Separate connections of E and KE to PE and/or vehicle chassis
8	A1, A2	Connection to U_S = DC 24 V via fuses, 2 A each
9	L1/+, L2/-	Connection of both coupling terminals L1/+ and L2/- to lifting arm of the work platform

ISOMETER® iso685-…

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- UPS systems, battery systems
- Heaters with phase control
- Systems including switched-mode power supplies
- IT systems with high leakage capacitances

Approvals

Device features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of ***AMP**Plus* and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ
- High-resolution graphical LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated), which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for data exchange with other Bender devices
- BCOM, Modbus TCP and web server

Device variants

- **iso685-D**
  The device version iso685-D features a high-resolution graphic LC display and control elements for direct operating of the device functions.
- **iso685-S**
  The device version iso685-S neither features a display nor a control unit. It can only be used in combination with FP200 and is indirectly operated via this front panel.
- **Option "W"**
  Device variants with Option "W" are available for extreme climatic and mechanical conditions.

Standards

The ISOMETER® has been developed in compliance with the following standards::

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage range U_n		Supply voltage U_S		Display	Option "W"	Type		Art. No.
AC	DC	AC	DC					
0…690 V; 0.1…460 Hz	0…1000 V	24…240 V; 50…400 Hz	24…240 V	integrated	–	iso685-D		B91067010
					-40…+70 °C, 3K5, 3M7	iso685W-D		B91067010W
				detached	–	iso685-S + FP200		B91067210
					-40…+70 °C, 3K5, 3M7	iso685W-S + FP200W		B91067210W

Accessories

Description	Art. No.
A set of screw terminals[1)]	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) [1)]	B91067903
Transparent cover 144x72 (IP65) for FP200 [2)]	B98060005

[1)] included in the scope of delivery

[2)] If the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7 / -0 mm).

Suitable system components

Description	Type	Art. No.	Page
Device version without display	iso685-S	B91067110	–
	iso685W-S	B91067110W	–
Display for front panel mounting	FP200	B91067904	65
	FP200W	B91067904W	65
Coupling devices	AGH150W-4	B98018006	326
	AGH204S-4	B914013	328
	AGH520S	B913033	329
	AGH676S-4	B913055	332

Suitable measuring instruments on request!

Technical data

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	(L1/+, L2, L3/-)
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3, X4)
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-5)	8 kV
IC2/(IC3-5)	4 kV
IC3/(IC4-5)	4 kV
IC4/IC5	4 kV
Rated insulation voltage:	
IC1/(IC2-5)	1000 V
IC2/(IC3-5)	250 V
IC3/(IC4-5)	250 V
IC4/IC5	250 V
Pollution degree for accessible parts on the outside of the device housing (U_n < 690 V)	3
Pollution degree for accessible parts on the outside of the device housing (U_n >690 < 1000 V)	2
Protective separation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1000 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC3/(IC4-5)	Overvoltage categoryIII, 300 V
IC4/IC5	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-5)	AC 2,2 kV
IC3/(IC4-5)	AC 2,2 kV
IC4/IC5	AC 2,2 kV

Supply voltage

Supply via A1/+, A2/-:	
Supply voltage range U_s	AC/DC 24…240 V
Tolerance of U_s	-30…+15%
Maximum permissible input current of U_s	650 mA
Frequency range of U_s	DC, 50…400 Hz [1)]
Tolerance of the frequency range of U_s	-5…+15 %
Power consumption, typically DC	≤ 12 W
Power consumption, typically 50/60 Hz	≤ 12 W/21 VA
Power consumption, typically 400 Hz	≤ 12 W/45 VA
Supply via X1:	
Supply voltage U_s	DC 24 V
Tolerance of U_s	DC -20…+25 %

IT system being monitored

Nominal system voltage range U_n	AC 0…690 V DC 0…1000 V AC/DC 0…600 V (for UL applications)
Tolerance of U_n	AC/DC +15 %
Frequency range of U_n	DC, 0.1…460 Hz
Max. AC voltage $U_{\sim}$ in the frequency range f_n = 0.1…4 Hz	$U_{\sim\,max}$ = 50 V/Hz^2 *(1+ f_n^2)

Response values

Response value R_{an1} (alarm 1)	1 kΩ…10 MΩ
Response value R_{an2} (alarm 2)	1 kΩ…10 MΩ
Relative uncertainty (acc. to IEC 61557-8)	profile dependent, ±15 %, at least ±1 kΩ
Hysteresis	25 %, at least 1 kΩ

Time response

Response time t_{an} at R_F = 0.5 x R_{an} (R_{an} = 10 kΩ) and C_e = 1 µF according to IEC 61557-8	profile dependent, typ. 4 s (see diagrams in manual)
Response time DC alarm at C_e = 1 µF	profile dependent, typ. 2 s (see diagram in manual)
Start-up delay $T_{start-up}$	0…120 s

Measuring circuit

Measuring voltage U_m	profile dependent, ±10 V, ±50 V (see profile overview)
Measuring current I_m	≤ 403 µA
Internal resistance R_i, Z_i	≥ 124 kΩ
Permissible extraneous DC voltage U_{fg}	≤ 1200 V
Permissible system leakage capacitance C_e	profile dependent, 0…1000 µF

Measuring ranges

Measuring range f_n	0,1…460 Hz
Tolerance measurement of f_n	±1 % ±0.1 Hz
Voltage range measurement of f_n	AC 25…690 V
Measuring range U_n	AC 25…690 V DC 25…1000 V
Voltage range measurement of U_n	AC/DC > 10 V
Tolerance measurement of U_n	±5 % ±5 V
Measuring range C_e	0…1000 µF
Tolerance measurement of C_e	±10 % ±10 µF
Frequency range measurement of C_e	DC, 30…460 Hz
Min. insulation resistance measurement of C_e	depending on the profile and coupling mode, typ. > 10 kΩ

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm [2)]
Display range measured value	0.1 kΩ…20 MΩ
Operating uncertainty (according to IEC 61557-8)	±15 %, at least ±1 kΩ

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8)	≤ 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	I_{LmaxX1} = 10 mA + 7 mA/V * U_s [3)] (negative values are not allowed for I_{LmaxX1})

Digital Inputs (I1, I2, I3)

Number	3
Operating mode, adjustable	active high, active low
Functions	off, test, reset, deactivate device, start initial measurement
Voltage	Low DC -3…5 V, High DC 11…32 V
Tolerance Voltage	±10 %

Digital Outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4)], DC+ alarm [4)], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Voltage	passive DC 0…32 V, active DC 0/19.2…32 V

Analogue Output (M+)

Number	1
Operating mode	linear, midscale point 28 kΩ/120 kΩ
Functions	insulation value, DC offset
Current	0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kΩ)
Voltage	0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)
Tolerance related to the current/voltage final value	±20 %

Interfaces

Field bus:

Interface/protocol	web server/Modbus TCP/BCOM
Data rate	10/100 Mbit/s, autodetect
Max. amount Modbus requests	< 100/s
Cable length	≤ 100 m
Connection	RJ45
IP address	DHCP/manual 192.168.0.5
Network mask	255.255.255.0
BCOM address	system-1-0
Function	communication interface

Sensor bus:

Interface/protocol	RS-485/BS
Data rate	9.6 kBaud/s
Cable length	≤ 1200 m
Cable: twisted pair, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	terminals X1.A, X1.B
Terminating resistor at the beginning and at the end of the transmission path	120 Ω, can be connected internally
Device address, BS bus	1…90

Switching elements

Number of switching elements	2 changeover contacts
Operating mode	N/C operation/N/O operation
Contact 11-12-14	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Contact 21-22-24	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Electrical endurance under rated operating conditions, number of cycles	10.000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage ≤ 2000 m NN					250 V
Rated insulation voltage ≤ 3000 m NN					160 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 61326-2-4 [5]

Ambient temperatures:

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤ 3000 m NN

Connection

Connection type	pluggable screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals:

Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals X1:

Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other

Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [6]
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D)	108 x 93 x 110 mm
Weight	< 390 g

Option „W“ data different from the standard version

Rated operational current of switching elements	max. 3 A (for UL applications)

Ambient temperatures:

Operating temperature	-40…+70 °C -40…+65 °C (for UL applications)
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7

[1] At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

[2] Indication limited outside the temperature range -25…+55 °C.

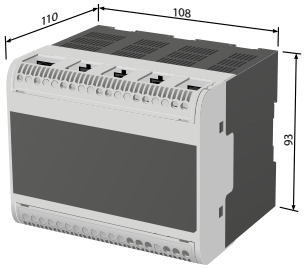
[3] U_s [Volt] = supply voltage ISOMETER®

[4] For $U_n \geq 50$ V only.

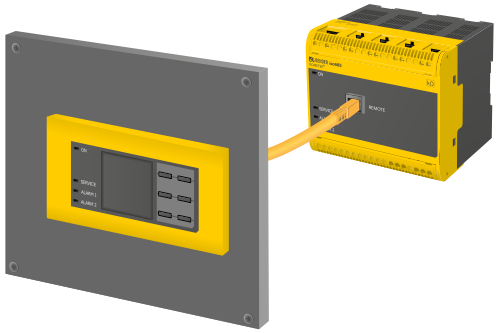
[5] This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.

[6] Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically). For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C. For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

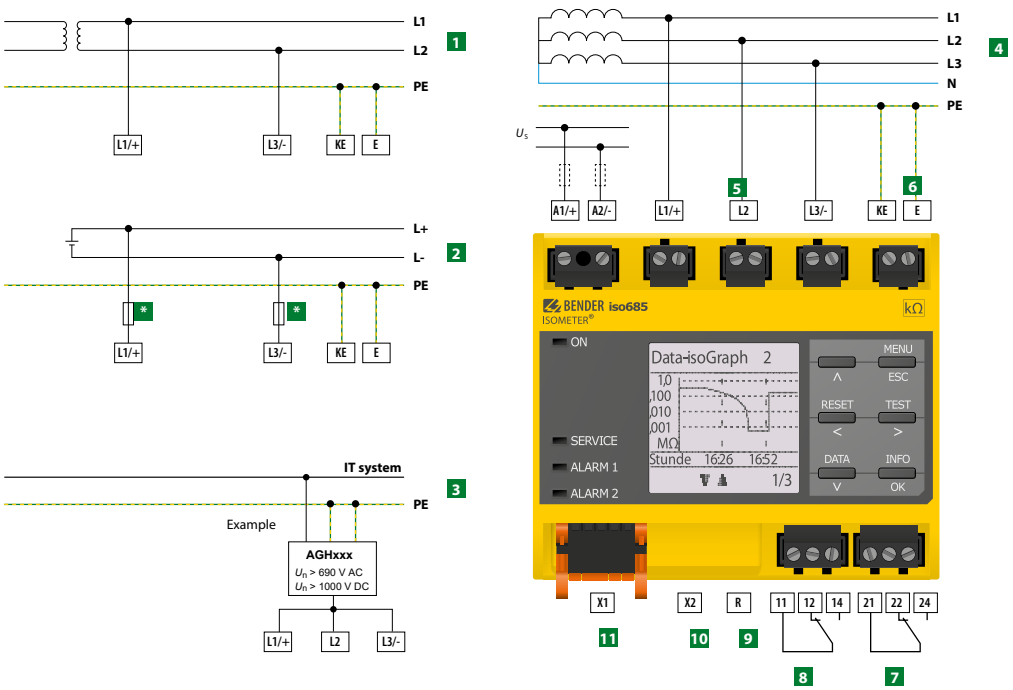
Dimension diagram (dimensions in mm)



Connection to FP200



Wiring diagram



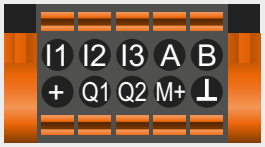
1 Connection to an AC system U_n
2 Connection to a DC system U_n
3 Connection to an IT system with coupling device
4 Connection to a 3(N)AC system
5 Connection to the IT system to be monitored (L1/+, L2, L3/-)
6 Separate connection of KE, E to PE
7 (K1) Alarm relay 1, available changeover contacts
8 (K2) Alarm relay 2, available changeover contacts
9 Switchable resistor R for RS-485 bus termination
10 Ethernet interface
11 Digital interface
* For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.

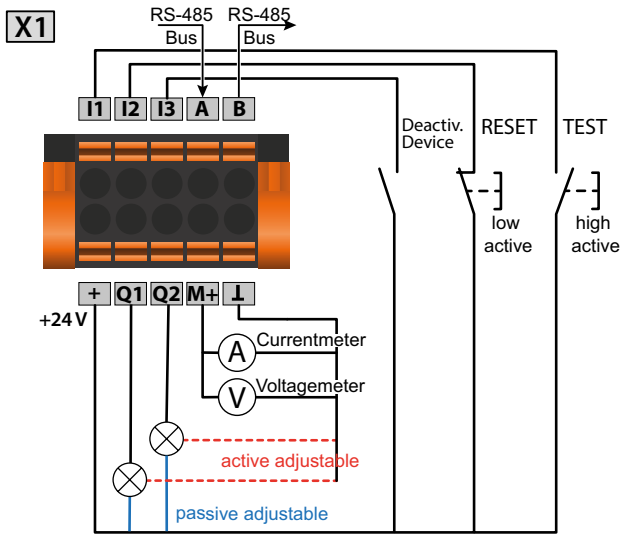
Provide line protection!
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

NOTE:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:
Use 60/70°C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.

Digital interface X1

Digital interface	Terminal	Colour
 X1	I1	Input 1
	I2	Input 2
	I3	Input 3
	A	RS-485 A
	B	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	⊥	Ground



ISOMETER® iso685-…-B

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- UPS systems, battery systems
- Heaters with phase control
- Systems including switched-mode power supplies
- IT systems with high leakage capacitances

Approvals

Device features

- Insulation monitoring for unearthed systems AC, 3(N)AC 0…690 V, DC 0…1000 V
- Two separately adjustable response values 1 kΩ…10 MΩ
- Combination of ***AMP***^{PLUS} and other profile-specific measurement methods
- Continuous measurement of capacitance, voltage and system frequency
- Predefined measurement profiles to meet different requirements
- Automatic adaptation to the system leakage capacitance
- INFO button to display devices and network settings
- Self-monitoring with automatic alarm message
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current and voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system
- Permanent coupling monitoring of the measuring lines
- Freely configurable digital and analogue inputs and outputs
- High-resolution graphic LC display
- IsoGraph function for time-related representation of the insulation resistance
- Remote setting and diagnosis via Internet (web server/option; COMTRAXX® Gateway)
- Modbus TCP, web server and BCOM
- Internal system isolating switch for use in coupled systems (ISOnet)
- Multilingual

Device variants

- **iso685-D-B**
  The device version iso685-D-B features a high-resolution graphic LC display and control elements for direct operating of the device functions.
- **iso685-S-B**
  The device version iso685-S-B neither features a display nor a control unit. It can only be used in combination with FP200 and is indirectly operated via this front panel.
- **Option "W"**
  Device variants with Option "W" are available for extreme climatic and mechanical conditions.

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage range U_n		Supply voltage U_S		Display	Option "W"	Type		Art. No.
AC	DC	AC	DC					
0…690 V; 1…460 Hz	0…1000 V	24…240 V; 50…400 Hz	24…240 V	■	–	iso685-D-B		B91067020
					-40…+70 °C, 3K5, 3M7	iso685W-D-B[1)]		B91067020W
				–	–	iso685-S-B +FP200		B91067220
					-40…+70 °C, 3K5, 3M7	iso685W-S-B +FP200W[1)]		B91067220W

Accessories

Description	Art. No.
A set of screw terminals[1)]	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) [1)]	B91067903
Transparent cover 144x72 (IP65) for FP200 [2)]	B98060005

[1)] included in the scope of delivery

[2)] If the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7 / -0 mm).

Suitable system components

Description	Type	Art. No.	Page
Device version without display	iso685-S-B	B91067120	–
	iso685W-S-B	B91067120W	–
Display for front panel mounting	FP200	B91067904	65
	FP200W	B91067904W	65
Coupling devices	AGH150W-4	B98018006	326
	AGH204S-4	B914013	328
	AGH520S	B913033	329
	AGH676S-4	B913055	332

Suitable measuring instruments on request!

Technical data

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2, L3/-
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3, X4)
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-5)	8 kV
IC2/(IC3-5)	4 kV
IC3/(IC4-5)	4 kV
IC4/IC5	4 kV
Rated insulation voltage:	
IC1/(IC2-5)	1000 V
IC2/(IC3-5)	250 V
IC3/(IC4-5)	250 V
IC4/IC5	250 V
Pollution degree for accessible parts on the outside of the device housing (U_n < 690 V)	3
Pollution degree for accessible parts on the outside of the device housing (U_n >690 < 1000 V)	2
Protective separation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1000 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC3/(IC4-5)	Overvoltage category III, 300 V
IC4/IC5	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-5)	AC 2,2 kV
IC3/(IC4-5)	AC 2,2 kV
IC4/IC5	AC 2,2 kV

Supply voltage

Supply via A1/+, A2/-:

Supply voltage range U_s	AC/DC 24…240 V
Tolerance of U_s	-30…+15%
Maximum permissible input current of U_s	650 mA
Frequency range of U_s	DC, 50…400 Hz [1)]
Tolerance of the frequency range of U_s	-5…+15 %
Power consumption, typically DC	≤ 12 W
Power consumption, typically 50/60 Hz	≤ 12 W/21 VA
Power consumption, typically 400 Hz	≤ 12 W/45 VA

Supply via X1:

Supply voltage U_s	DC 24 V
Tolerance of U_s	DC -20…+25 %

IT system being monitored

Nominal system voltage range U_n	AC 0…690 V DC 0…1000 V AC/DC 0…600 V (for UL applications)
Tolerance of U_n	AC/DC +15 %
Frequency range of U_n	DC, 0.1…460 Hz
Max. AC voltage $U_{\sim}$ in the frequency range f_n = 0.1…4 Hz	$U_{\sim\,max} = 50\ V/Hz^2 * (1 + f_n^2)$

Response values

Response value R_{an1} (alarm 1)	1 kΩ…10 MΩ
Response value R_{an2} (alarm 2)	1 kΩ…10 MΩ
Relative uncertainty (acc. to IEC 61557-8)	profile dependent, ±15 %, at least ±1 kΩ
Hysteresis	25 %, at least 1 kΩ

Time response

Response time t_{an} at R_F = 0.5 x R_{an} (R_{an} = 10 kΩ) and C_e = 1 µF according to IEC 61557-8	profile dependent, typ. 4 s (see diagrams in manual)
Response time DC alarm at C_e = 1 µF	profile dependent, typ. 2 s (see diagram in manual)
Start-up delay $T_{start-up}$	0…120 s

Measuring circuit

Measuring voltage U_m	profile dependent, ±10 V, ±50 V (see profile overview)
Measuring current I_m	≤ 403 µA
Internal resistance R_i, Z_i	≥ 124 kΩ
Internal resistance on decoupled systems (inactive by I/O, inactive by ISOnet or cut-off)	typ. 50 MΩ
Permissible extraneous DC voltage U_{fg}	≤ 1200 V
Permissible system leakage capacitance C_e	profile dependent, 0…1000 µF

Measuring ranges

Measuring range f_n	0.1…460 Hz
Tolerance measurement of f_n	±1 % ±0.1 Hz
Voltage range measurement of f_n	AC 25…690 V
Measuring range U_n	AC 25…690 V DC 0…1000 V
Voltage range measurement of U_n	AC/DC > 10 V
Tolerance measurement of U_n	±5 % ±5 V
Measuring range C_e	0…1000 µF
Tolerance measurement of C_e	±10 % ±10 µF
Frequency range measurement of C_e	DC, 30…460 Hz
Min. insulation resistance measurement of C_e	depending on the profile and coupling mode, typ. > 10 kΩ

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm [2)]
Display range measured value	0.1 kΩ…20 MΩ
Operating uncertainty (according to IEC 61557-8)	±15 %, at least ±1 kΩ

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8)	≤ 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	$I_{LmaxX1} = 10\ mA + 7\ mA/V * U_s$ [3)] (negative values are not allowed for I_{LmaxX1})

Digital Inputs (I1, I2, I3)

Number	3
Operating mode, adjustable	active high, active low
Functions	off, test, reset, deactivate device, start initial measurement
Voltage	Low DC -3…5 V, High DC 11…32 V
Tolerance Voltage	±10 %

Digital Outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4)], DC+ alarm [4)], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Voltage	passive DC 0…32 V, active DC 0/19.2…32 V

Analogue Output (M+)

Number	1
Operating mode	linear, midscale point 28 kΩ/120 kΩ
Functions	insulation value, DC offset
Current	0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kΩ)
Voltage	0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)
Tolerance related to the current/voltage final value	±20 %

Interfaces

Field bus:

Interface/protocol	web server/Modbus TCP/BCOM
Data rate	10/100 Mbit/s, autodetect
Max. amount Modbus requests	< 100/s
Cable length	≤ 100 m
Connection	RJ45
IP address	DHCP/manual 192.168.0.5
Network mask	255.255.255.0
BCOM address	system-1-0
Function	communication interface

ISOnet:

Number ISOnet devices	≤ 20
Max. nominal system voltage range ISOnet	AC 690 V; DC 1000 V

Sensor bus:

Interface/protocol	RS-485/BS
Data rate	9.6 kBaud/s
Cable length	≤ 1200 m
Cable: twisted pair, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	terminals X1.A, X1.B
Terminating resistor at the beginning and at the end of the transmission path	120 Ω, can be connected internally
Device address, BS bus	1…90

Switching elements

Number of switching elements	2 changeover contacts
Operating mode	N/C operation/N/O operation
Contact 11-12-14	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Contact 21-22-24	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Electrical endurance under rated operating conditions, number of cycles	10.000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage ≤ 2000 m NN					250 V
Rated insulation voltage ≤ 3000 m NN					160 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 61326-2-4 [5]

Ambient temperatures:

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤ 3000 m NN

Connection

Connection type	pluggable screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals:

Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals X1:

Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other

Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [6]
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D	108 x 93 x 110 mm
Weight	< 390 g

Option „W" data different from the standard version

Rated operational current of switching elements	max. 3 A (for UL applications)

Ambient temperatures:

Operating temperature	-40…+70 °C -40…+65 °C (for UL applications)
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7

[1] At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

[2] Indication limited outside the temperature range -25…+55 °C.

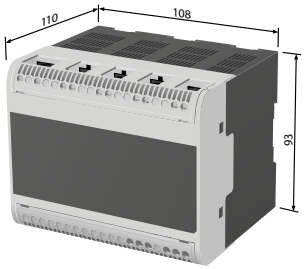
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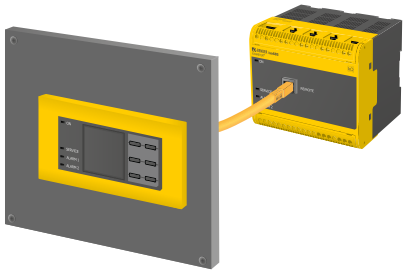
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For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

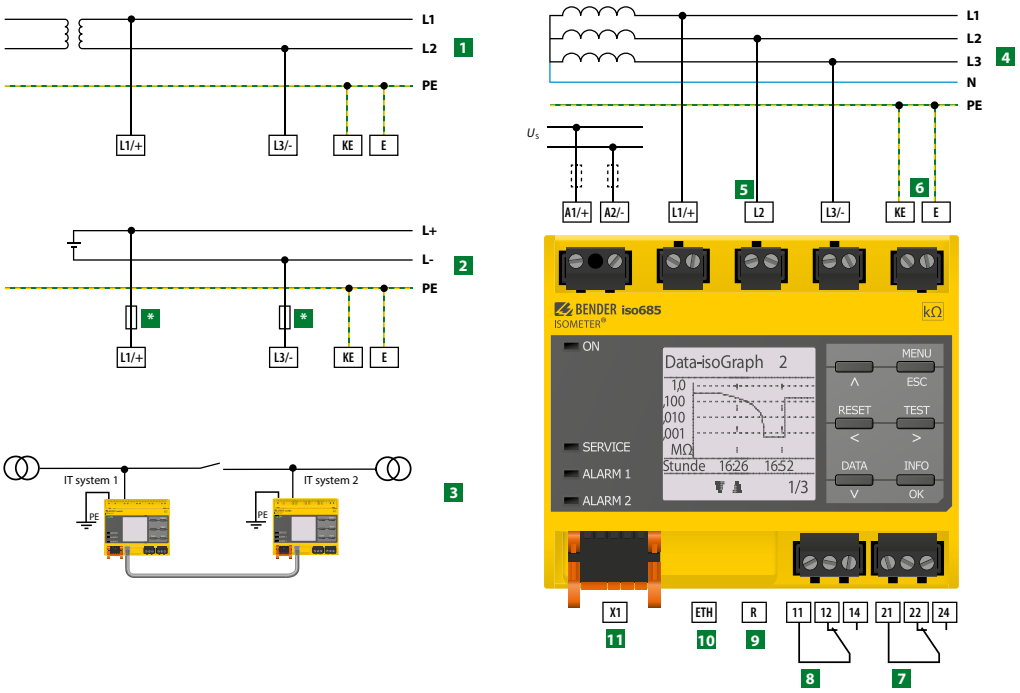
Dimension diagram (dimensions in mm)



Connection to FP200



Wiring diagram



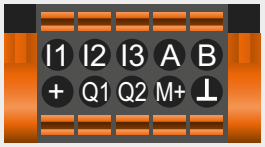
1 Connection to an AC system U_n
2 Connection to a DC system U_n
3 Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.
4 Connection to a 3(N)AC system
5 Connection to the IT system to be monitored (L1/+, L2, L3/-)
6 Separate connection of KE, E to PE
7 (K1) Alarm relay 1, available changeover contacts
8 (K2) Alarm relay 2, available changeover contacts
9 Switchable resistor R for RS-485 bus termination
10 Ethernet interface
11 Digital interface
* For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.

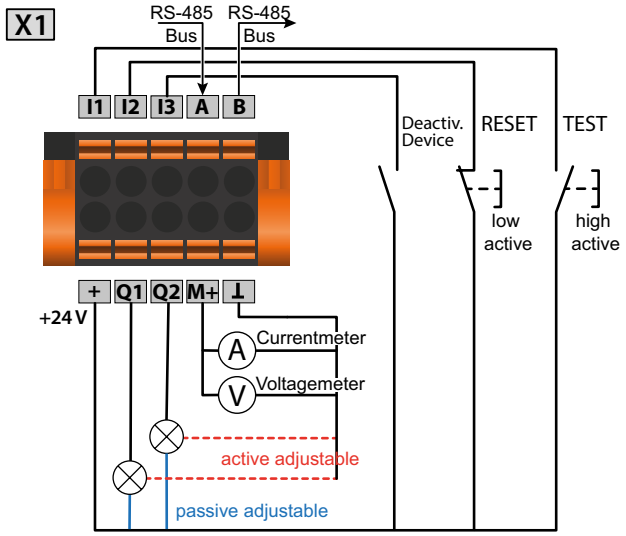
Provide line protection!
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

NOTE
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. Ensure short-circuit-proof and earth-fault-proof wiring.
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:
Use 60/70°C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.

Digital interface X1

Digital interface	Terminal	Colour
 X1	I1	Input 1
	I2	Input 2
	I3	Input 3
	A	RS-485 A
	B	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	⊥	Ground



ISOMETER® iso685-…-P

Insulation monitoring device with integrated locating current injector for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- UPS systems, battery systems
- Heaters with phase control
- Systems including switch-mode power supplies
- IT systems with high leakage capacitances
- Installations with insulation fault location

Approvals

Device features

iso685-…-P

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ for Alarm 1 and Alarm 2
- High-resolution graphical LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated), which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for data exchange with other Bender devices
- ISOnet: Internal separation of the ISOMETER® from the IT system to be monitored (e.g. if several IT systems are interconnected)
- BCOM, Modbus TCP and web server
- Locating current injection for selective insulation fault location
- Indication of the insulation faults selectively located by the EDS system
- Parameter setting of EDS systems
- Customer-specific texts for each measuring channel

EDS44x

- Insulation fault location in AC, 3AC and DC IT systems
- Up to 12 measuring current transformers of the W…, WR…, WS… measuring current transformer series can be connected
- Response sensitivity insulation fault location: EDS440 2…10 mA, EDS441 0.2…1 mA
- Response sensitivity residual current measurement: EDS440 100 mA…10 A, EDS441 100 mA…1 A
- Communication of the components via BS bus (RS-485) or BB bus

Device variants

- **iso685-D-P**
  The device variant ISOMETER® iso685-D-P features a high-resolution graphic LC display and operating controls for direct operation of the device functions. It **cannot** be combined with an FP200.
- **iso685-S-P**
  The device variant ISOMETER® iso685-S-P features **neither a display nor operating controls**. It can only be used in combination with the FP200 and it is operated via this front panel.
- **Option "W"**
  The ISOMETER®s with and without integrated display are available with option "W" for extreme climatic and mechanical conditions (ISOMETER® iso685W-D-P and iso685W-S-P).

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage range U_n		Supply voltage U_S		Display	Option "W" [1]	Type		Art. No.
AC	DC	AC	DC					
0…690 V; 0.1…460 Hz	0…1000 V	24…240 V; 50…400 Hz	24…240 V	integrated	–	iso685-D-P		B91067030
					-40…+70 °C, 3K5, 3M7	iso685W-D-P		B91067030W
				detached	–	iso685-S-P +FP200		B91067230
					-40…+70 °C, 3K5, 3M7	iso685W-S-P +FP200W		B91067230W

Insulation fault locators

Description	Supply voltage U_S [1]	Response value	Type	Art. No.	Page
Insulation fault locators	AC/DC 24…240V	2…10mA	EDS440-S-1	B91080201	154
			EDS440W-S-1	B91080201W	154
			EDS440-L-4	B91080202	154
			EDS440W-L-4	B91080202W	154
		0.2…1mA	EDS441-S-1	B91080204	154
			EDS441W-S-1	B91080204W	154
			EDS441-L-4	B91080205	154
			EDS441W-L-4	B91080205W	154
			EDS441-LAB-4	B91080207	154
			EDS441W-LAB-4	B91080207W	154
Relay module	DC 24 V	–	IOM441-S	B95012057	375
			IOM441W-S	B95012057W	375

[1] Absolute values

Accessories

Description	Art. No.
A set of screw-type terminals[1]	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) [1]	B91067903
Transparent cover 144x72 (IP65) for FP200 [2]	B98060005
BB bus 6TE connector [3]	B98110001

[1] included in the scope of delivery

[2] If the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7/-0 mm).

[3] Necessary for the connection of the ISOMETER®s with an EDS44…-S

Suitable system components

Description	Type	Art. No.	Page
Device version without display	iso685-S-P	B91067130	–
	iso685W-S-P	B91067130W	–
Display for front panel mounting	FP200	B91067904	65
	FP200W	B91067904W	65

Suitable measuring instruments on request!

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	(L1/+, L2, L3/-)
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3, X4)
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-5)	8 kV
IC2/(IC3-5)	4 kV
IC3/(IC4-5)	4 kV
IC4/IC5	4 kV
Rated insulation voltage:	
IC1/(IC2-5)	1000 V
IC2/(IC3-5)	250 V
IC3/(IC4-5)	250 V
IC4/IC5	250 V
Pollution degree for accessible parts on the outside of the device housing (U_n < 690 V)	3
Pollution degree for accessible parts on the outside of the device housing (U_n >690 < 1000 V)	2
Protective separation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1000 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC3/(IC4-5)	Overvoltage categoryIII, 300 V
IC4/IC5	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-5)	AC 2,2 kV
IC3/(IC4-5)	AC 2,2 kV
IC4/IC5	AC 2,2 kV

Supply voltage

Supply via A1/+, A2/-:

Supply voltage range U_s	AC/DC 24…240 V
Tolerance of U_s	-30…+15%
Maximum permissible input current of U_s	650 mA
Frequency range of U_s	DC, 50…400 Hz [1]
Tolerance of the frequency range of U_s	-5…+15 %
Power consumption, typically DC	≤ 12 W
Power consumption, typically 50/60 Hz	≤ 12 W/21 VA
Power consumption, typically 400 Hz	≤ 12 W/45 VA

Supply via X1:

Supply voltage U_s	DC 24 V
Tolerance of U_s	DC -20…+25 %

IT system being monitored

Nominal system voltage range U_n	AC 0…690 V DC 0…1000 V AC/DC 0…600 V (for UL applications)
Tolerance of U_n	AC/DC +15 %
Frequency range of U_n	DC 0.1…460 Hz
Max. AC voltage $U_{\sim}$ in the frequency range f_n = 0.1…4 Hz	$U_{\sim\ max} = 50\ V/Hz^2 * (1 + f_n^2)$

Response values

Response value R_{an1} (alarm 1)	1 kΩ…10 MΩ
Response value R_{an2} (alarm 2)	1 kΩ…10 MΩ
Relative uncertainty (acc. to IEC 61557-8)	dependent on the profile, ±15 %, at least ±1 kΩ
Hysteresis	25 %, at least 1 kΩ

Time response

Response time t_{an} at R_F = 0.5 x R_{an} (R_{an} = 10 kΩ) and C_e = 1 µF according to IEC 61557-8	profile dependent, typ. 4 s (see diagrams in manual)
Response time DC alarm at Ce = 1 µF	profile dependent, typ. 2 s (see diagram in manual)
Start-up delay $T_{start-up}$	0…120 s

Measuring circuit

Measuring voltage U_m	profile dependent, ±10 V, ±50 V (see profile overview)
Measuring current Im	≤ 403 µA
Internal resistance R_i, Z_i	≥ 124 kΩ
Internal resistance on decouppled systems (inactive by I/O, inactive by ISOnet or cut-off)	typ. 50 MΩ
Permissible extraneous DC voltage U_{fg}	≤ 1200 V
Permissible system leakage capacitance C_e	profile dependent, 0…1000 µF

Measuring ranges

Measuring range f_n	0.1…460 Hz
Tolerance measurement of f_n	±1 % ±0.1 Hz
Voltage range measurement of f_n	AC 25…690 V
Measuring range U_n	AC 25…690 V DC 0…1000 V
Voltage range measurement of U_n	AC/DC > 10 V
Tolerance measurement of U_n	±5 % ±5 V
Measuring range C_e	0…1000 µF
Tolerance measurement of C_e	±10 % ±10 µF
Frequency range measurement of C_e	DC, 30…460 Hz
Min. insulation resistance measurement of C_e	depending on the profile and coupling mode, typ. > 10 kΩ

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm [2]
Display range measured value	0.1 kΩ…20 MΩ
Operating uncertainty (according to IEC 61557-8)	±15 %, at least ±1 kΩ

LEDs

ON (operation LED)	green
PGH ON	yellow
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8)	≤ 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	$I_{LmaxX1} = 10\ mA + 7\ mA/V * U_s$ [3] (negative values are not allowed for I_{LmaxX1})

Digital Inputs (I1, I2, I3)

Number	3
Operating mode, adjustable	active high, active low
Functions	off, test, reset, deactivate device, start initial measurement, insulation fault location
Voltage	Low DC -3…5 V, High DC 11…32 V
Tolerance Voltage	±10 %

Digital Outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS
Voltage	passive DC 0…32 V, active DC 0/19.2…32 V

Analogue Output (M+)

Number	1
Operating mode	linear, midscale point 28 kΩ/120 kΩ
Functions	insulation value, DC offset
Current	0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kΩ)
Voltage	0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)
Tolerance related to the current/voltage final value	±20 %

Interfaces

Field bus:

Interface/protocol	web server/Modbus TCP/BCOM
Data rate	10/100 Mbit/s, autodetect
Max. amount Modbus requests	< 100/s
Cable length	≤ 100 m
Connection	RJ45
IP address	DHCP/manual* 192.168.0.5*
Network mask	255.255.255.0*
BCOM address	system-1-0
Function	communication interface

ISOnet:

Number ISOnet devices	0…20 devices
Max. nominal system voltage range ISOnet	AC 690 V/DC 1000 V

EDSsync:

Number EDSsync devices	2…10 devices

ISOloop

Number ISOloop devices	2…10 devices

Sensor bus:

Interface/protocol	RS-485/BB-Bus
Data rate	9.6 kBaud/s
Cable length	≤ 1200 m
Cable: twisted pair, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	terminals X1.A, X1.B
Terminating resistor	120 Ω, can be connected internally
Device address	1…90

Switching elements

Number of switching elements	2 changeover contacts
Operating mode	N/C operation/N/O operation
Contact 11-12-14	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS
Contact 21-22-24	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm, common alarm EDS
Electrical endurance under rated operating conditions, number of cycles	10.000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage ≤ 2000 m NN					250 V
Rated insulation voltage ≤ 3000 m NN					160 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 61326-2-4 [5]

Ambient temperatures:

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤ 3000 m NN

Connection

Connection type	pluggable screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals:

Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals X1:

Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other

Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [6]
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D)	108 x 93 x 110 mm
Weight	< 510 g

Option "W" data different from the standard version

Rated operational current of switching elements	max. 3 A (for UL applications)

Ambient temperatures:

Operating temperature	-40…+70 °C -40…+65 °C (for UL applications)
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7

[1] At a frequency > 200 Hz, the connection of X1 ande Remote must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

[2] Indication limited outside the temperature range -25…+55 °C.

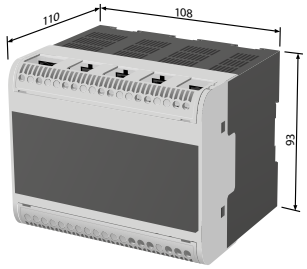
[3] U_s [Volt] = ISOMETER® supply voltage

[4] For $U_n \geq 50$ V only.

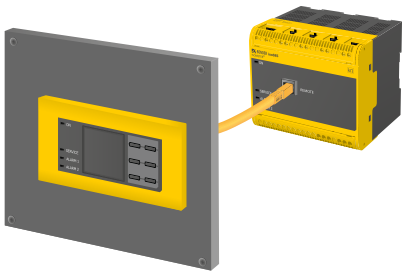
[5] This is a class A product. This product may cause radio interference in residential areas. In this case, the user may be required to take corrective actions.

[6] Recommendation: Devices mounted at 0° (display oriented, cooling slots must be ventilated vertically) For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C. For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

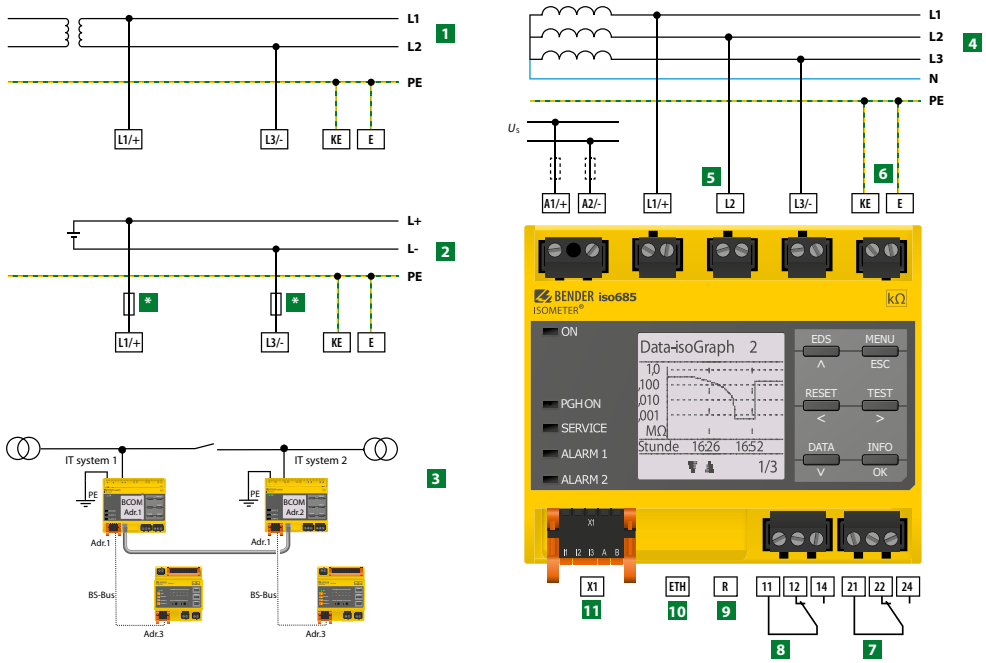
Dimension diagram (dimensions in mm)



Connection to FP200



Wiring diagram



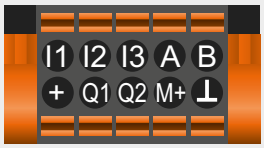
1 Connection to an AC system U_n
2 Connection to a DC system U_n
3 Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.
4 Connection to a 3(N)AC system
5 Connection to the IT system to be monitored (L1/+, L2, L3/-)
6 Separate connection of KE, E to PE
7 (K1) Alarm relay 1, available changeover contacts
8 (K2) Alarm relay 2, available changeover contacts
9 Switchable resistor R for RS-485 bus termination
10 Ethernet interface
11 Digital interface
* For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.

Provide line protection!
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

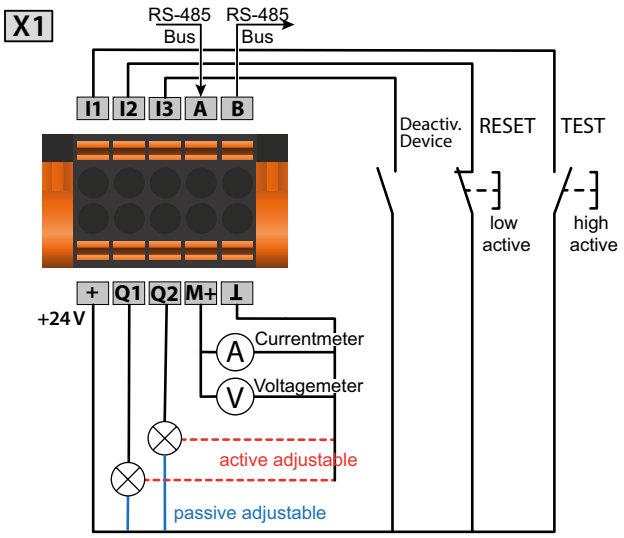
Note
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum.
(A short-circuit-proof and earth-fault-proof wiring is recommended).
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

Digital interface X1

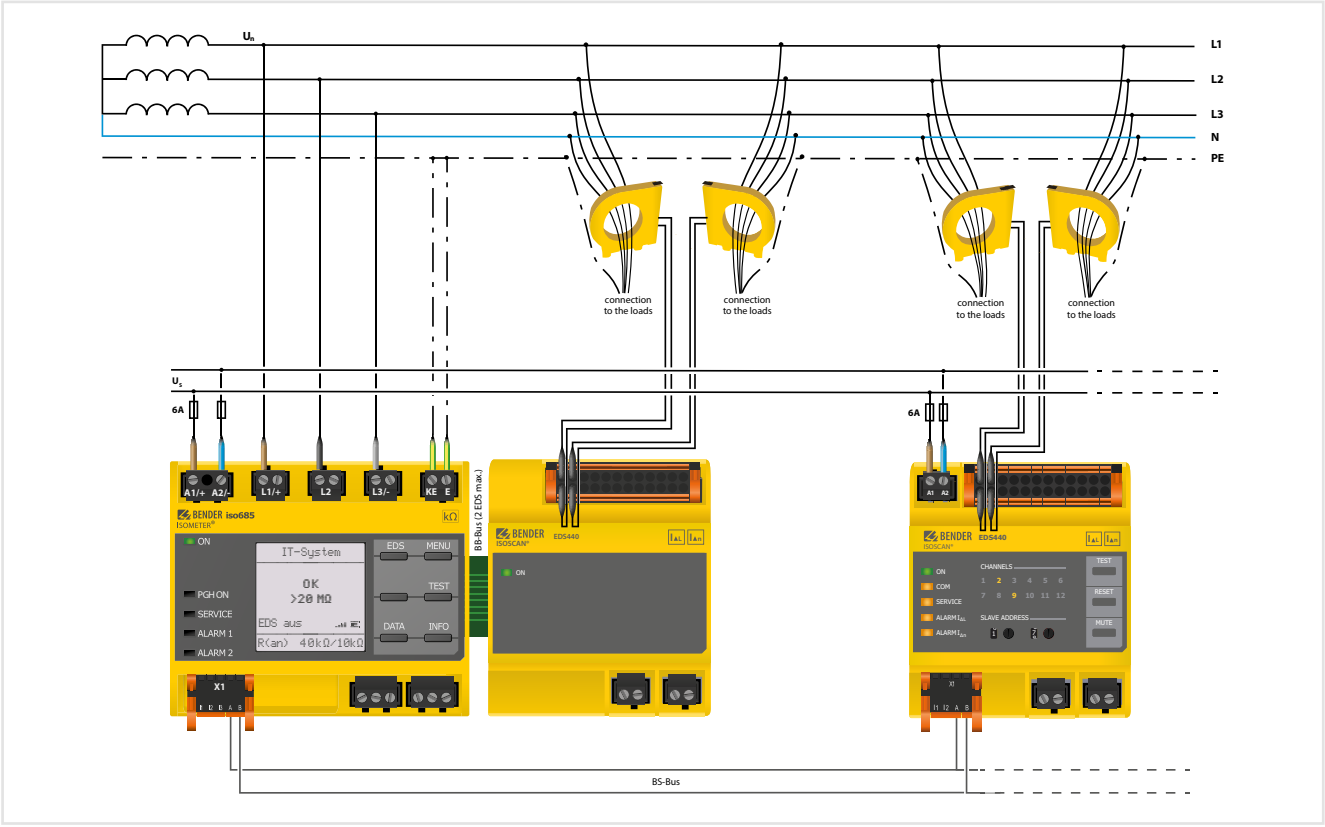
Digital interface	Terminal	Colour
	I1	Input 1
	I2	Input 2
	I3	Input 3
	A	RS-485 A
	B	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	⊥	Ground



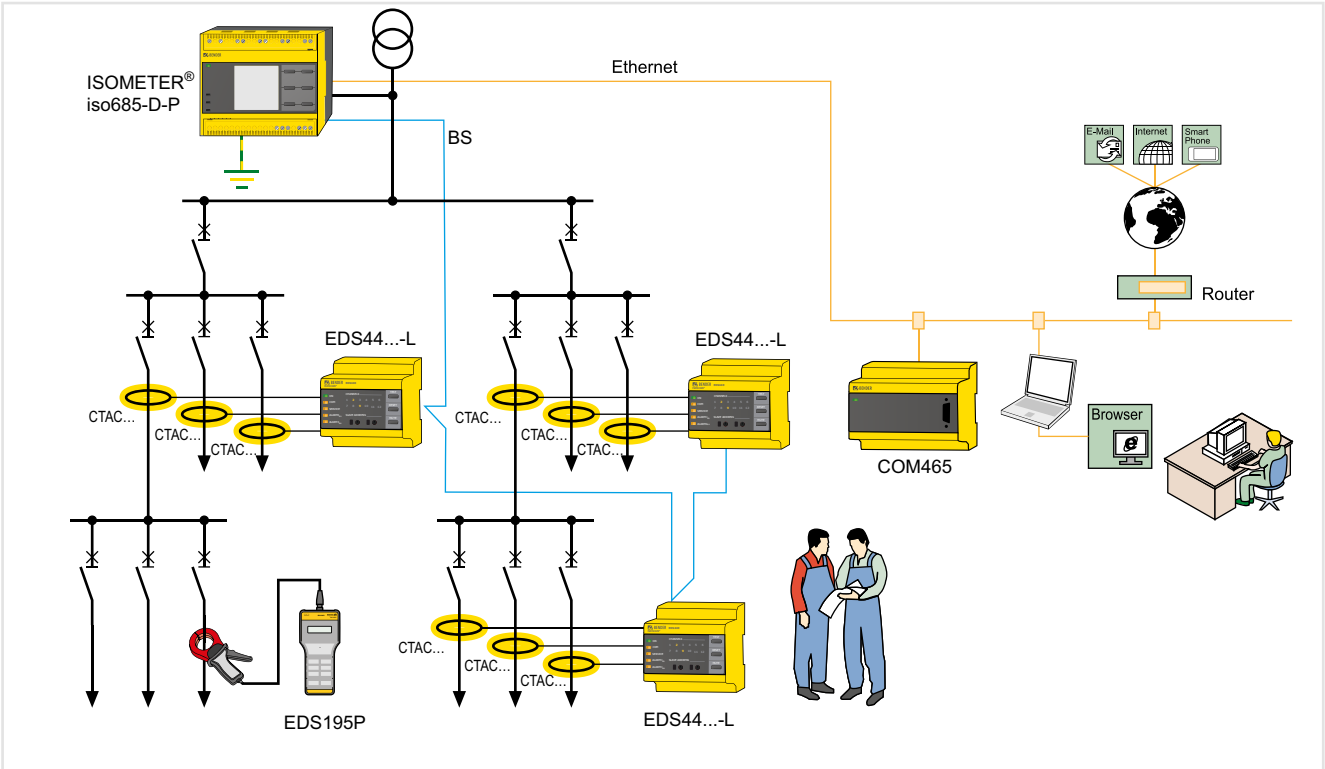
X1



Connection example ISOMETER® with insulation fault locators



System setup



ISOMETER® isoNAV685-D

Insulation monitoring device for IT AC systems with galvanically connected rectifiers and converters

AC/DC



Typical applications

- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- Systems including switch mode power supplies
- Systems including frequency inverters

Approvals

Device features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of ***AMP***^{Plus} and other profile-dependent measurement methods
- An adjustable response value for insulation monitoring in the range of 1 kΩ…10 MΩ (factory setting = 5 kΩ) and a response value of 150 V for the DC offset voltage
- High-resolution graphic LC display for excellent readability and recording of the device status
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- BCOM, Modbus TCP and web server.

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage range U_n		Supply voltage U_S		Type		Art. No.
AC	DC	AC	DC			
0…690 V; 1…460 Hz	0…1000 V	24…240 V; 50…400 Hz	24…240 V	isoNAV685-D		B91067014

Accessories

Description	Art. No.
A set of screw-type terminals[1)]	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) [1)]	B91067903
Front cover 144x72 transparent (for IP65)	B98060005

[1)] included in the scope of delivery

Suitable measuring instruments on request!

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	(L1/+, L2, L3/-)
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3)
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-5)	8 kV
IC2/(IC3-5)	4 kV
IC3/(IC4-5)	4 kV
IC4/IC5	4 kV
Rated insulation voltage:	
IC1/(IC2-5)	1000 V
IC2/(IC3-5)	250 V
IC3/(IC4-5)	250 V
IC4/IC5	250 V
Pollution degree for accessible parts on the outside of the device housing (U_n < 690 V)	3
Pollution degree for accessible parts on the outside of the device housing (U_n >690 < 1000 V)	2
Protective separation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1000 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC3/(IC4-5)	Overvoltage categoryIII, 300 V
IC4/IC5	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-5)	AC 2,2 kV
IC3/(IC4-5)	AC 2,2 kV
IC4/IC5	AC 2,2 kV

Supply voltage

Supply via A1/+, A2/-:

Supply voltage range U_s	AC/DC 24…240 V
Tolerance of U_s	-30…+15 %
Maximum permissible input current of U_s	650 mA
Frequency range of U_s	DC, 50…400 Hz [1]
Tolerance of the frequency range of U_s	-5…+15 %
Power consumption, typically 50/60 Hz	≤ 12 W/21 VA
Power consumption, typically 400 Hz	≤ 12 W/45 VA

Supply via X1:

Supply voltage U_s	DC 24 V
Tolerance of U_s	DC -20…+25 %

IT system being monitored

Nominal system voltage range U_n	AC 0…690 V; DC 0…1000 V AC/DC 0…600 V (for UL applications)
Tolerance of U_n	AC/DC +15 %
Frequency range of U_n	60 Hz

Response values

Response value R_{an1} (alarm 1)	1 kΩ…10 MΩ
Response value DC residual voltage (Alarm 2) (U_{DC})	20 V…1 k V
Relative uncertainty (acc. to IEC 61557-8)	profile dependent, ±15 %, at least ±1 kΩ
Hysteresis	25 %, at least 1 kΩ

Time response

Response time t_{an} for DC residual voltage > 1,1xU_{DC} and Alarm 1	max. 150 ms [2]
Response time t_{an} at R_F = 0.5 x R_{an} (R_{an} = 10 kΩ) and C_e = 1 µF acc. to IEC 61557-8	profile dependent, typ. 4 s (see diagrams in manual)
Startup delay $T_{startup}$	0…120 s

Measuring circuit

Measuring voltage U_m	±50 V
Measuring current I_m	≤ 403 µA
Internal resistance R_i, Z_i	≥ 124 kΩ
Permissible extraneous DC voltage U_{fg}	≤ 1200 V
Permissible system leakage capacitance C_e	profile dependent, 0…150 µF

Measuring ranges

Measuring range f_n	10…460 Hz
Tolerance measurement of f_n	±1 % ±0.1 Hz
Voltage range measurement of f_n	AC 25…690 V
Measuring range U_n	AC 25…690 V
Voltage range measurement of U_n	AC/DC > 10 V
Tolerance measurement of U_n	±5 % ±5 V
Measuring range C_e	0…1000 µF
Tolerance measurement of C_e	±10 % ±10 µF
Min. insulation resistance measurement of C_e	depending on the profile and coupling mode, typ. > 10 kΩ

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm [3]
Display range measured value	0.1 kΩ…20 MΩ
Operating uncertainty (according to IEC 61557-8)	±15 %, at least ±1 kΩ

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1 (Iso. Alarm 1)	yellow
ALARM 2 (Insulation fault + DC offset fault)	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8)	≤ 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	$I_{LmaxX1} = 10\ mA + 7\ mA/V * U_s$ [3] (negative values are not allowed for I_{LmaxX1})

Digital Inputs (I1, I2, I3)

Number	3
Operation mode, adjustable	active high, active low
Functions	none, test, reset, device deactivated, initial measurement
Voltage:	Low DC -3…5 V, High DC 11…32 V
Tolerance Voltage	±10 %

Digital Outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	none, insulation Alarm 1, insulation fault + DC residual voltage, connection fault, device fault, collective alarm, measurement ended, device inactive
Voltage	passive DC 0…32 V, active DC 0/19.2…32 V

Analogue Output (M+)

Number	1
Operating mode	linear, midscale point 28 kΩ/120 kΩ
Functions	insulation value, DC offset
Current	0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kΩ)
Voltage	0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)
Tolerance related to the current/voltage final value	±20 %

Interfaces

Field bus:

Interface/protocol	web server/Modbus TCP/BCOM
Data rate	10/100 Mbit/s, autodetect
Max. amount Modbus requests	< 100/s
Cable length	≤ 100 m
Connection	RJ45
IP address	DHCP/manual 192.168.0.5
Network mask	255.255.255.0
BCOM address	system-1-0
Function	communication interface

Switching elements

Number of switching elements	2 changeover contacts
Operating mode	N/C operation/N/O operation
Contact 11-12-14	none, insulation Alarm 1, insulation fault + DC residual voltage, connection fault, device fault, collective alarm, measurement ended, device inactive
Contact 21-22-24	none, insulation Alarm 1, insulation fault + DC residual voltage, connection fault, device fault, collective alarm, measurement ended, device inactive
Electrical endurance under rated operating conditions, number of cycles	10.000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage ≤ 2000 m NN					250 V
Rated insulation voltage ≤ 3000 m NN					160 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Environment/EMC	
EMC	IEC 61326-2-4 [5]
Ambient temperatures:	
Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤ 3000 m NN

Connection	
Connection type	pluggable screw-type terminal or push-wire terminal
Screw-type terminals:	
Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Push-wire terminals:	
Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals X1:	
Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other	
Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [6]
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D)	108 x 93 x 110 mm
Weight	< 390 g

[1] At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

[2] Fast tripping only works in IT networks with a mains frequency of 60 Hz.

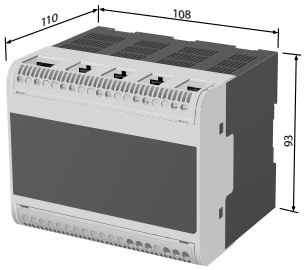
[3] Indication limited outside the temperature range -25…+55 °C.

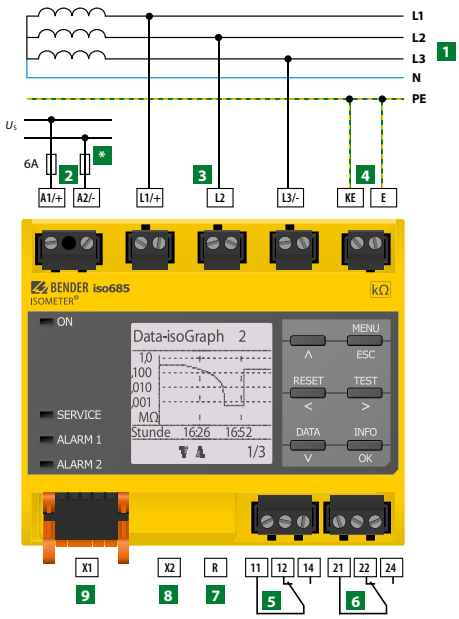
[4] U_s [Volt] = supply voltage ISOMETER®

[5] This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.

[6] Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically).
For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

Dimension diagram (dimensions in mm)



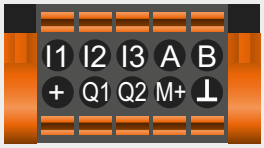


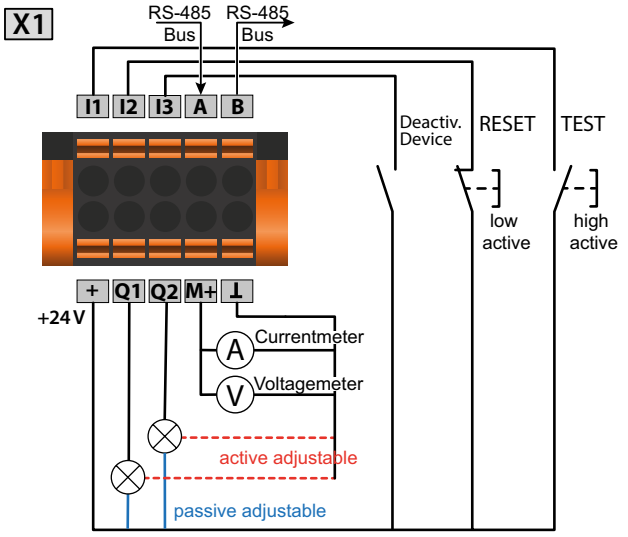
1 Connection to a 3(N)AC system
2 Supply voltage U_S (see nameplate) via 6 A fuse
3 Connection to the IT system to be monitored (L1/+, L2, L3/-)
4 Separate connection of KE, E to PE
5 (K1) Alarm relay 1, available changeover contacts
6 (K2) Alarm relay 2, available changeover contacts
7 Switchable resistor R for RS-485 bus termination
8 Ethernet interface
9 Digital interface
* 6 A fuse for systems > 690 V

NOTE:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:
Use 60/70 °C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.

Digital interface X1

Digital interface	Terminal	Colour
 X1	I1	Input 1
	I2	Input 2
	I3	Input 3
	A	RS-485 A
	B	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	⊥	Ground



Connection to X1

CAUTION

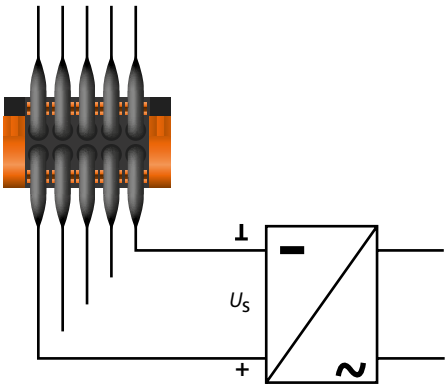
Danger of damage to property due to faulty connections!

The device can be damaged if the unit is simultaneously connected to the supply voltage via the X1 interface, and A1/+and A2/- terminals. Do not connect the device simultaneously via X1, and A1/+and A2/-to different supply voltages.

CAUTION

Danger of damage to property due to incorrect nominal voltage!

When the device is powered via the X1 interface, the nominal voltage must be 24 V otherwise the unit may be damaged. Only connect a nominal voltage of 24 V to the X1 interface.



ISOMETER® isoNAV685-D-B

Insulation monitoring device for offline monitoring of de-energised loads

AC/DC



Typical applications

- Monitoring of de-energised loads and systems

Approvals

Device features

- ISOMETER® to monitor the insulation resistance in de-energised systems
- Automatic adaptation to the existing system leakage capacitance
- ***AMP***^{Plus} measurement method
- An adjustable response value in the range 10 kΩ…1 MΩ (factory setting = 50 kΩ)
- High-resolution graphic LC display for excellent readability and recording of the device status
- Earth connection monitoring
- Automatic device self test
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® Gateway)
- Worldwide remote diagnosis via the Internet
- BCOM, Modbus TCP and web server

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage range U_n	Supply voltage U_S		Type		Art. No.
	AC	DC			
offline	100…240 V; 47…460 Hz	24 V, 100…240 V	isoNAV685-D-B		B91067024

Accessories

Description	Art. No.
A set of screw-type terminals[1)]	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) [1)]	B91067903

[1)] included in the scope of delivery

Suitable measuring instruments on request!

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	(L1/+, L2, L3/-)
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3, X4)
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-5)	8 kV
IC2/(IC3-5)	4 kV
IC3/(IC4-5)	4 kV
IC4/IC5	4 kV
Rated insulation voltage:	
IC1/(IC2-5)	1000 V
IC2/(IC3-5)	250 V
IC3/(IC4-5)	250 V
IC4/IC5	250 V
Pollution degree for accessible parts on the outside of the device housing (U_n < 690 V)	3
Pollution degree for accessible parts on the outside of the device housing (U_n >690 < 1000 V)	2
Protective separation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1000 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC3/(IC4-5)	Overvoltage categoryIII, 300 V
IC4/IC5	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-5)	AC 2,2 kV
IC3/(IC4-5)	AC 2,2 kV
IC4/IC5	AC 2,2 kV

Supply voltage

Supply via A1/+, A2/-:

Supply voltage range U_s	AC/DC 24…240 V
Tolerance of U_s	-30…+15%
Maximum permissible input current of U_s	650 mA
Frequency range of U_s	DC, 50…400 Hz [1]
Tolerance of the frequency range of U_s	-5…+15 %
Power consumption, DC	≤ 12 W
Power consumption, typically 50/60 Hz	≤ 12 W/21 VA
Power consumption, typically 400 Hz	≤ 12 W/45 VA

Supply via X1:

Supply voltage U_s	DC 24 V
Tolerance of U_s	DC -20…+25 %

IT system being monitored

Nominal system voltage range U_n	offline
Circuit capacity internal mains switch	AC 0…690 V; DC 0…1000 V AC/DC 0…600 V (for UL applications)

Response values

Response value R_{an1} (alarm 1)	1 kΩ…10 MΩ
Response value R_{an2} (alarm 2)	1 kΩ…10 MΩ
Relative uncertainty (acc. to IEC 61557-8)	profile dependent, ±15 %, at least ±1 kΩ
Hysteresis	25 %, at least 1 kΩ

Time response

Response time t_{an} at R_F = 0.5 x R_{an} (R_{an} = 10 kΩ) and C_e = 1 µF according to IEC 61557-8	30 s
Start-up delay $T_{start-up}$	0…120 s

Measuring circuit

Measuring voltage U_m	±5 V
Measuring current I_m	≤ 13,4 µA
Internal resistance R_i, Z_i	≥ 372 kΩ
Permissible extraneous DC voltage U_{fg}	≤ 1200 V
Permissible system leakage capacitance C_e	150 µF

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm [2]
Display range measured value	0.1 kΩ…20 MΩ
Operating uncertainty (according to IEC 61557-8)	±15 %, at least ±1 kΩ

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1 (L1 and L2)	yellow
ALARM 2 (L3)	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8)	≤ 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	I_{LmaxX1} = 10 mA + 7 mA/V * U_s [3] (negative values are not allowed for I_{LmaxX1})

Digital Inputs (I1, I2, I3)

Number	3
Operating mode, adjustable	active high, active low
Functions	none, test, reset, device deactivated
Voltage:	Low DC -3…5 V, High DC 11…32 V
Tolerance Voltage	±10 %

Digital Outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm
Voltage	passive DC 0…32 V, active DC 0/19.2…32 V

Interfaces

Field bus:

Interface/protocol	web server/Modbus TCP/BCOM
Data rate	10/100 Mbit/s, autodetect
Max. amount Modbus requests	< 100/s
Cable length	≤ 100 m
Connection	RJ45
IP address	DHCP/manual 192.168.0.5
Network mask	255.255.255.0
BCOM address	system-1-0
Function	communication interface

Switching elements

Number of switching elements	2 changeover contacts
Operating mode	N/C operation/N/O operation
Contact 11-12-14	off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm
Contact 21-22-24	off, connection fault, Alarm L1, Alarm L2, Alarm L3, device fault, common alarm
Electrical endurance under rated operating conditions, number of cycles	10.000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage ≤ 2000 m NN					250 V
Rated insulation voltage ≤ 3000 m NN					160 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 61326-2-4 [4]

Ambient temperatures:

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤ 3000 m NN

Connection	
Connection type	pluggable screw-type terminal or push-wire terminal
Screw-type terminals:	
Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Push-wire terminals:	
Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Push-wire terminals X1:	
Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other	
Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [5]
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D)	108 x 93 x 110 mm
Weight	< 390 g

[1] At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

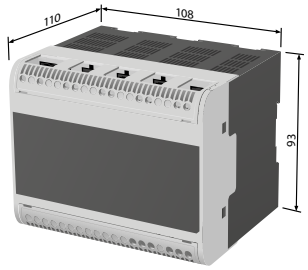
[2] Indication limited outside the temperature range -25…+55 °C.

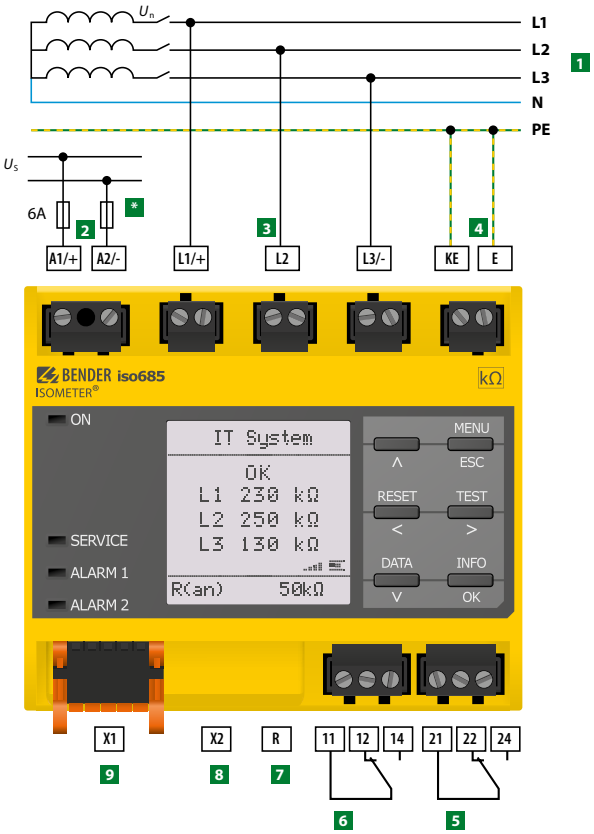
[3] U_s [Volt] = supply voltage ISOMETER®

[4] This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.

[5] Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically).
For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

Dimension diagram (dimensions in mm)



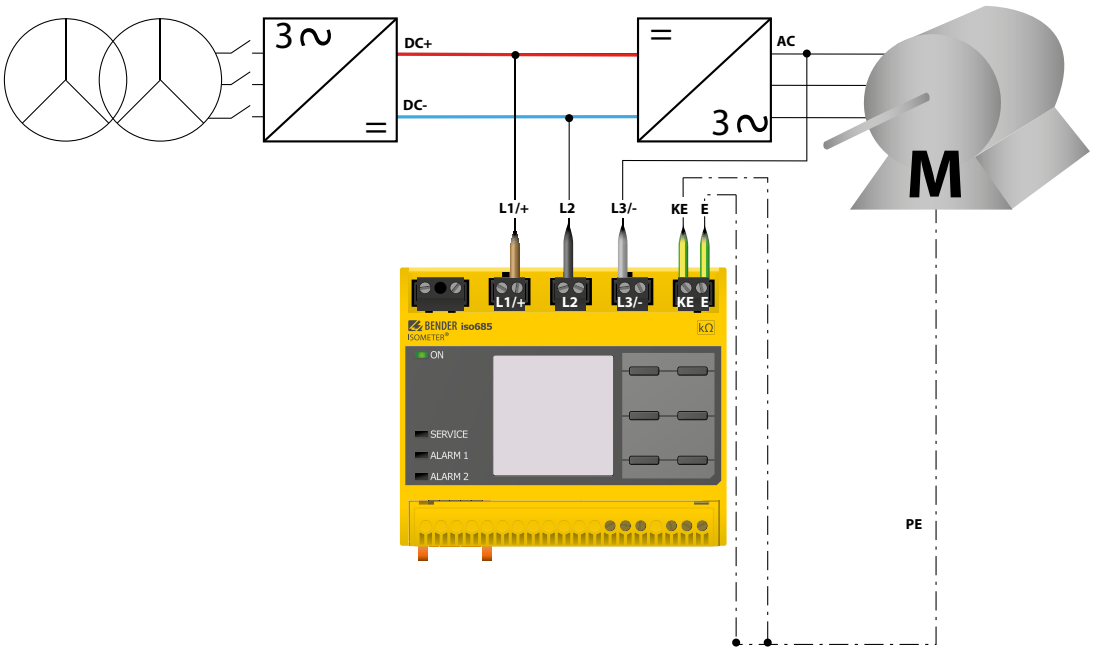


1 Connection to a 3(N)AC system
2 Supply voltage U_S (see nameplate) via 6 A fuse
3 Connection to the IT system to be monitored (L1/+, L2, L3/-)
4 Separate connection of KE, E to PE
5 (K1) Alarm relay 1, available changeover contacts
6 (K2) Alarm relay 2, available changeover contacts
7 Switchable resistor R for RS-485 bus termination
8 Ethernet interface
9 Digital interface
* 6 A fuse for systems > 690 V

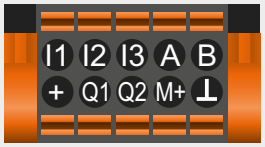
NOTE:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

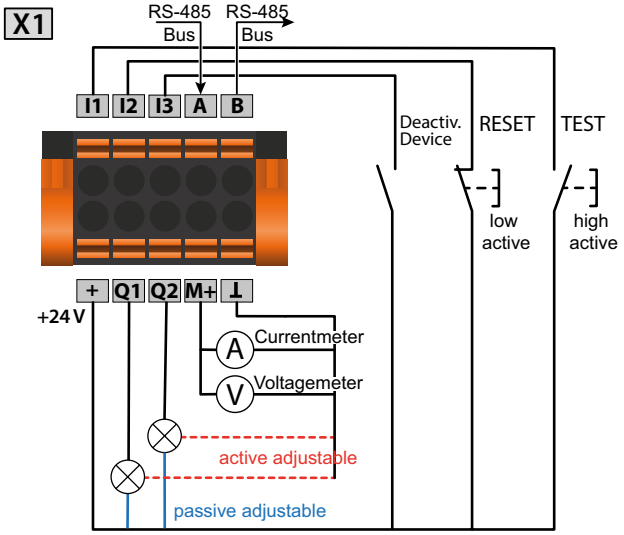
For UL applications:
Use 60/70 °C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.

Anschluss an einen Frequenzumrichter zur Überwachung im abgeschalteten Zustand (Offline)



Digital interface X1

Digital interface	Terminal	Colour
 X1	I1	Input 1
	I2	Input 2
	I3	Input 3
	A	RS-485 A
	B	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	⊥	Ground



Connection to X1

CAUTION

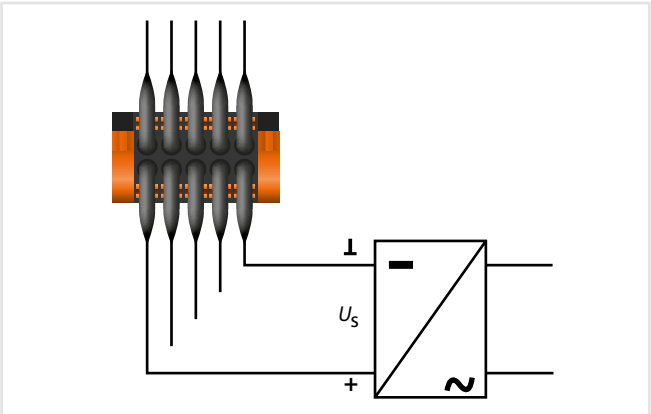
Danger of damage to property due to faulty connections!

The device can be damaged if the unit is simultaneously connected to the supply voltage via the X1 interface, and A1/+and A2/- terminals. Do not connect the device simultaneously via X1, and A1/+and A2/-to different supply voltages.

CAUTION

Danger of damage to property due to incorrect nominal voltage!

When the device is powered via the X1 interface, the nominal voltage must be 24 V otherwise the unit may be damaged. Only connect a nominal voltage of 24 V to the X1 interface.



ISOMETER® isoHR685W-x-I-B

Insulation monitoring device for IT AC systems with galvanically connected rectifiers and inverters and for IT DC systems

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- UPS systems, battery systems
- Heaters with phase control
- Systems including switch-mode power supplies
- coupled IT systems with high leakage capacitances
- Monitoring of long capacitive coupled lines

Approvals

Device features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of AMPPlus and other profilespecific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…3 GΩ
- High-resolution graphic LC display
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current or voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated), which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver/Option: COMTRAXX® gateway).
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for communication with other Bender devices
- BCOM, Modbus TCP and web server
- isoData – Recording of measured data
- ISOsync – timely synchronization of measurement processes

Device variants

- **isoHR685W–D–I–B**
  The device version isoHR685W-D-I-B features a high-resolution graphical LC display and control elements for direct operation of the device functions. It **cannot** be combined with an FP200.
- **isoHR685W–S–I–B**
  The isoHR685W–S–I–B device contains **no display** and **no operating unit**. It can **only be used in combination with FP200W** and is indirectly operated via this front panel.

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage range U_n		Supply voltage U_S		Display	Type		Art. No.
AC	DC	AC	DC				
0…1000 V 0,1…460 Hz	0…1300 V	24…240 V; 50…400 Hz	24…240 V	integrated	isoHR685W–D–I–B		B91067025W
				detached	isoHR685W–S–I–B + FP200W [1]		B91067225W

[1] Only available in combination

Accessories

Description	Art. No.
A set of screw terminals[1)]	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) [1)]	B91067903
Transparent cover 144x72 (IP65) for FP200 [2)]	B98060005

[1)] included in the scope of delivery

[2)] If the "transparent front cover 144x72 (IP65)" is used, the cutout in the control cabinet must be increased in height from 66 mm to 68 mm (+ 0.7 / -0 mm).

Suitable system components

Description	Type	Art. No.	Page
Device version without display	isoHR685W-S-I-B	B91067125W	
Display for front panel mounting	FP200W	B91067904W	65
Coupling devices	AGH150W-4	B98018006	326
	AGH204S-4	B914013	328
	AGH520S	B913033	329
	AGH676S-4	B913055	332

Suitable measuring instruments on request!

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2, L3/-
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3, X4)
Rated voltage	1300 V
Overvoltage category	II
Rated impulse voltage:	
IC1/(IC2-5)	8 kV
IC2/(IC3-5)	4 kV
IC3/(IC4-5)	4 kV
IC4/IC5	4 kV
Rated insulation voltage:	
IC1/(IC2-5)	1000 V
IC2/(IC3-5)	250 V
IC3/(IC4-5)	250 V
IC4/IC5	250 V
Pollution degree for accessible parts on the outside of the device housing (U_n < 690 V)	3
Pollution degree for accessible parts on the outside of the device housing (U_n >690 < 1000 V)	2
Safe isolation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1000 V Overvoltage category II, 1300 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC3/(IC4-5)	Overvoltage category III, 300 V
IC4/IC5	overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1	
IC2/(IC3-5)	AC 2.2 kV
IC3/(IC4-5)	AC 2.2 kV
IC4/IC5	AC 2.2 kV

Supply voltage

Supply via A1/+, A2/-:

Supply voltage range U_S	AC/DC 24…240 V
Tolerance of U_S	-30…+15 %
Maximum permissible input current of U_S	650 mA
Frequency range of U_S	DC, 50…400 Hz[1)]
Tolerance of the frequency range of U_S	-5…+15 %
Power consumption, typically DC	≤ 12 W
Power consumption, typically 50/60 Hz	≤ 12 W/21 VA
Power consumption, typically 400 Hz	≤ 12 W/45 VA

Supply via X1:

Supply voltage U_S	DC 24 V
Tolerance of U_S	DC -20…+25 %

IT system being monitored

Nominal system voltage range U_n	AC 0…1000 V; DC 0…1300 V AC/DC 0…1000 V (for UL applications)
Tolerance of U_n	AC/DC +15 %
Frequency range of U_n	DC 0.1…460 Hz
Max. AC voltage $U_{\sim}$ in the frequency range f_n = 0.1… 4 Hz	$U_{\sim\ max} = 50\ V/Hz^2 * (1+ f_n^2)$

Response values

Response value R_{an1} (Alarm 1)	1 kΩ…3 GΩ
Response value R_{an2} (Alarm 2)	1 kΩ…3 GΩ
Relative uncertainty (acc. to IEC 61557-8)	dependent on the profile, ±15 %, at least ±1 kΩ
Hysteresis	25 %, at least 1 kΩ

Time response

Response time t_{an} at $R_{F\ (without\ fault)}$ = 1 MΩ -> $R_{F\ (with\ fault)}$ = 0,5 x R_{an} (R_{an} = 20 kΩ) and C_e = 1 µF acc. to IEC 61557-8	profile dependent, typ. 10 s (see diagrams in manual)
Response time DC Alarm at $R_{F\ (without\ fault)}$ = 1 MΩ und C_e = 1 µF	profile dependent, typ. 5 s (see diagram in manual)
Start-up delay $T_{start-up}$	0…120 s

Measuring circuit

Measuring voltage U_m	profile dependent, ±10 V, ±50 V (see profile overview)
Measuring current I_m	≤ 403 µA
Internal resistance R_i, Z_i	≥ 124 kΩ
Internal resistance on decouppled systems (inactive by I/0, inactive by ISOnet or cut-off)	typ. 50 MΩ
Permissible extraneous DC voltage U_{fg}	≤ 1500 V
Permissible system leakage capacitance C_e	profile dependent, 0…1000 µF

Measuring ranges

Measuring range f_n	0.1…460 Hz
Tolerance measurement of f_n	±1 % ±0.1 Hz
Voltage range measurement of f_n	AC 25…690 V
Measuring range U_n(without an external coupling device)	AC 25…1000 V; 3AC 25…690 V; DC 0…1300 V
Voltage range measurement of U_n	AC/DC 10…1000 V [2)]
Tolerance measurement of U_n	±5 % ±5 V
Measuring range C_e	0…1000 µF
Tolerance measurement of C_e	±10 % ±10 µF
Frequency range measurement of C_e	DC, 10…460 Hz
Min. insulation resistance measurement of C_e	depending on the profile and coupling mode, typ. > 10 kΩ

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm [3)]
Display range measured value	0.1 kΩ…10 GΩ
Operating uncertainty (according to IEC 61557-8)	±15 %, at least ±1 kΩ

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8)	≤ 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	I_{LmaxX1} = 10 mA + 7 mA/V * U_s [3)] (negative values are not allowed for I_{LmaxX1})

Digital inputs (I1, I2, I3)

Number	3
Operating mode, adjustable	active high, active low
Functions	off, test, reset, deactivate device, start initial measurement
Voltage	Low DC -3…5 V, High DC 11…32 V
Voltage tolerance	± 10 %

Digital outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	off, Ins. alarm 1, Ins. Alarm 2, connection fault, DC- alarm [5)], DC+ alarm [5)], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Voltage passive	DC 0…32 V, active DC 0/19.2…32 V

Analogue output (M+)

Number	1
Operating mode	linear, midscale point 28 kΩ/120 kΩ
Functions	insulation value, DC shift
Current	0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kΩ)
Voltage	0…10 V (>1 kΩ), 2…10 V (>1 kΩ)
Tolerance related to the current/voltage final value	± 20 %

Interfaces

Field bus:

Interface/protocol	web server/Modbus TCP/BCOM
Data rate	10/100 Mbit/s, autodetect
Max. number of Modbus requests	<100/s
Cable length	≤ 100 m
Connection	RJ45
IP address	DHCP/manual* 192.168.0.5*
Network mask	255.255.255.0*
BCOM address	system-1-0
Function	communication interface

ISOsync:

Number ISOsync devices	≤ 50

ISOnet:

Number ISOnet devices	≤ 20
Max. nominal system voltage range ISOnet	AC, 690 V/DC, 1000V

isoData:

Interface/Protocol	RS-485/isoData
Data rate mode 1	9.6 kBaud/s
Data rate mode 2	115.2 kBaud/s
Data rate mode 3	115.2 kBaud/s
Leitungslänge (dependant on the Baudrate)	≤1200 m
Cable: twisted pair, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	terminals X1.A, X1.B
Terminating resistor	120 Ω, can be connected internally
Device address	1…90

Switching elements

Number of switching elements	2 changeover contacts
Operating mode	N/C operation/N/O operation
Contact 11-12-14	off, Ins. alarm 1, Ins. Alarm 2, connection fault, DC- alarm [5], DC+ alarm [5], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Contact 21-22-24	off, Ins. alarm 1, Ins. Alarm 2, connection fault, DC- alarm [5], DC+ alarm [5], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Electrical endurance under rated operating conditions, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Rated insulation voltage ≤ 2000 m NN					250 V
Rated insulation voltage ≤ 3000 m NN					160 V
Minimum contact rating					1 mA at AC/DC ≥ 10 V

Environment/EMC and temperature range

EMC	IEC 60533, IEC 61326-2-4 [6]
Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Staionary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤3000 m NN

Connection

Connection type	pluggable screw terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic collar	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible withTWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals:

Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic collar	0.25…2.5 mm²
Multiple conductor, flexible withTWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals X1:

Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with ferrule with plastic sleeve	0.25…0.75 mm²

Other

Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [7]
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D)	108 x 93 x 110 mm
Weight	< 390 g

[1] At a frequency > 200 Hz, the connection of X1 ande Remote must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

[2] Deactivation of voltage metering in a DC system at U_n > DC 1000 V and asymmetric insulation fault at R_f < 500 kΩ. Reactivation of voltage metering if R_f > 500 kΩ

[3] Indication limited outside the temperature range -25…+55 °C.

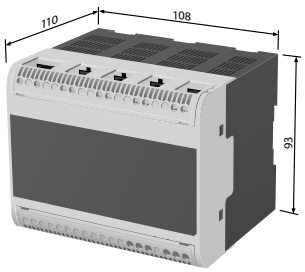
[4] U_s [Volt] = ISOMETER® supply voltage

[5] For U_n ≥ 50 V only.

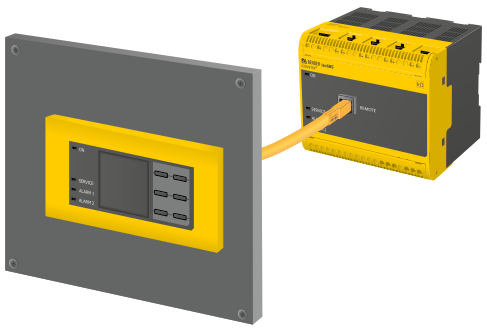
[6] This is a class A product. This product may cause radio interference in residential areas. In this case, the user may be required to take corrective actions.

[7] Recommendation: Devices mounted at 0° (display oriented, cooling slots must be ventilated vertically)
For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

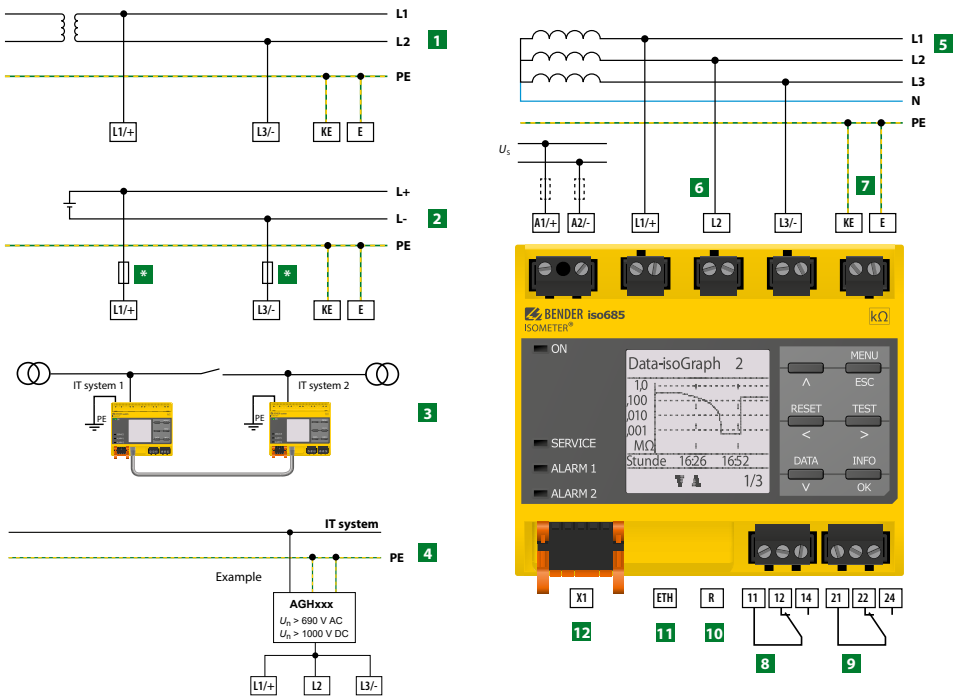
Dimension diagram (dimensions in mm))



Connection to FP200



Wiring diagram



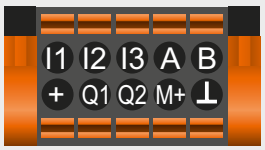
1 Connection to an AC system U_n
2 Connection to a DC system U_n
3 Linked with two IT systems which can be interconnected via a coupling switch. Information regarding the state of the coupling switch is not necessary.
4 Connection to an IT system with coupling device
5 Connection to a 3(N)AC system
6 Connection to the IT system to be monitored (L1/+, L2, L3/-)
7 Separate connection of KE, E to PE
8 (K1) Alarm relay 1, available changeover contacts
9 (K2) Alarm relay 2, available changeover contacts
10 Switchable resistor R for RS-485 bus termination
11 Ethernet interface
12 Digital interface
* For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided.
Recommendation: 2A screw-in fuses.

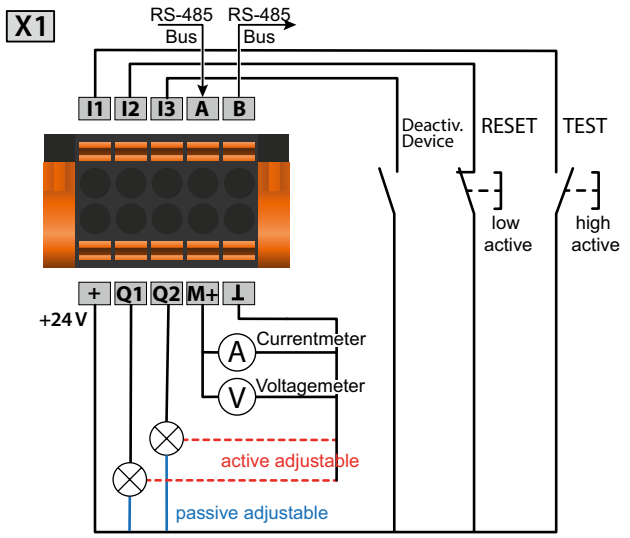
Provide line protection!
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

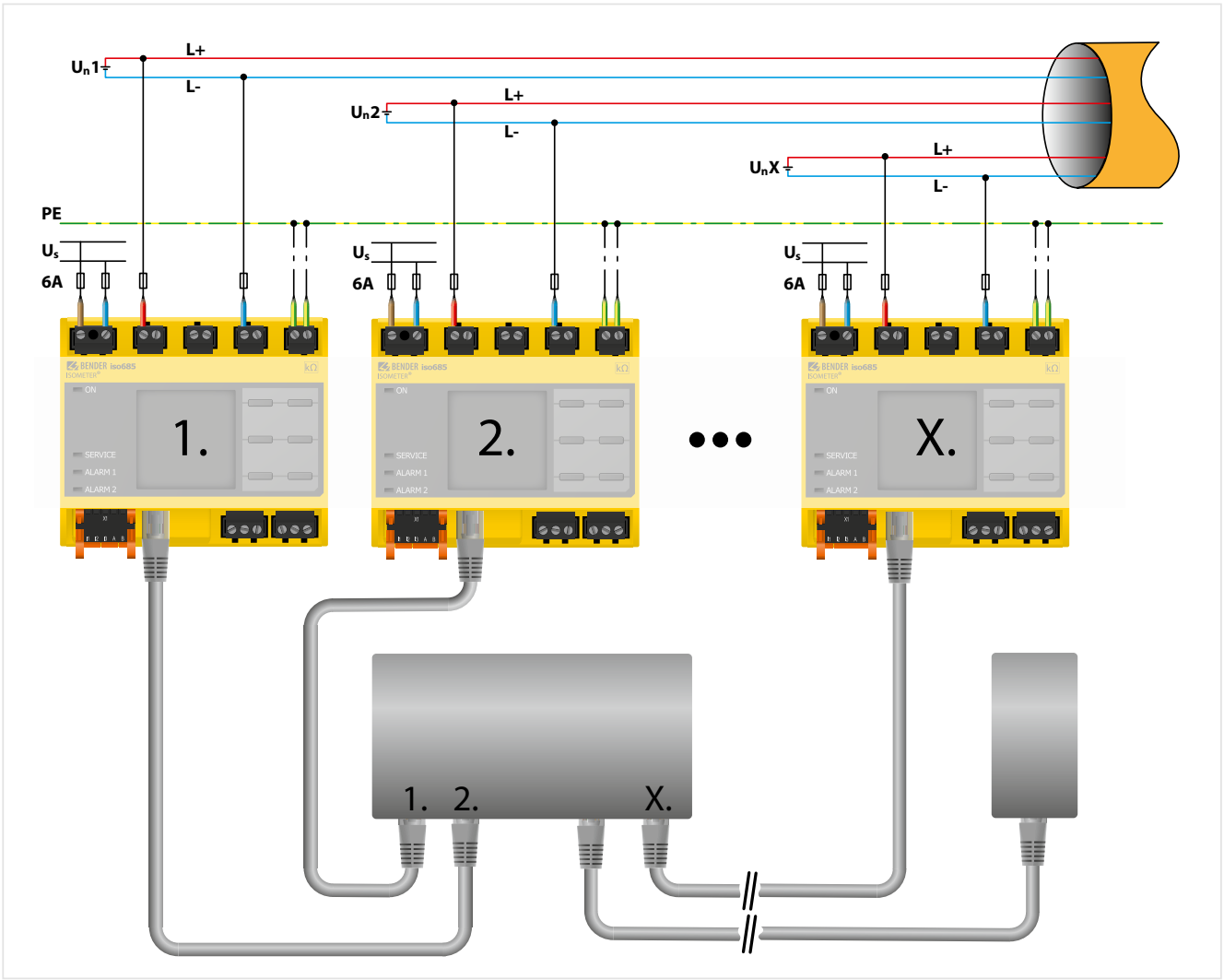
NOTE
According to DIN VDE 0100-430, devices for protection against a short-circuit can be omitted for the coupling of terminals L1/+, L2 and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum. Ensure short-circuit-proof and earth-fault-proof wiring.
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

For UL applications:
Use 60/70°C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.

Digital interface X1

Digital interface	Terminal	Colour
 X1	I1	Input 1
	I2	Input 2
	I3	Input 3
	A	RS-485 A
	B	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	⊥	Ground




Un1
L+
L-
Un2
L+
L-
UnX
L+
L-
PE
Us
6A
Us
6A
Us
6A
1.
2.
X.
1. 2.
X.

ISOMETER® isoRW685W-D

Insulation monitoring device for IT AC systems with galvanically connected rectifiers and converters and for IT systems especially for railway applications

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, variable-speed drives
- UPS systems, battery systems
- Heaters with phase control
- Systems with switch-mode power supplies
- IT systems with high leakage capacitances

Approvals

Device features

- ISOMETER® for IT AC systems with galvanically connected rectifiers or inverters and for IT DC systems (IT = unearthed systems)
- Nominal system voltage U_n expandable via coupling devices
- Automatic adaptation to the existing system leakage capacitance
- Combination of ***AMP***^{Plus} and other profile-specific measurement methods
- Two separately adjustable response value ranges of 1 kΩ…10 MΩ for alarm 1 and alarm 2
- High-resolution graphic LC display for excellent readability and recording of the device status
- Connection monitoring (monitoring of the measuring lines)
- Automatic device self test
- Graphical representation of the insulation resistance over time (isoGraph)
- History memory with real-time clock (buffer for three days) for storing 1023 alarm messages with date and time
- Current and voltage output 0(4)…20 mA, 0…400 µA, 0…10 V, 2…10 V (galvanically separated) which is analogous to the measured insulation value of the system
- Freely programmable digital inputs and outputs
- Remote setting via the Internet or Intranet (Webserver / Option: COMTRAXX® Gateway)
- Worldwide remote diagnosis via the Internet (made available by Bender Service only)
- RS-485/BS (Bender sensor bus) for communication with other Bender devices
- BCOM, Modbus TCP and web server

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- DIN EN 50155

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage range U_n		Supply voltage U_S		Type		Art. No.
AC	DC	AC	DC			
0…690 V; 1…460 Hz	0…1000 V	24…240 V; 50…400 Hz	24…240 V	isoRW685W-D		B91067012W

Accessories

Description	Art. No.
A set of screw terminals[1)]	B91067901
A set of push-wire terminals	B91067902
Enclosure accessories (terminal cover, 2 mounting clips) [1)]	B91067903

[1)] included in the scope of delivery

Matching system components

Description	Type	Art. No.	Page
Coupling devices	AGH150W-4	B98018006	326
	AGH204S-4	B914013	328
	AGH520S	B913033	329
	AGH676S-4	B913055	332

Suitable measuring instruments on request!

Insulation coordination according to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	(L1/+, L2, L3/-)
Supply circuit (IC2)	A1, A2
Output circuit 1 (IC3)	11, 12, 14
Output circuit 2 (IC4)	21, 22, 24
Control circuit (IC5)	(E, KE), (X1, ETH, X3, X4)
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-5)	8 kV
IC2/(IC3-5)	4 kV
IC3/(IC4-5)	4 kV
IC4/IC5	4 kV
Rated insulation voltage:	
IC1/(IC2-5)	1000 V
IC2/(IC3-5)	250 V
IC3/(IC4-5)	250 V
IC4/IC5	250 V
Pollution degree for accessible parts on the outside of the device housing (U_n < 690 V)	3
Pollution degree for accessible parts on the outside of the device housing (U_n >690 < 1000 V)	2
Protective separation (reinforced insulation) between:	
IC1/(IC2-5)	Overvoltage category III, 1000 V
IC2/(IC3-5)	Overvoltage category III, 300 V
IC3/(IC4-5)	Overvoltage categoryIII, 300 V
IC4/IC5	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-5)	AC 2,2 kV
IC3/(IC4-5)	AC 2,2 kV
IC4/IC5	AC 2,2 kV

Supply voltage

Supply via A1/+, A2/-:

Supply voltage range U_s	AC/DC 24…240 V
Tolerance of U_s	-30…+15%
Maximum permissible input current of U_s	650 mA
Frequency range of U_s	DC, 50…400 Hz [1]
Tolerance of the frequency range of U_s	-5…+15 %
Power consumption, typically 50/60 Hz	≤ 12 W/21 VA
Power consumption, typically 400 Hz	≤ 12 W/45 VA

Supply via X1:

Supply voltage U_s	DC 24 V
Tolerance of U_s	DC -20…+25 %

IT system being monitored

Nominal system voltage range U_n	AC 0…690 V DC 0…1000 V AC/DC 0…600 V (for UL applications)
Tolerance of U_n	AC/DC +15 %
Frequency range of U_n	DC, 0.1…460 Hz
Max. AC voltage $U_{\sim}$ in the frequency range f_n = 0.1…4 Hz	$U_{\sim\ max}$ = 50 V/Hz^2 *(1+ f_n^2)

Response values

Response value R_{an1} (alarm 1)	1 kΩ…10 MΩ
Response value R_{an2} (alarm 2)	1 kΩ…10 MΩ
Relative uncertainty (acc. to IEC 61557-8)	profile dependent, ±15 %, at least ±1 kΩ
Hysteresis	25 %, at least 1 kΩ

Time response

Response time t_{an} at R_F = 0.5 x R_{an} (R_{an} = 10 kΩ) and C_e = 1 µF according to IEC 61557-8	profile dependent, typ. 4 s (see diagrams in manual)
Response time DC alarm at C_e = 1 µF	profile dependent, typ. 2 s (see diagram in manual)
Start-up delay $T_{start-up}$	0…120 s

Measuring circuit

Measuring voltage U_m	profile dependent, ±10 V, ±50 V (see profile overview)
Measuring current I_m	≤ 403 µA
Internal resistance R_i, Z_i	≥ 124 kΩ
Permissible extraneous DC voltage U_{fg}	≤ 1200 V
Permissible system leakage capacitance C_e	profile dependent, 0…1000 µF

Measuring ranges

Measuring range f_n	10…460 Hz
Tolerance measurement of f_n	±1 % ±0.1 Hz
Voltage range measurement of f_n	AC 25…690 V
Measuring range U_n	AC 25…690 V DC 25…1000 V
Voltage range measurement of U_n	AC/DC > 10 V
Tolerance measurement of U_n	±5 % ±5 V
Measuring range C_e	0…1000 µF
Tolerance measurement of C_e	±10 % ±10 µF
Frequency range measurement of C_e	DC, 30…460 Hz
Min. insulation resistance measurement of C_e	depending on the profile and coupling mode, typ. > 10 kΩ

Display

Indication	graphic display 127 x 127 pixels, 40 x 40 mm [2]
Display range measured value	0.1 kΩ…20 MΩ
Operating uncertainty (according to IEC 61557-8)	±15 %, at least ±1 kΩ

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

In-/Outputs (X1-Interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to earth (PE) on one end, recommended: J-Y(St)Y min. 2x0,8)	≤ 100 m
Total max. supply output current for each output (device supplied by X1.+/X1.GND)	max. 1 A
Total max. supply output current on X1 (device supplied by A1+/A2-)	max. 200 mA
Total max. supply output current on X1 (device supplied by A1+/A2- between 16,8 V and 40 V)	I_{LmaxX1} = 10 mA + 7 mA/V * U_s [3] (negative values are not allowed for I_{LmaxX1})

Digital Inputs (I1, I2, I3)

Number	3
Operating mode, adjustable	active high, active low
Functions	off, test, reset, deactivate device, start initial measurement
Voltage	Low DC -3…5 V, High DC 11…32 V
Tolerance Voltage	±10 %

Digital Outputs (Q1, Q2)

Number	2
Operating mode, adjustable	active, passive
Functions	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Voltage	passive DC 0…32 V, active DC 0/19.2…32 V

Analogue Output (M+)

Number	1
Operating mode	linear, midscale point 28 kΩ/120 kΩ
Functions	insulation value, DC offset
Current	0…20 mA (< 600 Ω), 4…20 mA (< 600 Ω), 0…400 µA (< 4 kΩ)
Voltage	0…10 V (> 1 kΩ), 2…10 V (> 1 kΩ)
Tolerance related to the current/voltage final value	±20 %

Interfaces

Field bus:

Interface/protocol	web server/Modbus TCP/BCOM
Data rate	10/100 Mbit/s, autodetect
Max. amount Modbus requests	< 100/s
Cable length	≤ 100 m
Connection	RJ45
IP address	DHCP/manual 192.168.0.5
Network mask	255.255.255.0
BCOM address	system-1-0
Function	communication interface

Sensor bus:

Interface/protocol	RS-485/BS
Data rate	9.6 kBaud/s
Cable length	≤ 1200 m
Cable: twisted pair, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	terminals X1.A, X1.B
Terminating resistor at the beginning and at the end of the transmission path	120 Ω, can be connected internally
Device address, BS bus	1…90

Switching elements

Number of switching elements	2 changeover contacts
Operating mode	N/C operation/N/O operation
Contact 11-12-14	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Contact 21-22-24	off, Ins. alarm 1, Ins. alarm 2, connection fault, DC- alarm [4], DC+ alarm [4], symmetrical alarm, device fault, common alarm, measurement complete, device inactive, DC offset alarm
Electrical endurance under rated operating conditions, number of cycles	10.000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13/AC-14/DC-12/DC-12/DC-12
Rated operational voltage	230 V/230 V/24 V/110 V/220 V
Rated operational current	5 A/3 A/1 A/0.2 A/0.1 A max. 3 A (for UL applications)
Rated insulation voltage ≤ 2000 m NN	250 V
Rated insulation voltage ≤ 3000 m NN	160 V
Minimum contact rating	1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 50121-3-2, IEC 61326-2-4 [5]

Ambient temperatures:

Operating temperature	-40…+70 °C -40…+65 °C (for UL applications)
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K7 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤ 3000 m NN

Connection

Connection type	pluggable screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals:

Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals X1:

Nominal current	≤ 8 A
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other

Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [6]
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	3 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	V-0
ANSI code	64
Dimensions (W x H x D)	108 x 93 x 110 mm
Weight	< 390 g

[1] At a frequency > 200 Hz, the connection of X1 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

[2] Indication limited outside the temperature range -25…+55 °C.

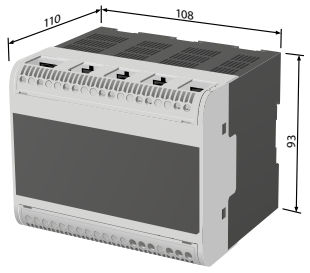
[3] U_s [Volt] = supply voltage ISOMETER®

[4] For $U_n \geq 50$ V only.

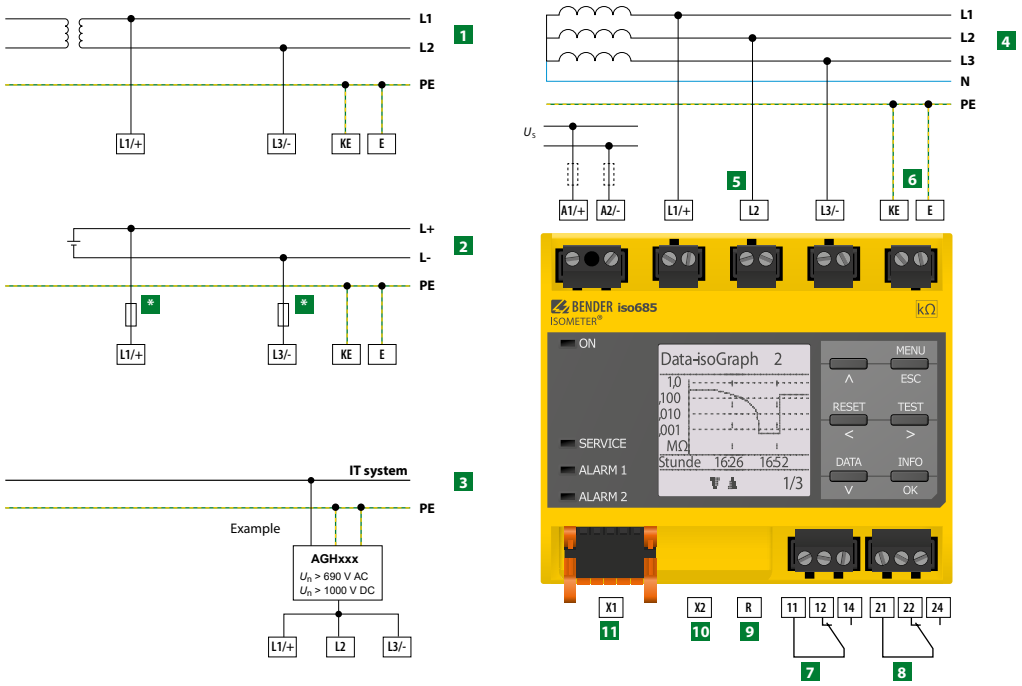
[5] This is a class A product. In a domestic environment, this product may cause radio interference. In this case, the user may be required to take corrective actions.

[6] Recommendation: Devices mounted at 0 ° (display-oriented, cooling slots must be ventilated vertically).
For devices mounted at an angle of 45°, the max. working temperature is reduced by 10 °C.
For devices mounted at an angle of 90°, the max. working temperature is reduced by 20 °C.

Dimension diagram (dimensions in mm)



Wiring diagram



1 Connection to an AC system U_n
2 Connection to a DC system U_n
3 Connection to an IT system with coupling device
4 Connection to a 3(N)AC system
5 Connection to the IT system to be monitored (L1/+, L2, L3/-)
6 Separate connection of KE, E to PE
7 (K1) Alarm relay 1, available changeover contacts
8 (K2) Alarm relay 2, available changeover contacts
9 Switchable resistor *R* for RS-485 bus termination
10 Ethernet interface, connection to Ethernet interface by Bender Service staff only
11 Digital interface
* For systems > 690 V and with overvoltage category III a fuse for the connection to the system to be monitored must be provided. Recommendation: 2A screw-in fuses.

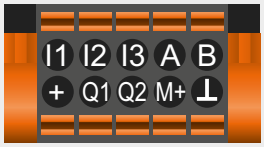
Provide line protection!
According to DIN VDE 0100-430, a line protection shall be provided for the supply voltage.

NOTE:
According to DIN VDE 0100-430, devices for protection against a short circuit can be omitted for the coupling of terminals L1/+ and L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short circuit to a minimum. (Recommendation: Ensure short-circuit-proof and earth-fault-proof wiring).
The connecting lines L1/+, L2, L3/- to the system to be monitored must be carried out as spur lines. No load current may be conducted through the terminals.

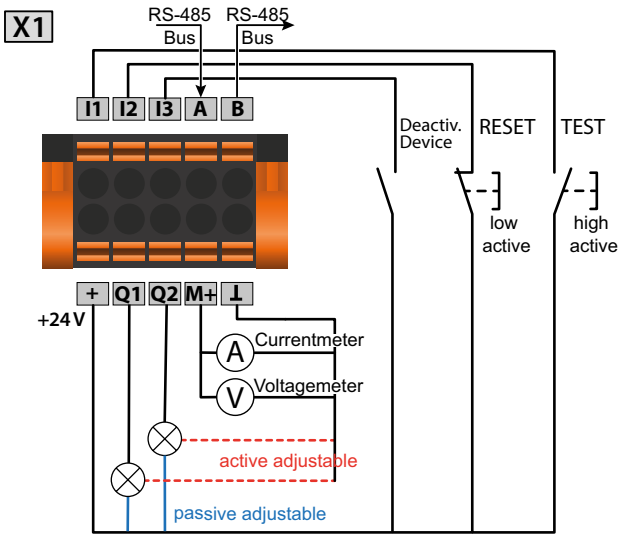
For UL applications:
Use 60/70°C copper lines only!
UL and CSA application require the supply voltage to be protected via 5 A fuses.

Digital interface X1

Digital interface	Terminal	Colour
	I1	Input 1
	I2	Input 2
	I3	Input 3
	A	RS-485 A
	B	RS-485 B
	+	+24 V
	Q1	Output 1
	Q2	Output 2
	M+	Analogue output
	⊥	Ground



X1



Display FP200

Display and operator unit for devices of the iso685 series without display



Device features

- Display for front panel mounting of series iso685
- Various mounting options
- Uniform operation
- Backlit buttons

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- Display and operator unit for devices of the iso685 series without display

Approvals

Ordering information

Supply voltage/frequency range U_S	Power consumption	Type	Art. No.
DC			
24 V/-20…+25 %	typ. 3 W	FP200	B91067904
		FP200W[1)]	B91067904W

[1)] Device version Option "W" with increased shock and vibration resistance

Accessories

Description	Art. No.
FP200 mechanical accessories comprising: 2 screw attachments	B91067907
Front cover 144x72 transparent (for IP65)	B98060005
Patch cable CAT5e (without UL, temperature range 0…+60 °C) Included in the scope of delivery	B91067906
FP200 adapter for front panel mounting IRDH575	B91067905
Front cover 144x96 transparent (for IP65)	B98060007

Technical data

Insulation co-ordination (IEC 60664-1/IEC 60664-3)

Rated voltage	50 V
Overvoltage category (OVC)	III
Rated impulse voltage	800 V
Rated insulation voltage	50 V
Pollution degree for accessible parts on the outside of the device housing	3

Supply voltage

Supply voltage U_S	DC 24 V (via iso685-S variant)
Power consumption	1.2 W

Display

Graphic display	127 x 127 pixel, 40 x 40 mm

LEDs

ON (operation LED)	green
SERVICE	yellow
ALARM 1	yellow
ALARM 2	yellow

Interfaces

Interface/protocol	Internal Bender
Cable length	≤ 5 m
REMOTE Cable	Patch cable at least CAT5e

Environment/EMC

EMC	IEC 61326-2-4; EN 50121-3-2; EN 50121-4

Ambient temperatures

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-time storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transportation (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Area of application	≤3000 m NN

Connection

Connection type	plug connectors

Other

Operating mode	continuous operation
Mounting (0°)	display oriented, cooling slots must be ventilated vertically [1]
Degree of protection, built-in components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Degree of protection with transparent cover	IP65
Panel cut-out	138x66 mm
Permissible tolerance of panel cut-out	+0.5 /–0
Screw mounting	with mounting brackets
Torque screw mounting	0,3 Nm ±10%
Enclosure material	polycarbonate
Flammability class	UL94V-0
Dimensions (W x H x D)	144 x 72 x 35.6 mm
Weight	< 180 g

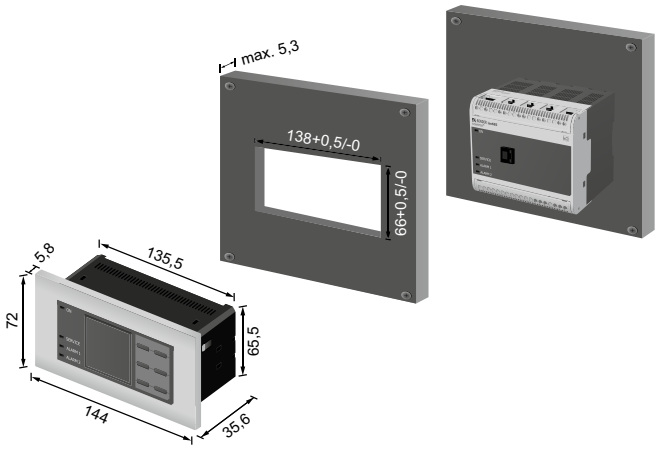
Option „W“ data different from the standard version

(Only for remote mounting)	
Ambient temperatures:	
Operating temperature	-40…+70 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M7

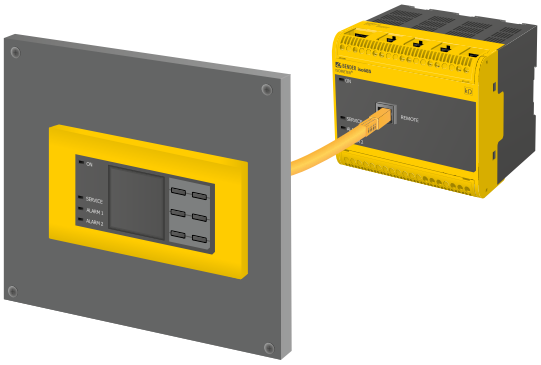
( )* = factory setting

[1] Recommendation: Devices mounted at 0° (display-oriented, cooling slots must be ventilated vertically). For devices mounted at an angle ≠ 0°, the max. working temperature is reduced by 10 °C for devices with a “W” in the device name.

Dimension diagram (dimensions in mm)



Connection to iso685



ISOMETER® IRDH275

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, and thyristor-controlled DC drives
- UPS systems, battery systems
- Heaters with phase control
- Installations including switch mode power supplies
- IT systems including high leakage capacitances
- Coupled IT systems

Device features

- Insulation monitoring for unearthed AC, AC/DC systems 0…793 V, DC 0…650 V
- Nominal voltage extendable via coupling device
- Two separately adjustable response values1 kΩ…10 MΩ
- ***AMP**Plus* measurement method
- Automatic adaptation to the system leakage capacitance
- Info button to display device settings and system leakage capacitance
- Self monitoring with automatic alarm
- Automatic self test, selectable
- Connection for external kΩ indication
- Test and reset button
- External test/reset button can be connected
- Two separate alarm relays with two potential-free changeover contacts
- N/O or N/C operation, selectable
- Backlit LC display
- RS-485 interface

Additional device features, version IRDH275B

- History memory with real-time clock to store all alarm messages with date and time stamp
- Electrically isolated RS-485 interface (BMS protocol) for communication with other Bender devices
- Isometer disconnecting relays for the operation of several ISOMETER®s in coupled IT systems
- Current output 0(4)…20 mA (electrically isolated)

Approvals

c UL us LISTED

Lloyd's Register TYPE APPROVED

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

RS-485 interface	Coupled IT systems	Output	Supply voltage U_S[1]		Type	Art. No.
			AC	DC		
ASCII-IsoData	not applicable	Current output 0…400 µA	88…264 V	77…286 V	IRDH275-435	B91065100
			19.2…55 V	19.2…72 V	IRDH275-427	B91065104
			–	10.2…36 V	IRDH275-425	B91065108
BMS	applicable	Current output 0(4)…20 mA	88…264 V	77…286 V	IRDH275B-435	B91065101
			19.2…55 V	19.2…72 V	IRDH275B-427	B91065105
			–	10.2…36 V	IRDH275B-425	B91065109

[1] Absolute values

Device "Option-W" with increased shock and vibration resistance: Indicated by the letter "W" at the end of the order number.

Suitable system components

Description	Type	Art. No.	Page
External kΩ measuring instruments	7204-1421	B986763	371
	9604-1421	B986764	371
	9620-1421	B986841	371
Coupling devices	AGH150W-4	B98018006	326
	AGH204S-4	B914013	328
	AGH520S	B913033	329

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

Voltage ranges

IRDH275…:

Nominal system voltage U_n	AC, 3/(N)AC 0…793 V*
Nominal frequency f_n (for f < 50 Hz see characteristic curve in the manual)	0,1…460 Hz
Nominal system voltage U_n	DC 0…650 V*

IRDH275…-435:

Supply voltage U_S (also see nameplate)	AC 88…264 V*
Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 77…286 V*

IRDH275…-427:

Supply voltage U_S (also see nameplate)	AC 19.2…55 V*
Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 19.2…72 V*

IRDH275…

Power consumption	≤ 14 VA

Response values

Response value R_{an1} (Alarm1)	1 kΩ…10 MΩ
Response value R_{an2} (Alarm2)	1 kΩ…10 MΩ
Relative uncertainty (20 kΩ…1 MΩ) (acc. to IEC 61557-8)	± 15 %
Relative uncertainty (1…20 kΩ +2 kΩ/+20 %	
Relative uncertainty (1…10 MΩ)	0.2 kΩ/+20 %
Response time t_{an} at R_F = 0.5 x R_{an} and C_e = 1 µF	≤ 5 s
Hysteresis (1…10 kΩ)	+2 kΩ
Hysteresis (10 kΩ…10 MΩ)	25 %

Measuring circuit

Measuring voltage U_m	≤ 50 V
Measuring current I_m (at R_F = 0 Ω)	≤ 280 µA
Internal DC resistance R_i	≥ 180 kΩ
Impedance Z_i at 50 Hz	≥ 180 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1200 V
Permissible system leakage capacitance	≤ 500 µF
Factory setting	150 µF

Displays

Display, illuminated	two-line display
Characteristics (number)	2 x 16
Display range measured value	1 kΩ…10 MΩ
Operating uncertainty (20 kΩ…1 MΩ) (nach IEC 61557-8)	± 15 %**
Operating uncertainty (1…20 kΩ)	± 1 kΩ/± 15 %**
Operating uncertainty (1…10 MΩ)	± 0.1 MΩ/± 15 %**

Outputs/Inputs

Test/reset button	internal/external
Cable length test/reset button, external	≤ 10 m
Current output for measuring instrument SKMP (scale centre point = 120 kΩ):	
Current output IRDH275 (load)	400 µA (≤ 12.5 kΩ)
Current output IRDH275B (load)	20 mA (≤ 500 Ω)
Accuracy current output (1 kΩ…1 MΩ)	
related to the value indicated	±10 %, ±1 kΩ

Serial interface

Interface/protocol IRDH275	RS-485/ASCII-IsoData
Interface/protocol IRDH275B	RS-485/BMS
Connection	terminals A/B
Cable length	≤ 1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 Ω (0.5 W)
Device address, BMS bus	1…30 (factory setting = 3)

Switching elements

Switching elements	2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
Operating principle K1, K2 (Alarm 1/Alarm 2)	N/O or N/C operation
Factory setting (Alarm 1/Alarm 2)	N/O operation
Electrical endurance, number of cycles	12000
Contact class	IIB (DIN IEC 60255-23)
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi = 0.4
	0.2 A, DC 220 V, L/R = 0.04 s
Contact rating at DC 24 V	≥ 2 mA (50 mW)

Environment/EMC

EMC	acc. to IEC 61326-2-4 Ed. 1.0
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+55 °C
Ambient temperature (during storage)	-40…+70 °C
Climatic class acc. to IEC 60721-3-3	3K5

Connection

Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
flexible with ferrules without/with plastic sleeve	0.25…2.5 mm²
Tightening torque	0.5 Nm
Conductor sizes (AWG)	24…12

Other

Operating mode	continuous operation
Mounting	display-oriented
Distance to adjacent devices	≥ 30 mm
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	X112, free from halogen
DIN rail mounting	DIN EN 60715/IEC 60715
Flammability class	UL94 V-0
Documentation number	D00122
Weight	≤ 510 g

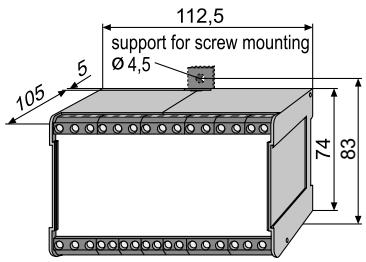
Option "W"

Shock resistance IEC 60068-2-27 (device in operation)	30 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6	1.6 mm/10…25 Hz
	4 g/25…150 Hz
Ambient temperature (during operation)	-40…+70 °C
Storage temperature range	- 40…+85 °C
Screw mounting	2 x M4

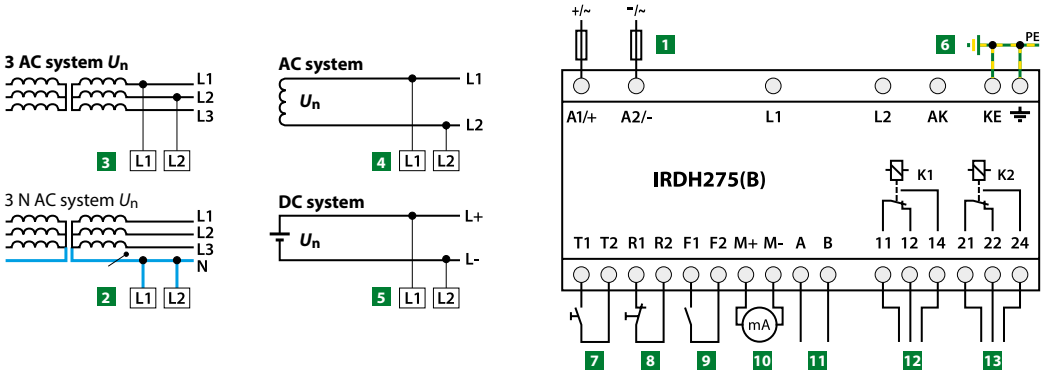
The data labelled with an * are absolute values

** = Under EMC test conditions in accordance with IEC 61326-2-4 the specified tolerances can double

Dimension diagram (dimensions in mm)



Wiring diagram



1 Supply voltage U_S (see ordering information) 6 A fuse recommended; for UL and CSA applications, it is mandatory to use 5 A fuses.

2 **3** Connection to the 3AC system being monitored:
Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.

4 Connection of the AC system to be monitored:
Connect terminals L1, L2 to conductor L1, L2.

5 Connection to the DC systems to be monitored:
Connect terminal L1 to conductor L+, terminal L2 to conductor L-

6 Separate connection of the equipotential bonding conductor to PE and KE

7* External test button "T1/T2" (N/O contact)

8* External reset button "R1, R2" (N/C contact or wire jumper). When the terminals are open the fault messages will not be stored, provided that the fault memory has not been activated via the operating menu.

9* Standby by means of the function input "F1, F2":
with the contact in closed position no insulation measurement takes place (Isometer disconnection B version only/no disconnection when operated via AK).

10 IRDH275: Currrent output, electrically isolated: 0…400 µA
IRDH275B: Currrent output, electrically isolated: 0…20 mA or 4…20 mA

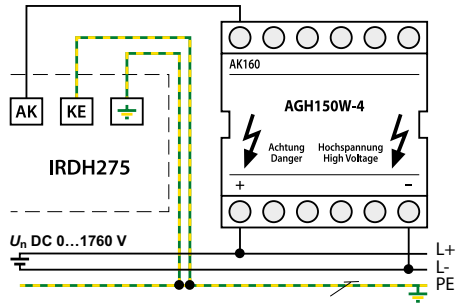
11 RS-485 interface

12 Alarm relay: Alarm 1

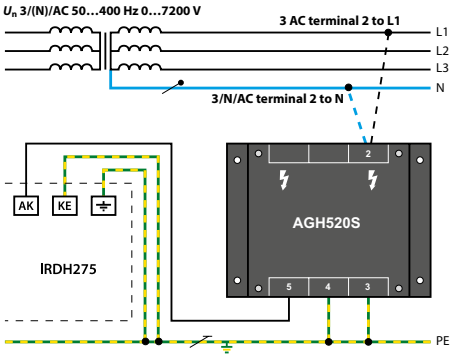
13 Alarm relay: Alarm 2/system

* **the terminal pairs 7, 8 and 9 have to be wired electrically isolated and do not have to be connected to earth!**

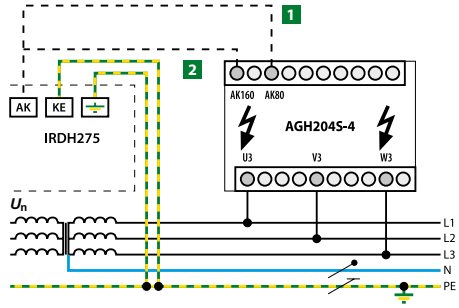
Wiring diagrams



ISOMETER® IRDH275 with coupling device AGH150W-4



ISOMETER® IRDH275 with coupling device AGH520S



ISOMETER® IRDH275 with coupling device AGH204S-4

1 without rectifiers
U_n = 3AC 0…1650 V (DC max. 1000 V)

2 with rectifiers
U_n = 3AC 0…1300 V (peak voltage downstream of the rectifier or intermediate circuit voltage of max. 1840 V)

ISOMETER® IRDH275BM-7 with coupling device AGH675-7 and AGH675-7MV15

Device combination for insulation monitoring in unearthed AC, AC/DC and DC power systems (IT systems)

AC/DC



Typical applications

- AC, DC or AC/DC medium voltage systems
- AC/DC medium voltage systems with directly connected DC components, such as rectifiers, converters, and thyristor-controlled DC drives

Approvals

IRDH275BM-7

Device features

- Insulation monitoring for drives including medium voltage converters up to 15.5 kV
- Two separately adjustable response values100 kΩ…10 MΩ
- ***AMP**Plus* measurement method (European patent: EP 0 654 673 B1)
- Automatic adaptation to the system leakage capacitance
- Info button to display device settings and the system leakage capacitance
- History memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 electrically isolated)
- Current output 0(4)…20mA (electrically isolated) analogously to the measured insulation value
- Self monitoring with automatic alarm
- Automatic self test, selectable
- Connection for external kΩ indication
- Test and reset button
- Connection external test and reset button
- Two separate alarm relays with two potential-free changeover contacts
- N/O or N/C operation, selectable
- Backlit two-line plain text display
- Remote setting of specific parameters via Internet (option; COM460IP with at least Option C required)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage U_n	Supply voltage U_S		Cable length	Type	Art. No.	Page
AC, 3(N)AC/DC	AC	DC				
–	19.2…55 V	19.2…72 V	–	IRDH275BM-727	B91065120	–
0…7.2 kV, 0…460 Hz	–	–	2000 mm	AGH675S-7-2000	B913061	330
			500 mm	AGH675S-7-500	B913060	330
0…15.5 kV, 0…460 Hz	–	–	500 mm	AGH675S-7MV15-500	B913058	330

Suitable system components

Description	Type	Art. No.	Page
External kΩ measuring instruments	9620-1421	B986849	371

Insulation coordination acc. to IEC 60664-1

Rated voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

Voltage ranges

Nominal voltage range U_n	via AGH675S-7…
Supply voltage U_S (also see nameplate)	AC 19.2…55 V*
Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 19.2…72 V*
Power consumption	≤14 VA

Response values

Response value Ran1 (Alarm 1)	100 kΩ…10 MΩ
Response value Ran2 (Alarm 2)	100 kΩ…10 MΩ
Relative percentage error 100…500 kΩ	±100 kΩ
Relative percentage error 500 kΩ…10 MΩ	0 %…+20 %
Response time tan	≤ 5 min
Hysteresis	25 %

Measuring circuit

Measuring voltage Um	≤ 50 V
Measuring current Im (at RF = 0 Ω)	≤ 21 µA
Internal DC resistance Ri	≥ 2.4 MΩ
Internal impedance Zi, at 50 Hz	≥ 2.4 MΩ
Permissible extraneous DC voltage Ufg	with AGH675S-7…
Permissible system leakage capacitance Ce	≤ 5 µF
Factory setting	2 µF

Displays

Display, illuminated	two-line display
Characters (number of characters)	2 x 16
Display range, measuring value	50 kΩ…10 MΩ
Relative percentage error 50…500 kΩ	±50 kΩ
Relative percentage error 500 kΩ…10 MΩ	±10 %

Outputs/inputs

TEST/ RESET button	internal/external
Cable length TEST/RESET button external	≤ 10 m

Current output for measuring instrument SKMP (scale centre point = 1.2 MΩ):

Current output (load)	20 mA (≤ 500 Ω)
Accuracy current output (100 kΩ…10 MΩ)	±10 %, ±100 kΩ

Serial interface

Interface/Protocol IRDH275B	RS-485/BMS
Connection	terminals A/B
Cable length	≤ 1200 m
Recommended cable (screened, screen on one side connected to PE)	J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0.5 W)
Device address, BMS bus	1…30 (factory setting = 3)

Switching components

Switching components	2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, system fault)
Operating principle K1, K2 (Alarm 1, Alarm 2)	N/O or N/C operation
Factory setting (Alarm 1/Alarm 2)	N/O operation
Electrical endurance	12 000 switching operations
Contact class	IIB (IEC 60255-23)
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi = 0.4 0,2 A, DC 220 V, L/R = 0.04 s
Minimum contact current at DC 24 V	≥ 2 mA (50 mW)

Environment/EMC

EMC immunity	acc. to EN 61326
EMC emission	acc. to EN 61326
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (during transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (during transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10 …+55 °C
Storage temperature range	-40 …+70 °C
Climatic class acc. to IEC 60721-3-3	3K5

Connection

Connection	screw terminals
Connection	
rigid, flexible	0.2…4 mm²/0.2…2.5 mm²
flexible with connector sleeve, without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Other

Operating mode	continuous operation
Mounting	as indicated on the display
Protection class, internal components (DIN EN 60529)	IP30
Protection class, terminals (DIN EN 60529)	IP20
Type of enclosure	X112, free from halogen
DIN rail mounting	IEC 60715
Flammability class	UL94 V-0
Tightening torque	0.5 Nm
Documentation number	D00123
Weight approx.	510 g

Technical data AGH675S-7…

Insulation coordination acc. to DIN EN 61800-5-1

AGH675S-7

Rated insulation voltage	AC 7.2 k V

AGH675S-7MV15

Rated insulation voltage	AC 15.5 k V

Voltage test acc. to DIN EN 61800-5-1

Type test:

AGH675S-7

Voltage impulse test (basic insulation)	40 kV
AC voltage test (basic insulation)	20 kV
Partial discharge test	14 kV

AGH675S-7MV15

Voltage impulse test (basic insulation)	111 kV
AC voltage test (basic insulation)	70 kV
Partial discharge test	29 kV

Routine test:

AC voltage test	40 kV

Voltage ranges

AGH675S-7

Nominal system voltage U_n	AC, 3(N)AC, DC 0…7.2 kV
Nominal frequency f_n	0…460 Hz
Internal DC resistance R_i	≥ 2.39 MΩ

AGH675S-7MV15

Nominal system voltage U_n	AC, 3(N)AC, DC 0…15.5 kV
Nominal frequency f_n	0…460 Hz
Internal DC resistance R_i	≥ 4.7 MΩ

Environment

Operating temperature (normal operation)	- 10…+ 60 °C
Operating temperature (continuous operation with asymetrical earth fault	- 10…+ 55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4 (3M7 Y shaft)
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

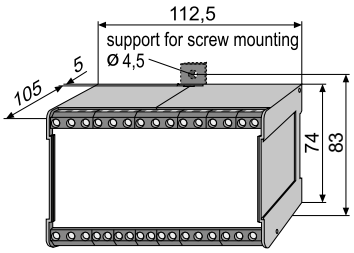
Connection terminal 2 (medium voltage)	high-voltage cable (encapsulated on the device side)
Connection, flexible with ring terminal	M4
Connection 3, 4, 5	screw-type terminals
Connection	
rigid, flexible	0.2…4 mm²/0.2…2.5 mm²
flexible with connector sleeve	0.25…2.5 mm²

Other

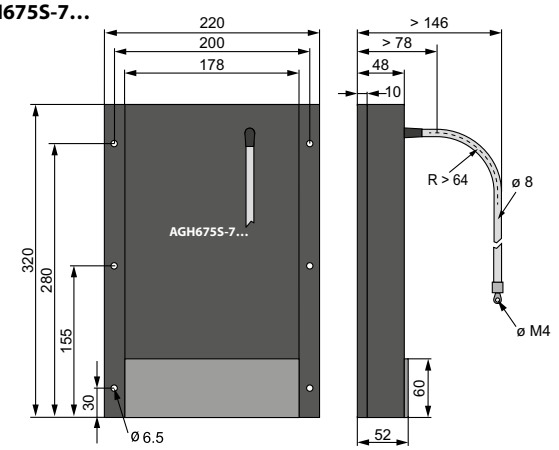
Operating mode	continuous operation
Mounting	any position
Protection class, internal components (DIN EN 60529)	IP64
Protection class, terminals (DIN EN 60529)	IP20
Type of enclosure	resin-encapsulated block
Screw mounting	M5
Flammability class	UL94 HB
Documentation number	D00095
Weight approx.	≤ 5100 g

Dimension diagrams (dimensions in mm)

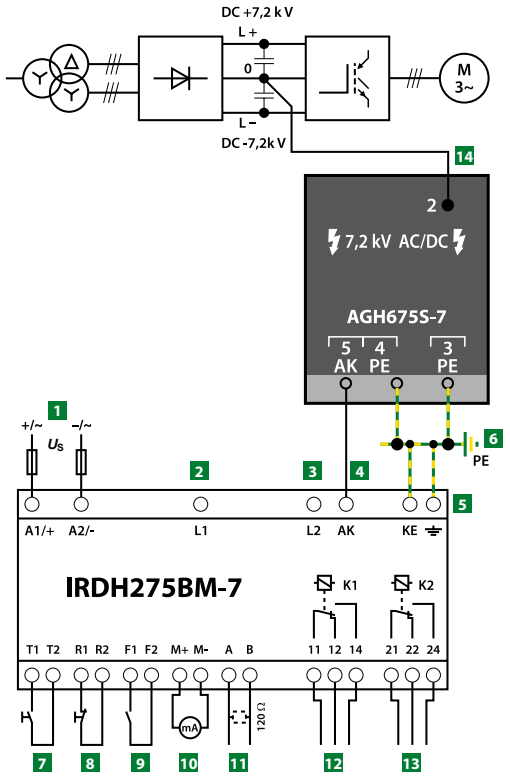
IRDH275BM-7



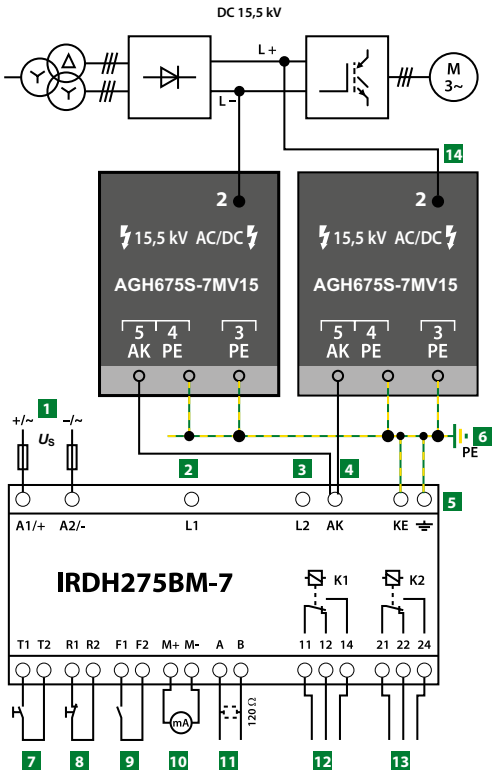
AGH675S-7…



Connection AGH675S-7



Connection AGH675S-7MV15



1 Supply voltage U_S (see ordering information) via 6 A fuse

2 3 Terminals L1, L2 are not connected!

4 Connection to the coupling device AGH675S-7 or the two coupling devices AGH675S-7MV15:
Connect terminal AK to terminal(s) 5 of the coupling device AGH675S-7 (or the two coupling devices AGH675S-7MV15),
Connection with standard low-voltage cable, maximum voltage at terminal 5: 200 V

5 Separate connection of ⏚ and KE to PE

6 Separate connection of the terminals 3 and 4 of the AGH675S-7 or AGH675S-7MV15 to PE

7 External TEST button (NO contact)

8 External RESET button (NC contact or wire jumper), when the terminals are open, the fault message will not be stored

9 STANDBY by means of the function input F1, F2: When the contact is closed, insulation measurement does not take place.

10 Current output, galvanically separated: 0…20 mA or 4…20 mA

11 Serial interface RS-485 (termination 120 Ω resistor)

12 Alarm relay 1; changeover contacts provided

13 Alarm relay 2 (system fault relay); changeover contacts provided

14 Connection of the coupling device AGH675S-7 to the converter: connect the high voltage cable encapsulated on one end to the mid-point of the DC intermediate circuit.
Connection of the two coupling devices AGH675S-7MV15 to the converter: connect the high voltage cable encapsulated on L+and L-.

ISOMETER® IRDH375

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems)

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components, such as rectifiers, converters, and thyristor-controlled DC drives
- UPS systems, battery systems
- Heaters with phase control
- Installations including switch-mode power supplies
- IT systems including high leakage capacitances
- Coupled IT systems

Approvals

Device features

- Insulation monitoring for unearthed AC, AC/DC systems 0…793 V, DC 0…650 V
- Nominal voltage extendable via coupling device
- Two separately adjustable response values1 kΩ…10 MΩ
- ***AMP***^{Plus} measurement method
- Automatic adaptation to the system leakage capacitance
- Info button to display device settings and the system leakage capacitance
- Continuous self monitoring, with automatic alarm message
- Automatic self test, selectable
- Connection for external kΩ indication
- Test and reset button
- Connection external test and reset button
- Two separate alarm relays with two potential-free changeover contacts
- N/O or N/C operation
- Alarm relay for system fault (N/C operation)
- Backlit LC display
- RS-485 interface
- Plug-in terminals

Additional device features, version IRDH375B

- History memory with real-time clock to store all alarm messages with date and time stamp
- Electrically isolated RS-485 interface (BMS protocol) for communication with other Bender devices
- Isometer disconnecting relays for the operation of several ISOMETER®s in coupled IT systems
- Current output 0(4)…20 mA

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1),
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

RS-485 interface	Coupled IT systems	Output	1 -Supply voltage U_S		Type	Art. No.
			AC	DC		
ASCII	not applicable	external kΩ indication 0…400 µA	88…264 V	77…286 V	IRDH375-435	B91065000
			–	19.2…72 V	IRDH375-427	B91065002
BMS	applicable	current output 0(4…20 mA)	88…264 V	77…286 V	IRDH375B-435	B91065004
			–	19.2…72 V	IRDH375B-427	B91065006

[1] Absolute values

Device "Option-W" with increased shock and vibration resistance : Indicated by the letter "W" at the end of the order number.

Suitable system components

Description	Type	Art. No.	Page
External kΩ measuring instruments	7204-1421	B986763	371
	9604-1421	B986764	371
	9620-1421	B986841	371
Coupling devices	AGH150W-4	B98018006	326
	AGH204S-4	B914013	328
	AGH520S	B913033	329
Transparent front plate cover IP65	144x72	B98060005	413

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

Voltage ranges

IRDH375…:

Nominal system voltage U_n	AC, 3/(N)AC 0…793 V*
Nominal frequency f_n (for f < 50 Hz see characteristic curve in the manual)	0,1…460 Hz
Nominal system voltage U_n	DC 0…650 V*

IRDH375…-435:

Supply voltage U_S (also see nameplate)	AC 88…264 V*
Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 77…286 V*

IRDH375…-427:

Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 19.2…72 V*

IRDH375…:

Power consumption	≤ 14 VA

Response values

Response value R_{an1} (Alarm1)	1 kΩ…10 MΩ
Response value R_{an2} (Alarm2)	1 kΩ…10 MΩ
Relative uncertainty (20 kΩ…1 MΩ) (acc. to IEC 61557-8)	± 15 %
Relative uncertainty (1…20 kΩ)	+2 kΩ/+20 %
Relative uncertainty (1…10 MΩ)	0.2 MΩ/+20 %
Response time t_{an} at R_F = 0.5 x R_{an} and C_e = 1 µF	≤ 5 s
Hysteresis (1…10 kΩ)	+2 kΩ
Hysteresis (10 kΩ…10 MΩ)	25 %

Measuring circuit

Measuring voltage U_m	≤ 40 V
Measuring current I_m (at R_F = 0 Ω	≤ 220 µA
Internal DC resistance R_i	≥ 180 kΩ
Impedance Z_i at 50 Hz	≥ 180 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1200 V
Permissible system leakage capacitance C_e	≤ 500 µF
Factory setting	150 µF

Displays

Display, illuminated	two-line display
Characteristics (number)	2 x 16
Display range measured value	1 kΩ…10 MΩ
Operating uncertainty (20 kΩ…1 MΩ) (acc. to IEC 61557-8)	±15 %**
Operating uncertainty (1…20 kΩ)	±1 kΩ/±15 %**
Operating uncertainty (1 MΩ…10 MΩ)	±0.1 MΩ/±15 %**

Outputs/Inputs

Test/reset button	internal/external
Cable length test/reset button, external	≤ 10 m
Current output for measuring instrument SKMP (scale centre point = 120 kΩ):	
Current output IRDH375 (load)	400 µA (≤ 12.5 kΩ)
Current output IRDH375B (load)	20 mA (≤ 500 Ω)
Accuracy current output (1 kΩ…1 MΩ) related to the value indicated	±10 %, ±1 kΩ

Serial interface

Interface/protocol IRDH375	RS-485/ASCII
Interface/protocol IRDH375B	RS-485/BMS
Connection	terminals A/B
Cable length	≤ 1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 Ω (0.5 W)
Device address, BMS bus	1…30 (factory setting = 3)

Switching elements

Switching elements	3 changeover contacts K1 (Alarm 1), K2 (Alarm 2), K3 (device error)
Operating principle K1, K2 (Alarm 1/Alarm 2)	N/O or N/C operation
Factory setting (Alarm 1/Alarm 2)	N/O operation
Operating principle K3 (device error)	N/C operation
Electrical endurance, number of cycles	12000
Contact class	IIB acc. to DIN IEC 60255 Part 0-20
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi = 0.4 0.2 A, DC 220 V, L/R = 0.04 s
Contact rating at DC 24 V	≥ 2 mA (50 mW)

Environment/EMC

EMC	according to IEC 61326-2-4 Ed. 1.0
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+55 °C
Ambient temperature (during storage)	-40…+70 °C
Climatic class acc. to IEC 60721-3-3	3K5

Connection

Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
flexible with ferrules without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Other

Operating mode	continuous operation
Mounting	display-oriented
Distance to adjacent devices	≥ 30 mm
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	X300, free from halogen
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00124
Weight	≤ 510 g

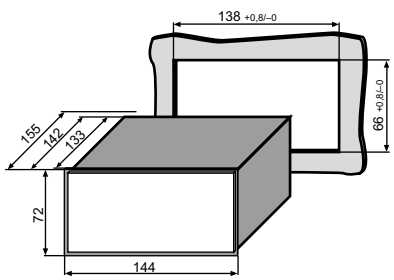
Option "W"

Shock resistance IEC 60068-2-27 (device in operation)	30 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6	1.6 mm/10…25 Hz 4 g/25…150 Hz
Ambient temperature, during operation	-25…+70 °C
Ambient temperature for storage	-40…+85 °C
Screw mounting	2 x M4

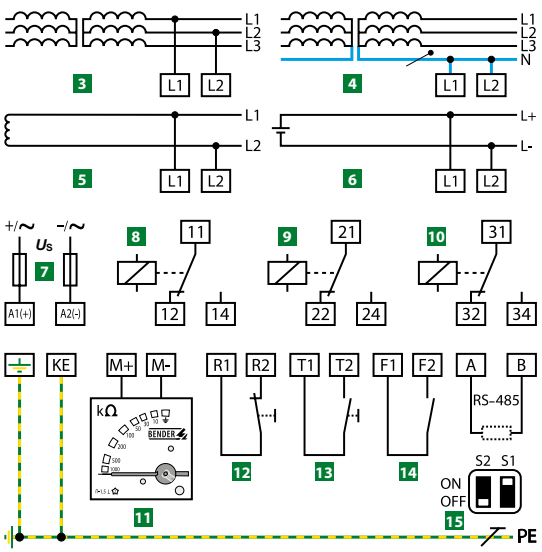
The data labelled with an * are absolute values

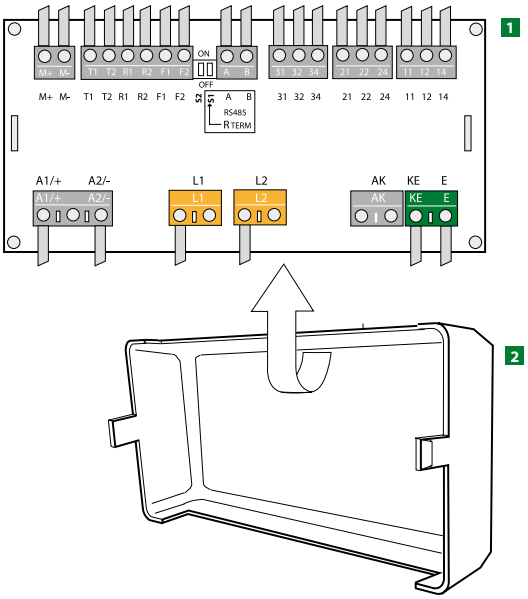
** = Under EMC test conditions in accordance with IEC 61326-2-4 the specified tolerances can double

Dimension diagram (dimensions in mm)



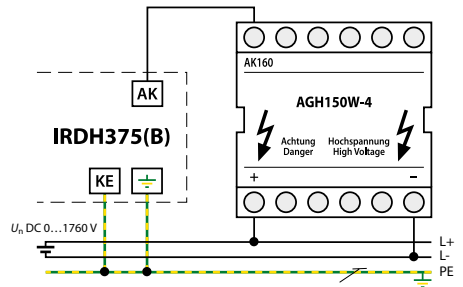
Wiring diagrams



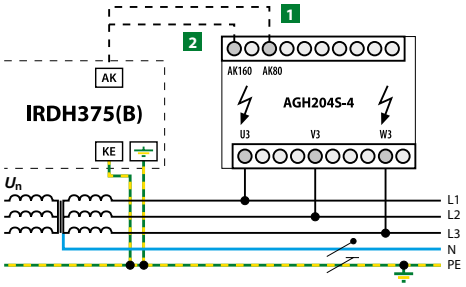


1 Rear view IRDH375
2 Detachable terminal cover
3 3AC system
4 3NAC system
5 AC system
6 DC system
7 Supply voltage U_S (see ordering information) via 6 A fuse; for UL and CSA applications, it is mandatory to use 5 A fuses.
8 Alarm relay R_{ALARM1}
9 Alarm relay R_{ALARM2}
10 Alarm relay system fault
11 External kΩ indication 0…400 µA or current output 0(4)…20 mA (option).
12* External reset button "R1, R2" (N/C contact or wire jumper). When the terminals are open the fault messages will not be stored, provided that the fault memory has not been activated via the operating menu.
13* External test button "T1/T2" (N/O contact)
14* Standby by means of the function input "F1, F2": with the contact in closed position no insulation measurement takes place
15 DIP switch, S1 "ON"-RS-485 terminated (120 Ω on), S2 – unassigned
* **The terminal pairs 10, 11 and 12 must be wired electrically isolated and may not be connected to earth!**

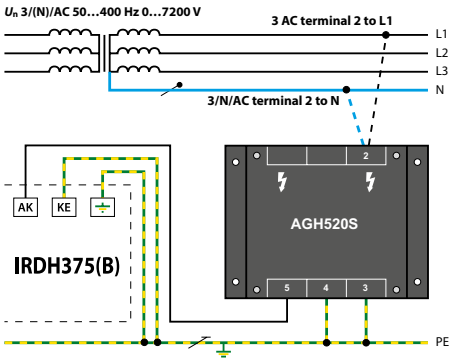
Wiring diagrams



ISOMETER® IRDH375 with coupling device AGH150W-4



ISOMETER® IRDH375 with coupling device AGH204S-4



ISOMETER® IRDH375 with coupling device AGH520S

1 without rectifier
U_n = 3AC 0…1650 V (DC max. 1000 V)

2 with rectifier
U_n = 3AC 0…1300 V (peak voltage downstream of the rectifier or intermediate circuit voltage of max. 1840 V)

ISOMETER® IRDH575

Insulation monitoring device for unearthed AC, DC and AC/DC systems (IT systems) with control and display function for EDS insulation fault location systems

AC/DC



Typical applications

- Insulation resistance monitoring in IT systems
- Localisation of insulation faults with additional insulation fault locators EDS4…

Approvals

Device features

- Universal application in 3(N)AC, AC/DC and DC IT systems 20…575 V/340…760 V
- Response range 1 kΩ…10 MΩ
- Info button for the indication of various parameters and the system leakage capacitance
- Comprehensive self-monitoring function including system fault alarm relay
- Internal/external test and reset button
- Two separate alarm relays, N/C or N/O operation selectable
- Backlit plain text display 4 x 16 characters
- RS-485 interface
- Data memory, disconnection from supply and 0/4…20 mA current output
- Can be extended to an insulation fault location system for max.1080 circuits
- Adjustable locating current for insulation fault location
- Appropriate for EDS4… insulation fault location systems
- AMP measurement method

Other functions

- History memory to store max. 99 alarm messages with date and time stamp
- Isometer disconnecting relays for the operation of several ISOMETER®s in coupled IT systems
- Built-in RS-485 interface (BMS bus) for communication with other Bender devices

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3
- DIN EN 61557-9
- VDE 0413-9
- IEC 61557-9
- ASTM F1669M-96
- ASTM F1207M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Permissible extraneous DC voltage U_{fg}	Nominal system voltage U_n		Supply voltage U_S		Type	Art. No.
DC	AC	DC	AC	DC		
≤ 810 V	20…575 V	20…575 V	–	19.2…72 V	IRDH575B1-427	B91065502
			77…286 V	88…264 V	IRDH575B1-435	B91065500
	20…150 V	20…150 V	–	19.2…72 V	IRDH575B1-4227[1)]	B91065505
			77…286 V	88…264 V	IRDH575B1-4235	B91065504
≤ 1060 V	340…760 V	340…575 V	–	19.2…72 V	IRDH575B2-427	B91065506
			77…286 V	88…264 V	IRDH575B2-435	B91065503

[1)] Measuring voltage U_m 10 V (version -4227) for usage in control circuits.
Device "Option-W" with increased resistance to shock and vibrations: Indicated by the letter "W" at the end of the order number.

Suitable system components

Description	Type	Art. No.	Page
Panel seal for IP 42	–	B98060006	–
Transparent cover for IP 65	–	B98060007	413
Adapter for DIN rail mounting	–	B98060010	–
Measuring instruments	9620-1421	B986841	371
	9620S-1421	B986842	371

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

Voltage ranges

IRDH575B1-4235:

Nominal system voltage U_n	AC, 3/(N)AC 20…150 V*
Nominal frequency f_n	50…460 Hz
Nominal system voltage U_n	DC 20…150 V*

IRDH575B1-435:

Nominal system voltage U_n	AC, 3/(N)AC 20…575 V*
Nominal frequency f_n	50…460 Hz
Nominal system voltage U_n	DC 20…575 V*

IRDH575B2-435:

Nominal system voltage U_n	AC, 3/(N)AC 340…760 V*
Nominal frequency f_n	50…460 Hz
Nominal system voltage U_n	DC 340…575 V*

IRDH575B1-435:

Supply voltage U_S (also see nameplate)	AC 88…264 V*
Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 77…286 V*

IRDH575B1-427:

Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 19.2…72 V*
Power consumption	≤ 14 VA

Response values

Response value R_{an1} (Alarm1)	1 kΩ…10 MΩ
Response value R_{an2} (Alarm2)	1 kΩ…10 MΩ
Relative uncertainty (20 kΩ…1 MΩ) (acc. to IEC 61557-8)	±15 %
Relative uncertainty (1…20 kΩ)	+2 kΩ/+20 %
Relative uncertainty (1…10 MΩ)	0.2 MΩ/+20 %
Measuring time	see characteristic curves
Hysteresis (1…10 kΩ)	+2 kΩ
Hysteresis (10 kΩ…10 MΩ)	25 %

Measuring circuit for insulation measurement

Measuring voltage U_m	≤ 40 V
Measuring voltage U_m (IRDH575B1-4227)	≤ 10 V
Measuring current I_m (at R_F = 0Ω)	≤ 220 µA
Internal DC resistance R_i	≥ 180 kΩ
Impedance Z_i at 50 Hz	≥ 180 kΩ
Permissible extraneous DC voltage U_{fg} (variant B1)	≤ DC 810 V
Permissible extraneous DC voltage U_{fg} (variant B2)	≤ DC 1060 V
System leakage capacitance C_e	500 µF
Factory setting C_e	150 µF

Measuring circuit for insulation fault location (EDS)

Locating current I_L DC	1/2.5/10/25/50 mA
Test pulse/break	2/4 s

Displays

Display, illuminated	four-line display
Characters (number of characters)	4 x 16
Display range measured value	1 kΩ…10 MΩ
Operating uncertainty (20 kΩ…1 MΩ) (acc. to IEC 61557-8)	±15 %**
Operating uncertainty (1…20 kΩ)	±1 kΩ/15 %**
Operating uncertainty (1…10 MΩ)	±0.1 MΩ/15 %**

Outputs/Inputs

Test/reset button	internal/external
Current output for measuring instrument SKMP (scale centre point = 120 kΩ):	
Current output IRDH575 (max. load)	0/4…20 mA (≤ 500 Ω)
Accuracy current output (1 kΩ…1 MΩ)	±10 %, ± 1 kΩ

Serial interface

Interface/protocol	RS-485/BMS
Max. cable length	≤ 1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 Ω (0.5 W)

Switching elements

Switching components	3 changeover contacts: K1 (Alarm 1), K2 (Alarm2), K3 (device error, additionally selectable EDS alarm)
Operating principle K1, K2	N/O or N/C operation
Factory setting (Alarm 1/Alarm 2)	N/O operation
Operating principle K3	N/C operation
Electrical endurance, number of cycles	12000
Contact class	IIB (DIN IEC 60255-23)
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi = 0.4 – 0.2 A, DC 220 V, L/R = 0.04 s
Contact rating at DC 24 V	≥ 2 mA (50 mW)

Environment/EMC

EMC	acc. to IEC 61326-2-4 Ed. 1.0
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (during operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+55 °C
Ambient temperature (during storage)	-40…+70 °C
Climatic class acc. to DIN IEC 60721-3-3	3K5

Connection

Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
flexible with ferrules without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Other

Operating mode	continuous operation
Mounting	display-oriented
Distance to adjacent devices	≥ 30 mm
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Degree of protection, for door mounting (DIN EN 60529)	IP40
Degree of protection, for door mounting with panel sealing (DIN EN 60529)	IP42
Degree of protection, for mounting the transparent front plate cover (DIN EN 60529)	IP65
Type of enclosure: suitable for panel mounting	free from halogen
Flammability class	UL94 V-0
Documentation number	D00089
Weight	≤ 900 g

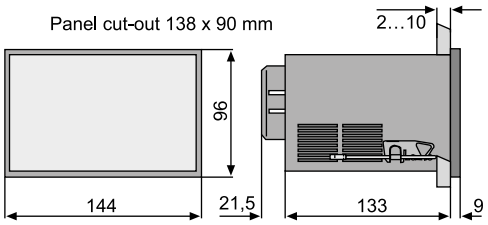
Option "W"

Shock resistance IEC 60068-2-27 (device in operation)	30 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6	1.6 mm/10…25 Hz 4 g/25…150 Hz
Ambient temperature, during operation	-25…+70 °C
Ambient temperature, during operation	> 55 °C (not for continuous operation in the insulation fault location mode with 50 mA)
Ambient temperature for storage	-40…+85 °C

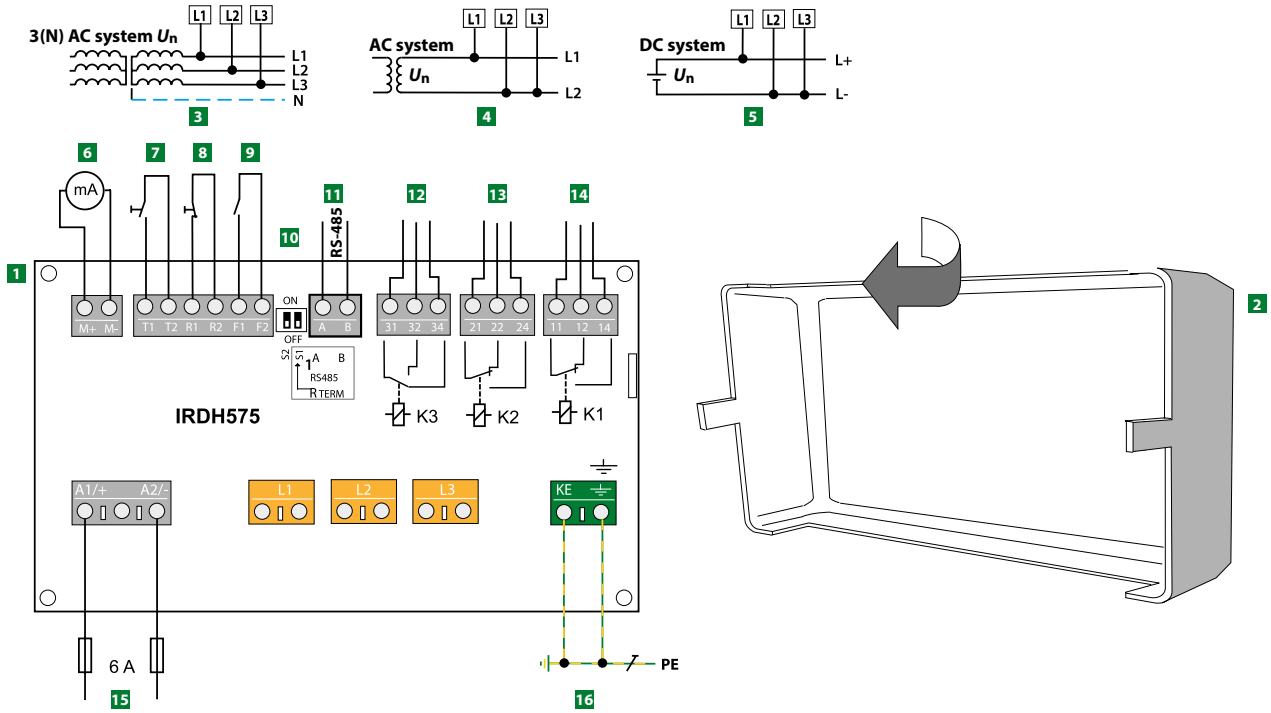
The data labelled with an * are absolute values

** = Under EMC test conditions in accordance with IEC 61326-2-4 the specified tolerances can double

Dimension diagram (dimensions in mm)



Wiring diagram



1 Rear view IRDH575

2 Detachable terminal cover

3 Connection to the 3AC system to be monitored:
Connect terminals L1, L2 L3 to conductor L1, L2, L3

4 Connection to the AC system to be monitored:
Connect L1 to conductor L1and terminals L2, L3 to conductor L2

5 Connection to the DC system to be monitored:
Connect L1 to conductor L+ and terminals L2, L3 to conductor L-

6 For external indicating instrument
Current output 0…20 mA or 4…20 mA

7* External test button "T1, T2" (N/O contact)

8* External reset button "R1, R2" (N/C contact or wire jumper), (with the terminals open and the ISO-SETUP setting Memory:off, insulation faults will not be stored)

9* STANDBY, when the contact is closed, no insulation measurement is carried out; disconnection from the IT system being monitored

10 S1 = ON : Termination of the serial RS-485 interface (A/B) with 120 Ω
S2 = not wired)

11 Serial RS-485 interface (BMS bus)

12 Alarm relay "K3" (device error and EDS alarm) (addr.: 1)

13 Alarm relay "K2" (insulation fault 2); available changeover contacts

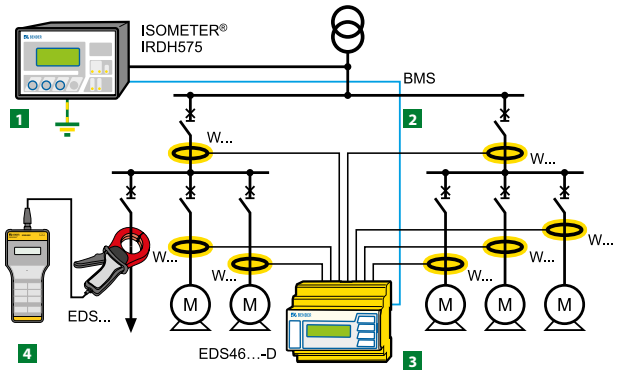
14 Alarm relay "K1" (insulation fault 1); available changeover contacts

15 Supply voltage U_S (see nameplate) via 6 A fuse; for UL and CSA applications, it is mandatory to use 5 A fuses.

16 Separate connection of ⏚ and KE to PE

* **The terminal pairs 2, 3 and 4 have to be wired electrically isolated and must not be connected to PE!**

System configuration – Example



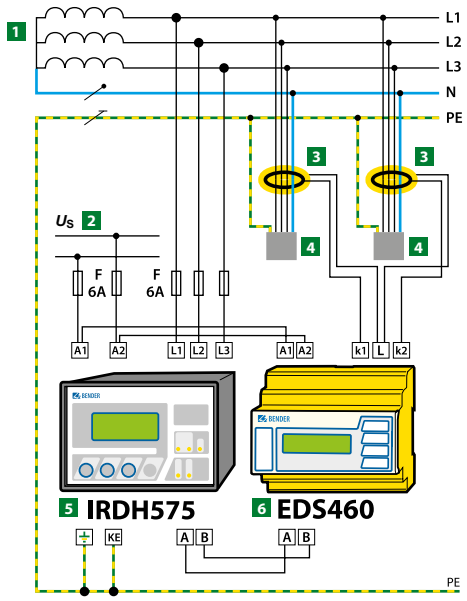
1 ISOMETER® IRDH575

2 RS-485/BMS protocol

3 EDS460/EDS461

4 EDS3090/EDS3091

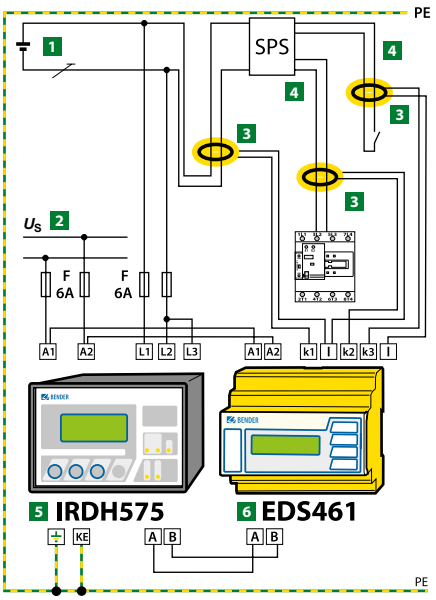
Wiring example EDS system with EDS460 and IRDH575



EDS system with IRDH575, EDS460 and measuring current transformers W… in a 3AC system

1 3AC, 3NAC, DC 20…575 V bzw. 3AC, 3NAC, DC 340…760 V
2 U_S see ordering information, 6 A fuse recommended.
Note: Supply voltage U_S in the IT system requires two fuses.
3 Measuring current transformers W…
4 Outgoing circuits to the loads
5 ISOMETER® IRDH575
6 Insulation fault locator EDS460

Wiring example EDS system with EDS461 and IRDH575



1 AC 20…265V/DC 20 V…308 V
2 U_S see ordering information, 6 A fuse recommended.
Note: Supply voltage U_S in the IT system requires two fuses.
3 Measuring current transformers W…/8000
4 Outgoing circuits PLC: inputs and outputs
5 ISOMETER® IRDH575
6 Insulation fault locator EDS461

Design of an insulation fault location system with EDS461

The example above shows an EDS461 system in a DC system for the supply of a programmable logic controller (PLC). Due to the fact that the inputs of PLC systems are very sensitive, the use of an EDS461 is recommended.
The locating current of the IRDH575 is to be set to max. 2.5 mA or as necessary to 1 mA, in order to avoid influences on the PLC system.

ISOMETER® IR1575

Insulation monitoring device for unearthed AC, 3(N)AC systems up to 480 V and DC systems up to 480 V

AC/DC



Typical applications

- AC or AC/DC main circuits
- AC/DC main circuits with directly connected DC components
- UPS systems, battery systems
- Heaters with phase control
- Installations including switch mode power supplies

Device features

- Insulation monitoring for unearthed AC, AC/DC systems 0…480 V and DC systems 0…480 V
- Two separately adjustable response values 2 kΩ…1 MΩ
- AMP measurement method
- Automatic adaptation to the system leakage capacitance
- Injection of the locating current required for selective insulation fault location (only IR1575PG1)
- Alarm LEDs for Alarm 1/Alarm 2
- Fault memory selectable
- Connection monitoring system conductor/earth
- Test and reset button
- External test/reset button can be connected
- Two separate alarm relays with one potential-free changeover contact each
- N/O or N/C operation, selectable
- Backlit LC display
- Self monitoring with automatic alarm
- Plug-in terminals
- Door mounting enclosure 96 x 96 mm

Approvals

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Design	Supply voltage U_S[1]		Type	Art. No.
	AC	DC		
Standard	88…264 V 340…460 V	77…286 V	IR1575-435	B91064000
			IR1575PG1-435	B91064002
	16…72 V	10.2…84 V	IR1575-434	B91064003
			IR1575PG1-434	B91064004
Increased shock and vibration resistance	88…264 V 340…460 V	77…286 V	IR1575W-435	B91064000W
			IR1575PG1W-435	B91064002W

[1] Absolute values

Insulation coordination acc. to IEC 60664-1

Rated voltage	AC 500 V
Rated impulse voltage/pollution degree	4 kV/3

Voltage ranges

IR1575-…:

Nominal system voltage U_n	AC, 3(N)AC 0…480 V, DC 0…480 V
Nominal frequency f_n	DC, 30…420 Hz

IR1575PG1…:

Nominal system voltage U_n	AC/3 AC 20…480 V
Nominal frequency f_n	30…460 Hz
Nominal system voltage U_n	DC 20…480 V

IR1575x-435:

Supply voltage U_s at A0/A1 (see nameplate)	AC 88…264 V
Frequency range of U_s	42…460 Hz
Supply voltage U_s at A0/A2 (see nameplate)	AC 340…460 V
Frequency range of U_s	47…63 Hz
Supply voltage U_s at A0/A1 (see nameplate)	DC 77…286 V

IR1575x-434:

Supply voltage U_s at A0/A1 (see nameplate)	AC 16…72 V
Frequency range of U_s	42…460 Hz
Supply voltage U_s at A0/A1 (see nameplate)	DC 10.2…84 V

IR1575…:

Power consumption	≤ 5 V

Response values

Response value R_{an1} (Alarm1)	2 kΩ…1 MΩ
Response value R_{an2} (Alarm2)	2 kΩ…1 MΩ
Specified response value (2 kΩ…10 kΩ)	+ 2 kΩ
Specified response value (10 kΩ…1 MΩ)	0 %…+20 %
Response time t_{an} at $R_F = 0.5 \times R_{an}$ and $C_e = 1$ µF	≤ 5 s
Hysteresis (2 kΩ…10 kΩ)	+2 kΩ
Hysteresis (10 kΩ…1 MΩ)	25 %

Measuring circuit for insulation measurement

Measuring voltage U_m	±20 V
Measuring current I_m (bei $R_F = 0$ W)	≤ 170 µA
Internal DC resistance R_i	≥ 119 kΩ
Internal impedance Z_i, at 50 Hz	
IR1575-…	≥ 14 kΩ
IR1575PG1-…	≥ 119 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 680 V
Permissible system leakage capacitance C_e	≤ 60 µF

Measuring circuit for insulation fault location (EDS) (only IR1575PG1…)

Test current I_p DC	10/25 mA
Test pulse/break	2 s/4 s

Displays

Display, illuminated	LC display
Characters (number of characters, height)	2 x 16 (4.5 mm)
Display range measuring value	1 kΩ…5 MΩ
Absolute error (1 kΩ…10 kΩ)	±1 kΩ
Relative percentage error (1 kΩ…10 kΩ)	±10 %

Outputs

Test and reset button internal/external	

Switching elements

Switching elements	2 x 1 changeover contact
Operating principle	N/O or N/C operation
Factory setting (Alarm1/Alarm2)	N/O operation
Admissible number of operations/h	12 000 cycles
Contact class	IIB (DIN EN 60255-23)
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	UC 5 A
Breaking capacity	2 A, AC 230 V, cos φ = 0.4
	0.2 A, DC 220 V, L/R = 0.04 s
Minimum contact current at DC 24 V	≥ 2 mA (50 mW)

Environment

EMC immunity	acc. to EN 61326
EMC emission	acc. to EN 61326
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance acc. to IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance acc. to IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+55 °C
Ambient temperature (during storage)	-40…+70 °C
Classification of climatic conditions acc. to DIN IEC 60721-3-3	3K5

Connection

Connection	plug-in terminals
Connection properties	
rigid/flexible	0.2…4/0.2…2.5 mm²
flexible with ferrule with/without plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12
Tightening torque	0.5…0.6 Nm (4.3…5.3 lb-in)

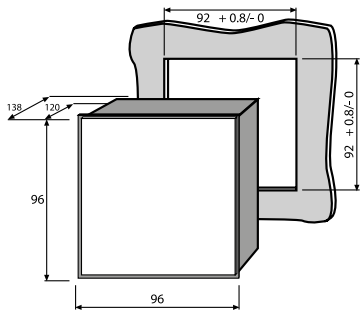
Other

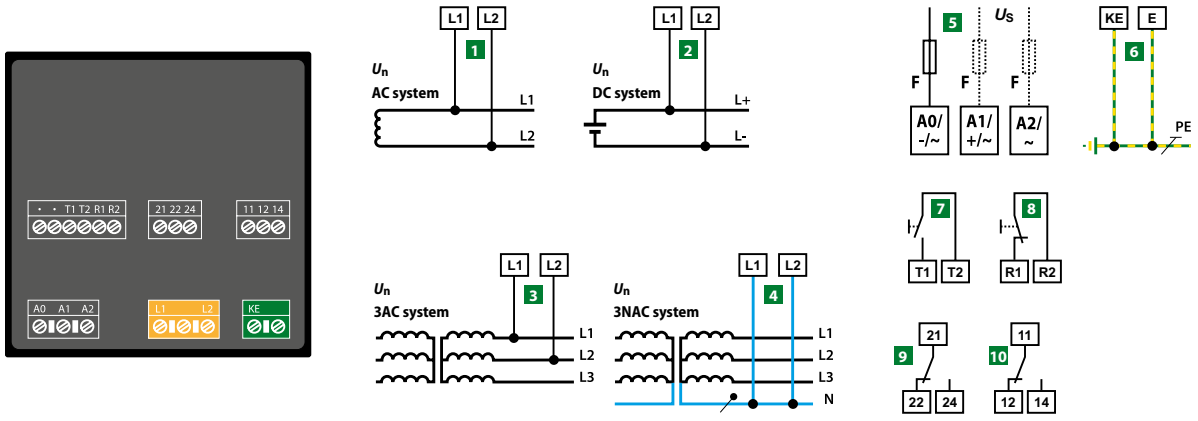
Operating mode	continuous operation
Mounting position	display-oriented
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Mounting	panel mounting
Flammability class	UL94 V-2
Documentation number	
IR1575	D00116
IR1575PG1	D00357
Weight	≤ 400 g

Option „W“

Shock resistance acc. to IEC 60068-2-27 (during operation)	30 g/11 ms
Bumping acc. to IEC 60068-2-29 (during transport)	40 g/6 ms
Vibration resistance acc. to IEC 60068-2-6	1.6 mm/10…25 Hz
	4 g/25…150 Hz
Ambient temperature (during operation)	-10 °C…+55 °C
Storage temperature range	-40 °C…+85 °C

Dimension diagram (dimensions in mm)





1 Connection to the AC system to be monitored:
connect terminals L1, L2 to conductor L1, L2

2 Connection to the DC system to be monitored:
Connect terminal L1 to conductor L+, terminal L2 to conductor L-

3 Connection to the 3AC system to be monitored:

4 Connect terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2

5 Supply voltage U_S (see nameplate) via 6 A fuse:
A0 - A1 = AC 88…264 V, DC 77…286 V
A0 - A2 = AC 340…460 V

6 Separate connection of E and KE to PE

7 External test button "T1, T2" (N/O contact)

8 External reset button "R1, R2" (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored

9 Alarm relay: Alarm 2

10 Alarm relay: Alarm 1

ISOMETER® IR427 with alarm indicator and test combination MK7

Insulation monitoring device with integrated load and temperature monitoring for medical IT systems in accordance with IEC 60364-7-710, IEC 61557-8 and DIN VDE 0100-710

AC/DC MED





Typical applications

- Medical IT systems in accordance with IEC 60364-7-710, IEC 61557-8 and DIN VDE 0100-710

Approvals

CE EAC

Device features

ISOMETER® IR427

- Insulation monitoring for medical IT systems
- Load and temperature monitoring for IT system transformers
- Adjustable response value for insulation monitoring
- Adjustable load current response value
- Integrated voltage monitoring for four alarm and test combinations MK7
- Temperature monitoring with PTC thermistor or bimetal switch
- Connection monitoring earth
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test button
- Configurable alarm relay: N/O or N/C operation selectable
- Self monitoring with automatic alarm
- Compact two-module enclosure (36 mm)
- Four-wire interface for four alarm indicator and test combinations MK7

Remote alarm indicator and test combination MK7

- Easy-to-clean front foil surface
- Label field
- Panel frame alpine white
- Alarm LEDs: Power On, insulation fault overload, overtemperature
- Test button, mute button
- Standard flush-mounting enclosure 66 mm

Standards

The ISOMETER® has been developed in compliance with the following standards:

- IEC 60364-7-710
- IEC 61557-8
- DIN VDE 0100-710

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		Nominal system voltage U_n [1]	Type	Art. No.	
AC	DC	AC		screw-type terminals	push-wire terminals
70…264 V, 42…460 Hz	–	70…264 V, 42…460 Hz	IR427-2	B92075300	B72075300
–	18…28 V	–	MK7 Remote alarm indicator and test combination	B95100201	–

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008
MK-cavity-wall-box-60mm	B95100203

Suitable system components

Description	Type	Art. No.	Page
Measuring current transformers	STW2	B942709	–
Temperature sensor (PTC)	ES0107	B924186	–
Mounting frame	XM420	B990994	412

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Protective separation (reinforced insulation) between	(L1, L2, E, KE, 1, 2, 3, 4 Z, Z/k, I) -(11, 12, 14)
Voltage test acc. to IEC 61010-1	2.21 kV

Supply voltage

Supply voltage U_S	$= U_n$
Power consumption	≤ 4 VA

IT system being monitored

Nominal system voltage U_n	AC 70…264 V
Nominal frequency f_n	47…63 Hz

Insulation monitoring

Response value R_{an}	50…500 kΩ (50 kΩ)*
Relative uncertainty	±10 %
Hysteresis	25 %
Response time t_{an} at $R_F = 0.5 \times R_{an}$ and $C_e = 0.5$ µF	≤ 5 s
Permissible system leakage capacitance C_e	≤ 5 µF

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m (at $R_F = 0$ Ω)	≤ 50 µA
Internal DC resistance R_i	≥ 240 kΩ
Impedance Z_i at 50 Hz	≥ 200 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 300 V

Load current monitoring

Response value, adjustable	5…50 A (7 A)*
Relative uncertainty	±5 %
Hysteresis	4 %
Setting values load current measurement:	

Transformer	3150 VA	4000 VA	5000 VA	6300 VA	8000 VA	10000 VA
I_{alarm} 1~	14 A	18 A	22 A	28 A	35 A	45 A

Response time overload, (50 % to 120 %)	< 5 s
Response time for measuring current transformer monitoring	at restart, test or every 1 h

Temperature monitoring:

Response value (fixed value)	4 kΩ
Release value (fixed value)	1.6 kΩ
PTC resistors acc. to DIN 44081	max. 6 in series
Response time overtemperature	< 2 s
Response time connection fault PTC resistors	< 2 s

Displays, memory

LC display	multifunctional, not illuminated
Measured value insulation resistance	10 kΩ…1 MΩ
Operating uncertainty	±10 %, ±2 kΩ
Measured value load current (as % of the set response value)	10 %…199 %
Operating uncertainty	±5 %, ±0.2 A
Password	on, off/0…999 (off, 0)*

Interface for MK7

Cable length, twisted in pairs, shielded	200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2x0.8

Power supply (terminals 1 and 2):

U_{off}	DC 24 V
I_{max} (max. 4 MK7)	80 mA

Communication (terminal 3 and 4):

Interface/protocol	RS-485/proprietary, no BMS
Terminating resistor	120 (0.25 W), internal, switchable

Cable lengths for the connection of the measuring current transformer STW2 and the temperature sensor

single wire > 0.5 mm²	≤ 1 m
single wire, twisted > 0.5 mm²	≤ 10 m
twisted in pairs, twisted > 0.5 mm²	≤ 40 m
Cable (shield on one side connected to PE)	recommended: J-Y(St)Y min. 2x0.6

Switching elements

Number	1 changeover contact
Operating principle	N/C operation or N/O operation (N/C operation)*
Electrical endurance, number of cycles	10000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A

Minimum contact rating	1 mA at AC/DC 10 V

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 69721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

Connection type	**screw-type terminals**
Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Connection type	**push-wire terminals**
Connection properties:	
rigid/flexible	0.2…2.5 mm² (AWG 24…14)
Flexible without ferrule	0,75…2,5 mm² (AWG 19…14)
Flexible with ferrule	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

Operating mode	continuous operation
Position of normal use	any
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94V-0
Screw mounting	2 x M4
DIN rail mounting acc. to	IEC 60715
Documentation number	D00118
Weight	≤ 150 g

( )* = Factory setting

Technical data MK7

Insulation coordination acc. to IEC 60664-1/IEC 60664-3	
Rated insulation voltage	50 V
Rated impulse voltage/pollution degree	500 V/3

Supply voltage	
Supply voltage U_S	DC 18…28 V
Power consumption	0.5 VA

Environment/EMC	
EMC	IEC 61326
Operating temperature	-10…+55 °C

Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 69721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

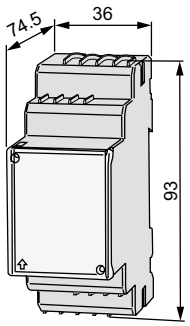
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection	
Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2…2.5 mm² (AWG 24…14)
Flexible with ferrule	0.2…1.5 mm² (AWG 24…16)
Stripping length	8 mm

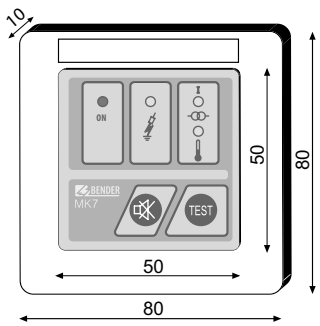
Other	
Operating mode	continuous operation
Position of normal use	any
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Front plate colour	alpine white
Flush-mounting enclosure, diameter (included in the scope of delivery)	66 mm
Weight (including mounting frame)	≤ 80 g

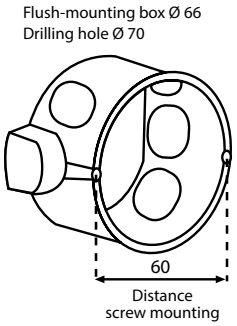
Dimension diagram (dimensions in mm)

IR427



MK7



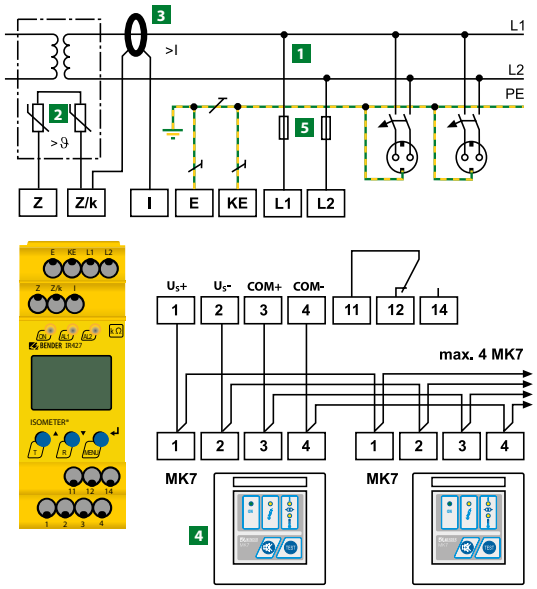


Alarm messages LEDs

	IR427			MK7			
	"ON"	"AL1"	"AL2"	ON	Ins. fault	Overload	Overtemp.
Operation	■	–	–	■	–	–	–
System fault[1)]	flashing	flashing	flashing	flashing	flashing	flashing	flashing
Insulation fault	■	■	–	■	■	–	–
Overcurrent	■	–	■	■	–	■	–
Overtemperature	■	–	■	■	–	–	■
No communication betw. IR 427+MK7	–	–	–	flashing	–	–	–

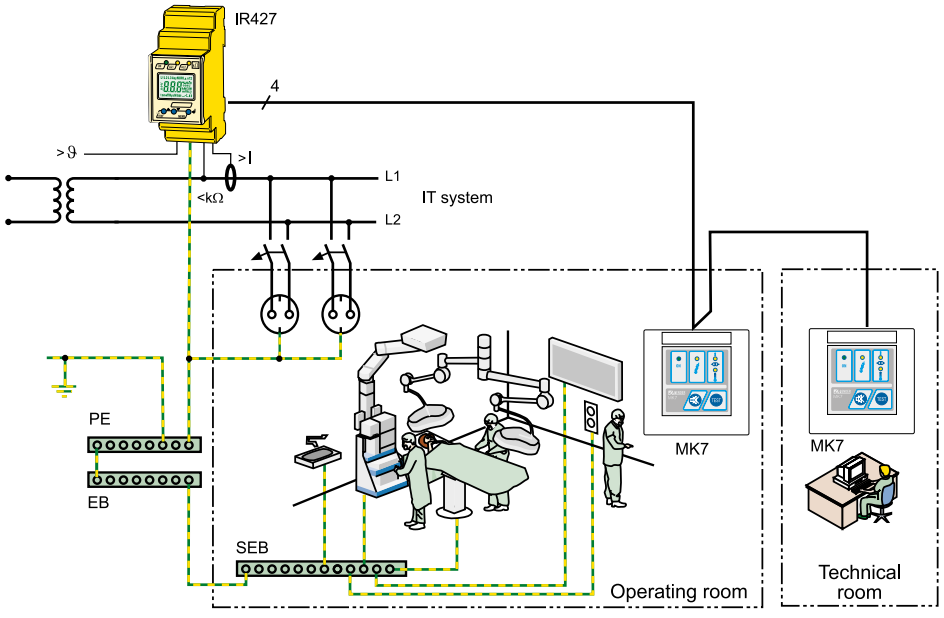
[1)] Detailed alarm information on LCD

Wiring diagram



1 Connection to the IT system to be monitored = supply voltage U_S via fuse
2 Temperature sensor
3 Measuring current transformer for load current monitoring
4 Connection alarm indicator and test combination MK7 (max. 4 pieces)
5 Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended) In case of supply (L1/L2) from an IT system, both lines have to be protected by a fuse.

Example of application



PE = Protective earth
EB = Equipotential bonding
SEB = Supplementary Equipotential Bonding

ISOMETER® isoMED427P

Insulation monitoring device with integrated load and temperature monitoring and locating current injector and insulation fault location systems for medical IT systems

AC/DC MED



Typical applications

- Medical IT system in accordance with IEC 60364-7-710, IEC 61557-8, IEC 61557-9 and DIN VDE 0100-710

Approvals

CE Lloyd's Register TYPE APPROVED

Device features

- Insulation monitoring for medical IT systems
- Adjustable response value for insulation monitoring
- Locating current injector for insulation fault location systems
- Load and temperature monitoring for IT system transformers
- Adjustable load current response value
- Temperature monitoring with PTC thermistor or bimetal switch
- Self monitoring with automatic alarm
- PE connection monitoring
- Internal/external test button
- LEDs: Power On, Alarm 1, Alarm 2
- Configurable alarm relay: N/O or N/C operation selectable
- Compact two-module enclosure (36 mm)
- BMS interface

Standards

The ISOMETER® has been developed in compliance with the following standards:

- IEC 60364-7-710
- IEC 61557-8
- IEC 61557-9
- DIN VDE 0100-710

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S= U_n[1)] AC	Type	Art. No.
70…264 V, 42…460 Hz	isoMED427P-2	B72075301

[1)] Absolute values of the voltage range

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Suitable system components

Description	Type	Art. No.	Page
Measuring current transformers	STW2	B942709	–
Temperature sensor (PTC)	ES0107	B924186	–
Three phase load monitor	CMS460-D4-2	B94053030	–
Mounting frame	XM420	B990994	412

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Protective separation (reinforced insulation) between	(L1, L2, E, KE, T1, T2, A, B, Z, Z/k, I) - (11, 12, 14)
Voltage test acc. to IEC 61010-1	2.21 kV

Voltage supply

Supply voltage U_S	$= U_n$
Power consumption	≤ 6.5 VA

IT system being monitored acc. to IEC 60364-7-710

Nominal system voltage U_n	AC 70…264 V
Nominal frequency f_n	47…63 Hz

Insulation monitoring acc. to IEC 61557-8

Response value R_{an}	50…500 kΩ (50 kΩ)*
Relative uncertainty	±10 %
Hysteresis	25 %
Response time t_{an} at $R_F = 0.5 \times R_{an}$ and $C_e = 0.5$ µF	≤ 5 s
Response time for PE connection monitoring	≤ 1 h
Permissible system leakage capacitance C_e	5 µF

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m (at $R_F = 0$ Ω)	≤ 50 µA
Internal DC resistance R_i	≥ 240 kΩ
Impedance Z_i at 50 Hz	≥ 200 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 300 V

Locating current injector acc. to IEC 61557-9

Locating current	≤ 1 mA
Test pulse/break	2/4 s

Load current monitoring

Response value, adjustable	5…50 A (7 A)*
Relative uncertainty	± 5 %
Hysteresis	4 %
Nominal frequency f_n	47…63 Hz

Setting values load current measurement:

Transformer	3150 VA	4000 VA	5000 VA	6300 VA	8000 VA	10000 VA
/alarm 1~	14 A	18 A	22 A	28 A	35 A	45 A

Temperature monitoring:

Response value (fixed value)	4 kΩ
Rated frequency f_n	47…63 Hz
Release value (fixed value)	1.6 kΩ
PTC resistors acc. to DIN 44081	max. 6 in series
Relative uncertainty	± 10 %
Response time overtemperature	< 2 s
Response time connection fault PTC resistors	< 2 s

Displays, memory

LC display	multifunctional, not illuminated
Measured value insulation resistance	10 kΩ…1 MΩ
Operating uncertainty	± 10 %, ± 2 kΩ
Measured value load current (as % of the set response value)	10 %…199 %
Operating error	± 5 %, ± 0.2 A
Password	on, off/0…999 (off, 0)*

Interface

Interface/protocol	RS-485/BMS
Baud rate	9.6 kbit/s
Cable length	0…1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 (0.25 W), internal, switchable
Device address, BMS bus	2…90 (3)*

Interfaces for measuring current transformer STW2 and temperature sensor

Cable lengths:	
single wire > 0.5 mm²	≤ 1 m
single wire, twisted > 0.5 mm²	≤ 10 m
twisted in pairs, shielded > 0.5 mm²	≤ 40 m
Cable (shield on one side connected to PE)	recommended: J-Y(St)Y min. 2 x 0.6

Switching elements

Number	1 changeover contact
Operating principle	N/C operation or N/O operation (N/C operation)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC 10 V				

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

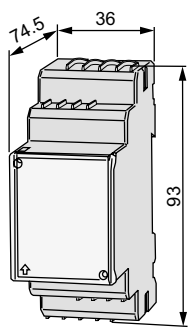
Connection type	push-wire terminals
Connection properties	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrule	0.75…2.5 mm² (AWG 19…14)
flexible with ferrule	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

Operating mode	continuous operation
Position of normal use	any
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00043
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)

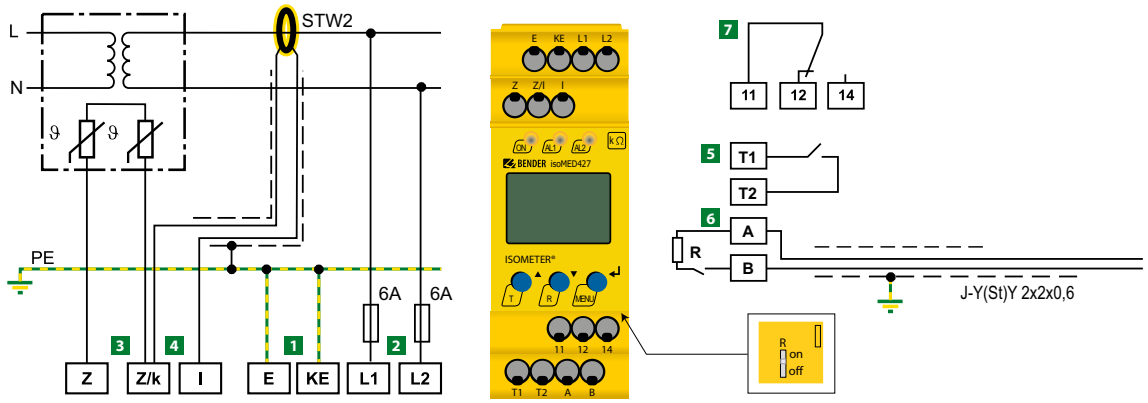


Alarm messages LEDs

	isoMED427P		
	"ON"	"AL1"	"AL2"
Operation	■	–	–
System fault*	flashing	flashing	flashing
Insulation fault	■	■	–
Overcurrent	■	–	■
Overtemperature	■	–	■

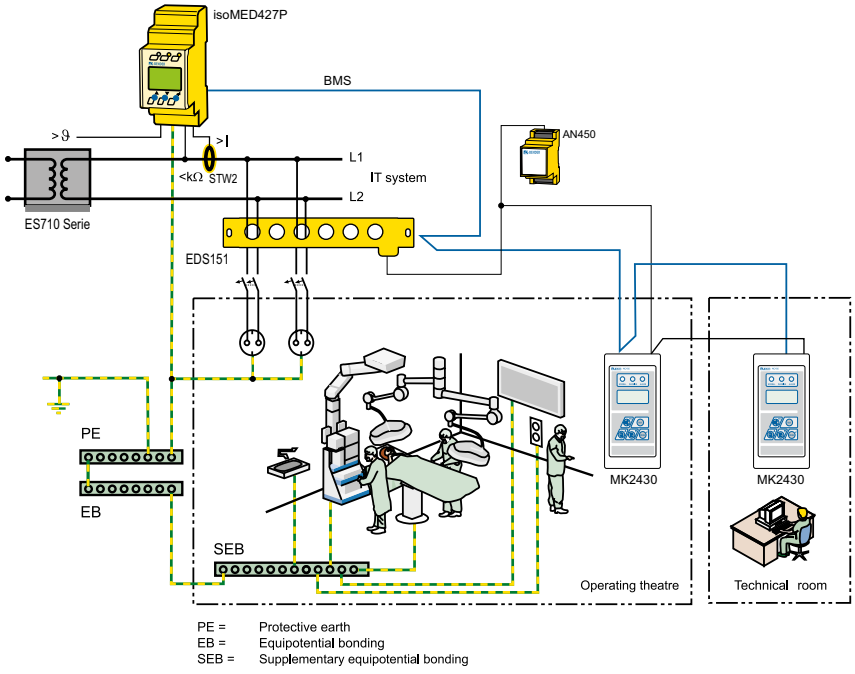
* Detailed alarm information on LCD

Wiring diagram



1	E, KE	Connect the leads E and KE separately to PE	
2	L1, L2	Connection to the IT system being monitored. Supply voltage (see nameplate) 6 A fuse recommended	
3	Z, Z/k	Connection to the temperature sensor (PTC)	
4	Z/k, I	Connection to the measuring current transformer (STW2)	
5	T1, T2	Connection for external test button	
6	A, B	RS-485 interface, Terminate the connection with switch R (on, off) if the device is connected at the end of the bus.	
7	11, 12, 14	Alarm relay K1	

Example of application



ISOMETER® isoPV with coupling device AGH-PV

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for photovoltaic systems up to AC 793 V/DC 1100 V

AC/DC PV



Typical applications

- AC, DC or AC/DC main circuits
- Solar systems with directly connected inverters
- Solar systems with large system capacitances of up to 2000 µF
- Solar systems with high but slow voltage fluctuations
- Installations including switch mode power supplies
- Coupled IT systems

Approvals

Device features

isoPV

- ISOMETER® for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems (IT = unearthed systems)
- Particularly suitable for monitoring photovoltaic systems
- isoPV is always operated in combination with the coupling device AGH-PV
- Automatic adaptation to the existing system leakage capacitance
- ***AMP***^{Plus}-Measurement method (European Patent: EP 0 654 673 B1)
- Choice of measurement methods to meet different requirements
- Two separately adjustable response ranges of 0.2…100 kΩ each (Alarm 1, Alarm 2)
- Two-line LC display
- Automatic device self test
- Memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 galvanically isolated)
- Internal disconnection of the ISOMETER® (via control signal; terminals F1/F2) from the IT system to be monitored (e.g. if several ISOMETER®s are interconnected)
- Current output 0(4)…20mA (electrically isolated) in relation to the measured insulation value

AGH-PV

- Coupling device required for ISOMETER® isoPV, each AGH-PV is specially designed for the corresponding isoPV
- Nominal voltage range AC 0…793 V and DC 0…1100 V
- DIN rail mounting

Additional functions

- History memory with real-time clock to store all alarm messages with date and time stamp
- Electrically isolated RS-485 interface (BMS protocol) for communication with other Bender devices
- Isometer disconnecting relays for the operation of several ISOMETER®s in coupled IT systems
- Current output 0(4)…20 mA (electrically isolated)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- UL 508
- UL 1998 (Software)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal voltage U_n		Supply voltage U_S		Set comprising		Art. No.
3(N)AC	DC	AC	DC	Type	Art. No.	
0…793 V	0…1100 V	19.2…55 V	19.2…72 V	isoPV-327	B91065130W	B91065132W
				AGH-PV	B98039020W	
		88…264 V	77…286 V	isoPV-335	B91065131W	B91065133W
				AGH-PV	B98039020W	

Devices are available as a set.

Accessories

Description	Art. No.
Screw mounting	B990056

Suitable system components

Description	Type	Art. No.	Page
External kΩ measuring instruments	9620-1421	B986841	371

Insulation coordination acc. to IEC 60664-1

Definitions:	
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	Up, KE, T/R, A, B, AK1, GND, AK2
Rated voltage	240 V
Overvoltage category	III
Rated impulse voltage:	
IC2/(IC3-4)	4 kV
IC 3/(IC4)	4 kV
Rated insulated voltage:	
IC2/(IC3-4)	250 V
IC 3/(IC4)	250 V
Polution degree	3
Protective separation (reinforced insulation) between:	
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/(IC4)	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/(IC4)	AC 2.2 kV

Voltage ranges

Nominal system voltage U_n	via AGH-PV
isoPV-335:	
Supply voltage U_s (also see nameplate)	AC 88…264 V**
Frequency range U_s	42…460 Hz
Power consumption	≤ 21,5 VA
Supply voltage U_s (also see nameplate)	DC 77…286 V**
Power consumption	≤ 5,5 VA
isoPV-327:	
Supply voltage U_s (also see nameplate)	AC 19,2…55 V**
Frequency range U_s	42…460 Hz
Supply voltage U_s (also see nameplate)	DC 19.2…72 V**
Power consumption	≤ 6 VA
For UL-application	
Nominal system voltage U_n	via AGH-PV
isoPV-335:	
Supply voltage U_s (also see nameplate)	AC 88…250 V
Frequency range U_s	42…460 Hz
Power consumption AC	≤ 21,5 VA
Supply voltage U_s (also see nameplate)	DC 80…250 V
Power consumption DC	≤ 5,5 VA
isoPV-327:	
Supply voltage U_s (also see nameplate)	DC 24…65 V
Power consumption	≤ 6 VA

Response values

Response value R_{an1}	0.2…100 kΩ
Factory setting R_{an1} (Alarm1)	4 kΩ
Response value R^{an2}	0.2…100 kΩ
Factory setting R_{an2} (Alarm2)	1 kΩ
Relative uncertainty (7…100 kΩ) (in accordance with IEC 61557-8:2007-01)	±15 %
Relative uncertainty (0.2…7 kΩ)	±1 kΩ
Response time t_{an}	see table in manual
Hysteresis	25 %, +1 kΩ

Measuring circuit

Measuring voltage U_m (peak value)	± 50 V
Measuring current I_m (at $R_F = 0$ Ω)	≤ 1.5 mA
Internal DC resistance DC R_i	≥ 35 kΩ
Impedance Z_i at 50 Hz	≥ 35 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1100 V
Max. system leakage capacitance C_e	≤ 2000 µF (2000 µF)*

Displays

Display, illuminated	two-line display
Characters (number/height)	2 x 16/4 mm
Display range measured value	0.2 kΩ…1 MΩ
Operating uncertainty	±15%, ±1 kΩ

Outputs/Inputs

Test/reset button	internal/external
Cable length test/reset button, external	≤ 10 m
Current output (load)	0/4…20 mA (≤ 500 Ω)
Accuracy current output, related to the value indicated (1…100 kΩ)	±15 %, ±1 kΩ

Serial interface

Interface/protocol	RS-485/BMS
Connection	terminals A/B
Cable length	≤ 1200 m
Shielded cable (shield to PE on one end)	2-core, ≥ 0.6 mm2, z. B. J-Y(St)Y 2 x 0.6
Terminating resistor	120 Ω (0.5 Ω)
Device address, BMS bus	1…30 (3)*

Switching elements

Switching elements	2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
Operating mode K1, K2	N/C operation n.c./N/O operation n.o. (N/O operation n.o.)*

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC- not suitable for household and small companies	IEC 61326-2-4
Operating temperature	-25…+65 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (with condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (with condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (with condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	
for screw fixing with accessories B990056	3M7
for DIN rail mounting	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection

Connection	screw-type terminals
Connection, rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
Connection flexible with connector sleeve, without/with plastic sleeve	0.25…2.5 mm²
Tightening torque	0.6…0.8 Nm
Conductor sizes (AWG)	24…12
Cable length between isoPV and AGH-PV	≤ 0.5 m

Other

Operating mode	continuous operation
Mounting	display oriented
Distance to adjacent devices	≥ 30 mm
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	X112, free from halogen
DIN rail mounting	DIN EN 60715/IEC 60715
Screw mounting by means of support (see Seite 67 in manual)	2 x M4
Flammability class	UL94 V-0
Software version	D351 V2.0
Weight	< 510 g

( )* = factory setting

The values marked with** are absolute values

Technical data coupling device AGH-PV

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

Voltage ranges

Nominal system voltage U_n	AC, 3(N)AC 0…793 V, DC 0…1100 V
Nominal frequency f_n	DC, 10…460 Hz
Max. AC voltage U~ in the frequency range f_n = 0.1…10 Hz:	U~ max = 110 V/Hz * f_n

Environment/EMC

EMC	IEC61326-2-4
Operating temperature	-25…+65 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (with condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (with condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (with condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection

Connection	screw-type terminals
Connection, rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
Connection flexible with connector sleeve, without/with plastic sleeve	0.25…2.5 mm²
Tightening torque	0.5 Nm
Conductor sizes (AWG)	24…12
Cable length between isoPV and AGH-PV	≤ 0.5 m

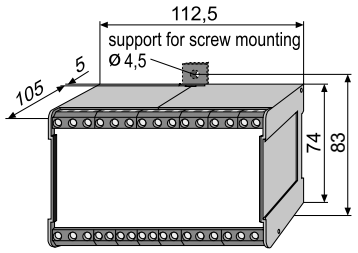
Other

Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically!
Distance to adjacent devices	≥ 30 mm
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	X200, free from halogen
DIN rail mounting	DIN EN 60715/IEC 60715
Screw fixing	2 x M4
Flammability class	UL94 V-0
Weight	< 230 g

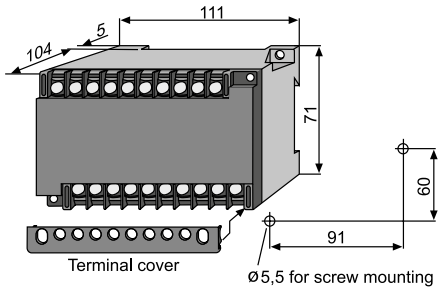
( )* = factory setting
The values marked with** are absolute values

Dimension diagrams (dimensions in mm)

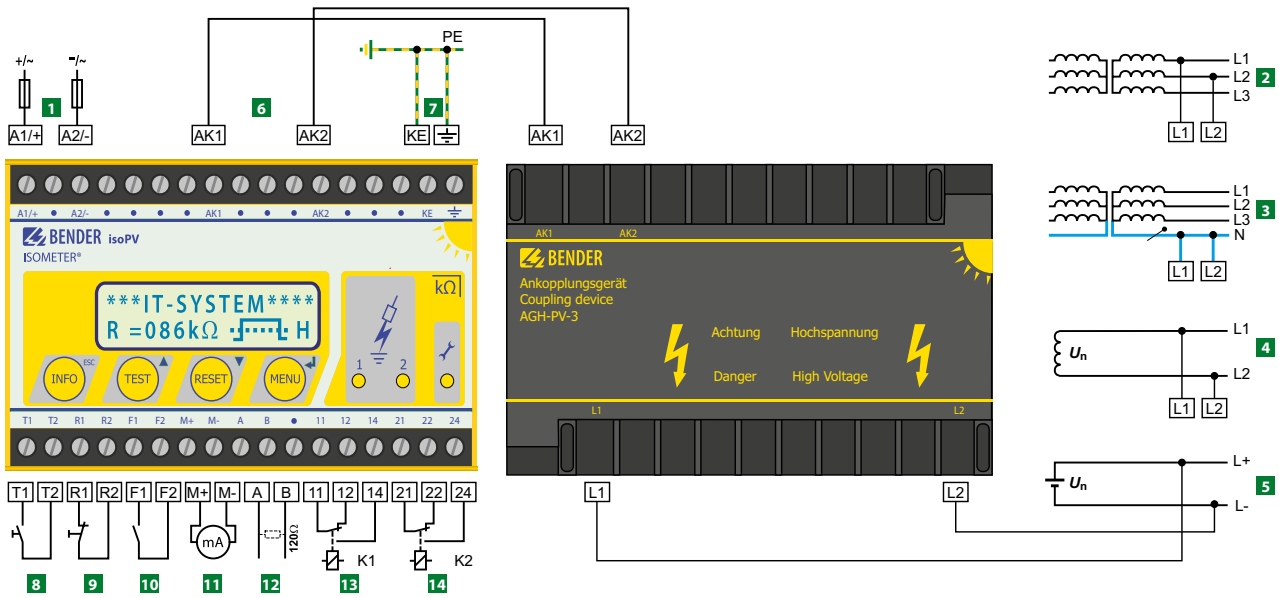
isoPV



AGH-PV



Wiring diagrams



1 Supply voltage U_S (see nameplate) via 6 A fuse;
For UL and CSA applications, it is mandatory to use 5 A fuses

2 3 Connection to the 3 AC system to be monitored:
Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.

4 Connection to the AC system to be monitored:
connect terminals L1, L2 to conductor L1, L2.

5 Connection to the DC system to be monitored:
Connect terminal L1 to conductor L+, terminal L2 to conductor L-

6 Connection to the coupling device AGH-PV

7 Separate connection of ⏚ and KE to PE

8 External test button "T1, T2" (N/O contact)

9 External reset button (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored.

10 STANDBY by means of the function input "F1, F2":
when the contact is closed, the insulation resistance is not measured. Disconnection from the IT system

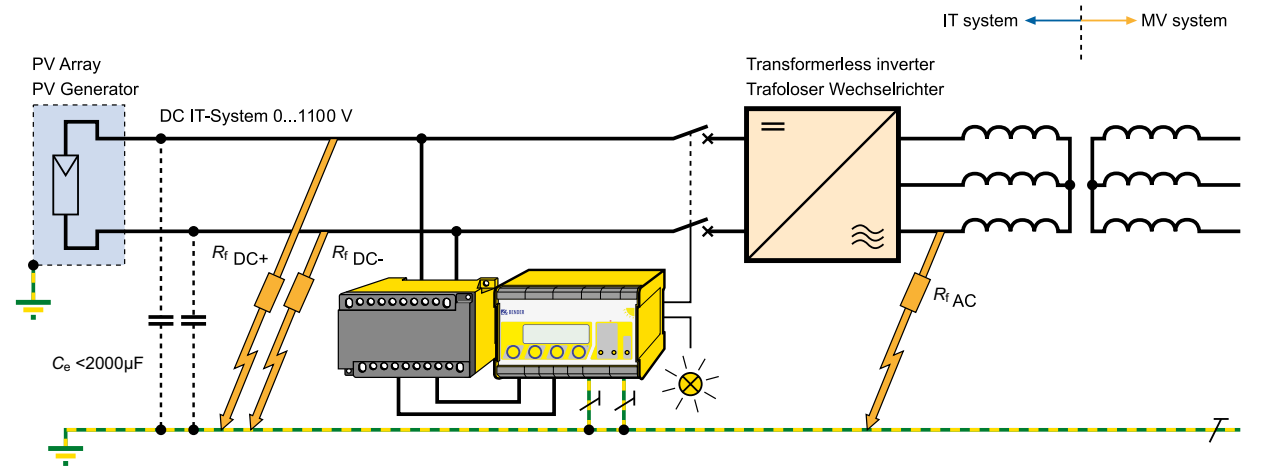
11 Currrent output, electrically isolated: 0…20 mA or 4…20 mA

12 Serial interface RS-485
(termination by means of a 120 Ω resistor)

13 Alarm relay "K1": available changeover contacts

14 Alarm relay "K2" (device error relay); available changeover contacts

Typical application



PV generator unearthed (IT system) with nominal voltage ≤ DC 1100 V and ISOMETER® isoPV with coupling device AGH-PV

ISOMETER® isoPV425 with coupling device AGH420

Insulation monitoring device for unearthed DC circuits (IT systems) for photovoltaic installations up to 3(N)AC, AC 690 V/DC 1000 V

AC/DC PV



Typical applications

- AC, DC or AC/DC main circuits
- Solar systems with directly connected inverters
- Solar systems with high system leakage capacitances
- Solar systems with high but slow voltage fluctuations
- Systems including switched mode power supplies

Approvals

Device features

- Monitoring for unearthed AC and DC systems with galvanically connected rectifiers or inverters
- Measurement of the nominal system voltage (r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC voltages system to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 500 µF
- Automatic device self-test with connection monitoring
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…500 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - isoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		Nominal voltage U_n		System leakage capacitance	Type	Art. No.	
AC	DC	AC	DC			Screw-type terminal	Push-wire terminal
100…240 V, 47…63 Hz	24…240 V	0…690 V	0…1000 V	≤ 500 µF	isoPV425-D4-4 with AGH420	B91036303	B71036303

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A, B, AK1, GND, AK2
Rated voltage	240 V
Overvoltage category	III
Rated impulse voltage:	
IC2/(IC3-4)	4 kV
IC 3/(IC4)	4 kV
Rated insulated voltage:	
IC2/(IC3-4)	250 V
IC 3/(IC4)	250 V
Polution degree	3
Protective separation (reinforced insulation) between:	
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/(IC4)	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/(IC4)	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n with AGH420	3(N)AC, AC 0…690 V/DC 0…1000 V
Tolerance of U_n	AC +15 %, DC +10 %
Nominal system voltage range U_n with AGH420 (UL508)	AC/DC 0…600 V
Frequency range of U_n	DC, 15…460 Hz

Measuring circuit

Permissible system leakage capacitance C_e at insulation value ≤ 300 kΩ	≤ 1000 µF
Permissible system leakage capacitance C_e at insulation value ≥ 300 kΩ	≤ 500 µF
Permissible extraneous DC voltage U_{fg}	≤ 1150 V

Response values

Response value R_{an1}	2…500 kΩ (10 kΩ)*
Response value R_{an2}	1…490 kΩ (5 kΩ)*
Relative uncertainty R_{an}	± 15 %, at least ±1 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection	30…1.14 kV (off)*
Overvoltage detection	31…1.15 kV (off)*
Relative uncertainty U	± 5 %, at least ± 5 V
Relative uncertainty depending on the frequency ≥ 200 Hz	-0.03 %/Hz
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} at R_F = 0.5 x R_{an} and C_e=1 µF acc. to IEC 61557-8	≤ 10 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…1 MΩ
Operating uncertainty at R_F ≤ 1 MΩ	± 15 %, at least ±1 kΩ
Display range measured value nominal system voltage (U_n)	30…1.15 kV r.m.s.
Operating uncertainty	± 5 %, at least ± 5 V
Relative uncertainty depending on the frequency ≥ 200 Hz	-0.03 %/Hz
Display range measured value system leakage capacitance at R_F > 10 kΩ	0…1000 µF
Operating uncertainty	± 15 %, at least ± 2 µF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kBit/s), Modbus RTU (selectable), isoData (115.2 kBits/s)
Cable length (9.6 kBits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0,25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 N/O contacts, common terminal 11
Operating principle	N/C operation/N/O operation (N/O operation)*
Electrical endurance, number of cycles	10000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operation	-40…+70 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K7 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K4 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	8 mm
Rigid/flexible	0.2…2.5 mm²
Flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor rigid	0.2…1.5 mm²
Multi-conductor flexible	0.2…1.5 mm²
Multi-conductor flexible with ferrules without plastic sleeve	0.25…1.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.25…1.5 mm²

Push-wire terminals:

Nominal current	≤10 A
Conductor sizes	AWG 24-14
Stripping length	10 mm
rigid	0.2…2.5 mm²
flexible without ferrules	0.75…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm
Wiring of the terminals Up, AK1, GND, AK2	refer to technical data AGH420 under the heading “Connection”

Other

Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Documentation number	D00028
Weight	≤ 150 g

( )* = Factory setting

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2/-
Control circuit (IC2)	AK1, GND, AK2, Up, E
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2)	8 kV
Rated insulated voltage:	
IC1/(IC2)	1000 V
Polution degree	3
Protective separation (reinforced insulation) between:	
IC1/(IC2)	Overvoltage category III, 1000 V

Monitored IT system

Nominal system voltage range U_n	AC/DC 0…1000 V
Tolerance of U_n	AC/DC +10 %
Nominal system voltage range U_n (UL508)	AC/DC 0…600 V

Measuring circuit

Measuring voltage U_m	± 45 V
Measuring current I_m at R_F	≤ 400 µA
Internal resistance DC R_i	≥ 120 kΩ

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operation	-40…+70 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K7 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K4 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	8 mm
Rigid/flexible	0.2…2.5 mm²
Flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor rigid	0.2…1.5 mm²
Multi-conductor flexible	0.2…1.5 mm²
Multi-conductor flexible with ferrules without plastic sleeve	0.25…1.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.25…1.5 mm²

Push-wire terminals:

Nominal current	≤10 A
Conductor sizes	AWG 24-14
Stripping length	10 mm
Rigid	0.2…2.5 mm²
Flexible without ferrules	0.75…2.5 mm²
Flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm
Connection type	terminals Up, AK1, GND, AK2

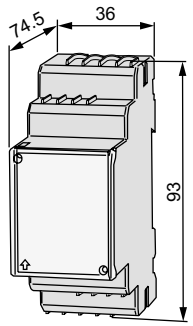
Single cables for terminals Up, AK1, GND, AK2:

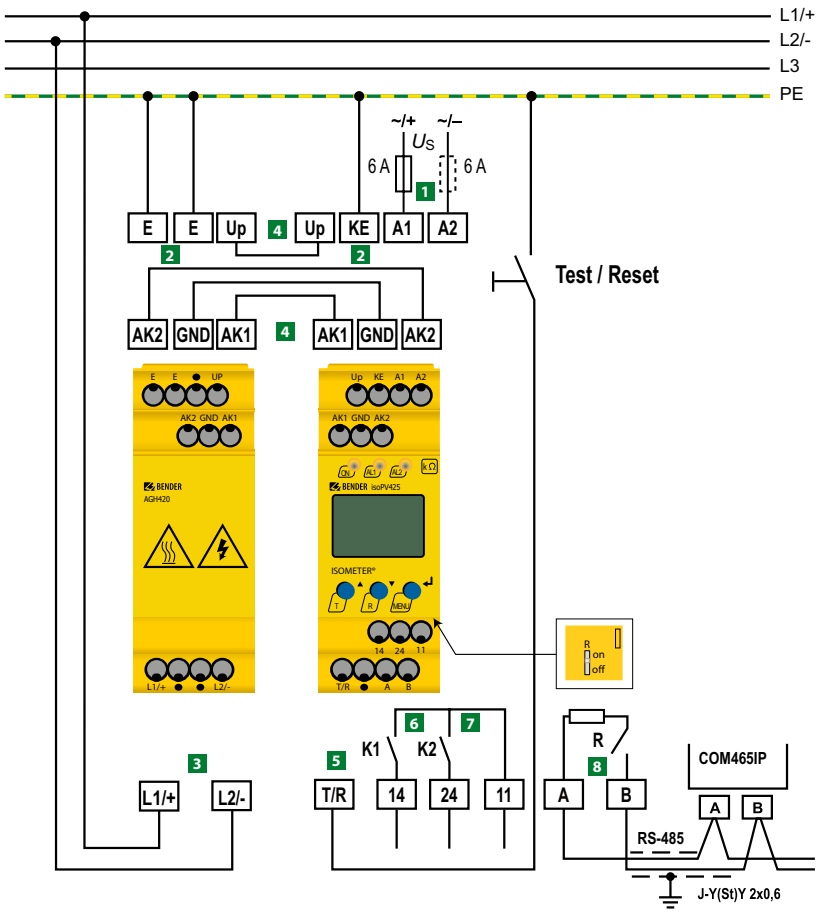
Cable lengths	≤ 0.5 m
Connection properties	≥ 0.75 mm²

Other

Operating mode	Continuous operation
Mounting	cooling slots must be ventilated vertically
Distance to adjacent devices from U_n > 800 V	≥ 30 mm
Degree of protection internal components (DIN EN 60529)	IP30
Degree of protection terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Weight	≤ 150 g

Dimension diagram (dimensions in mm)





1	A1, A2	Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.*
2	E, E, KE	Connect each terminal separately to PE: The same wire cross section as for A1, A2 must be used.
3	L1/+, L2/–	Connection to the 3(N)AC, AC or DC system to be monitored.
4	Up, AK1, GND, AK2	Connect the terminals of the AGH420 to the corresponding terminals of the isoPV425
5	T/R	Connection for external combined test and reset button
6	11, 14	Connection to alarm relay K1
7	11, 24	Connection to alarm relay K2
8	A, B	RS-485 communication interface with selectable terminating resistance.

*** For UL applications:**
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

ISOMETER® isoPV1685…

Insulation monitoring device with residual current monitoring (isoPV1685PFR only) for unearthed DC systems in photovoltaic installations up to 1500 V

DC PV



Typical applications

- Große als IT-System ausgeführten PV-Anlagen bis DC 1500 V

Approvals

for isoPV1685RTU only

Device features

Only device versions isoPV1685PFR and isoPV1685P provide a locating current injector. The device version isoPV1685PFR additionally provides residual current monitoring!

- Insulation monitoring of large-scale photovoltaic systems
- Measurement of low-resistance insulation faults
- Separately adjustable response values Ran1 (alarm 1) and Ran2 (alarm 2) (both 200 Ω…1 MΩ) for prewarning and alarm. $R_{an1} \geq R_{an2}$ applies.
- Automatic adjustment to high system leakage capacitances up to 2000 µF, selectable range
- Connection monitoring of L+, L- for reverse polarity
- Integrated locating current injector up to 50 mA (isoPV1685P(FR) only)
- Fast detection of insulation faults on the AC side by means of residual current monitoring (inverter, transformer) allowing fast disconnection (isoPV1685PFR only)
- Residual current response values $I_{\Delta n}$ for prewarning and alarm (1…5 A) (isoPV1685PFR only)
- CT connection monitoring (isoPV1685PFR only)
- Device self test with automatic message in the event of a fault
- Alarm relays separately adjustable for insulation faults, residual current faults and device errors (isoPV1685PFR only);
- Alarm relays separately adjustable for insulation fault 1, insulation fault 2 (isoPV1685P, isoPV1685RTU only)
- CAN interface to output measured values, statuses and alarms
- RS-485 interface
  – isoPV1685(P)FR: BMS bus, e.g. to control the insulation fault location
  – isoPV1685RTU: BMS bus or Modbus (can be switched using the DIP switch)
- µSD card with data logger and history memory for alarms

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61557-9 (isoPV1685P, isoPV1685PFR only)
- IEC 61326-2-4
- IEC 60730-1
- DIN EN 60664-1 (VDE 0110-1)
- UL1998 (software, isoPV1685RTU only)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Response value range	Supply voltage [1]	Incl. µSD card	Type	Art. No.
200 Ω…1 MΩ	DC 18…30 V	–	isoPV1685RTU-425	B91065603
		■	isoPV1685P-425	B91065604
			isoPV1685PFR-425	B91065600

[1] Absolute values

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Insulation coordination acc. to IEC 60664-1	
Rated voltage	DC 1500 V
Rated impulse voltage/pollution degree	8 kV/2

Voltage ranges

Nominal system voltage U_n	DC 0…1500 V
Tolerance of U_n	DC +6 %
Supply voltage U_S (refer also to device name plate)	DC 18…30 V
Power consumption	≤ 7 W

Measuring circuit for insulation monitoring

Measuring voltage U_m (peak value)	±50 V
Measuring current I_m (at $R_F = 0\ \Omega$)	≤ 1.5 mA
Internal DC resistance R_i	≥ 70 kΩ
Impedance Z_i at 50 Hz	≥ 70 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1500 V
Permissible system leakage capacitance C_e	≤ 2000 µF (500 µF)*

Response values for insulation monitoring

Response value R_{an1} (Alarm 1)	200 Ω…1 MΩ (10 kΩ)*
Response value R_{an2} (Alarm 2)	200 Ω…1 MΩ (1 kΩ)*
Upper limit of the measuring range when set to C_{emax} = 2000 µF	50 kΩ
Relative uncertainty (10 kΩ…1 MΩ) (acc. to IEC 61557-8)	±15 %
Relative uncertainty (0.2 kΩ…< 10 kΩ)	±200Ω ±15 %
Response time t_{an}	see graphic
Hysteresis	25 %, +1 kΩ

isoPV1685P(FR) only:
Measuring circuit for insulation fault location (EDS)

Locating current I_L DC	≤ 50 mA
Test cycle/pause	2/4 s

isoPV1685PFR only:
Measuring circuit for residual current measurement

External measuring current transformer	type Ferroxcube T140/120/25-3E25
Rated insulation voltage (measuring current transformer)	1500 V
Rated frequency	1…6 kHz
Rated continuous thermal current I_{cth}	150 A
Operating uncertainty	0…35 %
Load	1 Ω
Number of turns of measurement winding	20
Number of turns of test winding	10

isoPV1685PFR only:
Response values for residual current measurement (AC instantaneous tripping)

Rated residual operating current $I_{\Delta n1}$ (prewarning)	1 A…5 A (1 A)*
Rated residual operating current $I_{\Delta n2}$ (Alarm)	1 A…5 A (5 A)*
Relative uncertainty	±1 A
Response time t_{an}	≤ 1s
Hysteresis	25 %

isoPV1685PFR only:
Cable lengths for measuring current transformers

Cable length	≤ 3 m

isoPV1685PFR only:
Test winding

Output voltage across kT/IT at max. 40 mA locating current	0.5...0.8 V

Displays, memory

LEDs for alarms and operating states	2x green, 4 x yellow
µSD card (Spec. 2.0) for history memory and log files	≤ 32 GByte

Inputs

Digital inputs DigIn1/DigIn2:

High level	10…30 V
Low level	0…0.5 V

Serial interfaces

BMS/Modbus:

Interface/protocol	RS-485/BMS(Slave)/Modbus RTU (Slave); Protocol switchable
Connection	terminals A/B Shield: Terminal S
Cable length	≤ 1200 m
Shielded cable (shield to functional earth on one end)	2-core, ≥ 0.6 mm², e.g. J-Y(St)Y 2 x 0.6
Terminating resistor, switchable (RS-485 Term.)	120 Ω (0.5 W)
Device address, BMS bus or Modbus adjustable (DIP switch)	isoPV1685RTU: 2…17 (2)*
Device address, BMS bus adjustable (DIP switch)	isoPV1685P(FR): 2…33 (2)*

CAN:

Protocol	acc. to SMA/Bender specification V2.5
Frame format	CAN 2.0A 11-bit identifier
Baud rate	500 kBit/s
Connection via 2 x RJ45 acc. to CiA-303-1 connected in parallel	Pin 1: CAN-H Pin 2: CAN-L Pin 3, 7: CAN-GND
CAN identifier	permanently set acc. to the specification above
Cable length	≤ 130 m
Shielded cable	CAT 5 with RJ45 plug
Terminating resistor, can be connected (Term. CAN)	120 Ω (0.5 W)
Potential of the socket housing	functional earth potential

Switching elements

Switching elements	3 changeover contacts: K1 (insulation fault), K2 (isoPV1685P & isoPV1685RTU: insulation fault, isoPV1685PFR: residual current fault) K3 (device error)
Operating principle K1, K2	N/C operation or N/O operation (N/C operation)*
Operating principle K3	N/C operation, not changeable

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A

Minimum contact rating	1 mA at AC/DC ≥ 10 V

For UL application:

Utilisation category for AC control circuits with 50/60 Hz (Pilot duty)	B300
AC load of the alarm relay outputs	AC 240 V, 1.5 A in case of a power factor of 0.35
AC load of the alarm relay outputs	AC 120 V, 3 A in case of a power factor of 0.35
AC load of the alarm relay outputs	AC 250 V, 8 A in case of a power factor of 0.75 to 0.80
DC load of the alarm relay outputs	DC 30 V, 8 A in case of ohmic load

Connection (except system coupling)

Connection type	pluggable push-wire terminals
Connection	
rigid/flexible	0.2…2.5 mm²/0.2…2.5 mm²
flexible with ferrule, without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Connection of the system coupling

Connection type	pluggable push-wire terminals
Connection	
rigid/flexible	0.2…10 mm²/0.2…6 mm²
flexible with ferrule, without/with plastic sleeve	0.25…6 mm²/0.25…4 mm²
Conductor sizes (AWG)	24…8
Stripping length	15 mm
Opening force	90…120 N

Environment/EMC

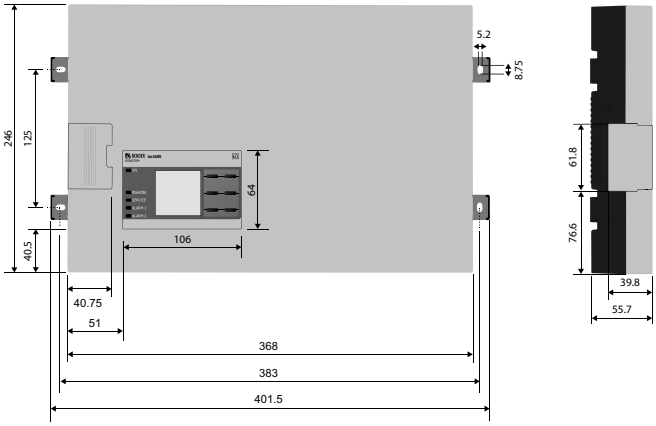
EMC	IEC 61326-2-4 Ed. 1.0
Classification of climatic conditions acc. to IEC 60721:	
Without solar radiation, precipitation, water, icing. Condensation possible temporarily:	
Stationary use (IEC 60721-3-3)	3K5
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Deviation from the classification of climatic conditions:	
Ambient temperature during operation	-40 …+70 °C
Ambient temperature for transport	-40 …+80 °C
Ambient temperature for long-term storage	-25 …+80 °C
Relative humidity	10…100 %
Atmospheric pressure	700…1060 hPa (max. height 4000 m)

Other

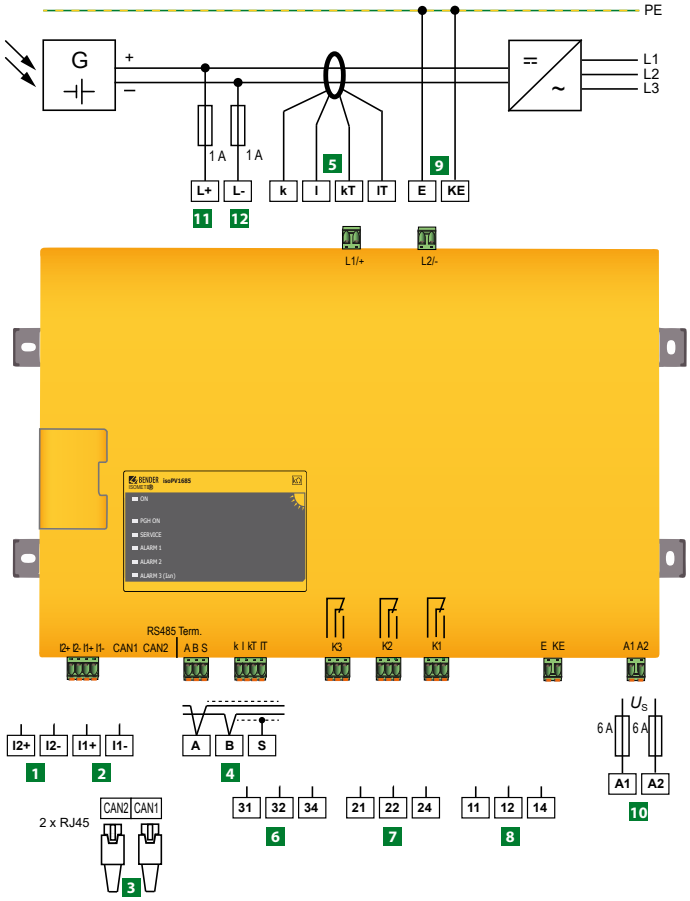
Operating mode	continuous operation
Position of normal use	vertical, system coupling on top
PCB fixation	lens head screw DIN7985TX
Tightening torque	4.5 Nm
Degree of protection, internal components	IP30
Degree of protection, terminals	IP30
Weight	≤ 1300 g

( )* = Factory settings

Dimension diagram (dimensions in mm)



Wiring diagram



1	I2+, I2–	Currently has no function, digital input.
2	I1+, I1–	Digital input isoPV1685PFR: Currently has no function. isoPV1685P: Starting the insulation fault location in the manual mode.
3	CAN2, CAN1	Connection to CAN bus, 2 x RJ-45, can be terminated with CAN 120-Ω termination plug.
4	A, B, S	Connection to Modbus or BMS bus, RS-485, S= shield (connect one end to PE), can be terminated with RS-485 Term. switch.
5	k, l/kT, lT	isoPV1685PFR only: Connection to measuring current transformer k, l = measurement winding/kT, lT = test winding
6	31, 32, 34	Alarm relay K3 for internal device errors
7	21, 22, 24	Description of relay assignment according to device type; isoPV1685RTU and isoPV1685P only: Alarm relay K2 for insulation faults. isoPV1685PFR only: Alarm relay K2 for residual current faults
8	11, 12, 14	Alarm relay K1 for insulation faults.
9	E, KE	Separate connections for E and KE to PE.
10	A1, A2	Connection to U_S = DC 24 V via a 6 A fuse on each line.
11	L+	Connection to L+ of the PV generator via 1 A fuse.
12	L–	Connection to L – of the PV generator via 1 A fuse.

ISOMETER® isoLR275 with coupling device AGH-LR

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for installations with a low level of insulation

AC/DC



Typical applications

- AC, DC or AC/DC main circuits
- IT systems with directly connected inverters
- IT systems with high system capacitances of up to 500 µF
- IT systems with high but slow voltage fluctuations
- Installations including switch mode power supplies
- Coupled IT systems

Approvals

Device features

isoLR275

- ISOMETER® for IT AC systems with galvanically connected rectifiers or converters and for IT DC systems (IT = unearthed systems)
- Particularly suitable to monitor installations with a low level of insulation
- Use the isoLR275 only combination with the coupling device AGH-LR
- Automatic adaptation to the existing system leakage capacitance
- ***AMP**Plus* measurement method (European patent: EP 0 654 673 B1)
- Choice of measurement methods to meet different requirements
- Two separately adjustable response ranges of 0.2…100 kΩ (Alarm 1, Alarm 2)
- Two-line LC display
- Automatic device self test
- History memory with real-time clock to store alarm messages with date and time stamp
- BMS interface (Bender Measuring Device Interface) for communication with other Bender devices (RS-485 electrically isolated)
- Internal disconnection of the ISOMETER® from the IT system to be monitored (via control signal; terminals F1/F2) (e.g. if several ISOMETERs® are interconnected)
- Current output 0(4)…20mA (electrically isolated) analogously to the measured insulation value

AGH-LR

- Appropriate coupling device for ISOMETER® isoLR275
- Nominal voltage range AC 0…793 V and DC 0…1100 V
- DIN rail mounting

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- IEC 61326-2-4 Ed. 1.0
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		Set comprising		Art. No.
AC	DC	Type	Art. No.	
19.2…55 V	19.2…72 V	isoLR275-327	B91065700W	B91065702W
		AGH-LR-3	B98039022W	
88…264 V	77…286 V	isoLR275-335	B91065701W	B91065703W
		AGH-LR-3	B98039022W	

Devices are available as a set.

Accessories

Description	Art. No.
Screw mounting	B990056

Suitable system components

Description	Type	Art. No.	Page
External kΩ measuring instruments	9620-1421	B986841	371

Technical data ISOMETER® isoLR275

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage for isoLR275-3	AC 250 V
Rated impulse voltage/pollution degree	6 kV/III
Protective separation (reinforced insulation) between	(A1/+, A2/-) - (11,12, 14, 21, 22, 24) - (AK1, AK2, KE, PE, T1, T2, R1, R2, F1, F2, M+, M-, A, B)
Voltage test acc. to IEC 61010-1	3.536 kV
Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	4 kV/3
Basic insulation between:	(11, 12, 14) - (21, 22, 24)
Voltage test acc. to IEC 61010-1	2.21 kV

Voltage ranges

Nominal system voltage U_n	via AGH-LR

isoLR275-335:

Supply voltage U_S (also see nameplate)	AC 88…264 V**
Frequency range U_S	42…460 Hz
Power consumption	≤ 16 VA
Supply voltage U_S (also see nameplate)	DC 77…286 V**
Power consumption	≤ 8 W

isoLR275-327:

Supply voltage U_S (also see nameplate)	AC 19,2…55 V**
Frequency range U_S	42…460 Hz
Supply voltage U_S (also see nameplate)	DC 19.2…72 V**
Power consumption	≤ 8 W

Response values

Response value R_{an1}	0.2…100 kΩ
Factory setting R_{an1} (Alarm1)	4 kΩ
Response value R_{an2}	0.2…100 kΩ
Factory setting R_{an2} (Alarm2)	1 kΩ
Relative uncertainty (7…100 kΩ) (acc. to IEC 61557-8)	± 15 %
Relative uncertainty (0.2…7 kΩ)	± 1 kΩ
Response time t_{an}	see table in the manual
Hysteresis	25 %, + 1 kΩ

Measuring circuit

Measuring voltage U_m (peak value)	± 50 V
Measuring current I_m (at $R_F = 0$ Ω)	≤ 1.5 mA
Internal DC resistance R_i	≥ 35 kΩ
Impedance Z_i at 50 Hz	≥ 35 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1100 V
Permissible system leakage capacitance C_e	≤ 500 µF (150 µF)*

Displays

Display, illuminated	two-line display
Characters (number/height)	2 x 16/4/mm
Display range measured value	0.2 kΩ…1 MΩ
Operating uncertainty	±15%, ±1 kΩ

Outputs/Inputs

Test/reset button	internal/external
Cable length test/reset button, external	≤ 10 m
Current output (load)	0/4…20 mA (≤ 500 Ω)
Accuracy current output, related to the value indicated (1…100 kΩ)	±15 %, ±1 kΩ

Serial interface

Interface/protocol	RS-485/BMS
Connection	terminals A/B
Cable length	≤ 1200 m
Shielded cable (shield to PE on one end)	2-core, ≥ 0.6 mm², e.g. J-Y(St)Y min. 2 x 0.6
Terminating resistor	120 Ω (0.5 W)
Device address, BMS bus	1…30 (3)*

Switching elements

Switching elements	2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
Operating mode K1, K2 (Alarm 1/Alarm 2)	N/C operation/N/O operation (N/O operation)*

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	
not suitable for household and small companies	IEC 61326-2-4 Ed. 1.0
Operating temperature	-25…+65 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (with condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (with condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (with condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	
for screw mounting with accessories B990056	3M7
for DIN rail mounting	3M4
Transport (IEC 60721-3-2)	2M2
Long term storage (IEC 60721-3-1)	1M3

Connection

Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
flexible with ferrules without/with plastic sleeve	0.25…2.5 mm²
Tightening torque	0.5 Nm
Conductor sizes (AWG)	24…12
Cable length between isoLR275 and AGH-LR	≤ 0.5 m

Other

Operating mode	continuous operation
Mounting	display-oriented
Distance to adjacent devices	≥ 30 mm
Degree of protection, terminals (DIN EN 60529	IP30
Degree of protection, terminals (DIN EN 60529	IP20
Type of enclosure	X112, free from halogen
Screw mounting with mounting clip	2 x M4
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00127
Weight	≤ 510 g

( )* = factory setting
Data labelled with ** are absolute values

Technical data coupling device AGH-LR

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

Voltage ranges

Nominal system voltage U_n	AC, 3(N)AC 0…793 V, DC 0…1100 V
Nominal frequency f_n	DC, 10…460 Hz
Max. AC voltage U~ in the frequency range f_n = 0.1…10 Hz	U~max = 110 V/Hz * f_n

Environment/EMC

EMC	IEC 61326-2-4 Ed. 1.0
Operating temperature	-25…+65 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (with condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (with condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (with condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

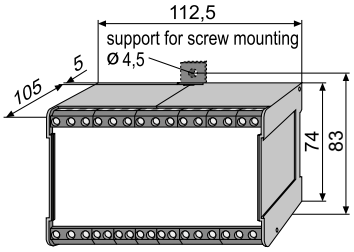
Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
flexible with ferrules without/with plastic sleeve	0.25…2.5 mm²
Tightening torque	0.5 Nm
Conductor sizes (AWG)	24…12
Cable length between isoLR275 and AGH-LR	≤ 0.5 m

Other

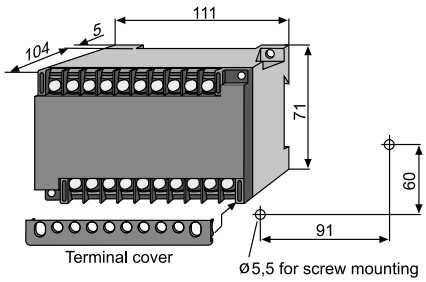
Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically!
Distance to adjacent devices	≥ 30 mm
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	X200
Screw mounting	2 x M4
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Weight	≤ 230 g

Dimension diagrams (dimensions in mm)

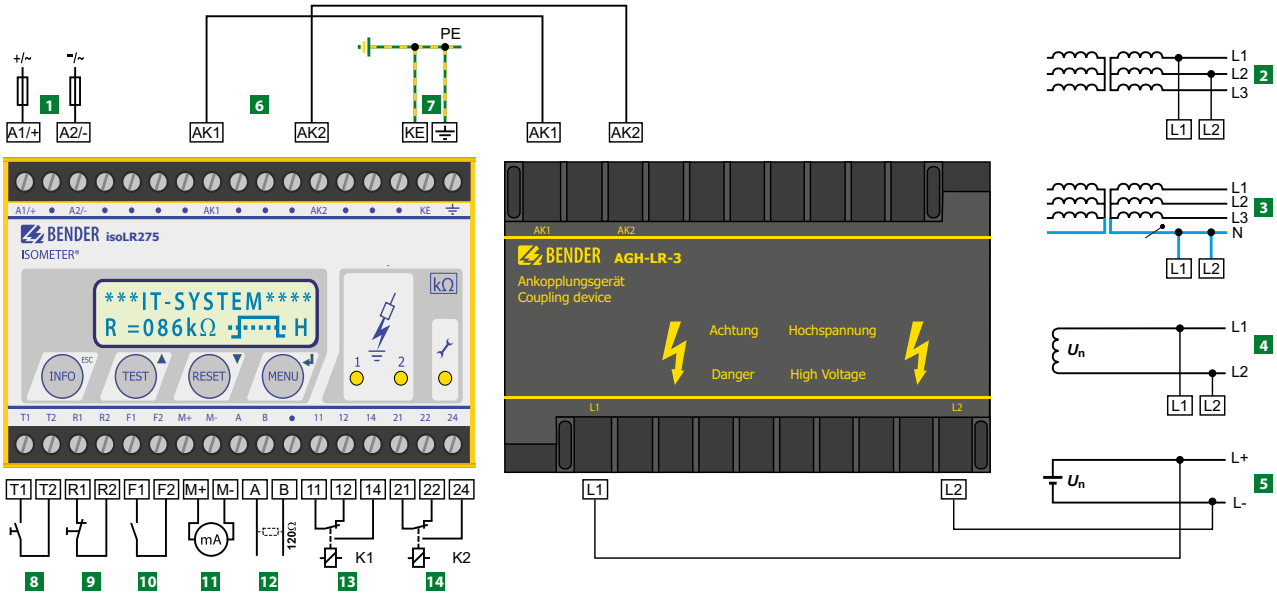
isoLR275



AGH-LR



Wiring diagrams



1 Supply voltage U_S (see nameplate) via 6 A fuse; For UL and CSA applications, it is mandatory to use 5 A fuses

2 3 Connection to the 3AC system to be monitored:
Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.

4 Connection to the AC system to be monitored:
connect terminals L1, L2 to conductor L1, L2.

5 Connection to the DC system to be monitored:
Connect terminal L1 to conductor L+, terminal L2 to conductor L-

6 Connection to the coupling device AGH-PV

7 Separate connection of ⏚ and KE to PE

8* External test button (N/O contact)

9* External reset button (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored

10* STANDBY by means of the function input F1, F2:
when the contact is closed, the insulation resistance is not measured.
Disconnection from the IT system

11 Currrent output, electrically isolated: 0…20 mA or 4…20 mA

12 Serial interface RS-485 (termination by means of a 120-Ω resistor)

13 Alarm relay "K1"; available changeover contacts

14 Alarm relay "K2" (device error relay); available changeover contacts

* **The terminal pairs 7, 8 and 9 have to be wired electrically isolated and do not have to be connected to earth!**

ISOMETER® IR420-D6

Offline monitor for de-energised AC, DC and 3(N)AC loads in TN,TT and IT systems

AC



Device features

- Insulation monitoring for de-energised TN,TT and unearthed systems AC, 3(N)AC and DC
- Nominal voltage extendable via coupling device
- Two separately adjustable response values 100 kΩ…10 MΩ
- LEDs: Power On LED, LEDs Alarm 1, Alarm 2 for signalling insulation faults
- Combined test/reset button
- Two separate alarm relays with one changeover contact each
- Fault memory behaviour, selectable
- Push-wire terminal (two terminals per connection)

Typical applications

- De-energised loads such as automatic fire extinguisher pumps, emergency drives, ship cranes, slide-valve drives in supply lines (gas, water, oil), motor-driven closing systems, diving pumps, drives for anchors, elevators, flue-gas valves and emergency power generators

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96 (2007)
- ASTM F1207M-96 (2007)

Approvals

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 42…460 Hz	9.6…94 V	IR420-D6-1	B91016415	B71016415
70…300 V, 42…460 Hz	70…300 V	IR420-D6-2	B91016407	B71016407
		IR420-D64-2	B91016408	B71016408

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Suitable system components

Description	Type	Art. No.	Page
Coupling device	AGH520S	B913033	329
	AGH676S-4	B913055	332

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	(A1, A2) - (11, 12, 14) - (21, 22, 24) 300 V
Rated insulation voltage	(L1, AK, E, KE, T/R) 500 V
Rated impulse voltage	6 kV
Overvoltage category	II
Pollution degree	3
Protective separation (reinforced insulation) between:	
	(A1, A2) - (L1, AK, E, KE, T/R) - (11, 12, 14) - (21, 22, 24)
Voltage test acc. IEC 61010-1	2.2 kV

Supply voltage

IR420-D6-1:	
Supply voltage U_s	AC 16…72 V/DC 9.6…94 V
Frequency range U_s	42…460 Hz/DC
IR420-D6-2:	
Supply voltage U_s	AC/DC 70…300 V
Frequency range U_s	42…460 Hz, DC
Power consumption	≤ 3 VA

System being monitored

Nominal system voltage U_n	AC 0…400 V
Tolerance of U_n	+25 %
Frequency range of U_n	42…460 Hz
without AGH:	nominal contact voltage of the N/C. contact (switch-on contactor)
with AGH520S:	AC 0…7200 V, 50…400 Hz

Response values

Response value R_{an1} (AL 1)	100 kΩ…10 MΩ (1 MΩ)*
Response value R_{an2} (AL 2)	100 kΩ…10 MΩ (100 kΩ)*
Operating error	±15 %
Hysteresis	+25 %

Time response

Response time t_{an} at $R_F = 0{,}5 \times R_{an}$ and $C_e = 1$ µF	≤ 4 s
Starting delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m ($R_F = 0$ Ω)	≤ 10 µA
Internal d.c. resistance R_i	≥ 1.2 MΩ
Internal impedance Z_i (50 Hz)	≥ 1.1 MΩ
Admissible extraneous d.c. voltage U_{fg}	≤ DC 300 V
System leakage capacitance C_e	≤ 10 µF

Displays, memory

Display	LC display, multi-functional, non-illuminated
Display range, measuring value	10 kΩ…20 MΩ
Percentage operating error	±15 %
Password	off/0…999 (off)*
Fault memory (alarm relay)	on/off (off)*

Inputs

Cable length external test/reset button	≤ 10 m

Switching elements

Number of	2 (changeover contacts K1, K2)
Operating principle	N/O operation, N/C operation (N/O operation n.o.)*
Electrical endurance	10000 switching operations

Contact data according IEC 60947-5-1

Utilization category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	220 V	110 V	24 V
Rated operational current	5 A	3 A	0.1 A	0.2 A	1 A
Minimum current	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	acc. to IEC 61326
Operating temperature	-25 °C…+55 °C
Climatic categories acc. to IEC 60721:	
Stationary use (IEC 60721-3-3) (except condensation and formation of ice)	3K5
Transport (IEC 60721-3-2) (except condensation and formation of ice)	2K3
Storage (IEC 60721-3-1) (except condensation and formation of ice)	1K4
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

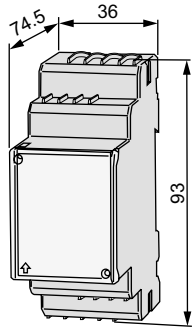
Connection	**screw-type terminals**
Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm² /AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm
Connection	**push-wire terminals**
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

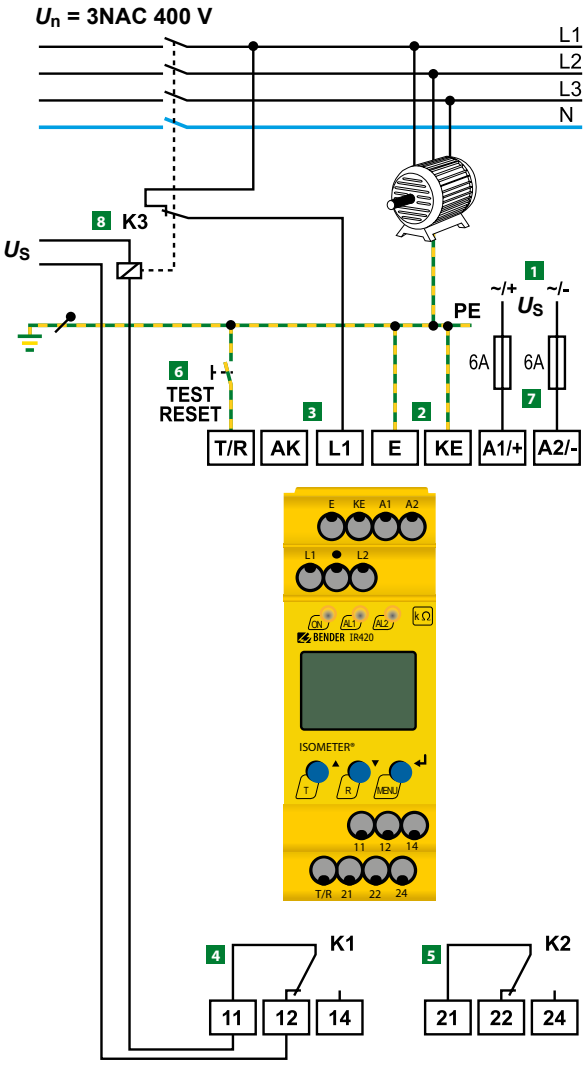
Other

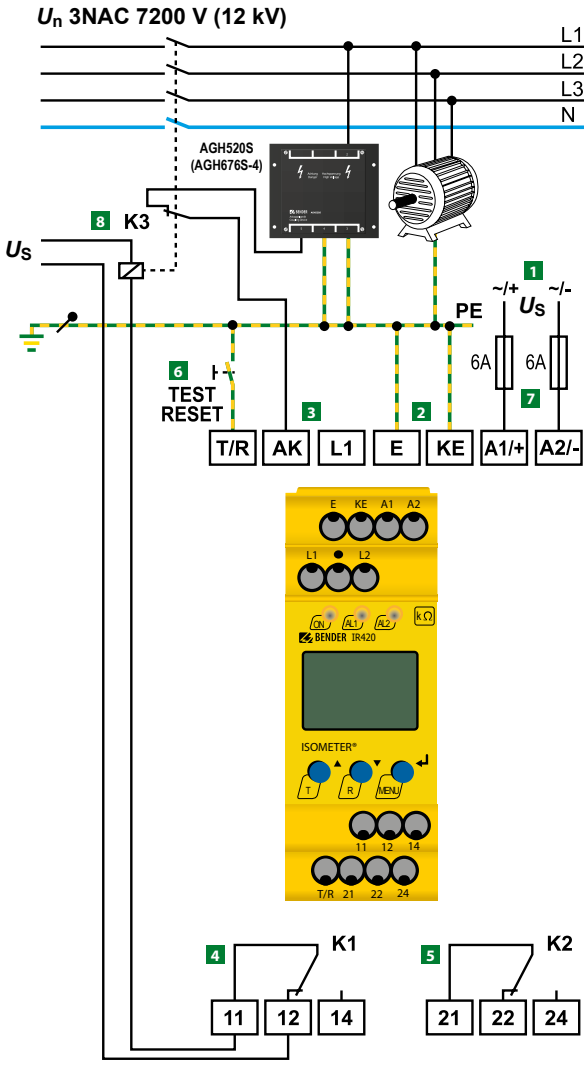
Operating mode	continuous
Position	any position
Degree of protection internal components (EN 60529)	IP30
Degree of protection terminals (EN 60529)	IP20
Enclosure material	polycarbonat
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Weight	approx. 150 g

( )* = Factory setting

Dimension diagram (dimensions in mm)







1 Supply voltage U_S (see ordering details) via fuse
2 Separate connection of E, KE to PE
3 Connection of the AC system to be monitored:
4 Alarm relay "K1": Alarm 1
5 Alarm relay "K2": Alarm 2
6 Combined test and reset button "TEST RESET"
short-time pressing (< 1.5 s) = RESET
long-time pressing (> 1.5 s) = TEST
7 Line protection by a fuse in accordance with IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.
8 K3 is also required and is not included in IR420-D6

ISOMETER® IR423

Insulation monitoring device for mobile generators

AC



Typical applications

- IEC 60364-7-717, DIN VDE 0100-717 (2005) Electrical installations in mobile or transportable units
- DIN VDE 0100-551 (VDE 0100-551), IEC 60364-5-551 Low-voltage generating sets (mobile generators)
- GW 308 "Mobile Stromerzeuger für Rohrleitungsbaustellen 8/00" (Mobile auxiliary power generators on pipeline site") (DVGW)
- BGI 867 (German Berufsgenossenschaft Information) Auswahl und Betrieb von Ersatzstromerzeugern auf Bau-und Montagestellen (Selecting and operating standby generators on construction and installation sites)

Approvals

Device features

- Insulation monitoring for mobile generators AC 0…300 V
- Protection by electrical separation with insulation monitoring and disconnection
- Version "W" for protection against high mechanical stress
- Two separately adjustable response values
- Connection monitoring system/earth
- Power On LED, alarm LEDs: Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation, selectable
- Fault memory behaviour, selectable
- Self monitoring with automatic alarm
- Multi-functional LC display
- Adjustable response delay
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- EN 61557-8
- IEC 61557-8
- IEC 61326-2-4
- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 60664-3 (VDE 0110-3)
- ASTM F1669M-96
- ASTM F1207M-96

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Version	Supply voltage [1] U_S			Type	Art. No.	
	AC	DC	AC/DC		Screw-type terminal	Push-wire terminal
Standard	16…72 V, 30…460 Hz	9,6…94 V	–	IR423-D4-1	B91016304	B71016304
	–	–	70…300 V, 30…460 Hz	IR423-D4-2	B91016305	B71016305
High mechanical stress	16…72 V, 30…460 Hz	9,6…94 V	–	IR423-D4W-1	B91016304W	B71016304W
	–	–	70…300 V, 30…460 Hz	IR423-D4W-2	B91016305W	B71016305W

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Protective separation (reinforced insulation) between	(A1, A2) -(L1, L2, E, KE, T/R) -(11, 12, 14) -(21, 22, 24)
Voltage test acc. to IEC 61010-1	2.21 kV

Supply voltage

Supply voltage U_S	see ordering information
Frequency range U_S	30…460 Hz
Power consumption	≤ 4 VA

IT system being monitored

Nominal system voltage U_n	AC 0…300 V
Nominal frequency f_n	30…460 Hz

Response values

Response value R_{an1} (Alarm 1)	1…200 kΩ (46 kΩ)*
Response value R_{an2} (Alarm 2)	1…200 kΩ (23 kΩ)*
Relative uncertainty 1…5 kΩ/5…200 kΩ	±0.5 kΩ/±15 %
Hysteresis 1…5 kΩ/5…200 kΩ	+1 kΩ/+25 %

Time response

Response time t_{an} at $R_F = 0.5 \times R_{an}$ and $C_e = 1$ µF	≤ 1 s
Start-up delay (start time) t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m (at $R_F = 0$ Ω)	≤ 200 µA
Internal DC resistance R_i	≥ 62 kΩ
Impedance Z_i at 50 Hz	≥ 60 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 300 V
Permissible system leakage capacitance	≤ 5 µF

Displays, memory

Display	LC display, multi-functional, non-illuminated
Display range, measured value	1 kΩ…1 MΩ
Operating uncertainty 1…5 kΩ/5 kΩ…1 MΩ	±0.5 kΩ/±15 %
Password	off/0…999 (off)*
Fault memory (alarm relay)	on/off*

Outputs

Cable length test and reset button	≤ 10 m

Switching elements

Number of switching elements	2 x 1 changeover contact
Operating principle	NC or N/O operation (N/O operation)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	220 V	110 V	24 V
Rated operational current	5 A	3 A	0.1 A	0.2 A	1 A
Contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	acc. to IEC 61326
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection

Connection type	push-wire terminal
Connection properties	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrule	0,75…2,5 mm² (AWG 19…14)
flexible with ferrule	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00038
Weight	≤ 150 g

Option "W"

Ambient temperature	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

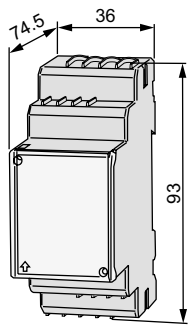
Stationary use (IEC 60721-3-3)	3K5 (with condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

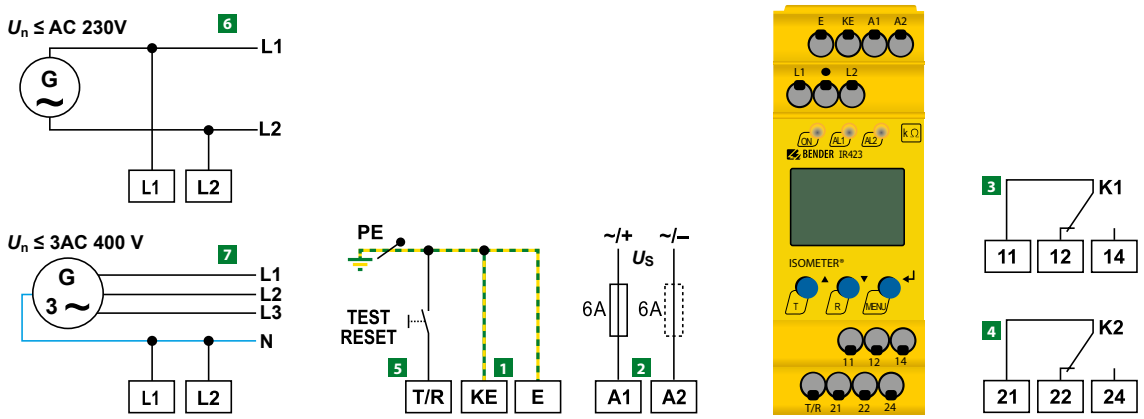
Stationary use (IEC 60721-3-3)	3M7
Vibration resistance	acc. to IEC 60068-2-6
For DIN rail mounting	3 g/30…150 Hz
For screw mounting	6 g/30…150 Hz

( )* = factory setting

Dimension diagram (dimensions in mm)

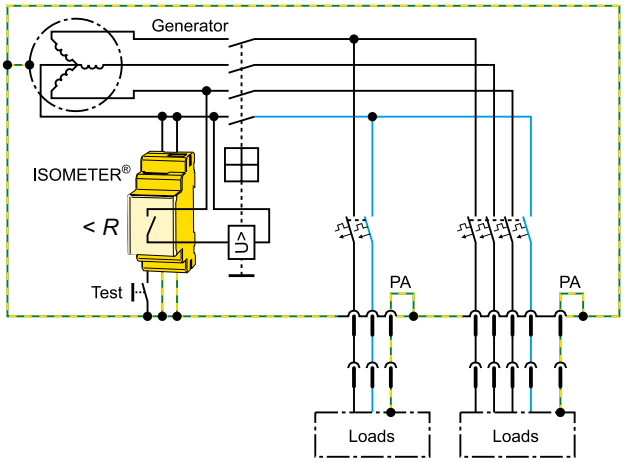


Wiring diagram

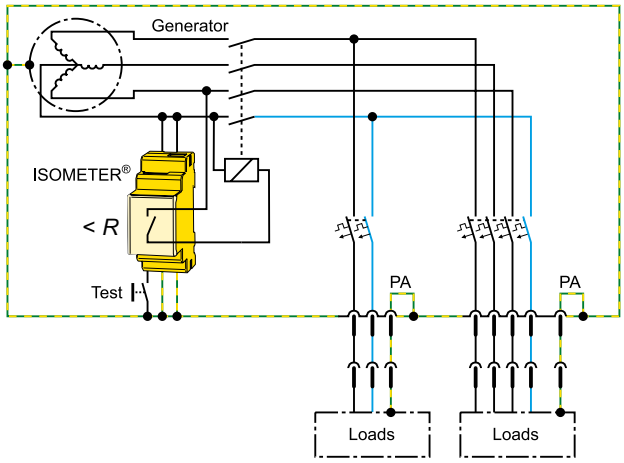


1 Connect the leads E and KE separately to PE.
2 Supply voltage U_S (see nameplate) via 6 A fuse
3 Alarm relay K1
4 Alarm relay K2 (system fault relay)
5 For combined external test/reset button
6 U_n ≤ AC 230 V: Terminals L1/L2 to L1/L2 of the generator
7 U_n ≤ 3AC 400 V: Terminals L1/L2 to N of the generator

Protective measure for mobile generators: "Protection by electrical separation with insulation monitoring and disconnection"



Setting K1/K2 for **overvoltage release**:
N/O operation (n.o.); fault memory setting: OFF



Setting K1/K2 for **contactor**:
N/C operation (n.c.), fault memory setting: ON

ISOMETER® IR123P

Insulation monitoring device for mobile generators

AC



Typical applications

- Monitoring of unearthed AC systems (IT systems) in mobile generators

Approvals

CE EAC

Device features

- Insulation monitoring for unearthed DC systems (IT systems) 100…300 V
- Automatic adaptation to the existing system leakage capacitance
- Optimised measurement technique for low-frequency control processes
- Electrically isolated PWM output for the kΩ measuring value
- Optocoupler output for signalling the device status
- Automatic device self test
- Certonal coating
- Permanently set response value for the insulation resistance 23/46 kΩ
- Second response range 40/80 kΩ selectable via a jumper

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Connection	Nominal system voltage U_n	Supply voltage U_S[1)]	Type	Art. No.
	AC	AC		
Connectors	100…300 V, 22…460 Hz	$U_S = U_n$	IR123P-4-2	B91016308

[1)] Absolute values

Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	2.5 kV/3
Protective separation (reinforced insulation) between:	
(A1/L1, A2/L2, E, KE, T/R, T, R, M+, M-/OK-, OK+) -(11-12-14) -(21-22-24)	
Voltage test acc. to IEC 61010-1	2.21 kV

Supply voltage

Supply voltage U_S	= U_n
Power consumption	≤ 3 VA

IT system being monitored

Nominal system voltage U_n	AC 100…300 V
Nominal frequency f_n	22…460 Hz

Response values

Response value R_{an2} (Alarm 2)	(46 kΩ)*
Response value R_{an1} (Alarm 1)	(23 kΩ)*
Second response range, adjustable via jumper JP1	80/40 kΩ
Relative percentage error	±15 %
Hysteresis	+25 %

Time response

Response time t_{an} at R_F = 0.5 x R_{an} and C_e = 1 µF	≤ 1 s

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m (at R_F = 0 Ω	≤ 200 µA
Internal DC resistance R_i	≥ 62 kΩ
Impedance Z_i at 50 Hz	≥ 60 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 300 V
Permissible system leakage capacitance C_e	≤ 5 µF

Memory

Fault memory (alarm relay)	on / off (on)*

Inputs

Reset button	N/O contact
Test button	N/O contact
Cable length external test/reset button	3 m

Switching elements

Number of switching elements	2 (changeover contacts K1, K2)
Operating principle K1/K2	N/C or N/O operation (N/O operation)*
Electrical endurance, number of cycles	10,000

Interfaces

Optocoupler, alarm			U_{CE} 24 V, I_C 10 mA
Optocoupler, measured value			U_{CE} ≤ DC 24 V, I_C ≤ 10 mA
			PWM signal, duty cycle 0 % = ∞ kΩ
			PWM signal, duty cycle 50 % = 120 kΩ
			PWM signal, duty cycle 100 % = 0 kΩ
Contact data acc. to IEC 60947-5-1:			
Rated operational voltage AC		230 V	230 V
Utilisation category AC		AC 13	AC 14
Rated operational current AC		5 A	3 A
Rated operational voltage DC	220 V	110 V	24 V
Utilisation category DC	DC 12	DC 12	DC 12
Rated operational current DC	0.1 A	0.2 A	1 A
Minimum current			1 mA at AC/DC ≥ 10 V

Environment/EMC

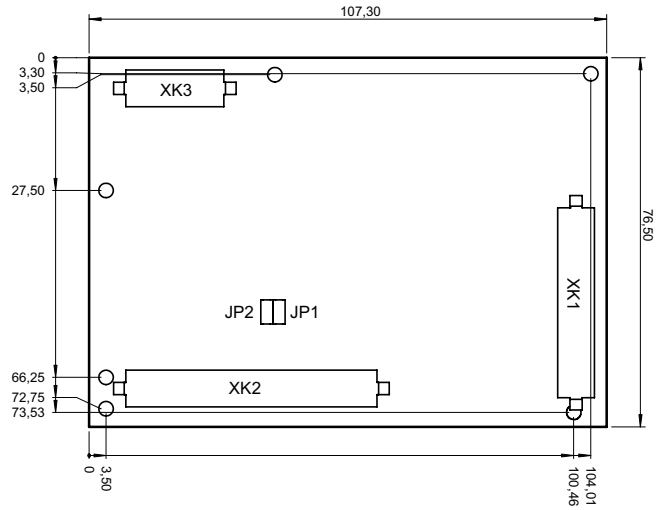
EMC	acc. to IEC 61326-2-4
Operating temperature	-25…+60 °C
Climatic categories acc. to IEC 60721, valid for one encapsulated p.c.b.:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721, valid for one encapsulated p.c.b:	
Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3
Connection	connectors Universal MATE-N-LOK
	3-pole TE Connectivity Nr. 350789-1
	6-pole TE Connectivity Nr. 641831-1
	8-pole TE Connectivity Nr. 641828-1

Other

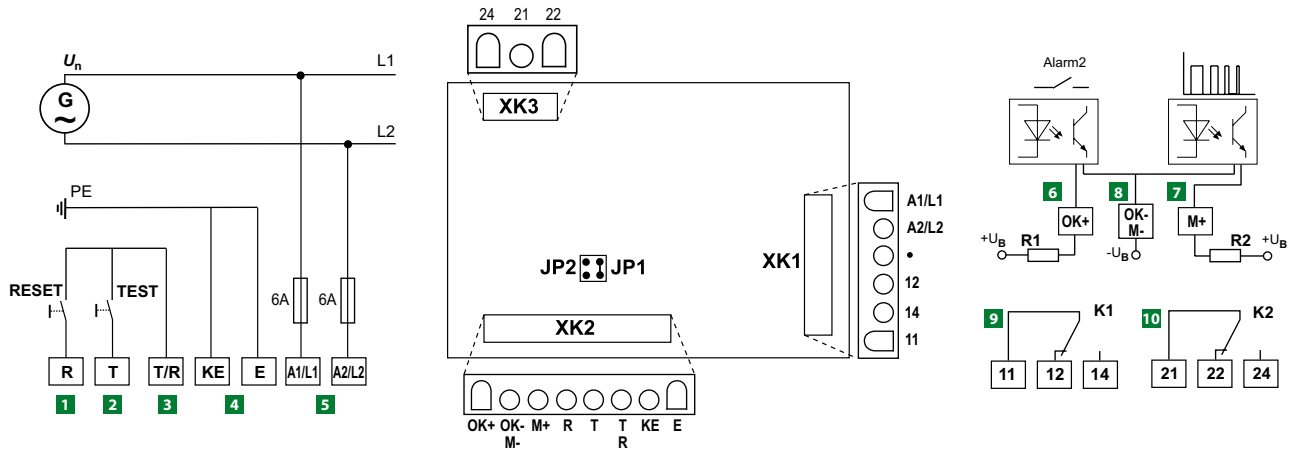
Operating mode	continuous operation
Mounting	any position
Dimensions of the p.c.b., L x W x H, without connectors 107.5 x 76.5 x 20 mm, with connectors 107.5 x 76.5 x 35 mm	
Enclosure	without
Documentation number	D00113
Weight	≤ 150 g

( )* = factory setting

Dimension diagrams (dimensions in mm)

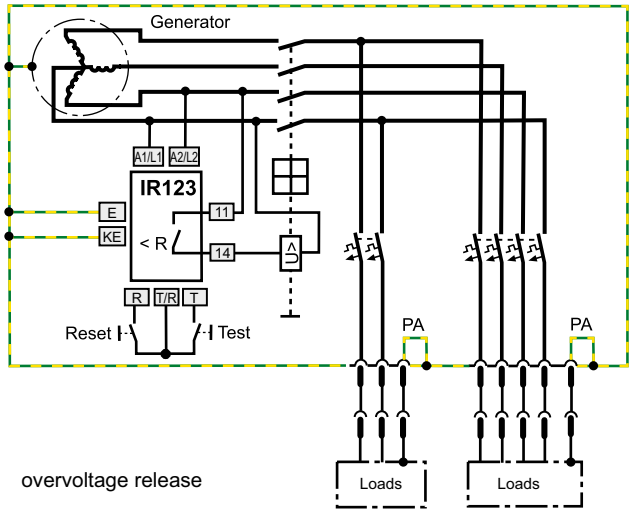


Wiring diagrams

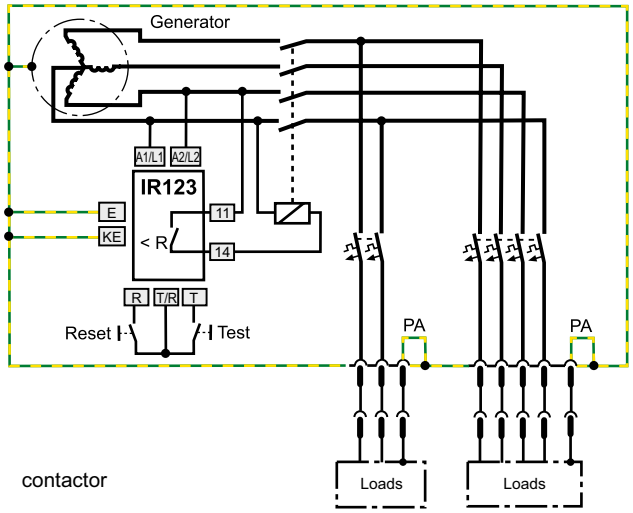


1 Input for reset button "R" (N/O contact)
2 Input for test button "T" (N/O contact)
3 Common input for test and reset button "T/R"
4 Connect the leads E and KE separately to PE
5 Supply voltage $U_S = U_n$
Connection to the IT system to be monitored
6 Digital output optocoupler "OK+": Alarm 2;
Connect to external operating voltage U_B: max. +24 V
7 Pulse-width-modulated output optocoupler "M+": Measuring value;
Connect to external operating voltage U_B: max. +24 V
8 Common reference point -U_B "OK-, M-" for OK+and M+
9 Alarm relay "K1"
10 Alarm relay "K2"

Application example with overvoltage release or contactor



Setting K1/K2 for **overvoltage release**: N/O operation



Setting K1/K2 for **contactor**: N/C operation

ISOMETER® IR155-3203/IR155-3204

Insulation monitoring device for unearthed DC drive systems (IT systems) in electric vehicles

AC/DC



Typical applications

- Monitoring for unearthed DC drive systems (IT systems) in electric vehicles

Approvals

CE EAC

Device features

- Suitable for 12 V and 24 V systems
- Automatic device self test
- Continuous measurement of the insulation resistance 0…10 MΩ
  - Response time for the first measurement of the system state (SST) is < 2 s after switching the supply voltage on
  - Response time < 20 s for insulation resistance measurement (DCP)
- Automatic adaptation to the existing system leakage capacitance (≤ 1 µF)
- Detection of earth faults and interruption of the earth connection
- Insulation monitoring of AC and DC insulation faults for unearthed systems (IT systems) 0…1000 V
- Undervoltage detection for voltages below 500 V (adjustable at factory by Bender)
- Short circuit proof outputs for:
  - Fault detection (high-side output)
  - Measured value (PWM 5…95 %) and status (f = 10…50 Hz) at high or inverted low-side driver (M_{HS}/M_{LS} output)
- Protective coating (SL 1301ECO-FLZ)

Standards

IEC 61557-8
IEC 61010-1
IEC 60664-1
ISO 6469-3
ISO 23273-3
ISO 16750-1
ISO 16750-2
ISO 16750-4
E1 (ECE regulation No. 10 version 5)
acc. 72/245/EWG/EEC
DIN EN 60068-2-38
DIN EN 60068-2-30
DIN EN 60068-2-14
DIN EN 60068-2-64
DIN EN 60068-2-27

Normative exclusion

The device went through an automotive test procedure in combination with multi customer requirements reg. ISO16750-x.

The standard IEC61557-8 will be fulfilled by creating the function for LED warning and test button at the customer site if necessary.

The device includes no surge and load dump protection above 60 V. An additional central protection is necessary.

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Parameters	Response value R_{an}	F_{ave}	Undervoltage detection	Measured value output	Type	Art. No.
Continuously set value	100 kΩ	10	300 V	Low-side	IR155-3203	B91068138V4
			0 V (inactive)	High-side	IR155-3204	B91068139V4
Customer-specific setting	100 kΩ…1 MΩ	1…10	0 V…500 V	Low-side	IR155-3203	B91068138CV4
				High-side	IR155-3204	B91068139CV4

Accessories

Description	Art. No.
Fastening set	B 9106 8500
Connector set IR155-32xx	B 9106 8501

Insulation coordination acc. to IEC 60664-1

Protective separation (reinforced insulation)	
	between (L+/L-) – (Kl. 31, Kl. 15, E, KE, M_{HS}, M_{LS}, OK_{HS})
Voltage test	AC 3500 V/1 min

Supply/IT system being monitored

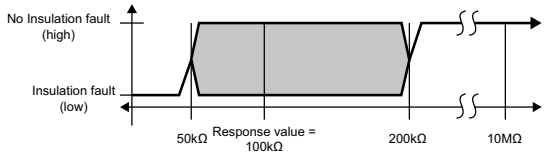
Supply voltage U_S	DC 10…36 V
Max. operating current I_S	150 mA
Max. current I_k	2 A
	6 A/2 ms inrush current
HV voltage range (L+/L-) U_n	AC 0…1000 V (peak value)
	0…660 V r.m.s. (10 Hz…1 kHz)
	DC 0…1000 V
Power consumption	< 2 W

Response values

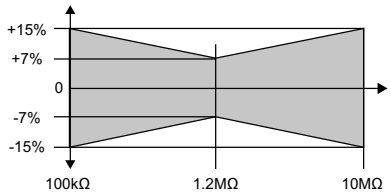
Response value hysteresis (DCP)	25 %
Response value R_{an}	100 kΩ…1 MΩ
Undervoltage detection	0…500 V

Measuring range

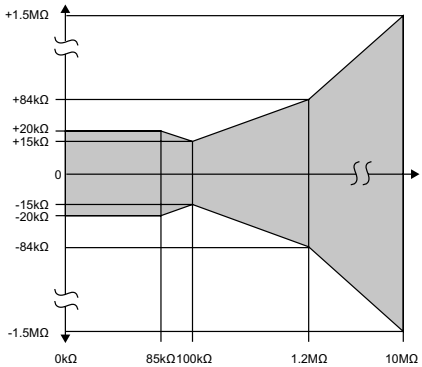
Measuring range	0…10 MΩ
Undervoltage detection	0…500 V default setting: 0 V (inactive)
Relative uncertainty	
SST (≤ 2 s)	good > 2* R_{an}; bad < 0.5* R_{an}
Relative uncertainty DCP	0…85 kΩ ▸ ±20 kΩ
(default setting 100 kΩ)	100 kΩ…10 MΩ ▸ ±15%
Relative uncertainty output M (fundamental frequency)	±5 % at each frequency
	(10 Hz; 20 Hz; 30 Hz; 40 Hz; 50 Hz)
Relative uncertainty	
undervoltage detection	U_n ≥ 100 V ▸ ±10 %; at U_n ≥300 V ▸ ±5 %
Relative uncertainty (SST)	"Good condition" ≥ 2* R_{an}
	"Bad condition" ≤ 0.5* R_{an}



Relative uncertainty DCP	100 kΩ…10 MΩ ±15 %
	100 kΩ…1.2 MΩ ▸ ±15 % to ±7 %
	1.2 MΩ ▸ ±7 %
	1.2…10 MΩ ▸ ±7 % to ±15 %
	10 MΩ ▸ ±15 %



Absolute uncertainty	0…85 kΩ ▸ ±20 kΩ



Time response

Response time t_{an} (OK_{HS}; SST)	t_{an} ≤ 2 s (typ. < 1 s at U_n > 100 V)
Response time t_{an} (OK_{HS}; DCP)	
(when changing over from R_F = 10 MΩ to R_{an}/2; at C_e = 1 µF; U_n = DC 1000 V)	
	t_{an} ≤ 20 s (at F_{ave} = 10*)
	t_{an} ≤ 17.5 s (at F_{ave} = 9)
	t_{an} ≤ 17.5 s (at F_{ave} = 8)
	t_{an} ≤ 15 s (at F_{ave} = 7)
	t_{an} ≤ 12.5 s (at F_{ave} = 6)
	t_{an} ≤ 12.5 s (at F_{ave} = 5)
	t_{an} ≤ 10 s (at F_{ave} = 4)
	t_{an} ≤ 7.5 s (at F_{ave} = 3)
	t_{an} ≤ 7.5 s (at F_{ave} = 2)
	t_{an} ≤ 5 s (at F_{ave} = 1)
	during the self test t_{an} +10 s
Switch-off time t_{ab} (OK_{HS}; DCP)	
(when changing over from R_{an}/2 = 10 MΩ to R_F; at C_e = 1 µF; U_n = DC 1000 V	
	t_{ab} ≤ 40 s (at F_{ave} = 10)
	t_{ab} ≤ 40 s (at F_{ave} = 9)
	t_{ab} ≤ 33 s (at F_{ave} = 8)
	t_{ab} ≤ 33 s (at F_{ave} = 7)
	t_{ab} ≤ 33 s (at F_{ave} = 6)
	t_{ab} ≤ 26 s (at F_{ave} = 5)
	t_{ab} ≤ 26 s (at F_{ave} = 4)
	t_{ab} ≤ 26 s (at F_{ave} = 3)
	t_{ab} ≤ 20 s (at F_{ave} = 2)
	t_{ab} ≤ 20 s (at F_{ave} = 1)
	during a self test t_{ab} +10 s
Duration of the self test	10 s
	(every five minutes; should be added to t_{an}/t_{ab})

Measuring circuit

System leakage capacitance C_e	≤ 1 µF
Smaller measurement range and increased measuring time at C_e	> 1 µF
	(e.g. max. range 1 MΩ @ 3 µF,
	t_{an} = 68 s when changing over from R_F 1 MΩ to R_{an}/2)
Measuring voltage U_M	±40 V
Measuring current I_M at R_F = 0	±33 µA
Impedance Z_i at 50 Hz	≥ 1.2 MΩ
Internal DC resistance R_i	≥ 1.2 MΩ

Output

Measurement output (M)

***M_{HS}* switches to U_S – 2 V (3204)**

(external pull-down resistor to Kl. 31 necessary 2.2 kΩ)

***M_{LS}* switches to Kl. 31 +2 V (3203)**

(external pull-up resistor to Kl. 15 reqired 2.2 kΩ

0 Hz ▸ Hi > short circuit to U_b +(Kl. 15); Low > IMD off or short circuit to Kl. 31

10 Hz ▸ Normal condition
Insulation measurement DCP;
starts two seconds after power on;
First successful insulation measurement at ≤ 17.5 s
PWM active 5…95 %

20 Hz ▸ undervoltage condition
Insulation measurement DCP (continuous measurement);
starts two seconds after power on;
PWM active 5…95 %
First successful insulation measurement at ≤ 17.5 s
Undervoltage detection 0…500 V
(Bender configurable)

30 Hz ▸ Speed start measurement
Insulation measurement (only good/bad evaluation)
starts directly after power on ≤ 2 s;
PWM 5…10 % (good) and 90…95 % (bad)

40 Hz ▸ Device error
Device error detected; PWM 47.5…52.5 %

50 Hz ▸ Connection fault earth
Fault detected on the earth connection (Kl. 31)
PWM 47.5…52.5 %

* F_{ave} = 10 is recommended for electric and hybrid vehicles

Status output (OK_{HS})

OK_{HS} switches to U_S – 2 V
(external pull-down resistor to Kl. 31 required 2.2 kΩ)

High ▸ No fault; R_F > response value
Low ▸ Insulation resistance ≤ response value detected;
Device error; Fault in the earth connection
Undervoltage detected or device switched off

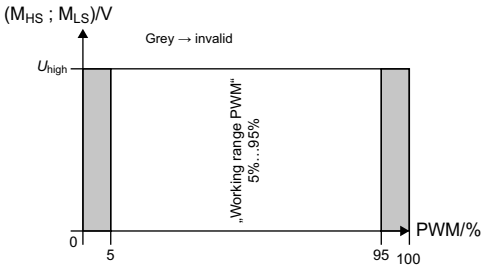
Operating principle PWM driver

- Condition "Normal" and "Undervoltage detected" (10 Hz; 20 Hz)

Duty cycle 5 % = > 50 MΩ (∞)
Duty cycle 50 % = 1200 kΩ
Duty cycle 95 % = 0 kΩ

$$R_F = \frac{90\ \% \times 1200\ k\Omega}{dc_{meas} - 5\%} - 1200\ k\Omega$$

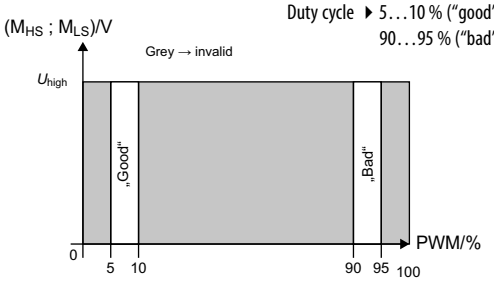
dc_{meas} = measured duty cycle (5 %…95 %)



Operating principle PWM driver

- Condition "SST" (30 Hz)

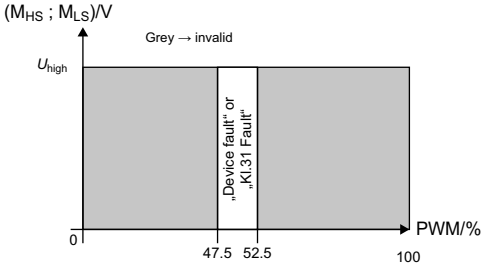
Duty cycle ▸ 5…10 % ("good")
90…95 % ("bad")



Operating principle PWM driver

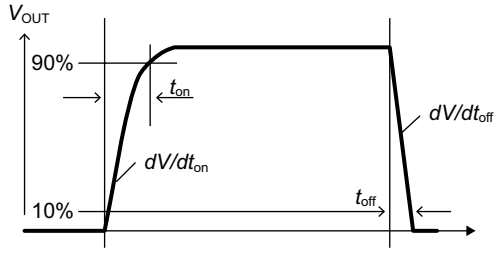
- Condition "Device error" and "Kl.31 fault" (40 Hz; 50 Hz;)

Duty cycle ▸ 47.5…52.5 %



Load current I_L	80 mA
Turn-on time ▸ to 90 % V_{out}	max. 125 µs
Turn-off time ▸ to 10 % V_{out}	max. 175 µs
Slew rate on ▸ 10…30 % V_{out}	max. 6 V/µs
Slew rate off ▸ 70…40 % V_{out}	max. 8 V/µs

Timing 3204 (inverse to 3203)



EMC

Load dump protection	< 60 V
Measurement method	Bender-DCP technology
Factor averaging	
F_{ave} (output M)	1…10 (factory set: 10)

ESD protection

Contact discharge – directly to terminals	≤ 10 kV
Contact discharge – indirectly to environment	≤ 25 kV
Air discharge – handling of the PCB	≤ 6 kV

Connection

On-board connectors	TYCO-MICRO MATE-N-LOK 1 x 2-1445088-8 Kl. 31, Kl.15, E, KE, M_{HS}, M_{LS}, OK_{HS} 2 x 2-1445088-2 (L+, L-); The connection between the respective connecting pins at L+or L-may only be used as redundancy. Cannot be used for looping through!
Crimp contacts	TYCO-MICRO MATE-N-LOK Gold 14 x 1-794606-1 Conductor cross section: AWG 20…24
Enclosure for crimp contacts	TYCO-MICRO MATE-N-LOK receptor HSG single R -1445022-8 TYCO-MICRO MATE-N-LOK receptor HSG single R -1445022-2

General data

Necessary crimp tongs (TYCO)	91501-1
Operating mode/mounting	continuous operation/any position
Temperature range	-40…+105 °C
Voltage failure	≤ 2 ms
Flammability class acc. to	UL 94 V-0

Mounting

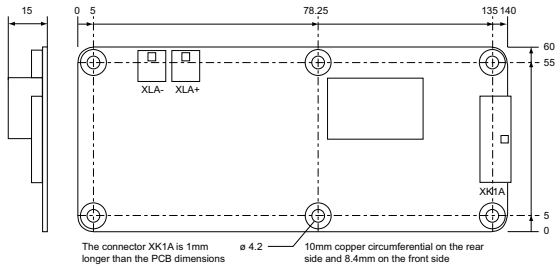
M4 metal screws with locking washers between screw head and PCB. Torx, T20 with a maximum tightening torque of 4 Nm for the screws. Furthermore, a maximum of 10 Nm tightening torque to the PCB at the mounting points.

Mounting and connector kits are not included in delivery, but are available as accessories. The maximum diameter of the mounting points is 10 mm.

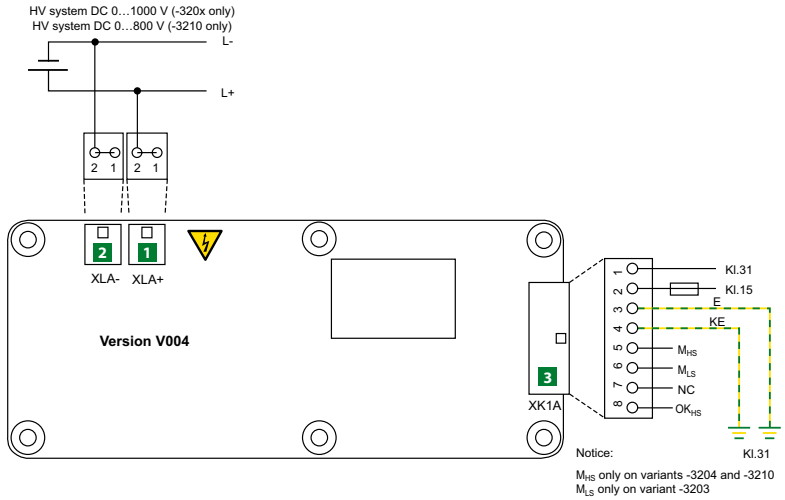
Before mounting the device, ensure sufficient insulation between the device and the vehicle or the mounting points (min. 11.4 mm to other parts). If the device is mounted on a metal or conductive subsurface, this subsurface has to be at earth potential (Kl.31; vehicle mass).

Deflection	max. 1 % of the length or width of the PCB
Coating	thick-film lacquer
Documentation number	D00115
Weight	52 g ±2 g

Dimension diagrams (dimensions in mm)



Wiring diagram



1 Connectors XLA+

Pin 1+2	L+	Line voltage

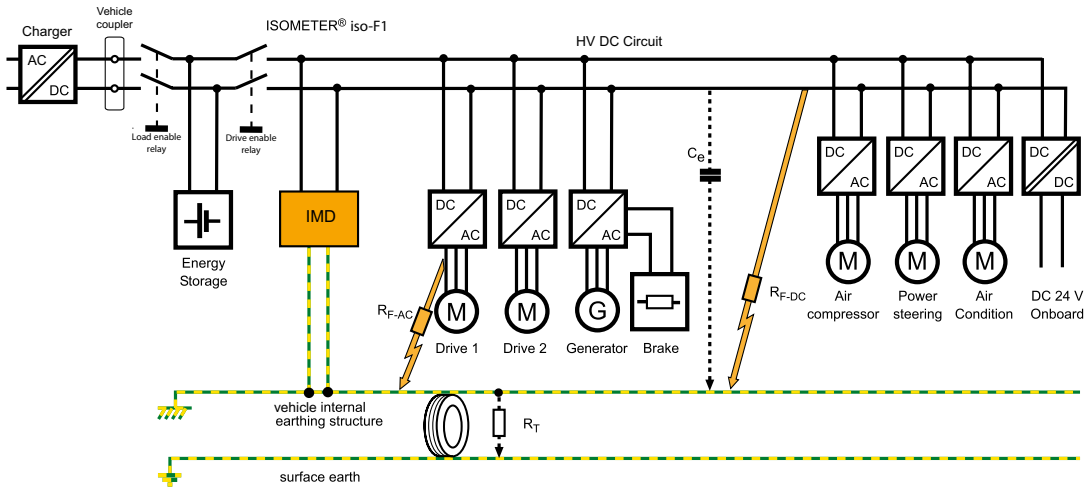
2 Connectors XLA-

Pin 1+2	L-	Line voltage

3 Connectors XK1A

Pin 1	Kl. 31	Chassis ground/electronic ground
Pin 2	Kl. 15	Supply voltage
Pin 3	Kl. 31	Chassis ground
Pin 4	Kl. 31	Chassis ground (separate line)
Pin 5	M_{HS}	Data Out, PWM (high side)
Pin 6	M_{LS}	Data Out, PWM (low side)
Pin 7	n.c.	
Pin 8	OK_{HS}	Status Output (high side)

Example of application



ISOMETER® isoEV425 with coupling device AGH420

Insulation monitoring device for unearthed DC circuits (IT systems) for charging electric vehicles

AC/DC



Typical applications

- DC charging stations for electric vehicles according to IEC 61851-23

Approvals

Device features

- Monitoring for DC charging stations (mode 4 according to IEC 61851-23) for charging electric vehicles
- Mains voltage measurement (r.m.s.) with under-/overvoltage detection
- DC voltage measurement to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 5 µF
- Automatic device self-test with connection monitoring
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…500kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		System leakage capacitance C_e	Type	Art. No.	
AC	DC			Screw-type terminal	Push-wire terminal
100…240 V, 47…63 Hz	24…240 V	≤ 5 µF	isoEV425-D4-4 with AGH420	B91036401	B71036401
		≤ 20 µF	isoEV425HC-D4-4 with AGH420	–	B71036397

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	Up, KE, T/R, A, B, AK1, GND, AK2
Rated voltage	240 V
Overvoltage category	III
Rated impulse voltage:	
IC2/(IC3-4)	4 kV
IC 3/(IC4)	4 kV
Rated insulated voltage:	
IC2/(IC3-4)	250 V
IC 3/(IC4)	250 V
Polution degree	3
Protective separation (reinforced insulation) between:	
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/(IC4)	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/(IC4)	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n with AGH420	3(N)AC, AC 0…690 V/DC 0…1000 V
Tolerance of U_n	AC + 15 %, DC +10 %
Nominal system voltage range U_n with AGH420 (UL508)	AC/DC 0…600 V
Frequency range of U_n	DC, 40…460 Hz

Measuring circuit

Permissible system leakage capacitance C_e (isoEV425)	≤ 5 µF
Permissible system leakage capacitance C_e (isoEV425HC)	≤ 20 µF
Permissible extraneous DC voltage U_{fg}	≤ 1150 V

Response values

Response value R_{an1} (isoEV425)	2…500 kΩ (500 kΩ)*
Response value R_{an1} (isoEV425HC)	2…500 kΩ (200 kΩ)*
Response value R_{an2} (isoEV425)	1…490 kΩ (100 kΩ)*
Operating uncertainty R_{an} (≤ 5 µF)	± 15 %, at least ±1 kΩ
Operating uncertainty R_{an} >100 kΩ (≤ 5 µF, isoEV425HC)	± (5 % * R_{an}/100 kΩ +10%)
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection	30…1.14 kV (off)*
Overvoltage detection	31…1.15 kV (off)*
Relative uncertainty U	± 5 %, at least ± 5 V
Relative uncertainty depending on the frequency ≥ 200 Hz	-0.03 %/Hz
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} at R_F = 0.5 x R_{an} and C_e=1 µF acc. to IEC 61557-8	≤ 10 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…1 MΩ
Operating uncertainty R_F (≤ 5 µF)	± 15 %, at least ±1 kΩ
Operating uncertainty R_F >100 kΩ (≤ 5 µF, isoEV425HC)	± (5 % * R_F /100 kΩ +10%)
Display range measured value nominal system voltage (U_n)	30…1.15 kV r.m.s.
Operating uncertainty	± 5 %, at least ± 5 V
Relative uncertainty depending on the frequency ≥ 200 Hz	-0.03 %/Hz
Display range measured value system leakage capacitance R_F > 10 kΩ (isoEV425)	0…10 µF
Display range measured value system leakage capacitance R_F > 10 kΩ (isoEV425HC)	0…25 µF
Operating uncertainty	± 15 %, at least ± 2 µF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kBit/s), Modbus RTU (selectable), isoData (115.2 kBits/s)
Cable length (9.6 kbits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0,25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 N/O contacts, common terminal 11
Operating principle	N/C operation/N/O operation (N/O operation)*
Electrical endurance, number of cycles	10000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operation	-40…+70 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K7 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K4 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminals:

Nominal current	≤10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	8 mm
Rigid/flexible	0.2…2.5 mm²
Flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor rigid	0.2…1.5 mm²
Multi-conductor flexible	0.2…1.5 mm²
Multi-conductor flexible with ferrules without plastic sleeve	0.25…1.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²

Push-wire terminals:

Nominal current	≤10 A
Conductor sizes	AWG 24-14
Stripping length	10 mm
Rigid	0.2…2.5 mm²
Flexible without ferrules	0.75…2.5 mm²
Flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm
Wiring of the terminals Up, AK1, GND, AK2	refer to technical data AGH420 under the heading “Connection”

Other

Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Documentation number	D00126
Weight	≤ 150 g

( )* = factory setting

Technical data coupling device AGH420

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	1000 V
Rated impulse voltage	8 kV
Pollution degree	3
Overvoltage category	III
Protective separation (reinforced insulation) between	(L1/+, L2/-) -(AK1, GND, AK2, Up, E)
Voltage test, routine test (IEC 61010-1)	4.3 kV

IT system being monitored

Nominal system voltage range U_n	AC/DC 0…1000 V
Tolerance of U_n	AC/DC +10 %
Nominal system voltage range U_n (UL508)	AC/DC 0…600 V

Measuring circuit

Measuring voltage U_m	±45 V
Measuring current I_m at R_F	≤ 400 µA
Internal DC resistance R_i	≥ 120 kΩ

Environment/EMC

EMC	IEC 61326-2-4
Ambient temperatures:	
Operation	-40…+70 °C
Transport	-40…+80 °C
Storage	-40…+70 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K7 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K4 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

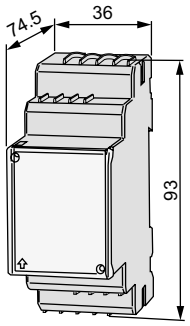
Connection type	push-wire terminal
Nominal current	≤ 10 A
Conductor sizes	AWG 24…14
Stripping length	10 mm
Connection properties:	
Rigid/flexible	0.2…2.5 mm²
Flexible with ferrule with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm
Connection type	terminals Up, AK1, GND, AK2
Single cables for terminals Up, AK1, GND, AK2:Cable lengths	≤ 0.5 m
Connection properties	≥ 0.75 mm²

Other

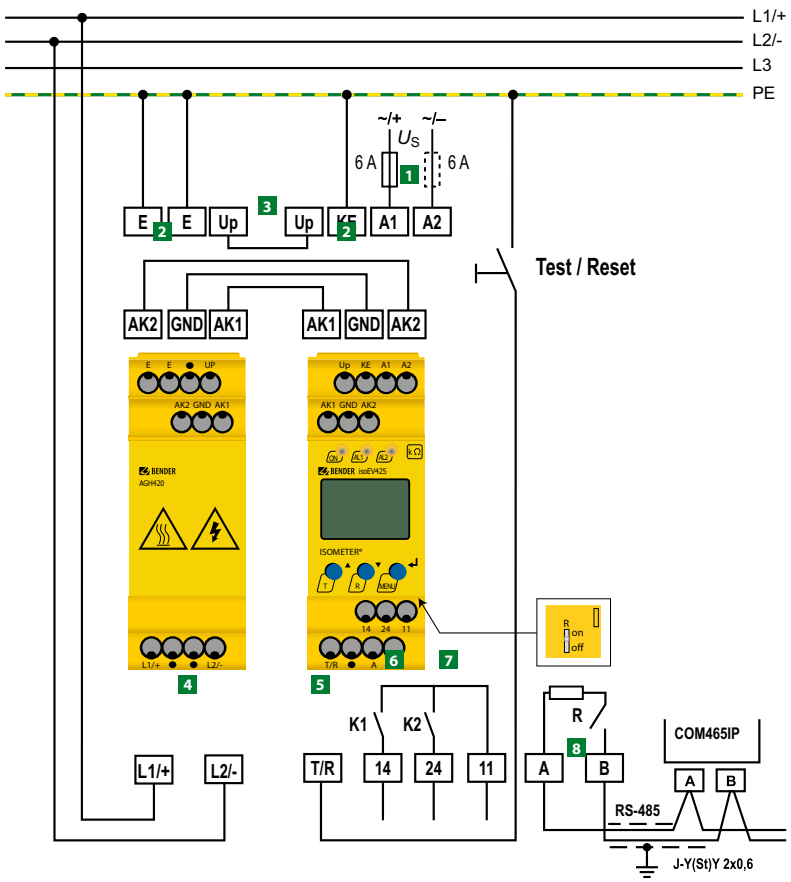
Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Distance to adjacent devices from U_n > 800 V	≥ 30 mm
Degree of protection, internal components (IEC 60529)	IP 30
Degree of protection, terminals (IEC 60529)	IP 20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)



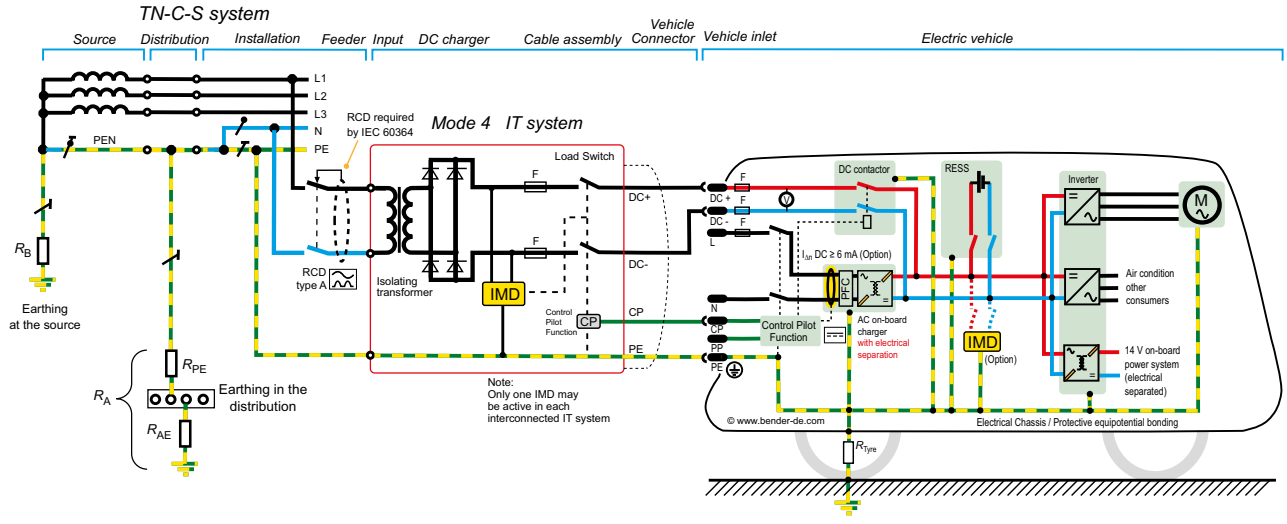
Wiring diagram



1	A1, A2	Connection to the supply voltage via a fuse. If supplied from an IT system, both lines have to be protected by a fuse.*
2	E, E, KE	Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.
3	L1/+, L2/–	Connection to the 3(N)AC, AC or DC system to be monitored.
4	Up, AK1, GND, AK2	Connect the terminals of the AGH420 to the corresponding terminals of the ISOMETER®.
5	T/R	Connection for external combined test and reset button.
6	11, 14	Connection to alarm relay K1
7	11, 24	Connection to alarm relay K2
8	A, B	RS-485 communication interface with selectable terminating resistance.

* **For UL applications:**
Only use 60/75°C copper lines!
UL and CSA applications require the supply voltage to be protected via 5 A fuses.

Example of application



ISOMETER® isoCHA425

Insulation monitoring device for unearthed DC systems (IT systems) DC 50 V up to 500 V
Suitable for the charging of electric vehicles acc. to Japanese charging standard CHAdeMO

DC



Typical applications

- DC charging stations for electric vehicles according the Japanese charging standard CHAdeMO

Approvals

CHAdeMO

c UL us LISTED

Device features

- Monitoring the insulation resistance for DC charging stations according to Japanese charging standard CHAdeMO
- Detection of asymmetrical insulation faults in the DC system voltage range between 50 V und 500 V within 1 s
- Detection of symmetrical insulation faults within 10 s
- Measurement of the system voltage (true RMS) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 2 µF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 5…250 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via multifunctional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  – BMS interface (Bender measuring device interface) for data exchange with other Bender components
  – Modbus RTU
  – IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- CHAdeMO Spec V1.0

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		System leakage capacitance C_e	Type	Art. No.
AC	DC			Push-wire terminal
100…240 V, 47…63 Hz	24…240 V	≤ 2 µF	isoCHA425-D4-4	B71036395

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L+, L
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A, B
Rated voltage	400 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-4)	6 kV
IC2/(IC3-4)	4 kV
IC3/IC4	4 kV
Rated insulation voltage:	
IC1/(IC2-4)	400 V
IC2/(IC3-4)	250 V
IC3/IC4	250 V
Polution degree	3
Protective separation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/IC4	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/IC4	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n	DC 0…400 V
Tolerance of U_n	+25 %

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m at R_F, $Z_F = 0$	≤ 110 µA
Internal resistance R_i, Z_i	≥ 115 kΩ
Permissible system leakage capacitance C_e	≤ 2 µF

Response values

Response value R_{an1}	R_{an2}…250 kΩ (46 kΩ)*
Response value R_{an2}	5 kΩ…R_{an1} (23 kΩ)*
Relative uncertainty R_{an}	±15 %, at least ±2 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection $U<$	10 V…$U>$ (off/10 V)*
Overvoltage detection $U>$	$U<$…500 V (off/500 V)*
Relative uncertainty U	±5 %, at least ±5 V
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} of $R_F = 0,5 \times R_{an}$ and C_e=1 µF according to IEC 61557-8	≤ 1 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…2 MΩ
Operating uncertainty	±15 %, at least ±2 kΩ
Display range measured value nominal system voltage (U_n)	0…500 VRMS
Operating uncertainty	±5 %, at least ±5 V
Display range measured value system leakage capacitance of R_F > 10 kΩ (only "dc" mode)	0…17 µF
Operating uncertainty of R_F ≥ 20 kΩ and C_e ≤ 5 µF	±5 %, at least ± 0,1 µF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kBit/s), Modbus RTU (selectable), isoData (115.2 kBits/s)
Cable length (9.6 kBits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2 x 0.6
Terminating resistor	120 Ω (0.25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 contacts, common terminal 11
Operating principle	N/C operation/N/O operation (N/C operation)*
Electrical endurance, number of cycles	10 000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operation	-40…+70 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Climatic class acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K7 (without condensation and formation of ice)
Transport (IEC 60721-3-2)	2K4 (without condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K5 (without condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

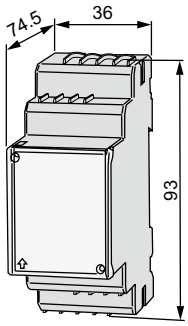
Connection type	push-wire terminal
Nominal current	≤ 10 A
Conductor sizes	AWG 24 -14
Stripping length	10 mm
rigid	0.2…2.5 mm²
flexible without ferrules	0.75…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm

Other

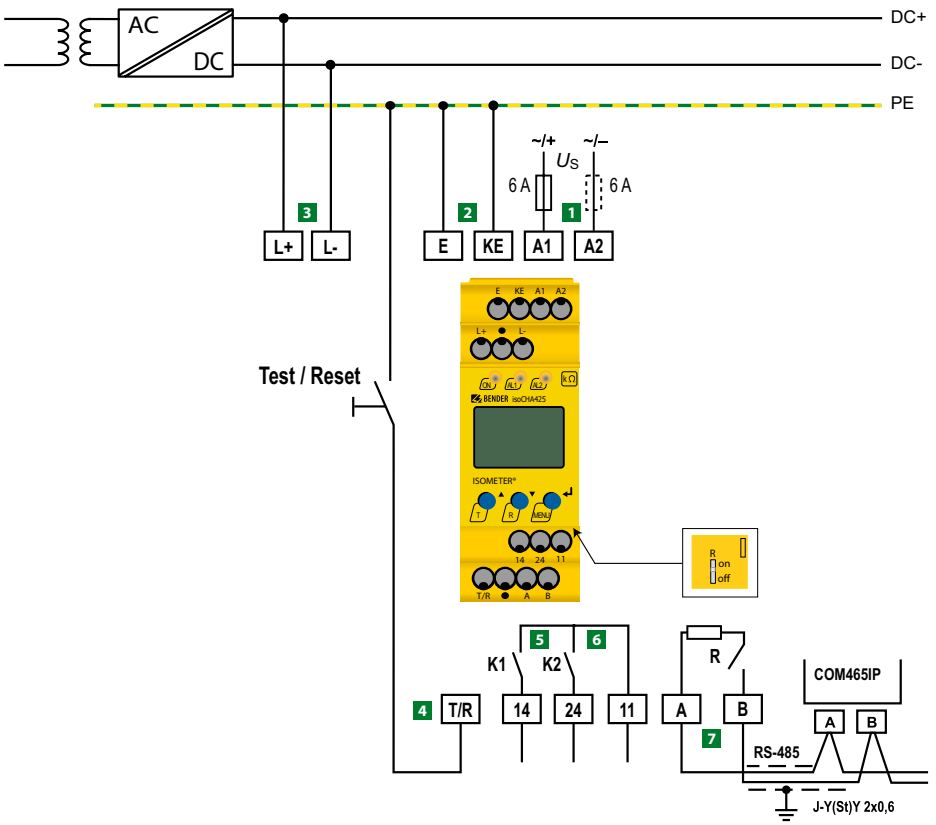
Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1 A1, A2 Connection to the supply voltage via fuse (line protection): If supplied from an IT system, both lines have to be protected by a fuse.*

2 E, KE Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.

3 L+, L– Connection to the IT system to be monitored.

4 T/R Connection for the external combined test and reset button

5 11, 14 Connection to alarm relay K1

6 11, 24 Connection to alarm relay K2

7 A, B RS-485 communication interface with connectable terminating resistance. Example: Connection of a BMS-Ethernet-Gateway COM465IP

* ***For UL applications:***
Only use 60/75 °C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

ISOMETER® iso165C...

Insulation Monitoring Device (IMD) for unearthed DC drive systems (IT systems) in electric vehicles

AC/DC



Typical applications

- Monitoring for unearthed DC drive systems (IT systems) in electric vehicles

Approvals

CE

Device features

- Insulation monitoring of AC and DC insulation faults for unearthed systems (IT systems) from 0…600 V peak
- Power supply for all internal voltages
- Continuous measurement of insulation resistance from 0 Ω…50 MΩ
- Response time of ≤ 20 s for measured insulation resistance (using Direct Current Pulse (DCP))
- Automatic adaptation to the existing system leakage capacitance (≤ 1 µF)
- Detection of ground faults and lost ground line
- Measurement of a second voltage
- The device works when:
  - HV is unstable
  - HV is powered off
  - There are symmetric or asymmetric insulation faults
  - Faults exist between HV lines and the supply voltage
- Galvanic insulation of all signals from the HV side
- HV coupled network
- CAN bus interface
- Light weight: < 220 g (including housing and connection frame)
- **iso165C-1 only:** The iso165C-1 variant features **Error** and **Warning** signals on the separated high-side driver

Standards – corresponding norms and regulations

General
IEC 61557-8; IEC 60664-1; ISO 6469-3; ISO 23273-3

EMV
CISPR 25; ISO 7637-2; ISO 11452-2; ISO 11452-4; ISO 11452-8; ISO 10605; IEC 61326-2-4; IEC 61000-4-4; E1 gem. 72/245/EWG/EEC; ISO 16750-2

Environmental
ISO 16750-1; ISO 20653; ISO 16750-3; IEC 60068-2-14; IEC 60068-2-27; IEC 60068-2-32; IEC 60068-2-64; ISO 16750-4; IEC 60068-2-1; IEC 60068-2-2; IEC 60068-2-38; IEC 60068-2-60; IEC 60068-2-78

Normative exclusion
The device has gone through an automotive test procedure in accordance with multi customer requirements as outlined by reg. ISO 16750-x. IEC 61557-8 will be fulfilled by creating an LED warning function and test button at the customer site if necessary.

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Response value range	Nominal voltage	Supply voltage	Type	Art. No.
	DC	DC		
Alarm1 (Error): 30 kΩ…1 MΩ (default 100 kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (default 200 kΩ)	0…600 V	12 V	iso165C	B91068175
Alarm1 (Error): 30 kΩ…1 MΩ (customer setting xxx kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (customer setting xxx kΩ)	0…600 V	12 V	iso165C	B91068175C
Alarm1 (Error): 30 kΩ…1 MΩ (default 200 kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (default 400 kΩ)	0…600 V	12 V	iso165C-1	B91068176
Alarm1 (Error): 30 kΩ…1 MΩ (customer setting xxx kΩ); Alarm2 (Warning): 40 kΩ…2 MΩ (customer setting xxx kΩ)	0…600 V	12 V	iso165C-1	B91068176C

Accessories

Type	Art. No.
iso165C connecting kit	B 9106 8503

Supply voltage

Supply voltage U_S	DC 9…16 V
Nominal supply voltage	DC 12 V
Max operational current I_S	300 mA (typ. 185 mA)
Max current I_K	5 A
Power dissipation P_S	< 2.5 W

Supervised IT system

Rated voltage range U_n	DC 0…600 V
Tolerance	+15%
Frequency range	10 Hz…1 kHz
System leakage capacity C_e	≤ 1 µF
Withstand voltage test	AC 1.9 kV/1 min.

Measuring circuit

Measurement method	Bender DCP technology
Measuring voltage U_m	±40 V
Measuring current I_m at $R_F = 0$	±33 µA
Impedance Z_i at 50 Hz (HV1)	≥ 1.2 MΩ (≥ 2.4 MΩ each line, high resistance in off state)
Internal resistance R_i (HV1)	≥ 1.2 MΩ (≥ 2.4 MΩ each line, high resistance in off state)
Impedance Z_i at 50 Hz (HV2)	≥ 10.5 MΩ (≥ 21 MΩ each line)
Internal resistance R_i (HV2)	≥ 10.5 MΩ (≥ 21 MΩ each line)

Measuring ranges

Insulation resistance range	0 Ω… 50 MΩ
Insulation resistance duration/Pulse (normal operation)	~ 1.6 s (≤ 1 µF/0 MΩ) ~ 6 s (≤ 1 µF/10 MΩ)
Relative error (DCP)	100 kΩ…5 MΩ, ±15 %
Absolute error (DCP)	0 Ω…100 kΩ, ±15 kΩ
High-voltage range	0…600V
High-voltage tolerance	0… 100 V, ±5 V 100… 600 V, ±5 %

High-side driver output (iso165C-1)

HST_1*	High-side driver 1, iso Error
Maximum current, Iout_max	80 mA
HST_2*	High-side driver 2, iso Warning
Maximum current, Iout_max	80 mA

Response Values

iso165C:

Response Alarm 1 (Error)	30 kΩ…1 MΩ (default 100 KΩ)
Response Alarm 2 (Warning)	40 kΩ…2 MΩ (default 200 KΩ)

iso165C-1:

Response Alarm 1 (Error)	30 kΩ…1 MΩ (default 200 KΩ)
Response Alarm 2 (Warning)	40 kΩ…2 MΩ (default 400 KΩ)

iso165C and iso165C-1:

Response uncertainty (according to IEC 61557-8)	±15 %
Hysteresis	+25 %
Factor averaging F_{ave}	1…10 (default: 3)
Response time t_{an} (DCP)	
(Changeover R_F: 10 MΩ - $R_{an/2}$; at C_e = 1 µF; U_n = 600 V DC)	t_{an} ≤ 20 s (at F_{ave} = 10**) during self test t_{an} + 10 s
Measurement time after power on (and after HV relays are closed)	≤ 3 s (<1 µF/150 kΩ)
Switch-off time t_{ab} (DCP)	
(Changeover R_F:$R_{an/2}$ - 10 MΩ; at C_e = 1 µF; U_n = DC 600 V)	t_{ab} ≤ 40 s (at F_{ave} = 10) during self test tab + 10 s

Interface

Protocol	HS-CAN

iso165C:

Data rate	250 kBaud
Termination resistance	124 Ω internally

iso165C-1:

Data rate	500 kBaud
Termination resistance	None

Environment/EMC)

EMC	IEC 61326-2-4
Overvoltage category/degree of pollution	II/2
Temperature range	-40…+85 °C
Range of application	5,000 m above sea level

Connectors (Tyco)

Receptor housing type	1719183-1, 1719183-2, 1719183-3 (black, white, blue)
Receptor drawing number	C-1719183
Contact type (tin plated)	5-963715-1
Contact wire range	0.50…0.75 mm²
Contact drawing number	929454
Crimp hand tool	539635-1

Other

Operating mode	Continuous operation
Degree of protection	IP5K0
Software version:	
iso165C	V1.0 - Release S010 (VIFC: V5.0 , IMC V5.0)
iso165C-1	V2.0 - Release S010 (VIFC: V10.0 , IMC V5.0)

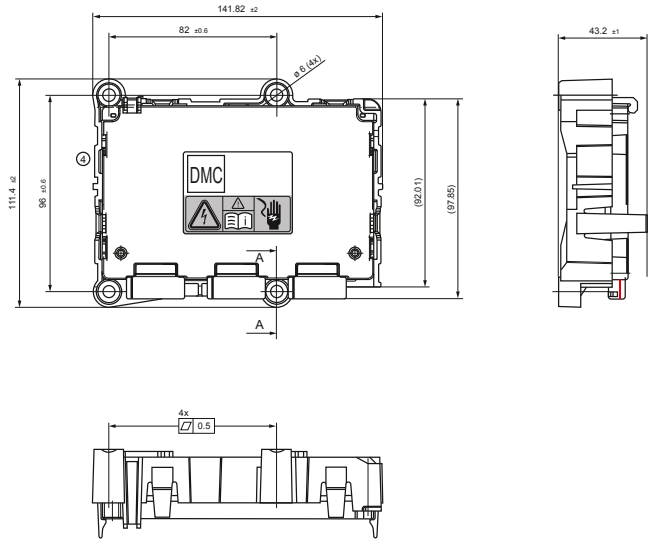
Mounting

Recommended screws for mounting	4 x M5 (not included)
Max. tightening torque	2.25 ± 0.25 Nm(XX lbs-in)

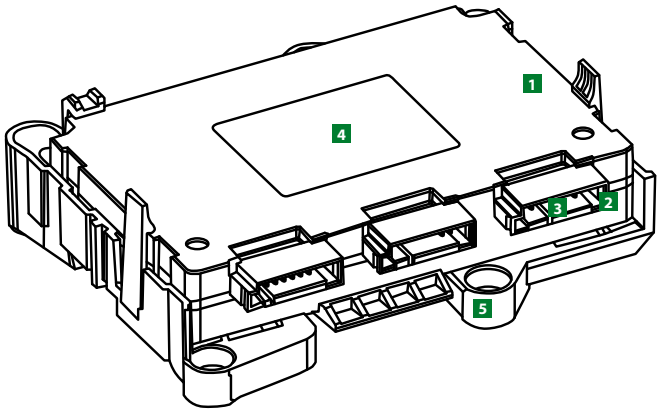
* External 2.2 kΩ pull-down resistor to chassis ground (KL.31) is required.
Not protected against a short circuit in the event that KL.31 is missing.
Therefore, a 100 Ω resistor is required on each driver output.

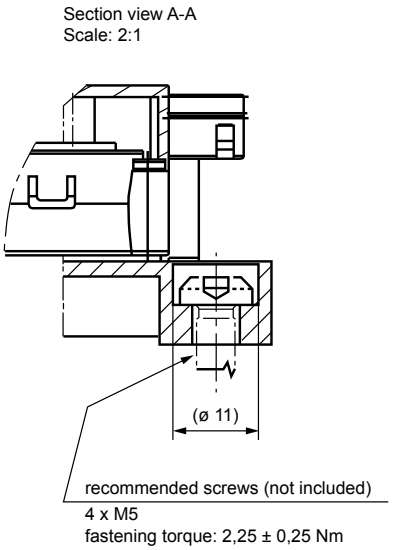
** Fave = 10 is recommended for electric vehicles

Dimension diagram (dimensions in mm)



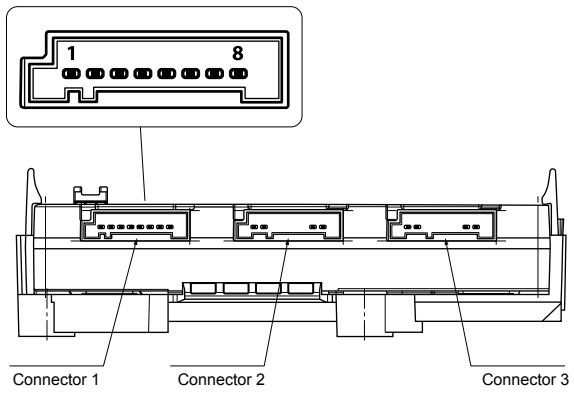
Wiring diagram





1	**Enclosure**	PBT GF30 black, UL Standard: UL94 V0	4	**Label**	White Polyester foil
2	**Cover**	PBT GF30 black, UL Standard: UL94 V0	5	**Bracket**	PBT GF30 black, UL Standard: UL94 V0
3	**Connector pin**	Cu-alloy, tin plated			

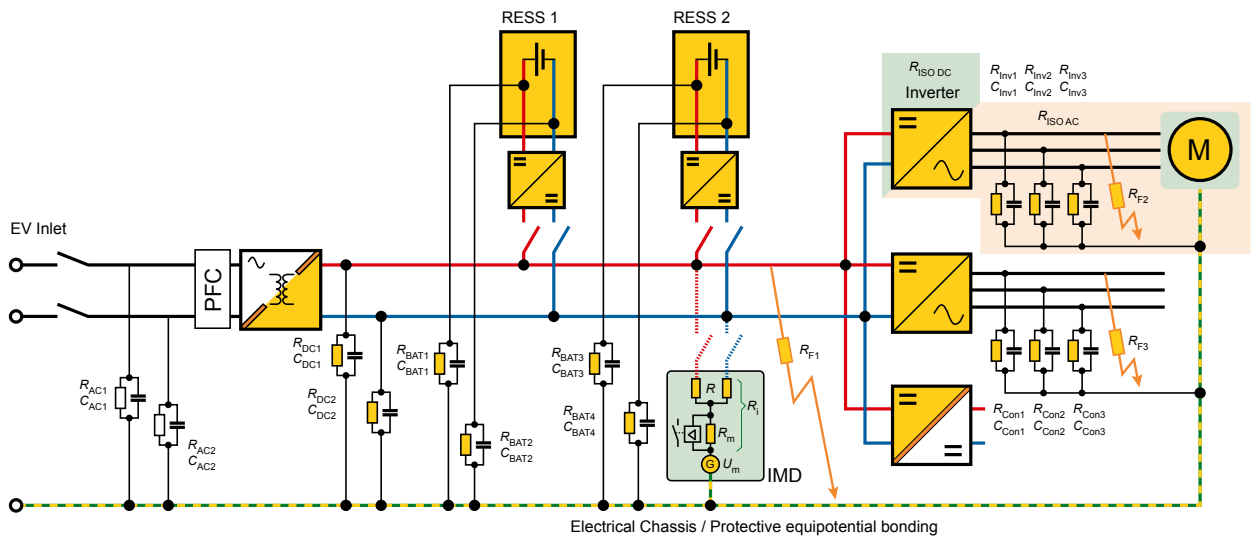
Connectivity



Connector [1]	Type	Code	Colour
1	1719183-1	A	Black
2	1719183-2	B	White
3	1719183-3	C	Blue

[1] Please refer to "Technical Data" for detailed connector information.

Typical application



ISOMETER® isoRW425

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for railway applications up to 3(N)AC, AC/DC 400 V

AC/DC



Typical applications

- AC control circuits in rolling stock according to EN 50155
- AC, DC or AC/DC circuits
- Systems including switched-mode power supplies
- Small AC-IT systems e. g. lighting systems

Approvals

Device features

- Monitoring of the insulation resistance (R mode) or the insulation impedance (Z mode) of unearthed 3(N)AC, AC and DC systems (IT systems) with galvanically connected rectifiers or inverters
- Insulation impedance (Z mode) for 50 Hz or 60 Hz
- Measurement of the nominal system voltage (RMS) with undervoltage and overvoltage detection
- Measurement of DC voltages system to earth (L+/PE and L-/PE)
- Automatic adaptation to the system leakage capacitance up to 300 µF in *R* mode and 1µF in *Z* mode
- Automatic device self test with connection monitoring
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response ranges of 1…990 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) interface including the following protocols:
  – BMS interface (Bender measuring device interface) for data exchange with other Bender components
  – Modbus RTU
  – isoData (for continuous data output)
- Password protection to prevent unauthorised changes of parameters

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- DIN EN 45545-2

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage U_n		Supply voltage U_S		System leakage capacitance C_e	Type	Art. No.	
3(N)AC, AC/DC	DC	AC	DC			Screw-type terminal	Push-wire terminal
0…440 V	15…460 Hz	100…240 V, 47…63 Hz	24…240 V	< 300 µF	isoRW425-D4W-4	B91037000W	B71037000W

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2/-
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A, B
Rated voltage	440 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-4)	6 kV
IC2/(IC3-4)	4 kV
IC 3/(IC4)	4 kV
Rated insulated voltage:	
IC1/(IC2-4)	500 V
IC2/(IC3-4)	250 V
IC 3/(IC4)	250 V
Polution degree	3
Protective separation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/(IC4)	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-4)	AC 2,2 kV
IC 3/(IC4)	AC 2,2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n	3(N)AC, AC 0…440V/DC 0…440 V
Nominal system voltage range U_n (UL508)	AC/DC 0…400 V
Tolerance of U_n	+15 %
Frequency range of U_n	DC, 15…460 Hz

Measuring circuit

Measuring voltage U_m	± 12 V
Measuring current I_m at R_F, $Z_F = 0\ \Omega$	≤ 110 µA
Internal resistance R_i, Z_i	≥ 115 kΩ
Permissible system leakage capacitance C_e (R mode)	≤ 300 µF
Permissible system leakage capacitance C_e (Z mode)	≤ 1 µF
Permissible extraneous DC voltage U_{fg}	≤ 700 V

Response values

Response value R_{an1}	2…990 kΩ (40 kΩ)*
Response value R_{an2}	1…980 kΩ (10 kΩ)*
Relative uncertainty R_{an} (R mode or $Z_F \approx R_F$)	± 15 %, at least ±1 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Response value Z_{an1}	11…500 kΩ (off)*
Response value Z_{an2}	10…490 kΩ (off)*
Relative uncertainty Z_{an}	± 15 %, at least ±1 kΩ
Hysteresis Z_{an}	25 %, at least 1 kΩ
Undervoltage detection	10…499 V (off)*
Overvoltage detection	11…500 V (off)*
Relative uncertainty U	± 5 %, at least ± 5 V
Relative uncertainty depending on the frequency ≥ 400 Hz	-0.015 %/Hz
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} of $R_F = 0.5 \times R_{an}$ and C_e=1 µF according to IEC 61557-8	≤ 10 s
Response time t_{an} of $Z_F = 0.5 \times Z_{an}$	≤ 5 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…4 MΩ
Display range measured value impedance (Z_F) with f_n = 50/60 Hz	1 kΩ…1 MΩ
Operating uncertainty (R_F in R mode, Z_F in Z mode)	± 15 %, at least ±1 kΩ
Display range measured value nominal system voltage (U_n)	0…500 V rms
Operating uncertainty	± 5 %, at least ± 5 V
Display range measured value system leakage capacitance of R_F > 10 kΩ	0…300 µF
Operating uncertainty	± 15 %, at least ± 2 µF
Display range measured value system leakage capacitance of Z_F > 10 kΩ	1 nF…1 µF
Operating uncertainty ($Z_F \approx X_c$)	± 15 %, at least ± 2 nF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbits/s)
Cable length (9.6 kbits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0,25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 N/O contacts, common terminal 11
Operating principle	N/C operation/N/O operation (N/O operation)*
Electrical endurance, number of cycles	10000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4, DIN EN50121-3-2

Ambient temperatures:

Operation	-40…+70 °C
Transport	-50…+85 °C
Storage	-55…+80 °C

Climatic class acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K7
Transport (IEC 60721-3-2)	2K4
Long-time storage (IEC 60721-3-1)	1K6

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal:

Nominal current	≤ 10 A
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	8 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor rigid	0.2…1.5 mm²
Multi-conductor flexible	0.2…1.5 mm²
Multi-conductor flexible with ferrules without plastic sleeve	0.25…1.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.25…1.5 mm²

Push-wire terminal:

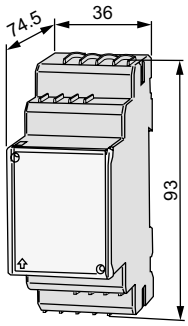
Nominal current	≤ 10 A
Conductor sizes	AWG 24-14
Stripping length	10 mm
Rigid	0.2…2.5 mm²
flexible without ferrules	0.75…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm

Other

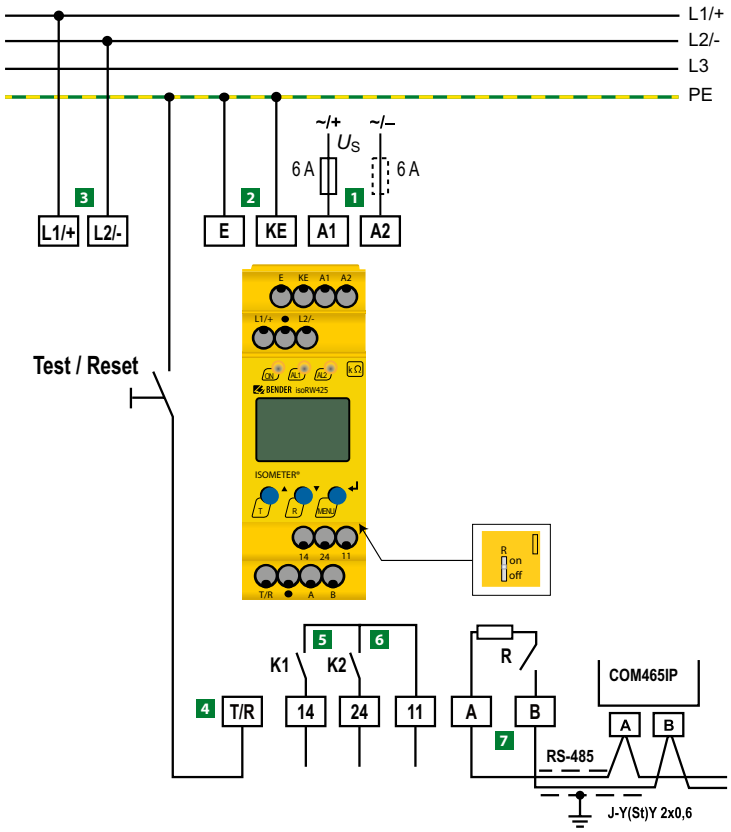
Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Documentation number	D00052
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	A1, A2	Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse.*
2	E, KE	Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.
3	L1/+, L2/–	Connection to the 3(N)AC, AC or DC system to be monitored
4	T/R	Connection for the external combined test and reset button.
5	11, 14	Connection to alarm relay K1
6	11, 24	Connection to alarm relay K2
7	A, B	RS-485 communication interface with connectable terminating resistance.

* **For UL applications:**
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

ISOMETER® isoUG425

Insulation monitoring device for unearthed DC systems (IT systems) up to 120 V

DC



Typical applications

- Simple battery systems
- Conveniently sized DC control voltage systems
- DC lamp circuits

Approvals

Device features

- Überwachung des unsymmetrischen Isolationswiderstandes für ungeerdete DC-Systeme
- Messung der Netzspannung (RMS und DC) mit Unter-/Überspannungserkennung
- Messung der DC-Spannungen Netz gegen Erde (L+/PE und L-/PE)
- Parametrierbare Anpassung an die Netzableitkapazität bis 50 µF
- Anlauf-, Ansprech- und Rückfallverzögerung einstellbar
- Zwei getrennt einstellbare Ansprechwert-Bereiche von 1…100 kΩ (Alarm 1, Alarm 2)
- Alarme werden über LEDs (AL1, AL2), ein Display und Alarmrelais (K1, K2) ausgegeben
- Ruhe- oder Arbeitsstromverhalten der Relais wählbar
- Messwertanzeige über multifunktionales LC-Display
- Fehlerspeicherung aktivierbar
- RS-485 (galvanisch getrennt) mit folgenden Protokollen:
  - BMS-Schnittstelle (Bender-Messgeräte-Schnittstelle) zum Datenaustausch mit anderen Bender-Komponenten
  - Modbus RTU
  - IsoData (für kontinuierliche Datenausgabe)
- Passwortschutz gegen unbefugtes Ändern von Parametern

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 50155

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		Nominal voltage U_n	System leakage capacitance	Type	Art. No.
AC	DC	DC			push-wire terminal
100…240 V, 47…63 Hz	24…240 V	12…120 V	≤ 50 µF	isoUG425-D4-4	B71036320

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2/-
Supply circuit (IC2)	A1, A2
Output circuit(IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A, B
Rated voltage	400 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-4)	6 kV
IC2/(IC3-4)	4 kV
IC 3/IC4	4 kV
Rated insulated voltage:	
IC1/(IC2-4)	400 V
IC2/(IC3-4)	250 V
IC 3/IC4	250 V
Pollution	3
Protective separation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/IC4	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/IC4	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n	DC 12…120 V
Tolerance of U_n	+20 %

Measuring circuit

Internal resistance R_i	≥ 115 kΩ
Permissible system leakage capacitance C_e	≤ 50 µF

Response values

Response value R_{an1}	2…100 kΩ (50 kΩ)*
Response value R_{an2}	1…95 kΩ (25 kΩ)*
Relative uncertainty R_{an}	±15 %, at least ±2 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection U_{DC}	8…143 V (off)*
Overvoltage detection U_{DC}	8.1…144 V (off)*
Relative uncertainty U_{DC}	±5 %, at least ±0.5 V
Hysteresis U_{DC}	5 %, at least 1 V

Time response

Response time t_{an} at R_F = 0.5 x R_{an} and C_e=1 µF acc. to IEC 61557-8	≤ 1 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…1 MΩ
Operating uncertainty	±15 %, at least ±2 kΩ
Display range measured value nominal system voltage (U_n)	0…150 V (R_F =∞ : 300 VP; R_F = 0 kΩ : 150 VP)
Operating uncertainty U_{DC}	±5 %, at least ±0.5 V
Operating uncertainty U_{RMS}	±5 %, at least ±1.5 V
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbits/s)
Cable length (9.6 kbits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0.25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 N/O contacts, common terminal 11
Operating principle	N/C operation/N/O operation (N/O operation)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operation	-40…+70 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K7 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K4 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

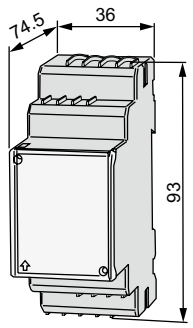
Connection type	push-wire terminal
Nominal current	≤ 10 A
Conductor sizes	AWG 24 -14
Stripping length	10 mm
Rigid	0.2…2.5 mm²
Flexible without ferrules	0.75…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm

Other

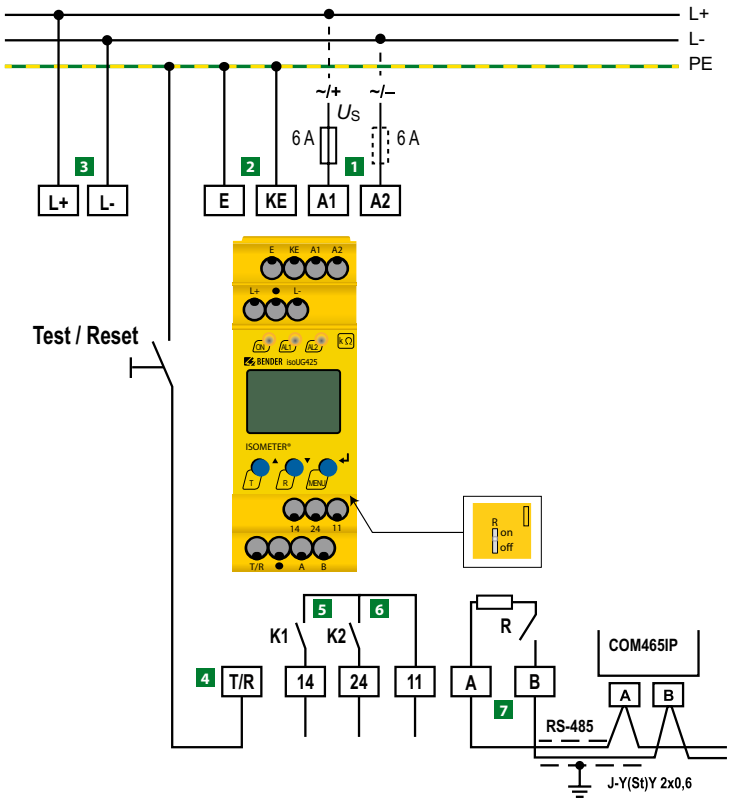
Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Documentation number	D00220
Weight	≤ 150 g

( )* = Factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	A1, A2	Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.*
2	E, KE	Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used
3	L1/+, L2/–	Connection to the DC system to be monitored
4	T/R	Connection for the external combined test and reset button
5	11, 14	Connection to alarm relay K1
6	11, 24	Connection to alarm relay K2
7	A, B	RS-485 communication interface with connectable terminating resistor Example: Connection of a BMS Ethernet gateway COM465IP

* **For UL applications:**
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

ISOMETER® isoES425

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) for energy storage devices up to AC/DC 400 V

AC/DC



Typical applications

- Monitoring the earth connection during network operation and monitoring the electrical installation during isolated operation.

Approvals

Device features

- Insulation monitoring for unearthed systems AC/DC
- Measurement of the mains voltage (r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC voltages system to earth (L1+/PE und L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 100 µF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 1…990 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- N/C operation or N/O operation of the relays selectable
- Measured value indication via multifunctional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage U_n	Supply voltage U_S		System leakage capacitance C_e	Type	Art. No.
AC/DC	AC	DC			Push-wire terminal
0…400 V, 15…460 Hz	100…240 V, 47…63 Hz	24…240 V	< 100 µF	isoES425-D4-4	B71037020

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2/-
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A, B
Rated voltage	400 V
Overvoltage category	III
Rated impulse withstand voltage:	
IC1/(IC2-4)	6 kV
IC2/(IC3-4)	4 kV
IC 3/(IC4)	4 kV
Rated insulation voltage:	
IC1/(IC2-4)	400 V
IC2/(IC3-4)	250 V
IC 3/IC4	250 V
Pollution degree	3
Protective separation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/(IC4)	Overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1:	
IC2/(IC3-4)	DC 2.2 kV
IC 3/(IC4)	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n	3(N)AC, AC 0…400 V/DC 0…400 V
Tolerance of U_n	25%
Frequency range of U_n	DC, 15…460 Hz

Measuring circuit

Measuring voltage U_m	± 12 V
Measuring current I_m at R_F	≤ 110 µA
Internal resistance R_i	≥ 115 kΩ
Permissible leakage capacitance C_e	≤ 100 µF
Permissible external DC voltage U_{fg}	≤ 700 V

Response values

Response value R_{an1}	2…990 kΩ (69 kΩ)*
Response value R_{an2}	1…980 kΩ (23 kΩ)*
Operating uncertainty R_{an}	± 15 %, at least ±1 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection U	10…499 V (off)*
Overvoltage detection U	11…500 V (off)*
Operating uncertainty U	± 5 %, at least ± 5 V
Frequency dependent operating uncertainty ≥ 400 Hz	-0.015 %/Hz
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} at R_F= 0.5 x R_{an} and C_e=1 µF acc. to IEC 61557-8	≤ 10 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…4 MΩ
Operating uncertainty	± 15 %, at least ±1 kΩ
Display range measured nominal system voltage value (U_n)	0…500 V r.m.s
Operating uncertainty U	± 5 %, at least ± 5 V
Display range measured leakage capacitance value for R_F > 10 kΩ	0…105 µF
Operating uncertainty	± 15 %, mindestens ± 2 µF
Password	off/0…999 (0, off)*
Fault memory alarm message	on/(off)*

Interface

Interface/protocol	RS-485/BMS, isoData
Baud rate	BMS (9.6 kBit/s), isoData (115.2 kBits/s)
Cable length (9.6 kBits/s	≤ 1200 m
Cable: twisted pair, shield connected to PE	min. J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0.25 W), internal, can be connected
Device address, BMS bus	3…90 (3)*

Switching elements

Switching elements	2 x 1 NO contacts, common terminal 11
Operating principle	N/C operation/N/O operation (N/C operation)*
Electrical endurance, number of cycles	10000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4,

Ambient temperatures:

Operation	-25…+70 °C
Transport	-40…+85 °C
Storage	-25…+70 °C

Climatic class acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (without condensation and icing)
Transport (IEC 60721-3-2)	2K3 (without condensation and icing)
Long-time storage (IEC 60721-3-1)	1K4 (without condensation and icing)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

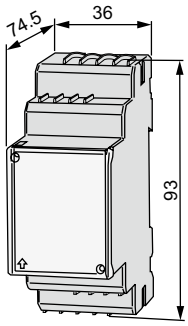
Connection type	Push-wire terminal
Nominal current	≤ 10 A
Conductor sizes	AWG 24-14
Stripping length	10 mm
rigid	0.2…2.5 mm²
flexible without ferrules	0.75…2.5 mm²
flexible with ferrules, with/without plastic collar	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm

Other

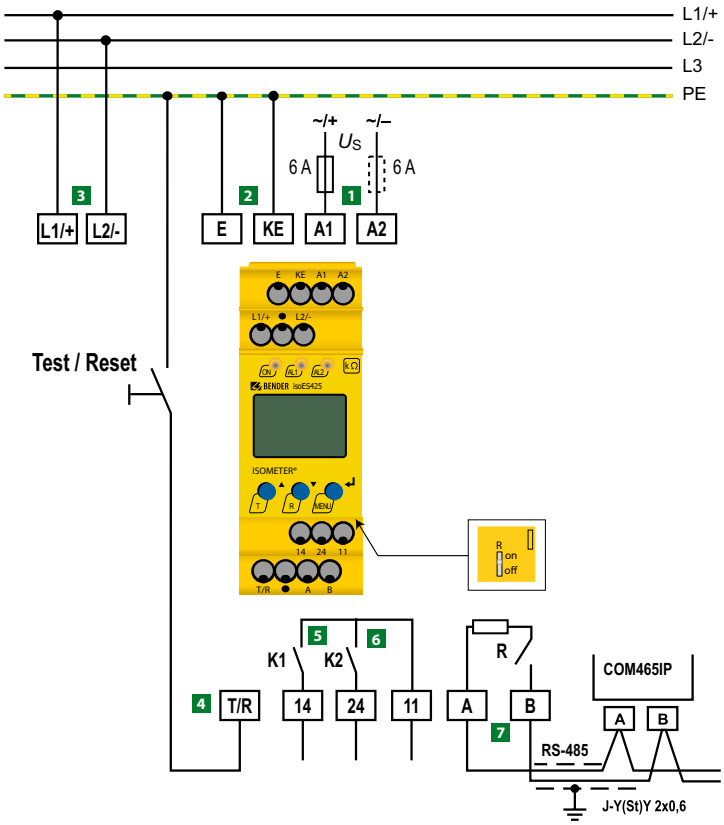
Operating mode	Continuous operation
Mounting	Cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	Polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Weight	≤ 150 g

( )* = Factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	A1, A2	Connection to the supply voltage via a fuse. If supplied from an IT system, both lines have to be protected by a fuse.*
2	E, KE	Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.
3	L1/+, L2/–	Connection to the AC or DC system to be monitored.
4	T/R	Connection for external combined test and reset button.
5	11, 14	Connection to alarm relay K1
6	11, 24	Connection to alarm relay K2
7	A, B	RS-485 communication interface with selectable terminating resistance.

* **For UL applications:**
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

ISOMETER® isoGEN423

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to 3(N)AC, AC 400 V, DC 400 V, suitable for the application of generators acc. to standard DIN VDE 0100-551

AC/DC



Typical applications

- AC main circuits up to 400 V
- DC main circuits up to 400 V
- Generators according to DIN VDE 0100-551

Approvals

Device features

- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the system voltage (true r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Two operating modes: GEn and DC
- Automatic adaptation to the system leakage capacitance up to 5 µF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 5…200 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via multifunctional LCD
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:
- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Version	Type	Art. No.
Push-wire terminal	isoGEN423-D4-4	B71036325

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2/-
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A, B
Rated voltage	400 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-4)	6 kV
IC2/(IC3-4)	4 kV
IC3/IC4	4 kV
Rated insulation voltage:	
IC1/(IC2-4)	400 V
IC2/(IC3-4)	250 V
IC3/IC4	250 V
Polution degree	3
Protective separation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/IC4	Overvoltage category III, 300 V
Voltage test (routine test) according to IEC 61010-1:	
IC2/(IC3-4)	AC 2,2 kV
IC 3/IC4	AC 2,2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n	3(N)AC, AC 0…400 V/DC 0…400 V
Tolerance of U_n	+25 %
Frequency range of U_n	DC, 35…460 Hz

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m at R_F, $Z_F = 0$	≤ 110 µA
Internal resistance R_i, Z_i	≥ 115 kΩ
Permissible system leakage capacitance C_e	≤ 5 µF
Permissible extraneous DC voltage U_{fg}	≤ 700 V

Response values

Response value R_{an1}	R_{an2}…200 kΩ (46 kΩ)*
Response value R_{an2}	5 kΩ…R_{an1} (23 kΩ)*
Relative uncertainty R_{an}	±15 %, at least ±2 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection $U<$	10 V…$U>$ (off/10 V)*
Overvoltage detection $U>$	$U<$…500 V (off/500 V)*
Relative uncertainty U	±5 %, at least ±5 V
Relative uncertainty depending on the frequency ≥ 400 Hz	-0,015 %/Hz
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} of $R_F = 0,5$ x R_{an} and C_e=1 µF according to IEC 61557-8	≤ 1 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…2 MΩ
Operating uncertainty	±15 %, at least ±2 kΩ
Display range measured value nominal system voltage (U_n)	0…500 VRMS
Operating uncertainty	±5 %, at least ±5 V
Display range measured value system leakage capacitance of R_F > 10 kΩ (only "dc" mode)	0…17 µF
Operating uncertainty of RF ≥ 20 kΩ and C_e ≤ 5 µF	±15 %, at least ± 0,1 µF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kBit/s), Modbus RTU (selectable), isoData (115.2 kBits/s)
Cable length (9.6 kBits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2 x 0,6
Terminating resistor	120 Ω (0.25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 contacts, common terminal 11				
Operating principle	N/C operation/N/O operation (N/O operation)*				
Electrical endurance, number of cycles	10 000				
Contact data acc. to IEC 60947-5-1:					
Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0,1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operation	-40…+70 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Climatic class acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K7 (without condensation and formation of ice)
Transport (IEC 60721-3-2)	2K4 (without condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K5 (without condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

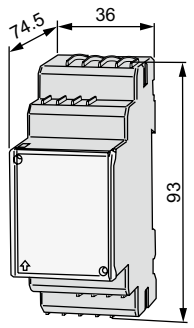
Connection type	**push-wire terminal**
Nominal current	≤ 10 A
Conductor sizes	AWG 24 -14
Stripping length	10 mm
rigid	0.2…2.5 mm²
flexible without ferrules	0.75…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm

Other

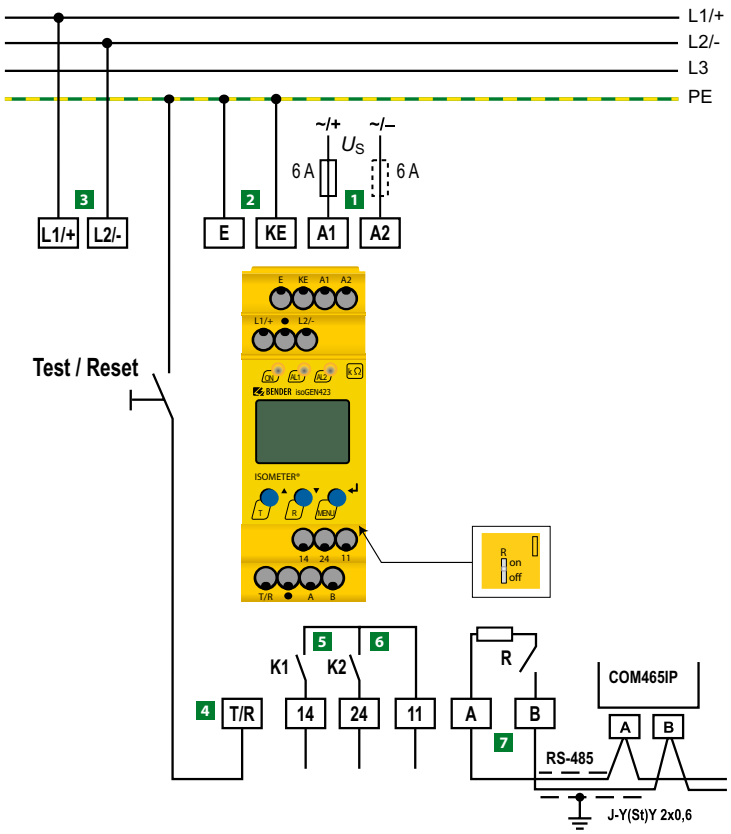
Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Documentation number	D00221
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	A1, A2	Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse.*
2	E, KE	Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used.
3	L1/+, L2/-	Connection to the IT system to be monitored
4	T/R	Connection for the external combined test and reset button.
5	11, 14	Connection to alarm relay K1
6	11, 24	Connection to alarm relay K2
7	A, B	RS-485 communication interface with connectable terminating resistance.

* **For UL applications:**
Only use 60/75°C copper lines!
For UL and CSA applications, it is mandatory to use 5 A fuses for the protection of the supply voltage.

ISOMETER® isoGEN523

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to 3(N)AC, AC 400 V, DC 400 V, suitable for use in applications using generators according to DIN VDE 0100-551

AC/DC



Typical applications

- AC main circuits up to 400 V
- DC main circuits up to 400 V
- Generators according to DIN VDE 0100-551

Approvals

CE

Device features

- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the system voltage (true r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Two operating modes: GEn and DC
- Automatic adaptation to the system leakage capacitance up to 5 µF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 5…200 kΩ (Alarm 1, Alarm 2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Fault memory can be activated
- RS-485 (galvanically isolated) including the following protocols:
  – BMS interface (Bender measuring device interface) for data exchange with other Bender components
  – Modbus RTU
  – IsoData (for continuous data output)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- IEC 61557-8
- DIN VDE 0100-551

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Version	Supply voltage U_s		Type	Art. No.
	AC	DC		
Digital interface	100…240 V	24…240 V	isoGEN523-S4-4	B91016330

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	3 (L1/+), 4 (L2/-)
Supply circuit (IC2)	1(A1), 2 (A2)
Output circuit (IC3)	9 (11), 10 (14), 11 (24)
Control circuit (IC4)	12 (E), 5 (KE), 6 (T/R), 7 (A), 8 (B)
Rated voltage	400 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-4)	6 kV
IC2/(IC3-4)	4 kV
IC3/IC4	4 kV
Rated insulation voltage:	
IC1/(IC2-4)	400 V
IC2/(IC3-4)	250 V
IC3/IC4	250 V
Pollution degree	3
Safe isolation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/IC4	Overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/IC4	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

Monitored IT system

Nominal system voltage U_n	3(N)AC, AC 0…400 V/DC 0…400 V
Tolerance of U_n	+25 %
Frequency range of U_n	DC, 35…460 Hz

Measuring circuit

Measuring voltage U_m	±12 V
Measuring current I_m at R_F, $Z_F = 0$	≤ 110 µA
Internal resistance R_i, Z_i	≥ 115 kΩ
Permissible system leakage capacitance C_e	≤ 5 µF
Permissible extraneous DC voltage U_{fg}	≤ 700 V

Response values

Response value R_{an1}	R_{an2}…200 kΩ (46 kΩ)*
Response value R_{an2}	5 kΩ…R_{an1} (23 kΩ)*
Relative uncertainty R_{an}	±15 %, at least ±2 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection $U<$	10 V…$U >$ (off/10 V)*
Overvoltage detection $U>$	$U<$…500 V (off/500 V)*
Relative uncertainty U	± 5 %, at least ± 5 V
Relative uncertainty depending on the frequency ≥400 Hz	-0.015 %/Hz
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} at R_F = 0.5 x R_{an} and C_e=1 µF acc. to IEC 61557-8	≤ 1 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Measured values, storage

Measured value insulation resistance (R_F)	1 kΩ…2 MΩ
Operating uncertainty	±15 %, at least ±2 kΩ
Measured value nominal system voltage (U_n)	0…500 Vr.m.s
Operating uncertainty	±5 %, at least ±5 V
Measured value system leakage capacitance at R_F > 10 kΩ (“dc” mode only)	0…17 µF
Operating uncertainty at R_F ≥ 20 kΩ and C_e ≤ 5 µF	±5 %, at least ±0.1 µF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbits/s)
Cable length (9.6 kbits/s)	≤ 1200 m
Cable: twisted pair, shield connected to PE on one side	min. J-Y(St)Y 2 x 0.6
Terminating resistor	120 Ω (0.25 W), external
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 N/O contacts, common terminal 11
Operating principle	N/C operation/N/O operation (N/O operation)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥10 V				

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operation	-40…+70 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K8
Transport (IEC 60721-3-2)	2K4
Long-term storage (IEC 60721-3-1)	1K6

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection type

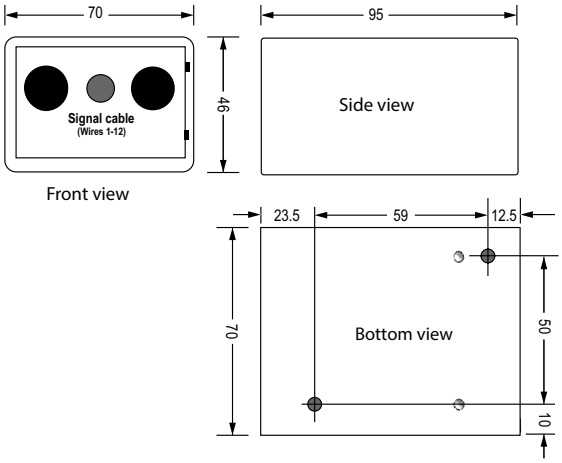
Connection type	0.8 m connecting wire
Minimum bending radius of the connecting cable	> 40 mm

Other

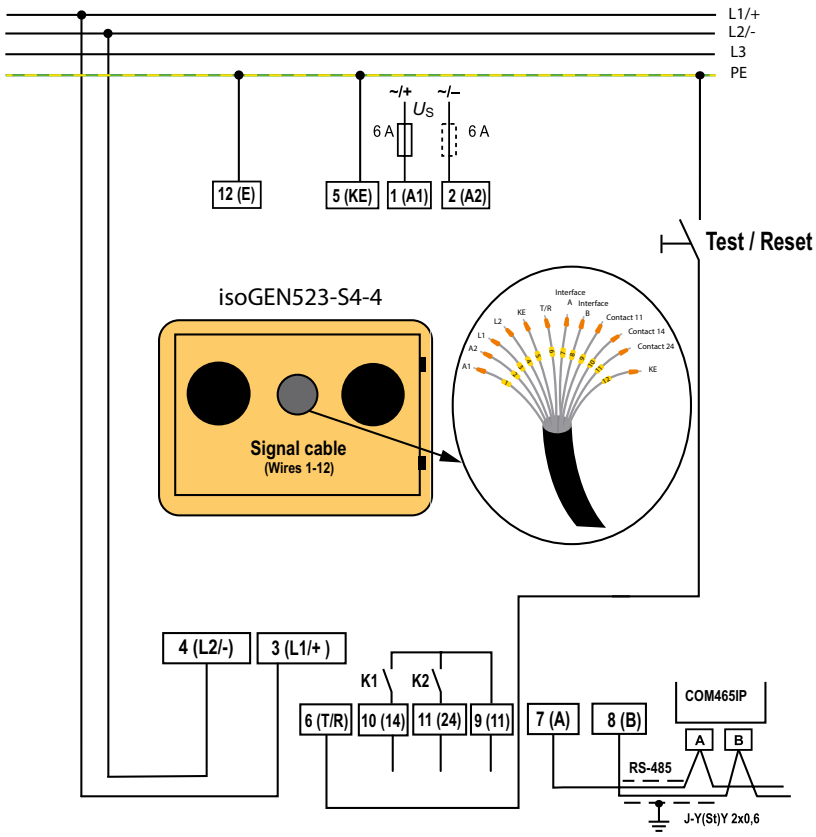
Operating mode	continuous operation
Degree of protection, built-in components (DIN EN 60529)	IP65
Enclosure material	polycarbonate (filled with Wevo PUR403FL)
Screw mounting	2 x M4
Tightening torque	max. 3 Nm (26 lb-in)
Documentation number	D00320
Weight	≤ 600 g

( )* = Factory settings

Dimension diagram (dimensions in mm)



Wiring diagram



Wire number	Terminal	Connections
1 2	A1 A2	Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.
3	L1	Connection to the system to be monitored
4	L2	Connection to the system to be monitored
5	KE	Connect to PE
6	T/R	Connection for the external combined test and reset button

Wire number	Terminal	Connections
7 8	A B	Serial communication interface Example: Connection of a BMS Ethernet gateway COM465IP
9 10 11	11 14 24	Common connection for K1 and K2 Connection to alarm relay K1 Connection to alarm relay K2
12	E	Connect to PE

ISOMETER® isoHV425 with coupling device AGH422

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT system) up to 3(N)AC, AC 1000 V, DC 1000 V

AC/DC



Typical applications

- AC main circuits up to 1000 V
- DC main circuits up to 1000 V
- Systems including switched-mode power supplies

Zulassungen

CE

Device features

- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the mains voltage (true r.m.s.) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 150 µF
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 10…500 kΩ (Alarm 1, Alarm 2)
- Alarm signalling via LEDs (AL1, AL2), a display and alarm relays (K1, K2)
- Automatic device self test with connection monitoring
- Selectable N/C or N/O relay operation
- Measured value indication via a multifunctional LC display
- Fault memory can be activated
- RS-485 (galvanically separated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)
- Password protection to prevent unauthorised parameter changes

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- DIN EN 45545-2

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		Nominal voltage U_n	Version	Type	Art. No.
AC	DC	AC-, 3(N)AC			
100…240 V, 47…63 Hz	24…240 V	0…1000 V	Push-wire terminal	isoHV425-D4-4 with AGH422	B71036501
				isoHV425W-D4-4 with AGH422W	B71036501W

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	Up, KE, T/R, A, B, AK1, GND, AK2
Rated voltage	240 V
Overvoltage category	III
Rated impulse voltage:	
IC2/(IC3-4)	4 kV
IC 3/IC4	4 kV
Rated insulation voltage:	
IC2/(IC3-4)	250 V
IC 3/IC4	250 V
Pollution degree	3
Safe isolation (reinforced insulation) between:	
IC2/(IC3-4)	overvoltage category III, 300 V
IC 3/IC4	overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/IC4	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n with AGH422	AC 0…1000 V/DC 0…1000 V
Tolerance of U_n	AC +10 %, DC +10 %
Frequency range of U_n	DC, 15…460 Hz

Measuring circuit

Permissible system leakage capacitance C_e	≤ 150 µF
Permissible extraneous DC voltage U_{fg}	≤ 1600 V

Response values

Response value R_{an1}	11…500 kΩ (50 kΩ)*
Response value R_{an2}	10…490 kΩ (25 kΩ)*
Relative uncertainty R_{an}	±15 %, at least ±3 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection	30…1.09 kV (off)*
Overvoltage detection	31…1.10 kV (off)*
Relative uncertainty U	±5 %, at least ±5 V
Relative uncertainty depending on the frequency ≥ 200 Hz	-0.075 %/Hz
Hysteresis U	5 %, at least 5 V

Time response

Response time t_{an} for R_F = 0.5 x R_{an} and C_e=1 µF acc. to IEC 61557-8	≤ 20 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Displays, memory

Display	LC display, multi-functional, not illuminated
Display range measured value insulation resistance (R_F)	1 kΩ…4 MΩ
Operating uncertainty	±15 %, at least ±3 kΩ
Display range measured value nominal system voltage (U_n)	30…1.15 kV r.m.s
Operating uncertainty	±5 %, at least ±5 V
Display range measured value system leakage capacitance for R_F > 20 kΩ	0…200 µF
Operating uncertainty	±15 %, at least ±2 µF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

Interface

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbits/s)
Cable length (9.6 kbits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0.25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Switching elements

Switching elements	2 x 1 N/O contact, common terminal 11
Operating principle	N/C operation/N/O operation (N/C operation)*
Electrical endurance under rated operating conditions, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4, EN 50121-3-2

Ambient temperatures:

Operation	-40…+55 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
for W variant	3K7
Transport (IEC 60721-3-2)	2K4 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
for W variant	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	push-wire terminal

Push-wire terminals:

Nominal current	≤ 10 A
Conductor sizes	AWG 24 -14
Stripping length	10 mm
Rigid	0.2…2.5 mm²
Flexible without ferrules	0.75…2.5 mm²
Flexible with ferrule with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm

Other

Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Minimum horizontal distance between the devices (DIN EN 45545)	see note * on page 6
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00082
Weight	≤ 150 g

( )* = Factory setting

Insulation coordination acc. to IEC 60664-1/IEC 60664-3	
Definitions:	
Measuring circuit (IC1)	L1/+, L2/-
Control circuit (IC2)	AK1, GND, AK2, Up, E
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/IC2	8 kV
Rated insulation voltage:	
IC1/IC2	1000 V
Pollution degree	3
Safe isolation (reinforced insulation) between:	
IC1/IC2	Overvoltage category III, 1000 V

IT system being monitored	
Nominal system voltage range U_n	AC 0…1000 V/DC 0…1000 V
Tolerance of U_n	AC +10 %/DC +10 %

Measuring circuit	
Measuring voltage U_m	±45 V
Measuring current I_m for R_F	≤ 120 µA
Internal resistance R_i	≥ 390 kΩ

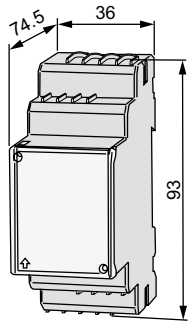
Environment/EMC	
EMC	IEC 61326-2-4, EN 50121-3-2

Ambient temperatures:	
Operation	-40…+55 °C
Transport	-40…+85 °C
Storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
for W variant	3K7
Transport (IEC 60721-3-2)	2K4 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
for W variant	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Dimension diagram (dimensions in mm)



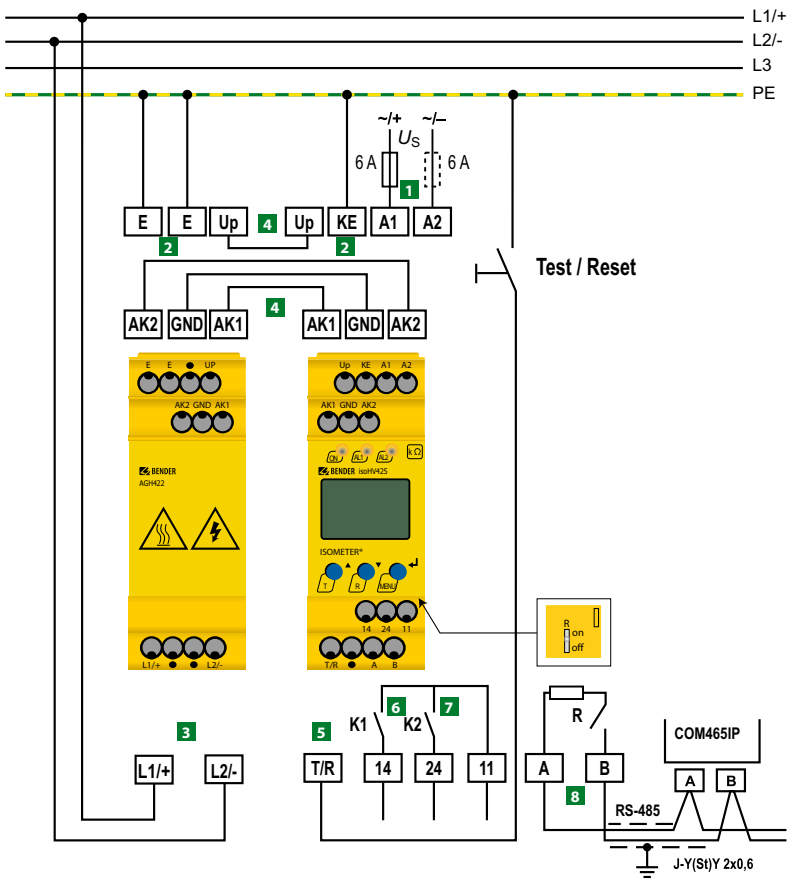
Connection	
Connection type	push-wire terminal

Push-wire terminals:	
Nominal current	10 A
Conductor sizes	AWG 24 -14
Stripping length	10 mm
Rigid	0.2…2.5 mm²
Flexible without ferrules	0.75…2.5 mm²
Flexible with ferrule with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Opening force	50 N
Test opening, diameter	2.1 mm
Connection type	terminals Up, AK1, GND, AK2
Single cables for terminals Up, AK1, GND, AK2:	
Cable length	0.5 m
Connection properties	≥ 0.75 mm²

Other	
Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Distance to adjacent devices from U_n > 800 V	≥ 30 mm
Minimum horizontal distance between the devices (DIN EN 45545)	see note *
Degree of protection, built-in components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Weight	150 g

* *If the devices are used in railway vehicles according to the requirements of DIN EN 45545-2 observe that:*

- *A horizontal mounting distance of ≥ 20 mm must be ensured, or*
- *Sufficiently dimensioned separating material according to DIN EN 45545-2 chapter 5.3.6 must be installed, or*
- *The device combination is installed in a control cabinet that complies with the fire safety requirements of DIN EN 45545-2 chapter 4.2 h.*



1	A1, A2	Connection to the supply voltage via fuse (line protection). If being supplied from an IT system, both lines have to be protected by a fuse.
2	E, KE	Connect each terminal separately to PE: The same wire cross section as for A1, A2 is to be used
3	L1/+, L2/–	Connection to the IT system to be monitored
4	Up, AK1, GND, AK2	Connect the terminals of the AGH422 to the corresponding terminals of the ISOMETER®.
5	T/R	Connection for the external combined test/reset button
6	11, 14	Connection to alarm relay K1
7	11, 24	Connection to alarm relay K2
8	A, B	RS-485 communication interface with connectable terminating resistor.

ISOMETER® isoHV525

Insulation monitoring device for unearthed AC, AC/DC and DC systems (IT systems) up to 3(N)AC, AC/DC 0…1000V or DC 0…1000 V

AC/DC



Typical applications

- AC main circuits up to 1000 V
- DC main circuits up to 1000 V
- Systems including switched-mode power supplies
- High shock and vibration requirements
- High temperature requirements

Approvals

CE

Device features

isoHV525-M4-4

- Monitoring the insulation resistance for unearthed AC/DC systems
- Automatic adaptation to the system leakage capacitance up to 150 µF
- Two separate response values for Alarm 1 and Alarm 2
- Alarms are signalled via alarm relays (K1, K2)
- 0…10 V analogue output (galvanically separated)

isoHV525-S4-4

- Monitoring the insulation resistance for unearthed AC/DC systems
- Measurement of the mains voltage (true rms) with undervoltage and overvoltage detection
- Measurement of DC system voltages to earth (L1+/PE and L2-/PE)
- Automatic adaptation to the system leakage capacitance up to 150 µF
- Two separate response values for Alarm 1 and Alarm 2
- Alarms are signalled via alarm relays (K1, K2)
- Selectable N/C or N/O relay operation
- Selectable start-up delay, response delay and delay on release
- Fault memory can be activated
- RS-485 (galvanically separated) including the following protocols:
  - BMS interface (Bender measuring device interface) for data exchange with other Bender components
  - Modbus RTU
  - IsoData (for continuous data output)

Standards

The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8)
- DIN EN 50155
- IEC 61557-8
- EN 45545-2 + A1 (for cable only
- UL94 V0

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		Nominal voltage U_n	Version	Type	Art. No.
AC	DC	AC-, 3(N)AC			
100…240 V, 47…63 Hz	24…240 V	0…1000 V	Analogue output	isoHV525-M4-4	B91036530
			Serial interface	isoHV525-S4-4	B91036531

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	L1/+, L2/-
Supply circuit (IC2)	A1, A2
Output circuit (IC3)	11, 14, 24
Control circuit (IC4)	E, KE, T/R, A/M-, B/M+
Rated voltage	1000 V
Overvoltage category	III
Rated impulse voltage:	
IC1/(IC2-4)	8 kV
IC2/(IC3-4)	4 kV
IC 3/(IC4)	4 kV
Rated insulation voltage:	
IC1/(IC2-4)	1000 V
IC2/(IC3-4)	250 V
IC 3/(IC4)	250 V
Pollution degree	3
Safe isolation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 1000 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC 3/(IC4)	Overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC 3/(IC4)	AC 2.2 kV

Supply voltage

Supply voltage U_s	AC 100…240 V/DC 24…240 V
Tolerance of U_s	-30…+15 %
Frequency range U_s	47…63 Hz
Power consumption	≤ 3 W, ≤ 9 VA

IT system being monitored

Nominal system voltage U_n	AC 0…1000 V/DC 0…1000 V
Tolerance of U_n	AC +10 %, DC +10 %
Frequency range of U_n	DC, 15…460 Hz

Measuring circuit

Permissible system leakage capacitance C_e	≤ 150 µF
Permissible extraneous DC voltage U_{fg}	≤ 1600 V
Measuring voltage U_m	±45 V
Measuring current I_m bei R_F	120 µA
Internal resistance R_i	390 kΩ

Response values

isoHV525-S4-4:

Response value R_{an1}	11…500 kΩ (50 kΩ)*
Response value R_{an2}	10…490 kΩ (25 kΩ)*
Relative uncertainty R_{an}	±15 %, at least ±3 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ
Undervoltage detection	30…1.09 kV (off)*
Overvoltage detection	30…1.10 kV (off)*
Relative uncertainty U	±5 %, at least ±5 V
Relative uncertainty depending on the frequency ≥ 200 Hz	-0.075 % / Hz
Hysteresis U	5 %, at least 5 V

isoHV525-M4-4:

Response value R_{an1}	(for customized variant refer to the name plate) 50 kΩ*
Response value R_{an2}	(for customized variant refer to the name plate) 25 kΩ*
Relative uncertainty R_{an}	±15 %, at least ±3 kΩ
Hysteresis R_{an}	25 %, at least 1 kΩ

Time response (valid for isoHV525-S4-4 only)

Response time t_{an} for R_F = 0.5 x R_{an} and C_e=1 µF acc. to IEC 61557-8	≤ 20 s
Start-up delay t	0…10 s (0 s)*
Response delay t_{on}	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0 s)*

Measured values, storage

isoHV525-S4-4:

Insulation resistance measured value range (R_F)	1 kΩ…4 MΩ
Operating uncertainty	±15 %, at least ±3 kΩ
Nominal system voltage measured value range (U_n)	30…1.15 kV r.m.s
Operating uncertainty	±5 %, at least ±5 V
System leakage capacitance measured value range for R_F > 20 kΩ	0…200 µF
Operating uncertainty	±15 %, at least ±2 µF
Password	off/0…999 (0, off)*
Fault memory alarm messages	on/(off)*

isoHV525-M4-4:

Insulation resistance measured value range (R_F)	1 kΩ…4 MΩ
Operating uncertainty	±15 %, at least ±3 kΩ

Serial interface (valid for isoHV525-S4-4 devices only)

Interface/protocol	RS-485/BMS, Modbus RTU, isoData
Baud rate	BMS (9.6 kbit/s), Modbus RTU (selectable), isoData (115.2 kbits/s)
Cable length (9.6 kbits/s)	≤ 1200 m
Cable: twisted pairs, shield connected to PE on one side	min. J-Y(St)Y 2x0.6
Terminating resistor	120 Ω (0.25 W), internal, can be connected
Device address, BMS bus, Modbus RTU	3…90 (3)*

Analogue output (valid for isoHV525-M4-4 only)

Operating mode	mid-scale 120 kΩ
Functions	Insulation value
Voltage	0…10 V (≥ 20 kΩ)
Tolerance	±10 %, +2 % of the full scale value

Switching elements

Switching elements	2 x 1 N/O contact, common terminal 11
Operating principle	N/C operation/N/O operation (N/O operation)*
Electrical endurance under rated operating conditions, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-12	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	2 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4, EN 50121-3-2

Ambient temperatures:

Operation:	
(U_n < 700)	-55…+70 °C
(U_n > 700)	-55…+55 °C
Transport	-55…+85 °C
Storage	-55…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K8
Transport (IEC 60721-3-2)	2K4
Long-term storage (IEC 60721-3-1)	1K6

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M7
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection type

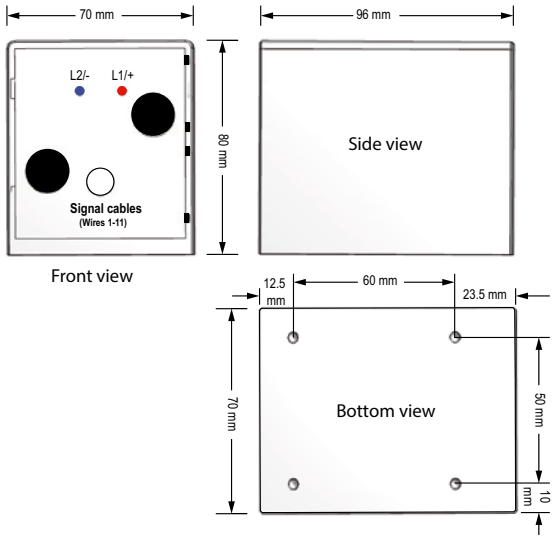
isoHV525-M4-4	0.5 m cable
isoHV525-S4-4	3 m cable
Minimum bending radius of the connection cable	> 40 mm

Other

Operating mode	continuous operation
Degree of protection, built-in components (DIN EN 60529)	IP65
Enclosure material	polycarbonate (filled with Wevo PUR403FL)
Screw mounting	4 x M4 (screw depth max. 7 mm)
Tightening torque	max. 3 Nm (26 lb-in)
Documentation number	D00297
Weight	≤ 1100 g

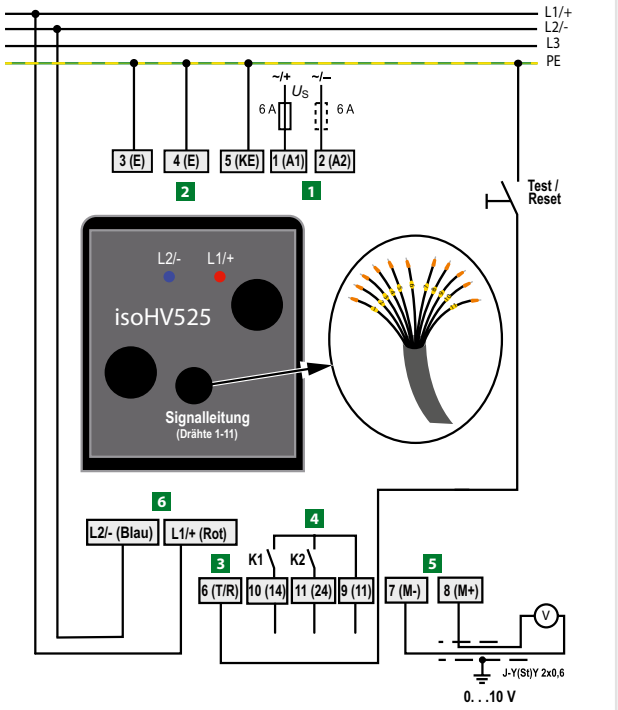
( )* = Factory setting

Dimension diagram (dimensions in mm)



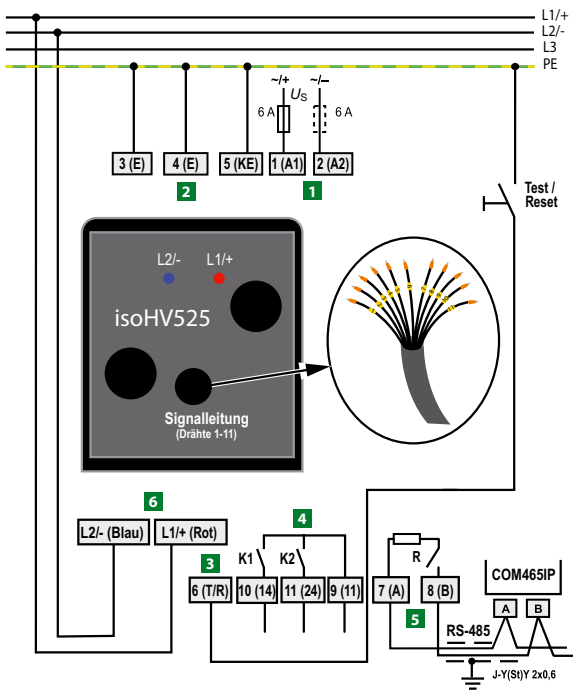
Wiring diagram

isoHV525-M4-4



	Wire number	Terminal	Connections
1	1 2	A1 A2	Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse.
2	3 and 4 5	E KE	Connect each terminal separately to PE
3	6	T/R	Connection for the external combined Test/Reset button
4	9 10 11	11 14 24	Common connection for K1 and K2 Connection to alarm relay K1 Connection to alarm relay K2
5	7 8	M- M+	Analogue communication interface
6	Red Blue	L1/+ L2/–	Connection to the system to be monitored

isoHV525-S4-4



	Wire number	Terminal	Connections
1	1 2	A1 A2	Connection to the supply voltage via fuse (line protection). If supplied from an IT system, both lines have to be protected by a fuse.
2	3 and 4 5	E KE	Connect each terminal separately to PE
3	6	T/R	Connection for the external combined Test/Reset button
4	9 10 11	11 14 24	Common connection for K1 and K2 Connection to alarm relay K1 Connection to alarm relay K2
5	7 8	A B	Serial communication interface (external terminating resistor include) Example: Connection of a BMS Ethernet gateway COM465IP
6	Red Blue	L1/+ L2/–	Connection to the system to be monitored

Insulation monitoring devices
ISOMETER®

7

Equipment for insulation fault location
ISOSCAN®



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Residual current monitoring systems
LINETRAXX®

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Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

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Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

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System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation

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Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

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Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service

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Device overview Equipment for insulation fault location ISOSCAN®

	ISOSCAN® EDS440	ISOSCAN® EDS441	ISOSCAN® EDS441-LAB	ISOSCAN® EDS460/490	ISOSCAN® EDS461/491
					
Page	154	154	154	161	161
Special applications			High-resistance insulation faults in case of high system leakage capacitances and low test current value		
Application	stationary	stationary	stationary	stationary	stationary
Circuits – Control circuits		■	■		■
Circuits – Main circuits	■			■	
Voltage system – 3(N)AC	■			■	
Voltage system – AC	■	■	■	■	■
Voltage system – AC/DC	■	■	■	■	■
Voltage system – DC	■	■	■	■	■
Nominal voltage U_n max	see Locating current injector (e. g. ISOMETER® iso685-D-P)	AC 230 V, DC 220 V	AC 230 V, DC 220 V	see Locating current injector (e. g. ISOMETER® iso685-D-P)	AC 230 V, DC 220 V
System leakage capacitance C_e µF	acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve
Response value R_{an} kΩ	acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve
Installation – DIN rail	■	■	■	■	■
Installation – Screw mounting	■	■	■	■	■
Interfaces – BB	EDS440-S	EDS441-S			
Interfaces – BS	EDS440-L	EDS441-L	■		
Interfaces – BMS				■	■

	Type	P.	Suitable system components				
Suitable ISOMETER®s with integrated PGH	iso685-D-P	40	■	■	■	■	■
	IRDH575	77	■	■		■	■
	isoMED427P	88		■		■	
	isoPV1685P	99				■	
	iso1685DP	25				■	
Measuring current transformers	CTAC…	336	■	■		■	■
	W…	–	■			■	
	W…-8000	–		■	■		■
	WR…S(P)	343	■			■	
	WS…	345	■			■	
	WS…-8000	345		■	■		■
	W…AB	–			■		
Power supply unit	AN410	367			■		
	AN450	369			■		
	AN450-133	369			■		

		
ISOSCAN® EDS150	**ISOSCAN® EDS151**	**ISOSCAN® EDS30…**
165	165	168
	Medical locations	EDS3096PG for de-energised systems
stationary	stationary	portable
	■	■
■		■
■		■
■	■	■
■	■	■
■	■	■
see Locating current injector (e. g. ISOMETER® iso685-D-P)	AC 20…276 V, DC 20…308 V	dependent on type
acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve
acc. to characteristic curve	acc. to characteristic curve	acc. to characteristic curve
■	■	
■	■	

Suitable system components		
■	■	■
■	■	■
	■	■
■		■
■		■
■	■	
■	■	
■	■	

ISOSCAN® EDS440/441

Insulation fault locators for localisation of insulation faults in unearthed DC, AC and three-phase power supply systems (IT systems)



Typical applications

- Insulation fault location in AC, 3AC and DC IT systems
- Main circuits and control circuits in industrial plants and ships
- Diode-decoupled DC IT systems in power plants
- Systems for medical locations

Approvals

Device features

- Universal system concept
- Modular design, therefore easily adjustable to the given circumstances
- Measuring current transformers available in various sizes and versions
- CT connection monitoring
- 12 measuring channels for measuring current transformer series W…, WR…, WS…
- Optional extension by 12 relay channels
- Fault memory behaviour selectable
- Up to 50 EDS insulation fault locators in the system, 600 measuring channels
- Response sensitivity: EDS440 2…10 mA, EDS441 0.2…1 mA
- AC residual current measurement with configurable response value
- Two alarm relays with one N/O contact each
- N/O or N/C operation selectable
- External test/reset
- Central indication of faulty outgoing circuits
- Serial interface RS-485, BS bus address range 2…79
- Connection to higher-level control and visualisation systems possible

Standards

Observe the applicable national and international standards. The EDS44x series meets the device standards:

- DIN VDE 0100-410 (VDE 0100-410)
- DIN EN 61557-9 (VDE 0413-9)
- IEC 61557-9
- DIN EN 50155 (VDE 0115-200)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S [1]	Response value	LED display	Option "W"	Type	Art. No.
AC/DC			-40…+70 °C, 3K5, 3M7		
24…240 V	2…10 mA	–	–	EDS440-S-1	B91080201
			■	EDS440W-S-1	B91080201W
		■	–	EDS440-L-4	B91080202
			■	EDS440W-L-4	B91080202W
	0.2…1 mA	–	–	EDS441-S-1	B91080204
			■	EDS441W-S-1	B91080204W
		■	–	EDS441-L-4	B91080205
			■	EDS441W-L-4	B91080205W
			–	EDS441-LAB-4	B91080207
			■	EDS441W-LAB-4	B91080207W

[1] Absolute values

Accessories

Description	Art. No.
Plug kit, screw terminals[1]	B91080901
Plug kit, push-wire terminals	B91080902
Mechanical accessories (terminal cover, 2 mounting clips) [1]	B91080903
BB bus 4TE Connector [2]	B98110002

[1] included in the scope of delivery
[2] included in the scope of delivery of EDS44x-S-4

Suitable system components

Description	Design	Type of construction	Type	Art. No.	Page
RS-485 repeater	Bus repeater	–	DI-1DL	B95012047	372
	Supplied by the USB port	–	DI-2USB	B95012045	374
Relay module	12-fold relay module (input/output mudule)	–	IOM441	B95012057(W)	375
Power supply unit	for current transformers	–	STEP-PS	B940531…	364
	for DI-1 or DI-2	–	AN471	B924189	–
Measuring current transformers	pulsed DC sensitive	circular	CTAC…	B981100…	336
			W…AB	B980800…	–
		rectangular	WR…S(P)	B9117…	343
		split-core	WS…	B980806…	345

Technische Daten

Insulation coordination

Rated insulation voltage (IEC 60664-1)	AC 250 V
Rated impulse voltage (IEC 60664-1)	4 kV
Overvoltage category	III
Pollution degree	3
Protective separation (reinforced insulation) between	(A1,A2)-(13,14)-(23,24)-(X1,X2,X3)
Voltage test acc. to IEC 61010-1	2.2 kV

Supply voltage

Supply voltage range U_S	AC/DC 24…240 V
Tolerance of U_S	-20…+15%
Frequency range of U_S	DC, 50…400 Hz [1) 2)]
Tolerance of the frequency range of U_S	-5…+15 %
Power consumption, typically 50 Hz (400 Hz) EDS44…-L	≤4 W/7 VA (≤4 W, 28 VA)
Power consumption, typically (DC via BB-Bus) EDS44…-S	≤1 W

Response values

Response value insulation fault location ($I_{\Delta L}$) EDS440	2…10 mA
Response value insulation fault location ($I_{\Delta L}$) EDS441	0.2…1 mA
Relative uncertainty ($I_{\Delta L}$) EDS440	±30 %, ±2 mA [3)]
Relative uncertainty ($I_{\Delta L}$) EDS441	±30 %, ±0.2 mA [3)]
Response value residual current measurement ($I_{\Delta n}$) EDS440	100 mA…10 A
Response value residual current measurement ($I_{\Delta n}$) EDS441	100 mA…1 A
Relative uncertainty ($I_{\Delta n}$) EDS44x (42…60 Hz)	±5 %
Relative uncertainty ($I_{\Delta n}$) EDS44x (61…1000 Hz)	-20…0 %
Hysteresis	20 %

Time response

Scanning time for all channels insulation fault location ($I_{\Delta L}$)	profile-dependent, min. 6 s
Response time residual current measurement ($I_{\Delta n}$)	≤ 400 ms
Response time for measuring current transformer monitoring	max.18 min

Measuring circuit

Nominal system voltage U_n EDS440	refer to locating current injector (e.g. ISOMETER® iso685-D-P)
Nominal system voltage U_n EDS441	AC 230 V, DC 220 V
Tolerance of U_n EDS441	AC +15 %, DC +40 %
Measuring current transformer external for EDS440 type	W…, WR…, WS…
Measuring current transformer external for EDS441 type	W…/8000, WS…/8000
Measuring current transformer external for EDS44x-LAB type	W…AB
Load EDS440	47 Ω
Load EDS441	1.5 Ω
Rated insulation voltage (measuring current transformer)	800 V

Connection EDS measuring current transformer

Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	1…10 m
Shielded cable ≥ 0.5 mm²	10…40 m
Recommended cable (shielded, shield connected to PE on one side)	J-Y (St) Y min. 2x0.8

Measuring ranges insulation fault location $I_{\Delta L}$

Rated frequency range	DC, 16.7…1000 Hz
Measuring range insulation fault location ($I_{\Delta L}$) EDS440	1.5…25 mA
Measuring range insulation fault location ($I_{\Delta L}$) EDS441	0.15…5 mA
Max. residual current	see diagrams in manual

Measuring ranges residual current measurement $I_{\Delta n}$

Measuring range residual current measurement ($I_{\Delta n}$) EDS440	100 mA…20 A
Rated frequency range EDS440	50…1000 Hz
Measuring range residual current measurement ($I_{\Delta n}$) EDS441	100 mA…2 A
Rated frequency range EDS441	50…60 Hz

LEDs

ON (operation LED)	green
COM	yellow
SERVICE	yellow
$I_{\Delta L}$ ALARM	yellow
$I_{\Delta n}$ ALARM	yellow
1…12 channel indication	yellow

Digital inputs

Number	2
Operating mode, adjustable	active high, active low
Function	none, test, reset
Voltage level	Low DC -5…5 V, High DC 11…32 V

Digital current output

Number	1
Function	none, $I_{\Delta L}$ alarm, $I_{\Delta n}$ alarm, device fault, transformer connection fault, common alarm
Current	0 mA DC inactive, 20 mA DC active
Tolerance	±10 %
Burden resistance	$R \leq 500\ \Omega$ / $P_R \geq 0{,}25$ W

Buzzer

Number	1
Function	none, $I_{\Delta L}$ alarm, $I_{\Delta n}$ alarm, device fault, transformer connection fault, insulation fault location active, common alarm

Interfaces

Interface/protocol	RS-485/BS
Data rate	9600 baud/s
Cable length	≤ 1200 m
Cable: twisted pair, one end of shield connected to PE	recommended: J-Y (St) Y min. 2x0.8
Connection	X1.A, X1.B
Terminating resistor	120 Ω, can be connected internally
Device address, BS bus	0, 2…79 (optional 0, 2…159)

Switching elements

Number	2 N/O contacts
Operating mode	N/C operation/N/O operation
Function contact 13,14	none, $I_{\Delta L}$ alarm, $I_{\Delta n}$ alarm, device fault, transformer connection fault, common alarm
Function contact 23,24	none, $I_{\Delta L}$ alarm, $I_{\Delta n}$ alarm, device fault, transformer connection fault, common alarm
Electrical endurance under rated operating conditions	30000
Rated operational voltage	250 VAC
Rated operational current	7 A
Rated insulation voltage	4 kV
Max. switching capacity	300 W/2770 VA
Max. switching capacity	30 VDC/277 VAC

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Storage	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3
Range of use	≤ 2000 m above sea level

Connection

Connection type	pluggable screw-type terminal or push-wire terminal

Screw-type terminal:

Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor, flexible	0.2…1.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible withTWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals:

Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrules, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible withTWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminals X1, X2:

Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other

Operating mode	continuous operation
Mounting	at an ambient temperature >55 °C vertical mounting required at an ambient temperature <55 °C mounting optional
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	UL 94V-0
Dimensions (W x H x D)	72 x 93 x 63
Documentation number	D00201
Weight	approx. 122 g (EDS44x-S) approx. 242 g (EDS44x-L)

Option "W" data different from the standard version

Devices with the suffix „W" feature increased shock and vibration resistance. The electronics is covered with a special varnish to provide increased protection against mechanical stress and moisture.

Ambient temperatures:

Operating temperature	-40…+70 °C
Transport	-40…+85 °C
Long-term storage	-40…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:

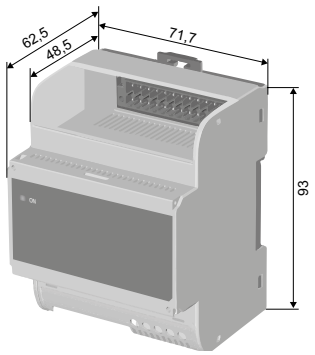
Stationary use (IEC 60721-3-3)	3M7

[1] = at a frequency >200 Hz, connection of X1 and k1-12/l1-12 must be insulated. Only permanently installed devices which at least have overvoltage category CAT2 (300V) may be connected.

[2] = only 50/60 Hz are permitted for UL applications.

[3] = effect of a residual current >100 mA results in a greater relative uncertainty.

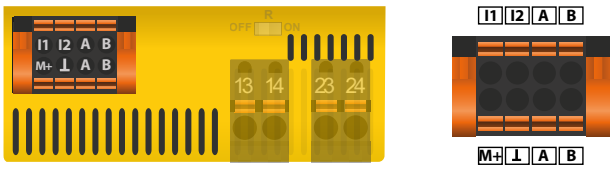
Dimension diagram (dimensions in mm)



Connection to the voltage supply

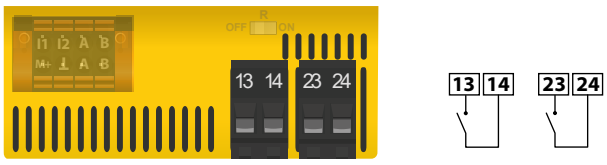


Connection to the X1 interface



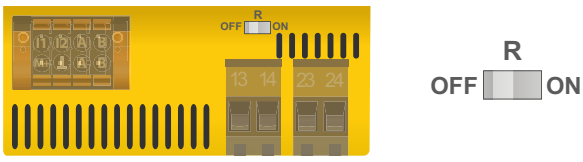
I1	Input 1	M+	Dig. current output
I2	Input 2	⊥	Ground
A	RS-485 A (input)	A	RS-485 A (output)
B	RS-485 B (input)	B	RS-485 B (output)

Connection of relays



Alarm relay 1	13 14	N/O contact	Alarm relay 2	23 24	N/O contact

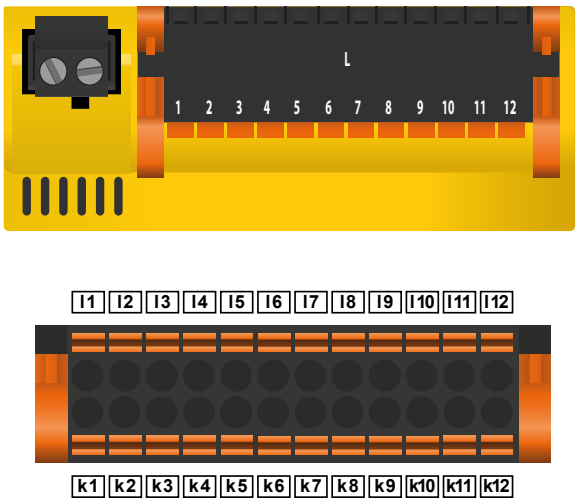
BS bus termination



Activating a terminating resistor to define the first and the last device in the bus system.

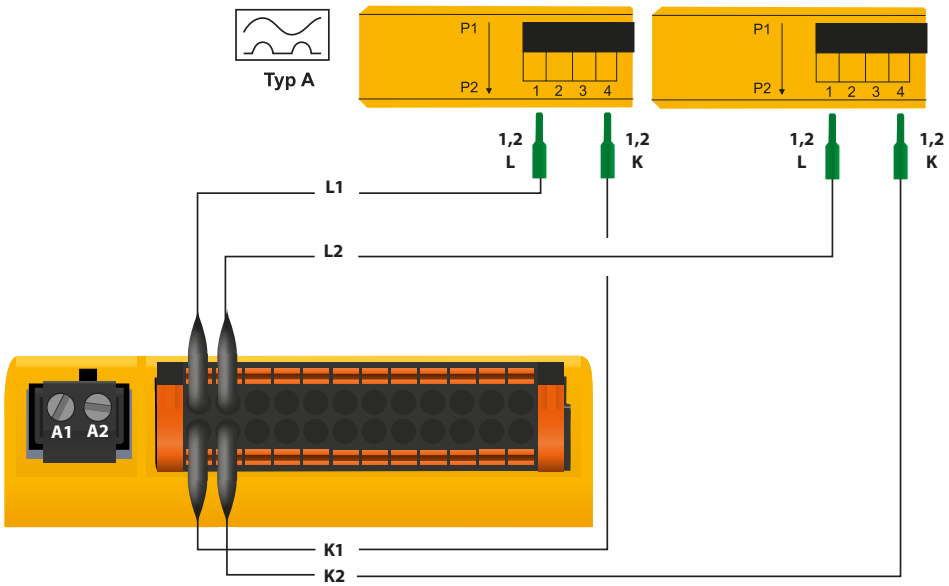
ON	First and last device in a bus	OFF	All devices between the first and the last device in the bus

Connection to the k1-12/I1-12 interface



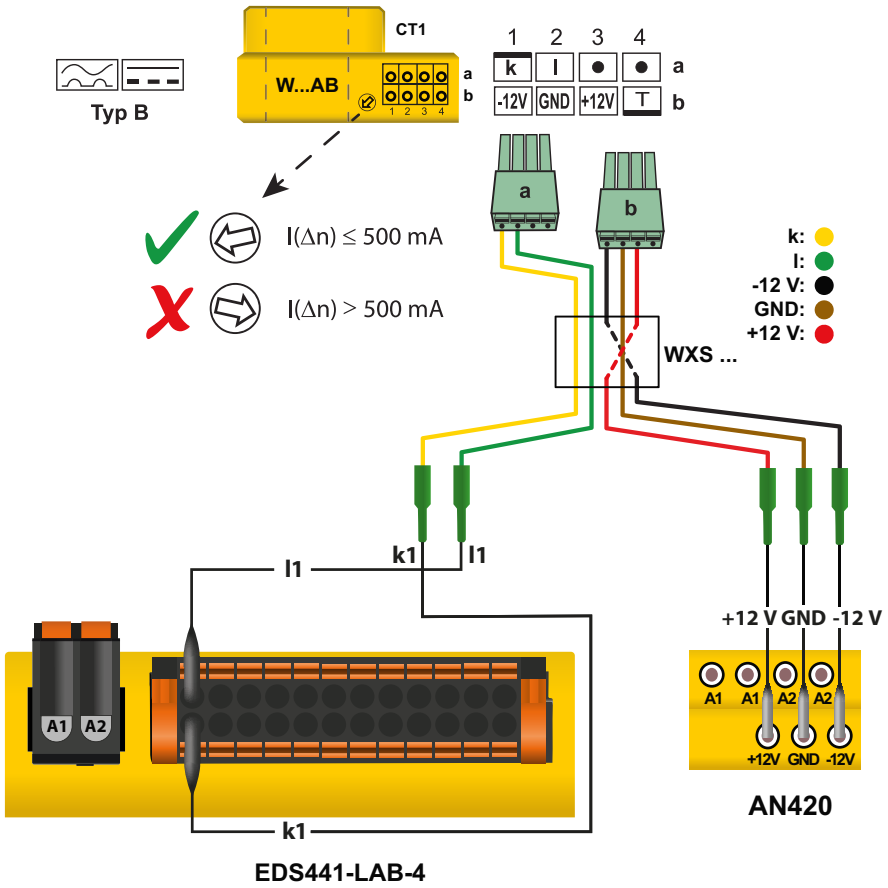
I1	Measuring CT 1	k1	I4	Measuring CT 4	k4
I2	Measuring CT 2	k2	…	…	…
I3	Measuring CT 3	k3	I12	Measuring CT 12	k12

Connection measuring current transformer CTAC..., WR..., WS... series



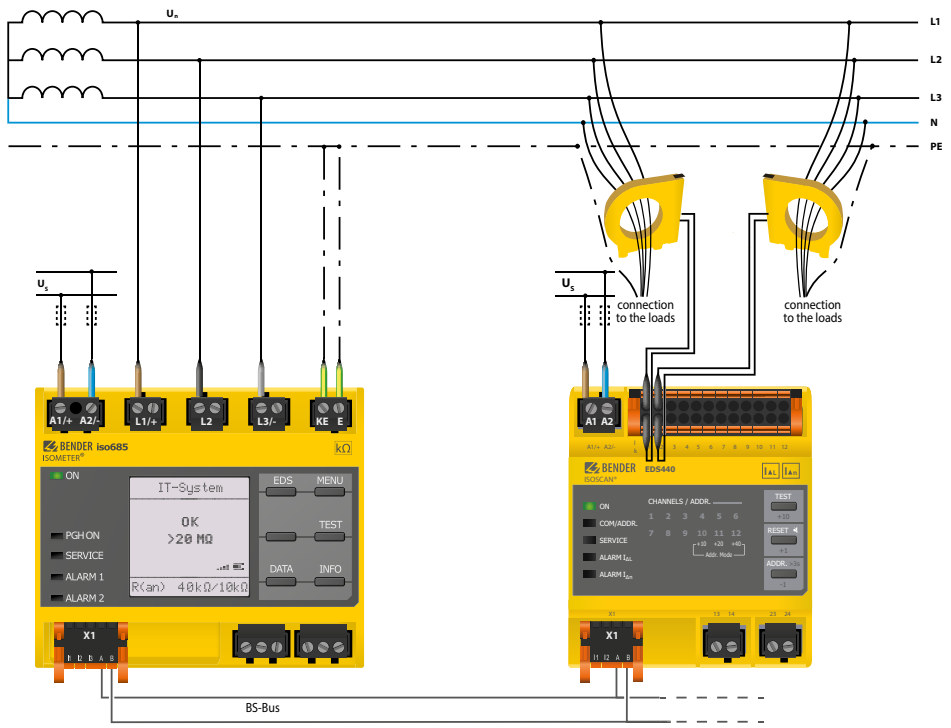
For insulation fault location, the measuring current transformers of the CTAC… (closed), WR… (rectangular) and WS… (split-core) series are used.

Connecting measuring current transformers of the W…AB series to EDS441-LAB

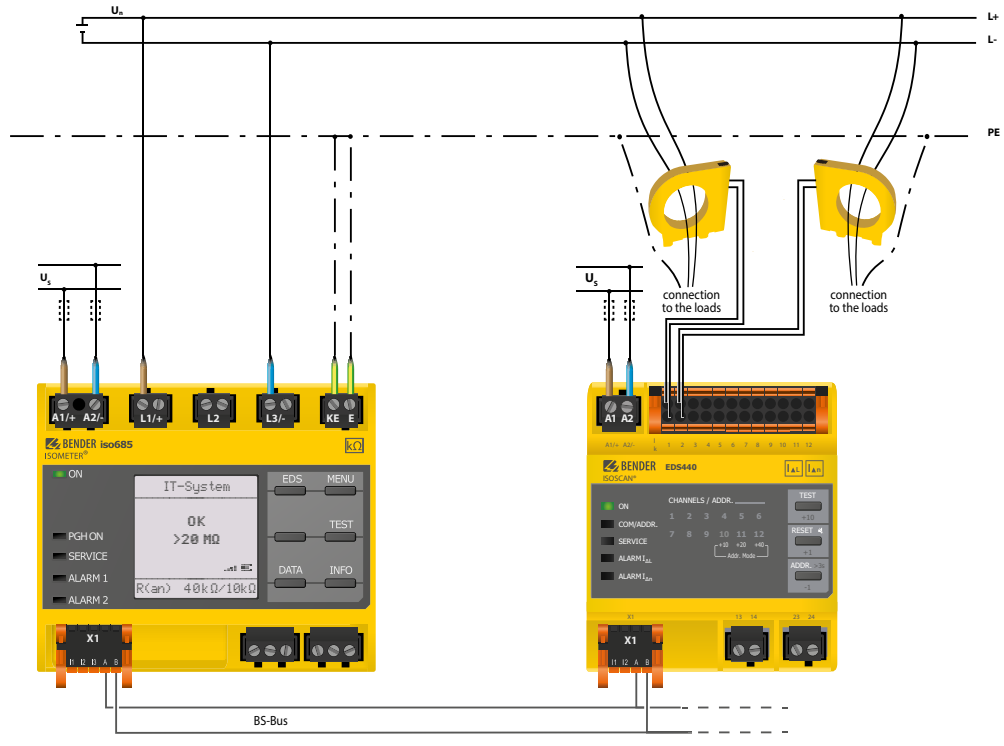


To use the EDS441-LAB with the maximum locating current of ≤ 1.8 mA, the closed measuring current transformers of the W…AB series are required. For every 6 measuring current transformers of the W…AB series, one power supply unit AN420 or AN110 is required.

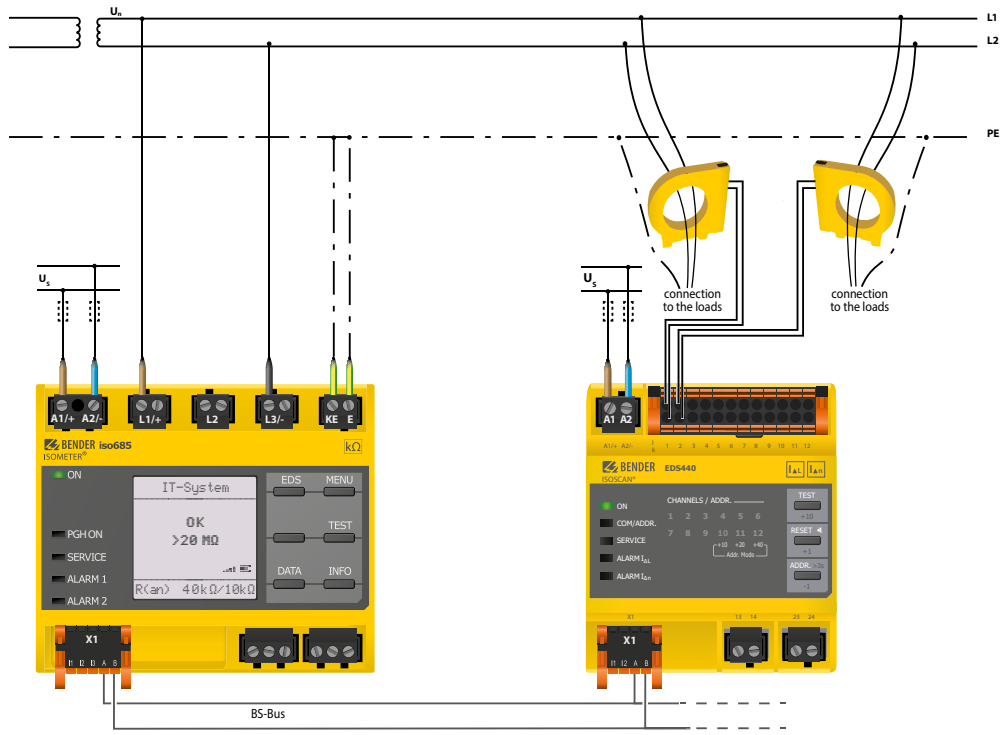
Wiring diagram to 3(N)AC system with iso685-D-P



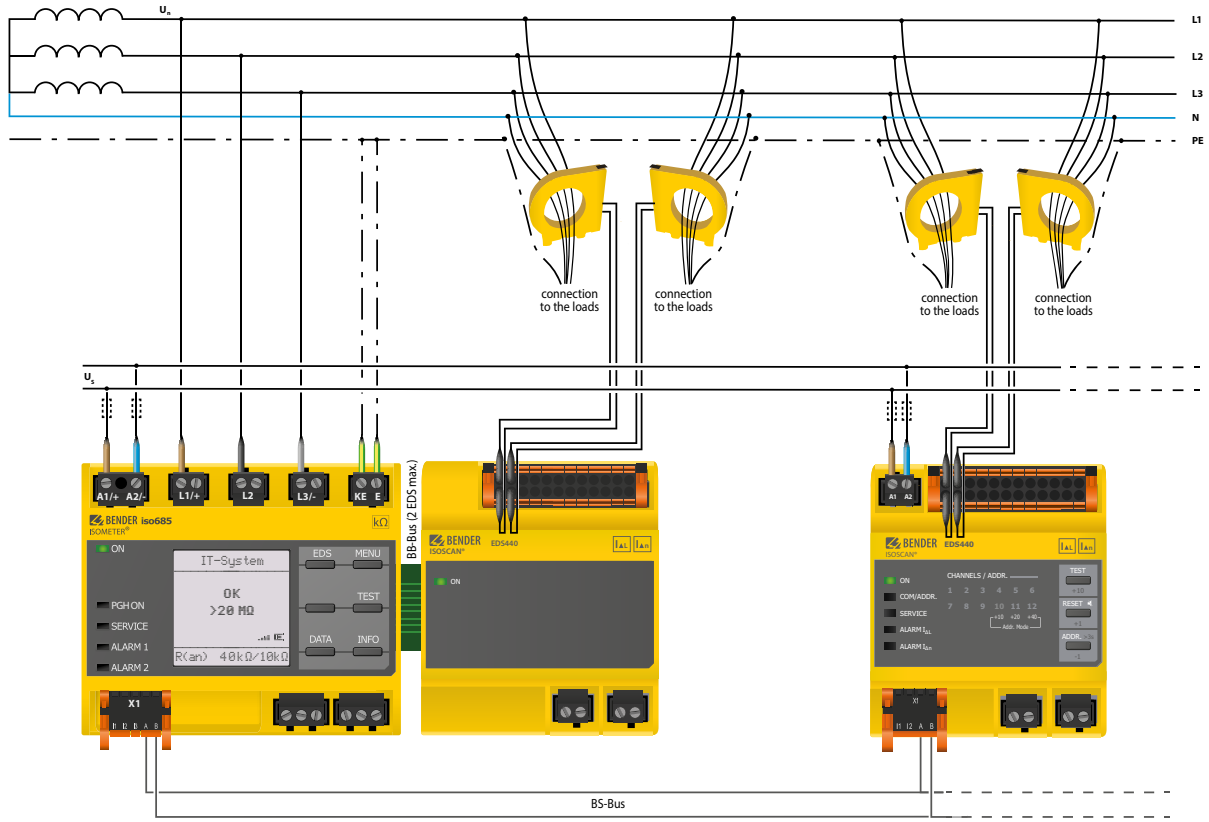
Wiring diagram to DC system with iso685-D-P



Wiring diagram to AC system with iso685-D-P



Connection example: iso685-D-P, EDS440-S and EDS440-L



ISOSCAN® EDS460/490 – EDS461/491

Insulation fault locators with control and display function for EDS systems (insulation fault location systems)



Typical applications

- Insulation fault location in AC, AC/DC and DC IT systems
- Main and control circuits in industrial plants and ships
- Diode-decoupled DC IT systems in power stations
- Systems for medical locations

Approvals

Device features

- Insulation fault location in IT systems
- For AC, 3AC, DC and IT systems
- Control and display function in a single device (EDS…-D)
- 12 measuring channels (circuits) for measuring current transformers of the W, WR, WS series
- Up to 90 EDS insulation fault locators in the system (1080 measuring channels)
- Scanning time max. 10 s for all measuring channels (parallel scanning)
- Response sensitivity EDS460/490 2…10 mA, EDS461/491 0.2…1 mA
- History memory to store 300 events
- Two alarm relays with one changeover contact each
- N/O or N/C operation, selectable
- Connection external test/reset button
- Indication via graphical display resp. 7-segment display and alarm LEDs
- BMS address range 1…90
- Serial interface RS-485
- Continuous CT connection monitoring
- Fault memory behaviour selectable
- Device version EDS490/491 with one alarm contactor per channel
- Additional AC residual current measurement

Standards

Observe the applicable national and international standards. The EDS… series meets the requirements of the following equipment standards:

- IEC 60364-4-41
  Low-voltage electrical installations - Part 4-41: Protection for safety – Protection against electric shock;
- IEC 61557-9
  Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. - Equipment for testing, measuring or monitoring of protective measures - Part 9: Equipment for insulation fault location in IT systems

Further information

For further information refer to our product range on www.bender.de.

Ordering information EDS460/490-D, EDS461/491-D

Measuring range		Common alarm relay for all channels	Alarm relay per channel	Supply voltage [1] U_S			Type	Art. No.
EDS-Funktion	RCM-Funktion			AC	DC	AC/DC		
2…10 mA	100 mA…10 A	2 x 1 changeover contact	–	16…72 V, 42…460 Hz	16…94 V	–	EDS460-D-1	B91080001
				42…460 Hz	–	70…276 V	EDS460-D-2	B91080002
0,2…1 mA	10 mA…1 A	2 x 1 changeover contact	–	16…72 V, 42…460 Hz	16…94 V	–	EDS461-D-1	B91080005
				42…460 Hz	–	70…276 V	EDS461-D-2	B91080006
2…10 mA	100 mA…10 A	2 x 1 changeover contact	12 x 1 N/O contact	16…72 V, 42…460 Hz	16…94 V	–	EDS490-D-1	B91080009
				42…460 Hz	–	70…276 V	EDS490-D-2	B91080010
0,2…1 mA	10 mA…1 A	2 x 1 changeover contact	12 x 1 N/O contact	16…72 V, 42…460 Hz	16…94 V	–	EDS491-D-1	B91080013
				42…460 Hz	–	70…276 V	EDS491-D-2	B91080014

[1] Absolute values

Ordering information EDS460/490-L, EDS461/491-L

Measuring range		Common alarm relay for all channels	Alarm relay per channel	Supply voltage [1] U_S			Type	Art. No.
EDS-Funktion	RCM-Funktion			AC	DC	AC/DC		
2…10 mA	100 mA…10 A	2 x 1 changeover contact	–	16…72 V, 42…460 Hz	16…94 V	–	EDS460-L-1	B91080003
				42…460 Hz	–	70…276 V	EDS460-L-2	B91080004
0,2…1 mA	10 mA…1A	2 x 1 changeover contact	–	16…72 V, 42…460 Hz	16…94 V	–	EDS461-L-1	B91080007
				42…460 Hz	–	70…276 V	EDS461-L-2	B91080008
2…10 mA	100 mA…10 A	2 x 1 changeover contact	12 x 1 N/O contact	16…72 V, 42…460 Hz	16…94 V	–	EDS490-L-1	B91080011
				42…460 Hz	–	70…276 V	EDS490-L-2	B91080012
0,2…1 mA	10 mA…1A	2 x 1 changeover contact	12 x 1 N/O contact	16…72 V, 42…460 Hz	16…94 V	–	EDS491-L-1	B91080015
				42…460 Hz	–	70…276 V	EDS491-L-2	B91080016

[1] Absolute values

Suitable system components

Description	Design	Type of construction	Type	Art. No.	Page
RS-485 repeater	Bus repeater	–	DI-1DL	B95012047	372
	Supplied by the USB port	–	DI-2USB	B95012045	374
	Power supply unit for DI-1 or DI-2	–	AN471	B924189	–
Condition Monitor	with integrated gateway: Bender devices/Ethernet	–	COM465IP	B950610…	384
Protocol converters	BMS bus – Modbus RTU	–	COM462RTU	B95061022	381
Measuring current transformers	pulsed DC sensitive	circular	CTAC…	B981100…	336
		rectangular	WR…S(P)	B9117…	343
		split-core	WS…	B980806…	345

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
for versions with a supply voltage of AC/DC 70…276 V/AC 42…460 Hz

Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	6 kV/3
Protective separation (reinforced insulation) between	(A1, A2) -(k1, I…k12, R, T/R, T, A, B,), C11, C12 C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), 61,64), (71,74), (81,84), (91,94), (101,104), (111,114), (121,124)
Protective separation (reinforced insulation) between	(C11, C12, C14) -(C21, C22, C24) - (11, 14, 21, 24, 31, 34) -(41, 44, 51, 54, 61, 64) -(71,74) - (81,84) -(91,94) -(101,104) -(111,114) -(121,124)
Voltage test acc. to IEC 61010-1	3.536 kV
Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	4 kV/3
Basic insulation between:	(k1, I…k12, R, T/R, T, A, B) -(C11, C12, C14), (C21, C22, C24)
Basic insulation between:	(11, 14) -(21, 24) -(31, 34) -(41, 44) -(51, 54) -(61, 64)
Voltage test acc. to IEC 61010-1	2.21 kV

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
for versions with a supply voltage of DC 16…94 V, AC 16…72 V/42…460 Hz

Rated insulation voltage	AC 100 V
Rated impulse voltage/pollution degree	2.5 kV/3
Protective separation (reinforced insulation) between	(A1, A2) -(k1, I…k12, R, T/R, T, A, B)
Voltage test acc. to IEC 61010-1	1.344 kV
Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	4 kV/3
Basic insulation between	(A1, A2), (k1, I…k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), (61,64), (71,74), (81,84), (91,94),(101,104), (111,114), (121,124)
Basic insulation between:	(11, 14) -(21, 24) -(31, 34) -(41, 44) -(51, 54) -(61, 64)
Voltage test acc. to IEC 61010-1	2.21 kV
Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	6 kV/3
Protective separation (reinforced insulation) between	(C11, C12, C14) -(C21, C22, C24) - (11, 14, 21, 24, 31, 34) -(41, 44, 51, 54, 61, 64) -(71,74) - (81,84) -(91,94) -(101,104) -(111,114) -(121,124)
Voltage test acc. to IEC 61010-1	3.536 kV

Supply voltage

Supply voltage U_S	see ordering information
Frequency range U_S	AC 42…460 Hz
Power consumption	≤ 10 VA (EDS460, EDS461) ≤ 14 VA (EDS490, EDS491)

Measuring circuit

Nominal system voltage U_n	see IRDH575, PGH (EDS460, EDS490) AC 20…276 V, DC 20…308 V (EDS461, EDS491)
External measuring current transformers type	CTAC…, WR…S(P), WS… (EDS460, EDS490) CTAC…, WS…/8000 (EDS461, EDS491)
CT monitoring	on/off (on)*
Load	10 Ω (EDS460, EDS490) 1.5 kΩ (EDS461, EDS491)
Rated insulation voltage (measuring current transformer)	800 V
Response sensitivity	2…10 mA (EDS460, EDS490) 0.2…1 mA (EDS461, EDS491)
Rated frequency	DC, AC 400, 60, 50 Hz
Measuring range EDS function	1.5…50 mA (EDS460/490) 0.15…5 mA (EDS461/491)
Measuring range RCM function	100 mA…10 A (EDS460/490) 10 mA…1 A (EDS461/491)
Number of measuring channels (per device/system)	12/1080

Time response

Response delay t_{on}	0…24 s
Delay on release t_{off}	0…24 s
Scanning time for all channels	approx. 8…24 s (EDS460/490) approx. 14…30 s (EDS461/491)

Displays, memory

LEDs	ON/ALARM (EDS4…-D) ON/ALARM/measuring channel 1…12 (EDS4…-L)
LC display	backlit graphical display (EDS4…-D)
7-segment display	2 x 7.62 mm (EDS4…-L)
History memory	300 data records (EDS4…-D)
Password	off/0…999 (off)*
Language	D, GB, F (GB)*
Fault memory alarm relay	on/off (off)*

Inputs/outputs

Test/reset button	internal/external
Cable length for external test/reset button	0…10 m

Interface

Interface/protocol	RS-485/BMS
Baud rate	9.6 kbit/s
Cable length	0…1200 m
Cable (twisted pair, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2x0.8
Terminating resistor	120 Ω (0.25 W) connectable via DIP switch
Device address, BMS bus	1…90 (2)*

Connection: EDS -measuring current transformer

Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	1…10 m
Shielded cable ≥ 0.5 mm²	10…40 m
Shielded cable (shield on one side connected to L-conductor, not connected to earth)	recommended: J-Y(St)Y min. 2x0.8

Switching elements

Number	two relays, each with one changeover contact (EDS46.) two relays, each with one changeover contact, 12 relays, each with one N/O contact (EDS49.)
Operating principle	NC or N/O operation (N/O operation)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current (common alarm relays)	5 A	3 A	1 A	0.2 A	0.1 A
Rated operational current (alarm relay)	2 A	0.5 A	5 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-2-4 Ed. 1.0
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Technical data (continued)

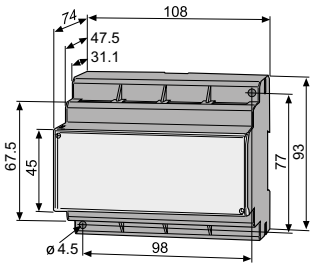
Connection	
Connection	screw-type terminals
Connection	
rigid/flexible	0.2…4/0.2…2.5 mm² (AWG 24…12)
Multi-conductor connection (2 conductors with the same cross section):	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8…9 mm
Tightening torque	0.5…0.6 Nm

Other	
Operating mode	continuous operation
Position of normal use	any
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
Screw mounting	2 x M4
DIN rail mounting acc. to	IEC 60715
Documentation number	D00085
Weight	≤ 360 g (EDS460)
	≤ 530 g (EDS490)

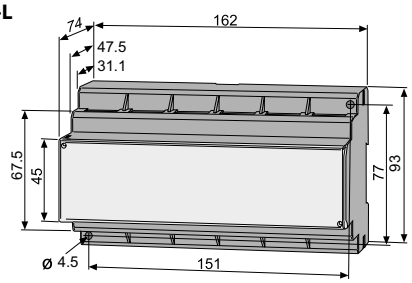
( )* factory setting

Dimension diagrams (dimensions in mm)

EDS46…-D/-L

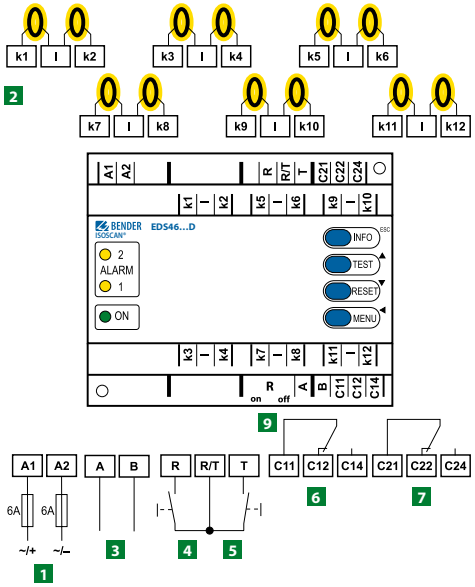


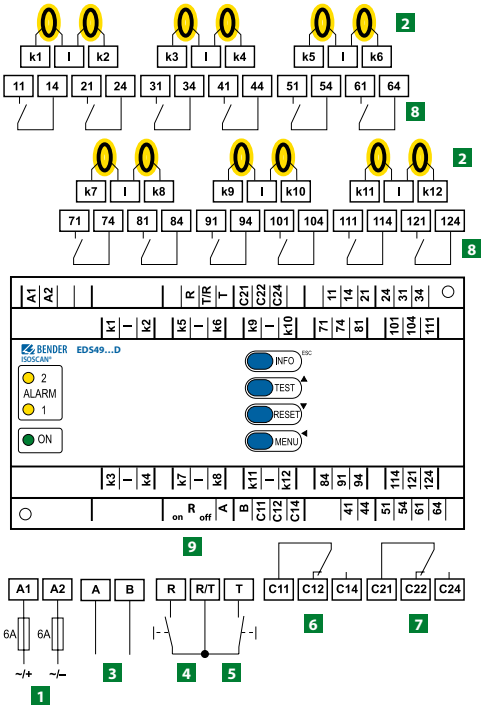
EDS49…-D/-L



Overview of device types

Distinctive device features	EDS460-D/EDS461-D	EDS460-L/EDS461 -L	EDS490-D/EDS491 -D	EDS490-L/EDS491 -L
Response value	EDS460: 2…10 mA		EDS490: 2…10 mA	
	EDS461: 0.2…1 mA		EDS491: 0.2…1 mA	
Residual current indication	EDS460: 100 mA…10 A		EDS490: 100 mA…10 A	
	EDS461: 10 mA…1 A		EDS491: 10 mA…1 A	
Backlit graphics LC display	■	–	■	–
7-segment display and LED line	–	■	–	■
Parameter setting function	■	–	■	–
Error code indication	■		■	
Address range	1…90	1…90	1…90	1…90
Internal clock	■	–	■	–
History memory	■	–	■	–
Alarm contact "Common alarm" for all channels	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact
Alarm contact per channel	–		12 x 1 N/O contact	
Enclosure	XM460		XM490	





1	A1, A2	Supply voltage U_S (see ordering information), 6 A fuse recommended; two-pole fuses should be used on IT systems. For UL and CSA applications, the use of 5 A fuses is mandatory.
2	k1, l…k12, l	Connection of measuring current transformers 1…12
3	A, B	BMS bus (RS-485 interface with BMS protocol)
4	R, R/T	External reset button (N/O contact)*
5	T, R/T	External test button (N/O contact)*
6	C11, C12, C14	Common alarm relay K1: Alarm 1, common alarm for alarm or device error.
7	C21, C22, C24	Common alarm relay K2: Alarm 2, common alarm for alarm or device error.
8	$R_{on/off}$	Activate or deactivate the BMS bus terminating resistor (120 Ω).

* **The external test/reset buttons of several devices must not be connected to one another.**

ISOSCAN® EDS150/EDS151

Insulation fault locator with integrated measuring current transformers for EDS systems



Typical applications

- Insulation fault location in AC, AC/DC and DC IT systems
- DC main circuits in industrial plants, power stations and ships
- IT systems for medical locations and control circuits (EDS151)

Approvals

Device features

- Insulation fault location in AC, AC/DC and DC IT systems
- 6 measuring channels with measuring current transformer per EDS150/151
- Up to 528 measuring channels can be combined by the BMS bus in the IT system being monitored: 88 x 6 measuring channels
- Response sensitivity EDS150: 5 mA, EDS151 0.5 mA
- A response time of up to 8 s in the AC system acc. to IEC 61557-9
- RS-485 interface with BMS protocol
- BMS address range 3…90
- Cyclical self test

Standards

The ISOSCAN® EDS150/151 series complies with the requirements of the device standards:

- IEC 61557-9

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Measuring range	Response value		Supply voltage [1] U_S		Type	Art. No.
	EDS function	RCM function	AC	DC		
5…25 mA	5 mA	10 A	17…24 V/50…60 Hz	14…28 V	EDS150	B91080103
0.5…2.5 mA	0.5 mA	1 A			EDS151	B91080101

[1] Absolute values

Accessories

Type designation	Art. No.
Mounting clip for enclosure XM150	B91080110

Suitable system components

Description	Voltage supply	Output voltage	Explanation	Type	Art. No.	Page
Power supply unit	AC 90…264 V/DC 120…370 V/47…63 Hz	DC 24 V, 420 mA	For the supply of max. 6 EDS15…	AN410	B924209	367
	AC 230 V/50…60 Hz	AC 20 V, 500 mA	For the supply of max. 6 EDS15…	AN450	B924201	369
	AC 127 V/50…60 Hz	AC 20 V, 500 mA	For the supply of max. 6 EDS15…	AN450-133	B924203	369

According to IEC 60364-7-710 only power supply units providing "Safe separation" (reinforced insulation) may be used for the supply voltage between the primary and secondary side. All power supply units listed above comply with this requirement!

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	6 kV/3

Voltage ranges

IT system being monitored:

Nominal system voltage U_n	see IRDH575, PGH (EDS150) AC 20…276 V, DC 20…308 V (EDS151)
Nominal frequency f_n	42…460 Hz

Supply voltage:

Supply voltage U_S	AC 17…24 V, DC 14…28 V
Frequency range of the supply voltage	50…60 Hz
Power consumption AC	≤ 3 VA
Power consumption DC	≤ 1.5 VA

Measuring circuit

Number of measuring channels (per device/system)	6/528

EDS function:

Response value	EDS150: 5 mA EDS151: 0.5 mA
Relative uncertainty	±30 %
Rated frequency	42…460 Hz
Measuring range EDS function	EDS150: 5…25 mA, EDS151: 0.5…2.5 mA
Response time in the AC system acc. to IEC 61557-9	≤ 8 s

RCM function:

Response value	EDS150: 10 A EDS151: 1 A
Relative uncertainty	±30 %
Frequency range	42…68 Hz

Displays

LEDs:

ON/COM, green	operation indicator/bus activity
Alarm K1…K6, yellow	EDS and RCM function

Interface

Interface/protocol	RS-485/BMS
Connection	terminals A/B
Cable (twisted pair, one end of shield connected to PE)	two-core, recommended: J-Y(St)Y min. 2x0.8
Cable length	≤ 1200 m
Terminating resistor	120 Ω (0.25 W)
Device address, BMS bus	3…90 (3)*

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-25…+55 °C
For UL application:	
Maximum ambient temperature 55 °C	
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

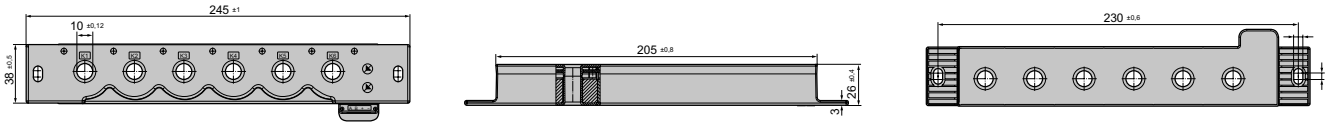
Connection type	pluggable push-wire terminal
For UL application:	
Only use 60/75°C copper conductors!	
Connection rigid /flexible/conductor sizes	0.2…1.5 mm² (AWG 24…16)
Multi-conductor connection (2 conductors of the same cross section)	
rigid	0.2…1.5 mm²
flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with ferrule with plastic sleeve	0.25…0.75 mm²
Stripping length	10 mm

Other

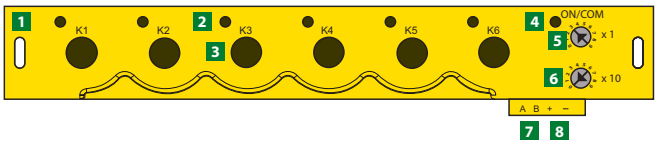
Operating mode	continuous operation
Position of normal use	any
Enclosure material	polycarbonate
Flammability class	UL94 V-0
Screw mounting	2 x M6
Tightening torque	1.5 Nm
Documentation number	D00106 (EDS150) D00107 (EDS151)
Weight	≤ 340 g

( )* = factory setting

Dimension diagrams (dimensions in mm)

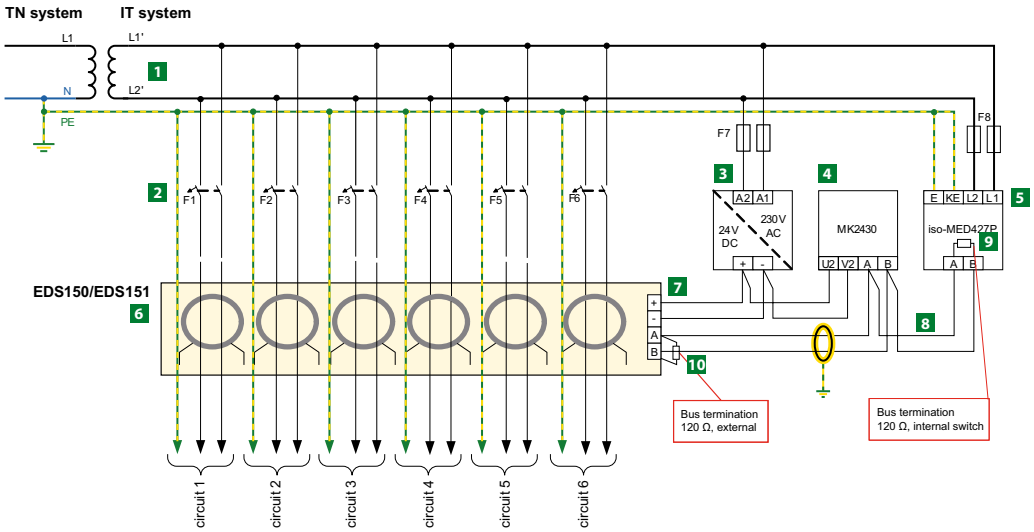


Displays and controls



1 Opening for screw mounting
2 Alarm LEDs measuring channels "K1…K6"
3 Cable lead-through of the measuring current transformers for the measuring channels K1…K6
4 "ON/COM" LED: Power On LED and bus activity
5 Set the ones position of the BMS address
6 Set the tens position of the BMS address
7 Connection to the supply voltage
8 Connection RS-485, BMS bus

Wiring diagrams



1 Transformer for the IT system to be monitored
2 Circuit breakers for the circuits
3 AN410 for DC 24 V supply voltage
4 Alarm indicator and test combination MK2430/MK800 for indication of alarm messages from the EDS150/151 (BMS master)
5 IRDH575 insulation monitoring devices with locating current injector for insulation fault location systems
6 Insulation fault locator EDS150/151 with integrated measuring current transformers
7 Supply voltage U_S DC 24 V
8 Serial interface BMS
9 Terminating resistor BMS bus (120 Ω, internally connected)
10 Terminating resistor BMS bus

ISOSCAN® EDS30…

Portable equipment for insulation fault location for unearthed and earthed systems (IT and TN systems) to be used in conjunction with or without equipment for insulation fault location



Typical applications

- IT systems with or without an incorporated equipment for insulation fault location (EDS)

Approvals

CE EAC

Device features

- Portable insulation fault location systems for IT systems AC 0…790 V/DC 0…960 V/42…460 Hz or de-energised systems
- Residual current measurement in TN/TT systems
- Use in main and control circuits, photovoltaic systems
- Measuring clamps 20/52 mm (115 mm optional)
- Robust aluminium case, convenient to carry
- Locating current injectors PGH18… with variable locating current 1…25 mA
- Integrated locating voltage for de-energised systems (PGH186)

Insulation fault locator EDS195PM

- Backlit LC display, 3 x 16 characters
- Measuring clamps 20/52 mm included in the scope of delivery
- Accumulator (delivered with a power supply unit)
- Response value insulation fault location 2…10 mA for main circuits
- Response value insulation fault location 0.2…1 mA for control circuits
- Response value residual current measurement 10 mA…10 A
- Selectable operating mode insulation fault location/residual current measurement

Standards

The ISOSCAN® EDS30… series complies with the requirements of the device standards:
DIN EN 61557-8 (VDE 0413-8), EN 61557-8, IEC 61557-8, IEC 61326-2-4, DIN EN 60664-1 (VDE 0110-1), DIN EN 60664-3, DIN EN 61557-9, VDE 0413-9, IEC 61557-9, ASTM F1669M-96 (2007), ASTM F1207M-96 (2007)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Main circuits		Control circuits		Nominal voltage U_n		Supply voltage U_S	Type	Art. No.
with EDS	without EDS	with EDS	without EDS	AC	DC	AC		
EDS460/490	–	–	–	20…575 V, 42…460 Hz	20…504 V	–	EDS3090	B91082026
–	■	–	–	20…575 V, 42…460 Hz	20…504 V	230 V, 50…60 Hz	EDS3090PG	B91082021
						90…132 V, 50…60 Hz	EDS3090PG-13	B91082022
				0…575 V, 42…460 Hz	0…504 V	230 V, 50…60 Hz	EDS3096PG	B91082025
						90…132 V, 50…60 Hz	EDS3096PG-13	B91082029
–	–	EDS461/491	–	20…265 V, 42…460 Hz	20…308 V	–	EDS3091	B91082027
–	–	–	■	20…265 V, 42…460 Hz	20…308 V	230 V, 50…60 Hz	EDS3091PG	B91082023
						90…132 V, 50…60 Hz	EDS3091PG-13	B91082024
–	■	–	■	20…265 V, 42…460 Hz	20…308 V	230 V, 50…60 Hz	EDS3092PG	B91082030
–	■	–	■	20…575 V, 42…460 Hz	20…504 V	230 V, 50…60 Hz		
–	■	–	–	20…575 V, 42…460 Hz	20…504 V	230 V, 50…60 Hz	EDS3096PV	B91082031

Suitable system components

Designation	Nominal voltage U_n		Type	Art. No.	Page
	AC	DC			
Measuring clamp 115 mm for EDS3090… and EDS3096…	–	–	PSA3165	B980852	–
Coupling device to extend the voltage range of the PGH185/186	500…790 V/ 42…460 Hz	400…960 V	AGE185	B980305	176
Accessories for fault location in diode-decoupled systems	–	–	EDS165-SET	B91082007	–

Scope of delivery

Insulation fault locator	Locating current injector	Measuring clamps 20 mm	Measuring clamps 52 mm	Type
EDS195PM	–	PSA3020	PSA3052	EDS3090
EDS195PM	PGH185	PSA3020	PSA3052	EDS3090PG
EDS195PM	PGH185-13	PSA3020	PSA3052	EDS3090PG-13
EDS195PM	PGH186	PSA3020	PSA3052	EDS3096PG
EDS195PM	PGH186-13	PSA3020	PSA3052	EDS3096PG-13
EDS195PM	–	PSA3320	PSA3352	EDS3091
EDS195PM	PGH183	PSA3320	PSA3352	EDS3091PG
EDS195PM	PGH183-13	PSA3320	PSA3352	EDS3091PG-13
EDS195PM	PGH183	PSA3320	PSA3352	EDS3092PG
	PGH185	PSA3020	PSA3052	
EDS195PM	PGH186	–	2 x PSA3052	EDS3096PV

Technical data EDS309…system

The technical data listed in this chapter apply to the components: PGH18…, EDS195PM, AGH185.

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-10…+55 °C
Classification of climatic conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Other

Operating mode	continuous operation
Position of normal use	any
Weight EDS309…	≤ 7000 g
Weight EDS309… with PSA3165	≤ 8500 g
Weight EDS3092	≤ 9000 g
Dimensions WxHxD	430 x 340 x 155 mm
Documentation number	D00012

Technical data PGH18…

Insulation coordination acc. to IEC 60664-1/ IEC 60664-3

Rated insulation voltage	AC 500 V
Rated impulse withstand voltage/pollution degree	4 kV/3

Nominal system voltage U_n

PGH183	AC 20…265 V 42…460 Hz, DC 20…308 V
PGH185	3AC/AC 20…575 V 42…460 Hz, DC 20…504 V
PGH186	3AC/AC 0…575 V 42…460 Hz, DC 0…504 V

Voltage supply

Supply voltage U_S	AC 230 V/50…60 Hz
Operating range of U_S	0.85…1.15 x U_S
Supply voltage U_S version -13	AC 90…132 V/50…60 Hz

PGH183, PGH185:

Power consumption	≤ 3 VA

PGH186:

Power consumption	≤ 6 VA

Locating current

PGH183

Test current, selectable, max.	1/2.5 mA

PGH185/186

Locating current I_L, selectable, max.	10/25 mA

PGH183/185/186

Clock pulse	2 s
Idle time	4 s

Measuring voltage U_m

PGH186	DC 50 V

Other

Degree of protection, internal components DIN EN 60529 (VDE 0470-1)	IP40
Enclosure material	ABS plastic
Flammability class	UL94 V-0
Weight	≤ 700 g
Dimensions WxHxD	160 x 148 x 81 mm

Technical data EDS195PM

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	50 V
Rated impulse withstand voltage/pollution degree	0.8 kV/3

Voltage supply

Supply voltage U_S	accumulators, batteries or USB power supply unit
Accumulators	3 x NiMh ≥ 2000 mAh
Hours of operation (without display illumination)	≥ 150 h
Charging time	≤ 5 h
Size	AA R6
Batteries	3 x LR6 AA – 1.5 V
USB power supply unit:	
Primary :	100…240 V, 50…60 Hz
Secondary:	DC 5 V, ±10 %,
Power consumption	≤ 0.5 W

Measuring circuit insulation fault location

Nominal system voltage	conductors uninsulated, including measuring clamp up to 600 V
Rated frequency	DC, 42…2000 Hz

Main circuit (I_{Lmax} = 50 mA)

Measuring range	2 mA…50 mA
Measuring clamps	PSA3020, PSA3052, PSA3165
Response value $I_{\Delta L}$, adjustable	2…10 mA (5 mA)*
Relative uncertainty	±30 %/±2 mA of the reference value

Control circuit (I_{Lmax} = 5 mA)

Measuring range	0.2 mA…5 mA
Measuring clamps	PSA3320, PSA3352
Response value $I_{\Delta L}$, adjustable	0.2…1.0 mA (0.5 mA)*
Relative uncertainty 0.2…0.9 mA	±30 %/±0.2 mA of the reference value
Relative uncertainty 1…5 mA	±30 %/±2 mA of the reference value

Measuring circuit residual current

with measuring clamps	PSA3020, PSA3052, PSA3165
Measuring range	5 mA…10 A (crest factor up to 3)
Response value $I_{\Delta L}$, adjustable	10 mA…10 A (100 mA)*
with measuring clamps	PSA3320, PSA3352
Measuring range	2 mA…2 A (crest factor up to 3)
Response value $I_{\Delta L}$, adjustable	5 mA…1 A (100 mA)*
Frequency range	42…1000 Hz
Relative uncertainty, 42…60 Hz	±5 %
Relative uncertainty, 61…1000 Hz	±20 %
Hysteresis	20%
Harmonics, adjustable	1st to 8th harmonic component

Connection

Type of connection measuring clamp	BNC plug
Power supply unit (DC 5 V)	µUSB plug

Indication

LCD	3 x 16 characters, selectable illumination
LED	Alarm

Other

Degree of protection, internal components DIN EN 60529 (VDE 0470-1)	IP40
Protection class acc. to IEC 60947-1, DIN EN 60947-1 (VDE 0660-100)	Class III
Enclosure material	ABS plastic
Flammability class	UL94 V-0
Dimensions WxHxD	84 x 197 x 30 mm
Weight	≤ 350 g

( )* = Factory settings

Technical data measuring clamps

Electrical safety

Standard	IEC 61010-2-030
Pollution degree	2
Installation category	III
Operating voltage	600 V
Nominal insulation voltage	AC 600 V CAT III resp. AC 300 V CAT IV

Transmission ratio

PSA30…	10 A/10 mA
PSA33…	1 A/0.1 mA
PSA3165	10 A/10 mA

Other

Degree of protection, internal components DIN EN 60529 (VDE 0470-1)		IP40
Protection class acc. to IEC 60947-1, DIN EN 60947-1 (VDE 0660-100)		Class III
Test port		BNC plug
Dimensions PSA3052/3352		216 x 111 x 45 mm
Dimensions PSA3020/3320		135 x 65 x 30 mm
Dimensions PSA3165		285 x 179 x 45 mm
Permissible cable diameter PSA3052/3352		52 mm
Permissible cable diameter PSA3052/3320		20 mm
Permissible cable diameter PSA3165		115 mm
Weight	PSA3052/3352	≤ 700 g
	PSA3020/3320	≤ 300 g
	PSA3165	≤ 1300 g

Technical data AGE185

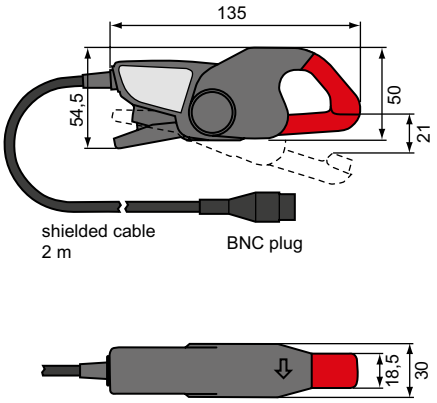
Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 1000 V
Rated impulse voltage/pollution degree	4 kV/3
Nominal system voltage U_n	3AC, AC 500…790 V, DC 400…960 V/42…460 Hz

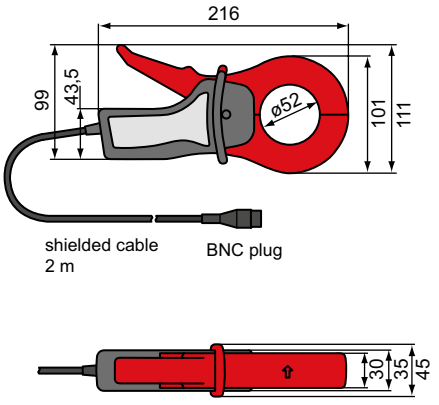
Other

Degree of protection, internal components DIN EN 60529 (VDE 0470-1)	IP30
Type of connection/cable:	safety plug with green-yellow connecting wire 1 mm²
Weight	≤ 400 g
Dimensions W x H x D	84 x 197 x 30 mm
Weight	≤ 200 g
Dimensions W x H x D	88.5 x 42 x 21 mm

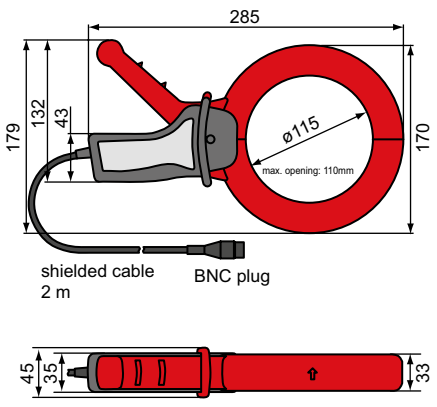
Dimension diagram PSA3020/3320 (dimensions in mm)



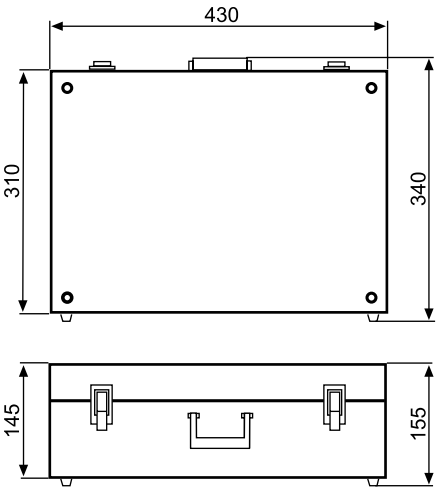
Dimension diagram PSA3052/3352 (dimensions in mm)



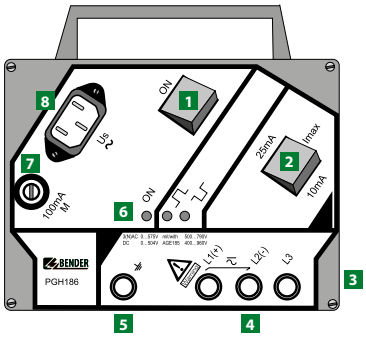
Dimension diagram PSA3165 (dimensions in mm)



Dimension diagram aluminium case(dimensions in mm)



Operating elements PGH18...



1 On/Off switch "ON", activates the test current

2 Selector switch for the maximum locating current 25/10 mA or 2.5/1 mA

3 Not visible: Magnetic adhesive strip at the back of the enclosure for fixing to metal parts (e.g. switchboard cabinet)

4 3 sockets for system coupling

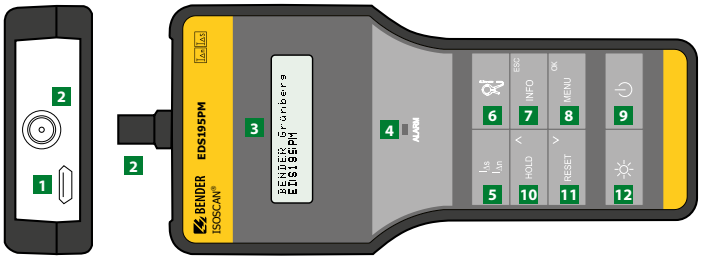
5 Socket for PE connection

6 LED indicators:
"ON" Power On LED
Indication of the positive clock pulse of the locating current
Indication of the negative clock pulse of the locating current

7 Microfuse 100 mA

8 Panel plug for supply voltage

Operating elements EDS195PM



1 Micro USB connection for charging the device's rechargeable battery

2 BNC connection for the measuring clamp

3 LC display, backlit, 3 lines à 16 characters

4 LED "ALARM", lights when the response value is exceeded

5 Button for the selection of the operating mode :
$I_{\Delta S}$ = insulation fault location in IT systems (EDS mode)
$I_{\Delta n}$ = residual current measurement in TN-S systems in (RCM mode)

6 Button for transformer selection

	for I_{Tmax} = 50 mA:	for I_{Tmax} = 5 mA:
P20	= PSA3020	= PSA3320
P52	= PSA3052	= PSA3352
P165	= PSA3165	----------
W/WR	= W…/WR…	= W…-8000
WS	= WS…	= W…-8000

7 "INFO" button: – device type – software version – current response values $I_{\Delta S}$ and $I_{\Delta n}$ – setup status
ESC button: to exit the menu function without changing parameters

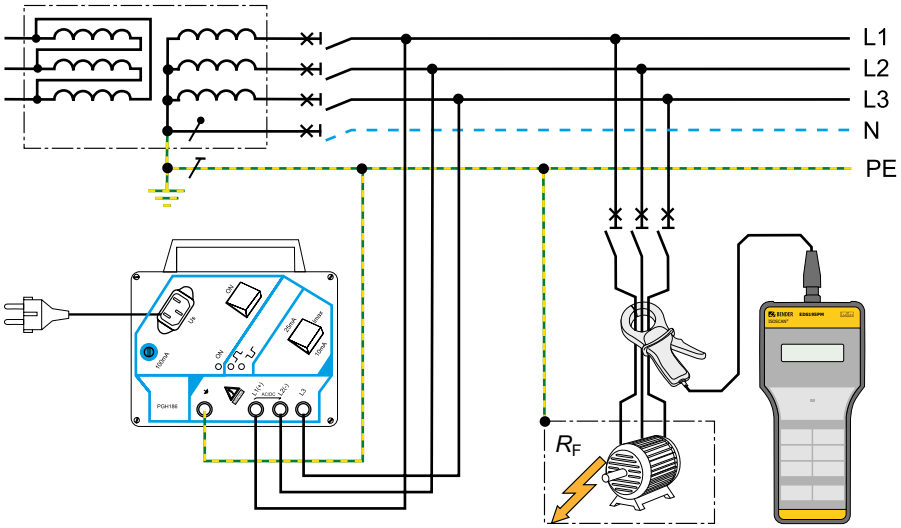
8 "MENU" button: to toggle between the standard display and the menu selection

9 On-Off button

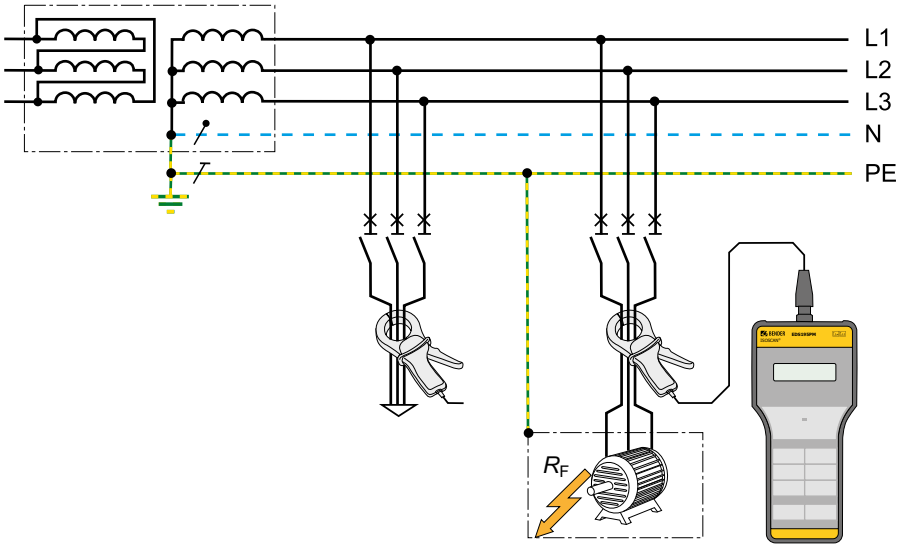
10 "HOLD" button: to store the currently indicated measured value
Arrow up button: Parameter changes, scroll

11 "RESET" button: fault memory acknowledgement
Arrow down button: Parameter changes, scroll

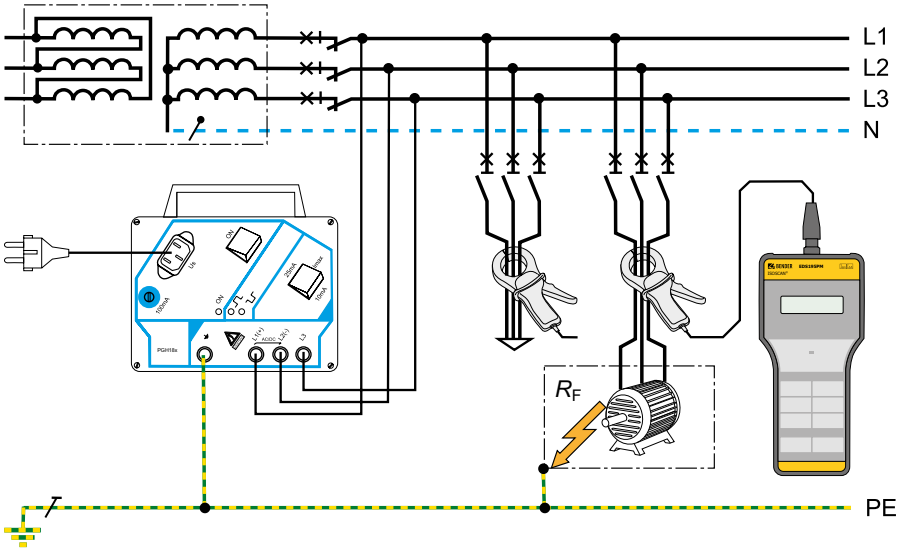
12 Illumination button: to switch on the display lighting



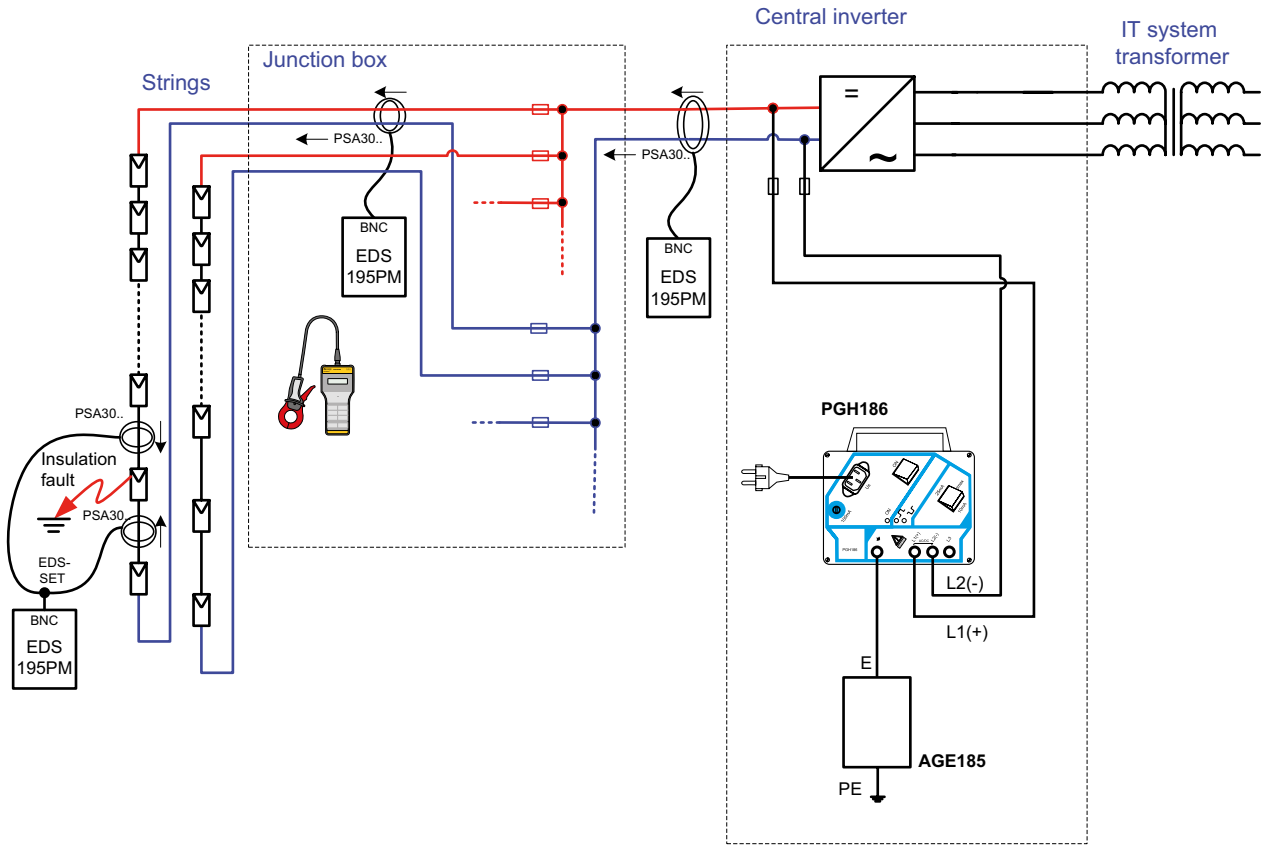
Equipment for insulation fault location EDS3096PG in de-energised systems (IT systems) (Note: TN-S system with all poles disconnected)



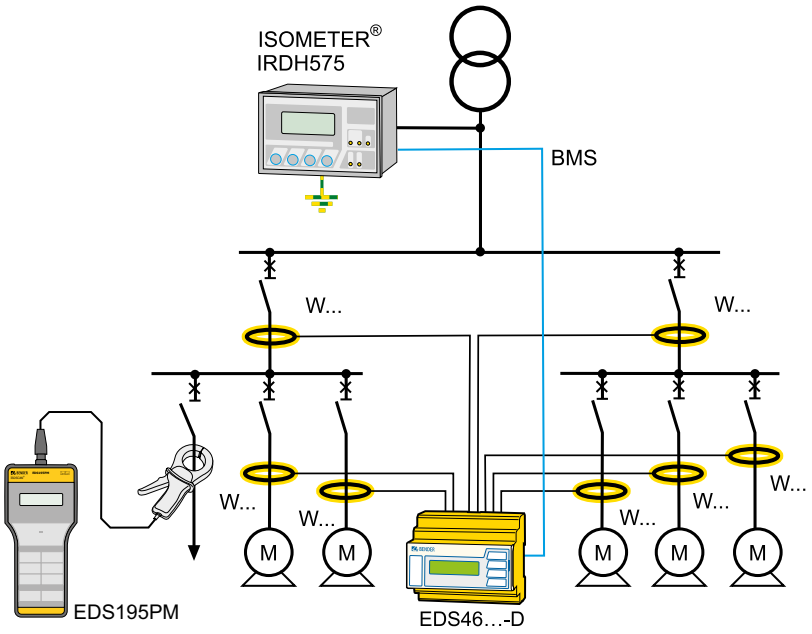
Residual current measurement with EDS309… in earthed systems (TN-S systems)



Equipment for insulation fault location EDS3090/3091PG for use in unearthed systems (IT systems) without a permanently installed equipment for insulation fault location



Insulation fault location system EDS3096PV in unearthed photovoltaic systems (IT systems)



Insulation fault location system EDS3090/3091 in unearthed systems (IT systems) with permanently installed equipment for insulation fault location EDS



Device selection for IT systems with integrated equipment for insulation fault location

Type of distribution system	AC, DC, AC/DC (mixed systems)		
Application range	Main circuits	Control circuits	Main circuits or Control circuits

Insulation monitoring device ISOMETER®/Locating current injector PGH






Type	IRDH575	IRDH575	iso685-x-P	isoxx1685xP
Nominal system voltage U_n	-B1: 3AC, AC 20…575 V, DC 20…504 V -B2: 3AC, AC 340…760 V, DC 340…575 V	3AC, AC 20…150 V, DC 20…150 V	AC 0…690 V, DC 0…1000 V	isoLR1685DP: AC 0…690, DC 0…690 V iso1685DP: AC 0…1000 V, DC 0…1500 V
U_S DC 19,2…72 V	IRDH575B1-427	IRDH575B1-4227	–	–
U_S AC 88…264 V/DC 77…286 V	IRDH575B1-435, IRDH575B2-435	IRDH575B1-4235	–	–
U_S AC/DC 24…240 V	–	–	iso685-x-P	–
U_S DC 18…30 V	–	–	–	isoxx1685xP
Locating current I_L	10/25/50 mA	1/2,5 mA	1/1.8/2.5/5/10/25/50 mA	1/2.5/5/10/25/50 mA
Response values	1 kΩ …. 10 MΩ	1 kΩ …. 10 MΩ	1 kΩ …. 10 MΩ	isoLR1685DP: 20 Ω …. 100 kΩ iso1685DP: 200 Ω …. 1 MΩ
LC display	4 x 20 characters	4 x 20 characters	graphic display	graphic display
Alarm relay	3 changeover contacts	3 changeover contacts	2 changeover contacts	3 changeover contacts
Interface/protocol	RS-485 (BMS)	RS-485 (BMS)	RS-485 (BS)	RS-485 (BS)
Address range	1…30	1…30	1…90	1…90

Insulation fault locator



Type	EDS195PM
LC display	3 x 16 characters
Evaluating current $I_{\Delta L}$	0.2…50 mA
Response value	0.2…1/2…10 mA selectable

Messzangen

Application range	Main circuits			Control circuits	
Type	PSA3020	PSA3052	PSA3165 (optional)	PSA3320	PSA3352
20 mm	■			■	
52 mm		■			■
115 mm			■		







Complete systems

Type	EDS3090		EDS3091
Comprising	Aluminium case, EDS195PM, PSA3020, PSA3052, power supply unit	Aluminium case, EDS195PM, PSA3020, PSA3052, power supply unit	Aluminium case, EDS195PM, PSA3320, PSA3352, power supply unit

Device selection for IT systems without a permanently installed equipment for insulation fault location

Application	Main circuit		Control circuit
	energised	offline	energised
Locating current injector PGH			
			
Nominal system voltage U_n	3AC, AC 20…575 V DC 20…504 V	3AC, AC 0…575 V DC 0…504 V	AC 20…265 V, DC 20…308 V
U_S AC 230 V	PGH185	PGH186	PGH183
U_S AC 90…132 V	PGH185-13	PGH186-13	PGH183-13
Locating current I_L max.	10/25 mA	10/25 mA	1/2.5 mA

Insulation fault locator	
	
Type	EDS195PM
LC display	3 x 16 characters
Evaluating current $I_{\Delta L}$	0.2…50 mA
Response value	0.2…1/2…10 mA selectable

Measuring clamps



Type	PSA3020	PSA3052	PSA3165 (optional)	PSA3320	PSA3352
20 mm	■			■	
52 mm		■			■
115 mm			■		

Components EDS309…

Device type	Aluminium case with carrying handle	Operating manual	EDS195PM with Accessories					PGH18… with accessories for							Measuring clamps			
			Insulation fault locator	Clamping connector on 4 mm	Adapter BNC/4mm connector for curr. transform	Adapter BNC-PS2 for WF-CT, optional	Plug power supply for EDS195PM	Locating current injector	Supply cable for PGH18…	Safety measuring cable, black	Safety measuring cable, green/yellow	Safety claw grip, black	Safety claw grip, green/yellow	Coupling device, optional (EDS3096PV only: in the scope of delivery)	Measuring clamps 20 mm	Measuring clamps 52 mm	Measuring clamps 115 mm, optional	EDS-Set, optional
EDS3090	1	1	EDS195PM	1	1	1	1								PSA3020	PSA3052	PSA3165	1
EDS3090PG	1	1	EDS195PM	1	1	1	1	PGH185	1	3	1	3	1	AGE185	PSA3020	PSA3052	PSA3165	1
EDS3090PG-13	1	1	EDS195PM	1	1	1	1	PGH185-13	1	3	1	3	1	AGE185	PSA3020	PSA3052	PSA3165	1
EDS3091	1	1	EDS195PM	1	1	1	1								PSA3320	PSA3352		1
EDS3091PG	1	1	EDS195PM	1	1	1	1	PGH183	1	3	1	3	1		PSA3320	PSA3352		1
EDS3091PG-13	1	1	EDS195PM	1	1	1	1	PGH183-13	1	3	1	3	1		PSA3320	PSA3352		1
EDS3092PG	1	1	EDS195PM	1	1	1	1	PGH183 PGH185	2	6	2	6	2		PSA3320 PSA3020	PSA3352 PSA3052		1
EDS3096PG	1	1	EDS195PM	1	1	1	1	PGH186	1	3	1	3	1	AGE185	PSA3020	PSA3052	PSA3165	1
EDS3096PG-13	1	1	EDS195PM	1	1	1	1	PGH186-13	1	3	1	3	1	AGE185	PSA3020	PSA3052	PSA3165	1

Coupling device AGE185

AC/DC



Typical applications

- Monitoring of AC IT systems of up to 790 V and DC IT systems of up to 960 V

Further information

For further information refer to our product range on www.bender.de.

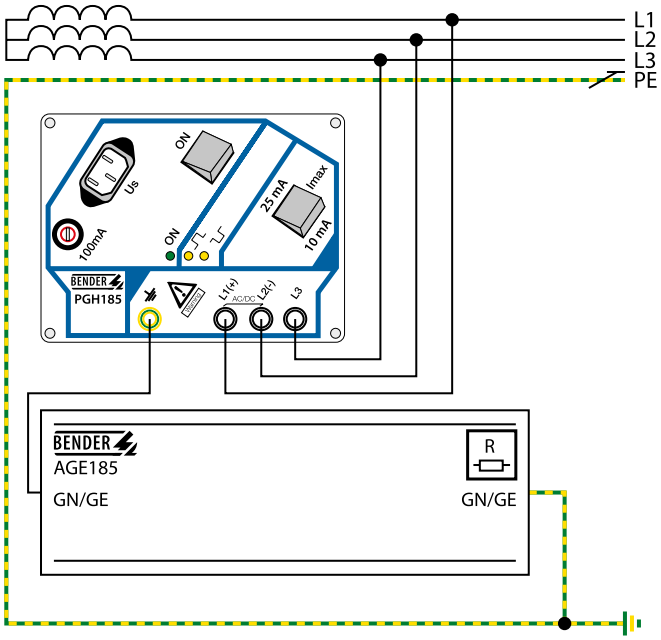
Approvals

CE

Ordering information

Nominal system voltage U_S		Type	Art. No.
AC, 3(N)AC	DC		
500…790 V	400…960 V	AGE185	B980305

Wiring diagram



Locating current injector PGH185 and coupling device AGE185

Insulation monitoring devices
ISOMETER®

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Equipment for insulation fault location
ISOSCAN®

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Residual current monitoring systems
LINETRAXX®



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Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

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Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

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System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation

317

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

415

427

Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service

449

Device overview residual current monitors LINETRAXX®

	LINETRAXX® RCM420	LINETRAXX® RCMA420	LINETRAXX® RCMA423	LINETRAXX® RCMS460/RCMS490	LINETRAXX® RCMS150
Page	180	183	186	189	196
Special applications					Monitoring of final circuits, DGUV Regulation 3 (German Social Accident Insurance)
Type of distribution system – TN/TT	■	■	■	■	■
Type of distribution system – IT					
Residual currents – ⏦	■	■	■	■	■
Residual currents – ⎓		■	■	■	■
Rated frequency range	42…2000 Hz	0…2000 Hz	0…2000 Hz	0…2000 Hz	0…1000 Hz
Number of measuring channels	1	1	1	12 (per device) 1080 (per system)	6 virtual 12
Response value – $I_{\Delta n1}$	50…100 % x $I_{\Delta n2}$	50…100 % x $I_{\Delta n2}$	50…100 % x $I_{\Delta n2}$	10…100 % x $I_{\Delta n2}$ min. 5 mA	50…100 % x $I_{\Delta n2}$
Response value – $I_{\Delta n2}$	10 mA…10 A	10…500 mA	30 mA…3 A	10 mA…10 A (Type AB) 6 mA…20 A (Type A)	3…300 mA (Type B) 3…300 mA (DC)
Response delay t_{on}	0…10 s	0…10 s	0…10 s	0…99 s	0…600 s
Start-up delay t	0…10 s	0…10 s	0…10 s	0…99 s	0.5…600 s
Delay on release t_{off}	0…300 s	0…99 s	0…99 s	0…999 s	0…600 s
Operating principle, alarm relays	N/C operation or N/O operation	N/C operation or N/O operation	N/C operation or N/O operation	N/C operation or N/O operation	–
Installation – DIN rail	■	■	■	■	■
Installation – Screw mounting	■	■	■	■	■

	Type	S.	Suitable system components				
Measuring current transformers	CTAC…	336	■			■	
	CTUB100	339		■	■	■	
	WR…S(P)	343	■			■	
	WS…	345	■			■	
	WF…	349	■			■	
RS-485 repeater	DI-1DL	372				■	■
Power supply units	STEP-PS	364				■	■



					
LINETRAXX® RCMB42…	LINETRAXX® MRCDB300 series	LINETRAXX® RCMB300 series	RCMB131-01	RCMB131-02	RCMB132-01
199	202	206	210	213	216
Fault current monitoring of electric vehicle AC charging stations	MRCD application				
■	■	■	■	■	■
■	■	■	■	■	■
■	■	■	■	■	■
0…2000 Hz	DC…100 kHz	DC…100 kHz	DC…2 kHz	DC…2 kHz	DC…2 kHz
1 (RCMB422EC) or 2 (RCMB420EC)					
DC 6 mA	10 mA…10 A	30 mA…3 A	3,5…100 mA (DC)	3,5…100 mA (DC)	3,5…100 mA (DC)
RMS 30 mA			3,5…100 mA (r.m.s.)		3,5…100 mA (r.m.s.)
	0 s…60 min	50 ms…60 min			
	0 s…60 min	0 s…60 min			
2 s (after reset)	0 s…60 min	0 s…60 min			
N/C operation	N/C operation or N/O operation	N/C operation or N/O operation			
■			■	■	■
■	■	■	■	■	■

Suitable system components					
	■	■			

LINETRAXX® RCM420

Residual current monitor for AC current monitoring in TN and TT systems



Typical applications

- Residual current monitoring in earthed 2, 3 or 4-conductor systems
- Current monitoring of, in the normal case, de-energised single conductors
- Socket-outlet circuits for devices which are operated unattended for a long time and which may not fail
- Alarm systems, safety devices
- Air conditioning systems, EDP systems
- Cooling equipment with valuable frozen goods
- Canteen kitchens
- Monitoring of earthed power supplies for stray currents
- Impact on N conductors
- Trace heating systems

Approvals

Device features

- AC and pulsed DC sensitive residual current monitor Type A according to IEC 62020
- r.m.s. value measurement (AC)
- Two separately adjustable response values
- Frequency range 42…2000 Hz
- Start-up delay, response delay and delay on release
- Restart function
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory behaviour selectable
- Password protection for device setting
- Device self monitoring
- Sealable transparent cover
- Two-module enclosure (36 mm)
- RoHS compliant
- Push-wire terminal (two terminals per connection)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 40…460 Hz	9.6…94 V	RCM420-D-1	B94014001	B74014001
70…300 V, 40…460 Hz	70…300 V	RCM420-D-2	B94014002	B74014002

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Suitable system components

Description	Type of construction	Type	Art. No.	Page
Measuring current transformers	circular	CTAC…	B981100…	336
	rectangular	WR…S(P)	B9117…	343
	split-core	WS…	B980806…	345
	flexible	WF…	B780802…	349

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

RCM420-D-1

Rated insulation voltage	100 V
Rated impulse voltage/pollution degree	2,5 kV/3
Overvoltage category	III

RCM420-D-2

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III

Supply voltage

RCM420-D-1

Supply voltage range U_S	AC 24…60 V/DC 24…78 V
Operating range U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	DC, 42…460 Hz

RCM420-D-2

Supply voltage range U_S	AC/DC 100…250 V
Operating range U_S	AC/DC 70…300 V
Frequency range U_S	42…460 Hz
Protective separation (reinforced insulation) between	(A1, A2) - (k/l, T/R) - (11, 12, 14) - (21, 22, 24)
Voltage test according to IEC 61010-1	2.21 kV
Power consumption	≤ 4 VA

Measuring circuit

External measuring current transformer type	series CTAC…, WR…S(P), WS…
Load	68 Ω
Rated insulation voltage (measuring current transformer)	800 V
Operating characteristic acc. to IEC 62020	type A
Frequency range	42…2000 Hz
Measuring range	3 mA…16 A
Relative uncertainty	0…-20 %
Operating uncertainty	0…30 %

Response values

Rated residual operating current $I_{\Delta n1}$ (prewarning, AL1)	50…100 % x $I_{\Delta n2}$, (50 %)*
Rated residual operating current $I_{\Delta n2}$ (Alarm, AL2)	10 mA…10 A (30 mA)*
Hysteresis	10…25 % (15%)*

Specified time

Starting delay t	0…10 s (0.5 s)*
Response delay t_{on2} (Alarm)	0…10 s (0 s)*
Response delay t_{on1} (prewarning)	0…10 s (1 s)*
Delay on release t_{off}	0…300 s (1 s)*
Operating time t_{ae} at $I_{\Delta n} = 1$ x $I_{\Delta n1/2}$	≤ 180 ms
Operating time t_{ae} at $I_{\Delta n} = 5$ x $I_{\Delta n1/2}$	≤ 30 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms
Number of reload cycles	0…100 (0)*

Cable lengths for measuring current transformers

Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	0…10 m
Shielded cable ≥ 0.75 mm²	0…40 m
Recommended cable (shielded, shield on one side connected to terminal l of the RCM420, not connected to earth)	J-Y(St)Y min. 2x0.8
Connection	screw terminals

Displays, memory

Display range, measured value	3 mA…16 A
Error of indication	± 15 %/± 2 digit
Measured-value memory for alarm value	data record measured values
Password	off/0…999 (OFF)*
Fault memory alarm relay	on/off (off)*

Inputs/outputs

Cable length for external test/reset button	0…10 m

Switching elements

Number of switching elements	2 x 1 changeover contact
Operating principle	N/C operation/ N/O operation (N/O operation)*
Electrical service life under rated operating conditions	10000 switching operations

Contact data acc. to IEC 60947-5-1:

Utilization category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational voltage UL	200 V	200 V	24 V	110 V	200 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact load	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 62020
Operating temperature	-25…+55 °C

Classification of climatic conditions IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transportation (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transportation (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

For UL application

use 60/70°C copper conductors only

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

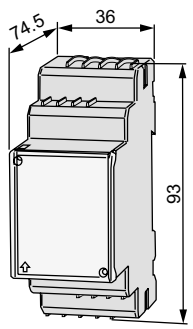
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

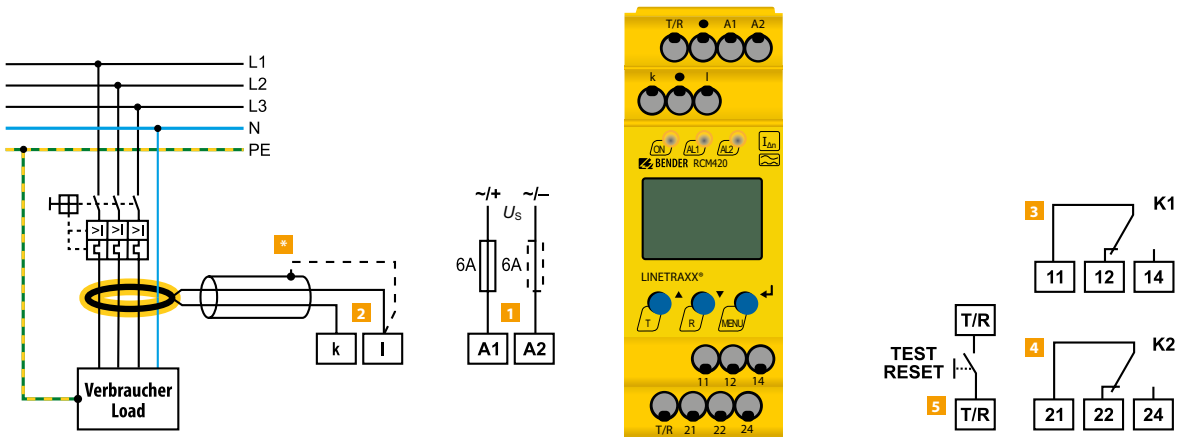
Other

Operating mode	continuous operation
Position of normal use	any
Protection class, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529	IP20
Enclosure material	polycarbonate
Flammability class	UL94V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00057
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)





1	A1, A2	Supply voltage U_S see ordering information, 6 A fuse recommended
2	k, l	Connection of the external measuring current transformer
3	11, 12, 14	Alarm relay "K1": configurable for alarm $I_{\Delta n1}$/$I_{\Delta n2}$/TEST/ERROR
4	21, 22, 24	Alarm relay "K2": configurable for alarm $I_{\Delta n1}$/$I_{\Delta n2}$/TEST/ERROR
5	T/R	Combined test and reset button "T/R" short-time pressing (< 1.5 s) = RESET long-time pressing (> 1.5 s) = TEST
*	when a shielded cable is used	

Do not route the PE conductor through the measuring current transformer!

LINETRAXX® RCMA420

Residual current monitor for monitoring AC, DC and pulsed DC currents in TN and TT systems



Typical applications

- AC/DC sensitive residual current monitoring in earthed two, three or four conductor systems (TN and TT systems)
- Monitoring of variable-speed drives, UPS systems, construction site equipment, printing machines, battery systems, laboratory equipment, wood working machines, MF welding systems, furniture industry, medical electrical equipment, etc.
- AC/DC sensitive current monitoring of, in the normal case, de-energised single conductors (e.g. N and PE conductors)

Approvals

Device features

- AC/DC sensitive residual current monitor Type B acc. to IEC 62020 and IEC/TR 60755
- r.m.s. value measurement (AC+DC)
- Two separately adjustable response values 10…500 mA
- Frequency range 0…2000 Hz
- Start-up delay, response delay and delay on release
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory selectable
- Continuous self monitoring
- Multi-functional LC display
- Password protection for device settings
- Sealable transparent cover
- Two-module enclosure (36 mm)
- RoHS compliant
- Push-wire terminal (two terminals per connection)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage[1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 42…460 Hz	9.6…94 V	RCMA420-D-1	B94043001	B74043001
70…300 V, 42…460 Hz	70…300 V	RCMA420-D-2	B94043002	B74043002

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Suitable system components

Description	Type of construction	Type	Art. No.	Page
Measuring current transformers	circular	CTUB100	B781200…	339
Connecting cables for Measunging current transformers	–	CTX…	B9811008…	339

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

RCMA420-D-1:

Rated insulation voltage	100 V
Rated impulse voltage/pollution degree	2,5 kV/3
Overvoltage category	III

RCMA420-D-2:

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III

Supply voltage

RCMA420-D-1:

Supply voltage range U_S	AC 24…60 V/DC 24…78 V
Operating range U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	DC, 42…460 Hz

RCMA420-D-2:

Supply voltage range U_S	AC/DC 100…250 V
Operating range U_S	AC/DC 70…300 V
Frequency range U_S	42…460 Hz
Protective separation (reinforced insulation) between	(A1, A2) - (k/l, T/R) - (11, 12, 14) - (21, 22, 24)
Voltage test according to IEC 61010-1	2.21 kV
Power consumption	≤ 6,5 VA

Measuring circuit

External measuring current transformer	CTUB10x-CTBC20(P), CTUB10x-CTBC35(P), CTUB10x-CTBC60(P)
Rated insulation voltage (measuring current transformer)	800 V
Operating characteristic acc. to IEC 62020 and IEC/TR 60755	Type B
Frequency range	0…2000 Hz
Measuring range AC	0…1.5 A
Measuring range DC	0…600 mA
Relative uncertainty for f ≤ 2 Hz or ≥ 16 Hz	0…-35 %
Relative uncertainty for f >2…<16 Hz	-35…+100 %
Operating uncertainty	0…35%

Response values

Rated residual operating current $I_{\Delta n1}$ (prewarning, AL1)	50…100 % x $I_{\Delta n2}$, (50 %)*
Rated residual operating current $I_{\Delta n2}$ (Alarm, AL2)	10…500 mA (30 mA)*
Hysteresis	10…25 % (15%)*

Specified times

Starting delay t	0…10 s (0.5 s)*
Response delay t_{on2} (alarm)	0…10 s (0 s)*
Response delay t_{on1} (prewarning)	0…10 s (1 s)*
Delay on release t_{off}	0…99 s (1 s)*
Operating time t_{ae} at $I_{\Delta n}$ = 1 x $I_{\Delta n1/2}$	≤ 180 ms
Operating time t_{ae} at $I_{\Delta n}$ = 5 x $I_{\Delta n1/2}$	≤ 30 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms

Displays, memory

Display range, measured value AC	0…1.5 A
Display range, measured value DC	0…600 mA
Error of indication	±17.5 %/± 2 digit
Measured-value memory for alarm value	data record measured values
Password	off/0…999 (off)*
Fault memory alarm relay	on/off (on)*

Inputs/outputs

Cable length for external test/reset button	0…10 m

Cable lengths for measuring current transformers

Connection CTX…	1 m/2.5 m/5 m/10 m
or alternatively: single wire 6 x 0.75 mm²	0…10 m

Switching elements

Number of switching elements	2 x 1 changeover contact
Operating principle	N/C operation/N/O operation (N/C operation)*
Electrical service life under rated operating conditions	10000 switching operations

Contact data acc. to IEC 60947-5-1

Utilization category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational voltage UL	200 V	200 V	24 V	110 V	200 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact load	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 62020
Operating temperature	-25…+55 °C

Classification of climatic conditions IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transportation (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transportation (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

For UL applications:
use 60°C/70°C copper conductors only

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

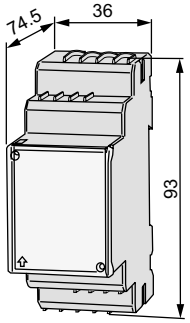
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

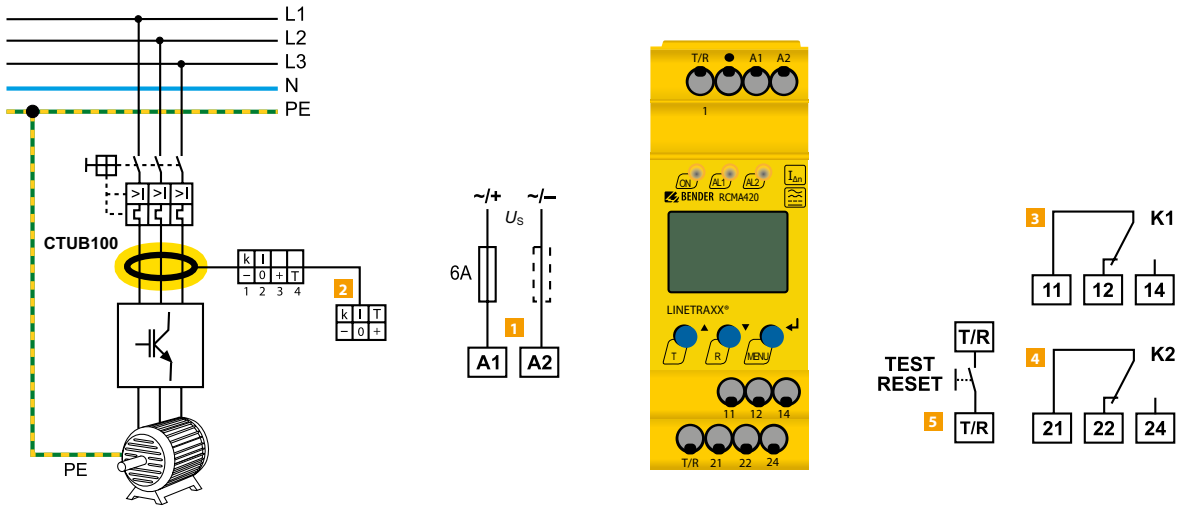
Operating mode	continuous operation
Position of normal use	display-oriented
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94V-0
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Documentation number	D00059
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1 A1, A2 Supply voltage U_S see ordering information, 6 A fuse recommended

2 Connector for the external CTUB10x-CTBC20…CTUB10x-CTBC60 series measuring current transformer

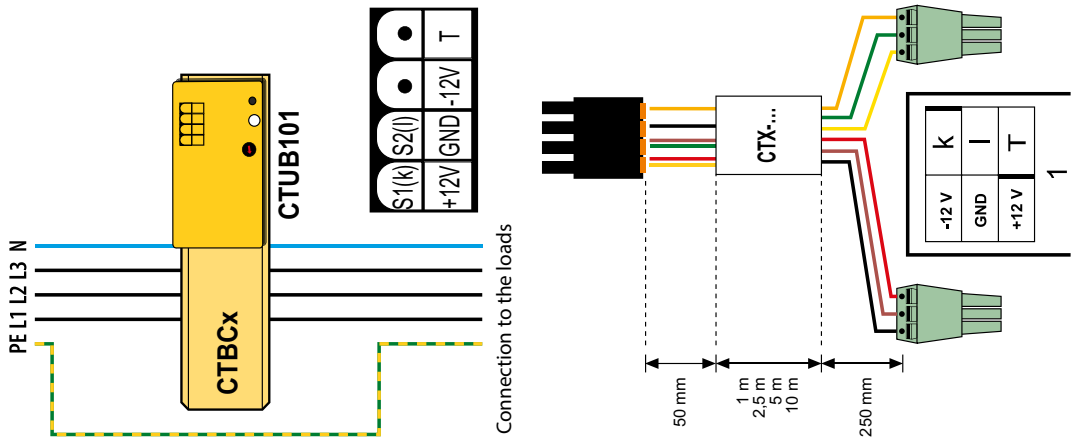
3 11, 12, 14 Alarm relay "K1": $I_{\Delta n1}$ (prewarning)

4 21, 22, 24 Alarm relay "K2": alarm $I_{\Delta n2}$ (alarm)

5 T/R Combined test and reset button "T/R"
short-time pressing (< 1.5 s) = RESET
long-time pressing (> 1.5 s) = TEST

Do not route the PE conductor through the measuring current transformer!

Connection of measuring current transformers



Connection to the RCMA423 residual current monitor using the CTX-… connecting cable.
Colour coding for CTX…: k = yellow, I = green, -12 V = black, GND = brown, +12 V = red, Test (T) = orange

LINETRAXX® RCMA423

Residual current monitor for monitoring AC, DC and pulsed DC currents in TN-and TT systems



Typical applications

- AC/DC sensitive residual current monitoring in earthed two, three or four conductor systems (TN and TT systems)
- Monitoring of variable-speed drives, UPS systems, construction site equipment, printing machines, battery systems, laboratory equipment, wood working machines, MF welding systems, furniture industry, medical electrical equipment, etc.
- AC/DC sensitive current monitoring of, in the normal case, de-energised single conductors (e.g. N conductors)

Approvals

Device features

- AC/DC sensitive residual current monitor Type B acc. to IEC 62020 and IEC/TR 60755
- r.m.s. value measurement (AC+DC)
- Two separately adjustable response values 30…3 A
- Frequency range 0…2000 Hz
- Start-up delay, response delay and delay on release
- Digital measured value display via LC display
- Measured value memory for operating value
- CT connection monitoring
- LEDs: Power On, Alarm 1, Alarm 2
- Internal/external test/reset button
- Two separate alarm relays (one changeover contact each)
- N/O or N/C operation and fault memory selectable
- Continuous self monitoring
- Multi-functional LC display
- Password protection for device settings
- Sealable transparent cover
- Push-wire terminal (two terminals per connection)
- Two-module enclosure (36 mm)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage[1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 42…460 Hz	9.6…94 V	RCMA423-D-1	B94043023	B74043023
70…300 V, 42…460 Hz	70…300 V	RCMA423-D-2	B94043025	B74043025

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Suitable system components

Description	Type of construction	Type	Art. No.	Page
Measuring current transformers	circular	CTUB100	B781200…	339
Connecting cables for Measunging current transformers	–	CTX…	B9811008…	339

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

RCMA423-D-1:

Rated insulation voltage	100 V
Rated impulse voltage/pollution degree	2.5 kV/3
Overvoltage category	III

RCMA423-D-2:

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III

Supply voltage

RCMA423-D-1:

Supply voltage range U_S	AC 24…60 V/DC 24…78 V
Operating range U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	DC, 42…460 Hz

RCMA423-D-2:

Supply voltage range U_S	AC/DC 100…250 V
Operating range U_S	AC/DC 70…300 V
Frequency range U_S	42…460 Hz
Protective separation (reinforced insulation) between	(A1, A2) -(k/l, T/R) -(11, 12, 14) -(21, 22, 24)
Voltage test according to IEC 61010-1	2.21 kV
Power consumption	≤ 6.5 VA

Measuring circuit

External measuring current transformer	CTUB100 series
Rated insulation voltage (measuring current transformer)	800 V
Operating characteristic acc. to IEC 62020 and IEC/TR 60755	Type B
Rated frequency	0…2000 Hz
Relative uncertainty for f ≤ 2 Hz or ≥ 16 Hz	0…-35 %
Relative uncertainty for f >2 Hz…<16 Hz	-35 %…+100 %
Operating uncertainty	0…35 %

Response values

Rated residual operating current $I_{\Delta n1}$ (prewarning, AL1)	50…100 % of $I_{\Delta n2}$ (50 %)*
Rated residual operating current $I_{\Delta n2}$ (alarm, AL2)	30 mA…3 A (30 mA)*
Hysteresis	10…25 % (15%)*

Specified time

Start-up delay t	0…10 s (0.5 s)*
Response delay t_{on1} (prewarning)	0…10 s (1 s)*
Response delay t_{on2} (alarm)	0…10 s (0 s)*
Delay on release t_{off}	0…99 s (1 s)*
Operating time t_{ae} bei $I_{\Delta n}$ = 1 x $I_{\Delta n1/2}$	≤ 180 ms
Operating time t_{ae} bei $I_{\Delta n}$ = 5 x $I_{\Delta n1/2}$	≤ 30 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms

Displays, memory

Display range, measured value AC/DC	0…6 A
Error of indication	±17.5 %/±2 digit
Measured-value memory for alarm value	data record measured values
Password	off/0…999 (off)*
Fault memory alarm relay	on/off (on)*

Inputs/outputs

Cable length for external test/reset button	0…10 m

Cable lengths for measuring current transformers

Connection CTX…	1 m/2.5 m/5 m/10 m
or alternatively: single wire 6 x 0.75 mm²	0…10 m

Switching elements

Number of switching elements	2 x 1 changeover contact
Operating principle	N/C operation/N/O operation (N/C operation)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational voltage UL	200 V	200 V	24 V	110 V	200 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 62020
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

For UL application

use 60/70°C copper conductors only

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

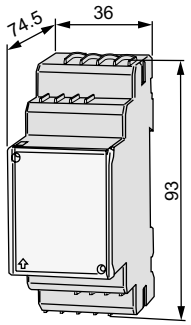
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

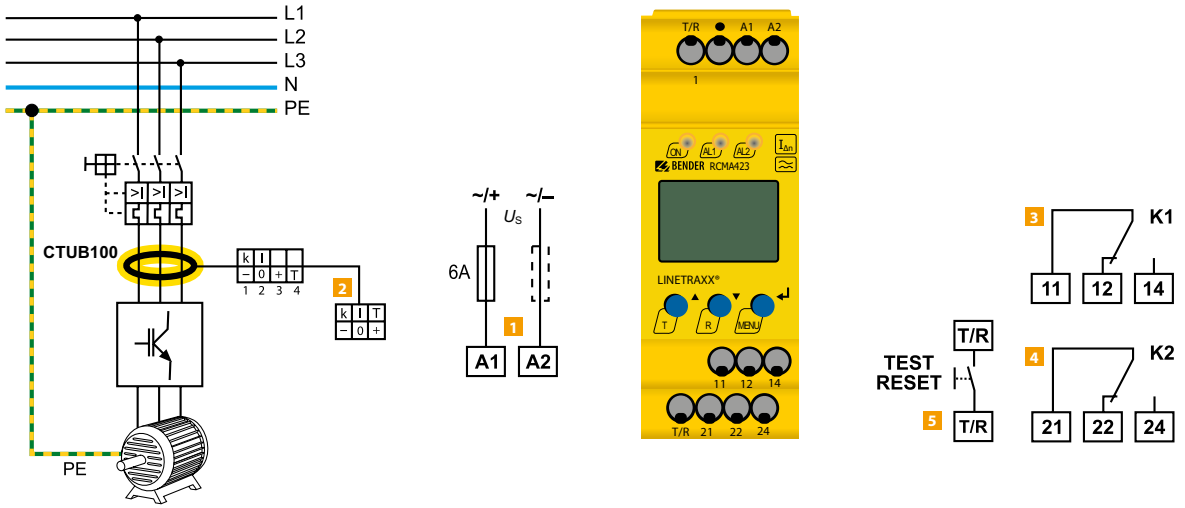
Operating mode	continuous operation
Position of normal use	display-oriented
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00063
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1 Supply voltage U_S see ordering information, 6 A fuse recommended

2 Connector for the external W20AB…W210AB series measuring current transformer

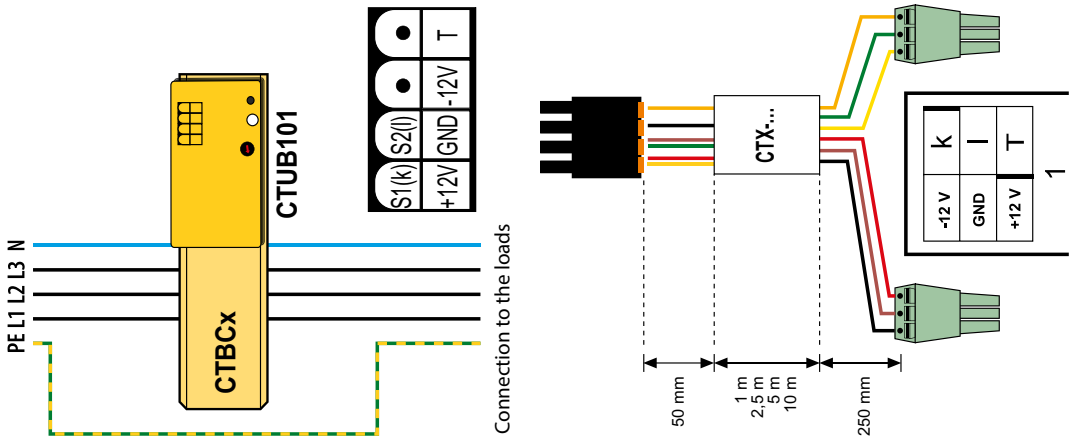
3 Alarm relay "K1": $I_{\Delta n1}$ (prewarning)

4 Alarm relay "K2": alarm $I_{\Delta n2}$ (alarm)

5 Combined test and reset button "T/R"
short-time pressing (< 1.5 s) = RESET
long-time pressing (> 1.5 s) = TEST

Do not route the PE conductor through the measuring current transformer!

Connection of measuring current transformers



Connection to the RCMA423 residual current monitor using the CTX-… connecting cable.
Colour coding for CTX…: k = yellow, l = green, -12 V = black, GND = brown, +12 V = red, Test (T) = orange

LINETRAXX® RCMS460-D/-L – RCMS490-D/-L

Multi-channel AC, pulsed DC and AC/DC sensitive residual current monitors for earthed AC, DC and AC/DC systems (TN and TT systems)



Typical applications

- Measuring and evaluating residual, fault and rated currents of loads and installations in the frequency range of 0…2000 Hz (W…AB(P) series measuring current transformers), 42…2000 Hz (W, WR, WS WF series measuring current transformers)
- Monitoring of currents regarded as fire hazards in flammable atmospheres
- EMC monitoring of TN-S systems for "stray currents" and additional N-PE connections
- Monitoring of N conductors for overload caused by harmonics
- Monitoring of PE and equipotential bonding conductors to ensure they are free of current
- Residual current monitoring of stationary electrical equipment and systems to determine test intervals which meet practical requirements in compliance with the DGUV regulation 3 (German Social Accident Insurance).
- Personnel and fire protection due to rapid disconnection
- Monitoring of digital inputs

Approvals

Device features

- Optional AC, pulsed DC or AC/DC sensitive measurement by selecting the respective measuring current transformer for each channel
- True r.m.s. value measurement
- 12 measuring channels per device for residual current measurement or digital input
- Up to 90 RCMS… monitors, up to1080 measuring channels in the system
- Fast parallel scanning for all channels
- Response ranges:
  10 mA…10 A (0…2000 Hz), 6 mA…20 A (42…2000 Hz), 100 mA…125 A (42…2000 Hz) RCMS…-D4
- Preset function
- Adjustable time delays
- The frequency response characteristics can be set for the protection of persons, fire and plant protection
- History memory with date and time stamp for 300 data records
- Data logger for 300 data records/channel
- Analysis of the harmonics, DC, THF
- Two alarm relays with one changeover contact each
- Device version RCMS490 with one alarm contact per channel
- N/O or N/C operation and fault memory selectable
- Connection external test/reset button
- Backlit graphical display and alarm LEDs
- Data exchange via BMS bus
- Password protection for device setting
- Continuous CT connection monitoring
- RoHS compliant

Standards

The LINETRAXX® RCMS460/490 series complies with the requirements of the device standards:
- DIN EN 62020 (VDE 0663)
- IEC 62020.

Further information

For further information refer to our product range on www.bender.de.

Ordering information RCMS460/490-D

Differential measurement method		Common alarm relay for all channels	Alarm relay per channel	4 channels for load current measurement	Supply voltage [1] U_S		Type	Art. No.
pulsed DC sensitive	AC/DC sensitive				AC	DC		
6 mA…20 A	10 mA…10 A	2 x 1 changeover contact	–	–	16…72 V, 50/60 Hz	16…94 V	RCMS460-D-1	B94053001
					70…276 V, 50/60 Hz[2]	70…276 V[2]	RCMS460-D-2	B94053002
				100 mA…125 A	16…72 V, 50/60 Hz	16…94 V	RCMS460-D4-1	B94053009
					70…276 V, 50/60 Hz[2]	70…276 V[2]	RCMS460-D4-2	B94053010
			12 x 1 N/O contact	–	16…72 V, 50/60 Hz	16…94 V	RCMS490-D-1	B94053005
					70…276 V, 50/60 Hz[2]	70…276 V[2]	RCMS490-D-2	B94053006
				100 mA…125 A	16…72 V, 50/60 Hz	16…94 V	RCMS490-D4-1	B94053011
					70…276 V, 50/60 Hz[2]	70…276 V[2]	RCMS490-D4-2	B94053012

[1] Absolute values

[2] For UL application: U_S max = DC 250 V; AC 250 V, 50/60 Hz

Ordering information RCMS460/490-L

Current measurement		Common alarm relay for all channels	Alarm relay per channel	Supply voltage [1] U_S		Type	Art. No.
pulsed DC sensitive	AC/DC sensitive			AC	DC		
6 mA…20 A	10 mA…10 A	2 x 1 changeover contact	–	16…72 V, 50/60 Hz	16…94 V	RCMS460-L-1	B94053003
				70…276 V, 50/60 Hz[2]	70…276 V[2]	RCMS460-L-2	B94053004
		2 x 1 changeover contact	12 x 1 N/O contact	16…72 V, 50/60 Hz	16…94 V	RCMS490-L-1	B94053007
				70…276 V, 50/60 Hz[2]	70…276 V[2]	RCMS490-L-2	B94053008

[1] Absolute values

[2] For UL application: U_S max = DC 250 V; AC 250 V, 50/60 Hz

RCMS460-L4 and RCMS490-L4 on request

Accessories

Description	Art. No.
XM460 mounting frame, 144 x 72 mm	B990995
XM490 mounting frame, 198 x 72 mm	B990996

Suitable system components

Description	Version	Type of construction	Type	Art. No.	Page
Measuring current transformers	pulsed DC sensitive	circular	CTAC…	B981100…	336
		rectangular	WR…S(P)	B9117…	343
		split-core	WS…	B980806…	345
		flexible	WF…	B780802…	349
	AC/DC sensitive	circular	CTUB100	B781200…	339
Connecting cables for Measunging current transformers CTUB100 series	–	–	CTXS…	B9811009…	339
Condition Monitor	with integrated gateway: Bender system/Ethernet	–	COM465IP	B950610…	384
	BMS bus – Modbus RTU	–	COM462RTU	B95061022	381
	for the connection of Bender BMS devices and universal measuring devices to TCP/IP networks	–	CP700	B95061030	396
RS-485 repeater	–	–	DI-1DL	B95012047	372
Power supply unit	for supplying up to six CTUB100 series measuring current transformers	–	STEP-PS	B940531…	364
	for DI-1	–	AN471	B924189	–
Alarm indicator and test combination	acc. DIN VDE 0100-710	–	MK800	B951001…	402
			MK2430	B951000…	406

Overview of device types

Device features/distinguishing features			RCMS460-D…	RCMS460-L	RCMS490 -D…	RCMS490-L…
	Parameter setting function		■	–	■	–
	Master/Slave		■	■	■	■
	Address range		1…90	1…90	1…90	1…90
Measuring circuit	Measuring channels per device		12	12	12	12
	W…, WR…S(P), WS…, W…AB(P), W…F series measuring current transformers		■	■	■	■
	CT monitoring		■	■	■	■
	Rated residual operating current $I_{\Delta n2}$ (Alarm)	AC/DC sensitive 0…2000 Hz (Type B)	10 mA…10 A	10 mA…10 A	10 mA…10 A	10 mA…10 A
		pulsed DC sensitive 42…2000 Hz (Type A)	6 mA…20 A	6 mA…20 A	6 mA…20 A	6 mA…20 A
		pulsed DC sensitive 42…2000 Hz (Type A) for the channels 9…12 (RCMS4x0-D4/-L4)	100 mA…125 A	100 mA…125 A	100 mA…125 A	100 mA…125 A
	Rated residual operating current $I_{\Delta n1}$ (prewarning)		10…100 %, min. 5 mA	10…100 %, min. 5 mA	10…100 %, min. 5 mA	10…100 %, min. 5 mA
	Function selectable per channel off, <, >, I/O		■	■	■	■
	Cut-off frequency adjustable for personnel, plant and fire protection		■	*	■	*
	Preset function for $I_{\Delta n2}$ and I/O		■	■	■	■
	Hysteresis		2…40 %	2…40 %	2…40 %	2…40 %
	Factor for additional CT		■	■	■	■
Switching elements	Common alarm relay for all channels		2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact	2 x 1 changeover contact
	Alarm relay per channel		–	–	12 x 1 N/O contact	12 x 1 N/O contact
Time response	Start-up delay 0…99 s		■	■	■	■
	Response delay tv, adjustable 0…999 s		■	■	■	■
	Operating time at	$I_{\Delta n}$ = 1 x $I_{\Delta n2}$: ≤ 180 ms	■	■	■	■
		$I_{\Delta n}$ = 5 x $I_{\Delta n2}$: ≤ 30ms	■	■	■	■
Displays, memory	Analysis of the harmonics (I_{Δ}, DC, THF)		■	*	■	*
	History memory 300 data records		■	–	■	––
	Data logger for 300 data records/ channel		■	–	■	–
	Internal clock		■	–	■	–
	Password		■	–	■	–
	Language English, German, French, Swedish		■	–	■	–
	Backlit graphics LC display		■	–	■	–
	7-segment display and LED line		–	■	–	■

* only in conjunction with RCMS4xx-D, MK2430 or COM460IP

Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for the versions:

a) RCMS4x0-D1

Supply voltage U_S	DC 24…75 V/AC 24…60 V (AC/DC ±20 %)
Supply voltage frequency	DC, 50/60 Hz
Rated insulation voltage	100 V
Rated impulse voltage/pollution degree	2.5 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between	(A1, A2) - (k1, l…k12, R, T/R, T, A, B)
Voltage test acc. to IEC 61010-1	1.344 kV
Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III
Basic insulation between	(A1, A2), (k1, l…k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), (61,64), (71,74), (81,84), (91,94),(101,104), (111,114), (121,124)
Basic insulation between:	(11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
Voltage test acc. to IEC 61010-1	2.21 kV
Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	6 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between	(C11, C12, C14) - (C21, C22, C24) - (11, 14, 21, 24, 31, 34) - (41, 44, 51, 54, 61, 64) - (71,74) - (81,84) - (91,94) - (101,104) - (111,114) - (121,124)
Voltage test acc. to IEC 61010-1	3.536 kV

b) RCMS4x0-D2

Supply voltage U_S	AC/DC 100…240 V (-20…+15 %)
Supply voltage frequency	DC, 50/60 Hz
Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	6 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between	(A1, A2) - (k1, l…k12, R, T/R, T, A, B), (C11, C12, C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), (61,64), (71,74), (81,84), (91,94),(101,104), (111,114), (121,124)
Protective separation (reinforced insulation) between	(C11, C12, C14) - (C21, C22, C24) - (11, 14, 21, 24, 31, 34) - (41, 44, 51, 54, 61, 64) - (71,74) - (81,84) - (91,94) - (101,104) - (111,114) - (121,124)
Voltage test acc. to IEC 61010-1	3.536 kV
Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III
Basic insulation between:	k1, l…k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24)
Basic insulation between:	(11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
Voltage test acc. to IEC 61010-1	2.21 kV

Measuring circuit

External measuring current transformers	W…, WR…, WS…, WF… series (Type A), W…AB series (Type B)
CT monitoring	on/off (on)*
Rated burden RCMS…-D/-L	68 Ω
Rated burden RCMS…-D4/-L4 (channels 9…12 only)	1 Ω
Rated insulation voltage (measuring current transformer)	800 V
Operating characteristics acc. to IEC/TR 60755	type A and type B depending on measuring current transformer series (type A)*
Rated frequency	0…2000 Hz (Type B) / 42…2000 Hz (type A)
Cut-off frequency	none, IEC, 50 Hz, 60 Hz (none)*
Measuring range RCMS…-D/-L	0…30 A (measuring current transformer type A) 0…20 A (measuring current transformer type B) Crest factor up to 10 A = 4, up to 20 A = 2
Measuring range RCMS…-D4/-L4 (channels 9…12 only)	100 mA…125 A
Rated residual operating current IΔn2 (alarm)	10 mA…10 A (type B) 6 mA…20 A (type A) (100 mA overcurrent)*
Rated residual operating current $I_{\Delta n2}$ (alarm) for RCMS…-D4/-L4 (channels 9…12 only)	100 mA…125 A (16 A overcurrent)*
Rated residual operating current $I_{\Delta n1}$ (prewarning)	10…100 % x $I_{\Delta n2}$ min. 5 mA (50 %)*
Digital input	1: < 100 Ω 0: > 250 Ω
Preset for alarm	I_Δ x factor 1…99 (3)* Offset 0…20 A (30 mA)*
Preset for digital input	0/1 (1)*
Relative uncertainty RCMS…-D/-L	0…-20 %**
Relative uncertainty RCMS…-D4/-L4 (channels 9…12 only)	+10…-20 %**
Hysteresis	2…40% (20 %)*
Factor for additional CT	/1…10; x 1…250 (x 1)*
Number of measuring channels (per device/system)	12/1080

Time response

Start-up delay t (start-up) per device	0…99 s (0 ms)*
Response delay t_{on} per channel	0…999 s (200 ms)*
Delay on release t_{off} per channel	0…999 s (200 ms)*
Operating time t_{ae} at $I_{\Delta n} = 1 \times I_{\Delta n1/2}$	≤ 180 ms
Operating time t_{ae} at $I_{\Delta n} = 5 \times I_{\Delta n1/2}$	≤ 30 ms
Response time t_{an} for residual current measurement	$t_{an} = t_{ae} + t_{on1/2}$
Operating time t_{ae} digital inputs	≤ 3.5 s
Scanning time for all measuring channels (residual current measurement)	≤ 180 ms
Recovery time t_b	500…600 ms

Displays, memory

Measured value display range RCMS…-D / -L	0…30 A (CT Type A) 0…20 A (CT type B)
Display range, measured value RCMS…-D4/-L4 (channels 9…12)	0…125 A (CT type A)
Error of indication	± 10 %
LEDs	ON/ALARM (RCMS…-D…) ON/ALARM / measuring channel 1…12 (RCMS…-L…)
LC display	backlit graphical display (RCMS…-D…)
7-segment display	2 x 7.62 mm (RCMS4…-L)
History memory	300 data records (RCMS…-D…)
Data logger	300 data records per measuring channel (RCMS…-D…)
Password	off / 0…999 (off)*
Language	D, GB, F (GB)*
Fault memory alarm relay	on/off (off)*

Inputs/outputs

Test/reset button	internal/external
Cable length for external test/reset button	0…10 m

Interface

Interface/protocol	RS-485/BMS
Baud rate	9.6 kbit/s
Cable length	0…1200 m
Cable (shielded, shield connected to PE on one side)	recommended: min. J-Y(St)Y min. 2x0.8
For UL application: : Copper lines	at least 60/70 °C
Terminating resistor	120 Ω (0.25 W) connectable via DIP switch
Device address, BMS bus	1…90 (2)*

Cable lengths for W…, WR…, WS…, WF… series measuring current transformers

Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	0…10 m
Shielded cable ≥ 0.5 mm²	0…40 m
Cable (shielded, shield connected to terminal l at one end, must not be earthed)	recommended: J-Y(St)Y min. 2 x 0.8

Cable lengths for W…AB series measuring current transformers

Single wire ≥ 0.75 mm²	0…10 m
Connection	plug-in connector, recommended WXS…

Switching elements

Number	2 x 1 changeover contact (RCMS460) 2 x 1 changeover contact, 12 x 1 N/O contact (RCMS490)				
Operating principle	NC or N/O operation (N/O operation)*				
Electrical endurance under rated operating conditions, number of cycles	10.000				
Contact data acc. to IEC 60947-5-1					
Utilisation category	AC-13	AC-14	DC-1	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current (common alarm relay)	5 A	3 A	1 A	0.2 A	0.1 A
Rated operational current (alarm relay)	2 A	0.5 A	5 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 62020
Operating temperature	-25…+ 55 °C

Climatic class acc. to IEC 60721

Stationary use (IEC 60721-3-3	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Technical data (continued)

Connection	
Connection	screw terminals
Connection properties:	
Rigid/flexible/conductor sizes	0.2…4/0.2…2.5 mm²/AWG 24…12
Multi-conductor connection (2 conductors with the same cross section):	
Rigid/flexible	0.2…1.5/0.2…1.5 mm2
Stripping length	8…9 mm
Tightening torque	0.5…0.6 Nm

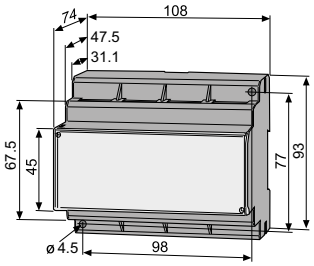
Other	
Operating mode	continuous operation
Mounting	display-oriented
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94V-0
Screw mounting	2 x M4
DIN rail mounting acc. to	IEC 60715
Software version measurement technique	D233 V2.42
Software version display	D256 V2.29
Power consumption	≤10 VA (RCMS460) ≤12 VA (RCMS490)
Documentation number	D00067
Weight	≤ 360 g (RCMS460), ≤ 510 g (RCMS490)

( )* factory setting

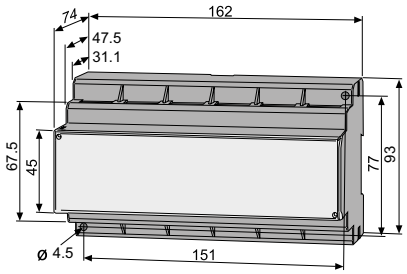
** In the frequency range of < 15 Hz, the relative uncertainty is between -35 % and 100 %.

Dimension diagrams (dimensions in mm)

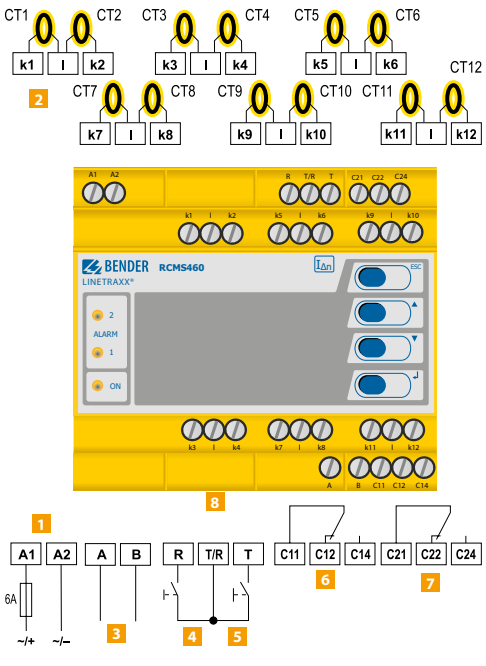
RCMS460-D/-L

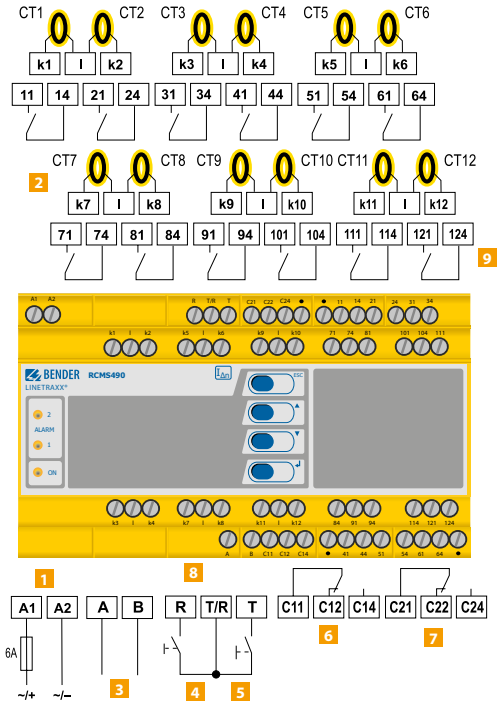


RCMS490-D/-L



Wiring diagrams





1 A1, A2 — Connection of supply voltage U_S (see ordering information): we recommend the use of 6 A fuses.

2 k1, l… k12, l — Connection of measuring current transformers CT1…CT12. Either Type A or Type B measuring current transformers can be selected for each measuring channel. Six CTUB100 series measuring current transformers require one STEP-PS power supply unit. The channels k9…k12 of the device versions RCMS460-D4/-L4 require the connection of Type A measuring current transformers.

3 A, B — BMS bus (RS-485 interface with BMS protocol)

4 R, T/R — External reset button (N/O contact). The external reset buttons of several devices must not be connected to one another.

5 T, T/R — External test button (N/O contact). The external test buttons of several devices must not be connected to one another.

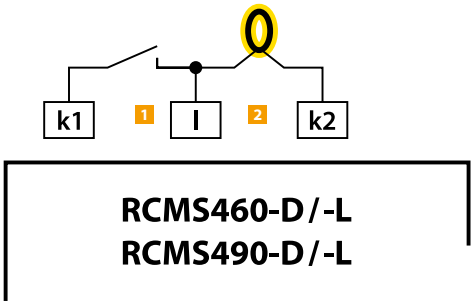
6 C11, C12, C14 — Common alarm relay K1: Alarm 1, common message for alarm, prewarning, device error.

7 C21, C22, C24 — Common alarm relay K2: ALARM 2, common message for alarm, prewarning, device error.

8 $R_{on/off}$ — Activate or deactivate the terminating resistor of the BMS bus (120 Ω).

9 CT — Measuring current transformers (CTAC…, CTUB100, WR…, WS…, WF… series)

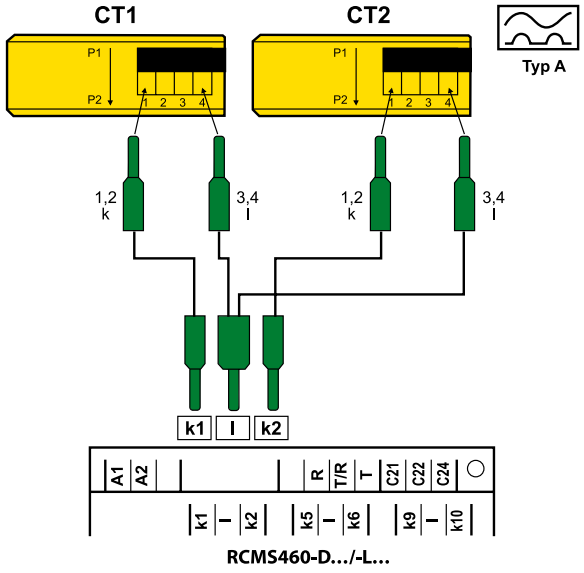
Digital input



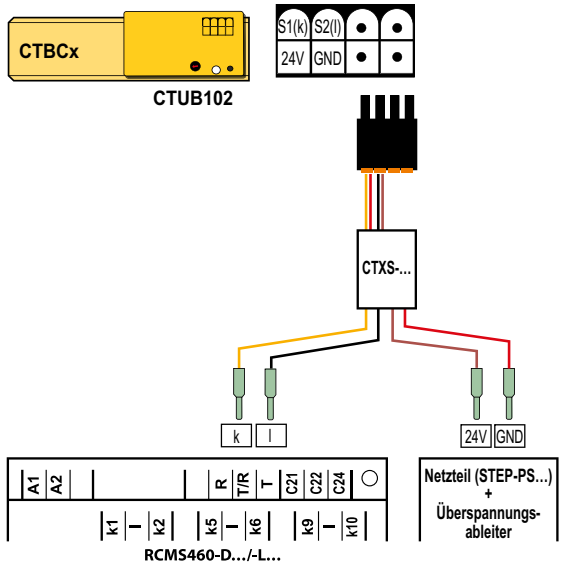
1 Potential-free contact
0 ≙ Resistance between k and I > 250 Ω
I ≙ Resistance between k and I < 100 Ω

2 Measuring current transformers

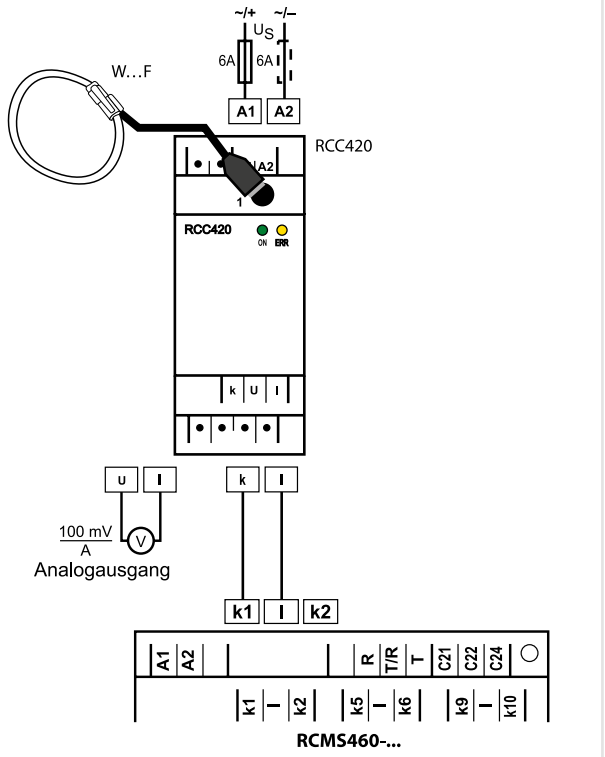
Connection CTAC..., WR...S(P), WS... series measuring current transformers (pulsed current sensitive)



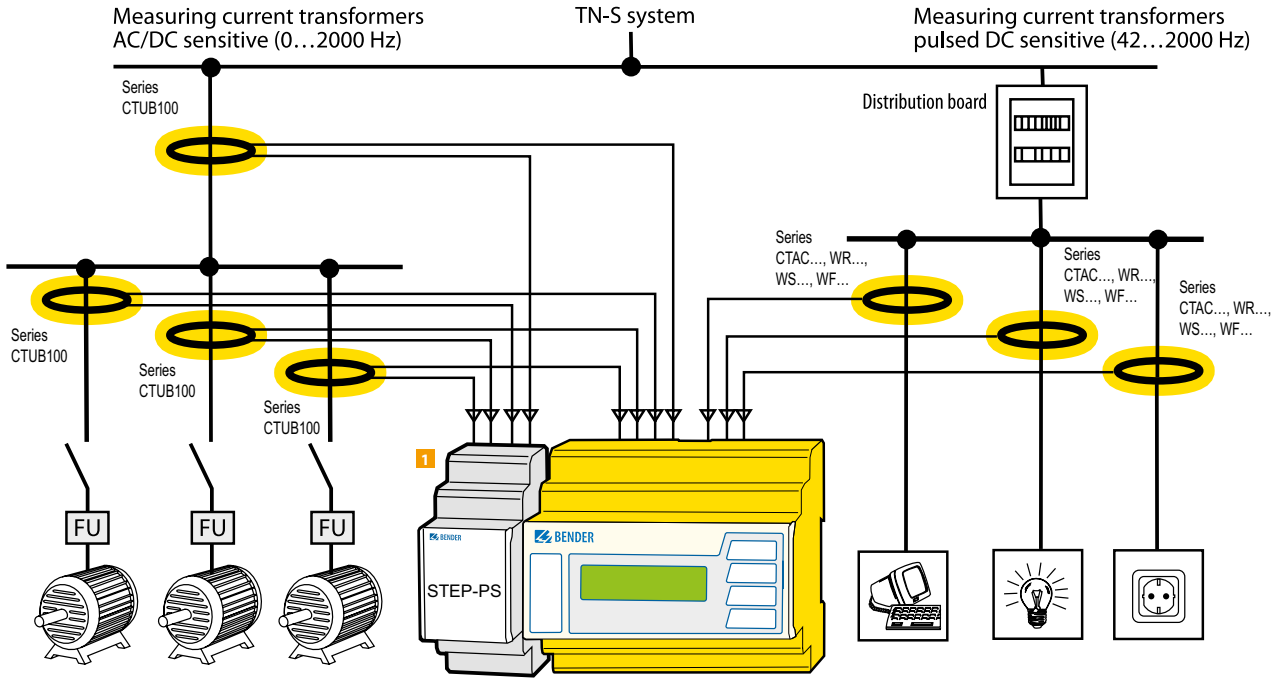
Connection CTUB100 series measuring current transformer (AC/DC current sensitive)



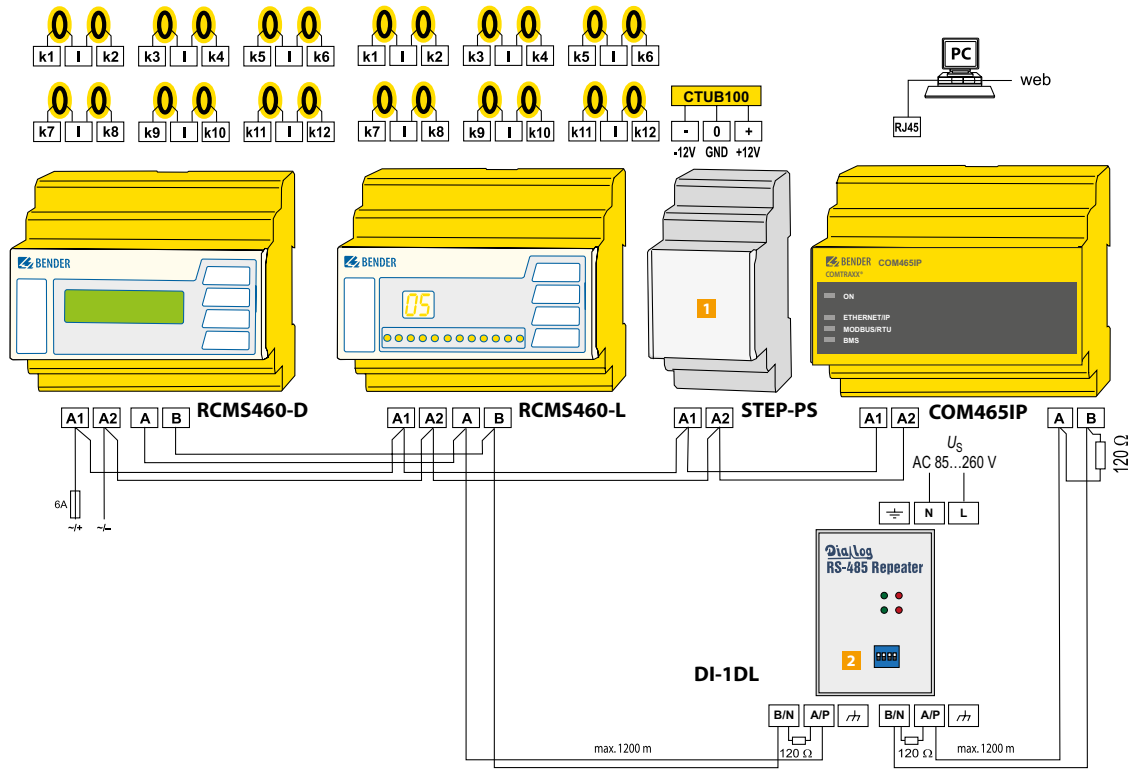
Connection WF... series measuring current transformers



Example for a system design – minimum system consisting of an RCMS460-D and 12 measuring points



Example for a system design of – standard system consisting of an RCMS460-D and RCMS460-L and a protocol converter COM460IP



Note:

1 When AC/DC sensitive measuring current transformers of the CTUB100 series are used, an STEP-PS is required that supplies up to six measuring current transformers of this type.

2 The DI-1DL repeater only is required when the length of the cable exceeds 1200 m or when more than 32 devices are connected to the bus.

LINETRAXX® RCMS150

Residual current monitor type B with integrated measuring current transformers for unearthed AC/DC systems (TN and TT systems)



Typical applications

- Residual current monitoring system for current outlets and final circuits
- Monitoring residual currents of stationary electrical installations and equipment to determine practice-oriented test intervals in accordance with DGUV Regulation 3 (German Social Accident Insurance) and BetrSichV (Occupational Safety and Health Regulation)
- EMC monitoring of TN-S systems for „stray" currents and additional unwanted N-PE bridges
- Monitoring currents regarded as fire hazards in flammable atmospheres
- Monitoring the PE to ensure that there is no current flow

Approvals

CE

UL508 in preparation
CSA in preparation

Device features

- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3)
- AC/DC sensitive residual current monitor type B with 6 channels K1…6 (each channel features 2 measuring channels: 1 x r.m.s., 1 x DC)
- Compatible with RCMS460/490 in a system setup
- Ideal for applications with space limitations
- Easy DIN rail or screw mounting to standard distribution panels
- 2 separately adjustable response values (DC or r.m.s.) per channel
- Continuous self monitoring
- Fully shielded measuring current transformers to avoid external influences due to magnetic fields that may cause disturbances
- Compatible with Bender gateways of type COM460IP, COM465IP, CP700
- Up to 534 measuring channels in the monitored system that can be combined via BMS bus
- RS-485 interface with BMS bus (Modbus RTU on request)
- BMS address range 2…90

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S	Type	Art. No.
DC		
24 V	RCMS150	B 9405 3025

Accessories

Description	Art. No.
Mounting clip for DIN rail mounting	B 9108 0110

Suitable system components

Description	Type	Art. No.	Page
Condition Monitor with integrated gateway	COM465IP[1]	B95061065	384
Condition Monitor	CP700[1]	B95061030	396
RS-485 repeater	DI-1DL	B95012047	372
Power supply	STEP-PS	B940531…	364
Residual current monitor[2]	RCMS460-D	B940530…	189
	RCMS490-D	B940530…	189

[1] from function module C

[2] suitable for measured value and alarm indication only, not suitable for parameter setting

Insulation coordination according to IEC 60664-1

The data are valid for the monitored primary circuit to the output circuit

Output circuit	(+, -, A, B)
Rated insulation voltage	300 V
Overvoltage category	III
Rated impulse withstand voltage monitored circuit/output circuit	4 kV
Range of use	≤ 2000 m AMSL
Rated insulation voltage	250 V
Pollution degree	3
Insulation	BI: Overvoltage category III DI: Overvoltage category II
To achieve double insulation (DI) for overvoltage category III, insulated primary conductors with sufficient rated voltage must be used on the application side.	
Voltage test acc. to IEC 61010-1	AC 2.2 kV

Power supply

Nominal supply voltage U_S with galvanic separation	DC 24 V
Power consumption	< 4 W

Residual current measuring range

Frequency range	0…1000 Hz
Measuring range	±500 mA
Resolution measured value	1 % of the set response value

Response values

Residual current $I_{\Delta N2}$	RMS 0…300 mA (30 mA)*
Residual current $I_{\Delta N2}$	DC 3…300 mA (6 mA)*
Ratio $I_{\Delta N2\ RMS}/I_{\Delta N2\ DC}$	0.2…5
Prewarning $I_{\Delta N1\ RMS/DC}$	50…100 % (50 %)*
Response tolerance $I_{\Delta N2}$	
DC 10…500 Hz	-20…0 %
500 Hz…1 kHz	-20…+100 %
Hysteresis	10…25 % (15 %)

Time response

Start-up delay $t_{start\text{-}up}$	0.5…600 s (0.5 s)*
Response delay	
$t_{on1\ RMS/DC}$	0…600 s (0 s)*
$t_{on2\ RMS/DC}$	0…600 s (0 s)*
Delay on release	
t_{off1} DC	0…600 s (1 s)*
t_{off2} RMS	0…600 s (1 s)*

Indication (LEDs)

ON

green	normal operation indication
green (flashing quickly)	internal device fault or BMS bus address set incorrectly
green (flashing slowly)	indication BMS bus address (after device start/address modification)

ALARM K1…6

yellow	$I_\Delta > I_{\Delta n}$
yellow (flashing)	measured value range exceeded

Interface

Interface/protocol	RS-485/BMS
Connection	terminals A/B
Shielded cable (one end of shield connected to PE)	twisted pair, e.g.: J-Y(St)Y 2x0.8
Cable length	≤ 1200 m
Bus terminating resistor external	120 Ω (0.25 W)
Device address, BMS bus	2…90 (2)*

Environment/EMC

EMC	
immunity	IEC 61000-6-2
emission	IEC 61000-6-3
Operating temperature	-25…+70 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	pluggable push-wire terminal
Connection properties:	
rigid, flexible/conductor sizes AWG	0.2…1.5 mm²/AWG 24…16
Multi-conductor connection (2 conductors with the same cross section):	
rigid	0.2…1.5 mm²
flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with ferrule with plastic sleeve	0.25…0.75 mm²
Stripping length	10 mm

Other

Operating mode	continuous operation
Position of normal use	any
Enclosure material	polycarbonate
Flammability class	UL94 V-0
Screw mounting to standard distribution panels with 12 TE	2 x M6
DIN rail mounting	mounting clip (accessories)
Tightening torque	1.5 Nm
Documentation number	D00259
Weight	170 g

Measuring current transformer

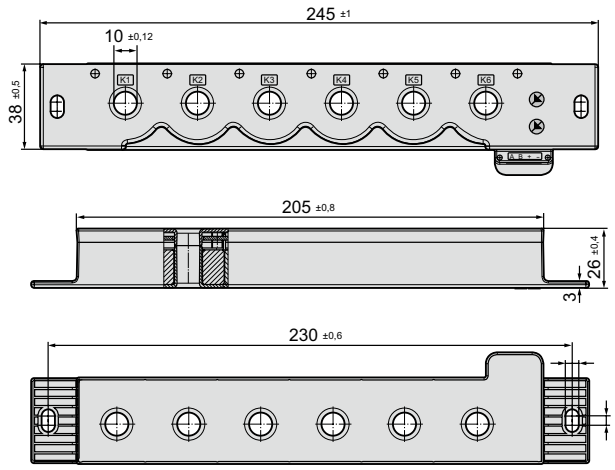
Diameter cable gland	10 mm
Load current	32 A

Bus parameter

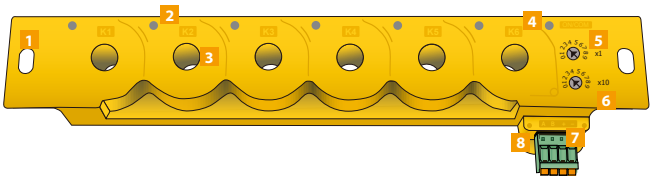
Alarm	threshold value exceeded, system fault
Measured value	measured value, DC component, r.m.s. (resolution 0.1 mA)
Times	response delay, delay on release, start-up delay

( )* = factory settings

Dimension diagrams (dimensions in mm)

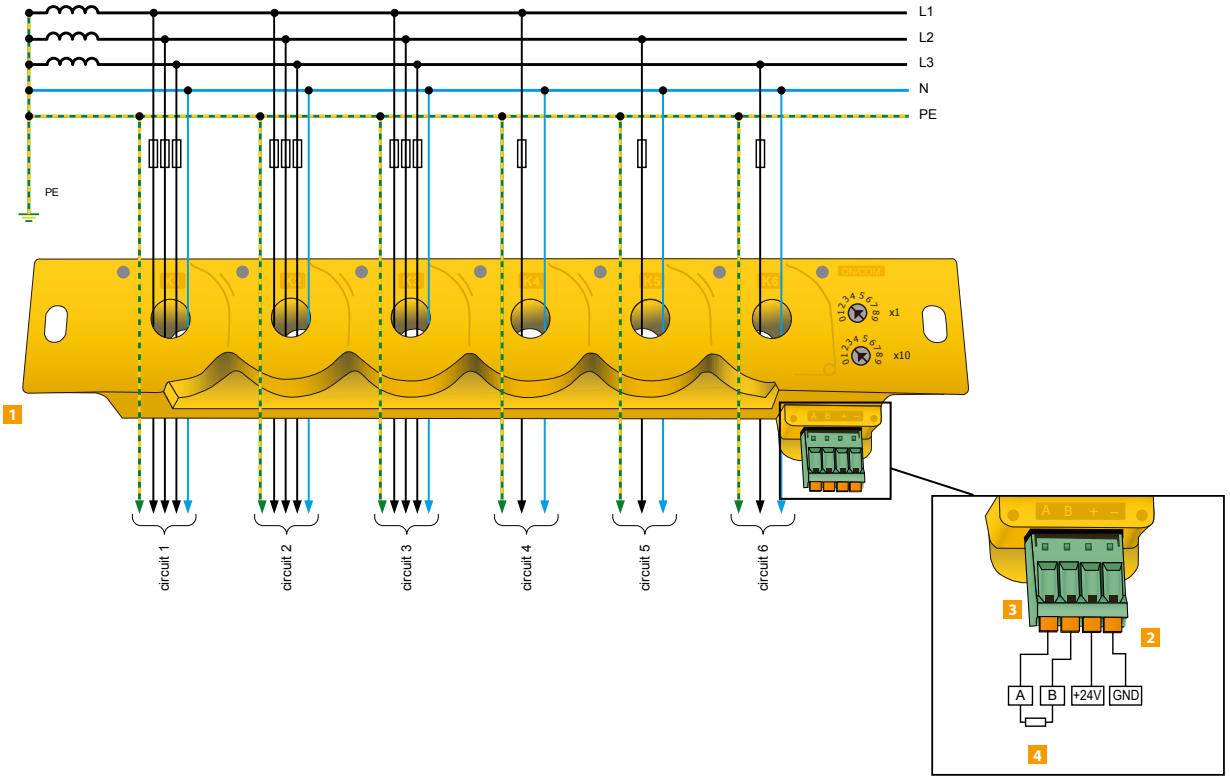


Display and operating controls



1 Slot for screw mounting
2 Alarm LEDs for the measuring channels K1…K6
3 Line feed-through of the measuring current transformers for the measuring channels K1…K6
4 ON LED: Power On LED
5 Determination of ones' position of the BMS address
6 Determination of tens' position of the BMS address
7 Connection to the supply voltage
8 Connection RS-485, BMS bus

Wiring diagram



1 Residual current monitor RCMS150
2 Supply voltage US DC 24 V
3 RS-485 interface with BMS bus (Modbus RTU on request)
4 Terminating resistor (required at the beginning and at the end of the bus)

Note:
Only insulated primary conductors suited for the indicated rated voltages are to be used!

LINETRAXX® RCMB42…

AC/DC sensitive residual current monitor



Typical applications

- Residual current monitoring of AC charging stations for electric vehicles

Approvals

CE

Device features

- DC sensor with additional AC tripping (type B characteristic)
- Response value 2 – AC/DC 30 mA: r.m.s. value measurement
- Response value 1: DC 6 mA
- Frequency range residual current 0…2000 Hz
- Frequency range load current 45…65 Hz
- Monitoring of the connection to the measuring current transformer
- Fully shielded residual current transformer to avoid influences due to external disturbances
- Connection via push-wire terminals
- Variants: One-channel and two-channel residual current measurement

Sandards

The LINETRAXX® RCMB42… series complies with the following device standard:

- IEC 62752

Further information

For further information refer to our product range on www.bender.de.

3

Ordering information

Measuring range		Frequency range	Number of measuring current transformers (Ø 15 mm, 1.5 m cable)	Channels	Supply voltage U_S		Type	Art. No.
DC	r.m.s.				AC	DC		
0…6 mA	0…30 mA	0…2000 Hz	2	2 x residual current	110…240 V, 50/60 Hz	150…220 V	RCMB420-2	B74042500
					–	18…36 V	RCMB420-25	B74042503
			1	1 x residual current	110…240 V, 50/60 Hz	150…220 V	RCMB422-2	B74042502
					–	18…36 V	RCMB422-25	B74042504

Delivery incl. measuring current transformers.
Measuring current transformers available with shorter cable on request (minimum order quantity 250 pcs.)

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination according to IEC 60664-1

Definitions	
Supply circuit (IC1)	A1, A2
Measuring circuit (IC2)	Id1, Id2 Err, Test, GND
Output circuit 1 (IC3)	13, 14
Output circuit 2 (IC4)	23, 24
Monitored current circuit (IC5)	Un
Rated voltage	250 V
Overvoltage category (OVC)	III
Pollution degree	2

RCMB42…-25

Rated insulation voltage	
IC1/IC2	40 V
(IC1-IC2)/(IC3-IC5)	250 V
IC3/(IC4-IC5)	250 V
IC4/IC5	250 V
Rated impulse voltage	
IC1/IC2	800 V
(IC1-IC2)/(IC3-IC5)	4 kV
IC3/(IC4-IC5)	4 kV
IC4/IC5	4 kV
Safe isolation (reinforced insulation) between	
(IC1-IC2)/(IC3-IC5)	OVC III, 250 V
(IC3-IC4)-IC5	OVC III, 250 V
Basic insulation between	
IC3/IC4	OVC III, 250 V
Functional insulation between	
IC1/IC2	DC 1 kV 60 s
Voltage tests (routine test) acc. to IEC 61010-1	
(IC1-IC2)/(IC3-IC4)	AC 2.2 kV
IC2-IC5	AC 2.2 kV
IC3/IC4	AC 2.2 kV

RCMB42…-2

Rated insulation voltage	
IC1/(IC2-IC5)	250 V
IC2/(IC3-IC5)	250 V
IC3/IC4-IC5	250 V
IC4/IC5	250 V
Rated impulse voltage	
IC1/(IC2-IC5)	4 kV
IC2/(IC3-IC5)	4 kV
IC3/IC4-IC5	4 kV
IC4/IC5	4 kV
Safe isolation (reinforced insulation) between	
IC1/(IC2-IC5)	OVC III, 250 V
IC2-(IC3-IC5)	OVC III, 250 V
IC3-(IC4-IC5)	OVC III, 250 V
(IC3-IC4)-IC5	OVC III, 250 V
Basic insulation between	
IC3/IC4	OVC III, 250 V
Voltage tests (routine test) acc. to IEC 61010-1	
IC1/(IC2-IC5)	AC 2.2 kV
IC2/(IC3-IC5)	AC 2.2 kV
IC2/(IC3-IC4)	AC 2.2 kV
IC4-IC5	AC 2.2 kV

Supply voltage

RCMB42…-25

Nominal voltage U_S	DC 24 V
Nominal voltage range U_S	DC 18…36 V
Nominal current	110 mA (RCMB420-25) 70 mA (RCMB422-25)
Internal protection against reverse polarity and short circuit	

RCMB42…-2

Nominal voltage range U_S	AC 110…240 V, 50/60 Hz DC 150…220 V
Tolerance of the nominal voltage range of U_S	-5…+15 %
Nominal current	30 mA

Residual current measuring range

Rated frequency	0…2000 Hz
Measuring range	±300 mA

Response values

Residual current $I_{\Delta n1}$	6 mA
Response tolerance $I_{\Delta n1}$	-50…0 %
Residual current $I_{\Delta n2}$	30 mA (r.m.s.)
Response tolerance $I_{\Delta n2}$	
for $f \leq 1$ kHz	-20…0 %
for $f > 1$ kHz	-20…+100 %
Restart sequence value	
DC 6 mA	< 3 mA
AC/DC 30 mA (r.m.s.) for $f \leq 1$ kHz	< 12 mA
AC/DC 30 mA (r.m.s.) for $f > 1$ kHz	< 22 mA
Operating time t_{ae1} for 1 x $I_{\Delta n1}$	< 600 ms
Operating time t_{ae2} for	
1 x $I_{\Delta n2}$	< 180 ms
2 x $I_{\Delta n2}$	< 70 ms
5 x $I_{\Delta n2}$	< 20 ms

Inputs and operation

Test button	on front side
Test	internal/external
Cable length Test/Err, GND	< 10 m
Transformer connection	external
LED device function	green
LED alarm channel 1	yellow
LED alarm channel 2	yellow

Output

Common alarm signal Err	Open-Collector (npn)
No error	0…0.6 V
Error	11.4…12.6 V

Switching elements

Alarm relays K1, K2	$I_{\Delta n} \geq 6$ mA DC; $I_{\Delta n} \geq 30$ mA r.m.s.
Switching elements	2 x 1 N/O contacts
Operating principle	N/C operation
Electrical endurance, number of cycles	10,000

Contact data according to IEC 60947-5-1

Utilisation category	AC-14/DC-13
Rated operational voltage U_e	250 V
Rated operational current I_e	5 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 61851-1, IEC 61851-22
Operating temperature	-30…+75 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K2
Long-term storage (IEC 60721-3-1)	1K2

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

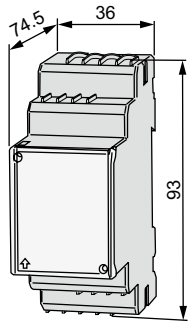
Connection type	push-wire terminals
Connection properties	
Rigid	0.2…2.5 mm² (AWG 24…14)
Flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
Flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Technical data (continued)

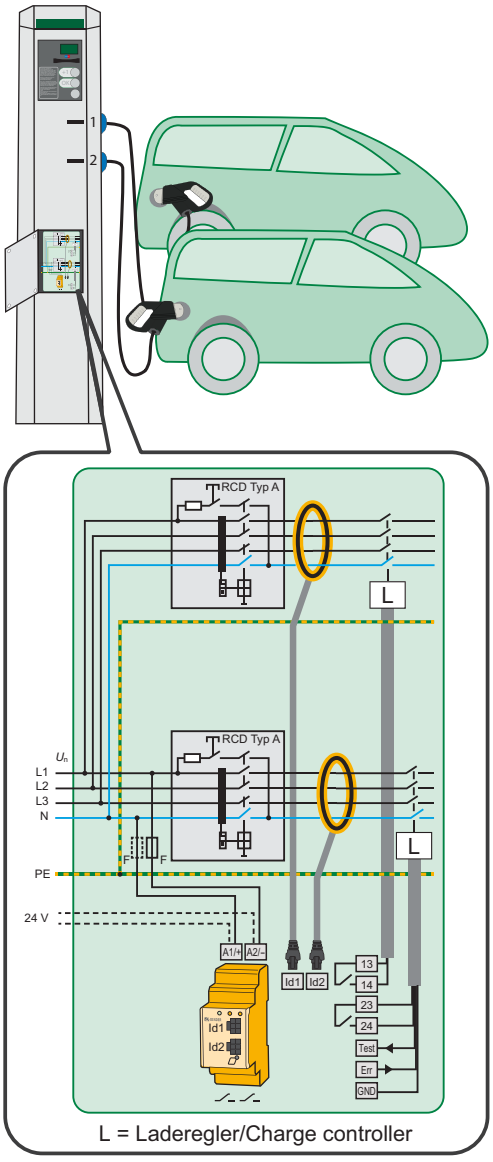
Other	
Operating mode	continuous operation
Degree of protection, internal components	IP 30
Degree of protection, terminals	IP 20
Area of application	≤ 2000 m AMSL
Quick DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip

Measuring current transformer	
Diameter cable gland measuring current transformer	15 mm
Cable length	1.5 m
Max. cable cross section	4 x 6 mm²
Mounting	with cable ties
Connection to RCMB42…	plug-in connector with 6 poles
Rated voltage U_n	3/(N) AC 400/230 V
Rated current I_n	3x32 A
Rated impulse withstand voltage U_{imp}	4 kV

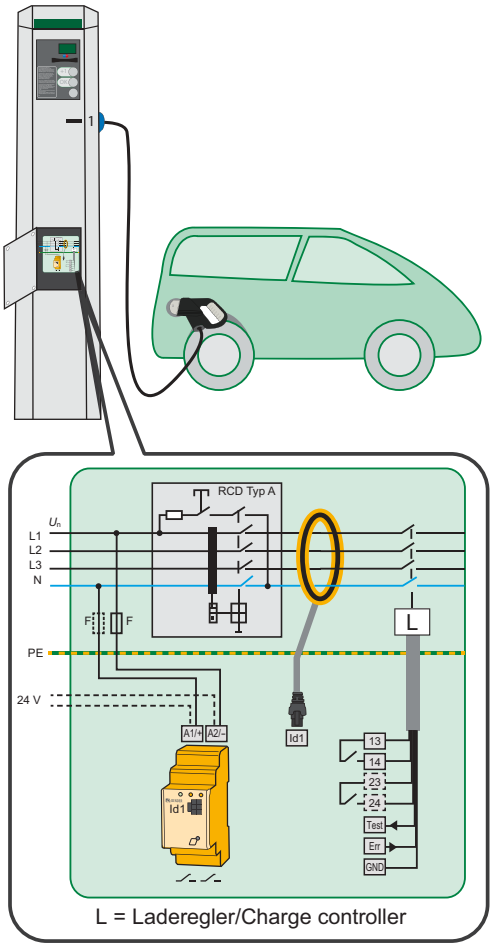
Dimension diagram (dimensions in mm)



Wiring diagrams



RCMB420EC with 2 channels with I_Δ = DC ≥ 6 mA and I_Δ = AC/DC ≥ 30 mA (r.m.s.)



RCMB422EC with 1 channel with I_Δ = DC ≥ 6 mA and I_Δ = AC/DC ≥ 30 mA (r.m.s.)

LINETRAXX® MRCDB300 series

AC/DC sensitive residual current monitoring modules for MRCD applications



Typical applications

- for MRCD applications

Approvals

Device features

- Structure of a protective device in accordance with IEC 60947-2 Annex M in combination with a circuit breaker providing isolating properties
- Monitoring of the connected circuit breaker by means of contact feedback
- RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
- Integrated switching outputs with two changeover contacts K1 and K2 (galvanically isolated)
- Fulfils the protection goals protection of persons, fire protection and plant protection (depending on the variant)
- Frequency range DC…100 kHz
- Combined test and reset button
- Multicolour LED indicating operation, exceeded response value, disturbances and status messages
- AC/DC sensitive type B measured value acquisition acc. to IEC 60755
- AC/DC sensitive type B+ measured value acquisition acc. to VDE 0664-400
- Exchangeable electronic enclosure without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTBC20P…210P only)
- Connection monitoring of the measuring current transformer with cyclical test current
- Use of all MRCDB300 for all CTBC… measuring current transformer sizes
- Supply voltage DC 24

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Electronic modules

Supply voltage U_s	Variant	Type	Art. No.
DC			
24 V (19.2…28.8 V)	Protection of persons	MRCDB301	B74043120
	Fire protection	MRCDB302	B74043121
	Protection of persons, fire protection and plant protection (freely configurable)	MRCDB303	B74043122

Required terminals are included in the scope of delivery.

Measuring current transformers

Internal diameter	Type	Art. No.
20 mm	CTBC20	B98120001
	CTBC20P	B98120002
35 mm	CTBC35	B98120003
	CTBC35P	B98120004
60 mm	CTBC60	B98120005
	CTBC60P	B98120006
120 mm	CTBC120	B98120007
	CTBC120P	B98120020
210 mm	CTBC210	B98120008
	CTBC210P	B98120021

P = full magnetic shield

Accessories

Description	Art. No.
Interface converter USB to RS-485	B95012045
Terminal block for MRCD module	B74043124

Suitable system components

Description	max. connected current transformers	Type	Art. No.	Page
Voltage supply	4	STEP-PS/1 AC/24 DC/0.5	B94053110	364
	14	STEP-PS/1 AC/24 DC/1.75	B94053111	364
	34	STEP-PS/1 AC/24 DC/4.2	B94053112	364

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	Primary conductors routed through the current transformer
Secondary (IC2)	Terminal block 1 (24 V, GND, D1, DG, T/R, GND, A, B, X1, X2)
Control circuit 1 (IC3)	Terminal block 1 (11,12,14)
Control circuit 2 (IC4)	Terminal block 2 (21,22,24)
Rated insulation voltage	800 V
Overvoltage category	III
Area of application	≤ 2000 m AMSL
Rated impulse voltage:	
IC1((IC2-IC4)	8 kV
IC2/(IC3-IC4)	4 kV
IC3/IC4	4 kV
Rated insulation voltage:	
IC1/(IC2-IC4)	800 V
IC2/(IC3-IC4)	250 V
IC3/IC4	250 V
Pollution degree	2
Safe isolation (reinforced insulation) between:	
IC2/(IC3-IC4)	300 V
Basic insulation between:	
IC1/(I2-IC4)	800 V
IC3/IC4	300 V
Voltage test (routine test) acc. to IEC 61010-1:	
IC2/(IC3-IC4)	AC 2.2 kV
IC3/IC4	AC 2.2 kV

Supply voltage

Supply voltage U_S	DC 24 V
Operating range of U_S	±20 %
Ripple U_S	≤ 1 %
Power consumption	≤ 2.5 W
Inrush current	1.7 A for 1 ms

Measuring circuit

Internal diameter measuring current transformer	see dimension diagrams page 204
Characteristics according to IEC 62020 and IEC/TR 60755	AC/DC sensitive, type B
Measuring range	5 mA…20 A
Response value $I_{\Delta n}$	see frequency responses in manual
MRCDB301 (protection of persons)	30 mA
MRCDB302 (fire protection)	300 mA
MRCDB303	30 mA…3 A (freely configurable), (30 mA)*
Pre alarm	50 %…100 % $I_{\Delta n}$ (freely configurable), (60 %)*
Rated current I_n	
CTBC20 at $I_{\Delta n}$ = 30 mA	40 A
CTBC20 at $I_{\Delta n}$ = 300 mA	63 A
CTBC20P	80 A
CTBC35 at $I_{\Delta n}$ = 30 mA	80 A
CTBC35 at $I_{\Delta n}$ = 300 mA	125 A
CTBC35P	160 A
CTBC60 at $I_{\Delta n}$ = 30 mA	160 A
CTBC60 at $I_{\Delta n}$ = 300 mA	250 A
CTBC60P	320 A
CTBC120 at $I_{\Delta n}$ = 100 mA	330 A
CTBC120P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210 at $I_{\Delta n}$ = 300 mA	630 A
CTBC210P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210P at $I_{\Delta n}$ = 300 mA	1000 A
Operating uncertainty	±17.5 %
Relative uncertainty	0…-35 %
Test winding	yes

Possible response values (to be set on the evaluator)

CTBC20, CTBC20P	10…500 mA
CTBC35, CTBC35P, CTUBC60, CTBC60P	30 mA…10 A
CTBC120P, CTBC210P	100 mA…10 A
CTBC120, CTBC210	300 mA…10 A

Time response

Response delay t_{on}	
MRCDB301, MRCDB302	0 s
MRCDB303	0 s…60 min (freely configurable), (0 s)*
Start-up delay t_{an}	0 s…60 min (freely configurable), (0 s)*
Delay on release t_{off}	2 s after reset
Operating time t_{ae}	
at 1 x $I_{\Delta n}$	≤ 180 ms
at 2 x $I_{\Delta n}$	≤ 130 ms
at 5 x $I_{\Delta n}$	≤ 20 ms
Response time	$t_{an} = t_{ae} + t_{on}$
Recovery time t_b	≤ 1 s

Indication

Multicolour LED	red/green, see table “System states: LED and output relays” on page 204

Inputs

	T/R, GND, D1, DG

Outputs

Number of changeover contacts	2
Operating principle	
MRCDB301, MRCDB302	N/C principle
MRCDB303	N/C or N/O principle (freely configurable) (N/C principle)*
Switching outputs (K1, K2)	250 V, 5 A
Switching capacity	1500 VA/144 W

Contact data acc. to IEC 60947-5-1

Rated operational voltage AC	250 V/250 V
Utilisation category	AC-13/AC-14
Rated operational current AC	5 A/3 A
Rated operational current AC (for UL applications)	3 A/3 A
Rated operational voltage DC	220/110/24 V
Utilisation category	DC12
Rated operational current DC	0.1/0.2/1 A
Minimum current	10 mA at DC 5 V
Electrical endurance, number of cycles	10,000

Environment/EMC

EMC	IEC 60947-2 Annex M
Operating temperature	-25…70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K11 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12

Connection

Required terminals are included in the scope of delivery.

Terminal block 1

Manufacturer	Phoenix Contact
Type	DFMC 1.5/5-ST-3.5 BK
The connection conditions of the manufacturer apply.	
Connection properties	
rigid	0.2…1.5 mm² (AWG 24…16)
flexible	0.2…1.5 mm² (AWG 24…16)
with ferrule	0.25…0.75 mm² (AWG 24…19)

Terminal block 2, 3

Manufacturer	Phoenix Contact
Type	FKCVW 2.5/ 3-ST-5.08
The connection conditions of the manufacturer apply.	
Connection capacity	
rigid	0.2…2.5 mm² (AWG 24…13)
flexible	0.2…2.5 mm² (AWG 24…13)
with ferrule	0.25…2.5 mm² (AWG 24…13)

Mounting CTBC…

Screw type	
CTBC20…60(P)	DIN EN ISO 7045 - M5
CTCB120…210(P)	DIN EN ISO 7045 - M6
Washer type	
CTBC20…60(P)	DIN EN ISO 7089/7090 - 5
CTCB120…210(P)	DIN EN ISO 7089/7090 - 6
Tightening torque	
CTBC20…35 (P)	0.6 Nm
CTCB60…210(P)	1 Nm

Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Flammability class	UL94 V-0
Software	D0579
Documentation number	D00343
Weight	
MRCDB300	≤ 100 g
CTBC20	≤ 160 g
CTBC20P	≤ 220 g
CTBC35	≤ 240 g
CTBC35P	≤ 320 g
CTBC60	≤ 460 g
CTBC60P	≤ 620 g
CTBC120	≤ 1390 g
CTBC120P	≤ 1750 g
CTBC210	≤ 4220 g
CTBC210P	≤ 4870 g

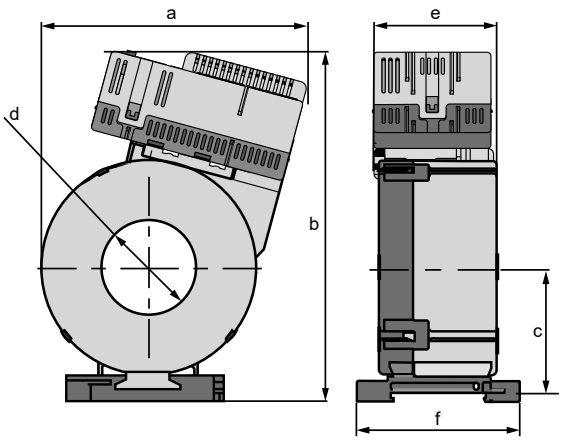
( )* Factory setting

The use of the power supply units listed at “Accessories” is recommended.

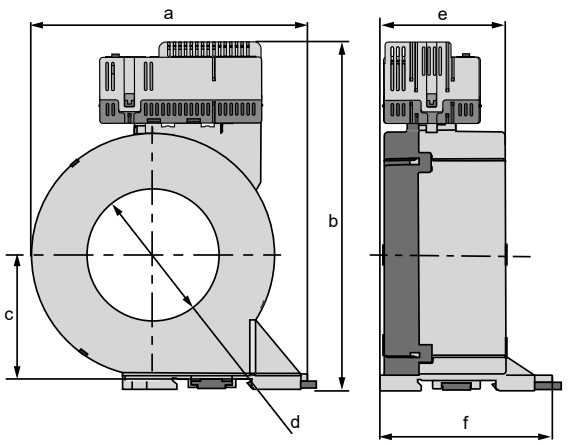
The use of a surge protection device is mandatory for these power supply units.

Dimension diagram

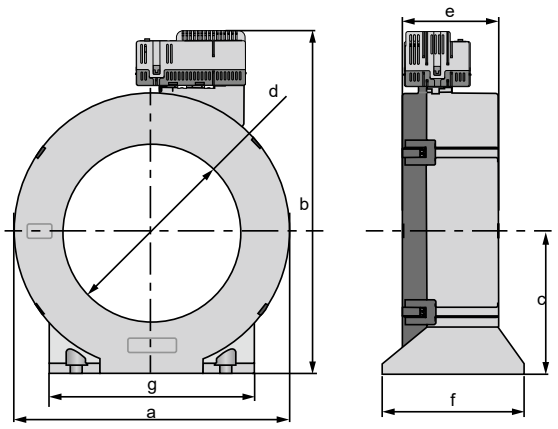
A



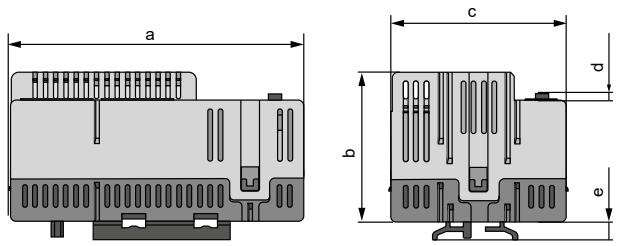
B



C



D



Dimensions (mm)								
	Type	a	b	c	d	e	f	g
A	MRCDB30…-CTBC20(P)	81	112	37	ø 20	46	60	
	MRCDB30…-CTBC35(P)	97	130	47	ø 35	46	61	
B	MRCDB30…-CTBC60(P)	126	158	57	ø 60	56	78	
C	MRCDB30…-CTBC120(P)	188	232	96	ø 120	65	96	139
	MRCDB30…-CTBC210(P)	302	346	153	ø 210	67	113	277
D	MRCDB30…	74	37	44	2	4,6		

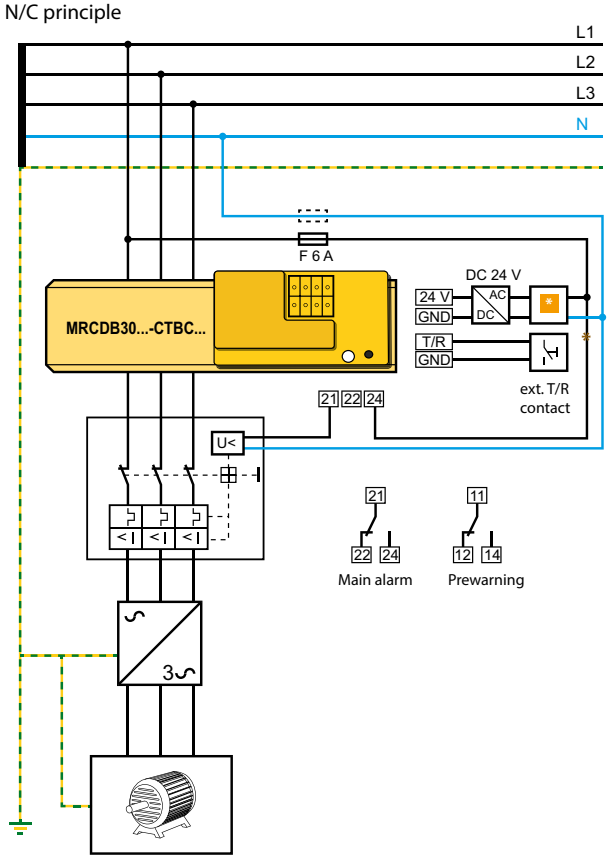
Tolerance: ±0.5 mm

System states: LED and output relays

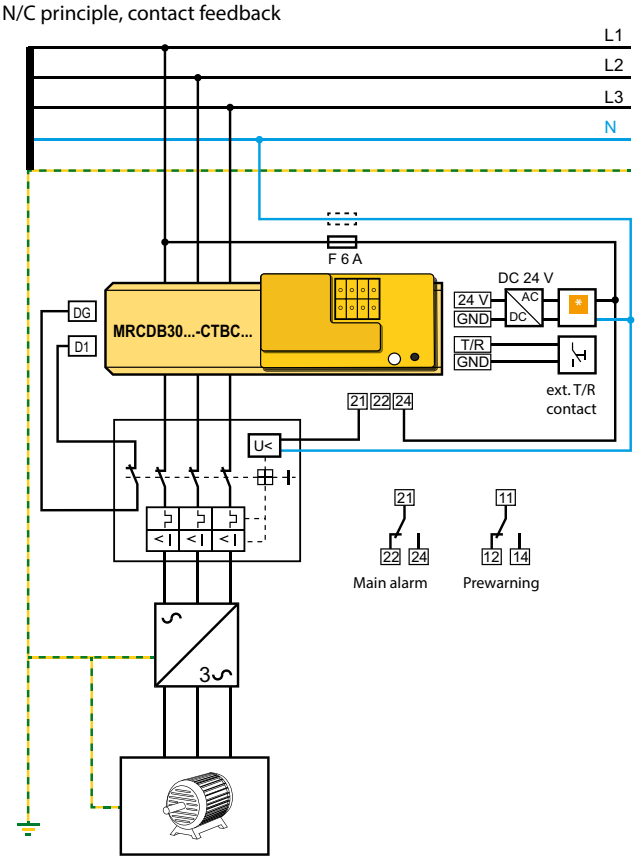
The LED indicates the system state by means of colours and lighting/flashing. The N/O contacts of relay outputs K1 and K2 have defined switching positions for each system state.

System state	LED		Notes	Changeover contact	
	green (ON)	red (alarm)		K1	K2
Device switched off	off	off	Device is deenergised, no monitoring, no monitoring function	de-energised	de-energised
Normal operating state	lights	off	The device is supplied with the specified voltage and monitors the primary circuit. No residual current flows which would lead to tripping.	energised	energised
Prewarning	lights	Flashes briefly	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the prewarning.	de-energised	energised
Alarm state	off	lights	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the alarm.	de-energised	de-energised

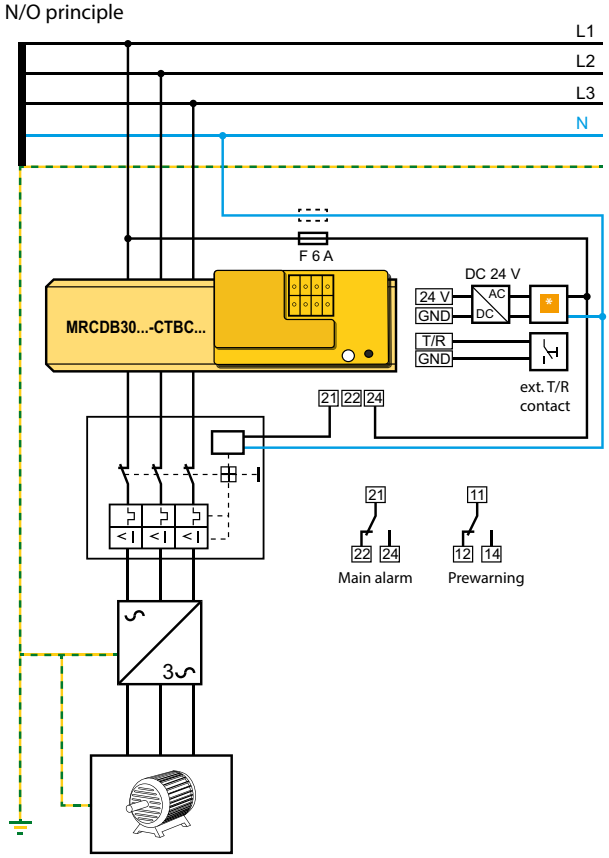
N/C principle



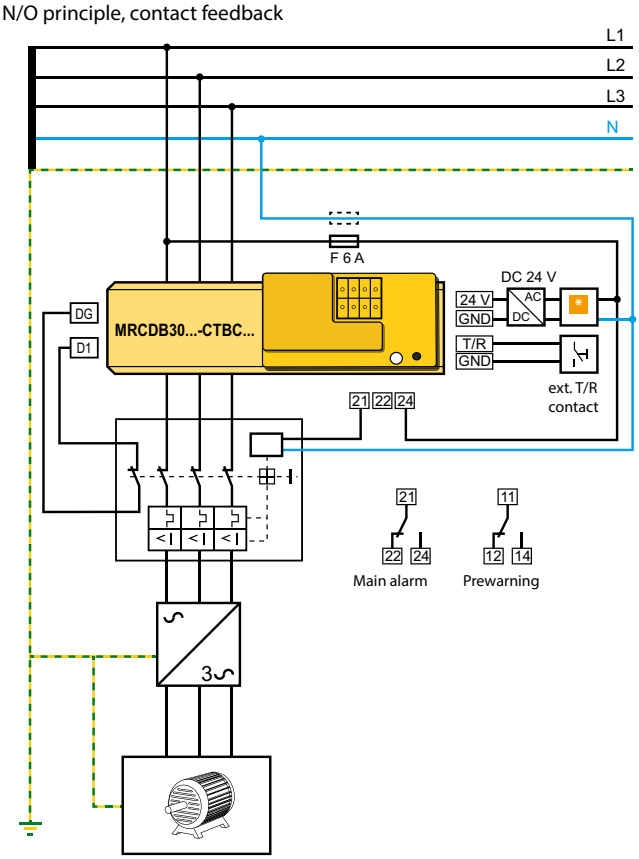
N/C principle, contact feedback



N/O principle



N/O principle, contact feedback



* – The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.
– The surge protection device must be connected upstream of the power supply unit on the supply side.
– Features of the surge protection device:
Nominal discharge current I_n (8/20 µs): 20 kA
Response time: 25 ns
two-stage: 1 varistor + 1 spark gab
Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.

LINETRAXX® RCMB300 series

AC/DC sensitive residual current monitoring modules with an integrated measuring current transformer



Typical applications

- AC and DC fault currents in earthed systems (TN and TT systems).

Approvals

Device features

- Continuous residual current monitoring in compliance with DGUV Vorschrift 3 (German Social Accident Insurance Regulation 3)
- Easy DIN rail or screw mounting
- RS-485 interface with Modbus RTU (reading out measured values/setting parameters)
- Integrated switching outputs with two changeover contacts K1 and K2 (galvanically isolated)
- Frequency range DC…100 kHz
- Combined test and reset button
- Multicolour LED indicating operation, exceeded response value, disturbances and status messages
- AC/DC sensitive type B measured value acquisition acc. to IEC 60755
- AC/DC sensitive type B+ measured value acquisition acc. to VDE 0664-400
- The AC and DC components as well as the r.m.s. value of the residual current can be evaluated separately
- Exchangeable electronic enclosure without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTBC20P…210P only)
- Connection monitoring of the measuring current transformer with cyclical test current
- Use of the RCMB301 for all CTBC… measuring current transformer sizes
- Supply voltage DC 24 V

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Evaluation electronics

Supply voltage U_s	Variant	Type	Art. No.
DC			
24 V (19.2…28.8 V)	Modbus RTU	RCMB301	B74043100

Required terminals are included in the scope of delivery.

Measuring current transformers

Internal diameter	Type	Art. No.
20 mm	CTBC20	B98120001
	CTBC20P	B98120002
35 mm	CTBC35	B98120003
	CTBC35P	B98120004
60 mm	CTBC60	B98120005
	CTBC60P	B98120006
120 mm	CTBC120	B98120007
	CTBC120P	B98120020
210 mm	CTBC210	B98120008
	CTBC210P	B98120021

P = full magnetic shield

Accessories

Description	Art. No.
Interface converter USB to RS-485	B95012045
Terminal block for RCMB301 module	B74043124

Suitable system components

Description	max. connected current transformers	Type	Art. No.	Page
Voltage supply	4	STEP-PS/1 AC/24 DC/0.5	B94053110	364
	14	STEP-PS/1 AC/24 DC/1.75	B94053111	364
	34	STEP-PS/1 AC/24 DC/4.2	B94053112	364

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	Primary conductors routed through the current transformer
Secondary (IC2)	Terminal block 1 (24 V, GND, T/R, GND, A, B, X1, X2)
Control circuit 1 (IC3)	Terminal block 1 (11,12,14)
Control circuit 2 (IC4)	Terminal block 2 (21,22,24)
Rated insulation voltage	800 V
Overvoltage category	III
Area of application	≤ 2000 m AMSL
Rated impulse voltage:	
IC1((IC2-IC4)	8 kV
IC2/(IC3-IC4)	4 kV
IC3/IC4	4 kV
Rated insulation voltage:	
IC1/(IC2-IC4)	800 V
IC2/(IC3-IC4)	250 V
IC3/IC4	250 V
Pollution degree	2
Safe isolation (reinforced insulation) between:	
IC2/(IC3-IC4)	300 V
Basic insulation between:	
IC1/(I2-IC4)	800 V
IC3/IC4	300 V
Voltage test (routine test) acc. to IEC 61010-1:	
IC2/(IC3-IC4)	AC 2.2 kV
IC3/IC4	AC 2.2 kV

Supply voltage

Supply voltage U_S	DC 24 V
Operating range of U_S	±20 %
Ripple U_S	≤ 1 %
Power consumption	≤ 2.5 W
Inrush current	1.7 A for 1 ms

Measuring circuit

Internal diameter measuring current transformer	see dimension diagrams on page 208
Characteristics according to IEC 62020 and IEC/TR 60755	AC/DC sensitive, type B
Measuring range	5 mA…20 A
Response value $I_{\Delta n}$	30 mA…3 A (freely configurable), (30 mA)*
Prewarning	50…100 % $I_{\Delta n}$ (freely configurable), (60 %)*
Rated current I_n	
CTBC20 at $I_{\Delta n}$ = 30 mA	40 A
CTBC20 at $I_{\Delta n}$ = 300 mA	63 A
CTBC20P	80 A
CTBC35 at $I_{\Delta n}$ = 30 mA	80 A
CTBC35 at $I_{\Delta n}$ = 300 mA	125 A
CTBC35P	160 A
CTBC60 at $I_{\Delta n}$ = 30 mA	160 A
CTBC60 at $I_{\Delta n}$ = 300 mA	250 A
CTBC60P	320 A
CTBC120 at $I_{\Delta n}$ = 100 mA	330 A
CTBC120P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210 at $I_{\Delta n}$ = 300 mA	630 A
CTBC210P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210P at $I_{\Delta n}$ = 300 mA	1000 A
Operating uncertainty	±17.5 %
Relative uncertainty	0…-35 %
Test winding	yes

Possible response values (to be set on the evaluator)

CTBC20, CTBC20P	10 mA…500 mA
CTBC35, CTBC35P, CTUBC60, CTBC60P	30 mA…10 A
CTBC120P, CTBC210P	100 mA…10 A
CTBC120, CTBC210	300 mA…10 A

Time response

Response delay t_{on}	50 ms…60 min (freely configurable), (0 s)*
Start-up delay t_{an}	0 s…60 min (freely configurable), (0 s)*
Delay on release t_{off}	0 s…60 min (freely configurable), (1 s)*
Operating time t_{ae}	
at 1 x $I_{\Delta n}$	≤ 230 ms
at 2 x $I_{\Delta n}$	≤ 180 ms
at 5 x $I_{\Delta n}$	≤ 70 ms
Response time	$t_{an} = t_{ae} + t_{on}$
Recovery time t_b	≤ 1 s

Indication

Multicolour LED	Refer to “System states: LED and output relays” on page 208

Inputs

	T/R, GND

Outputs

Number of changeover contacts	2
Operating principle	N/C or N/O principle (freely configurable), (N/C principle)*
Switching outputs (K1, K2)	250 V, 5 A
Switching capacity	1500 VA/144 W

Contact data acc. to IEC 60947-5-1

Rated operational voltage AC	250 V/250 V
Utilisation category	AC-13/AC-14
Rated operational current AC	5 A/3 A
Rated operational current AC (for UL applications)	3 A/3 A
Rated operational voltage DC	220/110/24 V
Utilisation category	DC12
Rated operational current DC	0.1/0.2/1 A
Minimum current	10 mA at DC 5 V
Electrical endurance, number of cycles	10,000

Environment/EMC

EMC	IEC 62020
Operating temperature	-25…70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K11 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12

Connection

Required terminals are included in the scope of delivery.

Terminal block 1

Manufacturer	Phoenix Contact
Type	DFMC 1.5/5-ST-3.5 BK
The connection conditions of the manufacturer apply.	
Connection properties	
rigid	0.2…1.5 mm² (AWG 24…16)
flexible	0.2…1.5 mm² (AWG 24…16)
with ferrule	0.25…0.75 mm² (AWG 24…19)

Terminal block 2, 3

Manufacturer	Phoenix Contact
Type	FKCVW 2.5/ 3-ST-5.08
The connection conditions of the manufacturer apply.	
Connection capacity	
rigid	0.2…2.5 mm² (AWG 24…13)
flexible	0.2…2.5 mm² (AWG 24…13)
with ferrule	0.25…2.5 mm² (AWG 24…13)

Mounting CTBC…

Screw type	
CTBC20…60(P)	DIN EN ISO 7045 - M5
CTCB120…210(P)	DIN EN ISO 7045 - M6
Washer type	
CTBC20…60(P)	DIN EN ISO 7089/7090 - 5
CTCB120…210(P)	DIN EN ISO 7089/7090 - 6
Tightening torque	
CTBC20…35 (P)	0.6 Nm
CTCB60…210(P)	1 Nm

Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Flammability class	UL94 V-0
Software	D0610
Documentation number	D00372
Weight	
RCMB301	≤ 100 g
CTBC20	≤ 160 g
CTBC20P	≤ 220 g
CTBC35	≤ 240 g
CTBC35P	≤ 320 g
CTBC60	≤ 460 g
CTBC60P	≤ 620 g
CTBC120	≤ 1390 g
CTBC120P	≤ 1750 g
CTBC210	≤ 4220 g
CTBC210P	≤ 4870 g

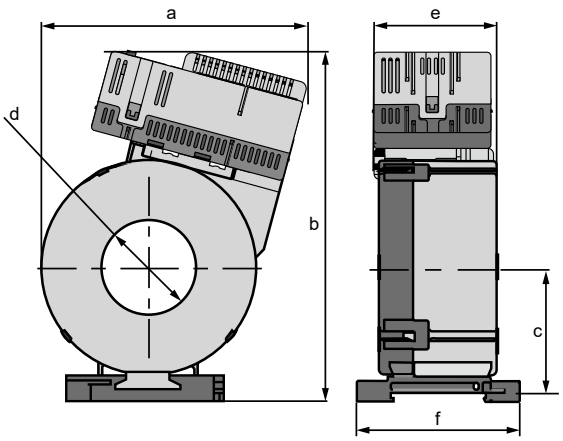
( )* Factory setting

The use of the power supply units listed at “Accessories” is recommended.

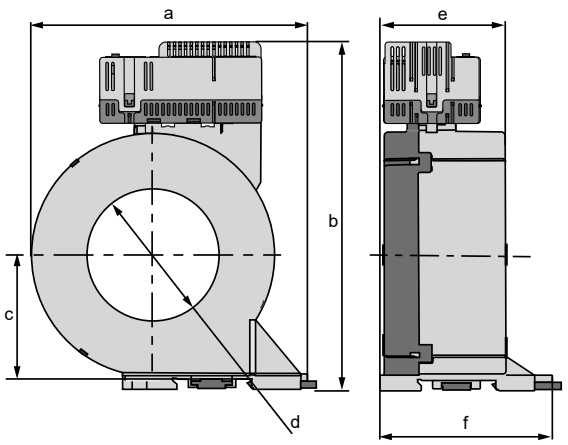
The use of a surge protection device is mandatory for these power supply units.

Dimension diagram

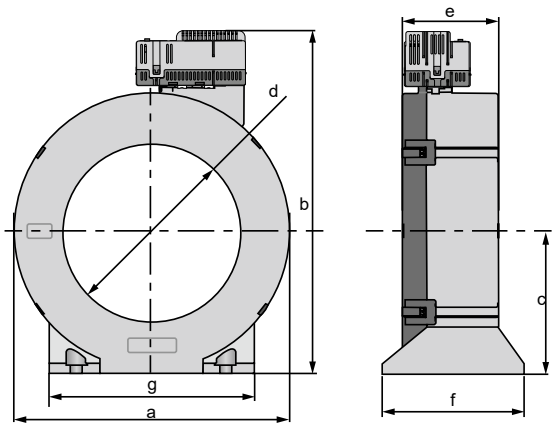
A



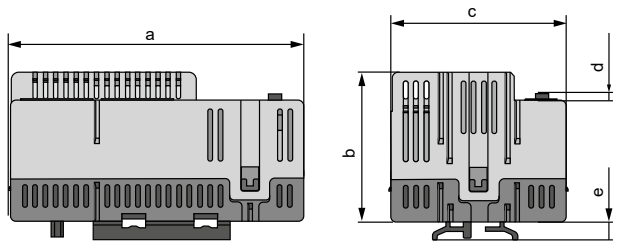
B



C



D



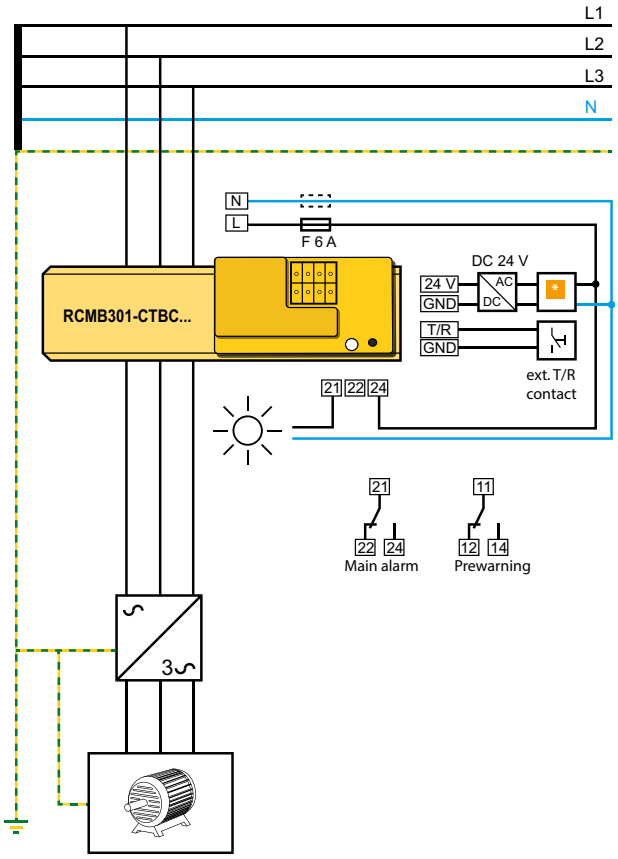
Dimensions (mm)								
	Type	a	b	c	d	e	f	g
A	RCMB301-CTBC20(P)	81	112	37	ø 20	46	60	
	RCMB301-CTBC35(P)	97	130	47	ø 35	46	61	
B	RCMB301-CTBC60(P)	126	158	57	ø 60	56	78	
C	RCMB301-CTBC120(P)	188	232	96	ø 120	65	96	139
	RCMB301-CTBC210(P)	302	346	153	ø 210	67	113	277
D	RCMB301	74	37	44	2	4,6		

Tolerance: ±0.5 mm

System states: LED and output relays

The LED indicates the system state by means of colours and lighting/flashing. The N/O contacts of relay outputs K1 and K2 have defined switching positions for each system state.

System state	LED		Notes	Changeover contact	
	green (ON)	red (alarm)		K1	K2
Device switched off	off	off	Device is de-energised, no monitoring, no monitoring function	de-energised	de-energised
Normal operating state	lights	off	The device is supplied with the specified voltage and monitors the primary circuit. No residual current flows which would lead to tripping.	energised	energised
Prewarning	lights	Flashes briefly	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the prewarning.	de-energised	energised
Alarm state	off	lights	The device is supplied with the specified voltage and monitors the primary circuit. A fault current flows which exceeds the set limit of the alarm.	de-energised	de-energised



* – The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.
– The surge protection device must be connected upstream of the power supply unit on the supply side.
– Features of the surge protection device:
Nominal discharge current I_n (8/20 µs): 20 kA
Response time: 25 ns
two-stage: 1 varistor + 1 spark gab
Alternatively, the power supply unit must be connected to a CAT II supply without a surge protection device.

RCMB131-01

AC/DC sensitive residual current monitoring module for measuring AC and DC currents up to ±100 mA



Typical applications

- Designed for installation in PDUs and outlet boxes
- Communication with a master via an RS-485 interface via Modbus RTU

Approvals

CE

Device features

- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- Suitable for PCB mounting
- High resolution for implementing equipment leakage current monitoring
- Measured value and alarm transmission via Modbus RTU (RS-485)
- Frequency range DC…2 kHz
- Compact design for monitoring nominal loads up to I_n = 32 A
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12…24 V

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Output range	Supply voltage U_S	Type	Art. No.
	DC		
0…100 mA (r.m.s.)	12…24 V	RCMB131-01	B94042131

Technical data

Insulation coordination according to IEC 60664-1

Primary circuit	monitored primary conductors
Secondary circuit	Connections Vcc, GND, A, B, S1, S2
All following specifications apply to the insulation between the primary and secondary circuit	
Rated voltage	300 V
Overvoltage category	III
Rated impulse voltage	4 kV
Operating altitude	up to 3000 m AMSL
Rated insulation voltage	320 V
Pollution degree	2
Safe separation (reinforced insulation)	between primary and secondary circuit
Voltage test acc. to IEC 61010-1	AC 2.2 kV

Voltage supply

Supply voltage U_S	DC 12…24 V
Operating range of the supply voltage	±20 %
Ripple	100 mV
Power consumption	< 0.75 W

Measuring circuit

Internal diameter primary conductor opening	15 mm
Measured value evaluation	DC, r.m.s.
Measuring range	AC/DC ±300 mA
Characteristics according to IEC 60755	AC/DC sensitive, type B
$I_{\Delta n1}$	
Response value	DC 3.5…100 mA (* 6 mA)
Response tolerance	0.7…1.0 x $I_{\Delta n1}$
$I_{\Delta n2}$	
Response value	r.m.s. 3.5…100 mA (* 30 mA)
Response tolerance	
DC…1 kHz	0.7…1.0 x $I_{\Delta n2}$
1…2 kHz	1.0…2.0 x $I_{\Delta n2}$
Output range	0…100 mA (r.m.s.)
Resolution	< 0.2 mA
Frequency range	DC…2 kHz
Measuring time	180 ms

Operating uncertainty

DC…500 Hz	±(5 % +0.5 mA)
501…1000 Hz	±(15 % +0.5 mA)
1…2 kHz	-(50 % ±0.5 mA)

Time response

Response time tae (relay switching time of 10 ms considered)	
for 1 x $I_{\Delta n}$	≤ 290 ms
for 2 x $I_{\Delta n}$	≤ 140 ms
for 5 x $I_{\Delta n}$	≤ 30 ms
Recovery time t_b	≤ 2s

Disturbances

Load current I_n	32 A

Response value assignment

$I_{\Delta n1}$ (DC)	S1
$I_{\Delta n2}$ (r.m.s.)	S2

Outputs

Interface	RS-485
Protocol	Modbus RTU
Switching outputs	Open Collector, not short-circuit-proof
Switching capacity	40 V / 50 mA
Output voltage LOW level	0…0.6 V
Output voltage HIGH level	3.1…3.6 V
Hysteresis	≤ 30 %

Environment/EMC

EMC	DIN EN 62020:2003 (VDE 0663), where applicable
Ambient temperature (incl. primary conductors routed through module)	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K11 (except condensation and formation of ice)
Long-term storage (IEC 60271-3-1)	1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60271

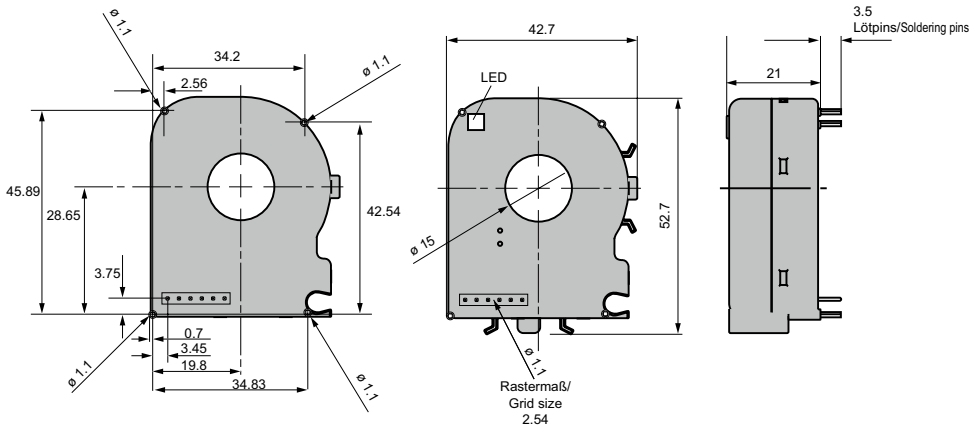
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60271-3-1)	1M12

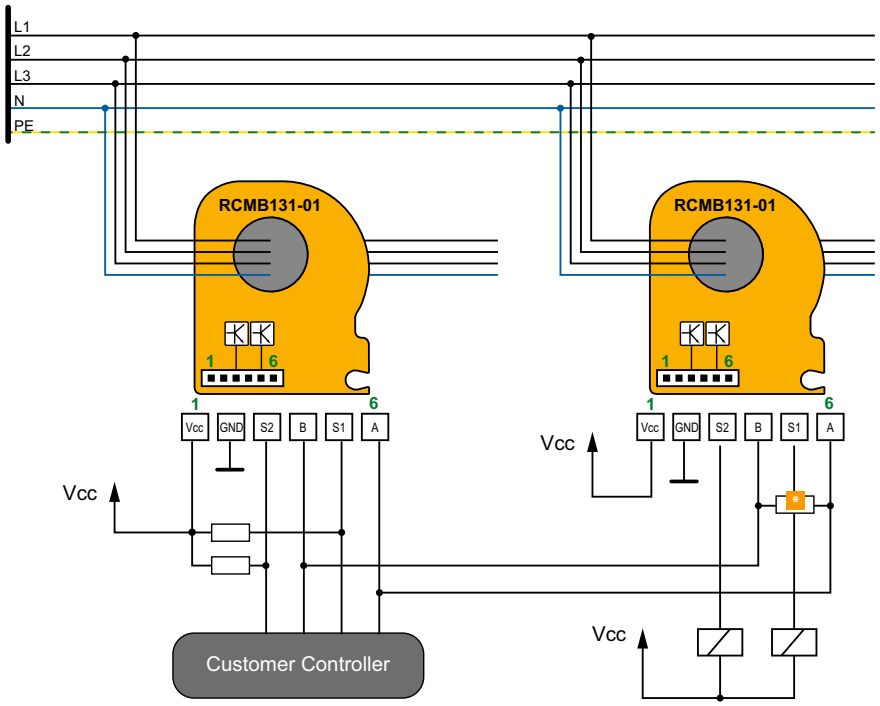
Other

Operating mode	continuous operation
Mounting	any position
Protection class	IP 30
Flammability rating	UL94 V-0
Service life at 40 °C	10 years
Software	D0604
Documentation number	D00358

* = factory settings

Dimension diagram (dimensions in mm)





* Terminating resistor 120 Ω must only be set on the last device in the RS-485 bus chain

RCMB131-02

AC/DC sensitive residual current monitoring module for measuring AC and DC currents up to ±100 mA



Typical applications

- Designed for installation in PDUs and outlet boxes
- Outputs the r.m.s. value of the residual current via a PWM output, which is read out and evaluated by a higher-level circuit

Approvals

CE

Device features

- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- Suitable for PCB mounting
- High resolution for implementing equipment leakage current monitoring
- Measurement signal output via PWM output
- Frequency range DC…2 kHz
- Compact design for monitoring nominal loads up to I_n = 32 A
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12…24 V

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Output range	Supply voltage U_S	Type	Art. No.
	DC		
0…100 mA (r.m.s.)	12…24 V	RCMB131-02	B94042132

Insulation coordination according to IEC 60664-1

Primary circuit	monitored primary conductors
Secondary circuit	Connections Vcc, GND, T, PWM, S1, ERR
All following specifications apply to the insulation between the primary and secondary circuit	
Rated voltage	300 V
Overvoltage category	III
Rated impulse voltage	4 kV
Operating altitude	up to 3000 m AMSL
Rated insulation voltage	320 V
Pollution degree	2
Safe separation (reinforced insulation)	between primary and secondary circuit
Voltage test acc. to IEC 61010-1	AC 2.2 kV

Voltage supply

Supply voltage U_S	DC 12…24 V
Operating range of the supply voltage	±20 %
Ripple	100 mV
Power consumption	< 0.75 W

Measuring circuit

Internal diameter primary conductor opening	15 mm
Measured value evaluation	DC, r.m.s.
Characteristics according to IEC 60755	AC/DC sensitive, type B
Response value $I_{\Delta n1}$	DC 3.5…100 mA (* 6 mA)
Response tolerance $I_{\Delta n1}$	0.7…1.0 x $I_{\Delta n1}$
Measuring range	AC/DC ±300 mA
Resolution	< 0.2 mA
Frequency range	DC…2 kHz
Measuring time	180 ms

Operating uncertainty

DC…500 Hz	±(5 % + 0.5 mA)
501…1000 Hz	±(15 % + 0.5 mA)
1001…2000 Hz	±(50 % + 0.5 mA)

Time response

Response time t_{ae} (relay switching time of 10 ms considered)	
for 1 x $I_{\Delta n}$	≤ 290 ms
for 2 x $I_{\Delta n}$	≤ 140 ms
for 5 x $I_{\Delta n}$	≤ 30 ms
Recovery time t_b	≤ 2s

Disturbances

Load current I_n	32 A

Outputs

Switching outputs S1, ERR	Open Collector, not short-circuit-proof
Switching capacity	40 V / 50 mA
Hysteresis	≤ 30 %
PWM	PWM signal, push pull
Internal resistance PWM signal	4.7 kΩ
Voltage HIGH level	3.1…3.6 V
Voltage LOW level	0…0.6 V
Frequency PWM signal	8 kHz
Specification of the PWM signal	(0…100) % = (0…100) mA
Output resistance	not short-circuit-proof

Response value assignment

$I_{\Delta n1}$ (DC)	S1
Internal error	ERR

Environment/EMC

EMC	DIN EN 62020:2003 (VDE 0663), where applicable
Ambient temperature (incl. primary conductors routed through module)	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K11 (except condensation and formation of ice)
Long-term storage (IEC 60271-3-1)	1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60271

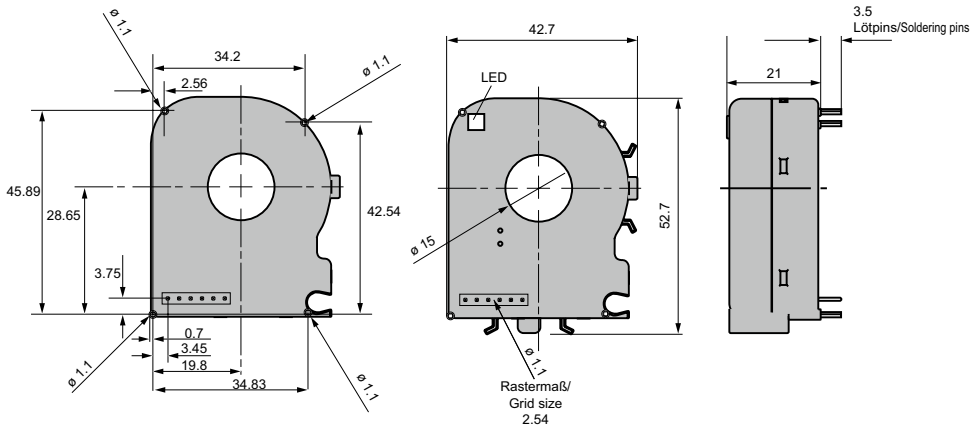
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60271-3-1)	1M12

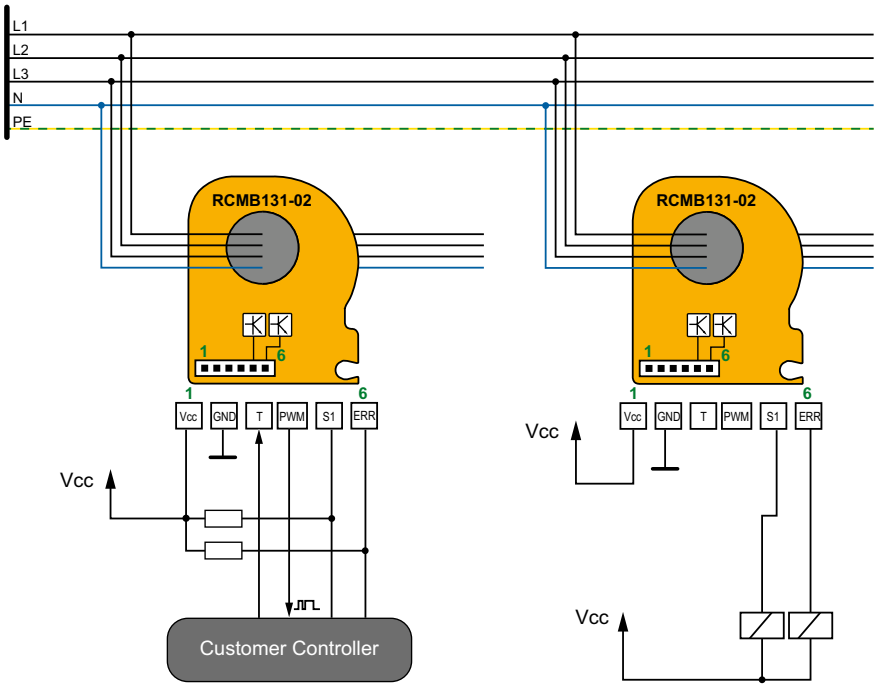
Other

Operating mode	continuous operation
Mounting	any position
Protection class	IP 30
Flammability rating	UL94 V-0
Service life at 40 °C	10 years
Software	D0604
Documentation number	D00354

* = factory settings

Dimension diagram (dimensions in mm)




L1
L2
L3
N
PE
RCMB131-02
RCMB131-02
1
6
Vcc
GND
T
PWM
S1
ERR
Vcc
Vcc
Vcc
Customer Controller

RCMB132-01

AC/DC sensitive residual current monitoring module for measuring AC and DC currents up to ±100 mA



Typical applications

- Designed for installation in PDUs and outlet boxes
- Communication with a master via an RS-485 interface via Modbus RTU
- Connection of several devices in a daisy chain. For this purpose, the RCMB132-01 provides two identical connectors for RS-485 (incl. power supply)

Approvals

CE

Device features

- AC/DC sensitive leakage and fault current monitoring for preventive maintenance
- High resolution for implementing equipment leakage current monitoring
- Measured value and alarm transmission via Modbus RTU (RS-485)
- Frequency range DC…2 kHz
- Compact design for monitoring nominal loads up to I_n = 32 A
- Low load current sensitivity due to fully shielded measuring current transformer
- Continuous monitoring of the connection to the measuring current transformer
- Integrated test function
- Supply voltage DC 12…24 V

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Measuring range	Supply voltage U_s	Type	Art. No.
AC/DC	DC		
±100 mA	12…24 V	RCMB132-01	B94042136
		Mounting foot MCCT20	B91080111

Technical data

Insulation coordination according to IEC 60664-1	
Primary circuit	monitored primary conductors
Secondary circuit	Connections Vcc, GND, A, B, S1, S2
All following specifications apply to the insulation between the primary and secondary circuit	
Rated voltage	300 V
Overvoltage category	III
Rated impulse voltage	4 kV
Operating altitude	up to 3000 m AMSL
Rated insulation voltage	320 V
Pollution degree	2
Safe separation (reinforced insulation)	between primary and secondary circuit
Voltage test acc. to IEC 61010-1	AC 2.2 kV

Voltage supply	
Supply voltage U_S	DC 12…24 V
Operating range of the supply voltage	±20 %
Ripple	100 mV
Power consumption	< 0.75 W

Measuring circuit	
Internal diameter primary conductor opening	15 mm
Measured value evaluation	DC, r.m.s.
Measuring range	AC/DC ±300 mA
Characteristics according to IEC 60755	AC/DC sensitive, type B
$I_{\Delta n1}$	
Response value	DC 3.5…100 mA (* 6 mA)
Response tolerance	0.7…1.0 x $I_{\Delta n1}$
$I_{\Delta n2}$	
Response value	r.m.s. 3.5…100 mA (* 30 mA)
Response tolerance	
DC…1 kHz	0.7…1.0 x $I_{\Delta n2}$
1…2 kHz	1.0…2.0 x $I_{\Delta n2}$
Output range	0…100 mA (r.m.s.)
Resolution	< 0.2 mA
Frequency range	DC…2 kHz
Measuring time	180 ms

Operating uncertainty	
DC…500 Hz	±(5 % + 0.5 mA)
501…1000 Hz	±(15 % + 0.5 mA)
1…2 kHz	-(50 % ± 0.5 mA)

Time response	
Response time t_{ae} (relay switching time of 10 ms considered)	
for 1 x $I_{\Delta n}$	≤ 290 ms
for 2 x $I_{\Delta n}$	≤ 140 ms
for 5 x $I_{\Delta n}$	≤ 30 ms
Recovery time t_b	≤ 2 s

Disturbances	
Load current I_n	32 A

Response value assignment	
$I_{\Delta n1}$ (DC)	S1
$I_{\Delta n2}$ (r.m.s.)	S2

Outputs	
Interface	RS-485
Protocol	Modbus RTU
Switching outputs	Open Collector, not short-circuit-proof
Switching capacity	40 V / 50 mA
Output voltage LOW level	0…0.6 V
Output voltage HIGH level	3.1…3.6 V
Hysteresis	≤ 30 %

Environment/EMC	
EMC	DIN EN 62020:2003 (VDE 0663), where applicable
Ambient temperature (incl. primary conductors routed through module)	-25…+70 °C

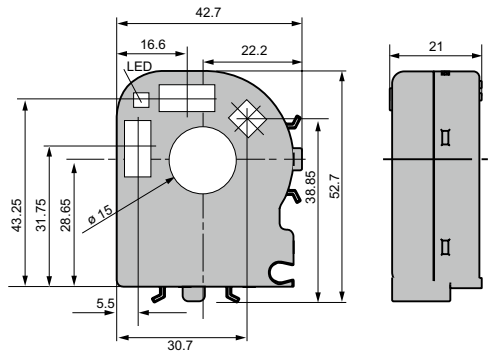
Classification of climatic conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K11 (except condensation and formation of ice)
Long-term storage (IEC 60271-3-1)	1K22 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60271	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60271-3-1)	1M12

Other	
Operating mode	continuous operation
Mounting	any position
Protection class	IP 30
Flammability rating	UL94 V-0
Service life at 40 °C	10 years
Software	D0604
Plug (included in scope of delivery)	Phoenix Contact, PTSM 0.5/4-P-2.5
Documentation number	D00356

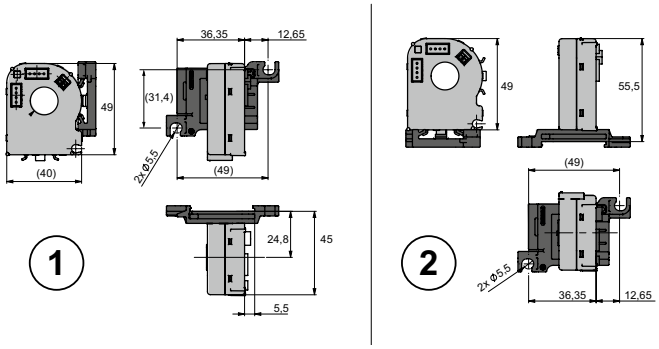
* = factory settings

Dimension diagram (dimensions in mm)



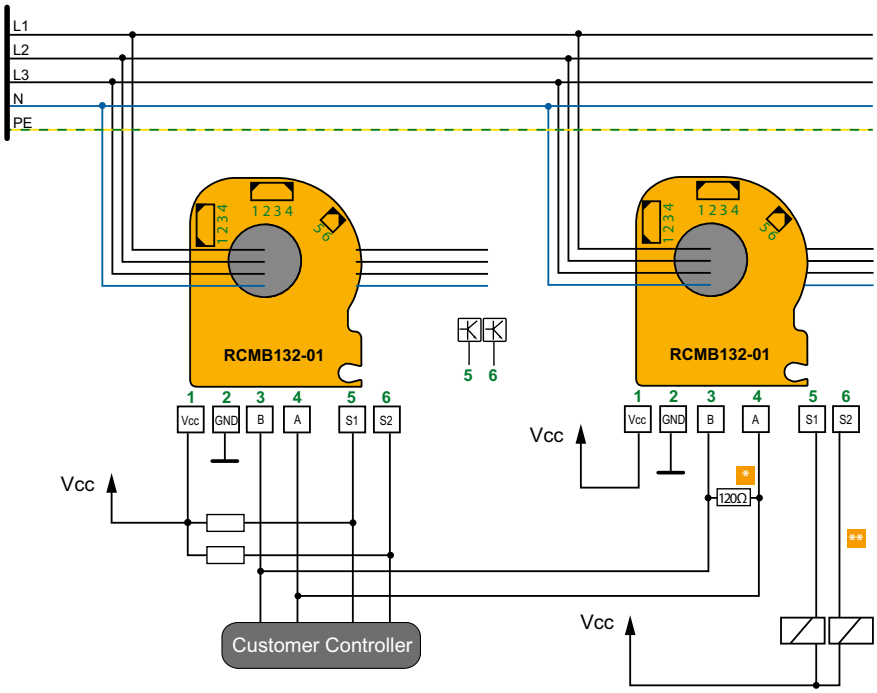
Rail mounting

with mounting foot MCCT20 (accessories, see ordering data)



3

RCMB132-01



* Terminating resistor 120 Ω must only be set on the last device in the RS-485 bus chain.
** An external protective circuit is especially required for inductive loads.

Insulation monitoring devices
ISOMETER®

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Equipment for insulation fault location
ISOSCAN®

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Residual current monitoring systems
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Neutral Grounding Resistor Monitor (NGR)
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Power Quality and Energy Measurement
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Measuring and monitoring relaries
LINETRAXX®

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System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
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Switching equipment
ATICS® transfer switching and monitoring devices

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Test systems
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Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service

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Device overview neutral grounding resistance monitoring (NGR) LINETRAXX®

		 LINETRAXX® NGRM500	 LINETRAXX® NGRM700
Page		222	227
Special applications		Neutral grounding resistance monitoring (NGR monitoring)	Neutral grounding resistance monitoring (NGR monitoring)
System type	HRG	■	■
Fault currents		■	■
		■	■
Phase monitoring L1, L2, L3			■
System voltage L-L*		600 V…25000 V	600 V…25000 V
Harmonic analysis	RMS 0…32	■	■
	Analysis range	■	■
Relay operating mode		Configurable fail-safe or non-fail-safe	Configurable fail-safe or non-fail-safe
Communication		Webserver, BCOM, Modbus RTU, Modbus TCP	Webserver, BCOM, Modbus RTU, Modbus TCP
Maximum altitude		2000 m	5000 m
Mounting	Detachable HMI for front panel mounting		■
	DIN rail	■	
	Screw mounting		■

* Freely configurable in the device, taking suitable coupling devices into account.



Device overview coupling devices for NGR monitoring

	CD1000	CD1000-2	CD5000	CD14400	CD25000
					

Page		233	235	237	239	241
Special applications		Coupling device for HRG applications	Coupling device for HRG applications	Coupling device for HRG applications	Coupling device for HRG applications	Coupling device for HRG applications
System voltage L-L (U_{NGR} voltage)		Up to U_{LL} = 690 V (U_{NGR} = 400 V)	Up to U_{LL} =1000 V (U_{NGR} = 600 V)	Up to U_{LL} = 4300 V (U_{NGR} = 2500 V)	Up to U_{LL} =14400 V (U_{NGR} = 8400 V)	Up to U_{LL} =25 kV (U_{NGR} = 14.5 kV)
Mounting	Screw mounting	■	■	■	■	■

Recommended minimum value RNGR (tripping level 50 %)															
		CD1000			CD1000-2				CD5000		CD14400					CD25000
U_{sys}		400 V	600 V	690 V	400 V	600 V	690 V	1000 V	2400 V	4200 V	6 kV	6.6 V	7.2 kV	11 kV	14.4 kV	25 kV
I_{NGR}	1 A	231 Ω	346 Ω	398 Ω	231 Ω	346 Ω	398 Ω	577 Ω	1386 Ω	–	–	–	–	–	–	–
	5 A	46 Ω	69 Ω	80 Ω	46 Ω	69 Ω	80 Ω	115 Ω	277 Ω	485 Ω	693 Ω	762 Ω	831 Ω	1270 Ω	1663 Ω	–
	10 A	*(23 Ω)*	35 Ω	40 Ω	*(23 Ω)*	35 Ω	40 Ω	58 Ω	139 Ω	242 Ω	346 Ω	381 Ω	416 Ω	635 Ω	831 Ω	1443 Ω
	15 A	*(15 Ω)*	*(23 Ω)*	*(27 Ω)*	*(15 Ω)*	*(23 Ω)*	*(27 Ω)*	38 Ω	92 Ω	162 Ω	231 Ω	254 Ω	277 Ω	423 Ω	554 Ω	962 Ω
	20 A	–	*(17 Ω)*	*(20 Ω)*	–	*(17 Ω)*	*(20 Ω)*	29 Ω	69 Ω	121 Ω	*(173 Ω)*	191 Ω	208 Ω	318 Ω	416 Ω	722 Ω
	25 A	–	–	*(16 Ω)*	–	–	*(16 Ω)*	*(23 Ω)*	55 Ω	97 Ω	*(139 Ω)*	*(152 Ω)*	*(166 Ω)*	254 Ω	333 Ω	577 Ω
	30 A	–	–	–	–	–	–	*(19 Ω)*	*(46 Ω)*	81 Ω	*(115 Ω)*	*(127 Ω)*	*(139 Ω)*	212 Ω	277 Ω	481 Ω
	40 A	–	–	–	–	–	–	–	*(35 Ω)*	61 Ω	*(87 Ω)*	*(95 Ω)*	*(104 Ω)*	*(159 Ω)*	208 Ω	361 Ω
	50 A	–	–	–	–	–	–	–	*(28 Ω)*	*(48 Ω)*	–	*(76 Ω)*	*(83 Ω)*	*(127 Ω)*	*(166 Ω)*	289 Ω
	100 A	–	–	–	–	–	–	–	–	*(24 Ω)*	–	–	–	–	*(83 Ω)*	*(144 Ω)*

Temperature range -40…+70 °C, field calibration at 25 °C
(Limited temperature range 0…+40 °C, field calibration at 25 °C)

LINETRAXX® NGRM500

Neutral Grounding Resistor Monitor



Typical applications

- For use in high-resistance grounded systems

Approvals

CE

UL in preparation

Device features

- Determination of R_{NGR} with passive and active measurement methods
- Continuous monitoring of the R_{NGR} even if the installation is de-energised;
- Alarm or trip on ground fault
- Monitoring of the current I_{NGR}
- Monitoring of the voltage U_{NGR}
- Ethernet communication
- Web server
- Language selection (German, English GB and US, Spanish, French)
- Test button (internal, external) with/without tripping
- FFT analysis of the measuring signals
- Pulser for manual ground fault location
- Relay for detection of ground faults and resistor faults
- Relay for shutdown of the installation after a configurable time
- Can be combined with RCMS… for automatic shutdown of feeders
- Graphical user interface
- Wide supply voltage range (24 to 240 Vac/Vdc)
- Range of use up to 2000 m AMSL
- Fault/History memory
- Analogue output of measured values (0…10 V, 4…20 mA, etc., selectable parameters)
- Password protection
- Tripping on RMS, fundamental component signal or harmonics
- Detection of AC and DC ground faults

Further information

For further information refer to our product range on www.bender.de.

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Ordering information

Supply voltage U_S / Frequency range Hz		Type	Art. No.
AC	DC		
48…240 V, 40…70 Hz	48…240 V	NGRM500	B94013500

Suitable system components

Description	Type	Art. No.	Page
Coupling device	CD…	B980390…	233
Measuring current transformer	CTUB…	B781200…	339
	W…AB	B980800…	–
Voltage supply for measuring current transformers	AN420	B94053100	–

Insulation coordination according to IEC 60664-1/IEC 60664-3/DIN EN 50187

Definitions	
Supply circuit (IC1)	(A1, A2)
Measuring circuit/Control circuit (IC2)	(RS, E, CT), (X1, Ethernet)
Output circuit 1 (IC3)	(11, 12, 14)
Output circuit 2 (IC4)	(21, 22, 24)
Output circuit 3 (IC5)	(31, 32, 34)
Rated voltage	250 V
Overvoltage category	III
Rated impulse voltage	
IC1/(IC2…5)	4 kV
IC2/(IC3…5)	4 kV
IC3/(IC4…5)	4 kV
IC4/(IC5)	4 kV
Rated insulation voltage	
IC1/(IC2…5)	250 V
IC2/(IC3…5)	250 V
IC3/(IC4…5)	250 V
IC4/(IC5)	250 V
Pollution degree exterior	3
Safe isolation (reinforced insulation) between	
IC1/(IC2…5)	overvoltage category III, 300 V
IC2/(IC3…5)	overvoltage category III, 300 V
IC3/(IC4…5)	overvoltage category III, 300 V
IC4/(IC5)	overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1	
IC1/(IC2…5)	AC 2,2 kV
IC2/(IC3…5)	AC 2,2 kV
IC3/(IC4…5)	AC 2,2 kV
IC4/(IC5)	AC 2,2 kV

Supply voltage

Nominal supply voltage U_s	AC/DC, 48…240 V
for UL applications	AC/DC, 48…240 V
for AS/NZS 2081	AC/DC, 48…230 V
Tolerance U_s	±15 %
Tolerance U_s (for UL applications)	-50…+15 %
Tolerance U_s (for AS/NZS 2081)	-25…+20 %
Frequency range U_s	DC, 40…70 Hz
Power consumption (max.)	≤ 7 W/16 VA

Monitoring R_{NGR}

Measuring input R_S	< 33 V RMS
Measuring range NGR (with R_S = 20 kΩ) active	0…10 kΩ
Measurement uncertainty for T = 0…+40 °C	±20 Ω
Measurement uncertainty for T = -40…+70 °C	±40 Ω
Measuring range NGR (with R_S = 100 kΩ) active	0…10 kΩ
Measurement uncertainty for T = 0…+40 °C	±30 Ω
Measurement uncertainty for T = -40…+70 °C	±80 Ω
Setting range $R_{NGR\ nom}$	15 Ω…5 kΩ
Response value $R_{NGR\ nom}$	10…90 % $R_{NGR\ nom}$
	110…200 % $R_{NGR\ nom}$
Response delay NGR relay	7 s (±2.5 s)
Response delay trip relay	0…60 s

Monitoring I_{NGR}

Measuring circuit 5 A	
Nominal measuring current I_n	DC/50/60 Hz/50…3200 Hz 5 A
Maximum continuous current	2 x I_n
Overload capacity	10 x I_n for 0,03 s
Measurement accuracy	±2 % of I_n
Load	10 mΩ
Measuring circuit 50 mA	
Nominal measuring current I_n	DC/50/60 Hz/50…3200 Hz 50 mA
Maximum continuous current	2 x I_n
Overload capacity	10 x I_n for 2 s
Measurement accuracy	±2 % of I_n
Load	68 Ω
Measuring circuits 5 A and 50 mA	
Response value I_{NGR}	10…90 % $I_{NGR\ nom}$
Response delay ground-fault relay	≤ 40 ms (±10 ms)
Response delay trip relay (configurable)	100 ms…24 h, ∞
Tolerance t_{trip} when set to	
RMS	-20…0 ms
Fundamental	0…+150 ms (filter time)
Harmonics	0…+150 ms (filter time)
Measuring current transformer ratio primary	1…10,000
Measuring current transformer ratio secondary	1…10,000
Measuring range	2 x $I_{NGR\ nom}$

Coupling

R_S for U_{sys} ≤ 4.3 kV	CD1000, CD1000-2, CD5000 (20 kΩ)
R_S for U_{sys} > 4.3 kV	CD14400, CD25000 (100 kΩ)

Monitoring U_{NGR}

U_{NGR} with R_S = 20 kΩ	DC/50/60 Hz/50…3200 Hz; (400/√3) … ≤ (4300/√3) V
U_{NGR} with R_S = 100 kΩ	DC/50/60 Hz/50…3200 Hz; > (4.3 /√3) …(25/√3) kV
Measuring range	1.2 x $U_{NGR\ nom}$
Overload capacity	2 x U_{NGR} for 10 s
Measurement accuracy	2 % of $U_{NGR\ nom}$ with $U_{NGR\ nom}$ = ($U_{sys\ (L-L)}$/√3)
Voltage response value	0…90 % $U_{NGR\ nom}$
Response delay ground-fault relay	≤ 40 ms (±10 ms)
Response delay trip relay (configurable)	100 ms…24 h, ∞
Tolerance t_{trip} when set to	
RMS	-20…0 ms
Fundamental	0…+150 ms (filter time)
Harmonics	0…+150 ms (filter time)
PT ratio primary	1…10,000
PT ratio secondary	1…10,000
DC immunity in case of active R_{NGR} measurement	
with R_S = 20 kΩ	DC ±12 V
with R_S = 100 kΩ	DC ±60 V

Digital inputs

Galvanic separation	no
Length connecting cables	max. 10 m
U_{in}	DC 0 V, 24 V
Overload capacity	-5…32 V

Digital outputs

Galvanic separation	no
Length connecting cables	max. 10 m
Currents (sink) for each output	max. 300 mA
Voltage	24 V
Overload capacity	-5…32 V

Ground-fault, NGR, trip relay

Switching elements	changeover contacts
Operating mode	configurable fail-safe/non-fail-safe
Electrical endurance, number of cycles	10,000
Switching capacity	2000 VA/150 W

Contact data acc. to IEC 60947-5-1

Rated operational voltage AC	250 V/250 V
Utilisation category	AC-13/AC-14
Rated operational current AC	5 A/3 A
Rated operational current AC (for UL applications)	3 A/3 A
Rated operational voltage DC	220/110/24 V
Utilisation category	DC12
Rated operational current DC	0.1/0.2/1 A
Minimum current	1 mA at AC/DC > 10 V

Environment/EMC

EMC immunity (IEC6100-6-2/IEC 60255-26 Ed. 3.0)	DIN EN 61000-6-2
EMC emission (IEC6100-6-2/IEC 60255-26 Ed. 3.0)	DIN EN 61000-6-4
Operating temperature	-40…+60 °C
	-40…+60 °C (for UL applications)
Humidity	≤ 98 %

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (-40…+85 °C) (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (-40…+70 °C) (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721/IEC 60255-21/DIN EN 60068-2-6

Stationary use	3M7
Transport	2M2
Long-term storage	1M3

Technical data (continued)

Connection

Screw-type terminals

Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Stripping length	7 mm
Recommended connecting cables	see overview in the manual
rigid/flexible	0.2…2.5 mm² (AWG 24…13)
flexible with ferrule with/without plastic sleeve	0.25…2.5 mm² (AWG 24…13)
Multiple conductor, rigid	0.2…1 mm² (AWG 24…18)
Multiple conductor flexible	0.2…1.5 mm² (AWG 24…16)
Multiple conductor flexible with ferrule without plastic sleeve	0.25…1 mm² (AWG 24…18)
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm² (AWG 24…16)

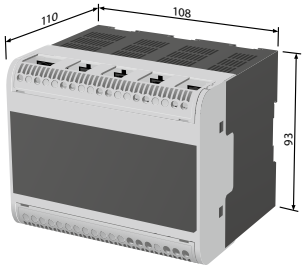
Push-wire terminals X1

Stripping length	10 mm
rigid/flexible	0.2…1.5 mm² (AWG 24…16)
flexible with ferrule without plastic sleeve	0.25…1.5 mm² (AWG 24…16)
flexible with ferrule with plastic sleeve	0.25…0.75 mm² (AWG24…18)

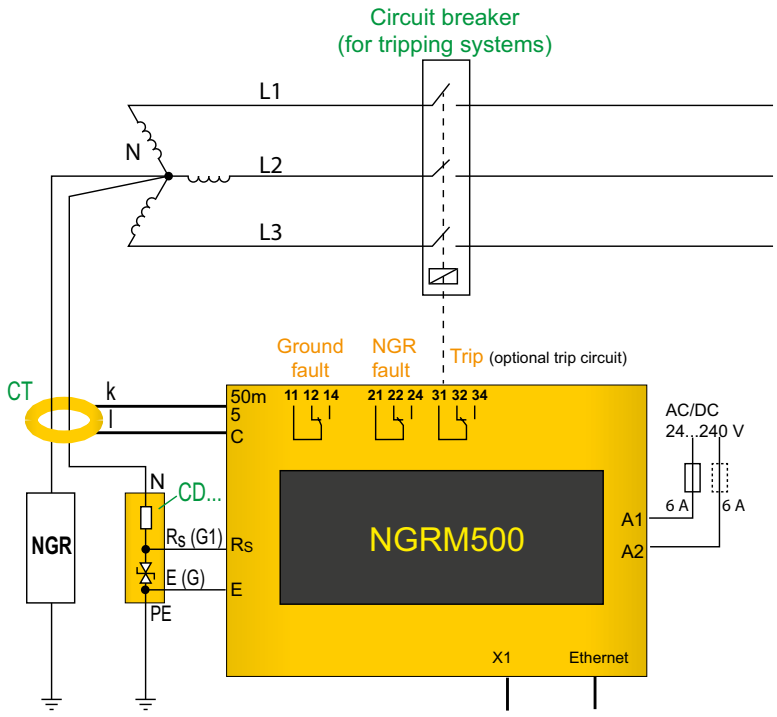
Other

Operating mode	continuous operation
Mounting	display-oriented
Altitude	max. 2000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP30
Flammability class	UL 94V-0
Protective coating measurement equipment	SL1307, UL file E80315
Documentation number	D00373
Weight	500 g

Dimension diagram (dimensions in mm)

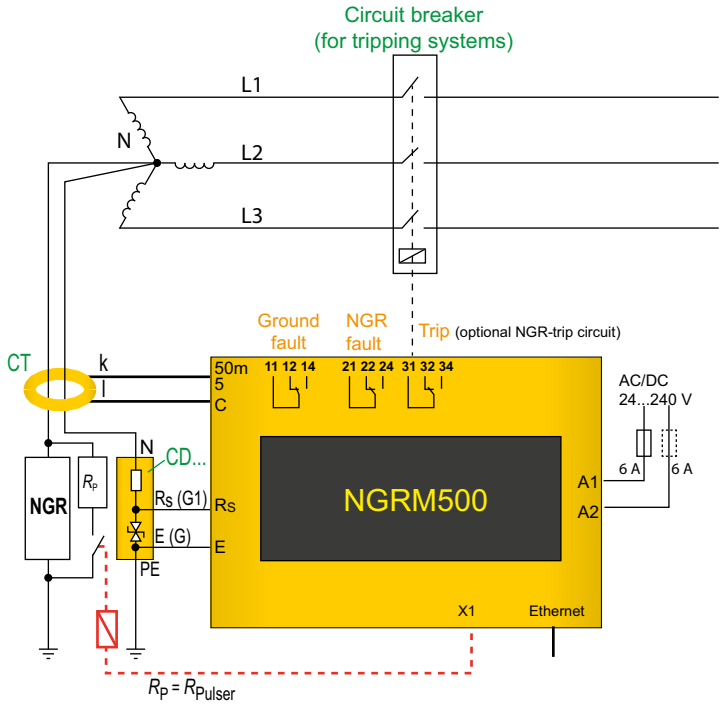


Connection star connection



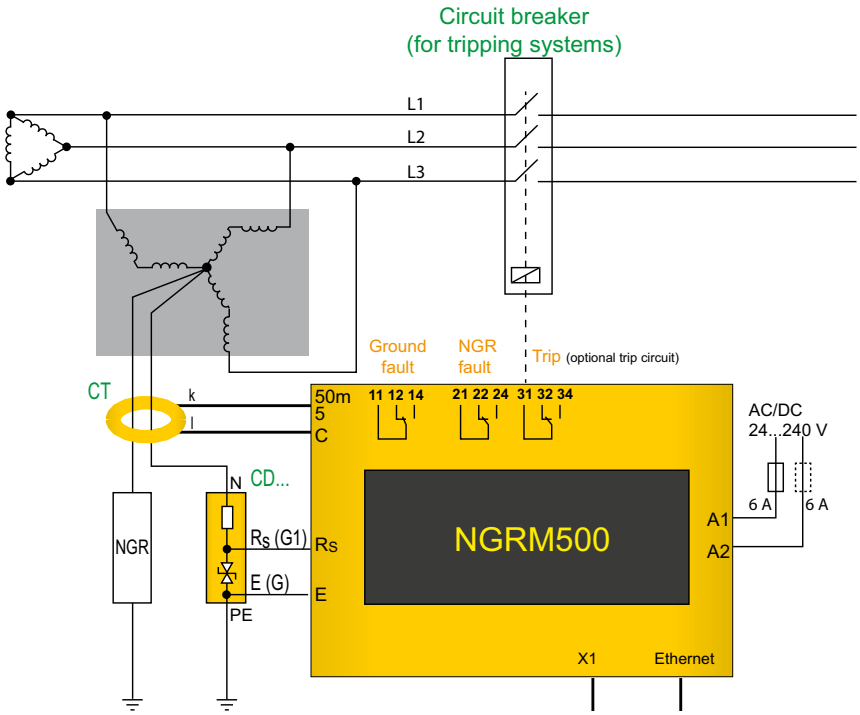
The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

Connection Star connection with pulser



The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.
An intermediate relay may be required between the power contactor of the pulser and the digital output at X1 of the FP200-NGRM.

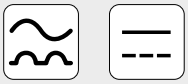
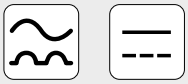
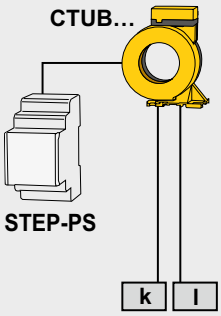
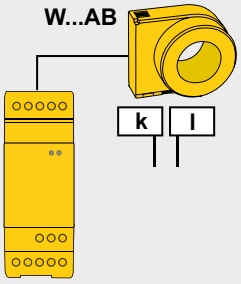
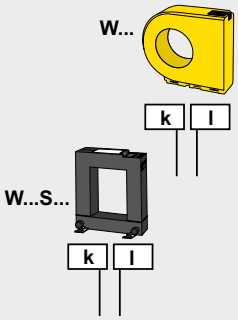
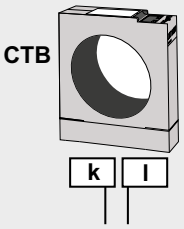
Connection artificial neutral (delta connection): zigzag transformer



If no star point is available, the following circuit can create an artificial neutral.

Measuring current transformer connection

Depending on the system to be monitored, a suitable measuring current transformer has to be chosen. All common measuring current transformers (50 mA or 5 A on the secondary side) can be used. The following table helps you with the choice:

System type	AC + DC	AC + DC	AC	AC
I	1…10 A	1…10 A	5…25 A	5…25 A
f	0…3800 Hz	0…3800 Hz	42…3800 Hz	50/60 Hz
Conversion ratio	600:1	600:1	600:1	60:5
Length connecting cables	max. 10 m (supplied cable or 0,75…1,5 mm²/ AWG18…16)	max. 10 m (supplied cable or 0,75…1,5 mm²/ AWG18…16)	max. 40 m (supplied cable or 0,75…1,5 mm²/ AWG18…16)	max. 25 m (4 mm²) max. 40 m (6 mm²)
$I_{\Delta n}$				
Type	CTUB… 	W35…120AB 	W20…120 W1-S35…W5-S210 	CTB31…41 
CT: k	NGRM500: **50 mA**	NGRM500: **50 mA**	NGRM500: **50 mA**	NGRM500: **5 A**
CT: l	NGRM500: **C**	NGRM500: **C**	NGRM500: **C**	NGRM500: **C**

LINETRAXX® NGRM700

Neutral Grounding Resistor Monitor



Typical applications

- For use in high-resistance grounded systems

Approvals

Device features

- Determination of R_{NGR} with passive and active measurement methods
- Continuous monitoring of the R_{NGR} even if the installation is de-energised;
- Alarm or trip on ground fault
- Monitoring of the current I_{NGR}
- Monitoring of the voltage U_{NGR}
- Phase-to-ground fault indication (optional; up to 690 V direct coupling, otherwise via potential transformers)
- Ethernet communication
- Web server
- Language selection (German, English GB and US, Spanish, French)
- Test button (internal, external) with/without tripping
- FFT analysis of the measuring signals
- Pulser for manual ground fault location
- Relay for detection of ground faults and resistor faults
- Relay for shutdown of the installation after a configurable time
- Can be combined with RCMS… for automatic shutdown of feeders
- Graphical user interface
- Wide supply voltage range (24 to 240 Vac/Vdc)
- Range of use up to 5000 m AMSL
- Fault/History memory
- Analogue output of measured values (0…10 V, 4…20 mA, etc., selectable parameters)
- Detachable HMI for door mounting
- Password protection
- Tripping on RMS, fundamental component signal or harmonics
- Detection of AC and DC ground faults

Further information

For further information refer to our product range on www.bender.de.

4

Ordering information

Supply voltage U_S / Frequency range Hz		Type	Art. No.
AC	DC		
24…240 V, 40…70 Hz	24…240 V	NGRM700	B94013700

Accessories

Description	Art.-Nr.
Accessory for FP200-NGRM: Transparent front cover 144x72 (for IP65)[1]	B98060005
Accessory for FP200-NGRM: Front mounting fixing clips	B91067907

[1] When using the "transparent front cover 144x72 (IP 65)" the cutout in the switchboard cabinet must be extended in height from 66 mm to 68 mm (+0.7/-0 mm).

The degree of protection IP65 applies only to the user interface FP200-NGRM when using the front cover. The degree of protection for the complete device is still IP30.

Suitable system components

Description	Type	Art. No.	Page
Coupling device	CD…	B980390…	233
Measuring current transformer	CTUB…	B781200…	339
	W…AB	B980800…	–
Voltage supply for measuring current transformers	AN420	B94053100	–

Insulation coordination according to IEC 60664-1/IEC 60664-3/DIN EN 50187

Definitions	
Measuring circuit 1 (IC1)	(L1, L2, L3)
Supply circuit (IC2)	(A1, A2)
Measuring circuit/Control circuit (IC3)	(RS, E, CT), (X1, Ethernet)
Output circuit 1 (IC4)	(11, 12, 14)
Output circuit 2 (IC5)	(21, 22, 24)
Output circuit 3 (IC6)	(31, 32, 34)
Rated voltage	690 V
Overvoltage category	III
Rated impulse voltage	
IC1/(IC2…6)	8 kV
IC2/(IC3…6)	4 kV
IC3/(IC4…6)	4 kV
IC4/(IC5…6)	4 kV
IC5/(IC6)	4 kV
Rated insulation voltage	
IC1/(IC2…6)	800 V
IC2/(IC3…6)	250 V
IC3/(IC4…6)	250 V
IC4/(IC5…6)	250 V
IC5/(IC6)	250 V
Pollution degree exterior	3
Safe isolation (reinforced insulation) between	
IC1/(IC2…6)	overvoltage category III, 800 V
IC2/(IC3…6)	overvoltage category III, 300 V
IC3/(IC4…6)	overvoltage category III, 300 V
IC4/(IC5…6)	overvoltage category III, 300 V
IC5/(IC6)	overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1	
IC2/(IC3…6)	AC 2.2 kV
IC3/(IC4…6)	AC 2.2 kV
IC4/(IC5…6)	AC 2.2 kV
IC5/(IC6)	AC 2.2 kV

Supply voltage

Nominal supply voltage U_s	
≤ 2000 m	AC/DC, 24…240 V
≤ 2000 m (for UL applications)	AC/DC, 48…240 V
≤ 2000 m (for AS/NZS 2081)	AC/DC, 48…230 V
> 2000…≤ 5000 m	AC/DC, 24…120 V
> 2000…≤ 5000 m (for UL applications, AS/NZS 2081)	AC/DC, 48…120 V
Tolerance U_s	±15 %
Tolerance U_s (for UL applications)	-50…+15 %
Tolerance U_s (for AS/NZS 2081)	-25…+20 %
Frequency range –	DC, 40…70 Hz
Power consumption (typ. 50/60 Hz)	≤ 6.5 W/13 VA

Phase monitoring

Nominal measuring voltage U_n	3 AC 100…690 V, CAT III
Measuring range	1.2 x U_n
Measurement accuracy	±1 % of U_n
Power consumption per phase	≤ 0.5 W
Overload capacity	2 x U_n continuous
Input resistance	1,76 MΩ
PT ratio primary	1…10,000
PT ratio secondary	1…10,000
Measuring range with PT	100 V…25 kV

Monitoring R_{NGR}

Measuring input R_S	< 33 V RMS
Measuring range NGR (with R_S = 20 kΩ) active	0…10 kΩ
Measurement uncertainty for T = 0…+40 °C	±20 Ω
Measurement uncertainty for T = -40…+70 °C	±40 Ω
Measuring range NGR (with R_S = 100 kΩ) active	0…10 kΩ
Measurement uncertainty for T = 0…+40 °C	±30 Ω
Measurement uncertainty for T = -40…+70 °C	±80 Ω
Setting range $R_{NGR\ nom}$	15 Ω…5 kΩ
Response value $R_{NGR\ nom}$	10…90 % $R_{NGR\ nom}$ 110…200 % $R_{NGR\ nom}$
Response delay NGR relay	7 s (±2.5 s)
Response delay trip relay	0…60 s

Monitoring I_{NGR}

Measuring circuit 5 A	
Nominal measuring current I_n	DC/50/60 Hz/50…3200 Hz 5 A
Maximum continuous current	2 x I_n
Overload capacity	10 x I_n for 2 s
Measurement accuracy	±2 % of I_n
Load	10 mΩ
Measuring circuit 50 mA	
Nominal measuring current I_n	DC/50/60 Hz/50…3200 Hz 50 mA
Maximum continuous current	2 x I_n
Overload capacity	10 x I_n for 2 s
Measurement accuracy	±2 % of I_n
Load	68 Ω
Measuring circuits 5 A and 50 mA	
Response value I_{NGR}	10…90 % $I_{NGR\ nom}$
Response delay ground-fault relay	≤ 40 ms (±10 ms)
Response delay trip relay (configurable)	100 ms…24 h, ∞
Tolerance t_{trip} when set to	
RMS	-20…0 ms
Fundamental	0…+150 ms (filter time)
Harmonics	0…+150 ms (filter time)
Measuring current transformer ratio primary	1…10,000
Measuring current transformer ratio secondary	1…10,000
Measuring range	2 x $I_{NGR\ nom}$

Coupling

R_S for U_{sys} ≤ 4.3 kV	CD1000, CD1000-2, CD5000 (20 kΩ)
R_S for U_{sys} > 4.3 kV	CD14400, CD25000 (100 kΩ)

Monitoring U_{NGR}

U_{NGR} with R_S = 20 kΩ	DC/50/60 Hz/50…3200 Hz; (400/√3) … ≤ (4300/√3) V
U_{NGR} with R_S = 100 kΩ	DC/50/60 Hz/50…3200 Hz; > (4.3 /√3) …(25/√3) kV
Measuring range	1.2 x $U_{NGR\ nom}$
Overload capacity	2 x U_{NGR} for 10 s
Measurement accuracy	2 % of $U_{NGR\ nom}$ with $U_{NGR\ nom}$ = ($U_{sys\ (L-L)}$/√3)
Voltage response value	0…100 % $U_{NGR\ nom}$
Response delay ground-fault relay	≤ 40 ms (±10 ms)
Response delay trip relay (configurable)	100 ms…24 h, ∞
Tolerance t_{trip} when set to	
RMS	-20…0 ms
Fundamental	0…+150 ms (filter time)
Harmonics	0…+150 ms (filter time)
PT ratio primary	1…10,000
PT ratio secondary	1…10,000
DC immunity in case of active R_{NGR} measurement	
with R_S = 20 kΩ	DC ±12 V
with R_S = 100 kΩ	DC ±60 V

Digital inputs

Galvanic separation	no
Length connecting cables	max. 10 m
U_{in}	DC 0 V, 24 V
Overload capacity	-5…32 V

Digital outputs

Galvanic separation	no
Length connecting cables	max. 10 m
Currents (sink) for each output	max. 300 mA
Voltage	24 V
Overload capacity	-5…32 V

Analogue output (M+)

Operating mode	Linear
Functions	I_{NGR}, R_{NGR}
Current	0…20 mA (≤ 600 Ω), 4…20 mA (≤ 600 Ω), 0…400 µA (≤ 4 kΩ)
Voltage	0…10 V (≥ 1 kΩ), 2…10 V (≥ 1 kΩ)
Tolerance related to the current/voltage end value	±20 %

Ground-fault, NGR, trip relay

Switching elements	changeover contacts
Operating mode	configurable fail-safe/non-fail-safe
Electrical endurance, number of cycles	10,000
Switching capacity	2000 VA/150 W

Contact data acc. to IEC 60947-5-1

Rated operational voltage AC	250 V/250 V
Utilisation category	AC-13/AC-14
Rated operational current AC	5 A/3 A
Rated operational current AC (for UL applications)	3 A/3 A
Rated operational voltage DC	220/110/24 V
Utilisation category	DC12
Rated operational current DC	0.1/0.2/1 A
Minimum current	1 mA at AC/DC > 10 V

Environment/EMC

EMC immunity (IEC6100-6-2/IEC 60255-26 Ed. 3.0)	DIN EN 61000-6-2
EMC emission (IEC6100-6-2/IEC 60255-26 Ed. 3.0)	DIN EN 61000-6-4
Operating temperature	-40…+70 °C -40…+60 °C (for UL applications)
Humidity	≤ 98 %

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (-40…+85 °C) (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (-40…+70 °C) (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721/IEC 60255-21/DIN EN 60068-2-6

Stationary use	3M7
Transport	2M2
Long-term storage	1M3

Connection

Screw-type terminals

Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrule with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, rigid	0.2…1 mm²
Multiple conductor flexible	0.2…1.5 mm²
Multiple conductor flexible with ferrule without plastic sleeve	0.25…1 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

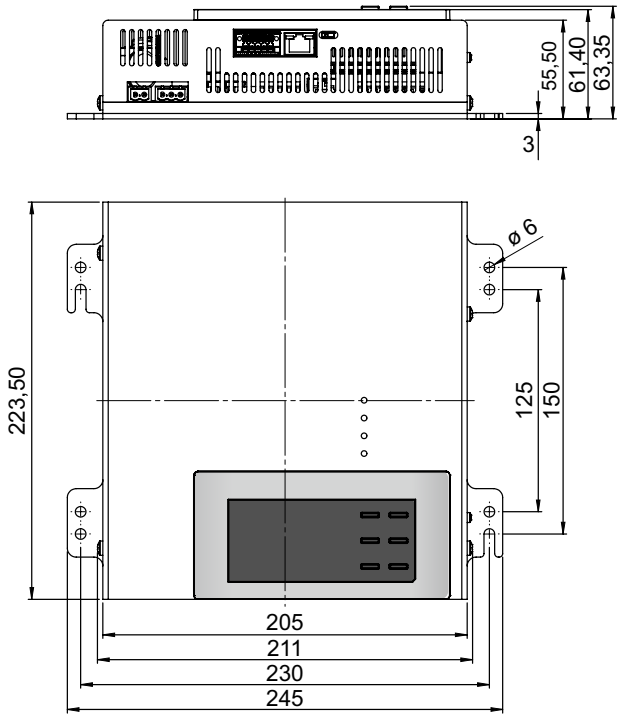
Push-wire terminals X1

Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with ferrule with plastic sleeve	0.25…0.75 mm²

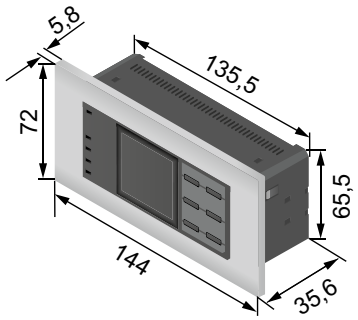
Other

Operating mode	continuous operation
Mounting	display-oriented
Altitude	5000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP30
Flammability class	UL 94V-0
Protective coating measurement equipment	SL1307, UL file E80315
Documentation number	D00292
Weight	1050 g

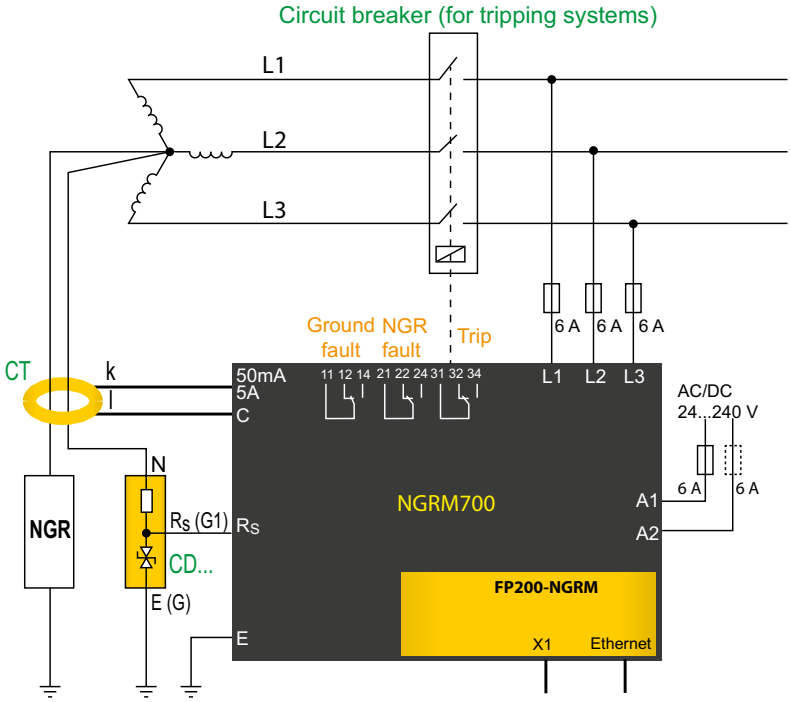
Dimension diagram NGRM700 (dimensions in mm)



Dimension diagram FP200-NGRM (dimensions in mm)



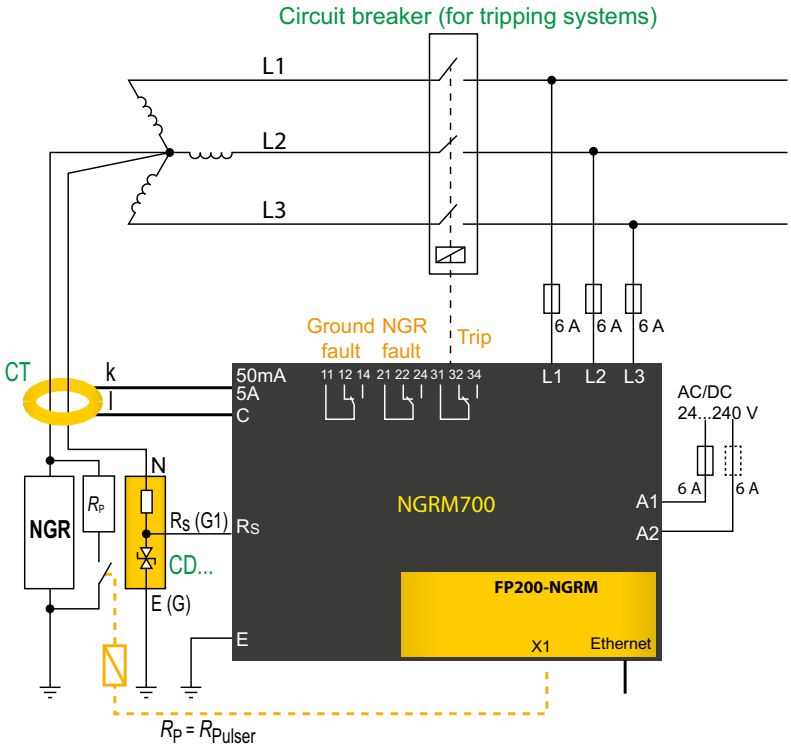
Connection star connection: $U_{sys} \leq 690$ V



For these voltages, the phase monitor of the NGRM700 can be connected directly to the conductors to be monitored.

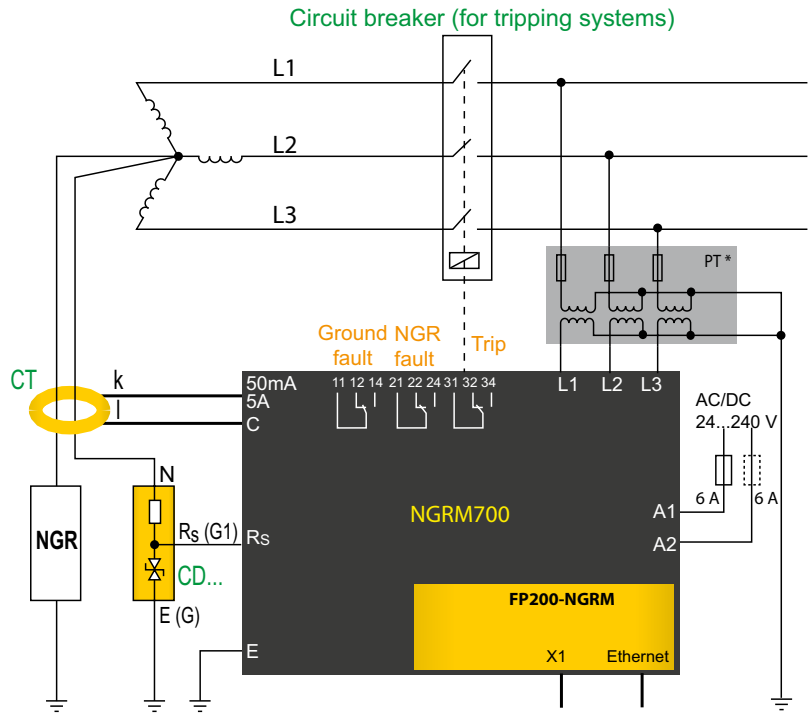
The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

Connection Star connection: $U_{sys} \leq 690$ V with pulser



The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.
An intermediate relay may be required between the power contactor of the pulser and the digital output at X1 of the FP200-NGRM.

Connection star connection: U_{sys} > 690 V

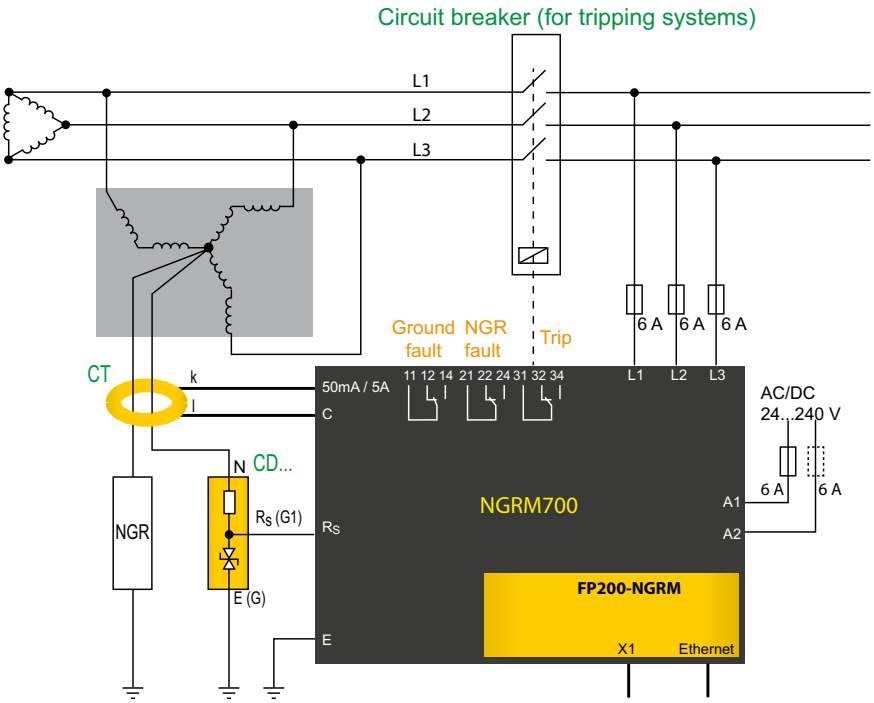


For these voltages, the phase monitor of the NGRM700 can only be connected to the conductors to be monitored via potential transformers (PT).

*Note: * PT ratio „primary: secondary" can be adjusted in the NGRM700.*

The "N" connection of the CD-series coupling device should be as close to the transformer star point as possible.

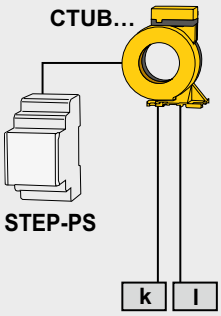
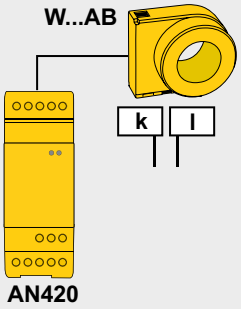
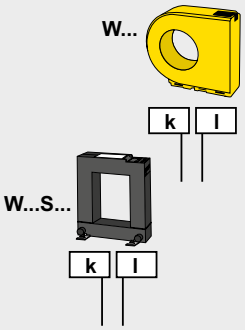
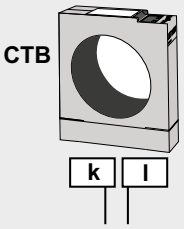
Connection artificial neutral (delta connection): zigzag transformer



If no star point is available, the following circuit can create an artificial neutral.

Measuring current transformer connection

Depending on the system to be monitored, a suitable measuring current transformer has to be chosen. All common measuring current transformers (50 mA or 5 A on the secondary side) can be used. The following table helps you with the choice:

System type	AC + DC	AC + DC	AC	AC
I	1…10 A	1…10 A	5…25 A	5…25 A
f	0…3800 Hz	0…3800 Hz	42…3800 Hz	50/60 Hz
Conversion ratio	600:1	600:1	600:1	60:5
Length connecting cables	max. 10 m	max. 10 m	max. 40 m	max. 25 m (4 mm²) max. 40 m (6 mm²)
$I_{\Delta n}$	~ ⎓	~ ⎓	~	~
Type	CTUB… 	W…AB 	W…/W…S 	CTB… 
CT: k	NGRM700: **50 mA**	NGRM700: **50 mA**	NGRM700: **50 mA**	NGRM700: **5 A**
CT: l	NGRM700: **C**	NGRM700: **C**	NGRM700: **C**	NGRM700: **C**

CD1000

Coupling device



Device features

- Coupling device for NGRM
- Range of use up to AC 690 V/DC 400 V system voltage
- Range of use up to 2000 m

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- The coupling device is suitable for HRG applications up to AC 690 V and/or DC 400 V.

Approvals

Ordering information

Nominal system voltage U_{LL} (U_{NGR})	Type	Art. No.
Up to U_{LL} = 690 V (U_{NGR} = 400 V)	CD1000	B98039010

Technical data

Insulation coordination DIN EN 50178:1997

Definition	
Measuring circuit (IC1)	N
Output circuit (IC2)	G1
Protective circuit (IC3)	G, PE
Rated voltage	400 V
Overvoltage category	III
Pollution degree	2
Rated insulation voltage	
no galvanic separation between the circuits!	
IC1/(IC2 – IC3)	400 V
IC2/IC3	50 V

Voltage range

U_n	DC / 50/60 Hz / 50…3200 Hz 400 V
I_n	30 mA
Overload capacity	1.15 x U_n for < 30 minutes

Resistance

20 kΩ	±5 %
Temperature coefficient	25 ppm/K

Environment

Ambient temperature	-40…+70 °C
Ambient temperature for U_L	-40…+60 °C
Humidity	≤ 98 %

Classification of climatic conditions acc. to IEC 60721

(except condensation and formation of ice)	
Stationary use (IEC 60721-3-3)	3K5
Transport (IEC 60721-3-2)	2K3 (-40…+85 °C)
Long-term storage (IEC 60721-3-1)	1K4 (-40…+70 °C)

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M7
Transport	2M2
Long-term storage	1M3

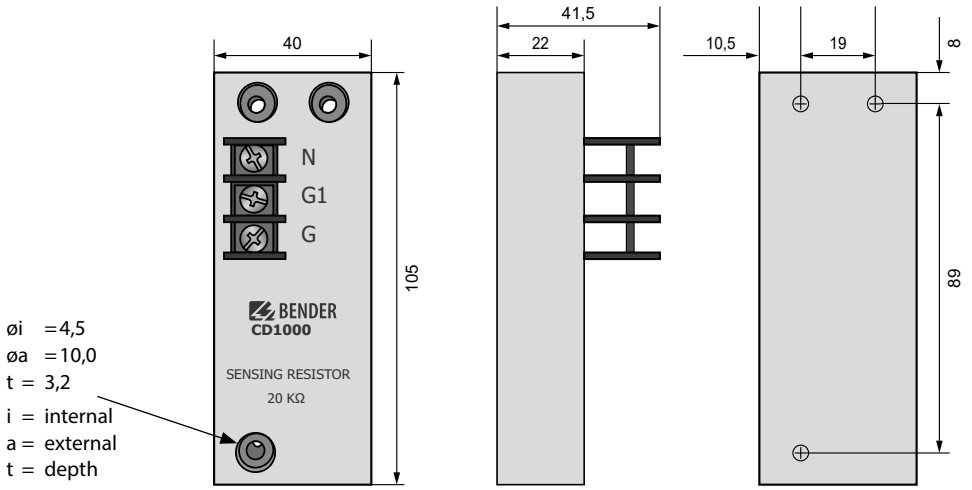
Connection

Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
Conductor, rigid	0.2…4 mm²
Conductor, flexible	0.2…2.5 mm²
Multiple conductor, flexible with ring cable lug	
without plastic sleeve	0.25…1.5 mm²
with plastic sleeve	0.25…2.5 mm²

Other

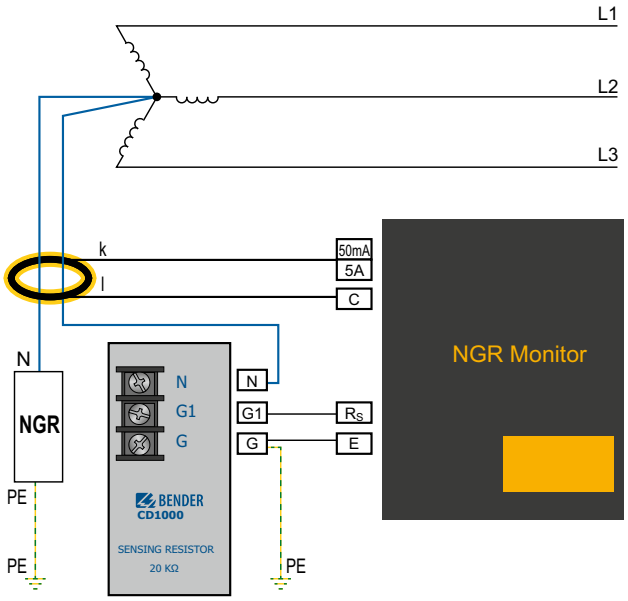
Tightening torque mountings screws (M4x30)	2.5 Nm (22.1 lb-in)
Operating mode	continuous operation
Mounting	any position
Operating altitude	up to 2000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP30
Flammability class	UL94 HB
Documentation number	D00397
Weight	< 190 g

Dimension diagram (dimensions in mm)

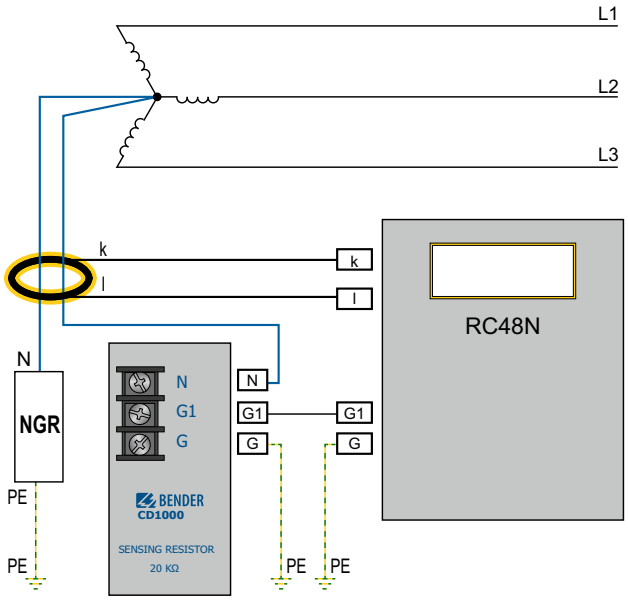


Wiring diagram

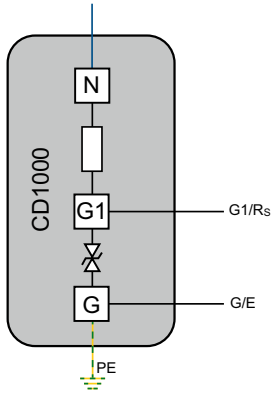
NGR monitor



RC48N



Internal wiring diagram CD1000



Terminal	Use	Connecting cable	
		Metrical	Imperial
N	Connection to the star point of the HRG system	1.5 mm²	AWG16
G1	Connection to R_S of the NGRM…		
G	Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)		
PE	Connection to enclosure	≥ 1.5 mm²	AWG16 or greater

CD1000-2

Coupling device



Device features

- Coupling device for NGRM
- Range of use up to AC 1000 V/DC 600 V system voltage
- Application up to 5000 m

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- The coupling device is suitable for HRG applications up to AC 1000 V and/or DC 690 V.

Approvals

Ordering information

Nominal system voltage U_n	Type	Art. No.
Up to U_{LL} = 1000 V (U_{NGR} = 600 V)	CD1000-2	B98039053

Technical data

Insulation coordination DIN EN 50178:1997

Definition	
Measuring circuit (IC1)	N
Output circuit (IC2)	R_S
Protective circuit (IC3)	E, PE
Rated voltage	600 V
Overvoltage category	III
Pollution degree	2
Rated insulation voltage	
no galvanic separation between the circuits!	
IC1/(IC2 – IC3)	600 V
IC2/IC3	50 V

Voltage range

U_n	DC / 50/60 Hz / 50…3200 Hz 600 V
I_n	30 mA
Overload capacity	1.15 x U_n for < 30 minutes

Resistance

20 kΩ	±0.5 %
Temperature coefficient	20 ppm/K

Environment

Ambient temperature	-40…+70 °C
Ambient temperature for U_L	-40…+60 °C
Humidity	≤ 98 %

Classification of climatic conditions acc. to IEC 60721

(except condensation and formation of ice)	
Stationary use (IEC 60721-3-3)	3K5
Transport (IEC 60721-3-2)	2K3 (-40…+85 °C)
Long-term storage (IEC 60721-3-1)	1K4 (-40…+70 °C)

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M7
Transport	2M2
Long-term storage	1M3

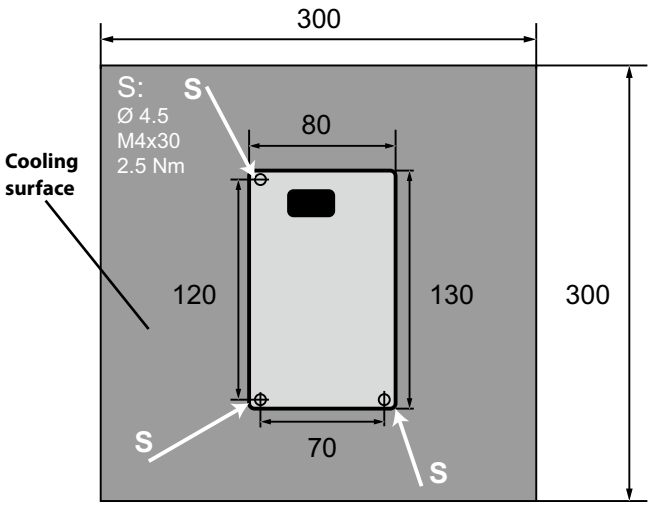
Connection

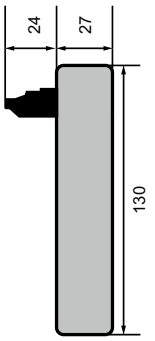
Tightening torque	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
Conductor, rigid	0.2…4 mm²
Conductor, flexible	0.2…2.5 mm²
Multiple conductor, flexible with ferrule	
without plastic sleeve	0.25…1.5 mm²
with plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule	
with plastic sleeve	0.5…1.5 mm²

Other

Tightening torque mounting screws (M4x30)	2.5 Nm (22.1 lb-in)
Operating mode	continuous operation
Mounting	any position
Operating altitude	up to 5000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP30
Flammability class	UL 94V-0
Documentation number	D00345
Weight	< 700 g

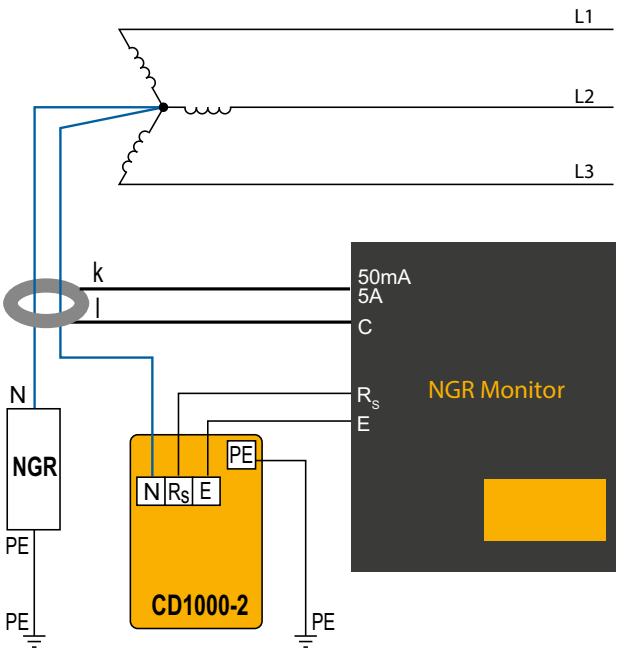
Dimension diagram (dimensions in mm)



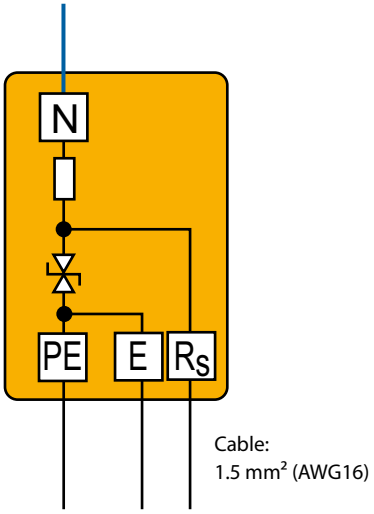


Wiring diagram

Wiring diagram



Internal wiring diagram CD1000-2



Terminal	Use	Connecting cable	
		Metrical	Imperial
N	Connection to the star point of the HRG system	1.5 mm²	AWG16
R_S	Connection to R_S of the NGRM…		
E	Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)		
PE	Connection to the protective conductor (internally connected to E, see internal wiring diagram)	≥ 1.5 mm²	AWG16 or greater

CD5000

Coupling device



Device features

- Coupling device for NGRM
- Range of use up to AC 4300 V/DC 2500 V system voltage
- Range of use up to 2000 m

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- The coupling device is suitable for HRG applications up to AC 4300 V and/or DC 2500 V.

Approvals

UL in preparation

Ordering information

Nominal system voltage U_{LL} (U_{NGR})	Type	Art. No.
Up to U_{LL} = 4300 V (U_{NGR} = 2500 V)	CD5000	B98039011

Technical data

Insulation coordination DIN EN 50178:1997

Definition	
Measuring circuit (IC1)	N
Output circuit (IC2)	G1
Protective circuit (IC3)	G, PE
Rated voltage	3 kV
Overvoltage category	III
Pollution degree	2
Rated insulation voltage	
no galvanic separation between the circuits!	
IC1/(IC2 – IC3)	3 kV
IC2/IC3	50 V

Voltage range

U_n	DC / 50/60 Hz / 50…3200 Hz 2500 V
I_n	125 mA
Overload capacity	1.15 x U_n for < 5 minutes

Resistance

20 kΩ	±1 %
Temperature coefficient	20 ppm/K

Environment

Ambient temperature	-40…+70 °C
Ambient temperature for U_L	-40…+60 °C
Humidity	≤ 98 %

Classification of climatic conditions acc. to IEC 60721

(except condensation and formation of ice)	
Stationary use (IEC 60721-3-3)	3K5
Transport (IEC 60721-3-2)	2K3 (-40…+85 °C)
Long-term storage (IEC 60721-3-1)	1K4 (-40…+70 °C)

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M7
Transport	2M2
Long-term storage	1M3

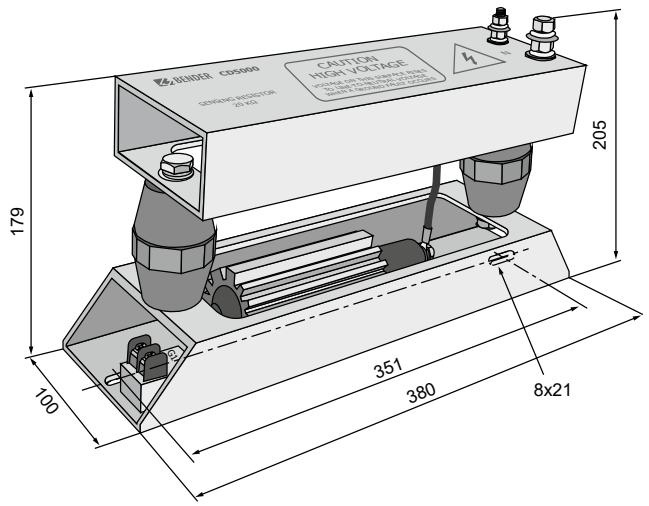
Connection

Tightening torque G1 and G	0.5…0.6 Nm (5…7 lb-in)
Conductor sizes	AWG 24-12
Connection G1 and G	cable lug
Conductor	≥ 1.5 mm²
Connection PE	cable lug M6
Conductor	≥ 2.5 mm²
Connection N	cable lug M6, M10

Other

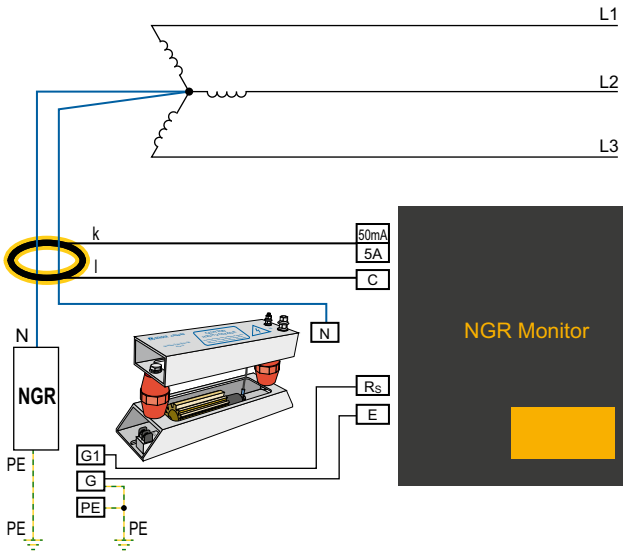
Operating mode	continuous operation
Mounting	any position
Operating altitude	up to 2000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP0
Flammability class	UL 94V-0
Documentation number	D00398
Weight	< 3800 g

Dimension diagram (dimensions in mm)

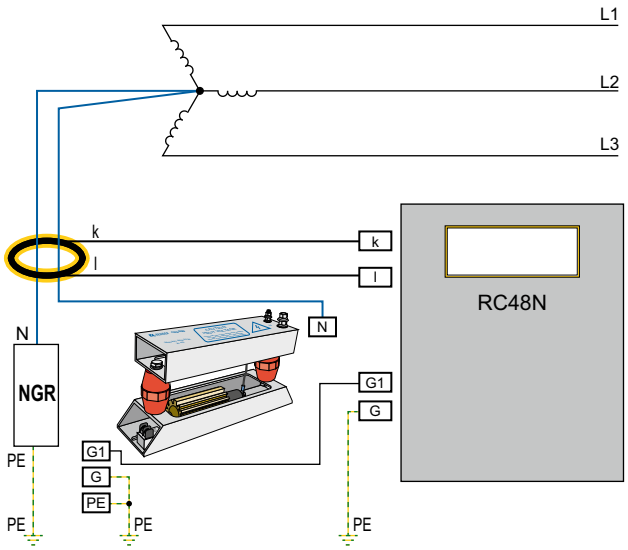


Wiring diagram

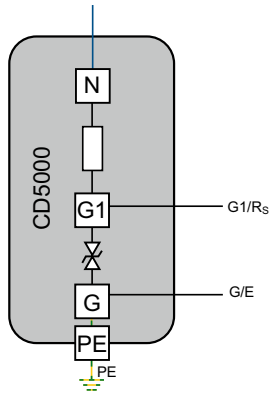
NGR monitor



RC48N



Internal wiring diagram CD5000



Terminal	Use	Connecting cable	
		Metrical	Imperial
N	Connection to the star point of the HRG system	via cable lug M6 or M10	
G1	Connection to R_S of the NGRM…	1.5 mm²	AWG16
G	Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)		
PE to enclosure	Connection to the protective conductor (internally connected to E, see internal wiring diagram)	≥ 1.5 mm²	AWG16 or greater

CD14400

Coupling device



Device features

- Coupling device for NGRM
- Range of use up to 14400 V system voltage
- Application up to 5000 m
- IP54

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- The coupling device is suitable for HRG applications up to a system voltage of 14400 V.

Approvals

UL in Vorbereitung

Ordering information

Nominal system voltage U_n	Type	Art. No.
Up to U_{LL} = 14400 V (U_{NGR} = 8400 V)	CD14400	B98039054

Technical data

Insulation coordination DIN EN 50178:1997

Definitions	
Measuring circuit (IC1)	N
Output circuit (IC2)	R_S
Protective circuit (IC3)	E, PE
Rated voltage	8400 V
Overvoltage category	III
Pollution degree	2
Rated insulation voltage	
no galvanic separation between the circuits!	
IC1/(IC2 – IC3)	8400 V
IC2/IC3	50 V

Voltage range

U_n	DC / 50/60 Hz / 50…3200 Hz 8400 V
I_n	84 mA
Operating time	
without ground fault (1900 V)	unlimited
with ground fault (4200 V)	90 seconds
with ground fault (8400 V)	60 seconds
Cool-down period	120 minutes
Overload capacity	1.15 x U_n for < 30 seconds

Resistance

100 kΩ	±0.5 %
Temperature coefficient	20 ppm/K

Environment

Ambient temperature	-40…+70 °C
Ambient temperature for U_L	-40…+60 °C
Humidity	≤ 98 %

Classification of climatic conditions acc. to IEC 60721

(except condensation and formation of ice)	
Stationary use (IEC 60721-3-3)	3K5
Transport (IEC 60721-3-2)	2K3 (-40…+85 °C)
Long-term storage (IEC 60721-3-1)	1K4 (-40…+70 °C)

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M7
Transport	2M2
Long-term storage	1M3

Connection

Connection R_S and E

Tightening torque	0.5…0.6 Nm (4.4…5.3 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
Conductor, rigid	0.2…4 mm²
Conductor, flexible	0.2…2.5 mm²

Multiple conductor, flexible with ferrule

without plastic sleeve	0.25…1.5 mm²
with plastic sleeve	0.25…2.5 mm²

Multiple conductor, flexible with TWIN ferrule

with plastic sleeve	0.5…1.5 mm²

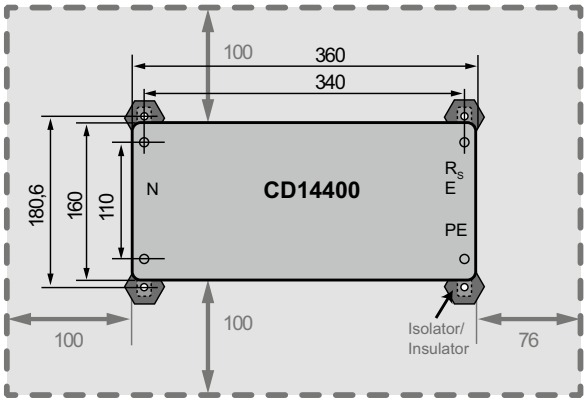
Connection N and PE

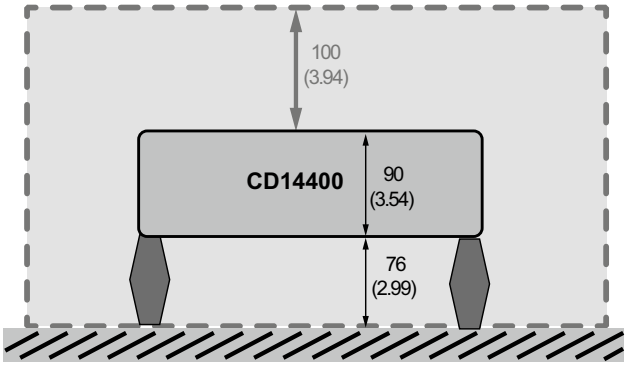
Tightening torque cable lug M10	17 Nm (150 lb-in)
Tightening torque cable lug M5	2.2 Nm (19.5 lb-in)

Other

Tightening torque	
cover screws	2.5 Nm (22.1 lb-in)
mounting screws	21 Nm (186 lb-in)
Operating mode	in case of a ground fault maximum 60 s
Mounting	any position
Operating altitude	up to 5000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP54
Flammability class	UL 94V-0
Documentation number	D00346
Weight	< 4.4 kg

Dimension diagram (dimensions in mm)



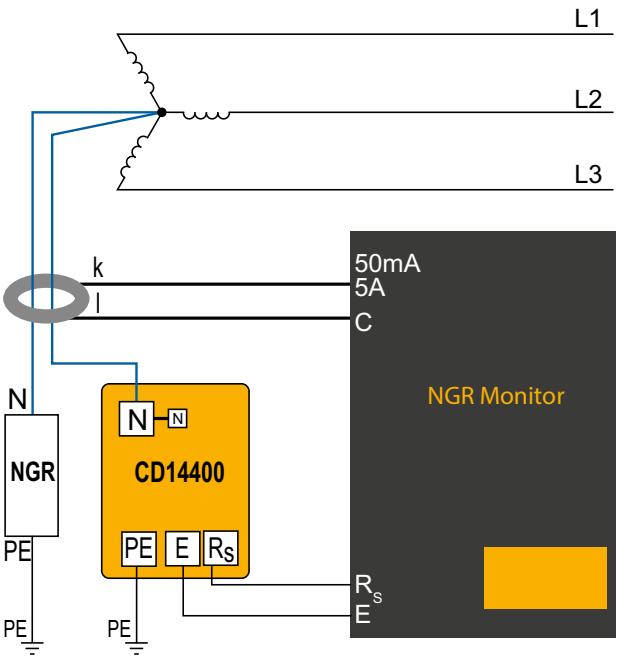


Tightening torque cover screws: 2.5 Nm (22.1 lb-in)

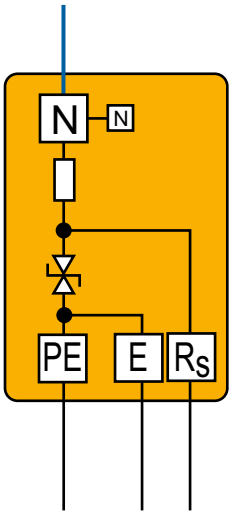
Minimum distance to adjacent devices

Wiring diagram

Wiring diagram



Internal wiring diagram CD14400



Terminal	Use	Connecting cable	
		Metrical	Imperial
R_S	Connection to R_S of the NGRM…	1.5 mm²	AWG16
E	Connection to E of the NGRM…; internally connected to PE		
N	Connection to the star point of the HRG system; via cable lug M5 or M10	≥ 1.5 mm²	AWG16 or greater
PE	Connection to protective earth conductor; internally connected to E, cable lug M5		

CD25000

Coupling device



Device features

- Coupling device for NGRM
- Range of use up to AC 25 kV/DC 14.5 kV system voltage
- Application up to 5000 m

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- The coupling device is suitable for HRG applications up to AC 25 kV and/or DC 14.5 kV

Approvals

CE EAC

Ordering information

Nominal system voltage U_n	Type	Art. No.
Up to U_{LL} = 25 kV (U_{NGR} = 14.5 kV)	CD25000	B98039055

Technical data

Insulation coordination DIN EN 50178:1997

Definition	
Measuring circuit (IC1)	N
Output circuit (IC2)	R_S
Protective circuit (IC3)	E, PE
Rated voltage	14500 V
Overvoltage category	III
Pollution degree	2
Rated insulation voltage	
no galvanic separation between the circuits!	
IC1/(IC2 – IC3)	14500 V
IC2/IC3	50 V

Voltage range

U_n	DC / 50/60 Hz / 50…3200 Hz 14500 V
I_n	145 mA

Operating time

without ground fault (2800 V)	unlimited
with ground fault (14500 V)	10 seconds
Cool-down period	120 minutes
Overload capacity	1.15 x Un for < 10 seconds

Resistance

100 kΩ	±0.5 %
Temperature coefficient	20 ppm/K

Environment

Ambient temperature	-40…+70 °C
Ambient temperature for U_L	-40…+60 °C
Humidity	≤ 98 %

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (-40…+85 °C) (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (-40…+70 °C) (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721 / IEC 60255-21 / DIN EN 60068-2-6

Stationary use	3M7
Transport	2M2
Long-term storage	1M3

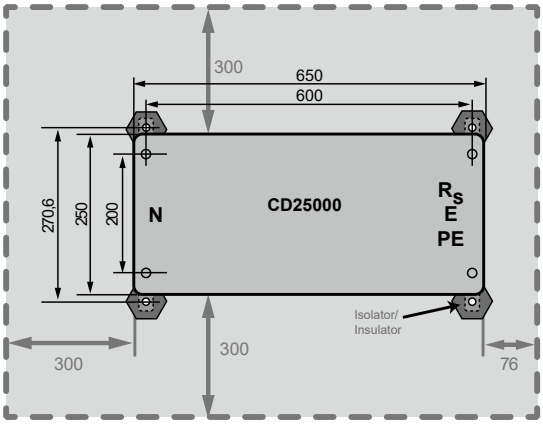
Connection

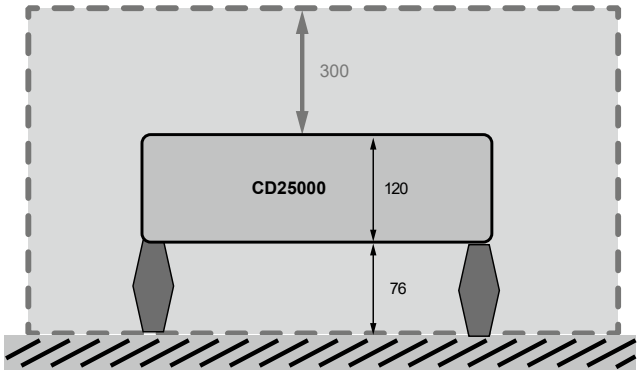
Connection R_S and E	
Tightening torque	0.5…0.6 Nm (4.4…5.3 lb-in)
Conductor sizes	AWG 24-12
Stripping length	7 mm
Conductor, rigid	0.2…4 mm²
Conductor, flexible	0.2…2.5 mm²
Multiple conductor, flexible with ferrule without plastic sleeve	0.25…1.5 mm²
Multiple conductor, flexible with ferrule with plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²
Connection PE for cable lug	
Tightening torque cable lug M5	2.2 Nm (19.5 lb-in)
Connection N	
Connection via HV line with open end	cable lug provided by the customer

Other

Operating mode	in case of a ground fault maximum 10 s
Mounting	any position
Operating altitude (when mounted on insulators)	up to 5000 m AMSL
Degree of protection, internal components (DIN EN 60529)	IP54
Flammability class	UL 94V-0
Documentation number	D00347
Weight	< 11 kg
Tightening torque cover screws	2.5 Nm (22.1 lb-in)

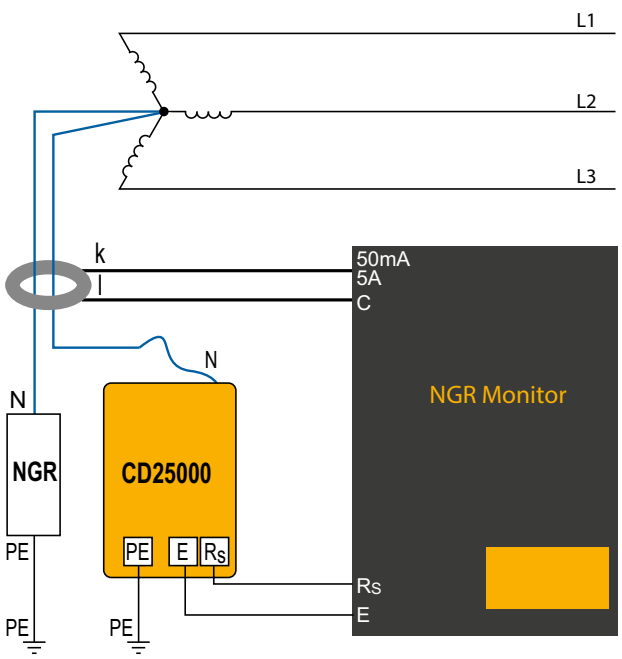
Dimension diagram (dimensions in mm)



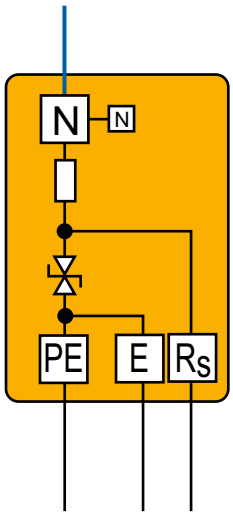


Wiring diagram

Wiring diagram



Internal wiring diagram CD25000



Terminal	Use	Connecting cable	
		Metrical	Imperial
R_S	Connection to R_S of the NGRM…	1.5 mm²	AWG16
E	Connection to E of the NGRM… (internally connected to PE, see internal wiring diagram)		
N	Connection to the star point of the HRG system (cable lug M5 or M10)	≥ 1.5 mm²	AWG16 or greater
PE	Connection to the protective conductor (internally connected to E, cable lug M5)		

Insulation monitoring devices
ISOMETER®

7

Equipment for insulation fault location
ISOSCAN®

151

Residual current monitoring systems
LINETRAXX®

177

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

219

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®



243

270



System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation

317

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

415

427

Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service

449



Device overview Universal Devices for Power Quality and Energy Measurement PEM



LINETRAXX® PEM353



LINETRAXX® PEM575

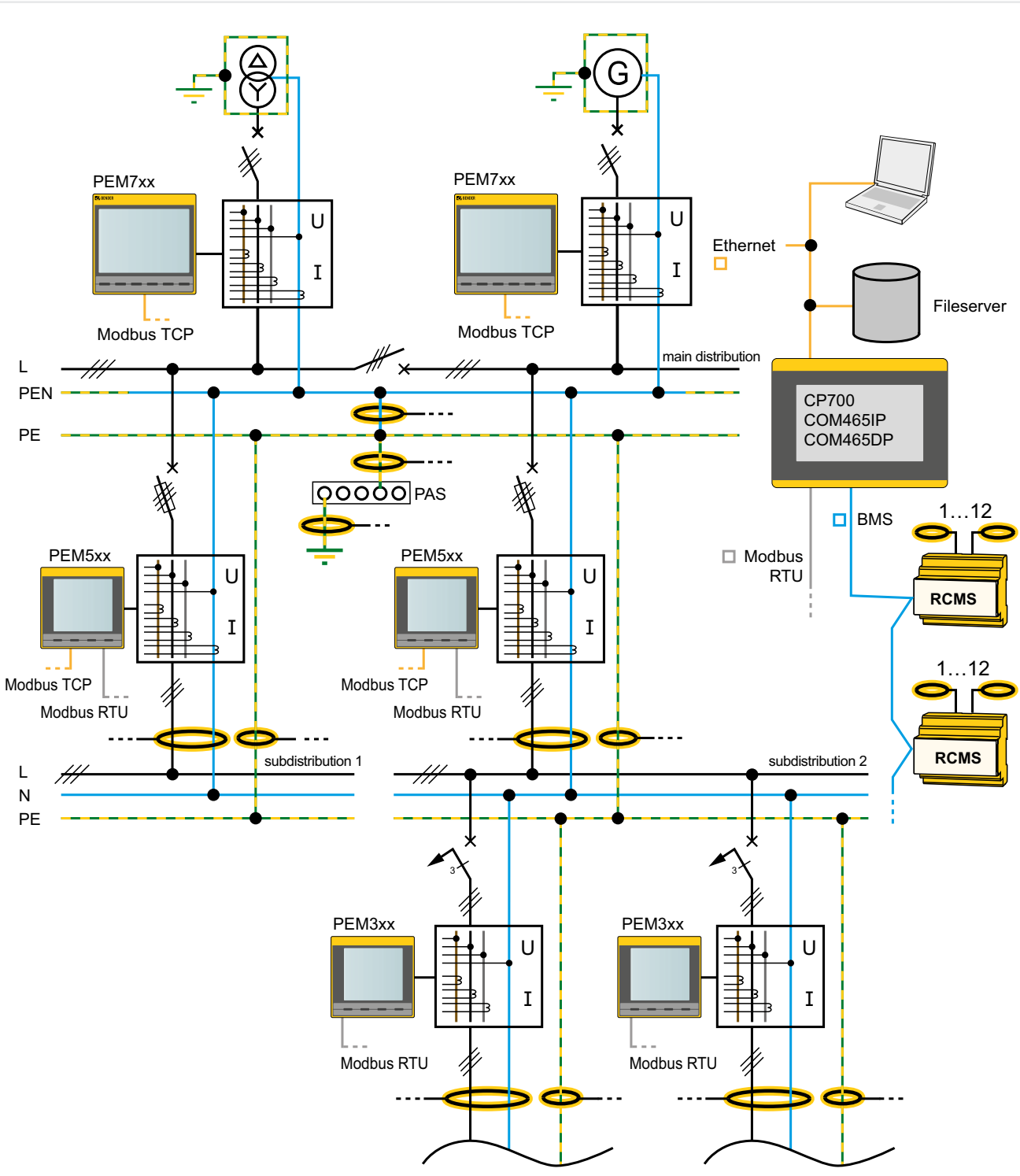


LINETRAXX® PEM735

		Seite	246	251	255
Normative requirements		Accuracy class according to IEC 62053-22	0.5 s	0.2 s	0.2 s
		DIN EN 50160 (report)	–	–	■
		DIN EN 61000-4-7 (harmonic)	Class II	Class I	Class I
		DIN EN 61000-4-15 (flicker) DIN EN 61000-4-30 (PQ measurement method)	–	–	■
Parameters		Phase voltages/ Line voltages	■	■	■
		Phase currents	■	■	■
		Neutral current I_4	■ (PEM353-N only)	■	■
		Neutral current I_4 (calculated)	■	■	■
		Frequency/phase angle	■	■	■
		Reactive and active power import/ Reactive and active power export	■	■	■
		Voltage unbalance/current unbalance	■	■	■
		Power	per phase and total S in kVA, P in kW, Q in kvar		
		Displacement factor cos (φ)/ power factor λ	■	■	■
		Total harmonic distortion (THD_U/THD_I)	up to the 31rd	up to the 63rd	up to the 63rd
		Harmonic components voltage	up to the 31rd	up to the 63rd	up to the 63rd
		Harmonic components current	up to the 31rd	up to the 63rd	up to the 63rd
		Transient detection	–	longer than 80 µs	longer than 40 µs
		Overvoltage (swell)	–	■	■
		Undervoltage (sag)	–	■	■
		Flicker severity P_{ST}	–	–	■
Features		Data recorder / HighSpeed data recorder	5/0	16/4	16/4
		Waveform recorder	–	32	128
		Digital inputs	4	6	8
		Digital outputs	2 (PEM353-P only)	–	2
		Relay outputs (RO)	2 (PEM353, PEM353-N only)	3	4
Technical aspects		Voltage supply	AC/DC 95…250 V (47…440 Hz)		
		Sampling rate	3,2 kHz	12,8 kHz	25,6 kHz
		Temperature	-25…+55 °C		
		Communication	Modbus RTU	Modbus RTU & TCP	Modbus RTU & TCP

All PEM measuring devices can be operated with standard measuring current transformers (1 A or 5 A). It should be ensured that the measuring device and the measuring transformers used at least comply with accuracy class 0.5 S or higher. Bender provides a selection of measuring current transformers, from the manufacturer MBS AG (catalogue pages 263 to 266), that are suitable for the operation of Power Quality and Energy Measurement devices.

Example of system design



NSHV = Low-voltage main distribution board



Power Quality and Energy Measurement PEM353



Typical applications

- Modern indicating instrument for electrical quantities, e.g. as a replacement for analogue indicating instruments
- Power quality monitoring
- Limit value monitoring (setpoints) with alarm forwarding
- Measurement and monitoring of the N conductor
- Energy and power measurement, e.g. as part of energy data monitoring

Approvals

CE

Device features

- Accuracy class according to IEC 62053-22: 0,5 S
- Measured quantities
  - Phase voltages U_{L1}, U_{L2}, U_{L3} in V
  - Line voltages U_{L1L2}, U_{L2L3}, U_{L3L1} in V
  - Phase currents I_1, I_2, I_3 in A
  - Neutral current (calculated) I_4 in A
  - Frequency f in Hz
  - Phase angle for U and I in °
  - Power per phase conductor S in kVA, P in kW, Q in kvar
  - Total power S in kVA, P in kW, Q in kvar
  - Displacement factor cos (φ)
  - Power factor λ
  - Active and reactive energy import in kWh, kvarh
  - Active and reactive energy export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Harmonic distortion (THD) for U and I
  - k-factor for I
- Limit value monitoring (setpoints) with alarm forwarding
- Energy and power measurement with log and tariff system
- Configurable start page with 4 measured quantities
- Measurement and monitoring of the N conductor (PEM353-N only)

Standards

PEM353 was designed in accordance with the following standards:

- **DIN EN 62053-22 (VDE 0418 Part 3-22)**
  Electricity metering equipment (a.c.) - Particular requirements - Part 22: Static meters for active energy (classes 0.2 S and 0.5 S) (IEC 62053);
- **DIN EN 61557-12 (VDE 0413-12)**
  Electrical safety in low voltage distribution systems up to 1000 V a.c. and 1500 V d.c. – Equipment for testing, measuring or monitoring of protective measures – Part 12:
  Performance measuring and monitoring devices (PMD)
- **DIN IEC 61554:2002-08**
  Panel mounted equipment – Electrical measuring instruments – Dimensions for panel mounting (IEC 61554:1999)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

			PEM353	PEM353-P	PEM353-N
Ordering details			B93100355	B93100354	B93100353
Measurement technique	Accuracy class of the active energy (acc. to IEC 62053-22)		Current transformer 5 A: Class 0,5 Current transformer 1 A: Class 1,0		
	Volatage inputs (L1, L2, L3)		45…65 Hz TN and TT system (earthed): AC 230/400…400/690 V, CAT III 600 V IT system (unearthed): AC 400…480 V, CAT III 300 V / AC 500…690 V, CAT II 1000 V		
	Current inputs (I_1, I_2, I_3)		5 A / 1 A		
	I_4		–	–	5 A
	Harmonic / Distortion U/I		up to the 31st		
	Sampling rate		3,2 kHz		
Data logger	Setpoints limit value monitoring		9		
	Logs		Event log (SOE log), Max./Min. log Peak demand log, Energy meter log (monthly values)		
	4 MB	Data recorder	–	–	5
		Load data log (daily and monthly values)	–	–	■
Properties	Digital inputs		4		
	Digital outputs		2 x relay	2 x pulse	2 x relay
	Supply voltage		95…250 V; DC, AC 47…440 Hz		
	Communication interface		RS-485 (Modbus RTU, BACnet MS/TP, DNP)		
	Language		English		

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Pollution degree	2
Climate category operation	3K6
Max. installation altitude above NN:	2000 m

Definitionen

Measuring circuit 1 (IC1)	(L1, L2, L3, N)
TN and TT system	
Nominal voltage	400/690 V
Overvoltage category/Rated insulation voltage	III/600 V
IT system	
Nominal voltage	480 V
Overvoltage category/Rated insulation voltage	III/300 V
Nominal voltage	690 V
Overvoltage category/Rated insulation voltage	II/1000 V
Measuring circuit 2 (IC2)	(•I11, I12, •I21, I22, •I31, I32)
Overvoltage category/Rated insulation voltage	III/300 V
Supply circuit (IC3)	(A1/+, A2/-)
Overvoltage category/Rated insulation voltage	III/300 V
Output circuit 1 (IC4) at PEM353-N and PEM353	(DO13, DO14)
Overvoltage category/Rated insulation voltage	III/300 V
Output circuit 1 (IC4) at PEM353-P	(E1+, E1-)
Overvoltage category/Rated insulation voltage	III/50 V
Output circuit 2 (IC5) at PEM353-N and PEM353	(DO23, DO24)
Overvoltage category/Rated insulation voltage	III/300 V
Output circuit 2 (IC5) at PEM353-P	(E2+, E2-)
Overvoltage category/Rated insulation voltage	III/50 V
Control circuit 1 (IC6)	(DIC, DI1, DI2, DI3, DI4)
Overvoltage category/Rated insulation voltage	III/50 V
Control circuit 2 -RS-485 (IC7)	(D+, D-)
Overvoltage category/Rated insulation voltage	III/50 V
Rated impulse voltage	
IC1/(IC2…7)	6 kV
IC2/(IC3…7)	4 kV
IC3/(IC4…7)	4 kV
IC4/(IC5…7)	4 kV
IC5/(IC6…7)	4 kV
IC6/IC7	800 V
Rated insulation voltage	
IC1/(IC2…7)	1000 V
IC2/(IC3…5)	250 V
IC2/(IC6…7)	250 V
IC3/(IC4…7)	250 V
IC4/(IC5…7)	250 V
IC5/(IC6…7)	250 V
IC6/IC7	32 V
Safe separation (reinforced insulation) between	
IC1/(IC2…7)	overvoltage category III, 600 V
IC2/(IC3…7)	overvoltage category III, 300 V
IC3/(IC4…7)	overvoltage category III, 300 V
IC4/(IC5…7)	overvoltage category III, 300 V
IC5/(IC6…7)	overvoltage category III, 300 V
Voltage test (routine test) acc. to IEC 61010-1:	
IC1/(IC2…7)	AC 2.0 kV, 1 minute
IC2/(IC3…7)	AC 2.0 kV, 1 minute
IC3/(IC4…7)	AC 2.0 kV, 1 minute
IC4/(IC5…7)	AC 2.0 kV, 1 minute
IC5/(IC6…7)	AC 2.0 kV, 1 minute

Supply voltage

Supply voltage	AC/DC 95…250 V (±10 %)
Frequency range	DC, 47 … 440 Hz
Power consumption	< 5 VA

Measuring voltage inputs

see insulation coordination	
Measuring range	10… 828 V (120 % U_n, max)
Rated frequency	45…65 Hz
Internal resistance $U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	> 12 MΩ

Transformation ratio of the measuring voltage transformer

Primary	1 …1,000,000 V
Secondary	1…690 V
Max. transformation ratio	10,000

Measuring current transformer inputs

I_{nom}	5 A
Measuring range	0.1 … 200 % I_{nom}
Load	< 0.15 VA
Overload range	2 x I_{nom} permanent, 20 x I_{nom} ≤ 1 s

Transformation ratio of the measuring current transformer

Primary	1 … 30000 A
Secondary	1…5 A

Accuracies (OMV = of measured value/OFS = of full-scale value)

Phase voltage $U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	±0.2 % OMV, +0.05 % OFS
Current $I_{1, 2, 3}$	±0.2 % OMV, +0.05 % OFS
Neutral current I_4 (PEM353-N)	±0.2 % OMV
Frequency f	±0.02 Hz
Phasing	±1 °
Active power, reactive power	±0.5 % OMV, +0.05 % OFS
Power factor λ	±0.5 %
Measurement of the active energy acc. to DIN EN 62053-22 (VDE 0418 part 3-22)	
Accuracy class with 5 A measuring current transformers	0.5 S
Accuracy class with 1 A measuring current transformers	1 S
Measurement of the voltage rms values	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
Measurement of the phase current rms values	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.5
Frequency measurement	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

Interface

Interface: Protocol	RS-485: Modbus RTU, BACnet MS/TP, DNP
Baud rate	1.2…38.4 kbit/s
Cable length	0…1200 m
Recommended cable (shielded)	J-Y(St)Y min. 2 x 0.8

Switching elements

Outputs	2 N/O contacts
Operating principle	N/O operation
PEM353-N, PEM353	
Relay contacts, N/O operation, AC 250 V or DC 30 V	5 A
Minimum current I_{min}	1 mA at AC/DC ≥ 10 V
PEM353-P	
Pulse output	max. DC 30 V, max. 30 mA
Cable length	≤ 30 m
Inputs	4 common galv. isolated digital inputs
I_{min}	1 mA
U_{DI}	DC 24 V

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C
Classification of climatic conditions acc. to IEC 60721 (stationary use)	3K6
Classification of mechanical conditions acc. to IEC 60721 (stationary use)	3M4
Range of use	< 2000 m

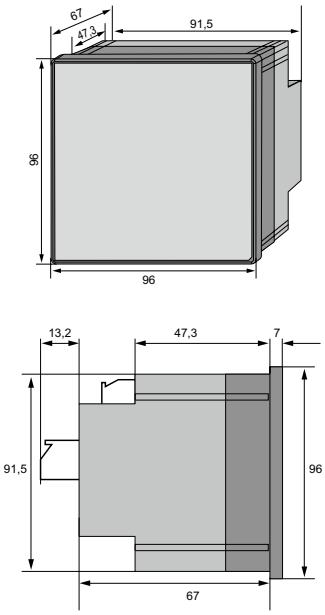
Connection

Connection type	screw-type terminals, plug-in connector

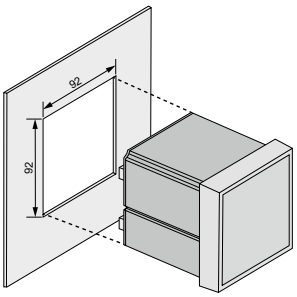
Other

Degree of protection, installation	IP20
Degree of protection, front (with rubber seal)	IP54
Documentation number	D00335
Weight	≤ 350 g

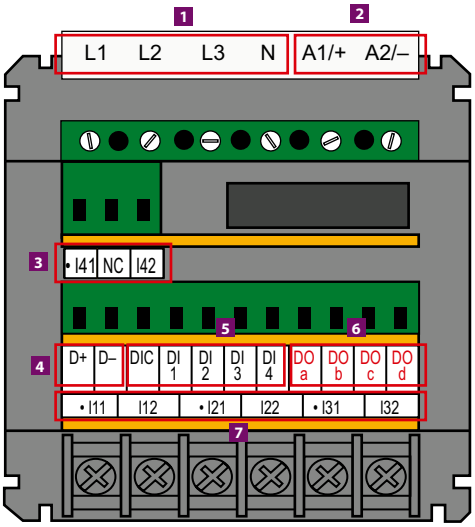
Dimension diagram (dimensions in mm)



Panel cutout (dimensions in mm)

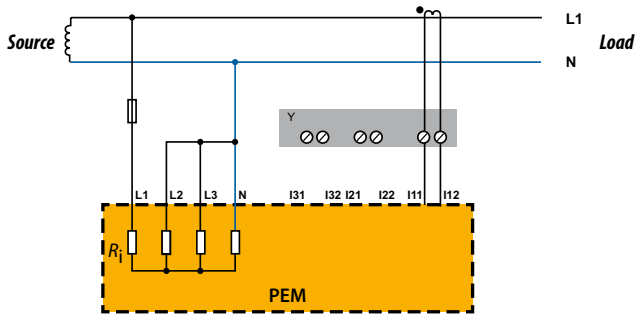


Terminals

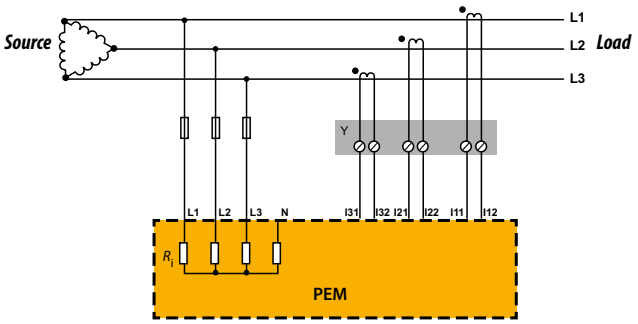


1. Measuring voltage inputs:
   The measuring leads should be protected with appropriate fuses.
2. Supply voltage: Power protection by a 6 A fuse, quick response.
   If being supplied from an IT system, both lines have to be protected by a fuse.
3. Measuring current inputs I4 (only PEM353-N)
4. RS-485 bus connection
5. Digital inputs
6. Digital outputs (N/O contacts)
7. Measuring current inputs $I_{1...3}$

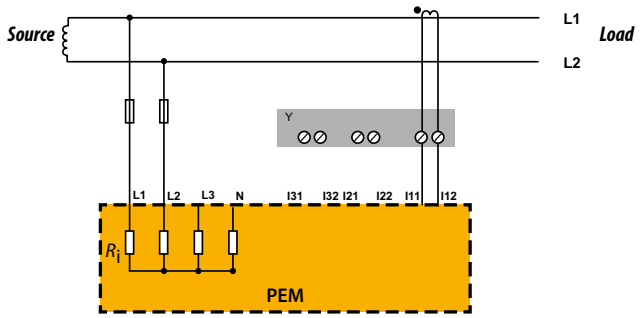
	DO a	DO b	DO c	DO d
PEM353(-N)	D013	D014	D023	D024
PEM353-P	E1+	E1-	E2+	E2-



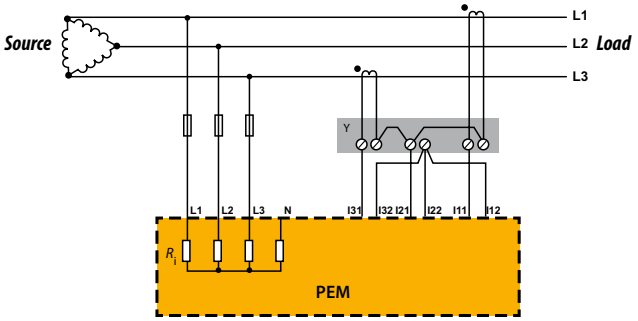
Single-phase 2-wire system 1P2W L-N
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **1P2W L-N**.



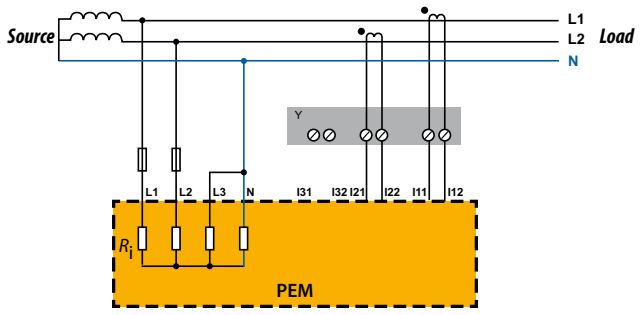
3P3W with 3 measuring current transformers
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to **3P3W**.



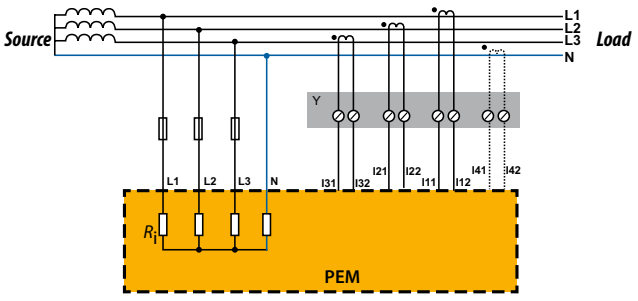
Single-phase 2-wire system 1P2W L-L
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **1P2W L-L**.



3P3W with 2 measuring current transformers (Aron circuit)



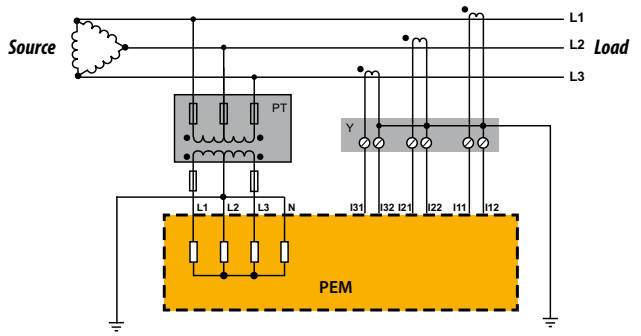
Single-phase 3-wire system 1P3W with 2 measuring current transformers
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to **1P3W**.



3P4W with 3 (4) measuring current transformers
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **3P4W**.

Y Isolating terminal of the measuring current transformers

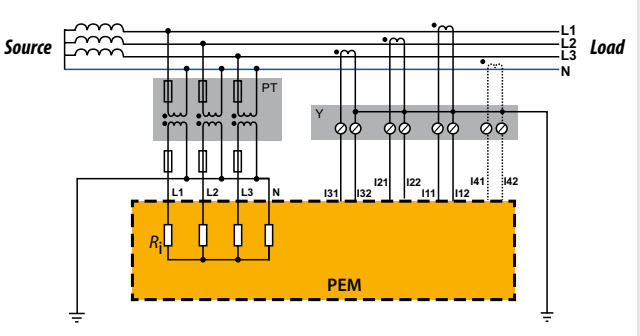
Y Isolating terminal of the measuring current transformers
I_4 Measurement I_4 for PEM353-N only



Three-phase 3-wire system 3P3W with 3 measuring current transformers
When used in a 3-wire system, the connection type (Setup > Basic > Wiring Mode) must be set to **3P3W**.

Y Isolating terminal of the measuring current transformers

PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.



Three-phase 4-wire system (example TN-S system) 3P4W with 3 voltage transformers
When using this wiring, the connection type (Setup > Basic > Wiring Mode) must be set to **3P4W**.

Y Isolating terminal of the measuring current transformers

I_4 Measurement I_4 for PEM353-N only

PT The transformation ratio in the PEM353 can be set by specifying the primary and secondary transformation ratio. Odd ratios can also be configured.

Power Quality and Energy Measurement PEM575





Typical applications

- As a compact device for front panel mounting, the PEM575 is a replacement for analogue indicating instruments
- Typical application in low and medium-voltage networks (via measuring voltage transformer)
- Power quality monitoring
- Collection of relevant data for energy management
- Cost allocation of energy consumption
- High-resolution waveform recording allows analysis of power quality phenomena

Approvals

CE

Device features

- Accuracy class according to IEC 62053-22: 0.2 S
- Measured quantities
  - Phase voltages U_{L1}, U_{L2}, U_{L3} in V
  - Line conductor voltages U_{L1L2}, U_{L2L3}, U_{L3L1} in V
  - Phase currents I_1, I_2, I_3 in A
  - Neutral current (calculated) I_0 in A
  - Neutral current (measured) I_4 in A
  - Frequency f in Hz
  - Phase angle for U and I in °
  - Power per phase conductor S in kVA, P in kW, Q in kvar
  - Total power S in kVA, P in kW, Q in kvar
  - Displacement factor cos (φ)
  - Power factor λ
  - Active and reactive energy import in kWh, kvarh
  - Active and reactive energy export in kWh, kvarh
  - Voltage unbalance in %
  - Current unbalance in %
  - Harmonic distortion (THD) for U and I
  - k-Factor for I
- Programmable setpoint monitoring
- LED pulse outputs for active and reactive energy
- Modbus RTU and Modbus TCP
- 3 digital outputs
- Requirements of energy and current for particular time frames
- Peak demands with timestamps
- Individual, current/voltage harmonics up to the 63rd harmonic
- Minimum and maximum values
- Waveform recording (12.8 kHz)
- Data recorder
- Sag/swell detection
- High-resolution waveform recording
- Detection of transient events

Standards

PEM575 was designed in accordance with the following standards:

- **DIN EN 62053-22 (VDE 0418 Part 3-22)**
  Electricity meter equipment (AC) - Particular requirements - Part 22: Static meters for active energy (classes 0.2 S and 0.5 S (IEC 62053));
- **DIN EN 61557-12 (VDE 0413-12)**
  Elektrische Sicherheit in Niederspannungsnetzen bis AC 1000 V und DC 1500 V – Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen – Teil 12:
  (Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V - Equipment for testing, measuring or monitoring of protective measures _ Part 12) Performance measuring and monitoring device (PMD))

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Interface	Nominal system voltage 3(N)AC	Current input	Type	Art. No.
RS-485/Ethernet	400/230 V	5 A	PEM575	B93100575
		1 A	PEM575-251	B93100576
	69/120 V	5 A	PEM575-155	B93100579
		1 A	PEM575-151	B93100580

Insulation coordination

Measuring circuit

Rated insulation voltage	300 V
Overvoltage category	III
Pollution degree	2

Supply circuit

Rated insulation voltage	300 V
Overvoltage category	II
Pollution degree	2

Supply voltage

Rated supply voltage U_S	AC/DC 95…415 V
Frequency range of U_S	DC, 44…440 Hz
Power consumption	≤ 11 VA

Measuring circuit

Measuring voltage inputs

$U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	230 V
	69 V (only -151, -155)
$U_{L1\text{-}L2,L2\text{-}L3,L3\text{-}L1}$	400 V
	120 V (only -151, -155)
Measuring range	10… 120 % U_n
Rated frequency	45…65 Hz
Internal resistance (L-N)	> 500 kΩ

Measuring current inputs

External measuring current transformer should at least comply with accuracy class 0.5 S	
Burden	n.A., internal current transformers
Measuring range	0.1… 120 % I_n
PEM575/PEM575-155	
I_n	5 A
Measuring current transformer ratio	1…6000
Accuracy class according with 5 A measuring current transformer	0.2
Accuracy class according with 1 A measuring current transformer	0.5
PEM575-251/PEM575-151	
I_n	1 A
Measuring current transformer ratio	1…30000
Accuracy class according with 1 A measuring current transformer	0.2

Accuracies (of measured value/of full scale value)

Phase voltage $U_{L1\text{-}N}$, $U_{L2\text{-}N}$, $U_{L3\text{-}N}$	±0.2 % of measured value.
Current	±0.2 % of measured value +0.05 % of full scale value.
Neutral current I_4	0.5 % of full scale value
Frequency	±0.01 Hz
Phase position	±1 °
Active energy measurement according to	DIN EN 62053-22 (VDE 0418 Part 3-22)
r.m.s. voltage measurement according to	DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
r.m.s. phase current measurement according to	DIN 61557-12 (VDE 0413-12), chapter 4.7.5
Frequency measurement according to	DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4

Interface

Interface/protocol				RS-485, Modbus RTU
Baud rate				1.2…19.2 kbits/s
Cable length				0…1200 m
Shielded cable (shield connected to terminal SH on one side)				recommended: J-Y(St)Y min. 2x0.8
Interface/protocol				Ethernet, Modbus TCP
Baud rate				100 Mbits/s

Switching elements

Outputs				3 N/O contacts
Operating principle				N/O operation
Rated operational voltage	AC 230 V	DC 24 V	AC 110 V	DC 12 V
Rated operational current	5 A	5 A	6 A	5 A
Minimum contact rating				1 mA at AC/DC ≥ 10 V
Inputs				6 electrically separated digital inputs
I_{min}				2.4 mA
U_{DI}				DC 24 V

Environment/EMC

EMC	DIN EN 61326-1
Operating temperature	-25…+55 °C
Classification of climatic conditions acc. to DIN EN 60721	
Stationary use	3K5
Classification of mechanical conditions acc. to DIN EN 60721	
Stationary use	3M4
Height	to 4000 m

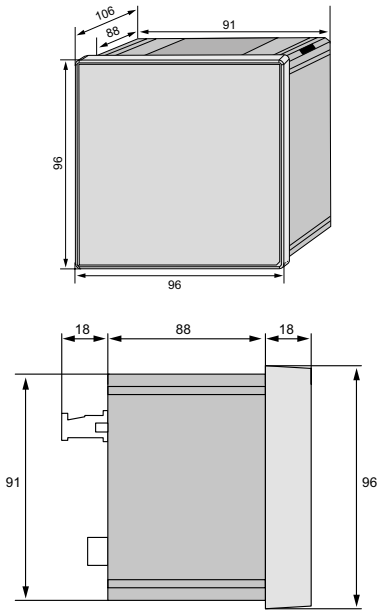
Connection

Connection	screw-type terminals

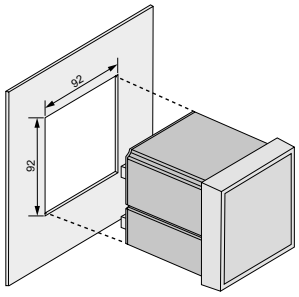
Other

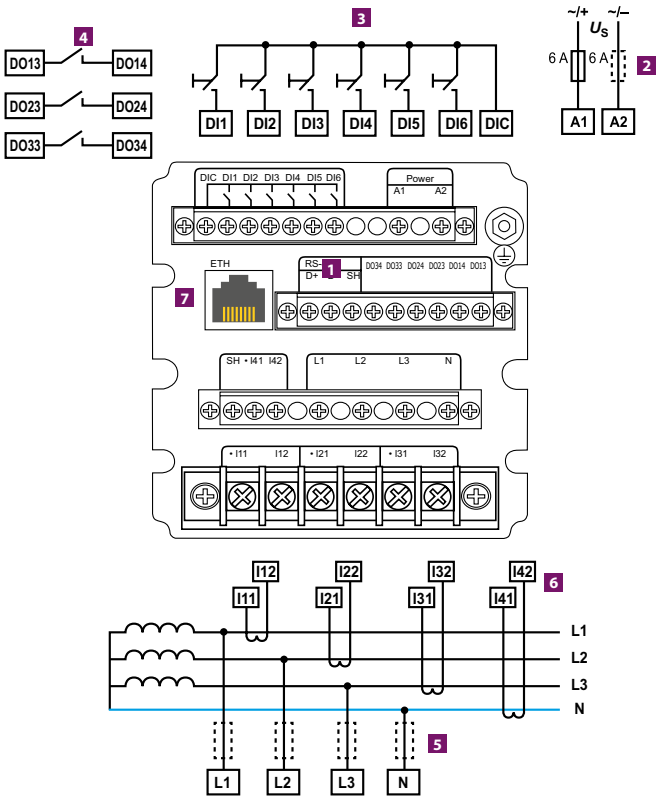
Degree of protection, installation	IP20
Degree of protection, front	IP52
Documentation number	D00016
Weight	≤ 1100 g

Dimension diagram (dimensions in mm)



Panel cut-out (dimensions in mm)





1 Connection RS-485 bus

2 Supply voltage. Power protection by a 6 A fuse, quick response. If being supplied from an IT system, both lines have to be protected by a fuse.

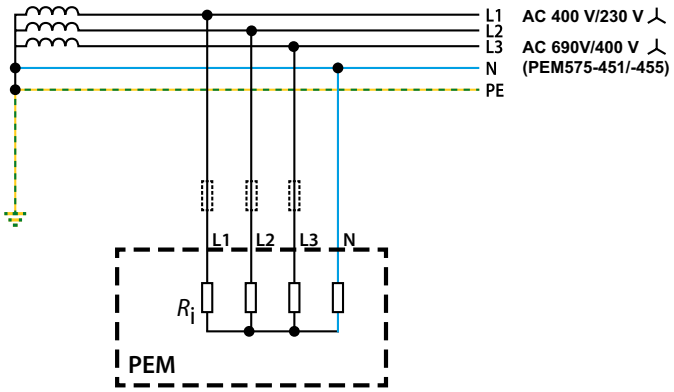
3 Digital inputs

4 Digital outputs (N/O contacts)

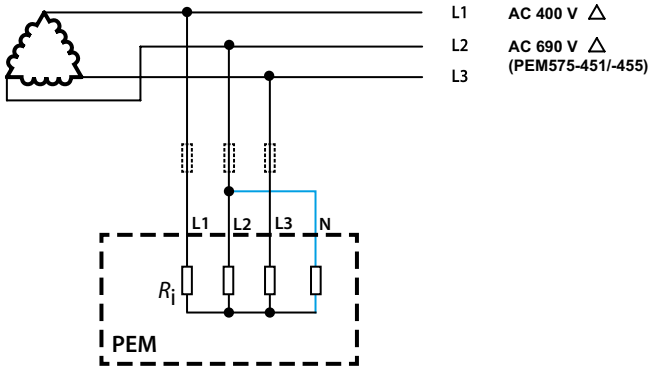
5 Measuring voltage inputs: The measuring leads should be protected by appropriate fuses

6 Connection to the system to be monitored

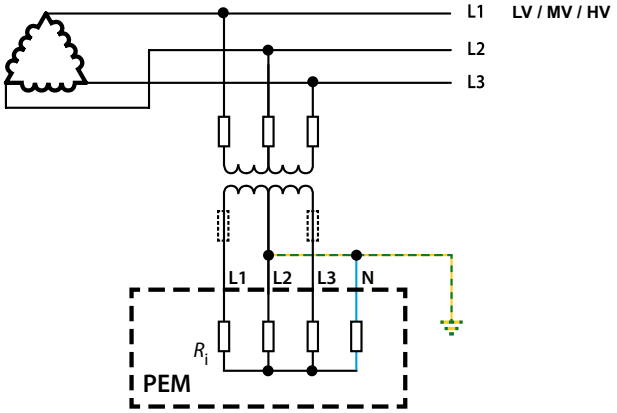
7 Connection Modbus TCP



Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).



Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems.



Connection via voltage transformers
The coupling via measuring voltage transformers allows the use of a measuring device in medium and high voltage systems.
The transformation ratio in PEM575 can be adjusted (1…10000).

Power Quality and Energy Measurement PEM735





Typical applications

- Contiuous monitoring of the voltage quality in accordance with DIN EN 50160
- Collection of relevant data for energy management systems
- High-resolution waveform recording allow analysis of power quality phenomena

Approvals

CE

Device features

- Power analyser of Class A, certified according to DIN EN 61000-4-30
- Monitoring the voltage quality in accordance with DIN EN 50160
- Accuracy class in accordance with IEC 62053-22: 0.2 S
- TFT colour display (640x480) 5.7”
- Modbus RTU and Modbus TCP
- 4 current inputs
- 5 voltage inputs
- 1 GB internal memory
- Panel mounting 144x144
- Integrated web server
- Data export via FTP: comtrade, PQDIF
- Flicker measurement
- Detection and recording of transients (40 µs)
- Sampling rate: 512 samples/cycle
- Freely configurable recorders for waveform, consumption and long-term recording

Standards

PEM735 was designed in accordance with the following standards:

- **DIN EN 50160**
  Merkmale der Spannung in öffentlichen Elektrizitätsversorgungsnetzen (Voltage characteristics of electricity supplied by public distribution networks)
- **DIN EN 61000-4-30 VDE 0847-4-30**
  Elektromagnetische Verträglichkeit (EMV)
  Teil 4-30: Prüf- und Messverfahren – Verfahren zur Messung der Spannungsqualität
  (Electromagnetic compatibility (EMC): Part 4-30: Testing and measurement techniques – Power quality measurement methods) (IEC 61000-4-30)
- **DIN EN 61557-12 (VDE 0413-12)**
  Elektrische Sicherheit in Niederspannungsnetzen bis AC 1000 V und DC 1500 V – Geräte zum Prüfen, Messen oder Überwachen von Schutzmaßnahmen – Teil 12: Kombinierte geräte zur Messung und Überwachung des Betriebsverhaltens
  (Electrical safety in low voltage distribution systems up to AC 1000 V and DC 1500 V – Equipment for testing, measuring or monitoring of protective measures - Part 12: Performance measuring and monitoring devices (PMD)
- **DIN EN 62053-22 (VDE 0418 Teil 3-22)**
  Wechselstrom-Elektrizitätszähler - Besondere Anforderungen – Teil 22: Elektronische Wirkverbrauchszähler der Genauigkeitsklassen 0,2 S und 0,5 S
  (Electricity meter equipment (AC) - Particular requirements – Part 22: Static meters for active energy (classes 0,2 S and 0,5 S) (IEC 62053)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage 3(N)AC	Current input	Type	Art. No.
100…690 V	5 A	PEM735	B 9310 0735

Suitable system components

Description	Type	Art. No.	Page
Measuring current transformers	CTB41	B980860…	263
	CTB51	B980860…	263
	KBR18	B980860…	263
	KBR32	B980860…	263

Insulation coordination

Measuring circuit

Rated insulation voltage	600 V
Overvoltage category	III
Pollution degree	2

Supply circuit

Rated insulation voltage	300 V
Overvoltage category	II
Pollution degree	2

Supply voltage

Rated supply voltage U_S	95…250 V
Frequency range of U_S	DC, 44…440 Hz
Power consumption	≤ 14 VA

Measuring circuit

Measuring voltage inputs

$U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	400 V
$U_{L1\text{-}L2,L2\text{-}L3,L3\text{-}L1}$	690 V
Measuring range	10… 120 % U_n
CT transformation ratio	
Primary	1…1,000,000 V
Secondary	100…690 V ULL (1…3)
Secondary	1…400 V (U4)
Internal resistance (L-N)	> 6 MΩ

Measuring current inputs

External measuring current transformer	should at least comply with accuracy class 0.2 S
Burden	n.A., internal current transformers
Measuring range	0.1… 120 % I_N
Transducer ratio, secondary	1…5 A
Transducer ratio, primary	1…30000 A

Accuracies (of measured value/of full scale value)

Phase voltage $U_{L1\text{-}N}$, $U_{L2\text{-}N}$, $U_{L3\text{-}N}$	±0.1 % of the measured value.
Current	±0.1 % of measured value +0.05 % of full scale value.
Neutral current I_4	0.5 % v. S.
Frequency	±0.005 Hz
Phase position	±1 °
Active energy measurement acc. to	DIN EN 62053-22 (VDE 0418 Part 3-22)
R.m.s. voltage measurements acc. to	DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
R.ms. phase current measurements acc. to	DIN EN 61557-12 (VDE 0413-12), chapter 4.7.5
Frequency measurements acc. to	DIN EN 61557-12 (VDE 0413-12), chapter. 4.7.4
Measurement of the harmonics acc. to	DIN EN 61000-4-7 class A

Interface

Interface/protocol	2 x RS-485, Modbus RTU
Baud rate	1.2…19.2 kbits/s
Cable length	0…1200 m
Shielded cable ((shield connected to PE on one side)	recommended: J-Y(St)Y min. 2x0.8
Interface	Ethernet
Protocol	Modbus TCP
Baud rate	100 MBit/s

Switching elements

2 electronic outputs (DO)				max. 80 V
				I_{max} 50 mA
Outputs (RO)				4 x N/O contacts
Operating principle				N/O operation
Rated operational voltage	AC 230 V	DC 24 V	AC 110 V	DC 12 V
Rated operational current	5 A	5 A	6 A	5 A
Minimum contact rating				1 mA at AC/DC ≥ 10 V
Inputs				8 electrically separated digital inputs
I_{min}				2.4 mA
U_{DI}				DC 24 V

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C
Classification of climatic conditions acc. to DIN EN 60721 stationary use	3K5
Classification of mechanical conditions acc. to IEC 60721 stationary use	3M4
Height	to 4000 m

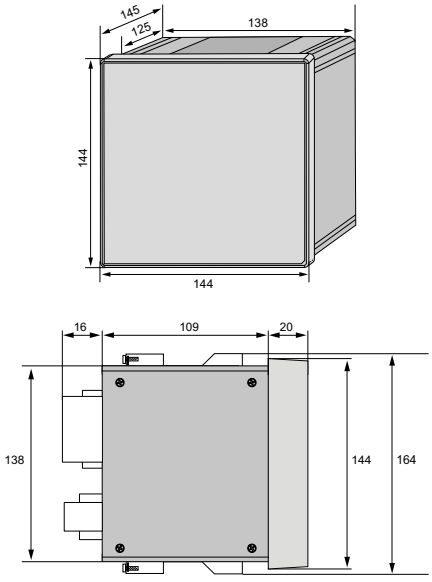
Connection

Connection	screw-type terminals

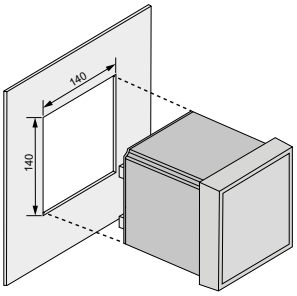
Other

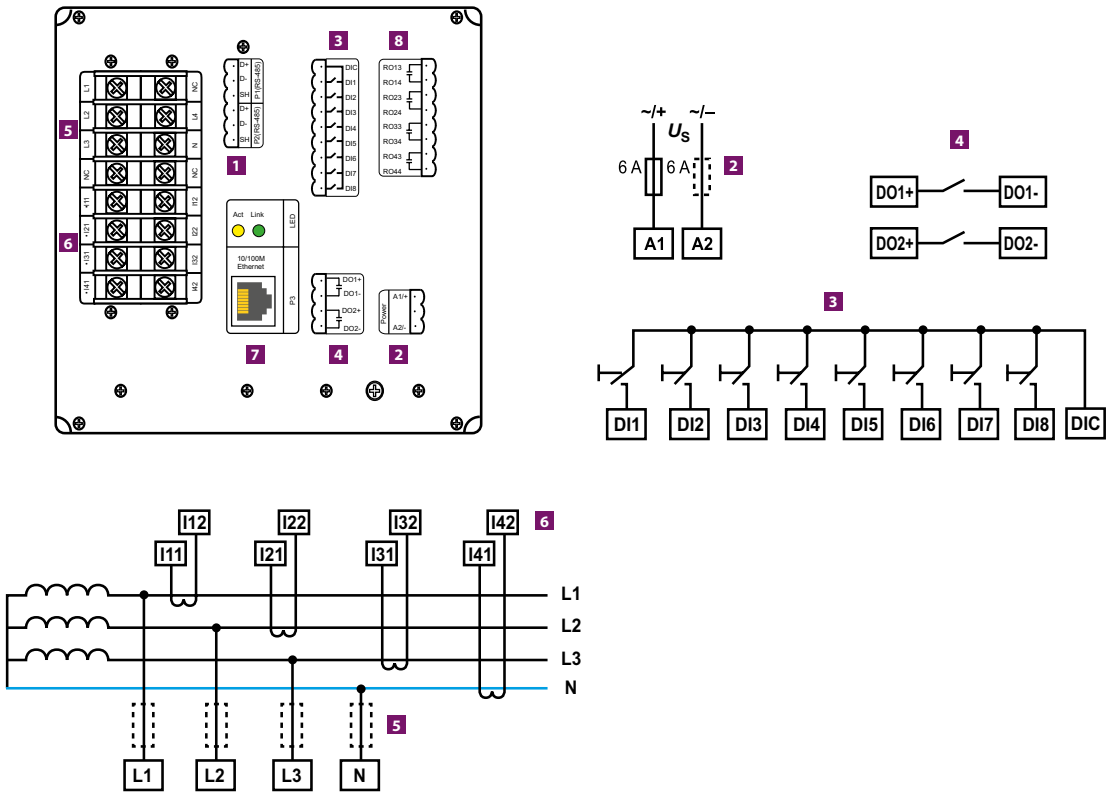
Degree of protection, installation	IP20
Degree of protection, front	IP52
Documentation number	D00084
Weight	≤ 2000 g

Dimension diagram (dimensions in mm)



Panel cut-out (dimensions in mm)





1 Connection RS-485 bus

2 Supply voltage. Power protection by a 6 A fuse, quick response. If being supplied from an IT system, both lines have to be protected by a fuse.

3 Digital inputs

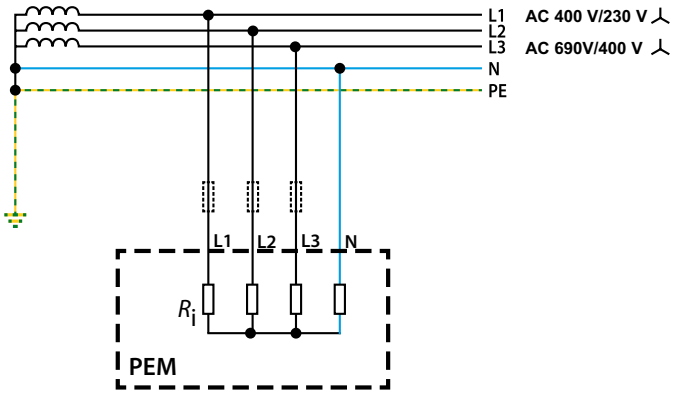
4 Digital outputs (N/O contacts)

5 Measuring voltage inputs: The measuring leads should be protected by appropriate fuses

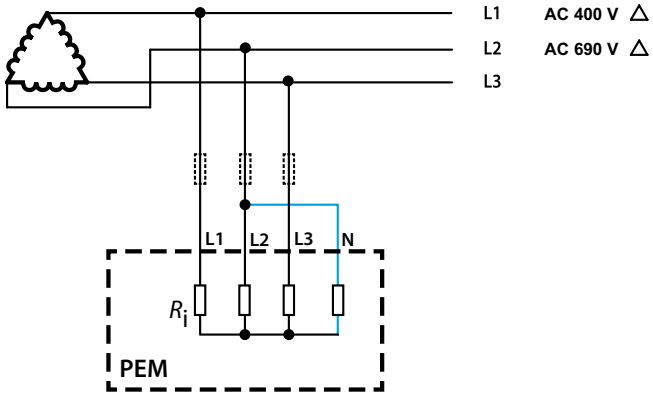
6 Connection to the system to be monitored

7 Connection Ethernet

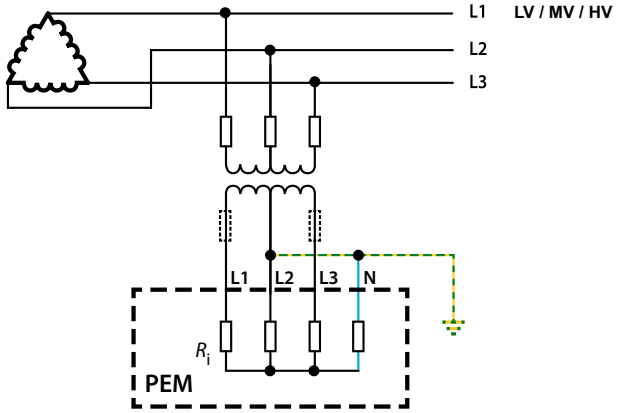
8 Relay output



Three-phase 4-wire system (TN, TT, IT systems)
The PEM can be used in three-phase 4-wire systems, independent of the type of distribution system (TN, TT, IT system).



Three-phase 3-wire system
The PEM can be used in three-phase 3-wire systems.



Connection via voltage transformers
The coupling via measuring current transformers allows the use of the measuring device in medium and high voltage systems.
The transformation ratio can be adjusted in the PEM735.

Power Quality and Energy Measurement
PEM735 measuring case



Typical applications

- Contiuous monitoring of the voltage quality in accordance with DIN EN 50160
- Collection of relevant data for energy management systems
- High-resolution waveform recording allow analysis of power quality phenomena

Approvals

CE

Device features

- Class A power analyser certified acc. to DIN EN 61000-4-30
- Voltage quality monitoring acc. to DIN EN 50160
- Accuracy class acc. to IEC 62053-22: 0.2 S
- TFT colour display (640x480) 5.7“
- Modbus TCP
- 4 current inputs
- 5 voltage inputs(3L/N/PE)
- 1 GB internal memory
- An integrated web server
- Flicker measurement
- Transient detection and recording (40 µs)
- Sampling rate: 512 samples/cycle
- Individually configurable recorder for waveforms, consumption, long-term recordings

Standards

The universal measuring device for Power Quality and Energy Measurement/PEM735 was developed in accordance with the following standards: IEC 62053-22(VDE 0418 Part 3-22), DIN EN 61557-12 (VDE 0413-12), DIN EN 50160, DIN EN 61000-4-30 (VDE 0847-4-30), DIN EN 61000-4-7 (VDE 0847-4-7), DIN EN 61000-4-15 (VDE 0847-4-15)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Type	Art. No.
PEM735 measuring case	B 9830 0014

Scope of delivery

Description
4 flexible current transformers for measurements up to 4000 A
1 current measuring clamp 1000 A, 5 kHz
1 current measuring clamp 250/500/1000 A, 1 kHz
incl. integrated WLAN router, a trolley, various safety test probes

Insulation coordination

Measuring circuit

Rated insulation voltage	600 V
Overvoltage category	III
Pollution degree	2

Supply circuit

Rated insulation voltage	300 V
Overvoltage category	II
Pollution degree	2

Supply voltage

Rated supply voltage	100…240 V
Frequency range of U_S	47…63 Hz

Measuring circuit

Measuring voltage inputs

$U_{L1\text{-}N,L2\text{-}N,L3\text{-}N}$	400 V
$U_{L1\text{-}L2,L2\text{-}L3,L3\text{-}L1}$	690 V
Measuring range	10… 120 % U_n
Rated frequency	45…65 Hz
Internal resistance (L-N)	> 6 MΩ

Measuring current inputs

External measuring current transformers	should at least comply with accuracy class 0.2 S
Burden	n.A., internal current transformers
Measuring range	0.1… 120 % I_n
Measuring current transformer conversion ratio, secondary	1…5 A
Measuring current transformer conversion ratio, primary	1…30000 A

Accuracies (mv = of measured value/fs = of full scale value)

Phase voltage $U_{L1\text{-}N}$, $U_{L2\text{-}N}$, $U_{L3\text{-}N}$	±0.1 % mv
Current	±0.1 % mv +0.05 % fs
Frequency	±0.005 Hz
Phasing	±1 °
Measurement of the active energy	acc. to DIN EN 62053-22 (VDE 0418 part 3-22)
Measurement of the voltage r.m.s. values	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.6
Measurement of the phase current r.m.s. values	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.5
Frequency measurement	acc. to DIN EN 61557-12 (VDE 0413-12), chapter 4.7.4
Measurement of the harmonics	acc. to DIN EN 61000-4-7 class A

Interface

Interface/protocol	RJ-45, Modbus TCP

Switching elements

Outputs (RO)	2 x N/O contacts			
Operating principle	N/O operation			
Rated operational voltage	AC 230 V	DC 24 V	AC 110 V	DC 12 V
Rated operational current	5 A	5 A	6 A	5 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V			
Inputs	2 electrically separated digital inputs			
I_{min}	2.4 mA			
U_{DI}	DC 24 V			

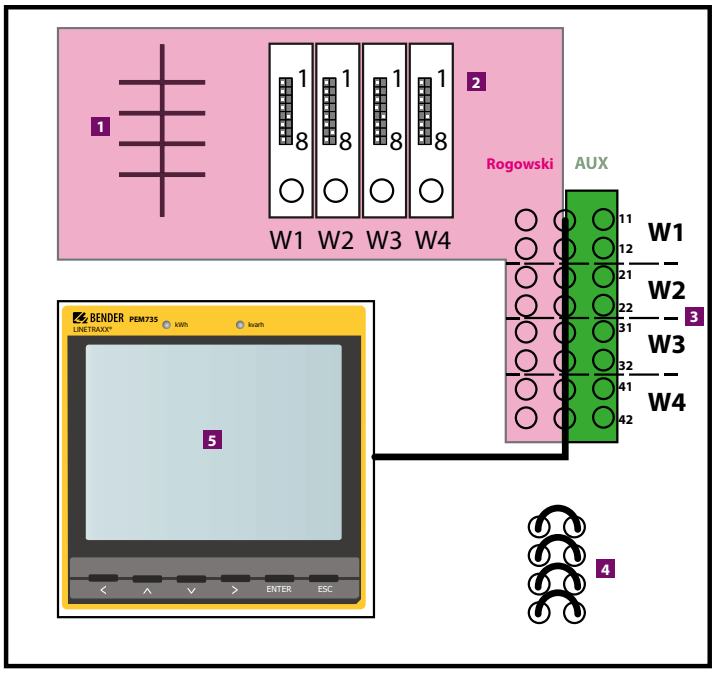
Environment/EMC

Operating temperature	-0…+40 °C
Classification of climatic conditions	acc. to DIN EN 60721
Height	up to 4000 m

Other

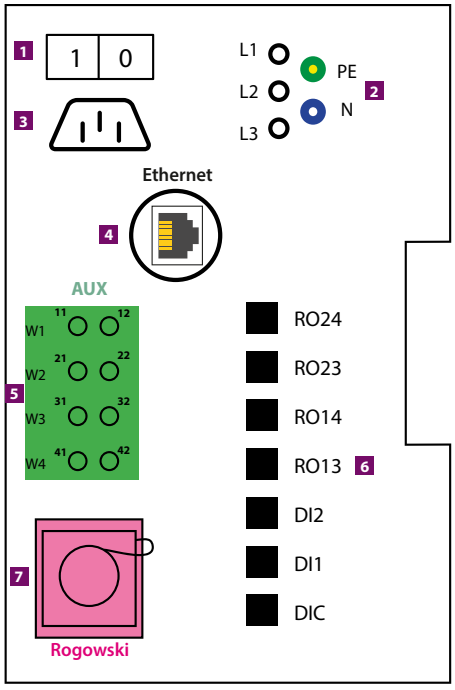
Degree of protection	IP20
Dimensions	approx. 556 x 416 x 295 mm
Documentation number	D00240
Weight	≤ 16 kg

Wiring diagram of the front plate



1 Overview of the DIP switch settings for the transducers of the Rogowski coils
2 Transducers for the Rogowski coils
3 Jumper wire slots to configure the measuring current transformers in use
4 Slots for replacement jumper wires
5 Universal measuring device PEM735

Wiring panel side



1 On/off switch of the measuring case
2 Measuring voltage inputs
3 Power supply socket for measuring case
4 Ethernet connection socket
5 Measuring current transformer inputs
6 Digital inputs and relay outputs
7 Connection Rogowski coils

Wiring panel measuring case



Measuring current transformer included in the scope of delivery



Material for voltage measurement



Measuring current transformer for universal measuring devices

Window-type/Split-core current transformer



Device features

CTB41/CTB51

- Window-type current transformer
- Screwless connection technique
- Maintenance-free, gas-tight connection
- Max. operating voltages up to 1.2 kV
- Can also be used in 690 V systems
- Unbreakable plastic enclosure, self-extinguishing, UL94-V0, flame-resistant

KBR18/KBR32

- Split-core current transformer (mounting without disconnecting the primary conductor)
- Incl. connecting cable (2.5 m)
- Max. operating voltages up to 0.72 kV

Approvals

CE

Standards

The measuring current transformers were designed in accordance with the following standards:

- IEC 61869-1
- IEC 61869-2
- IEC 61010-1

Further information

For further information refer to our product range on www.bender.de.

Ordering details window-type current transformer

Primary current	Secondary current	Accuracy	Type	Model	Art. No.
60	5	1	WL605 KL. 1	CTB41	B98086001
	1	1	WL601 KL. 1	CTB41	B98086002
75	5	1	WL755 KL. 1	CTB41	B98086003
	1	1	WL751 KL. 1	CTB41	B98086004
125	5	0.5	WL1255 KL. 0,5	CTB41	B98086005
		1	WL1255 KL. 1	CTB41	B98086007
	1	0.5	WL1251 KL. 0,5	CTB41	B98086006
		1	WL1251 KL. 1	CTB41	B98086008
150	5	0.5	WL1505 KL. 0,5	CTB41	B98086009
		1	WL1505 KL. 1	CTB41	B98086011
	1	0.5	WL1501 KL. 0,5	CTB41	B98086010
		1	WL1501 KL. 1	CTB41	B98086012
200	5	0.5	WL2005 KL. 0,5	CTB41	B98086013
		1	WL2005 KL. 1	CTB41	B98086015
	1	0.5	WL2001 KL. 0,5	CTB41	B98086014
		1	WL2001 KL. 1	CTB41	B98086016
250	5	0.5	WL2505 KL. 0,5	CTB41	B98086017
		1	WL2505 KL. 1	CTB41	B98086019
	1	0.5	WL2501 KL. 0,5	CTB41	B98086018
		1	WL2501 KL. 1	CTB41	B98086020
300	5	0.5	WL3005 KL. 0,5	CTB41	B98086021
		1	WL3005 KL. 1	CTB41	B98086023
	1	0.5	WL3001 KL. 0,5	CTB41	B98086022
		1	WL3001 KL. 1	CTB41	B98086024
400	5	1	WL4005 KL. 1	CTB41	B98086026
		0.5	WL4005 KL. 0,5	CTB41	B98086027
	1	1	WL4001 KL. 1	CTB41	B98086028
		0.5	WL4001 KL. 0,5	CTB41	B98086025
500	5	1	WL5005 KL. 1	CTB41	B98086029
		0.5	WL5005 KL. 0,5	CTB41	B98086031
	1	1	WL5001 KL. 1	CTB41	B98086032
		0.5	WL5001 KL. 0,5	CTB41	B98086033

Primary current	Secondary current	Accuracy	Type	Model	Art. No.
600	5	1	WL6005 KL. 1	CTB51	B98086034
		0.5	WL6005 KL. 0,5	CTB51	B98086035
	1	1	WL6001 KL. 1	CTB51	B98086036
		0.5	WL6001 KL. 0,5	CTB51	B98086037
800	5	1	WL8005 KL. 1	CTB51	B98086038
		0.5	WL8005 KL. 0,5	CTB51	B98086039
	1	1	WL8001 KL. 1	CTB51	B98086040
		0.5	WL8001 KL. 0,5	CTB51	B98086041
1000	5	1	WL10005 KL. 1	CTB51	B98086042
		0.5	WL10005 KL. 0,5	CTB51	B98086043
	1	1	WL10001 KL. 1	CTB51	B98086044
		0.5	WL10001 KL. 0,5	CTB51	B98086045

Ordering details split-core current transformer

Primary current	Secondary current	Accuracy	Type	Model	Art. No.
50	1	3FS5	WLS501 KL. 3FS5	KBR18	B98086046
100	1	3FS5	WLS1001 KL. 3FS5	KBR18	B98086047
150	1	3FS5	WLS1501 KL. 3FS5	KBR18	B98086048

Primary current	Secondary current	Accuracy	Type	Model	Art. No.
250	1	3FS5	WLS2501 KL. 3FS5	KBR32	B98086049
500	1	3FS5	WLS5001 KL. 1FS5	KBR32	B98086050

Selection guide current transformer/PEM

Design specifications of the measuring ranges current transformer/PEM

The secondary current of the current transformer has to be adjusted to the current input of the measuring device. The following table will help you to select the device type.

Current transformer secondary current	PEM353(-x) (5 A)	PEMxxx(-xx5) (5 A)	PEMxxx-xx1 (1 A)
5 A	■	■	–
1 A	–[1)]	–[1)]	■

[1)] *Note: In principle, measuring current transformers can also be operated with 1 A secondary current on measuring devices with 5 A current input. In this case, the accuracy class is expected to be reduced by one class (e.g. 0.5 to 1).*

The measurement accuracy classes of the system

The measurement accuracy class of the system is influenced by both the accuracy classes of the measuring current transformers und the measuring device. Refer to DIN EN 61557-12, Annex E.2.

Accuracy classes of measuring current transformers	PEM3xx (0.5 S)	PEM5xx (0.5 S)	PEM735 (0.2 S)
1	1	1	1
0.5	1	1	0.5

Technical Data

CTB41

Rated continuous thermal current I_{cth}	1.2 x I_N
Rated short-time thermal current I_{th}	60 x I_N, 1 s
Max. operating voltage U_m	1.2 kV, U_{eff}
Insulation test voltage	6 kV, U_{eff}, 50 Hz, 1 min
Nominal frequency	50/60 Hz
Insulation class	E
Operating temperature	-5…50 °C

CTB51

Rated continuous thermal current I_{cth}	1.2 x I_N
Rated short-time thermal current I_{th}	60 x I_N, 1 s
Max. operating voltage U_m	1.2 kV, U_{eff}
Insulation test voltage	6 kV, U_{eff}, 50 Hz, 1 min
Nominal frequency	50/60 Hz
Insulation class	E
Operating temperature	-5…50 °C

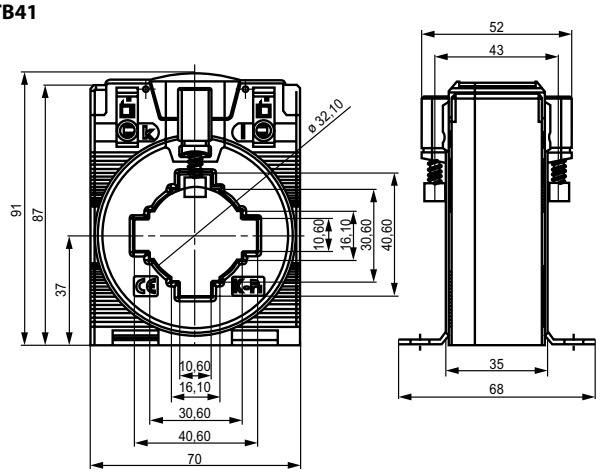
KBR18

Rated continuous thermal current I_{cth}	1.2 x I_N
Rated short-time thermal current I_{th}	60 x I_N, 1 s
Max. operating voltage U_m	0.72 kV, U_{eff}
Insulation test voltage	3 kV, U_{eff}, 50 Hz, 1 min
Nominal frequency	50 Hz
Insulation class	E
Operating temperature	-5…50 °C

KBR32

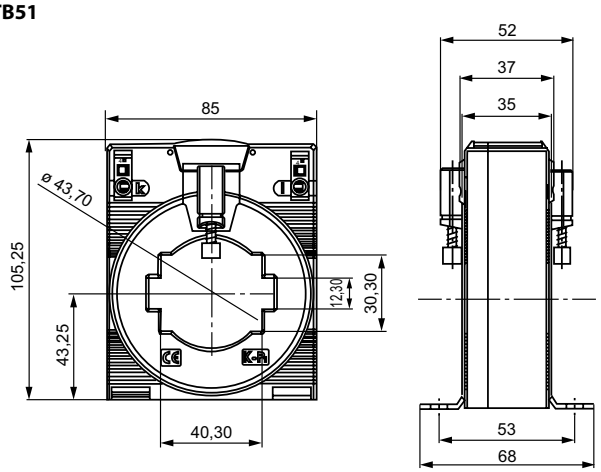
Rated continuous thermal current I_{cth}	1.2 x I_N
Rated short-time thermal current I_{th}	60 x I_N, 1 s
Max. operating voltage U_m	0.72 kV, U_{eff}
Insulation test voltage	3 kV, U_{eff}, 50 Hz, 1 min
Nominal frequency	50 Hz
Insulation class	E
Operating temperature	-5…50 °C

CTB41



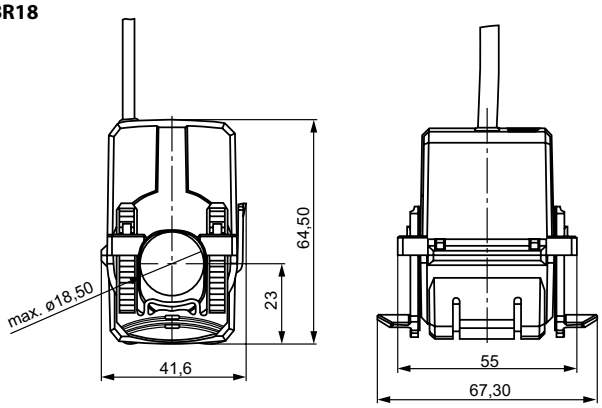
Dimensions (mm)	
Busbar 1	40 x 10
Busbar 2	30 x 15
Circular conductor	32
Installation width	70
Installation height	91
Overall depth	52

CTB51



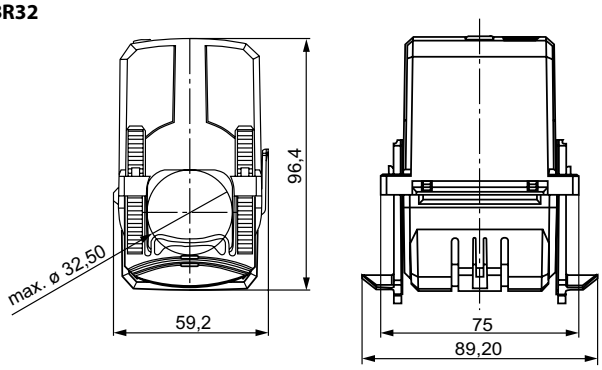
Dimensions (mm)	
Busbar 1	50 x 12
Busbar 2	40 x 30
Circular conductor	44
Installation width	85
Installation height	105.25
Overall depth	52

KBR18



Dimensions (mm)	
Circular conductor	18
Installation width	41.6
Installation height	64.5
Installation depth incl. fixation clips	67.3

KBR32



Dimensions (mm)	
Circular conductor	32.5
Installation width	59.2
Installation height	96.4
Installation depth incl. fixation clips	89.2

Energy meter



Device features

- Energy meter with Modbus RTU interface
- MID approved
- 7-digit display
- Automatic recognition of bus transmission rate and parity
- Lead seal possible with cap as accessory
- Resettable, partial reading
- In addition to active energy metering, measured data such as current, voltage, power and cos (phi) is also available.
- DIN rail mounting

Approvals

CE

Application fields

- Registration of relevant energy management data
- Suitable for billing purposes

Standards

The energy meters have been developed in accordance with the following standards:
Accuracy class B acc. to EN 50470-3, accuracy class 1 acc. to IEC 62053-21.

Further information

For more information see our product range on www.bender.de.

Ordering information

Description	Type	Art. No.
Energy meter 1Ph/32 A MID Modbus RTU	ALD1	B93101005
Energy meter 3Ph/65 A MID Modbus RTU	ALE3	B93101006
Energy meter 3Ph/6 A MID Modbus RTU	AWD3	B93101007
S0 pulse counter (four-fold) with Modbus RTU	PCD7	B93101008

Accessories

Description	Type	Art. No.
Sealable cover for ALD1 (two per counter)	–	B93101009
Sealable cover for ALE3/AWD3 (four per counter)	–	B93101010

Technical data ALD1

Accuracy class	B acc. to EN 50470-3 1 acc. to IEC 62053-21
Operating voltage	AC 230 V, 50 Hz
Tolerance	-20 %/+15 %
Reference current/maximum current	I_{ref} = 5 A, I_{max} = 32 A
Starting current/minimum current	I_{st} = 20 mA, I_{min} = 0.25 A
Power consumption	active power 0.4 W
Counting range	00'000.00…99'999.99 100'000.0…999'999.9
Pulses per kWh	LC display 2000 imp/kWh

Technical data ALE3

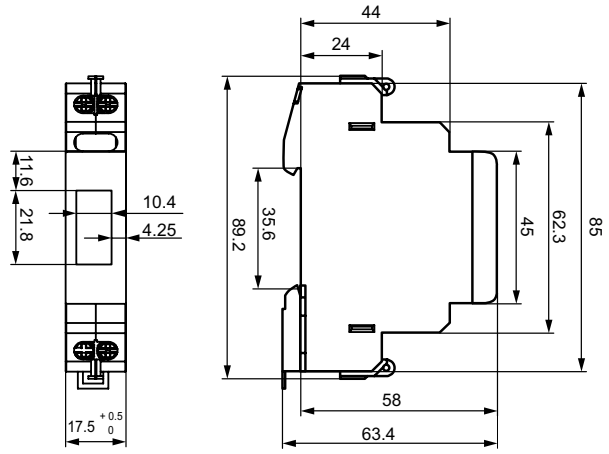
Accuracy class	B acc. to EN 50470-3 1 acc. to IEC 62053-21
Operating voltage	3 x AC 230/400 V, 50 Hz
Tolerance	-20 %/+15 %
Reference current/maximum current	I_{ref} = 10 A, I_{max} = 65 A
Starting current/minimum current	I_{st} = 40 mA, I_{min} = 0.5 A
Power consumption	active 0.4 W per phase
Counting range	00 000.00…99 999.99 100 000.0…999 999.9
LC display with background illumination,	6 mm high digits
Display without mains voltage	capacitor supported LCD maximum for two periods of 10 days
Pulses per kWh	LED 1000 imp/kWh

Technical data AWD3

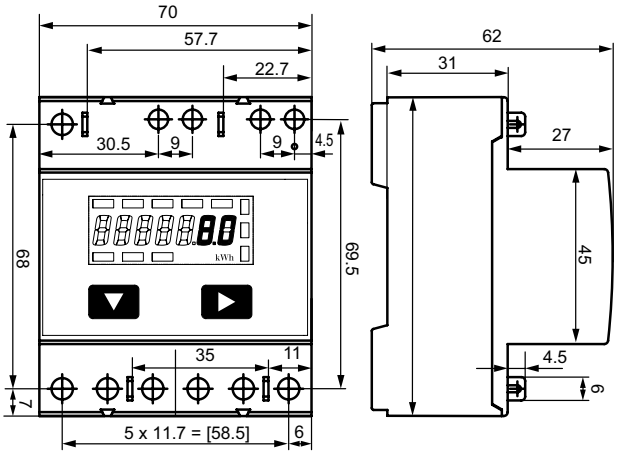
Accuracy class	B acc. to EN50470-3, 1 acc. to IEC 62053-21
Operating voltage	3 x AC 230/400 V, 50 Hz
Tolerance	-20 %/+15 %
Transformer measurement	5…1500 A
Reference current/maximum current	I_{ref} = 5 A, I_{max} = 6 A
Starting current/minimum current	I_{st} = 10 mA, I_{min} = 0,05 A
Conversion factor	5:5, 50:5, 100:5, 150:5, 200:5, 250:5, 300:5, 400:5, 500:5, 600:5, 750:5, 1000:5, 1250:5, 1500:5
Power consumption	active 0.4 W per phase
Counting range	000˙000.0…999˙999.9 1˙000˙000…9˙999˙999
LC display with background illumination	6 mm high digits
Display without mains voltage	capacitor supported LCD maximum for two periods of 10 days

Dimension diagram(dimensions in mm)

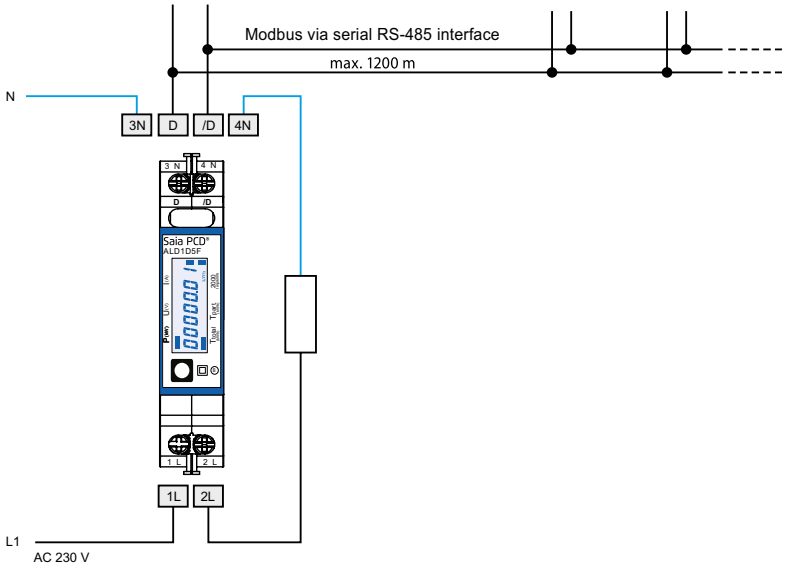
1 phase

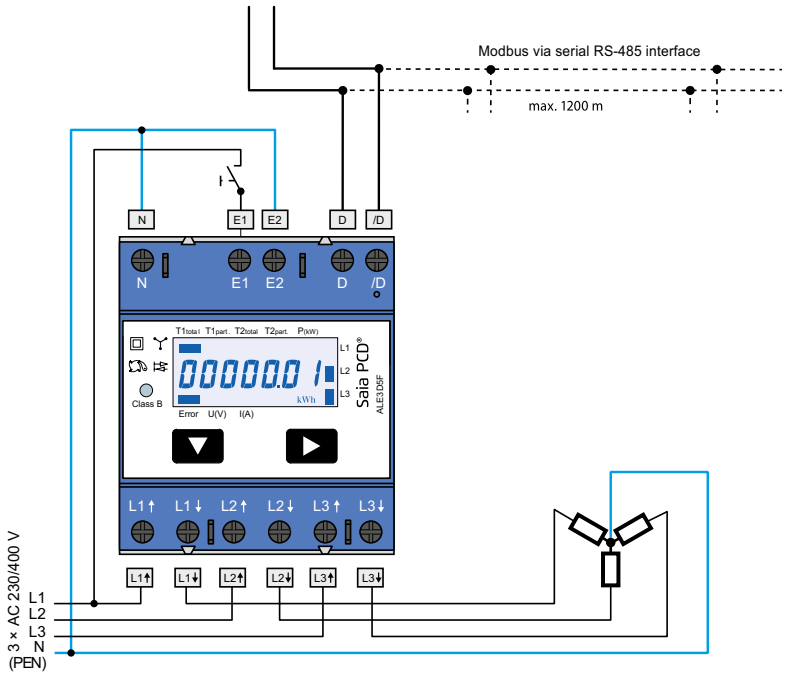


3 phase

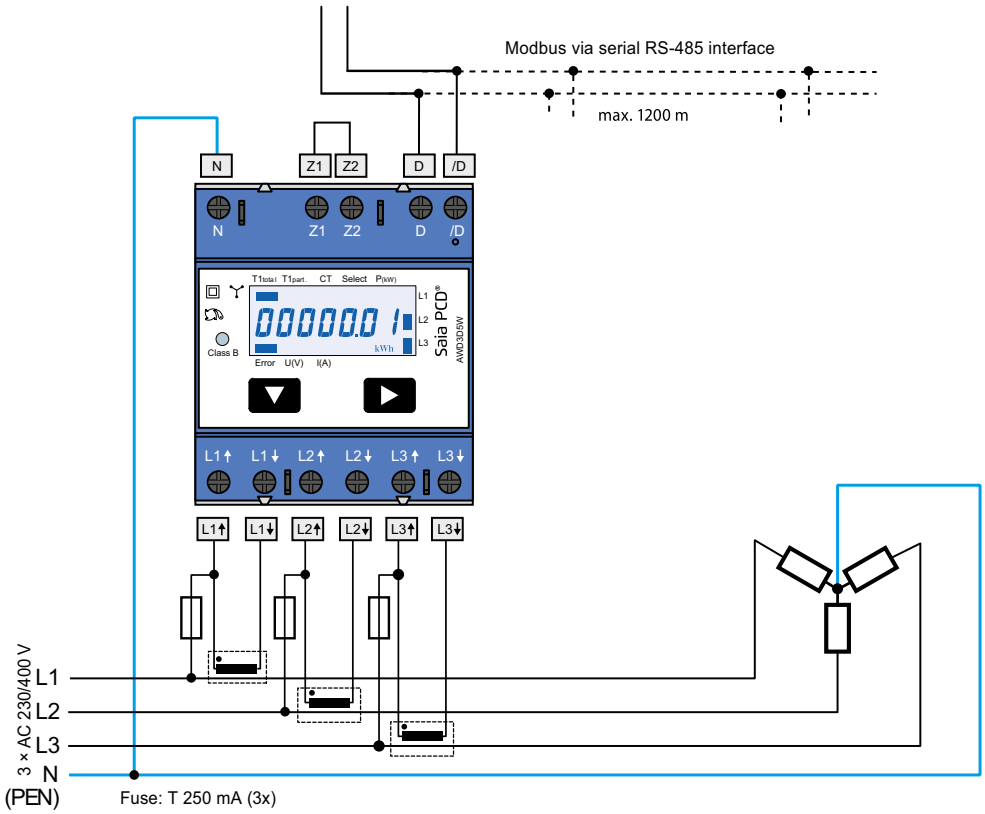


Wiring diagrams





Connections E1 and E2
To switch between tariffs, connect to the control signal of the ripple control receiver.



The secondary current transformer connection on the network side has to be connected to the phase to be measured. For this reason the current transformer must not be earthed.



Device overview measuring and monitoring relays LINETRAXX®

			 LINETRAXX® VME420	 LINETRAXX® VME421H	 LINETRAXX® VMD258	 LINETRAXX® ES258	 LINETRAXX® VMD420	 LINETRAXX® VMD421H
Page			272	275	278	281	282	275
Special applications					Power plant	Energy backup for device series VMD258		
Application	**Voltage monitoring**		■	■	■		■	■
	Current monitoring							
Voltage monitoring	**AC**	with U_s	*U*<, *U*>					
		without U_s		*U*<, *U*>				
	3AC	with U_s					*U*<, *U*>	
		without U_s			*U*<, *U*>			*U*<, *U*>
	3(N)AC	with U_s					*U*<, *U*>	
		without U_s						*U*<, *U*>
	DC	with U_s	*U*<, *U*>					
		without U_s		*U*<, *U*>				
Measuring range/ nominal system voltage U_n			AC/DC systems 0…300 V	AC/DC systems 9.6…150 V (VME421H-D-1), 70…300 V (VMD421H-D-2)	3AC 690/500/480/440/ 400/230/110/100 V		(L-N) 0…288 V (L-L) 0…500 V	(L-N) 0…288 V (L-L) 0…500 V
Frequency			*f*<, *f*>	*f*<, *f*>			*f*<, *f*>	*f*<, *f*>
Asymmetry/phase failure							■	■
Phase sequence							■	■
Current monitoring	**1 AC with U_s**							
	3 AC with U_s							
Special function								
Installation	**DIN rail**		■	■	■	■	■	■
	Screw mounting		■	■	■	■	■	■

5.2



							
LINETRAXX® VMD423/VMD423H	**LINETRAXX® VMD460-NA**	**LINETRAXX® VMD461**	**LINETRAXX® CME420**	**LINETRAXX® CMD420/CMD421**	**LINETRAXX® CMS460**	**LINETRAXX® GM420**	**SB146**
288	291	296	302	305	308	311	314
Interface Protection System/Decoupling protection relay	Interface Protection System/Decoupling protection relay	Interface Protection System/Decoupling protection relay				Loop monitoring	Fault voltage relay
■	■	■					
			■	■	■		
	U<, *U*<<, *U*>, *U*>>, U_{10min}>	*U*<, *U*<<, *U*<<<, *U*>, *U*>>, *U*>>>					
	U<, *U*<<, *U*>, *U*>>, U_{10min}>	*U*<, *U*<<, *U*<<<, *U*>, *U*>>, *U*>>>					
U<, *U*>, U_{10min}> (423)	*U*<, *U*<<, *U*>, *U*>>, U_{10min}>	*U*<, *U*<<, *U*<<<, *U*>, *U*>>, *U*>>>					
U<, *U*>, U_{10min}> (423H)							
(L-N) 0…288 V (L-L) 0…500 V	(L-N) 0…300 V (L-L) 0…520 V	(L-N) AC 50…260 V (L-L) AC 87…450 V (DC+ / DC–) DC 50…450 V					
f<, *f*>	*f*<, *f*<<, *f*>, *f*>>	*f*<, *f*<<, *f*<<<, *f*>, *f*>>, *f*>>>					
■	■	■					
■	■	■					
			I<, *I*>		*I*<, *I*>		
				I<, *I*>	*I*<, *I*>		■
	RS-485 interface, Islanding detection: -ROCOF (df/dt) -Vector shift	RS-485 interface, Islanding detection: -ROCOF (df/dt) -Vector shift			RS-485 interface		
■	■	■	■	■	■	■	
■	■	■	■	■	■	■	

5.2



LINETRAXX® VME420

Multi-functional monitoring relay for undervoltage, overvoltage and frequency monitoring in AC/DC systems with separate supply voltage



Typical applications

- Voltage and frequency monitoring of single-phase machines and electrical installations
- Earth fault monitoring in medium-voltage systems via voltage transformers
- Monitoring of battery systems
- Switching machinery and equipment on and off at a certain voltage level

Approvals

Device features

- Monitoring AC/DC systems for undervoltage, overvoltage and frequency in the voltage range of 0…300 V
- Various monitoring functions selectable *U* <, *U* >, *f* <, *f* >
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Further information

For further information refer to our product range on www.bender.de.

5.2

Ordering information

Supply voltage [1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 15…460 Hz	9,6…94 V	VME420-D-1	B93010001	B73010001
70…300 V, 15…460 Hz	70…300 V	VME420-D-2	B93010002	B73010002

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between:	
	(A1, A2) -(U1/+, U2/-) -(11-12-14) -(21-22-24)

Supply voltage

VME420-D-1:

Supply voltage U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	15…460 Hz

VME420-D-2:

Supply voltage U_S	AC/DC 70…300 V
Frequency range U_S	15…460 Hz
Power consumption	≤ 4 VA

Measuring circuit

Measuring range (rms value)	AC/DC 0…300 V
Rated frequency f_n	DC, 15…460 Hz
Frequency display range	10…500 Hz

Response values

Undervoltage $U <$ (Alarm 2)	AC/DC 6…300 V
Overvoltage $U >$ (Alarm 1)	AC/DC 6…300 V
Resolution of setting U 6.0…49.9 V	0.1 V
Resolution of setting U 50…300 V	1 V

Preset function:

Undervoltage $U <= (0.85\ U_n)$:*	
for U_n = 230/120/60/24 V	196/102/51/20.4 V
Overvoltage $U >= (1.1\ U_n)$:*	
for U_n = 230/120/60/24 V	253/132/66/26.4 V
Relative uncertainty voltage at 50/60 Hz	±1.5 %, ±2 digits
Relative uncertainty, voltage in the range of 15…460 Hz	±3 %, ±2 digit
Hysteresis U	1…40 % (5 %)*
Underfrequency < Hz	10…500 Hz**
Overfrequency > Hz	10…500 Hz**
Resolution of setting f 10.0…99.9 Hz	0.1 Hz
Resolution of setting f 100…500 Hz	1 Hz

Preset function:

Underfrequency for f_n = 400/60/50/16.7 Hz	399/59/49/15.7 Hz
Overfrequency for f_n = 400/60/50/16.7 Hz	401/61/51/17.7 Hz
Hysteresis frequency Hys Hz	0.1…2 Hz (0.2 Hz)*
Relative uncertainty, frequency range 15…460 Hz	±0.2 %, ±1 digit

Time response

Start-up delay t	0…300 s (0 s)*
Response delay $t_{on1/2}$	0…300 s (0 s)*
Delay on release t_{off}	0…300 s (0.5 s)*
Resolution of setting t, $t_{on1/2}$, t_{off} (0…10 s)	0.1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (10…99 s)	1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (100…300 s)	10 s
Operating time, voltage t_{ae}	DC/AC 16.7 Hz: ≤ 130 ms, AC 42…460 Hz: ≤ 70 ms
Operating time frequency t_{ae}	AC 15…460 Hz: ≤ 310 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms

Displays, memory

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0…300 V
Operating uncertainty at 50/60 Hz	±1.5 %, ±2 digits
Operating uncertainty, voltage in the range of 15…460 Hz	±3 %, ±2 digits
Operating uncertainty, frequency in the range of 15…460 Hz	±0.2 %, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	off/0…999 (off)*
Fault memory (M) alarm relay	on/off/con (on)*

Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation/N/O operation
	K2: Err, $U <$, $U >$, Hz <, Hz >, S.AL (undervoltage $U <$: N/C operation n.c.)*
	K1: Err, $U <$, $U >$, Hz <, Hz >, S.AL (overvoltage $U >$: N/O operation n.o.)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

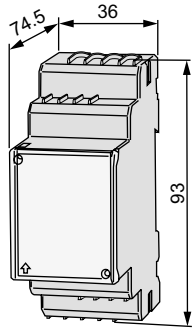
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529	IP20
Enclosure material	polycarbonate
Screw mounting	2 x M4 with mounting clip
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00026
Weight	≤ 150 g

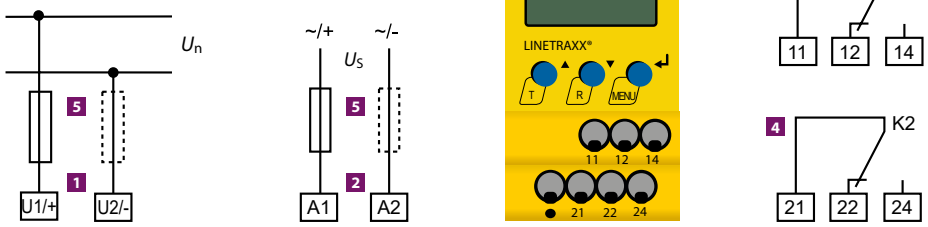
( )* = factory setting

** = The technical data applies to the operating range of the rated frequency 15…460 Hz only

Dimension diagram (dimensions in mm)



Wiring diagram



1	U1/+, U2/-	Connection to the system/load being monitored
2	A1, A2	Supply voltage U_S (see ordering information)
3	11, 12, 14	Alarm relay "K1": Configurable for *U*</*U*>/*f*</*f*>/ERROR
4	21, 22, 24	Alarm relay "K2": Configurable for *U*</*U*>/*f*</*f*>/ERROR

5 Line protection according to IEC 60364-4-43:
A fuse recommended recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

LINETRAXX® VME421H

Multi-functional monitoring relay for undervoltage, overvoltage and frequency monitoring in AC/DC systems without separate supply voltage



Typical applications

- Voltage and frequency monitoring of single-phase machines and electrical installations
- Earth fault monitoring in medium-voltage systems via voltage transformers
- Monitoring of battery systems
- Switching machinery and equipment on and off at a certain voltage level

Approvals

Device features

- Monitoring undervoltage, overvoltage and frequency of AC/DC systems of 9.6…150 V (VME421H-D-1), 70…300 V (VME421H-D-2)
- Without external supply voltage
- Integrated energy backup
- Various monitoring functions selectable *U* <, *U* >, *f* <, f >
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage [1] U_n		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
9.6…150 V, 15…460 Hz	9.6…150 V	VME421H-D-1	B93010003	B73010003
70…300 V, 15…460 Hz	70…300 V	VME421H-D-2	B93010004	B73010004

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between:	(U1/+, U2/-) -(11-12-14) -(21-22-24)
Voltage test acc. to IEC 61010-1	2.21 kV

Supply voltage

VME421H-D-1:

Supply voltage U_S	none (internally supplied by U_n)

VME421H-D-2:

Supply voltage U_S	none (internally supplied by U_n)
Power consumption	≤ 6 VA

Measuring circuit

Measuring range (rms value) (VME421H-D-1)	AC/DC 0…150 V
Measuring range (rms value) (VME421H-D-2)	AC/DC 0…300 V
Rated frequency f_n	DC, 15…460 Hz
Frequency display range	10…500 Hz

Response values

VME421H-D-1:

Undervoltage U < (Alarm 2)	AC/DC 9.6…150 V
Overvoltage U > (Alarm 1)	AC/DC 9.6…150 V
Preset function:	
Undervoltage U < (0.85 U_n)* for U_n = 120/60/24 V	102/51/20.4 V
Overvoltage U > (1.1 U_n)* for U_n = 120/60/24 V	132/66/26.4 V
Resolution of setting U 9.6…49.9 V	0.1 V
Resolution of setting U 50…150 V	1 V

VME421H-D-2:

Undervoltage U < (ALARM 2)	AC/DC 70…300 V
Overvoltage U > (ALARM 1)	AC/DC 70…300 V
Resolution of setting U 70…300 V	1 V
Preset function:	
Undervoltage U < (0.85 U_n)* for U_n = 230/120 V	196/102 V
Overvoltage U > (1.1 U_n)* for U_n = 230/120 V	253/132 V

VME421H…:

Relative uncertainty voltage at 50/60 Hz	1.5 %, 2 digits
Relative uncertainty voltage in the range 15…460 Hz	±3 %, ±2 digit
Hysteresis U	1…40 % (5 %)*
Underfrequency Hz <	10…500 Hz**
Overfrequency Hz >	10…500 Hz**
Resolution of setting f 10.0…99.9 Hz	0.1 Hz
Resolution of setting f 100…500 Hz	1 Hz
Preset function:	
Underfrequency for f_n = 400/60/50/16.7 Hz	399/59/49/15.7 Hz
Overfrequency for f_n = 400/60/50/16.7 Hz	401/61/51/17.7 Hz
Hysteresis frequency Hys Hz	0.1…2 Hz (0.2 Hz)*
Relative uncertainty, frequency in the range of 15…460 Hz	±0.2 %, ±1 digit

Time response

Start-up delay t	0…300 s (0 s)*
Response delay $t_{on1/2}$	0…300 s (0 s)*
Delay on release t_{off}	0…300 s (0.5 s)*
Resolution of setting t, $t_{on1/2}$, t_{off} (0…10 s)	0.1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (10…99 s)	1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (100…300 s)	10 s
Operating time, voltage t_{ae}	DC/AC 16.7 Hz: ≤ 130 ms, AC 42…460 Hz: ≤ 70 ms
Operating time frequency t_{ae}	AC 15…460 Hz: ≤ 310 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Discharging time energy backup on power failure (VME421H-D-1)	3 s
Discharging time energy backup on power failure (VME421H-D-1)	2.5 s at f_n < 42 Hz
Discharging time energy backup (VME421H-D-2)	≥ 4 s at DC 70 V ≥ 6 s at DC 80 V/AC 70 V
Charging time energy backup (VME421H-D-1)	60 s
Charging time energy backup (VME421H-D-2)	120 s
Recovery time t_b	≤ 300 ms

Displays, memory

Display	LC display, multifunctional, not illuminated
Display range measured value (VME421H-D-1)	AC/DC 0…150 V
Display range measured value (VME421H-D-2)	AC/DC 0…300 V
Operating uncertainty at 50/60 Hz	±1.5 %, ±2 digits
Operating uncertainty voltage in the range of 15…460 Hz	±3 %, ±2 digits
Operating uncertainty in the frequency range 15…460 Hz	±0.2 %, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	off/0…999 (off)*
Fault memory (M) alarm relay	on/off/con (on)*

Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation/N/O operation K2: Err, U <, U >, Hz <, Hz >, S.AL (undervoltage U <: N/C operation n.c.)* K1: Err, U <, U >, Hz <, Hz >, S.AL (overvoltage U >: N/O operation n.o.)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

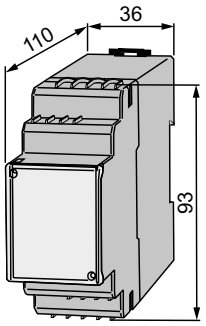
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529	IP20
Enclosure material	polycarbonate
Screw mounting	2 x M4 with mounting clip
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00141
Weight	≤ 240 g

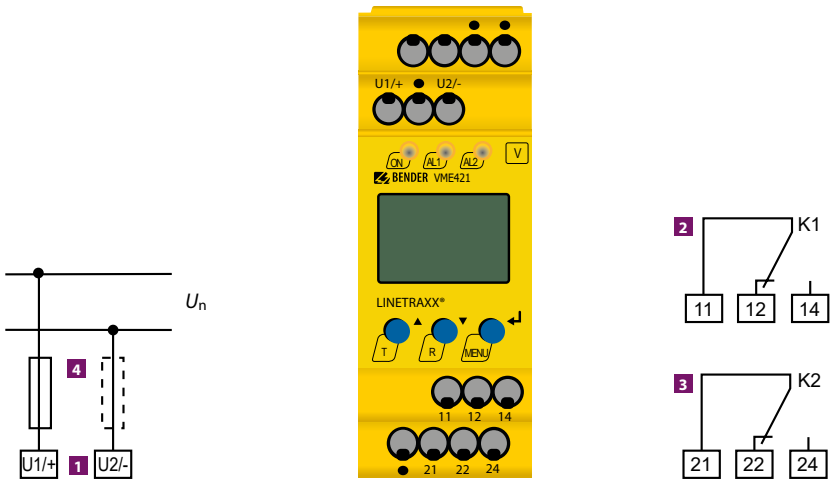
( )* = factory setting

** = The technical data applies to the operating range of the rated frequency 15…460 Hz only.

Dimension diagram (dimensions in mm)



Wiring diagram



1 U1/+, U2/- Connection to the system/load being monitored

2 11, 12, 14 Alarm relay "K1": Configurable for *U*</*U*>/*f*</*f*>/ERROR

3 21, 22, 24 Alarm relay "K2": Configurable for *U*</*U*>/*f*</*f*>/ERROR

4 Line protection according to IEC 60364-4-43:
A fuse recommended recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

LINETRAXX® VMD258

Undervoltage/overvoltage relay for monitoring three-phase AC systems (window function) for power plant applications



Device features

- High availability due to purely analogue technology
- Undervoltage and overvoltage monitoring for 3AC systems
- No separate supply voltage required
- Separate alarm relays for undervoltage and overvoltage with two potential-free changeover contacts
- Adjustable response value: 0.7…0.95 x U_n / 1.05…1.3 x U_n
- Nominal system voltages: 3AC 690/500/480/440/400/230/110/100 V
- Adjustable response delay: 0…5 s
- LEDs for operation, overvoltage, undervoltage

Typical applications

- Monitoring of the power supply of machines and electrical installations
- Monitoring of loads
- Switching electrical systems on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems

Standards

The LINETRAXX® VMD258 series complies with the requirements of the device standards:

- DIN EN 60255-1 VDE 0435-300
- E DIN IEC 60255-127 VDE 0435-3127.

Further information

For further information refer to our product range on www.bender.de.

Approvals

CE

Ordering details

Connection	Type	Art. No.
3AC, 100 V	VMD258 3AC 100 V	B93010060
3AC, 110 V	VMD258 3AC 110 V	B93010061
3AC, 230 V	VMD258 3AC 230 V	B93010062
3AC, 400 V	VMD258 3AC 400 V	B93010063
3AC, 440 V	VMD258 3AC 440 V	B93010064
3AC, 480 V	VMD258 3AC 480 V	B93010065
3AC, 500 V	VMD258 3AC 500 V	B93010066
3AC, 690 V	VMD258 3AC 690 V	B93010067

Accessories

Description	Art. No.
Additional mounting clips (screw mounting)	B 9806 0008

Suitable system components

Description	Type	Art. No.	Page
Energy backup	ES258	B93010068	281

Insulation coordination acc. to DIN EN 60255-27

Supply voltage U_S AC (V)	690	480/500	400/440	230	100/110
Rated voltage AC (V)	1000	1000	600	300	150
Rated impulse voltage (kV)	12	12	8	6	4
Pollution degree					3
Overvoltage category					III

Voltage ranges

Frequency range of U_S								45…66 Hz
Operating range								0.5…1.5 x U_S
Nominal supply voltage U_S 3AC (V)	690	500	480	440	400	230	110	100
Power consumption at 50 Hz, 1.3 x U_S (VA)	19	15	12	14	9	16	15	10
Power consumption at 60 Hz, 1.3 x U_S (VA)	11	9	8	8	6	9	9	7

Measuring circuit

Nominal system voltage U_n	3AC 690/500/480/440/400/230/110/100 V
Setting range	0.7…1.3 x U_n
Frequency range U_n	45…66 Hz
Max. permissible measuring voltage	1.5 x U_n
Response value U_n adjustable	$U>$, $U<$

Response values

Undervoltage $U <$ (alarm)	0.7…0.95 x U_n
Overvoltage $U >$ (alarm)	1.05…1.3 x U_n
Relative uncertainty at the setting limits	45…66 Hz: ±3 %
	47,5…63 Hz: ±2 %
Hysteresis	< 3 %
Repetition accuracy	±1 %
LED ON	LED (green)
Alarm for $U <$	LED (yellow)
Alarm for $U >$	LED (yellow)

Time response

Start-up delay t	500 ms ±20 %
Response delay t_{on}	0…5 s ±10 %
Delay on release t_{off}	100 ms ±20 %
Operating time t_{ae} at overvoltage	60 ms* ±20 %
Operating time t_{ae} at undervoltage	100 ms**±20 %
Response time t_{an}	$t_{an} = t_{ae} + t_{on}$
Long-term influence	–10 %
Overshoot time tov	< 60 ms

Connection for external energy storage device

U_{min}	DC 24 V
U_{max}	DC 68 V
U_{typ} at 1.0 x U_n	42…47 V ±15 %
Short circuit proof (Z+, Z-)	short time yes

Switching elements

Number of switching elements	2 x 2 changeover contacts
Operating mode	N/C operation (undervoltage)
	N/O operation (overvoltage)
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Rated operational voltage AC	230 V/230 V
Utilisation category	AC-13/AC-14
Rated operational current AC	5 A/3 A
Rated operational voltage DC	220/110/24 V
Utilisation category	DC12
Rated operational current DC	1/0.2 /0.1 A
Minimum current	1 mA at AC/DC > 10 V

Environment/EMC

EMC immunity	acc. to IEC 60255-26
EMC emission	acc. to IEC 60255-25
Operating temperature	-20…+70 °C

Classification of climatic conditions acc. to DIN IEC 60721-3-3

Stationary use	3K5
Transport	2K3
Long-term storage	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M4
Transport	2M2
Long-term storage	1M3
Requirements acc. to IEC 60255	Class 2

Connection

Connection	screw terminals
Connection properties	
rigid/flexible	0.2…2.5 mm²
flexible with connector sleeve	0.25…2.5 mm²
without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…13
Tightening torque	0.5…0.6 Nm
Current through L1L1, L2L2 , L3L3	each max. 3 A

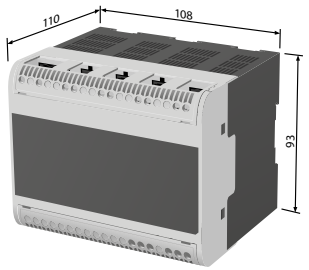
Other

Operating mode	continuous operation
Position	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	4 x M4
Documentation number	D00068
Weight	825 g

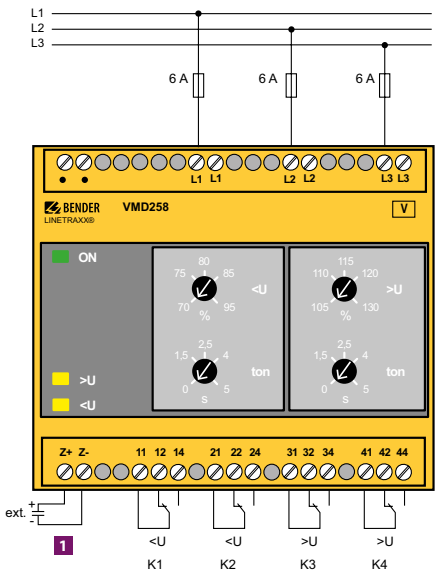
* Operating time **t_{ae} overvoltage** increase from 100 % to 130 %, switching threshold at 105 %

** Operating time **t_{ae} undervoltage** decrease from 100 % to 0 %, switching threshold at 95 %

Dimension diagram (dimensions in mm)



Wiring diagram



1 Z+, Z- Connection ES258 for a backup time of > 5 s

ES258

Energy backup for undervoltage/overvoltage relays



Typical applications

- Supplementary device for the undervoltage/overvoltage relay VMD258.

Further information

For further information refer to our product range on www.bender.de.

Approvals

CE

Ordering information

Type	Art. No.
ES258	B93010068

Technical data

Insulation coordination according to IEC 60664-1

Rated insulation voltage	DC 100 V
Rated impulse voltage/pollution degree	800 V/3
Overvoltage category	II

Output Z1/Z2

Supply voltage	DC 41…47 V (±30 %)
Storage capacity to supply the undervoltage and overvoltage relays	min. 5 s (±0.5 s)
Recovery time	≤ 60 s
Internal fuse, triggered in case of incorrect connection	yes

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4

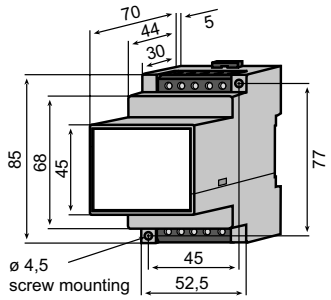
Connection

Connection	screw -type terminal
Connection properties	
single wire	2 x (0.5…4) mm²
flexible with end ferrule	2 x (0.5…2.5) mm²

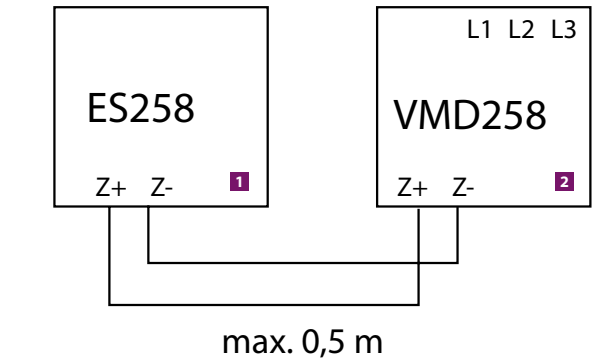
Other

Operating mode	continuous operation
Mounting	any position
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Documentation number	D00086
Weight	≤ 160 g

Dimension diagram (dimensions in mm)



Wiring diagram



1 Energy backup

2 Undervoltage/overvoltage relay

5.2

LINETRAXX® VMD420

Multi-functional voltage relay for 3(N)AC systems, frequency/overvoltage/undervoltage, phase, phase failure, asymmetry



Typical applications

- Monitoring of voltage-sensitive machines and electrical installations
- Switching machinery and equipment on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads
- Protection of three-phase motors against phase failure and phase open-circuit
- Transformer protection, asymmetrical load can be recognised

Device features

- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 0…500 V
- Asymmetry, phase failure and phase sequence monitoring
- Various monitoring functions selectable *U* <, *U* >, *f* <, *f* >
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Further information

For further information refer to our product range on www.bender.de.

Approvals

Ordering information

Supply voltage [1] U_S			Type	Art. No.	
AC	DC	AC/DC		Screw-type terminal	Push-wire terminal
16…72 V	9.6…94 V, 15…460 Hz	–	VMD420-D-1	B93010005	B73010005
–	–	70…300 V, 15…460 Hz	VMD420-D-2	B93010006	B73010006

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between	
	(A1, A2) -(N, L1, L2, L3) -(11, 12, 14) -(21, 22, 24)
Voltage test acc. to IEC 61010-1:	
(N, L1, L2, L3) -(A1, A2), (11, 12, 14)	3.32 kV
(N, L1, L2, L3) -(21, 22, 24)	2.21 kV
(A1, A2) -(11, 12, 14) -(21, 22, 24)	2.21 kV

Supply voltage

VMD420-D-1:

Supply voltage U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	15…460 Hz

VMD420-D-2:

Supply voltage U_S	AC/DC 70…300 V
Frequency range U_S	15…460 Hz
Power consumption	≤ 4 VA

Measuring circuit

Measuring range (rms value) (L-N)	AC 0…288 V
Measuring range (rms value) (L-L)	AC 0…500 V
Rated frequency f_n	15…460 Hz
Frequency display range	10…500 Hz

Response values

Type of distribution system	3(N)AC/3AC (3AC)*
Undervoltage $U <$ (Alarm 2) (measurement method: 3Ph/3n)	AC 6…500/6…288 V
Overvoltage $U >$ (Alarm 1) (measurement method: 3Ph/3n)	AC 6…500/6…288 V
Resolution of setting U	1 V

Preset function for 3AC measurement:

Undervoltage $U <$ (0.85 U_n)* for U_n = 400/208 V	340/177 V
Overvoltage $U >$ (1.1 U_n)* for U_n = 400/208 V	440/229 V

Preset function for 3(N)AC measurement:

Undervoltage $U <$ (0.85 U_n)* for U_n = 230/120 V	196/102 V
Overvoltage $U >$ (1.1 U_n)* for U_n = 230/120 V	253/132 V
Asymmetry	5…30 % (30 %)*
Phase failure	by setting the asymmetry
Phase sequence	clockwise/anticlockwise rotation (off)*
Relative uncertainty, voltage at 50/60 Hz	±1.5 %, ±2 digits
Relative uncertainty, voltage in the range 15…460 Hz	±3 %, ±2 digits
Hysteresis U	1…40 % (5 %)*
Underfrequency Hz <	10…500 Hz**
Overfrequency Hz >	10…500 Hz**
Resolution of setting f (10.0…99.9 Hz)	0.1 Hz
Resolution of setting f (100…500 Hz)	1 Hz

Preset function:

Underfrequency for f_n = 400/60/50/16.7 Hz	399/59/49/15.7 Hz
Overfrequency for f_n = 400/60/50/16.7 Hz	401/61/51/17.7 Hz
Hysteresis, frequency Hys Hz	0.1…2 Hz (0.2 Hz)*
Relative uncertainty, frequency range 15…460 Hz	±0.2 %, ±1 digit

Time response

Start-up delay t	0…300 s (0 s)*
Response delay $t_{on1/2}$	0…300 s (0 s)*
Delay on release t_{off}	0…300 s (0.5 s)*
Resolution of setting t, $t_{on1/2}$, t_{off} (0…10 s)	0.1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (10…99 s)	1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (100…300 s)	10 s
Operating time, voltage t_{ae}	≤ 140 ms
Operating time, frequency t_{ae}	≤ 335 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms

Displays, memory

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0…500 V
Operating uncertainty, voltage at 50 Hz/60 Hz	1.5 %, 2 digits
Operating uncertainty voltage in the range of 15…460 Hz	±3 %, ±2 digits
Operating uncertainty, frequency in the range of 15…460 Hz	±0.2 %, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	off/0…999 (off/ 0)*
Fault memory (M) alarm relay	on/off/con (on)*

Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation n.c. or N/O operation n.o.
	K2: Err, $U <$, $U >$, Asy, Hz <, Hz >, PHS, S.AL (undervoltage $U <$, asymmetry Asy, N/C operation n.c.)*
	K1: Err, $U <$, $U >$, Asy, Hz <, Hz >, PHS, S.AL (overvoltage $U >$, asymmetry Asy, N/O operation n.o.)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

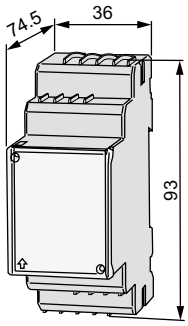
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529	IP20
Enclosure material	polycarbonate
Screw mounting	2 x M4 with mounting clip
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00137
Weight	≤ 150 g

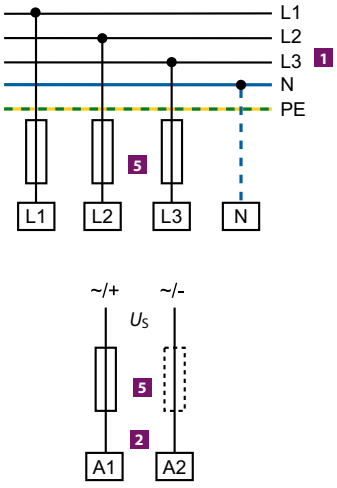
( )* = factory setting

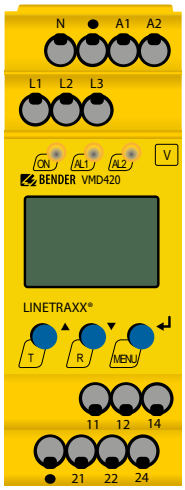
** = The technical data can only be ensured in the operating range of the nominal frequency 15…460 Hz.

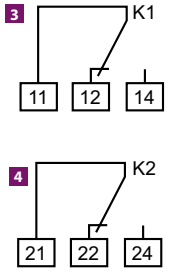
Dimension diagram (dimensions in mm)



Wiring diagram







1 L1, L2, L3, (N) Connection to the system/load to be monitored

2 A1, A2 Supply voltage U_S (see ordering information)

3 11, 12, 14 Alarm relay "K1":
Configurable for *U*</*U*>/*f*</*f*>/Asy/PHS/ERROR

4 21, 22, 24 Alarm relay "K2":
Configurable for *U*</*U*>/*f*</*f*>/Asy/PHS/ERROR

5 Line protection according to IEC 60364-4-43:
A fuse recommended recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

LINETRAXX® VMD421H

Multi-functional voltage relay for 3(N)AC systems, frequency/overvoltage/undervoltage, phase, phase failure, asymmetry



Typical applications

- Monitoring of voltage-sensitive machines and electrical installations
- Switching machinery and equipment on and off at a certain voltage level
- Monitoring of stand-by and emergency supply systems
- Supply voltage monitoring of portable loads
- Protection of three-phase motors against phase failure and phase open-circuit
- Transformer protection, asymmetrical load can be recognised

Approvals

Device features

- Undervoltage, overvoltage and frequency monitoring in 3(N)AC systems 70…500/288 V
- Without external supply voltage
- Integrated energy backup
- Asymmetry, phase failure and phase sequence monitoring
- Various monitoring functions selectable *U* <, *U* >, *f* <, *f* >
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Standards

The LINETRAXX® VMD421H series complies with the requirements of the device standards:

- IEC 61010-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage [1] U_n	Type	Art. No.	
3(N)AC		Screw-type terminal	Push-wire terminal
70…500 V, 15…460 Hz	VMD421H-D-3	B93010007	B73010007

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between (N, L1, L2, L3) -(11, 12, 14) -(21, 22, 24)	
Voltage test acc. to IEC 61010-1:	
(N, L1, L2, L3) -(11, 12, 14)	3.32 kV
(N, L1, L2, L3) -(21, 22, 24)	2.21 kV

Supply voltage

Supply voltage U_S	none (internally supplied by U_n)
Power consumption	≤ 6 VA

Measuring circuit

Measuring range (rms value) (L-N)	AC 0…288 V
Measuring range (rms value) (L-L)	AC 0…500 V
Rated frequency f_n	15…460 Hz
Frequency display range	10…500 Hz

Response values

Type of distribution system	3(N)AC/3AC (3AC)*
Undervoltage $U <$ (Alarm 2) (measurement method: 3Ph/3n)	AC 70…500/70…288 V
Overvoltage $U >$ (Alarm 1) (measurement method: 3Ph/3n)	AC 70…500 V/70…288 V
Resolution of setting U	1 V
Preset function for 3AC measurement:	
Undervoltage $U <$ (0.85 U_n)* for U_n = 400/208 V	340/177 V
Overvoltage $U >$ (1.1 U_n)* for U_n = 400/208 V	440/229 V
Preset function for 3(N)AC measurement:	
Undervoltage $U >$ (0.85 U_n)* for U_n = 230/120 V	196/102 V
Overvoltage $U >$ (1.1 U_n)* for U_n = 230/120 V	253/132 V
Asymmetry	5…30 % (30 %)*
Phase failure	by setting the asymmetry
Phase sequence	clockwise/anticlockwise rotation (off)*
Relative uncertainty, voltage at 50/60 Hz	±1.5 %, ±2 digits
Relative uncertainty voltage in the range 15…460 Hz	±3 %, ±2 digits
Hysteresis U	1…40 % (5 %)*
Underfrequency Hz <	10…500 Hz
Overfrequency Hz >	10…500 Hz
Resolution of setting f 10.0…99.9 Hz	0.1 Hz
Resolution of setting f 100…500 Hz	1 Hz
By preset function :	
Underfrequency for f_n = 400/60/50/16.7 Hz	399/59.5/49.5/16.2 Hz
Overfrequency for f_n = 400/60/50/16.7 Hz	401/60.5/50.5/17.2 Hz
Hysteresis frequency Hys Hz	0.2…2 Hz (0.2 Hz)*
Relative uncertainty, frequency in the range of 15…460 Hz	±0.2 %, ±1 digit

Time response

Start-up delay t	0…300 s (0 s)*
Response delay $t_{on1/2}$	0…300 s (0 s)*
Delay on release t_{off}	0…300 s (0.5 s)*
Operating time, voltage t_{ae}	≤ 140 ms
Operating time, frequency t_{ae}	≤ 335 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Discharging time energy backup on power failure	2.5 s
Charging time energy storage	60 s
Recovery time t_b	≤ 300 ms

Displays, memory

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0…500 V
Operating uncertainty, voltage at 50/60 Hz	±1.5 %, ±2 digits
Operating uncertainty voltage in the range of 15…460 Hz	±3 %, ±2 digits
Operating uncertainty, frequency in the range of 15…460 Hz	±0.2 %, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	Off/0…999 (OFF)*
Fault memory (M) alarm relay	on/off/con (on)*

Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation n.c. or N/O operation n.o.
	K2: Err, $U <$, $U >$, Asy, Hz <, Hz >, PHS (undervoltage $U <$, asymmetry Asy, N/C operation n.c.)*
	K1: Err, $U <$, $U >$, Asy, Hz <, Hz >, PHS (overvoltage $U >$, asymmetry Asy, N/O operation n.o.)*
Electrical endurance, number of cycles	10,000
Fault memory	on/off (on)*

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

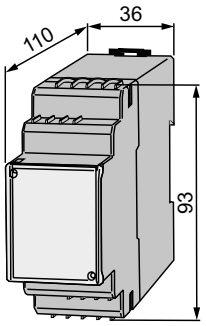
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

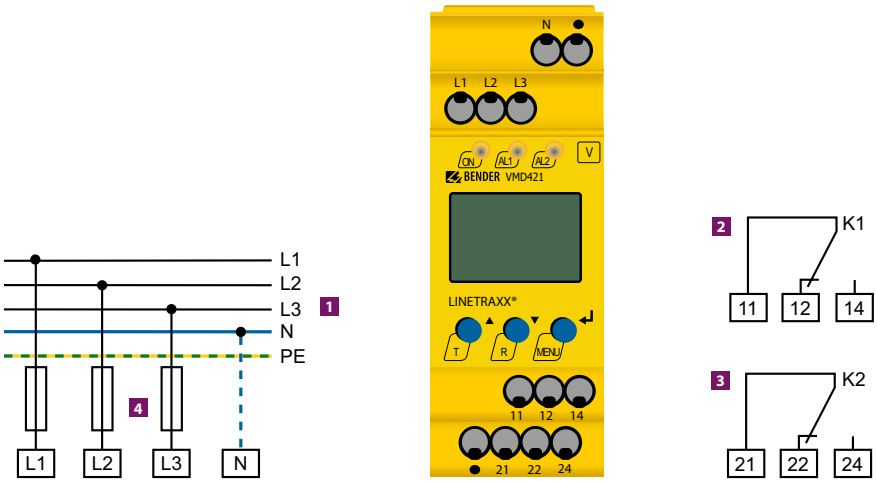
Operating mode	continuous operation
Mounting position	vertically, see dimension diagram
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP30
Enclosure material	polycarbonate
Screw mounting	2 x M4 with mounting clip
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00138
Weight	≤ 240 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	L1, L2, L3, (N)	Connection to the system/load to be monitored
2	11, 12, 14	Alarm relay "K1": Configurable for <U/>U/<f/>f/Asy/PHS/ERROR
3	21, 22, 24	Alarm relay "K2": Configurable for <U/>U/<f/>f/Asy/PHS/ERROR

4 Fuse as line protection.
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.



LINETRAXX® VMD423/VMD423H

Three-phase voltage and frequency monitoring relay for CHPs (Combined Heat and Power plants), wind power stations, hydroelectric power plants and photovoltaic systems in accordance with DIN V VDE V 0126-1-1



Typical applications

- Monitoring of automatic switching points between private electricity generation power system in parallel operation with the public low voltage grid
- Applications according to DIN V VDE V 0126-1-1 (VDE V 0126-1-1), C 10/11, EN 50438
- Universally applicable for photovoltaic systems, CHPs (Combined Heat and Power plants), wind power and hydro power plants

Approvals

Device features

- VMD423 with separate supply voltage
- VMD423H is supplied by the system being monitored
- Undervoltage, overvoltage and underfrequency and overfrequency monitoring in 3(N)AC systems AC 0…500 V
- Monitoring of overvoltage by average determination of the latest 10-minute measuring interval
- Asymmetry, phase failure and phase sequence monitoring
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement (AC+DC)
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device settings
- Sealable transparent cover
- Push-wire terminal (two terminals per connection)
- Two-module enclosure (36 mm)
- RoHS compliant

Certificates of non-objection

- DIN V VDE V 0126-1-1 (France, Switzerland)
- DIN V VDE V 0126-1-1 and EN 50438 (Czech Republic)
- C 10/11 (Belgium)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Response value	Type	Art. No.	
AC	DC	AC		Screw-type terminal	Push-wire terminal
16…72 V, 15…460 Hz	9,6…94 V	10…500 V	VMD423-D-1	B93010020	B73010020
70…300 V, 15…460 Hz	70…300 V	10…500 V	VMD423-D-2	B93010021	B73010021
U_n	U_n	70…500 V	VMD423H-D-3	B93010022	B73010022

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV/3
Overvoltage category	III
Protective separation (reinforced insulation) between	
(A1, A2) -(N, L1, L2, L3) -(11, 12, 14) -(21, 22, 24)	
Voltage test according to IEC 61010-1:	
VMD423 and VMD423H: (N, L1, L2, L3) -(A1, A2), (11, 12, 14)	3.32 kV
(N, L1, L2, L3) -(21, 22, 24)	2.21 kV
VMD423: (A1, A2) -(11, 12, 14) -(21, 22, 24)	2.21 kV

Supply voltage

VMD423-D-1:

Supply voltage U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	15…460 Hz

VMD423-D-2:

Supply voltage U_S	AC/DC 70…300 V
Frequency range U_S	15…460 Hz
Power consumption	≤ 4 VA

VMD423H-D-3:

Supply voltage U_S	U_n
Power consumption	≤ 6 VA

Measuring circuit

Measuring range (rms value) (L-N)	AC 0…288 V
Measuring range (rms value) (L-L)	AC 0…500 V
Rated frequency f_n	40…65 Hz
Frequency display range	25…100 Hz

Response values

VMD423-D-1/VMD423-D-2

Type of distribution system	3(N)AC/3AC (3(N)AC)*
Undervoltage U < (Alarm 2) (measurement method: 3Ph/3n)	AC 10…500/10…288 V (184)*
Overvoltage $U1$ > (Alarm 1) (measurement method: 3Ph/3n)	AC 10…500/10…288 V (264)*
Overvoltage $U2$ > (Alarm 1) (measurement method: 3Ph/3n)	AC 10…288 V (253)*
Overvoltage $U2$	10-minute average determination
Resolution of setting U	1 V

VMD423H-D-3

Type of distribution system	3(N)AC/3AC (3(N)AC)*
Undervoltage U < (Alarm 2) (measurement method: 3Ph/3n)	AC 70…500/70…288 V
Overvoltage U > (Alarm 1) (measurement method: 3Ph/3n)	AC 70…500/70…288 V
Resolution of setting U	1 V
Asymmetry	5…30 % (30 %)*
Phase failure	by setting the asymmetry
Phase sequence	clockwise R/anticlockwise L (R/on)*
Relative uncertainty, voltage at 50/60 Hz	±1.5 %, ±2 digits
Hysteresis U	1…40 % (5 %)*
Underfrequency Hz <	45…65 Hz (47.5 Hz)*
Overfrequency Hz >	45…65 Hz (50.2 Hz)*
Resolution of setting f	0.1 Hz
Hysteresis frequency Hys Hz	0.1…2 Hz (0.1 Hz)*
Relative uncertainty, frequency 40…65 Hz	±0.1 %, ±1 digit

Time response

Start-up delay t	0…300 s (30 s)*
Response delay $t_{on1/2}$	0…300 s (0.1)
Delay on release t_{off}	0…300 s (30 s)*
Resolution of setting t, t_{off}, $t_{on1/2}$ (0…10 s)	0.1 s
Resolution of setting t, t_{off}, $t_{on1/2}$ (10…99 s)	1 s
Resolution of setting t, t_{off}, $t_{on1/2}$ (10.0…300 s)	10 s
Operating time, voltage t_{ae}	≤ 80 ms
Operating time, frequency t_{ae}	≤ 80 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms
Discharging time energy backup on power failure for VMD423H	≥ 2.5 s
Charging time energy backup for VMD423H	≤ 60 s

Displays, memory

Display	LC display, multifunctional, not illuminated
Display range measured value	AC/DC 0…500 V
Operating uncertainty, voltage at 50/60 Hz	±1.5 %, ±2 digits
Operating uncertainty, frequency in the range of 40…65 Hz	±0.1 %, ±1 digit
History memory (HiS) for the first alarm value	data record measured values
Password	off/on/0…999 (on/126)*
Fault memory (M) alarm relay	on/off/con (OFF)*

Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle K1/K2	N/O operation n.o/N/C operation n.c
	K1: (undervoltage < U, overvoltage > $U1$, asymmetry Asy, underfrequency < Hz, overfrequency > Hz, alarm when starting SAL, N/C operation n.c.)*
	K2: (device error Err, undervoltage < U, overvoltage > $U1$, asymmetry Asy, underfrequency < Hz, overfrequency > Hz, phase sequence PHS , overvoltage > $U2$, alarm when starting SAL, N/C operation n.c.)*
Electrical endurance, number of cycles	10,000
Fault memory	on/off/con (off)*

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

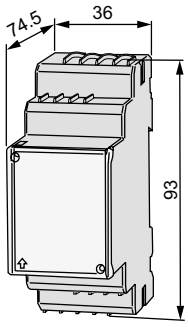
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP30
Enclosure material	polycarbonate
Screw mounting	2 x M4 with mounting clip
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00139 (VMD423)
	D00140 (VMD423H)
Weight	≤ 150 g (VMD423)
	≤ 240 g (VMD423H)

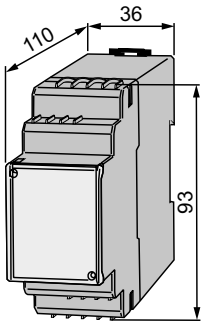
( )* = Factory setting

Dimension diagrams (dimensions in mm)

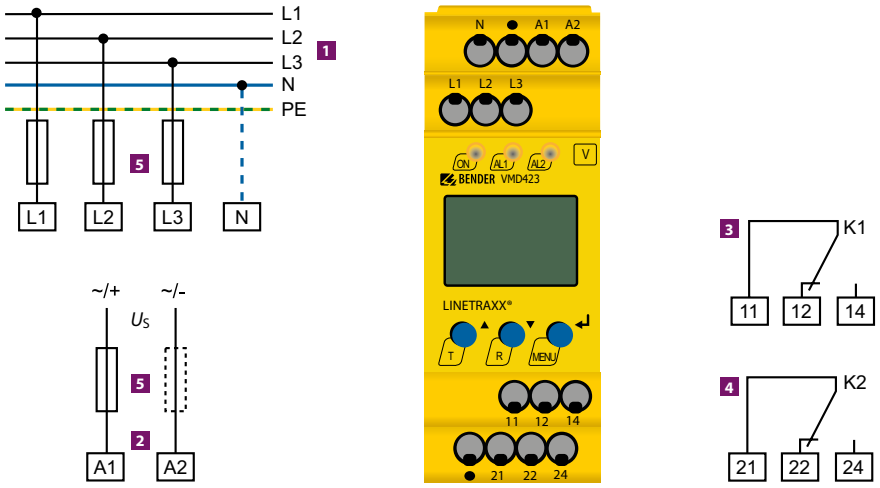
VMD423



VMD423H



Wiring diagram – VMD423



1 L1, L2, L3, (N) Connection to the system/load to be monitored

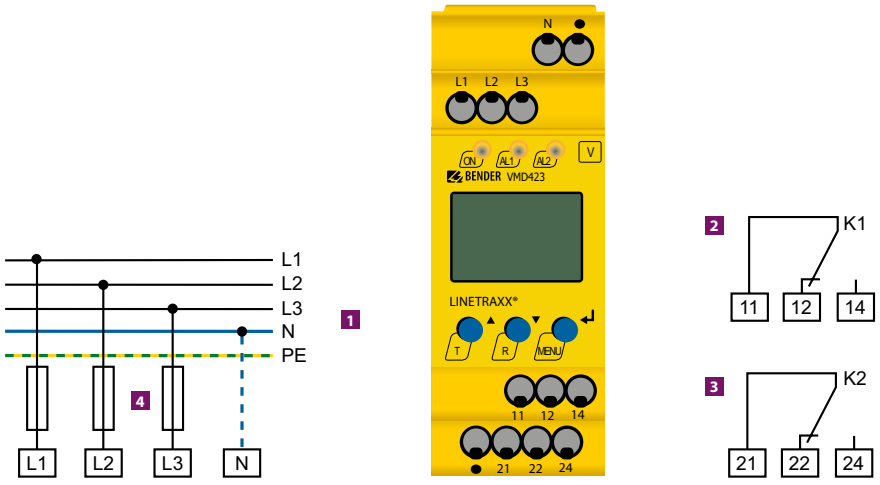
2 A1, A2 Supply voltage U_S (see ordering information)

3 11, 12, 14 Alarm relay "K1":
Configurable for *U*</*U*1>/*U*2>/*f*</*f*>/Asy/PHS/ERROR

4 21, 22, 24 Alarm relay "K2":
Configurable for *U*</*U*1>/*U*2>/*f*</*f*>/Asy/PHS/ERROR

5 Fuse as line protection.
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse

Wiring diagram – VMD423H



1 L1, L2, L3, (N) Connection to the system/load to be monitored

2 11, 12, 14 Alarm relay "K1":
Configurable for *U*</*U*1>/*U*2>/*f*</*f*>/Asy/PHS/ERROR

3 21, 22, 24 Alarm relay "K2":
Configurable for *U*</*U*1>/*U*2>/*f*</*f*>/Asy/PHS/ERROR

4 Fuse as line protection.
6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse

LINETRAXX® VMD460-NA

Network and system protection (NS protection) for monitoring the power feed-in of power generation systems



Typical applications

- Central NS protection (VDE-AR-N 4105)
- Protective disconnection (VDE-AR-N 4110, BDEW)
- Interface Protection (IP) (Engineering Recommendations; EREC G99, G59, G83, G59)
- Protezione di interfaccia (CEI 0-21)
- Automatic disconnection device between a generating plant parallel to the network and the public network
- Universal for generating plants for safe network decoupling

Approvals

Device features

- Straightforward commissioning due to pre-set basic programs for national standards and regulations
- Single-fault tolerance
- Monitoring of the connected coupling switch (configurable: NC/NO/off)
- Islanding detection df/dt (ROCOF)
- Vector shift
- Interface RS-485 (data exchange, parameter setting, software update)
- Test function for the determination of the disconnection time
- Test button for the trigger circuit
- The last 300 distribution network faults can be recalled with time stamp/real-time clock
- Continuous monitoring of the phase and line-to-line voltage
- Separate switching conditions after a threshold infringement
- Language selection (German, English, Italian)
- Backlit graphics LC display
- Remote shutdown via ripple control signal receiver
- Password protection for device setting
- Sealable enclosure

Certificates of non-objection/certificate of conformity

- VDE-AR-N 4105
- VDE-AR-N 4110
- BDEW technical guideline
- G99/1
- G59/2
- G59/3
- G98/1
- G83/2
- CEI 0-21
- C10/11
- DIN V VDE V 0126-1-1

Standards

- UL 508
- CSA (22.2 No. 14-13)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S	Type	Art. No.
AC		
100…240 V	VMD460-NA-D-2	B93010045

Device version with push-wire terminal on request.

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated voltage	400 V
Rated impulse voltage/pollution degree	6 kV/2
Overvoltage category	III
Protective separation (reinforced insulation) between	
	(A1, A2) - (L1, L2, L3, N) - (11, 12, 14, 21, 22, 24)
	(D1, D2, D3, D4, DG1/2, DG3/4, RTG, RT1)-(A1, A2, L1, L2, L3, N)
Voltage test according to IEC 61010-1:	
(N, L1, L2, L3) - (A1, A2), (11, 12, 14, 21, 22, 24)	3.32 kV

Supply voltage

Nominal supply voltage U_S	AC/DC 100…240 V
	DC/50/60 Hz
Operating range U_S	AC/DC 75…300 V
	DC/40…70 Hz
Power consumption at AC 230 V	< 7.5 VA/< 3.5 W
maximum	9 VA/3.5 W

Measuring circuit

Nominal system voltage U_n (rms value) (L-N)	AC 0…300 V
Nominal system voltage U_n (rms value) (L-L)	AC 0…520 V
Rated frequency f_n (U_n > 20 V)	45…65 Hz

Response values

System type	1AC: 230 V, 50 Hz
	3(N)AC: 400/230 V, 50 Hz
Relative uncertainty, voltage	$U \leq 280$ V: ≤ ±1 %
	$U > 280$ V: ±3 %
Resolution of setting, voltage	1 %
Nominal frequency	50/60 Hz
Relative uncertainty, frequency	≤ ±0.1 %
Resolution of setting *f*	0.05 Hz

Recording of measurement values, condition for connection

L-N, L-L	0…1.5 U_n
f< , *f*<<	45…60 Hz
f> , *f*>>	50…65 Hz

Recording of measurement value, condition for disconnection

L-N, L-L	0…1.5 U_n
f< , *f*<<	45…60 Hz
f> , *f*>>	50…65 Hz
df/dt	0.05…9.9 Hz/s
Vector shift	1…25 %
Unbalance	1…50 %
(Neutral-Voltage-Displacement 59 (N))	

Time response

Delay time for connection t_{on}	40 ms…60 min
Resolution of setting t_{on}	< 50 ms: 5 ms
	50 …200 ms: 10 ms
	200 ms …5 s: 50 ms
	5 …10 s 0.1 s
	10 s…60 s: 1 s
	60 …300 s: 10 s
	300 s…60 min: 1 min
Operating time voltage t_{ae}	half a supply period
Operating time, frequency t_{ae}	≤ 40 ms
Recovery time t_b	300 ms

Digital inputs

Monitoring of potential-free contacts or voltage inputs:	
	closed = low; 0…4 V; I_{in} < -5 mA
	open = high; > 6…≤ 30 V
D1	feedback signal contact K1
D2	feedback signal contact K2
D3	local control (mode)
D4	external signal (mode)
RT1	remote trip
DG1/2, DG3/4, RTG	GND
Max. length of the connecting cables of digital inputs	3 m

Displays, memory

Display	LC display, multi-functional, illuminated
Display range, measured value	AC/DC 0…520 V
Operating uncertainty, voltage	$U \leq 280$ V: ≤ ±1 %
	$U > 280$ V: ±3 %
Operating uncertainty, frequency	≤ ±0.1 %
History memory for the last 300 messages	1 data record of measured values each
Password	off/on/0…999 (off)*

Switching elements

Number of changeover contacts	2 x 1 (K1, K2)
Operating mode	N/C operation / N/O operation
Electrical endurance in rated operating conditions	10 000 cycles

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	DIN EN 60255-26/CEI 0-21
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

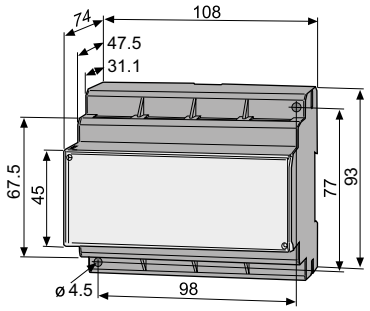
Connection type	screw-type terminals or push-wire terminals
Connection properties:	
rigid	0.2…4 mm² (AWG 24…12)
flexible	0.2…2.5 mm² (AWG 24…14)
Stripping length	8…9 mm
Tightening torque	0.5…0.6 Nm

Other

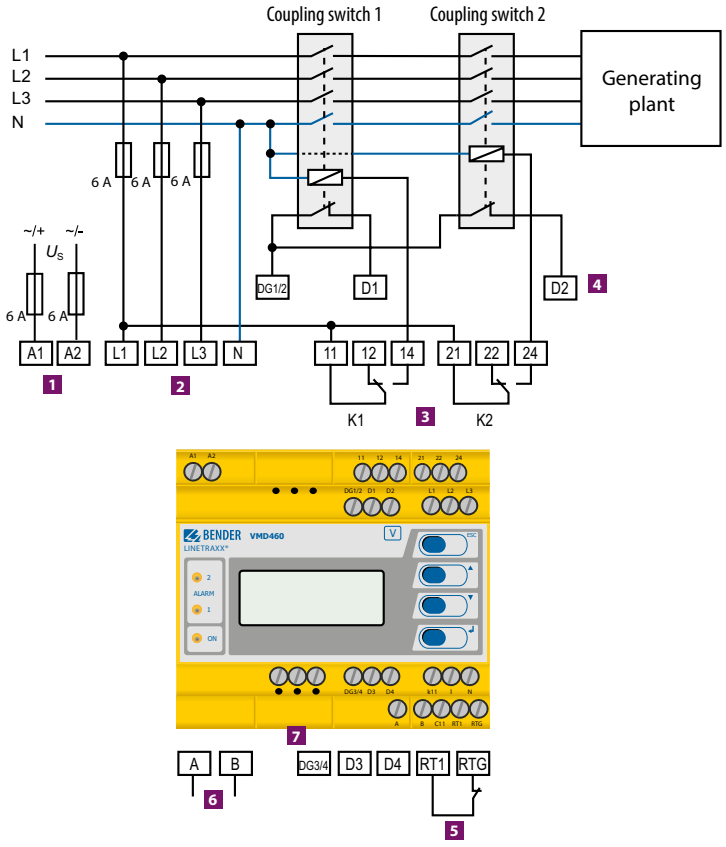
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00001
Weight	≤ 360 g

( )* = Factory setting

Dimension diagrams (dimensions in mm)

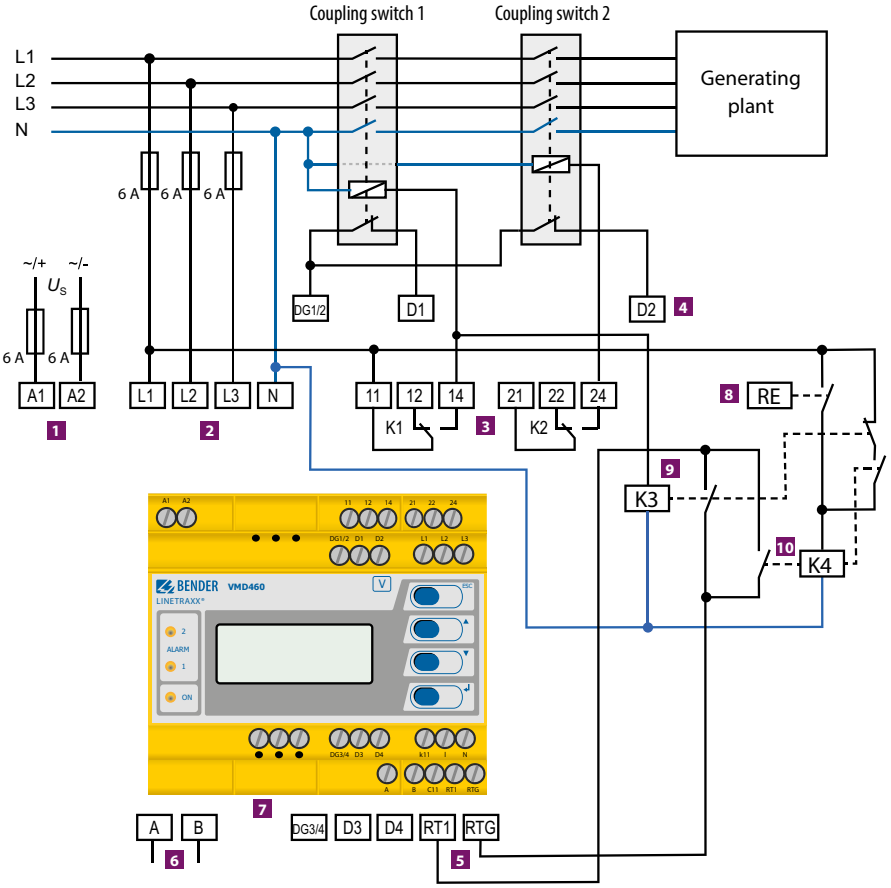


Wiring diagram VMD460 (VDE-AR-N-4105)



1	A1, A2	Supply voltage U_S (see ordering details)
2	L1, L2, L3, N	Power supply connection
3	K1, K2	Relay connections
4	DG1/2, D1, D2	Contact monitoring, coupling switch DG1/2: GND D1: Feedback signal contact K1 D2: Feedback signal contact K2 *(feedback signal contacts optionally NC/NO/off)**
5	RTG, RT1	RTG: GND RT1: Remote trip input *(optionally NC/NO/off)**
6	A, B	Service interface
7	$R_{on/off}$	Activate or deactivate the terminating resistor of the BMS bus (120 Ω)

* **NO** (in non-operating state open)
NC (in non-operating state closed)
off (contact monitoring switched off)



Within the scope of VDE-AR-N 4110, the VMD460-NA can be used as protective disconnection device for the generating unit or as higher-level protective disconnection, the latter, however, only if the Q-U protection function may be dispensed with. According to VDE-AR-N 4110 chapter 10.3.3.4 par. 5, this is possible after consultation with the network operator and under the following conditions:

- Generating plants with limited dynamic network support or
- Generating plants < 1 MVA

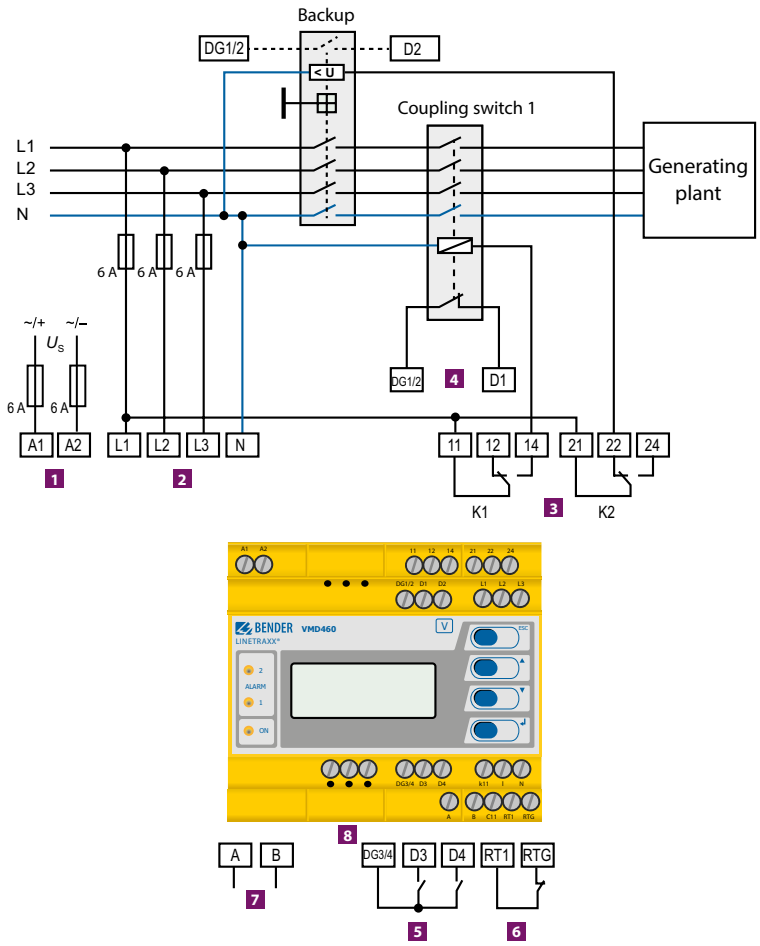
Both types of application are possible when the generating plant is connected to the busbar of a substation (MV-busbar) or when the generating plant is connected to the medium-voltage network (MV-network).

1	A1, A2	Supply voltage U_S (see ordering details)	
2	L1, L2, L3, N	Power supply connection	
3	K1, K2	Relay connections	
4	DG1/2, D1, D2	Contact monitoring coupling switchDG1/2: GND D1: Feedback signal contact K1 D2: Feedback signal contact K2 *(feedback signal contacts optionally NC/NO/off)**	
5	RTG, RT1	RTG: GND RT1: remote trip input *(optionally NC/NO/off)**	
6	A, B	Service interface	
7	$R_{on/off}$	Activate or deactivate the terminating resistor of the service interface (120 Ω)	
8	RE	Ripple-control receiver	
9	K3	External relay with an N/C contact and an N/O contact	
10	K4	External relay with two N/O contacts	
	DG3/4, D3, D4	Not used for the standard mentioned before	

* **NO** (in non-operating state open)

NC (in non-operating state closed)

off (contact monitoring switched off)



1	A1, A2	Supply voltage U_S (see ordering details)
2	L1, L2, L3, N	Power supply connection
3	K1, K2	Relay connections
4	DG1/2, D1, D2	Contact monitoring, coupling switch DG1/2: GND D1: Feedback signal contact K1 D2: Feedback signal contact K2 *(feedback signal contacts optionally NC/NO/off)**
5	DG3/4, D3, D4	Digital inputs (external monitoring) DG3/4: GND D3: local control (CEI 0-21 8.6.2.1.1)** D4: external signal (CEI 0-21 8.6.2.1.2)** *(optionally NC/NO/off)**
6	RTG, RT1	RTG: GND RT1: Remote trip input *(optionally NC/NO/off)**
7	A, B	Service interface
8	$R_{on/off}$	Activate or deactivate the terminating resistor of the BMS bus (120 Ω)

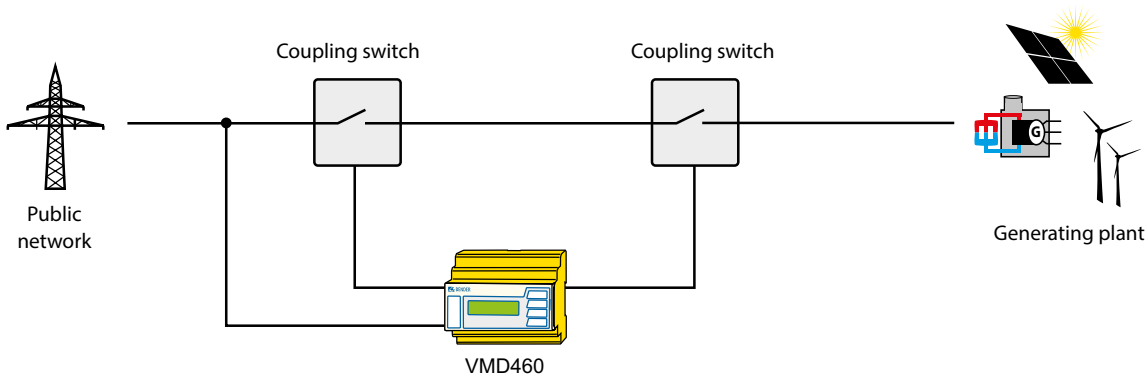
* **NO** (in non-operating state open)

NC (in non-operating state closed)

off (contact monitoring switched off)

** In order to evaluate the inputs D3 and D4, the mode can be adjusted correspondingly in the menu (menu: 3. Settings --> 1. General --> 4. Mode)

Intended use



Principle of a plant according to CEI 0-21; VDE-AR-N 4105 (ab 30 kW), C10/11, BDEW technical guideline, DIN V VDE V 0126-1-1/A1, G59/2, G59/3, G83/2



LINETRAXX® VMD461 with CD440 coupling device

Multifunctional voltage relay for AC, DC, 3(N)AC systems



Typical applications

- Monitoring of voltage-sensitive machines and installations
- Switching installations on and off at a certain voltage level
- Protection of three-phase motors against phase failure and phase open-circuit
- Vector shift detection for protection of electrical machines
- Islanding detection ROCOF (rate of change of frequency)
- Transformer protection by recognising asymmetrical load

Approvals

CE

Device features

- When combined with a CD440 coupling device, DC systems up to 1200 V, 1AC systems up to 690 V, 3AC systems up to 1200 V and 3NAC systems up to 690 V can be monitored
- All functions are represented in ANSI codes
- Monitoring of DC, 1AC, 3(N)AC systems DIN EN 60255-1:2010-9
- Single-fault safety
- Unbalance, phase failure and phase sequence monitoring
- Monitoring of the connected switches and/or disconnectors (configurable: NC/NO/off)
- Islanding detection df/dt (ROCOF)
- Vector shift function
- RS-485 interface (data exchange/parameter setting/software update)
- Test function to determine the switch-off time
- Test button for the trigger circuit
- The last 300 network faults can be recalled with time stamp/real-time clock
- Continuous monitoring of the phase voltage and line-to-line voltage
- Special switch-on conditions after an infringement of a response value
- Language selection (German, English, French)
- Backlit graphic LC display
- Password protection for device setting
- Remote shutdown via ripple control signal receiver
- Sealable enclosure

Standards

The device fulfils the requirements of the following standards:

- DIN EN 60255-127 (IEC 60255-127)
- VDE 0435-3127
- UL File: E173157

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Description	Supply voltage U_S	Type	Art. No.
	AC/DC		
Multifunctional voltage relay	100…240 V	VMD461-D-2	B93010047
Coupling device	–	CD440	B73010046

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

Suitable system components

Description	Device variants / Supply voltage U_S	Type	Art. No.	Page
Condition Monitor	with an integrated gateway: Bender system/Ethernet	COM465IP	B950610…	384
	for the connection of Bender BMS devices and universal measuring devices to TCP/IP systems	CP700	B95061030	396
RS-485 repeater	DC 10…30 V	DI-1	B95012015	–
	AC/DC 24 V ± 20 %	DI-1PSM	B95012044	–
Power supply unit for DI-1	AC 230 V, 50…60 Hz / AC/DC 20 V	AN471	B924189	–

Insulation coordination of the device combination VMD461/CD440:	
Rated voltage ≤ 1000 V	acc. to IEC 60664-1/IEC 60664-3
Rated voltage > 1000 V	acc. to EN 50178:1998
Definitions	
Measuring circuit (IC1)	CD440 (L1, L2/DC+, L3, N/DC–)
Measuring circuit (IC2)	VMD461 (L1, L2/DC+, L3, N/DC–)
Supply circuit (IC3)	VMD461 (A1, A2)
Control circuit (IC4)	VMD461 (D1, D2, DG1/2, RTG, RT1)
Output circuit 1 (IC5)	VMD461 (11, 12, 14)
Output circuit 2 (IC6)	VMD461 (21, 22, 24)
Output circuit 3 (IC7)	VMD461 (A, B)
Rated voltage	
IC1	DC, 3AC: 1200 V 1AC, 3NAC: 690 V
IC2	400 V
IC3	250 V
IC5, IC6	250 V
Rated impulse voltage	
Overvoltage category	III
Max. altitude	2000 m
IC1/(IC2…6)	10.5 kV
IC2/(IC3…6)	4 kV
IC3/(IC4…6)	4 kV
IC4/(IC5…6)	4 kV
IC5/IC6	4 kV
Rated insulation voltage	
Pollution degree	3
IC1/(IC2…6)	DC, 3AC: 1250 V 1AC, 3NAC: 800 V
IC2/(IC3…6)	400 V
IC3/(IC4…6)	400 V
IC4/(IC5…6)	400 V
IC5/IC6	4 kV
Protective separation (reinforced insulation):	
IC1/(IC3…6)	DC, 3AC: Overvoltage category III, 1250 V 1AC, 3NAC: Overvoltage category III, 1000 V
IC2/(IC3…6)	300 V
IC3/(IC4…6)	300 V
IC4/(IC5…6)	300 V
IC5/IC6	300 V
Voltage test (routine test) acc. to IEC 60255-27/DIN EN 50178:1998	
IC2/(IC3…6)	2.21 kV
IC3/(IC4…6)	2.21 kV
IC4/(IC5…6)	2.21 kV
IC5/IC6	2.21 kV

Supply voltage	
Nominal supply voltage U_s	100…240 V
Tolerance U_s	±25 %
Nominal frequency range U_s	DC, 50/60 Hz
Power consumption at AC 230 V	< 3.5 W/ < 7.5 VA
maximum	3.5 W/9 VA

Measuring circuit	
VMD461	
System type	DC, 1AC, 3AC, 3NAC
Nominal voltage U_n	
L-N)	AC 50…260 V
(L-L)	AC 87…450 V
(DC+/DC–)	DC 50…450 V
Measuring range	0…1.15 x U_n
Overload capacity	1.5 x U_n max for 5 s
Response values	1…150 %
Operating uncertainty U_n	≤ ±1 %
Resolution of setting U_n	1 %
Rated frequency	DC, 50/60 Hz
Frequency range U_n	DC, 45…65 Hz
Resolution of setting f	0.05 Hz
Relative uncertainty f	≤ ±0.1 %

VMD461 with CD440	
System type	DC, 1AC, 3AC, 3NAC
Nominal voltage U_n	
(L-N)	AC 250…690 V
(L-L)	AC 440…1200 V
(DC+/DC–)	DC 250…1200 V
Nominal voltage U_n for Canada	
(L-N)	AC 250…600 V
(L-L)	AC 440…600 V
(DC+/DC–)	DC 250…600 V
Measuring range	0…1.15 x U_n
Overload capacity	1.5 x U_n max for 5 s
Response values	1…150 %
Operating uncertainty U_n	≤ ±2 %
Resolution of setting U_n	1 %
Rated frequency	DC, 50/60 Hz
Frequency range U_n	DC, 45…65 Hz
Resolution of setting f	0.05 Hz
Relative uncertainty f	≤ ±0.1 %

Recording of measurement values, switch-on condition	
$U<$, $U<<$, $U<<<$	1…100 %
$U>$, $U>>$, $U>>>$	100…150 %
$f<$, $f<<$, $f<<<$	45…60 Hz
$f>$, $f>>$, $f>>>$	50…65 Hz
Phase sequence/Polarity	right, left

Recording of measurement value, switch-off condition	
$U<$, $U<<$, $U<<<$	1…100 %
$U>$, $U>>$, $U>>>$	100…150 %
$f<$, $f<<$, $f<<<$	45…60 Hz
$f>$, $f>>$, $f>>>$	50…65 Hz
df/dt	0.05…9.95 Hz/s
Vector shift	1…25 %
Unbalance	1…50 %

Time response	
Start-up delay $t_{start-up}$	200 ms…60 min (200 ms)*
Switch-on delay t_{on}	off, 50 ms…60 min (100 ms)*
Response delay t_{off}	off, 50 ms…60 min (100 ms)*
Operating time voltage t_{ae}	half a supply period
Operating time, frequency t_{ae}	≤ 40 ms
Recovery time t_b	300 ms

Digital inputs	
Monitoring of potential-free contacts or voltage inputs:	closed = low; 0…4 V; Iin < –5 mA open = high; > 6…≤ 30 V
D1	Feedback signal contact of alarm relay K1
D2	Feedback signal contact of alarm relay K2
RT1	remote trip
DG1/2, RTG	GND
max. length of the connecting cables of the digital inputs (shielded cable recommended)	10 m
Cable length for external test/reset button	0…10 m

Displays, memory	
Display	LC display, multi-functional, illuminated
Display range, measured value	0…9.99 kV
History memory for the last 300 messages	per 1 data record measured values
Password	on/off/0…999 (off*)

Interface	
Interface/protocol	RS-485/BMS
Baud rate	9.6 kBit/s
Cable length	0…1200 m
Recommended cable (shielded, shield connected to PE on one side)	min. J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 Ω (0.25 W) connectable via DIP switch
Device address, BMS bus	1…90 (2)*

Switching elements

Number of changeover contacts	2 x 1 (K1, K2)
Operating principle K1, K2	N/C operation or N/O operation (N/C)*
Electrical endurance under rated operating conditions, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC 13	AC 14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	DIN EN 60255-26
Operating temperature	–25…+55 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection VMD461

Connection	screw-type terminals
Connection properties:	
Rigid	0.2…4 mm² (AWG 24…12)
Flexible with ferrule	0.2…2.5 mm² (AWG 24…14)
Stripping length	8…9 mm
Tightening torque	0.5…0.6 Nm (5…7 lb-in)

Connection CD440

Connection	push-wire terminals
Rigid	0.2…2.5 mm² (AWG 24…14)
Flexible without ferrule	0.75…2.5 mm² (AWG 19…14)
Flexible with ferrule	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

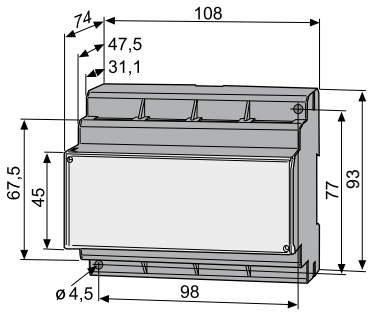
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting CD440	2 x M4 with mounting clip
Screw mounting VMD461	2 x M4
Software version, measurement technology	D570 V1.2x
Software version, display	D256 V2.3x
Weight	
VMD461	≤ 360 g
CD440	≤ 125 g

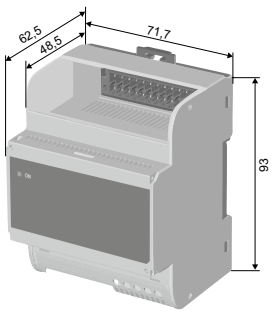
( )* Factory setting

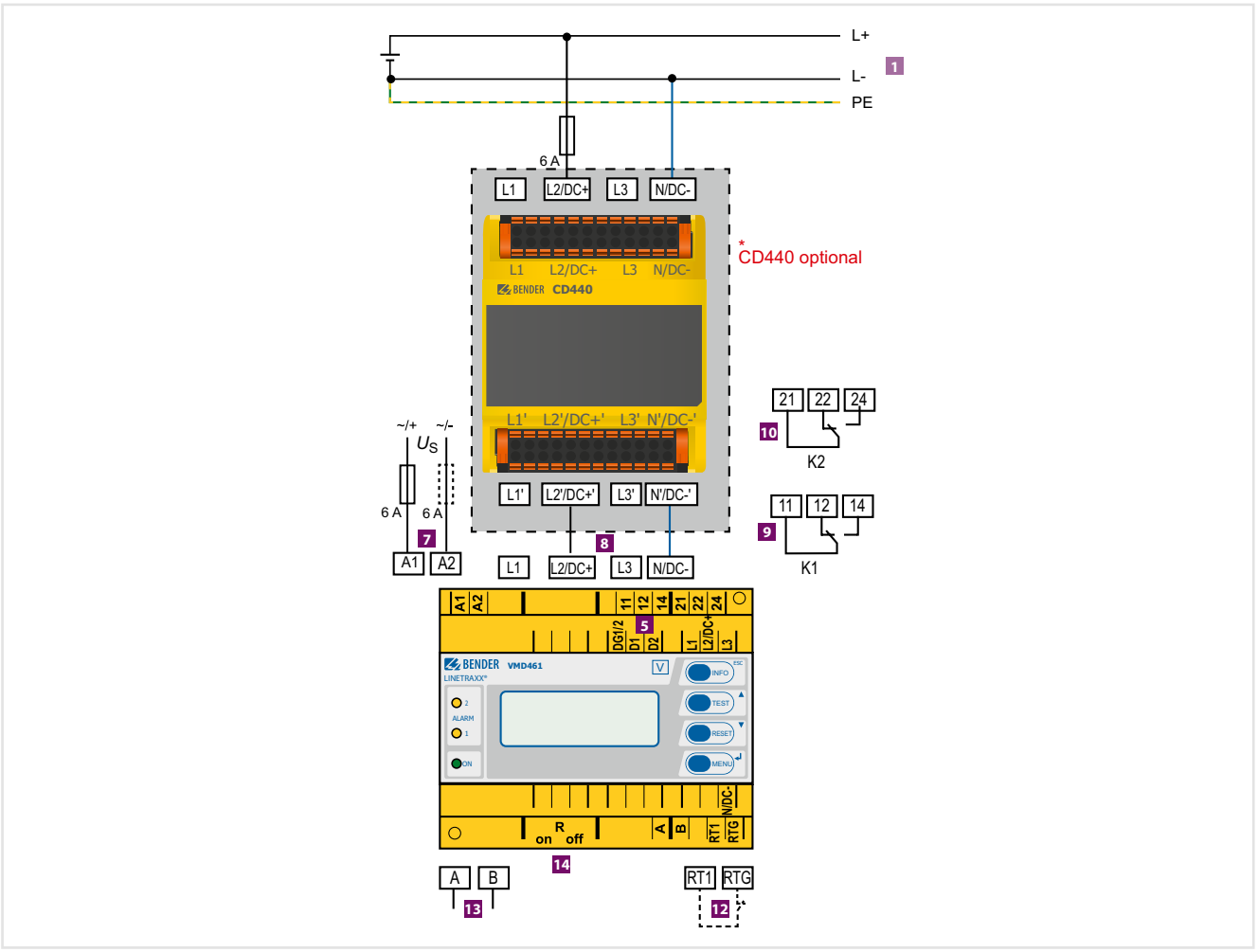
Dimension diagram (dimensions in mm)

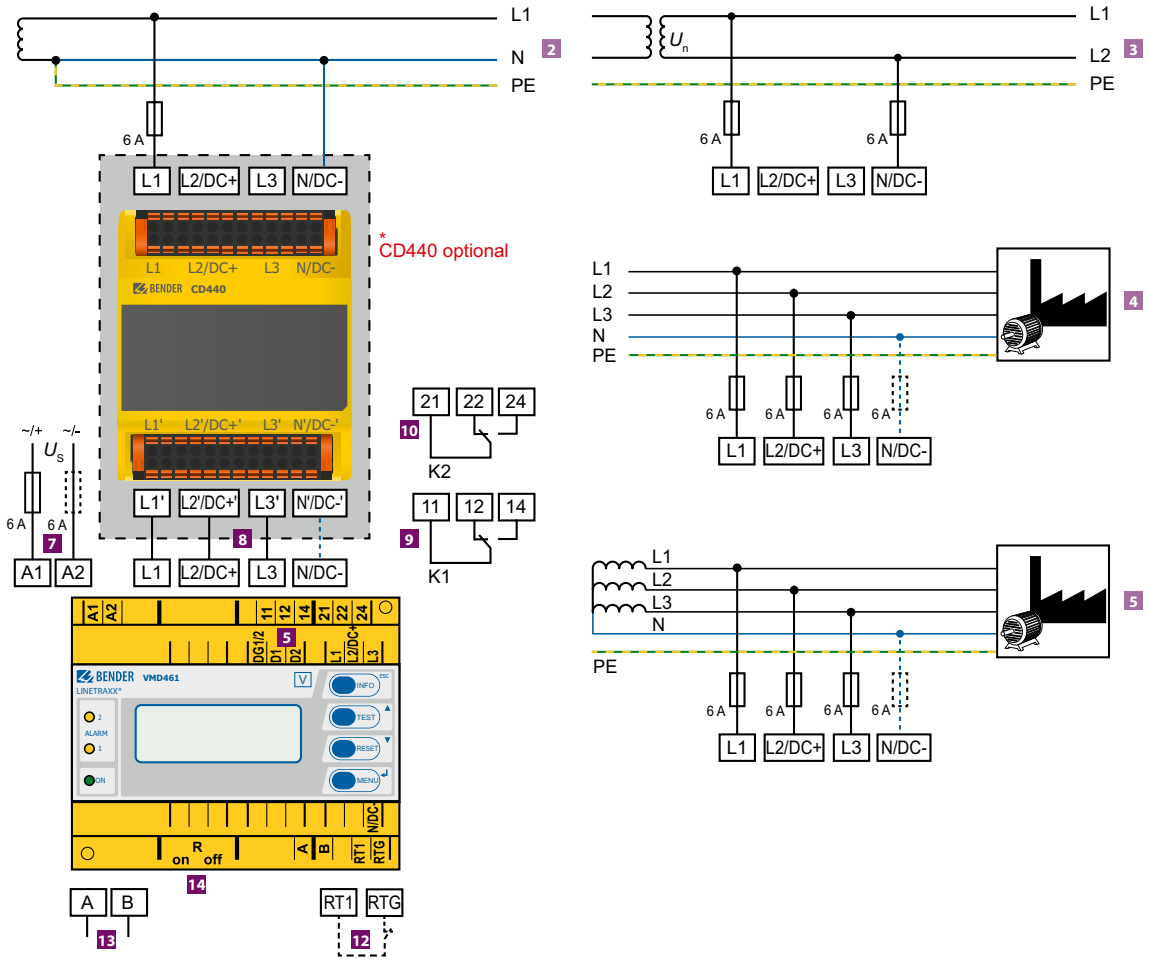
VMD461

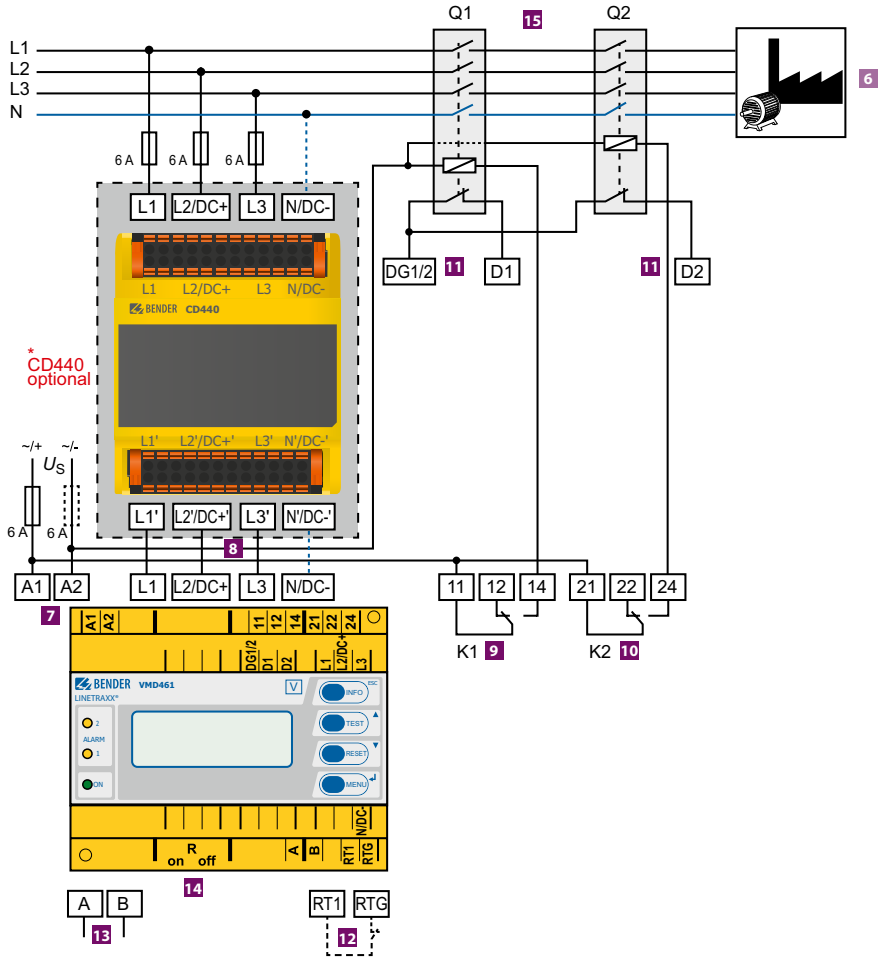


CD440




L+
L-
PE
1
6 A
L1
L2/DC+
L3
N/DC-
*CD440 optional
BENDER CD440
L1'
L2'/DC+'
L3'
N'/DC-'
~/+
~/-
U_S
6 A
6 A
7
A1
A2
8
21
22
24
10
K2
11
12
14
9
K1
5
BENDER VMD461
LINETRAXX®
INFO
TEST
RESET
MENU
ALARM
ON
R
on
off
A
B
RT1
RTG
14
13
12


L1
N
PE
2
6 A
L1
L2/DC+
L3
N/DC-
*CD440 optional
BENDER CD440
L1'
L2'/DC+'
L3'
N'/DC-'
~/+
~/-
U_S
6 A
6 A
7
A1
A2
8
21
22
24
10
K2
11
12
14
9
K1
5
BENDER VMD461
LINETRAXX®
INFO
TEST
RESET
MENU
ALARM
ON
R
on
off
A
B
RT1
RTG
14
13
12
U_n
L1
L2
PE
3
4
5

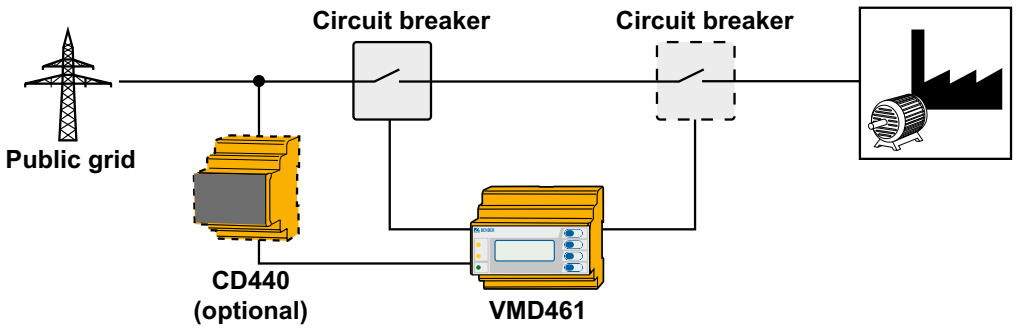


1 Connection DC: VMD461 with CD440
2 Connection AC: VMD461 with CD440 (earthed system)
3 Connection AC: VMD461 with CD440 (unearthed system)
4 Connection 3(N)AC: VMD461 with CD440 (earthed system)
5 Connection 3(N)AC: VMD461 with CD440 (unearthed system)
6 Possible wiring diagram with 2 circuit breakers

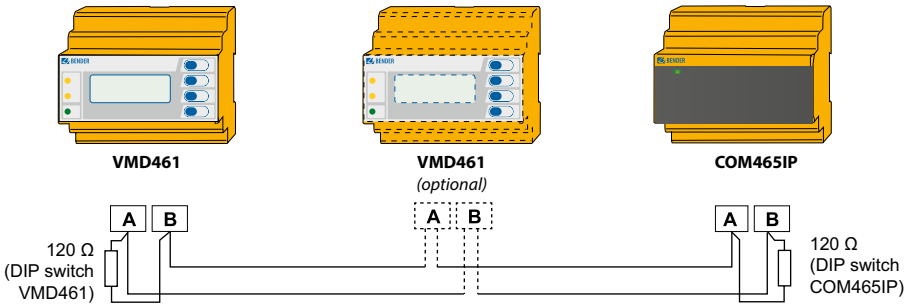
7 A1, A2 — Supply voltage U_S (see ordering details)
8 L1, L2/DC+, L3, N/DC- — Power supply connection
9 11, 12, 14 — Connection to alarm relay K1
10 21, 22, 24 — Connection to alarm relay K2
11 DG1/2, D1, D2 — Contact monitoring
DG1/2: GND
D1: Feedback signal contact to alarm relay K1
D2: Feedback signal contact to alarm relay K2
*(feedback signal contacts optionally NC/NO/off)**
12 RTG, RTG: GND
RT1: Remote-trip input *(optionally NC/NO/off)**
13 A, B — Connection to communication interface BMS bus
14 $R_{on/off}$ — Activate or deactivate the terminating resistor of the BMS bus (120 Ω)
15 Q1, Q2 — Circuit breakers

* **NO** (closed in non-operating state)
NC (open in non-operating state)
aus (switched off)

Schematic diagram with circuit breakers



Example for a system design



LINETRAXX® CME420

Multi-functional current relay, AC, overcurrent/undercurrent/window discriminator function



Typical applications

- Current consumption of motors, such as pumps, elevators, cranes
- Monitoring of lighting circuits, heating circuits, charging stations
- Monitoring of emergency lighting
- Monitoring of screw conveyors, e.g. in sewage plants
- Dust removal in wood working

Approvals

Device features

- Undercurrent and overcurrent monitoring in AC systems 0.1…16 A without measuring current transformer
- Indirect current monitoring with standard current transformers x/1 A, x/5 A, x/10 A
- Transformation ratio n allows adaptation to all standard current transformers x/1 A, x/5 A, x/10 A
- Different monitoring functions selectable < *I*, > *I* or < *I*/> *I*
- Start-up delay, response delay, delay on release
- Adjustable switching hysteresis
- r.m.s. value measurement (AC)
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays (one changeover contact each)
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 42…460 Hz	9.6…94 V	CME420-D-1	B93060001	B73060001
70…300 V, 42…460 Hz	70…300 V	CME420-D-2	B93060002	B73060002

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	250 V
Rated impulse voltage/overvoltage category	4 kV/III
pollution degree	3
Protective separation (reinforced insulation) between	(A1, A2) -(k, l) -(11, 12, 14) -(21, 22, 24)
Maximum nominal voltage of the system being monitored when the conductor being monitored is directly connected:	
With protective separation	AC 230 V
Without protective separation	AC 400 V

Supply voltage

CME420-D-1:

Supply voltage U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	42…460 Hz

CME420-D-2:

Supply voltage U_S	AC/DC 70…300 V
Frequency range U_S	42…460 Hz
Power consumption	≤ 4 VA

Measuring circuit

Measuring range (r.m.s. value, screw-type terminal)	AC 0.05…16 A
Measuring range (r.m.s. value, push-wire terminal)	AC 0.05…12 A
Overload capability < 1 s	40 A
Rated frequency f_n	42…2000 Hz

Response values

Undercurrent

Undercurrent *I*< (alarm I_2), direct connection:	
Push-wire terminal	AC 0.1…12 A (1 A)*
Screw-type terminal or external current transformer	AC 0.1…16 A (1 A)*
Undercurrent *I*< (prewarning I_1)	100…200 % (150 %)*

Overcurrent

Overcurrent *I*> (alarm I_2), direct connection:	
Push-wire terminal	AC 0.1…12 A (1 A)*
Screw-type terminal or external current transformer	AC 0.1…16 A (1 A)*
Overcurrent *I*> (prewarning I_1)	10…100 % (50 %)*

Others

External current transformer	x/1 A, x/5 A, x/10 A
Transformation ratio factor n	1…2000 (1)*
Relative percentage error at 50/60 Hz	±3 %, ±2 digits
Relative percentage error in the range of 42…2000 Hz	±5 %, ±2 digits
Hysteresis	10…40 % (15 %)*

Specified time

Starting delay	0…300 s (0.5 s)*
Response delay t_{on1}	0…300 s (1 s)*
Response delay t_{on2}	0…300 s (0 s)*
Delay on release t_{off}	0…300 s (1 s)*
Operating time t_{ae}	≤ 70 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms

Displays, memory

Display	LC display, multi-functional, not illuminated
Measuring range measured value x transformation ratio factor	AC 0.01…16 A x n
Operating error at 50/60 Hz	±3 %, ±2 digits
Operating error in the range of 42…2000 Hz	±5 %, ±2 digits
Measured-value memory (HiS) for the first alarm value	data record measured values
Password	Off/0…999 (Off)*
Fault memory (M) alarm relay	on/off (on)*

Switching elements

Number	2 relays, with one changeover contact each (K1, K2)
Operating principle	N/C operation n.c./N/O operation n.o. (N/C operation n.c.)*
Electrical service life under rated operating conditions	10,000 switching operations

Contact data acc. to IEC 60947-5-1

Utilization category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact load	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transportation (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transportation (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

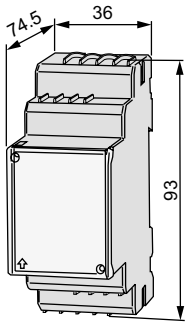
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

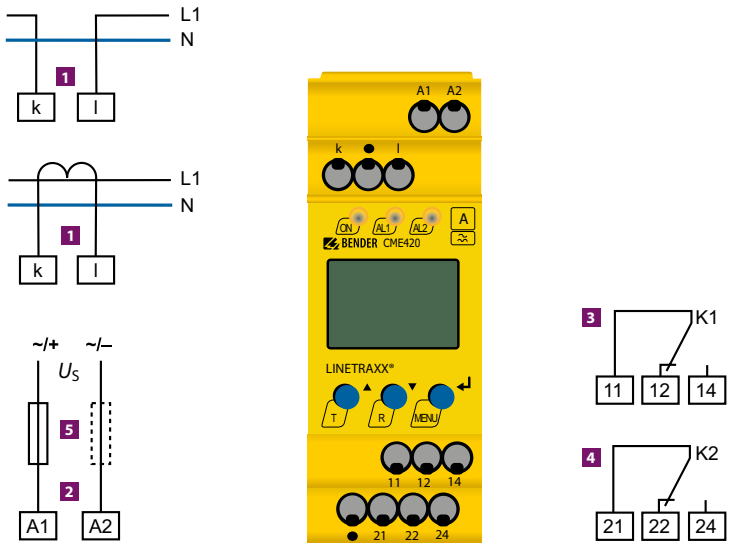
Operating mode	continuous operation
Position	any position
Degree of protection DIN EN 60529, internal components	IP30
Degree of protection DIN EN 60529, terminals	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00034
Weight	≤ 160 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	k, l	Connection to the system/load being monitored
2	A1, A2	Supply voltage U_S (see ordering information)
3	11, 12, 14	Alarm relay "K1": configurable for *I*<, *I*> or *I*<//>/ERROR/TEST
4	21, 22, 24	Alarm relay "K2": configurable for *I*< , *I*> or *I*<//>/ERROR/TEST
5		Line protection according to IEC 60364-4-43: 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

LINETRAXX® CMD420/CMD421

Current monitoring relays for monitoring 3AC currents for overcurrent and undercurrent using measuring current transformers or current monitoring with window discriminator function



Typical applications

- Current consumption of motors, such as pumps, elevators, cranes
- Monitoring of lighting circuits, heating circuits, charging stations
- Monitoring of emergency lighting
- Monitoring of screw conveyors, e.g. in sewage plants
- Dust removal in wood working

Approvals

Device features

- Undercurrent and overcurrent monitoring in AC systems with prealarm and main alarm or current monitoring with window discriminator function
- Current monitoring using current transformers, suitable for standard transformers x/1 A, x/5 A (depending on the device type)
- Transformation ratio n allows adaptation to all standard current transformers x/1 A, x/5 A
- Start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- rms value measurement AC
- Digital measured value display via multi-functional LC display
- LEDs: Power On, Alarm 1, Alarm 2
- Fault memory for the operating value
- Cyclical self monitoring
- Internal test/reset button
- Two separate alarm relays with one changeover contact each
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Suitable for current transformer types	Response value	Supply voltage [1] U_S			Type	Art. No.	
		AC	DC	AC/DC		Screw-type terminal	Push-wire terminal
x/1A	0.1…1 A x n	16…72 V, 15…460 Hz	9.6 V…94 V		CMD420-D-1	B93060006	B73060006
		–	–	70…300 V, 15…460 Hz	CMD420-D-2	B93060007	B73060007
x/5A	0.5…5 A x n	16…72 V, 15…460 Hz	9.6 V…94 V		CMD421-D-1	B93060008	B73060008
		–	–	70…300 V, 15…460 Hz	CMD421-D-2	B93060009	B73060009

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	6 kV/3
Protective separation (reinforced insulation) between	(A1, A2) -(k, l) -(11, 12, 14) -(21, 22, 24)
Protective separation (reinforced insulation) between	(k1, l1, k2, l2, k3, l3) -(11, 12, 14)
Voltage test acc. to IEC 61010-1	3.536 kV
Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	4 kV/3
Basic insulation between:	(k1, l1, k2, l2, k3, l3) -(A1, A2), (21, 22, 24)
Basic insulation between:	(11, 12, 14) -(21, 22, 24)
Voltage test acc. to IEC 61010-1	2.21 kV

Supply voltage

CMD420-D-1, CMD421-D-1:

Supply voltage U_S	AC 16…72 V/DC 9.6…94 V
Frequency range U_S	15…460 Hz

CMD420-D-2, CMD421-D-2:

Supply voltage U_S	AC/DC 70…300 V
Frequency range U_S	15…460 Hz
Power consumption	≤ 4 VA

Measuring circuit CMD420

Nominal measuring range (r.m.s. value) n = 1	AC 0…1 A
Overload capability, continuous	2 A
Overload capability < 5 s	5 A
Load per measuring input	50 mΩ
Rated frequency f_n	42…2000 Hz

Response values CMD420

Undercurrent Lo /< (Alarm 2) n = 1	AC 0.1…1 A (0.3 A)*
Undercurrent Lo /< (Alarm 1) n = 1	100…200 % (150 %)*
	Take a maximum nominal current of 1 A into consideration!
Overcurrent Hi /> (Alarm 2) n = 1	AC 0.1…1 A (0.3 A)* (Hi)*
Overcurrent Hi /> (Alarm 1) n = 1	50…100 % (50 %)* (Hi)*
Window I_n /> (Alarm 2) n = 1	AC 0.1…1 A (0.3 A)*
Window I_n /< (Alarm 1) n = 1	50…100 % (50 %)*
External current transformer	x/1 A
Transformation ratio n	1…2000 (1)*
Relative uncertainty in the range of 42…460 Hz	±5 %, ±2 digits
Hysteresis	3…40% (15 %)*

Measuring circuit CMD421

Nominal measuring range (r.m.s. value)	AC 0…5 A
Overload capability, continuous	7.5 A
Overload capability < 5 s	with screw-type terminal connection: 20 A
	with push-wire terminals: 12 A
Load per measuring input	3 mΩ
Rated frequency fn	42…460 Hz

Response values CMD421

Undercurrent Lo < / (Alarm 2) n = 1	AC 0.5…5 A (1.5 A)*
Undercurrent Lo < / (Alarm 1) n = 1	100…200 % (150 %)*
	Take a maximum nominal current of 5 A into consideration!
Overcurrent Hi /< (Alarm 2) n = 1	AC 0.5…5 A (1.5 A)* (Hi)*
Overcurrent Hi /< (Alarm 1) n = 1	50…100 % (50 %)* (Hi)*
Window I_n /> (Alarm 2) n = 1	AC 0.5…5 A (1.5 A)*
Window I_n /> (Alarm 1) n = 1	50…100 % (50 %)*
External current transformer	x/5 A
Transformation ratio n	1…2000 (1)*
Relative uncertainty in the range of 42…460 Hz	±5 %, ±2 digits
Hysteresis	3…40% (15 %)*

Time response

Start-up delay t	0…300 s (0.5 s)*
Response delay t_{on1}	0…300 s (1 s)*
Response delay t_{on2}	0…300 s (0 s)*
Delay on release t_{off}	0…300 s (1 s)*
Resolution of setting t, $t_{on1/2}$, t_{off} (0…10 s)	0.1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (10…99 s)	1 s
Resolution of setting t, $t_{on1/2}$, t_{off} (100…300 s)	10 s
Operating time t_{ae}	≤ 130 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Device release time t_{re}	≤ 135 ms
Release time t_{off}	$t_{off} = t_{re} + t_{off}$
Recovery time t_b	≤ 300 ms

Displays, memory

Display	LC display, multifunctional, not illuminated
Display range, measured value (r.m.s. value) x transformation ratio n	CMD420: AC 0…1 A x n
	CMD421: AC 0…5 A x n
Operating uncertainty in the range of 42…460 Hz	±5 %, ±2 digit
Measured-value memory (HiS) for the first alarm value	data record measured values
Password	on/off/0…999 (OFF)*
Fault memory (M) alarm relay	on/off/con (on)*

Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation/N/O operation
	K1: Err, I1, I2, tES
	(device error Err, overcurrent prewarning > I1, test button tES)*
	K2: Err, I1, I2, tES
	(device error Err, overcurrent alarm > I2, test button tES)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

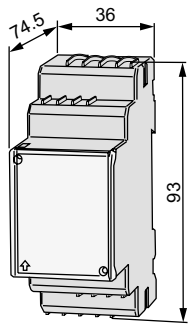
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

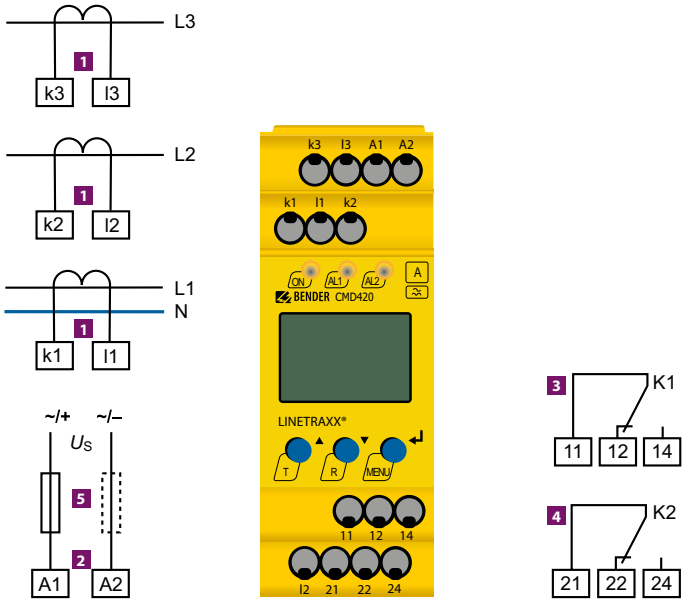
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94 V-0
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Documentation number	D00101
Weight	≤ 150 g

( )* = factory setting

Dimension diagram (dimensions in mm)



Wiring diagram



1	k, l	Connection to the conductors to be monitored; using current transformers
2	A1, A2	Supply voltage U_S (see ordering information)
3	11, 12, 14	Alarm relay "K1": configurable for *I*<, *I*> or *I*</*I*>/ERROR/TEST
4	21, 22, 24	Alarm relay "K2": configurable for alarm *I*<, *I*> or *I*</*I*>/ERROR/TEST
5		Line protection according to IEC 60364-4-43: 6 A fuse recommended. If being supplied from an IT system, both lines have to be protected by a fuse.

LINETRAXX® CMS460-D

Multi-channel AC, pulsed DC sensitive load current evaluator for AC systems (TN, TT and IT systems)



Typical applications

- Monitoring of loads and installations for load currents in the frequency range of 42…2000 Hz (measuring current transformers CTAC…, WR…S(P), WS…, WF…)
- Monitoring of currents regarded as fire hazards in flammable atmospheres
- EMC monitoring of TN systems for "stray currents" and additional N-PE connections
- Monitoring of N conductors for overload caused by harmonics
- Monitoring of PE and equipotential bonding conductors to ensure they are free of current

Approvals

CE

Device features

- Optional AC or pulsed DC sensitive measurements for each channel
- rms value measurement
- 12 measuring channels per individual device for load current
- Up to 90 evaluators CMS460-D in the system (1080 measuring channels)
- Fast parallel scanning for all channels
- Response ranges 100 mA…125 A (42…2000 Hz)
- Preset function
- Adjustable time delays
- Adjustable frequency behaviour (e.g. fire and plant protection)
- History memory with date and time stamp for 300 data records/channel
- Data logger for 300 data records/channel
- Analysis of the harmonics, THD
- Two alarm relays with one changeover contact each
- N/O or N/C operation and fault memory selectable
- Connection external test and reset button
- Backlit graphical display (7-segment display) and alarm LEDs
- Data exchange via BMS bus
- Password protection for device setting
- RoHS compliant

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Type	Art. No.
DC	AC		
16…94 V	16…72 V, 42…460 Hz	CMS460-D-1	B94053017
70…276 V	70…276 V, 42…460 Hz	CMS460-D-2	B94053018

[1] Absolute values

Accessories

Description	Art. No.
XM460 mounting frame, 144 x 82 mm	B990995

Suitable system components

Description	Version	Type of construction	Type	Art. No.	Page
Measuring current transformers	pulsed DC sensitive	circular	CTAC…	B981100…	336
		rectangular	WR…S(P)	B9117…	343
		split-core	WS…	B980806…	345
		flexible	WF…	B780802…	349
Condition Monitor	with integrated gateway: Bender system/Ethernet	–	COM465IP	B950610…	384
Protocol converters	BMS bus – Modbus RTU	–	COM462RTU	B95061022	381
		–	CP700	B95061030	396
Alarm indicator and test combination	–	–	MK800	B951001…	402
RS-485 repeater	–	–	DI-1DL	B95012047	372
Power supply unit	for DI-1	–	AN471	B924189	–

Insulation coordination acc. to IEC 60664-1/IEC 60664-3 for the versions:

a) CMS460-D1

Supply voltage U_S	DC 24…75V/AC 24…60 V (AC/DC ±20 %)
Supply voltage frequency	DC, 50/60 Hz
Rated insulation voltage	100 V
Overvoltage category/pollution degree	III/3
Rated impulse voltage	2.5 kV
Protective separation (reinforced insulation) between	(A1, A2) - (k1, l…k12, R, T/R, T, A, B)
Voltage test acc. to IEC 61010-1	1.344 kV
Rated insulation voltage	250 V
Overvoltage category/pollution degree	III/3
Rated impulse voltage	4 kV
Basic insulation between:	(A1, A2), (k1, l…k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), (61,64), (71,74), (81,84), (91,94),(101,104), (111,114), (121,124)
Basic insulation between:	(11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
Voltage test acc. to IEC 61010-1	2.21 kV
Rated insulation voltage	250 V
Overvoltage category/pollution degree	III/3
Rated impulse voltage	6 kV
Protective separation (reinforced insulation) between	(C11, C12, C14) - (C21, C22, C24) - (11, 14, 21, 24, 31, 34) - (41, 44, 51, 54, 61, 64) - (71,74) - (81,84) - (91,94) - (101,104) - (111,114) - (121,124)
Voltage test acc. to IEC 61010-1	3.536 kV

b) CMS460-D2

Supply voltage U_S	AC/DC 100…240 V (-20…+15 %)
Supply voltage frequency	DC, 50/60 Hz
Rated insulation voltage	250 V
Overvoltage category/pollution degree	III/3
Rated impulse voltage	6 kV
Protective separation (reinforced insulation) between	(A1, A2) - (k1, l…k12, R, T/R, T, A, B), (C11, C12, C14), (C21, C22, C24), (11,14), (21,24), (31,34), (41,44), (51,54), (61,64), (71,74), (81,84), (91,94),(101,104), (111,114), (121,124)
Protective separation (reinforced insulation) between	(C11, C12, C14) - (C21, C22, C24) - (11, 14, 21, 24, 31, 34) - (41, 44, 51, 54, 61, 64) - (71,74) - (81,84) - (91,94) - (101,104) - (111,114) - (121,124)
Voltage test acc. to IEC 61010-1	3.536 kV
Rated insulation voltage	250 V
Overvoltage category/pollution degree	III/3
Rated impulse voltage	4 kV
Basic insulation between:	k1, l…k12, R, T/R, T, A, B) - (C11, C12, C14), (C21, C22, C24)
Basic insulation between:	(11, 14) - (21, 24) - (31, 34) - (41, 44) - (51, 54) - (61, 64)
Voltage test acc. to IEC 61010-1	2.21 kV

Measuring circuit

External measuring current transformers	CTAC…, WR…, WS…, WF… series (type A)
Load	1 Ω
Rated insulation voltage (measuring current transformer)	800 V
Operating characteristics acc. to IEC 60755	type A
	depending on measuring current transformer series (type A)*
Rated frequency	42…2000 Hz (type A)
Cut-off frequency	none, IEC, 50 Hz, 60 Hz (none)*
Measuring range	100 mA…125 A (measuring current transformer type A)
	100 mA…30 A (measuring current transformer Flex)
	Crest factor up to 10 A = 4, up to 125 A = 2
Rated operating current In2 (alarm)	100 mA…125 A (16 A overcurrent)*
Rated operating current In1 (prewarning)	10…100 % x In2*
Preset for alarm	offset: 0…20 A (1 A)* and I x factor 1…99 (3)*
Relative uncertainty	+10…-20 %
Hysteresis	2…40% (20 %)*
Factor for additional CT	/2…10; x 1…10 (x 1)*
Number of measuring channels (per device/system)	12/1080

Time response

Start-up delay t(start-up) per device	0…99 s (0 ms)*
Response delay t_{on} per channel	0…999 s (200 ms)*
Delay on release t_{off} per channel	0…999 s (200 ms)*
Operating time t_{ae} at $I_n = 1 \times I_{n1/2}$	≤ 180 ms
Operating time t_{ae} at $I_n = 5 \times I_{n1/2}$	≤ 30 ms
Response time t_{an} for current measurement	$t_{an} = t_{ae} + t_{on1/2}$
Scanning time for all measuring channels (current measurement)	≤ 180 ms
Recovery time t_b	500…600 ms

Displays, memory

Display range, measuring value	< 10 mA…125 A (CT type A)
	< 10 mA…30 A (measuring current transformer Flex)
Operating uncertainty	± 10 %
LEDs	ON/ALARM
LC display	backlit graphical display
History memory	300 data records
Data logger	300 data records per measuring channel
Password	off/0…999 (off)*
Language	D, GB, F (GB)*
Fault memory alarm relay	on/off (off)*

Inputs/outputs

Test/reset button	internal/external
Cable length for external test/reset button	0…10 m

Interface

Interface/protocol	RS-485/BMS
Baud rate	9.6 kbit/s
Cable length	0…1200 m
Recommended cable (shielded, shield connected to PE on one side)	
	min. J-Y(St) min. 2x0.8
For UL applications:	Copper lines at least 60/70 °C
Terminating resistor	120 Ω (0.25 W) connectable via DIP switch
Device address, BMS bus	1…90 (2)*

Cable lengths for CTAC…, WR…, WS…, WF… series measuring current transformers

Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	0…10 m
Shielded cable ≥ 0.5 mm²	0…40 m
Recommended cable (shielded, shield connected to terminal l at one end, must not be earthed)	
	J-Y(St)Y min. 2x0.8

Switching elements

Number of changeover contacts	2 x 1 changeover contacts
Operating principle	N/C or N/O operation (N/O operation)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current (common alarm relay)	5 A	3 A	1 A	0.2 A	0.1 A
Rated operational current (alarm relay)	2 A	0.5 A	5 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326-1
Operating temperature	-25 °C

Climatic class acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

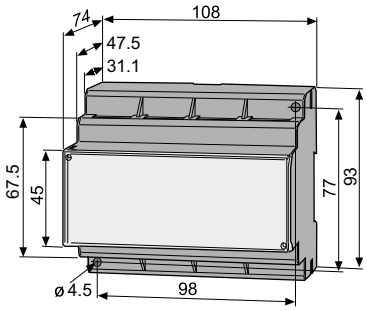
Connection	screw-type terminals
Connection properties:	
Rigid/flexible/conductor sizes	0.2…4/0.2…2.5 mm²/AWG 24…12
Multi-conductor connection (2 conductors with the same cross section):	
Rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8…9 mm
Tightening torque	0.5…0.6 Nm

Other

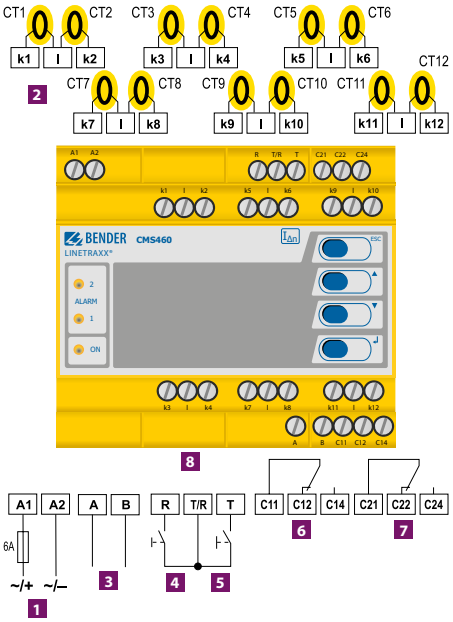
Operating mode	continuous operation
Mounting	display-oriented
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
Flammability class	UL94V-0
Screw fixing	2 x M4
DIN rail mounting acc. to	IEC 60715
Power consumption	≤ 10 VA
Weight	≤ 360 g

( )* Factory setting

Dimension diagrams (dimensions in mm)

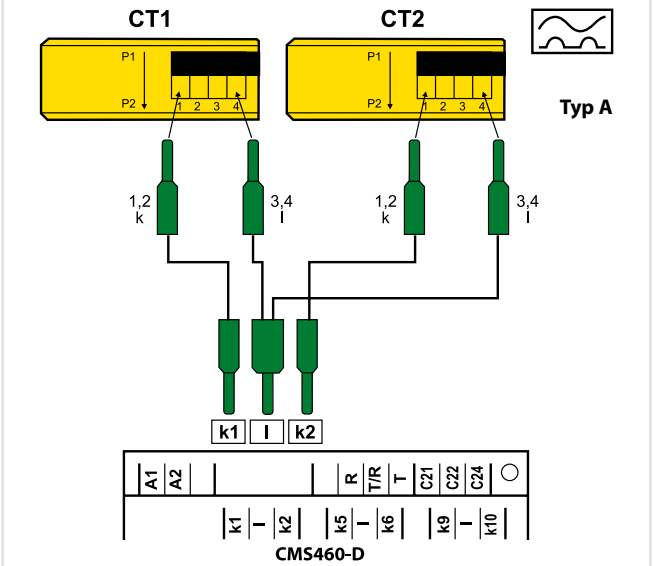


Wiring diagrams

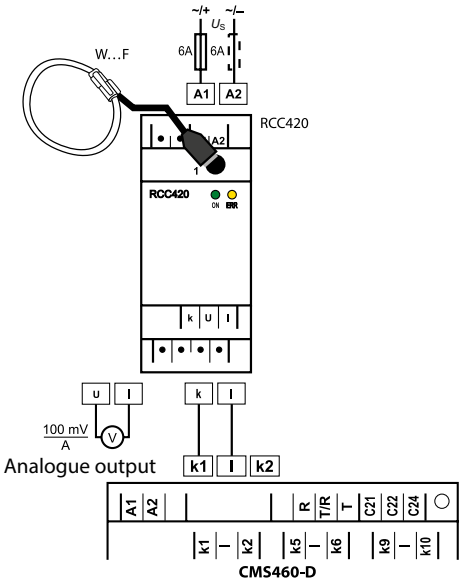


1	A1, A2	Connection of supply voltage US (see ordering information), 6 A fuse recommended.
2	I, k1…k12	Connection of measuring current transformers CT1…CT12
3	A, B	RS-485 interface with BMS protocol
4	R	External reset button "R" (N/O contact)
5	T, T/R	External test button "T" (N/O contact). The external "T/R" buttons of several devices must not be connected to one another.
6	C11, C12, C14	Alarm relay "K1": Alarm 1, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
7	C21, C22, C24	Alarm relay "K2": Alarm 2, common alarm for alarm, prewarning, device error, ext. alarm (adjustable)
8	$R_{on/off}$	Activate or deactivate the BMS bus terminating resistor (120 Ω)

Connection W…, WR…S(P), WS… series measuring current transformers (pulsed DC sensitive)



Connection WF… series measuring current transformer (pulsed DC sensitive)



LINETRAXX® GM420

Loop monitoring relay to monitor loop resistances or PE conductor connections



Typical applications

- Loop monitoring of motors
- Loop monitoring of PE conductor connections for wire interruptions in electrical installations
- Monitoring of earthing systems

Approvals

Device features

- Loop monitoring of the PE conductor in AC systems
- Measuring circuit providing a high resistance against extraneous voltages and indication of extraneous voltages
- Adjustable start-up delay, response delay and delay on release
- Adjustable switching hysteresis
- Digital measured value display via multi-functional LC display
- Preset function (automatic setting of basic parameters)
- LEDs: Power On, Alarm 1, Alarm 2
- Measured value memory for operating value
- Continuous self monitoring
- Internal test/reset button
- Two separate alarm relays with one changeover contact each
- N/C or N/O operation and fault memory behaviour selectable
- Password protection for device setting
- Sealable transparent cover
- Two-module enclosure (36 mm)
- Push-wire terminal (two terminals per connection)
- RoHS compliant

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage [1] U_S		Type	Art. No.	
AC	DC		Screw-type terminal	Push-wire terminal
16…72 V, 15…460 Hz	9.6…94 V	GM420-D-1	B93082001	B73082001
70…300 V, 15…460 Hz	70…300 V	GM420-D-2	B93082002	B73082002

[1] Absolute values

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B98060008

5.2

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated insulation voltage	400 V
Rated impulse voltage/pollution degree	4 kV/3
Protective separation (reinforced insulation) between:	(A1, A2) -(E, KE) -(11-12-14) -(21-22-24)
Voltage test acc. to IEC 61010-1:	
(E, KE) -[(A1-A2), (11-12-14)]	3.32 kV
(E, KE) -(21-22-24)	2.21 kV
(A1-A2) -(11-12-14) -(21-22-24)	2.21 kV

Supply voltage

Supply voltage U_S	see ordering information
Frequency range U_S	see ordering information
Power consumption	≤ 4 VA

Measuring circuit

Loop resistance R_m:

Measuring range R_m	0…100 Ω
Measuring current I_m	DC 20 mA
Measuring voltage U_m	≤ DC 24 V

Extraneous voltage U_f:

Measuring range U_f	AC 0…50 V
Rated frequency f_n	42…460 Hz
Disconnection of the measuring loop at U_f	≥ 12 V
Reconnection of the measuring loop	≤ 10 V
Permissible extraneous voltage U_f	≤ 440 V
Permissible extraneous DC voltage, without influence on the measurement	DC 0 V

Response values

Loop resistance > *R* (Alarm 1)	0.1…100 Ω
Resolution of setting *R* = 0…10 Ω	0.1 Ω
Resolution of setting *R* = 10…100 Ω	1 Ω

Preset function:

Loop resistance (> *R*) =	((R_m +0.5 Ω) x 1.5)*
Relative uncertainty 0…1 Ω	±20 %, ±1 digit
Relative uncertainty 1…100 Ω	±5 %, ±1 digit
Hysteresis > *R*	1…40 % (25 %)*
Extraneous voltage > *U* (Alarm 2)	1…50 V (25 V)*
Resolution of setting U_f 1…50 V	0.5 V
Relative uncertainty Uf (> U) in the range of 50/60 Hz	±2 %, ±1 digit
Relative uncertainty U_f (> *U*) in the range of 42…460 Hz	±10 %, ±1 digit
Hysteresis > *U*	1…40 % (5 %)*

Time response

Start-up delay *t*	0…99 s (0 s)*
Response delay $t_{on1/2}$	0…99 s (0 s)*
Delay on release t_{off}	0…99 s (0.5 s)*

Operating time

In the case of loop interruption (*R* > 50 kΩ) t_{ae}	≤ 40 ms
In the case of closed loop (> *R*) t_{ae}	≤ 500 ms
In the case of extraneous voltage (> *U*) and overload (OL) t_{ae}	≤ 100 ms
Response time t_{an}	$t_{an} = t_{ae} + t_{on1/2}$
Recovery time t_b	≤ 300 ms
Recovery time t_b after safety shutdown	≤ 1 s

Displays, memory

Display	LC display, multifunctional, not illuminated
Display range, measuring value R_m	0…100 Ω
Display range, measuring value U_f	AC 0…50 V
Operating uncertainty, loop resistance 0…1 Ω	±20 %, ±1 digit
Operating uncertainty loop resistance 1…100 Ω	±5 %, ±1 digit
Operating uncertainty voltage in the range of 50/60 Hz	±2 %, ±1 digit
Operating uncertainty voltage in the range of 42…460 Hz	±10 %, ±1 digits
History memory (HiS) for the first alarm value	data record measured values
Password	off/0…999 (off)*
Fault memory (M) alarm relay	on/off (on)*

Switching elements

Number	2 x 1 changeover contacts (K1, K2)
Operating principle	N/C operation or N/O operation
	K1: Err, > *R*, OL, > *U*, tES (device error, loop resistance, measuring current disconnection: N/O operation n.o.)*
	K2: Err, > *R*, OL, > *U*, tES (overvoltage: N/O operation n.o.)*
Electrical endurance, number of cycles	10,000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12	DC-12	DC-12
Rated operational voltage	230 V	230 V	24 V	110 V	220 V
Rated operational current	5 A	3 A	1 A	0.2 A	0.1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V				

Environment/EMC

EMC	IEC 61326
Operating temperature	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection

Connection type	screw-type terminal or push-wire terminal

Screw-type terminal

Connection properties:	
rigid/flexible/AWG	0.2…4/0.2…2.5 mm²/AWG 24…12
Two conductors with the same cross section:	
rigid/flexible	0.2…1.5/0.2…1.5 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5…0.6 Nm

Push-wire terminals

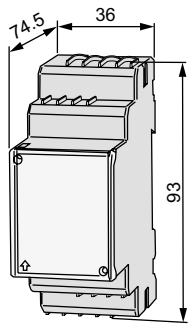
Connection properties:	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrules	0.75…2.5 mm² (AWG 19…14)
flexible with ferrules	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

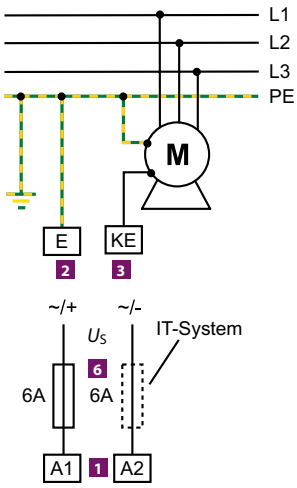
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP30
Enclosure material	polycarbonate
Screw mounting	2 x M4 with mounting clip
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Documentation number	D00112
Weight	≤ 150 g

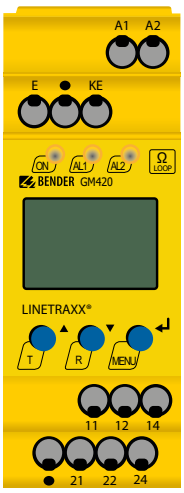
( )* = factory setting

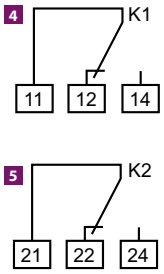
Dimension diagram (dimensions in mm)



Wiring diagram







1	A1, A2	Supply voltage U_S (see ordering details) via fuse
2	E	Connection of E to the PE conductor
3	KE	Connection of KE to the loads or the monitoring conductor
4	11, 12, 14	Alarm relay "K1": Alarm 1 configurable for > *R*, OL, > U_f, ERROR, TEST
5	21, 22, 24	Alarm relay "K2": Alarm 2 configurable for > *R*, OL, > U_f, ERROR, TEST
6		Line protection by a fuse in accordance with DIN VDE 0100-430/ IEC 60364-4-43 (6 A fuse recommended). In case of supply (A1/A2) from an IT system, both lines have to be protected by a fuse.



SB146

Fault voltage monitor



Device features

- Voltage monitoring of 6 secondary circuits of welding transformers
- Alarm LEDs for fault voltage per channel, PE/KE interruption, interruption of the measuring line
- Connection monitoring of measuring line and earth connection
- Fault memory
- Reset button
- 1 potential-free changeover contact
- 45 mm enclosure

Typical applications

- Monitoring of welding equipment according to DIN VDE 0545 (VDE 0545-1)

Standards

The SB146 series complies with the requirements of the device standard:

- DIN VDE 0545-1

Approvals

CE

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S		Type	Art. No.
AC	DC		
10…65 V	10…90 V	SB146-34	B93083017
65…276 V	90…308 V	SB146-35	B93083018

Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	6 kV/3

Supply voltage

Supply voltage U_S	see ordering information
Power consumption	≤ 3 VA

Measuring circuit

Nominal system voltage U_n	600 V
Nominal voltage range	0…1.15 x U_n
Response value	
U_F for sinusoidal voltages	AC 21.6…24 V, 50…1000 Hz
U_F for DC voltages	DC 19…24 V
Response time t_{an} at 1.1 x U_{Fmax}	≤ 100 ms
Response time for coupling monitoring	≤ 5 s
Recovery time t_b	≤ 500 ms

Switching elements

Number of changeover contacts	1 x 1
Operating principle	N/C operation

Fault memory behaviour

Electrical endurance, number of cycles	12,000
Contact class IEC 60255-0-20	IIB
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi 0.4 0.2 A, DC 220 V, L/R = 0.04 s

Environment/EMC

EMC immunity	acc. to IEC 61000-6-2
EMC emission	acc. to IEC 61000-6-4
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g/10…150 Hz
Ambient temperature, during operation	-10…+55 °C
Ambient temperature for storage	-45…+70 °C
Classification of climatic conditions acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

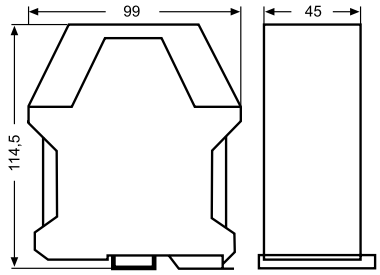
Connection

Connection type	modular terminals
Connection properties single wire/flexible	0.14…2.5 mm²

Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP30
Screw mounting	no
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Documentation number	D00134
Weight	≤ 210 g

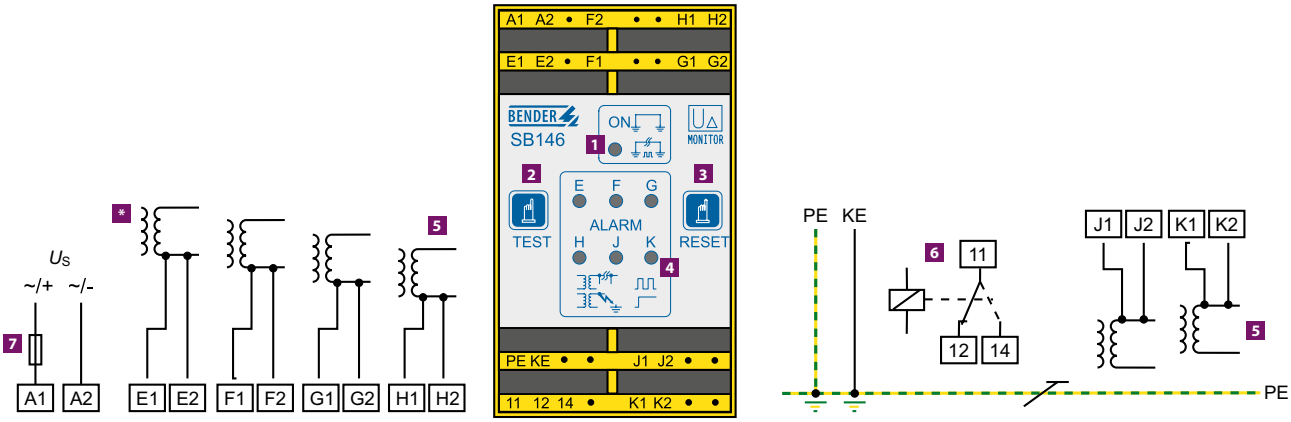
Dimension diagram (dimensions in mm)



Alarm messages

Condition				Messages		
U_S	$U_{F>}$	Connection		LED		Relay
		System	PE	ON	"E...K"	
on	–	OK	OK	■	–	on
on	–	open	OK	■	flashes	de-energised
on	■	OK	OK	■	on	de-energised
on	–	OK	open	flashes	–	de-energised
off	–	–	–	–	–	de-energised

Wiring diagram



1 Power On LED "ON":
– lights during operating mode
– flashes in case of interruption of the connection PE/KE

2 Test button "TEST"

3 Reset button "RESET"

4 Alarm LEDs
– light in the case of fault voltage
– flash in case of a fault in the connection monitoring

5 Welding transformers monitored

6 Alarm relay in N/C operation (marked by dotted lines: without fault voltage)

7 6 A fuse recommended.

* Unassigned inputs have to be bridged individually

Insulation monitoring devices
ISOMETER®

7

Equipment for insulation fault location
ISOSCAN®

151

Residual current monitoring systems
LINETRAXX®

177

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

219

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

243

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System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation



317



Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

415

427

Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service

449

Device overview coupling devices

	AGH150W-4	AGH204S-4	AGH520S	AGH675S-7 AGH675S-7MV	AGH676S-4
					

Page		326	328	329	330	332
Application		Extension of the nominal voltage range for ISOMETER®s	Extension of the nominal voltage range for ISOMETER®s	Extension of the nominal voltage range for ISOMETER®s	Extension of the nominal voltage range for ISOMETER®s	Extension of the nominal voltage range for ISOMETER®s
Nominal system voltage U_n		AC 0…1150 V, DC 0…1760 V	AC 0…1300 V / AC 0…1650 V	AC/3(N)AC 0…7200 V	AC, 3(N)AC, DC 0…7.2 kV AC, 3(N)AC, DC 0…15.5 kV	AC/3(N)AC 0…12 kV
Device family	IRDH275/375	■	■	■		■
	IRDH275BM				■	
	IR420-D64					■
	iso685-D	■	■	■		■
	iso685-S	■	■	■		■

Device overview measuring current transformers

	W0-S20…W5-S210, W10/600	CTAC…	CTUB100-CTBC…
			

Page		334							336					339									
Characteristics																							
CT type		W10/600	W0-S20	W1-S35	W2-S70	W3-S105	W4-S140	W5-S210	CTAC20(P)	CTAC35 (P)	CTAC60 (P)	CTAC120(P)	CTAC210(P)	CTUB101-CTBC20(P)	CTUB101-CTBC35(P)	CTUB101-CTBC60(P)	CTUB101-CTBC120(P)	CTUB101-CTBC210(P)	CTUB102-CTBC20(P)	CTUB102-CTBC35(P)	CTUB102-CTBC60(P)	CTUB102-CTBC120(P)	CTUB102-CTBC210(P)
Dimensions (mm)	Inside diameter	10	20	35	70	105	140	210	20	35	60	120	210	20	35	60	120	210	20	35	60	120	210
	Width x height																						
	Strip length																						
Device family	EDS440	■	■	■	■	■	■	■	■	■	■	■	■										
	EDS441																						
	EDS441-LAB																						
	EDS460/490	■	■	■	■	■	■	■	■	■	■	■	■										
	EDS461/491																						
	RCM420	■	■	■	■	■	■	■	■	■	■	■	■										
	RCMA420													■	■	■			■	■	■		
	RCMA423													■	■	■	■	■	■	■	■	■	■
	RCMS460/490	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■



WR...S(P)



WS...
WS...-8000



WS...S



WF...

343				345					347				349					
				split-core					split-core				flexible					
WR70x175S(P)	WR115x305S(P)	WR150x350S(P)	WR200x500S(P)	WS20x30	WS50x80	WS80x120	WS20x30-8000	WS50x80-8000	WS50x80S	WS80x80S	WS80x120S	WS80x160S	WF170	WF250	WF500	WF800	WF1200	WF1800
70 x 175	115 x 305	150 x 350	200 x 500	20 x 30	50 x 80	80 x 120	20 x 30	50 x 80	50 x 80	80 x 80	80 x 120	80 x 160						
													170	250	500	800	1200	1800
■	■	■	■	■	■	■												
							■	■										
							■	■										
■	■	■	■	■	■	■			■	■	■	■						
							■	■										
■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■			■	■	■	■	■	■	■	■	■	■

6

Device overview isolating transformers, transformers for operating theatre lights

			
	ES710	DS0107	ESL0107

Page		352	357	360
Application		Design of medical IT systems	Supply of three-phase loads in group 0, 1 or 2 medical locations	Supply of operating theatre luminaires
Type of distribution system		single-phase	three-phase	single-phase
Voltages	Input	AC 230 V	3AC 400 V	AC 230 V (±5 %, ±10 %)
	Output	AC 230 V	3NAC 230 V	AC 23…28 V
	Frequency range	50…60 Hz	50…60 Hz	50…60 Hz
Power		3150 VA 4000 VA 5000 VA 6300 VA 8000 VA 10000 VA	2000 VA 3150 VA 4000 VA 5000 VA 6300 VA 8000 VA 10000 VA	120 VA 160 VA 280 VA 400 VA 630 VA 1000 VA
Design type	vertical	■	■	■
	horizontal	■	■	
	encapsulated (protection class B)	■	■	

Device overview measuring transducer

	
	RK170

Page		362
Application		Conversion of DC currents
Input	Current	DC 0…400 µA
Output	Current	0/4…20 mA
	Voltage	DC 0…10 V

Device overview power supply units

	STEP-PS	AN410	AN450
			
Page	364	367	369
Application	for measuring current transformers	for DC 24 V power supply	for voltage supply
Rated voltage	DC 24 V	DC 24 V	AC 20 V, 50…60 Hz
Rated input voltage U_{IN}	AC 85…264 V, 45…65 Hz DC 95…250 V	AC 90…264 V DC 120…370 V	AC 230 V, 50…60 Hz AC 127 V, 50…60 Hz

Device overview measuring instruments

	7204	7220	9604	9620
				
Page	371	371	371	371
Input current	0…400 µA	0…20 mA	0…400 µA	0…20 mA
Dimensions (mm)	72 x 72	72 x 72	96 x 96	96 x 96
Device family IRDH275/375	■		■	
IRDH275B/375B			■	
IRDH575	■		■	
iso685…		■	■	■

Device overview interface converters and repeaters



DI-1DL



DI-2USB

Page		372	374
Application		Interface repeater BMS bus	Interface converter BMS/USB
Input	Input	RS-485	RS-485
	Connection	screw-type terminal	screw-type terminal
	Cable length	≤ 1200 m	≤ 1200 m
Output	Output	RS-485	USB
	Connection	screw-type terminal	USB Type B
	Cable length	≤ 1200 m	≤ 5 m
	Expansion of bus devices	≤ 30	
Supply voltage U_S		AC 85…260 V, 50…60 Hz	via USB
Particular features			Driver CD

Device overview Relay module



IOM441

Page	375
Application	for extension of EDS44x applications
Relay number	12 N/O contacts
Supply voltage U_S	via BB bus
Interface	BB bus
Connection	push-wire terminal / BBbus PCB
Relay operation	configurable

Device overview Charge Controller



CC612

Page		377
Application		Charge Controller
DC 6 mA sensor		■
Supply voltage U_S		DC 12 V
Interface	Modbus	■
	eHz meter	■
Modem		3G modem (optional)

Device overview gateways

	 COMTRAXX® COM462RTU	 COMTRAXX® COM465IP	 COMTRAXX® COM465DP	 COMTRAXX® COM465ID	 COMTRAXX® CP700
Page	381	384	388	392	396
Application	BMS-Modbus RTU-Gateway	Condition Monitor/Gateway	Condition Monitor/ PROFIBUS-Gateway	Condition Monitor/Gateway	Condition Monitor/Gateway
Functions – **Protocol input**	BMS	BMS/Modbus RTU/TCP	BMS/Modbus RTU/TCP	isoData/Modbus TCP	BMS/Modbus RTU/TCP
Functions – **Protocol output**	Modbus RTU	Ethernet/Modbus TCP	Ethernet/Modbus TCP, PROFIBUS DP	Ethernet/Modbus TCP/OPC-UA	Ethernet/Modbus TCP
Functions – **Display**	LCD/LED	LED	LED	LED	7"-colour LCD
Functions – **Alarm messages**	■	■ [1, 2)]	■ [1, 2)]	■ [1, 2)]	■ [1, 2, 3)]
Functions – **Measured values**	■	■ [1, 2)]	■ [1, 2)]	■ [1, 2)]	■ [1, 2, 3)]
Functions – **Device parameter setting**		■ [1)]	■ [1)]	■ [1)]	■ [1)]
Functions – **Alarm list**		■ [1)]	■ [1)]	■ [1)]	■ [1, 3)]
Functions – **History memory**		■ [1)]	■ [1)]	■ [1)]	■ [1)]
Functions – **Diagrams**		■ [1)]	■ [1)]	■ [1)]	■ [1, 3)]
Functions – **Visualisation**		■ [1)]	■ [1)]	■ [1)]	■ [1)]
Functions – **E-mail notification**		■ [1, 4)]	■ [1, 4)]	■ [1, 4)]	■ [1, 4)]
Functions – **Device tests**	■	■ [1, 2)]	■ [1, 2)]	■ [1, 2)]	■ [1, 2)]
Functions – **PEM… and energy meter support**		■ [1)]	■ [1)]	■ [1)]	■ [1)]
Functions – **SNMP**		■ [1)]	■ [1)]	■ [1)]	■ [1)]
Functions – **Data logger**		■ [1)]	■ [1)]	■ [1)]	■ [1)]
Connection – **BMS**	screw-type terminal	screw-type terminal	screw-type terminal		screw-type terminal
Connection – **Modbus RTU**	screw-type terminal	screw-type terminal	screw-type terminal		screw-type terminal
Connection – **isoData**				screw-type terminal	
Connection – **Output**	screw-type terminal	RJ 45	RJ 45, Sub-D 9-pole	RJ 45	RJ 45
System requirements – **Supply voltage U_S**	AC/DC 76…276 V	AC/DC 24…240 V, DC 24V	AC/DC 24…240 V, DC 24V	AC/DC 24…240 V	DC 24 V
System requirements – **Browser**		Internet Explorer, Chrome, Firefox etc.	Internet Explorer, Chrome, Firefox etc.	Internet Explorer, Chrome, Firefox etc.	Internet Explorer, Chrome, Firefox etc.

[1)] Functions available on the web server – accessible via a personal computer with browser

[2)] Available via the protocol

[3)] On the device's own LC display

[4)] TLS/SSL Support

Device overview alarm indicator and test combinations

		 COMTRAXX® CP9xx	 COMTRAXX® MK800 (DI400)	 COMTRAXX® MK2430	 Visualisation
Page		399	402	406	409
Messages/displays	MEDICS® systems	■	■	■	■
	RCMS Residual current monitoring system	■	■	■	■
	EDS insulation fault locator	■	■	■	■
Installation type	Flush-mounting	■	■	■	■
	Cavity wall mounting	■	■	■	■
	Cable-duct mounting			■	
	Panel mounting	■	■	■	■
	Surface mounting	■	■	■	
Inputs/outputs	Digital inputs (potential free)	12	0/16	0/12	
	N/O or N/C operation	selectable	selectable	selectable	
	Relay outputs	1	1	1	
	N/O or N/C operation	programmable	programmable	programmable	
	Common alarm	programmable	programmable	programmable	
	System fault alarm	programmable	programmable	programmable	
Parameter setting/text message	Languages selectable	25	21	20	programmable
	Standard display	Graphic LCD (7", 15.6", 24")	4 x 20 characters	4 x 20 characters	
	Additional text display	■	3 x 20 characters	3 x 20 characters	
	Standard texts	■	■	■	
	Freely configurable text messages	■	1000	200	
	History memory, maximum number of data records	1000	1000	250	
	Real-time clock	■	■	■	
	Parameterisation software	integrated	TMK-Set V 4.xx (USB, BMS)	TMK-Set V 4.xx (USB, BMS)	
	Messages/alarms, medical gases	acc. to EN475, EN737-3	acc. to EN475, EN737-3	acc. to EN475, EN737-8	
Interfaces	RS-485 (BMS protocol)	■	2	■	
	BMS address range	1…150	internal: 1 (…150), external: 1…99	1…150	
	Master redundancy, BMS internal	■	■	■	
	Master redundancy, BMS external		■		
	USB	■	■	■	
	Ethernet (TCP/IP)	■			■
Supply voltage U_S		DC 24 V/AC 250 V	AC/DC 24 V	AC/DC 24 V	
Stored energy time in the event of power failure		≥ 15 s	≤ 2 s	≤ 15 s	

Device overview POWERSCOUT®



POWERSCOUT®

	Page	410
Functions	Multi-tenant	Unlimited
	User management	Unlimited
	Logger	Unlimited (all measured values)
	Real-time capable (alerting)	–
	Parameterisation of sensors/devices	–
	Web front end	■
	Cloud	■
	On-premise installation	■
	Max. number of devices/data points	Unlimited
	Creation of dashboards	■
	Event aggregation on the main page	■
	Configuration of an individual main page	■
	Reporting	■
	Export data	csv export
	Import data	csv import
	Virtual measuring point calculation	■
	Login overview	■
Widgets	Graph	■
	Event statistics	■
	Measurement statistics	■
	Text editor	■
	Table view	■
	Alarm state	■
	Event protocol	■
	Gauge	■
	Heat map	■
	Sankey diagram	■
	Bar graph	■

AGH150W-4

Coupling device

AC/DC



Typical applications

- Extension of the nominal voltage range for the ISOMETER®s iso685… series and IRDH… series to AC 0…1150 V, DC 0…1760 V

Further information

For further information refer to our product range on www.bender.de.

Approvals

AGH150W-4

Ordering information

Nominal system voltage U_S		Type	Art. No.
AC	DC		
0…1150 V	0…1100 V	AGH150W	B915576
	0…1760 V	AGH150W-4	B98018006

Technical data

Insulation coordination acc. to DIN EN 61800-5-1 (VDE 0160-105-1)

AGH150W

Rated insulation voltage	AC 1000 V
Voltage test acc. to IEC 60255	12 kV

AGH150W-4

Rated insulation voltage	AC 1600 V
Voltage test acc. to IEC 60255	17 kV

Voltage test acc. to DIN EN 61800-5-1 (VDE 0160-105-1)

AGH150W

Voltage impulse test (basic insulation)	≥ AC 8 kV
AC voltage test (basic insulation	≥ AC 4.3 kV

AGH150W-4

Voltage impulse test (basic insulation)	≥ AC 11 kV
AC voltage test (basic insulation	≥ AC 6.6 kV

Voltage ranges

AGH150W

Nominal system voltage U_n	AC 0…1150 V, DC 0…1100 V
Frequency range of $U_{n\ (sinus)}$	DC 1…460 Hz
Overvoltage category/rated impulse voltage	CAT III/≥8 kV
Internal DC resistance R_i	≥80 kΩ
Tolerance of internal DC resistance R_i	±2 kΩ

AGH150W-4

Nominal system voltage U_n	AC 0…1150 V, DC 0…1760 V DC 0…1600 V (for UL applications)
Frequency range of $U_{n\ (sinus)}$	DC 1…460 Hz
Overvoltage category/rated impulse voltage	CAT III/≥11 kV
Internal DC resistance R_i	≥160 kΩ
Tolerance of internal DC resistance R_i	±4 kΩ

Environment

Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+55 °C
Ambient temperature (during storage)	-40…+70 °C
Climatic class acc. to DIN IEC 60721-3-3	3K5 (except condensation and formation of ice)

Connection

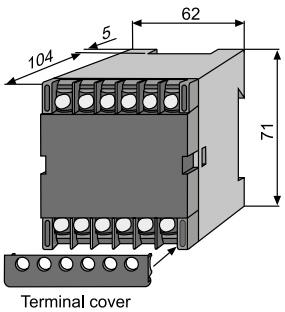
Connection	flat terminals
Connection properties	
rigid/flexible	0.2…4/0.2…2.5 mm²

Other

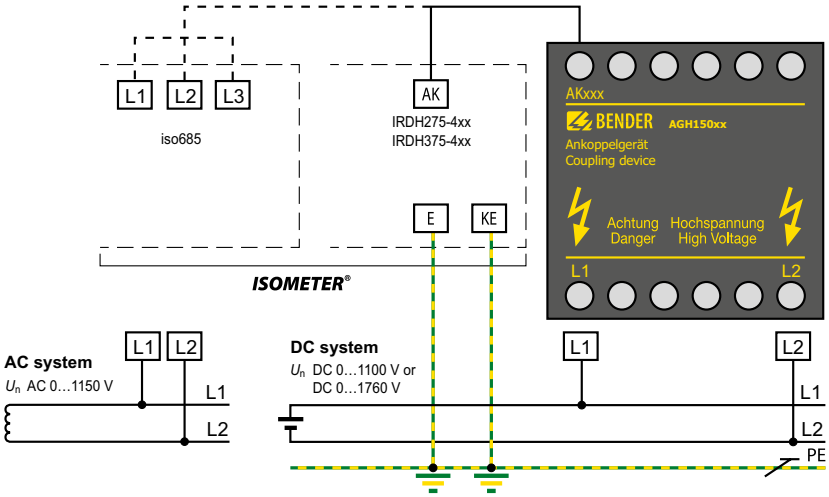
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Weight	≤ 900 g

* The tolerance range affects the measured value of the insulation monitoring device used and must be taken into account accordingly

Dimension diagram (dimensions in mm)



Wiring diagram



AGH204S-4

Coupling device

AC/DC



Typical applications

- Extension of the nominal voltage range to AC, 3(N)AC 0…1650 V/0…1300 V, 50… 400 Hz for the ISOMETER®s iso685… series and IRDH275-4…/IRDH375-4…/IR470LY-40/IRDH1065B-4.

Approvals

Further information

For further information refer to our product range on www.bender.de.

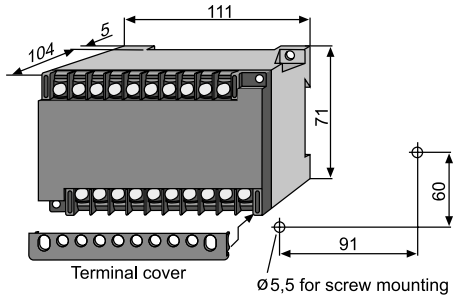
Ordering information

Nominal system voltage U_S	Type	Art. No.
AC		
0…1650 V/0…1300 V	AGH204S-4	B914013

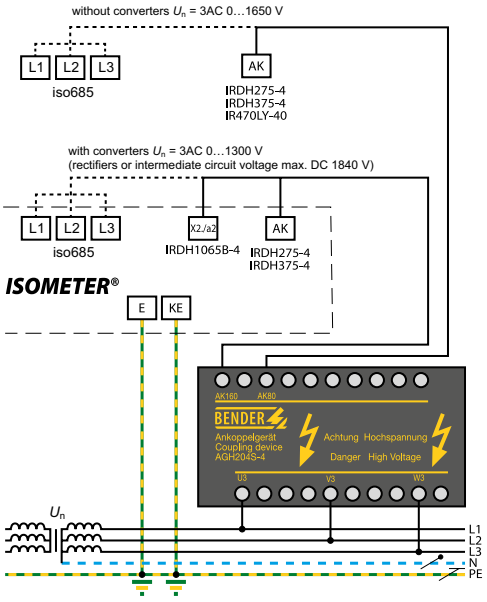
Technical data

Insulation coordination acc. to DIN EN 61800-5-1 (VDE 0160-105-1)	
Rated insulation voltage	AC 1500 V
Voltage test acc. to DIN EN 61800-5-1 (VDE 0160-105-1)	
Impulse voltage test (basic insulation)	≥ AC 10.4 kV
AC voltage test (basic insulation)	≥ AC 5 kV
Partial discharge test	≥ 3 kV
Voltage ranges	
Nominal system voltage U_n (including DC components)	0…1300 V
Nominal system voltage U_n (AC only)	0…1650 V
Nominal frequency f_n	50…400 Hz
Overvoltage category/rated impluse voltage	III/≥10.4 kV
Internal DC resistance R_i	
Coupling to AK80	80 kΩ
Coupling to AK160	160 kΩ
Environment	
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+55 °C
Ambient temperature for UL applications (during operation)	-10…+45 °C
Ambient temperature (during storage)	-40…+70 °C
Climatic class acc. to DIN IEC 60721-3-3	3K5 (except condensation and formation of ice)
Connection	
Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
Tightening torque	0.5 Nm
Conductor sizes (AWG)	24…12
Length of the connecting lead between the ISOMETER® and AGH	≤ 0.5 m
Other	
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	X112, free from halogen
Screw mounting	2 x M4
DIN rail mounting	DIN EN 60715/IEC 60715
Flammability class	UL94 HB
Documentation number	D00094
Weight	≤ 1350 g

Dimension diagram (dimensions in mm)



Wiring diagram



6.1

AGH520S

Coupling device

AC



Typical applications

- Extension of the nominal voltage range to (3)AC 0…7200 V, 50…400 Hz for the ISOMETER®s iso685… series and IRDH275-4…/IRDH375-4…/IR470LY-40/IR420-D6/IRDH1065B-4

Approvals

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage U_S	Type	Art. No.
3(N)AC		
0…7200 V	AGH520S	B913033

Technical data

Insulation coordination acc. to IEC 61800-5-1

Operating voltage	AC 6.3 kV

Voltage test according to IEC 61800-5-1

Overvoltage category/impulse voltage test (basic insulation)	III /AC 35 kV
AC voltage test (basic insulation)	AC 17.5 kV
Partial discharge test	12 kV

Voltage ranges

Nominal system voltage U_n	AC, 3(N)AC 0…7.2 kV
Nominal system voltage U_n for UL applications	AC, 3(N)AC 0…6 kV
Nominal frequency f_n	50…400 Hz
Internal DC resistance R_i	≥ 80 kΩ
Impedance Z_i at 7.2 kV and 50 Hz	≥ 6 MΩ

Environmental conditions

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3
Ambient temperature (during operation)	-10…+55 °C
Ambient temperature for UL applications (during operation)	-10…+45 °C
Ambient temperature (during storage)	-20…+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

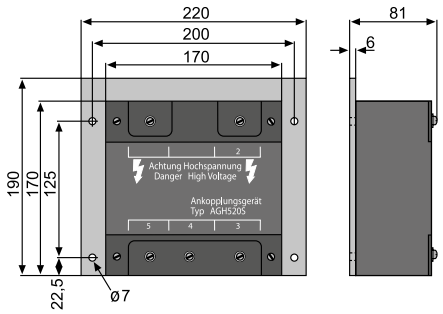
Connection

Connection terminal 2 (medium voltage)	screw-type terminal
Connection terminals 3, 4, 5	screw-type terminals
Connection properties	
rigid/flexible	0.2…4 mm²/ 0.2…2.5 mm² (AWG 24…12)
Tightening torque	2.9 Nm

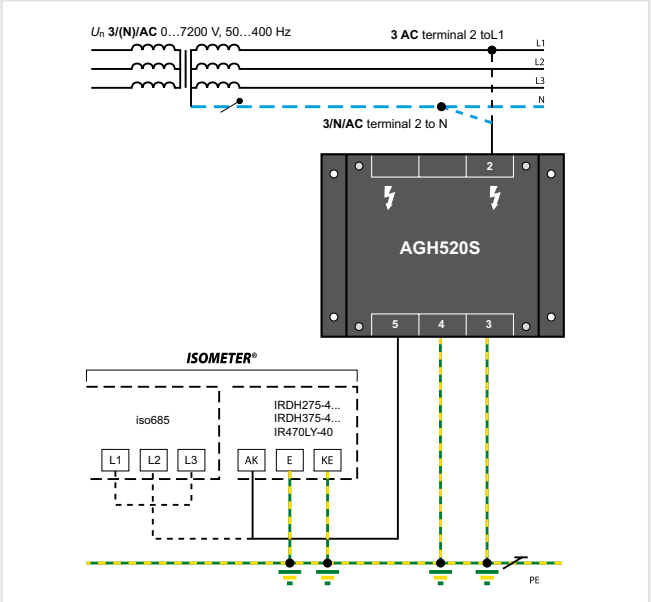
General data

Operating mode	continuous operation
Position	any position
Degree of protection, internal components (DIN EN 60529)	IP64
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	resin-encapsulated block
Screw mounting	4 x M5
Flammability class	UL94 HB
Documentation number	D00073
Weight	≤ 4500 g

Dimension diagram (dimensions in mm)



Wiring diagram



AGH675S-7/AGH675S-7MV15

Coupling device

AC/DC



Typical applications

- Extension of the nominal voltage range to AC/DC 0…15.5 kV for the ISOMETER® IRDH275BM-7

Approvals

CE EAC

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal system voltage U_n AC/DC	Cable length	Type	Art. No.
0…7.2 kV, 0…460 Hz	500 mm	AGH675S-7-500	B913060
	2000 mm	AGH675S-7-2000	B913061
0… 15.5 kV, 0…460 Hz	500 mm	AGH675S-7-MV15-500	B913058

Technical data

Insulation coordination acc. to DIN EN 61800-5-1

AGH675S-7

Rated insulation voltage	AC 7.2 kV

AGH675S-7MV15

Rated insulation voltage	AC 15.5 kV

Voltage test according to IEC 61800-5-1

Type test:

AGH675S-7

AC voltage test (basic insulation)	40 kV
AC voltage test (basic insulation)	20 kV
Partial discharge test	14 kV

AGH675S-7MV15

Impulse voltage test (basic insulation)	111 kV
AC voltage test (basic insulation)	70 kV
Partial discharge test	29 kV

Routine test:

AC voltage test	40 kV

Voltage ranges

AGH675S-7

Nominal system voltage U_n	AC, 3(N)AC, DC 0…7.2 kV
Nominal frequency f_n	0…460 Hz
Internal DC resistance R_i	≥ 2.39 MΩ

AGH675S-7MV15

Nominal system voltage U_n	AC, 3(N)AC, DC 0…15.5 kV
Nominal frequency f_n	0…460 Hz
Internal DC resistance R_i	≥ 4.7 MΩ

Environment/EMC

Operating temperature (normal operation)	- 10…+ 60 °C
Operating temperature (continuous operation with asymmetrical earth fault)	- 10…+ 55 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4 (3M7 Y axis)
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

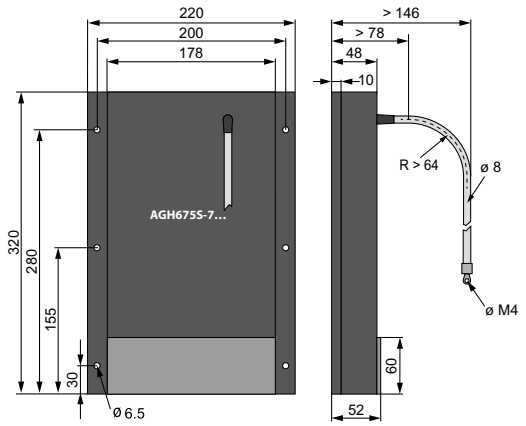
Connection

Connection terminal 2 (medium voltage)	high-voltage cable (encapsulated on the device side)
Connection, flexible with ring eyelet	M4
Connection type terminals 3, 4, 5	screw-type terminals
Connection	
rigid/flexible	0.2…4 mm²/0.2…2.5 mm²
flexible connector sleeve	0.25…2.5 mm²

Other

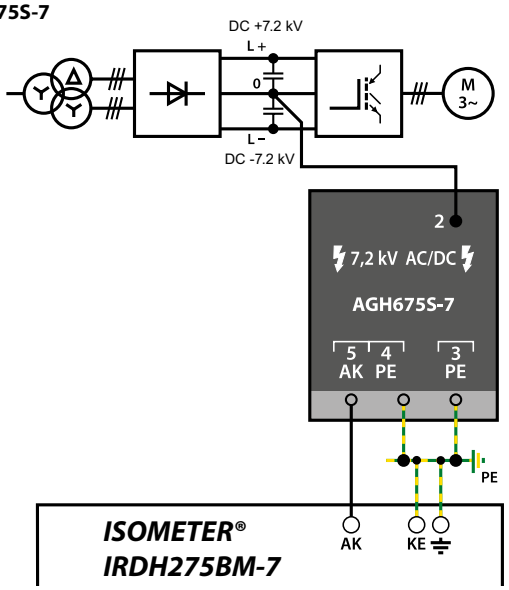
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP 64
Degree of protection, terminals (DIN EN 60529)	IP 20
Type of enclosure	resin-encapsulated block
Screw mounting	M5
Flammability class	UL94 HB
Documentation number	D00095
Weight	≤ 5100 g

Dimension diagram (dimensions in mm)

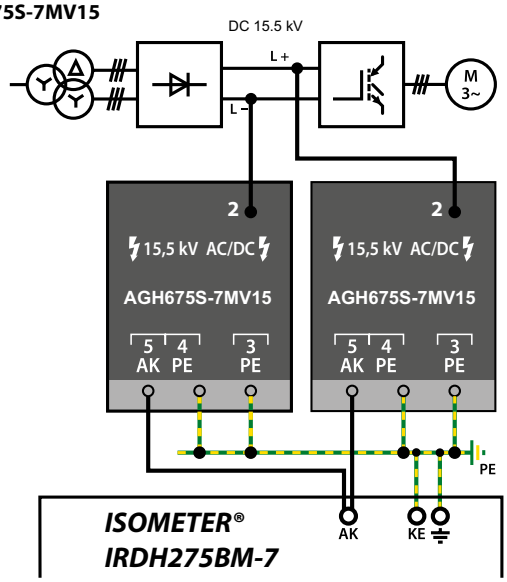


Wiring diagram

AGH675S-7



AGH675S-7MV15



Both AKs (one from each coupling device) are bridged and coupled with the AK from the IRDH275BM-7.

AGH676S-4

Coupling device

AC



Typical applications

- Extension of the nominal voltage range to AC, 3(N)AC 0…12 kV, 50…460 Hz for the ISOMETER®s iso685… series and IRDH275-4xx/IRDH375-4xx/IR420-D64

Further information

For further information refer to our product range on www.bender.de.

Approvals

Ordering information

Nominal system voltage U_S AC, 3(N)AC	Cable length	Type	Art. No.
0…12 kV, 50…460 Hz	2000 mm	AGH676S-4	B913055

Technical data

Insulation coordination acc. to IEC 61800-5-1

Rated insulation voltage	AC 12 kV

Voltage test acc. to IEC 61800-5-1

Type test

Voltage impulse test	≥ AC 75 kV
AC voltage test	≥ AC 45 kV
Partial discharge test	≥ 16.5 kVeff

Routine test

AC voltage test, rate of increase < 2 kV/s	AC 25 kV

Voltage ranges

Nominal system voltage Un	AC / 3(N)AC 0...12 kV
Nominal frequency fn	50...460 Hz
Internal DC resistance Ri	≥ 160 kΩ
Impedance Zi at 12 kV and 50 Hz	≥ 12 MΩ

Environmental conditions

Shock resistance IEC 60068-2-27 (during operation)	15 g/11 ms
Bumping IEC 60068-2-29 (during transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (during operation)	1 g / 10…150 Hz
Vibration resistance IEC 60068-2-6 (during transport)	2 g / 10…150 Hz
Ambient temperature, during operation	-10…+55 °C
Storage temperature range	-40…+70 °C
Climatic class acc. to IEC 60721-3-3	3K5 (except condensation and formation of ice)

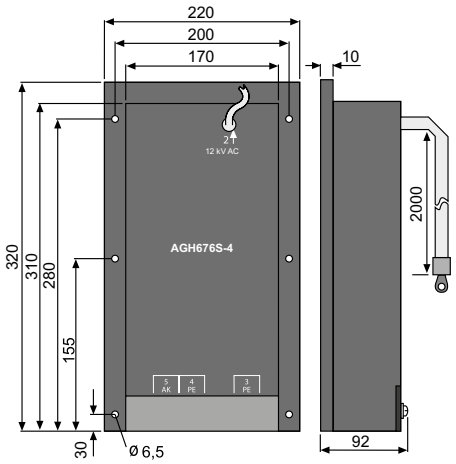
Connection

Connection medium voltage	high-voltage cable (encapsulated on the device side)
Connection, flexible with ring terminal	M8
Connection terminals 3, 4, 5	screw terminals
Connection properties rigid/flexible	0.2…4 mm²/0.2…2.5 mm²

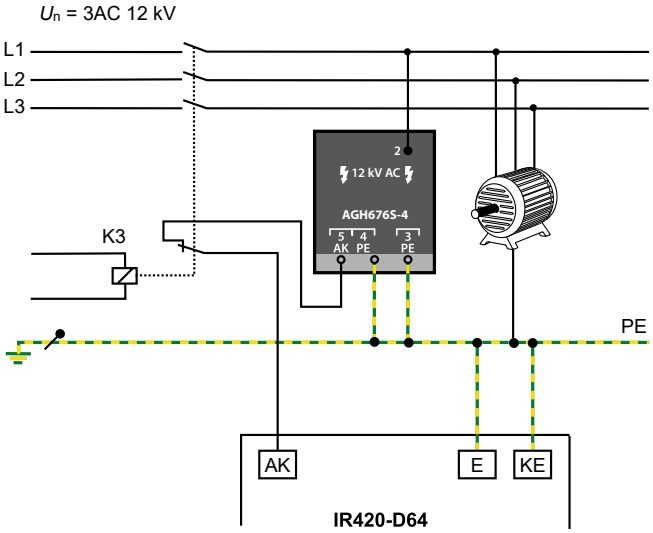
Other

Operating mode	continuous operation
Position	any position
Degree of protection, internal components (DIN EN 60529)	IP64
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	resin-encapsulated block
Screw fixing	M5
Flammability class	UL94 HB
Documentation number	D00096
Weight	≤ 8400 g

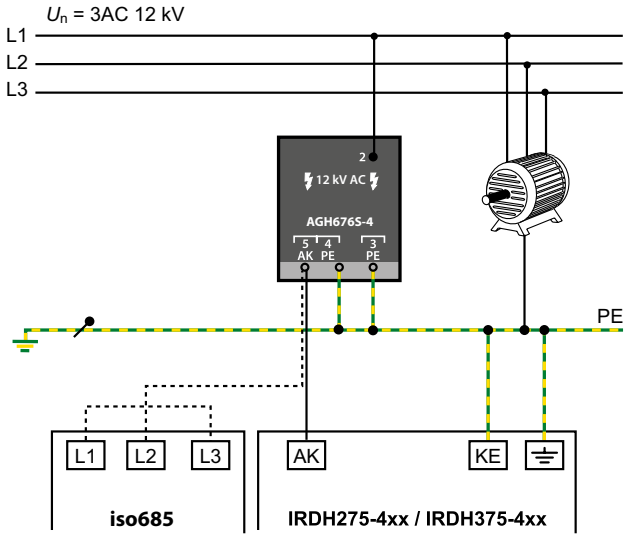
Dimension diagram (dimensions in mm)



Wiring diagram offline (IR420-D64)



Wiring diagram online (iso685/IRDH275-4xx/IRDH375-4xx)



W0-S20…W5-S210, W10/600

Measuring current transformers



Measuring current transformer W10/600



Measuring current transformer W0-S20



Measuring current transformer W1-S35

Typical applications

- For residual current monitors (RCM)
- For residual current monitoring systems (RCMS)
- For insulation fault locators with additional EDS in AC and DC systems

Standards

W0-S20…W5-S210 series measuring current transformers comply with the device standard: IEC 61869-1.

Approvals

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Inside diameter	Approvals			Type	Art. No.
	UL	EAC	LR		
10 mm	–	–	–	W10/600	B911761
20 mm	–	■	■	W0-S20	B911787
35 mm	■	■	–	W1-S35	B911731
70 mm	■	■	–	W2-S70	B911732
105 mm	■	■	–	W3-S105	B911733
140 mm	■	■	–	W4-S140	B911734
210 mm	■	■	–	W5-S210	B911735

Technical data

Insulation coordination acc. to IEC 60044-1	
Highest system voltage for electrical equipment U_m	AC 720 V
Rated impulse withstand voltage U_{isol}	3 kV

Measuring circuit	
Rated transformation ratio	600/1
Rated burden	180 Ω (18 Ω at 100 A)
Phase displacement	<4°
Rated primary current	≤10 A (100 A)
Rated primary current	≥10 mA
Nominal power	50 mVA
Rated frequency	15…400 Hz
Internal resistance	5…8 Ω
Secondary overvoltage protection	with suppressor diode P6KE6V8CP
Accuracy class	3
Rated continuous thermal current	100 A
Rated short-time thermal current	14 kA 1 s
Rated dynamic current	35 kA 30 ms

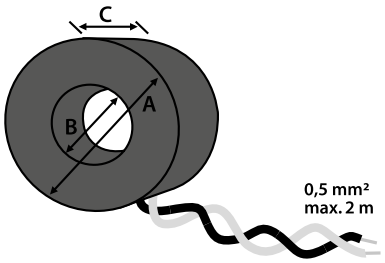
Environment	
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Virbation resistance IEC 60068-2-6 (device in operation)	
W1-S35…W3-S105	1 g/10…150 Hz
W4-S140, W5-S210	1 g/10…150 Hz/0.075 mm
Vibration resistance IEC 60068-2-6 (device not in operation)	2 g/10…150 Hz
Ambient temperature (during operation/during storage)	-10…+ 50 °C/-40…+ 70 °C
Climatic class acc. to DIN IEC 60721-3-3	3K5

Connection	
Connection	screw-type terminals
Connection	
rigid/flexible	0.2…/4/0.2…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12
Connection to the evaluator	
single wire ≥ 0.75 mm²	0…1 m
single wire, twisted ≥ 0.75 mm²	0…10 m
shielded cable ≥ 0.6 mm²	0…40 m
Shielded cable (shield connected to PE on one side)	recommended cable J-Y(St)Y min. 2 x 0.6

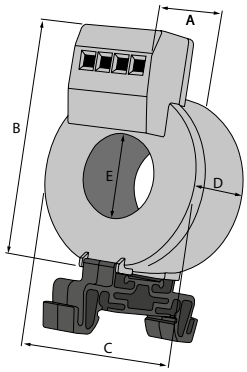
Other	
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Screw mounting	M5
Flammability class	UL94 V-0
Documentation number	D00142 (W(0-5)-S)
	D00143 (W10)

Dimension diagrams

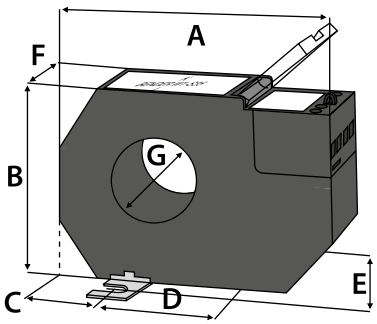
Type W10/600



Type W0-S20



Type W1-S35…W5-S210



Type	Dimensions (mm)							Weight
	A	B	C	D	E	F	G	
W10/600	ø 37	ø 10	18	–	–	–	–	85 g
W0-S20	32.4	60	ø 46	23.2	ø 20	–	–	70 g
W1-S35	100	79	26	48.5	33	46	ø 35	250 g
W2-S70	130	110	32	66	33	46	ø 70	380 g
W3-S105	170	146	38	94	33	46	ø 105	700 g
W4-S140	220	196	48.5	123	33	46	ø 140	1500 g
W5-S210	299	284	69	161	33	46	ø 210	2500 g

LINETRAXX® CTAC…

Measuring current transformers



Typical applications

- Für Differenzstrom-Überwachungssysteme der Serie RCM bzw. RCMS
- Für den Einsatz zur Isolationsfehlersuche für IT-Systeme (EDS) geeignet

Approvals

CE

Device features

Measuring current transformers CTAC…

- For RCMS460/490 residual current monitoring systems
- For RCM420 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators

Measuring current transformers CTAC…/01

- For EDS461 and EDS491 insulation fault locators

Standards

CTAC series measuring current transformers comply with the following device standard:

- IEC 61869-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Mounting	Inside diameter	Type	Art. No.
Mounting brackets, DIN rail	20 mm	CTAC20	B98110005
		CTAC20/01[1)]	B98110006
	35 mm	CTAC35	B98110007
		CTAC35/01[1)]	B98110008
	60 mm	CTAC60	B98110017
		CTAC60/01[1)]	B98110018
Mounting brackets	120 mm	CTAC120	B98110019
	210 mm	CTAC210	B98110020

[1)] For EDS461/491 and EDS473/474 insulation fault locators

Accessories

Type designation	Art. No.
Snap-on mounting for CTAC20 and CTAC20/01	B91080111
Snap-on mounting for CTAC35 and CTAC35/01	B91080112

Technical data

Insulation coordination acc. to IEC 60664-1	
Rated insulation voltage	800 V
Rated impulse voltage/pollution degree	8 kV/3

Measuring current transformer circuit CTAC…	
Rated primary residual current	10 A
Rated secondary residual current	0.0167 A
Rated transformation ratio K_n	10/0.0167 A
Rated burden	max. 180 Ω
Nominal power	0.05 VA
Frequency range	42 Hz…3 kHz
Rated continuous thermal current I_{cth}	40 A
Rated short-time thermal current I_{th}	60 x I_{cth} = 2.4 kA/1 s
Rated dynamic current I_{dyn}	2.5 x I_{th} = 6.0 kA/40 ms
Rated current I	
CTAC20 at $I_{\Delta n}$ ≥ 30 mA	40 A
CTAC20 at $I_{\Delta n}$ ≥ 300 mA	63 A
CTAC35 at $I_{\Delta n}$ ≥ 30 mA	80 A
CTAC35 at $I_{\Delta n}$ ≥ 300 mA	125 A
CTAC60 at $I_{\Delta n}$ ≥ 30 mA	160 A
CTAC60 at $I_{\Delta n}$ ≥ 300 mA	250 A
CTAC120 at $I_{\Delta n}$ ≥ 100 mA	330 A
CTAC210 at $I_{\Delta n}$ ≥ 300 mA	630 A

Measuring current transformer circuit CTAC…/01	
Rated primary residual current	1 A
Rated secondary residual current	0.125 mA
Rated transformation ratio K_n	1 A/0.125 mA
Frequency range	42 Hz…3 kHz
Rated continuous thermal current I_{cth}	6 A
Rated short-time thermal current I_{th}	60 x I_{cth} = 0.36 kA/1 s
Rated dynamic current I_{dyn}	2.5 x I_{th} = 0.9 kA/40 ms
Rated current I	
CTAC20/01	80 A
CTAC35/01	160 A
CTAC60/01	320 A

Environment	
Operating temperature	-25…+70 °C

Climatic class acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K5 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)

Classification of mechanical conditions IEC 60721	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-time storage (IEC 60721-3-1)	1M12

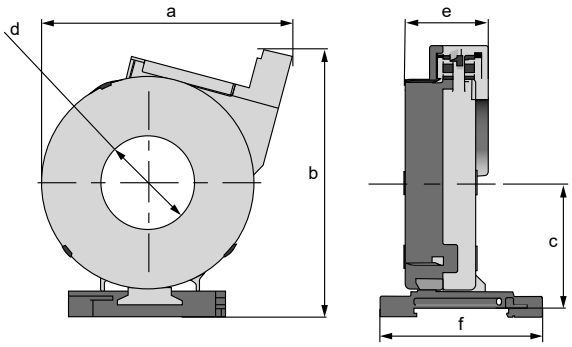
Connection	
Connection	cage clamp spring terminal
Connection	
rigid/flexible/conductor sizes	0.08…2.5/0.08…2.5 mm² (AWG 28…12)
Stripping length	8…9 mm

Connection EDS, RCM(S) measuring current transformers	
Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	0…10 m
Shielded cable ≥ 0.5 mm²	0…40 m
Shielded cable (shield on one side connected to L-conductor, not connected to earth)	recommended: J-Y(St)Y min. 2x0.8

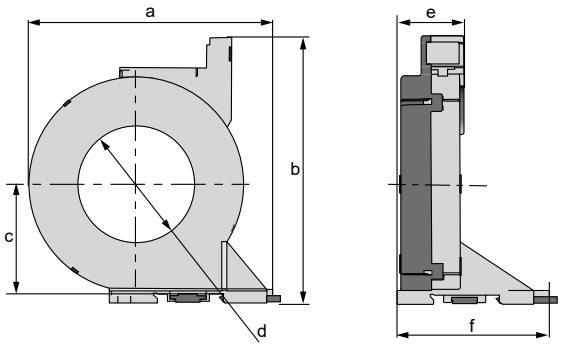
Other	
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (IEC 60529)	IP20
Screw mounting	M5 with mounting bracket
Flammability class	UL94 V-0
Documentation number	D00386

Dimension diagram

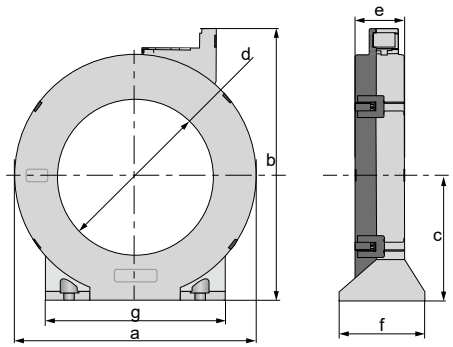
A



B

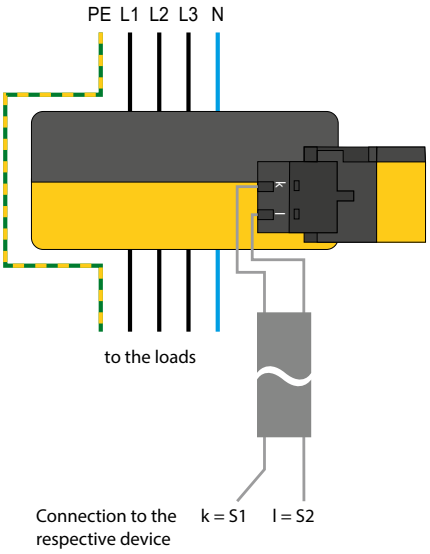


C



Dimensions (mm)								
	Type	a	b	c	d	e	f	g
A	CTAC20(/01)	75	82	37	ø 20	32	60	
	CTAC35(/01)	94	100	47	ø 35	30	61	
B	CTAC60(/01)	126	137	57	ø 60	33	78	
C	CTAC120(/01)	188	211	96	ø 120	38	66	139
	CTAC210(/01)	302	324	153	ø 210	40	74	277

Tolerance: ±0,5 mm



Measuring current transformers CTAC…
Connection to the respective residual current monitoring system RCMS, residual current monitors RCM or to insulation fault location systems EDS

Measuring current transformers CTAC…/01
Connection to the respective EDS474(E)-12, EDS461 and EDS491 insulation fault locator

LINETRAXX® CTUB100 series

AC/DC sensitive measuring current transformer (Type B)





Typical applications

- For RCMS460/490 residual current monitoring systems
- For RCM420/423 residual current monitors

Approvals

Device features

- Combined test and reset button
- Multicolour LED for operation, fault and status messages
- Exchangeable electronic module without mechanical separation of the primary conductors
- Extension/retrofitting or modification of functionalities in case of changed monitoring requirements
- Insensitive to load currents due to full magnetic shield (CTUB10x-CTBC20P… 210P only)
- Monitoring of the connection to the measuring current transformer
- Supply voltage DC ±12 V/DC 24 V
- CTUB101-CTBC20…60 for AC/DC sensitive residual current monitors of the RCMA420 series
- CTUB10x-CTBC20…210 for residual current monitoring systems of the RCMS460/490 series as well as for RCMA423 residual current monitor
- CTUB10x-CTBC20P…210P for residual current monitoring systems of the RCMS460/490 series as well as for RCMA420/423 residual current monitors. Can be used for short-term system-related load currents.

Standards

CTUB100 series measuring current transformers comply with the following device standard:

- IEC 62020 in combination with an evaluator (RCMS460/490 or RCMA420/423)

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage	Current transformer diameter	Shielding	Type	Art. No.
DC ±12 V	ø 20		CTUB101-CTBC20	B78120010
	ø 20	■	CTUB101-CTBC20P	B78120020
	ø 35		CTUB101-CTBC35	B78120012
	ø 35	■	CTUB101-CTBC35P	B78120022
	ø 60		CTUB101-CTBC60	B78120014
	ø 60	■	CTUB101-CTBC60P	B78120024
	ø 120		CTUB101-CTBC120	B78120016
	ø 120	■	CTUB101-CTBC120P	B78120026
	ø 210		CTUB101-CTBC210	B78120018
	ø 210	■	CTUB101-CTBC210P	B78120028
DC 24 V	ø 20		CTUB102-CTBC20	B78120011
	ø 20	■	CTUB102-CTBC20P	B78120021
	ø 35		CTUB102-CTBC35	B78120013
	ø 35	■	CTUB102-CTBC35P	B78120023
	ø 60		CTUB102-CTBC60	B78120015
	ø 60	■	CTUB102-CTBC60P	B78120025
	ø 120		CTUB102-CTBC120	B78120017
	ø 120	■	CTUB102-CTBC120P	B78120027
	ø 210		CTUB102-CTBC210	B78120019
	ø 210	■	CTUB102-CTBC210P	B78120029

Ordering details for accessories and spare parts

Electronic modules

Supply voltage U_s	Type	Art. No.
DC		
±12 V	CTUB101	B78120050
24 V (19,2…28,8 V)	CTUB102	B78120051

Required terminals or connecting cables are optionally available.

Connecting cables

Length (m)	Connection to	Type	Art. No.
1	RCMA42…	CTX-100	B98110080
2,5		CTX-250	B98110081
5		CTX-500	B98110082
10		CTX-1000	B98110083
1	RCMS46…	CTXS-100	B98110090
2,5		CTXS-250	B98110091
5		CTXS-500	B98110092
10		CTXS-1000	B98110093

Measuring current transformer cores

Internal diameter	Type	Art. No.
20 mm	CTBC20	B98120001
	CTBC20P	B98120002
35 mm	CTBC35	B98120003
	CTBC35P	B98120004
60 mm	CTBC60	B98120005
	CTBC60P	B98120006
120 mm	CTBC120	B98120007
	CTBC120P	B98120020
210 mm	CTBC210	B98120008
	CTBC210P	B98120021

P = full magnetic shield

Suitable system components

Description	max. connected current transformers	Type	Art. No.	Page
Voltage supply	4	STEP-PS/1 AC/24 DC/0.5	B94053110	364
	14	STEP-PS/1 AC/24 DC/1.75	B94053111	364
	34	STEP-PS/1 AC/24 DC/4.2	B94053112	364

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Definitions:	
Measuring circuit (IC1)	primary conductors routed through the current transformer
Secondary (IC2)	connections terminal block
Rated insulation voltage	800 V
Overvoltage category	III
Area of application	≤ 2000 m AMSL
Rated impulse voltage:	
IC1/IC2	8 kV
Rated insulation voltage (reinforced insulation):	
IC1/IC2	800 V
Pollution degree	2

Supply voltage

CTUB101

Description	+12 V, GND, -12 V
Supply voltage U_s	DC ±12 V
Operating range of U_s	±2 %
Ripple U_s	≤ 1 %
Power consumption	≤ 2.5 W
Inrush current	500 mA (related to the RCMA423)

CTUB102

Description	24 V, GND
Supply voltage U_s	DC 24 V
Operating range of U_s	±20 %
Ripple U_s	≤ 1 %
Power consumption	≤ 2.5 W
Inrush current	1A related to the Phoenix power supply unit (accessory), may vary and depends on various influencing factors

Measuring circuit

Internal diameter measuring current transformer	see dimension diagrams on page 341
Rated current I_n	
CTBC20 at $I_{\Delta n}$ = 30 mA	40 A
CTBC20 at $I_{\Delta n}$ = 300 mA	63 A
CTBC20P	80 A
CTBC35 at $I_{\Delta n}$ = 30 mA	80 A
CTBC35 at $I_{\Delta n}$ = 300 mA	125 A
CTBC35P	160 A
CTBC60 at $I_{\Delta n}$ = 30 mA	160 A
CTBC60 at $I_{\Delta n}$ = 300 mA	250 A
CTBC60P	320 A
CTBC120 at $I_{\Delta n}$ = 100 mA	330 A
CTBC120P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210 at $I_{\Delta n}$ = 300 mA	630 A
CTBC210P at $I_{\Delta n}$ = 100 mA	630 A
CTBC210P at $I_{\Delta n}$ = 300 mA	1000 A
Measurement accuracy	±1 %
Test winding	yes
Rated continuous thermal current I_{cth}	30 A
Rated short-time thermal current I_{th}	2.4 kA/1 s
Rated dynamic current I_{dyn}	6 kA/40 ms

Possible response values (to be set on the evaluator)

CTBC20, CTBC20P	10 mA…500 mA
CTBC35, CTBC35P, CTUBC60, CTBC60P	30 mA…10 A
CTBC120P, CTBC210P	100 mA…10 A
CTBC120, CTBC210	300 mA…10 A

Measuring ranges

Measuring range 1 ($I_{\Delta n}$ ≤ 0.1 A)	0…900 mA (peak)
Measuring range 2 (0.1 A < $I_{\Delta n}$ ≤ 0.5 A)	0…3.5 A (peak)
Measuring range 3 ($I_{\Delta n}$ > 0.5 A)	0…20 A (peak)

Indication

Multicolour LED	see table "System states: LED" on page 342

Technical data (continued)

Output

Name	S1 (k), S2 (l)
Scaling	400 mV/1 A
Max. voltage	±10 V
Max. connector length	10 m
Output resistance	172 Ω

Input

Name	T (only on CTUB101)
Current-carrying capacity	< 300 mA

Environment/EMC

EMC	IEC 62020: 2005-11
Operating temperature	-25…70 °C
Classification of climatic conditions acc. to IEC 60721 (except condensation and formation of ice)	
Stationary use (IEC 60721-3-3)	3K5
Transport (IEC 60721-3-2)	2K11
Long-term storage (IEC 60721-3-1)	1K22
Classification of mechanical conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12

Connection

Connecting cables are optionally available

Terminal block

Manufacturer	Phoenix Contact
Type	DFMC 1.5/4-ST-3.5 BK
The connection conditions of the manufacturer apply.	
Connection properties	
rigid	0.2…1.5 mm² (AWG 24…16)
flexible	0.2…1.5 mm²
with ferrule	0.25…0.75 mm²

Mounting CTBC…

Screw type	
CTBC20…60(P)	DIN EN ISO 7045 - M5
CTCB120…210(P)	DIN EN ISO 7045 - M6
Washer type	
CTBC20…60(P)	DIN EN ISO 7089/7090 - 5
CTCB120…210(P)	DIN EN ISO 7089/7090 - 6
Tightening torque	
CTBC20…35 (P)	0.6 Nm
CTCB60…210(P)	1 Nm

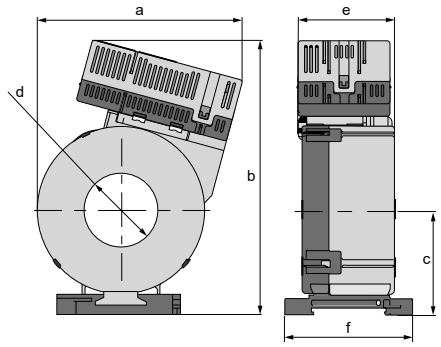
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Flammability class	UL94 V-0
Software	D591
Weight	
CTUB10x- CTBC20	≤ 230 g
CTUB10x- CTBC20P	≤ 290 g
CTUB10x- CTBC35	≤ 310 g
CTUB10x- CTBC35P	≤ 390 g
CTUB10x- CTBC60	≤ 530 g
CTUB10x- CTBC60P	≤ 690 g
CTUB10x- CTBC120	≤ 1460 g
CTUB10x- CTBC120P	≤ 1820 g
CTUB10x- CTBC210	≤ 4290 g
CTUB10x- CTBC210P	≤ 4940 g

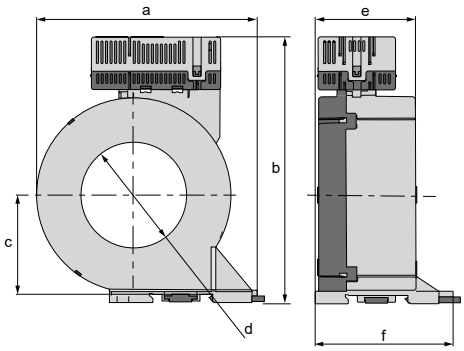
The use of the power supply units listed at “Accessories” is recommended.
The use of a surge protection device is mandatory.

Dimension diagrams

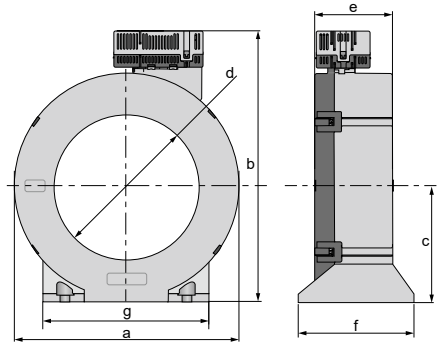
A



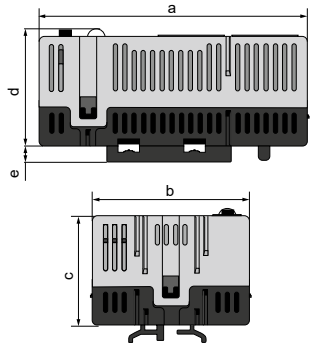
B



C



D



Dimensions (mm)								
	Type	a	b	c	d	e	f	g
A	CTUB10…-CTBC20(P)	75	83	37	ø 20	46	60.5	
	CTUB10…-CTBC35(P)	97	130	47	ø 35	46	61	
B	CTUB10…-CTBC60(P)	126	151	57	ø 60	56	78	
C	CTUB10…-CTBC120(P)	188	225	96	ø 120	65	96	139
	CTUB10…-CTBC210(P)	302	339	153	ø 210	67	113	277
D	CTUB10…	74	44	30	32	4.6		

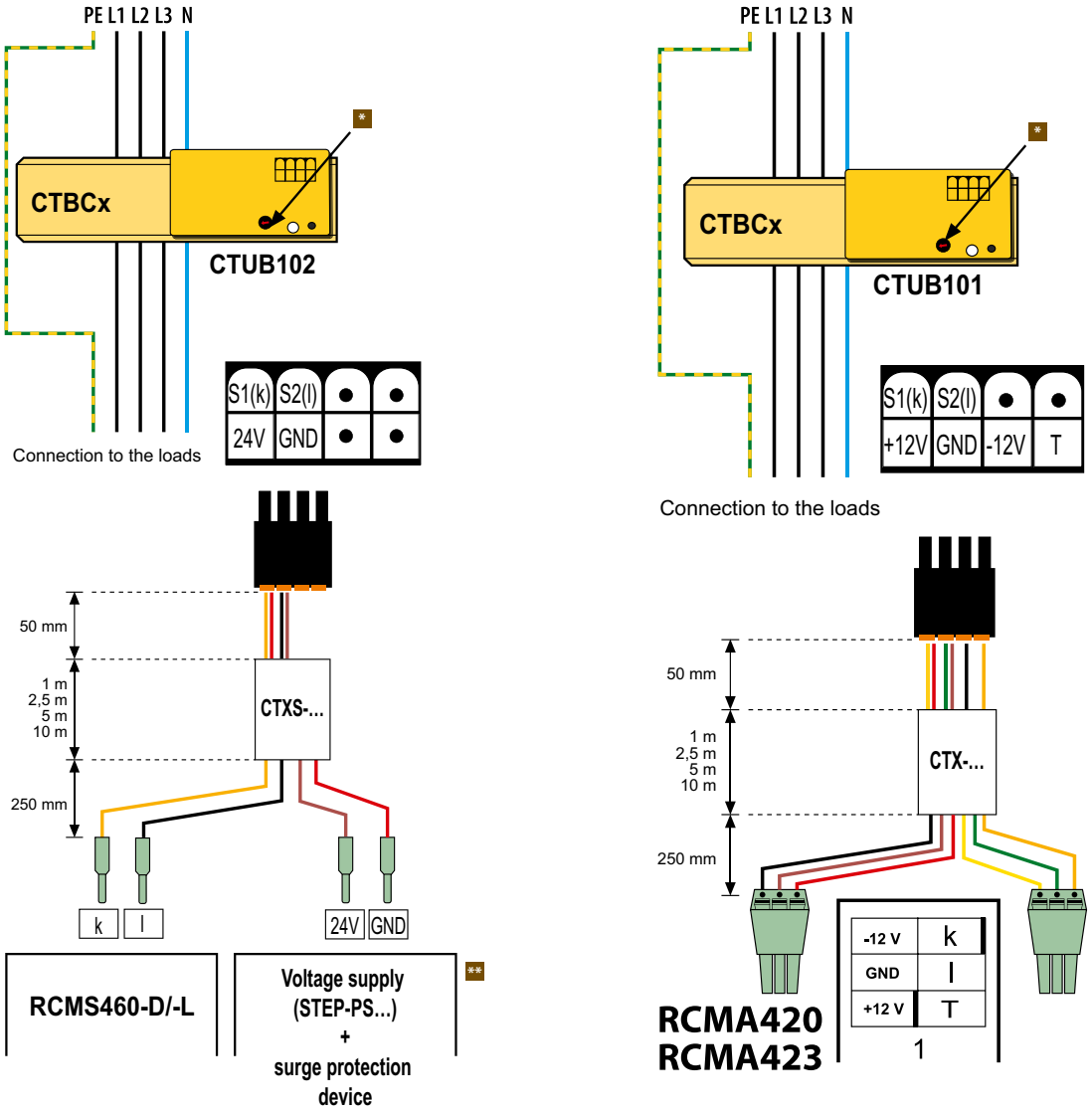
Tolerance: ±0.5 mm

System states: LED

The LED indicates the system state by means of colours and lighting/flashing.
The priority specifies which system state is displayed if different conditions exist.

System state	LED		Notes
	green (ON)	red (alarm)	
Device switched off	off	off	Device is deenergised
Normal operating state	lights	off	The device is supplied with the specified voltage and the measuring current transformer core is connected to the electronic module.
Device error	off	flashes	The device is supplied with the specified voltage but there is no connection to the measuring current transformer core.

Wiring diagram



* The measuring range must be selected according to the response value $I_{\Delta N}$ set on the RCMS460 or RCMA420/423 evaluator.
If, however, a larger measuring range is selected, the resolution deteriorates.

Measuring range setting				
#	Potentiometer setting	Response value RCMA/RCMS	Measuring range r.m.s.	Measuring range peak
1	↙	$I_{\Delta n} \leq 0.1$ A	0…450 mA	0…900 mA
2	↑	0.1 A < $I_{\Delta n} \leq 0.5$ A	0…0.75 A	0…3.5 A
3	↘	$I_{\Delta n} > 0.5$ A	0…10 A	0…20 A

** – The use of a type 2 surge protection device (SPD) is mandatory due to possible impulse voltages and in order to comply with normative requirements.
– The surge protection device must be connected upstream of the power supply unit on the supply side.
– The surge protection device 7P.22.8.275.1020 from Finder or an equivalent alternative can be used.

WR70x175S(P)…WR200x500S(P) series

Measuring current transformers





Measuring current transformers WR70x175S(P)



Measuring current transformers WR200x500S(P)

Typical applications

- For RCMS460/490 residual current monitoring systems
- For RCM420 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems
- The WR…SP measuring current transformers are particularly suitable for use in busbar systems. This series is to be used for load currents ≥ 500 A.

Standards

WR70x175S(P)…WR200x500S(P) measuring current transformers comply with the device standards:

- DIN EN 60044-1
- IEC 61869.

Further information

For further information refer to our product range on www.bender.de.

Approvals

Ordering information

Screening	Internal dimensions	Approvals	Type	Art. No.
		UL		
without screening	70 x 175 mm	■	WR70x175S	B911738
	115 x 305 mm	■	WR115x305S	B911739
	150 x 350 mm	■	WR150x350S	B911740
	200 x 500 mm	–	WR200x500S	B911763
Screening integrated	70 x 175 mm	–	WR70x175SP	B911790
	115 x 305 mm	–	WR115x305SP	B911791
	150 x 350 mm	–	WR150x350SP	B911792
	200 x 500 mm	–	WR200x500SP	B911793

6.1

Technical data

Insulation coordination acc. to IEC 61869-2	
Highest system voltage for electrical equipment U_m	AC 720 V
Rated impulse withstand voltage U_{isol}	3 kV

Measuring circuit	
Rated transformation ratio	600/1
Rated burden	180 Ω
Rated primary current	≤ 10 A (100 A)
Rated primary current	≥ 10 mA
Nominal power	50 mVA
Rated frequency	50…400 Hz
Internal resistance	5…8 Ω
Secondary overvoltage protection	suppressor diode P6KE6V8CP
Accuracy class	5
Rated continuous thermal current	100 A
Rated short-time thermal current	14 kA/1 s
Rated dynamic current	35 kA/30 ms

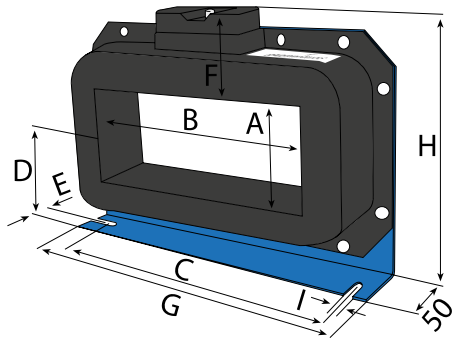
Environment	
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 s
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+50 °C
Ambient temperature (during storage)	-40…+70 °C
Climatic class acc. to DIN IEC 60721-3-3	3K5

Connection	
Connection	screw-type terminals
Connection	
rigid/flexible	0.2…4/0.2…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12
Connection to the evaluator	
single wire ≥ 0.75 mm²	0…1 m
single wire, twisted ≥ 0.75 mm²	0…10 m
shielded cable ≥ 0.6 mm²	0…40 m
Shielded cable (shield on one side connected to PE)	recommended: J-Y(St)Y min. 2 x 0.6

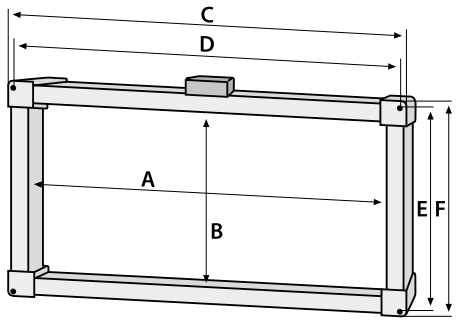
Other	
Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Screw mounting	M5
Flammability class	UL94 V-0
Documentation number	D00144

Dimension diagrams

WR70x175S(P)…WR150x350S(P)

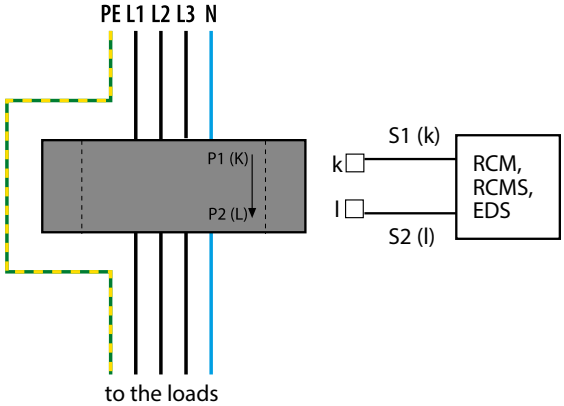


WR200x500S(P)



Type	Dimensions (mm)									Weight
	A	B	C	D	E	F	G	H	I	
WR70x175S(P)	70	175	225	85	22	46	261	176	7.5	2900 g
WR115x305S(P)	115	305	360	116	25	55	397	240	8	6300 g
WR150x350S(P)	150	350	415	140	28	55	460	285	8	8250 g
WR200x500S(P)	500	200	585	568.5	268.5	285	–	–	–	9000 g

Wiring diagram



WS…/WS…-8000 series

Split-core type measuring current transformers



Typical applications

WS… measuring current transformers

- For RCMS460/490 residual current monitoring systems
- For RCM420/RCM460 residual current monitors
- For EDS470, EDS460/490 and EDS440 insulation fault locators in AC and DC systems

WS…-8000 measuring current transformer

- For EDS473(E)-12, EDS474(E)-12, EDS461 and EDS491 insulation fault locators

Approvals

Standards

WS… and WS…-8000 measuring current transformers comply with the device standard: IEC 61869-1.

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Mounting	Internal dimensions	Type	Art. No.
Mounting brackets	20 x 30 mm	WS20x30	B98080601
		WS20x30-8000[1)]	B98080602
	50 x 80 mm	WS50x80	B98080603
		WS50x80-8000[1)]	B98080604
	80 x 120 mm	WS80x120	B98080606

[1)] For EDS461/491 and EDS473/474 insulation fault locators

Selection list

Type	RCM420	RCMS460 RCMS490	EDS460 EDS490	EDS461 EDS491	EDS440	EDS441	EDS441-LAB
WS20x30	■	■	■	–	■	–	–
WS50x80	■	■	■	–	■	–	–
WS80x120	■	■	■	–	■	–	–
WS20x30-8000	–	–	–	■	–	■	■
WS50x80-8000	–	–	–	■	–	■	■

6.1

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3	
Rated insulation voltage	800 V
Rated impulse voltage/pollution degree	8 kV/3

CT circuit WS…	
Rated primary residual current	10 A
Rated secondary residual current	0.0167 A
Rated transformation ratio K_n	10/0.0167 A
Rated burden	max. 180 Ω
Nominal power	0.05 VA
Frequency range	42 Hz…3 kHz
Rated continuous thermal current I_{cth}	40 A
Rated short-time thermal current I_{th}	60 x I_{cth} = 2.4 kA/1 s
Rated dynamic current I_{dyn}	2.5 x I_{th} = 6.0 kA/40 ms

CT circuit WS…-8000	
Rated primary residual current	1 A
Rated secondary residual current	0.125 mA
Rated transformation ratio K_n	1 A/0.125 mA
Frequency range	42 Hz…3 kHz
Rated continuous thermal current I_{cth}	6 A
Rated short-time thermal current I_{th}	60 x I_{cth} = 0.36 kA/1 s
Rated dynamic current I_{dyn}	2.5 x I_{th} = 0.9 kA/40 ms

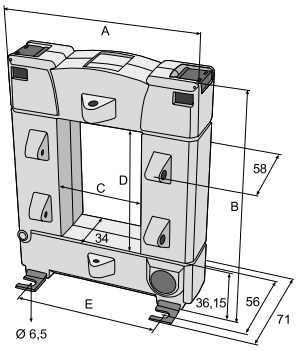
Environmental conditions	
Operating temperature	-25…+70 °C
Classification of climatic conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K5 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K5 (except condensation and formation of ice)
Classification of mechanical conditions IEC 60721	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection	
Connection	screw-type terminals
Connection rigid/flexible/conductor sizes	0.08…2.5 mm² (AWG 28…12)
Stripping length	8…9 mm

Connection EDS, RCM(S) measuring current transformers	
Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	0…10 m
Shielded cable ≥ 0.5 mm²	0…40 m
Shielded cable (shield on one side connected to L-conductor, not connected to earth)	recommended: J-Y(St)Y min. 2x0.8

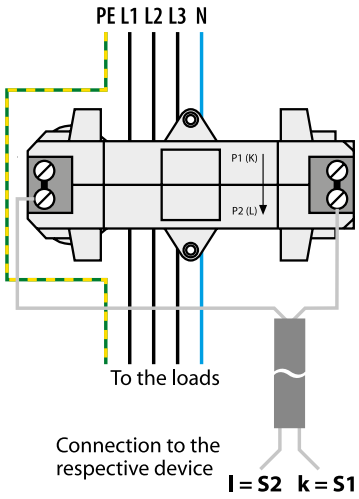
Other	
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Screw mounting	M5 with mounting brackets
Flammability class	UL94 V-0
Documentation number	D00077
Approvals and certifications	UL under development

Dimension diagram



Dimensions (mm)						Weight
Type	A	B	C	D	E	
WS20x30	93	106.15	23	33	64	≤ 600 g
WS50x80	125	158.15	55	85	96	≤ 1040 g
WS80x120	155	198.15	85	125	126	≤ 1400 g
WS20x30-8000	93	106.15	33	33	64	≤ 630 g
WS50x80-8000	125	158.15	85	85	96	≤ 1080 g

Wiring diagram



WS… series measuring current transformers
Connection to the respective RCMS series residual current monitoring system, RCM series residual current monitors or to EDS series insulation fault location systems

WS…-8000 measuring current transformer
Connection to the respective EDS461 and EDS491 insulation fault locator

WS50x80S…WS80x160S series

Split-core type measuring current transformers



Measuring current transformer WS50x80S



Measuring current transformer WS80x160S

Typical applications

- For residual current monitors (RCM)
- For residual current monitoring systems (RCMS)
- For insulation fault locators with additional EDS in AC and DC systems

Standards

WS… measuring current transformers comply with the device standard:

- IEC 61869-1.

Approvals

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Internal dimensions	Approvals		Type	Art. No.
	UL	EAC		
50 x 80 mm	■	■	WS50x80S	B911741
80 x 80 mm	■	■	WS80x80S	B911742
80 x 120 mm	■	■	WS80x120S	B911743
80 x 160 mm	–	■	WS80x160S	B911755

Technical data

Insulation coordination acc. to IEC 60044-1

Highest system voltage for electrical equipment U_m	AC 720 V
Rated impulse withstand voltage U_{isol}	3 kV

Measuring circuit

Rated transformation ratio	600/1
Rated burden	180 Ω
Rated primary current	≤ 10 A (100 A)
Rated primary current	≥ 10 mA
Nominal power	50 mVA
Rated frequency	50…400 Hz
Internal resistance	5…8 Ω
Secondary overvoltage protection	with suppressor diode P6KE6V8CP
Accuracy class	5
Rated continuous thermal current	100 A
Rated short-time thermal current	14 kA/1 s
Rated dynamic current	35 kA/30 ms

Environment

Standard	IEC 60044-1
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 s
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	-10…+50 °C
Storage temperature range	-40…+70 °C
Climatic class acc. to DIN IEC 60721-3-3	3K5

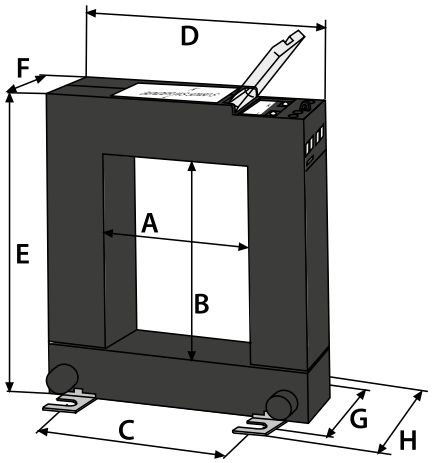
Connection

Connection	screw-type terminals
Connection	
rigid/flexible	0.2…4/0.2…2.5 mm²
flexible with ferrules with/without plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12
Connection to the evaluator	
single wire ≥ 0.75 mm²	0…1 m
single wire, twisted ≥ 0.75 mm²	0…10 m
shielded cable ≥ 0.6 mm²	0…40 m
Shielded cable (shield on one side connected to PE)	recommended: J-Y(St)Y min. 2 x 0.6

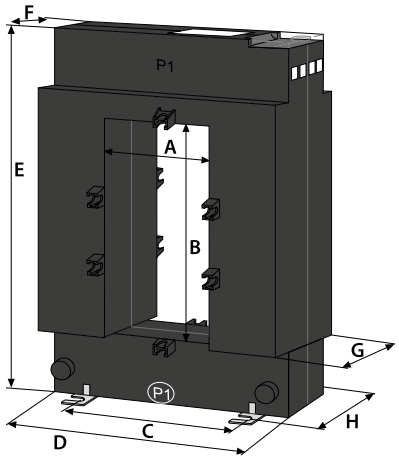
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (DIN EN 60529)	IP40
Degree of protection, terminals (DIN EN 60529)	IP20
Screw mounting	M5
Flammability class	UL94 V-0
Documentation number	D00145

WS50x80S…WS80x120S



WS80x160S



Dimensions (mm)									Weight
Type	A	B	C	D	E	F	G	H	
WS50x80S	50	80	78	114	145	32	45	59	900 g
WS80x80S	80	80	108	144	145	32	45	59	1050 g
WS80x120S	80	120	108	144	185	32	45	59	1250 g
WS80x160S	80	160	120	184	225	32	52	59	2550 g

LINETRAXX® Series WF...

Consisting of an RCC420 signal converter and a W…F measuring current transformer
Flexible WF170, WF250, WF500, WF800, WF1200, WF1800 measuring current transformers





Typical applications

- Residual, fault and nominal current monitoring of loads and systems which cannot be switched off
- EMC monitoring of TN-S systems for "stray currents" and additional N-PE connections in the central earthing point (CEP)
- Monitoring of PE and equipotential bonding conductors to ensure they are free of current

Device features

- Flexible measuring current transformer in different lengths
- Space-saving design, quick installation
- Easy retrofitting into existing installations
- Can be installed without the need to disconnect the conductors
- Connection monitoring WF… measuring current transformers
- For RCMS460/490 series residual current monitoring systems
- For RCM420 series residual current monitors
- Analogue output (U, I) for external measuring devices
- RCC420 with push-wire terminals (two terminals per connection)

Further information

For further information refer to our product range on www.bender.de.

Approvals

CE

Ordering information

Length A measuring current transformer	Supply voltage U_S[1]		Type	Art. No.
	DC	AC		
170 mm	9.6…94 V	16…72 V, 42…460 Hz	WF170-1	B78080201
	70…300 V	70…300 V, 42…460 Hz	WF170-2	B78080202
250 mm	9.6…94 V	16…72 V, 42…460 Hz	WF250-1	B78080203
	70…300 V	70…300 V, 42…460 Hz	WF250-2	B78080204
500 mm	9.6…94 V	16…72 V, 42…460 Hz	WF500-1	B78080205
	70…300 V	70…300 V, 42…460 Hz	WF500-2	B78080206
800 mm	9.6…94 V	16…72 V, 42…460 Hz	WF800-1	B78080207
	70…300 V	70…300 V, 42…460 Hz	WF800-2	B78080208
1200 mm	9.6…94 V	16…72 V, 42…460 Hz	WF1200-1	B78080209
	70…300 V	42…460 Hz, 70…300 V	WF1200-2	B78080210
1800 mm	9.6…94 V	16…72 V, 42…460 Hz	WF1800-1	B78080221
	70…300 V	42…460 Hz, 70…300 V	WF1800-2	B78080222

[1] Absolute values

Accessories

Description	Type	Art. No.
Mounting clip for screw mounting (1 piece per device)	XM420 (RCC420)	B98060008

6.1

Technical data

Electrical safety	
Standard: RCC420	IEC 61010-2-030: 2004-05-01
Pollution degree	3
Rated insulation voltage	250 V
Standard: WF…	IEC 61010-1 and IEC 61010-2-032 CAT III
Pollution degree	2
Rated insulation voltage (CAT III)	1000 V_{rms} or DC

Supply voltage	
Supply voltage U_S	see ordering information
Power consumption	≤ 3 VA

Measuring circuit	
Measuring range	100 mA…20 A
Rated transformation ratio	K_n (U -I): 100 mV/A, K_N (k -I): 1.67 mA/A
Rated burden (signal output k, l)	68 Ω
Rated frequency	42…2000 Hz
Rated continuous thermal current I_{cth}	1 kA
Rated short-time thermal current I_{th}	60 kA/1 s
Rated dynamic current I_{dyn}	150 kA/40 ms

Environment/EMC	
EMC	IEC 62020
Operating temperature	-25…+55 °C
Classification of climatic conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-time storage (IEC 60721-3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-time storage (IEC 60721-3-1)	1M3

Connection RCC420	
Connection type	push-wire terminal
Connection properties	
rigid	0.2…2.5 mm² (AWG 24…14)
flexible without ferrule	0.75…2.5 mm² (AWG 19…14)
flexible with ferrule	0.2…1.5 mm² (AWG 24…16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm
Connection measuring current transformer W…F	PS/2 plug
Cable length WF…	2 m

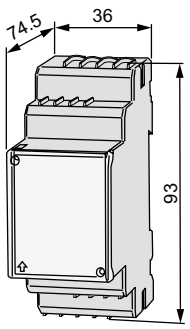
Cable lengths RCMS-RCC420…	
Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	0…10 m
Shielded cable ≥ 0.5 mm²	0…40 m
Shielded cable (shield to terminal l, not connected to earth)	recommended: J-Y(St)Y min. 2x0.8

Other		
Operating mode		continuous operation
Mounting		any position
Degree of protection, internal components (IEC 60529)		IP30
Degree of protection, terminals (IEC 60529)		IP30
Enclosure material RCC420		polycarbonate
Screw mounting		2 x M4 with mounting clip
DIN rail mounting acc. to		IEC 60715
Flammability class		UL94V-0
Documentation number		D00072
Weight		RCC 420 ≤ 160 g
	WF170 ≤ 160 g	WF800 ≤ 230 g
	WF250 ≤ 180 g	WF1200 ≤ 310 g
	WF500 ≤ 200 g	WF1800 ≤ 430g

Note: The measuring current transformer is adapted to the associated signal converter RCC420.

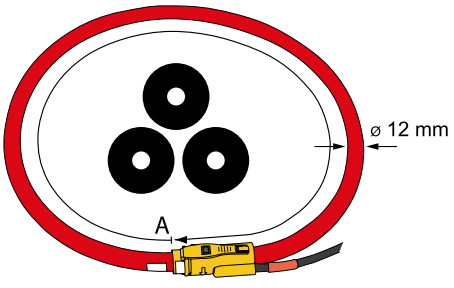
Dimension diagrams (dimensions in mm)

XM420 (RCC420)



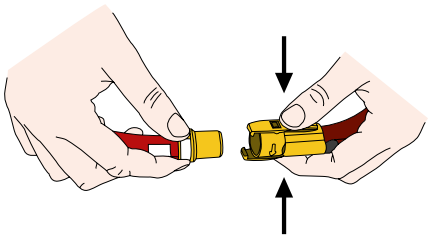
WF… measuring current transformers

A = For details about the length of the measuring current transformer refer to ordering information.

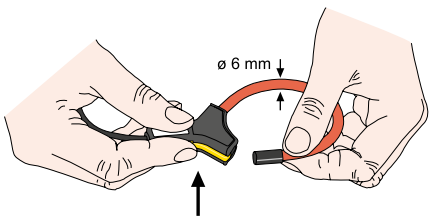


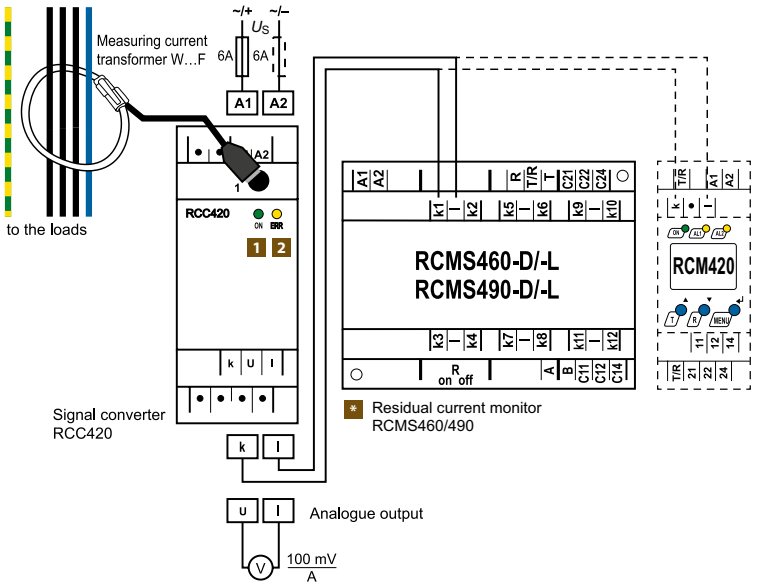
Dimension diagrams (dimensions in mm)

Locking connector measuring current transformer WF500…WF1800
Keep the locking connector clean



Locking connector WF170…WF250





Connection to the respective RCMS460/490 residual monitoring system or to an RCM420 residual current monitor.

1 Power On LED "ON": lights up when voltage is available and when the device is in operation

2 Alarm LED "ERR": Lights in the event of a short circuit and interruption of the WF…

* When using software version D233 V 2.21 or an earlier version, switch off CT monitoring

When using software version D233 V 2.31 or higher, set the CT type to "flex".

Isolating transformer ES710

Single-phase isolating transformers for the design of medical IT systems



Typical applications

- For IT systems in medical locations

Approvals

VDE test mark for all ES710/3150… ES710/10000 and ES…GL types, ES…SK2, ES…SN-GL are not VDE certified,

Device features

- Built-in temperature sensors acc. to DIN 44081 (120 °C)
- Screen winding with brought-out insulated connection terminal
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Degree of protection, IP23 (with enclosure)
- Protection class I
- Protection class II (option: encapsulated version)
- Reinforced insulation
- Classification of insulation: ta40/B
- Connections: screw terminals
- Noise level < 35 dB (A)(no-load and nominal load)
- Vector group: IiO
- Inrush current I_E GL version < 8 x $\hat{I}_n$

Standards

ES710 isolating transformers comply with the device standards and the regulations for installation:

- DIN EN 61558-1 (VDE 570-1)
- IEC 61558-1
- DIN VDE 0100-710 (VDE 0100-710)
- DIN EN 61558-2-15 (VDE 0570-2-15)
- IEC 61558-2-15
- IEC 60364-7-710

Further information

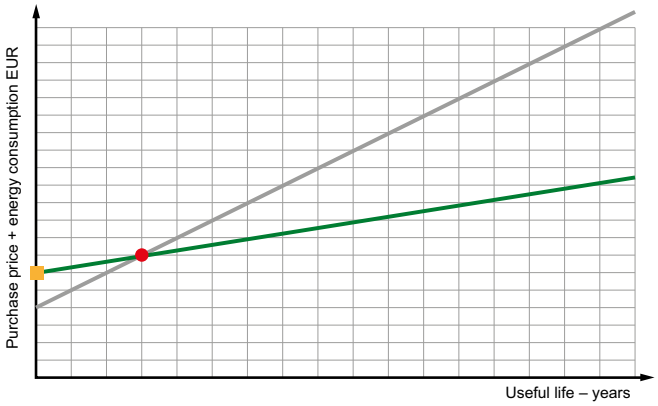
For further information refer to our product range on www.bender.de.

Technical data

Type ES710/3150	ES710/4000	ES710/5000	ES710/6300	ES710/8000	ES710/10000	
Power/voltages/currents						
Rated power	3150 VA	4000 VA	5000 VA	6300 VA	8000 VA	10000 VA
Rated frequency	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz
Rated input voltage	AC 230 V	AC 230 V	AC 230 V	AC 230 V	AC 230 V	AC 230 V
Rated input current	14.2 A	18 A	22.5 A	28.5 A	36 A	45.3 A
Rated output voltage	AC 230/115 V	AC 230/115 V	AC 230/115 V	AC 230/115 V	AC 230/115 V	AC 230/115 V
Rated output current	13.7 A	17.4 A	21.7 A	27.4 A	34.7 A	43.5 A
Inrush current I_E	< 12 x $\hat{I}_n$	< 12 x $\hat{I}_n$	< 12 x $\hat{I}_n$	< 12 x $\hat{I}_n$	< 12 x $\hat{I}_n$	< 12 x $\hat{I}_n$
Inrush current I_E GL version	< 8 x $\hat{I}_n$	< 8 x $\hat{I}_n$	< 8 x $\hat{I}_n$	< 8 x $\hat{I}_n$	< 8 x $\hat{I}_n$	< 8 x $\hat{I}_n$
Leakage current	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA
No-load input current i_0	≤ 3 %	≤ 3 %	≤ 3 %	≤ 3 %	≤ 3 %	≤ 3 %
No-load input current i_0 GL version	≤ 2 %	≤ 2 %	≤ 2 %	≤ 2 %	≤ 2%	≤ 2%
No-load output voltage U_0	≤ 236 V	≤ 234 V	≤ 234 V	≤ 235 V	≤ 233 V	≤ 233 V
Short-circuit voltage U_k	≤ 3 %	≤ 3 %	≤ 3 %	≤ 3 %	≤ 3 %	≤ 3 %
Environmental conditions						
Ambient temperature	≤ 40 °C	≤ 40 °C	≤ 40 °C	≤ 40 °C	≤ 40 °C	≤ 40 °C
No-load temperature rise	≤ 20 °C	≤ 23 °C	≤ 26 °C	≤ 23 °C	≤ 35 °C	≤ 37 °C
Full-load temperature rise	≤ 69 °C	≤ 48 °C	≤ 62 °C	≤ 65 °C	≤ 70 °C	≤ 70 °C
Noise level (under no-load conditions and nominal load)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)
Other						
Insulation classification	t_a40/B	t_a40/B	t_a40/B	t_a40/B	t_a40/B	t_a40/B
Degree of protection	IP00	IP00	IP00	IP00	IP00	IP00
Protection class	I/II*	I/II*	I/II*	I/II*	I/II*	I/II*
Core U/I	180/93	210/63	210/73	210/88	210/103	240/83
Core U/I GL version	180/93	210/63	210/73	210/88	210/103	210/120
Recommended use when used in accordance with DIN VDE 0100-710	25 A gL/gG	35 A gL/gG	50 A gL/gG	50 A gL/gG	63 A gL/gG	80 A gL/gG
Recommended use when used in accordance with DIN VDE 0100-710 GL version	25 A gL/gG	25 A gL/gG	35 A gL/gG	50 A gL/gG	50 A gL/gG	63 A gL/gG
Induction	0.86 T	0.94 T	1.00 T	1.05 T	1.05 T	1.05 T
$R_{primary}$ ±5 %	0.255 Ω	0.135 Ω	0.100 Ω	0.080 Ω	0.064 Ω	0.050 Ω (-GL 0,054)
$R_{secondary}$ ±5 %	0.230 Ω	0.110 Ω	0.095 Ω	0.070 Ω	0.056 Ω	0.036 Ω (-GL 0,045)
Efficiency	95 %	96 %	96 %	96 %	96 %	96 %
Documentatin number: D00109						
Loss at 20…22 ° C ambient temperature						
Fe loss (iron loss)	< 55 W	< 60 W	< 80 W	< 105 W	< 110 W	< 150 W
Fe loss (iron loss) GL version	< 18 W	< 20 W	< 26 W	< 33 W	< 38 W	< 42 W
Cu loss (copper loss)	< 90 W	< 80 W	< 100 W	< 125 W	< 165 W	< 190 W
Cu loss (copper loss) GL version	< 90 W	< 80 W	< 100 W	< 125 W	< 165 W	< 205 W
Heat dissipation loss at 40 ° C ambient temperature and 100 % continuous load						
Heat dissipation loss	< 165 W	< 160 W	< 202 W	< 265 W	< 320 W	< 380 W
Heat dissipation loss GL version	< 125 W	< 115 W	< 140 W	< 185 W	< 230 W	< 270 W

* Option: completely encapsulated version
Energy efficient version GL = Green Line

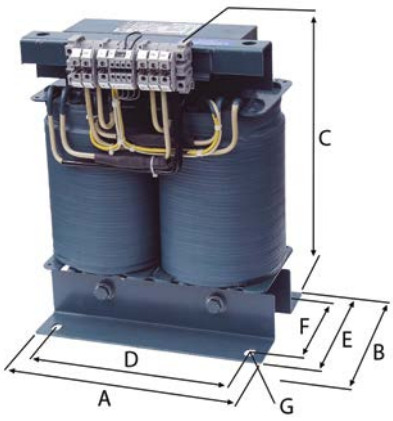
Green Line transformer (energy efficient version) – High degree of energy saving over the life time (16 years AfA) (German AfA table for deprecation of wear and tear)



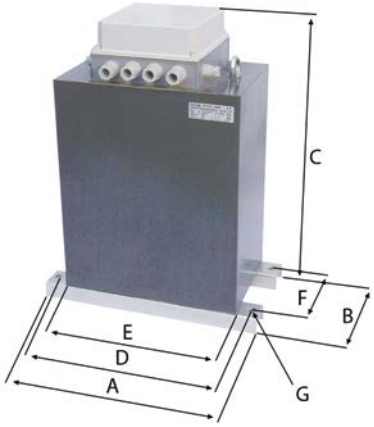
This general illustration is based on calculations of the transformer's energy consumption while energy costs remained constant at 13.4 ct/kWh (source: first energy) for 16 years. The wide variety of bandwidths result from the different transformer capacities.

Afa = Deprecation of wear and tear
= Standard version
= GL version (Green Line)
= A higher purchase price of approx. 15-20%
= ROI (Return on Investment) after about 1-3 years

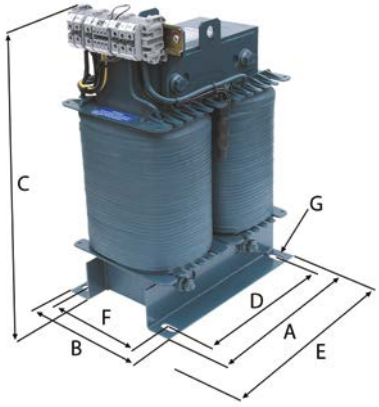
Standard
Dimension B is the depth incl. terminals



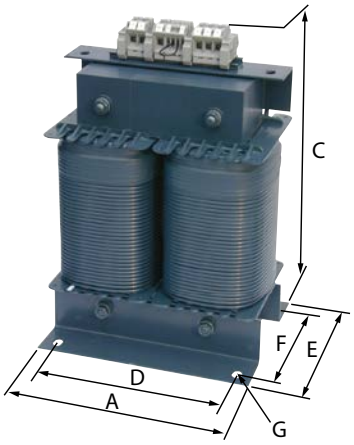
SK2 series



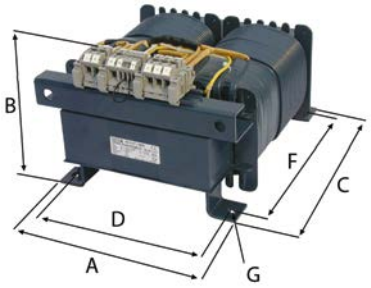
S series
Dimension E is the depth incl. terminals



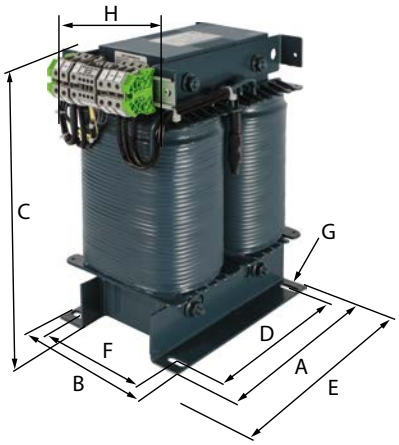
K series



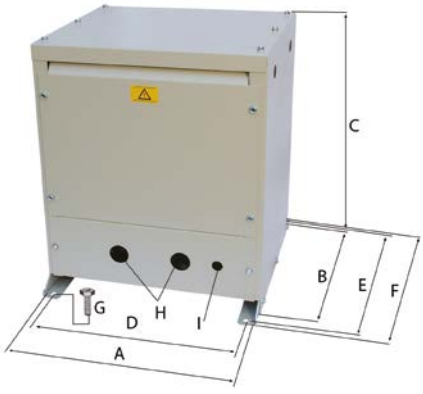
LG series



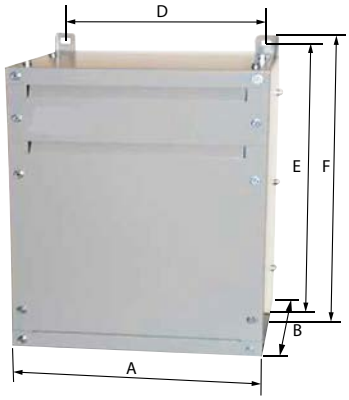
SN-GL series



Enclosure ESDS0107-1



Enclosure ESDS710



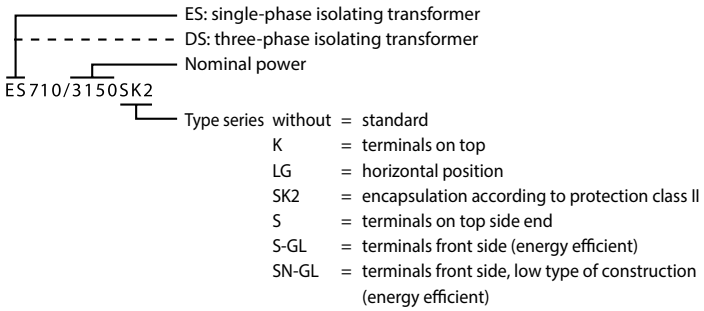
Ordering information

	Dimensions (mm)							Cu weight (kg)	Weight (kg)	Core U/I	Type	Art. No.
	A	B	C	D	E	F	G					
GL series	240	230	325	200	180	145	11 x 28	15	49	180/93	ES710/3150-GL	B92090001
	280	200	370	240	150	115	11 x 28	24	59	210/63	ES710/4000-GL	B92090002
	280	210	370	240	160	125	11 x 28	25	61	210/73	ES710/5000-GL	B92090003
	280	225	370	240	175	140	11 x 28	26	65	210/88	ES710/6300-GL	B92090004
	280	240	370	240	190	155	11 x 28	27	74	210/103	ES710/8000-GL	B92090005
	280	255	370	240	205	170	11 x 28	33	85	210/120	ES710/10000-GL	B92090006
S-GL series	280	180	370	240	290	145	11 x 28	15	49	180/93	ES710/3150S-GL	B92090061
	280	150	420	240	290	115	11 x 28	24	59	210/63	ES710/4000S-GL	B92090062
	280	160	420	240	290	125	11 x 28	25	61	210/73	ES710/5000S-GL	B92090063
	280	175	420	240	290	140	11 x 28	26	65	210/88	ES710/6300S-GL	B92090064
	280	190	420	240	290	155	11 x 28	27	74	210/103	ES710/8000S-GL	B92090065
	280	205	420	240	290	170	11 x 28	33	85	210/120	ES710/10000S-GL	B92090066
SN-GL series	280	180	370	240	290	145	11 x 28	15	49	180/93	ES710/3150SN-GL	B92090121
	280	150	370	240	320	115	11 x 28	24	59	210/63	ES710/4000SN-GL	B92090122
	280	160	370	240	320	125	11 x 28	25	61	210/73	ES710/5000SN-GL	B92090123
	280	175	370	240	320	140	11 x 28	26	65	210/88	ES710/6300SN-GL	B92090124
	280	190	370	240	320	155	11 x 28	27	74	210/103	ES710/8000SN-GL	B92090125
	280	205	375	240	325	170	11 x 28	33	85	210/120	ES710/10000SN-GL	B92090126
Standard	240	230	325	200	180	145	11 x 28	15	49	180/93	ES710/3150	B924211
	280	200	370	240	150	115	11 x 28	24	59	210/63	ES710/4000	B924212
	280	210	370	240	160	125	11 x 28	25	61	210/73	ES710/5000	B924213
	280	225	370	240	175	140	11 x 28	26	65	210/88	ES710/6300	B924214
	280	240	370	240	190	155	11 x 28	27	74	210/103	ES710/8000	B924215
	320	260	420	270	200	160	13 x 35	39	85	240/83	ES710/10000	B924216
K series	240		360	200	180	145	11 x 28	15	49	180/93	ES710/3150K	B924221
	280		420	240	150	115	11 x 28	24	59	210/63	ES710/4000K	B924222
	280		420	240	160	125	11 x 28	25	61	210/73	ES710/5000K	B924223
	280		420	240	175	140	11 x 28	26	65	210/88	ES710/6300K	B924224
	280		420	240	190	155	11 x 28	27	74	210/103	ES710/8000K	B924225
	320		480	270	200	160	13 x 35	39	85	240/83	ES710/10000K	B924226
LG series	230	235	320	204		240	9 x 14	15	49	180/93	ES710/3150LG	B924231
	260	210	365	234		280	9 x 14	24	59	210/63	ES710/4000LG	B924232
	260	220	365	234		280	9 x 14	25	61	210/73	ES710/5000LG	B924233
	260	235	365	234		280	9 x 14	26	65	210/88	ES710/6300LG	B924234
	260	250	365	234		280	9 x 14	27	74	210/103	ES710/8000LG	B924235
	294	240	410	264		320	13 x 20	39	85	240/83	ES710/10000LG	B924236
SK2 series	380	200	450	350	270	150	11 x 16	15	69	180/93	ES710/3150SK2	B924241
	380	190	500	350	310	150	11 x 16	24	75	210/63	ES710/4000SK2	B924242
	380	200	500	350	310	160	11 x 16	25	77	210/73	ES710/5000SK2	B924243
	380	215	500	350	310	175	11 x 16	26	86	210/88	ES710/6300SK2	B924244
	380	230	500	350	310	190	11 x 16	27	90	210/103	ES710/8000SK2	B924245
	410	240	560	380	350	200	11 x 16	39	105	240/83	ES710/10000SK2	B924246
S series	280	180	370	240	290	145	11 x 28	15	49	180/93	ES710/3150S	B924261
	280	150	420	240	290	115	11 x 28	24	59	210/63	ES710/4000S	B924262
	280	160	420	240	290	125	11 x 28	25	61	210/73	ES710/5000S	B924263
	280	175	420	240	290	140	11 x 28	26	65	210/88	ES710/6300S	B924264
	280	190	420	240	290	155	11 x 28	27	74	210/103	ES710/8000S	B924265
	320	200	440	270	330	160	13 x 35	39	85	240/83	ES710/10000S	B924266

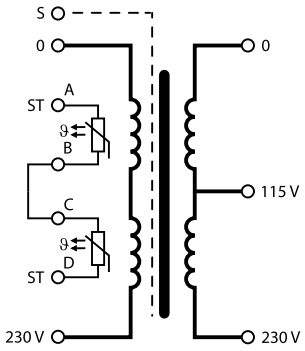
Ordering information enclosure

Dimensions (mm)									Weight (kg)	Version	Type	Art. No.
A	B	C	D	E	F	G	H	I				
430	380	500	385	420	450	M10	ø 37,5	ø 20,5	16	floor mounting	ESDS0107-1	B924673
350	300		315	550	580				18	hanging mounting	ESDS710	B924741

Nameplate

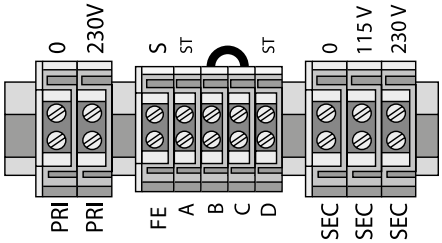


Wiring diagram

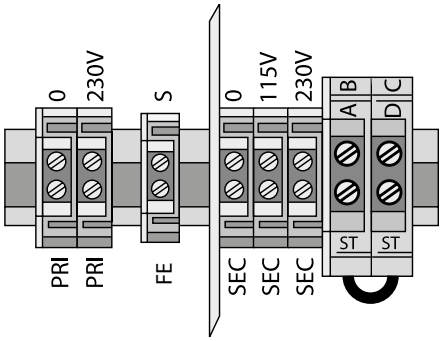


Terminal diagram

Standard, K series, LG series
S series, S-GL series, SN-GL series



SK2 series



Connection properties

Type	Input terminals flexible/rigid	Screen winding flexible/rigid	Control terminals flexible/rigid	Control terminals for protection class II flexible/rigid	Output terminals flexible/rigid
ES710/3150	16/25 mm²	16/25 mm²	4/6 mm²	2.5/4 mm²	16/25 mm²
ES710/4000	16/25 mm²	16/25 mm²	4/6 mm²	2.5/4 mm²	16/25 mm²
ES710/5000	16/25 mm²	16/25 mm²	4/6 mm²	2.5/4 mm²	16/25 mm²
ES710/6300	16/25 mm²	16/25 mm²	4/6 mm²	2.5/4 mm²	16/25 mm²
ES710/8000	16/25 mm²	16/25 mm²	4/6 mm²	2.5/4 mm²	16/25 mm²
ES710/10000	35/35 mm²	35/35 mm²	4/6 mm²	2.5/4 mm²	35/35 mm²

Isolating transformers DS0107

Three-phase isolating transformers for the supply of three-phase loads in medical locations



Typical applications

- For IT systems in medical locations

Approvals

CE EAC

Device features

- Built-in temperature sensors acc. to DIN 44081 (120 °C)
- Screen winding with brought-out insulated connection terminal
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Degree of protection, IP23 (with enclosure)
- Protection class I
- Protection class II (option: encapsulated version)
- Reinforced insulation
- Classification of insulation ta40/B
- Connections: screw terminals
- Noise level < 35 dB (A)(no-load and nominal load)
- Vector group: Yyn O

Standards

DS0107 isolating transformers comply with the device standards and the regulations for installation:

- DIN EN 61558-1 (VDE 570-1)
- IEC 61558-1
- DIN VDE 0100-710 (VDE 0100-710)
- DIN EN 61558-2-15 (VDE 0570-2-15)
- IEC 61558-2-15
- IEC 60364-7-710

Note:

- According to DIN VDE 0100-710 (VDE 0100-710), para. 710.512.1.6.2, single -phase transformers shall be used for the erection of medical IT systems.
- The transformers of the DS0107 series are not suitable for the erection and installation of medical IT systems.

Further information

For further information refer to our product range on www.bender.de.

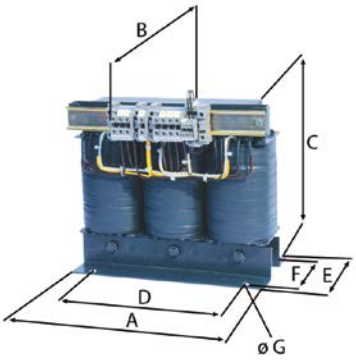
Technical data

Type	DS0107/2000	DS0107/3150	DS0107/4000	DS0107/5000	DS0107/6300	DS0107/8000	DS0107/10000
Insulation classification	t_a 40/B	t_a 40/B	t_a 40/B	t_a 40/B	t_a 40/B	t_a 40/B	t_a 40/B
Degree of protection	IP00	IP00	IP00	IP00	IP00	IP00	IP00
Protection class	I/II*	I/II*	I/II*	I/II*	I/II*	I/II*	I/II*
Power/voltages/currents							
Rated power	2000 VA	3150 VA	4000 VA	5000 VA	6300 VA	8000 VA	10000 VA
Rated frequency	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz
Rated input voltage	3AC 400 V	3AC 400 V	3AC 400 V	3AC 400 V	3AC 400 V	3AC 400 V	3AC 400 V
Rated input current	3 A	4.9 A	6.1 A	7.7 A	9.8 A	12.2 A	15.6 A
Rated output voltage	3NAC 230 V	3NAC 230 V	3NAC 230 V	3NAC 230 V	3NAC 230 V	3NAC 230 V	3NAC 230 V
Rated output current	5 A	7.9 A	10 A	12.6 A	15.8 A	20.1 A	25.2 A
Inrush current I_E	< 12 x $\hat{I}$n	< 12 x $\hat{I}$n	< 12 x $\hat{I}$n	< 12 x $\hat{I}$n	< 12 x $\hat{I}$n	< 12 x $\hat{I}$n	< 12 x $\hat{I}$n
Leakage current	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA	≤ 0.5 mA
No-load input current i_0	≤ 3.0 %	≤ 3.0 %	≤ 3.0 %	≤ 3.0 %	≤ 3.0 %	≤ 3.0 %	≤ 3.0 %
No-load output voltage u_0	≤ 232 V	≤ 235 V	≤ 234 V	≤ 236 V	≤ 236 V	≤ 235 V	≤ 235 V
Short-circuit voltage u_k	≤ 2.9 %	≤ 2.9 %	≤ 2.8 %	≤ 3 %	≤ 2.8 %	≤ 2.8 %	≤ 2.5 %
Environmental conditions							
Ambient temperature	≤ 40 °C	≤ 40 °C	≤ 40 °C	≤ 40 °C	≤ 40 °C	≤ 40 °C	≤ 40 °C
No-load temperature rise	≤ 25 °C	≤ 21 °C	≤ 24 °C	≤ 28 °C	≤ 24 °C	≤ 27 °C	≤ 32 °C
Full-load temperature rise	≤ 50 °C	≤ 50 °C	≤ 53 °C	≤ 67 °C	≤ 60 °C	≤ 72 °C	≤ 75 °C
Noise level (no load and full load)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)
Other							
Recommended fuse when used in accordance with DIN VDE 0100-710	10 A gL/gG	16 A gL/gG	20 A gL/gG	20 A gL/gG	25 A gL/gG	35 A gL/gG	35 A gL/gG
Induction	1.0 T	0.8 T	0.86 T	0.8 T	0.8 T	0.8 T	0.82 T
$R_{primary}$	1.12 Ω	0.7 Ω	0.42 Ω	0.38 Ω	0.33 Ω	0.26 Ω	0.13 Ω
$R_{secondary}$	0.27 Ω	0.17 Ω	0.13 Ω	0.12 Ω	0.07 Ω	0.055 Ω	0.05 Ω
FE loss (iron loss)	45 W	51 W	70 W	75 W	80 W	96 W	120 W
Cu loss (copper loss)	60 W	105 W	115 W	170 W	200 W	255 W	270 W
Efficiency	95 %	96 %	95 %	95 %	96 %	96 %	96 %
Documentation number: D00105							

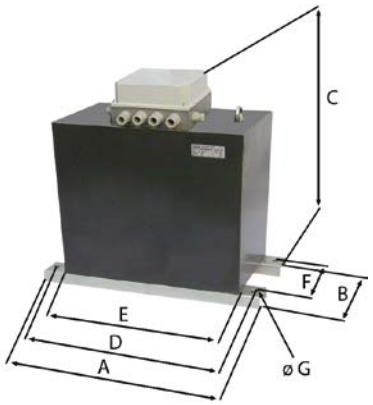
* Option: completely encapsulated version

Dimension diagrams

Standard – Dimension B: depth incl. terminals

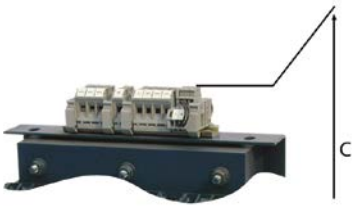


SK2 series

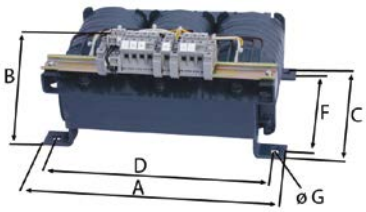


K series

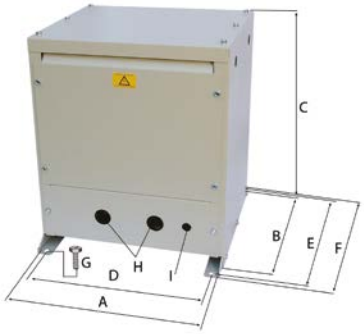
All other dimensions correspond to the standard dimensions.



LG series



Isolating transformer enclosure



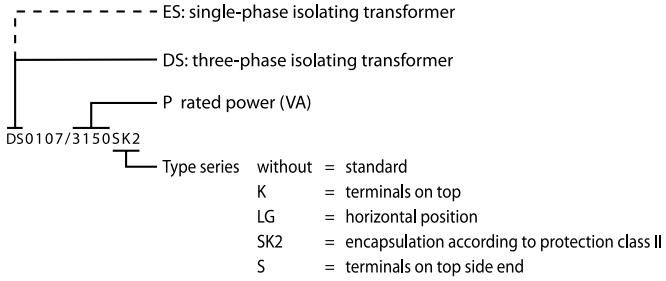
Ordering information

	Dimensions (mm)							Cu weight (kg)	Weight (kg)	Type	Art. No.
	A	B	C	D	E	F	G				
Standard	300	200	270	240	160	130	11	16	34	DS107/2000	B924694
	360	210	325	310	170	135	11	28	63	DS107/3150	B924106
	360	225	325	310	185	150	11	29	70	DS107/4000	B924121
	360	240	325	310	200	165	11	31	77	DS107/5000	B924112
	420	230	370	370	200	160	11	48	97	DS107/6300	B924107
	420	245	370	370	215	175	11	51	107	DS107/8000	B924628
	420	260	370	370	230	190	11	59	130	DS107/10000	B924672
K series	300		310	240	162	130	11	16	34	DS107/2000K	B924687
	360		360	310	170	135	11	28	63	DS107/3150K	B924688
	360		360	310	185	150	11	29	70	DS107/4000K	B924689
	360		360	310	200	165	11	31	77	DS107/5000K	B924690
	420		420	370	200	160	11	48	97	DS107/6300K	B924691
	420		420	370	215	175	11	51	107	DS107/8000K	B924692
	420		420	370	230	190	11	59	130	DS107/10000K	B924693
LG series	330	195	265	298		200	7	16	34	DS107/2000LG	B924695
	394	198	310	358		240	9	28	63	DS107/3150LG	B924658
	394	214	310	358		240	9	29	70	DS107/4000LG	B924659
	394	228	310	358		240	9	31	77	DS107/5000LG	B924660
	452	212	360	408		280	12	48	97	DS107/6300LG	B924661
	452	227	360	408		280	12	51	107	DS107/8000LG	B924662
	452	250	360	408		280	12	59	130	DS107/10000LG	B924679
SK2 series	410	190	400	380	330	125	11	16	49	DS107/2000SK2	B924696
	520	190	450	490	390	135	11	28	75	DS107/3150SK2	B924122
	520	190	450	490	390	135	11	29	80	DS107/4000SK2	B924123
	520	200	450	490	390	150	11	31	86	DS107/5000SK2	B924124
	520	200	500	490	450	150	11	48	107	DS107/6300SK2	B924125
	520	215	500	490	450	175	11	51	130	DS107/8000SK2	B924126
	520	230	500	490	450	175	11	59	155	DS107/10000SK2	B924678

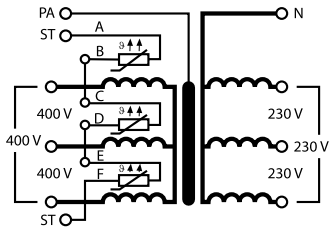
Ordering information enclosure

Dimensions (mm)									Suitable for the following device types	Weight (kg)	Type	Art. No.
A	B	C	D	E	F	G	H	I				
430	380	490	385	420	450	M10	ø 29	ø 21	DS0107/2000 bis DS0107/5000	16	ESDS0107-1	B924673
600	420	490	555	460	490	M10	ø 36	ø 16	DS0107/6300 bis DS0107/10000	23	ESDS0107-2	B924674

Nameplate

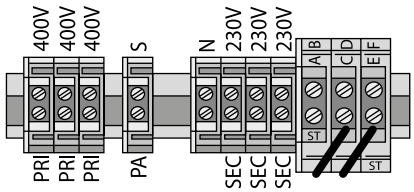


Wiring diagram

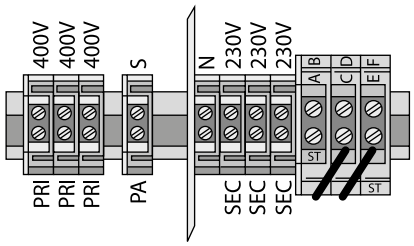


Terminal diagram

Standard, K series, LG series



SK2 series,



Connection properties

Type	Input terminals flexible/rigid	Screen winding flexible/rigid	Control terminals flexible/rigid	Output terminals flexible/rigid
DS0107/2000	10/16 mm²	10/16 mm²	2.5/4 mm²	10/16 mm²
DS0107/3150	10/16 mm²	10/16 mm²	2.5/4 mm²	10/16 mm²
DS0107/4000	10/16 mm²	10/16 mm²	2.5/4 mm²	10/16 mm²
DS0107/5000	10/16 mm²	10/16 mm²	2.5/4 mm²	10/16 mm²
DS0107/6300	10/16 mm²	10/16 mm²	2.5/4 mm²	16/25 mm²
DS0107/8000	10/16 mm²	10/16 mm²	2.5/4 mm²	16/25 mm²
DS0107/10000	16/25 mm²	16/25 mm²	2.5/4 mm²	16/25 mm²

ESL0107 transformers for operating theatre lights

Single-phase isolating transformers for the supply of operating theatre lights



Typical applications

- For the supply of operating theatre lights in group 2 medical locations

Approvals

CE

Device features

- Screen winding lead out for external connection
- Insulated mounting angles
- Degree of protection, IP00 (open design)
- Reinforced insulation
- Classification of insulation ta 40/E
- Connections: screw terminals
- Vector group: IiO

Standards

ESL0107 isolating transformers comply with the device standards and the regulations for installation:

- DIN EN 61558-1 (VDE 0570-1)
- IEC 61558-1
- DIN EN 61558-2-6 (VDE 0570-2-6)
- IEC 61558-2-6

Further information

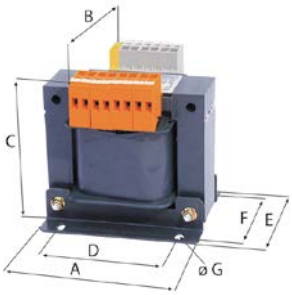
For further information refer to our product range on www.bender.de.

Technical data

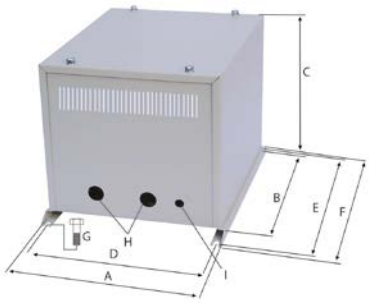
Type	ESL0107/120	ESL0107/160	ESL0107/280	ESL0107/400	ESL0107/630	ESL0107/1000
Insulation classification	t_a 40/E	t_a 40/E	t_a 40/E	t_a 40/E	t_a 40/E	t_a 40/E
Degree of protection/protection class	IP00/I	IP00/I	IP00/I	IP00/I	IP00/I	IP00/I
Power/voltages/currents						
Rated power	120 VA	160 VA	280 VA	400 VA	630 VA	1000 VA
Rated frequency	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz	50…60 Hz
Rated input voltage	230 V	230 V	230 V	230 V	230 V	230 V
Rated input current	0.6 A	0.8 A	1.4 A	1.9 A	3 A	4.6 A
Rated output voltage	23…28 V	23…28 V	23…28 V	23…28 V	23…28 V	23…28 V
Rated output current	4.3 A	5.7 A	10 A	14.3 A	22.5 A	35.7 A
Inrush current I_E	< 15 x $\hat{I}_n$	< 15 x $\hat{I}_n$	< 15 x $\hat{I}_n$	< 15 x $\hat{I}_n$	< 15 x $\hat{I}_n$	< 15 x $\hat{I}_n$
Leakage current	≤ 5 µA	≤ 5 µA	≤ 5 µA	≤ 5 µA	≤ 5 µA	≤ 5 µA
No-load input current i_0	≤ 95 mA	≤ 120 mA	≤ 140 mA	≤ 237 mA	≤ 270 mA	≤ 320 mA
No-load output voltage u_0	≤ 31.7 V	≤ 30.7 V	≤ 30.6 V	≤ 29.7 V	≤ 30 V	≤ 30 V
Short-circuit voltage u_k	≤ 11 %	≤ 8.8 %	≤ 7.9 %	≤ 5.3 %	≤ 5 %	≤ 4.3 %
Environmental conditions						
Ambient temperature	40 °C	40 °C	40 °C	40 °C	40 °C	40 °C
No-load temperature rise	≤ 17 °C	≤ 20 °C	≤ 18 °C	≤ 26 °C	≤ 23 °C	≤ 26 °C
No-load temperature rise	≤ 66 °C	≤ 64 °C	≤ 71 °C	≤ 62 °C	≤ 64 °C	≤ 65 °C
Noise level (no load and full load)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)	≤ 35 dB(A)
Other						
Recommended fuse when used in accordance with DIN VDE 0100-710	6 A gL/gG	6 A gL/gG	6 A gL/gG	10 A gL/gG	16 A gL/gG	16 A gL/gG
Induction	1.23 T	1.17 T	1.14 T	1.14 T	1.06 T	1 T
$R_{primary}$	15.3 Ω	8.9 Ω	4.7 Ω	2 Ω	1.2 Ω	0.6 Ω
$R_{secondary}$	0.32 Ω	0.2 Ω	0.095 Ω	0.05 Ω	0.028 Ω	0.016 Ω
FE loss (iron loss)	5.5 W	6.3 W	9 W	15 W	18 W	26 W
Cu loss (copper loss)	15.8 W	16 W	25 W	23 W	33 W	44 W
Efficiency	85 %	88 %	89 %	91 %	92 %	94 %
Documentation number: D00110						

Dimension diagram

Isolating transformer



Isolating transformer enclosure



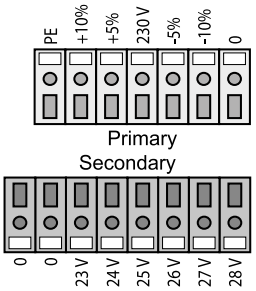
Ordering information

Dimensions (mm)							Cu weight (kg)	Weight (kg)	Type	Art. No.
A	B	C	D	E	F	G				
96	96	105	84	82	65	5.5	0.5	2.3	ESL0107/120	B924632
96	106	105	84	92	75	5.5	0.8	2.8	ESL0107/160	B924633
120	102	125	90	92	74	5.5	1	4	ESL0107/280	B924634
120	134	125	90	128	110	5.5	1.6	6.7	ESL0107/400	B924637
150	135	150	122	130	108	6.5	3	10.2	ESL0107/630	B924638
174	145	175	135	150	120	6.5	5.8	16.5	ESL0107/1000	B924639

Ordering information enclosure

Dimensions (mm)									Weight (kg)	Type	Art. No.
A	B	C	D	E	F	G	H	I			
240	280	220	220	300	320	M6	ø 29	ø 21	3.5	ESL0107-0	B924204

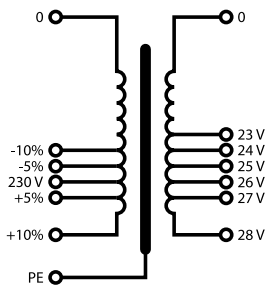
Terminal diagram



Connection properties

Type	Input terminals flexible/rigid	Screen winding flexible/rigid	Output terminals flexible/rigid
ESL0107/120	4/6 mm²	4/6 mm²	4/6 mm²
ESL0107/160	4/6 mm²	4/6 mm²	4/6 mm²
ESL0107/280	4/6 mm²	4/6 mm²	4/6 mm²
ESL0107/400	4/6 mm²	4/6 mm²	4/6 mm²
ESL0107/630	10/16 mm²	4/6 mm²	10/16 mm²
ESL0107/1000	10/16 mm²	4/6 mm²	10/16 mm²

Wiring diagram



RK170

Measuring converter



Device features

- Plastic enclosure for DIN rail mounting
- Zero setting 0 or 4 mA
- Electrical separation between the input and output signal

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- Conversion of DC 0…400 µA current signals into 0(4)…20 mA or 0…10 V signals
- For ISOMETER®s and RCM and RCMA residual current monitors with measurement instrument output DC 0…400 µA

Approvals

CE

Ordering information

Supply voltage [1] U_S		Type	Art. No.
AC	DC		
19…264 V	20…297 V	RK170	B98041500

[1] Absolute values

Technical data

Voltage ranges

Supply voltage U_S	DC 20…297 V/AC 19…264 V
Frequency range U_S	50…120 Hz
Power consumption	≤ 3 VA

Inputs

Current input	DC 0…400 µA
Max. permissible current	DC 4 mA
Rated input resistance	approx. 2.5 kΩ

Outputs

Outputs	two outputs with common ground
Voltage output	DC 0 … 10 V
Max. no load voltage	DC 12 V
Rated burden	1 kΩ
Current output	DC 0/4…20 mA
Short-circuit current	≤ DC 50 mA short-circuit proof
Rated burden	500 Ω
Accuracy at T_u = 23 °C	class 0.5
Temperature coefficient	0.025 %/°C
Rated rise time T 0.9	50 ms
Dielectric strength input/output/supply	AC 2500 V

Environment

Shock resistance IEC 60068-2-27 (device in operation)	5 g/11 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10…150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10…150 Hz
Ambient temperature (during operation)	0…+50 °C
Ambient temperature (during storage)	-20…+70 °C
Classification of climatic conditions acc. to IEC 60721-3-3	3K3

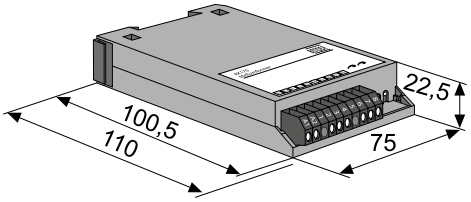
Connection

Connection type	modular terminals
Connection properties rigid/flexible	0.5…2.5 mm²/0.14…1.5 mm²

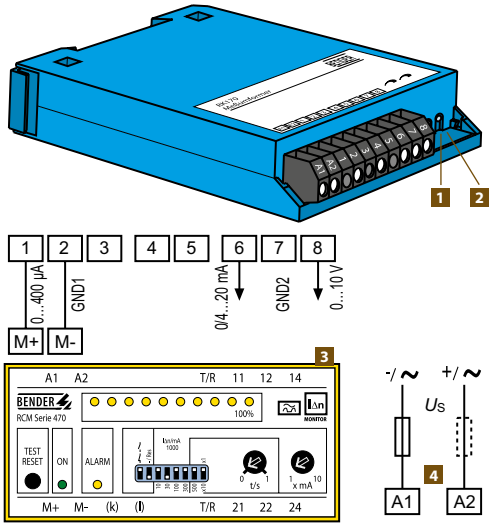
Other

Operating mode	continuous operation
Mounting	any position
Degree of protection, internal components (IEC 60529)	IP40
Degree of protection, internal components (IEC 60529)	IP20
Dimensions	75 x 22.5 x 110 mm
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-2
Documentation number	D00132
Weight	≤ 200 g

Dimension diagram (dimensions in mm)



Wiring diagram



1 Zero: zero setting
2 Scale: full-scale value calibration
3 Device of the RCM series
4 U_S see nameplate, 2 A slow-blow fuse recommended

STEP-PS

For supply of Bender devices with a supply voltage of DC 24 V



Device features

- Easy DIN rail and wall mounting
- Maximum energy efficiency thanks to low idling losses
- Fast commissioning with LED function monitoring
- High operational reliability thanks to long power failure buffering under full load and high MTBF (> 500,000 h)
- Can be used worldwide in all industrial sectors due to a wide-range input and an international approval package
- Wide temperature range from -25 °C to +70 °C
- Can be connected in parallel to increase power

Typical applications

- For supply of Bender devices with a supply voltage of DC 24 V
- The compact design makes them especially suitable for installation distributors and flat control panels

Further information

For further information refer to our product range on www.bender.de.

Approvals

Ordering information

Rated input voltage U_{IN}		Rated voltage	Type	Art. No.
AC	DC	DC		
85 …264 V, 45…65 Hz	95…250 V	24 V	STEP-PS/1 AC/24 DC/0.5	B94053110
			STEP-PS/1 AC/24 DC/1.75	B94053111
			STEP-PS/1 AC/24 DC/4.2	B94053112

Input data

Nominal input voltage range	AC 100…240 V
AC input voltage range	AC 85…264 V
DC input voltage range	DC 95 V…250 V
AC frequency range	45…65 Hz
DC frequency range	0 Hz

STEP-PS/1AC/24DC/0.5 (12 W)

Current consumption	approx. 0.28 A (AC 120 V) approx. 0.13 A (AC 230 V)
Inrush current limitation	< 15 A (typical)
I^2t	< 0.1 A^2s
Power failure buffering	> 15 ms (AC 120 V) > 90 ms (AC 230 V)
Typical turn-on time	< 0.5 s
Input fuse, integrated	1.25 A (slow acting, internal)

STEP-PS/1AC/24DC/1.75 (40 W)

Current consumption	approx. 0.6 A (AC 120 V) approx. 0.3 A (AC 230 V)
Inrush current limitation	< 15 A (typical)
I^2t	< 0.6 A^2s
Power failure buffering	> 25 ms (AC 120 V) > 150 ms (AC 230 V)
Typical turn-on time	< 0.5 s
Input fuse, integrated	3.15 A (slow acting, internal)
Recommended back-up fuse for line protection	6 A 10 A 16 A (characteristic B)

STEP-PS/1AC/24DC/4.2 (100 W)

Current consumption	approx. 1.3 A (AC 120 V) approx. 0.8 A (AC 230 V)
Inrush current limitation	< 15 A (typical)
I^2t	< 1 A^2s
Power failure buffering	> 20 ms (AC 120 V) > 100 ms (AC 230 V)
Typical turn-on time	< 0.5 s
Input fuse, integrated	4 A (slow acting, internal)
Recommended back-up fuse for line protection	6 A 10 A 16 A (characteristic B)

Output data

Nominal output voltage	DC 24 V ±1 %

STEP-PS/1AC/24DC/0.5 (12 W)

Output current	0.5 A (-25…+55 °C) 0.55 A (-25…40 °C permanent) 1 A (maximum output current)
Control deviation	< 1 % (change in load, static 10…90 %) < 2 % (change in load, dynamic 10…90 %) < 0.1 % (change in input voltage ±10 %)
Efficiency	> 84 % (for AC 230 V and nominal values)
Residual ripple	< 20 mV_{SS} (20 MHz)
Peak switching voltages	< 30 mV_{SS} (20 MHz)
Connection in parallel	yes, for increased power
Connection in series	yes
Protection against internal overvoltages	yes, limited to approx. DC 35 V
Resistance to reverse feed	≤ DC 35 V

STEP-PS/1AC/24DC/1.75 (40 W)

Setting range of the output voltage	DC 22.5 V…29.5 V (> 24 V constant power)
Output current	1.75 A (-25…70 °C) 1.9 A (-25…40 °C permanent) 3.75 A (maximum output current)
Derating	above +55 °C: 2.5 % per kelvin
Control deviation	< 1 % (change in load, static 10…90 %) < 2 % (change in load, dynamic 10…90 %) < 0.1 % (change in input voltage ±10 %)
Maximum power loss nominal load	5 W
Maximum power dissipation idling	0.7 W
Efficiency	> 89 % (for AC 230 V and nominal values)
Ascent time	< 0.5 s (U_{OUT} (10…90 %))
Residual ripple	< 35 mV_{SS} (with nominal values)
Switching transients	< 35 mV_{SS} (with nominal values)
Connection in parallel	yes, for increased power
Connection in series	yes
Overvoltage protection against internal overvoltages	yes, limited to approx. DC 35 V
Resistance to reverse feed	max. DC 35 V

STEP-PS/1AC/24DC/4.2 (100 W)

Setting range of the output voltage	DC 22.5…29.5 V (> 24 V constant power)
Output current	4.2 A (-25…70 °C) 4.4 A (-25… 40 °C permanent) 6.5 A (maximum output current)
Derating	above +55 °C: 2.5 % per kelvin
Control deviation	< 1 % (change in load, static 10…90 %) < 2 % (change in load, dynamic 10…90 %) < 0.1 % (change in input voltage ±10 %)
Maximum power loss nominal load	13.2 W
Maximum power dissipation idling	0.7 W
Efficiency	> 88 % (for AC 230 V and nominal values)
Ascent time	< 0.5 s (U_{OUT} (10…90 %))
Residual ripple	< 25 mV_{SS} (with nominal values)
Peak switching voltages	< 25 mV_{SS} (with nominal values)
Connection in parallel	yes, for increased power
Connection in series	yes
Overvoltage protection against internal overvoltages	yes, limited to approx. DC 35 V
Resistance to reverse feed	max. DC 35 V

Power consumption

STEP-PS/1AC/24DC/0.5 (12 W)

Maximum power dissipation idling	< 0.3 W
Maximum power loss nominal load	< 2.2 W

STEP-PS/1AC/24DC/1.75 (40 W)

Maximum power dissipation idling	5 W
Maximum power loss nominal load	0.7 W

STEP-PS/1AC/24DC/4.2 (100 W)

Maximum power dissipation idling	13.2 W
Maximum power loss nominal load	0.7 W

LED status indicator

Status display	"DC OK" LED green/U_{OUT} > 21.5 V: LED lights up < 21.5 V: LED off

Environmental conditions

Ambient temperature (operation)	-25…70 °C (> 55 °C derating)
Ambient temperature (storage/transport)	-40…85 °C
Max. perm. humidity (operation)	≤ 95 % (at 25 °C, no condensation)
Vibration (operation)	< 15 Hz, amplitude ±2.5 mm acc. to IEC 60068-2-6 15…150 Hz, 2.3 g, 90 min.
Shock	30 g in all directions, acc. to IEC 60068-2-27
Pollution degree acc. to EN 50178	2
Classification of climatic conditions	3K3 (acc. to EN 60721)

Connection

Connection type	screw connection
Connection properties	
Rigid/flexible	0.2 … 2.5 mm^2
Conductor sizes (AWG)	24…12
Tightening torque	0.6 … 0.8 Nm
Stripping length	6.5 mm

Other

Insulation voltage input/output	AC 4 kV (type test) AC 2 kV (routine test)
Insulation voltage input/PE	AC 3.5 kV (type test) AC 2 kV (routine test)
Insulation voltage output/PE	DC 500 V ((routine test)
Degree of protection	IP20
Protection class	II
MTBF (IEC 61709)	500000 h
Enclosure material	polycarbonate
Foot latch material	plastic POM
Dimensions W/H/D (state of delivery)	
STEP-PS/1AC/24DC/0.5 (12 W)	18/90/61 mm
STEP-PS/1AC/24DC/1.75 (40 W)	54/90/61 mm
STEP-PS/1AC/24DC/4.2 (100 W)	90/90/61 mm
Weight	
STEP-PS/1AC/24DC/0.5 (12 W)	100 g
STEP-PS/1AC/24DC/1.75 (40 W)	200 g
STEP-PS/1AC/24DC/4.2 (100 W)	400 g

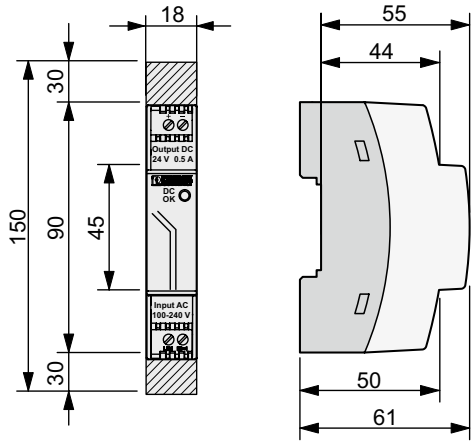
Technische Daten (Fortsetzung)

Standards	
Electrical equipment of machines	EN 60204
Safety isolating transformers for switch mode power supplies	IEC 61558-2-17
Electrical safety (of information technology equipment)	IEC 60950-1/VDE 0805 (SELV)
Electronic equipment for use in power installations	EN 50178/VDE 0160 (PELV)
Protective extra-low voltage	IEC 60950-1 (SELV) and EN 60204 (PELV)
Protective separation	DIN VDE 0100-410 DIN VDE 0106-1010
Protection against electric shock	DIN 57100-410
Protection against electric shock, basic requirements for protective separation in electrical equipment	DIN VDE 0106-101
Limits for harmonic current emissions	EN 61000-3-2
STEP-PS/1AC/24DC/1.75 (40W) and STEP-PS/1AC/24DC/4.2 (100 W)	
Certificate	CB Scheme

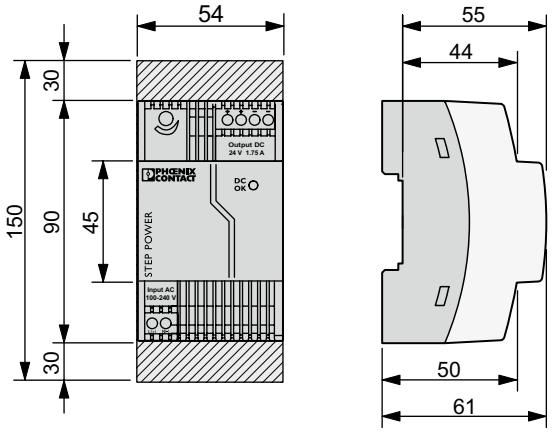
Approvals and certifications	
STEP-PS/1AC/24DC/0.5 (12W)	
UL approvals	UL/C-UL Listed UL 508 UL/C-UL Recognized UL 60950 NEC Class 2 as per UL 1310 UL/C-UL Listed ANSI/ISA-12.12.01 Class I, Division 2, Groups A, B, C, D
STEP-PS/1AC/24DC/1.75 (40W)	
UL approvals	UL/C-UL Listed UL 508 UL/C-UL Recognized UL 60950 NEC Class 2 as per UL 1310
Shipbuilding sector	Germanischer Lloyd
STEP-PS/1AC/24DC/4.2 (100W)	
UL approvals	UL/C-UL Listed UL 508 UL/C-UL Recognized UL 60950
Shipbuilding sector	Germanischer Lloyd

Dimension diagram (dimensions in mm)

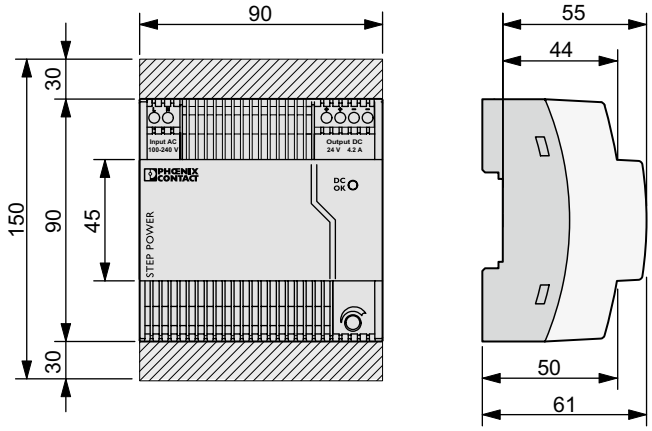
STEP-PS/1AC/24DC/0.5 (12 W)



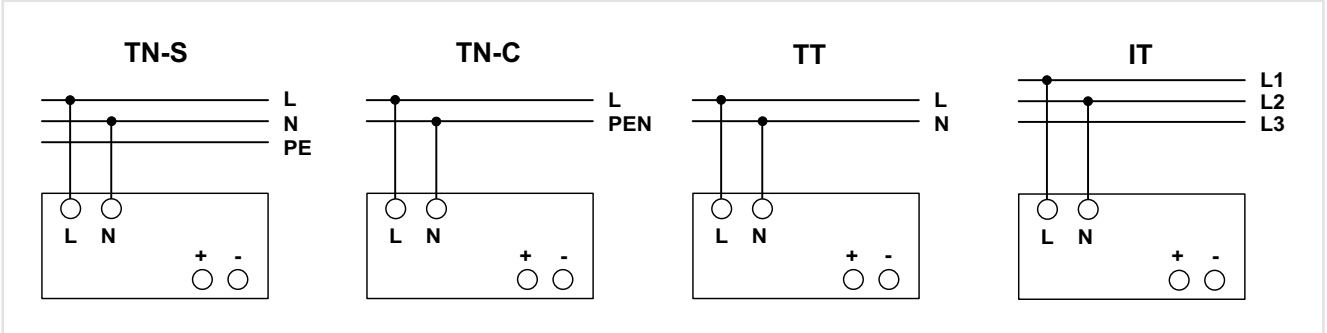
STEP-PS/1AC/24DC/1.75 (40 W)



STEP-PS/1AC/24DC/4.2 (100 W)



Connection to different systems



AN410

Power supply unit for DC 24 V supply



Device features

- Primary-pulsed power supply unit for the power supply of Bender devices with a supply voltage of DC 24 V and a power consumption of max. 10 VA
- Power supply for max. 3 MK2430/max. 2 MK800 alarm indicator and test combinations
- Protected against idle running, overload and continuous short circuits

Standards

The AN410 series complies with the requirements of the device standard: EN 61204.

Typical applications

- To supply Bender devices with DC 24 V and maximum 10 VA power consumption

Further information

For further information refer to our product range on www.bender.de.

Approvals

*) Approval relating to the rated input voltage U_{IN}

Ordering information

Rated input voltage U_{IN}		Rated output voltage	ABB type	Type	Art. No.
AC	DC	DC			
90…264 V, 47…63 Hz	120…370 V	24 V	CP-D 24/0.42/Art. No. 1SVR 427 041 R0000	AN410	B924209
–	9…35 V	9…35 V	CP-D RU/Art. No. 1SVR 427 049 R0000	AN420-R	B95100250

Technical data

Insulation coordination acc. to IEC 60664-1

Rated impulse voltage/pollution degree	3 kV/2
Rated insulation voltage U_i input circuit/output circuit	3 kV

Input circuits

Rated input voltage U_{IN}		see ordering information
Power consumption		≤ 3 W
Inrush current		≤ 30 A, ≤ 3 ms
Stored energy time in the event of power system failure		≥ 30 ms
Typical current/power consumption	at AC 110 V	184 mA/11.62 W
	at AC 230 V	120.6 mA/12 W
Primary fuse (internal device protection, not accessible)		1 A time-lag/AC 250 V

Output circuit

Rated output voltage	DC 24 V (±1 %)
Rated output current	420 mA
Derating of the output current 60 °C < T_U ≤ 70 °C	2.5 %/K
Parallel connection option	with redundance unit AN420-R
Protection against short circuits/no-load	continuous protection against short circuits/no-load

Environment/EMC

EMC immunity	acc. to EN 61000-6-2
EMC emission	acc. to EN 61000-6-3
Ambient temperature (during operation/during storage)	-25…+70 °C/-25…+85 °C
Classification of mechanical conditions acc. to IEC/EN 60068-2	

Connection

Connection	screw-type terminals
Connection	
rigid, flexible (with or without ferrule)/conductor sizes	0.2…2 mm² (AWG 24…14)
Stripping length	6 mm (0.24 inches)
Tightening torque	0.36…0.56 Nm

Standards, approvals and certifications

c UL us	UL 508, CAN/CSA C22.2 No. 14*)
c UL us	UL 1310, CAN/CSA C22.2 No. 223 (Class 2 Power Supply) *)
c UL us	UL 6090, CAN/CSA C22.2 No. 60950 *)
CCC	CCC *)

Mark

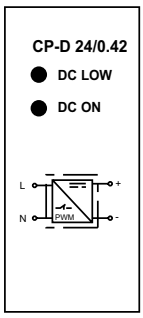
CE	CE

Other

Status indicators	2 LEDs: output voltage present, output votlage low
Operating mode	continuous operation
Mounting	vertically (terminals +/– at the top)
Degree of protection, internal components DIN EN 60529 (VDE 0470-1)	IP30
Degree of protection, terminals (DIN EN 60529 (VDE 0470-1))	IP20
Protection class	II
Minimum distance to adjacent devices vertically/horizontally	25/25 mm
Enclosure dimensions (W x H x D)	18 x 91 x 57.5 mm (0.71 x 3.58 x 2.26 inches)
DIN rail mounting acc. to	IEC 60715
Protective extra low voltage	SELV (EN 60950-1)
Documentation number	D00099
Weight	≤ 70 g

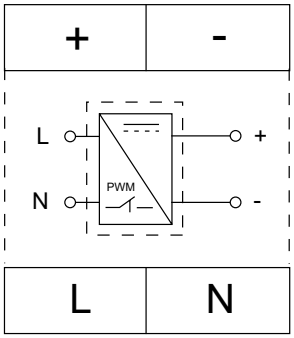
*) Approval relating to the rated input voltage U_{IN}

Displays and controls



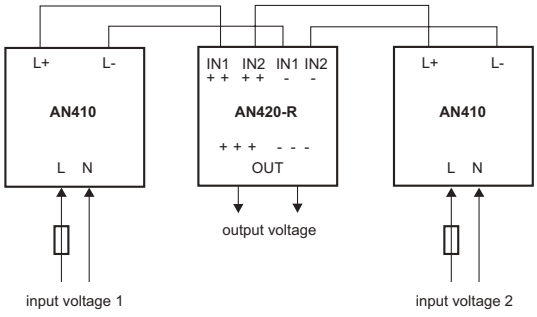
Power On LED "DC ON" lights up green signalling that voltage is available at the output of the power supply unit.
LED "DC LOW" lights red signalling that the output voltage is too low.

Wiring diagram



L, N: input voltage
+, -: output voltage

Option for redundant power supply



AN450

Power supply unit



Typical applications

- Supply of Bender devices with AC 20 V and a power consumption of maximum 9 VA

Approvals

Device features

- Power supply unit for the supply of Bender devices with AC 20 V and a power consumption of maximum 9 VA
- Supply of 3 MK2430/1 MK800 alarm indicator and test combinations (for example)
- Protected secondary circuit

Standards

The AN450 series complies with the requirements of the device standards:

- DIN EN 61558-1 (VDE 0570-1)
- IEC 61558-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Output voltage	Supply voltage U_S	Type	Art. No.
AC	AC		
20 V, 50…60 Hz	230 V, 50…60 Hz	AN450	B924201
	127 V, 50…60 Hz	AN450-133	B924203

Technical data

Insulation coordination acc. to IEC 60664-1

Rated voltage	AC 250 V
Overvoltage category/pollution degree	III/2
Rated impulse voltage	4 kV
Altitude	≤ 2000 m NN

Voltage ranges

Nominal voltage	see ordering details
Frequency range	see ordering details
Operating range of rated voltage	0.85…1.1
Output voltage	AC 20 V, 50…60 Hz
Rated output Power	≤ 9 VA
Internal secondary protection	PTC resistor

Enviroment/EMC

EMC immunity	acc. to EN 61000-6-2
EMC emission	acc. to EN 61000-6-4

Classification of climatic conditions acc. to IEC 60721

Stationary use	3K5 (except condensation, water and formation of ice)
Transport	2K2
Storage	1K2
Operating temperature	- 10…+ 55 °C

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M4
Transport	2M2
Storage	1M3

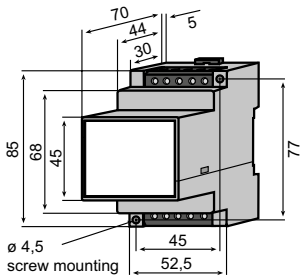
Connection

Connection	screw terminals
Connection properties:	
rigid/flexible/Conductor sizes	0.2…4/0.2…2.5 mm²/AWG 24-12
Connection, flexible with connector sleeve	0.25…2 mm²
Stripping length	8 mm
Tightening torque, terminal screws	0.5 Nm

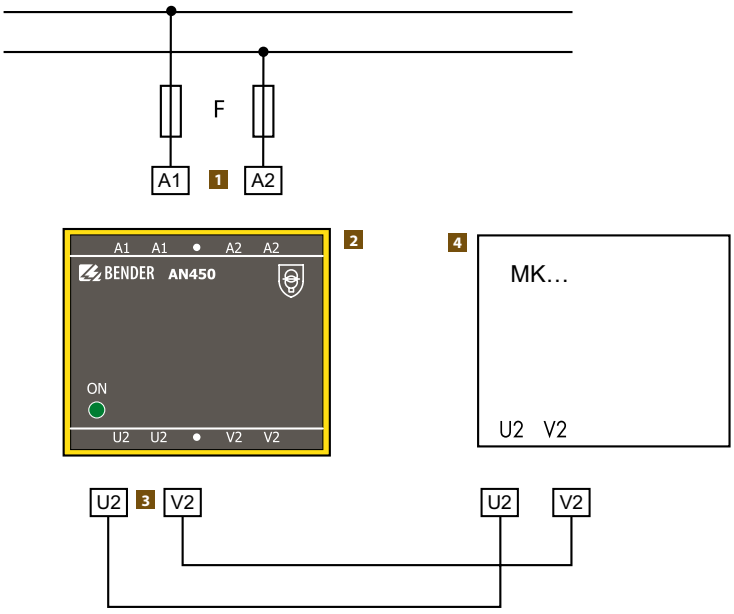
Other

Operating mode	continuous operation
Mounting	any position
Protection class internal components/terminals (DIN EN 60529)	IP30/IP20
Screw fixing	2 x M4
DIN rail mounting acc. to	DIN EN 60715/IEC 60715
Flammability class	UL94V-0
Standards	IEC 61558-2-6
Weight	≤ 400 g

Dimension diagram (dimensions in mm)



Wiring diagram



1	A1, A2 supply voltage U_S; F = short circuit protection	3	U2, V2 output voltage
2	Power supply unit AN450	4	Alarm indicator and test combination

7204/7220/9604/9620

Measuring instruments



Measuring instruments 9604/7204/9620

Device features

- Dimensions: 72 x 72 mm (7204/7220) or 96 x 96 mm (9604/9620)
- Version S for increased shock and vibration resistance
- Scale background: white, imprint: black

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- The analogue measuring instruments of the 96…/72… series for indication of measured values from Bender devices utilising an appropriate output

Approvals

CE EAC

Ordering information

Suitable ISOMETER®	Input current	Dimensions	Scale centre point (SKMP)	Type	Art. No.
IRDH275/375, iso685…	0…400 µA	72 x 72 mm	120 kΩ	7204-1421	B986763
				7204S-1421	B986804
		96 x 96 mm	120 kΩ	9604-1421	B986764
				9604S-1421	B986784
IRDH275B/375B/575, iso685…	0…20 mA	96 x 96 mm	120 kΩ	9620-1421	B986841
				9620S-1421	B986842
iso685…	0…400 µA	96 x 96 mm	1,2 MΩ	9604-1621	B986782
IRDH275B/375B/575, iso685…	0…20 mA	72 x 72 mm	120 kΩ	7220-1421	B986844
				7220S-1421	B986848

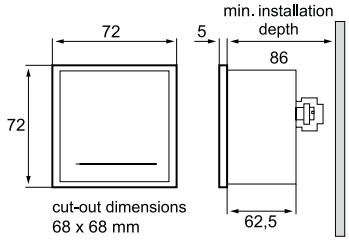
Technical data

Test voltage	3 kV
Accuracy class acc. to DIN 43780	1.5
Normal position	vertical +5°
Temperature range	-25…+40 °C

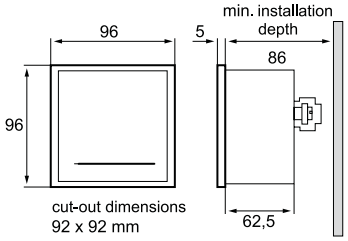
Protection class acc. to DIN 40050	
Enclosure	IP52
Terminals	IP00
Terminals with contact protection	
Documentation number	D00092

Dimension diagram (dimensions in mm)

7204/7220



9604/9620



DI-1DL

RS-485 interface repeater for RS-485 bus extension



Device features

- Plastic enclosure for DIN rail mounting
- Dynamic baud rate setting
- Galvanic separation between the input and output circuit and the power supply – overvoltage protection
- Supply voltage AC 85…260 V, 50…60 Hz
- Automatic baud rate changeover – can therefore be used for the internal BMS bus without limitations

Typical applications

- Extension of the maximum possible bus length by 1200 m in BMS systems (EDS, RCMS, MEDICS® systems)
- Extension of the maximum possible bus nodes by 31*
- Protection against spikes by galvanic separation between the input and output circuit and the power supply
- Implementation of resonant stubs (refer also to BSM instruction leaflet)

Approvals

CE

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S	Type	Art. No.
AC		
85…260 V, 50…60 Hz	DI-1DL	B95012047

Technical data

Supply voltage

Supply voltage U_S	AC 85…260 V, 50…60 Hz
Power consumption	0.1 A/7 W

Interfaces

BMS

Interface/protocol	2 x RS-485/BMS
Baud rate	dynamic
Cable length	≤ 1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2x0.8
Data direction switching	automatic
Cascading option	yes
Number of bus devices:	31 additional bus devices per repeater, cascading allows a virtually unrestricted number of connections
Terminating resistor and bus bias voltage can be activated by a switch	
Device address, BMS bus	–
Alarm LEDs	activity indication: direction and faults (green) internal operating voltage (red)

Environment

Operating temperature	0…+70 °C

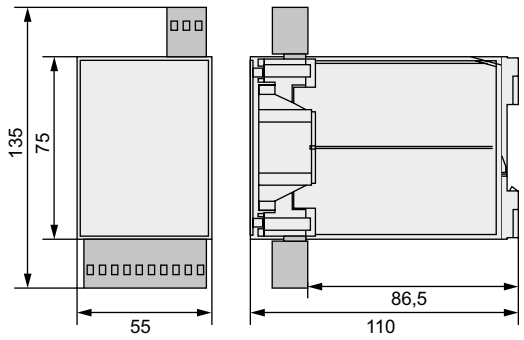
Connection

Connection	push-wire/plug-in terminals

Other

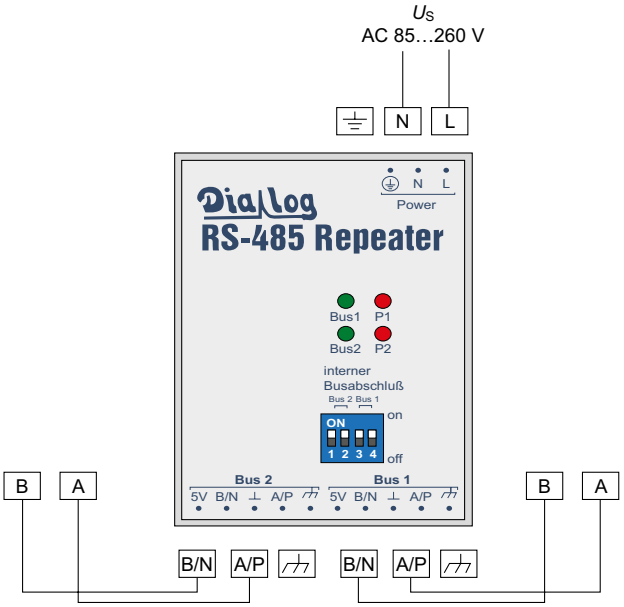
Operating mode	continuous operation
Mounting	any position
Enclosure	for standard DIN rail 32 mm (approx.110 x 75 x 55)
Operating manual	DiaLog RS-485 repeater type CN-2-1
Documentation number	D00125
Weight	approx. 90 g

Dimension diagram (dimensions in mm)



* depending on used transceivers

Wiring diagram

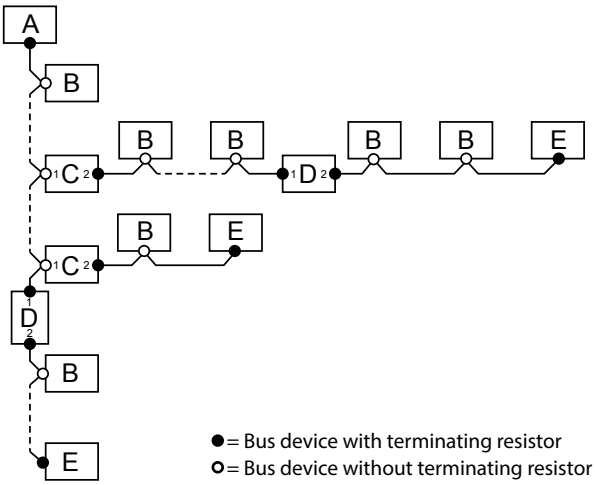


Settings

a) When used in the BMS bus, the rotary switch is to be set to position 4 for baud rate/interference suppression. The rotary switch is located at the bottom of the device.

b) Two DIP switches are available per bus segment to terminate the bus and to generate the required bias voltage. Both DIP switches must be switched on for activation.

The termination is carried out as shown in the following example of a BMS bus system:



Termination/bias voltage		
A	Master	Terminating resistor activated via switch on device (ON)* or external terminating resistor between terminals A and B
B	Slave	Terminating resistor deactivated via switch on device (OFF)*
C	RS-485 interface repeater DI-1DL	Bus 1: Terminating resistor and bias voltage generation deactivated via switch on device (DIP switch 1, 2: OFF)
		Bus 2: Terminating resistor and bias voltage generation activated via switch on device (DIP switch 3, 4: ON)
D	RS-485 interface repeater DI-1DL	Bus 1: Terminating resistor and bias voltage generation deactivated via switch on device (DIP switch 1, 2: OFF), external terminating resistor between terminals A/P and B/N
		Bus 2: Terminating resistor and bias voltage generation activated via switch on device (DIP switch 3, 4: ON)*
E	Slave	Terminating resistor activated via switch on device (ON) or external terminating resistor between terminals A and B

* The bias voltage generation is generally activated for the BMS bus master (via software) and deactivated for the BMS slaves.

DI-2USB

Interface converter USB to RS-485



Device features

- Plastic enclosure
- Galvanic separation between the input and output circuit
- Power supply via USB port
- USB cable and driver CD included in the scope of delivery

Approvals

CE

Typical applications

- Conversion of USB interface into RS-485 interface
- Parameterisation of alarm indicator and operator panels (MK800, MK2430) via RS-485 interface by means of software
- Parameterisation of Modbus RTU devices via RS-485 interface by means of software

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage	Type	Art. No.
from USB port, no additonal power supply required	DI-2USB	B 9501 2045

Technical data

Insulation coordination acc. to IEC 60664-1

Rated voltage	
Rated impulse voltage/pollution degree	3 kV/3

Supply voltage

Supply voltage U_S	see ordering details
Power consumption	95 mVA

Interfaces

RS-485

Interface/protocol	1 x RS-485/–
Baud rate	9.6…115.2 kbit/s
Cable length	≤ 1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2x0.8
Mode	–
Connection	A, B
Integrated terminating resistors, selectable via jumper, factory setting	terminating resistors included
Device address	–

USB

Serial interface	1 x USB
Alarm LEDs	ON (yellow), R x Data (green), T x Data (red)

Environment/EMC

EMC immunity/EMC emission	EN 61000-6-2/EN 61000-6-4
Operating temperature	-10…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use	3K5
Transport	2K3
Long-term storage	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M4
Transport	2M2
Long-term storage	1M3

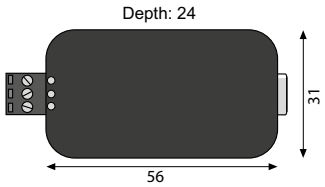
Connection

Connection	screw-type terminals/USB plug type B
Connection properties rigid/flexible/conductor sizes	0.5…2.5 mm² (AWG 22…12)

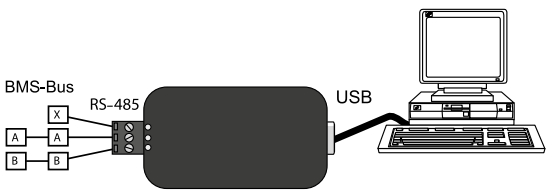
Other

Operating mode	continuous operation
Mounting	any position
Screw mounting	2 x M3
DIN rail mounting acc. to	IEC 60715
Operating manual	manual of third-party manufacturer
Documentation number	D00103
Weight	≤ 25 g

Dimension diagram (dimensions in mm)



Wiring diagram



DI-2USB to connect a personal computer utilising a USB interface to a BMS network.

Note:
Consider BMS bus termination

IOM441-S / IOM441W-S

Relay module

DC



Device features

- Extension of Bender devices by 12 relays
- N/O and N/C selectable

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- Extension of the measuring channels during insulation fault location by potential-free contacts

Approvals

CE

Ordering information

Supply voltage U_S	Option "W"	Type	Art. No.
DC			
24 V	–	IOM441-S	B95012057
	■	IOM441W-S	B95012057W

Accessories

Description	Art. No.
Plug Kit Pushin [1]	B95012902

[1] included in the scope of delivery

Technical data

Insulation coordination according to IEC 60664-1

Definitions:	
Supply circuit	BB bus
Output circuits	relay contacts [(13, 14), (23, 24), (33, 34), (43, 44), (53, 54), (63, 64), (73, 74), (83,84), (93, 94), (103, 104), (113, 114), (123, 124)]
Protective separation (reinforced insulation) between	(BB bus) – (relay contacts)
Rated voltage	250 V
Overvoltage category	III
Pollution degree	2
Rated impulse voltage	6 kV
Voltage test (routine test) acc. to IEC 61010-1	AC 3.51 kV
Basic insulation between	(relay contact) – (relay contact)
Rated voltage	250 V
Overvoltage category	III
Pollution degree	2
Rated impulse voltage	4 kV
Voltage test (routine test) acc. to IEC 61010-1	AC 2.21 kV

Supply voltage

Supply voltage U_S	DC 24 V
Tolerance of U_S	5 %
Power consumption	< 1.7 W

LEDs

ON (operation LED)	green

Switching elements

Number	12 N/O contacts
Rated operational voltage	AC 250 V/DC 30 V
Rated operational current	5 A
Minimum contact rating	1 mA at ≥ DC 5 V

Environment/EMC

EMC	IEC 61326-2-4

Ambient temperatures:

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Storage	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K11
Long-term storage (IEC 60721-3-1)	1K22

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12
Area of application	≤ 2000 m AMSL

6.2

Technical data (continued)

Connection

Connection type	pluggable push-wire terminal
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrule, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Other

Operating mode	continuous operation
Degree of protection internal components	IP40
Degree of protection terminals	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4 with mounting clip
Enclosure material	polycarbonate
Flammability class	UL 94V-0
Dimensions (W x H x D)	72 x 93 x 63
Documentation number	D00300
Weight	approx. 180 g

Device version "W"

Devices with the suffix "W" feature increased shock and vibration resistance.
The electronics is covered with a special varnish to provide increased protection against mechanical stress and moisture.

Ambient temperatures:

Operating temperature	-40…+70 °C
Transport	-40…+85 °C
Long-term storage	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721:

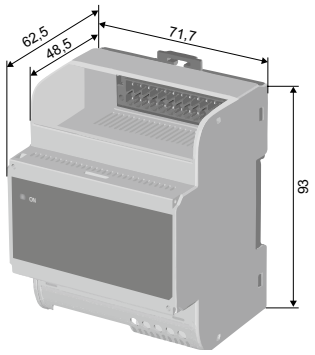
Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)

Classification of mechanical conditions acc. to IEC 60721:

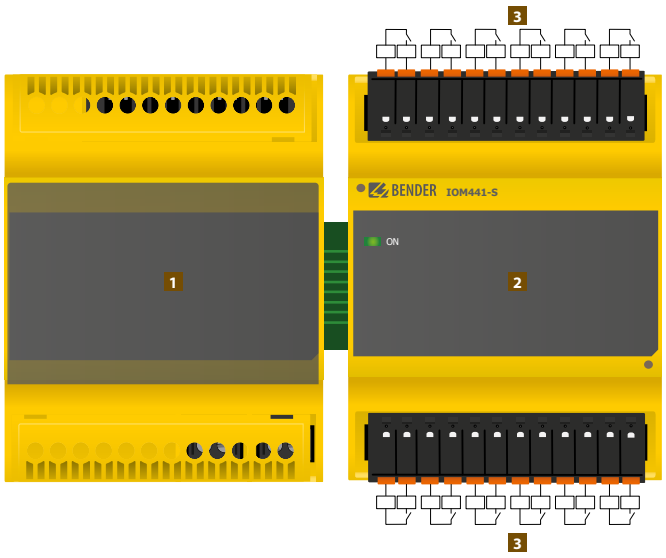
Stationary use (IEC 60721-3-3)	3M7

( )* = Factory settings

Dimension diagram (dimensions in mm)



Wiring diagram



1 Basic device
2 IOM441-S
3 Relay outputs

Charge Controller CC612



Typical applications

- Electric vehicle (EV) charging stations, wall boxes or street light charging points

Approvals

CE

Device features

- Charge controller acc. to IEC 61851-1 (mode 3)
- It can be configured as either a Master or Slave
- The charge controller can be integrated into a single or three-phase system up to 80 A
- Smart Grid enabled using standard OCPP functionality
- OCPP 1.5 and OCPP 1.6 compliant with JSON, SOAP and Binary implementation
- Supports 4G (LTE), 3G (UMTS) und 2G (GSM) mobile networks with an integrated 4G modem in all data gateways with 4G modem
- Two USB interfaces:
  – CONFIG for local configuration
  – Other is used an extension port for peripheral USB devices (Ethernet/WiFi home applications)
  – Master/slave hardware configuartion
- Control Pilot and Proximity Pilot signal management
- Universal charge plug control (support for different vendors of sockets)
- Configurable support for one additional household socket
- Can connect to eHZ or Modbus meters and to meters with an S0 interface
- User interface board for customer-specific applications
- Configurable 3-channel input/output extension interface for additional functionality
- Only an external RCD type A is required.
- Internal temperature sensors
- A Peer Group Mechanism or Dynamic Load Management where a set current is shared between a group of charge controllers
- **Optional** integrated ISO/IEC 15118 power line communication (PLC) for plug & charge and load management systems
- Local and remote configuration

Standards

The charge controller has been developed in compliance with the following standards:

- EN 50581
- EN 61851-1
- EN 301 489-1: V2.2.0 Draft
- EN 301 511 V12.5.1
- EN 301 908-13 V11.1.2
- EN 62311
- EN 61851-22
- EN 301 489-52 V1.1.0 Draft
- EN 301 908-1 V11.1.1
- EN 301 908-2 V11.1.2

Further information

For further information refer to our product range on www.bender.de.

Ordering information

User interface	RDC-MD [1]	Modem	PLC[2] hardware	LEDs	Meter	Type	Art. No.
■	■	4G	■	Ready, Alarm, PLC	eHZ- and S0 interface	CC612 -1M4PR	B94060011
					Modbus and S0 interface	CC612 -2M4PR	B94060013
			–	Ready, Alarm	Modbus and S0 interface	CC612 -2M4R	B94060015
		–	■	Ready, Alarm, PLC	eHZ- and S0 interface	CC612 -1S0PR	B94060005
					Modbus and S0 interface	CC612 -2S0PR	B94060007
			–	Ready, Alarm	Modbus and S0 interface	CC612 -2S0R	B94060010

[1] The charge controller with optional RDC-MD only works in combination with the measuring current transformer, which must be ordered separately. Various cable lenghts are available (see table below).

[2] Optional and enabled by a software update

Accessories

Designation	Art. No.
RFID110-L1 with RJ45 cable (length 500 mm)	B94060110
RFID114 with RJ45 cable (length 500 mm)	B94060114
Measuring current transformer[1] W15BS (Cable length 1500 mm)	B98080065
Measuring current transformer[1] W15BS-02 (Cable length 180 mm)	B98080067
Measuring current transformer[1] W15BS-03 (Cable length 320 mm)	B98080068
DPM2x16FP (display module)	B94060120

[1] The measuring current transformer has an internal diameter of 15 mm.

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Rated voltage	12.5 V
Overvoltage category/Pollution degree	III/3
Rated impulse withstand voltage	800 V
Altitude	≤ 2000 m AMSL

Supply voltage

Nominal voltage	DC 12 V
Operating range of the supply voltage	DC 11.4 V…12.6 V
Nominal current	1 A

RDC-MD

Measuring range	100 mA

Response values:

Residual current $I_{\Delta n}$	DC 6 mA
Response tolerance $I_{\Delta n}$	-50…0 %

Restart sequence value:

DC 6 mA	< 3 mA

Wireless parameters (Optional for data gateways with 4G modem only)

Frequency bands	800 MHz/850 MHz/900 MHz/1,800 MHz/2,100 MHz/2,600 MHz
Impedance	50 Ω
Data rate	**GSM:**
	GPRS: UL 85,6 kBit/s; DL 107 kBit/s
	EDGE: UL 236,8 kBit/s; DL 296 kBit/s
	UMTS:
	WCDMA: UL 384 kBit/s; DL 384 kBit/s
	DC-HSDPA: DL 42 MBit/s
	HSUPA: UL 5,76 MBit/s
	LTE:
	LTE FDD: UL 5 MBit/s; DL 10 MBit/s
	LTE TDD: UL 3,1 MBit/s; DL 8,96 MBit/s
Required antenna	Panorama Antennas B4BE-7-27-05SP

Inputs/outputs and display

LED ALARM	yellow
LED READY	green
LED PLC (Optional)	green
USB Extension interface (Ethernet, WLAN, …)	USB socket type A
CONFIG (Configuration interface)	Micro socket type AB
SIM card (For data gateways with 4G modem only)	micro SIM

Terminal A:

IN	Actuator IN
+	Actuator +
OUT	Actuator pul-up output
-	Actuator -

Terminal B:

12V	+12 V IN*
0V	0 V IN
11	Relay 1 NO
14	Relay 1 NO

Terminal C:

PP	Proximity Pilot
CP	Control Pilot (Optional Powerline Communication PLC acc. to ISO/IEC 15118)
Maximum cable length (PP, CP)	< 15 m
21	Relay 2 NO
24	Relay 2 NO
IN1-	Input 1-
IN1+	Input 1+
IN2-	Input 2-
IN2+	Input 2+
CT	Current transformer

Input 1 and Input 2:

Input voltage	DC 11.4 V…25.2 V
Input current	1.7…3.8 mA
Meter	Meter interface
User interface	User interface RJ45

Switching elements	
Relay 1	configurable
Relay 2	charging contactor
Switching elements	2 x 1 N/O contacts
Operating principle	N/C operation
Electrical service life	10,000 switching cycles
Contact data acc. to IEC 60947-5-1:	
Rated operational voltage U_e	30 V
Rated operational current I_e	1 A
Minimum contact rating	1 mA ≥ 10 V
Rated voltage U_i	32 V

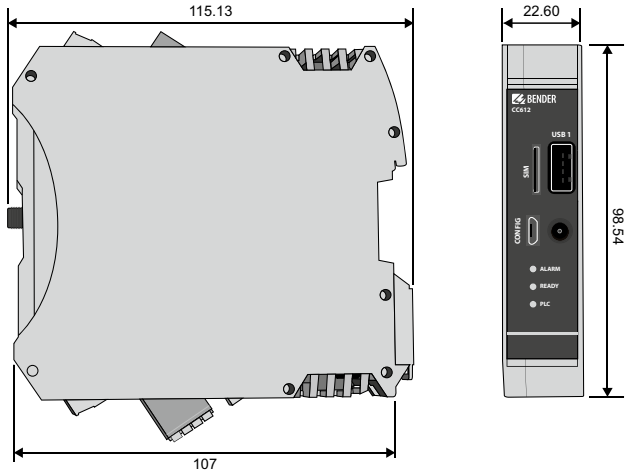
Environment/EMC	
EMC	EN 61851-1,IEC 61851-21-2 FDIS:2017-09 EN 301 489-1, EN 301 489-52
Operating temperature	-30…+70°C
Climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation, water and formation of ice)
Transport (IEC 60721-3-2)	2K2
Long-term storage (IEC 60721-3-1)	1K2
Mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M12

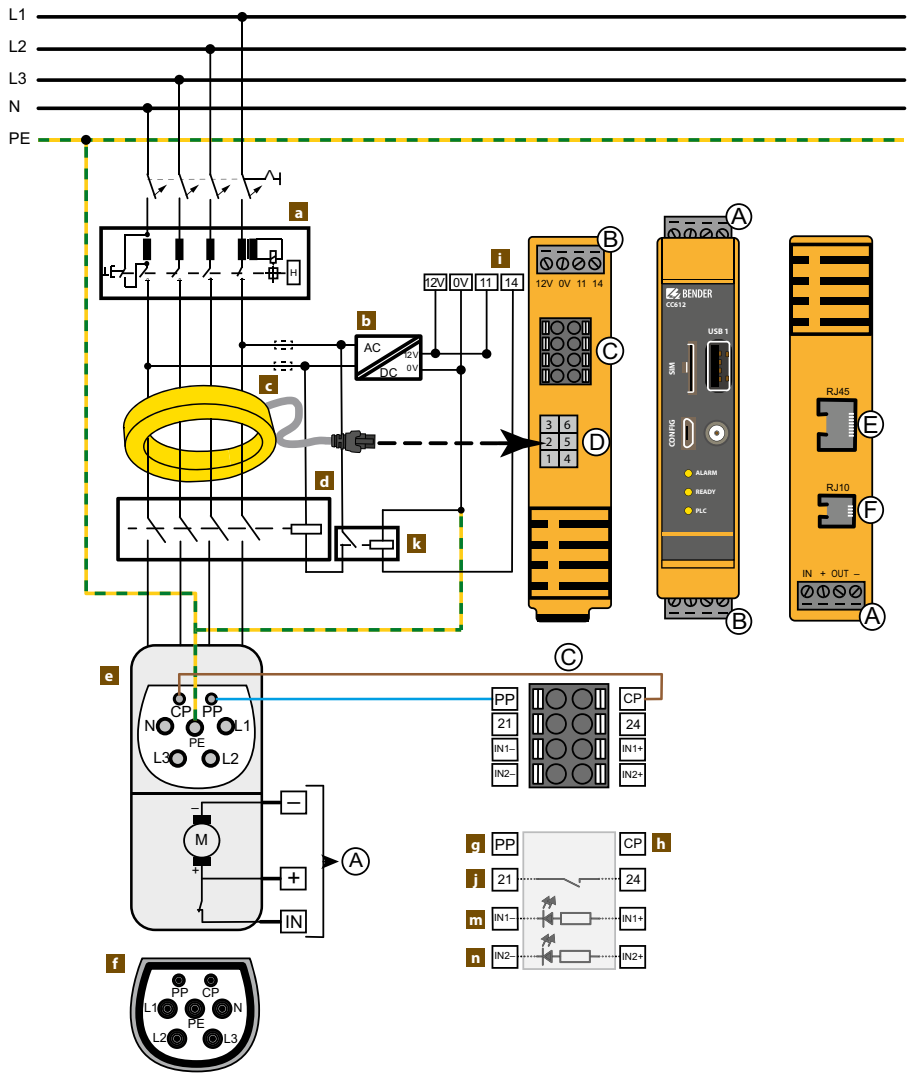
Connection	
Connection cable	RJ45
Maximum cable length	< 3 m
Connection type (terminal block C)	**push-in terminal**
Connection properties:	
rigid/flexible	0.2…1.5 mm² (AWG 24…16)
flexible with ferrule without plastic sleeve	0.25…1.5 mm² (AWG 24…16)
flexible with ferrule with plastic sleeve	0.25…0.75 mm² (AWG 24…20)
Stripping length	10 mm
Opening force	0.5 - 0.6 Nm (4 - 5 lb-in)
Connection type (terminal blocks A and B)	**screw terminal**
Connection properties:	
rigid/flexible	0.2…2.5 mm² (AWG 24…12)
flexible with ferrule without plastic sleeve	0.25…2.5 mm² (AWG 24…14)
flexible with ferrule with plastic sleeve	0.25…1.5 mm² (AWG 24…16)
Stripping length	7 mm

Other	
Operating mode	continuous operation
Degree of protection	IP20
DIN rail mounting	IEC 60715
Weight	160 g

*) Surge test is carried out at Phoenix power supply STEP-PS/1AC/12DC/1.5.
The 12V cable length is less than1 meter.

Dimension diagram (dimensions in mm)





- Ⓐ Connection locking engine
- Ⓑ Connection socket User Interface
- Ⓒ Connection socket
- Ⓓ Connection Current Transformer (CT)
- Ⓔ Terminal User Interface (RJ45)
- Ⓕ Terminal Modbus/eHZ meter (RJ10)
- a RCD Type A
- b Voltage supply DC 12 V
- c Current Transformer (CT) with plug
- d Contactor
- e Type 2 socket *
- f Type 2 plug *
- g Connection Proximity Pilot
- h Connection Control Pilot
- i Relay 1: Control pin intermediate relay
- j Output relay 2
- k Intermediate relay
- m Optocoupler input 1
- n Optocoupler input 2

Assignment of the terminals

A1	IN	C1	PP
A2	+	C2	CP
A3	OUT	C3	21
A4	–	C4	24
B1	12V	C5	IN1-
B2	0V	C6	IN1+
B3	11	C7	IN2-
B4	14	C8	IN2+

COMTRAXX® COM462RTU

BMS Modbus RTU gateway



Typical applications

- Usage of professional visualisation programs by converting BMS data to Modbus RTU protocols.
- Observing and analysing Bender products that support communication, such as RCMS, EDS and MEDICS® systems.

Approvals

Device features

- Setting of address data for the BMS bus and Modbus RTU and date and time setting using the internal operating menu.
- Time synchronisation for all BMS bus devices
- Can be operated on the internal BMS bus
- Modbus RTU data access to the internal BMS bus, max. 150 BMS devices
- Commands can be sent from an external application (e.g. visualisation software) to BMS devices and measured values read.

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage/ frequency range U_S	Supply voltage/frequency range U_S for UL applications		Power consumption	Type	Art. No.
AC/DC	AC	DC			
76…276 V [1], 42…460 Hz	76…250 V, 40…150 mA, 42…460 Hz	76…250 V, 10…35 mA	3.5…40 VA, 2.4 W	COM462RTU	B95061022

[1] Absolute values

Technical data

Insulation coordination acc. to IEC 60664-1	
Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	4 kV/3

Supply voltage	
Supply voltage U_S	see ordering information
Frequency range U_S	see ordering information
Power consumption	see ordering information

LED indicators	
ALARM	internal device error
COM	data traffic BMS bus
ON	operation indicator

Interfaces

BMS bus, internal:	
Interface/protocol	RS-485/BMS bus, internal
Operating mode	master/slave (slave)*
Baud rate BMS internal	9.6 kbit/s
Cable length	≤ 1200 m
Cable (twisted pair, shielded, shield connected to PE on one side)	recommended: J-Y(St)Y 2x0.8
Connection, BMS internal	terminals A, B
Terminating resistor	120 Ω (0.25 W)
Device address, BMS bus internal	1…99 (2)*

Modbus RTU:	
Interface/protocol	RS-485/Modbus RTU
Operating mode	slave
Baud rate Modbus RTU	9.6…57.6 kbit/s
Cable length	≤ 1200 m
Cable (twisted pair, shielded, shield connected to PE on one side)	recommended: J-Y(St)Y 2x0.8
Connection, Modbus RTU	terminals D+, D
Terminating resistor	120 Ω (0.25 W)
Device address, Modbus RTU	2…247 (2)*

Environment/EMC	
EMC	EN 61326-1
Operating temperature	-10…+55 °C

Classification of climatic conditions acc. to IEC 60721	
Stationary use	3K5
Transport	2K3
Long-term storage	1K4

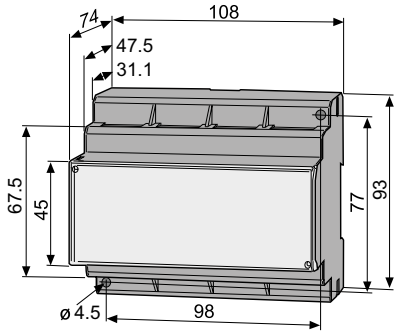
Classification of mechanical conditions acc. to IEC 60721	
Stationary use	3M4
Transport	2M2
Long-term storage	1M3

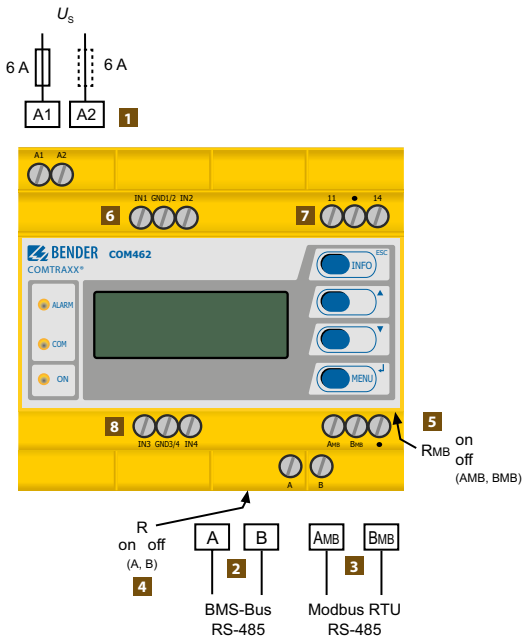
Connection	
Connection	screw-type terminals
Connection properties:	
rigid/flexible	0.2…4/0.2…2.5 mm² (AWG 24…12)
Multi-conductor connection (2 conductors with the same cross section):	
rigid/flexible	0.2…1.5 0.2…1.5 mm²
Stripping length	8…9 mm
Tightening torque	0.5…0.6 Nm

Other	
Operating mode	continuous operation
Mounting	display oriented
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Type of enclosure	X460
Screw mounting	2 x M4
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94V-0
Documentation number	D00010
Weight	≤ 310 g

( )* = factory setting

Dimension diagram (dimensions in mm)





1	A1, A2	Connection to the supply voltage, 6 A fuse recommended, two-pole fuses should be used on IT systems. For UL and CSA applications, it is mandatory to use 5 A fuses.
2	A, B	Connection to the BMS bus (internal) with shielded cable (e.g. J-Y(St)Y 2x0.8)
3	AMB, BMB	Connection Modbus RTU with shielded cable (e.g. J-Y(St)2x0.8)
4	$R_{on/off}$ (A, B)	Switch for BMS bus termination. When the device is installed at the end of the bus, set the terminating switch to "on".
5	$R_{MBon/off}$ (AMB, BMB)	Switch for Modbus RTU termination. When the device is installed at the end of the bus, set the terminating switch to "on"
6	IN1, GND1/2, IN2	Zurzeit ohne Funktion (Digitale Eingänge)
7	11, 14	Zurzeit ohne Funktion (Alarmrelais K1)
8	IN3, GND3/4, IN4	Zurzeit ohne Funktion (Digitale Eingänge)

COMTRAXX® COM465IP

Condition Monitor with integrated gateway for the connection of Bender devices to Ethernet TCP/IP networks



Typical applications

- Optimum indication und visualisation of device and system statuses via web browser
- Observation and analysis of compatible Bender products (ISOMETER®, ATICS®, RCMS, EDS, Linetraxx® and MEDICS® systems, universal measuring devices and energy meters)
- Specific system overview through individual system description
- Selective notification to various users in the event of alarms
- Use of professional visualisation programs by converting to Modbus TCP protocol
- Parameter setting for devices, saving, documenting and restoring of parameters in a clear and practice-oriented manner
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

Approvals

Device features

- Condition Monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or the Internet
- Range of functions adjustable through function modules
- Ethernet (10/100 Mbit/s) for remote access via LAN, WAN or the Internet
- Support of devices connected to the internal or external BMS bus via BCOM, Modbus RTU or Modbus TCP

Range of functions

Basic device (without function modules)

- Condition Monitor with web interface for use with Bender BMS and BCOM as well as universal measuring devices.
- Supports devices that are connected
  – to the internal (max. 139 devices) or the external* BMS bus (max. 98 * 139 devices),
  – via BCOM interface (refer to BCOM manual)
  – via Modbus RTU or via Modbus TCP (max. 247 devices).
- Remote indication of current measured values, operation/alarm messages and parameters*.
- Gateway to Modbus TCP: Reading-out of current measured values, operation/alarm messages of addresses 1…10 of the own subsystem via Modbus TCP.
- Ethernet interface with 10/100 Mbit/s for remote access via LAN, WAN or the Internet.
- Setting for internal parameters and for configuration of Bender universal measuring devices and energy meters.**
- Time synchronisation for all associated devices.
- History memory (1,000 entries).
- Data loggers, freely configurable (30 * 10,000 entries).
- 50 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system.
- A virtual device with 16 channels can be created.

*) Indicating the parameters of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

**) Parameters can be set via web application and externally (via BMS/ICOM/BCOM), but not via Modbus. The parameters of associated devices can only be read; Function module C is necessary for modification of settings!

No reports can be generated – also not for your own device.

Function module A

- Assignment of individual texts for devices, channels (measuring points) and alarms.
- Device failure monitoring.
- E-mail notifications to various users in the event of alarms and system faults.
- Configuration of e-mail notifications.
- Device documentation can be created by any device in the system. Present measured values, settings and software statuses are stored.
- System documentation can be created. It documents all devices in the system at once.

*) Generating device documentations of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

Function module B

- Supports external applications (such as visualisation programs or PLCs) via the Modbus TCP protocol
- Reading-out of current measured values, operation/alarm messages of associated devices. Uniform access to all associated devices via Modbus TCP over integrated server.
- Control commands: Commands can be sent to devices by an external application (e.g. visualisation software or PLC) via Modbus TCP.
- Access via SNMP protocol (V1, V2c or V3) to alarms and measured values.

Function module C

- Quick and easy parameterisation of all devices* assigned to the gateway via web browser.
- Backups can be generated and restored from all devices in the system.

*) Parameter setting of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

Function module D*

Fast and simple visualisation without any programming.
Device conditions, alarms or measured values can be arranged and displayed on a background image (e.g. a room plan).

- Displaying an overview the content of which takes up more than one page. Click to jump to another view. Return to the overview page.
- Graphical presentation with the scaling of the time axis.
- System visualisation: Several gateways (COM460IP, COM465IP, COM465DP, CP700) are displayed on one website. Indication of common alarms of the devices. Clicking on a device that is being displayed will open its web user interface.

*) Currently, the Silverlight web interface is still necessary for this function.

Function module E

- 100 virtual devices with 16 channels each can be created.

Function module F

1,600 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system.

Examples:

- To write parameters via Modbus, the function modules B and C are required.
- To read parameters via Modbus, the function module B is required.

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage/frequency range U_S		Power consumption	Application	Type	Art. no.
AC/DC	DC				
24…240 V, 50…60 Hz	–	≤ 6.5 VA/≤ 4 W	Condition Monitor with integrated gateway: Bender system/Ethernet	COM465IP-230 V	B95061065
–	24 V	≤ 3 W		COM465IP-24 V	B95061066

Function modules

Application	Function module (software license)	Art. No.
Individual text messages for all devices/ channels, device failure monitoring, e-mail in the event of an alarm	Function module A	B75061011
Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server	Function module B	B75061012
Parameter setting of BMS devices as well as BCOM and universal measuring devices	Function module C	B75061013
Visualisation of Bender systems, System visualisation	Function module D	B75061014
Virtual devices	Function module E	B75061015
Integration of third-party devices	Function module F	B75061016

Insulation coordination acc. to IEC 60664-1/IEC 60664-3 (For 230 V variants B95061060)

Rated insulation voltage	AC 250 V
Rated impulse voltage/Overvoltage category	4 kV/III
Pollution degree	3
Protective separation (reinforced insulation) between	(A1/+, A2/-) - [(AMB, BMB), (ABMS, BBMS), (X2), (X3, X4)]

Insulation coordination acc. to IEC 60664-1/IEC 60664-3 (For 24 V variants B95061061)

Rated insulation voltage	AC 50 V
Rated impulse voltage/Overvoltage category	0.5 kV/III
Pollution degree	3

Supply voltage

Supply voltage U_S	see ordering information
Frequency range U_S	see ordering information
Power consumption	see ordering information

Indications

LEDs:

ON	operation indicator
ETHERNET IP	data traffic Ethernet
MODBUS RTU	data traffic Modbus
BMS	data traffic BMS
Ethernet (terminal X2)	lights during network connection, flashes during data transfer

Memory

E-mail configuration (function module A only) and device failure monitoring	max. 250 entries
Individual texts (function module A only)	unlimited number of texts with 100 characters each
Number of data points for "third-party devices" on Modbus TCP and Modbus RTU	50

Quantity

Data loggers	30
Number of data points per data logger	10,000
Number of history memory entries	1,000

Visualisation

Number of pages	20
Size of the background image	50 kByte (scaled down if larger)
Data points (per page)	50 devices or channels, 150 text elements

Interfaces

Ethernet

Port	RJ45
Data rate	10/100 MBit/s, autodetect
DHCP	on/off (on)*
t_{off} (DHCP)	5…60 s (30 s)*
IP address	nnn.nnn.nnn.nnn, can always be reached over: 192.168.0.254, (169.254.0.1)*
Netmask	nnn.nnn.nnn.nnn (255.255.0.0)*
Protocols (depending on the function module selected)	TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP

SNMP

Versions	1, 2c, 3
Supported devices	Querying all devices (channels) possible (no trap functionality)

BMS bus (internal/external)

Interface/protocol	RS-485/BMS internal or BMS external (BMS internal)*
Operating mode	master/slave (master)*
Baud rate BMS	internal 9.6 kBit/s external 19.2; 38,4; 57.6 kBit/s
Cable length	≤1,200 m
Cable: twisted pair, shielded, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	X1 (ABMS, BBMS)
Connection type	refer to connection "push-wire terminal X1"
Terminating resistor	120 Ω (0.25 W), can be connected internally
Device address, BMS bus external/internal	1…99 (2)*

BCOM

Interface/protocol	Ethernet/BCOM
BCOM subsystem address	1…99 (1)*
BCOM device address	1…99 (2)*

Modbus TCP

Interface/protocol	Ethernet/Modbus TCP
Operating mode	client for associated PEM and "third-party devices"
Operating mode	server for access to the process image and for Modbus control commands
Parallel data access by different clients	max. 8

Modbus RTU

Interface/protocol	RS-485/Modbus RTU
Operating mode	master
Baud rate	9.6…57.6 kBit/s
Cable length	≤1,200 m
Connection	X1 (AMB, BMB)
Connection type	refer to connection "push-wire terminal X1"
Terminating resistor	120 Ω (0.25 W), can be connected internally
Supported Modbus RTU slave addresses	2…247

Environment/EMC

EMC	EN 61326-1

Ambient temperatures

Operation	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Option "W" data different from the standard version

Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M7

Connection

Connection type	pluggable push-wire terminals

Push-wire terminals

Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrule, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminal X1

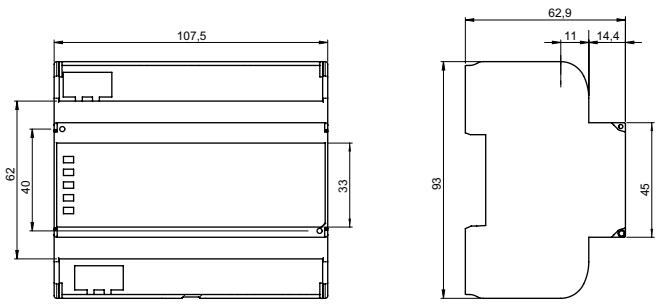
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other

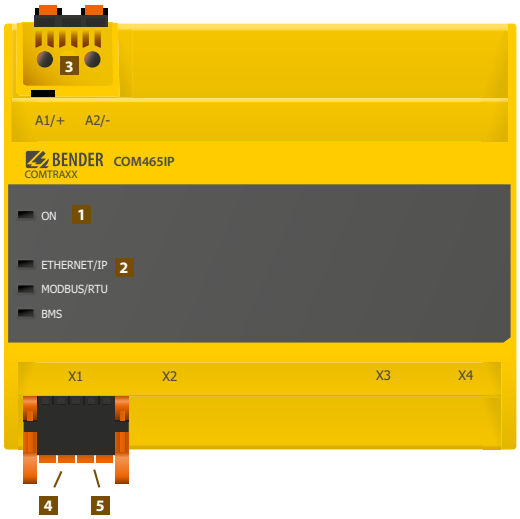
Operating mode	continuous operation
Mounting	front-oriented, cooling slots must be ventilated vertically
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Quick DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4
Enclosure type	J460
Enclosure material	polycarbonate
Flammability class	UL94V-0
Dimensions (W x H x D)	107.5 x 93 x 62.9 mm
Documentation number	D00216
Weight	≤ 240 g

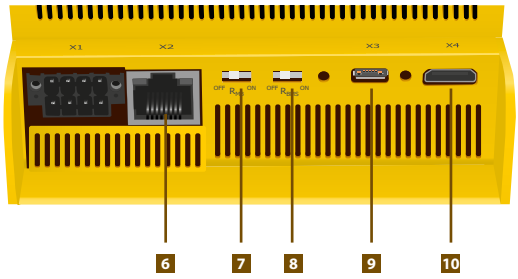
( )* = factory setting

Dimension diagram (dimensions in mm)



Operating controls and connections





1	ON	LED "ON": Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.
2	ETHERNET/IP ISODATA 1 ISODATA 2	LEDs show activities on the different interfaces
3	A1/+, A2/-	Supply voltage: see nameplate and ordering information
4	X1	Interface Modbus RTU
5	X1	BMS bus (Bender measuring device interface)
6	X2	Ethernet port (RJ45) for connection to the PC network as well as BCOM
7	R_{MB} on/off	Terminating resistor Modbus RTU switch
8	R_{BMS} on/off	Terminating resistor BMS bus switch
9	X3	Micro USB interface (currently without function)
10	X4	Mini HDMI interface (currently without function)

For UL applications, the following has to be observed:
– Maximum ambient temperature: 55 °C
– Use 60/75-°C copper wires only

COMTRAXX® COM465DP

Condition Monitor with integrated gateway for the connection of Bender devices to PROFIBUS DP and Ethernet TCP/IP networks



Typical applications

- Optimum indication und visualisation of device and system statuses via web browser
- Observation and analysis of compatible Bender products (ISOMETER®, ATICS®, RCMS, EDS, Linetraxx® and MEDICS® systems, universal measuring devices and energy meters)
- Specific system overview through individual system description
- Selective notification to various users in the event of alarms
- Use of professional visualisation programs by converting to Modbus TCP protocol or PROFIBUS DP
- Parameter setting for devices, saving, documenting and restoring of parameters in a clear and practice-oriented manner
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

Approvals

Device features

- Condition Monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or the Internet
- Range of functions adjustable through function modules
- Ethernet (10/100 Mbit/s) for remote access via LAN, WAN or the Internet
- Support of devices connected to the internal or external BMS bus via BCOM, Modbus RTU or Modbus TCP
- Integrated gateway between Bender system and PROFIBUS DP

Range of functions

Basic device (without function modules)

- Condition Monitor with web interface for use with Bender BMS and BCOM as well as universal measuring devices.
- Supports devices that are connected
  - to the internal (max. 139 devices) or the external* BMS bus (max. 98 * 139 devices),
  - via BCOM interface (refer to BCOM manual)
  - via Modbus RTU or via Modbus TCP (max. 247 devices).
- Remote indication of current measured values, operation/alarm messages and parameters*.
- Gateway for coupling of associated devices with the PROFIBUS DP.
- Gateway to Modbus TCP: Reading-out of current measured values, operation/alarm messages of addresses 1…10 of the own subsystem via Modbus TCP.
- Ethernet interface with 10/100 Mbit/s for remote access via LAN, WAN or the Internet
- Setting for internal parameters and for configuration of Bender universal measuring devices and energy meters.**
- Time synchronisation for all associated devices
- History memory (1,000 entries)
- Data loggers, freely configurable (30 * 10,000 entries)
- 50 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system.
- A virtual device with 16 channels can be created.
- Supports external applications (such as visualisation programs or PLCs) via the PROFIBUS DP protocol
- Reading-out of current measured values, operation/alarm messages of associated devices. Uniform access to all associated devices via PROFIBUS DP over an integrated server.
- Control commands: Commands can be sent to devices by an external application (e.g. visualisation software or PLC) via PROFIBUS DP.

*) Indicating the parameters of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.
**) Parameters can be set via web application and externally (via BMS/ICOM/BCOM), but not via Modbus or PROFIBUS. The parameters of associated devices can only be read; Function module C is necessary for modification of settings!

No reports can be generated – also not for your own device.

Function module A

- Assignment of individual texts for devices, channels (measuring points) and alarms.
- Device failure monitoring.
- E-mail notifications to various users in the event of alarms and system faults.
- Configuration of e-mail notifications.
- Device documentation can be created by any device in the system. Present measured values, settings and software statuses are stored.
- System documentation can be created. It documents all devices in the system at once.

*) Generating reports of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

Function module B

- Supports external applications (such as visualisation programs or PLCs) via the Modbus TCP protocol
- Reading-out of current measured values, operation/alarm messages of associated devices. Uniform access to all associated devices via Modbus TCP over integrated server.
- Control commands: Commands can be sent to devices by an external application (e.g. visualisation software or PLC) via Modbus TCP.
- Access via SNMP protocol (V1, V2c or V3) to alarms and measured values.

Function module C

- Quick and easy parameterisation of all devices* assigned to the gateway via web browser.
- Backups can be generated and restored from all devices in the system.

*) Parameter setting of BMS bus devices is only possible when the gateway is connected to the internal BMS bus.

Function module D*

Fast and simple visualisation without any programming. Device conditions, alarms or measured values can be arranged and displayed on a background image (e.g. a room plan).

- Displaying an overview the content of which takes up more than one page. Click to jump to another view. Return to the overview page.
- Graphical presentation with the scaling of the time axis.
- System visualisation: Several gateways (COM460IP, COM465IP, COM465DP, CP700) are displayed on one website. Indication of common alarms of the devices. Clicking on a device that is being displayed will open its web user interface.

*) Currently, the Silverlight web interface is still necessary for this function.

Function module E

- 100 virtual devices with 16 channels each can be created.

Function module F

- 1,600 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system.

Examples:

- To write parameters via Modbus, the function modules B and C are required.
- To read parameters via Modbus, the function module B is required.
- For parameterisation via PROFIBUS, the function module C is required.

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage/frequency range U_S		Power consumption	Application	Type	Art. no.
AC/DC	DC				
24…240 V, 50…60 Hz	–	≤ 6.5 VA/≤ 4 W	Condition Monitor with integrated gateway: Bender system/PROFIBUS DP/Ethernet	COM465DP-230 V	B95061060
–	24 V	≤ 3 W		COM465DP-24 V	B95061061

Function modules

Application	Function module (software licence)	Art. no.
Individual text messages for all devices/ channels, device failure monitoring, e-mail in the event of an alarm	Function module A	B75061011
Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server	Function module B	B75061012
Parameter setting of BMS devices as well as BCOM and universal measuring devices	Function module C	B75061013
Visualisation of Bender systems, System visualisation	Function module D	B75061014
Virtual devices	Function module E	B75061015
Integration of third-party devices	Function module F	B75061016

Insulation coordination acc. to IEC 60664-1/IEC 60664-3 (For 230 V variants B95061060)

Rated insulation voltage	AC 250 V
Rated impulse voltage/Overvoltage category	4 kV/III
Pollution degree	3
Protective separation (reinforced insulation) between	(A1/+, A2/-) - [(AMB, BMB), (ABMS, BBMS), (X2), (X3, X4), (PROFIBUS DP)]

Insulation coordination acc. to IEC 60664-1/IEC 60664-3 (For 24 V variants B95061061)

Rated insulation voltage	AC 50 V
Rated impulse voltage/Overvoltage category	0.5 kV/III
Pollution degree	3

Supply voltage

Supply voltage U_S	see ordering information
Frequency range U_S	see ordering information
Power consumption	see ordering information

Indications

LEDs:

ON	operation indicator
PROFIBUS	data traffic PROFIBUS DP
ETHERNET IP	data traffic Ethernet
MODBUS RTU	data traffic Modbus
BMS	data traffic BMS
Ethernet (terminal X2)	lights during network connection, flashes during data transfer

Memory

E-mail configuration (function module A only) and device failure monitoring	max. 250 entries
Individual texts (function module A only)	unlimited number of texts with 100 characters each
Number of data points for "third-party devices" on Modbus TCP and Modbus RTU	50

Quantity

Data loggers	30
Number of data points per data logger	10,000
Number of history memory entries	1,000

Visualisation

Number of pages	20
Size of the background image	50 kByte (scaled down if larger)
Data points (per page)	50 devices or channels, 150 text elements

Interfaces

Ethernet

Port	RJ45
Data rate	10/100 MBit/s, autodetect
DHCP	on/off (on)*
t_{off} (DHCP)	5…60 s (30 s)*
IP address	nnn.nnn.nnn.nnn, can always be reached over: 192.168.0.254, (169.254.0.1)*
Netmask	nnn.nnn.nnn.nnn (255.255.0.0)*
Protocols (depending on the function module selected)	TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP

SNMP

Versions	1, 2c, 3
Supported devices	Querying all devices (channels) possible (no trap functionality)

BMS bus (internal/external)

Interface/protocol	RS-485/BMS internal or BMS external (BMS internal)*
Operating mode	master/slave (master)*
Baud rate BMS	internal 9.6 kBit/s external 19.2; 38,4; 57.6 kBit/s
Cable length	≤1,200 m
Cable: twisted pair, shielded, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	X1 (ABMS, BBMS)
Connection type	refer to connection "push-wire terminal X1"
Terminating resistor	120 Ω (0.25 W), can be connected internally
Device address, BMS bus external/internal	1…99 (2)*

BCOM

Interface/protocol	Ethernet/BCOM
BCOM subsystem address	1…99 (1)*
BCOM device address	1…99 (2)*

Modbus TCP

Interface/protocol	Ethernet/Modbus TCP
Operating mode	client for associated PEM and "third-party devices"
Operating mode	server for access to the process image and for Modbus control commands
Parallel data access by different clients	max. 8

Modbus RTU

Interface/protocol	RS-485/Modbus RTU
Operating mode	master
Baud rate	9.6…57.6 kBit/s
Cable length	≤1,200 m
Connection	X1 (AMB, BMB)
Connection type	refer to connection "push-wire terminal X1"
Terminating resistor	120 Ω (0.25 W), can be connected internally
Supported Modbus RTU slave addresses	2…247

PROFIBUS DP

Interface/protocol	RS-485 galvanically separated/PROFIBUS DP
Operating mode	slave
Baud rate	automatic baud rate detection: 9.6 kBit/s…1.5 MBit/s 9.6/19.2/93.75/187.5/500 kBit/s, 1.5 MBit/s
Connection	9-pole sub D
Device address, PROFIBUS DP	1…125 (3)*

Environment/EMC

EMC	EN 61326-1

Ambient temperatures

Operation	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Option "W" data different from the standard version

Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice possible)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M7

Connection

Connection type	pluggable push-wire terminals

Push-wire terminals

Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrule, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminal X1

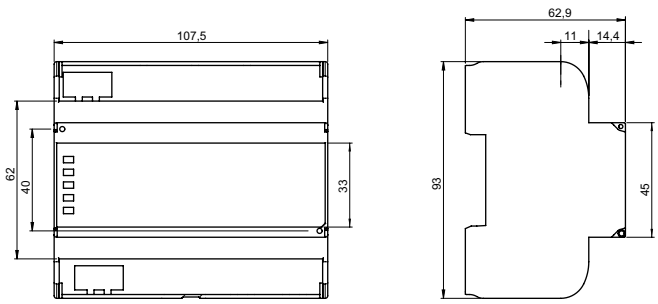
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with TWIN ferrule with plastic sleeve	0.25…0.75 mm²

Other

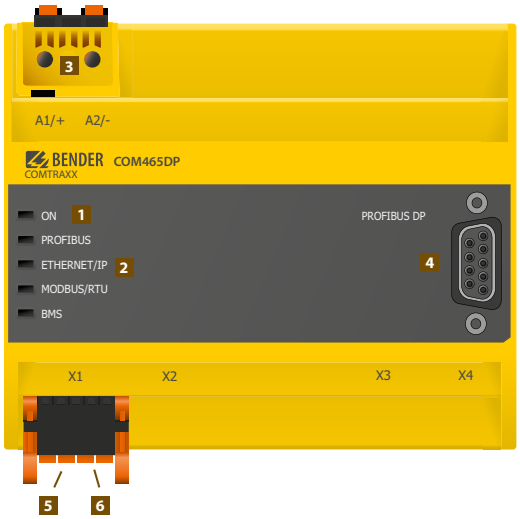
Operating mode	continuous operation
Mounting	front-oriented, cooling slots must be ventilated vertically
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4
Enclosure type	J460
Enclosure material	polycarbonate
Flammability class	UL94V-0
Dimensions (W x H x D)	107.5 x 93 x 62.9 mm
Documentation number	D00216
Weight	≤ 240 g

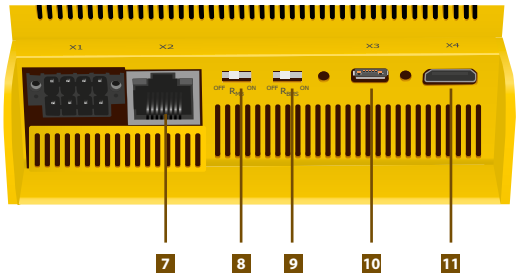
( )* = factory setting

Dimension diagram (dimensions in mm)



Operating controls and connections





1	ON	LED "ON": Flashes during start-up. The LED lights permanently as soon as the device is ready for operation.
2	ETHERNET/IP MODBUS/RTU BMS	LEDs show activities on the different interfaces
3	A1/+, A2/-	Supply voltage: see nameplate and ordering information
4	PROFIBUS DP	Connection PROFIBUS DP
5	X1	Interface Modbus RTU
6	X1	BMS bus (Bender measuring device interface)
7	X2	Ethernet port (RJ45) for connection to the PC network as well as BCOM
8	R_{MB} on/off	Terminating resistor Modbus RTU switch
9	R_{BMS} on/off	Terminating resistor BMS bus switch
10	X3	Micro USB interface (currently without function)
11	X4	Mini HDMI interface (currently without function)

For UL applications, the following must be observed:
– Maximum ambient temperature: 55 °C
– Only 60/75 °C copper wires must be used

COMTRAXX® COM465ID

Condition Monitor with an integrated gateway for the connection of Bender isoData devices to Ethernet TCP/IP networks



Typical applications

- Optimum display and visualisation of device and plant statuses in the web browser
- Collecting information from the Bender system and making it available via Modbus TCP and OPC UA
- Specific system overview through individual installation description
- Selective notification to various users in case of alarms
- Information from the Bender system can be transmitted to POWERSCOUT® for analysis and archiving.
- Commissioning and diagnosis of Bender systems
- Remote diagnosis, remote maintenance

Approvals

CE

Device features

- Condition Monitor for Bender systems
- Integrated modular gateway between Bender systems and TCP/IP enables remote access via LAN, WAN or the Internet
- Range of functions adjustable through function modules
- Ethernet (10/100 Mbit/s) for remote access via LAN, WAN or the Internet
- Integration of devices that are connected via IsoData or BCOM
- OPC UA interface for data transmission

Range of functions

Basic device (without function modules)

- Condition Monitor with a web interface for use with Bender isoData and BCOM as well as universal measuring devices.
- Support for devices that are connected
  – via IsoData (1 device per interface),
  – via the BCOM interface (see the BCOM operating manual),
  – via Modbus TCP (max. 247 devices).
- Remote display of present measured values, operating status and alarm messages.
- Gateway to Modbus TCP: Reading the latest subsystem measured values, operating status and alarm messages from addresses 1…10 via Modbus TCP.
- Ethernet interface with 10/100 Mbit/s for remote access via LAN, WAN or the Internet.
- Setting for internal parameters and for configuration of Bender universal measuring devices and energy meters.*
- Time synchronisation for all assigned devices.
- History memory (1,000 entries).
- Data loggers, freely configurable (30 * 10,000 entries).
- 50 data points from third-party devices (via Modbus TCP) can be integrated into the system.
- A virtual device with 16 channels can be created.

*) Individual parameters can be set via a web-based application and externally (via BCOM), but not via Modbus. The parameters of assigned devices can only be read; in order to change settings, function module C is required!

No reports can be generated – also not for your own device.

Function module A

- Assigning individual texts for devices, channels (measuring points) and alarms
- Device failure monitoring
- E-mail notification in the event of alarms or system faults to different users
- Configuration of e-mail notifications
- Device documentation can be created by any device in the system. Present measured values, settings and software statuses are stored.
- System documentation can be created. It documents all devices in the system at once.

Function module B

- Supports external applications (e.g. visualisation programs or PLCs) by means of the Modbus TCP protocol.
- Reading the latest measured values, operating status and alarms messages from all assigned devices. Uniform access to all assigned devices by means of Modbus TCP via an integrated server.
- Control commands: From an external application (e.g. visualisation software or PLC), commands can be sent to devices by means of Modbus TCP.
- Access to alarms and measurement values via SNMP protocol (V1, V2c or V3).

Function module C

- Quick and easy parameterisation of all devices* assigned to the gateway via web browser.
- Backups can be generated and restored from all devices in the system.

*) Only BCOM devices can be parameterised. IsoData devices cannot be parameterised.

Function module D*

Fast, simple visualisation without programming. Device statuses, alarms or readings can be arranged and displayed (e.g. a spatial plan) in front of a background image.

- Display of an overview covering several pages. Jump to another view page and return to the overview page.
- Graphical display of the data loggers with scaling of the time axis.

*) Currently, the Silverlight web interface is still necessary for this function.

Function module E

- 100 virtual devices with 16 channels each can be created.

Function module F

- 1,600 data points from third-party devices (via Modbus TCP) can be integrated into the system.

Examples:

- To write parameters via Modbus, the function modules B and C are required.
- To read parameters via Modbus, the function module B is required.

Further information

For further information refer to our product range on www.bender.de..

Ordering information

Supply voltage/Frequency range U_S		Power consumption	Application	Type	Art. No.
AC/DC	DC				
24…240 V, 50…60 Hz	–	≤ 6.5 VA/≤ 4 W	Condition Monitor with an integrated gateway: Bender system/Ethernet	COM465ID-230 V	B95061070

Function modules

Application	Function module (software licence)	Art. No.
Individual texts for devices/channels, device failure monitoring, e-mail in case of an alarm	Function module A	B75061011
Modbus TCP server for max. 98 * 139 BMS nodes as well as BCOM and universal measuring devices, SNMP server	Function module B	B75061012
Parameter setting of BMS devices as well as BCOM and universal measuring devices	Function module C	B75061013
Visualisation of Bender systems, System visualisation	Function module D	B75061014
Virtual devices	Function module E	B75061015
Integrating third-party devices	Function module F	B75061016

Insulation coordination acc. to IEC 60664-1/IEC 60664-3
(For 230 V variants B95061070)

Rated voltage	AC 250 V
Rated impulse voltage/Overvoltage category	4 kV/III
Pollution degree	3
Protective separation (reinforced insulation) between	(A1/+, A2/-) - [(AMB, BMB), (ABMS, BBMS), (X2)]

Supply voltage

Supply voltage U_S	see ordering details
Frequency range U_S	see ordering details
Power consumption	see ordering details

Indication

LEDs:

ON	operation indicator
ETHERNET IP	data traffic Ethernet
ISODATA1	data traffic ISODATA1
ISODATA2	data traffic ISODATA2
Ethernet (X2 terminal)	lights during network connection, flashes during data transmission

Internal memory

E-mail configuration (function module A only) and device failure monitoring	max. 250 entries
Individual texts (function module A only)	unlimited number of texts with 100 characters each
Number of data points for "third-party devices" on Modbus TCP and Modbus RTU	50
Data loggers	30
Number of data points per data logger	10,000
Number of history memory entries	1,000

Visualisation

Number of pages	20
Size of the background image	50 kByte (scaled down if larger)
Data points (per page)	50 devices or channels, 150 text elements

Interfaces

Ethernet

Port	RJ45
Data rate	10/100 Mbit/s, autodetect
DHCP	on/off (on)*
t_{off} (DHCP)	5…60 s (30 s)*
IP address	nnn.nnn.nnn.nnn, can always be reached over: 192.168.0.254, (169.254.0.1)*
Netmask	nnn.nnn.nnn.nnn (255.255.0.0)*
Protocols (depending on function module selected)	TCP/IP, Modbus TCP, Modbus RTU, DHCP, SMTP, NTP, OPC UA

SNMP

Versions	1, 2c, 3
Devices supported	Queries to all devices (channels) possible (no trap functionality)

ISODATA

Interface/protocol	RS-485/ISODATA
Operating mode	master
Baud rate ISODATA	9.6 kbit/s
Cable length	≤ 1200 m
Cable: twisted pair, shielded, one end of shield connected to PE	recommended: J-Y(St)Y min. 2x0.8
Connection	X1 (A-ID1, B-ID1, A-ID2, B-ID2)
Connection type	refer to connection "push-wire terminal X1"
Terminating resistor	120 Ω (0.25 W), can be connected internally
Device address	ISODATA1 (2); ISODATA2 (3)

BCOM

Interface/protocol	Ethernet/BCOM
BCOM subsystem address	1…99 (1)*
BCOM device address	1…99 (2)*

Modbus TCP

Interface/protocol	Ethernet/Modbus TCP
Operating mode	client for associated PEM and "third-party devices"
Operating mode	server for access to the process image and for Modbus control commands
Parallel data access by different clients	max. 8

Environment/EMC

EMC	EN 61326-1

Ambient temperatures

Operating temperature	-25…+55 °C
Transport	-40…+85 °C
Long-term storage	-25…+70 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Connection

Connection type	pluggable push-wire terminals

Push-wire terminals

Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrule, with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Push-wire terminal X1

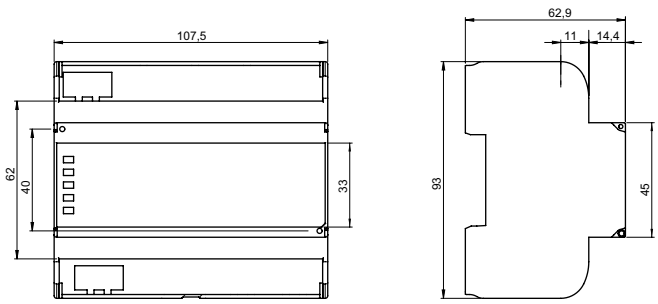
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with ferrule with plastic sleeve	0.25…0.75 mm²

Other

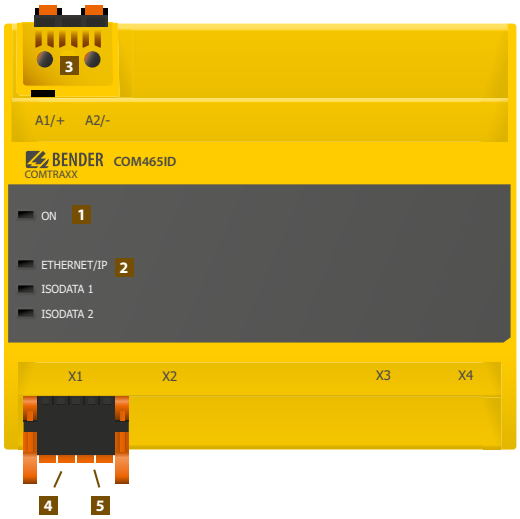
Operating mode	continuous operation
Mounting	front-oriented, cooling slots must be ventilated vertically
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
DIN rail mounting acc. to	IEC 60715
Screw fixing	2 x M4
Enclosure type	J460
Enclosure material	polycarbonate
Flammability class	UL94V-0
Dimensions (W x H x D)	107.5 x 93 x 62.9 mm
Weight	≤ 240 g

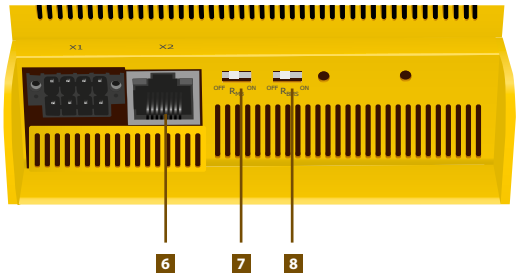
( )* = Factory settings

Dimension diagram (dimensions in mm)



Operating controls and connections





1	ON	The LED flashes during start-up. The LED lights permanently as soon as the device is ready for operation.	
2	ETHERNET/IP ISODATA 1 ISODATA 2	LEDs show activities on the different interfaces	
3	A1/+, A2/-	Voltage supply: see nameplate and ordering details	
4	X1		IsoData 1 interface 1
5	X1		IsoData 1 interface 2
6	X2		Ethernet port (RJ45) for connection to the PC network as well as BCOM
7	R_{MB} on/off		IsoData 1 terminating resistor switch
8	R_{BMS} on/off		IsoData 2 terminating resistor switch

COMTRAXX® CP700

Condition Monitor for Bender BMS devices and universal measuring devices



Typical applications

- Clear information about device and system statuses via 7-inch touch screen
- Specific system overview according to individual system description
- Display und visualisation of device and system statuses via web browser
- Selective e-mail notification to various user groups in the event of alarms
- Support of professional visualisation programs
- Observing and analysing of Bender products with communication capabilities (universal measuring devices, RCMS, Isometer, EDS systems)
- Parameter setting for devices, storing, documentation and restoring of parameters in a clear and practice-oriented manner
- Remote diagnosis, remote maintenance

Approvals

CE

Device features

- Condition Monitor for Bender BMS devices and universal measuring devices
- 7" TFT WVGA Color Display
- Analogue resistive touch screen
- Small mounting depth
- Fanless operation
- Integrated gateway to Ethernet (TCP/IP), 10/100/1000 Mbit/s
- Remote access via LAN, WAN or Internet
- Support for devices connected to the internal BMS bus via Modbus RTU or Modbus TCP.

Device characteristics

Range of functions

- Display of currently measured values, operating and alarm messages from Bender BMS devices and Bender universal measuring devices on the touch screen
- Remote indication of data from Bender BMS devices and Bender universal measuring devices using a standard web browser with Silverlight plug-in
- Time synchronisation for all BMS bus devices and Bender univeral measuring devices
- Easy address setting via touch screen
- Fast, simple parameter setting of BMS devices using the PC's web browser.
- Report function saves measured values and settings. Saved settings can be compared with the current settings and can be reloaded.
- Password-protected device menu
- Assignment of individual texts for devices and measuring points (channels) and alarms
- E-mail notifications to different user groups according to a time controlled schedule in the event of alarms and system faults
- Monitoring for device failure

Function module E

- 100 virtual devices with 16 channels each can be created.

Function module F

- 1,600 data points from third-party devices (via Modbus RTU or Modbus TCP) can be integrated into the system.

Access via Modbus TCP

- Uniform access to all Bender devices assigned to the CP700 via the integrated Modbus TCP server (max. 247 devices)
- Bender BMS devices can be controlled by an external application (e.g. visualisation or SPS) via Modbus TCP
- Support of professional visualisation programs by the Modbus TCP protocol

Visualisation

- Fast and easy visualisation on a personal computer without previous knowledge of computer programming. Measured values or alarms can be arranged in front of a graphic (system diagram, room plan) and displayed
- Multipage documents supported

Further information

For further information refer to our product range on www.bender.de.

6.2

Ordering information

Supply voltage/frequency range U_S	Power consumption	Type	Art. No.
DC			
24 V/±25 %	24 W	CP700	B95061030

Device version with Gost certification available.

Function modules

Application	Function module (software licence)	Art. no.
Virtual devices	Function module E	B75061015
Integration of third-party devices	Function module F	B75061016

Recommended power supply units

Material number/type	Manufacturer	Description
0PS1025.2	B&R	DC 24 V power supply unit, 2.5 A, input AC 100…240 V, DIN-rail mounting/wall mounting WxHxD: 72 x 90 x 61 mm
0PS1020.0	B&R	DC 24 V power supply unit, 2 A, input AC 100…240 V, DIN rail mounting WxHxD: 45 x 99 x 107 mm
1SVR427044R0200/CP-D 24/2.5 EAN: 4016779661188	ABB	Power supply unit In: AC 100…240 V Out: DC 24 V/2.5 A, DIN-rail mounting WxHxD: 71 x 91 x 57.5 mm

Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	4 kV/3

Supply voltage

Supply voltage U_S	see ordering information
Frequency range U_S	see ordering information
Power consumption	see ordering information

Displays, memory

Display	7" TFT WVGA Color
LEDs	Power, CF, Link, Run, Master/Slave
Button	Power, Reset
Buzzer	no
Memory card for special device functions (CF card)	4 GB
E-mail configuration and device failure monitoring	max. 250 entries
Individual texts	max. 1200 texts with 100 characters each
Devices that can be displayed	max. 247

Interfaces

BMS bus:

Interface/protocol	RS-485/BMS internal
Operating mode (max. one CP700 per bus)	master/slave (slave)*
Device address, BMS bus	1…99 (2)*
Baud rate BMS	9.6 kbit/s

Modbus RTU:

Interface/protocol	RS-485/Modbus RTU
Operating mode	master
Baud rate Modbus RTU	1.2 kbit/s … 57.6 kbit/s
Cable length	≤ 1200 m
Cable (twisted pairs, shielded, shield connected to PE on one side)	recommended: J-Y(St)Y min. 2x0.8
Connection, BMS	terminals A, B
Connection, Modbus RTU	terminals D+, D-
Terminating resistor	120 Ω (0.25 W)

Ethernet:

Connection	RJ45
Data rate	10/100/1000 Mbit/s, autodetect
DHCP	on/off (on)*
t_{off} (DHCP)	5…60 s (30 s)*
IP address	nnn.nnn.nnn.nnn (192.168.0.254)*
Netmask	nnn.nnn.nnn.nnn (255.255.0.0)*
Protocols	TCP/IP, Modbus TCP, DHCP, SMTP, NTP
Additional interface protocols	connection to SCADA systems and/or PLC via OPC, BACnet or other protocols on request

Environment/EMC

EMC	EN 61326-1
Operating temperature	0…+55 °C
Ventilation	fanless

Classification of climatic conditions acc. to IEC 60721

Stationary use	3K5
Transport	2K3
Long-term storage	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use	3M4
Transport	2M2
Long-term storage	1M3

Connection

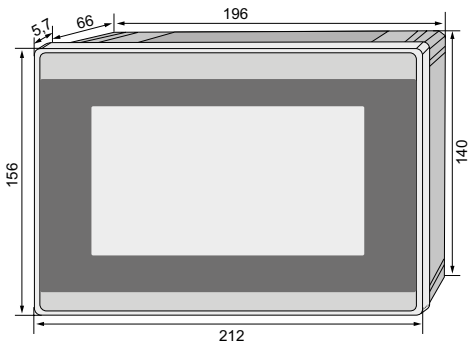
Connection	plug connectors

General data

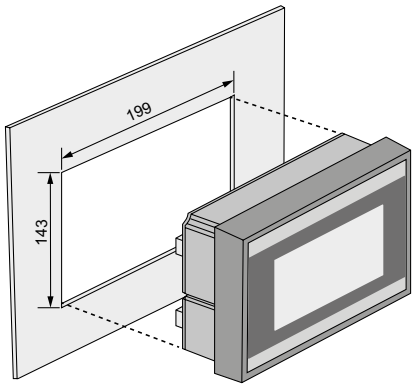
Operating mode	continuous operation
Mounting	display oriented
Degree of protection, on the front (IEC 60529)	IP65
Degree of protection, on the rear (IEC 60529)	IP20
Type of enclosure	panel mounting
Control panel cut-out	199x143 mm
Screw mounting	with mounting brackets
Flammability class	UL94V-0
Documentation number	D00005
Weight	≤ 1200 g

( )* = factory setting

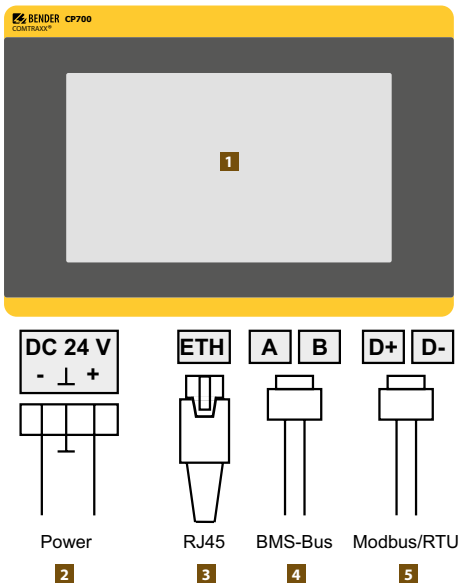
Dimension diagram (dimensions in mm)



Control panel cut-out (dimensions in mm)

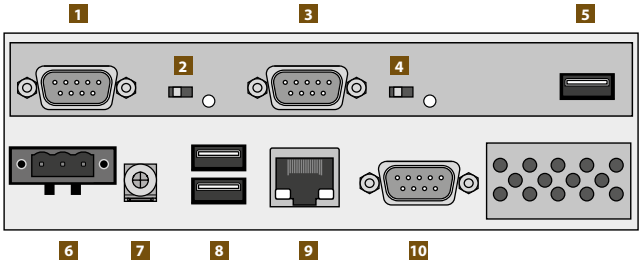


Operating elements and Wiring diagram



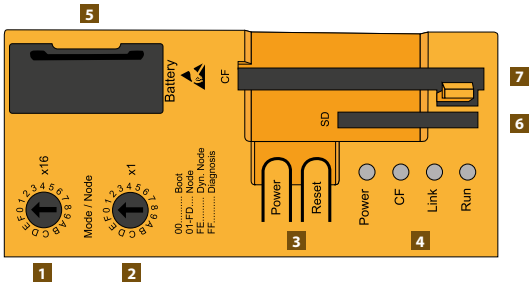
1 LC display with touch screen for standard and menu mode
2 Connection to supply voltage, DC 24 V
3 RJ45 connection for connection to personal computer resp. to the local network
4 Connection BMS bus (cable included in the scope of delivery)
5 Connection Modbus RTU (cable included in the scope of delivery)

Interfaces



1 Interface Modbus RTU
2 Switch and LED master/slave for interface Modbus RTU
3 BMS bus (Bender measuring device interface)
4 Switch and LED master/slave for BMS bus
5 USB interface, without function
6 Connection of supply voltage, DC 24 V
7 Functional earth
8 USB interfaces, without function
9 Ethernet 10/100/1000,
port for connection to the personal computer resp. to the local network (hub, switch, router)
10 RS-232 interface, without function

Rear cover



1 Mode/node switch x16
2 Mode/node switch x1
3 Buttons: Power, Reset
4 LEDs: Power, CF, Link, Run
5 Battery
6 SD memory card slot
7 Compact flash card slot

COMTRAXX® CP9xx

Alarm indicator and operator panel for medical locations and other areas



Typical applications

Monitoring, operation and display of:
- IT systems
- Supply systems for medical gases
- Ventilation and air-conditioning systems
- Room lighting
- Operating theatre lights
- Special power supply systems (BSV (battery-based safety power supply) or UPS (uninterruptible power supply))
- Further systems from different manufacturers.

Approvals

CE

Device features

- Display size 7", 15" and 24" with tempered and anti-reflective glass
- Easy to clean and to desinfect, degree of protection IP54
- Screwless mounted front plate
- User-friendly touch-sensitive monitoring system for medical locations and other applications
- Particularly simple operation
- Additional information for medical and technical personnel
- Visual and acoustic notification in the event of an alarm
- Clear menu structure with self-explanatory interactive images
- Clearly marked safety functions
- Silent due to operation without fan
- High-quality representation with excellent contrast, high resolution and a wide viewing angle
- Possibility of graphical integration of building plans or status display in photo quality
- Easy integration of external subsections like charging stations for operating theatre table controls and intercom systems with front foil
- Simple conversion and expansion with minimal service interruptions

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Complete devices

Type	Display size	Supply	Device dimensions (W x H x D)	Weight	Display unit	Art. No.
CP907	7" (17.6 cm)	DC 24 V, < 15 W; PoE possible as an alternative	226 x 144 x 78 mm	1.1 kg	Glass, tempered, white	B95061080
CP915	15,6" (38.6 cm)	AC 100…240 V, < 30 W	505 x 350 x 92 mm	6.1 kg	Glass, tempered, white	B95061081
					Glass, tempered, gray	B95061085
CP924	24" (54.5 cm)	AC 100…240 V, < 55 W	654 x 441 x 100 mm	9.1 kg	Glass, tempered, white	B95061083
					Glass, tempered, gray	B95061084

Scope of delivery: display unit, flush-mounting enclosure incl. mounting plate with electronics, CP9xx connecting cable and plug connector kit.

Components separately

Device series	Type	Art. No.
CP907	Flush-mounting enclosure	B95100140
CP915	Display unit white	B95061090
	Display unit gray	B95061110
	Flush-mounting enclosure incl. mounting plate with electronics	B95061092
CP924	Display unit white	B95061111
	Display unit gray	B95061097
	Flush-mounting enclosure incl. mounting plate with electronics	B95061099

Accessories

Description	Art. No.
CP9xx replacement plug connector kit	B95061910
CP9xx suction lifter	B95061911

[1] The suction lifter is needed to remove the display.

Other project-specific versions with foil surface or with additional internal components available on request:

- Charging tray for operating theatre table remote controls
- Intercom systems
- Operating theatre light controls
- Programmable backlit keypads
- Digital/Analogue inputs/outputs for installation in panel enclosures or control cabinets
- Data coupling to third-party systems
- Project-specific built-in enclosures
- Integration of third-party systems
- Antibacterial or highly transparent foil
- Exchange of existing control panels (Retrofit)
- etc.

Insulation coordination CP907 acc. to IEC 60664-1

Rated voltage	50 V
Overvoltage category	III
Pollution degree	2
Rated impulse voltage	800 V

Insulation coordination CP915 acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Overvoltage category	III
Pollution degree	2
Rated impulse voltage	4 kV

Supply CP907 via plug-in terminal (A1/+;A2/-)

Nominal voltage CP907	DC 24 V SELV/PELV
Nominal voltage tolerance	±20 %
Typical power consumption at DC 24 V	< 15 W
Connection	plug-in terminal (A1/+;A2/-)
Maximum cable length when supplied via B95061210 (DC 24 V power supply unit 1.75 A):	
0.28 mm²	75 m
0.5 mm²	130 m
0.75 mm²	200 m
1.5 mm²	400 m
2.5 mm²	650 m

Supply via PoE

Nominal voltage	DC 48 V SELV/PELV
Nominal voltage tolerance	-25…+15 %
Typical power consumption for PoE	< 15 W
Maximum cable length when supplied via AWG 26/7; 0.14 mm²	100 m

Supply CP915 via terminal block (L1; N)

Nominal voltage CP915 via external power supply unit	AC 100… 240 V
Nominal voltage tolerance	-15…+10 %
Frequency range Us	50…60 Hz
Typical power consumption at AC 230 V	< 30 W
Connection	terminal block (L1; N)

Stored energy time in the event of voltage failure

Time, date	min. 3 days
Restart after voltage interruption	min. 15 seconds

Displays, memory

Display CP907	7″ TFT touch display
Display CP915	15.6″ TFT touch display
Display CP924	24″ TFT touch display
E-mail configuration and device failure monitoring	max. 250 entries
Individual texts	1200 texts with 100 characters each
Displayable devices	247
Number of data points for “third-party devices” to Modbus TCP and Modbus RTU	50
Number of data loggers	30
Number of data points per data logger	10,000
Number of entries in the history memory	1,000

Visualisation

Number of pages	20
Background image size	max. 3 MB/image; max. 50 MB total memory

Interfaces

Ethernet

Connection	RJ45
Data rate	10/100 Mbit/s, autodetect
DHCP	on/off (off)*
Toff (DHCP)	5…60 s (30 s)*
IP address	nnn.nnn.nnn.nnn (192.168.0.254)*, can always be reached via: 169.254.0.1
Net mask	nnn.nnn.nnn.nnn (255.255.0.0)*
Protocols (depending on function module selected)	TCP/IP, Modbus RTU, DHCP, SMTP, NTP

BCOM

Interface/protocol	Ethernet/BCOM
BCOM system name	(SYSTEM)*
BCOM subsystem address	1…255 (1)*
BCOM device address	1…255 (1)*

USB

Number	2
Operating mode	USB-2.0-Host (5 V, 500 mA)
Datarate	480 Mbit/s
Connection type	USB 2 Standard-A

Modbus TCP

Interface/protocol	Ethernet/Modbus TCP
Operating mode	Client for PEM and „third-party devices“ assigned
Operating mode	Server for access to process image and for Modbus control commands

SNMP

Versions	1, 2c, 3
Devices supported	Queries to all devices (channels) possible (no trap functionality)

BMS bus

Interface/protocol	RS-485/BMS internal
Operating mode	master/slave (master)*
Baud rate	9.6 kbit/s
Cable length	< 1200 m
Cable: twisted pair, shielded, one end of shield connected to PE	
	recommended: J-Y(St)Y min. 2x0.8
Connection	„ABMS“, „BBMS“ (see plug-in terminal)
Terminating resistor	120 Ω (0.25 W), can be switched on internally (see plug-in terminal)
Device address	1…99 (1)*

Modbus RTU

Interface/protocol	RS-485/Modbus RTU
Operating mode	master
Baud rate	9.6…57.6 kbit/s
Cable length	< 1200 m
Cable: twisted pair, shielded, one end of shield connected to PE	
	recommended: J-Y(St)Y min. 2x0.8
Connection	„AMB“, „BMB“ (see plug-in terminal)
Terminating resistor	120 Ω (0.25 W), can be switched on internally (see plug-in terminal)
Supported Modbus RTU slave addresses	2…247

Digital inputs (1-12)

Number	12
Galvanic separation	yes
Operating mode	selectable for each input: active-high or active-low
Factory setting	active-high
Voltage range (high)	AC/DC 10…30 V
Voltage range (low)	AC/DC 0…2 V
Connection	plug-in terminal: (1;1;2;…12;12)
Maximum cable length	< 1000 m

Switching elements

Number	1 changeover contact
Operating mode	N/C operation / N/O operation
Function	programmable
Electrical endurance under rated operating conditions, number of cycles	10,000

Contact data acc. to IEC 60947-5-1:

Utilisation category	AC-13	AC-14	DC-12
Rated operational voltage	24 V	24 V	24 V
Rated operational current	2 A	2 A	2 A
Minimum contact rating	1 mA at AC/DC > 10 V		
Connection	plug-in terminal: (11;12;14)		

Buzzer

Buzzer message	can be acknowledged, adoption of characteristics of new value
Buzzer interval	configurable
Buzzer frequency	configurable
Buzzer repetition	configurable

Audio (for CP015 and CP924 only)

Line IN	STEREO signal input via 3.5 mm jack plug
Line OUT	Output to a STEREO playback device via 3.5 mm jack plug

Device connections

Terminal block (L1; N; PE) (for CP015 and CP924 only)

Conductor sizes	AWG 20-12
Stripping length	10…11 mm
rigid/flexible	0.5…4 mm²
flexible with ferrule with/without plastic sleeve	0.5…4 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…4 mm²

Plug-in terminal (A1/+;A2/) (11;12;14)

Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2…2.5 mm²
flexible with ferrule with/without plastic sleeve	0.25…2.5 mm²
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5…1.5 mm²

Technical data (continued)

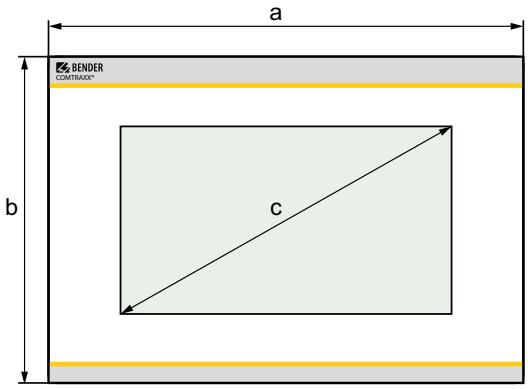
Plug-in terminal (l1;k1;l2;k2…l12;k12) (AMB;BMB;SMB;ABMS;BBMS;SBMS)	
Conductor sizes	AWG 24-16
Stripping length	10 mm
rigid/flexible	0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1.5 mm²
flexible with ferrule with plastic sleeve	0.25…0.75 mm²

Environment/EMC	
EMC	IEC 61326-1
Operating temperature	-10…+55 °C
Range of use	≤ 2000 m AMSL
Humidity	≤ 98%
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K11
Long-term storage (IEC 60721-3-1)	1K22
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12

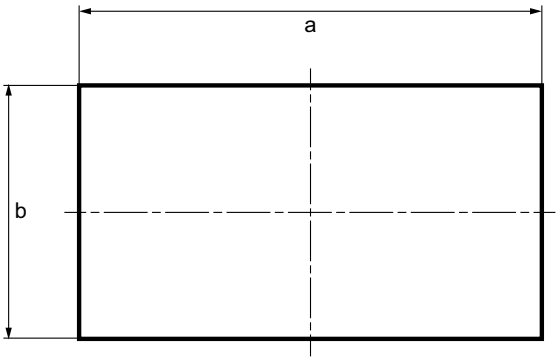
Other	
Operating mode	continuous operation
Mounting	display-oriented
Degree of protection, front	IP54
Degree of protection, enclosure	IP20
Flammability class	UL 94V-0
Dimensions	
CP907 (W x H x D)	226 x 144 x 78 mm
CP915 (W x H x D)	505 x 350 x 92 mm
CP924 (W x H x D)	654 x 441 x 100 mm
Documentation number	D00349
Weight	
CP907	approx. 1.1 kg
CP915	approx. 6.1 kg
CP924	approx. 9.1 kg

Dimensions

External dimensions



Installation dimensions – panel cut-out



Type	Dimensions (mm)		
	a	b	c
CP907	226	144	176 (7")
CP915	505	350	386 (15,6")
CP924	654	441	545 (24")

Type	Abmessungen (mm)		Required installation depth
	a	b	
CP907	212	124	75
CP915	461	306	92
CP924	610	398	95

Glass thickness 3 mm

COMTRAXX® MK800 (DI400)

Alarm indicator and test combination with LCD



DI400

MK800

Typical applications

MK800

- Visual and acoustic signalling of operating status and alarm messages
- Display of measured values and setting of limit values for monitoring purposes from BMS-capable Bender monitoring systems

DI400

- Expansion module for Bender monitoring systems exchanging data via the BMS bus

Approvals

MK800:

Device features

- Display of operating status, warning and alarm messages from Bender monitoring systems
- Backlit clear LC text display (4 x 20 characters, 8 mm)
- Additional text to be displayed, if required.
- A set of LEDs, red, yellow and green, allowing warning and alarm messages to be indicated in an order of priority
- Predefined standard texts in 21 languages
- 1000 freely programmable message texts
- Easy parameter setting with PC (USB interface) or menu
- Memory with real-time clock to store 1000 warning and alarm messages with date and time stamp
- 16 digital inputs (option)
- One programmable relay (option)
- Five large function buttons
- Versions available for flush and surface mounting as well as for mounting into cavity walls or for door mounting
- Non-reflecting, multicoloured foil
- Smooth surfaces without openings to meet the hygiene requirements for medical locations

Standards

The MK800 alarm indicator and test combination meets the requirements for installation:

- DIN VDE 0100-710 (VDE 0100 Part 710)
- IEC 60364-7-710

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Enclosure	Indication	Digital inputs/relay outputs	Type	Art. No.
Flush-mounting enclosure	LCD	16/1	MK800-11	B95100100
	3 LEDs	–	MK800-12	B95100101
Surface mounting	LCD	16/1	MK800A-11	B95100102
	3 LEDs	–	MK800A-12	B95100103
Surface mounting, front door	LCD	16/1	MK800AF-11	B95100104
	3 LEDs	–	MK800AF-12	B95100105
Built-in type without enclosure	LCD	16/1	MK800E-11	B95100106
	3 LEDs	–	MK800E-12	B95100107
Surface mounting	3 LEDs	16/1	DI400-11	B95100113
		–	DI400-12	B95100114

Accessories

Description	Type	Art. No.
Parameterisation software	TMK-SET V3.xx	as Internet download
Flush-mounting enclosure for MK800	UP800	B95100110
Bezel frame silver for MK800	BR800-1	B95100111
Bezel frame white for MK800	BR800-2	B95100112

Suitable system components

Description	Type	Art. No.	Page
Power supply unit	AN410	B924209	367

Insulation coordination according to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse withstand voltage/pollution degree	4 kV/3

Supply voltage

Supply voltage U_S	AC/DC 24 V
Frequency range U_S	AC 40…60 Hz/DC
Operating range U_S	AC 18…28/DC 18…30 V
Power consumption	≤ 5 VA

Stored energy time in the event of power system failure

Time, date	> 5 days (MK800 only)
Restart in the event of voltage failure for at least	1.5 s

Displays and LEDs

Display, characters	four lines, 4 x 20 characters
Standard message texts in	21 national languages
Alarm addresses, programmable	250
Text messages, programmable	1000
Permissible number of operating messages on the internal BMS bus	176
History memory (messages)	1000
Standard text message	3 x 20 characters
Additional text message (press button to access)	3 x 20 characters
Alarm LEDs (a set of LEDs)	NORMAL (green) WARNING (yellow) ALARM (red)
Menu texts	German/English
Buttons	5 (test of assigned devices, buzzer mute, additional text, scroll, menu)

Buzzer

Buzzer message	can be acknowledged, adoption of characteristics of new value
Buzzer interval	configurable
Buzzer frequency	configurable
Buzzer repetition configurable	configurable

Inputs (MK800…-11/DI400-11 only)

Digital inputs	16 (IN1…IN16)
Galvanic separation	yes
Control of digital inputs	via potential-free contacts/extraneous voltage
Operation mode	N/O, N/C operation, off, selectable for each input
Factory setting	Off
Voltage range (high)	AC/DC 10…30 V
Voltage range (low)	AC/DC 0…2 V

Interface internal/external

Interface/protocol	2 x RS-485/BMS
Baud rate internal/external (default setting)	9.6 kbit/s/57.6 kbit/s
Cable length	≤ 1200 m
Cable: twisted pair, shield connected to PE on one side	recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 Ω (0.25 W) can be connected via DIP switch
factory setting	both on „off" position
Device address, BMS bus external/internal	1…150/1…99
Factory setting device address internal/external	1 (master)/1 (master)

Programming

Interfaces	RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on type B plug
Software	TMK-SET V 4.0 and higher
Factory setting password query	activated

Cable length when the power supply for the MK800 is taken from AN450

0.28 mm²	50 m
0.5 mm²	90 m
0.75 mm²	150 m
1.5 mm²	250 m
2.5 mm²	400 m

Cable length when the power supply for the MK800 is taken from AN410

0.28 mm²	150 m
0.5 mm²	300 m
0.75 mm²	500 m
1.5 mm²	1000 m
2.5 mm²	1600 m

Colours

MK800

Front foil	RAL 7035 (light grey) / RAL 7040 (basalt grey)
Marking	RAL 5005 (signal blue)
Front plate	RAL 7035 (light grey)

DI400

Front foil	RAL 7035 (light grey)/RAL 7012 (basalt grey)
Marking buttons	RAL 5002 (ultramarine blue), lettering: RAL 7035 (light grey)
Front plate	RAL 7035 (light grey)

Switching elements (MK800-11/DI400-11 only)

Number	1 changeover contact		
Function	programmable		
Operation mode	N/C or N/O operation (programmable)		
Electrical service life under rated operating conditions	10,000 switching operations		
Contact data acc. to IEC 60947-5-1:			
Utilisation category	AC-13	AC-14	DC-12
Rated operational voltage	24 V	24 V	24 V
Rated operational current	5 A	3 A	1 A
Minimum contact rating	1 mA at AC/DC > 10 V		

Environment/EMC

EMC immunity	acc. to EN 61000-6-2
EMC emission	acc. to EN 61000-6-3

Ambient temperatures

Operating temperature	-5…+55 °C
Transport	-25…+70 °C
Long-term storage	-25…+55 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K5 (no condensation, no formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4

Classification of mechanical conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Option „W" data different from the standard version

Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (condensation and formation of ice is possible)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M7

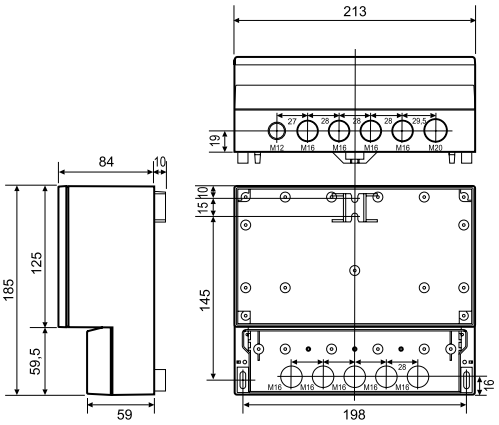
Connection

Connection	pluggable screw terminals
Connection properties (supply voltage, BMS bus):	
Rigid/flexible/conductor sizes	0.2…2.5/0.2…2.5 mm2/AWG 24-12
Flexible with ferrules, without/with plastic sleeve	0.25…2.5/0.25…2.5 mm2
Connection properties (inputs):	
Rigid/flexible/conductor sizes	0.08…1.5/0.08…1.5 mm2/ AWG 28-16
Flexible with ferrules, without/with plastic sleeve	0.25…1.5/0.25…0.5 mm2
Stripping length	7 mm
Tightening torque	0.5…0.6 Nm (4.5…5.3 lb-in)

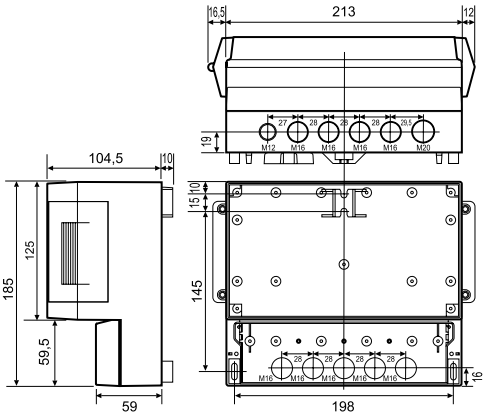
Other

Operation mode	continuous operation
Mounting	display-oriented
Degree of protection, built-in components (DIN EN 60529)	IP50
Degree of protection, terminals (DIN EN 60529)	IP20
Flammability class	UL94 V-0
Documentation number	D00053 (MK800) D00104 (DI400)
Weight:	
Flush-mounting/cavity wall (MK800)	≤ 950 g
Surface-mounting (MK800A(DI400)	≤ 880 g
Surface-mounting (MK800AF)	≤ 1150 g

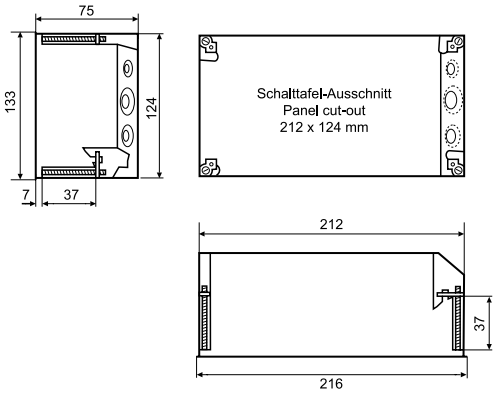
MK800A-11/MK800A-12/DI400-11/DI400-12, surface-mounting



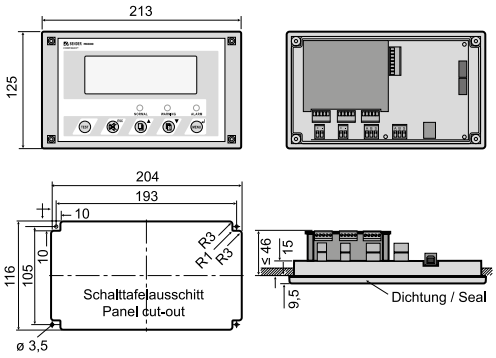
MK800AF-11/MK800AF-12, surface-mounting with door



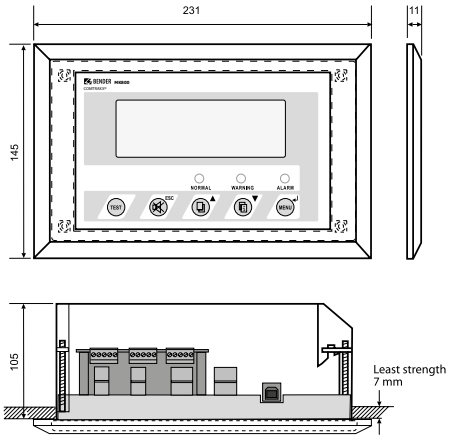
Flush-mounting enclosure UP800

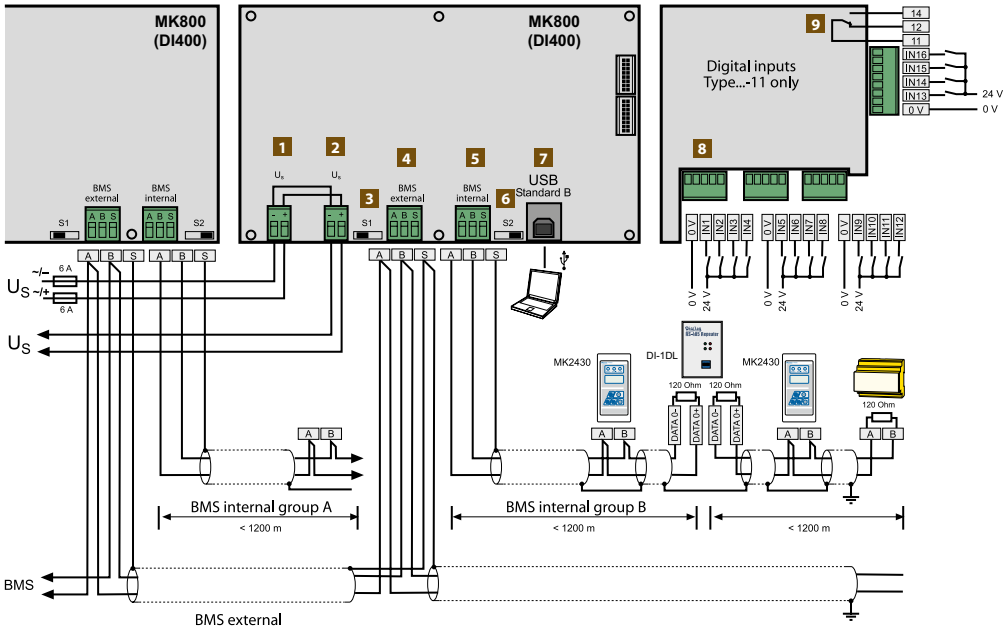


MK800-11/MK800-12, example: door mounting



MK800-11/MK800-12 with bezel frame BR800 and flush-mounting enclosure UP800, example: cavity wall mounting





1 Supply voltage U_S

2 Looped through connection for supply voltage (e.g. for control voltage relay contacts)

3 Switch S1 to terminate the external BMS bus. If two or more devices are connected to each other via the BMS bus, the bus line must be terminated at both ends with a resistor (R = 120 Ω).

4 External BMS bus connection. The external BMS bus is primarily used for the connection of several MK800 or TM800. SMI472-12 signal converters can also be connected.

5 Internal BMS bus connection. Various Bender devices with a BMS bus interface can be connected to the BMS bus. These may include: Insulation monitoring devices 107TD47, control devices PRC487, residual current monitors RCMS470 and many more.

6 Switch S2 to terminate the internal BMS bus. If two or more devices are connected to each other via the BMS bus, the bus line must be terminated at both ends with a resistor (R = 120 Ω).

7 USB interface. For PC connection. The TMK-SET PC software is used to program the MK800. You can use the PC software TMK-HISTORY to read out the MK800 history memory.

8 MK800-11 only: Digital inputs. The digital inputs can be controlled by an internal or external voltage and potential-free contacts. If the inputs are controlled via an external voltage, the common 0(-) is applied to terminal "0 V" and the 1(+) signal to the corresponding input IN1…IN16.

9 MK800-11 only: Relay output. Programmable contact for device errors, test of assigned devices, device failure, common alarm message, buzzer.

COMTRAXX® MK2430

Alarm indicator and test combination with LCD



Typical applications

- Visual and acoustic signalling of operating status and alarm messages
- Display of measured values and setting of limit values for monitoring purposes from BMS-capable Bender monitoring systems

Approvals

CE EAC

Device features

- Display of operating status, warning and alarm messages in accordance with DIN VDE 0100-710, IEC 60364-7-710 and other standards
- Backlit clear LC text display (4 x 20 characters)
- Predefined standard texts in 20 languages
- 200 freely programmable message texts
- Bus technology for easy installation and reduced fire load
- Acoustic alarm with mute function
- Parameter setting via menu (German/English)
- Suitable for flush and surface mounting
- Easy commissioning due to predefined message texts
- 12 digital inputs/1 relay output (MK2430-11 only)
- History memory with real-time clock to store 250 warning and alarm messages
- MK2418 can easily be exchanged for MK2430/MK2007

Standards

The MK2430 alarm indicator and test combination meets the requirements for installation:

- DIN VDE 0100-710 (VDE 0100 Part 710)
- IEC 60364-7-710

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Enclosure	Enclosure included in the scope of delivery	Digital inputs/ relay output	factory-programmed	Type	Art. No.
Flush-mounting	■	12/1	–	MK2430-11	B95100001
			■	MK2430C-11	B95100003C
		–	–	MK2430-12	B95100002
			■	MK2430C-12	B95100004C
Flush-mounting, horizontal mounting	–	–	–	MK2430H-12	B95100024
Surface-mounting	■	12/1	–	MK2430A-11	B95100005
			■	MK2430CA-11	B95100007C
		–	–	MK2430A-12	B95100006
			■	MK2430CA-12	B95100008C

Accessories

Type designation	Art. No.
Parameterisation software TMK-SET	as Internet download
MK2430-mounting kit, complete	B95101000
Flush-mounting enclosure	B923710

Suitable system components

Description	Type	Art. No.	Page
Power supply unit	AN410	B924209	367
	AN450	B924201	369

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse withstand voltage/pollution degree	4 kV/3

Supply voltage

Supply voltage U_S	AC/DC 24 V
Frequency range U_S	0/40…60 Hz
Operating range U_S	AC 18…28/DC 18…30 V
Power consumption	≤ 3 VA
Voltage failure without reset	≤ 15 s

Displays and LEDs

Display, characters	four lines, 4 x 20 characters
Standard message texts in	20 languages
Alarm addresses configurable	150
Programmable text messages	200
History memory (messages)	250
Standard text message	3 x 20 characters
Additional text message (press button to access)	3 x 20 characters
Alarm LEDs (three different colours)	NORMAL (green), WARNING (yellow), ALARM (red)
Menu texts	German/English
Buttons	5 (Isometer test, buzzer mute, additional text, scroll, menu)

Buzzer

Buzzer message	can be acknowledged, adoption of characteristics of new value operation
Buzzer interval	configurable
Buzzer frequency	configurable
Buzzer repetition	configurable

Inputs (MK2430…-11 only)

Digital inputs	12 (IN1…IN12)
Galvanic separation	yes
Activation of the digital inputs	via potential-free contacts/extraneous voltage
Operating principle	N/O or N/C operation individually selectable for each input
Factory setting	N/O operation
Voltage range (high)	AC/DC 10…30 V
Voltage range (low)	AC/DC 0…2 V
Recommended cable: J-Y(St)Y min. x 0.8	
Cable length	≤ 500 m

Interfaces

Interfaces	RS-485 and USB (V2.0/V1.1)

Technical data for the RS-485 interface:

Protocol	BMS
Baud rate	9.6 kbit/s
Cable length	≤ 1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 Ω (0.25 W) connectable via DIP switch
Device address, BMS bus	1…150
Factory setting device address	1 (master)

Programming

Interfaces	RS-485 or USB (V2.0/V1.1), USB cable: Type A plug on type B plug
Software	TMK-SET V 4.0 or higher
Factory setting password	activated

Max. cable length in case of power supply of 1/2/3 MK24.. from one AN450

0.28 mm² (e.g. J-Y(St)Y nx0.6)	160/40/– m
0.5 mm² (e.g. J-Y(St)Y nx0.8)	250/70/– m
0.75 mm²	400/100/– m
1.5 mm²	800/210/10 m
2.5 mm²	1300/360/20 m

Max. cable length in case of power supply of 1/2/3 MK24.. from one AN410

0.28 mm² (e.g. J-Y(St)Y nx0.6)	300/150/100 m
0.5 mm² (e.g. J-Y(St)Y n x 0.8)	500 /250/150 m
0.75 mm²	750/375/250 m
1.5 mm²	1500/750/500 m
2.5 mm²	2500/1200/750 m

Colours

Front foil	RAL 7035 (light grey); RAL 7040 (basalt grey)
Marking	RAL 5005 (ultramarine blue)
Front plate	RAL 7035 (light grey)

Switching elements (MK2430...-11 only)

Number	1 changeover contact
Function	programmable
Operation mode	N/C or N/O operation (programmable)
Electrical endurance, number of cycles	10000

Contact data acc. to IEC 60947-5-1

Utilisation category	AC-13	AC-14	DC-12
Rated operational voltage	24 V	24 V	24 V
Rated operational current	5 A	3 A	1 A
Minimum contact rating	1 mA at AC/DC > 10 V		

Environment/EMC

EMC immunity	DIN EN 61000-6-2
EMC emission	DIN EN 61000-6-3
Operating temperature	-5…+55 °C

Classification of climatic conditions acc. to IEC 60721:

Stationary use	3K5
Transport	2K3
Long-term storage	1K4

Classification of mechanical conditions acc. to IEC 60721:

Stationary use	3M4
Transport	2M2
Long-term storage	1M3

Connection

Connection	pluggable screw terminals

Connection properties (supply voltage, BMS bus):

Connection of single conductors	
rigid/flexible/conductor sizes	0.2…2.5/0.2…2.5 mm² (AWG 24…12)
flexible with ferrule without/with plastic sleeve	0.25…2.5/0.25…2.5 mm²
Multi-conductor connection (2 conductors of the same cross section)	
rigid/flexible	0.2…1/0.2…1.5 mm²
flexible with ferrule without plastic sleeve	0.25…1 mm²
flexible with TWIN ferrules with plastic sleeve	0.5…1.5 mm²

Connection properties (inputs):

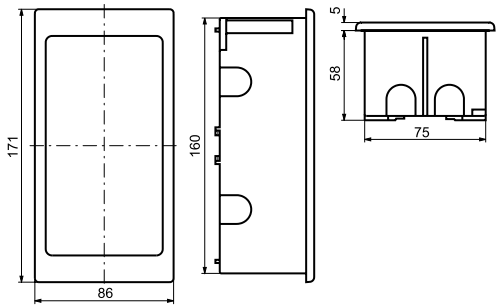
Connection of single conductors	
rigid/flexible/conductor sizes	0.08…1.5/0.08…1.5 mm² (AWG 28…16)
flexible with ferrule without/with plastic sleeve	0.25…1.5/0.25…0.5 mm²
Multi-conductor connection (2 conductors with the same cross section):	
rigid/flexible	0.08…0.5/0.08…0.75 mm²
flexible with ferrules without plastic sleeve	0.25…0.34 mm²
flexible with TWIN ferrules with plastic sleeve	0.5 mm²
Stripping length	7 mm
Tightening torque	0.5...0.6 Nm

Other

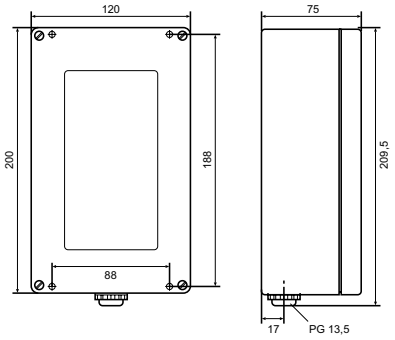
Operating mode	continuous operation
Mounting	display-oriented
Degree of protection (DIN EN 60529	IP50 (surface-mounting type: IP54)
Degree of protection (DIN EN 60529)	IP20
Flammability class	UL94V-0
Documentation number	D00129
Weight	flush mounting ≤ 210 g, surface mounting ≤ 400 g

Dimension diagram (dimensions in mm)

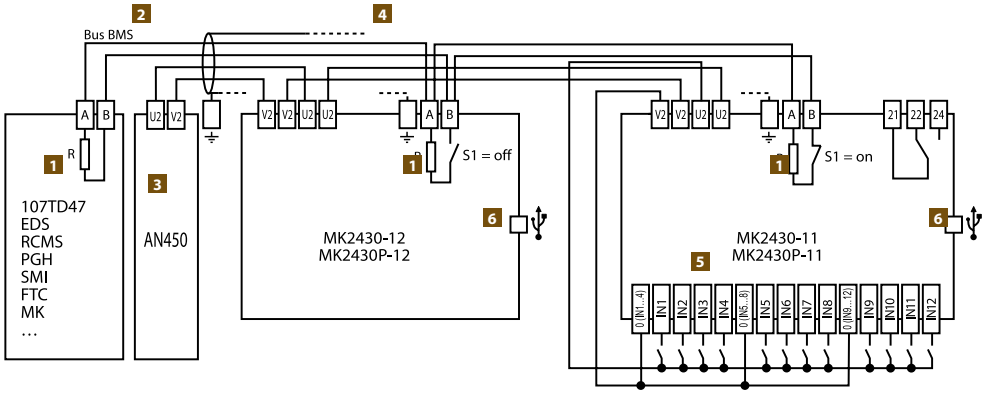
Flush-mounting type



Surface-mounting type



Wiring diagram



1 Terminating resistor BMS bus (120 Ω)

2 Connection BMS bus

3 Power supply unit incorporated in the MEDICS® module, sufficient for supplying power to maximum three MK2430

4 Cable between MEDICS® module and MK2430

When the MK2430 is supplied by the AN410 or AN450 power supply unit in the MEDICS® modules, the permissible cable lengths and cable cross sections have to be considered.

5 Digital inputs

The digital inputs may be controlled either via potential-free contacts or via voltage signals. If you are using potential-free contacts, the voltage can be drawn from the AN410 or AN450 (3).

When the inputs are activated via an external voltage, the common 0(-) is connected to terminal 0 and the 1(+)-signal is connected to the respective input IN1…IN12. In this case, the connections between the terminals 0 and V2 and the common connections and U2 are not required.

6 USB connection for programming purposes

Visualisation



Typical applications

- Visualisation of Bender systems

Device features

- Graphical representation on a screen showing the design and status of Bender systems, e.g. in the form of an outline view or a circuit diagram
- Localising and identifying faults easier and faster
- Display of operating messages, alarm messages and currently measured values
- Displaying and analysing historical data
- Viewing and operating from remote computers
- Display and operation via the gateway COM460IP option D by means of a browser and a personal computer in the network.
- Individually programmed visualisation on a touch panel PC or a PC

Our service range:

Bender offers you the following solution package:

- Bender gateway to connect your Bender system to a computer
- Touch panel computer and/or computer with monitor for displaying the visualisation solution
- Customer-specific programming of the visualisation solution using a high-performance software
- On-site setting and testing of the visualisation

Your advantages:

- Continuous overview of the system at any place
- Faults can be detected easily and hence remedied faster
- Correlations can be recognised and faults can be avoided in the future

Further information

For further information refer to our product range on www.bender.de.

POWERSCOUT®

Recognising connections – optimising maintenance



Device features

- Transmission of measured values every 15 min
- Resolution of the data as a function of the velocity of the bus system
- 16 visible dashboards
- 256 public dashboards
- Commissioning wizards
  - Residual current
  - Stray currents
  - Neutral conductor
  - Central earthing point
- Dashboard management
- Tree views management
- Report management
- Automated sending of reports
- Integration via CP700, COM465IP and COM465DP
- Integration of third-party devices
- A web-based application for all types of devices
- Languages
  - English
  - German
- User management
- Supported browsers
  - Chrome
  - Firefox
  - Internet Explorer

Typical applications

- ***Commissioning wizards***
  The wizards support the user in generating dashboards and reports. With just a few steps, meaningful dashboards related to a specific subject of electrical safety can be generated.
- ***Residual current***
  The commissioning wizard supports you in creating a dashboard that allows evaluating the level of the residual current at a glance. The ratio of residual current and load current is calculated.
- ***Stray currents***
  The wizard for stray currents indicates the system parts where excessive stray currents exist.
- ***Central earthing point***
  The central earthing point wizard generates a meaningful visualisation for the user by querying the current at the CEP and the corresponding phase current.
- ***Neutral conductor***
  The excessive load on the neutral conductor challenges many system operators. The commissioning wizard evaluates the neutral currents and indicates whether they are too high.

Further information

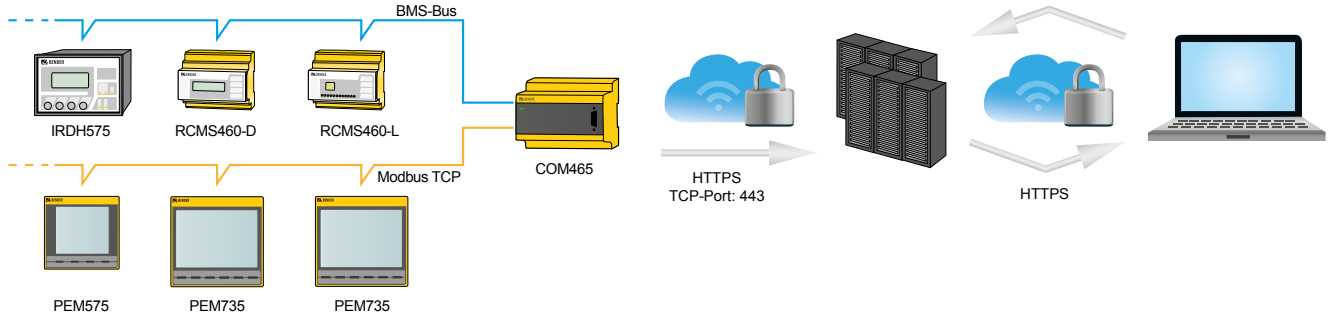
For further information refer to our product range on www.bender.de.

Overview price model

Model	Collectors (gateways)	User	Type	Art. No.
Hosted	up to 2	10	POWERSCOUT 2	B95061500
	up to 5	20	POWERSCOUT 5	B95061501
	up to 10	40	POWERSCOUT 10	B95061502
	> 10	> 40	POWERSCOUT project	B95061503
On-Premise	v 2	10	POWERSCOUT 2	B95061504
	up to 5	20	POWERSCOUT 5	B95061505
	up to 10	40	POWERSCOUT 10	B95061506
	> 10	> 40	POWERSCOUT project	B95061507

- If you choose the Hosted model, we will operate POWERSCOUT for you in a German data centre. We take care of updates and maintenance for you.
- If you choose the On-Premise model, POWERSCOUT will be installed on one of your servers.

System architecture



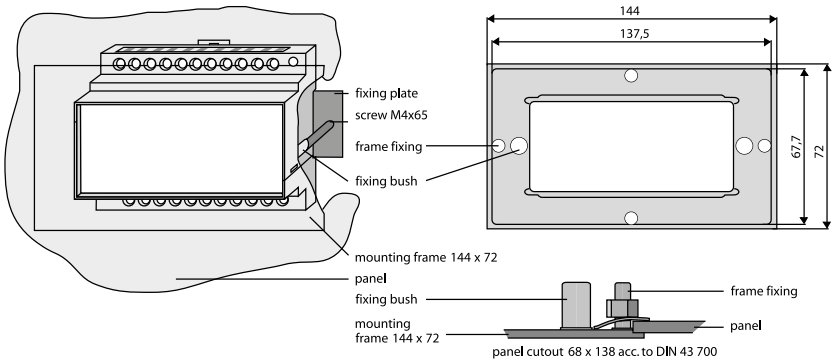
Enclosure mounting



Type	Art. No.
X470 Mounting frame	B990991
XM460 Mounting frame	B990995
XM490 Mounting frame	B990996

Mounting frame for installing enclosures into control panels with standard cutout

For mounting X470/XM460 enclosures into panels with 144 x 72 mm cutout, made of silver anodised aluminium. Suitable for the 470 and 460 series, e.g. IR470, EDS470, RCMS470, RCMS460 and EDS460 devices.
For mounting XM490 enclosures into panel cutouts of 198 x 72 mm. Suitable for 490 series devices, e.g. RCMS490, EDS490/491. Dimensions are given in mm.

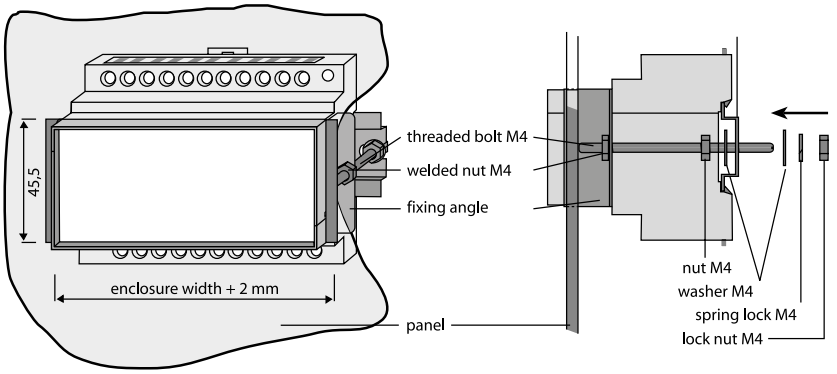




Type	Art. No.
X450 Fixing set	B990992
X460 Fxing set	B990993
X470 Fixing set	B990990

Fixing set for enclosure mounting into panels with 45 mm cutout

For mounting X440, X460, X470 enclosures into 45 mm panel cutouts, made of stainless steel.
Suitable for all 470 series devices, e.g. RCM470, RCMA470. Dimensions are given in mm.

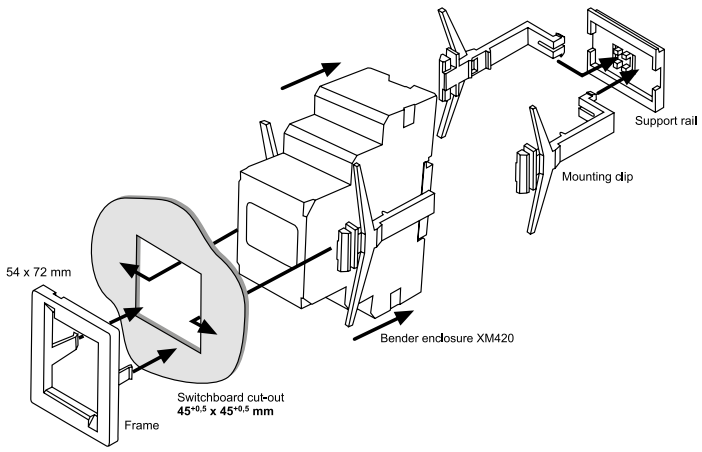




Type	Art. No.
XM420 Mounting frame	B990994

XM420 mounting frame for mounting enclosures into panels

For mounting XM420 enclosures into panels. Suitable for all XM420 series devices, e.g. RCM420, RCMA420, RCMA423.



6.3

Front plate cover

for protection class IP65



Front plate cover IRDH375



Front plate cover IRDH575

Typical applications

Transparent front plate cover for use in harsh environmental conditions and for increasing the degree of protection (IP65), suitable for devices of the IRDH375/575 series and FP200.

Ordering information

Suitable for	Type	Art. No.
IRDH375, FP200	**Front plate cover 144 x 72 mm**	**B98060005**
IRDH575	**Front plate cover 144 x 96 mm**	**B98060007**

Insulation monitoring devices
ISOMETER®

7

Equipment for insulation fault location
ISOSCAN®

151

Residual current monitoring systems
LINETRAXX®

177

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

219

Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

243

270

System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation

317

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser



415

427

Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service

449



ATICS®, the worldwide safest and most compact all-in-one changeover and monitoring device

for safety-relevant and medical locations

Safe

Functional safety SIL2 according to IEC 61508
guarantees protection against malfunction hazards

Continuous self monitoring
of electronic system and circuit paths with automatic notification

Preventive safety
by automatic reminders for prescribed tests

Maximum reliability during changeover

- Patented changeover system with mechanical and electrical interlock
- Weld-free switching contacts with circuit breaker mechanism
- Insensitive to voltage fluctuations or shocks, for example, due to stable operating position and constant contact pressure
- Monitoring for short circuits

Easy-to-use

Easy to operate and perfect overview
due to clear menu structure and user guidance

Correct information at the correct time
due to clear messages via an illuminated graphic display and via bus

Safe manual changeover during service
due to integrated manual/automatic mode with mechanical restart interlock

Complete documentation of events

- Changeover procedures
- Testing
- Parameter changes

External functional test or replacement without service interruption
by optional bypass switch

Compact

Compact design
of electronic system and switching elements in one enclosure

Changeover, IT system monitoring and locating current injector
in one device

Simple wiring
due to integrated design

Completely pluggable

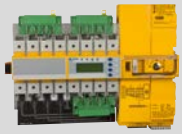
Efficient

Small space required

Tests according to the regulations without interruption of the power supply

Easy integration into existing installations

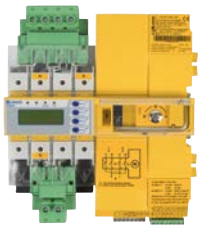
Device overview ATICS® switchover and monitoring devices

		 ATICS®-...-ISO	 ATICS®-...-DIO
Page		418	422
Application		Unearthed safety power supplies	Safety power supplies
Rated insulation voltage		2-pole: 250 V	2-pole: 250 V 4-pole: 400 V
Voltages	**Nominal system voltage U_n**	AC 230 V (AC 160...276 V)	2-pole: AC 230 V 4-pole: 3N AC 400/230 V
	Frequency range	48...62 Hz	48...62 Hz
Insulation monitoring Measuring range		10 kΩ...1 MΩ	
Insulation monitoring Response value R_{an1}		50...500 kΩ	
Digital inputs/relays		1/1	4/4
Interface/protocol		RS-485/BMS	RS-485/BMS
Connection	**Pluggable screw terminals**	■	■ (up to 125 A)
	Screw terminals		■ (160 A)
Installation	**DIN rail**	■	■
	Screw mounting	4 x M5	6 x M5

7.1

ATICS®-...-ISO

Automatic transfer switching devices with monitoring function for unearthed safety power supplies



Typical applications

- Design of safety power supplies in group 2 medical locations, e.g.
  - intensive care unit
  - operating theatres
- Retrofit

Approvals

CE

Device features

Perfectly suitable for space-saving installation/retrofitting

- Compact device for easy setup of safety power supplies with functional safety in accordance with DIN EN 61508 (SIL 2) e.g. for group 2 medical locations in compliance with DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710
- Increased safety and availability by integrating changeover and IT system monitoring in one compact device
- All-in-one: Integration of switch disconnector, control and monitoring electronics for unearthed safety power supplies
- Solutions for any application

Convenient installation and commissioning

- Saves time and money

Safe operation

- Robust switch disconnector contacts
- Mechanical locking
- Manual operation directly on the device
- Functional safety SIL 2
- Certification by TÜV SÜD in accordance with EN 61508 (VDE 0803) SIL 2 and DIN VDE 0100-710 (VDE 0100-710)

Uninterrupted maintenance

- Plug connectors and optional bypass switch
- Excellent communication and parameterisation options

Standards

The transfer switching device conforms to the following standards:

- DIN VDE 0100-710 (VDE 0100-710)*
- DIN VDE 0100-718 (VDE 0100-718)
- ÖVE/ÖNORM E 8007
- IEC 60364-7-710*
- DIN EN 61508-1 (VDE 0803-1)*
- IEC 61508-1 (2010-04) Ed. 2.0*
- DIN EN 61508-2 (VDE 0803-2)*
- IEC 61508-2 (2010-04) Ed. 2.0*
- DIN EN 61508-3 (VDE 0803-3)*
- IEC 61508-3 (2010-04) Ed. 2.0*
- DIN EN 60947-6-1 (VDE 0660-114)
- IEC 60947-6-1 (2013-12) Ed. 2.1
- DIN EN 61557-8 (VDE 0413-8)

Standard-compliant isolating transformer monitoring according to:

- DIN EN 61558-1 (VDE 0570-1)
- DIN EN 61558-1/A1 (VDE 0570-1/A1)

The standards marked with * were part of the test conducted by TÜV Süd.

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Rated operational voltage U_e	Nominal system voltage U_n	Rated operational current I_e	Type	Art. No.
AC	AC	AC		
230 V	230 V	63 A	ATICS-2-63A-ISO	B92057202
		80 A	ATICS-2-80A-ISO	B92057203
	400 V	63 A	ATICS-2-63A-ISO-400	B92057204
		80 A	ATICS-2-80A-ISO-400	B92057205
	230 V	63 A	ATICS-2-63A-ISO-ES	B92057206
		80 A	ATICS-2-80A-ISO-ES	B92057207

Accessories

Description	Rated operational current I_e	Type	Art. No.
	AC		
Bypass switch kit	63 A	ATICS-BP-2-63A-SET	B92057252
	80 A	ATICS-BP-2-80A-SET	B92057253
Energy storage for ATICS®	–	ATICS-ES*	B92057255

* ATICS-ES may only be used in combination with the following ATICS® transfer switching devices: B92057206, B92057207.

Suitable system components

Description	Type	Page
Insulation fault locator	EDS151	165

Technical data

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Overvoltage category	III
Pollution degree outside, inside	2
Rated insulation voltage	250 V
Protective separation between	line 1 – line 2; line 1, 2, 3 – RS-485
	line 1, 2, 3 – digital inputs; line 1, 2, 3 – relay outputs
Voltage test according to IEC 61010-1 (basic insulation/protective separation)	2.21 kV/3.54 kV

Supply voltage

Rated operational voltage U_e	AC 50…60 Hz, 230 V
Supply voltage U_S	see ordering details
Power consumption at 63 A	≤ 16 W
Power consumption at 80 A	≤ 28 W
Current during changeover process	17 A/< 30 ms

Power section/switching elements

Nominal system voltage U_n	refer to ordering details
Frequency range f_n	48…62 Hz
Crest factor	≤ 1.2
Number of switching cycles (mechanical)	≥ 8000
Short circuit current I_{cc} and fuses	
	refer to the manual, table “Utilisation category acc. to DIN EN 60947”

Voltage monitoring/changeover

Frequency range f_n	40…70 Hz
Undervoltage response value (Alarm 1)	160…207 V (1-V steps)
Overvoltage response value (Alarm 2)	240…275 V (1-V steps)
Response delay t_{on}	50 ms…100 s (resolution of setting starting 50 ms)
Delay on release t_{off}	200 ms…100 s (resolution of setting starting 50 ms)
Hysteresis	2…10 % (1-% steps)
Frequency measurement	40…70 Hz (resolution 0.1 Hz)
Display range measured value	20…300 V
Operating uncertainty	±1 %

Current monitoring (output current)

Measuring current transformers	STW3, STW4
Measuring range In (TRMS)	STW3: 0…> 150 A, STW4: 0…> 260 A
Response value for short-circuit detection ATICS-ISO (versions 63 A and 80 A) with STW3	130 A
Crest factor	min. 2
Hysteresis for short-circuit alarm	5 %
Cable length:	
Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	1…10 m
Shielded cable	10…40 m
Cable: twisted pairs, shield to terminal 1 at one end, must not be earthed	
	recommended: J-Y(St)Y min. n x 2 x 0.8

IT system monitoring

Insulation monitoring

Nominal system voltage (operating range)	80…275 V
Measuring range	10 kΩ…1 MΩ
Measurement method	AMP (adaptive measuring pulse)
Response value R_{an1} (ALARM 1)	50…250 kΩ
Relative uncertainty	±15 %
Hysteresis	≤ 25 %
Response time t_{an} at $R_F = 0.5 \times R_{an}$ and $C_e = 1$ µF	≤ 5 s
Measuring voltage U_m	DC 12 V
Measuring current I_m (at $R_F = 0$ Ω)	≤ 53 µA
Internal resistance R_i	≥ 240 kΩ
Impedance Z_i	≥ 220 kΩ
Internal resistance/impedance during test	≥ 100 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 370 V
Permissible system leakage capacitance C_e	≤ 5 µF
Automatic self test	every hour
Response time for loss of earth connection as well as loss of network connection	
	maximum 1 hour

Load current monitoring (IT system transformer)

Measuring current transformers	STW2, STW3, SWL-100 A
Measuring range IL (TRMS)	10…110 % of the response value
Adjustable response value (STW2, STW3, SWL-100A)	5…(50) 100 A (1-A steps)
Relative uncertainty	±5 %
Crest factor	≤ 2
Response time	< 1 s
Response delay ton	0…100 s (step-by-step in 1-s steps)
Delay on release toff	0…100 s (step-by-step in 1-s steps)
Hysteresis	5…30 %
Response time CT connection monitoring	
	approx. 1 h (or immediately in case of “TEST Isometer”)
Cable length:	
Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	1…10 m
Shielded cable 0.5 mm²	10…40 m
Cable: twisted pairs, shield to terminal 1 at one end, must not be earthed	
	recommended: J-Y(St)Y min. n x 2 x 0.8

Temperature monitoring (IT system transformer)

Response value	4 kΩ
Relative uncertainty	±10 %
Release value	1.6 kΩ
Response time (overtemperature or open-circuit temperature sensor)	≤ 2 s
PTC resistors acc. to DIN 44081	max. 6 in series

Insulation fault location

Test current I_T	< 1 mA
Test cycle/pause	2/4 s

Displays and data memory

Display: graphic display	languages DE, EN, FR
Alarm LEDs	line 1, line 2, alarm, com
History memory	500 data records
Data logger	500 data records/channel
Config. logger	300 data records
Test logger	100 data records
Service logger	100 data records

Input

Digital inputs	1
Galvanic separation	yes
Control	via potential-free contacts
Mode of operation	active at 0 V (low) or 24 V (high), adjustable
Voltage range high/low	AC/DC 10…30 V/AC/DC 0…0.5 V
Adjustable function	switching back interlocking function, manual/automatic mode, bypass operation, function test, changeover of the preferred line, alarm input for operating theatre lights, alarm input for other devices

Output

Switching element	1 potential-free changeover contact
Mode of operation adjustable	N/O or N/C operation
Adjustable function	refer to the manual, settings menu 5: "Relay"
Electrical endurance under rated operating conditions, number of cycles	10 000

Contact data according to IEC 61810

Rated operational current AC (resistive load, cos φ=1)	5 A/AC 250 V
Rated operational current DC	5 A/DC 30 V
Overvoltage category	III
Minimum contact rating	10 mA at DC > 5 V

BMS interface

Interface/protocol	RS-485/BMS
Baud rate	9.6 kbit/s
Cable length	≤ 1200 m
Cable (twisted pairs, shielded, shield connected to PE on one side)	recommended: J-Y(St)Y min. n x 2 x 0.8
Terminating resistor	120 Ω (0.25 W)
Device address, BMS bus	2…90

Environment/EMC

EMC	EN 61326 (see CE declaration)

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4
Operating temperature	-25…+55 °C

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Terminals

Power section

Connection directly on ATICS®, for plug connections	screw-type terminals
rigid (flexible)/conductor sizes	10…70 mm² (6…50 mm²)/8 (10)…0 AWG
Stripping length	15 mm
Tightening torque (hexagon socket 4 mm)	5 Nm
Connection type	pluggable screw-type terminals
Conductor cross section, rigid min/max	1.5/35 mm²
Conductor cross section, flexible min/max	1.5 mm²/25 mm²
Conductor cross section AWG/min/max	20/2
Stripping length (do not use ferrules)	20 mm
Tightening torque (Torx® screwdriver T20 or slotted screwdriver 6.5 x 1.2 mm)	2.5 Nm (≤ 25 mm²) 4.5 Nm (≥ 25 mm²)
Torque setting for manual operation (Allen 5 mm)	approx. 6 Nm

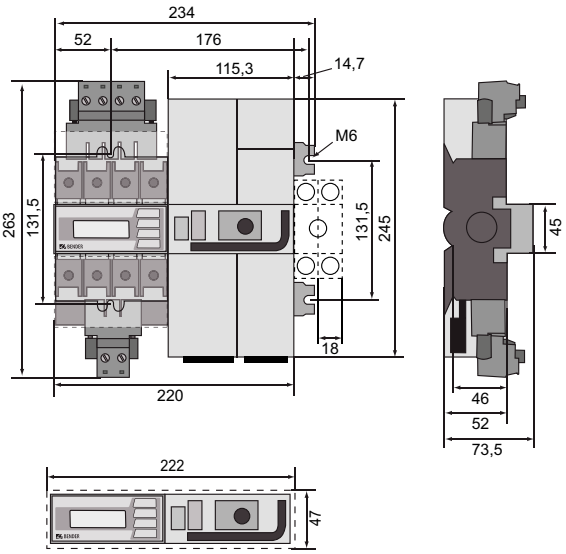
Electronics

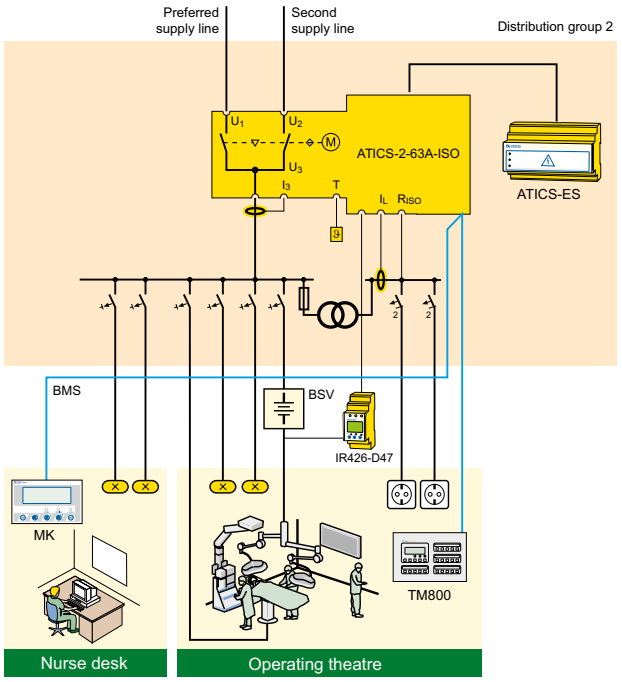
Connection	screw-type terminals
rigid/flexible/conductor sizes	0.14…1.5 mm²/28…16 AWG
Stripping length	7 mm
Tightening torque (slotted screws, screwdriver 2.5 x 0.4 mm)	0.22…0.25 Nm

Other

Operating mode	continuous operation
Mounting	display-oriented
Operating altitude up to a maximum of	2000 m AMSL
Protection class	Class I
Protection class LCD under foil (DIN EN 60529)	IP40
Enclosure material	polycarbonate
Flammability class	UL94V-0
DIN rail mounting	acc. to IEC 60715
Screw mounting	4 x M5
Dimensions incl. terminals (W x H x D)	234 x 270 x 73
Weight	approx. 3400 g

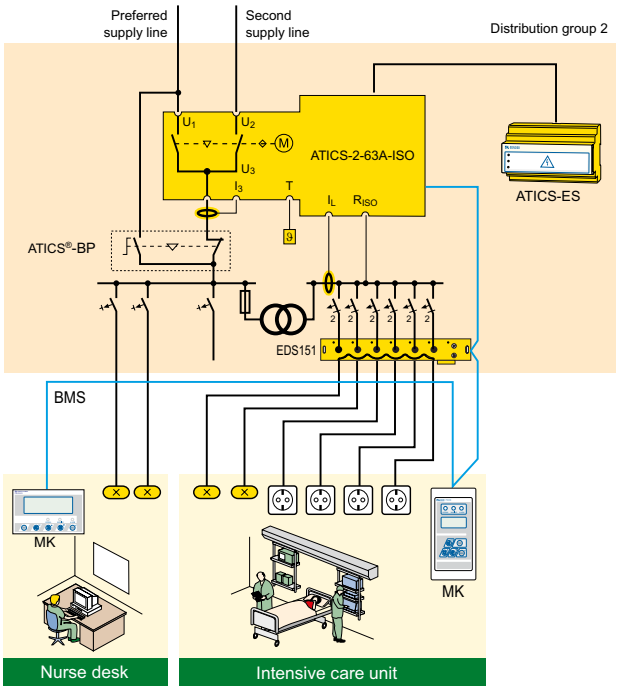
Dimension diagram (dimensions in mm)





Application example operating theatre

- ATICS®-2-63A-ISO: Changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring
- IR426-D47: Monitoring of the operating theatre light IT system (optional)
- MK2430/MK800/TM800: Alarm at at least two points with independent power supplies for functional safety
- ATICS-ES: Energy storage (B92057206, B92057207 only)

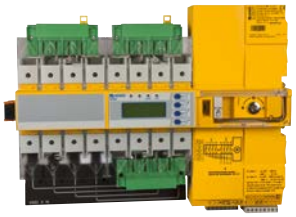


Example intensive care unit

- ATICS®-2-63A-ISO: Changeover between the preferred and the redundant line while monitoring the medical IT system with transformer load and temperature monitoring
- EDS151: Insulation fault locator or fast insulation fault localisation (recommended)
- ATICS®-BP: Bypass switch for uninterrupted test/maintenance (recommended)
- MK: Alarm at at least two points with independent power supplies for functional safety
- ATICS-ES: Energy storage (B92057206, B92057207 only)

ATICS®-...-DIO

Automatic transfer switching devices for safety power supplies



Typical applications

- Design of safety power supplies, e.g. for
  - main distribution boards
  - computing centres
  - industry
- Retrofit

Device features

Perfectly suitable for space-saving installation/retrofitting

- Compact device for designing safety power supplies with functional safety more easily, in accordance with DIN VDE 61508 (SIL 2), in computing centres, industry, or in group 2 medical locations in accordance with DIN VDE 0100-710 (VDE 0100-710)/IEC 60364-7-710
- All-in-one: Integration of switch disconnector and control electronics
- Compact design
- Solutions for any application

Convenient installation and commissioning

- Saves time and money

Safe operation

- Switch disconnector contacts of robust design
- Mechanical locking
- Manual operation directly on the device
- Functional safety SIL 2
- Certification by TÜV SÜD

Uninterrupted maintenance

- Plug connectors and optional bypass switch
- Excellent communication and parameterisation options

Standards

The transfer switching device conforms to the following standards:

- DIN VDE 0100-710 (VDE 0100 Part 710)*
- DIN VDE 0100-718 (VDE 0100-718)
- ÖVE/ÖNORM E 8007
- IEC 60364-7-710*
- DIN EN 61508-1 (VDE 0803-1)*
- IEC 61508-1 (2010-04) Ed. 2.0*
- DIN EN 61508-2 (VDE 0803-2)*
- IEC 61508-2 (2010-04) Ed. 2.0*
- DIN EN 61508-3 (VDE 0803-3)*
- IEC 61508-3 (2010-04) Ed. 2.0*
- DIN EN 60947-6-1 (VDE 0660-114)
- IEC 60947-6-1 (2013-12) Ed. 2.1

Standard-compliant isolating transformer monitoring according to:

- DIN EN 61558-1 (VDE 0570-1)
- DIN EN 61558-1/A1 (VDE 0570-1/A1)

The standards marked with * were part of the test conducted by TÜV Süd.

Further information

For further information refer to our product range on www.bender.de.

Ordering information ATICS®...-DIO 2-pole

Version	Rated operational current I_e	Scope of delivery	Type	Art. No.
	AC			
2-pole	63 A	1 x STW3, bridge, connectors, terminal cover	ATICS-2-63A-DIO	B92057212
	80 A	1 x STW3, bridge, connectors, terminal cover	ATICS-2-80A-DIO	B92057213
Bypass switch set	63 A	Bridge, terminal cover, auxiliary contacts, LEDs green/red	ATICS-BP-2-63A-SET	B92057252
	80 A	Bridge, terminal cover, auxiliary contacts, LEDs green/red	ATICS-BP-2-80A-SET	B92057253

Ordering information ATICS®...-DIO 4-pole

Version	Rated operational current I_e	Scope of delivery	Type	Art. No.
	AC			
4-pole	80 A	4 x STW3, bridge, connectors, terminal cover	ATICS-4-80A-DIO	B92057222
	125 A	4 x STW4, bridge, connectors, terminal cover	ATICS-4-125A-DIO	B92057223
	160 A	4 x STW4, bridge, terminal cover	ATICS-4-160A-DIO	B92057224
Bypass switch set	80 A	Bridge, terminal cover, auxiliary contacts, LEDs green/red	ATICS-BP-4-80A-SET	B92057260
	125 A	Bridge, terminal cover, auxiliary contacts, LEDs green/red	ATICS-BP-4-125A-SET	B92057262

Insulation coordination acc. to IEC 60664-1/IEC 60664-3

Overvoltage category	III
Pollution degree outside, inside	2
Rated insulation voltage ATICS-2-DIO/ATICS-4-DIO	250 V/400 V
Protective separation between	Line 1 – Line 2; Line 1, 2, 3 – RS-485 Line 1, 2, 3 – digital inputs; Line 1, 2, 3 – relay outputs
Voltage test according to IEC 61010-1 (basic insulation/protective separation)	2.21 kV/3.54 kV

Supply voltage

Rated operational voltage U_e	AC 50…60 Hz, 230 V
Supply voltage U_S	from monitored system
Power consumption ATICS-2-63A-DIO	≤ 16 W
Power consumption ATICS-2-80A-DIO	≤ 23 W
Power consumption ATICS-4-80A-DIO	≤ 39 W
Power consumption ATICS-4-125A-DIO	≤ 87 W
Power consumption ATICS-4-160A-DIO	≤ 119 W
Current during the changeover process	17 A/< 30 ms

Power section/switching elements

Nominal system voltage Un (operating range) ATICS-2-DIO/ATICS-4-DIO	AC 230 V/3NAC 400 V
Frequency range f_n	48…62 Hz
Crest factor	≤ 1.2
Number of switching cycles (mechanical)	≥ 8000
Short-circuit current Icc and fuses	refer to table “Utilisation category acc. to DIN EN 60947” in manual

Voltage monitoring/changeover

Frequency range f_n	40…70 Hz
Undervoltage response value (Alarm 1)	160…207 V (1-V steps)
Overvoltage response value (Alarm 2)	240…275 V (1-V steps)
Response delay t_{on}	50 ms…100 s (resolution of setting starting 50 ms)
Delay on release t_{off}	200 ms…100 s (resolution of setting starting 50 ms)
Hysteresis	2…10 % (1-% steps)
Frequency measurement	40…70 Hz (resolution 0.1 Hz)
Display range measured value ATICS-2-DIO	20…276 V
Display range measured value ATICS-4-DIO	20…520 V
Operating uncertainty	±1 %

Current monitoring (output current)

Measuring current transformers	STW3, STW4
Measuring range In (TRMS)	STW3: 0…> 150 A, STW4: 0…> 260 A
Response value for short-circuit detection ATICS-DIO (versions 63 A and 80 A) with STW3	130 A
Response value for short-circuit detection ATICS-DIO (versions 125 A and 160 A) with STW4	250 A
Crest factor	min. 2
Hysteresis for short-circuit alarm	5 %

Cable length:

Single wire ≥ 0.75 mm²	0…1 m
Single wire, twisted ≥ 0.75 mm²	1…10 m
Shielded cable	10…40 m
Cable: twisted pairs, shield to terminal 1 at one end, must not be earthed	recommended: J-Y(St)Y min. n x 2 x 0.8

Displays and data memory

Display: graphic display	languages DE, EN, FR
Alarm LEDs	line 1, line 2, alarm, com
History memory	500 data records
Data logger	500 data records/channel
Config. logger	300 data records
Test data logger	100 data records
Service logger	100 data records

Input

Digital inputs	4
Galvanic separation	yes
Control	via potential-free contacts
Mode of operation	active at 0 V (low) or 24 V (high), adjustable
Voltage range high/low	AC/DC 10…30 V/AC/DC 0…0.5 V
Adjustable function	switching back interlocking function, manual/automatic mode, bypass mode, functional test, changeover to the preferred line, alarm input for operating theatre lights, alarm input for other devices

Relay output 1

Switching element	1 potential-free changeover contact
Mode of operation adjustable	N/O or N/C operation
Adjustable function	see “Settings menu 4: Relay” in manual
Electrical endurance under rated operating conditions, number of cycles	10,000

Contact data according to IEC 61810

Rated operational current AC (resistive load, cos φ=1)	5 A/AC 250 V
Rated operational current DC	5 A/DC 30 V
Overvoltage category	III
Minimum contact rating	10 mA at DC > 5 V

Relay outputs 2…4

Switching element	1 potential-free N/O contact
Mode of operation adjustable	N/O or N/C operation
Adjustable function	see “Settings menu 4: Relay” in manual
Electrical endurance under rated operating conditions, number of cycles	80,000

Contact data according to IEC 61810

Rated operational current AC (resistive load, cos φ=1)	5 A/AC 150 V
Rated operational current DC	5 A/DC 30 V
Overvoltage category	III
Minimum switching capacity	120 mW

BMS interface

Interface/protocol	RS-485/BMS
Baud rate	9.6 kbit/s
Cable length	≤ 1200 m
Cable (twisted pairs, shielded, shield connected to PE on one side)	recommended: J-Y(St)Y min. n x 2 x 0.8
Terminating resistor	120 Ω (0.25 W)
Device address, BMS bus	2…90

Environment/EMC

EMC	EN 61326 (see CE declaration)

Classification of climatic conditions according to IEC 60721:

Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3
Long-term storage (IEC 60721-3-1)	1K4
Operating temperature	-25…+55 °C

Classification of mechanical conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Long-term storage (IEC 60721-3-1)	1M3

Terminals

Power section

Connection type (up to 125 A)	pluggable screw terminals
Conductor cross section, rigid min./max	1.5/35 mm²
Conductor cross section, flexible min./max.	1.5 mm²/25 mm²
Conductor cross section AWG/min./max	16/2
Stripping length (without ferrules)	20 mm
Tightening torque (Torx® screwdriver T20 or slotted screwdriver 6.5 x 1.2 mm)	2.5 Nm (≤ 25 mm²) 4.5 Nm (≥ 25 mm²)
Connection directly on ATICS®, for plug connections and connection of 160 A version	screw-type terminals
rigid (flexible)/conductor sizes	10…95 mm² (6…70 mm²)/8 (10)…000 (00) AWG
Stripping length	15 mm
Tightening torque (hexagon socket 4 mm)	5 Nm
Torque setting for manual operation (Allen 5 mm)	approx. 6 Nm

Electronics

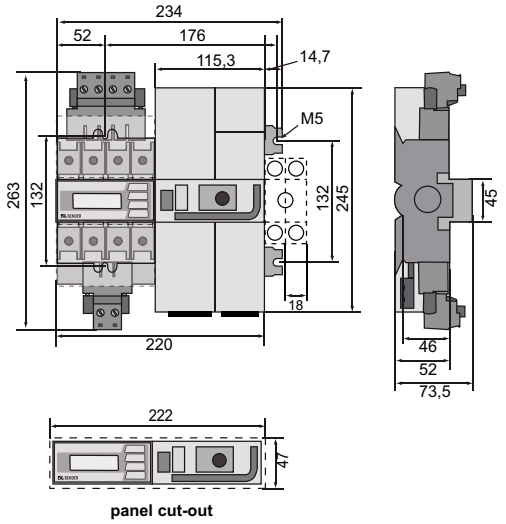
Connection	screw terminals
rigid/flexible/conductor sizes	0.14…1.5 mm²/28…16 AWG
Stripping length	7 mm
Tightening torque (slotted screws, screwdriver 2.5 x 0.4 mm)	0.22…0.25 Nm

Other

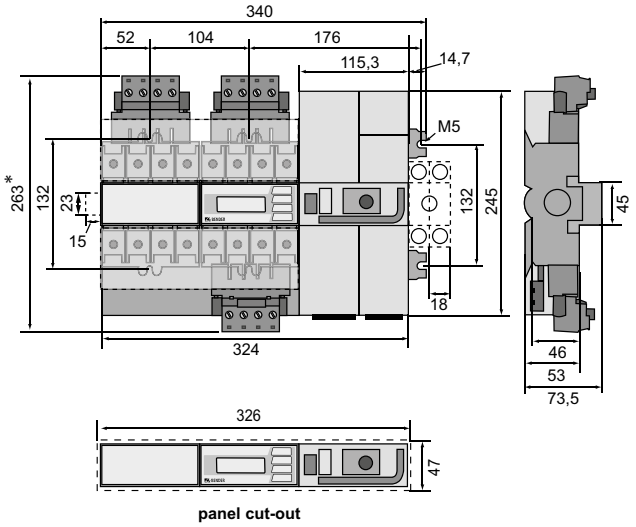
Operating mode	continuous operation
Mounting	display-oriented
For use at altitudes	up to 2000 m AMSL
Protection class	Class I
Protection class LCD under foil (DIN EN 60529)	IP40
Enclosure material	polycarbonate
Flammability class	UL94V-0
DIN rail mounting	acc. to IEC 60715
Screw mounting	4 x M5
Dimensions incl. terminals (W x H x D)	234 x 270 x 73
Weight	
ATICS-2-DIO	approx. 3400 g
ATICS-4-DIO	approx. 4800 g

Dimension diagrams (dimensions in mm)

2-pole

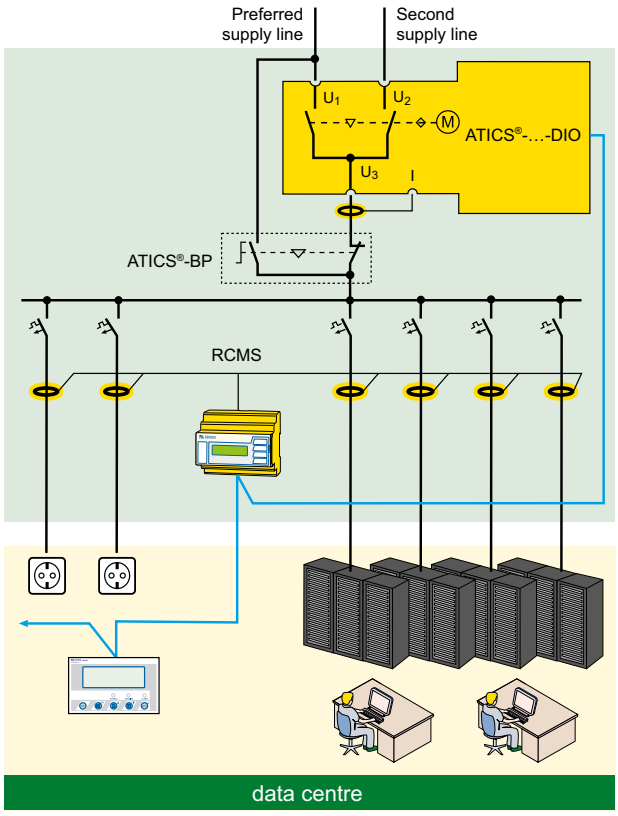


4-pole



* Version 80 A/125 A. Version 160 A without connectors.

Typical applications



Example application data centre

- ATICS®-…-DIO: Changeover between the preferred and the redundant line
- MK2430/MK800/TM800: Alarm at at least two points for functional safety



Safety Analyser

For over 30 years, the "Bender Tester" has been a well-known term for quality and long service life in the area of fully automated electrical safety testers. "UNIMET®" became the brand name.

UNIMET® – compact design – "Made in Germany", the user-friendly one among the safety analysers.

Device overview UNIMET® test systems

		UNIMET® 300ST	UNIMET® 400ST	UNIMET® 610ST	UNIMET® 810ST
					
Page		428	431	435	438
Application	Electrical equipment	■	■	■	■
	Electric hospital and care beds	■	■		■
	Medical electrical equipment	■ [1]	■		■
	Electrical machines			■	
Voltages	Supply voltage U_S	AC 230 V	AC 230 V	AC 230 V	AC 100…120 V, AC 220…240 V
	Voltage measurement Measuring range	AC 90…264 V	AC 90…264 V	AC 90…264 V	AC 90…264 V
	Load current measurement	0.01…16 A	0.01…16 A	0.01…16 A	0.01…16 A
Test sequence	manual	■	■	■	■
	semi-automatic			■	■
	automatic	■	■	■	■
Data exchange		UNIData300	UNIData300/400	UNIMET® 610ST Control Center	UNIMET® 810ST Control Center

[1] Medical electrical equipment without patient connections

7.2

UNIMET® 300ST

Test system for electrical equipment and electric hospital and care beds



Device features

- Easy operation and handling
- Automatic and manual test procedure
- Data input via keyboard or barcode scanner
- Visual inspection, functional testing and electrical testing
- 600 data records can be stored
- Data exchange and storage via UNIData 300
- Compatible with common application programs such as visual FM, MT Data and Fundamed

Typical applications

- Safe tests of electrical equipment, hospital and healthcare beds as well as medical electrical equipment without patient connections.

Approvals

CE

Standards

Die UNIMET® 300ST series tests are carried out in accordance with the requirements of the device standards:

- IEC 62353
- DIN EN 62353 (VDE 0751-1)
- ÖVE/ÖNORM EN 62353
- DIN VDE 0701-0702
- ÖVE E8701-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S	Version	Type	Art. No
AC			
230 V	Standard	UNIMET®300ST	B96023000
	CH	UNIMET®300ST	B96023001

Suitable system components

Description	Variant	Type	Art No.	Page
Adapter	German Schuko	VK701-6	B96020067	–
	Non-heating appliances	VK701-7	B96020066	–
	Adapter kit 16 A for DS32A	VK701-8	B96020097	–
Interface cable	–	RS-232/RS-232	B96012012	–
Test probe	–	Testprobe	B928748	–
Test terminal	–	Testterminal	B928741	–
Barcode scanner	–	PS/2	B96020082	–
Converter	–	USB1.1RS-232converter	B96020086	–
Flex keyboard	–	Flexkeyboard	B96020093	–
Three-phase adapter	–	DS32A	B96020098	443
		DS32A (CH/CH)	B96020110	443
		DS32DCT	B96020100	–

Technical data

Supply voltage	AC 230 V ±10 %)
Frequency range	45…65 Hz
Power consumption	max. 50 VA
Maximum load current	16 A
Max. connectable load at 230 V	3700 VA
Protection class	II
Ambient temperature	0…50 °C
Storage temperature	-10…+70 °C
Degree of protection	IP20

Testing of PE resistance

Test voltage	approx. 5 V, system frequency
Short-circuit current	> 2 A
Measuring range	0.001…29.999 Ω
Measuring accuracy	0.001…1.0 Ω: ±2.5 % of MV ±2 digits 1.001…29.999 Ω: ±5 % of MV ±2 digits

Leakage current, differential measurement method

Measuring range	0.02…19.99 mA
Measuring accuracy	±5 % of MV ±5 digits

Leakage current, direct measurement

Measuring range	0,001…19,999 mA
Measuring accuracy	0,001…19,999 mA: ±5 % of MV ±2 digits

Equipment leakage current -Alternative method

Measuring range	0.001…19.999 mA
Measuring accuracy	0,001…9,999 mA: ±5 % of MV ±2 digits 10,000…19,999 mA: ±7 % of MV ±2 digits
Test voltage (Equipment leakage current measurement – alternative method)	approx. system voltage, system frequency
Test current	max. 3.5 mA

Insulation resistance

Test voltage	approx. DC 500 V
Max. test current	2.5 mA
Measuring range	0.01…199.99 MΩ
Measuring accuracy	0.01…99.99 MΩ: ±5 % of MV ±2 digits 100.00…199.99 MΩ: ±10 % of MV ±2 digits

Load current measurement

Measuring range	0.01 A to 16 A
Measuring accuracy	±2.5 % of MV, ±3 digits

Voltage measurement

Measuring range	90…264 V
Measuring accuracy	±2.5 % of MV, ±2 digits

Apparent power

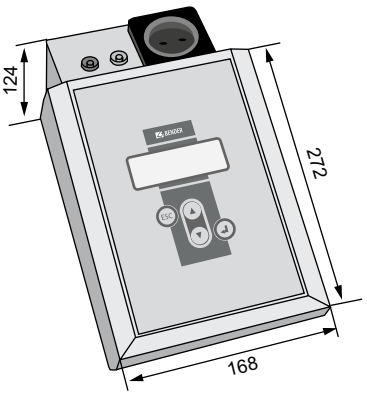
Measuring range	5…3700 VA
Measuring accuracy	±5 % of MV, ±5 digits

Other

Dimensions (without bag)	ca. 168 x 272 x 124 mm (W x D x H)
Weight (without accessories or bag)	approx. 2.2 kg
Calibration interval	36 months
Documentation number	D00135

of MV = of measured value

Dimension diagram (dimensions in mm)



Displays and controls





1 Function buttons

2 Backlit LCD for displaying the user menu and the measurement results. Four lines of 20 characters each.

3 Permanently attached power cable for connection to the supply voltage.

4 Sockets
- violet: Connection for test probe for testing exposed parts of the device under test.
- yellow (E): for a second test lead when the low-resistance continuity of the PE conductor is to be measured between two points (e.g., on single-phase, permanently connected devices or extension cables).

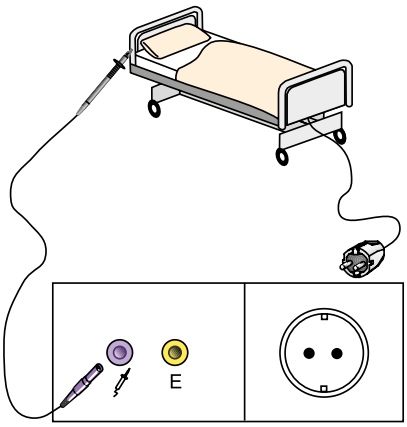
5 Test socket: This is where the DUT's power supply cable is plugged in

6 Durable plastic enclosure, with pushbuttons for safe storage in the carrying bag.

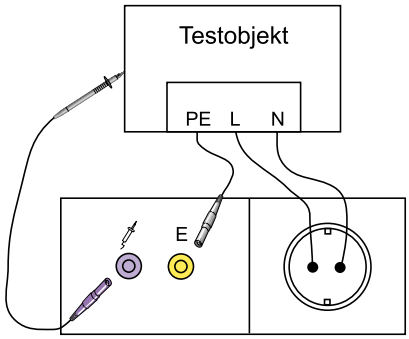
7 Power switch with thermo-magnetic circuit breaker

8 Interfaces
- 9-pole RS-232 interface, galvanically isolated, for connection to a personal computer
- Centronics interface for connection to a printer
- PS/2 port for connection to an external standard keyboard and a barcode reading wand or scanner.

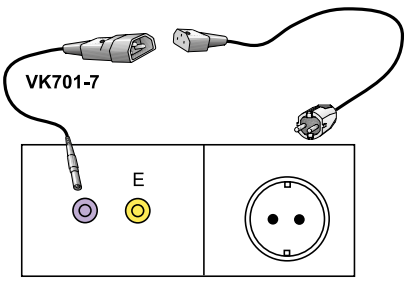
Wiring diagrams



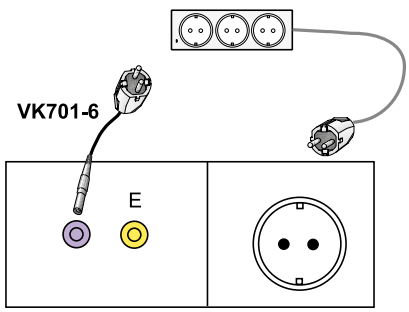
Connection of hospital and care beds and electrical equipment with plug-in connector.



For connecting single-phase permanently installed equipment to the test system
- Disconnect the device
- Disconnect the connection to the supply voltage



Testing of extension cables
- Connection of connecting and extension cords



Testing of extension cables
- Connection of connecting and extension cords

UNIMET® 400ST

Test system for medical electrical equipment, electrical hospital and care beds and electrical equipment



Typical applications

- Safe testing of medical electrical equipment with patient connections, hospital and care beds and electrical equipment.

Approvals

CE

Device features

- Easy operation and handling
- Automatic and manual test procedure
- Data input via keyboard or barcode scanner
- Visual inspection, functional testing and electrical testing
- 4mm socket for testing applied parts
- 600 data records can be stored
- Data exchange and storage via UNIData 300/400
- Compatible with common application programs such as visual FM, MT Data and Fundamed

Standards

The UNIMET® 400ST series carries out tests in accordance with the requirements of the device standards:

- IEC 62353
- DIN EN 62353 (VDE 0751-1)
- ÖVE/ÖNORM EN 62353
- DIN VDE 0701-0702
- ÖVE E8701-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Supply voltage U_S	Version	Type	Art. No.
AC			
230 V	Standard	UNIMET®400ST	B96024000
	CH	UNIMET®400ST	B96024001

Suitable system components

Description	Variant	Type	Art. No.	Page
PatBox	–	PatBox	B96020096	
Adapter	German Schuko	VK701-6	B96020067	–
	Non-heating appliances	VK701-7	B96020066	–
	Adapter kit 16 A for DS32A	VK701-8	B96020097	–
Interface cable	–	RS-232/RS-232	B96012012	–
Test probe	–	Testprobe	B928748	–
Test terminal	–	Testterminal	B928741	–
Barcode scanner	–	PS/2	B96020082	–
Converter	–	USB1.1RS-232converter	B96020086	–
Flex keyboard	–	Flexkeyboard	B96020093	–
Three-phase adapter	–	DS32A	B96020098	443
		DS32A (CH/CH)	B96020110	443
		DS32DCT	B96020100	–

Technical data

Supply voltage	AC 230 V ±10 %)
Frequency range	45…65 Hz
Power consumption	max. 50 VA
Maximum load current	16 A
Max. connectable load at 230 V	3700 VA
Protection class	II
Ambient temperature	0…50 °C
Storage temperature	-10…+70 °C
Degree of protection	IP20

Testing of PE resistance

Test voltage	approx. 5 V, system frequency
Short-circuit current	> 2 A
Measuring range	0.001…29.999 Ω
Measuring accuracy	0.001…1.0 Ω: ±2.5 % of MV ±2 digits
	1.001…29.999 Ω: ±5 % of MV ±2 digits

Leakage current, differential measuring method

Measuring range	0.02 mA…19.99 mA
Measuring accuracy	±5 % of MV ±5 digits

Leakage current, direct measurement

Measuring range	0.001…19.999 mA
Measuring accuracy	0.001…19.999 mA: ±5 % of MV ±2 digits

Equipment leakage current -alternative method

Measuring range	0,001…19,999 mA
Measuring accuracy	0,001…9,999 mA: ±5 % of MV ±2 digits
	10,000…19,999 mA: ±7 % of MV ±2 digits
Test voltage (Equipment leakage current measurement – alternative method)	
	approx. system voltage, system frequency
Test current	max. 3.5 mA

Insulation resistance

Test voltage	approx. DC 500 V
Max. test current	2.5 mA
Measuring range	0.01…199.99 MΩ
Measuring accuracy	0.01…99.99 MΩ: ±5 % of MV ±2 digits
	100.00…199.99 MΩ: ±10 % of MV ±2 digits

Load current measurement

Measuring range	0.01…16 A
Measuring accuracy	±2.5 % of MV, ±3 digits

Voltage measurement

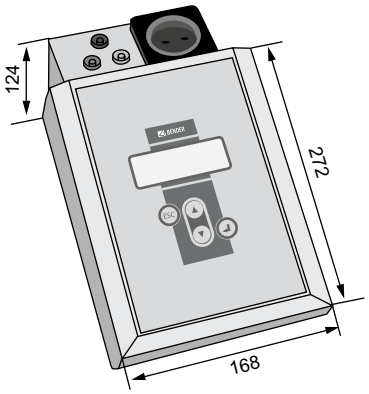
Measuring range	90…264 V
Measuring accuracy	±2.5 % of MV, ±2 digits
Apparent power	
Measuring range	5…3700 VA
Measuring accuracy	±5 % of MV, ±5 digits

Other

Dimensions (without bag)	ca. 168 x 272 x 124 mm (W x D x H)
Weight (without accessories or bag)	approx. 2.2 kg
Calibration interval	36 months
Documentation number	D00136

of MV = of measured value

Dimension diagram (dimensions in mm)



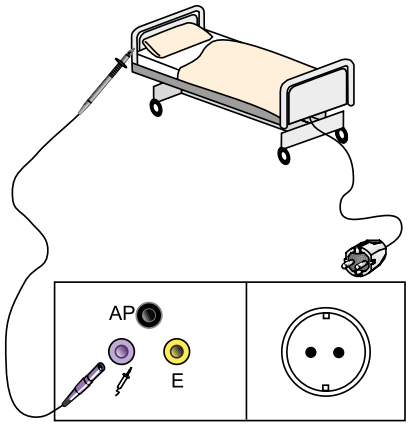
Displays and controls



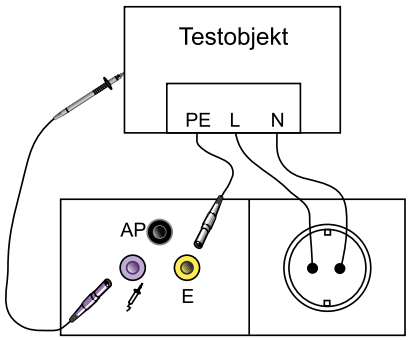


1. Function buttons
2. Backlit LCD for displaying the user menu and the measurement results. Four lines of 20 characters each.
3. Permanently attached power cable for connection to the supply voltage.
4. Sockets
   - black(AP): for testing applied parts
   - violet: Connection for test probe for testing exposed parts of the device under test.
   - yellow (E): for a second test lead when the low-resistance continuity of the PE conductor is to be measured between two points (e.g., on single-phase, permanently connected devices or extension cables).
5. Test socket: This is where the DUT's power supply cable is plugged in
6. Durable plastic enclosure, with pushbuttons for safe storage in the carrying bag.
7. Power switch with thermo-magnetic circuit breaker
8. Interfaces
   - 9-pole RS-232 interface, galvanically isolated, for connection to a personal computer
   - Centronics interface for connection to a printer
   - PS/2 port for connection to an external standard keyboard and a barcode reading wand or scanner.

Wiring diagrams

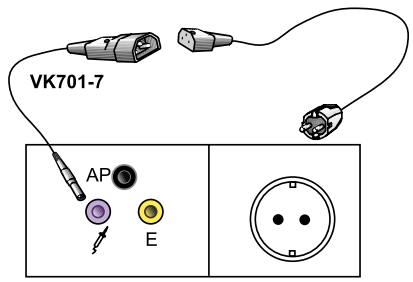


Connection of hospital and care beds and electrical equipment with plug-in connector.

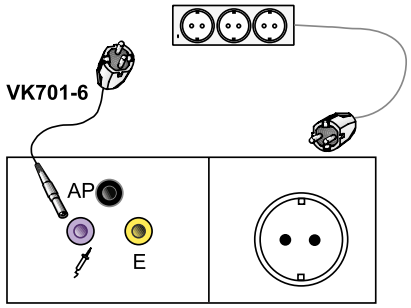


For connecting single-phase permanently installed equipment to the test system

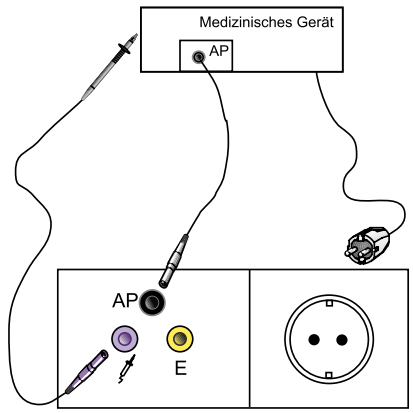
- Disconnect the device
- Disconnect the connection to the supply voltage



Testing of extension cables
– Connection of connecting and extension cords



Testing of extension cables
– Connection of connecting and extension cords



Connection of medical electrical equipment with plug-in connector

UNIMET® 610ST

Test system for electrical equipment and machines



Areas of application

- Electrical equipment "Inspection after repair, modification of electrical appliances – Periodic inspection on electrical appliances" acc. to DIN VDE 0701-0702 (VDE 0701-0702).
- DIN EN 60204-1/VDE 0113 Safety of machinery - Electrical equipment of machines - Part 1: General requirements

Certifications

CE

Device features

- The Windows user interface provides an easy-to-use solution
- Data exchange and storage via Control Center
- Automatic, semi-automatic or manual test sequences
- Data input via touch screen, keyboard or barcode scanner
- Visual inspection, electrical safety and functional test user-definable
- Test sequences user-definable
- Data storage > 10,000 data records
- Filter function for fast data selection
- Management of test dates
- Multitenancy
- Catalogue systems
- Test probe with two switching contacts – for semi-automatic testing of parts not connected to PE
- Compatible with all common application programs

Standards

The UNIMET® 610ST series tests according to the device standards:

- DIN VDE 0701-0702
- DIN VDE 0113/ EN 60204-1
- ÖVE/ÖNORM E 8701-1

Further information

For further information, refer to our product area at www.bender.de.

Ordering details

Nominal voltage range AC	Maximum output current	Version	Type	Art. No.
100…120 V and 220…240 V	16 A	Standard (DE/DE)	UNIMET® 610ST	B96026020

Suitable system components

Description	Variant	Type	Art. No.	Page
Adapter	Schuko	VK701-6	B96020067	–
	Non-heating devices	VK701-7	B96020066	–
	Adapter kit 16 A for DS32A	VK701-8	B96020097	445
Cable	For connecting the test system to a PC, 9-pin, female-female (null-modem cable)	RS-232/RS-232 interface cable	B96012012	–
	Measuring lead, 150 cm, 4-mm connector	Cable 150 cm	B928703	–
Test probe	TP800 active test probe (with switch)	TP800	B96020080	–
	Measuring lead, 3 m, with black test probe	–	B928748	–
Test terminal	Black	–	B928741	–
Touchscreen pen	–	Stylus pen	B928749	–
Barcode scanner	for UNIMET® 610ST (PS/2 port)	–	B96020082	–
Flex keyboard	for UNIMET® 610ST (USB port)	–	B96020093	–
Test kit	various adapters for connecting medical electrical equipment to test systems	PK3	B96020004	–
Three-phase adapter	for testing three-phase devices during operation	DS32A	B96020098	443

Technical data

Nominal voltage range	AC 100…120 V/±10 %, AC 220…240 V/±10 %
Frequency range	48…62 Hz
Power consumption	max. 100 VA
Maximum output current	see ordering details
Protection class	II

Testing of PE resistance

Measuring range	0.001… 29.999 Ω
Measuring current	max. AC 8 A
Measuring voltage	max. AC 8 V
Intrinsic uncertainty	0.001…1.000 Ω: ±2.5 % of MV ±5 digits
	1.001…29.999 Ω: ±5 % of MV ±5 digits
Operating uncertainty	0.001…1.000 Ω: ±5 % of MV ±10 digits
	1.001…29.999 Ω: ±7.5 % of MV ±10 digits

Insulation resistance

Measuring range	0.01…199.99 MΩ
Measuring voltage	max. DC 550 V
Measuring current	max. 2.5 mA
Intrinsic uncertainty	0.01…99.99 MΩ: ±5 % of MV ±2 digits
	100.00…199.99 MΩ: ±10 % of MV ±2 digits
Operating uncertainty	0.01…99.99 MΩ: ±7.5 % of MV ±4 digits
	100.00…199.99 MΩ: ±10 % of MV ±4 digits

Equipment leakage current - alternative method

Measuring range	0.001…19.999 mA
Measuring voltage	max. AC 250 V
Measuring current	max. 3 mA
Intrinsic uncertainty	±5 % of MV ±5 digits
Operating uncertainty	±7.5 % MV ±10 digits

Leakage current, residual current measuring method

Measuring range	0.02…19.99 mA
Intrinsic uncertainty	±5 % of MV ±2 digits
Operating uncertainty	±7.5 % of MV ±4 digits
Frequency response	40…100 kHz ±3 dB

Leakage current, direct measurement

Measuring range	0.001…19.999 mA
Intrinsic uncertainty	±5 % of MV ±2 digits
Operating uncertainty	±7.5 % of MV ±4 digits
Frequency response	up to 100 kHz ±3 dB

Voltage measurement

Measuring range	AC 90…264 V
Frequency range	48…62 Hz
Intrinsic uncertainty	±2.5 % of MV ±3 digits

Load current measurement

Measuring range	0.005…16 A
Frequency range	48…62 Hz
Intrinsic uncertainty	±2.5 % of MV ±3 digits

Apparent power

Measuring range	5…3600 VA
Frequency range	48…62 Hz
Intrinsic uncertainty	±5 % of MV ±3 digits

Environment/EMC

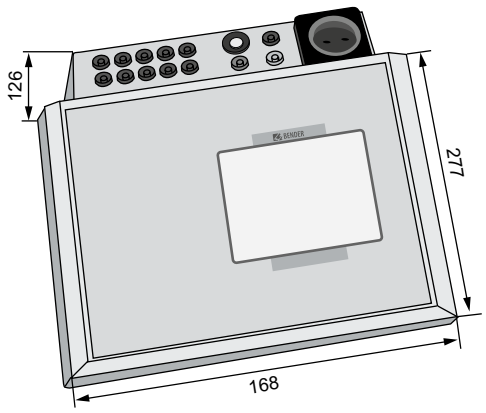
EMC	IEC 61326-1
Ambient temperature	0…+40 °C
Storage temperature	-10 …+70 °C
Relative humidity (up to 31 °C)	max. 80 %
Relative humidity (> 31…40 °C)	decreasing linearly, max. 50 %
	condensation must be avoided
Height AMSL	max. 2000 m

Other

Degree of protection	enclosure: IP40, connections: IP20
	in acc. with DIN VDE 0470 Part 1/EN 60529
Dimensions (without bag)	approx. 300x277x126 mm (W x D x H)
Weight (without accessories or bag)	approx. 3.5 kg
Calibration interval	36 months
Documentation number	D00380

of MV = of measured value

Dimension diagram (dimensions in mm)



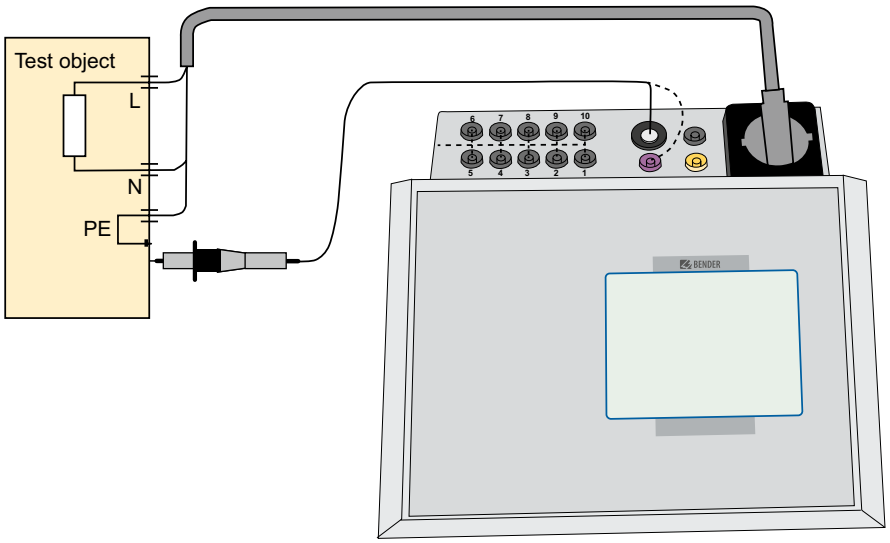
Operating elements





1. Touch screen for operation and display. For this purpose, a stylus is included in the scope of delivery.
2. Durable plastic enclosure, with push buttons for safe storage in the carrier bag.
3. 10 sockets (1…10) for the connection of VK adapters to test extension lines.
4. Measuring terminals
   - [B] (violet) for the connection of the single-pole test probe supplied with the product.
   - [A] for active test probe TP800 with push button (optional).
   - Socket [C] for equipotential bonding (e.g. connection for single-pole line extension with clip for the testing of permanently installed equipment).
   - Socket [D] for functional earth
5. Test socket: This is where the DUT's power supply cable is plugged in.
6. Connection to the supply voltage and power switch with thermo-magnetic circuit breaker.
7. Without function.
8. Interfaces:
   - PS/2 port for external keyboard
   - RS-485 serial interface for Bender Service
   - RS-232 interface, 9-pin, electrically isolated, for connection to a PC
   - USB interface for connection to a printer, a USB stick, an external keyboard or a barcode scanner (2 x host) and a PC (1 x device, for Bender Service only)
   - Ethernet network connection (optional)

Wiring diagram



UNIMET® 810ST

Test system for medical electrical equipment



Typical applications

- Tests of medical electrical equipment in accordance with DIN EN 60601-1 3rd edition
- Recurrent tests of medical electrical equipment in accordance with DIN EN 62353 (VDE 0751-1).
- Electrical equipment "Prüfung nach Instandsetzung, Änderung elektrischer Geräte (Recurrent test and test after repair and modification of electrical equipment)" in accordance with DIN VDE 0701-0702 (VDE 0701-0702).

Approvals

CE

Device features

- Easy operation by Windows user interface
- Data exchange and storage via Control Center
- Automatic, semi-automatic or manual test sequence
- Data input via touch screen, keyboard or barcode scanner
- Visual inspection, electrical tests, functional tests, user-definable
- Test sequences user-definable
- Data memory > 10,000 data records
- Filter function for fast data selection
- Management of test dates
- Multitenancy
- Catalogue systems
- Test probe with two switching contacts –for semi-automatic testing of conductive parts not connected to PE
- Compatible with common application programs such as visual FM, MT Data and Fundamed

Standards

The UNIMET® 810ST series carries out tests in accordance with the requirements of the device standards:

- IEC 60601-1
- IEC 62353
- DIN EN 62353 (VDE 0751-1)
- IEC 61010-1
- ÖVE/ÖNORM EN 62353
- DIN VDE 0701-0702
- ÖVE E8701-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Nominal voltage range	Maximum load current	Version	Type	Art. No.
AC				
100…120 V and 220…240 V	16 A	Standard (DE/DE)	UNIMET®810ST	B96028020
	13 A	GB/GB	UNIMET®810ST	B96028024
		B/B	UNIMET®810ST	B96028027
		US/US	UNIMET®810ST	B96028028
	10 A	CH	UNIMET®810ST	B96028026

Suitable system components

Description	Variant	Type	Art No.	Page
Adapter	German Schuko	VK701-6	B96020067	–
	Non-heating appliances	VK701-7	B96020066	–
	Adapter kit 16 A for DS32A	VK701-8	B96020097	445
Cable	for connecting the test system with a PC, 9-pole, female-female (Null modem cable)	RS-232/RS-232interfacecable	B96012012	–
	Measuring lead, 150 cm, 4 mm connector	Cable150cm	B928703	–
Test probe	Test probe active (with switch)	TP800	B96020080	–
	3 m measuring lead with black test probe	–	B928748	–
Test terminal	black	–	B928741	–
Touchscreen pen	–	Styluspen	B928749	–
Barcode scanner	for the UNIMET® 810ST (PS/2 connection)	–	B96020082	–
Flex keyboard	for the UNIMET® 810ST (USB connection)	–	B96020093	–
Test kit	various adapters for connecting medical electrical equipment to test systems	PK3	B96020004	–
Test box	for testing test systems	TB3	B96020025	446
Three-phase adapter	for testing three-phase devices during operation	DS32A	B96020098	443
		DS32A (CH/CH)	B96020110	443
External power source 25 A	for standard-compliant protective earth resistance measurements (only in conjunction with UNIMET® 810ST)	EPS800	B96028050	441

Technical data

Nominal voltage range	AC 100…120 V/±10 %, AC 220…240 V/±10 %
Frequency range	48…62 Hz
Power consumption	max. 100 VA
Maximum output current	see ordering information
Protection class	SKII

Testing of PE resistance

Measuring range	0.001… 29.999 Ω
Measuring current	max. AC 8 A
Measuring voltage	max. AC 8 V
Intrinsic uncertainty	0.001…1.000 Ω: ±2.5 % v. M. ±5 digits 1.001…29.999 Ω: ±5 % v. M. ±5 digits
Operating uncertainty	0.001…1.000 Ω: ±5 % v. M. ±10 digits 1.001…29.999 Ω: ±7.5 % v. M. ±10 digits

Insulation resistance

Measuring range	0.01…199.99 MΩ
Measuring voltage	max. DC 550 V
Measuring current	max. 2.5 mA
Intrinsic uncertainty	0.01…99.99 MΩ: ±5 % v. M. ±2 digits 100.00…199.99 MΩ: ±10 % v. M. ±2 digits
Operating uncertainty	0.01…99.99 MΩ: ±7,5 % v. M. ±4 digits 100.00…199.99 MΩ: ±10 % v. M. ±4 digits

Equipment leakage current -alternative method

Measuring range	0.001…19.999 mA
Measuring voltage	max. AC 250 V
Measuring current	max. 3 mA
Intrinsic uncertainty	±5 % v. M. ±5 digits
Operating uncertainty	±7.5 % v. M. ±10 digits

Leakage current, differential measurement method

Measuring range	0.02…19.99 mA
Intrinsic uncertainty	±5 % v. M. ±2 digits
Operating uncertainty	±7.5 % v. M. ±4 digits
Frequency response	40…100 kHz ±3 dB

Leakage current, direct measurement

Measuring range	0.001…19.999 mA
Intrinsic uncertainty	±5 % v. M. ±2 digits
Operating uncertainty	±7.5 % v. M. ±4 digits
Frequency response	up to 100 kHz ±3 dB

Voltage measurement

Measuring range	AC 90…264 V
Frequency range	48…62 Hz
Intrinsic uncertainty	±2.5 % v. M. ±3 digits

Load current measurement

Measuring range	0.005…16 A
Frequency range	48…62 Hz
Intrinsic uncertainty	±2.5 % v. M. ±3 digits

Apparent power

Measuring range	5…3600 VA
Frequency range	48…62 Hz
Intrinsic uncertainty	±5 % v. M. ±3 digits

Environment/EMC

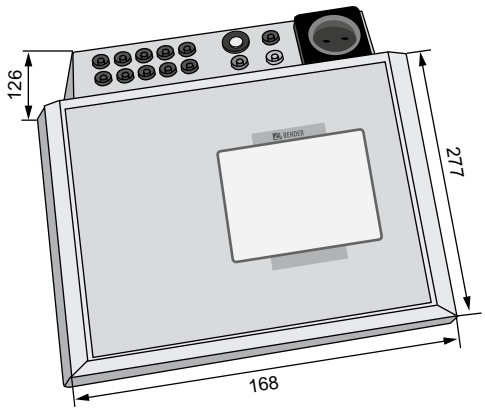
EMC	IEC 61326-1
Ambient temperature	0…+40 °C
Storage temperature	-10…+70 °C
Relative humidity (up to 31 °C)	max. 80 %
Relative humidity (> 31…40 °C)	decreasing linearily, max. 50 % condensation must be avoided
Height above sea level	max. 2000 m

Other

Degree of protection, enclosure: IP40, connections: IP20	
	according to DIN VDE 0470 Part 1/EN 60529
Dimensions (without bag)	approx. 300x277x126 mm (W x D x H)
Documentation number	D00008
Weight (without accessories or bag)	approx. 3.5 kg
Calibration interval	36 months
Documentation number	D00008

of MV = of measured value

Dimension diagram (dimensions in mm)



Displays and controls



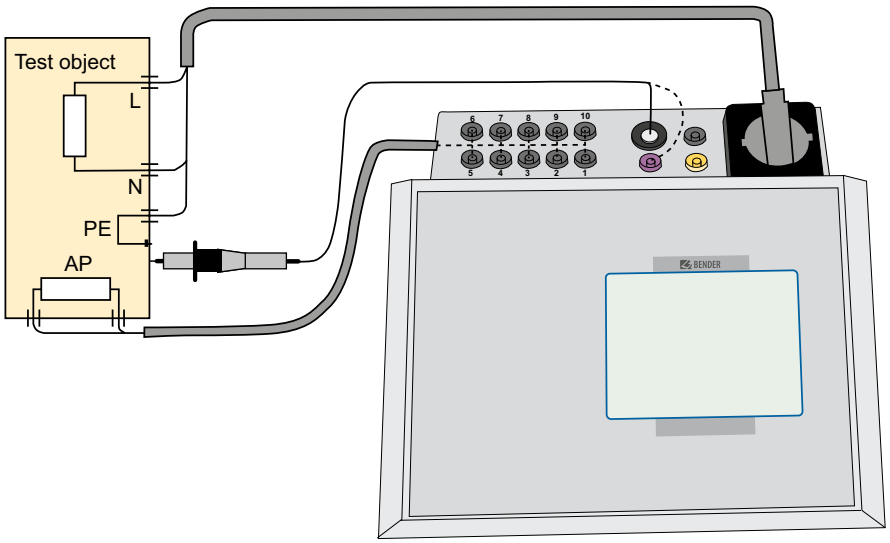


1. Touchscreen for operator control and indication. For this purpose, a stylus is included in the scope of supply.
2. Durable plastic enclosure, with pushbuttons for safe storage in the carrying bag.
3. 10 sockets (1…10) for the connection of patient electrodes.
4. Measuring terminals
   - [B] (violet) for the connection of the single-pole test probe supplied with the product.
   - [A] for active test probe TP800 with pushbutton (option).
   - Socket [C] for equipotential bonding (e.g. connection for single-pole line extension with clip for the testing of permanently installed equipment).
   - socket [D] for functional earth
5. Test socket: This is where the DUT's power supply cable is plugged in.
6. Connection to the supply voltage and power switch with thermo-magnetic circuit breaker.
7. Connection for the external 25 A power source EPS800.

   Note: The plug clicks into place and is secured against being pulled out accidentally.

   The plug can only be removed after pushing the movable grip back.
8. Interfaces:
   - PS/2 connection for external keyboard
   - RS-485 serial interface for Bender Service
   - 9-pole RS-232 interface, galvanically isolated, for connection to a personal computer
   - USB interface for connection to a printer, a USB stick, an external keyboard or a barcode scanner (2 x host) and a PC (1 x device, for Bender Service only)
   - Ethernet network connection (optional)

Wiring diagram



EPS800

External power source 25 A for UNIMET® 800/810ST



Typical applications

- External 25 A power source for standard-compliant protective earth resistance measurement acc. to IEC 60601-1 and IEC 61010-1

Approvals

CE

Device features

- To be used in conjunction with the appropriate UNIMET® 800/810ST

Standards

The EPS800 series carries out tests in compliance with the device standard:

- IEC 60601-1
- IEC 61010-1

Further information

For further information refer to our product range on www.bender.de.

Ordering information

Version	for UNIMET®		Type	Art. No.
	800ST	810ST		
Standard (German)	B96028010	B96028020	EPS800	B96028050
GB	B96028014	B96028024	EPS800	B96028054
CH	B96028016	B96028026	EPS800	B96028056
B	B96028017	B96028027	EPS800	B96028057
US	B96028018	B96028028	EPS800	B96028058

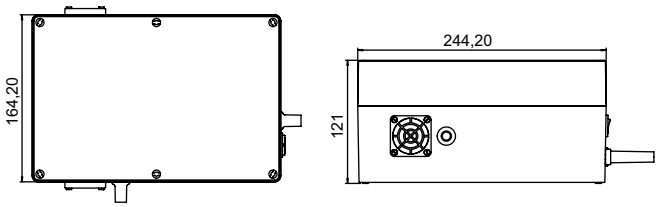
Technical data

Nominal voltage	AC 207…253 V, 48 … 62 Hz
Power consumption	400 VA
Measuring current	AC 25 A ±10 % (0 … 0.3 Ω)
Output power	230 VA
Operating mode	continuous operation
Protection class	II
Micro-fuse	5 x 20 mm, fast 5 A/250 V

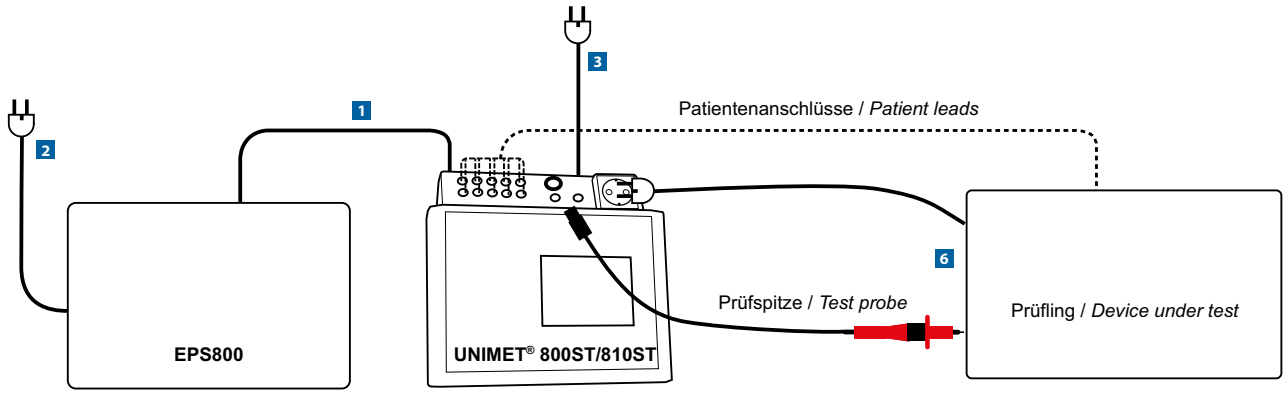
Other

EMC	IEC 61326-1
Ambient temperature	0…+40 °C
Storage temperature	-10…+70 °C
Relative humidity (up to 31 °C)	max. 80 %
Relative humidity (> 31…40 °C)	decreasing linearily, max. 50 % condensation must be avoided
Height above sea level	max. 2000 m
Degree of protection	IP20
Dimensions	ca. 244 x 164 x 120 mm (W x D x H)
Documentation number	D00146
Weight	≤ 4 kg

Dimension diagram (dimensions in mm)



Wiring diagram



1 Insert the control cable of the EPS800 into the "EPS800" connector socket on the rear of the UNIMET® 800ST/810ST.

Note: The plug clicks into place and is secured against being pulled out accidentally. The plug can only be removed after sliding back the movable handle piece.

2 Connect the supply line of the EPS800 to the power socket.

3 Connect the supply line of the UNIMET® 800ST/810ST to the power socket.

4 Switch on the power switch of the UNIMET® 800ST/810ST.

5 Switch on the power switch of the EPS800. The sound of the internal ventilator can be heard.

6 Connect the DUT. Determine the test sequence according to the classification.

DS32A

3AC three-phase adapter with differential current measurement



Device features

- To be used in conjunction with an UNIMET test system

Standards

The DS32A series carries out tests in compliance with the device standard:

- DIN VDE 0701-0702
- DIN EN 62353

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- Three-phase adapter for testing medical electrical three-phase devices during operation

Approvals

CE EAC

Ordering information

Type	Art. No.
DS32A	B96020098
DS32A (CH/CH)	B96020110

Technical data

Electrical safety

Protection class	I acc. to IEC 61010-1/EN 601010-1/VDE 0411-1
Pollution degree	2
Measurement category	CAT II
Test voltage	1.69 kV
Current carrying capacity	32 A/6 h three-phase current
EMC	EN 61326-1

Differential current

Measuring range	AC 0.02…20 mA
Intrinsic uncertainty	5 % v. M. ±50 µA

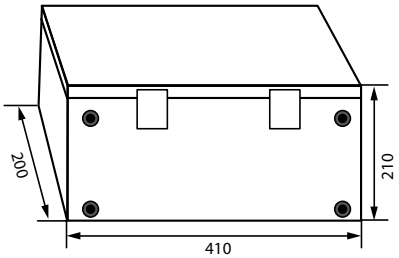
Supply voltage

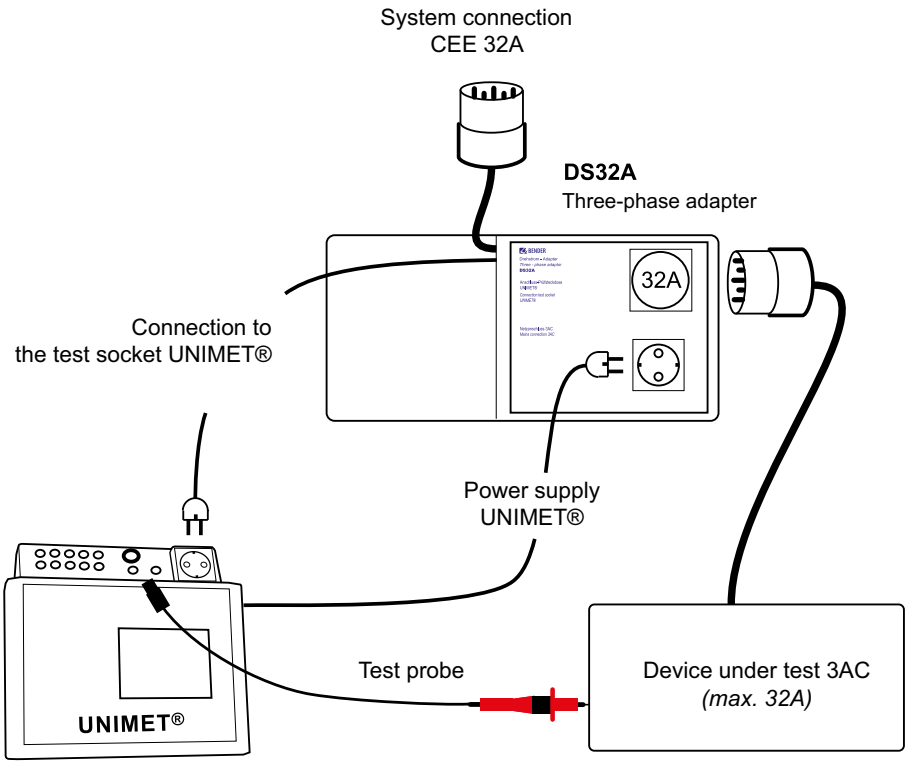
Supply voltage U_S	3AC 400 V ±10 %
Frequency range U_S	50…60 Hz
Power consumption	approx. 18 VA
Load current max.	32 A

Environmental conditions

Storage temperature	-10…+70 °C
Operating temperature	0…+50 °C
Degree of protection	IP20
Dimensions	405 x 210 x 200 mm (width x height x depth)
Weight	8.9 kg
Height above sea level	max. 2000 m
Operating mode	not suitable for continuous operation
Documentation number	D00147

Dimension diagram (dimensions in mm)




System connection
CEE 32A
DS32A
Three-phase adapter
32A
Connection to
the test socket UNIMET®
Power supply
UNIMET®
Test probe
UNIMET®
Device under test 3AC
(max. 32A)

VK701-8

Adapter kit 16 A for DS32A



Device features

- To be used in conjunction with the three-phase adapter DS32A

Further information

For further information refer to our product range on www.bender.de.

Typical applications

- for the measurement of 16-A-three-phase devices in conjunction with the three-phase adapter DS32A

Approvals

CE

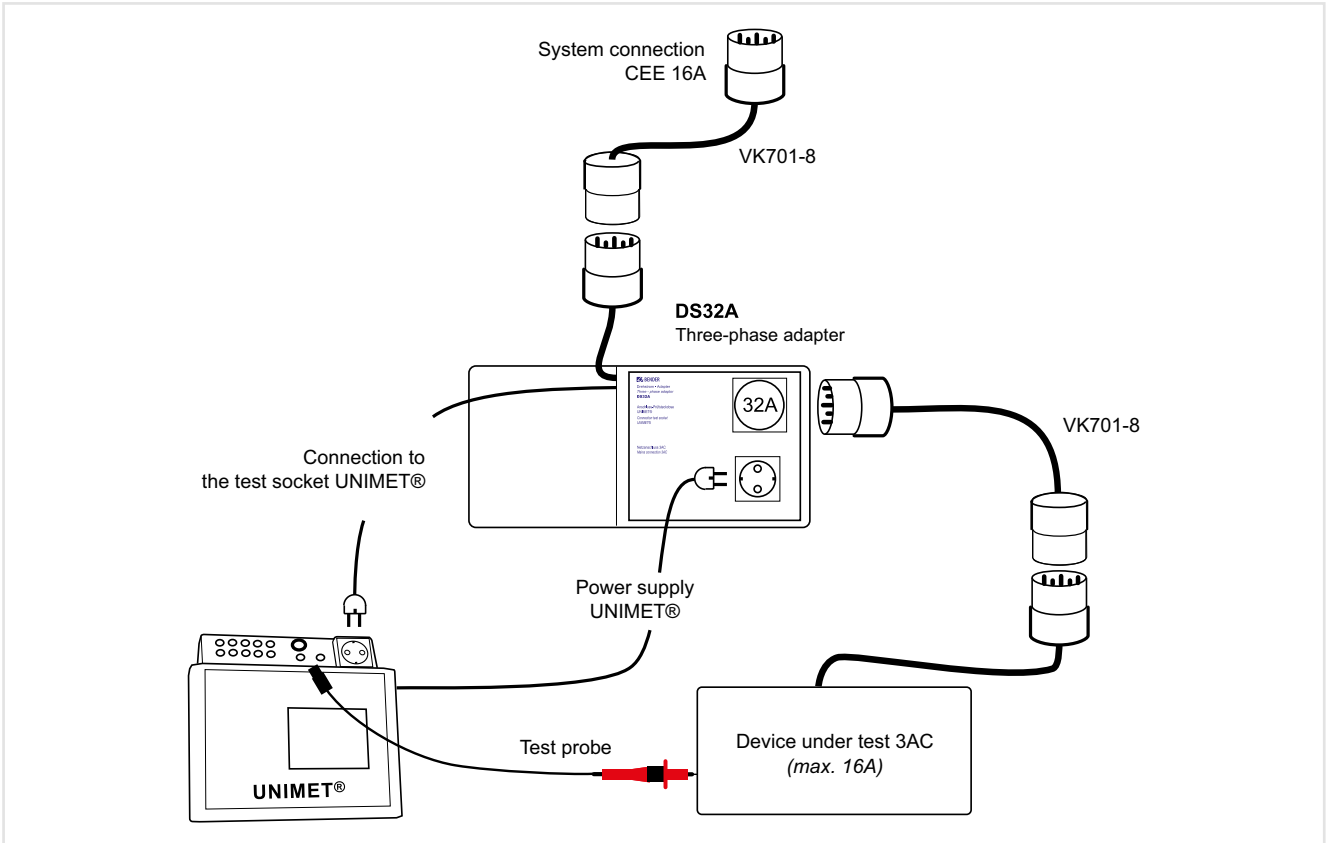
Ordering information

Type	Art. No.
VK701-8	B96020097

Technical data

Nominal voltage	
Nominal voltage	3AC 400 V
Max. current	16 A
Documentation number	D00172

Wiring diagram



TB3

Test box



Device features

- Test box for UNIMET® 800/810ST
- Time and cost saving through simple handling
- Simulation of a standardised DUT
- 10 patient sockets for individual calibration
- Magnetic adhesive stripes allow simple fixing to the safety tester

Typical applications

- Testing the measured values of safety testers
- Comprehensive system self test

Further information

For further information refer to our product range on www.bender.de.

Approvals

CE

Ordering information

Version	Type	Art. No.
Standard (German)	TB3testbox	B96020025
CH	TB3testbox	B96020055

Technical data

Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 250 V
Rated impulse voltage/pollution degree	4 kV/3

Voltage ranges

Nominal system voltage U_n	100…240 V
Rated frequency fn	AC 48…62 Hz
Output voltage U12	7.39 V (±2.5 %)
Max. power consumption	35 VA at 50 Hz, 230 V

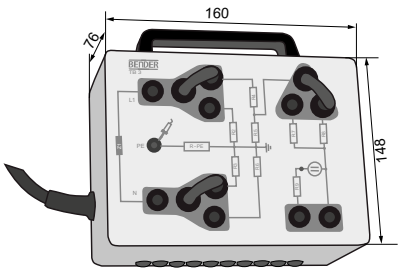
Evaluation of tolerance values

Precalculation	110 %
Tolerance	10 %
Built-in resistors	
R -MD (safety tester)	1000 Ω
R -PE	0.233 Ω
R3	25 000 Ω
R4	1 000 000 Ω
R5	1 500 000 Ω
R6	100 000 000 Ω
R7	1 000 000 Ω
R8	100 000 Ω
R9	130 000 Ω

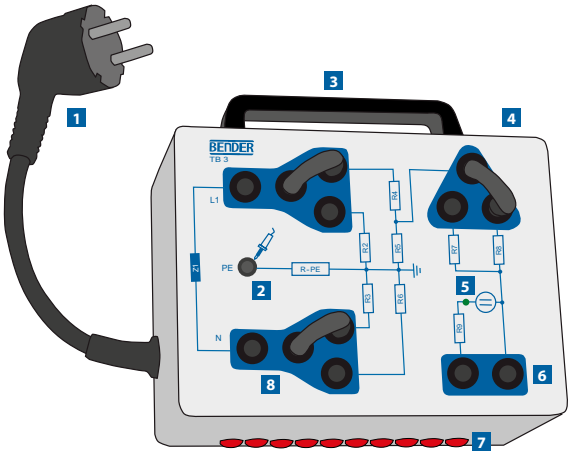
Other

Ambient temperature (during operation)	0…+50 °C
Ambient temperature (during storage)	-10…+70 °C
Operating mode	continuous operation
Mounting	any position
Protection class	Class I
Dimensions in mm (H x W x D)	148 x 160 x 76
Weight	≤ 900 g
24-month calibration interval	
Documentation number	D00149

Dimension diagram (dimensions in mm)



Displays and controls



1 Mains plug; only to be used for the test socket of the safety tester

2 Socket for the connection of the test probe

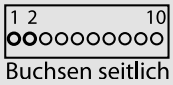
3 Carrying handle

4 Enclosure, magnetic adhesive stripes allow simple fixing to the safety tester µP601

5 LED lights when voltage is applied at the mains plug

6 Sockets for the patient connections 1 and 2 of the safety tester

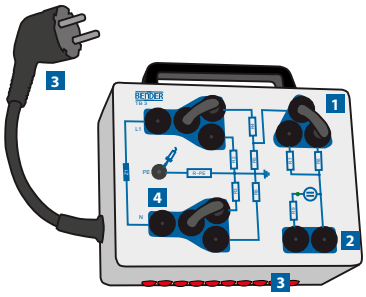
7 The sockets 1 and 2 at the side of the test box TB3 are internally connected to the sockets on the front. The sockets 3…10 can be used to test the patient connections 3…10 at the safety tester (patient auxiliary current measurement).The measured values differ from the values documented in the table "tolerance values".

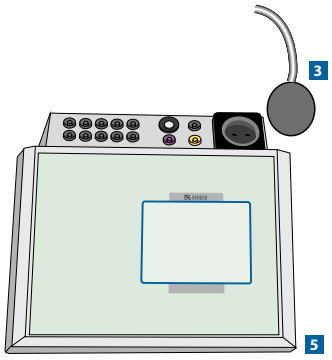


Buchsen seitlich

8 Jumpers allow simulation of different test situations

Connections





1 Jumpers. Insert the jumpers in such a way that the following sockets are connected:

µP601	UNIMET® 810ST
a-b	a-b
d-e	d-f
h-i	h-i

2 Connect the patient sockets 1 and 2 of the safety tester (at UNIMET® 810ST socket 2 only) to the respective socket of the test box TB3.

3 Insert the mains plug of TB3 into the test socket of the safety tester, as illustrated. Please observe the plug-in direction.

– at UNIMET® 810ST, insert the supply cable from the top

In case of wrong plug-in direction test results will become unusable.

4 Contact the test probe of the safety tester with the socket PE of TB3

5 UNIMET® 800/810ST test system

Insulation monitoring devices
ISOMETER®

7

Equipment for insulation fault location
ISOSCAN®

151

Residual current monitoring systems
LINETRAXX®

177

Neutral Grounding Resistor Monitor (NGR)
LINETRAXX®

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Power Quality and Energy Measurement
LINETRAXX®

Measuring and monitoring relays
LINETRAXX®

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System components

Coupling devices
Measuring current transformers
Transformers
Measuring transducers
Power supply units
Measuring instruments
Interface converters
Interface repeaters
COMTRAXX® Gateways
COMTRAXX® Alarm indicator and test combinations
COMTRAXX® condition monitors
Visualisation

317

Switching equipment
ATICS® transfer switching and monitoring devices

Test systems
UNIMET® Safety analyser

415

427

Annex

Standards and guidelines applied
Alphabetical list of devices
Technical terms
Service



449





Technical terms

Alarm state	Alarm state indicates that the residual current in the installation monitored has exceeded the preset level of the RCM.
Direct contact	Electric contact of persons or animals with live parts.
Earth	Part of the Earth which is in electric contact with an earth electrode and the electric potential of which is not necessarily equal to zero.
Earth electrode	Conductive part, which may be embedded in a specific conductive medium, e.g. concrete or caoke, in electric contact with the Earth.
Earth fault	Occurrence of an accidental conductive path between a live conductor and the Earth.
Earth fault current	Current flowing to earth due to an insulation fault.
Earth leakage current	Current flowing from the live parts of the installation to earth in the absence of an insulation fault.
Effect of the supply voltage	Effect influencing the functioning of measuring equipment and, consequently, the measured value produced by it.
Effects of the distribution system voltage	Effect influencing the operation and, consequently, the measured value produced by it.
Electric shock	Physiological effect resulting from an electric current through a human or animal body.
Equipment for insulation fault location	Device or combination of devices used for insulation fault location in IT systems. The insulation fault location system is used in addition to an insulation monitoring device. It injects a locating current between the electrical system and earth and locates insulation faults.
Equipotential bonding	Provision of electrical connections between conductive parts, intended to achieve equipotentiality.
Exposed-conductive part	Conductive part of equipment which can be touched and which is not normally live, but which can become live when basic insulation fails.
Extraneous conductive part	Conductive part not forming part of the electrical installation and liable to introduce an electric potential, generally the electric potential of a local earth.
Extraneous DC voltage U_{fg}	DC voltage occurring in AC systems between the AC conductors and earth (derived from DC parts).
Extraneous voltage	Voltage to which the measuring equipment can be subjected by external influences. This is not required for the operation of the measuring equipment, but can interfere with its operation.
Fault current I_{Δ}	Current which flows across a given point of fault resulting from an insulation fault.
Fault voltage (U_f)	Voltage appearing under fault conditions between exposed conductive and/or extraneous conductive parts and earth.
Fiducial value	A clearly specified value to which reference is made in order to define the fiducial error.
Indirect contact	Electric contact of persons or animals with exposed-conductive parts which have become live under fault conditions.
Influence quantity	A quantity which is not the subject of the measurement, but which influences the value of the measured quantity, or the indication of measuring equipment.
Insulation fault	A defect in the insulation of an equipment which can result either in an abnormal current through this insulation or in a disruptive discharge.
Insulation fault locator	Device or part of device for the location of the insulation fault.
Insulation monitoring device	Equipment which permanently monitors and indicate the insulation resistance of an electrical installation or a section of it in unearthed IT AC systems. The equipment is intended to signal a drop in insulation resistance below a minimum limit, so that the cause of the reduction can be found before a second fault occurs resulting in an unwanted disconnection of the electrical installation.
Insulation resistance R_F	Resistance in the system being monitored, including the resistance of all the connected appliances to earth.

Internal DC resistance R_i	Resistance of the insulation monitoring device between the terminals to the system being monitored and earth.
Internal impedance Z_i	Total impedance of the insulation monitoring device between the terminals to the system being monitored and earth, measured at the nominal frequency.
ISOMETER®	Registered trademark of Bender GmbH & Co. KG, Grünberg. An ISOMETER® actively measures the insulation resistance in IT systems with a measuring voltage which is superimposed between the system and the PE conductor.
Leakage current	Electric current in an unwanted conductive path under normal operating conditions.
Live part	Conductor or conductive part intended to be energised in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor.
Locating current I_L	r.m.s. value of the current that is injected by the locating current injector during the location process. The locating current can be generated by an independent locating voltage source, or an independent locating current source, or it can be driven directly from the system to be monitored.
Locating voltage U_L	r.m.s. value of the voltage present at the measuring terminals of the locating current injector during the measurement when the device has an independent locating voltage or current source.
Measuring current I_m	Maximum current that can flow between the system and earth, limited by the internal resistance from the measuring voltage source of the insulation monitoring device.
Measuring voltage U_m	Voltage present at the measuring terminals during the measurement.
Nominal current I_n	Current of the measuring equipment under nominal conditions.
Nominal frequency (f_n)	Frequency for which the measuring equipment is intended to be used and designed.
Nominal voltage of the distribution system (U_n)	Voltage by which a distribution system or equipment is designated and to which certain operating characteristics are referred.
Nominal voltage of the measuring equipment (U_{me})	Voltage for which the measuring equipment is intended to be used and the value of which is marked on the equipment.
Nominal voltage range	Voltage range for which the measuring and monitoring equipment is intended to be used and for which it has been designed.
Open-circuit voltage (U_q)	Voltage present across unloaded terminals on the measuring equipment.
Operating voltage in a system	The value of the voltage under normal conditions at a given, specific point of the system.
Origin (of the electrical installation)	Point at which electric energy is delivered to the electrical installation.
Output voltage (U_a)	Voltage across the measuring equipment terminals where this equipment does or can output electric power.
Performance characteristic	One of the quantities (described by values, tolerances, ranges) assigned to an equipment in order to define its performance.
Protective conductor PE	Conductor provided for purposes of safety for example protection against electric shock.
Puslating direct current	Current of pulsating waveform which assumes, in each period of the rated power frequency, the value 0 or the value not exceeding 0.006 A d.c. during one single interval of time, expressed in angular measure, of at least 150°.
Rated contact voltage	Voltage for which a relay contact is rated to open and close under specified conditions.
Rated operating conditions	A set of specified measuring ranges for performance characteristics and specified operating ranges for influence quantities, within which the variations of operating errors of an instrument are specified and determined.
Rated residual operating current $I_{\Delta n}$	The value of the residual operating current, assigned to the RCM by the manufacturer, at which the RCM shall operate under specified conditions.
RCM directionally discriminating	RCM used in IT systems, capable of directionally discriminating between supply side and load side residual currents.
RCM type A	RCM for which actuation is ensured for residual sinusoidal alternating currents and residual pulsating direct currents, whether suddenly applied or slowly rising.

RCM type B	RCM for which actuation is ensured for residual sinusoidal alternating currents, residual pulsating direct currents or smooth residual direct currents, whether suddenly applied or slowly rising.
Residual current I_Δ	Algebraic sum of the values of the electric currents in all live conductors, at the same time at a given point of an electric circuit in an electrical installation.
Residual current monitor	Device or association of devices which monitors the residual current in an electrical installation, and which activates an alarm when the residual current exceeds the operating value of the device.
Residual current monitoring system	Usually consists of the residual current monitor and measuring current transformers. The system localises occurring residual currents and indicates the location of the fault.
Residual operating current	Value of the residual current which causes the RCM to operate under specified conditions.
Response sensitivity	Value of the evaluating current or insulation resistance at which the evaluator responds under specified conditions.
Response time t_{an}	Time required by an insulation monitoring device to respond under specified conditions.
Response value R_a	Value of the insulation resistance at which the device responds under specified conditions.
Short circuit to exposed-conductive part	A conductive connection caused by a fault between the exposed-conductive part and the live parts of electrical equipment.
Short circuit current (I_k)	Current flowing across the short-circuited terminals of the measuring equipment.
Solid short circuit, short circuit to exposed-conductive parts, short circuit to earth	A solid short circuit, short circuit to exposed-conductive parts or short-circuit to earth exists if the impedance of the conductive connection at the point of fault is almost zero.
Specified operating range	Range of values of a single influence quantity which forms a part of the rated operating conditions.
Specified response value R_{an}	Value of the insulation resistance, permanently set or adjustable, on the device and monitored if the insulation resistance falls below this limit.
Supply voltage (U_S)	Voltage at a point where the measuring equipment does or can accept electric energy as a supply.
System leakage capacitance C_e	Total capacitance to earth of the system to be monitored, including any connected appliances, up to which value the insulation monitoring device can work as specified.
Total earthing resistance R_A	The resistance between the main earthing terminal and the earth.
Touch voltage (U_L)	Maximum value of the touch voltage which is permitted to be maintained indefinitely in specified conditions of external influences and is usually equal to AC 50 V, r.m.s. or 120 V ripple free DC.
Touch voltage U_t	Voltage between conductive parts when touched simultaneously by a person or an animal.
True value	The value which characterises a quantity perfectly defined, under the conditions which exist when the quantity is considered.
Variation	The difference between the indicated values for the same value of the measured quantity of an indicating or recording instrument, of the (conventional) true value of a supply instrument, when a single influence quantity assumes successively two different values.
Voltage against earth (U_o)	a) In distribution systems with an earthed neutral point, the voltage between a phase conductor and the earthed neutral point. b) In all other distribution systems, the voltage present between the remaining phase conductors and earth when one of the phase conductors is shorted to earth.

Short forms of residual current protective devices

Short form	German term	English term
MRCD	Gerät oder Anordnung von Geräten, das/die eine Strommesseinrichtung und eine Auswerteeinheit zur Erkennung und Bewertung sowie zur Ansteuerung des Kontaktöffnens einer Abschaltvorrichtung enthält.	device or an association of devices comprising a current sensing means and a processing device designed to detect and to evaluate the residual current and to control the opening of the contacts of a current breaking device
PRCD	ortsveränderliche FI-bzw. DI-Schutzeinrichtung (auch OVS)	portable residual current protective device
PRCD-S	OVS mit erweitertem Schutzumfang und Sicherstellung der bestimmungsgemäßen Nutzbarkeit des Schutzleiters	portable residual current protective device-safety
RCBO	FI-bzw. DI-Schutzeinrichtung mit eingebautem Überstromauslöser (FI/LS-bzw. DI/LS-Schalter)	residual-current-operated circuit breakers with integrated overcurrent protection
RCCB	FI-bzw. DI-Schutzeinrichtung ohne eingebauten Überstromschutz	residual-current-operated circuit breakers without integrated overcurrent protection
RCD (generic term)	Fehlerstrom-Schutzeinrichtung (RCD ohne Hilfsspannung, spannungsunabhängig) bzw. Differenzstrom-Schutzeinrichtung) (RCD mit Hilfsspannung, spannungsabhängig)	residual current protective device
RCM	Differenzstrom-Überwachungsgerät	residual current monitors for household and similar uses
SRCD	ortsfeste FI-bzw-DI-Schutzeinrichtung in Steckdosenausführung	fixed socket-outlets residual current protective device



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Support during all stages

Comprehensive service for your installation: remote, by phone, on site



Competent service for maximum safety and high availability of your installation



Fault location – made easy

With portable fault location systems, existing insulation faults can be quickly located. They are the best alternative if no stationary equipment for insulation fault location is available.

From planning to modernisation – Our extensive know-how is at your disposal during all project phases.

Furthermore, with our first-class service we guarantee maximum safety for your electrical installations.
We offer services ranging from support over telephone to repairs and on-site service – with modern measuring devices and competent employees.

Secure yourself:

- High availability of your installation thanks to fast reaction to fault messages
- Increased profitability of your capital expenditure (CapEx) via optimised maintenance processes
- Targeted operating expenditure (OpEx) due to less downtimes and shorter service visits
- Support for your prospective system monitoring and regular tests of your system/power quality/monitoring devices
- Automatic control, analysis, correction, new settings/updates
- Competent assistance with setting changes and updates

Bender Remote Assist
Bender Remote Assist offers you support via remote access, high-quality service and advice for your challenging task consisting in ensuring consistent high safety in your systems.

Many service visits, fault clearance but also analyses and controls can be carried out remotely – without the expenses of time and money that an on-site visit of a technician implies.

This fast, efficient help and advice by our expert network allows the highest possible availability of your system.

BENDER
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