

ISOSCAN® EDS440/441

Insulation fault locators for localisation
 of insulation faults in unearthed DC, AC and
 three-phase power supply systems (IT systems)



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Insulation fault locator EDS440-L

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..., W...AB
- Fault memory behaviour selectable
- Configuration possibilities enable individual adjustments
- Up to 21 EDS insulation fault locators in the system, 252 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 button via digital inputs
- Indication via iso685-D-P or LEDs
- Central indication of faulty outgoing circuits
- Serial interface RS-485, BS bus address range 2...90
- Connection to higher-level control and visualisation systems possible

Approvals



Product description

The insulation fault locators ISOSCAN® EDS44x are used in connection with the ISOMETER® iso685-D-P or the locating current injector PGH to locate insulation faults in unearthed power supply systems (IT systems).

They detect locating current signals generated by the insulation monitoring device iso685-D-P or IRDH575 or the locating current injector PGH and evaluate them correspondingly. Up to 12 measuring current transformers can be connected to an EDS44x. In total, up to 21 insulation fault locators can be connected via an RS-485 interface (BS bus protocol) and thereby up to 252 outgoing circuits can be monitored.

Application

- 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

Function description

When an insulation monitoring device detects the occurrence of an insulation fault, it starts the insulation fault location.

In the event of a first insulation fault, a residual current flows in IT systems that is primarily defined by the system leakage capacitances. The basic idea of the fault location is therefore closing the fault current circuit for a short period of time via a defined resistance. Due to this principle, a locating current, which contains an evaluable signal, is driven through the system voltage.

The locating current is generated by the locating current injector at regular intervals. It is limited in amplitude and time. Thereby, the system conductors are alternately connected to earth via a defined resistance. The resulting locating current depends on the size of the existing insulation fault and the system voltage. It is limited depending on the settings. During project planning it is important to observe that, even in unfavourable cases, there is no system part on which this locating current may cause harmful reactions.

The locating current flows from the locating current injector via the live lines to the insulation fault position taking the shortest way. From there, it flows through the insulation fault and the PE back to the locating current injector. This locating current pulse is detected by the measuring current transformer on the insulation fault path and signalled by the connected insulation fault locator.

Device variants

EDS44...-L

Alarm messages are directly indicated on the device display

EDS44...-S

Alarm messages are displayed on the respective ISOMETER®

System variants

The insulation fault locators EDS440 and EDS441 differ depending on their response sensitivity.

The EDS440 is suitable for main circuits. The EDS441 can be used in control circuits and in circuits in medical locations.

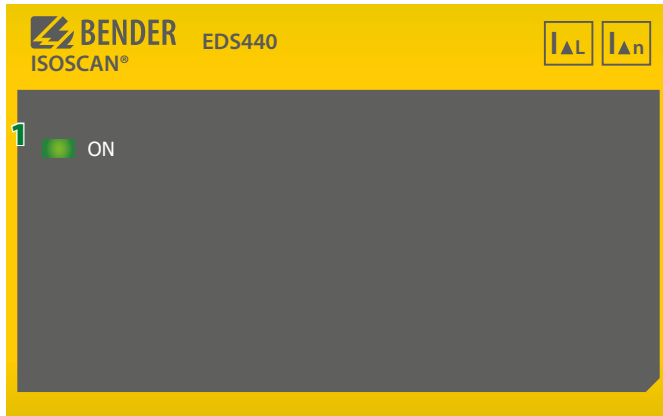
Standards

Observe the applicable national and international standards. The EDS... series meets the device standards:

- DIN VDE 0100-410 (VDE 0100-410):2007-06
Erection of low voltage electrical installations
Part 4-41: Protective measures – Protection against electric shock
(IEC 60364-4-41:2005, modified);
German adoption HD 60364-4-41:2007
- DIN EN 61557-9 (VDE 0413-9):2009-11
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 9:
Equipment for insulation fault location in IT systems (IEC 61557-9:2009); German
version: EN 61557-9:2009

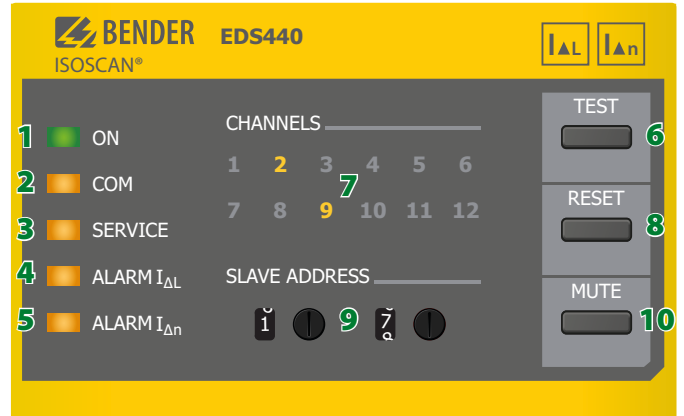
Operating and display elements EDS44x

EDS440-S



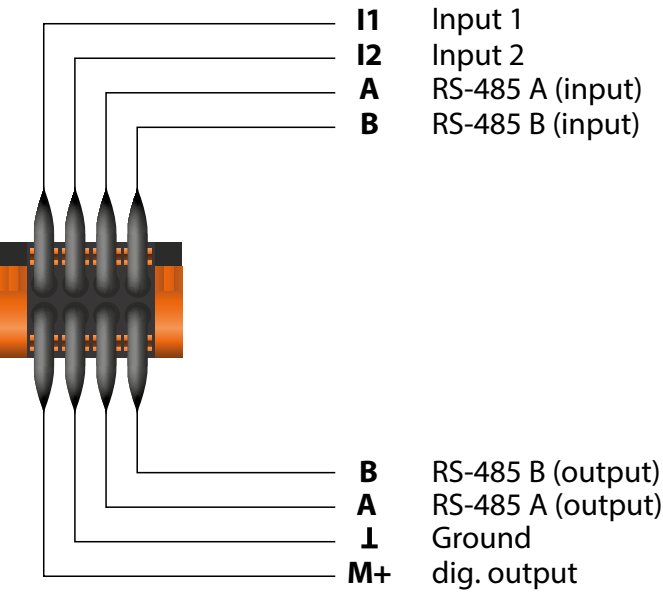
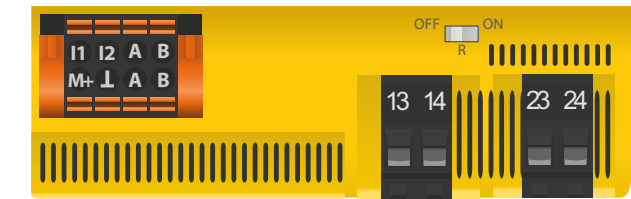
- 1 - The LED "ON" is lit when the device is switched on and flashes during power up until the device is ready for operation.
- 2 - The LED "COM" is lit when the fault location is active and the RS-485 interface communicates.
- 3 - The LED "SERVICE" lights either when there is a device fault, a connection fault of the measuring current transformers or an error message e.g. due to low-frequency residual currents, external magnetic fields, etc.
- 4 - The LED "ALARM $I_{\Delta L}$ " is the main alarm. The LED lights when an insulation fault is detected (EDS function) on one of the measuring channels.
- 5 - The LED "ALARM $I_{\Delta n}$ " lights if the set response value is exceeded. The factory setting for the response value is 10 A. This is the alarm LED for residual currents.

EDS440-L

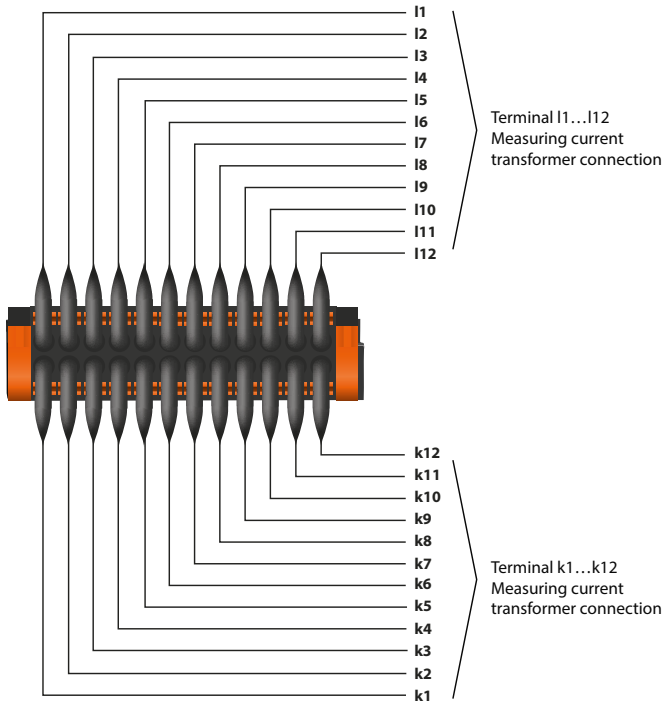
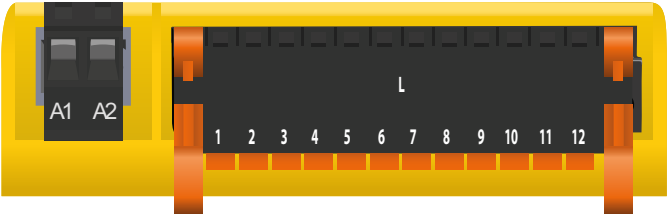


- 6 - TEST button: Initiate self test.
- 7 - The channel LEDs "1...12" light up if an insulation fault has been detected on the respective measuring channel. They flash if the measuring current transformer circuit is interrupted or short-circuited.
- 8 - RESET button: resets the fault memory. The fault memory can only be reset if it is activated and the fault has disappeared.
- 9 - SLAVE ADDRESS: Device address setting.
- 10 - MUTE button: Deactivates the buzzer.

Connection to the X1 interface

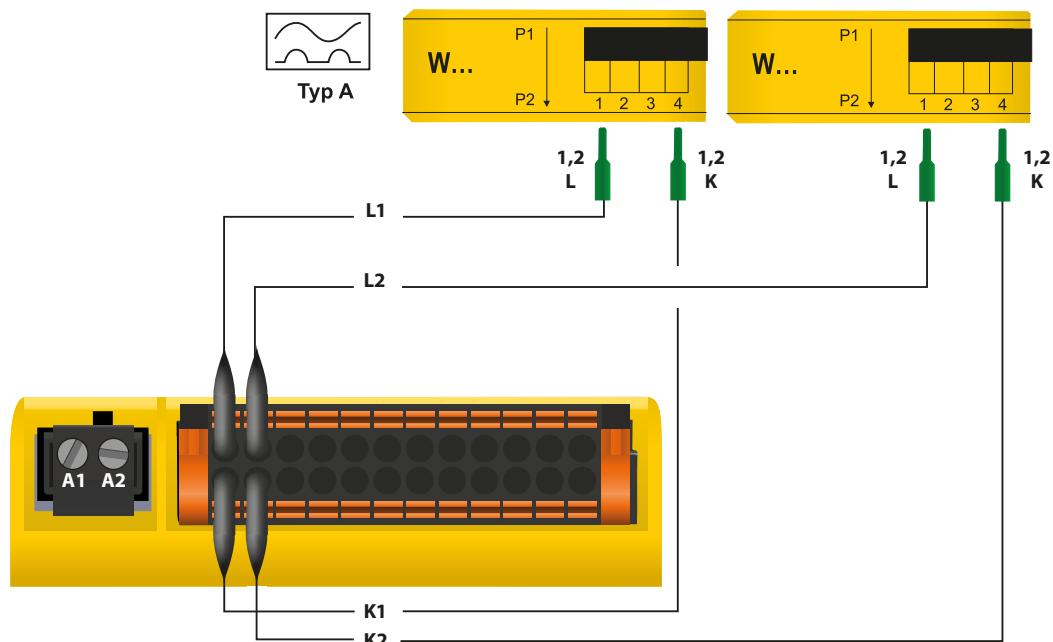


Connection to the k1-12/I1-12 interface



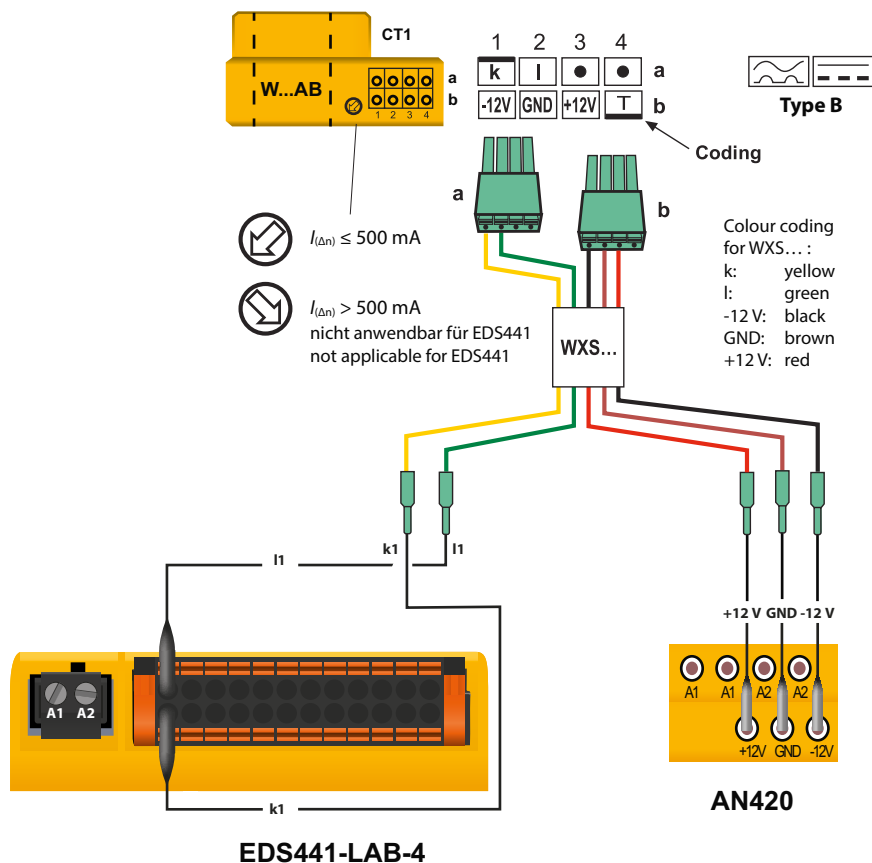
Connection measuring current transformer W..., WR..., WS... series

For insulation fault location, the measuring current transformers of the W... (closed), WR... (rectangular) and WS... (split-core) series are used.

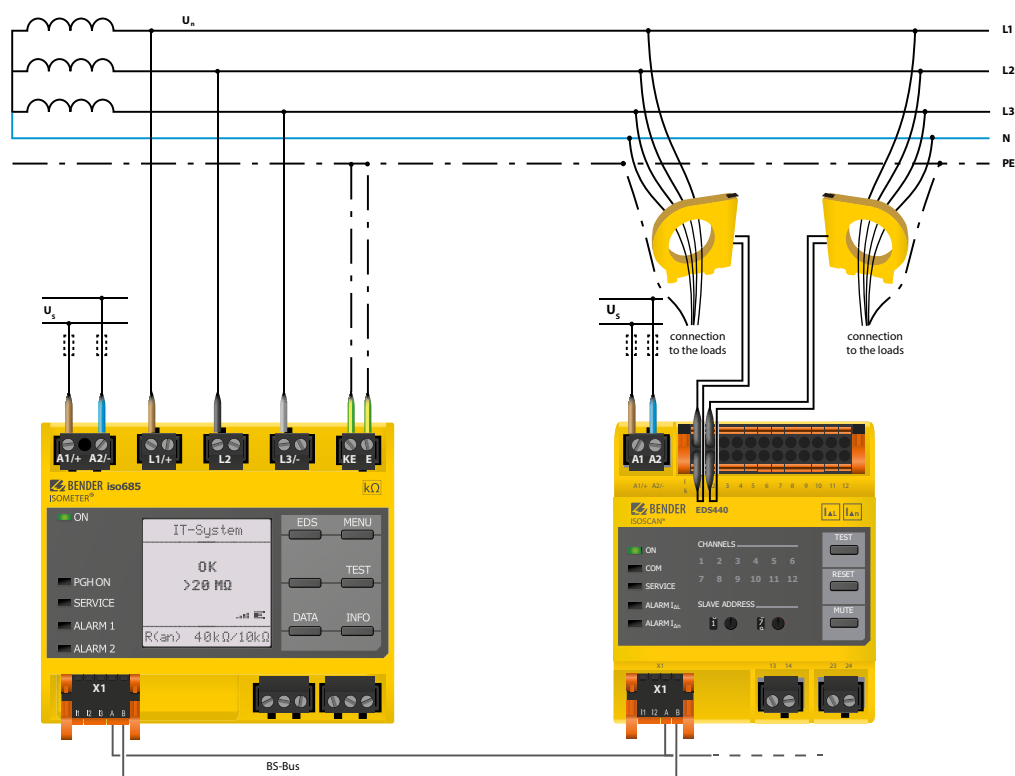


Connecting measuring current transformers of the W...AB series to EDS441-LAB

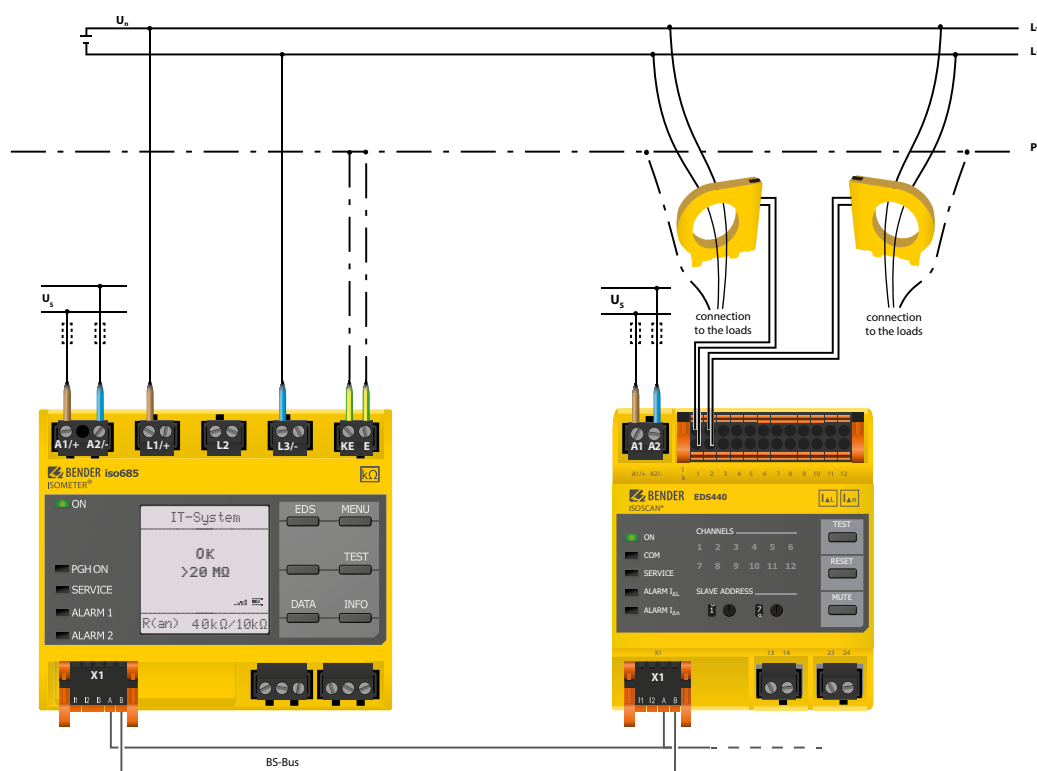
To use the EDS441-LAB with the maximum locating current of ≤ 1.8 mA, the closed measuring current transformers of the W...AB series are required. For every 6 measuring current transformers of the W...AB series, one power supply unit AN420 or AN110 is required.



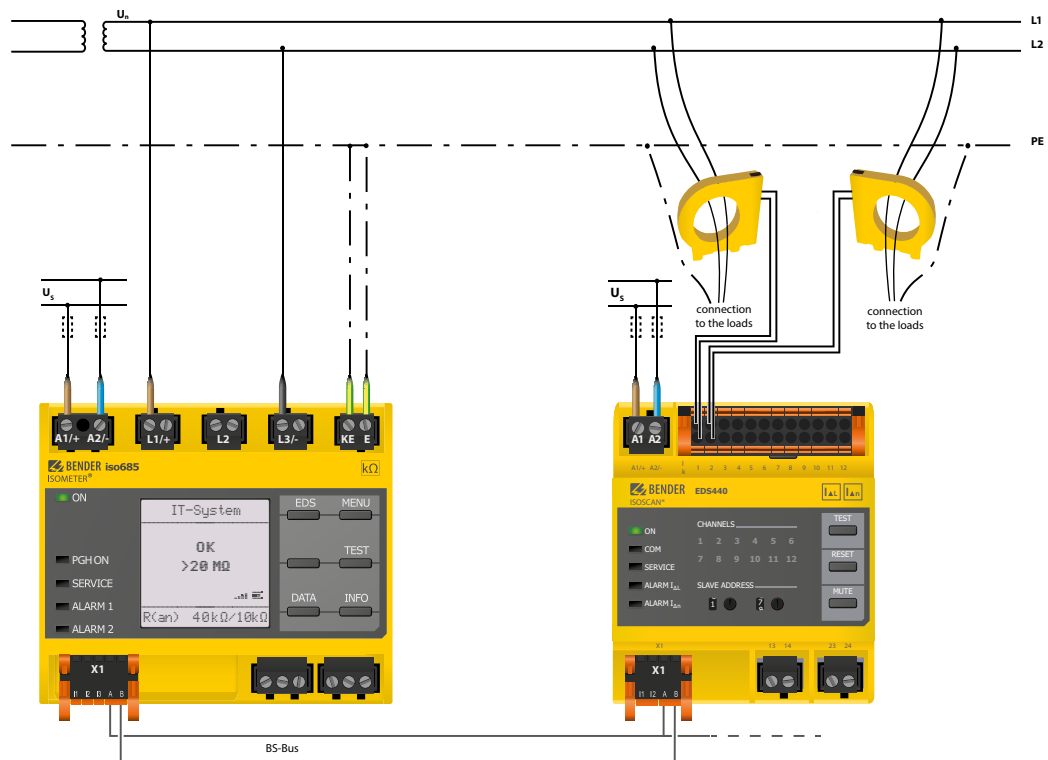
Wiring diagram to 3(N)AC system with iso685



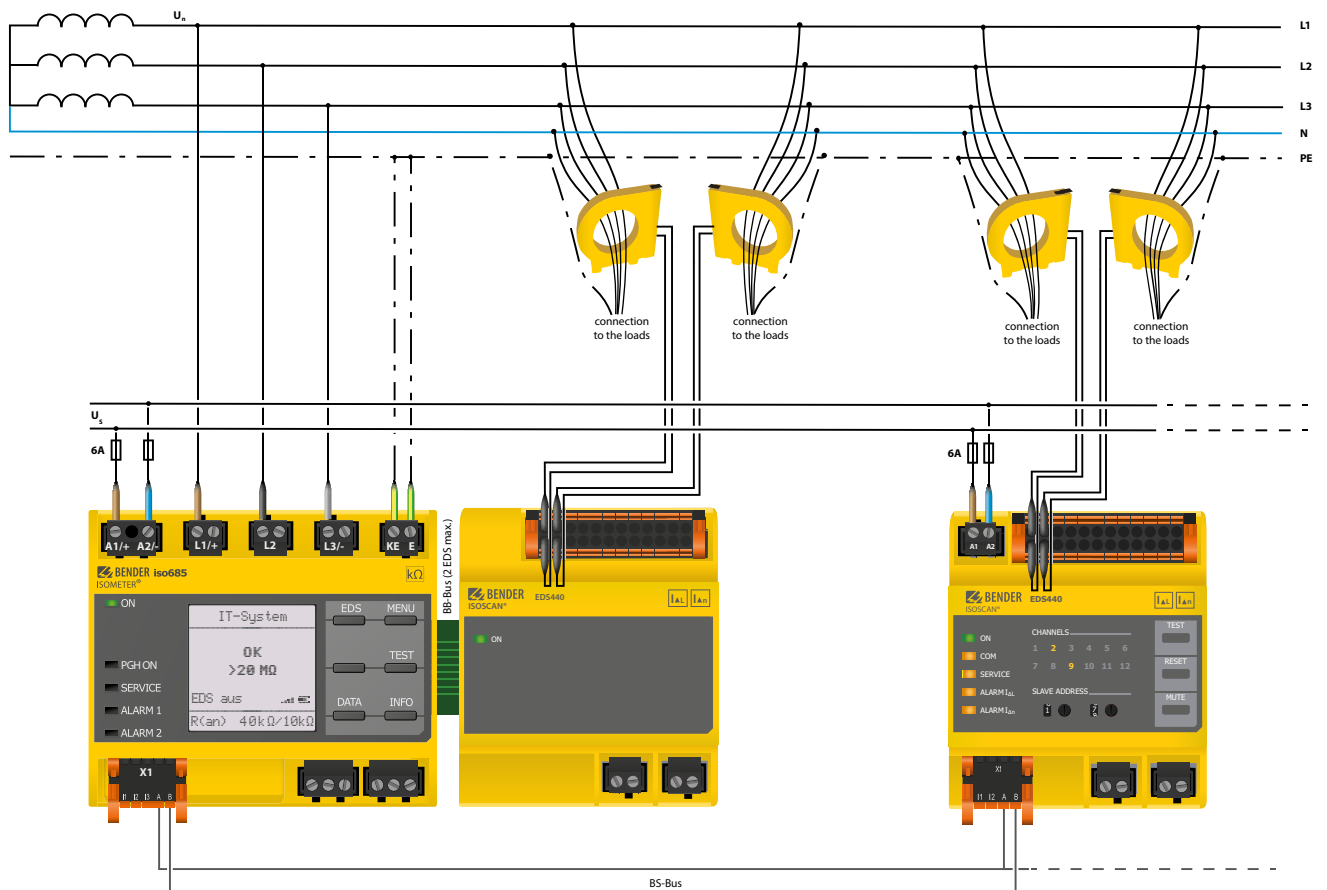
Wiring diagram to DC system with iso685



Wiring diagram to AC system with iso685



Connection example: iso685, EDS440-S and EDS440-L



Technical data

Insulation coordination

Rated insulation voltage (IEC 60664-1)	AC 250 V
Rated impulse voltage (IEC 60664-1)	4 kV
Overvoltage category	III
Pollution degree	2
Protective separation (reinforced insulation) between (A1,A2)-(13,14)-(23,24)-(X1,X2,X3)	
Voltage test acc. to IEC 61010-1	2.2kV

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 ($I_{\Delta n}$) EDS44... (42...60 Hz)	±5 %
Relative uncertainty ($I_{\Delta n}$) EDS44... (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 20...276 V, DC 20...308 V
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 mm ²	0...1 m
Single wire, twisted ≥ 0.75 mm ²	1...10 m
Shielded cable ≥ 0.5 mm ²	10...40 m
Recommended cable (shielded, shield connected to PE on one side)	J-Y (St) Y min. 2x0.8

Measuring ranges

Rated frequency range	DC, 42...1000 Hz ⁴⁾
Measuring range insulation fault location ($I_{\Delta L}$) EDS440	1.5...25 mA (50 mA in DC systems only)
Measuring range insulation fault location ($I_{\Delta L}$) EDS441	0.15...5 mA
Measuring range residual current measurement ($I_{\Delta n}$) EDS440	100mA...20 A
Measuring range residual current measurement ($I_{\Delta n}$) EDS441	100mA...2 A

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 %

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	2...90

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	-40...+70 °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

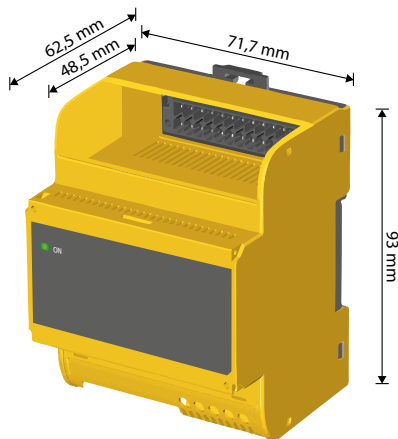
Technical data (continuation)

Connection		Other	
Connection type	pluggable screw-type terminal or push-wire terminal	Operating mode	continuous operation
Screw-type terminal:		Mounting	at an ambient temperature >55 °C vertical mounting required at an ambient temperature <55 °C mounting optional
Tightening torque	0.5...0.6 Nm (5...7 lb-in)	Degree of protection internal components	IP40
Conductor sizes	AWG 24-12	Degree of protection terminals	IP20
Stripping length	7 mm	DIN rail mounting acc. to	IEC 60715
rigid/flexible	0.2...2.5 mm ²	Screw fixing	2 x M4 with mounting clip
flexible with ferrules, with/without plastic sleeve	0.25...2.5 mm ²	Enclosure material	polycarbonate
Multiple conductor, rigid	0.2...1 mm ²	Flammability class	UL 94V-0
Multiple conductor, flexible	0.2...1.5 mm ²	Dimensions (W x H x D)	72 x 93 x 63
Multiple conductor, flexible with ferrule without plastic sleeve	0.25...1 mm ²	Documentation number	D00201
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5...1.5 mm ²	Weight	approx. 122 g (EDS44x-S) approx. 242 g (EDS44x-L)
Push-wire terminals:			
Conductor sizes	AWG 24-12		
Stripping length	10 mm		
rigid/flexible	0.2...2.5 mm ²		
flexible with ferrules, with/without plastic sleeve	0.25...2.5 mm ²		
Multiple conductor, flexible with TWIN ferrule with plastic sleeve	0.5...1.5 mm ²		
Push-wire terminals X1, X2:			
Conductor sizes	AWG 24-16		
Stripping length	10 mm		
rigid/flexible	0.2...1.5 mm ²		
flexible with ferrule without plastic sleeve	0.25...1.5 mm ²		
flexible with TWIN ferrule with plastic sleeve	0.25...0.75 mm ²		

- 1) = At a frequency >200 Hz, connection of X1 and k1-12/I1-12 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.
- 4) = The $I_{\Delta n}$ function of the EDS441... is only suitable for 50/60 Hz.

Dimension diagram

Dimensions in mm



Ordering information

Supply voltage U_s	Response value	LED display	Type	Art. no.
AC/DC				
24...240 V	2...10 mA	—	EDS440-S-1	B 9108 0201
		■	EDS440-L-4	B 9108 0202
	0.2...1 mA	—	EDS441-S-1	B 9108 0204
		■	EDS441-L-4	B 9108 0205
		■	EDS441-LAB-4	B 9108 0207
		■	EDS441-LAB-4	B 9108 0207

Accessories

Description	Art. no.
Plug kit, screw terminals ¹⁾	B 9108 0901
Plug kit, push-wire terminals	B 9108 0902
Mechanical accessories (terminal cover, 2 mounting clips) ¹⁾	B 9108 0903
BB bus 4TE Connector ²⁾	B 9811 0002

¹⁾ included in the scope of delivery

²⁾ included in the scope of delivery of EDS44x-S-4

Measuring current transformer for EDS440

Design type	Internal diameter/mm	Type	Art. no.
circular	20	W20	B 9808 0003
	35	W35	B 9808 0010
	60	W60	B 9808 0018
	120	W120	B 9808 0028
	210	W210	B 9808 0034
split-core	20 x 30	WS20x30	B 9808 0601
	50 x 80	WS50x80	B 9808 0603
	80 x 120	WS80x120	B 9808 0606

Alternative measuring current transformer from the Bender program

Design type	Internal diameter/mm	Type	Art. no.
circular	10	W10/600	B 911 761
	20	W0-S20	B 911 787
	35	W1-S35	B 911 731
	70	W2-S70	B 911 732
	105	W3-S105	B 911 733
	140	W4-S140	B 911 734
	210	W5-S210	B 911 735
rectangular	70x175	WR 70x175S	B 911 738
	115x305	WR 115x305S	B 911 739
	150x350	WR 150x350S	B 911 740
	200x500	WR 200x500S	B 911 763
split-core	50x80	WS 50x80S	B 911 741
	80x80	WS 80x80S	B 911 742
	80x120	WS 80x120S	B 911 743
	80x160	WS 80x160S	B 911 755

For further information regarding the measuring current transformers, refer to the respective data sheets.

Suitable system components

Supply voltage U_s	Type	Art. no.
AC/DC 24 V \pm 20 %	DI-1PSM (RS-485 repeater)	B 9501 2044
Supplied by USB interface	DI-2USB (interface converter RS-485/USB) with USB cable	B 9501 2045
AC 230 V, 50/60 Hz AC, DC 20 V	AN471 (power supply unit for DI-1 or DI-2)	B 924 189
—	Snap-on mounting W20.../35...	B 9808 0501
—	Snap-on mounting W60...	B 9808 0502

Measuring current transformer for EDS441

Design type	Internal diameter/mm	Type	Art. no.
circular	20	W20-8000	B 9808 0009
	35	W35-8000	B 9808 0017
	60	W60-8000	B 9808 0027
split-core	20 x 30	WS20x30-8000	B 9808 0602
	50 x 80	WS50x80-8000	B 9808 0604

Measuring current transformer for EDS441-LAB

Design type	Internal diameter/mm	Type	Art. no.
circular	20	W20AB	B 9808 0008
	35	W35AB	B 9808 0016
	60	W60AB	B 9808 0026
	120	W120AB	B 9808 0041
	210	W210AB	B 9808 0040

Alternative measuring current transformer from the Bender program

Design type	Internal diameter/mm	Type	Art. no.
circular	10	W10/8000	B 911 759
	35	W1-35/8000	B 911 756
circular, 6-fold	10	W10/8000-6	B 911 900
split-core	20 x 30	WS20x30/8000	B 911 764
	50 x 80	WS50x80/8000	B 911 757

For further information regarding the measuring current transformers, refer to the respective data sheets.

Characteristic curve for response sensitivity

Network configuration, mains voltage, mains frequency, leakage capacitance and test current influence the responsiveness of the EDS system.

The resulting insulation resistance response value R_{an} is determined step by step using the formulas and diagrams.

1. Evaluation of system types 3AC, AC or DC

- 3AC or AC system: $U_n = 0.6 U_n$
- DC system: $U_n = 1.0 U_n$

2. Calculate the standardised response value $R_{an}(C_e = 0 \mu F)$ with an assumed leakage capacitance of $C_e = 0 \mu F$ and the EDS response value $I_{an} = 5 \text{ mA}$: $R_{an}(C_e = 0 \mu F) = U_n / I_{an}$

3. Extract correction factor K from the diagram by forming the product with evaluated U_n and real leakage capacitance C_e .

4. Calculate real response value:

$$R_{an} = K \times R_{an}(C_e = 0 \mu F)$$

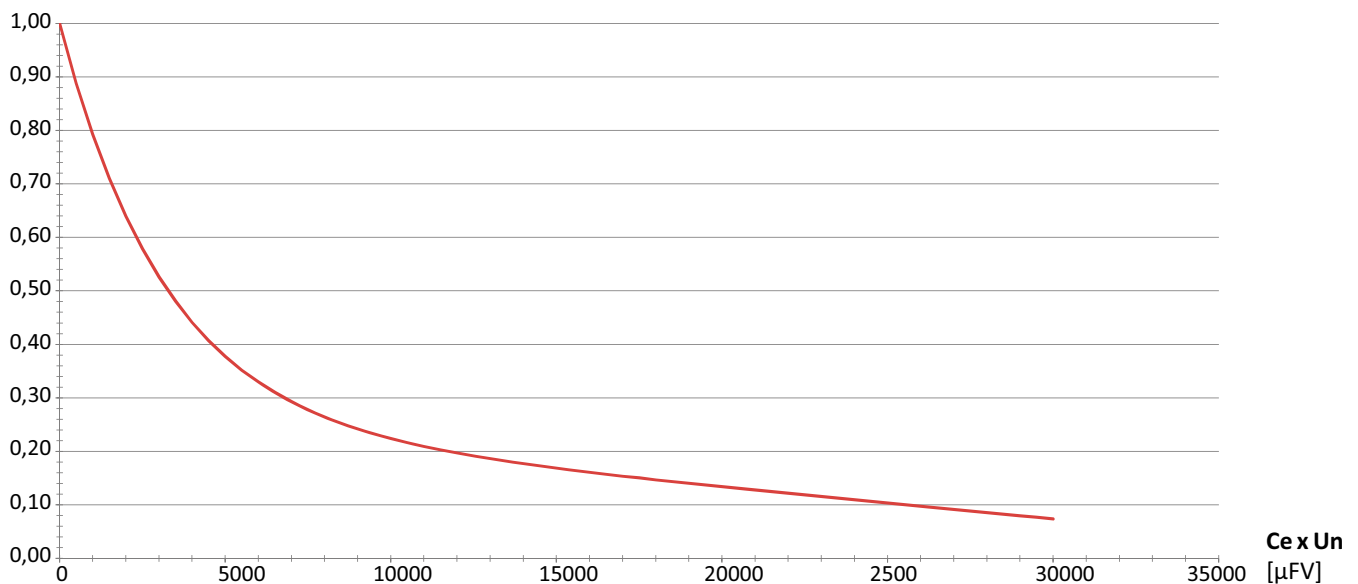
Example for a system with AC 230 V:

to 1) = 138 V

to 2) at 5 mA = 27.6 k Ω

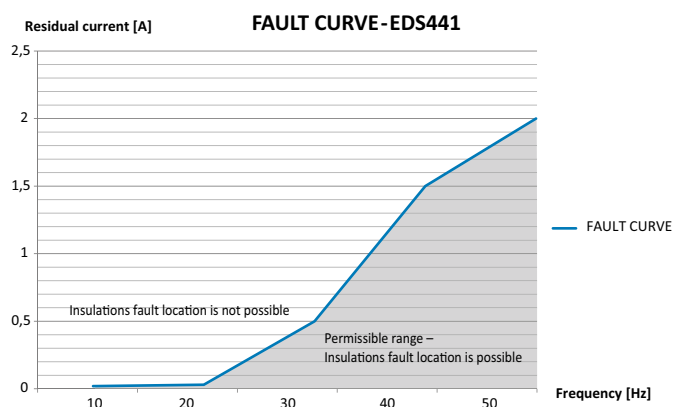
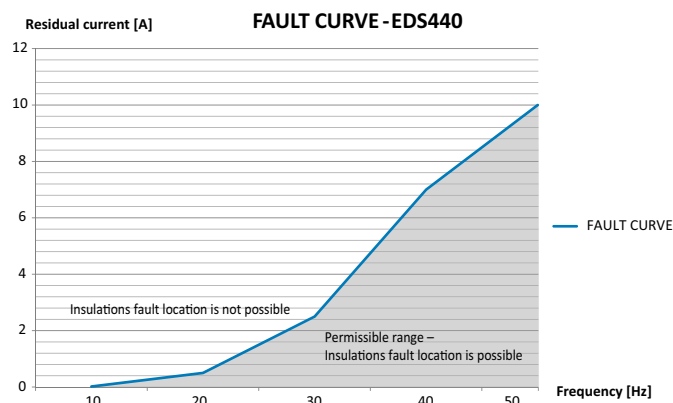
to 3) at 10 μF = 0.8

to 4) = 22 k Ω



Fault curve EDS440.../EDS441...

An insulation fault location beyond the grey area causes an error message. The EDS44...-L indicates error messages via flashing LEDs. Use an EDS44...-S, then the fault messages are indicated via the ISOMETER®.



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