

ISOMETER® isoBAT425

with coupling impedance ZE420

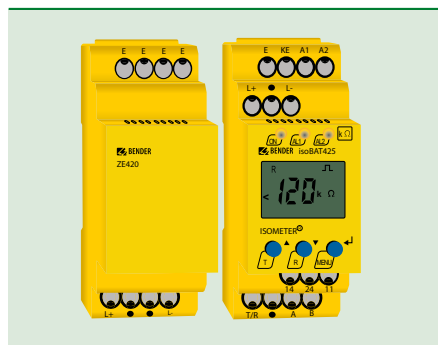
Insulation monitoring device for batteries up to DC 500 V



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Insulation monitoring device for
batteries up to DC 500 V



ISOMETER® isoBAT425

Device features

- Monitoring of the insulation resistance R_F to earth
- Monitoring of the battery voltage U_N between terminals L+ and L-
- Measurement of the voltages U_{L+e} and U_{L-e} of terminals L+ and L- to earth
- Determination of the fault location (%), i.e. the distribution of the insulation resistance R_F between terminals L+ and L-
- Monitoring and automatic adjustment to the system leakage capacitance up to 1 μF
- Continuous connection monitoring of terminals L+, L- and E
- Selectable start-up delay, response delay and delay on release
- Two separately adjustable response value ranges of 10 k Ω ... 5 M Ω (alarm 1, alarm 2)
- Configurable measuring frequency for adjustment to the physical characteristics of the battery
- Alarm signalling via LEDs (AL1, AL2), display and alarm relays (K1, K2)
- Automatic device self test
- N/C operation or N/O operation selectable
- Measured value indication via multi-functional LCD
- Fault memory can be activated
- Device supply via wide-range power supply
- RS-485 (galvanically isolated) including the following protocols:
 - BMS interface (Bender measuring device interface) for data exchange with other Bender components (bidirectional)
 - Modbus RTU (bidirectional)
 - IsoData for continuous data output (unidirectional)
- Password protection to prevent unauthorised parameter changes

Product description

This ISOMETER® is intended for monitoring the insulation resistance as well as the voltage of a battery during its assembly from individual battery cells. The ISOMETER® monitors the insulation resistance of batteries with nominal system voltages of DC 0...400 V. The maximum permissible system leakage capacitance C_e is 1 μF . The resulting measured values allow diagnosing the type and location of the insulation fault.

In order to meet the requirements of applicable standards, customised parameter settings must be made on the equipment in order to adapt it to local equipment and operating conditions. Please heed the limits of the area of application indicated in the technical specifications.

Any other use than that described in this manual is regarded as improper.

Application

- Batteries up to DC 500 V

Function

The isoBAT425 ISOMETER® is intended for monitoring the insulation resistance as well as the voltage of a battery during its assembly from individual battery cells. The ISOMETER® measures the insulation resistance R_F and the leakage capacitance C_e of the battery to earth. In addition, the voltages U_N between L+ and L-, U_{L+e} between L+ and earth as well as U_{L-e} between L- and earth are measured.

The first step consists of assembling the battery in two parallel strings (plus and minus string) which are not interconnected. During the second step, the two strings are connected to form a complete battery by means of another battery.

The resulting measured values allow diagnosing the type and location of the insulation fault. In the LC display, the fault location is marked with a plus or a minus sign preceding the value R_F .

It is possible to assign the detected fault or the faulty conductor to an alarm relay via the menu. If the values R_F or U_N violate the activated response values in "AL" menu, the LEDs and the relays K1 and K2 issue an alarm according to the alarm assignment settings in the "out" menu. In addition, the operating mode of the relay (n.c./n.o.) can be set and the fault memory "M" can be activated in this menu.

If the values R_F or U_N do not violate their respective release value (response value plus hysteresis) for the period t_{off} without interruption, the alarm relays will switch back to their initial position and the alarm LEDs AL1/AL2 will go out. If the fault memory is activated, the alarm relays remain in alarm condition and the LEDs light until the reset button "R" is pressed or the supply voltage is interrupted.

The device function can be tested using the test button "T". Parameters are assigned to the device via the LCD and the control buttons on the front panel; this function can be password-protected. The parameters of the device can be set via Modbus RTU.

ZE420 coupling impedance

In the case of open battery strings, the ZE420 coupling impedance provides a "low-resistance" connection (10 k Ω) between terminals L+ and L-, necessary for the measuring functions of the ISOMETER®. In the case of closed batteries, the resistance is optional due to the internal resistance of the battery.

In addition to this resistance, there is also an optional 1.5 mA current limitation. It starts above $U_N = 25$ V and increases the internal resistance of the coupling impedance. For this reason, in the event of a cross fault, the system connection monitoring may be additionally triggered but, at the same time, the responsivity of the cross fault detection is increased.

In addition, the coupling impedance contains two capacitances for a necessary minimum leakage capacitance to earth.

Standards

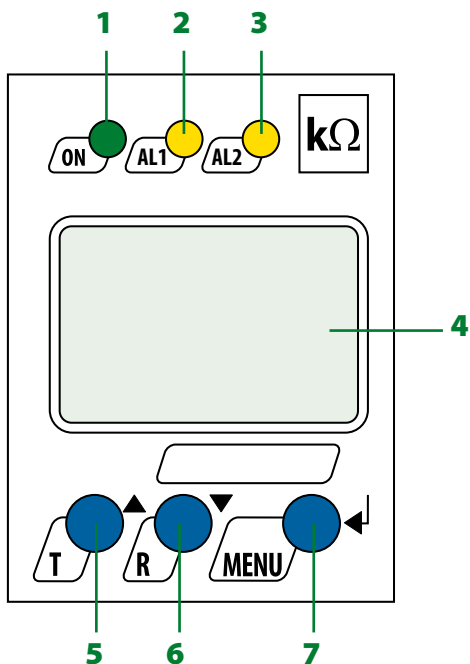
The ISOMETER® has been developed in compliance with the following standards:

- DIN EN 61557-8 (VDE 0413-8): 2015-12/Ber1: 2016-12
- IEC 61557-8: 2014/COR1: 2016

Certifications



Operating elements



- 1 - LED "ON" (operation LED) flashes in case of interruption to the connecting wires E/KE, L1(+)/L2(-) or system faults.
- 2 - Alarm LED "AL1" lights when the values fall below the set response value Alarm 1 and flashes in case of interruption to the connecting wires E/KE, L1(+)/L2(-) or system faults as well as in the case of overvoltage (can be activated).
- 3 - Alarm LED "AL2" lights when the values fall below the set response value Alarm 2 and flashes in case of interruption to the connecting wires E/KE, L1(+)/L2(-) or system faults as well as in the case of undervoltage (can be activated).
- 4 - LC display
- 5 - Test button "T": to call up the self test
Arrow up button: to change parameters, to move upwards in the menu
- 6 - Reset button "R": to delete stored insulation fault alarms
Down button: to change parameters, to move downwards in the menu
- 7 - Menu button "MENU": to call up the menu system
Enter button: to confirm parameter changes

Ordering information

Version	Type	Art. No.
Push-wire terminal	isoBAT425-D4-4	B71036324

Accessories

Description	Art. No.
Mounting clip for screw mounting (1 piece per device)	B 9806 0008

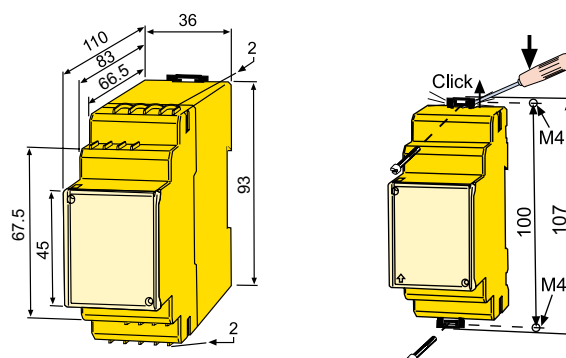
Dimension diagram XM420

Dimensions in mm

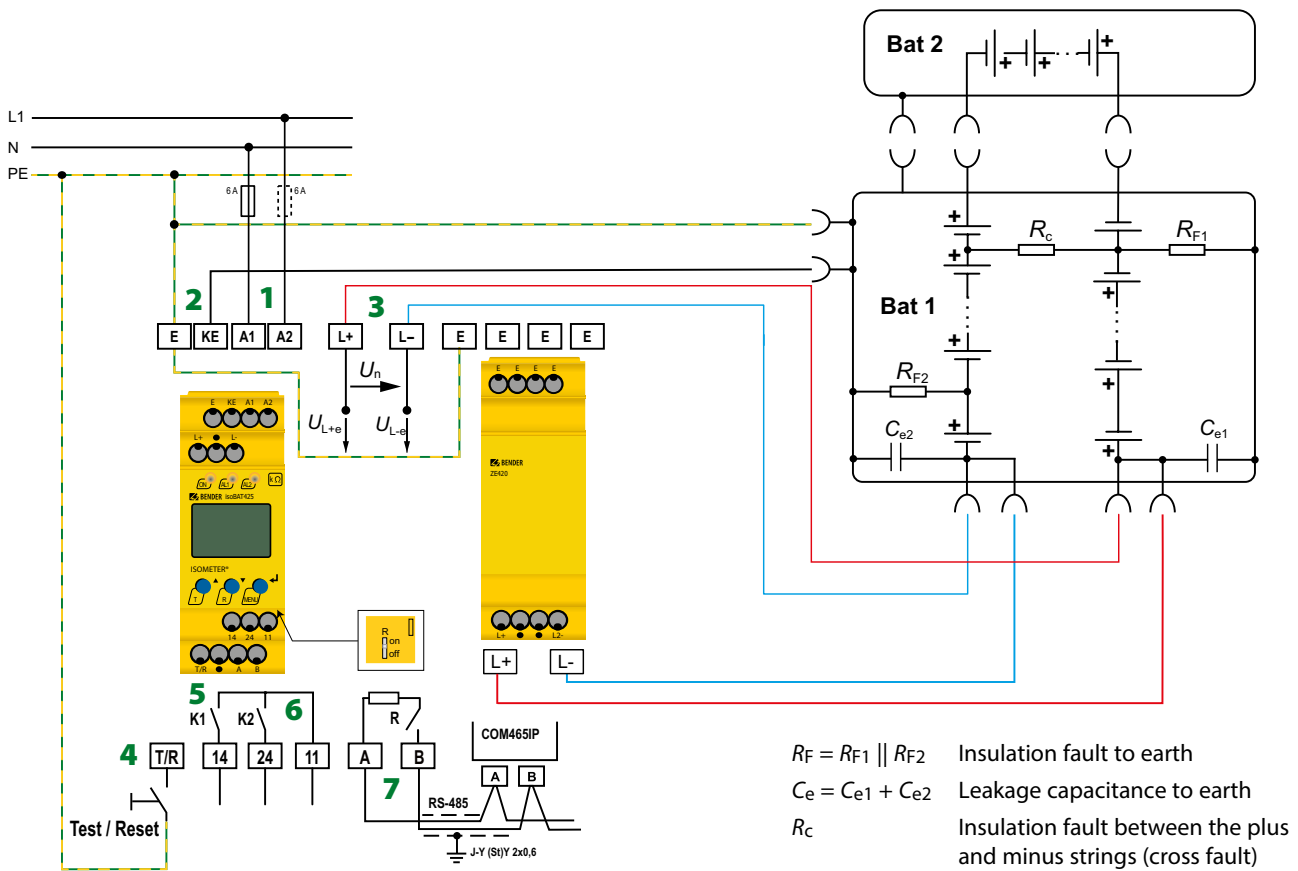
Open the front plate cover in direction of arrow!

Screw mounting

Note: The upper mounting clip must be ordered separately (see ordering information).



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 to PE: The same wire cross section as for A1, A2 is to be used
Connection to the battery enclosure
- 3 - L+, L- Connection to the battery 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, the supply voltage must be protected via 5-A fuses.
Connect the device as illustrated in the wiring diagram..

Technical data isoBAT425

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
Pollution degree	3
Safe isolation (reinforced insulation) between:	
IC1/(IC2-4)	Overvoltage category III, 600 V
IC2/(IC3-4)	Overvoltage category III, 300 V
IC3/(IC4)	Overvoltage category III, 300 V
Voltage tests (routine test) acc. to IEC 61010-1:	
IC2/(IC3-4)	AC 2.2 kV
IC3/(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 $R_f, Z_f = 0 \Omega$	≤ 110 μ A
Internal resistance R_i, Z_i	≥ 115 k Ω
Permissible system leakage capacitance C_e	≤ 1 μ F

Response values

Response value R_{an1}	11...5000 k Ω (1500 k Ω)*
Response value R_{an2}	10...4900 k Ω (1000 k Ω)*
Relative uncertainty R_{an}	±15 %, at least ±2 k Ω
Hysteresis R_{an}	25 %, at least 1 k Ω
Voltage detection U_{BattH}	4...500 V (400 V)
Voltage detection U_{BattL}	3...499 V (378 V)
Voltage detection U_{CrossH}	4...500 V (345 V)
Voltage detection U_{CrossL}	3...499 V (6 V)
Overvoltage detection	510 V
Relative uncertainty U	±5 %, at least ±0.5 V
Hysteresis U	5 %, at least 2 V

Time response

Response time t_{ae} at $R_f = 0.5 \times R_{an}$ for the measuring pulse period durations:	
TMP = 0.8 s	≤ 3.5 s
TMP = 2.0 s	≤ 8.0 s
TMP = 8.0 s	≤ 32 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 k Ω ...10 M Ω
Operating uncertainty	±15 %, at least ±2 k Ω
Display range measured value nominal system voltage (U_n)	0...500 V DC
Operating uncertainty	±5 %, at least ±0.5 V
Display range measured value system leakage capacitance at RF > 10 k Ω	0...1.6 μ F
Operating uncertainty	±10 %, at least ±0.02 μ F
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 kbits/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
Electrical endurance at DC 30 V / ≤ 0.1 A (L/R = 7 ms)	106 operating cycles

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
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Ambient temperatures:

Operation	-25...+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)
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 mm ²
Flexible without ferrules	0.75...2.5 mm ²
Flexible with ferrules with/without plastic sleeve	0.25...2.5 mm ²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5...1.5 mm ²
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 settings

Technical data ZE420

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

Definitions:	
Measuring circuit (IC1)	L+, L-
Control circuit (IC2)	E
Rated voltage	400 V
Overvoltage category	III
Rated impulse voltage:	
IC1/IC2	6 kV
Rated insulation voltage:	
IC1/IC2	400 V
Pollution degree	3
Safe isolation (reinforced insulation) between:	
IC1/IC2	Overvoltage category III, 600 V

Monitored IT system

Nominal system voltage U_n	DC 0...400 V
Tolerance of U_n	25 %

Environment/EMC

EMC	IEC 61326-2-4
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Ambient temperatures:

Operation	-25...+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)
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 mm ²
Flexible without ferrules	0.75...2.5 mm ²
Flexible with ferrules with/without plastic sleeve	0.25...2.5 mm ²
Multi-conductor flexible with TWIN ferrules with plastic sleeve	0.5...1.5 mm ²
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



Bender GmbH & Co. KG

P.O. Box 1161 • 35301 Gruenberg • Germany
 Londorfer Strasse 65 • 35305 Gruenberg • Germany
 Tel.: +49 6401 807-0 • Fax: +49 6401 807-259
 E-Mail: info@bender.de • www.bender.de



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