ISOMETER® isoMIL425HV with coupling device AGH421

Insulation monitoring device for unearthed
AC, AC/DC and DC systems (IT systems)
for military applications up to 3(N)AC, AC 690 V, DC 1000 V

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Device features

- Monitoring of the insulation resistance for unearthed 3(N)AC, AC and DC systems with galvanically connected rectifiers or inverters
- Measurement of the mains 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 700 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 of the relays selectable
- Measured value indication via multi-functional LC display
- 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

Certifications

Product description

The ISOMETER® of the isoMIL425HV series monitors the insulation resistance of unearthed AC/DC main circuits (IT systems) with nominal system voltages of 3(N)AC, AC/DC 0…690 V or DC 0…1000 V. DC components existing in 3(N)AC, AC/DC systems do not influence the operating characteristics, when a minimum load current of DC 10 mA flows. A separate supply voltage allows de-energised systems to be monitored too. The maximum permissible system leakage capacitance C_e is 700 µF. The ISOMETER® is always used in conjunction with the coupling device AGH421.

Application

- AC, DC control circuits in military applications

Funktion

The ISOMETER® measures the insulation resistance R_F and the leakage capacitance C_e between the system to be monitored (L1/+, L2/-) and earth (PE). The RMS value of the mains voltage U_n between L1/+ and L2/-, as well as the DC voltages between L1/+ and earth (U_{L1e}) and between L2/- and earth (U_{L2e}) are also measured.

From a minimum value of the DC system voltage, the ISOMETER® determines the fault location "R %", which shows the distribution of the insulation resistance between conductors L1/+ and L2/-. The distribution is indicated by a positive or negative sign preceding the insulation resistance measurement.

The value range of the fault location is ±100 %:

Indication	Meaning
-100 %	one-sided fault at conductor L-
0 %	symmetrical fault
+100 %	one-sided fault at conductor L+

The partial resistances can be calculated from the total insulation resistance R_F and the fault location (R %) using the following formula:

Fault at conductor L+ ->R_{L+F} = (200 % * R_F)/(100 % + R%)
Fault at conductor L- -> R_{L-F} = (200 % * R_F)/(100 % – R%)

Also from a minimum value of the DC system voltage, the ISOMETER® determines the insulation resistance R_{UGF} from the DC voltages U_{L1e} and U_{L2e}. It is an approximate value for one-sided insulation faults and can be used as a trend indicator in cases where the ISOMETER® has to adapt to an R_F and C_e relation that varies considerably.

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 response values activated in the "AL" menu, this will be indicated by the LEDs and relays K1 and K2 according to the signalling assignment set in the "out" menu. In addition, the operation of the relay (n.c./n.o.) can be set and the fault memory "M", activated.

If the values R_F or U_n do not violate their release value (response value plus hysteresis) for the period toff without interruption, the alarm relays will switch back to their initial position and the alarm LEDs AL1/AL2 stop lighting.

The ISOMETER® features a stop switch. When the stop switch is closed, the ISOMETER® is in operation. If the stop switch is opened, the ISOMETER® enters stop mode, i.e. a high-resistance connection (approx. 20 MΩ) is established between the coupling L1/+ and L2/- and the system to be monitored. In stop mode, if the memory function "M" is activated (reset function), the fault memory is cleared. The stop function can also be triggered via an interface command and in this case it can only be reset via the interface. When starting the device or leaving the stop mode, no device test is run.

Parameters are assigned to the device via the LCD and the control buttons on the front panel; this function can be password-protected. Parameterisation is also possible via the BMS bus, for example by using the BMS Ethernet gateway (COM465IP) or the Modbus RTU.

AC/DC

Measurement method

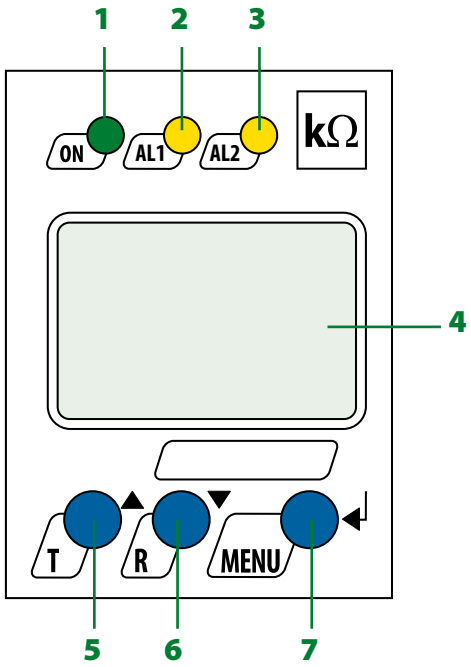
The ISOMETER® isoMIL425HV uses the AMP and PCP measurement methods.

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

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

Supply voltage U_S		Nominal system voltage U_n		System leakage capacitance	Type	Art. No
AC	DC	AC	DC			Push-wire terminal
100…240 V, 47…63 Hz	24…240 V	0…690 V	0…1000 V	≤ 500 µF	isoMIL425HV-D4W-4 mit AGH421W	B71036305W

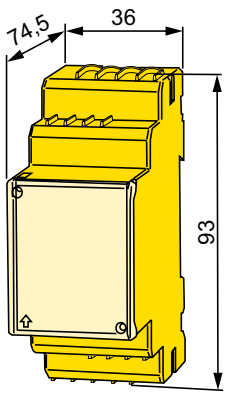
Accessories

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

Dimension diagram XM420

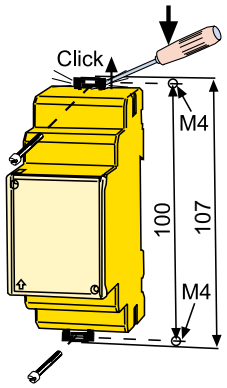
Dimensions in mm

Open the front plate cover in direction of arrow!

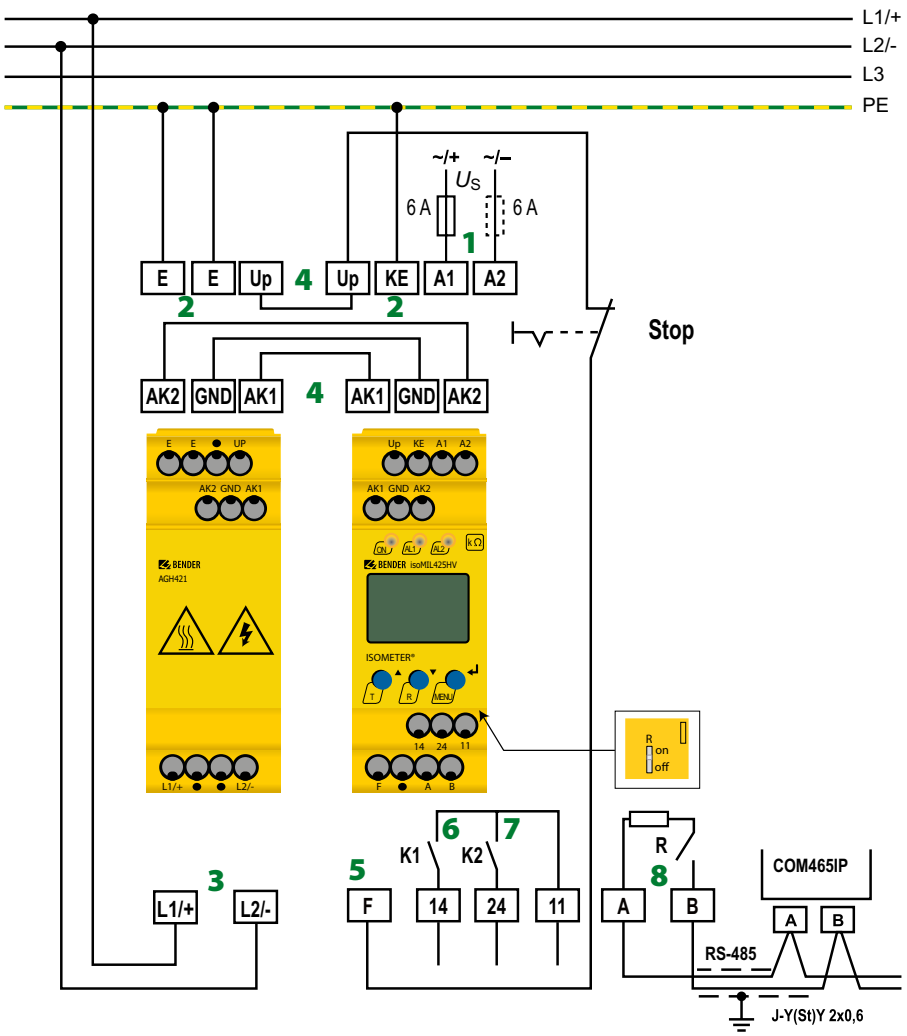


Screw mounting

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



Wiring diagram



1 - A1, A2 — Connection to the supply voltage via 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 3(N)AC, AC or DC system to be monitored

4 - Up, AK1, GND, AK2 — Connect the terminals of the AGH421 to the corresponding terminals of the ISOMETER®.

5 - F — External stop switch between terminals “F” and “Up”

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:***

Use 60/75°C copper lines only!
For UL and CSA applications, the supply voltage must be protected via 5A fuses.

Technical data ISOMETER® isoMIL425HV

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 AGH421-W	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 AGH42x (UL508)	AC/DC 0…600 V
Frequency range of U_n	DC, 15…460 Hz

Measuring circuit

Permissible system leakage capacitance C_e	≤ 700 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…5 MΩ
Operating uncertainty at R_F ≤ 1 MΩ	±15 %, at least ±1 kΩ
Operating uncertainty at R_F > 1 MΩ	
typically	±25 %
maximum	±45 %
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 R_F > 10 kΩ	0…700 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 kbit/s)
Cable length (9.6 kbit/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 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-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	-50…+85 °C
Storage	-55…+80 °C

Classification of climatic conditions acc. to IEC 60721

Stationary use (IEC 60721-3-3)	3K7
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

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
Wiring of the terminals Up, AK1, GND, AK2	refer to technical data AGH421 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
Weight	≤ 150 g

( )* = Factory settings

Technical data coupling device AGH421

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 %
Measuring circuit	
Measuring voltage U_m	±45 V
Measuring current I_m at R_F	≤ 400 µA
Internal resistance DC Ri	≥ 120 kΩ

Environment/EMC

EMC	IEC 61326-2-4
Ambient temperatures:	
Operation	-40…+70 °C
Transport	-50…+85 °C
Storage	-55…+80 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K7
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

Connection type	**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
Connection type	**Push-wire terminals:**
Nominal current	≤ 10 A
Conductor sizes	AWG 24…14
Stripping length	10 mm
Rigid	0.2…2.5 mm²
Flexible with ferrules with plastic sleeve	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 DIN EN 60529, internal components	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

BENDER
The Power in Electrical Safety©

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