ISOMETER® isoNAV685-D

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

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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.

Product description

The ISOMETER® isoNAV685-D is an insulation monitoring device for IT systems in accordance with IEC 61557-8. It is applicable for use in 3(N)AC systems with nominal system frequency 60 Hz.

Application

- 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

Function

The insulation monitoring device ISOMETER® isoNAV685-D continuously monitors the entire insulation resistance of an IT system during operation and gives a warning within 150 ms as soon as the insulation resistance falls below the set response value and the DC offset voltage exceeds the response value. Because of these characteristics, the ISOMETER® can, for example, quickly shut down a plant.

To obtain a measurement the device has to be connected between the IT system (unearthed system) and the protective earth conductor (PE). A measuring current in the µA range is superimposed onto the system which is recorded and evaluated by a micro-controlled measuring circuit. The measuring time is dependent on the selected measurement profiles, the system leakage capacitance, the insulation resistance and possible system-related disturbances.

The response values and other parameters are set using a commissioning wizard as well as via different setup menus using the device buttons and a high-resolution graphical LC display. The selected settings are stored in a permanent fail-safe memory. Different languages can be selected for the setup menus as well as the messages indicated on the display. The device utilises a clock for storing fault messages and events in a history memory with time and date stamp. The settings can be protected against unauthorised modifications by entering a password. To ensure proper functioning of connection monitoring, the device requires the setting of the system type 3AC and the prescribed wiring of the appropriate terminals L1/+, L2, L3/-.

The insulation monitoring device iso685 is able to measure the insulation resistance reliably and precisely in all common IT systems (unearthed systems). Due to various applications, system types, operating conditions, application of variable-speed drives, high system leakage capacitances etc., the measurement technique must be able to meet varying requirements in order to ensure an optimised response time and relative uncertainty. Different measurement profiles, which can be selected from a setup menu, allow optimum adaptation of the measurement technique to the specific application.

If the resistance value falls below a set response value R_{an}, the associated alarm relay turns off, the LED ALARM 1 lights and the LCD shows the measured value. The error message is saved. Pressing the RESET button resets the insulation fault message, provided that the insulation resistance is at least 25 % above the preset response value. As additional Information, the quality of the measuring signal and the time required to update the measured value are shown on the display. A poor signal quality (1-2 bars) may be an indication that the wrong measurement profile has been selected.

AC/DC

Interfaces

- Communication protocol Modbus TCP
- BCOM for Bender device communication via Ethernet
- Integrated web server for reading out measured values and for parameter setting

Measurement method

AMPPlus The isoNAV685 series uses the patented ***AMP***^{Plus} measurement method. This measurement method allows concise monitoring of modern power supply systems, also in case of extensive, directly connected DC components and high system leakage capacitances.

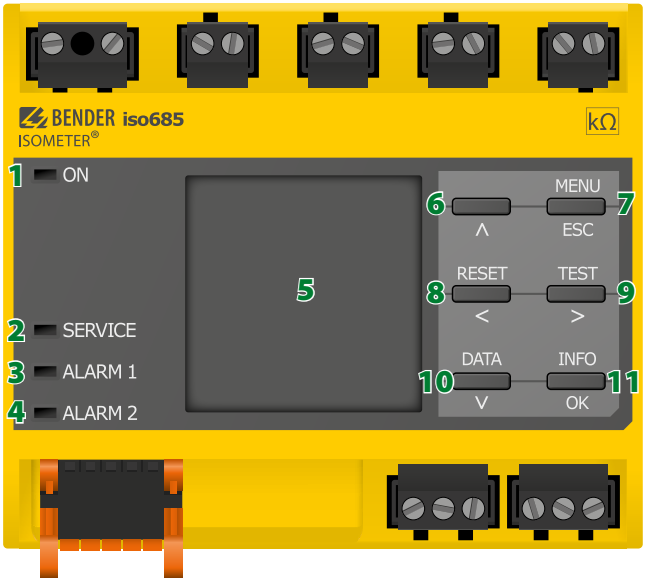
Standards

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

- DIN EN 61557-8 (VDE 0413-8):2015-12
- IEC 61557-8:2014-12
- IEC 61557-8:2014/COR1:2016
- DIN EN 61557-8 Ber 1 (VDE 0413-8 Ber 1):2016-12

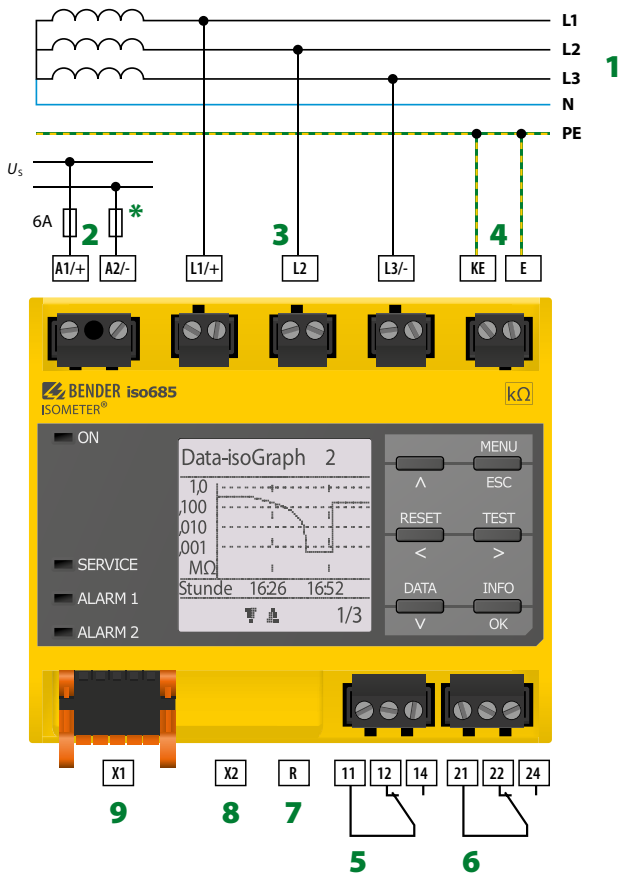
Certifications

Operating elements



1 -	ON	The LED “ON” lights when the device is turned on.
2 -	SERVICE	The LED “SERVICE” lights when there is either a device fault or a connection fault, or when the device is in maintenance mode.
3 -	ALARM 1	The LED “ALARM 1” lights when the insulation resistance of the IT system falls below the set response value R_{an1}.
4 -	ALARM 2	The LED “ALARM 2” lights when the insulation resistance of the IT system falls below the set response value R_{an2} and the DC offset voltage exceeds the response value.
5 -	Display	The device display shows information regarding the device and the measurements.
6 -	Λ	Navigates up in a list or increases a value.
7 -	MENU	Opens the device menu
	ESC	Cancels the current process or navigates one step back in the device menu.
8 -	RESET	Resets alarms.
	<	Navigates backwards (e.g. to the previous setting step) or selects a parameter.
9 -	TEST	Starts the device self test.
	>	Navigates forwards (e.g. to the next setting step) or selects a parameter.
10 -	DATA	Indicates data and values.
	V	Navigates down in a list or reduces a value.
11 -	INFO	Shows information.
	OK	Confirms an action or a selection.

Wiring diagram



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

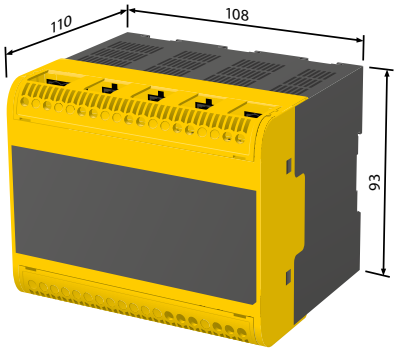
Note:
According to DIN VDE 0100-430, devices for protection against a short-circuit can be omitted for the coupling of terminals L1/+, L2, L3/- to the IT system ≤ 690 V to be monitored if the wiring is carried out in such a manner as to reduce the risk of a short-circuit to a minimum. (Recommendation: 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.

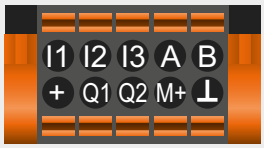
For UL applications:
Use 60/70 °C copper lines only!
UL and CSA applications require the supply voltage to be protected via 5 A fuses.

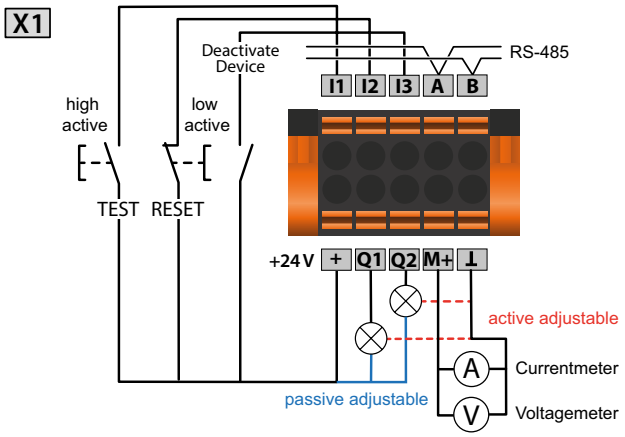
Dimension diagram

Dimensions in mm



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



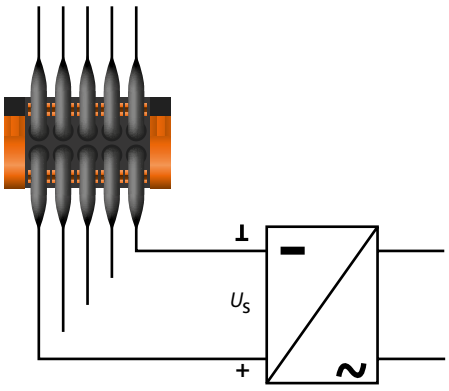
Connection to X1

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 via A1/+, A2/-. Do not connect the device simultaneously via X1 and A1/+, 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. Connect to the X1 interface with a nominal voltage of 24 V only.



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)
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 [4] (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 %

Technical data (continuation)

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 11-12-14/21-22-24	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	DC-12
Rated operational voltage	230 V	230 V	24 V	48 V	110 V	220 V
Rated operational current	5 A	3 A	1 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)	3K23 (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)	3M11
Transport (IEC 60721-3-2)	2M4
Long-term storage (IEC 60721-3-1)	1M12
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.

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

[1)] included in the scope of delivery
Suitable measuring instruments on request!

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