

ISOMETER® isoRW685W-D-B

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



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Device features

- ISOMETER® for AC IT systems with galvanically connected rectifiers or converters and for DC IT systems (IT = unearthed systems)
- Automatic adaptation to the existing system leakage capacitance
- Combination of **AMP^{plus}** and other profile-dependent measurement methods
- Two separately adjustable response value ranges of 1 kΩ...10 MΩ
- 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 13 days) for storing a maximum of 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 (web server/option: COMTRAXX® gateway)
- Remote diagnosis via the Internet (made available by Bender Service only)
- isoData: Continuous uninterrupted data transmission
- RS-485/BS (Bender sensor bus) for data exchange with other Bender devices via Modbus RTU protocol
- BCOM, Modbus TCP und web server
- ISOnet: Internal separation of the ISOMETER® from the IT system to be monitored (e.g. if several IT systems are interconnected)
- ISOnet priority: Permanent priority of a device within the network
- ISOLoop: Special function for ring systems (all systems are coupled)

Product description

The ISOMETER® isoRW685W-D-B is an insulation monitoring device for IT systems in accordance with IEC 61557-8 for railway applications and has been specifically tested according to DIN EN 50155. It is universally applicable in AC, 3(N)AC, AC/DC and DC systems. AC systems may include extensive DC-supplied loads (such as rectifiers, converters, variable-speed drives).

Application

- 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

Function

The insulation monitoring device continuously monitors the entire insulation resistance of an IT system during operation and triggers an alarm when the value falls below a preset response value. 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 depends on the selected measurement profiles, the system leakage capacitance, the insulation resistance as well as possible system-related interferences.

The response values and other parameters are set using a commissioning wizard or via different setup menus using the device buttons and a high-resolution graphic LC display. The selected settings are stored in a permanent fail-safe memory. Different languages can be selected for the setup menus and the messages indicated on the display. The device is equipped with a clock that allows storing fault messages and events in a history memory with time and date stamp. The settings can be protected against unauthorised modifications by means of a password.

To ensure proper functioning of the connection monitoring, the device requires the setting of the system type 3AC, AC or DC and the required use of the appropriate terminals L1/+, L2, L3/-.

The iso685 insulation monitoring device is able to measure the insulation resistance reliably and precisely in all common IT systems (unearthed systems). Due to the different applications, system types, operating conditions, use of variable-speed drives, high system leakage capacitances etc. the measurement technology must be able to meet varying requirements in order to ensure an optimised response time and relative uncertainty. Therefore, different measurement profiles can be selected, which allow an optimal adjustment of the device.

If the values falls below the preset response value for alarm 1 and/or alarm 2, the associated alarm relays switch, the ALARM 1 or ALARM 2 LEDs light and the measured value is shown on the LC display (in the case of insulation faults in DC systems, a trend graph for the faulty conductor L+/L- is also displayed). If the fault memory is activated, the fault message will be stored. 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.

The ISOMETER® has an internal system isolating switch, which makes it possible to operate several ISOMETER®s in coupled IT systems. For this purpose, the ISOMETER®s are connected via an Ethernet bus. The integrated ISOnet function ensures that only one ISOMETER® is actively measuring at a time, while the other devices are completely isolated from the system and waiting in standby mode for measuring permission.

The ISOMETER® is able to synchronise with other ISOMETER®s. This makes it possible to monitor capacitively coupled IT systems without mutual interference.

Interfaces

- Communication protocol Modbus TCP
- Communication protocol Modbus RTU
- BCOM for communication of Bender devices via Ethernet
- BS bus for communication of Bender devices (RS-485)
- Integrated web server for reading out measured values and setting parameters

Measurement method

AMPPlus The isoRW685W-D-B series operates using the patented **AMPPlus** measurement method. This measurement method allows accurate monitoring of modern power supply systems, even in the case of extensive, directly connected DC components and high system leakage capacitances.

Standards

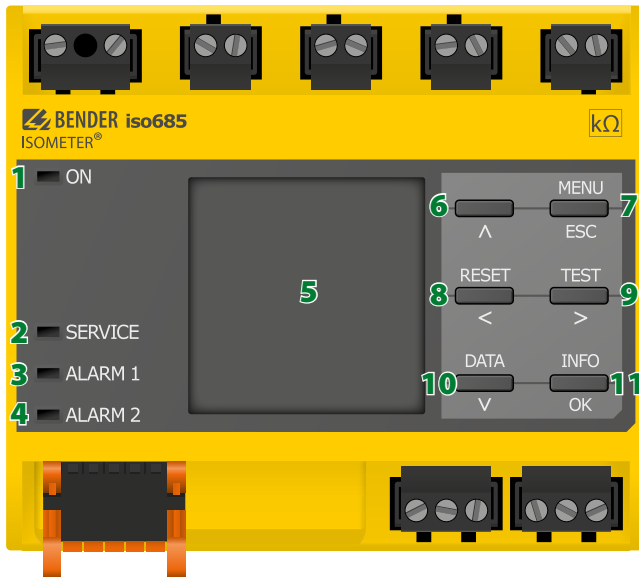
The ISOMETER® has been developed in compliance with the following standards:

- 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
- DIN EN 50155:2018-05
- DIN EN 45545-2:2016

Certifications

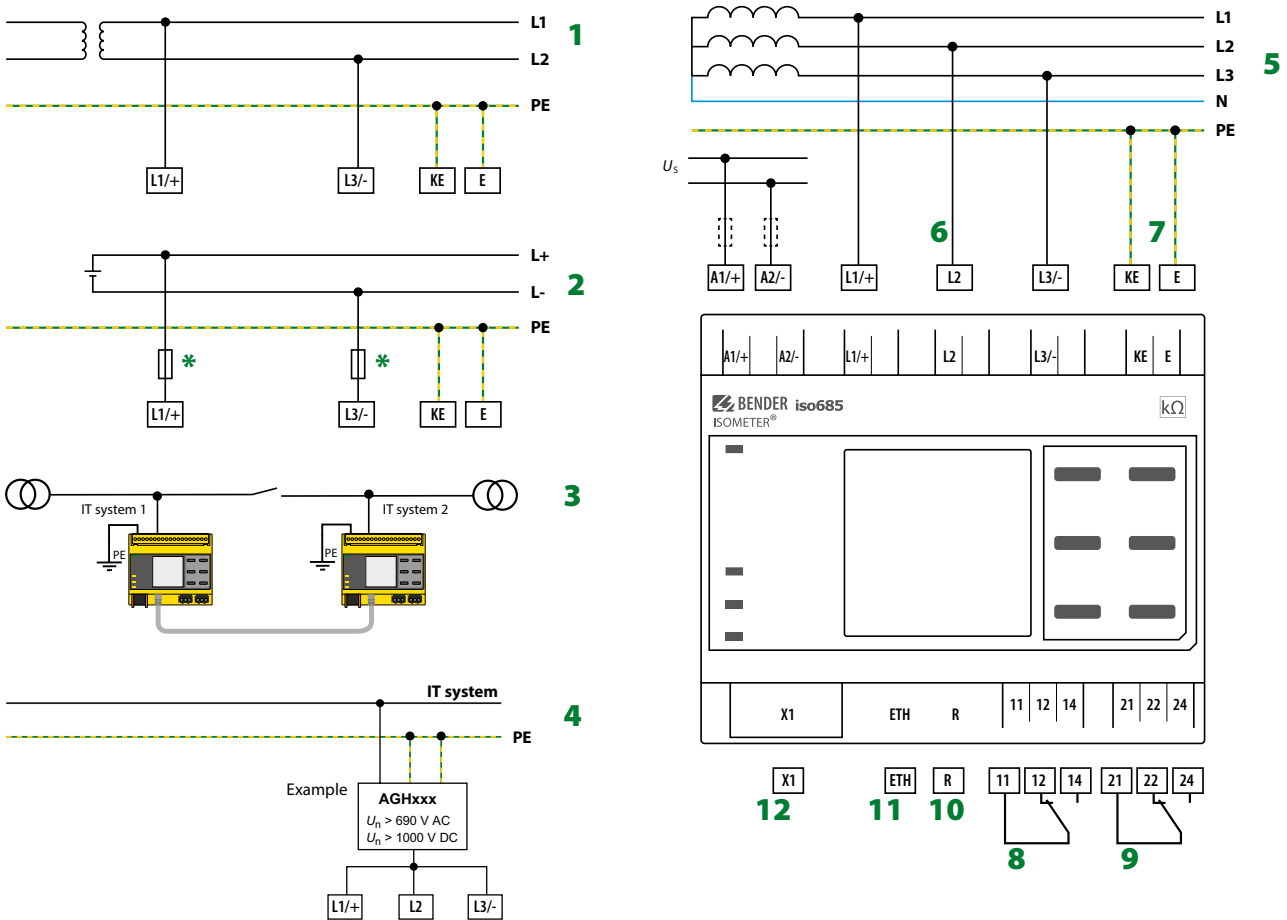


Operating elements



- 1 - ON The "ON" LED lights when the device is turned on.
- 2 - SERVICE The "SERVICE" LED lights when there is either a device error or a connection fault, or when the device is in maintenance mode.
- 3 - ALARM 1 The "ALARM 1" LED lights when the insulation resistance of the IT system falls below the set response value R_{an1} .
- 4 - ALARM 2 The "ALARM 2" LED lights when the insulation resistance of the IT system falls below the set response value R_{an2} .
- 5 - Display The device display shows information regarding the device and the measurements.
- 6 - \wedge 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 back (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 an AC system U_n
- 2 - Connection to a DC system U_n
- 3 - Connection to two IT systems that can be coupled with a coupling switch. Information about the state of the coupling switch is not necessary.
- 4 - Connection to an IT system using 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
- * - In 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-type fuses

Provide line protection!

According to DIN VDE 0100-430, 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 (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.

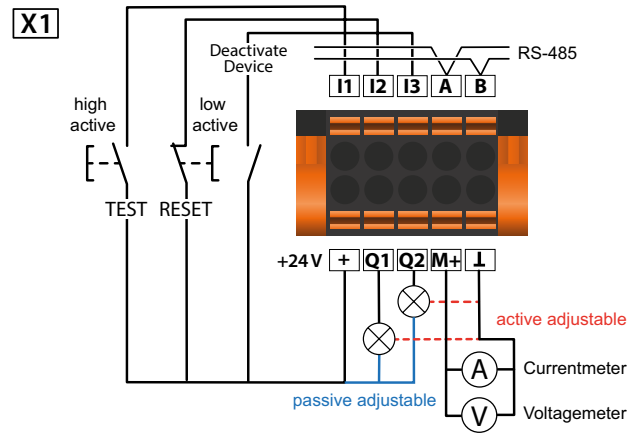
For UL applications:

Use 60/70 °C copper lines only!

UL and CSA applications require the supply voltage to be protected via 5 A fuses.

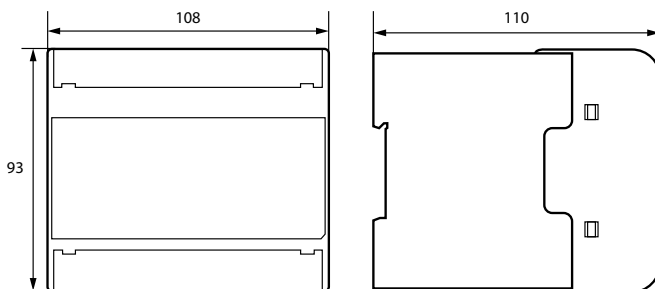
Digital interface X1

Digital interface	Terminal	Description
 <p>X1</p>	I1...I3	Configurable digital inputs (e.g. test, reset, ...)
	A, B	Serial interface RS-485, termination by means of a DIP switch R.
	+	Supply voltage of the inputs and outputs I, Q and M. Electrical overload protection. Automatic shutdown in the event of short circuits and transients (resettable). When supplied via an external 24 V source, A1/+, A2/- must not be connected.
	Q1, Q2	Configurable digital output
	M+	Configurable analogue output (e.g. measuring instrument)
	⊥	Reference potential ground



Dimension diagram

Dimensions in mm



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	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 outside ($U_n < 690$ V)	3
Pollution degree outside ($U_n > 690 < 1000$ 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) 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 %
Typical power consumption DC	≤ 12 W
Typical power consumption 50/60 Hz	≤ 12 W/21 VA
Typical power consumption 400 Hz	≤ 12 W/45 VA

Supply via X1:

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

Monitored IT system

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_n in the frequency range $f_n = 0.1...4$ Hz	$U_{n,max} = 50 \text{ V} \cdot (1 + f_n^2 / \text{Hz}^2)$

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 %, min. ±1 kΩ
Hysteresis	25 %, min. 1 kΩ

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. 4 s (see diagrams in the manual)
Response time DC alarm at $C_e = 1$ μF	profile-dependent, typ. 2 s (see diagram in the 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 with system isolation (inactive via I/O; inactive via ISOnet; shutdown)	typ. 50 MΩ
Permissible extraneous DC voltage U_{fz}	≤ 1200 V
Permissible system leakage capacitance C_e	profile-dependent, 0...1000 μF

Measuring ranges

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

Display

Display	graphic display 127 x 127 pixels, 40 x 40 mm ²⁾
Display range measured value	0.1 kΩ...20 MΩ
Operating uncertainty (acc. to IEC 61557-8)	±15 %, min. 1 kΩ

LEDs

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

Inputs/outputs (X1 interface)

Cable length X1 (unshielded cable)	≤ 10 m
Cable length X1 (shielded cable, shield connected to PE on one side, recommended: J-Y(St)Y min. 2x0.8)	≤ 100 m
Total max. supply output current via X1./X1.GND for each output	max. 1 A
Total max. supply output current via A1/A2 in total on X1	max. 200 mA
Total max. supply output current via A1/A2 in total on X1 between 16.8 V and 40 V	$I_{LmaxX1} = 10 \text{ mA} + 7 \text{ mA/V} \cdot U_s$ 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 ⁴⁾ , DC+ alarm ⁴⁾ , symmetrical alarm, device error, 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, mid-scale 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 (continued)
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 of ISOnet devices	2...20 dev
Maximum nominal system voltage ISOnet	AC, 690 V/DC, 1000 V

ISOloop

ISOloop devices	2...10 dev
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Sensor bus

Interface/protocol	RS-485/isoData/BS bus/Modbus RTU
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 end of the transmission path internally	120 Ω, can be connected internally
Device address, BS bus	1...90

Switching elements

Switching elements	2 changeover contacts
Operating mode	N/C operation or N/O operation
Contact 11-12-14/21-22-24	off, ins. alarm 1, ins. alarm 2, connection fault, DC- alarm ⁴⁾ , DC+ alarm ⁴⁾ , symmetrical alarm, device error, common alarm, measurement complete, device inactive, DC offset alarm
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	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	DIN EN 50121-3-2, IEC 61326-2-4 ⁵⁾
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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 (related to temperature and relative humidity)

Stationary use (IEC 60721-3-3)	3K24
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)	3M12
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 terminal or push-wire terminal
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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 mm ²
flexible with ferrule with/without plastic sleeve	0.25...2.5 mm ²
Multiple conductor rigid	0.2...1 mm ²
Multiple conductor flexible	0.2...1.5 mm ²
Multiple conductor flexible with ferrule without plastic sleeve	0.25...1 mm ²
Multiple conductor flexible with TWIN ferrule with plastic sleeve	0.5...1.5 mm ²

Push-wire terminals:

Nominal current	≤ 10 A
Conductor sizes	AWG 24-12
Stripping length	10 mm
rigid/flexible	0.2...2.5 mm ²
flexible with ferrule 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:

Nominal current	≤ 8 A
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 ferrule with plastic sleeve	0.25...0.75 mm ²

Other

Operating mode	Continuous operation
Mounting position (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 mounting	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
Documentation number	D00419
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 (300 V) may be connected.

²⁾ Indication limited outside the temperature range -25...+55 °C.

³⁾ U_s [Volt] = supply voltage ISOMETER®

⁴⁾ Only for $U_n \geq 50$ V.


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: Mounting position 0° (display-oriented, cooling slots must be ventilated vertically).

At mounting position 45°, the max. operating temperature is reduced by 10 °C.

At mounting position 90°, the max. operating 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; 0.1...460 Hz	0...1000 V	24...240 V; 50...400 Hz	24...240 V	isoRW685W-D-B	 B91067022W

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 system components

Description	Type	Art. No.
Coupling devices	AGH150W-4	B98018006
	AGH204S-4	B914013
	AGH520S	B913033
	AGH676S-4	B913055

Suitable measuring instruments on request!



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