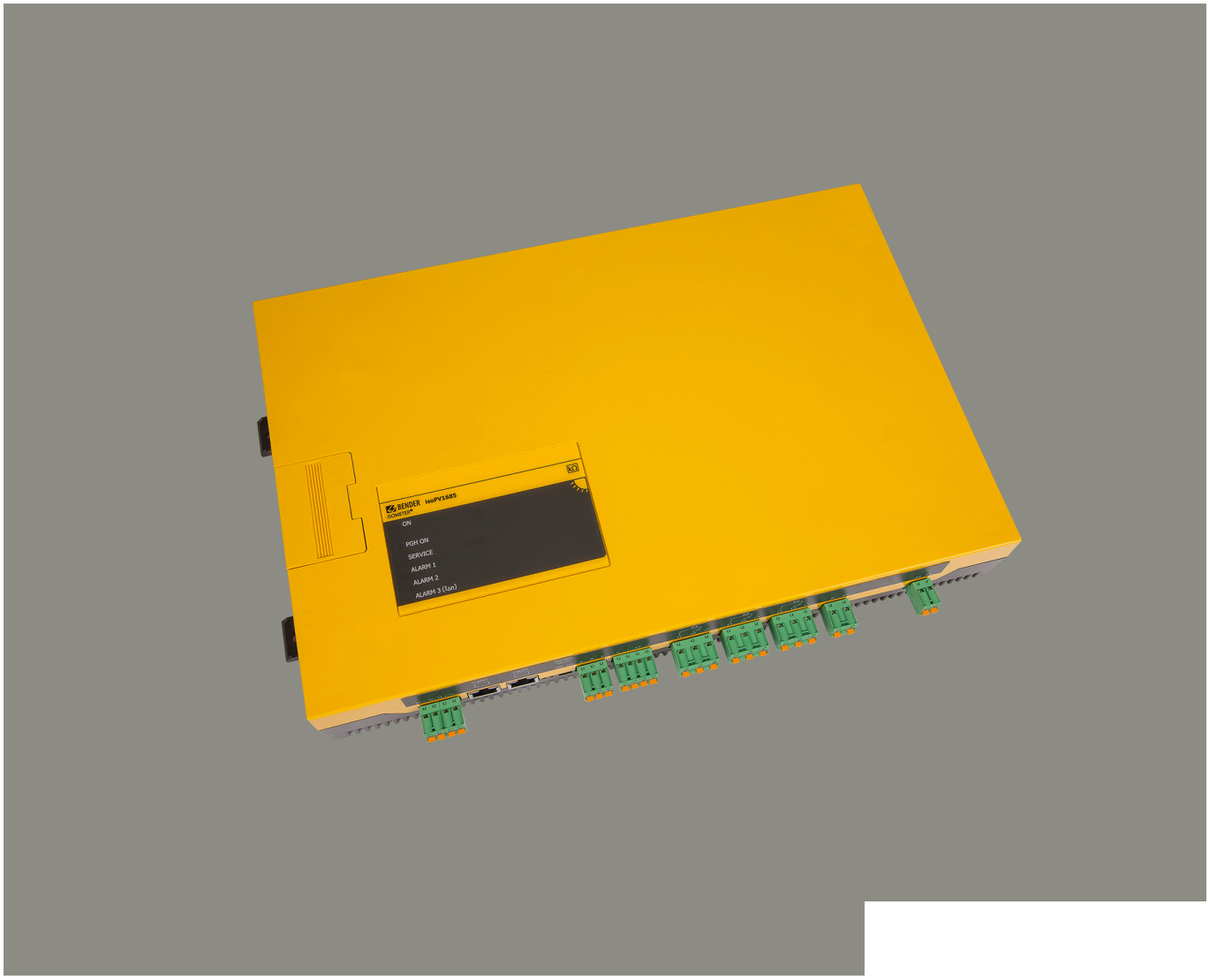
DC PV

ISOMETER® isoPV1685P

Insulation monitoring device
for unearthed photovoltaic systems



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BENDER

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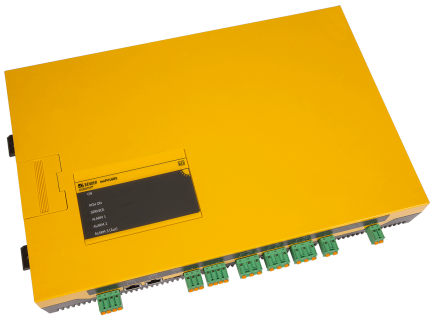


Device features

ISOMETER® for photovoltaic systems.

- Insulation monitoring of large PV systems
- Measurement of insulation faults 200 Ω…1 MΩ
- Automatic adjustment to high system leakage capacitances
- Separately adjustable response values R_{an1} (Alarm 1) and R_{an2} (Alarm 2) for prewarning and alarm
- Connection monitoring of L+, L– for polarity reversal
- Integrated locating current injector up to 50 mA for insulation fault localisation
- Device self test with automatic alarm message in the event of a fault
- µSD card with data logger and history memory for alarms
- Digital input
- Separate relays for insulation fault 1, insulation fault 2 and device error

Interfaces

- RS-485 interface for data exchange with other Bender devices
- BMS bus via RS-485 interface

Intended use

The device isoPV1685P is used for insulation monitoring of large photovoltaic systems up to DC 1500 V designed as IT systems. The measurement method specially developed for slow voltage fluctuations (MPP tracking) monitors the insulation resistance even in systems equipped with large solar generator panels where extremely high system leakage capacitances against earth exist due to interference suppression methods. Adaptation to system-related high leakage capacitances also occurs automatically.

The device isoPV1685P generates locating current pulses required for insulation fault location. That allows the localisation of the insulation fault using permanently installed or mobile insulation fault locators.

In order to meet the requirements of the 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 range of application indicated in the technical data.

Intended use also includes

- the observation of all information in the operating manual and
- compliance with test intervals.

Caution: This equipment is not intended for use in residential environments and may not provide adequate protection to radio reception in such environments.

Do not make any unauthorised changes to the device. Only use spare parts and optional accessories sold or recommended by the manufacturer.

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

Functional description

Insulation monitoring is carried out using an active measuring pulse which is superimposed onto the IT system to earth via the integrated coupling. If the insulation resistance between a PV system and earth falls below the set prewarning response value R_{an1}, the LED **ALARM 1** lights up and relay **K1** switches. If the insulation resistance falls below the alarm response value R_{an2}, the LED **ALARM 2** lights up and the alarm relay **K2** switches. The relay **K3** switches in case of device or connection failures.

The locating current injector integrated in the device for insulation fault location is either activated externally via the BMS interface or via the internal backup master function if no external master has been connected.

When starting the insulation fault location, the LED **PGH ON** signals the locating current pulse.

The insulation fault location can be started manually via the digital input 1, e.g. for insulation fault location with mobile insulation fault locators (e.g. EDS195).

Installation inside a control cabinet
If the ISOMETER® is installed inside a control cabinet, the insulation fault message must be audible and/or visible to attract attention.

IT systems with several ISOMETER®s
Only one ISOMETER® may be connected in a galvanically connected system. In IT systems that are interconnected via tie switches, ISOMETER®s that are not required must be disconnected from the IT system or switched to inactive.

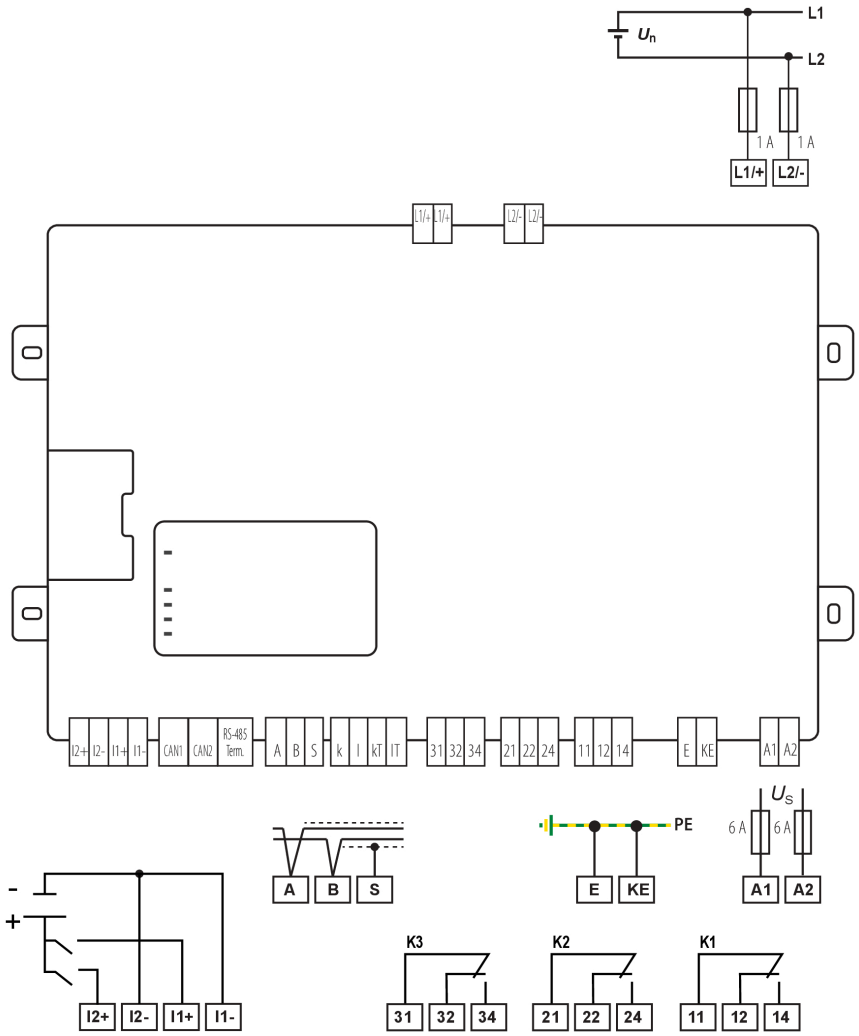
If IT systems are coupled via capacitors or diodes, a central control of the various ISOMETER® must be used.

Prevent measurement errors!
In galvanically coupled DC circuits, an insulation fault can only be detected correctly if a minimum current of > 10 mA flows through the rectifiers.

Unspecified frequency range
Depending on the application and the selected measurement profile, continuous insulation monitoring is also possible in low frequency ranges. For IT systems with frequency components above the specified frequency range, there is no influence on the insulation monitoring.

Wiring diagram

Connection to a DC-System



I2+, I2–	Digital input: Without function
I1+, I1–	Digital input: Start insulation fault location in manual mode
CAN1 / CAN2	without function
RS485 Term. off / on	RS-485 termination
A, B, S	RS-485 bus connection (A,B) Protocol: BMS; S = PE potential / Connect one end of shield
k, I, kT, IT	without function
31, 32, 34	Relay output for internal device errors (LED **SERVICE**)
21, 22, 24	Relay output for main alarm alarm 2 insulation faults
11, 12, 14	Relay output for prewarning alarm 1 insulation faults
E / KE	Separate connection of E (earth) and KE (reference) to PE.

A1, A2	Connection to voltage supply. Connection via fuses, 2 A each
L1/+	Connection to L1/+ of the IT system via 1 A fuse
L2/–	Connection to L2/– of the IT system via 1 A fuse

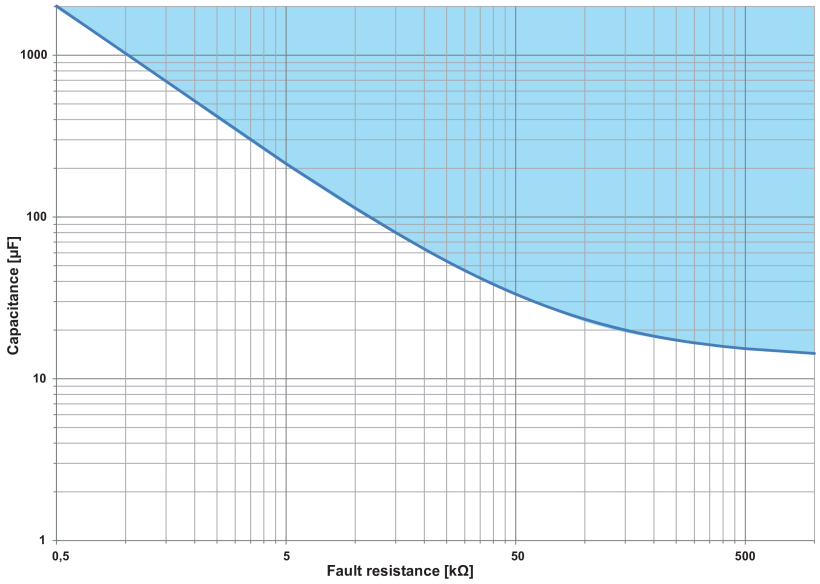
Diagrams

System leakage capacitance

The determination of the leakage capacitance depends on the size of the insulation resistance.

Examples

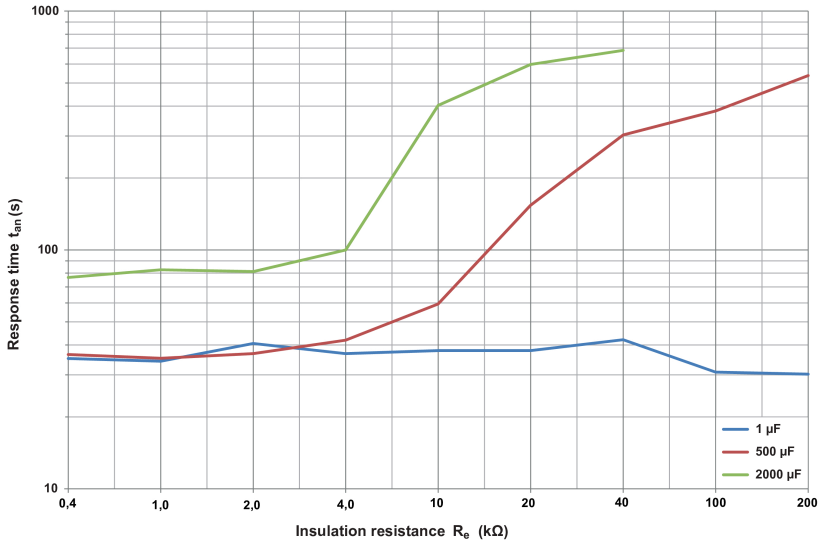
- minimum measurable leakage capacitance at R_F = 50 kΩ: **35 µF**
- minimum measurable leakage capacitance at R_F = 5 kΩ: **210 µF**



Response time

ADVICE

In the case of a leakage capacitance of 2000 µF, the measuring range for the insulation resistance is limited to 50 kΩ.



Technical data

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

Rated voltage	DC 1500 V
Rated impulse voltage	8 kV
Pollution degree	2

Voltage range

Nominal system voltage U_n	DC 0…1500 V
Tolerance of U_n	DC + 6 %
Supply voltage U_s	DC 18…30 V
Power consumption	≤ 7 W

Measuring circuit for insulation monitoring

Measuring voltage U_m (peak)	± 50 V
Measuring current I_m (bei R_F = 0 Ω)	≤ 1.5 mA
Internal DC resistance R_i	≥ 70 kΩ
Impedance Z_i at 50 Hz	≥ 70 kΩ
Permissible extraneous DC voltage U_{fg}	≤ DC 1500 V
Permissible system leakage capacitance C_e	≤ 2000 µF

Response values for insulation monitoring

Response value R_{an1} (Alarm 1)	200 Ω … 1 MΩ
Response value R_{an2} (Alarm 2)	200 Ω … 1 MΩ
Upper limit of the measuring range when set to $C_{e\,max}$ = 2000 µF	50 kΩ
Relative uncertainty (10 kΩ … 1 MΩ) (nach IEC 61557-8)	± 15 %
Relative uncertainty (0.2 kΩ … < 10 kΩ)	± 200 Ω ± 15 %
Response time t_{an}	"Response time", page 4
Hysteresis	25 %, +1 kΩ

Measuring circuit for insulation fault location (EDS)

Locating current I_L DC	≤ 50 mA
Test cycle / pause	2 s / 4 s
Number of turns of test winding	10

Display, storage

LEDs for alarms and operating states	2x green, 4 x yellow
µSD card (Spec. 2.0) for history memory and log files	≤ 32 GB

Inputs

Digital inputs DigIn1 / DigIn2:	
High level	10…30 V
Low level	0…0.5 V

Serial interface

BMS	
Interface / protocol	RS-485 / BMS (Slave)
Connection	Terminals A/B Shield: Terminal S
Cable length	≤ 1200 m
Shielded cable (shield to functional earth on one end)	2-core, ≥ 0.6 mm², e.g. J-Y(St)Y 2×0.6
Terminating resistor, can be connected (RS-485 Term.)	120 Ω (0.5 W)
Device address, BMS bus adjustable (DIP switch)	2…33

Switching elements

Switching elements	3 changeover contacts
K1	Insulation fault alarm 1
K2	Insulation fault alarm 2
K3	Device error
Operating principle K1, K2	N/C operation, N/O operation
Operating principle K3	N/C operation, cannot be changed
Contact data acc. to IEC 60947-5-1:	
Utilisation category	AC 13 | 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 | 3 A | 1 A | 0.2 A | 0.1 A
Minimum contact rating	1 mA bei AC/DC ≥ 10 V
For UL application: Utilisation category for AC control circuits with 50/60 Hz (Pilot duty)	B300
AC load of the alarm relay outputs	AC 240 V, 1,5 A in case of a power factor of 0.35
AC load of the alarm relay outputs	AC 120 V, 3 A in case of a power factor of 0.35
AC load of the alarm relay outputs	AC 250 V, 8 A in case of a power factor of 0.75...0.80
DC load of the alarm relay outputs	DC 30 V, 8 A in case of ohmic load

Connection (except system coupling)

Connection type	pluggable push-wire terminals
Connection, rigid/flexible	0.2…2.5 mm² / 0.2…2.5 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…2.5 mm²
Conductor sizes (AWG)	24…12

Connection of the system coupling

Connection type	pluggable push-wire terminals
Connection, rigid/flexible	0.2…10 mm² / 0.2…6 mm²
Connection, flexible with ferrule, without/with plastic sleeve	0.25…6 mm² / 0.25…4 mm²
Conductor sizes (AWG)	24…8
Stripping length	15 mm
Opening force	90…120 N

Environment/EMC

EMC	IEC 61326-2-4 Ed. 1.0
Ambient temperature during operation	–40…+ 70 °C
Ambient temperature transport	–40…+ 80 °C
Ambient temperature long-term storage	–25…+ 80 °C
Relative humidity	10…100 %

Classification of climatic conditions acc. to IEC 60721:

Stationary use (IEC 60721-3-3)	3K23
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
Atmospheric pressure	700…1060 hPa (max. height 4000 m)

Other

Operating mode	continuous operation
Position of normal use	vertical, system coupling on top
PCB fixation	lens head screw DIN7985TX
Tightening torque	4.5 Nm
Degree of protection, internal components	IP30
Degree of protection, terminals	IP30
Weight	≤1300 g

Standards and approvals

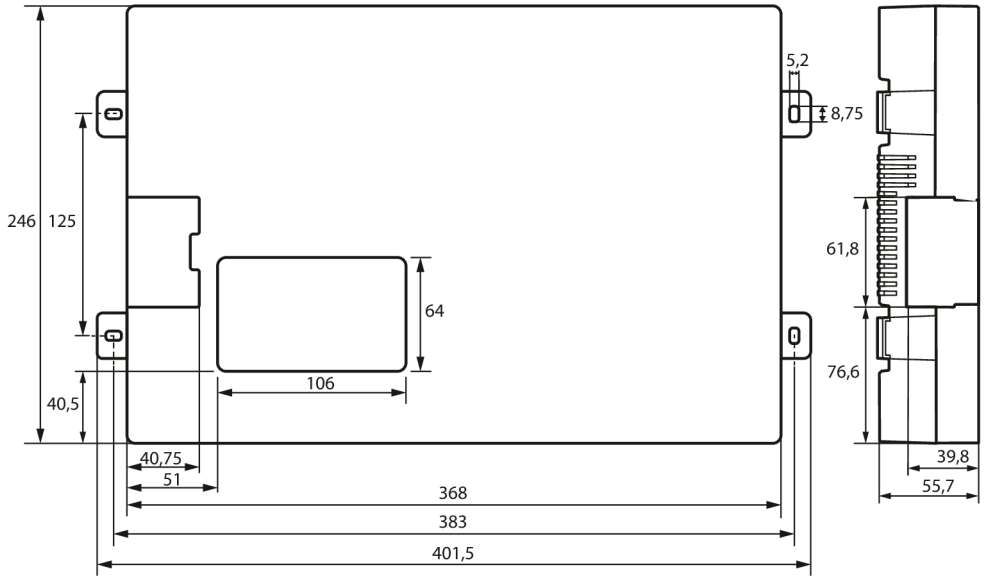
The ISOMETER® isoPV1685P was developed in compliance with the following standards:

- DIN EN 60664-1 (VDE 0110-1)
- DIN EN 61557-8 (VDE 0413-8)
- IEC 60730-1
- IEC 61326-2-4
- IEC 61557-8
- IEC 61557-9
- UL 508

Ordering details

Model	Response value	Nom. system voltage	Supply voltage	Art. No.
isoPV1685P-425	200 Ω…1 MΩ	DC 0…1500 V	DC 24 V ±25%	B91065604

Dimensions



Dimensions in mm

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