A-ISOMETER® isoPV
with coupling device AGH-PV

Product description
The A-ISOMETER® of the isoPV series is designed to monitor the insulation resistance of unearthed main circuits (IT systems) AC, AC/DC 0…793 V resp. DC 0…1100 V. Solar systems containing inverters and isolating transformers are often designed as IT systems. isoPV variants using the \textit{AMPPlus} measurement method capable of adapting to slow voltage fluctuations meet the particular requirements of modern solar systems. Due to wide spatial distribution or EMC interference suppression methods often high leakage capacitances against earth occur in these systems. Considering this, the isoPV automatically adapts to the system conditions in order to optimise the measuring time. In particular, the requirements for permissible voltage ranges along with a low level of insulation can be met here. Use the A-ISOMETER® isoPV in combination with the AGH-PV only. An external supply voltage allows deenergised systems to be monitored too.

Application
• AC, DC or AC/DC main circuits
• Solar systems with directly connected inverters
• Solar systems with high system leakage capacitances of up to 2000 μF
• Solar systems with high but slow voltage fluctuations
• Systems including switched-mode power supplies
• Coupled IT systems

Function
When the insulation resistance between the system conductors and earth falls below the set response value, the alarm relays switch and the alarm LEDs light up. Two separately adjustable alarm relays allow to distinguish between prewarning and alarm. The measured value is indicated on the LC display or an externally connectable measuring instrument. In this way any changes, for example when circuits are connected to the system, can be recognised easily. The fault message can be stored. The fault memory can be reset by pressing the reset button. By pressing the test button, the function of the device as well as the connections to system and earth can be tested. Pressing the Info button provides additional information, such as the existing system leakage capacitance or device settings. The function of the device and the system and earth connections are continuously monitored. When a fault occurs, the system fault relay switches and the alarm LED "system fault" lights up. The parameterisation of the device can be carried out via the LC display or the function buttons integrated in the front plate.

Additional functions
• History memory with real-time clock to store all alarm messages with date and time stamp
• Electrically isolated RS-485 interface (BMS protocol) for data exchange with other Bender devices
• Isometer disconnecting relays for the operation of several A-ISOMETER®s in coupled IT systems
• Current output 0(4)…20 mA (electrically isolated)

Use in coupled IT systems
Isometer disconnecting relays and the control inputs F1/F2 integrated in the insulation monitoring device make them suitable for coupled IT systems too, and guarantees that only one A-ISOMETER® is active at any one time.

Measurement method
\textit{AMPPlus} The isoPV uses the patented \textit{AMPPlus} measurement method. This measuring method allows concise monitoring of modern power supply systems, also in case of extensive, directly connected DC components and high system leakage capacitances.

Device features
• Insulation monitoring for unearthed systems AC, AC / DC 0…793 V, DC 0…1100 V
• Two separately adjustable response values 0.2 kΩ…100 kΩ
• Various \textit{AMPPlus} measurement methods selectable
• Automatic adaptation to the system leakage capacitance
• Info button to display device settings and the system leakage capacitance
• Self monitoring with automatic alarm
• Automatic self test, selectable
• Connection for external kΩ indication
• Test and reset button
• Connection external test and reset button
• Two separate alarm relays with two voltage-free changeover contacts
• N/O or N/C operation
• Backlit LC display
• RS-485 interface
• Presetting for PV systems via menu
1. **INFO** button: to query standard information/ESC button: back (menu function), to confirm parameter change
2. **TEST** button: to call up the self test Arrow up button: parameter change, to move up in the menu
3. **RESET** button: to delete stored insulation fault alarms parameter change, to move down in the menu
4. **MENU** button: to call up the menu system. Enter button: to confirm parameter change
5. Alarm LED “1” lights: insulation fault, first warning level reached
7. LED device error lights: isoPV faulty
8. Two-line display for standard and menu mode

### Wiring diagram

1. **A1/+** and **A2/-**
2. **AK1** and **AK2**
3. **KE**
4. **AGH-PV-3**
5. **isoPV-3**
6. **PE**
7. **7**
8. **8**
9. **9**
10. **10**
11. **11**
12. **12**
13. **13**

1. Supply voltage US (see nameplate) via 6 A fuse; For UL and CSA applications, the use of 5 A fuses is mandatory.
2, 3. Connection to the 3 AC system to be monitored: Connect the terminals L1, L2 to neutral conductor N or terminals L1, L2 to conductor L1, L2.
4. Connection to the AC system to be monitored: connect terminals L1, L2 to conductor L1, L2.
5. Connection to the DC system to be monitored: Connect terminal L1 to conductor L+, terminal L2 to conductor L-
6. Separate connection of E and KE to PE
7. External test button (N/O contact)
8. External reset button (N/C contact or wire jumper), when the terminals are open, the fault message will not be stored.
9. STANDBY by means of the function input F1, F2: when the contact is closed, the insulation resistance is not measured. Disconnection from the IT system
10. Current output, electrically isolated: 0...20 mA or 4...20 mA
11. Serial interface RS-485 (termination with a 120 Ω resistor)
12. Alarm relay 1; available changeover contacts.
13. Alarm relay 2 (device error relay); available changeover contacts.
**Wiring diagram**

PV generator unearthed (IT system) with nominal voltage ≤ DC 1100 V and A-ISOMETER® isoPV with coupling device AGH-PV

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**Wiring diagram – isoPV with coupling device AGH-PV**

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**Symbols used in the wiring diagram**

- **PV Array**: Photovoltaic array
- **PV Generator**: Photovoltaic generator
- **DC IT-System**: DC IT system
- **Transformerless inverter**: Transformerless inverter
- **Trafoloser Wechselrichter**: Transformerless inverter
- **AK1, AK2**: Actuator keys
- **KE**: Keypad
- **isoPV**: Isolation monitor
- **Uₚ, DC 0...1100 V**: Nominal voltage
- **L+, L-, PE**: Power lines
- **Cₑ <2000µF**: Capacitor
- **Rᵣ DC+**: DC resistance
- **Rᵣ DC⁻**: DC resistance
- **Rᵣ AC**: AC resistance

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**Notes**

- **Achtung**: Warning
- **Hochspannung**: High voltage
Several PV generators unearthed (IT system) with nominal voltage ≤ DC 1100 V as a coupled system and A-ISOMETER® isoPV with coupling device AGH-PV.
Technical data A-ISOMETER® isoPV

Insulation coordination acc. to IEC 60664-1

- Rated insulation voltage for isoPV-3: AC 250 V
- Rated impulse voltage/pollution degree: 6 kV / III
- Protective separation (reinforced insulation) between (A1/+, A2/-) - (11, 12, 14, 21, 22, 24) - (Ak1, AK2, KE, PE, T1, T2, R1, R2, F1, F2, M+, M-, A, B)
- Dielectric test acc. to IEC 61010-1: 3.536 kV
- Rated insulation voltage for isoPV-3: AC 250 V
- Rated impulse voltage/pollution degree: 4 kV / III
- Basic insulation between: (11, 12, 14) - (21, 22, 24)
- Voltage test acc. to IEC 61010-1: 2.21 kV

Voltage ranges

- Nominal system voltage Um via AGH-PV
- isoPV-335:
  - Supply voltage Us (also see nameplate): AC 88…264 V**
  - Frequency range: 42…460 Hz
  - Power consumption: ≤ 16 VA
- isoPV-327:
  - Supply voltage Us (also see nameplate): DC 19.2…72 V**
  - Power consumption: ≤ 8 W

Response values

- Response value R_an1: 0.2…100 kΩ
- Factory setting R_an1 (Alarm1): 4 kΩ
- Response value R_an2: 0.2…100 kΩ
- Factory setting R_an2 (Alarm2): 1 kΩ
- Relative uncertainty (7 kΩ…100 kΩ) in accordance with IEC 61557-8: ±15 %
- Relative uncertainty (0.2 kΩ…7 kΩ): ±1 kΩ
- Response time t_an: see table TGH1454 starting from page 39
- Hysteresis: 25 %, +1 kΩ

Measuring circuit

- Measuring voltage U_m (peak value): ± 50 V
- Measuring current I_m (at R_F = 0 Ω): ≤ 1.5 mA
- Internal DC resistance DC R_i: ≥ 35 kΩ
- Impedance Z_i at 50 Hz: ≥ 35 kΩ
- Permissible extraneous DC voltage U_d: ≤ DC 1100 V
- Max. system leakage capacitance C_s: ≤ 2000 μF (2000 μF)*

Displays

- Display, illuminated: two-line display
- Characters (number / height): 2 x 16 / 4 mm
- Display range measured value: 0.2 kΩ…1 MΩ
- Operating uncertainty: ± 15 %, ±1 kΩ

Outputs/Inputs

- Test / reset button: internal/external
- Cable length test / reset button, external: ≤ 10 m
- Current output (load): 0/4…20 mA (≤ 500 Ω)
- Accuracy current output, related to the value indicated (1 kΩ…100 kΩ): ± 15 %, ±1 kΩ

Serial interface

- Interface / protocol: RS-485 / BMS
- Connection: terminals A/B
- Cable length: ≤ 1200 m

Switching elements

- Switching elements: 2 changeover contacts: K1 (Alarm 1), K2 (Alarm 2, device error)
- Operating mode K1, K2:
  - N/C operation n.c. / N/O operation n.o.*
- 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 at AC/DC ≥ 10 V

Environment/EMC

- EMC:
  - not suitable for household and small companies
  - IEC 61326-2-4 Ed. 1.0
  - Operating temperature: -25 ºC…+65 ºC
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): S3K (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): S2K (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): S1K (with condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3):
  - for screw fixing with accessories B990056: 3M7
  - for DIN rail mounting: 3M4
  - Transport (IEC 60721-3-2): 2M2
  - Long-time storage (IEC 60721-3-1): 1M3

Connection

- Connection:
  - screw-type terminals
  - Connection, rigid/flexible: 0.2…4 mm² / 0.2…2.5 mm²
  - Connection flexible with connector sleeve, without/with plastic sleeve: 0.25…2.5 mm²
- Tightening torque: 0.5 Nm
- Conductor sizes (AWG): 24…12
- Cable length between isoPV and AGH-PV: ≤ 0.5 m

Other

- Operating mode: continuous operation
- Mounting:
  - display oriented
- Distance to adjacent devices: ≥ 30 mm
- Degree of protection, internal components (IEC 60529):
  - IP30
- Degree of protection, terminals (IEC 60529):
  - IP20
- Type of enclosure:
  - for DIN rail mounting: X112, free from halogen
  - DIN rail mounting: IEC 60775
- Screw mounting by means of support:
  - 2 x M4
- Flammability class: UL94 V-0
- Software version: D351 V2.0
- Weight: < 510 g

 (* = factory setting
 ** The values marked with** are absolute values
Technical data coupling device AGH-PV

**Insulation coordination acc. to IEC 60664-1**
- Rated insulation voltage: AC 800 V
- Rated impulse voltage/pollution degree: 8 kV / 3

**Voltage ranges**
- Nominal system voltage $U_n$: AC, 3(N)AC 0...793 V, DC 0...1100 V
- Nominal frequency $f_n$: DC, 10...460 Hz
- Max. AC voltage $U_s$ in the frequency range $f_n = 0.1...10$ Hz: $U_s \text{ max} = 110 \, \text{V/Hz} \times f_n$

**Environment/EMC**
- EMC: IEC 61326-2-4
- Operating temperature: -25 ºC...+65 ºC
- Classification of climatic conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3K5 (with condensation and formation of ice)
  - Transport (IEC 60721-3-2): 2K3 (with condensation and formation of ice)
  - Long-term storage (IEC 60721-3-1): 1K4 (with condensation and formation of ice)
- Classification of mechanical conditions acc. to IEC 60721:
  - Stationary use (IEC 60721-3-3): 3M7
  - Transport (IEC 60721-3-2): 2M2
  - Long-time storage (IEC 60721-3-1): 1M3

**Connection**
- Connection: screw-type terminals
- Connection, rigid/flexible: 0.2...4 mm² / 0.2...2.5 mm²
- Connection flexible with connector sleeve, without/with plastic sleeve: 0.25...2.5 mm²
- Tightening torque: 0.5 Nm
- Conductor sizes (AWG): 24...12
- Cable length between isoPV and AGH-PV: ≤ 0.5 m

**Other**
- Operating mode: continuous operation
- Mounting: cooling slots must be ventilated vertically!
- Distance to adjacent devices: ≥ 30 mm
- Degree of protection, internal components (IEC 60529): IP30
- Degree of protection, terminals (IEC 60529): IP20
- Type of enclosure: X112, free from halogen
- DIN rail mounting: IEC 60715
- Screw fixing: 2 x M4
- Flammability class: UL94 V-0
- Weight: < 230 g

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**Ordering information**

<table>
<thead>
<tr>
<th>Type</th>
<th>Nominal system voltage $U_n$</th>
<th>Supply voltage $U_S$</th>
<th>Art. No.</th>
</tr>
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<tbody>
<tr>
<td>isoPV-327 mit AGH-PV</td>
<td>3(N)AC 0...793 V / DC 0...1100 V</td>
<td>DC 19.2...72 V</td>
<td>B 9106 5132W</td>
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<tr>
<td>consisting of:</td>
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<td></td>
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<td>isoPV-327</td>
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<td></td>
<td>B 9106 5130W</td>
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<tr>
<td>AGH-PV</td>
<td></td>
<td></td>
<td>B 9803 9020W</td>
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</table>

| isoPV-335 mit AGH-PV  | 3(N)AC 0...793 V / DC 0...1100 V | AC 88...264 / DC 77...286 V | B 9106 5133W |
| consisting of:        |                             |                     |            |
| isoPV-335             |                             |                     | B 9106 5131W |
| AGH-PV                |                             |                     | B 9803 9020W |

Devices are delivered in sets.

**Accessories**

**External kΩ measuring instrument 20 mA**

<table>
<thead>
<tr>
<th>Type</th>
<th>Art. No.</th>
</tr>
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<tr>
<td>9620-1421</td>
<td>B 986 841</td>
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**Dimension diagram XM112 – A-ISOMETER® isoPV**
Dimensions in mm

**Dimension diagram X200 – coupling device AGH-PV**
Dimensions in mm

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