BENDER
The Power in Electrical Safety™

isoPV425 and AGH420

Ground Fault Detector for Ungrounded Solar Arrays < 100 kW

And Isolation Tester Prior to Array Startup (Grounded and Ungrounded)

Technical Bulletin

NAE1012670 / 08.2013

isoPV425 and AGH420

Ground fault detector for ungrounded solar arrays up to 100 kW

isoPV425 and AGH420

Features

- Fufills ground fault detection requirements of NEC 690.35 and CEC 64-018(1)(e) for ungrounded solar arrays
- Fufills upcoming 2014 requirements of NEC 690.5(A)(1) and NEC 690.35(C)(1) for isolation testing of grounded and ungrounded solar arrays prior to startup
- Designed specifically for ground fault detection on ungrounded photovoltaic systems up to 100 kW
- Works on systems up to 690 VAC / 1000 VDC
- Detects symmetrical ground faults
- Two separate adjustable response values
- Overvoltage and undervoltage detection available
- Measurements of system voltage to ground (+/GND and -/GND)
- Automatic adaptation to system leakage capacitance up to 600 µF
- Self monitoring
- Connection monitoring
- Automatic self-test setting
- RS-485 interface for connection to BENDER communication gateways
- Built-in and external test/reset
- Two single pole relay alarm outputs
- Normally energized (failsafe) or de-energized (non-failsafe) operation
- Latching or non-latching operation
- Separately adjustable response values for resistance and impedance
- LCD display

Description

This device meets or exceeds the requirements of NEC 690.35 and CEC 64-018(1)(e) for ground fault detection on ungrounded solar arrays.

Designed specifically for photovoltaic systems 100 kW and below, the isoPV425 ground fault detector provides early indication of ground faults before leakage current may even be present. The device detects both AC and DC ground faults by monitoring the system's insulation resistance. The isoPV425 and AGH420 can connect to systems up to 690 VAC / 1000 VDC.

Insulation resistance values are displayed in real-time on the device's LCD display. Additional overvoltage and undervoltage detection are available, with voltage measurements from positive to ground and negative to ground when connected to DC. Two single pole contacts are available, which may be set to normally energized (failsafe) or normally deenergized (non-failsafe) mode. An RS-485 interface is available for connection to remote BENDER communication gateways. For advanced users, separately adjustable values for resistance and impedance are available as well.

The isoPV425 may also be used for determining PV system isolation prior to startup on both grounded and ungrounded solar arrays, per the upcoming 2014 requirements of NEC 690.5(A)(1) and NEC 690.35(C)(1).

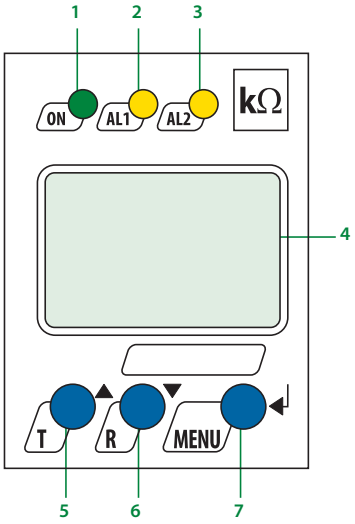
For solar arrays larger than 100 kW, please refer to the isoPV ground fault detector.

Function

The currently measured insulation resistance value is displayed on the LCD screen in real-time. The alarm value of the device is factory set to 10 kΩ (AL1) and 5 kΩ (AL2). When the value falls below the preset alarm values, the response delay "t_{on}" begins. Once the response delay "t_{on}" elapses, the alarm relays K1/K2 switch and the alarm LEDs AL1/AL2 illuminate. The behavior of these alarm relays is configurable in the device's onboard settings menu. The type of fault (+/GND, -/GND, or symmetrical) is indicated on the LCD display. The alarm relays are additionally configurable to the type of fault.

If latching is enabled ("fault memory"), the device will require a manual reset. If latching is disabled, the device will manually reset once the fault(s) clear.

Displays and Controls



1 - Power ON LED “ON”; flashes during connection error

2 - Alarm LED “AL1,” Lights when alarm value AL1 has activated or overvoltage alarm (flashes during connection error)

3 - Alarm LED “AL2,” Lights when alarm value AL2 has activated or undervoltage alarm (flashes during connection error)

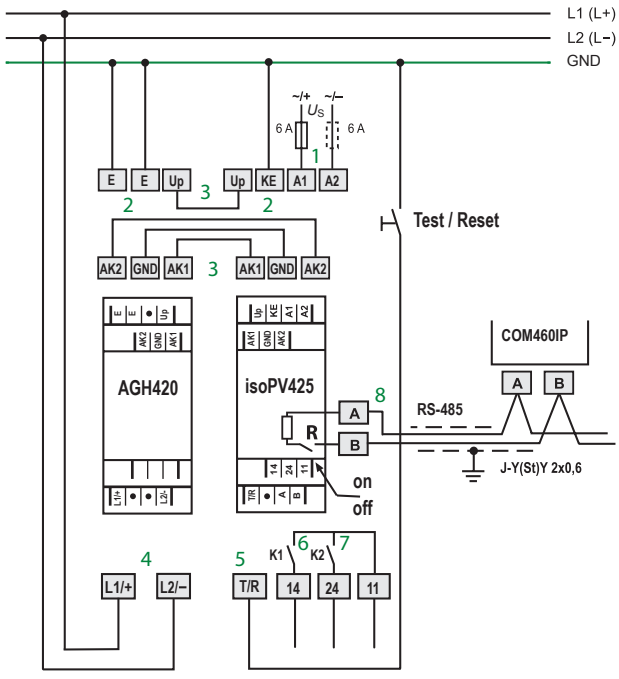
4 - LCD display

5 - Test button “T”: Activates self-test
Arrow up key: Scrolls up inside device's menu

6 - Reset button “R”: Resets device (if set to latching mode)
Arrow down key: Scrolls down inside device's menu

7 - MENU key: Activates device's internal menu
Enter key: Confirm changes inside device's menu

Wiring



1 - External supply voltage used to power device

2 - Separate connections to equipment ground

3 Corresponding connection between isoPV425 and AGH420

4 - System connections

5 - Connection for external test/reset

6 - Connection to alarm relay K1

7 - Connection to alarm relay K2

8 - Connection to BENDER communication bus (example shown: connecting to COM460IP Ethernet / Modbus/TCP gateway)

Technical data: isoPV425

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

Rated insulation voltage	250 V
Rated impulse voltage/pollution degree	4 kV/3
Protective separation (reinforced insulation) between	(A1, A2) - (AK1, GND, AK2, Up, KE) - (11, 14, 24)
Voltage test acc. to IEC 61010-1	2.21 kV

Supply voltage

Supply voltage U_S	DC 24 - 240 V, AC 100 - 240 V
Tolerance of U_S	-20 - +15 %
Frequency range	47 - 63 Hz
Power consumption	≤ 3 W, ≤ 6 VA

Monitored system

Nominal system voltage U_n	via AGH420

Response values

Undervoltage detection	30 - 1149 V (off)*
Overvoltage detection	31 - 1150 V (off)*
Hysteresis	5 %
Response value R_{an1} (Alarm 1)	1 - 500 kΩ (10 kΩ)*
Response value R_{an2} (Alarm 2)	1 - 500 kΩ (5 kΩ)*
Relative uncertainty	± 15 %
Hysteresis	25 %

Time response

Response time t_{an} at $R_F = 0.5 \times R_{an}$ and $C_e = 1$ µF IEC 61557-8	≤ 10 s
Start-up delay (start time) t	0 - 10 s (0 s)*
Response delay t_{on}	0 - 99 s (0 s)*

Displays, memory

Display range, measured value insulation resistance	1 kΩ - 1 MΩ
Operating uncertainty 1 - 5 kΩ/5 kΩ - 1 MΩ	± 0.5 kΩ/± 15 %
Display range, measured value nominal system voltage	10 - 1150 V RMS
Operating uncertainty	± 3 V/± 15 %
Display range, measured value system leakage capacitance	1 µF - 500 µF
Operating uncertainty	± 30 %
Password	off/0 - 999 (off)*
Fault memory alarm relay	on/(off)*

Interface

Interface/protocol	RS-485/BMS
Baud rate	9.6 kbit/s
Cable length	0 - 1200 m
Shielded cable (shield connected to PE on one side)	recommended: J-Y(St)Y min. 2 x 0.6
Terminating resistor	120 Ω (0.25 W), can be enabled in the device
Device address, BMS bus	3 - 90 (3)*

Switching elements

Switching elements	2 x 1 N/O contact (single pole)
Operating principle	N/C operation/N/O operation (N/C operation)*
Contact 11-14 indication	Alarm 1
Contact 11-24 indication	Alarm 2
Electrical endurance, number of cycles	10000
Contact data acc. to IEC 60947-5-1	
Utilization category	AC-13
AC-14	DC-12
DC-12	DC-12
Rated operational voltage	230 V
230 V	220 V
110 V	24 V
Rated operational current	5 A
3 A	0.1 A
0.2 A	1 A
Minimum contact rating	1 mA at AC/DC ≥ 10 V

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-25 - +70 °C
Classification of climatic conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3K5 (except condensation and formation of ice)
Transport (IEC 60721-3-2)	2K3 (except condensation and formation of ice)
Long-term storage (IEC 60721- 3-1)	1K4 (except condensation and formation of ice)
Classification of mechanical conditions acc. to IEC 60721:	
Stationary use (IEC 60721-3-3)	3M4
Transport (IEC 60721-3-2)	2M2
Storage (IEC 60721-3-1)	1M3

Connection

Connection type	push-wire terminal
Connection properties	
rigid	0.2 - 2.5 mm² (AWG 24 - 14)
flexible without ferrule	0.2 - 2.5 mm² (AWG 24 - 14)
flexible with ferrule	0.2 - 1.5 mm² (AWG 24 - 16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip

Technical data: AGH420

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

Rated insulation voltage	1000 V
Rated impulse voltage/pollution degree	8 kV/3
Protective separation (reinforced insulation) between (L1/+, L2/-) - (AK1, GND, AK2, Up, E)	
Voltage test acc. to IEC 61010-1	4.3 kV

Monitored system

Nominal system voltage U_n	DC 0 - 1000 V, AC 0 - 690 V
Tolerance of U_n	+15 %
Frequency range of U_n	DC, 10 - 460 Hz
Max. AC voltage U~ in the frequency range 0.1 - 10 Hz	U~max = 120 V/Hz * f_n

Measuring circuit

Measuring voltage U_m	± 45 V
Measuring current I_m (at R_f = 0 Ω)	≤ 400 µA
Internal DC resistance R_i	≥ 120 kΩ
Impedance Z_i at 50 Hz	≥ 120 kΩ
Permissible system leakage capacitance	≤ 500 µF

Environment/EMC

EMC	IEC 61326-2-4
Operating temperature	-25 - +70 °C
Classification of climatic conditions acc. to IEC 60721:	
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Connection

Connection type	push-wire terminal
Connection properties	
rigid	0.2 - 2.5 mm² (AWG 24 - 14)
flexible without ferrule	0.2 - 2.5 mm² (AWG 24 - 14)
flexible with ferrule	0.2 - 1.5 mm² (AWG 24 - 16)
Stripping length	10 mm
Opening force	50 N
Test opening, diameter	2.1 mm

Other

Operating mode	continuous operation
Mounting	cooling slots must be ventilated vertically
Distance to adjacent devices, Un > 800V	≥ 30 mm
Degree of protection, internal components (IEC 60529)	IP30
Degree of protection, terminals (IEC 60529)	IP20
Enclosure material	polycarbonate
DIN rail mounting acc. to	IEC 60715
Screw mounting	2 x M4 with mounting clip
Operating manual	D620014900
Weight	≤ 150 g

Ordering Information

Supply voltage [1] U_S		Type	Ordering No.
DC	AC		
24 - 240 V	100 - 240 V (47 - 63 Hz)	**isoPV425-D4 with AGH420**	**B 9103 6303**

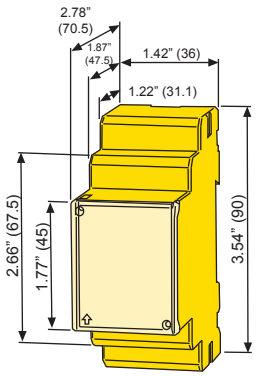
[1] Absolute values
Models with push-wire terminals available on request.

Accessories

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

Dimensions

Dimensions in inches (mm)



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