

# IRDH375 Series

Digital Ground Fault Monitor / Ground Detector  
For Ungrounded (Floating) AC/DC Systems



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For ungrounded (floating) AC/DC systems



IRDH375

### Features

- Meets or exceeds requirements for NEC 250.21(B) and CEC 10-106(2), as well as the upcoming 2014 requirement of NEC 250.167(A)
- Ground fault detection via insulation monitoring for ungrounded AC/DC systems, single-phase or three-phase
- Works on systems up to 793 VAC / 650 VDC
- Voltage ranges extendable up to 7200 VAC / 1760 VDC with voltage coupler modules
- Two separate adjustable response values, 1 k $\Omega$  - 10 M $\Omega$
- Advanced measuring principle which detects both AC and DC faults, symmetrical faults, automatically adapts to high system leakage capacitances
- Info button to display device settings and system leakage capacitance
- Self monitoring
- Automatic self-test setting
- Connection for external metering
- Built-in and external test/reset
- Two separate alarms with two voltage-free SPDT contacts
- Normally energized (failsafe) or de-energized (non-failsafe) operation
- Backlit LCD display
- RS-485 interface

### Approvals



### Description

This device meets or exceeds the requirements of NEC 250.21(B) and CEC 10-106(2) for ground detectors in ungrounded AC systems, as well as the upcoming 2014 requirement of NEC 250.167(A) for ungrounded DC systems.

The IRDH375 monitors for ground faults in ungrounded single-phase AC, three-phase AC, and DC systems by monitoring the system's insulation resistance. It may be connected to systems of up to 793 VAC / 650 VDC. Voltage coupler accessories extend this range. The AMP Plus measuring principle utilized by the IRDH375 meets the requirements of modern power systems, including pure DC systems, systems with rectifiers, and systems with variable frequency drives (VFDs). In systems with high leakage capacitances, the IRDH375 automatically adapts itself to ensure an accurate reading.

The IRDH375 features a digital display showing the system's insulation resistance in real-time. All settings are changed via the device's built-in menu. The IRDH375 utilizes an external supply voltage for power, which allows deenergized systems to also be monitored.

For a DIN rail mounted version, please refer to the IRDH275.

### Function

When the insulation resistance from system to ground falls below the set response value, the alarm relays switch and the alarm LEDs activate. Two separately adjustable alarm-contacts can be set to a prewarning and main warning alarm. The measured value is indicated on the LCD display or an externally connectable measuring instrument. A latching setting ("fault memory") allows the device to reset automatically or require a manual reset. An external and internal test/reset can be activated remotely or on the device. A comprehensive INFO menu displays additional information such as the system's leakage capacitance.

The IRDH375 continuously monitors the equipment ground connection to ensure proper operation. The device's easy-to-use onboard menu manages all settings via the detailed LCD screen.

### Additional Features

- History memory with real-time clock to store up to 300 timestamped event records
- Galvanically isolated RS-485 interface (BMS protocol) for data exchange with other Bender devices and communication systems
- Standby contacts and RS-485 communication for operating multiple ground fault detectors in systems tied together with tiebreakers or interlocks
- Galvanically isolated analog output, 0(4) - 20 mA

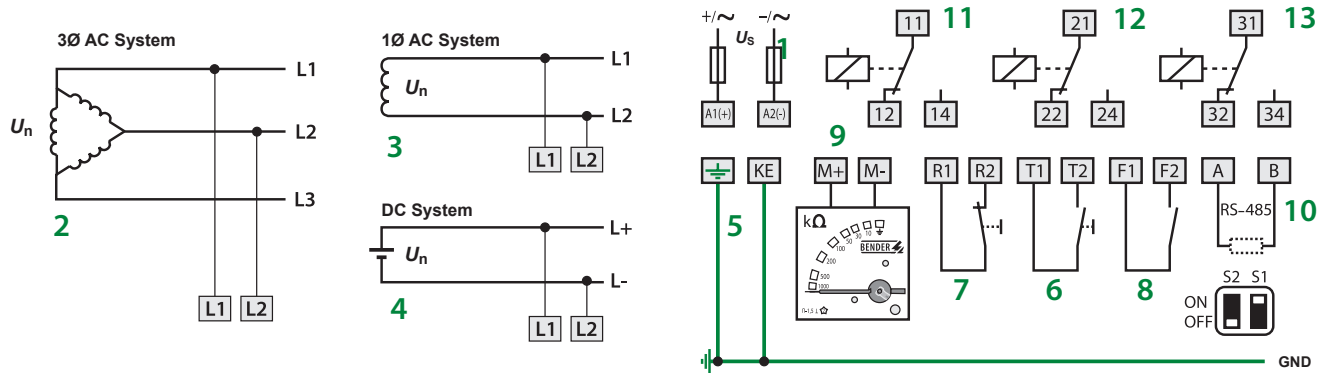
### Use in Interconnected Ungrounded Systems

Only one BENDER insulation monitor may be active when several ungrounded systems are coupled together via a tiebreaker or other means. The disconnect relays and control inputs F1/F2 integrated into the IRDH375 guarantee no interference with other BENDER devices when the system tiebreaker is closed. IRDH375B models feature automatic control via RS-485 with no control inputs necessary.

### Measurement Method

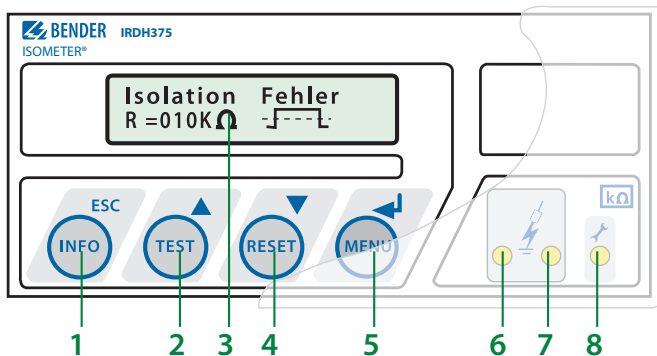
**AMPPlus** The IRDH375 series uses the **AMPPlus** measuring principle. This measuring principle allows for the precise monitoring of modern power supply systems, pure DC systems, systems where AC/DC rectification and power conversion may occur, systems with variable frequency drives (VFDs), and systems with high leakage capacitances.

## Wiring



- 1 - External supply voltage used to power device
- 2 - Wiring diagram for a three-phase system. Only two connections to the system are necessary to monitor all three phases.
- 3 - Wiring diagram for a single-phase system
- 4 - Wiring diagram for a DC system
- 5 - Equipment ground connections
- 6 - External test button (normally open contact)
- 7 - External reset button (normally closed contact). When the terminals are open, the fault message will not be stored.
- 8 - Standby contact. When the contact is closed, no insulation measurements take place.
- 9 - IRDH375: Analog output, electrically isolated: 0 - 400  $\mu$ A  
IRDH375B: Analog output, electrically isolated: 0 - 20 mA or 4 - 20 mA
- 10 - RS-485 interface:  
IRDH375: One-way ASCII stream with measurement status  
IRDH375B: Two-way communication with other BENDER devices, including communication gateways
- 11 - Alarm relay 1, normally energized or de energized contact
- 12 - Alarm relay 2, normally energized or de energized contact
- 13 - System fault relay, normally energized or de energized

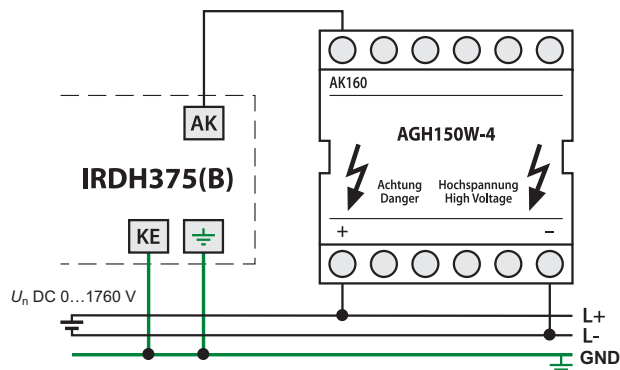
## Displays and Controls



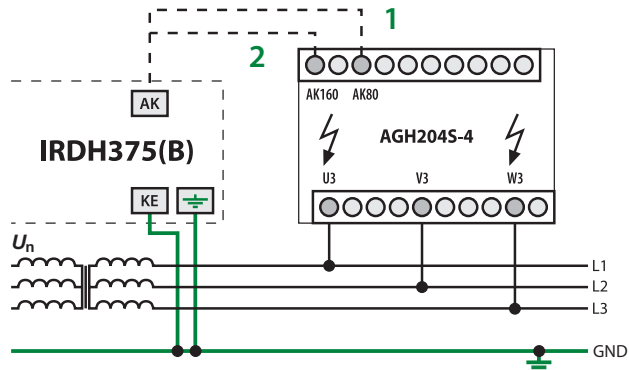
- 1 - INFO key: displays pertinent system information  
ESC key: Goes back a step inside device's menu
- 2 - TEST button: Activates self-test  
Arrow up key: Scrolls up inside device's menu
- 3 - LCD display
- 4 - RESET button: Resets device  
Arrow down key: Scrolls down inside device's menu
- 5 - MENU key: Activates device's internal menu  
Enter key: Confirm change inside device's menu
- 6 - Alarm LED 1 lights: Alarm, Prealarm
- 7 - Alarm LED 2 lights: Alarm, Main alarm
- 8 - System fault LED: Lights on connection or device error

## Wiring diagrams – Connecting to voltage couplers

### IRDH375 with voltage coupler AGH150W-4

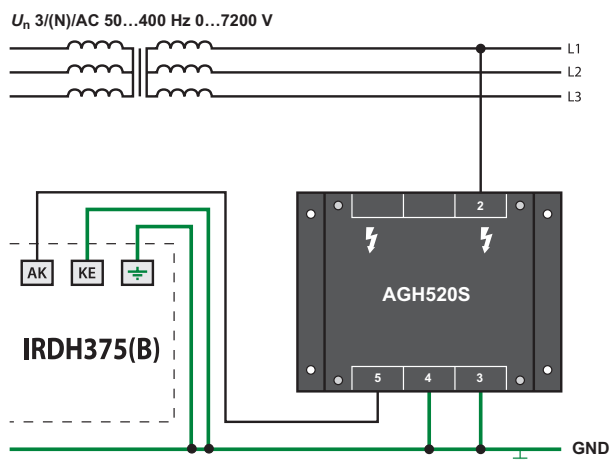


### IRDH375 with voltage coupler AGH204S-4

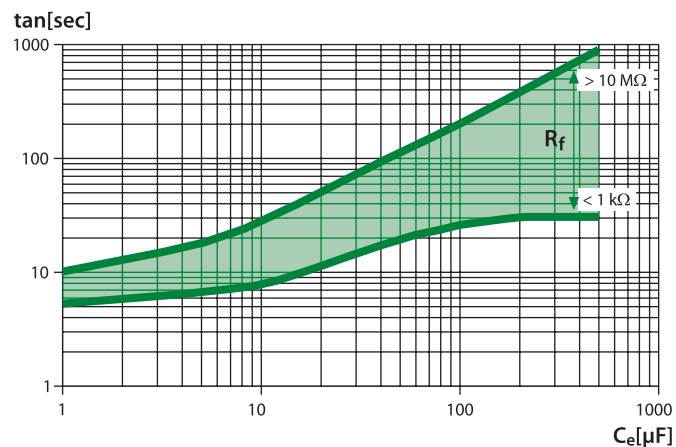


- 1 - without rectifiers  $U_n = 3AC\ 0 - 1650\ V\ (DC\ max.\ 1000\ V)$
- 2 - with rectifiers  $U_n = 3AC\ 0 - 1300\ V\ (peak\ voltage\ downstream\ of\ the\ rectifier\ or\ intermediate\ voltage\ max.\ 1840\ V)$

### IRDH375 with voltage coupler AGH520S



## Sample Response Times



Response times in relation to the system leakage capacitances:  $C_e = 1 - 500\ \mu F$ ,  $U_n = 0 - 793\ V/50\ Hz$

## Ordering Information

RS-485 interface	Analog Output	Supply voltage $U_S$ <sup>1)</sup>		Type	Ordering No.
		AC	DC		
One-way ASCII string	0 - 400 $\mu$ A	88 - 264 V (42 - 460 Hz)	77 - 286 V	IRDH375-435	B 9106 5000
		—	19.2 - 72 V	IRDH375-427	B 9106 5002
		—	10.2 - 36 V	IRDH375-425	B 9106 5001
Proprietary 2-way protocol, compatible with BENDER comm. equipment	0(4) - 20 mA	88 - 264 V (42 - 460 Hz)	77 - 286 V	IRDH375B-435	B 9106 5004
		—	19.2 - 72 V	IRDH375B-427	B 9106 5006
		—	10.2 - 36 V	IRDH375B-425	B 9106 5005

<sup>1)</sup> Absolute values

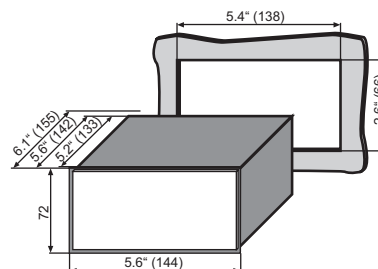
All versions support adding option "W" (added to the end of the part number), adding additional shock/vibration protection and wider temperature range.

## Accessories

Description	Type	Ordering No.
External meters	7204-1421	B 986 763
	9604-1421	B 986 764
	9620-1421	B 986 841
Coupling devices	AGH150W-4	B 9801 8006
	AGH204S-4	B 914 013
	AGH520S	B 914 033
Transparent front plate cover, IP65 rating	144x72	B 9806 0005

## Dimensions

Dimensions in inches (mm)



## Technical data

### Insulation coordination acc. to IEC 60664-1

Rated insulation voltage	AC 800 V
Rated impulse voltage/pollution degree	8 kV/3

### Voltage ranges

#### IRDH375 - :

Nominal system voltage $U_n$	AC, 3/(N)AC 0 - 793 V*
Nominal frequency $f_n$	50 - 460 Hz
Nominal system voltage $U_n$	DC 0 - 650 V*

#### IRDH375 - -435:

Supply voltage $U_S$ (also see nameplate)	AC 88 - 264 V*
Frequency range $U_S$	42 - 460 Hz
Supply voltage $U_S$ (also see nameplate)	DC 77 - 286 V*

#### IRDH375 - -427:

Supply voltage $U_S$ (also see nameplate)	DC 19.2 - 72 V*
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#### IRDH375 - :

Power consumption	≤ 14 VA
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### Response values

Response value $R_{an1}$ (Alarm1)	1 kΩ - 10 MΩ
Response value $R_{an2}$ (Alarm2)	1 kΩ - 10 MΩ
Relative uncertainty (20 kΩ - 1 MΩ) (acc. to IEC 61557-8)	± 15 %
Relative uncertainty (1 - 20 kΩ)	+2 kΩ/+20 %
Relative uncertainty (1 - 10 MΩ)	0.2 MΩ/+20 %
Response time $t_{an}$ at $R_f = 0.5 \times R_{an}$ and $C_e = 1 \mu F$	≤ 5 s
Hysteresis (1 - 10 kΩ)	+2 kΩ
Hysteresis (10 kΩ - 10 MΩ)	25 %

### Measuring circuit

Measuring voltage $U_m$	≤ 40 V
Measuring current $I_m$ (at $R_f = 0 \Omega$ )	≤ 220 μA
Internal DC resistance $R_i$	≥ 180 kΩ
Impedance $Z_i$ at 50 Hz	≥ 180 kΩ
Permissible extraneous DC voltage $U_{fg}$	≤ DC 1200 V
Permissible system leakage capacitance $C_e$	≤ 500 μF
Factory setting	150 μF

### Displays

Display, illuminated	two-line display
Characteristics (number)	2 x 16
Display range measured value	1 kΩ - 10 MΩ
Operating uncertainty (20 kΩ - 1 MΩ) (acc. to IEC 61557-8)	±15 %**
Operating uncertainty (1 - 20 kΩ)	±1 kΩ/±15 %**
Operating uncertainty (1 MΩ - 10 kΩ)	±0.1 MΩ/±15 %**

### Outputs/Inputs

Test/reset button	internal/external
Cable length test/reset button, external	≤ 10 m
Current output for measuring instrument SKMP (scale centre point = 120 kΩ):	
Current output IRDH375 (load)	400 μA (≤ 12.5 kΩ)
Current output IRDH375B (load)	20 mA (≤ 500 Ω)
Accuracy current output (1 kΩ - 1 MΩ) related to the value indicated	±10 %, ±1 kΩ

### Serial interface

Interface/protocol IRDH375	RS-485/ASCII
Interface/protocol IRDH375B	RS-485/BMS
Connection	terminals A/B
Cable length	≤ 1200 m
Cable (twisted in pairs, one end of shield connected to PE)	recommended: J-Y(St)Y min. 2 x 0.8
Terminating resistor	120 Ω (0.5 W)
Device address, BMS bus	1 - 30 (factory setting = 3)

### Switching elements

Switching elements	3 SPDT contacts
	K1 (Alarm 1), K2 (Alarm 2), K3 (device error)
Operating principle K1, K2 (Alarm 1/Alarm 2)	Normally energized or de-energized operation
Factory setting (Alarm 1/Alarm 2)	N/D operation
Operating principle K3 (device error)	N/E operation
Electrical endurance, number of cycles	12000
Contact class	IIB acc. to DIN IEC 60255 Part 0-20
Rated contact voltage	AC 250 V/DC 300 V
Making capacity	AC/DC 5 A
Breaking capacity	2 A, AC 230 V, cos phi = 0.4 0.2 A, DC 220 V, L/R = 0.04 s
Contact rating at DC 24 V	≥ 2 mA (50 mW)

### Environment/EMC

EMC	according to IEC 61326-2-4 Ed. 1.0
Shock resistance IEC 60068-2-27 (device in operation)	15 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6 (device in operation)	1 g/10 - 150 Hz
Vibration resistance IEC 60068-2-6 (transport)	2 g/10 - 150 Hz
Ambient temperature (during operation)	-10 - +55 °C
Ambient temperature (during storage)	-40 - +70 °C
Climatic class acc. to IEC 60721-3-3	3K5

### Connection

Connection	screw-type terminals
Connection properties	
rigid/flexible	0.2 - 4 mm <sup>2</sup> /0.2 - 2.5 mm <sup>2</sup>
flexible with ferrules without/with plastic sleeve	0.25 - 2.5 mm <sup>2</sup>
Conductor sizes (AWG)	24 - 12

### Other

Operating mode	continuous operation
Mounting	display-oriented
Distance to adjacent devices	≥ 30 mm
Degree of protection, internal components (DIN EN 60529)	IP30
Degree of protection, terminals (DIN EN 60529)	IP20
Type of enclosure	X300, free from halogen
DIN rail mounting acc. to	IEC 60715
Flammability class	UL94 V-0
Software version IRDH375	D183 V1.4
Software version IRDH375B	D184 V1.4
Operating manual	TGH1352
Weight	≤ 510 g

### Option "W"

Shock resistance IEC 60068-2-27 (device in operation)	30 g/11 ms
Bumping IEC 60068-2-29 (transport)	40 g/6 ms
Vibration resistance IEC 60068-2-6	1.6 mm/10 - 25 Hz 4 g/25 - 150 Hz
Ambient temperature, during operation	-25 - +70 °C
Ambient temperature for storage	-40 - +85 °C
Screw mounting	2 x M4

#### \* Absolute values

\*\* = Under EMC test conditions in accordance with IEC 61326-2-4 the specified tolerances can double



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