

# HRG & LRG

Electrical safety solutions NGR



Intelligence in  
electrical safety



# Enhance System Safety

## Bender Resistance Grounding Systems

- Minimize fault current
- Continue operation and locate faults while the system remains online in a single-fault condition
- Avoid emergency services and repairs with scheduled maintenance
- Reduce probability of an arc flash by as much as 95%

In industrial and commercial power systems, as many as 95% of electrical faults begin as a single-phase line-to-ground fault. In solidly grounded systems, ground-fault current can reach extremely high levels, as high as tens of thousands of amperes. In this situation, automatically interrupting the power supply is critical. However, coordination of tripping can be very difficult, and the protection is often not quick enough to prevent extensive equipment damage and arc-flash incidents. Bender high-resistance grounding (HRG) systems reduce the damage and hazards caused by ground-faults. A neutral-grounding resistor (NGR) is installed between the power system's neutral and ground, and limits the ground-fault current that may flow. This can allow the system to operate in a single-fault condition. This ground-fault current limitation minimizes additional equipment damage while dramatically reducing the probability of an arc-flash incident and the resulting hazard to personnel. To ensure the power system is grounded, several options are available to continuously monitor the grounding resistor and its connection to the system.

Bender's advanced HRG packages automatically and safely indicate the location of a ground-fault, and can offer protection in a double-fault situation. This provides optimal return on the investment by reducing the time required to locate faults.



Bender's resistance-grounding equipment provides scalable solutions to a wide variety of industries where continuity of power or sensitive-level protection is critical to operation:

- Oil and gas
- Pulp and paper
- Manufacturing
- Mining
- Water and wastewater
- Healthcare
- And many more

# NGRM500, NGRM550, NGRM700, NGRM750 (Neutral-Grounding Resistor Monitors)



**NGRM500  
NGRM550**

The **NGRM500** detects NGR failure and ground faults in high-resistance-grounded power systems. The **NGRM550** is used for low-resistance-grounded power systems.

## Features

- Open and short (HRG only) NGR-failure detection
- AC/DC ground-fault detection
- Integrated web server, Modbus TCP/IP, and Modbus RTU
- HMI (Human-Machine Interface) that displays measured values and provides easy programming in selectable languages

## Benefits

- Improves safety by monitoring of the grounding connection
- AC/DC ground-fault protection/detection to properly monitor non-linear loads, such as adjustable-speed drives
- Preventative maintenance – sensitive ground-fault pickup levels allow early warning of insulation degradation
- Simplified design - Controls pulsing contactor in pulsing HRG systems
- Compact DIN rail mount solutions for application in smaller control panels also removes the necessity of wiring to the panel door



**NGRM700  
NGRM750**

In addition to the features of the NGRM500/550, the **NGRM700** and **NGRM750** offer unique packaging that allows easy installation of the base unit and a removable HMI for panel mounting.

## Additional Features

- Designed for high-altitude use
- Detachable HMI
- Phase to-phase and phase-to-ground voltage monitoring

## Additional Benefits

- Altitude rating of 5,000 meters above sea-level
- Program and display information without opening doors
- Faulted-phase indication



# HRG Series

## Product



Series 1



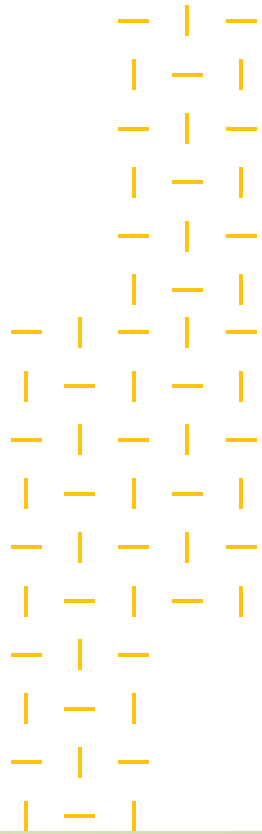
Series 2

<b>Ground-fault current limitation</b>	1 - 10 A	1 - 10 A
<b>Ground-fault detection</b>	AC	AC/DC Harmonic filtering
<b>Ground-fault function</b>	Pulsing	Pulsing
<b>Outputs</b>	Provides external fault indication or interruption where first-fault tripping is required	Provides external fault indication or interruption where first-fault tripping is required  Detects faults in systems with power conversion equipment, including variable frequency drives (VFD) and battery backup systems (UPS)
<b>Communication</b>	X	Modbus TCP/IP
<b>Feeders</b>	Up to 12	Up to 60
<b>Design</b>	Wall-mount galvanneal steel enclosure	Wall or floor mount
<b>Standard dimensions</b>		
<b>Metering</b>	Analog or digital	Digital
<b>Display</b>	LEDs, analog gauges, HMI's	LED
<b>Web-server</b>	X	✓
<b>Data logging</b>	X	✓
<b>NGR monitoring</b> Detection of open and shorted NGRs	Optional	NGRM500/700 Series Prevents loss of ground-fault detection and dangerously high fault currents
<b>Standards</b>	cULus listed IEEE C57.32 CSA 295	cULus listed IEEE C57.32 CSA 295
<b>Optional Features</b>	AC/DC ground-fault detection Zig-zag transformer - Available to convert an ungrounded system to an HRG system	Main-tie-main connections Zig-zag transformer - Available to convert an ungrounded system to an HRG system





Series 3



1 - 10 A

AC/DC  
Harmonic filtering

Pulsing

Provides external fault indication or interruption where first-fault tripping is required

Detects faults in systems with power conversion equipment, including variable frequency drives (VFD) and battery backup systems (UPS)

Modbus TCP/IP

Up to 120

Floor mount

Digital

Touch screen HMI  
PLC - ground-fault location annunciation



NGRM500/700 Series  
Prevents loss of ground-fault detection and dangerously high fault currents

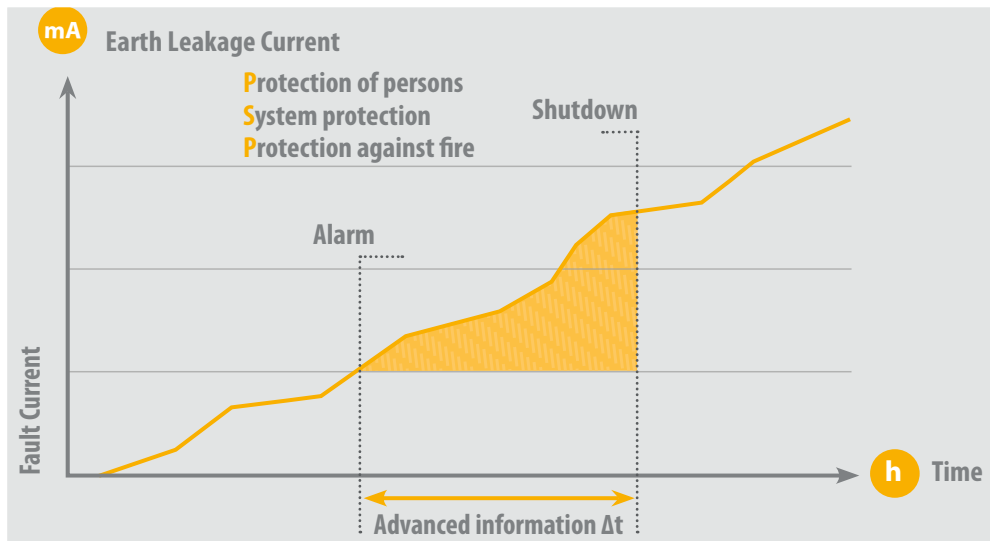
cULus listed  
IEEE C57.32  
CSA 295

Main-tie-main connections  
Multi-fault prioritization - Prioritizes circuit tripping in the event of a second ground-fault, allowing critical circuits to remain in operation  
Zig-zag transformer - Available to convert an ungrounded system to an HRG system



# The World's Most Advanced Ground Fault Protection

The NGRM Series of NGR monitors provide wide frequency ground-fault protection and harmonic analysis, and when a Type B CT is installed, can provide AC/DC detection. RCMS490 multi-channel ground-fault relays are used on many Bender NGR packages to provide advanced ground-fault indication or protection. As the graph below shows, they can provide advanced indication of degraded insulation and escalating leakage current - a useful tool in determining where to apply preventative maintenance.



## Standard NGRs

- All series available in two separate enclosures (controls and NGR)
- Low-voltage NGR packages can be manufactured with integrated monitoring and controls or with a separate control enclosure.
- Medium-voltage packages are available with separate control enclosure or a NEMA4 enclosure mounted to the side of the NGR enclosure and pre-wired to the NGR.



## Standard LRGs

- Ample current is available for tripping LSIG breakers
- Current range is 100s to 1,000s of Amps
- Available for medium-voltage applications
- Optional sensitive ground-fault protection to indicate an increasing trend in leakage current to allow preventative maintenance
- Monitoring and protection provided by NGRM550 and NGRM750

# Additional Bender Resistance Grounding System Components



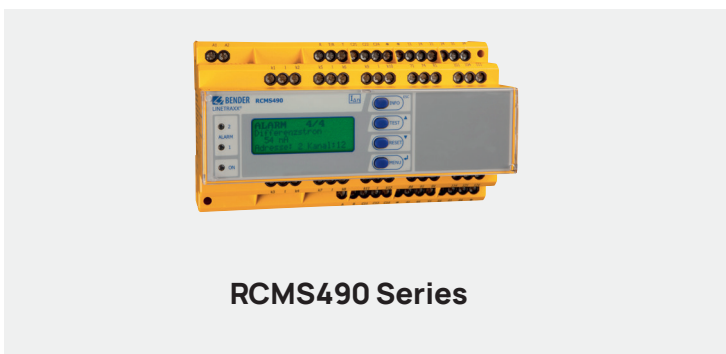
**NGRM550**

**NGRM700**

**RC48N**

## NGR Monitors for safer systems

- Monitors integrity of the NGR with appropriate voltage-rated coupling device (CD1000, CD5000, CD14400, CD25000)
- Adjustable ground-fault filters trip value and time delays
- Output contacts and communications (NGRM series)



**RCMS490 Series**

## Fault location via RCM(s) products

- AC/DC ground-fault detection; harmonic analysis
- Twelve channels with individual settings (RCMS)
- Digital display with real-time readout
- Individual Form A (SPST) outputs for each channel (RCMS490)
- Connects to COM465IP communication gateway for web-based alarm notifications and SCADA integration (RCMS Series)



**Resistors**

## Standard resistor or customized solution

- Open, helical stainless steel wire wrapped around tubular, porcelain core
- Ideal for low-current conditions
- Excellent power dissipation, stable resistance
- Seismic-rated resistor packages available
- Stocked components for on time delivery



**CT**

**CD14400**

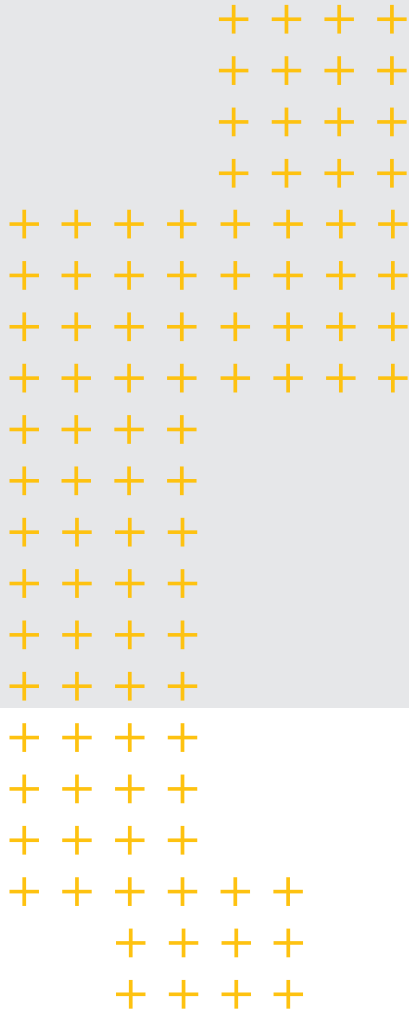
**CTUB103**

**WR Series**

**WS Series**

## CT's and coupling devices

- Measure AC or AC/DC ground-fault current
- Used in general purpose branch circuit monitoring, busbar and large conductor monitoring, and retrofit applications
- Compatible with Bender ground-fault relays, including RCM420 series, RCMS series, RC48N, and NGRM series
- Large window CT's are available for retrofitting existing switchgear



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