



**HIGH-RESISTANCE &
LOW-RESISTANCE
GROUNDING
SYSTEMS**

Enhance System Safety

With 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 and NGRM700

(Neutral-Grounding Resistor Monitors)

The **NGRM500** is intended for use in high-resistance grounded systems. The NGRM500 detects NGR (neutral-ground resistor) failure and ground faults by measuring the current through the NGR, the voltage between the transformer neutral and earth, NGR resistance, and its connection between the system neutral and earth.



NGRM500

Features

- Open and shorted NGR detection
- Monitors integrity of NGR using active and passive methods – works when the system is online or offline
- Integrated web server, Modbus TCP/IP, and Modbus RTU
- HMI (Human-Machine Interface) that displays measured values and provides easy programming via a simple menu structure in selectable languages

Benefits

- Improves safety with monitoring of the grounding connection
- AC/DC ground-fault protection/detection to properly monitor non-linear loads
- Preventative maintenance – sensitive ground-fault pickup levels allow early warning of insulation degradation
- Simplified design - Controls pulsing contractor 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

In addition to the features of the NGRM500, the **NGRM700** offers unique packaging that allows easy installation of the base unit and removal of the HMI for panel mounting. One Cat5 cable connects the two parts.

Features

All NGRM500 features in a different form factor plus:

- Detachable HMI
- Phase to-phase and phase-to-ground voltage monitoring

Benefits

- Designed for operation in extreme environments including an altitude rating of 5,000 meters above sea-level
- Program and display information without opening doors using door mounted HMI

Resistance-Grounding Systems

Series 1

High-resistance grounding system

Features and Options

- **Limits ground-fault current** - Allows power systems to remain in operation in a single-fault condition by limiting ground-fault current to a low level (1 - 10 A)
- **Pulsing ground-fault function** - Reduces the time required to locate ground-faults while the system remains online
- **Relay outputs** - Provides external fault indication or interruption where first-fault tripping is required
- **Artificial neutral** - Available to convert an ungrounded system to an HRG system
- **Visual indicators** - Wide variety available, including LEDs, analog gauges, and HMIs
- **Wall-mount, painted galvanized steel enclosure** - Back-plane configuration available on request
- **Certifications** - cULus listed to IEEE 57.32 and CSA 295



- Up to 12 feeders
- Ground-fault detection
- Pulsing
- Analog or digital metering
- Compact wall mount design
- Many low voltage designs UL listed to IEEE C57.32

Series 2 - Intermediate

High-resistance grounding system

Features and Options of Series 1 +

- **Multi-channel fault detection** - Individually monitor up to 60 feeders or loads to quickly identify and locate ground-faults
- **Feeder Level AC/DC fault detection** - Detects faults in systems with power conversion equipment, including variable frequency drives (VFD) and battery backup systems (UPS)
- **NGR connection monitoring** - Automatic detection of both open and shorted NGRs, preventing loss of ground-fault detection and dangerously high fault currents
- **Digital display** - Real-time readings using the built-in HMI
- **Integrated web server** - Get real-time data from any PC
- **Fieldbus communication** - Integrate with SCADA systems with Modbus TCP/IP
- Wall-mount or floor mount



- Up to 60 feeders
- AC/DC ground-fault detection
- Pulsing
- Resistor monitoring
- Harmonic filtering
- Communication / fieldbus
- Data logging

Resistance-Grounding Systems

Series 3 - Advanced Second-ground-fault protection system

Features and Options of Series 2 +

- **Multi-fault prioritization** - Prioritizes circuit tripping in the event of a second ground-fault, allowing critical circuits to remain in operation
- **PLC** - ground-fault location annunciation and simplified user interface
- **Two bus-tie connections** - Provides an additional layer of protection
- Scalable for very large systems



- Up to 120 feeders
- AC/DC ground-fault detection
- Second ground-fault protection
- Pulsing
- Resistor monitoring
- Harmonic filtering
- Communication / fieldbus
- Data logging
- Advanced feeder protection
- Touch screen HMI

LRG

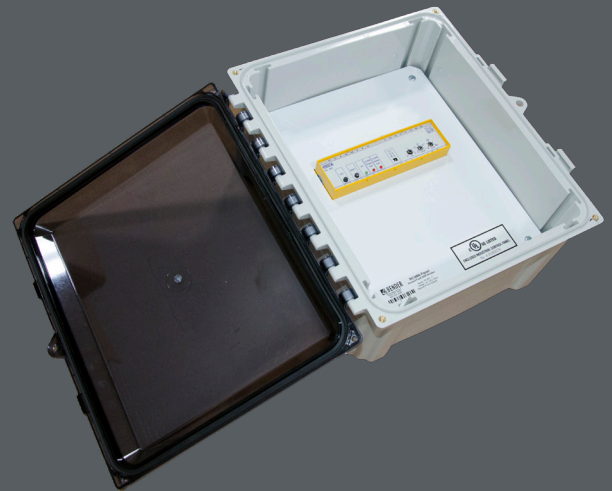
Low-resistance Grounding Systems

- 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 and increasing trend in leakage current to allow preventative maintenance



Additional options

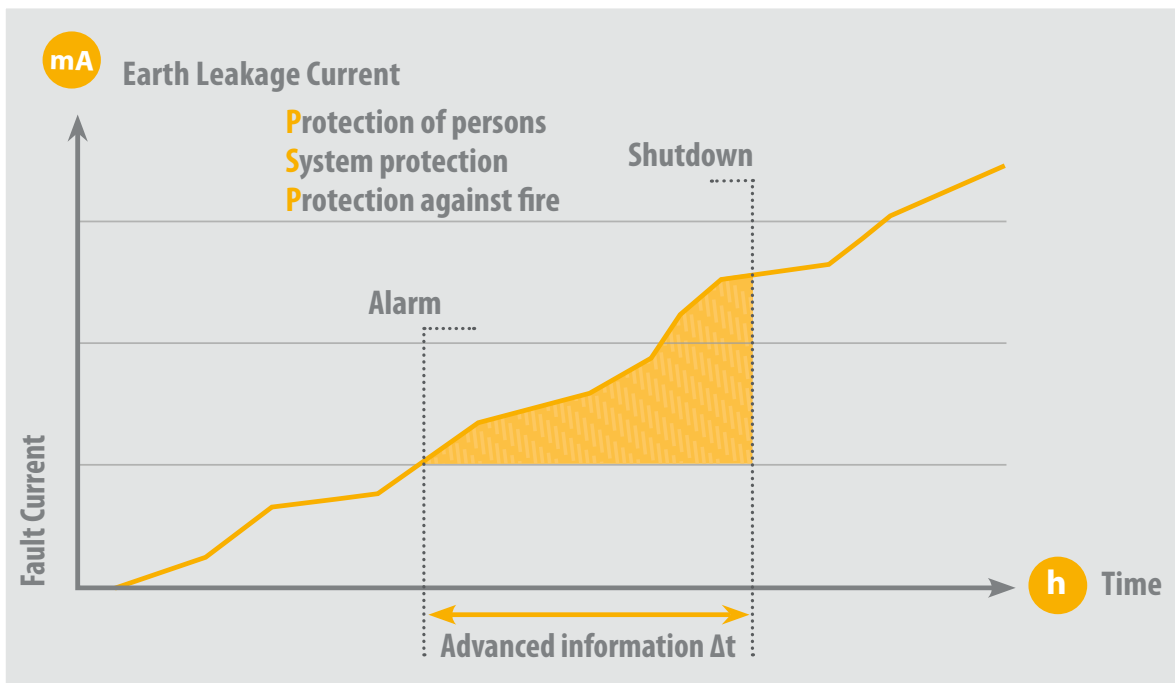
- **Separate NGR and controls** - All series available in two separate enclosures (controls and NGR)



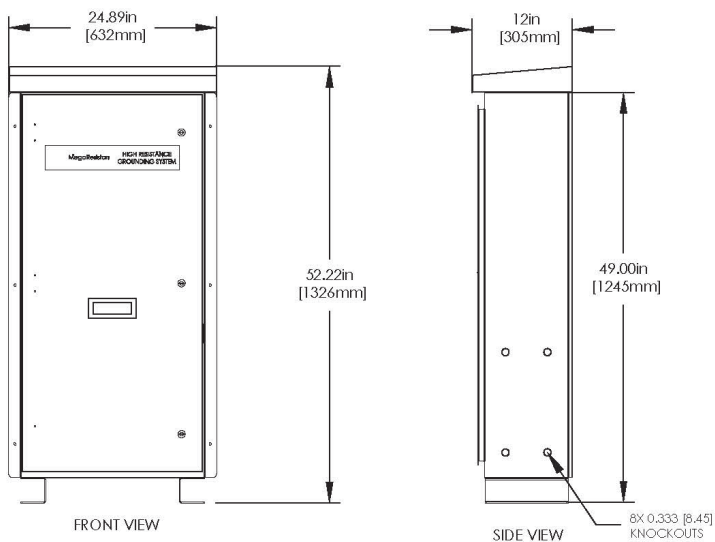
The World's Most Advanced Ground-Fault Protection

NGRM700 provide wide frequency ground-fault protection and harmonic analysis, and when a Type B CT is installed, can provide AC/DC detection.

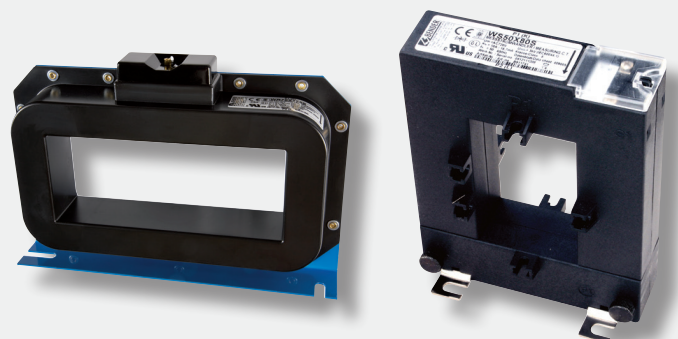
RCMS490 multi-channel ground-fault relays are used on many Bender NGR packages to provide advanced ground-fault indication or protection. As the graph below shows, they can provide advanced indication of degraded insulation and escalating leakage current:



Dimension drawings provided at time of quote:



Large window CT's are available for retrofitting existing switchgear:



Additional Bender Resistance Grounding System Components



RC48N

Features

- Monitors integrity of the NGR up to 5 kV with appropriate voltage rated coupling device (CD1000 / CD5000)
- Adjustable AC ground-fault trip value and time delays
- Two Form-C (SPDT) contact outputs
- Switchable wide band or band-pass filter



RCMS490 Series

Features

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

 MegaResistors



Resistors

Features

- Open, helical stainless steel wire wrapped around tubular, porcelain core
- Ideal for low-current conditions
- Excellent power dissipation, stable resistance
- Shock proofing

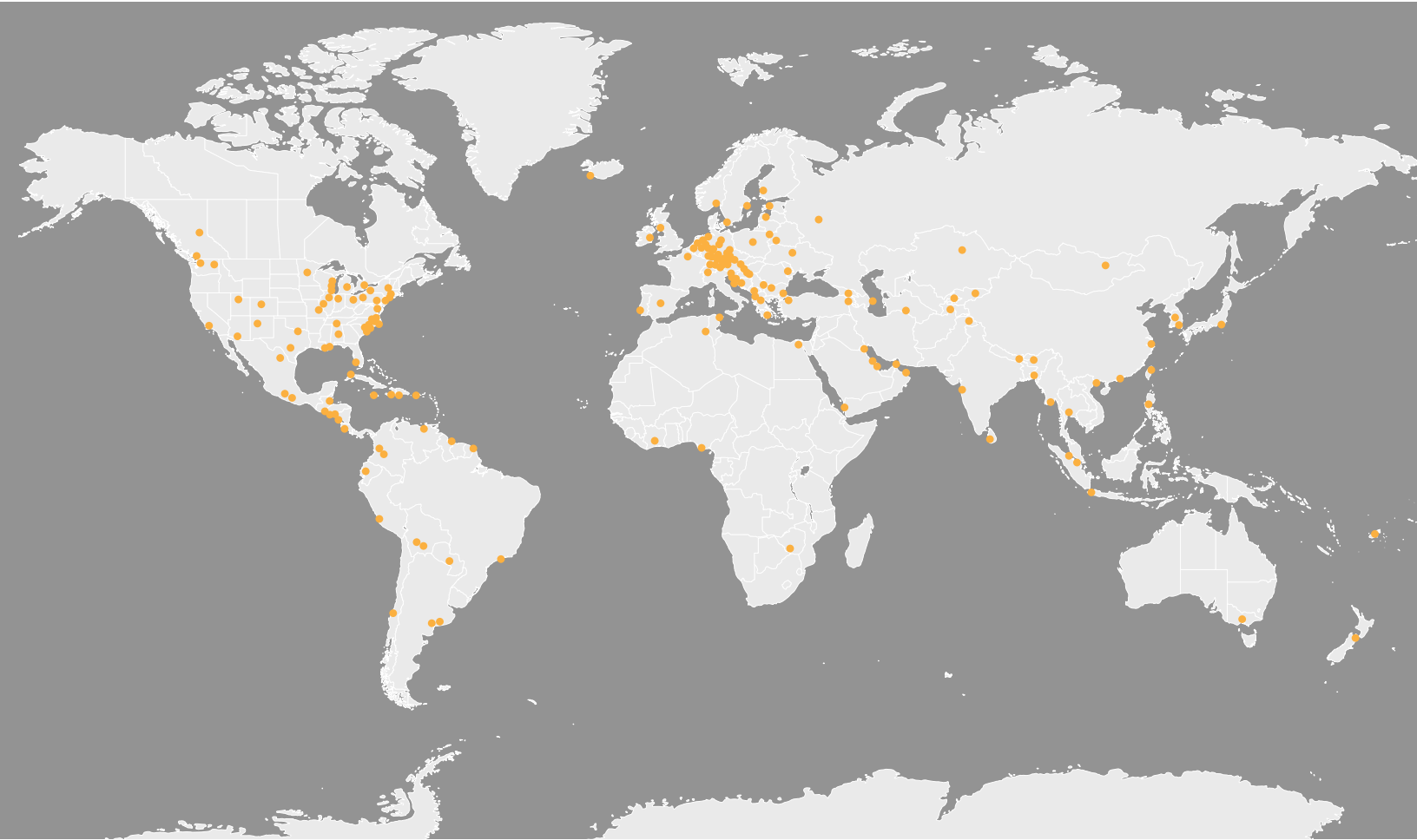


CT's

Features

- Measures 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

Bender is located in 70 countries around the world!



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