

# Marinas, Harbors, and Vessels

Electrical safety solutions



Intelligence in  
electrical safety

 BENDER

# Marinas, Harbors, Vessels

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## Insulation Monitoring Device for Shore and Ship Power Systems (iso685-D-P) + Earth Detection System (EDS 44x Series)

Monitor AC and DC ungrounded power systems with automatic fault location

- Minimizes unplanned outages and eliminates the need to interrupt power to identify faulted circuits
- Safeguards critical motors and pumps while improving continuity of service
- Eliminates labor-intensive fault location procedures by identifying faulted circuits automatically
- Protects against accelerated anode and other noble metal wear by continuously monitoring for leakage currents

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## Ground Continuity Monitoring (GM420, RC48C)

Monitor and detect deterioration of grounding conductors

- Reduces the risk of shock potential by monitoring grounding and bonding connections for shipyard cranes and shore-to-ship conductors
- Actively monitors for ground and cable deterioration in corrosive saltwater environments
- RC48C termination device meets the IEC/IEEE 80005-1 equipotential bonding specification for high voltage shore connections

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## High Resistance Grounded Systems (HRG Series)

Improve electrical safety and reliability of shore-to-ship power, emergency generators and shipyard cranes

- Reduces probability of an arc-flash incident by limiting current of the initial phase-to-ground fault
- Minimizes system interruption and enables continued operation of critical loads during ground-fault conditions
- Ensures system reliability by actively monitoring for short-circuit and open-grounding-resistor conditions
- Control touch potential during ground faults on portable loads and for shore-to-ship power supply (cold ironing)

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## Residual Current Monitors (RCM, RCMA, RCMS, RCMB Series)

Monitor AC and DC solidly grounded and/or resistance grounded systems

- Detects and locates ground faults in power conversion equipment
- Provide superior protection and information on faults by monitoring wide frequency range
- Minimizes unplanned outages and eliminates the need to interrupt power to identify faulted circuits
- Advanced filtering to prevent nuisance tripping

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## Protection against electric shock drowning (MarinaGuard®)

Sensitive ground-fault protection for marinas and docks

- Protects against hazardous ground-fault current to comply with NEC Article 555 and CEC Clause 78-052 requirements
- Type 4X enclosure with a high visibility strobe that flashes when an electrical hazard has been detected



Bender has a history of offering comprehensive know-how and solutions for safer power for maritime applications, including civilian, commercial, military, cranes and container handling systems. Bender's extensive experience in this industry has allowed for the development of devices which can withstand extreme environmental conditions. Bender works in close cooperation with the manufacturers of gantry crane systems to optimize protection against electrical faults and guarantee the safety of the operating personnel.

Additionally, today's recreational marinas and docks are filled with many potential electric hazards such as refrigerators, lighting, electric motors and pumps. Electrocution is the leading cause of death, injury and equipment damage in marinas and docks. Bender MarinaGuard® products help alert, locate, and de-energize faulted circuits which reduces the potential for Electric Shock Drowning (ESD) in fresh or saltwater applications.



## Complete electrical safety solutions for marinas - Stay on top of any potential water shock hazards

### Why does a marina need ground-fault protection?

The combination of water and electricity can create a hazardous situation. Boats continuously connecting to and disconnecting from shore power, poor ground bonding, "hot" conductors touching ground, mechanical damage and corrosion can lead to the possibility of electric current flow into the water. This situation is hazardous for people who come into contact with the water, resulting in severe injury or death by electric shock drowning (ESD).

### Requirements for ground-fault protection

There are several standards, code requirements, and state laws that require ground-fault protection on marina shore power, including:

- National Electric Code (NFPA 70 / NEC), Article 555.35
- NFPA 303 (Fire Protection Standard for Marinas and Boatyards)
- Canadian Electrical Code (CSA C22.1), Rule 78-052

### Advanced ground-fault monitoring systems by Bender

Bender provides advanced ground-fault monitoring and protection systems to assist in the mitigation of ground faults and electric shock hazards for marinas. Alarms activate or the power supply is tripped when a ground fault is detected, including at the moment a boat connects to shore power. Monitoring capabilities can be provided at the main feeder and coordinating with the individual pedestals and boats.

Low-level ground-fault current can be detected, even at the "let-go" current level and below. Continuous monitoring with digital metering inform staff and technicians of ground fault issues, assisting in predictive maintenance. Selective coordination allows bilge pumps in adjacent vessels to continue to operate, preventing sinking while moored.

### Marina-ready ground fault protection at the dock

The NEC requires 5, 30, or 100-mA ground-fault protection (tripping) for all marina electrical installations. Bender's MarinaGuard® provides advanced, protection in an easy to install solution designed specifically for marina docks. The MarinaGuard provides ground fault monitoring and circuit interruption by shunt tripping main and branch feeder circuit breakers, ideal for both new construction and retrofit installations.

# Main feeder and branch feeder protection

## A complete ground fault solution for marina power

### Benefits:

- Easily alert swimmers and pedestrians about stray electrical hazards
- Cost-effective solution to mitigate risks
- Secure enclosure, preventing unauthorized deactivation
- Fulfills requirements of various codes and laws, including NEC Article 555.35 listed Ground-Fault Protection of Equipment (GFPE)
- Time-coordinated protection to deenergize the faulted circuit without tripping the remaining system (selective coordination)



MarinaGuard® series ground fault monitoring system

### Features:

- UL1053 listed
- A complete ground fault monitoring solution for shore power feeders and branch circuits
- Units are factory set for 30 mA protection. They may be field adjusted to conform to local regulations
- Perfect for new installations and system retrofits to comply with new or updated regulations
- Strobe light for clear visual indication of alarm or trip status
- Options available for monitoring 1 or up to 12 feeders or branch circuits from one panel
- Self-test (without tripping) and manual test functions
- Lockable Type 4X enclosure conforming to NEC 555 requirements for marina panelboards
- Tamper resistant enclosure and wiring methods



# Bender ground fault protection relays inside

## Advanced ground fault monitoring for marina safety



RCM420 series ground fault monitor - MG-1.3

### Features:

- Single channel monitoring (main circuit breaker or one load)
- Digital display provides real-time readings. Unit information can be easily accessed by technicians
- Adjustable trip level from 10 mA to 10 A
- Two SPDT contact outputs
- Password protected to prevent unauthorized setting changes
- Compatible with a wide variety of circular and rectangular Bender current transformers (installed at the monitored feeder)



CTAC series Current Transformers

### Features:

- Sensitive current transformers for use with Bender ground-fault relays
- Available in
  - 20mm (.78")
  - 35mm (1.37")
  - 60mm (2.36")
  - 120mm (4.72")
  - 210mm (8.26")



RCMS490 series ground fault monitor - MG-T.3

### Features:

- 12 channel monitoring (allows selective coordination)
- Individual trip level settings for each channel / branch
- Digital display provides real-time readings. Unit information can be easily accessed by technicians
- Adjustable trip level from 6 mA to 20 A ; preconfigured for 30-mA protection
- Individual SPST contact outputs for each channel
- Password protected to prevent unauthorized setting changes
- Compatible with optional communications gateway modules
- Compatible with a wide variety of circular and rectangular Bender current transformers (installed at the monitored feeder)
- UL 1053 listed ground-fault protection



Bender Service

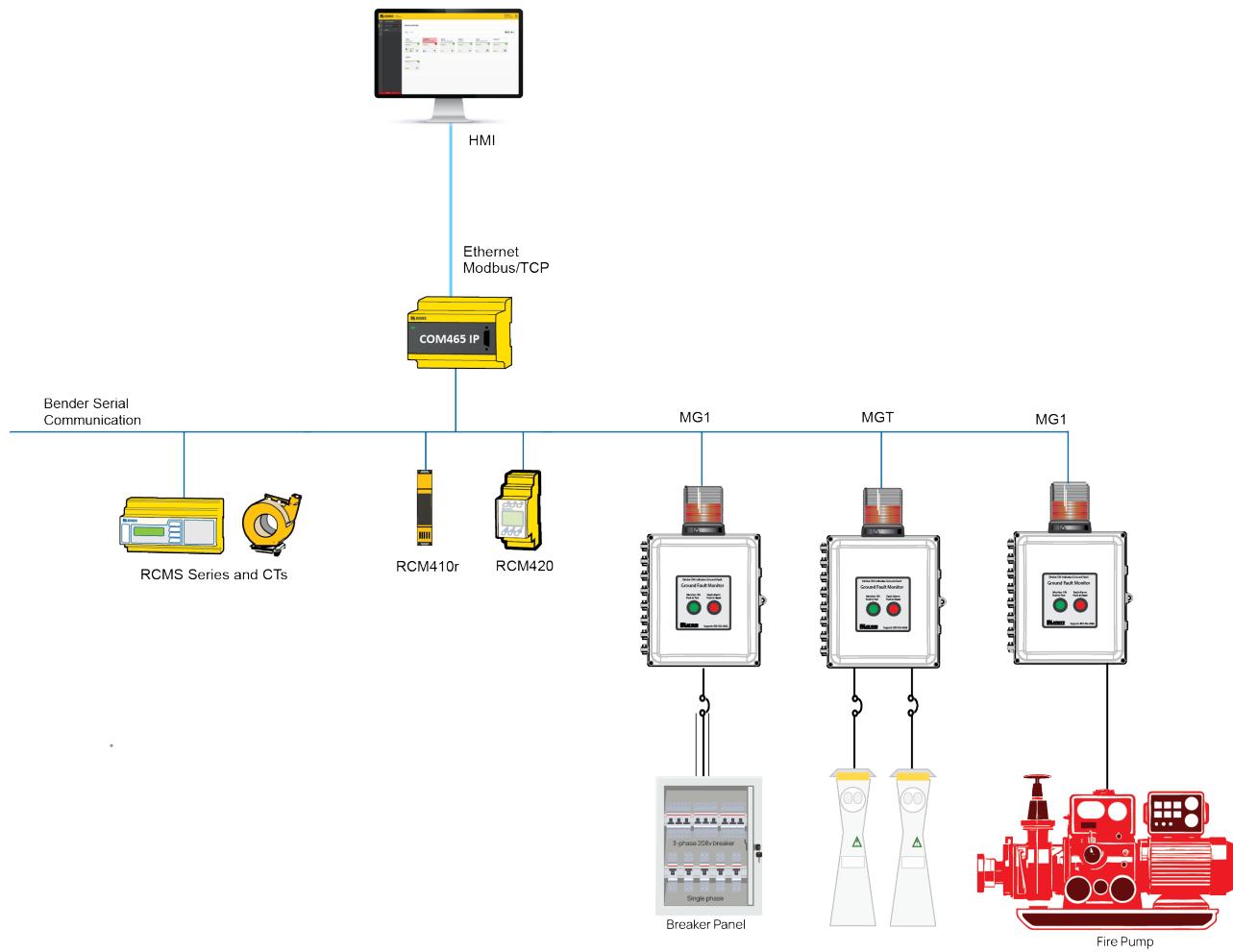
### Features:

- Factory trained experts to assist with commissioning the equipment and training local staff or owners

## Communication and centralized branch monitoring with MarinaGuard®

Remotely monitor one or several MarinaGuards for ground fault alerts from a centralized location, for rapid maintenance response to electrical problems

- Supports remote digital communication - connect to networks such as Ethernet and Modbus/TCP
- Able to support remote stations to monitor multiple panels from a centralized location
- Keep a data log to indicate problem circuits or vessels
- Requires optional communications gateway module

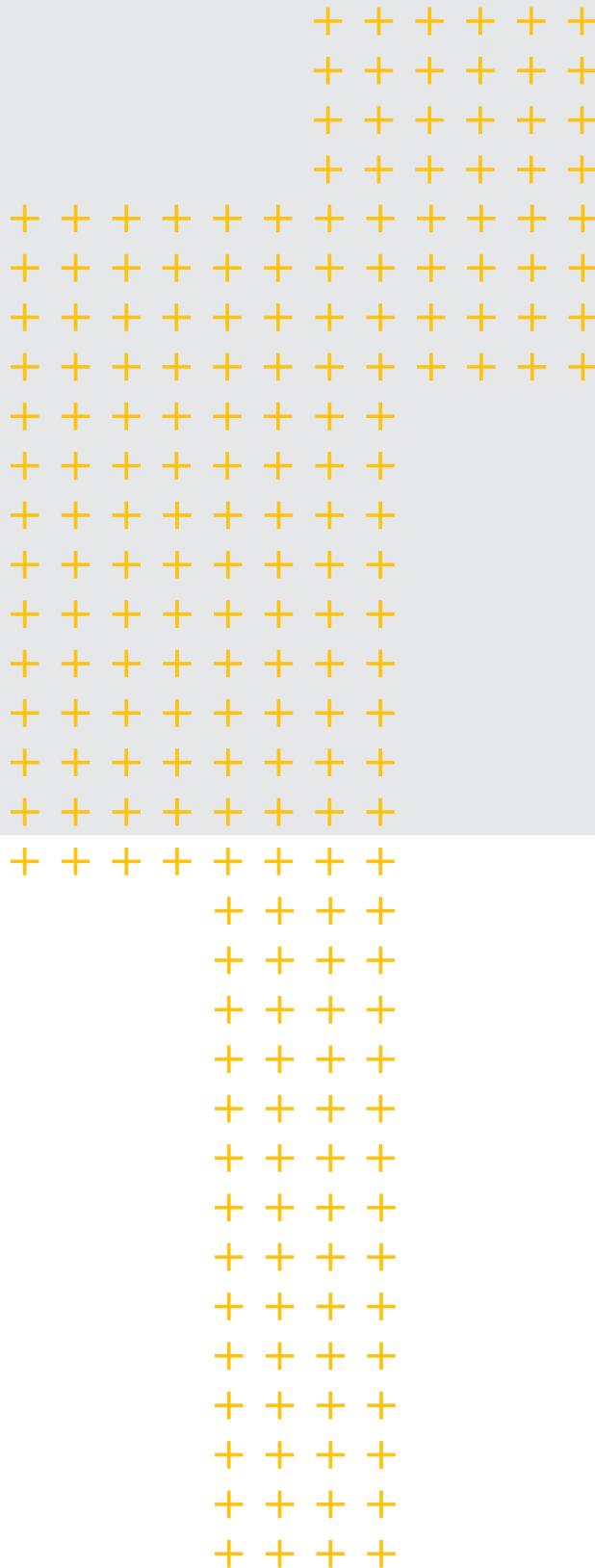


Drawing: Marina communications and centralized branch monitoring with MarinaGuard

## Testimonial

Senergy installed a Bender ground fault monitoring system at a new marina located in Winchester, TN. "At start-up and commissioning of the entire system, the Bender support staff was onsite to assist with this task, which went flawless. Bender support staff went through owner training showing us and the owner what the system was capable of performing and how to navigate through all screens. The electrical inspector was very pleased with the system and operations as were Senergy. We look forward to installing the Bender ground fault monitoring system on future marinas."

-Doug Sullivan, Project Manager  
Senergy, LLC



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