

MarinaGuard[®]



MG-1 Ground Fault Monitoring Panel For Marina Shore Power

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1. Introduction

1.1 MarinaGuard

MarinaGuard UL Listed Ground-Fault Protection Panels detect ground faults in feeder and branch circuits of electrical systems in marinas, boat yards, floating buildings, docking facilities, and similar locations. When correctly installed, MarinaGuard panels satisfy the requirements of National Electrical Code 555.35 (A) & (B)(1), 555.53 & 682.15 (B) (2023 edition); NEC 555.32, 555.35 (A)(1) & (3), 555.53, & 682.15 (B) (2020 edition); NEC 555.3 & 682.15 (2017 and earlier editions); and Canadian Electrical Code 78-052. The trip level can be set below the maximum Code-allowed trip level, if desired and the trip time can be adjusted for coordination with downstream protection. External current transformers, purchased separately and installed in distribution equipment, are used for measuring ground-fault current. Shunt-trip circuit breakers are required to interrupt the faulted circuit in the event of a ground fault. MarinaGuard panels require a site-supplied 120-Vac control voltage.

MarinaGuard features a lockable non-metallic type 4X enclosure suitable for outdoor use. A red strobe light mounted to the top of the enclosure provides clear visual indication of a trip or internal malfunction, and a "weep" fitting allows condensed moisture to drain.

1.2 Monitored Circuit

The MG-1.3 provides monitoring for a single circuit. The monitored circuit can be a single, split, or three-phase configuration. A ground fault in the circuit on the load side of the current transformer will be detected.

1.3 Current Transformers

Each monitored circuit requires a single ground-fault current transformer installed in the electrical-distribution equipment, with its secondary winding connected to the MarinaGuard panel. Current transformers are ordered separately and must match application requirements. Bender CTAC series CT's are compatible with MarinaGuard panels. See the CT datasheet for additional information.

2. Safety Instructions

2.1 General Safety Warning



DANGER

Hazard of Electric Shock, Burn, or Explosion

Only qualified maintenance personnel should operate or service this equipment. These instructions should not be viewed as sufficient for those who are not otherwise qualified to operate or service this equipment. No responsibility is assumed by BENDER for any consequences arising from use of this document.

Turn OFF all sources of electric power before performing any inspections, tests, or service on this equipment. Assume all circuits are live until they have been properly de-energized, tested, grounded, and tagged. Failure to observe these precautions will result in equipment damage, severe personal injury, or death.

Proper operation of this equipment depends on proper installation. Refer to NFPA 70, NFPA 70E, CSA Z462, and other relevant standards and codes for installation standards. Neglecting fundamental installation techniques will result in equipment damage, severe personal injury, or death.

Do not make any modifications to the equipment. Failure to observe this precaution will result in equipment damage or personal injury.

Use only manufacturer's and manufacturer recommended accessories with this equipment. Failure to do so may damage the equipment beyond repair.

To prevent unauthorized access, the panel should be locked unless being serviced by qualified personnel.

2.2 Using This Manual

Read these instructions carefully and become familiar with the equipment before attempting to install, operate, or service it. Throughout this manual, special messages may appear to warn of potential safety hazards or to call attention to information which clarifies instructions or procedures. Observe all safety messages that appear throughout this manual to avoid possible injury or death. An explanation of these symbols is given below.



DANGER: Indicates a hazardous situation which, if not avoided, **will** result in death or severe injury.



WARNING: Indicates a potentially hazardous situation which, if not avoided, may result in death or injury.



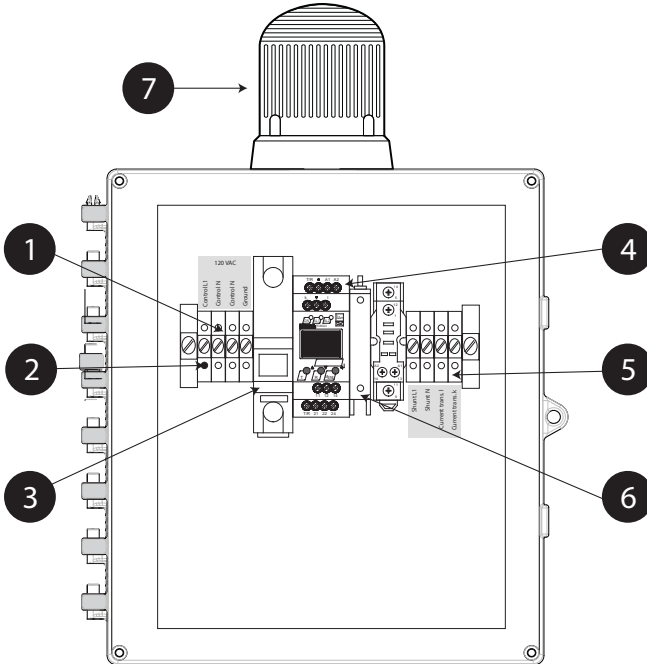
CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in injury or equipment damage.



NOTE: Provides additional information to clarify instructions for a product or procedure.

3. Installation and Connection

3.1 Internal Components

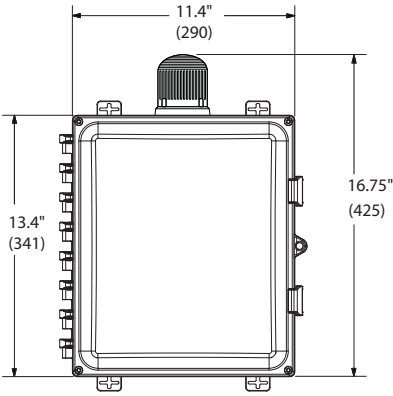


1	Terminal blocks for external 120 VAC control power and ground
2	Power indicating light - illuminates when control voltage is applied to panel, even if internal circuit breaker is open
3	Branch-circuit-rated circuit breaker - protects internal components and external trip circuit
4	RCM420 ground fault relay
5	Terminal blocks for external trip circuit and current transformer
6	Fuse holder - contains fuse protecting RCM420
7	Strobe light - flashes when ground fault is detected and circuit has tripped, the fuse is open, or the RCM420 malfunctions

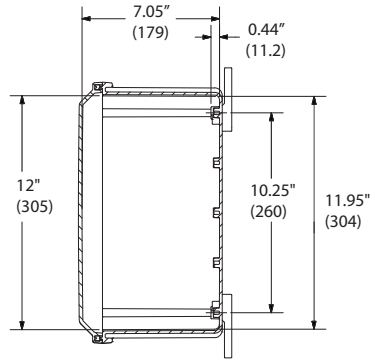
3.2 Dimensions

Dimensions shown in inches (mm). Mounting feet are shown installed. A weep hole is provided on the bottom of the panel to comply with NEC 555.32 (2020 & 2023 editions) and 555.11 (2017 and earlier editions).

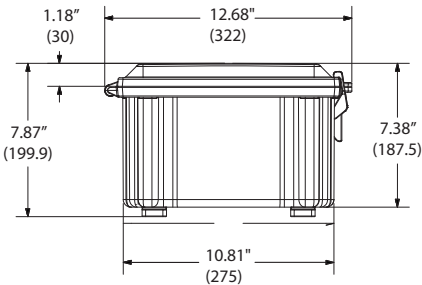
The enclosure is lockable.



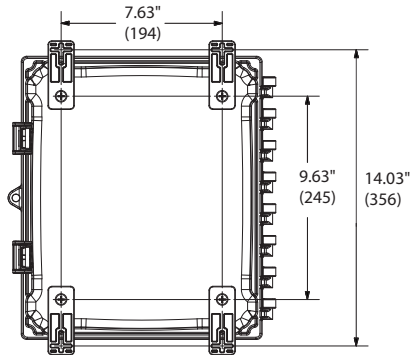
Front View with Strobe



Side View



Bottom View



Rear View

Model	Weight
MG-1.3	9.4 lb. (4.3 kg)

3.3 Mounting

Mounting feet are included with MarinaGuard panels. Place the mounting brackets over the octagon bosses. Fasten them to the enclosure using the provided 1/4"-20 x 0.25" SS, countersunk Phillips drive screws (30 in-lb torque limit).



NOTE: Mount the panel vertically, with the strobe light on the top.

3.4 Conduit

- Conduit shall be installed at the lower left or lower right sides of the panel.
- Conduit holes may be cut using standard hole saws. Secure the conduit, the connector, and the locknut through a pre-drilled hole.
- For metallic conduit, secure a grounding bushing over the connector locknut. All threaded inserts in the enclosure and for cover attachment are brass #10-32.



NOTE: Any fittings used must comply with any governing electrical code or requirements. Any fittings must also maintain the application-required enclosure rating.

3.5 Wiring - General Instructions



HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

This equipment must only be installed and serviced by qualified personnel.
 Disconnect all power before servicing.
 Observe all local, state, and national codes, standards and regulations when installing this equipment.

Failure to follow these instructions will result in death or severe injury.

3.5.1 Wire Size and Type

Use minimum 22, maximum 14 AWG wire. Use copper wire only. Current transformer connections must be made with 600 V rated conductors.

3.5.2 Wire Strip Length

Type	Wire Strip Length
All terminal blocks in MG-1	0.39" (10 mm)

3.5.3 Recommended Tightening Torque

Type	Tightening Torque
All terminal blocks in MG-1	5.0 - 5.6 lb-in (0.6 N-m)

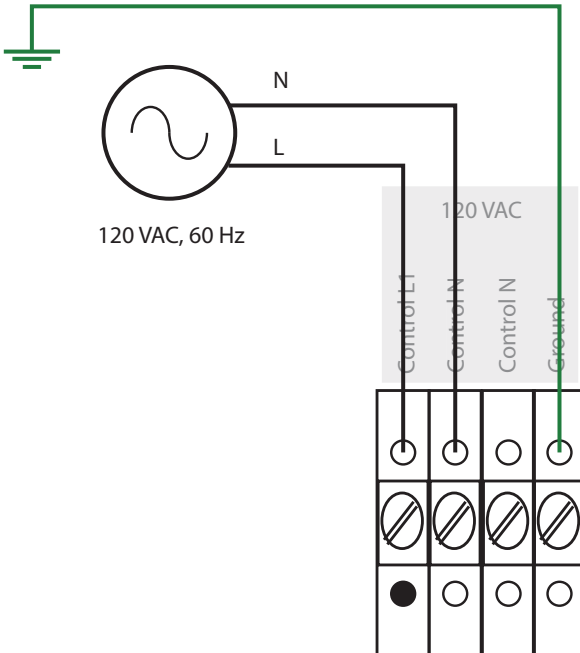
3.6 Wiring

3.6.1 Control Power and Ground Connections

Locate the connections labeled as Number 1 in the diagram in Section 3.1 (Page 7). Refer to the wiring diagram below. Use 120 VAC, 60 Hz, grounded power only. Make the connections to the top side of terminal blocks.

A branch-rated circuit breaker is provided to protect internal components, protect the external trip circuit, and allow connection to a feeder tap. Connection to a feeder tap increases the security of the ground-fault protection panel by making it electrically tamper resistant. Use a padlock to restrict access to internal components.

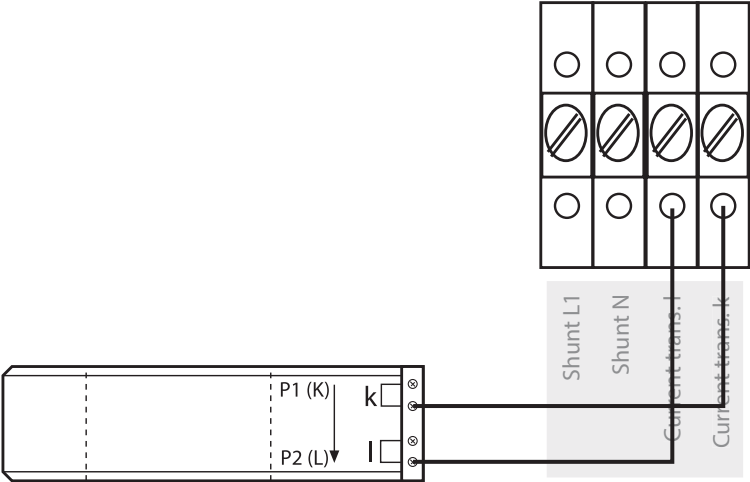
The L1 terminal block contains an indicating light, illuminating when control voltage is applied to the panel, regardless of the state of the internal circuit breaker.



3.6.2 Current Transformer Connection

Locate the connections labeled as Number 5 in the diagram in Section 3.1 (Page 7). Refer to the wiring diagram below. Make the connections to the bottom side of the terminal blocks.

Refer to Section 3.7 for instructions on routing system conductors through the current transformer.



3.6.3 External Trip Circuit Connection

A powered, non-fail-safe (normally open), output is provided to connect to an interruption device such as a shunt trip circuit breaker. Observe the following requirements when connecting an interruption device:

- Operation: Non-fail-safe, normally open, continuous closed when tripped
- Voltage: 120 VAC, 60 Hz coil
- Current draw: Minimum 1 mA, maximum 5 A

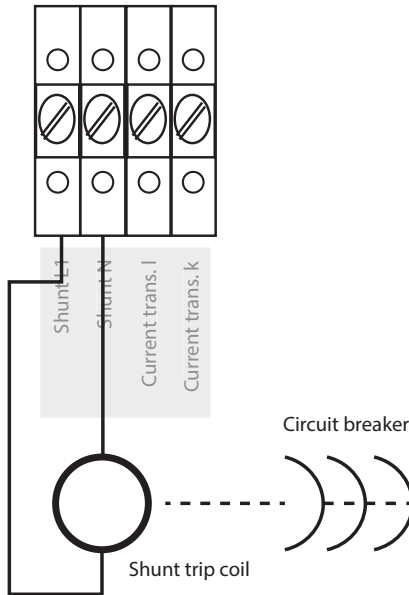


CAUTION: Do not connect interruption equipment that does not meet the requirements listed above. Connecting incompatible equipment may result in injury or equipment damage.

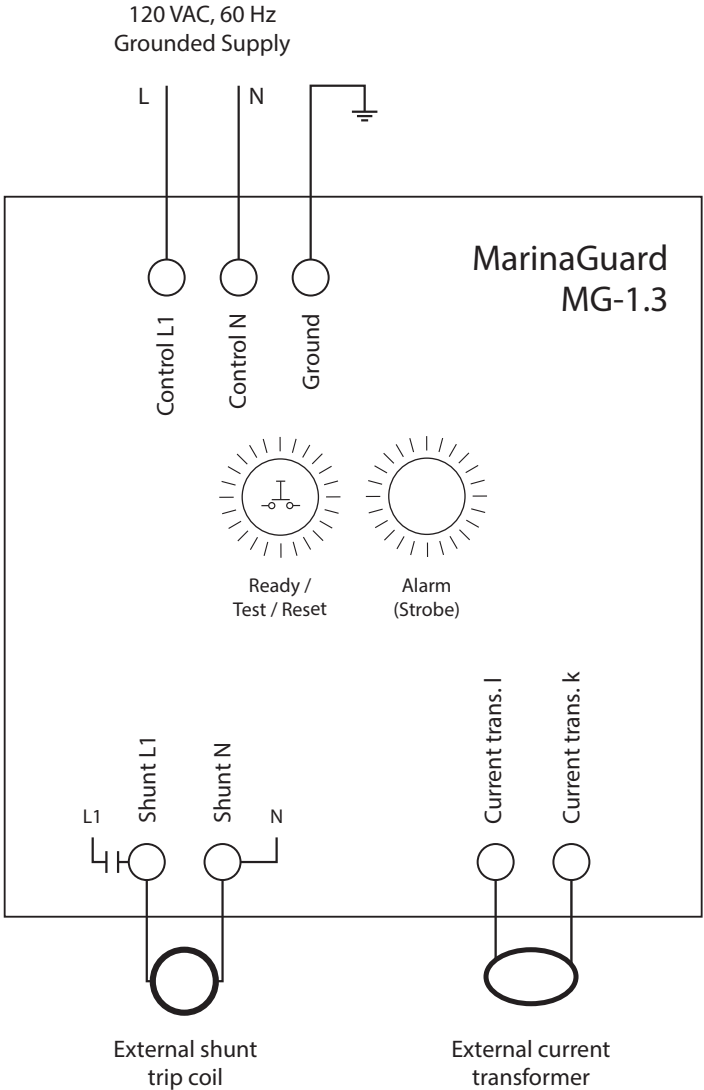


NOTE: Contact Bender if application requirements differ from those above, or if a separately derived trip voltage is required.

Locate the connections labeled as Number 5 in the diagram in Section 3.1 (Page 7). Refer to the wiring diagram below. Make connections to the bottom side of the terminal blocks.



3.6.4 Wiring Block Diagram Reference



3.7 Current Transformer Installation

Install one current transformer on the circuit to be monitored. The current transformer will detect a ground fault on the load side of its location. Pass all active conductors of the monitored circuit, including the neutral if present, through the current transformer opening. Do not pass the ground conductor through the current transformer.

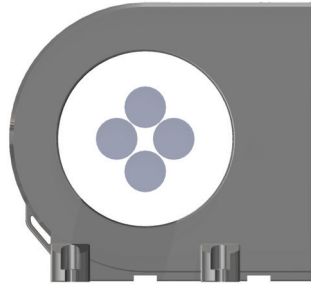
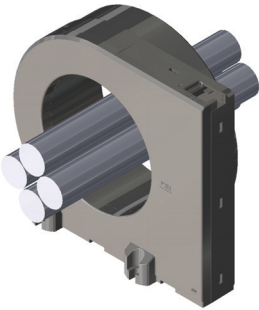
Ensure that the conductors are placed centrally through the opening. Direction (polarity) is unimportant. A monitored circuit will consist of two, three, or four conductors. Refer to figures below.



CAUTION: Do not route the ground conductor through the current transformer.



NOTE: Only specified Bender current transformers are compatible. Refer to Section 6. for a list of devices. Third party current transformers are not supported.



3.8 Field Adjustments



WARNING: Do not change any settings other than those shown in this chapter. Incorrect settings may result in death, personal injury, or damage to equipment.

3.8.1 RCM420 Ground-Fault Relay

The MG-1.3 MarinaGuard incorporates a Bender RCM420 series ground-fault relay. Key settings affecting the performance of the MarinaGuard are listed below. For additional information on use, refer to the RCM420 user manual.

3.8.2 Main Alarm

The RCM420 has an adjustable trip level range of 10 mA to 10 A (factory setting 30 mA). This value is adjustable to fit application requirements. The main alarm will activate the strobe light and trip the connected interruption device.

3.8.3 Pre-Trip Alarm

The pre-trip alarm is set as a percentage of the main trip alarm value. For example, the factory setting is 70% of 30 mA, which equates to 21 mA. The pre-trip alarm will only activate the RCM420 LED AL1. Connected interruption devices will not trip and the strobe light will not activate.

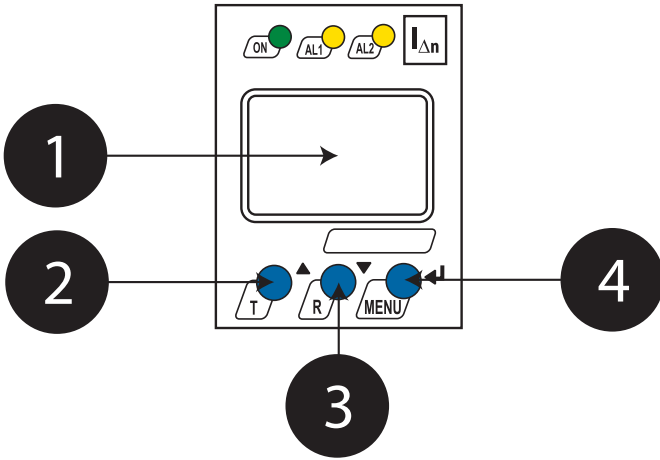
3.8.4 Time Delay




The RCM420 has an adjustable trip delay range of 0 to 10 s (factory setting 100 ms). This value is field adjustable for selective coordination of cascaded devices to minimize the number of de-energized circuits.

3.8.5 Digital Display

The RCM420 has a digital display which shows the measured ground-fault current in real-time. The display and pushbuttons are used to adjust factory settings. By default, the RCM420 is password protected with password "001." No settings can be changed until this password is entered.

3.8.6 RCM420 Interface Elements



1		Digital display Shows ground-fault current readings and menu options.
2		T / UP button: Scrolls up inside device main menu.
3		R / DOWN button: Scrolls down inside device main menu.
4		MENU / ENTER button: Activates main menu / confirms or cancels step inside main menu.







3.8.7 Using the Push Buttons

Hold for > 1.5 s	Press and hold the specified button for at least 1.5 seconds. Release the button when the display changes to the next menu item.
Press	Momentarily press the specified button.

3.8.8 Password Protection

When attempting to change any settings in the main menu, a prompt will appear to enter a password. Follow the steps below to enter the password. The factory setting is "1."














Once the correct password is entered, settings can be changed until leaving the main menu. Upon re-entering the main menu, the password must be entered again.

 Short press 	With the display showing the setting to be changed, press the MENU button. The lock icon will become solid. Three dashes will flash in the middle of the screen..
 Password Entry 	Press the UP and DOWN buttons to enter in the password (example shown: 470).
 Short press 	Press the MENU button. If the correct password was entered, the display will return to the previous menu item and settings will be modifiable until exiting the main menu.


















3.8.9 Change Trip Level

























CAUTION: Consult all federal, state/provincial, or local requirements before adjusting trip levels. Do not set the trip level above what is allowed by a governing code, standard, or regulation.

 Hold > 1.5 sec	 <p>Hold the MENU button for > 1.5 s. A flashing "AL" will appear on the screen.</p>
 Short press	 <p>Press the MENU button. A number will appear in the middle of the screen. "1 2" will appear flashing in the top right corner, and a greater than symbol (>) will appear flashing on the left side.</p>
 Short press	 <p>Press the MENU button. Password entry will be required. Afterwards, the "1 2" and greater than symbol will become solid, and the number in the middle will flash.</p>
 Pickup level adjustment	 <p>Press the UP and DOWN buttons to change the pickup level to the desired amount. At a certain threshold, the value may change to a decimal value with a "k" to the right. This indicates that the place of the value has changed and is measured multiplied by 1000 (in the example shown, 0.80k is equal to 800 A).</p>
 Short press	 <p>Once completed, press the MENU button to confirm the value. The number will become solid, and "1 2" and the greater than symbol (>) will flash.</p>
 Hold > 1.5 sec	 <p>Hold the MENU button for > 1.5 s. A flashing "AL" will appear on the screen.</p>
 Hold > 1.5 sec	<p>Hold the MENU button again for > 1.5 s. The device will exit the menu and return to the normal display.</p>

3.8.10 Change Trip Time Delay

 <p>Hold > 1.5 sec</p> 	<p>Hold the MENU button for > 1.5 s. A flashing "AL" will appear on the screen.</p>
 <p>x 2</p> 	<p>Press the DOWN button twice. A flashing "t" will appear on the screen.</p>
 <p>Short press</p> 	<p>Press the MENU button. A number will appear in the middle. A flashing "ton" will appear in the lower left corner, and a flashing "1" will appear in the top right corner.</p>
 	<p>Press the DOWN button once. The number "1" in the top right corner will change to "2." This is the time delay for the main pickup alarm.</p>
 <p>Short press</p> 	<p>Press the MENU button. Password entry will be required. Afterwards, the "2" and "ton" will become solid, and the number in the middle will flash.</p>
 <p>Delay Adjustment</p> 	<p>Press the UP and DOWN buttons to adjust the time delay to the desired value.</p>
 <p>Short press</p> 	<p>Once complete, press the MENU button. The middle number will become solid, and the "ton" and "2" will flash.</p>
 <p>Hold > 1.5 sec</p> 	<p>Hold the MENU button for > 1.5 s. A flashing "t" will appear on the screen.</p>
 <p>Hold > 1.5 sec</p>	<p>Hold the MENU button again for > 1.5 s. The device will exit the menu and return to the normal display.</p>

3.8.11 Change Password

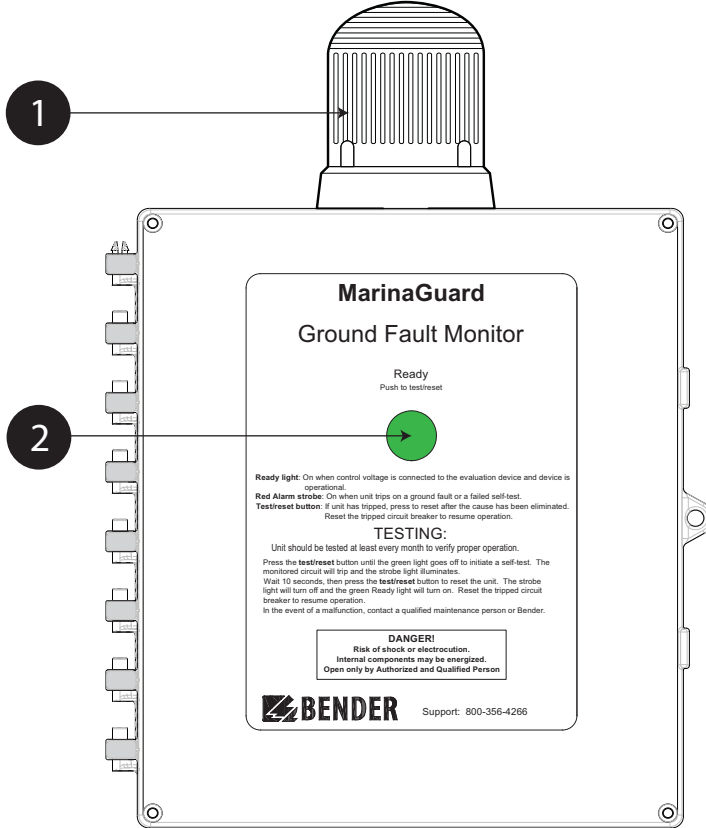
 <p>Hold > 1.5 sec</p> 	<p>Hold the MENU button for > 1.5 s. A flashing “AL” will appear on the screen.</p>
 <p>x 3</p> 	<p>Press the DOWN button three times. A flashing “SET” will appear on the screen.</p>
 <p>Short press</p> 	<p>Press the MENU button. The word “HI” will appear in the middle of the screen.</p>
 <p>x 2</p> 	<p>Press the DOWN button twice. A flashing lock icon will appear in the lower right corner, and the word “on” will appear in the middle.</p>
 <p>Short press</p> 	<p>Press the MENU button. The lock icon will become solid. Three dashes will flash in the middle of the screen..</p>
 <p>Password Entry</p> 	<p>Press the UP and DOWN buttons to enter in the password originally stored in the device (example shown: 470).</p>
 <p>Short press</p> 	<p>Press the MENU button. The number will become solid, and “on” at the bottom will appear and flash.</p>
 <p>Short press</p> 	<p>Press the MENU button. The “on” will no longer appear, and the number will flash.</p>
 <p>Password Adjustment</p> 	<p>Press the UP and DOWN buttons to enter in the new password (example shown: 282).</p>
 <p>Short press</p> 	<p>Once completed, press the MENU button. The word “ON” will appear in the middle to indicate the new password has been set. The lock symbol will flash.</p>
 <p>Hold > 1.5 sec</p> 	<p>Hold the MENU button for > 1.5 s. A flashing “SET” will appear on the screen. Hold the MENU button again for > 1.5 s. The device will exit the main menu.</p>

3.8.12 Factory Default Settings

	Description	Range	MG-1.3 Factory Setting	
	Main alarm trip level	10 mA - 10 A	30 mA	
	Prealarm trip level	50 - 100% (based on main alarm)	50%	
	Hysteresis	10 - 25%	15%	
	Latching behavior (Fault memory)	ON (latching) / OFF (non-latching) / CON (remains latched on power restore)	ON (latching)	
	Relay K1 operation (failsafe / non-failsafe)	N/O (non-failsafe) / N/C (failsafe)	N/C	
	Relay K2 operation (failsafe / non-failsafe)	N/O (normally de-energized) / N/C (normally energized)	N/O	
	Reload Cycles	0 - 100	0	
		Relay K1 trips on device error	ON / OFF	ON
		Relay K1 trips on main alarm	ON / OFF	OFF
		Relay K1 trips on prealarm	ON / OFF	ON
	Relay K1 trips on device self-test	ON / OFF	ON	
		Relay K2 trips on device error	ON / OFF	ON
		Relay K2 trips on main alarm	ON / OFF	ON
		Relay K2 trips on prealarm	ON / OFF	OFF
Relay K2 trips on device self-test		ON / OFF	ON	
		Response delay for prealarm	0 - 10 s	1 s
	Response delay main alarm	0 - 10 s	0.1 s	
	Startup delay (applies only on device startup)	0 - 10 s	0.5 s	
	Delay on release (to return to normal state)	0 - 99 s	1 s	
	Change between overcurrent / undercurrent / window	Hi (overcurrent) / Lo (undercurrent) / In (window)	Hi	
	Add transformer ratio for cascaded current transformers	1 - 100 (assuming 1 A secondary) (ex. 100 = 500.5)	1	

4. Operation

4.1 Panel Interface Elements



1	<p>Strobe light: Flashes red when circuit is tripped due to a ground fault, internal fuse has failed, or self-test has failed.</p>
2	<p>Ready light / Test and Reset button: Illuminates green when panel is powered and internal RCM420 is in the normal condition.</p> <p>Push and hold the button for > 1.5 s to initiate a functional test. Refer to Section 4.3 (Page 24) for what occurs during a self-test. When tripped, momentarily press the button to reset the MG-1 and return to the normal state. After the ground fault is eliminated, external trip devices can be reset.</p>

4.2 Applying Power

To apply power, close the circuit breaker or disconnect to the 120 VAC control power entering the panel. The MarinaGuard will immediately power on. The green READY light will illuminate.



NOTE: During startup, the strobe may flash briefly. This is normal power-up operation.

4.3 Performing a Functional Test



CAUTION: Performing a functional test will trip the circuit interrupting device and de-energize the monitored circuit.

- Press and hold the TEST/RESET button for at least two seconds. The strobe light will activate and the connected circuit breaker will trip.
- Wait 10 to 15 seconds until the internal self-test is completed.
- Momentarily Press the TEST/RESET button. The strobe light will turn off.
- Manually reset the connected circuit breaker.

5. Troubleshooting

5.1 General Troubleshooting

Condition	Possible Cause	Actions
No power to panel or connected circuits	De-energized or incorrect control power	If power indicator light on Control L1 terminal block is not lit, verify control connections for proper polarity. Verify external power supplied to panel.
	Internal circuit breaker open	Internal circuit breaker must be switched to ON for internal components and externally connected shunt trip breaker coils to receive power.
No power to internal ground fault relay	Blown fuse	Check condition of fuse protecting ground fault relay. Determine root cause of blown fuse and replace as necessary.
Unit does not reset after trip, test, or startup	Internal device error	Refer to Section 5.3 for error code information.
	Improper settings	Verify all settings are correct for the application. Verify any settings that must not be changed are the same as factory defaults.
Unit immediately trips after resetting connected shunt trip breaker	Ground fault	Verify any ground faults are cleared before resetting circuit breakers.

5.2 Fuse Replacement

Each panel contains quantity one of the fuse listed below.

Model	Fuse
MG-1.3	5 A / 250 V, type 3AG fast-acting fuse

5.3 Error Codes

Error codes are shown on the internal RCM420 display.

Error Code	Possible Cause / Actions
E.01 or E.02	CT connection monitoring failed. Verify current transformer is connected with proper polarity for k and l terminals.
All others	Contact Bender.

5.4 Technical Specifications

Supply	120 VAC
Relay protection fuse	5 A type 3AG fast acting
Internal overcurrent protection	15 A UL 489 circuit breaker
Ground-fault monitor	RCM420-D-2
Pickup range	10 mA to 10 A (30 mA factory setting)
Trip delay range	0 to 10 s (100 ms factory setting)
Current	1 A RMS, 5 A peak
Maximum protected-circuit voltage	600 Vac
Current withstand rating	160 A, 1 s
Dimensions (W x H x D)	11.4 x 16.75 x 7.87" (290 x 425 x 200 mm)
Weight	9.4 lb (4.3 kg)
Shipping weight	10 lb (4.5 kg)
Compatible current transformers	CTAC series
Compatible trip device	shunt trip, 120 Vac
Field connections	Copper wire only, 22 to 14 AWG, 60/70 C
CT-input and shunt-trip terminals, torque	5.0 to 5.6 lb-in (0.6 Nm)

6. Ordering Information

6.1 MarinaGuard

Part No.	Channels	Outputs	Ordering No.
MG-1.3	1	1	B541300778

6.2 Current transformers

One current transformer is required for an MG-1. Current transformers must be large enough to accommodate all normally energized conductors (including the neutral if it is used) centrally through the opening.

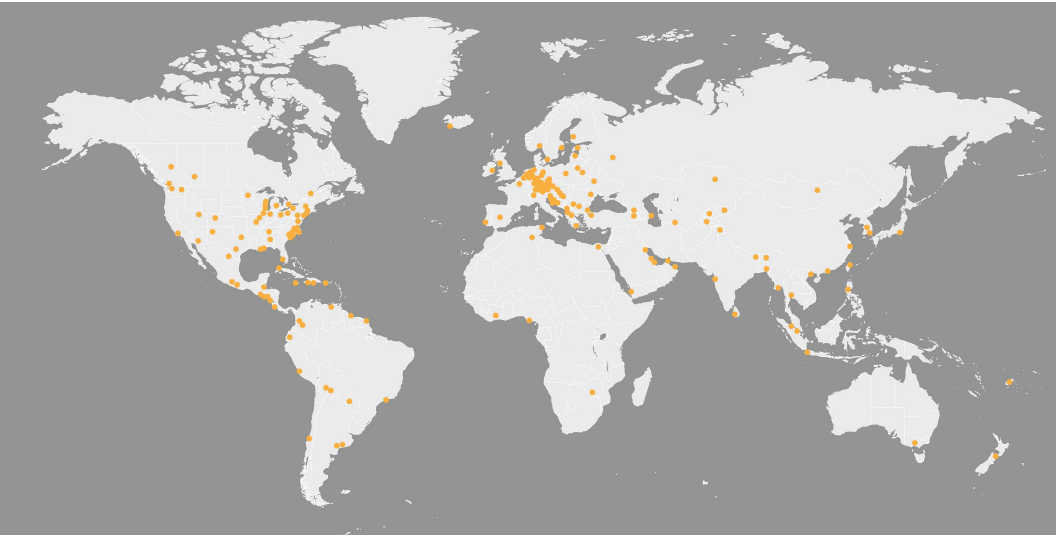
Part No.	Shape	Core Type	Opening Size	Ordering No.
CTAC20	Circular	Solid	.79" (20 mm)	B 981 10005
CTAC35	Circular	Solid	1.38" (35 mm)	B 981 10007
CTAC60	Circular	Solid	2.36" (60 mm)	B 981 10017
CTAC120	Circular	Solid	4.72" (120 mm)	B 981 10019
CTAC210	Circular	Solid	8.27" (210 mm)	B 981 10020

7. Certifications

MarinaGuard® panels are UL Listed Ground-Fault Protection for Equipment (GFPE).



**GROUND FAULT SENSING AND RELAYING EQUIPMENT
E478610**



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