

# MarinaGuard<sup>®</sup>



## Ground Fault Monitoring Panel For Marina Shore Power

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# 1. Introduction

## 1.1 MarinaGuard

MarinaGuard UL Listed Industrial Control Panels detect ground faults in feeder and branch circuits of electrical systems in marinas, boat yards, docking facilities, and similar locations. When correctly installed, MarinaGuard panels satisfy the requirements of NEC 555.35, 555.53 & 682.15 (2020 edition), NEC 555.3 & 682.15 (2017 and earlier editions) and CE 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.

All models have a non-metallic NEMA 4X rated enclosure suitable for outdoor use. A strobe light mounted to the top of the enclosure provides clear visual trip indication.

## 1.2 Panel Models

MarinaGuard panels are available in two models. The MG-1.2 provides monitoring for a single circuit. The MG-T.2 provides monitoring for up to twelve individual circuits from a single panel.

## 1.3 Current Transformers

Each monitored circuit requires a single current transformer installed in the electrical-distribution equipment and connected to the MarinaGuard panel. Current transformers are ordered separately and must match application requirements. A variety of sizes, shapes (circular and rectangular), and core types (solid or split) are available. Bender CTAC, W, WR, and WS series CT's are compatible with MarinaGuard panels.

## 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.



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

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

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

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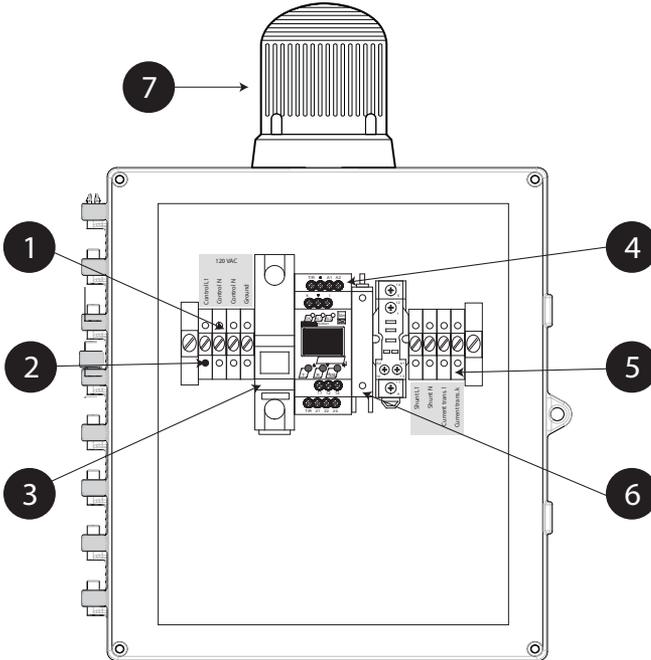
**NOTE:** Provides additional information to clarify instructions for a product or procedure.

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## 3. Installation and Connection

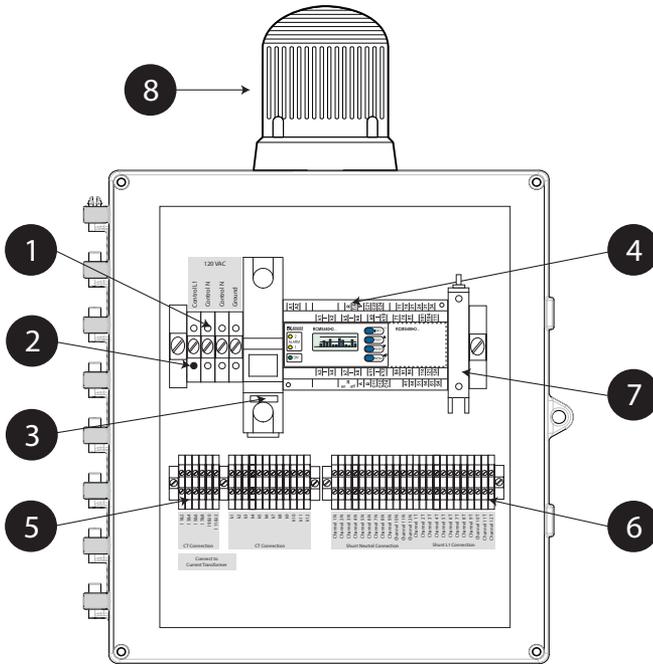
### 3.1 Internal Components

#### 3.1.1 Internal Components - MG-1.2



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

### 3.1.2 Internal Components - MG-T.2



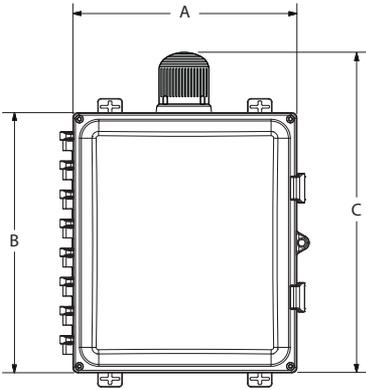
1	Terminal blocks for external 120 VAC control power and ground
2	Power indicating light - illuminates when control voltage is applied to panel, even if internal circuit breaker is open
3	Branch-circuit-rated circuit breaker - protects internal components and external trip circuits
4	RCMS490 multi-channel ground fault relay
5	Terminal blocks for external current transformers
6	Terminal blocks for external trip circuits
7	Fuse holder - contains fuse protecting RCMS490
8	Strobe light - flashes when ground fault is detected and circuit has tripped

## 3.2 Dimensions

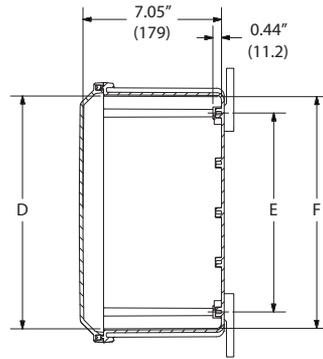
### 3.2.1 Drawings

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 edition) and 555.11 (2017 and earlier editions).

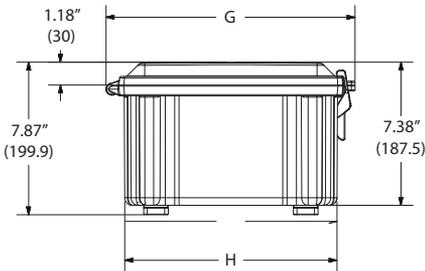
The enclosure is lockable.



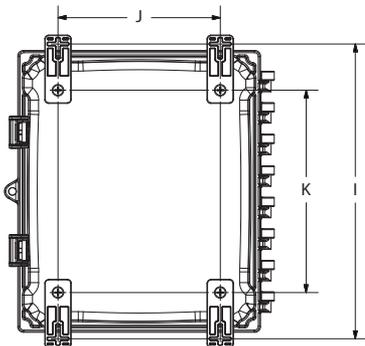
Front View with Strobe



Side View



Bottom View



Rear View

### 3.2.2 Legend

Model	A x B	C	D	E	F
MG-1.2	11.4" x 13.4" (290 x 341)	16.75" (425)	12" (305)	10.25" (260)	11.95" (304)
MG-T.2	13.4" x 15.4" (340 x 391)	18.75" (476)	14" (356)	12.25" (311)	13.95" (354)

Model	G	H	I	J x K
MG-1.2	12.68" (322)	10.81" (275)	14.03" (356)	7.63" x 9.63" (194 x 245)
MG-T.2	14.68" (373)	12.81" (325)	16.03" (407)	9.63" x 11.63" (245 x 295)

Model	Weight
MG-1.2	9.4 lb. (4.3 kg)
MG-T.2	12 lb. (5.5 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).



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

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### 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.



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

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### 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 size 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
MG-T.2 models - current transformer and shunt trip terminal blocks (labeled as numbers 5 and 6 in Section 3.1.2 (Page 9))	0.24" (6 mm)
All other terminal blocks in MG-T.2 and MG-1.2	0.39" (10 mm)

#### 3.5.3 Recommended Tightening Torque

Type	Tightening Torque
MG-T.2 models - current transformer and shunt trip terminal blocks (labeled as numbers 5 and 6 in Section 3.1.2 (Page 9))	4.2 - 4.6 lb-in (0.5 N-m)
All other terminal blocks in MG-T.2 and MG-1.2	5.0 - 5.6 lb-in (0.6 N-m)

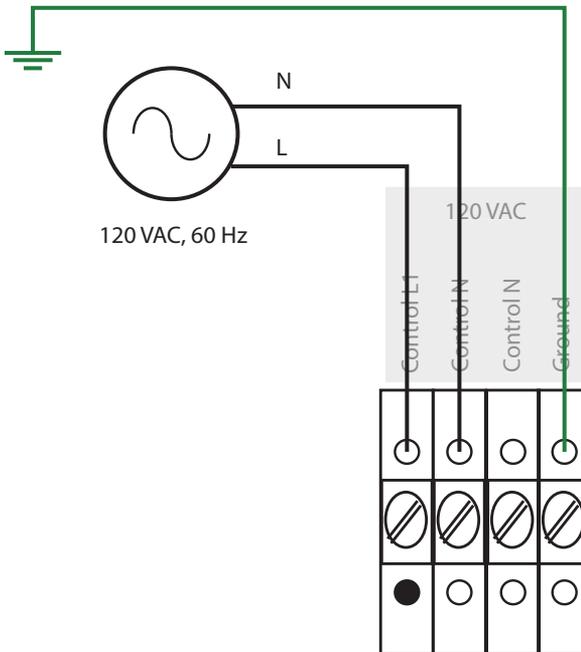
## 3.6 Wiring - MG-1.2

### 3.6.1 Control Power and Ground Connections

Locate the connections labeled as Number 1 in the diagram in Section 3.1.1 (Page 8). Refer to wiring diagram below. Use 120 VAC, 60 Hz, grounded power only. Connections are made at 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.

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

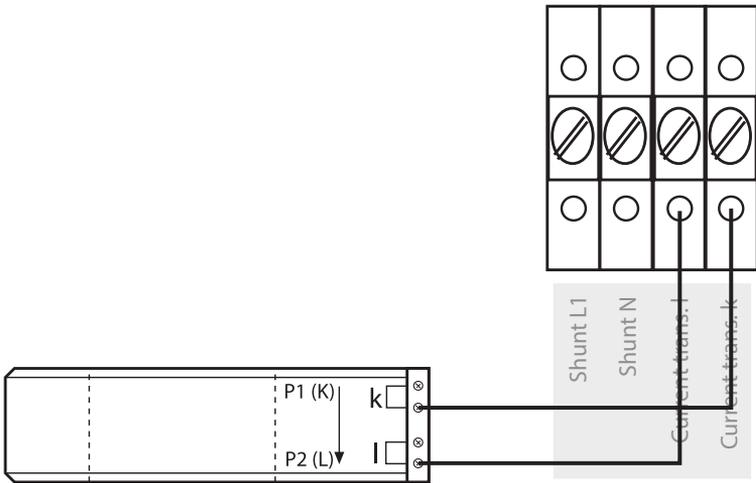


### 3.6.2 Current Transformer Connection

Locate the connections labeled as Number 4 in the diagram in Section 3.1.1 (Page 8). Refer to wiring diagram below. Connections are made at the bottom side of terminal blocks.

The diagram below shows an example connection to a W1-S35 current transformer. For additional models, refer to the respective current transformer user manual.

Refer to Section 3.8 for instructions on routing system conductors through the current transformer.



### 3.6.3 External Trip Circuit Connection

An energized, non-fail-safe (normally open), external trip circuit 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
- Voltage: 120 VAC, 60 Hz coil
- Current draw: Minimum 1 mA, maximum 5 A

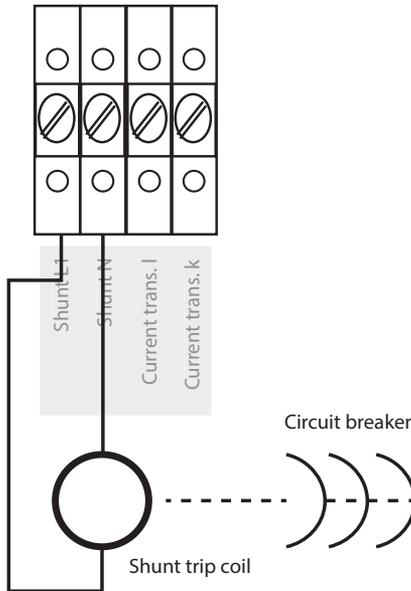


**CAUTION:** Do not connect interruption equipment that does not meet the requirements listed above. Connecting incompatible equipment may result in injury or equipment damage.

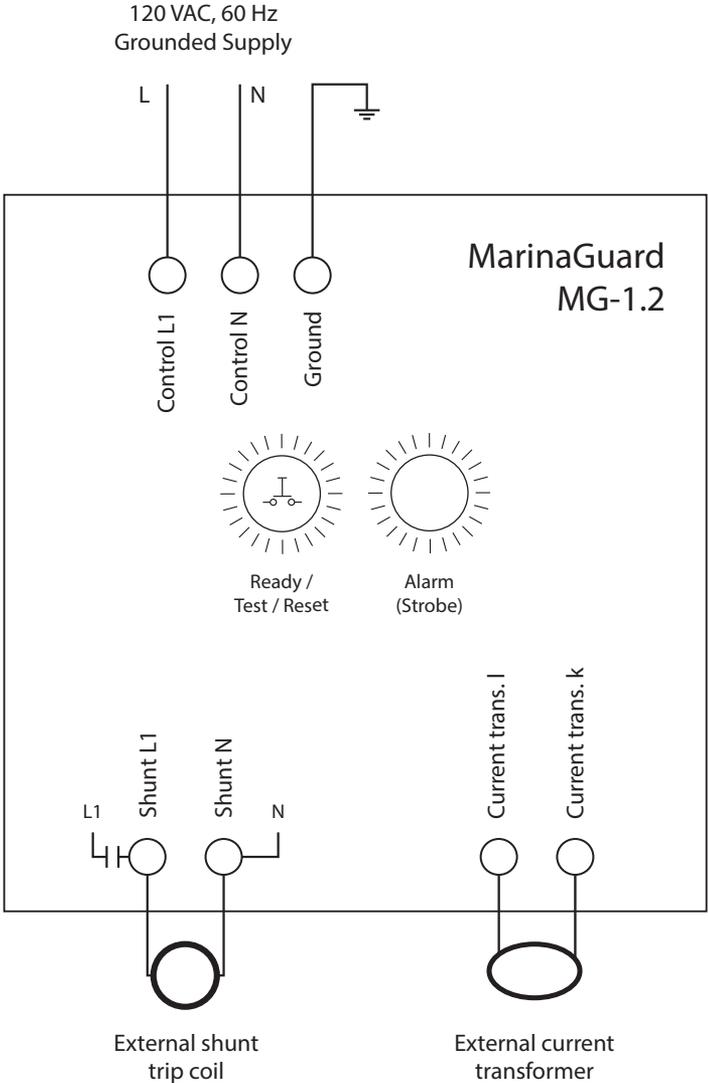


**NOTE:** Contact Bender if application requirements differ from those above, or if a separately derived power supply is required.

Locate the connections labeled as Number 4 in the diagram in Section 3.1.1 (Page 8). Refer to wiring diagram below. Connections are made at the bottom side of terminal blocks.



### 3.6.4 Wiring Block Diagram Reference



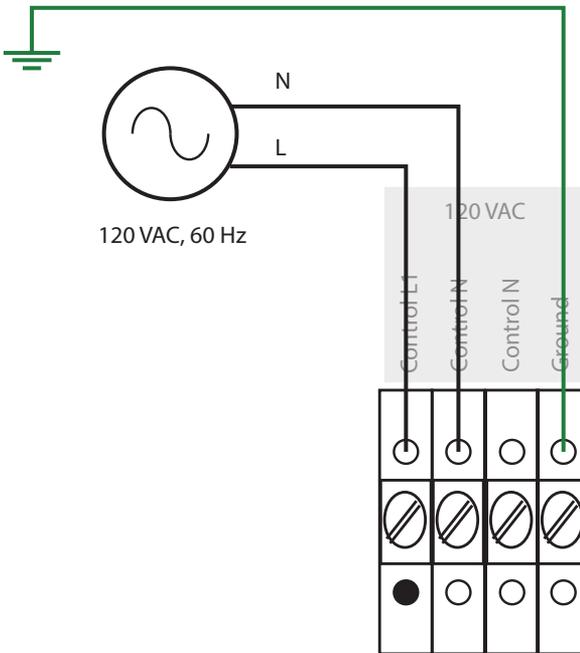
### 3.7 Wiring - MG-T.2

#### 3.7.1 Control Power and Ground Connections

Locate the connections labeled as Number 1 in the diagram in Section 3.1.2 (Page 9). Refer to wiring diagram below. Use 120 VAC, 60 Hz, grounded power only. Connections are made at 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.

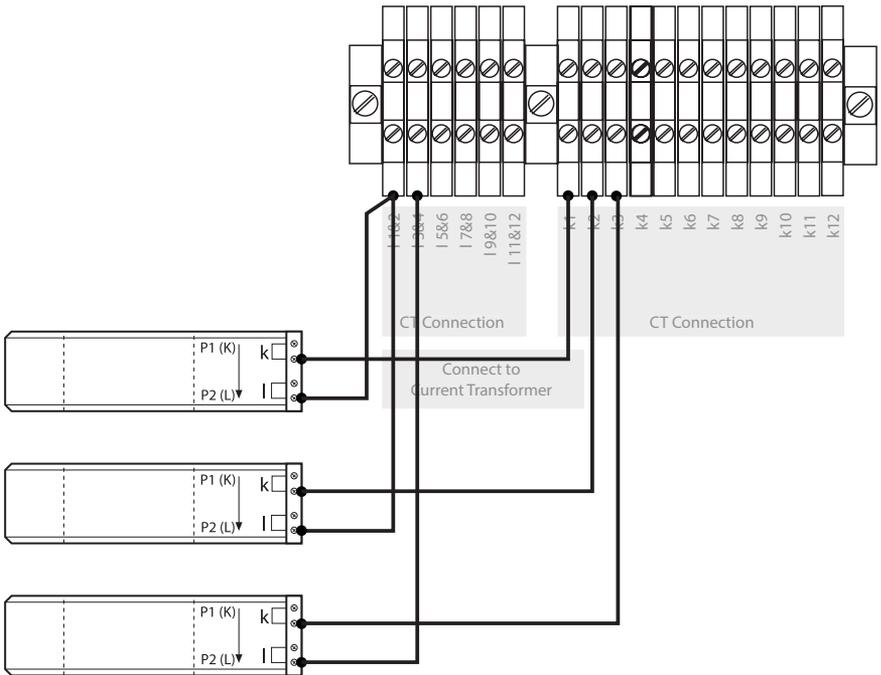
The L1 terminal block contains an indicating light, illuminating when control voltage is applied to the panel. This light illuminates regardless of the state of the internal circuit breaker.



### 3.7.2 Current Transformer Connections

Locate the connections labeled as Number 4 in the diagram in Section 3.1.2 (Page 9). Up to twelve current transformers may connect to an MG-T.2 panel. Each monitors a single circuit or feeder supplying branch circuits. Terminal “k” is an individual connection for each current transformer. Terminal “l” is a common terminal shared between up to two current transformers. Connections are made at the bottom side of the terminal blocks.

The diagram below shows example connections for three W1-S35 type current transformers. Repeat as necessary for up to twelve circuits. Connect all current transformers sequentially. For additional models or information, refer to the respective current transformer user manual.



### 3.7.3 External Trip Circuit Connections

An energized, non-fail-safe (normally open), external trip circuit is provided to connect to up to twelve interruption devices such as a shunt trip circuit breakers. Observe the following requirements when connecting an interruption device:

- Operation: Non-fail-safe, normally open
- Voltage: 120 VAC, 60 Hz coil
- Individual current draw: Minimum 1 mA, maximum 5 A



**CAUTION:** *The total current draw of all connected shunt trip coils must not exceed 12 A.*



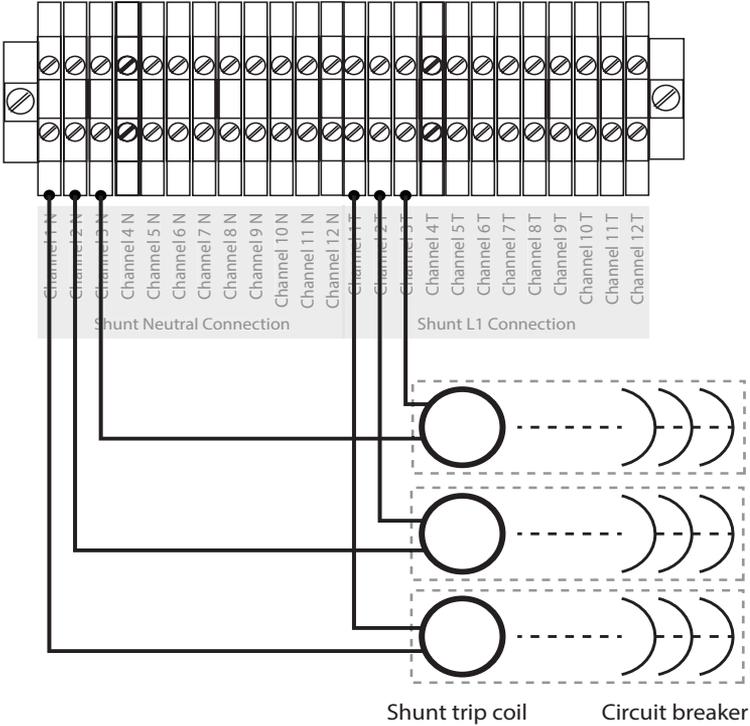
**CAUTION:** *Do not connect interruption equipment that does not meet the requirements listed above. Connecting incompatible equipment may result in injury or equipment damage.*



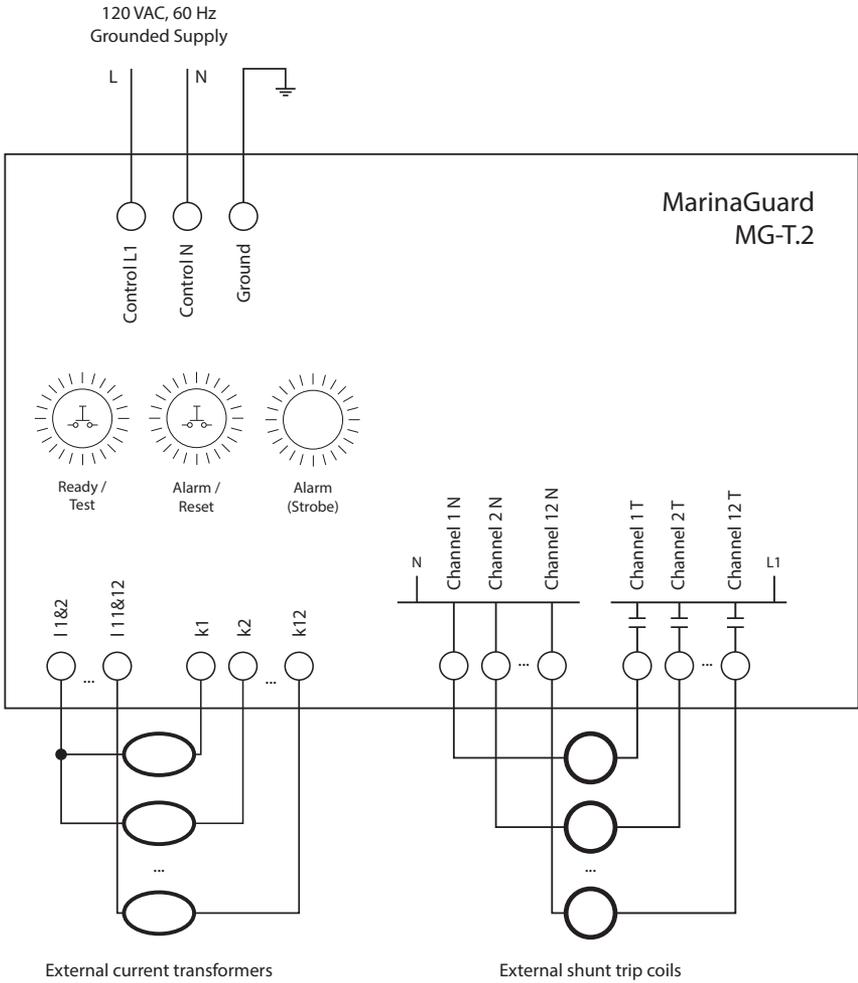
**NOTE:** *Contact Bender if application requirements differ from those above, or if a separately derived power supply is required.*

Locate the connections labeled as Number 5 in the diagram in Section 3.1.2 (Page 9). The wiring diagram on the following page shows example connections for three shunt trip breaker connections. Repeat as necessary for up to twelve circuits. Ensure that the connection number matches with the appropriate monitoring channel. Connections are made at the bottom side of terminal blocks.

Before startup, the RCMS490 settings must be updated to disable any unused channels. Refer to Section 3.10.8 (Page 34) for more information.



### 3.7.4 Wiring Block Diagram Reference



### 3.8 Wiring Current Transformer

Install one current transformer on each circuit to be monitored. The current transformer will detect a ground fault on the load side of its location. All conductors of the monitored circuit, including the neutral, must pass through the current transformer. Do not pass the ground conductor through the current transformer.

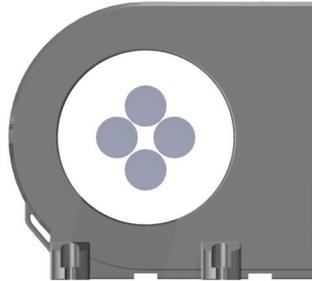
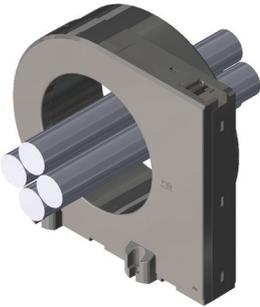
Ensure that the conductors are placed centrally through the opening. Direction (polarity) is unimportant. A monitored circuit will consist of two, three, or four conductors. Refer to figures below.



**CAUTION:** For proper operation, do not route the ground conductor through the current transformer.



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



## 3.9 Field Adjustments - MG1.2



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

### 3.9.1 RCM420 Ground-Fault Relay

The MG-1.2 MarinaGuard incorporates a Bender RCM420 series ground-fault relay. Key settings affecting the performance of the MarinaGuard are listed. For additional information on use, refer to RCM420 user manual.

### 3.9.2 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.

### 3.9.3 Pre-Trip Alarm

The pre-trip alarm is indicated 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.

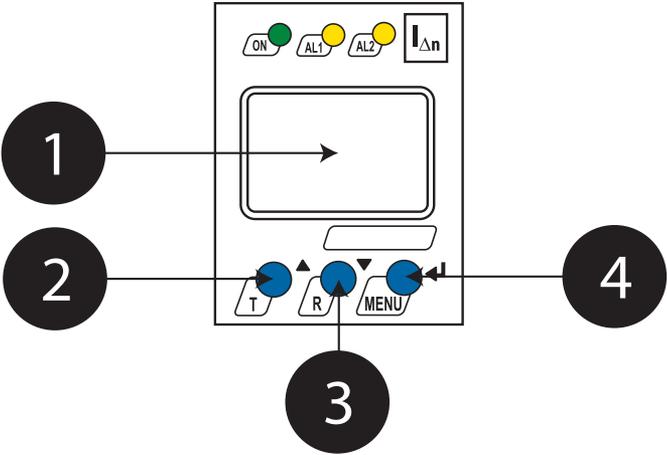
### 3.9.4 Time Delay

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.

### 3.9.5 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.

3.9.6 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.

### 3.9.7 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.

### 3.9.8 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.

### 3.9.9 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 any governing code or standard.

 Hold > 1.5 sec	 <p>Hold the MENU button for &gt; 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 (&gt;) 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 (&gt;) will flash.</p>
 Hold > 1.5 sec	 <p>Hold the MENU button for &gt; 1.5 s. A flashing "AL" will appear on the screen.</p>
 Hold > 1.5 sec	<p>Hold the MENU button again for &gt; 1.5 s. The device will exit the menu and return to the normal display.</p>

### 3.9.10 Change Trip Time Delay

 <p>Hold &gt; 1.5 sec</p> 	<p>Hold the MENU button for &gt; 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 &gt; 1.5 sec</p> 	<p>Hold the MENU button for &gt; 1.5 s. A flashing "t" will appear on the screen.</p>
 <p>Hold &gt; 1.5 sec</p>	<p>Hold the MENU button again for &gt; 1.5 s. The device will exit the menu and return to the normal display.</p>

### 3.9.11 Change Password

 <p>Hold &gt; 1.5 sec</p> 	<p>Hold the MENU button for &gt; 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 &gt; 1.5 sec</p> 	<p>Hold the MENU button for &gt; 1.5 s. A flashing “SET” will appear on the screen. Hold the MENU button again for &gt; 1.5 s. The device will exit the main menu.</p>

## 3.9.12 Factory Default Settings

	Description	Range	MG-1.2 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 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	
ESC				

## 3.10 Field Adjustments - MG-T.2



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

### 3.10.1 RCMS490 Multi-Channel Ground-Fault Relay

The MG-T.2 MarinaGuard incorporates a Bender RCMS490 multi-channel ground-fault relay, which monitors up to twelve separate circuits. Key settings affecting the performance of the MarinaGuard are listed. For additional information on use, refer to RCMS490 user manual.

### 3.10.2 Main Alarm

The RCMS490 has a trip level range of 6 mA to 20 A. This value is individually adjustable for each channel to fit application requirements. Activation of the main alarm on any channel will turn on the strobe light. Only the interruption device associated with the channel(s) in alarm will trip. By default, all twelve channels are active and set to a 30 mA trip level.

### 3.10.3 Pre-Trip Alarm

The pre-trip alarm is indicated as a percentage of the main trip alarm value for each channel. For example, the factory setting is 70% of 30 mA, which equates to 21 mA. The pre-trip alarm percentage applies to all channels. The pre-trip alarm will only activate the RCMS490 LED AL1. Connected interruption devices will not trip and the strobe light will not activate.

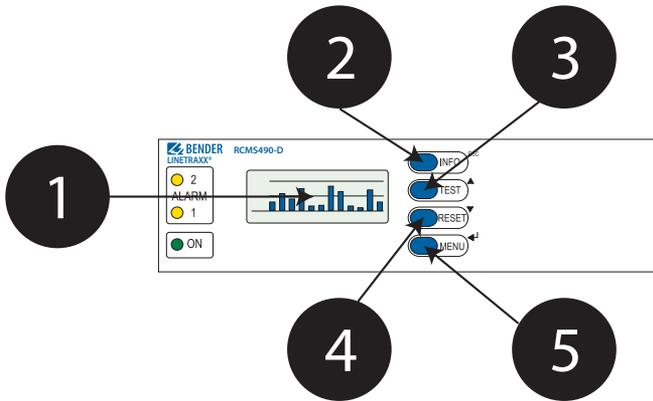
### 3.10.4 Time Delay

The RCMS490 has a trip delay range of 0 to 999 s (factory setting 100 ms). The time delay is individually field adjustable for each channel for selective coordination of cascaded devices to minimize the number of de-energized circuits.

### 3.10.5 Digital Display

The RCMS490 has a digital display which shows the measured ground-fault current in real-time. Measurements are visualized as a bar graph showing all channels. Current measurements are displayed as a percentage of the trip setting. The display and pushbuttons are used to adjust factory settings. By default, the RCMS490 is password protected with password "100." No settings can be changed until this password is entered.

### 3.10.6 RCMS490 Interface Elements



1		Digital display Shows ground-fault current readings and menu options.
2		INFO / ESC button: Cancels settings entry or goes back a step in main menu.
3		TEST / UP button: Changes settings entry or scrolls up in main menu.
4		RESET / DOWN button: Changes settings entry or scrolls down in main menu.
5		MENU / ENTER button: Enters the main menu from the normal display. Confirms settings entry or enters next level in main menu.

### 3.10.7 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 "100."

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.

 	<p>Press the UP or DOWN button until the correct digit is selected.</p>
	<p>Press the MENU button to confirm. Repeat these steps for the next two digits. After the third digit is entered, if the correct password was entered, the device will return to the previous menu item and settings will be modifiable until exiting the main menu.</p>

### 3.10.8 Disable Unused Channels (Required)

By default, all twelve RCMS490 channels are active. Unused channels must be disabled to prevent connection error messages during regular use. Repeat these steps as needed until all unused channels are disabled.

	<p>Press the MENU button.</p>
 	<p>Press the DOWN button until "Settings" is reached. Press the MENU button to enter the Settings menu.</p>
 	<p>Press the DOWN button until "Channel" is reached. Press the MENU button. Password entry will be required. A number of individual channel options will appear.</p>
	<p>Press the UP button until the numbers at the top of the screen are flashing. This is the channel selection option.</p>
	<p>Press the MENU button. The channel to apply settings to will flash.</p>
 	<p>Press the DOWN button until the desired channel number is selected. Press the MENU button to confirm selection. Any settings changed now will only affect the selected channel.</p>
 	<p>Press the DOWN button until "CT" is reached. Press the MENU button. The setting value will flash.</p>
 	<p>Press the DOWN button until "OFF" is reached. Press the MENU button to confirm. The setting value will no longer flash.</p>
	<p>Press the ESCAPE button until returning to the normal display.</p>

### 3.10.9 Change Trip Levels



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

	<p>Press the MENU button.</p>
 	<p>Press the DOWN button until "Settings" is reached. Press the MENU button to enter the Settings menu.</p>
 	<p>Press the DOWN button until "Channel" is reached. Press the MENU button. Password entry will be required. A number of individual channel options will appear.</p>
	<p>Press the UP button until the numbers at the top of the screen are flashing. This is the channel selection option.</p>
	<p>Press the MENU button. The channel to apply settings to will flash.</p>
 	<p>Press the DOWN button until the desired channel number is selected. To apply the trip level change to all channels, select "1...12." Press the MENU button to confirm selection. Any settings changed now will only affect the selected channel(s).</p>
 	<p>Press the DOWN button until "Resp. Value" is reached. Press the MENU button. The setting value will flash.</p>
 	<p>Press the DOWN button until the desired trip level is reached. Press the MENU button to confirm the change. The setting will no longer flash.</p>
	<p>Press the ESCAPE button until returning to the normal display.</p>

### 3.10.10 Change Pre-Trip Alarm Level

	<p>Press the MENU button.</p>
 	<p>Press the DOWN button until "Settings" is reached. Press the MENU button to enter the Settings menu.</p>
 	<p>Press the DOWN button until "General" is reached. Press the MENU button. Password entry will be required.</p>
 	<p>Press the DOWN button until "Prewarning" is reached. Press the MENU button. The value will flash.</p>
 	<p>Press the DOWN button until the desired prewarning value is selected. Press the MENU button to confirm the change. The setting will no longer flash.</p>
	<p>Press the ESCAPE button until returning to the normal display.</p>

### 3.10.11 Change Trip Time Delay

	<p>Press the MENU button.</p>
 	<p>Press the DOWN button until "Settings" is reached. Press the MENU button to enter the Settings menu.</p>
 	<p>Press the DOWN button until "Channel" is reached. Press the MENU button. Password entry will be required. A number of individual channel options will appear.</p>
	<p>Press the UP button until the numbers at the top of the screen are flashing. This is the channel selection option.</p>
	<p>Press the MENU button. The channel to apply settings to will flash.</p>
 	<p>Press the DOWN button until the desired channel number is selected. To apply the trip level change to all channels, select "1...12." Press the MENU button to confirm selection. Any settings changed now will only affect the selected channel(s).</p>
 	<p>Press the DOWN button until "T(on)" is reached. Press the MENU button. The setting value will flash.</p>
	<p>Press the DOWN button until the desired time delay is selected. Press the MENU button to confirm the change. The setting value will no longer flash.</p>
	<p>Press the ESCAPE button until returning to the normal display.</p>

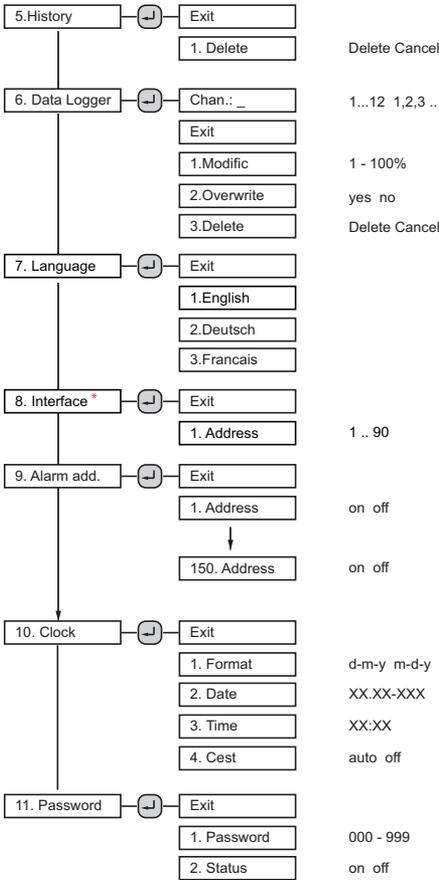
### 3.10.12 Change Password

	<p>Press the MENU button.</p>
 	<p>Press the DOWN button until "Settings" is reached. Press the MENU button to enter the Settings menu.</p>
 	<p>Press the DOWN button until "Password" is reached. Press the MENU button. Password entry will be required. The password used is the factory setting, or the previously set password if it was changed.</p>
	<p>Press the DOWN button until "Password" is reached, which includes a set of three numbers.</p>
	<p>Press the MENU button. The first digit in the password will flash.</p>
	<p>Press the DOWN button to change the digit to the desired value.</p>
	<p>Press the MENU button to confirm. Repeat these steps for the next two digits. After pressing MENU on the last digit, the numbers will no longer flash.</p>
	<p>Press the ESCAPE button until returning to the normal display.</p>

### 3.10.13 Factory Default Settings

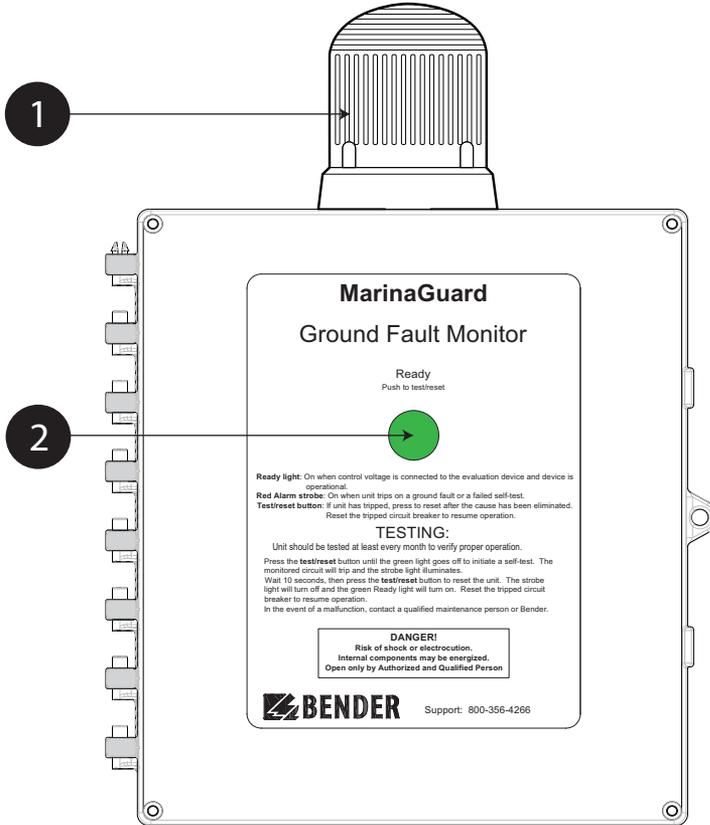
Table continues onto the following page.

		Range	MG-T2 Factory Setting
Exit			
1. Alarm/meas.val.			
2. % Bar graph			
3. History			
4. Harmonics			
5. Data logger			
6. Settings	Exit		
	1. General		
	1. Memory	off on	on
	2. Prewarning	10 - 100%	70%
	3. Hysteresis	2 - 40%	15%
	4. Frequency	50Hz 60Hz 400Hz DC	60Hz
	5. T (Start)	0 - 99 sec	0 sec
	Exit		
	2. Preset		
	1. Factor	*1 - *99	1
	2. Offset	0mA - 20A	0
	3. Preset	Preset Cancel	
	3. Channel*		
	Chan.: _	1 .. 12 1,2,3 ..	
	Exit		
	1. Factor	*1 - *250 </2 - /10>	1
	2. Resp. Value	6mA - 20A	30 mA
	3. Mode	> < Off 0/1	>
	4. T(on)	0 - 999 sec	0.1 sec
	5. T(off)	0 - 999 sec	0.2 sec
	6. Cut-off	none 50Hz 60Hz IEC	none
	7. CT	Type A Flex Type AB	Type A
	8. CT monitor	on off	on
	9. OP-mode	N/O-T N/C-T N/C N/O on off	N/O-T
	Exit		
	4. Relay		
	Relay:: _	1 .. 2 1,2	
	Exit		
	1. Relay mode	N/O-T N/C-T N/C N/O on off	N/C-T
	2. Alarm	on off	K1: on // K2: off
	4. Prewarning	on off	K1: off // K2: on
	5. Device error	on off	K1: off // K2: on
	5. Exter. alarm	on off	K1: off // K2: off
	Exit		



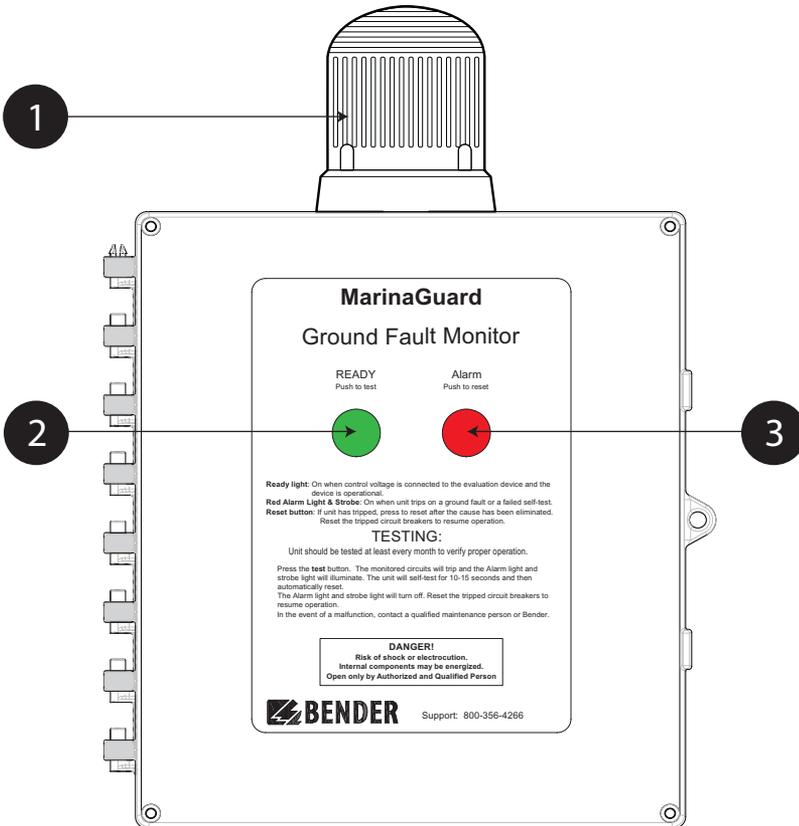
# 4. Operation

## 4.1 Panel Interface Elements - MG-1.2



<b>1</b>	<p><b>Strobe light:</b> Flashes red when circuit is tripped due to a ground fault, internal fuse has failed, or self-test has failed.</p>
<b>2</b>	<p><b>Ready light / Test and Reset button:</b> Illuminates green when panel is powered and internal RCM420 is in the normal condition.</p> <p>Push and hold the button for &gt; 1.5 s to initiate a functional test. Refer to Section 4. 4 (Page 43) for what occurs during a self-test. When circuit is tripped, momentarily press the button to reset the system and return to the normal state. External trip devices can be reset at this time.</p>

## 4.2 Panel Interface Elements - MG-T.2



<b>1</b>	<p><b>Strobe light:</b> Flashes red when any circuit is tripped due to a ground fault, internal fuse has failed, or self-test has failed.</p>
<b>2</b>	<p><b>Ready light / Test button:</b> Illuminates green when panel is powered and internal RCMS490 is in the normal condition. Press and hold the button for at least 1.5 s to initiate a functional test. Refer to Section 4. 4 (Page 43) for what occurs during a self-test.</p>
<b>3</b>	<p><b>Alarm light / Reset button:</b> Illuminates red when any circuit is tripped due to a ground fault, internal fuse has failed, or self-test has failed. Press and hold the button for &gt;1.5 s to reset the system and return to the normal state. External trip devices can be reset at this time.</p>

## 4.3 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.



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**NOTE:** During startup, the strobe may flash briefly. For MG-T.2 panels, the red ALARM light may also illuminate briefly. This is normal power-up operation.

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## 4.4 Performing a Functional Test

### 4.4.1 MG-1.2

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

### 4.4.2 MG-T.2

- Press and hold the TEST button for at least two seconds. The red ALARM light will illuminate and the strobe light will activate.
- Wait 10 to 15 seconds until the internal self-test completes.
- The RCMS490 will automatically reset when the self-test is completed.
- Manually reset all connected circuit breakers.

## 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.
Circuit does not trip on self-test (MG-T.2)	Inactive channel	Check RCMS490 settings to verify the respective channel is active.
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-1.2	5 A / 250 V, type 3AG fast-acting fuse
MG-T.2	5 A / 250 V, type 3AG time-delay fuse

## 5.3 Error Codes

### 5.3.1 MG-1.2

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.

### 5.3.2 MG-T.2

Error codes are shown on the internal RCMS490 display.

Error Code	Possible Cause / Actions
Channel X CT Connection	CT connection monitoring failed for the specified channel. Verify current transformer is properly connected. If channel is unused, disable the channel.
Device Error 71	No RS-485 master was detected. Ensure "Address" setting is set to the factory default of 1.
All others	Contact Bender.

## 6. Ordering Information

### 6.1 MarinaGuard

Part No.	Channels	Outputs	Ordering No.
MG-1.2	1	1	B 5413 00633
MG-T.2	12	12	B 5413 00635

### 6.2 Current transformers

One current transformer is required per measurement channel. Current transformers must be large enough to accommodate all normally energized conductors (including the neutral if it is used) centrally though the opening.

Part No.	Shape	Core Type	Opening Size	Ordering No.
W1-S35	Circular	Solid	1.35" (35 mm)	B 911 731
W2-S70	Circular	Solid	2.75" (70 mm)	B 911 732
W3-S105	Circular	Solid	4.1" (105 mm)	B 911 733
W4-S140	Circular	Solid	5.5" (140 mm)	B 911 734
W5-S210	Circular	Solid	8.25" (210 mm)	B 911 735
WR70x175S	Rectangular	Solid	2.75" x 6.9" (70 x 175 mm)	B 911 738
WR115x305S	Rectangular	Solid	4.5" x 12" (115 x 305 mm)	B 911 739
WR150x350S	Rectangular	Solid	5.9" x 13.8" (150 x 350 mm)	B 911 740
WR200x500S	Rectangular	Solid	7.9" x 19.7" (200 x 500 mm)	B 911 763
WS20x30	Rectangular	Split	0.75" x 1.2" (20 x 30 mm)	B 9808 0601
WS50x80	Rectangular	Split	2" x 3.1" (50 x 80 mm)	B 9808 0603
WS80x120	Rectangular	Split	3.1" x 4.7" (80 x 120 mm)	B 9808 0606

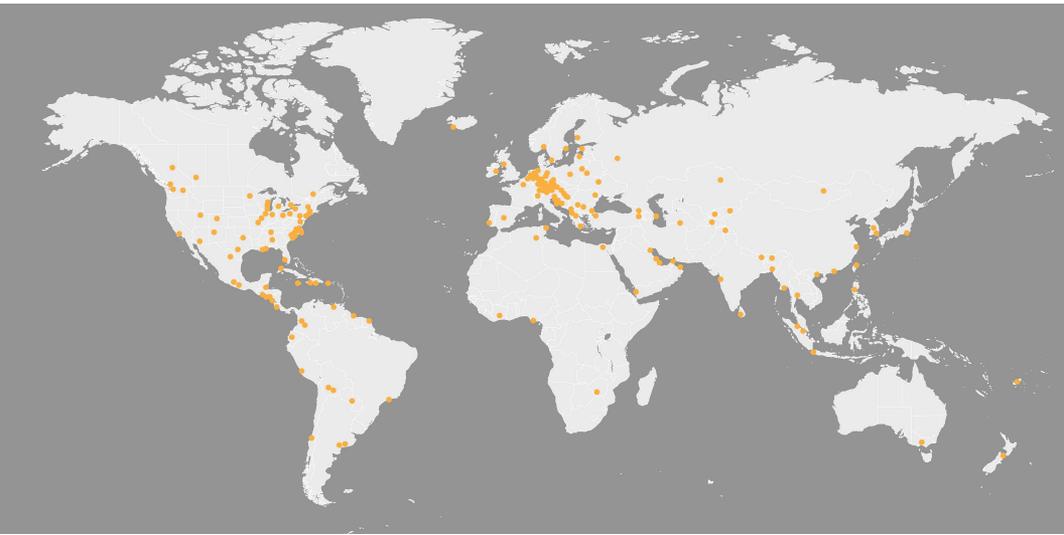
<b>Part No.</b>	<b>Shape</b>	<b>Core Type</b>	<b>Opening Size</b>	<b>Ordering No.</b>
CTAC20	Circular	Solid	.79" (20 mm)	B 981 10005
CTAC35	Circular	Solid	1.38" (35 mm)	B 981 10007
CTAC60	Circular	Solid	2.36" (60 mm)	B 981 10017
CTAC120	Circular	Solid	4.72" (120 mm)	B 981 10019
CTAC210	Circular	Solid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

## 7. Certifications

### 7.1 MarinaGuard

**MarinaGuard® panels are UL 508A Listed Enclosed Industrial Control Panels**





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