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**PM<sup>3</sup>**<sup>TM</sup>  
POWER ISOLATION TRANSFORMER

**INSTALLATION INSTRUCTIONS  
& OWNER'S MANUAL  
Model 9C-PM3-A**

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## INTRODUCTION AND APPLICATION

The PM3™ is an intelligent isolation transformer unit that takes potentially varying shoreline AC power and controls the output voltage to the boat providing consistent AC usage. This functionality allows for uninterrupted power consumption to appliances requiring electricity. Up to two display units are available with the PM3™ providing a convenient display of AC power consumption at all times.

The PM3™ operates using an automatic voltage boosting, phase correcting, and isolation transformer system intended for boats with up to two 208 VAC to 240 VAC shoreline connections, capable of up to 12 KVA each. When properly installed, it will electrically isolate the two AC shoreline power connections to the boat's AC power system, reducing galvanic current corrosion associated with the AC shore power connection. Should the power source fluctuate, the input voltage will automatically adjust, if necessary, and will safely combine the two inputs from the power source on shore creating a regulated output on the boat. This functionality is transparent during power usage.

The PM3™ has two power connections capable of 12 KVA input each, for a total of 24KVA 120/240 VAC. When only one source is available, the outputs are placed in parallel with each other to allow AC voltage up to 12KVA to be supplied to a boat's AC system.

With the utmost safety in mind, the boat's AC system and grounding conductor are not actually connected to the shore-side system when you use the PM3™. This design is intended to minimize shock hazards associated with the use of AC equipment. Power is transferred from the shore-side AC system to the boat's AC system by magnetic couplings. This means that there is no direct AC connection between the primary (shore) and the secondary (boat) transformer windings. For safety, a metallic shield is placed between the primary and secondary windings of each transformer. This shield assures AC current isolation on the boat by providing a protective layer between primary and secondary windings within the transformer. In the unlikely event of a breakdown within the transformer, the shield can withstand the fault current of a properly sized shore supply circuit breaker long enough for the breaker to trip.

### Warranty/Registration

Before proceeding, complete and mail back your Warranty Registration card.

### Manual Purpose

With your personal safety in mind, this manual lists important safety precautions first, then covers installation, operation, maintenance, troubleshooting, warranty, and service information.

## IMPORTANT SAFETY INSTRUCTIONS

**SAVE THESE INSTRUCTIONS.** This manual contains important safety and operating instructions for the PM3™. Read the entire manual before usage.



**DANGER**

**This device is not ignition protected. Avoid serious injury or death from fire or explosion. Do not install in compartment containing gasoline fueled engines or gasoline tanks, or in areas where ignition protected equipment is required.**



**DANGER**

**To avoid serious injury or death from high voltage electrical shock disconnect AC shore power before opening panel.**

### **WARNING – FIRE HAZARD**

**Primary and secondary overcurrent protection and conductor sizing must be in accordance with manufacturer's installation instructions.**

**WARNING – FIRE HAZARD**

Do not store equipment on or next to the PM3™. In operation, the PM3™'s transformers can reach high temperatures and must have free air flow to prevent overheating or possible damage to adjacent materials.

**WARNING – ELECTRICAL SHOCK AND FIRE HAZARD**

Non-metallic strain relief connectors must be used to prevent wires from chafing on the metal case, causing an electrical short. See installation instructions for suitable connector types or call the Charles Marine & Industrial Group to order a strain relief kit.

**Installation Precaution**

Boat wiring is a complex task that can pose shock, corrosion and other hazards if not done properly by trained, experienced personnel. For more information on this subject contact the **American Boat and Yacht Council (ABYC)** or see the standards and regulations below:

**American Boat and Yacht Council**  
**E-11 “Alternating Current (AC) Electrical**  
**Systems on Boats”**

3069 Solomon's Island Road  
 Edgewater, MD 21037  
 Telephone: 410.956.1050  
 FAX: 410.456.2737

**NFPA Standard 302**  
**“Pleasure and Commercial Motor Craft”**

National Fire Protection Association  
 1 Batterymarch Park  
 Quincy, MA 02169-7471  
 U.S.A.  
 Telephone: 800.344.3555

**Rules and Regulations for Recreational Boats**

Excerpts from the United States Code (USC) and the Code of Federal Regulations (CFR) (U.S. Coast Guard Regulations) are available from the **American Boat and Yacht Council** listed above.

*Note: Installation of the PM3™ must be made in accordance with all applicable standards and regulations.*

**Environmental Precaution**

The PM3™ is intended for installation inside an engine room or elsewhere on the interior of the boat. Be careful that the location will not subject the unit to rain, snow, excessive moisture, or excessive heat.

**Application Precaution**

These units are intended for hard-wired, permanent, on-board applications. Use of attachments not recommended or sold by the Charles Marine & Industrial Group may result in risk of fire, electrical shock or personal injury.

**Damaged Unit Precaution**

Do not operate the PM3™ if it has received a sharp blow, been dropped, immersed in water or otherwise damaged. See the section in this manual on *Warranty & Customer Service* for repair and replacement information.

**Disassembly Precaution**

Do not disassemble the PM3™. See the sections in this manual on *Maintaining the PM3™, Troubleshooting, and Warranty and Service*.



Figure 1. PM3™ – Control Unit

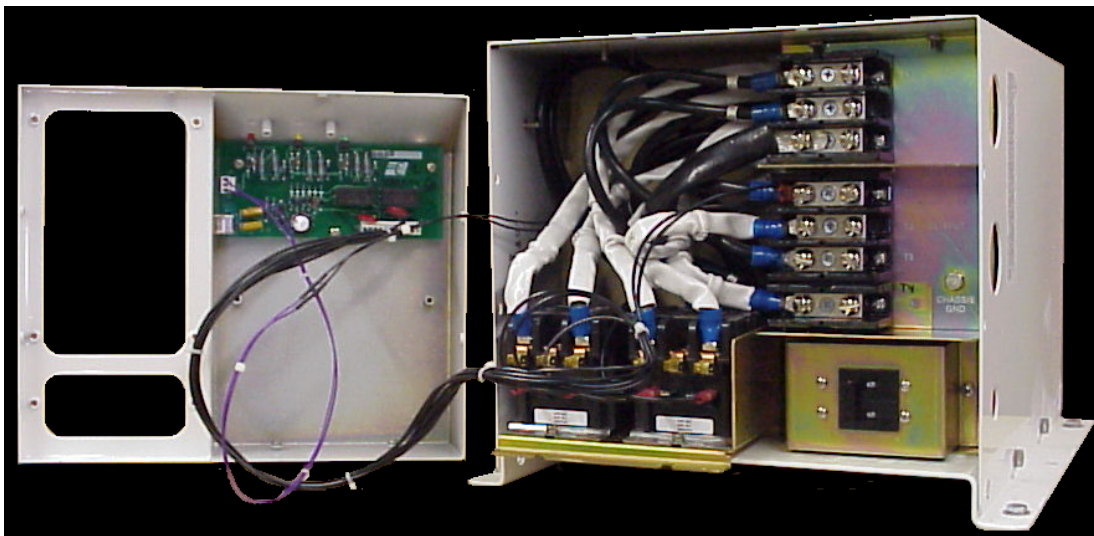


Figure 2. PM3™ – Transformer

## INSTALLING THE PM3™

The PM3™ consists of two transformer units, a control unit and a remote display panel. A second remote display panel can be purchased to provide an additional power output monitoring location on-board the boat.

### Choosing an Electrical Wiring Method

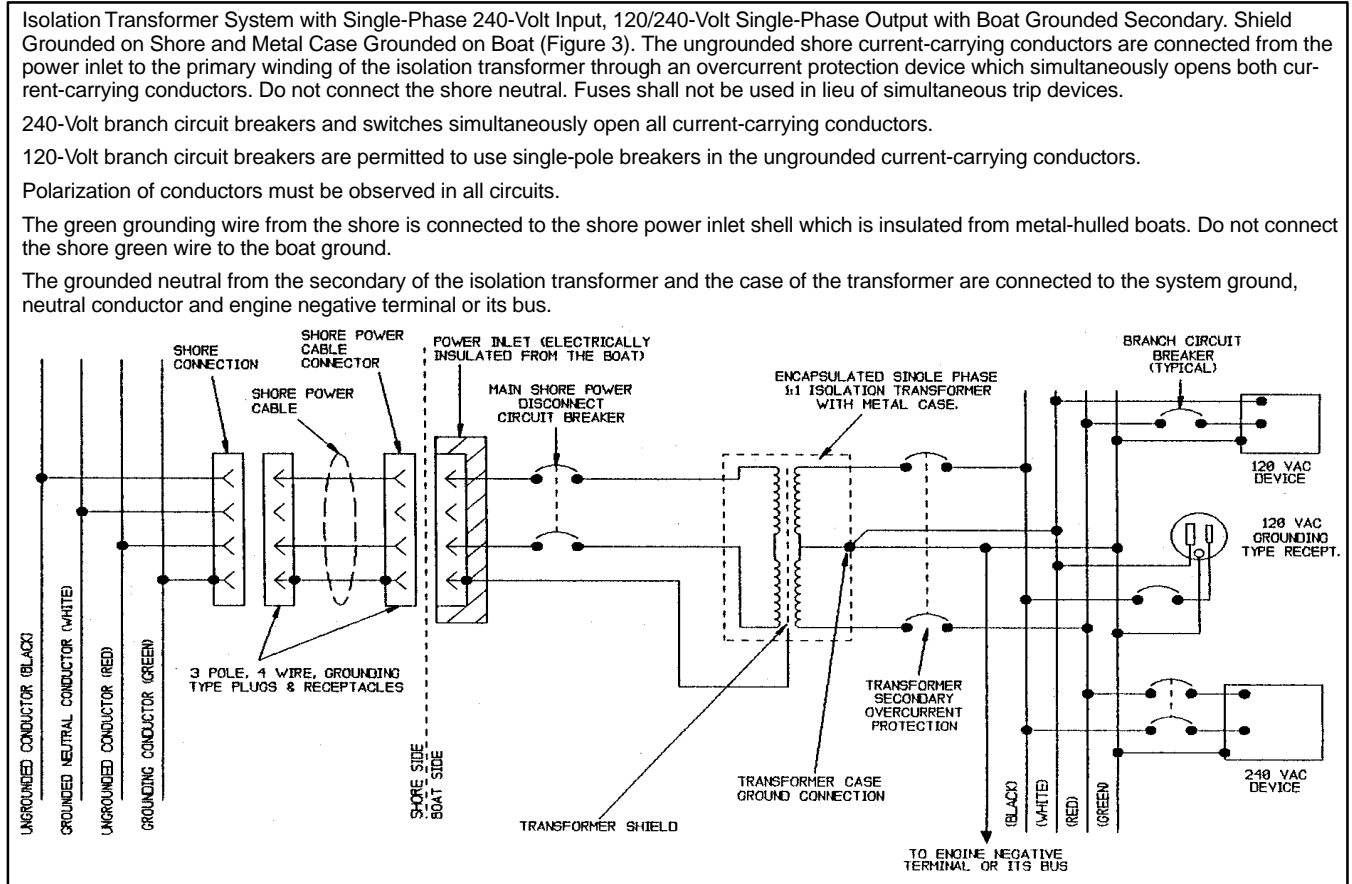
There are two wiring methods that are acceptable for installation of the PM3™ as an isolation transformer in accordance with the American Boat and Yacht Council (ABYC) *Alternating Current (AC) Electrical Systems on Boats* standard. See Figure 3 and Figure 4.

*Note: Figure 3 and Figure 4 are reprinted with permission from the American Boat and Yacht Council (ABYC). To obtain the complete standard referenced or any other standards contact the ABYC.*

**Wired as an Isolation Transformer**

The difference between the two methods below is that in Method 2, a main shore power circuit breaker with Ground Fault Protection (GFP) must be used instead of a conventional circuit breaker, and the shore grounding conductor is not wired past the inlet of the boat. Method 1 is most commonly used.

*Note: The following electrical diagrams do not illustrate complete systems. Refer to the appropriate ABYC text.*



**Figure 3. Electrical Diagram – Method 1**

Isolation Transformer System with Single-Phase 240-Volt Input, 120/240-Volt Single-Phase Output, Ground Fault Protection and a Grounded Secondary. Shield and Metal Case Grounded on Boat (Figure 4) – The ungrounded shore current-carrying conductors are connected from the power inlet to the primary winding of the isolation transformer through a ground fault protection device which simultaneously opens both current-carrying shore conductors. Fuses shall not be used in lieu of simultaneous trip devices.

240-Volt branch circuit breakers and switches simultaneously open all current-carrying conductors.

120-Volt branch circuit breakers are permitted to use single-pole breakers in the ungrounded current-carrying conductors.

Polarization of conductors must be observed in all circuits.

The green grounding wire from the shore power inlet is not connected to the isolation transformer shield or case nor to the boat ground.

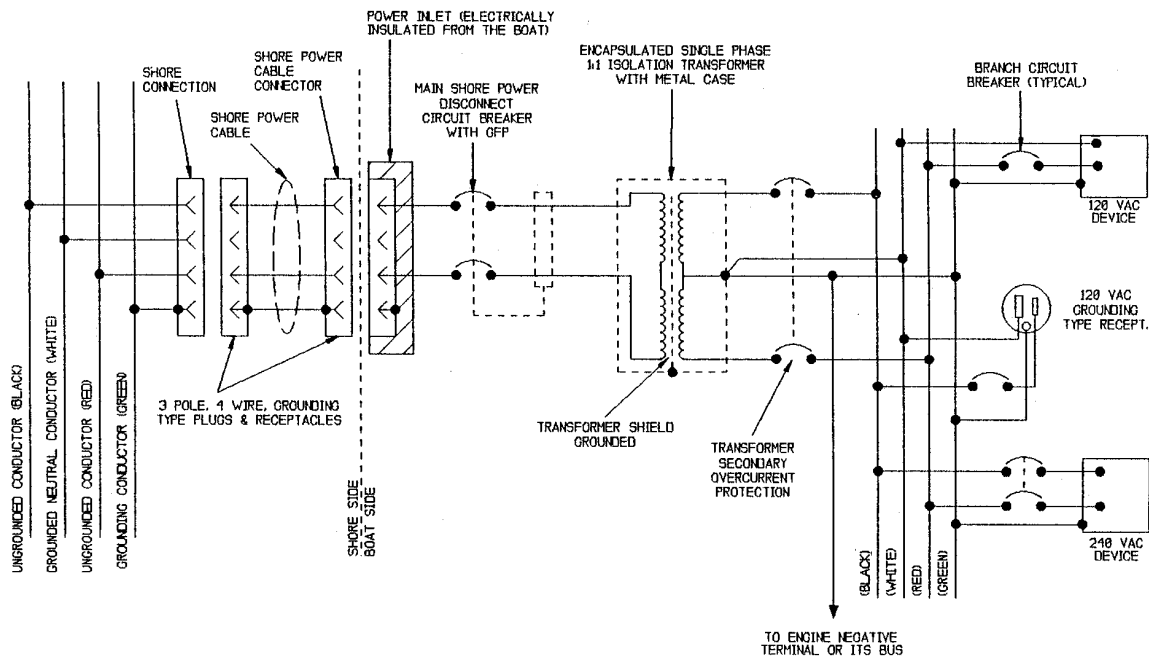


Figure 4. Electrical Diagram – Method 2

### Choosing a Mounting Location for the Transformers

When choosing a mounting location for the PM<sup>3</sup>™, placement of the two transformers can be up to 50 feet (15 meters) from the control unit, allowing for the equal weight distribution of the transformers to best balance the boat. Consideration should also be made for a light audible hum that is present when the transformers are in operation. It is best not to install the transformers adjacent to areas of the boat that are preferred to be kept quiet.

The transformers should be mounted horizontally. Special care should be taken to mount each of the transformers on supports that can sustain a shock load of at least twice the weight of itself. Finally, transformers generate heat during normal operation. Proper ventilation around the case is important. Allow for 4 inches (10 centimeters) of clearance on all sides of the unit and at least two inches between the back of the unit and the surface it is mounted on.

### Choosing a Mounting Location for the Control Unit

The control unit may be placed in a convenient location, not exceeding 50 feet (15 meters) from each of the transformers. It too should be mounted horizontally. Inside the control unit are contactors that make a soft “clanking” sound when the unit is in use. It may be preferable to not place the control unit in or near an area that should be kept quiet. Special care should be taken to mount the control unit on supports that can sustain a shock load of at least twice the weight of itself. The control unit will generate heat during normal operation. Proper ventilation around the case is important. Allow for two inches (5 centimeters) of clearance on all sides of the unit.

### WARNING – FIRE HAZARD

**Do not store equipment on or next to the PM<sup>3</sup>™. The PM<sup>3</sup>™ transformers, in operation, can reach high temperatures and must have free airflow to prevent overheating or possible damage to adjacent materials.**

**Choosing the Appropriate Wire Type and Gauge**

All input conductors should be at least 6 AWG, and all output conductors should be at least 4 AWG, stranded, 600 volt rating, UL type AWM, UL 1426 equivalent or better. See ABYC standards for AC electrical systems on boats for more details on conductor types and sizing.

**Choosing Electrical Wiring**

The PM3™ is intended to be used as an isolation transformer. In this application, there is no fault current path for the wiring from the shore power inlet to the PM3™ output connections. For this reason, the wiring should only be done with a jacketed cable (0.030 inches jacket thickness minimum) such as UL type 1426 boat cable or by using a marine cable set wire (type SO or equivalent). This wiring should be installed in the boat in a protected area and routed to avoid contact with sharp edges or hot surfaces.

**WARNING – ELECTRICAL SHOCK AND FIRE HAZARD**

**Strain relief cord grip connectors or another method must be used to prevent wires from chafing on the metal case and causing an electrical short. See installation instructions for suitable connector kit. Use wire rated for at least 90 degrees Celsius, and sized on the basis of 75 degrees Celsius rated wire amperage.**

The PM3™ is intended for hard-wiring in a permanent location. Non-metallic strain relief/grip connectors (see Table 1) are required, and included with the unit, to secure wires or cables going into or out of the PM3™.

**Table 1. Recommended Strain Relief Connectors and Accessories**

Description*	Manufacturer	Catalog Number	Locknut	Charles Number
Cord Range: 1.39 inches (35 millimeters)–1.69 inches (43 millimeters)	Thomas & Betts	2707	145	18-900736-0
0.89 inches (23 millimeters) to 1.09 inches (28 millimeters)	Thomas & Betts	2702	144	25223
0.66 inches (17 millimeters) to 0.78 inches (20 millimeters)	Thomas & Betts	2675	142	18-900250-0
Strain Relief Kit – 4 AWG Wire	Charles	N/A	Included	97–001121–A
Strain Relief Kit – 6 AWG Wire	Charles	N/A	Included	97–001120–A

\*All strain relief connectors must be of a non-metallic type to conform to UL requirements.

**Overcurrent Protection**

Overcurrent protection must be provided at the time of installation by a two-pole circuit breaker on each primary supply (incoming shore power AC) and each secondary (boat system AC power) circuit. Each shore power AC input breaker should be rated at 50 amps and each boat system AC output breaker should be rated at 100 amps. Each must be rated 120/240 volts AC, 5,000 Ampere Interrupting Capacity (AIC) and be of the “long delay” type. A Ground Fault Protector (GFP) must be provided if a shore power grounding conductor is not connected to the PM3™ input ground (TXFR shield). This should be rated at 20 milliamperes or less and if it is to be combined with the primary (incoming shore power AC) circuit breaker, it should be rated at 50 amps, 120/240 volts AC, 5,000 Ampere Interrupting Capacity (AIC) and be of the “long delay” type.

**WARNING – HIGH VOLTAGE**

**To avoid serious injury or death from high voltage electrical shock disconnect AC shore power before opening panel.**

While making connections to the PM3™ reference Figure 5.

The wiring installation will depend on the method chosen in the section titled *Choosing an Electrical Wiring Method*. Follow the procedure below to make the appropriate connections.



Step	Action
1.	Remove the terminal access cover on the transformer.
2.	Remove the front cover on the control unit.
3.	Install the strain relief connectors.
4.	Undo the chucks and compression grommets from the strain relief connectors.
5.	Slide the strain relief connector chuck and compression grommets down and over the input and output cables.
6.	Strip back the insulating layers to the appropriate length.
7.	Crimp ring terminals on all wires using the proper tool.
8.	Connect all wiring as shown in Figure 5 and described in Table 2 through Table 4.
9.	Re-assemble and tighten all strain relief connectors.
10.	Re-install the terminal access cover.

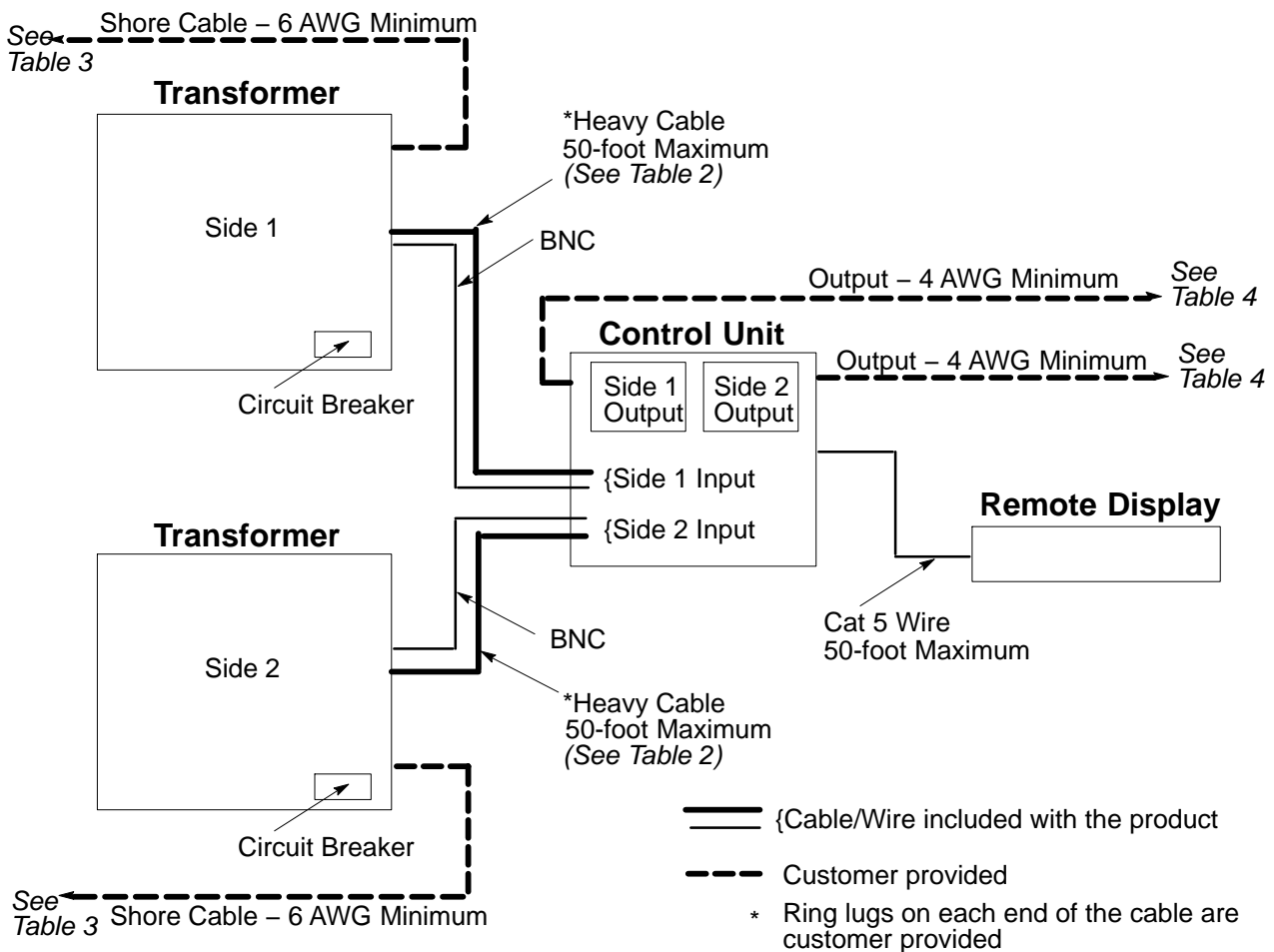


Figure 5. Typical Wiring Connections

**Table 2. PM3™ Connections from the Transformers to the Control Unit**

Side	Connection	Wire
1	T1	Black
1	T2	Red
1	T3	Black with Red Stripe
1	T4	Red with Black Stripe
Case Ground	Ground	Green with Yellow Stripe
2	T1	Black
2	T2	Red
2	T3	Black with Red Stripe
2	T4	Red with Black Stripe

**Table 3. Input Connections to the Transformers**

Side	Connection	Wire
1	L1	Black
1	N	Neutral
1	L2	Red
2	L1	Black
2	N	Neutral
2	L2	Red

**Table 4. Output Connections from the Control Unit**

Side	Connection	Wire
1	L1	Black
1	N	Neutral
1	L2	Red
2	L1	Black
2	N	Neutral
2	L2	Red

**Securing Covers**

After all connections and terminations have been made, the terminal access cover on the transformer and the front cover to the control unit should be re-installed using all hardware supplied.

Connect the BNC-BNC cables from the transformers to the control unit (see Figure 5).

**Installing and Wiring the Remote Panel**

The PM3™ remote panel provides a visual display of the operating modes of the unit without having to go physically look at it. Up to two remote panels may be used with the PM3™. Contact the Charles Marine & Industrial Group for more information on obtaining a second display unit if desired.

Follow the procedure below to connect the remote panel to the PM3™.

Step	Action
1.	Using the template provided with the remote panel, carefully cut out the shaded portion in the desired mounting location.
2.	Using the template provided, drill 4 pilot holes for no.10 self-tapping screws.
3.	Route the cable to the PM3™ control unit using care to avoid chafing and sharp bends.
4.	Strip back approximately 1/2-inch (13mm) of the outer cable jacket (not the wires).
5.	Insert the insulated conductors into the provided RJ45 plug assembly (see Figure 6) and crimp using the proper tool for CAT5 connectors.
6.	Insert the RJ45 plug from step 5 into the socket marked "IN" on the rear of the display. The PM3™ remote is provided with an additional socket "OUT" for the connection of a second display if desired.
7.	Insert the pre-installed RJ45-plug, provided on the 50-foot Cat 5 cable, into the RJ45-socket located on the right side of the PM3™ control unit.

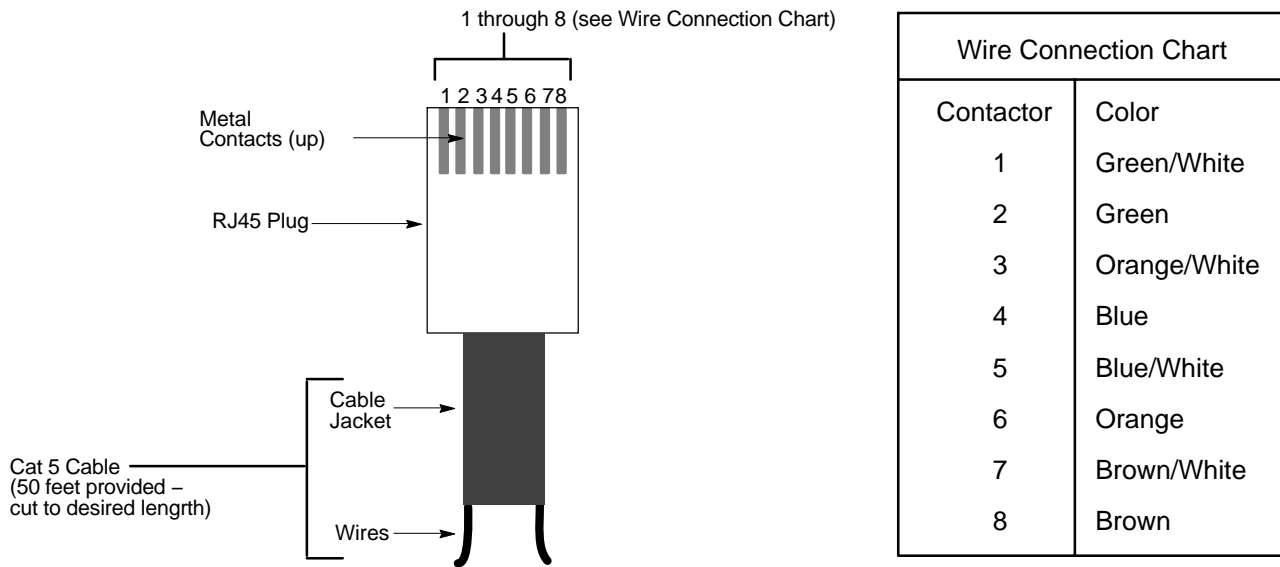


Figure 6. Remote Panel RJ45 Plug (Front View) with Wire Connection Chart

### Applying Power

Power should only be applied after all connections and terminations have been made and the terminal access cover is secure. Plug in the shore power AC and turn on the appropriate circuit breakers to apply power. Refer to the section on *Proper Operation*.

## OPERATING THE PM3™

### Proper Operation

The PM3™ is designed to operate in the best possible mode without any user intervention. The PM3™ will select one of three possible modes of operation automatically: Normal, Separate or Single-Source (Shore Cable 1 or Shore Cable 2). These modes of operation are described in Table 6 and more fully later in this document. Diagrams of the operating modes are shown in Figure 7. Boosting is available in all except the Manual Override mode and discussed later in this document.

*Note:* When operating in a single source mode, the source selector switch must be in the position that corresponds to the shore cable being used.

When power is first applied to Shore Cable 1 (assuming the PM3™ has been disconnected from the power source at least 15 seconds), there will be no output on the PM3™. The PM3™ will wait for approximately 25 seconds for a second shore cable to be connected. During this time, the PM3™ will display on the local and remote (if connected) displays the voltage found on the shore cables as referenced in Table 5.

**Table 5. Control Unit & Remote Display Examples at Initial Startup**

*Note: Typically the Remote Display shows the middle two lines of the Control Unit Display.*

CONTROL UNIT	MEANING
- Initial Startup - Src 1: Found 234V Src 2: Found 230V └ = Setup	1. Initial startup indicator. 2. Shore cable 1 connected, the display indicates the input voltage. 3. Shore cable 2 connected, the display indicates the input voltage. 4. Pressing the RETURN key will force the system to enter the setup menu.
REMOTE DISPLAY	
Src 1: Found 234V Src 2: Found 230V	1. Shore cable 1 connected, the display indicates the input voltage. 2. Shore cable 2 connected, the display indicates the input voltage.

CONTROL UNIT	MEANING
- Initial Startup - Src 1: Found 234V Src 2: └ = Setup	1. Initial startup indicator. 2. Shore cable 1 connected, the display indicates the input voltage. 3. Shore cable 2 is not connected or below the minimum operating voltage. 4. Pressing the RETURN key will force the system to enter the setup menu.
REMOTE DISPLAY	
Src 1: Found 234V Src 2:	1. Shore cable 1 connected, the display indicates the input voltage. 2. Shore cable 2 is not connected or below the minimum operating voltage.

The system will begin to analyze power 25 seconds after the initial startup. If the voltage is above the minimum required, the PM3™ will automatically select one of the three automatic modes.

**Table 6. Modes of Operation**

Mode	Description
Normal	This mode is available when the 2 shore power AC input cables (Shore Cable 1 and Shore Cable 2) are connected, functioning and either 0 degrees (in-phase) or 180 degrees (out-of-phase) when compared to each other. The AC load is shared between the 2 shore cables. The total AC amperage is the sum of Shore Cable 1 and Shore Cable 2, up to 100 amps at 240 volts (24,000 VA). (Figure 7)  <i>Note: The source selector switch, located in the manual override compartment, can be set to either the "Source 1" or "Source 2" position.</i>
Separate	This mode is selected by the PM3™ when the 2 shore power AC cables (Shore Cable 1 and Shore Cable 2) are connected, but phasing cannot be corrected by the PM3™. Shore Cable 1 and Shore Cable 2 remain isolated from each other and operate independently. The total AC amperage is up to 50 amps at 240 volts (12,000 VA) for each output. (Figure 7)  <i>Note: The source selector switch, located in the manual override compartment, can be set to either the "Source 1" or "Source 2" position.</i>

Mode	Description
Shore Cable 1	<p>This mode is selected by the PM3™ when AC shore power is connected to Shore Cable 1 only, and the source selector switch located in the manual override compartment is set to the “Source 1” position. The total AC amperage of outputs 1 and 2 is 50 amps at 240 volts (12,000 VA). (Figure 7)</p> <p><i>Note: When operating in Shore Cable 1 mode only, adding power to the second shore cable will cause the unit to restart after a pre-set cycle, allowing the system to switch into Normal or Separate mode if the power is stable.</i></p>
Shore Cable 2	<p>This mode is selected by the PM3™ when AC shore power is connected to Shore Cable 2 only, and the source selector switch located in the manual override compartment is set to the “Source 2” position. The total AC amperage of outputs 1 and 2 is 50 amps at 240 volts (12,000 VA). (Figure 7)</p> <p><i>Note: When operating in Shore Cable 2 mode only, adding power to the first shore cable will cause the unit to restart after a pre-set cycle, allowing the system to switch into Normal or Separate mode if the power is stable.</i></p>
Off	<p>Power is still being supplied to the PM3™, but the outputs are turned off. This mode is only available for doing maintenance on the PM3™.</p>

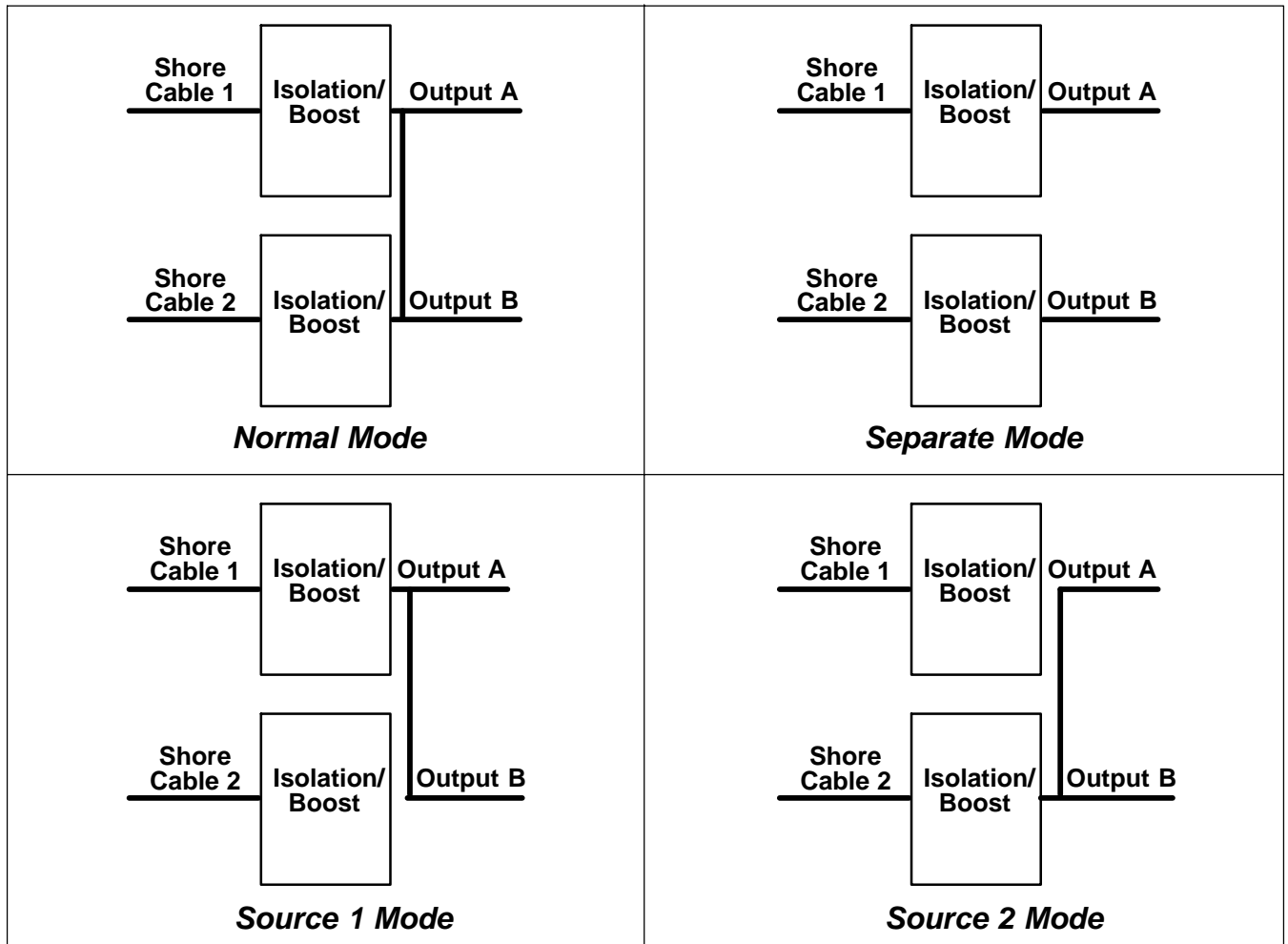


Figure 7. Modes of Operation Diagram

## EXPLANATION OF THE DISPLAY INFORMATION

In each of the modes of operation the PM3™ is continually monitoring the system. The modes of operation are summarized in Table 6 and illustrated in Figure 7.

*Note: The source selector switch, located in the manual override compartment, must be set to the mode that corresponds to the desired mode of operation.*

### Normal Mode

When the PM3™ is operating in a Normal mode the control unit will display the output similar to the one shown in Table 7. The Remote display will rotate the output between the first line and the middle two lines.

**Table 7. Control Unit & Remote Display Output in Normal Mode**

*Note: The Remote Display unit alternates the display of information two lines at a time.*

CONTROL UNIT	MEANING
Mode: Normal 14696VA 1:208V 35A BOOST	The system is running in Normal Mode. Output power is 14696 Volt-Amps. Shore cable 1 input voltage is 208V. Current draw is 35 Amps. Output voltage is boosted 15%.
2:206V 36A BOOST INV	Shore cable 2 input voltage is 206V. Current draw is 36 Amps. Output voltage is boosted 15%. The input phase is 180° out of phase as compared to shore cord 1.
↵= Setup	Pressing the RETURN key will force the system to enter the setup menu.

### Separate Mode

When the PM3™ is operating in a Separate mode the control unit will display the output similar to the one shown in Table 8. The Remote display will rotate the output between the first line and the middle two lines.

**Table 8. Control Unit & Remote Display Output in Separate Mode**

*Note: The Remote Display unit alternates the display of information two lines at a time.*

CONTROL UNIT	MEANING
Mode: Seprte 9540VA	The system is running in Separate Mode. Both cables, but not power, are combined. Output power is 9540 Volt-Amps.
1:240V 29A	Shore cable 1 input voltage is 240V. Current draw is 29 Amps.
2:215V 12A BOOST	Shore cable 2 input voltage is 215V. Current draw is 12 Amps. Output voltage is boosted 15%.
↵= Setup	Pressing the RETURN key will force the system to enter the setup menu.

If the PM3™ detects an incorrect shore power AC phase relationship, the PM3™ will not combine the incoming shore power AC sources. The PM3™'s outputs will be limited in amperes to their respective shore power inputs. Separate Mode will continue until both shore power sources are disconnected. Once reconnected, the PM3™ will attempt to restart following the standard startup sequence.

If the PM3™ has detected a fault on one side (example Shore Cable 1) it will disconnect the output power on the side with the fault, wait for the source power to stabilize and restart the faulted side following a normal power sequence for a single side. The user is notified of the problem.

### Source 1 and Source 2 Modes

When the PM3™ is operating with a single shore cable, either Shore Cable 1 or Shore Cable 2, the control unit will display the output similar to the one shown in Table 9. The Remote display will rotate the output between the first line and the middle two lines.

**Table 9. Control Unit & Remote Display Output in Source 1 Mode**

*Note: The Remote Display unit alternates the display of information two lines at a time.*

CONTROL UNIT	MEANING
Mode: Src 1 11092VA	The system is running in Source 1 Mode. Single cable only. Output power is 11092 Volt-Amps.
1:236V 47A	Shore cable 1 input voltage is 236V. Current draw is 47 Amps.
2:0V 0A NOT USED	Shore cable 2 input is not connected.
HEAVY LOAD ↵= Setup	System warning about heavy load. Reduce load. Pressing the RETURN key will force the system to enter the setup menu.

The system is operating on an incoming shore power supply. If an error occurs, the PM3™ will disconnect the power and attempt a restart in approximately 45 seconds.

Should a second incoming shore supply be detected, the system will shut down and restart. Power will be interrupted for a brief period of time during the restart. The system will analyze the shore supplies and switch to either Normal or Separate mode as appropriate.

### Off Mode (Only Available from the Setup Menu)

When the PM3™ is operating in an Off mode the control unit will display the output similar to the one shown in Table 10. The Remote display will rotate the output between the first line and the middle two lines.

**Table 10. Control Unit & Remote Display Output in Off Mode**

*Note: Typically the Remote Display shows the middle two lines of the Control Unit Display.*

CONTROL UNIT	MEANING
Mode: Off 0VA	The system is turned off. There is no voltage on the output. Output power is 0.
1:212V 0A	Shore cable 1 input voltage is 212V. Current draw is 0 Amps.
2:219V 0A	Shore cable 2 input voltage is 219V. Current draw is 0 Amps.
↵= Setup	Pressing the RETURN key will force the system to enter the setup menu.

### Isolation

All modes listed in Table 6 have 4000 VRMS isolation from the source side to the output side.

### Compatibility

The PM3™ will accept shore power AC input on either Shore Cable 1 or Shore Cable 2 within the following range:

- Voltage: 185 to 260 Volts AC (recommended maximum)
- Frequency: 50 Hz or 60 Hz
- Shore power Load: 0 to 50 Amps per input (55 Amps maximum)

### Thermal Protection

The PM3™ is equipped with a built-in thermal cutout that is embedded in the transformer windings. In the event of sustained overload or overheating, this device will disable the transformer and shut down. When this occurs all AC power being supplied from the transformer to the outputs will be disconnected and the manual override may not function. A red light on the transformer will indicate that the unit has been disabled due to overheating.

Reduce all AC loads and allow the unit to cool down. The thermal cutout will automatically reset and the PM3™ will re-energize and resume normal operation.

*Note: It may take a significant amount of time for the PM3™ to cool down depending on the ambient temperature.*

## Voltage Boosting

All modes will automatically boost (with the exception of the Manual Override mode) the output voltage 15% over the shore power AC voltage when it is less than optimal. This helps to prevent harm to voltage sensitive motors and electronics on the boat. Voltage boosting is done automatically by the PM3™ and follows these simple rules:

1. Upon power up, if the source voltage is less than 220 volts, the PM3™ will boost the output voltage by a factor of approximately 15% over the shore voltage.
2. If the shore voltage is or rises above 220 volts, the PM3™ will remove the boost and provide a 1:1 shore voltage to output voltage ratio.
3. Should the shore voltage drop below 210 volts, the PM3™ will again implement the boosting of the output voltage by approximately 15% over the shore voltage.

Important notes about voltage boosting:

- During voltage boosting, the usable current on the output side is reduced by 15% to prevent overloading shore circuit breakers.
- Shore Cable 1 voltage boosting is independent of Shore Cable 2 voltage boosting and vice versa.
- When switching in and out of boost, the output voltage is not interrupted. However, the output voltage may be reduced during the transition.
- Input to output conversion is approximate. Due to varying loads, boost percentages vary slightly.

## Power Interruptions and Recovery

- The PM3™ is designed with a momentary power black-out detector. If a momentary loss of power is detected by the PM3™ computer, the system will attempt a quick restart once the power situation has passed. This feature minimizes the time the boat will experience a power loss once the dock power has been restored.
- If the power loss is greater than a few seconds, when the power returns, the system will restart using the procedure described in section *Proper Operation* above.

## Safety

The PM3™ will display three types of warnings on the remote display to indicate to the user that the limits of the system are being reached. The warnings are below.

- Low Voltage warning: When the input voltage on the shore cables falls below 200 volts, the system will display a warning message on the remote display informing the user of low shore cable voltage. The user should consider disconnecting the shore cables to prevent damage to motors and other systems on the boat.
- High Voltage warning: When the input voltage on the shore cables rises above 252 volts, the system will display a warning message on the remote display informing the user of high shore cable voltage. The user should consider disconnecting the shore cables to prevent damage to motors and other systems on the boat.
- High Current warning: When the current draw on a shore cable reaches 46 amps, the system will display a warning message on the remote display informing the user of excessive current draw. The user should immediately reduce the load on the system by turning off some electrical appliances or systems to prevent a system shutdown if the current rises to the shutoff limit.

The PM3™ design is self-protecting and also protects the AC systems it powers. To do so, the PM3™ has several safety features.

- Low Source Voltage: If the shore power AC input voltage drops below 185 volts, The PM3™ will shut down. There is a built-in time delay to allow for large motor starting that may drag the voltage below the threshold for a minimal period of time.



- **Over Load Condition:** If the PM3™ detects an overload condition of 110% of the maximum current draw of each input for an extended period of time, the system will shut down to protect the system's internal components. (i.e. 55 amps per shore cable or 110 amps total if both shore cables are connected in Normal Mode)
- **Phasing:** Normal Mode is only available when the Shore Cable 1 source and Shore Cable 2 source are either 0 degrees or 180 degrees out of phase (typically, a source 180 degrees out of phase is due to incorrect wiring on the shore). If the phasing of the source cannot be determined, or is not 0 degrees or 180 degrees out of phase, the PM3™ will revert to Separate Mode.
- **External AC Voltage on the outputs:** If the PM3™ detects another AC power source (such as an AC generator) on the outputs during startup, the PM3™ will not allow shore power AC to be connected to the outputs until the external AC voltage source is removed from the outputs. This feature prevents potential damage to AC systems on the boat (such as an AC generator).
- **Extreme Temperature:** Should the PM3™ detect excess temperature internally (usually caused by overloading), the PM3™ will immediately shutdown and the red LED, "Over Temperature", located on the transformers will turn on.
- **Integrated wire protection:** If the wiring becomes shorted between the transformer and the control unit the circuit breakers located in the affected transformers will trip.
- **Incorrect wiring:** If the wiring between the transformer and the control unit is incorrect or missing, the PM3™ will shut down and indicate the location of the fault when it attempts a system startup.
- **Isolation:** 4000 VRMS isolation is designed to prevent a shock hazard from boat to shore.

### Remote Display Warning Messages

Should any of the messages in Table 11 appear on the remote display, follow the suggested action and take precaution to avoid a recurrence of the condition.

**Table 11. Remote Display Warning Messages**

REMOTE DISPLAY	MEANING
Heavy Load WARNING Reduce Load	1. The PM3™ is close to maximum power. Consider reducing the load.
Shore Cable WARNING! Voltage very low!	1. Shore cable voltage is nearing the minimum voltage needed for PM3™ to operate properly.
Shore Cable WARNING! Voltage very high!	1. Shore cable voltage is nearing the recommended maximum voltage for PM3™. Consider switching the a generator to prevent damage to other AC systems on the boat.
**** FAILURE **** **** Detected ****	1. Indicates the PM3™ has stopped because of some reason. Often it's due to shore cable problems.
**** SYSTEM **** **** HALTED ****	1. Indicates the PM3™ has been turned off. Usually this is due to a second shore cable that has been detected.
2nd Cable Detected Waiting for restart	1. Cable has been plugged in and the system has detected it. 2. Waiting for cable to stabilize before restarting.
System will attempt a restart in 15 sec	1. System will restart in the displayed number of seconds.

If any of the fault conditions triggers the PM3™ to shutdown (other than over temperature), the local and remote displays will describe the condition and the possible methods to remedy the problem. In addition, the system will try to restart after approximately 45 seconds.

**Manual Override**

Manual override is for emergency situations only, and is not intended for normal use. When operating in manual mode, the user should pay particular attention to the input voltage and load on the system as not to damage the PM3™ or systems that rely on the PM3™ for power. Of particular concern is extremely low or high input voltage which may damage devices in the boat.

**Table 12. Manual Override Mode**

Mode	Description
Manual Override	To be used when the PM3™ control unit has malfunctions or the operation of the PM3™ is necessary when voltage is outside of the normal operating limits. During the operation in manual override, isolation is maintained.  <i>Note: Display voltage and boost not available.</i>

Use the following procedure to enter the manual override mode.

Step	Action
1.	Disconnect all shore cables.
2.	Remove the manual override access cover on the PM3™ control unit and switch the manual override switch to "override mode".
3.	Connect one or both of the shore cables to power. If connecting only a single cord, shore cable 1 must be connected to the power source. The system will operate as in SEPARATE mode described earlier with the following exceptions: <ul style="list-style-type: none"> <li>a. The computer and all displays are disengaged and off.</li> <li>b. Four LEDs located in the manual override switch compartment are off.</li> <li>c. Boost is not available. The system only operates in non-boost mode.</li> <li>d. All the computer controlled safety shutdown mechanisms are disabled except over-temperature.</li> </ul>

Use the following procedure to exit the manual override mode.

Step	Action
1.	Disconnect all shore cables.
2.	Flip the manual override switch on the PM3™ control unit to automatic mode.
3.	Replace the manual override access cover.

**POST INSTALLATION VERIFICATION**

Post installation verification should be done after installing the PM3™ and making all the final connections, or after servicing the PM3™ to verify that the connections in the boat and to the control unit and transformers are functioning properly.

*Note: The remote display (and optional second display if present) should be installed prior to performing the Post Installation Verification.*

**Voltage Boosting**

During the testing sequence, depending on the shore power voltage, the PM3™ may automatically turn on the voltage boost mechanism. If this occurs, there may be a momentary reduction in the power and the remote display (if present) will indicate "BOOST" after the shore voltage. Likewise, if the voltage reaches a point where boost is not needed, there may be a momentary reduction in the power as it is removed. The post installation verification is not intended to verify voltage boosting, and therefore the voltage boost mechanism should be ignored. The PM3™'s voltage boosting function is set and pre-tested at the factory prior to shipment.

## Phase Inverting

During testing, depending on the phase of the shore power, the PM3™ may invert the shore input that is 180 degrees out of phase. The remote display (if present) will show “INV”. The post installation verification is not intended to verify phase correction, and therefore this should be ignored. The PM3™’s phase inverting function is set and pre-tested at the factory prior to shipment.

## Digital Multi-Meters

Often a digital multi-meter will display stray voltage on a circuit that is open and not connected. The meter, because of its high input impedance, is actually detecting stray induced power on the open wire. This stray power is not useable nor does it pose a danger to the user. However, this fact should be taken into consideration when making measurements. Consult the user manual for the digital multi-meter to determine how to reduce incorrect readings.

### **WARNING**

**It is possible to have back voltage on an unused shore cable if a wiring error has been made during the installation of the PM3™. Take appropriate precautions to prevent injury during the testing. The Post Installation Verification procedure checks for wiring errors, removing any chance of back voltage on an unused shore cable.**

## Testing Procedure

Before beginning the testing procedure the following should be readily available:

- Volt Meter capable of measuring 120/240VAC
- Estimated 15 minutes time to perform tests
- Required Connections: Two 50-amp 240VAC shore power inputs with phasing that is 0 or 180 degrees apart. Do not test with shore power that has 120 degree phasing (split phasing off, a three-phase connection is not acceptable.)
- At least 6 amps of load is available to load the PM3™ down properly.

Follow the procedure below after the PM3™ is installed and wired, shore power is available, and when sufficient wiring of the AC circuits on the boat are complete to provide at least 6 amps of load. (i.e. lighting, motors, etc.).

Each mode of operation in this test procedure must be performed in the order shown, which are:

1. Source 1 Mode
2. Source 2 Mode
3. Normal Mode
4. Manual Override Mode

### 1. Source 1 Mode

Use the following steps to perform the Post Installation Verification in Source 1 Mode.

Step	Action	Result
1.	Connect Shore Cable 1 (only) to the supply voltage. Switch the source selector switch in the manual override compartment to Source 1.	The remote display and the display on the control unit should power up indicating that Source 1 is found along with the input voltage. After approximately 25 seconds, the PM3™ will engage the outputs. The remote display will indicate that Source 1 is functioning by showing the input voltage. The remote display will indicate that Source 2 is not used.
2.	Verify the following: –The output on Side 1 is operating –The output on Side 2 is operating –Shore Cable 2 should have no power	Verification complete.
3.	Disconnect Shore Cable 1	Cable disconnected, no power.
4.	Verify the following: The output on Side 1 is off The output on Side 2 is off	Output on Side 1 and Side 2 is off.

### 2. Source 2 Mode

Use the following steps to perform the Post Installation Verification in Source 2 Mode.

Step	Action	Result
1.	Connect Shore Cable 2 (only) to the supply voltage. Switch the source selector switch in the manual override compartment to Source 2.	The remote display and the display on the control unit should power up indicating that Source 2 is found along with the input voltage. After approximately 25 seconds, the PM3™ will engage the outputs. The remote display will indicate that Source 2 is functioning by showing the input voltage. The remote display will indicate that Source 1 is not used.
2.	Verify the following: –The output on Side 1 is operating –The output on Side 2 is operating –Shore Cable 1 should have no power	Verification complete.
3.	Disconnect Shore Cable 2	Cable disconnected, no power.
4.	Verify the following: The output on Side 1 is off The output on Side 2 is off	Output on Side 1 and Side 2 is off.

### 3. Normal Mode

Use the following steps to perform the Post Installation Verification in Normal Mode.

Step	Action	Result
1.	Connect Shore Cable 1 to the supply voltage. Switch the source selector switch in the manual override compartment to Source 1.	The remote display and display on the control unit should power up indicating that Source 1 is found along with the input voltage. Within 25 seconds, connect Shore Cable 2 to the supply voltage. The remote display should show that Source 1 and Source 2 have been found along with the input voltage. After a brief time delay, the PM3™ will engage the outputs. The remote display will indicate that Source 1 and Source 2 are functioning by showing the input voltage.
2.	Verify the following: –The output on Side 1 is operating –The output on Side 2 is operating	Verification complete.
3.	Disconnect Shore Cable 2	Cable disconnected, no power.
4.	Verify the following: –The output on Side 1 is off –The output on Side 2 is off –Shore Cable 2 has no power –The remote display and local display on the control unit indicates a fault condition	Verification complete.
5.	Disconnect Shore Cable 1	Shore Cable is disconnected.

### 4. Manual Override Mode

Use the following steps to perform the Post Installation Verification in Manual Override Mode.

#### **WARNING**

**Both Shore Cables must be off (non-powered) prior to switching the manual override switch, or system damage may occur.**

Step	Action	Result
1.	Uncover the PM3™ and toggle the <i>Manual Override</i> switch, located on the lower right front of the control unit, to “Manual”.	The PM3™ is in Manual Override mode.
2.	Connect Shore Cable 1 and Shore Cable 2 to the supply voltage	The PM3™ will engage a select number of relays to provide “limp home” power only. Neither the main computer nor the remote display will power up. Boost is not available in manual override mode.
3.	Verify the following: –The 4 LED’s in the manual override switch compartment are off –The output on Side 1 is operating –The output on Side 2 is operating	Verification complete.
4.	Disconnect Shore Cable 1 and Shore Cable 2	Shore cables are disconnected.

Step	Action	Result
5.	Toggle the manual override switch back to automatic mode	The PM3™ resumes automatic mode.
6.	Replace the cover	The PM3™ is intact.

## MAINTAINING THE PM3™

### **WARNING – HIGH VOLTAGE**

**To avoid serious injury or death from high voltage electrical shock, disconnect the AC shore power before attempting any maintenance or cleaning.**

No adjustment or maintenance is required for the PM3™ other than periodic cleaning of the outside cabinet with a dry cloth and inspecting all connections for tightness and corrosion by a qualified service person.

## WARRANTY AND SERVICE

### Warranty

The CHARLES Marine & Industrial Group warrants the PM3™ will be free from defects in materials and workmanship which cause mechanical failure for one (1) year, as set forth in the Limited Warranty. Review the enclosed warranty carefully for information on what is covered by its terms. Complete and return the warranty registration card within ten (10) days of purchase to establish proof of ownership and validate the warranty coverage. You must provide notice of any alleged defect in material or workmanship within thirty (30) days of discovering the problem, and within the warranty period. Follow the procedure outlined below to obtain warranty service.

### Service and Repair

If the unit fails to operate properly after following all the instructions in the manual, or if the PM3™ requires service, contact the Service Center directly to purchase a *Service and Repair* manual.

*Note: Do not attempt to service the PM3™. Contact the Service Center.*

### Service Center and Correspondence

To contact the Service Center via telephone directly:

800.830.6523 (Voice)

217.932.2473 (FAX)

Correspondence can be sent to Corporate Headquarters via the address below:

Charles Industries, Ltd.

Marine & Industrial Group

5600 Apollo Drive

Rolling Meadows, IL 60008-4049

USA

[www.charlesindustries.com](http://www.charlesindustries.com)

Correspondence can be sent to the Service & Repair Center via the address below:

Charles Industries, Ltd.

Marine & Industrial Group

400 S.E. 8th Street

Casey, IL 62420-2054

USA

## SPECIFICATIONS

The operating specifications of the PM3™ are listed in Table 13.

**Table 13. PM3™ Operating Specifications**

Feature	Specification
Total Power	24 KVA
Power per Shore cable	12 KVA
Nominal Input Voltage	240 VAC
Minimum Input Voltage	185 VAC
Maximum Input Current	100 Amps (50 Amps per cord)
Operating Frequency	50/60 Hz
Nominal Output Voltage	240 VAC
Maximum Output Current	100 Amps (50 amps with a single shore cable) Non-boost mode)
Ambient Operating Temperature	-25° C to +55° C (-13° F to +131° F)

The physical specifications of the PM3™ control unit and transformer are listed in Table 14 and Table 15.

### Control Unit

**Table 14. PM3™ Control Unit – Physical Specifications**

Feature	Specification
Approximate Weight	62 pounds (28 kilograms)
Length	18.0 inches (45.7 centimeters)
Width (including mounting feet)	15 inches (38.1 centimeters)
Width (excluding the mounting feet)	13.0 inches (33.0 centimeters)
Height (with the mounting feet)	12.0 inches (30.5 centimeters)
Air space around unit	2 inches on all sides
Control Unit Display	4 line X 20 character
Keypad	12 keys

### Transformer

**Table 15. PM3™ Transformer – Physical Specifications**

Feature	Specification
Approximate Weight	245 pounds (111 kilograms)
Length	20.0 inches (50.8 centimeters)
Width (including mounting feet)	15 inches (38.1 centimeters)
Width (excluding the mounting feet)	13.0 inches (33.0 centimeters)
Height (with the mounting feet)	12.0 inches (30.5 centimeters)
Air space around unit	2 inches on the back and top. 4 inches on the sides.

The system specifications of the PM3™ are as follows.

- The distance between the control unit and transformer must not exceed 50 feet
- A high-speed microprocessor controls the Control Unit
- A keyboard is located on the front of the control unit for diagnostics
- An RJ-11C Telephone interface is available for remote debugging (United States compatible telephone systems only)
- Emergency operational mode (Manual Override).

For the remote display units:

- A maximum of two remote display units can be connected to the system
- One display unit is provided, the second is optional.
- The second remote display unit may be up to 50 feet from the first display unit
- Cable is provided.

The power and control cabling with the PM3™ includes the following:

- The cabling required between the control unit and transformer is provided
- Up to 100-foot 5 conductor 6 AWG jacketed cable
- (2) BNC-BNC control cables
- All strain reliefs are included.

The customer is required to provide:

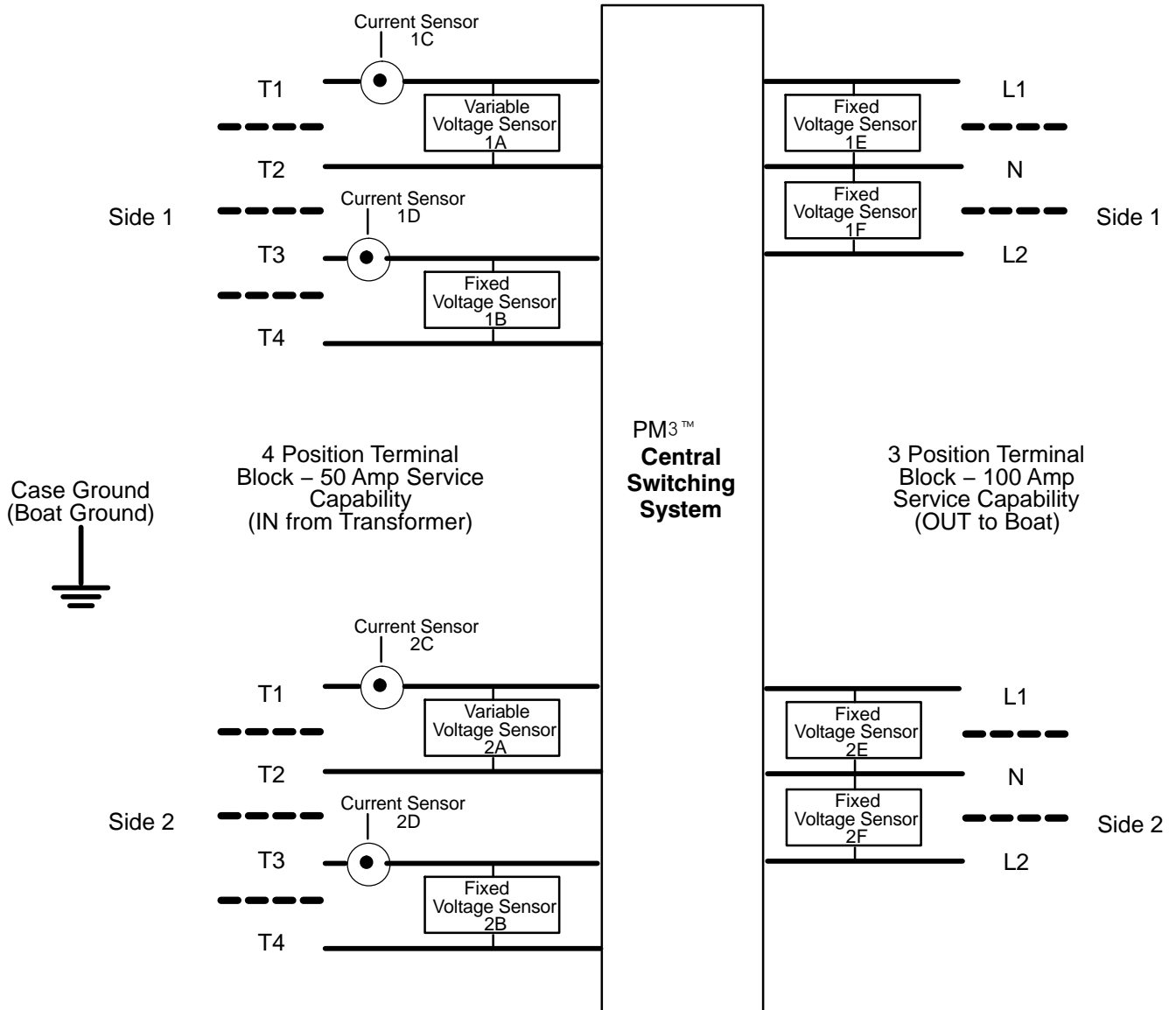
- 3 conductor minimum 6 AWG for input connection to power source (recommended)
- 3 conductor minimum 4 AWG for output connection to distribution source (recommended)

The PM3™ meets the following regulatory specifications.

- Marine UL
- CE
- FCC Class A: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: 1.) This device may not cause harmful interference, and 2.) this device must accept any interference received, including interference that may cause undesired operation.
- FCC Telephone ID: US: DWEMM00BXE2430G
- Ringer Equivalent: 03B
- Assembly location: United States of America



**APPENDIX A – SENSORS**



Sensor	Type
1A	Variable Voltage Sensor (measures voltage level)
1B	Fixed Voltage Sensor (only checks for voltage present)
1C	Variable Current Sensor (measures current level)
1D	Variable Current Sensor (measures current level)
1E	Fixed Voltage Sensor (only checks for voltage present)
1F	Fixed Voltage Sensor (only checks for voltage present)
2A	Variable Voltage Sensor (measures voltage level)
2B	Fixed Voltage Sensor (only checks for voltage present)
2C	Variable Current Sensor (measures current level)
2D	Variable Current Sensor (measures current level)
2E	Fixed Voltage Sensor (only checks for voltage present)
2F	Fixed Voltage Sensor (only checks for voltage present)

<b>Sensor</b>	<b>Phase Relationship</b>
1A	Reference for 1B,2A
1B	Phase Compared to 1A
1C	None
1D	None
1E	Reference for 1F
1F	Phase compared to 1E
2A	Reference for 2B, Phase Compared to 1A
2B	Phase Compared to 2A
2C	None
2D	None
2E	Reference for 2F
2F	Phase compared to 2E

**APPENDIX B – SAMPLE OF NON-VOLATILE ERROR MEMORY**

<b>CONTROL UNIT</b>	<b>MEANING</b>
Last Error #1 ↵= Exit Last Mode: Normal Err: Output Input Phase: 180 deg	Error report for most recent shutdown (page 1). Operating in NORMAL mode prior to shutdown. Cause of the shutdown was an output voltage error. Input voltage phase is inverted at shutdown.
Last Error #1 ↵= Exit 1: 195V MAX 249 MIN 192V  2: 208V MAX 245 MIN 200v  1: 20 21 2: 19 18 Amps	Error report for most recent shutdown (page 2). Shore cable 1 Shutdown at 195 volts. Highest voltage recorded is 249 volts during the time the system was running. Lowest voltage is 192 volts. Sensor 1A Shore cable 2 shutdown at 208 volts. Highest voltage recorded is 245 volts during the time the system was running. Lowest voltage is 200 volts. Sensor 2A At the time of shutdown Shore Cable 1, Current Sensor 1C is 20 Amps. Shore Cable 2, Current Sensor 1D, is 21 Amps. Shore Cable 2, Current Sensor 2C is 19 Amps. Shore Cable 2, Current Sensor 2D is 18 Amps.
Last Error #1 ↵= Exit Sensor 1B: Present Sensor 2B: Reversed Sensor 1E: Missing	Error report for most recent shutdown (page 3). Sensor reporting voltage. Sensor reporting voltage but with inverted phasing. Sensor reporting no voltage.
Last Error #1 ↵= Exit Sensor 1F: Missing Sensor 2E: Present Sensor 2F: Missing	Error report for most recent shutdown (page 4). Sensor reporting no voltage. Sensor reporting voltage. Sensor reporting no voltage.

**APPENDIX C – Troubleshooting**

**TROUBLESHOOTING**

If there is a problem with the PM3™, first check all connections and retest. If all connections are good, see if the problem is covered in Table 16. If the problem is not covered in Table 16, or if the PM3™ still malfunctions after performing the solution given, contact the Charles Marine & Industrial Group for technical assistance.

**Table 16. Troubleshooting Suggestions**

Item	Condition	Solution
1.	No display on the PM3™ controller.	<p>If the green LED indicator is NOT illuminated on either of the PM3™ transformers:</p> <ol style="list-style-type: none"> <li>1. Check the dockside circuit breakers</li> <li>2. Check the inlet circuit breakers.</li> </ol> <p>If the green LED indicator IS illuminated on both PM3™ transformers:</p> <ol style="list-style-type: none"> <li>1. Check the PM3™ transformer circuit breaker.</li> <li>2. Check the PM3™ controller manual override switch.</li> <li>3. Check the wiring polarity between each transformer and PM3™ controller.</li> <li>4. Remove the PM3™ controller cover and check all connections to the control PC board assembly.</li> </ol> <p>If only one AC shore power cord is used and the green LED indicator IS illuminated on only one of the PM3™ transformers:</p> <ol style="list-style-type: none"> <li>1. Check the PM3™ transformer circuit breaker</li> <li>2. Check the PM3™ controller position of the shore cable source switch.</li> </ol> <p>Check the PM3™ controller manual override switch. Set in Auto mode.</p>
2.	The dockside circuit breaker “trips”	<p>If the dockside circuit breaker immediately trips:</p> <ol style="list-style-type: none"> <li>1. Check the plug for physical damage.</li> <li>2. Turn off the inlet circuit breaker and attempt to turn on the dockside circuit breaker.</li> </ol> <p>If the dockside circuit breaker still trips then the cord-set may need repair or replacement.</p> <p>If the dockside circuit breaker does not trip, then turn on the inlet circuit breaker.</p> <p>If the circuit breaker immediately trips again, check the PM3™ transformers and input wiring for physical damage.</p> <p>If the dockside circuit breaker trips shortly after the PM3™ system is powered up:</p> <ol style="list-style-type: none"> <li>1. Ensure that both shore power cords are connected and all breakers are on.</li> <li>2. Reduce the AC loads applied on the boat, then re-apply power.</li> </ol>
3.	The PM3™ isn’t boosting the incoming shore power AC.	<p>The shore power is within the normal non-boost range. Boost is not available in Manual Override mode.</p>
4.	There is no AC power on the boat but the PM3™ display indicates there is power available.	<p>Check the AC circuit breaker that must be installed after each of the PM3™ outputs.</p>

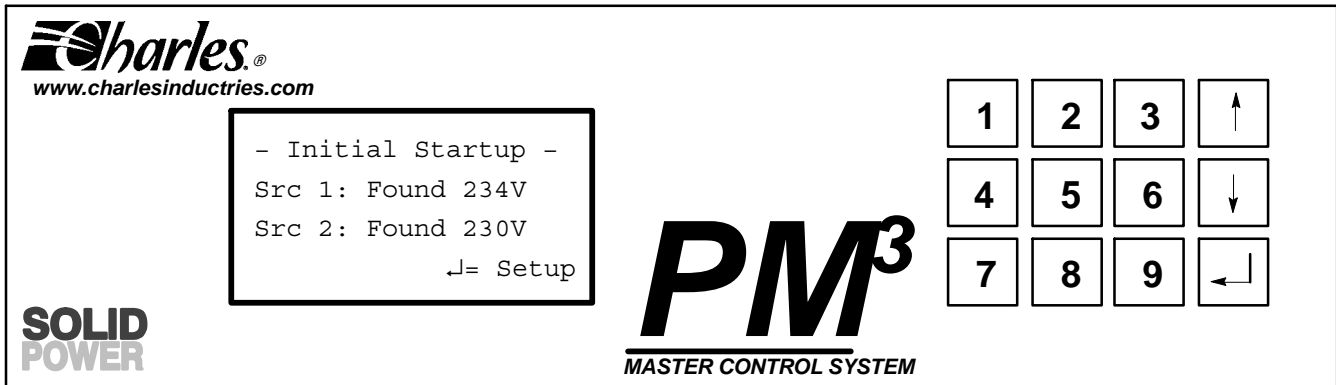
Item	Condition	Solution
5.	Shore power AC is available but the PM3™ will not enable the outputs.	<p>The PM3™ will not enable the outputs if there is insufficient shore power AC.</p> <p>The output load is exceeding limits. Reduce the load.</p> <p>An external AC power source is detected. Turn off all powering systems (i.e. generator) on the boat before enabling the PM3™.</p> <p>System is waiting in a reset timeout. Wait 45 seconds for a reset</p> <p>System has overheated due to overload condition. Wait for the system to cool off. This may take some time.</p>
6.	The PM3™ was operating but stopped.	<p>Check to see if a failure is being displayed and use that as a guide to correct the error.</p> <p>Check the circuit breakers and transformers.</p> <p>If there is no display available, check the shore power AC circuit breaker(s) and/or the required inlet breaker on the boat.</p>
7.	The circuit breakers that supply shore side AC power to the PM3™ are tripping.	<p>The PM3™ may be in the Separate Mode or Single Mode, thus reducing each AC output bus to a maximum of 12KVA(50Amps) or less.</p> <p>The combined total of AC amps demanded may be exceeding the PM3™'s current limits and the available shore side AC current. Reduce the amount of amps required (turn off some of the AC powered devices) and reset the affected shore side AC breakers.</p>
8.	The Remote Display does not function.	<p>The Remote Display is not connected to the PM3™.</p> <p>If the remote display was just connected, wait 30 seconds for the system to acknowledge the display.</p> <p>Check all connections for a loose wire.</p> <p>Incorrectly wired. Input to the remote display is the center connector. The side connector is output to an additional remote display.</p> <p>More than 2 remote displays are daisy-chained. The system is designed for up to a maximum of 2 remote displays.</p> <p>The remote display should have no more than 50-feet of cable.</p>
9.	The PM3™ is operating in Separate mode.	<p>The PM3™ operates in Separate mode whenever the phases of the power are incompatible.</p> <p>The shore power is from a 3-phase system.</p>
10.	The power "dims" when going into/out of boost.	Normal condition.
11.	The PM3™ will not power up with only a single shore cable connected.	<p>Check that the source selector switch, in the manual override compartment, is set to the appropriate source.</p> <p>Check the breakers in the transformers.</p> <p>The transformers have overheated. Allow sufficient time to cool.</p>
12.	One of the over-temperature indicators on the PM3™ transformers are on.	<p>You must wait for the transformers to cool down before the system restarts. The cooling period might take some time.</p> <p>Ensure there is adequate airflow around the transformer.</p> <p>Reduce the load on the PM3™ by turning off non-essential systems in the boat.</p>
13.	The circuit breakers in the transformers keep tripping.	Generally this is caused by a faulty wiring system either between the PM3™ transformers and the control unit or in the boat itself. Have the wiring system checked.

**Setup and Diagnostic Systems**

The PM3™ is equipped with an on board setup and diagnostic system that will facilitate trouble shooting of the system.

**CAUTION**

**Some parts of the diagnostic system require that all systems that the PM3™ is providing power to be turned off. Take this into consideration when using the diagnostic systems.**



**Figure 8. Display Panel on the Control Unit**

The keys used for the diagnostic system and their meaning are described below.

Key	Description
1 – 9	Option Keys: Even though an option may not be listed on the screen at the current time, the key is still valid. Example: The SETUP menu has 9 options. Only a few are shown on the screen at one time, yet all are valid entries. Note: some menu screens do not use all 9 option keys.
Scroll Keys ( ↑,↓ )	Moves the display up or down through the options and messages.
Return Key ( ↵ )	Return to the previous menu or enter the initial setup.

To enter the diagnostic system, do the following.

Step	Action	Result
1.	Press ↵ on the keypad	The first few lines of the setup menu will be displayed.

**Setup Menus**

The Setup Menu is primarily used for setup and diagnostic systems. The setup menu has the available options listed below.

Key	Option	Description
1	Power Down	Turns off the output power.
2	Automatic mode	Starts the automatic startup sequence for powering the system. Depending on the cables connected and the phasing, this may either be Normal mode, Separate mode or Shore Cable 1 mode.
3	Separate mode	Forces the system to start in Separate mode. In this mode, shore cable 1 supplies output 1. Shore cable 2 supplies output 2. Shore cable 1 and shore cable 2 are not interconnected.
4	Source 1 mode	Forces the system to start using only shore cable 1. <i>Note: Selecting this mode disables the “restart if a second shore cable is found.”</i>

Key	Option	Description
5	Source 2 mode	Forces the system to start using only shore cable 2. <i>Note: Selecting this mode disables the “restart if a second shore cable is found.”</i>
6	System Diagnostics	Runs a self test on the PM3™ to assist in determining problems. The test will halt on the first error found, display the suspected problem and allowing for troubleshooting of the system. To run this test, the system must be in Power Down mode, both shore cables connected, and all systems that the PM3™ supplies with power disconnected. Generally, this is simply accomplished by turning off the breakers in the boat’s distribution panel. <i>Note: Using this option could possibly damage systems connected to the PM3™. For this reason it is extremely important for the PM3™’s output to be disconnected from all loads. This is explained in the menu listing. Press the arrow keys to read all the warnings in this menu prior to engaging the diagnostic routines.</i>
7	Sensors display	All the PM3™ sensors are displayed along with their relationships for phase control. Use the arrow keys to scroll through the sensors. Appendix A shows the location of the sensors in the system. To obtain the best sensor information, the system should be in Normal mode or Separate mode, but is not required.
8	Relay Test	This option consists of two menus that allows the user to individually select each relay one at a time. Only one relay may be energized at a time and there is a slight delay after selecting a relay to energize so the system may turn off any relays that have been previously turned on. Use the arrow keys to scroll through the list. The system must be in Power Down mode to use this option. The boost relays are in the transformer modules. Boost relays are special as both relays in a single box are on for about half of a second. Exiting this menu turns off all relays in the control unit and returns the system to a non-boost mode.
9	Next menu	Switches to setup menu 2
↵	Exit	Exits Setup Menu 1 and returns the displays to their normal operation.

Setup menu 2 has the following options available.

Mode	Option	Description
1	Display Last Error	Each time the system successfully starts, it records the mode the system started up with. In addition, if an error occurs (other than loss of power on shore cable 1), the system records important information about the system into non-volatile memory. Each time a record is made, the previous error is pushed down one storage slot. So error in slot 1 is moved to slot 2, and slot 2 is moved to slot 3, etc. The information in the last slot is lost. Reference Appendix B for a representation of errors. The arrow keys can be used to scroll through the information while viewing. When the system is successfully running, the first slot only shows the mode the system is in. All the other information is invalid. After the system is reset to factory defaults, the mode of operation is reported as Power Down on all used error slots.
2	Factory Defaults	Selecting this option and following the on-screen display will return the system to factory defaults. It will also erase all the non-volatile error memory. Use with caution. Generally, this option is not needed.
3	Version	Displays the version of the PM3™’s software.
9	Previous menu	Switches to setup menu 1
↵	Exit	Exits Setup Menu 2 and returns the displays to their normal operation.

**Modem Interface**

The PM3™ is equipped with a modem interface to allow remote operation and diagnostics of the PM3™. When the modem interface is active, a remote user can operate the PM3™ as if the user is pressing the keys on the keypad. In addition, the remote user can see the local and remote displays on their computer terminal.

A low speed, 2400 baud modem is used (2400 baud, 8 bits, no parity, 1 stop bit) is used to provide the remote connection. The low speed modem has the distinct advantage of being able to connect when telephone lines are less than perfect.

**CAUTION**

**The modem interface is only designed for systems compatible with telephone systems used in the United States. Using the modem with any other type of telephone system is at the users own risk.**

*Note: It is highly recommended that all answering machines, computers, or faxes be disconnected from the telephone line as they may interfere with the operation of the PM3™ modem interface if they answer the telephone at the same time as the PM3™.*

To access the modem port, remove the cover label "Telephone Interface" and plug a standard phone cable into the system. Provide the remote user the telephone number of that phone line being used to connect with the PM3™. The remote user will then call the PM3™. The PM3™ will act similar to an answering machine, answering the phone on the first or second ring. After about 30 seconds, the modems will connect and the remote user can operate the system.

The information on the remote user's system is updated every 3 to 4 seconds. Since the system uses a low speed modem, the update is somewhat delayed. However, this does not affect the performance of the system. The keyboard on the remote users computer becomes the keypad on the system. The following computer keys translate to the keypad.

PM3™ Keypad	Remote Computer Keys
1 – 9	1 – 9
↑	u
↓	d
↵	Enter

*Note: Remote computer entry is not case sensitive.*

Pressing either the PM3™'s keypad or the computers keyboard accomplish the same effect and update both displays. In addition, selecting functions on the PM3™'s keypad will cause the display on the remote computer to update.

The remote user may disconnect the connection by hanging up the phone.

**WARNING**

**For security reasons, it is generally not a good idea to keep the PM3™ connected to the phone line any longer than is needed to remotely operate the system.**

