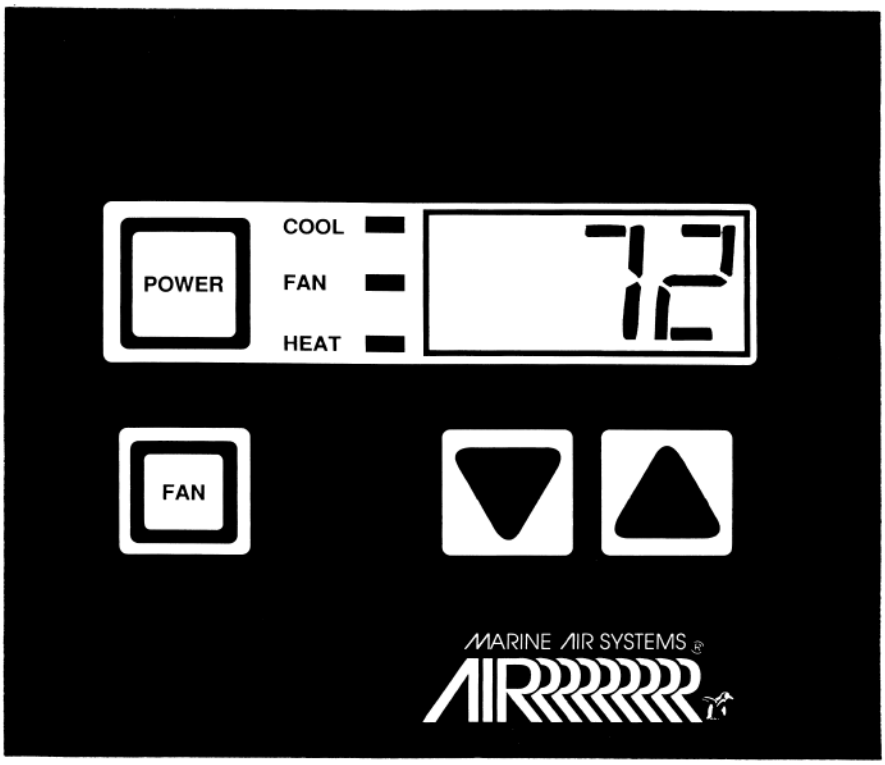
ENVIRONMENTAL CONTROL UNIT
ECU



INSTALLATION/OPERATION MANUAL

MARINE AIR SYSTEMS®
AIRRRRRRR

PREFACE

The **Environmental Control Unit (ECU)** is designed for use with direct expansion, reverse cycle marine air conditioning systems. It is available for 115 Volt or 230 Volt and 50/60 Hz operation. This controller provides optimum control and comfort of cabin environment by incorporating the following features:

- Non-Volatile Memory
- Low Voltage Display Panel
- LED Cabin Temperature Displayed in Fahrenheit or Celsius
- Automatic Operation in Cool and Heat Modes
- Factory Installed Air Sensor For Accurate Operation
- Multiple Fan Speed Selections
- User Selectable Programs For Optimum Control

This manual is intended to provide the information necessary to ensure proper installation and operation of the Environmental Control Unit. Improper installation or misunderstood operating procedures can result in unsatisfactory performance and/or premature failure of this controller.

BEFORE PROCEEDING, READ THIS MANUAL COMPLETELY

If further assistance is needed prior to or during the installation of this controller, call Marine Air Systems at (305) 973-2477; (800) 327-3137; Fax (305) 979-4414.

The **Environmental Control Unit (ECU)** is covered under the existing Marine Air Systems Warranty Policy.

In the interest of product improvement, Marine Air Systems' specifications and design are subject to change without prior notice.

TABLE OF CONTENTS

ENVIRONMENTAL CONTROL UNIT (ECU)

Model*	ECU	ECU	
Voltage	115 Volts 50/60 Hz	230 Volts 50/60Hz	
Circuit Protection (Fuses)			
Transformer:	L_1	1.0 Amp	Buss-Type
	L_2**	5.0 Amp	Diode-Type
Fan	6.25 Amp	Buss-Type	(Slo-Blo)
Pump	6.0 Amp	Buss-Type	
Reversing Valve	5.0 Amp	Buss-Type	
Temperature Ranges			
Set Point Temperature	55° - 85°F	(13° - 29°C)	
Display Temperature	0° - 150°F	(-18° - 66°C)	
Air Sensor Temperature	0° - 150°F	(-18° - 66°C)	
Dimensions			
Display Panel	4.50"W x 3.875"H		
Cut Out	3.375"W x 2.75"H		
Display Cable	Self Contained: 14' Central: 30'***		
Air Sensor Cable	Self-Contained: 7' Central: 30'***		

* 'VRE' model denotes Self Contained Series with ECU
'CSE' model denotes Central Series with ECU

** L_2 is fused only in 230 volt controls

*** Custom cables over 30' are made to order in 5' increments

MEMORY

The Environmental Control Unit incorporates a non-volatile memory which requires no batteries or any form of back-up power. When power is lost all operating parameters are retained indefinitely. When the power is restored the unit will resume operating as last programmed.

Operating and programmable parameters are retained into memory fifteen (15) seconds after being entered and are maintained indefinitely. If power is interrupted prior to the fifteen seconds required, the program will return to its previously selected parameter.

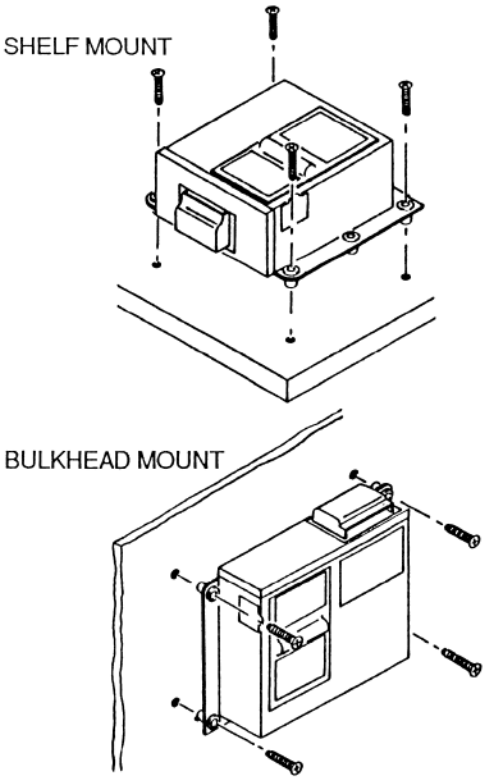
TEMPERATURE HYSTERESIS

While in a given mode the controller will maintain a two degree (2°F) temperature variation. For example, while in the cooling mode, the unit will cycle off at 72°F. The system will resume cooling when the room temperature reaches 74°F. The system maintains this two degree (2°F) hysteresis while in either the heating or cooling mode.

A four degree (4°F) temperature change is required to shift the unit into the opposite mode. The same system that was in cooling and set at 72°F would have to record a room temperature of 68°F before the unit would change to the heat mode. Once in the heating mode, the system will maintain a two degree (2°F) temperature variation.

Each **Environmental Control Unit (ECU)** consists of a display panel, display cable, factory-installed air sensor and a control circuit board assembled into the air conditioning unit's electrical box. Determine the proper location and routing of all components before proceeding with the installation.

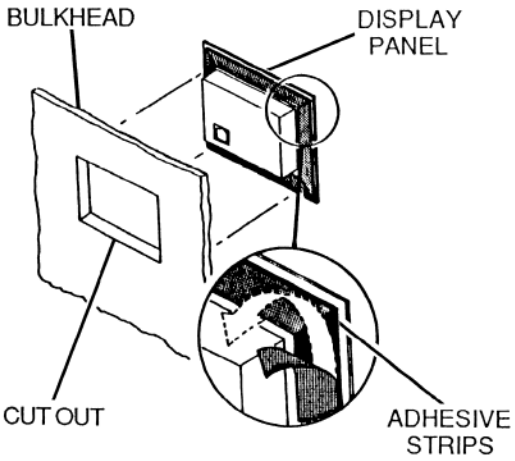
REMOTE ELECTRICAL BOX WITH CONTROL CIRCUIT BOARD



The control circuit board contains the triacs, fuses and socket connections for the display and air sensor cables.

— Locate the electrical box in a dry, accessible area.
— Fasten the box to a bulkhead or shelf with the isolation grommets and screws provided.
— Allow adequate access for proper wiring connections and service.
— **NOTES:**
  - The electrical boxes contain no position-sensitive components.
  - The central system electrical box can remain factory-installed on top of the unit.
  - All circuit breakers and wire gauge must be sized according to marine design standards. Only stranded tinned copper wire should be used. All equipment and/or components should be properly grounded.

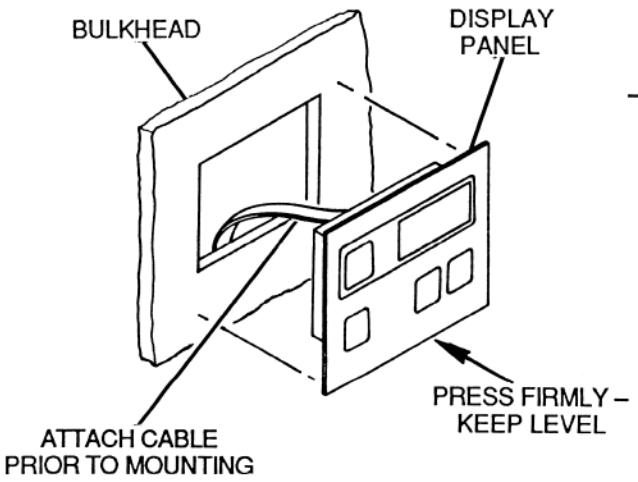
DISPLAY PANEL



The display panel contains the key pads and numerical L.E.D.'s for operation and programming of a system.

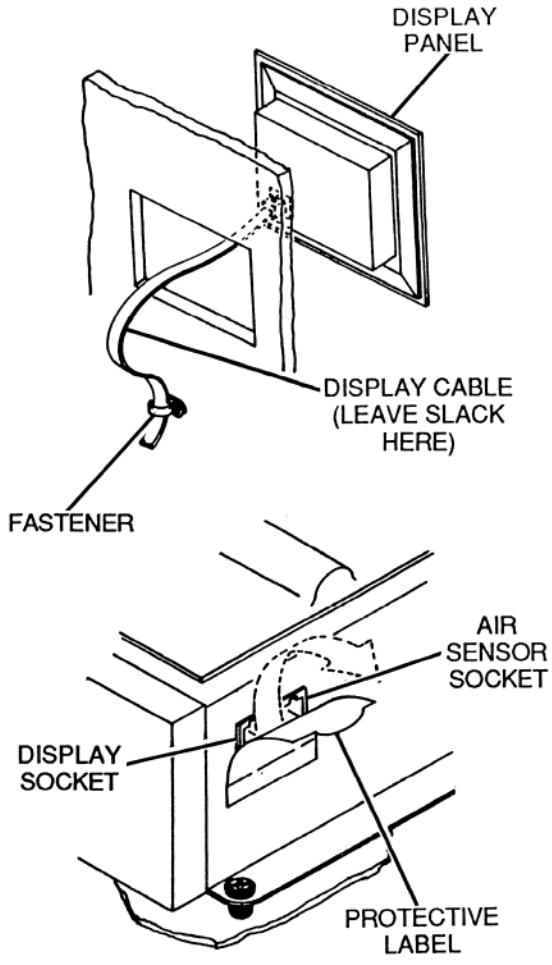
— Locate the panel in the cabin or area it is to condition.
— Cut a hole in the bulkhead (3.375" W x 2.75" H).
— Attach the display cable to the panel prior to securing it to the bulkhead.
— Peel off the backing to the adhesive strips attached to the display panel.

DISPLAY PANEL (Continued)



— Secure the panel through the bulkhead cut-out by pressing the panel against the bulkhead. Make sure the display panel is level.
— **NOTE:** Screws may be used, if necessary, by carefully cutting or drilling the lexan face plate in the corners over the pre-molded holes in the bezel. Use the template and screws provided with each display panel. **See page 12 for details.**

DISPLAY AND AIR SENSOR CABLES



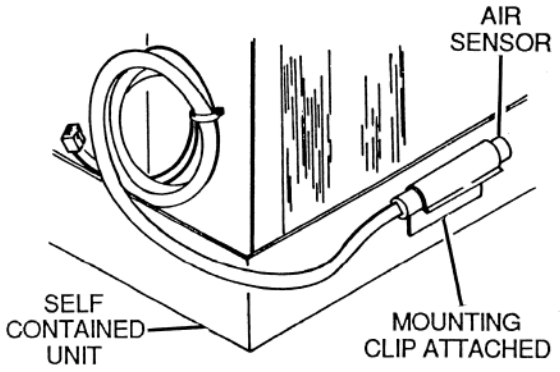
A display cable (8-pin connector) and an air sensor cable (6-pin connector) are provided for connections to the control circuit board.

Self contained system cables are routed from the unit located in the cabin area. Central system cables are routed from the unit located in the engine room, machinery compartment, etc., to the evaporator/blower assembly located in the cabin area. Central cables can be routed with the refrigerant lines.

— Secure the cable during installation to protect it from being cut or broken at the modular plugs.
— Leave a few inches of slack cable at each end for ease of installing or removing the components.
— Remove the protective labeling from the female sockets on the control circuit board for final connections.
— Plug the jack into the appropriate socket (display). Make sure the polarized key on the jack is locked into place.

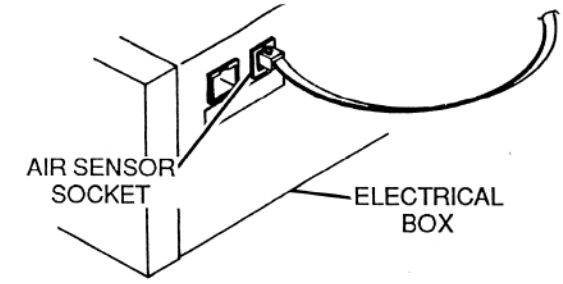
NOTE: Do not stretch or pull the display cable or remote sensor cables. Do not use staples to secure any cable.

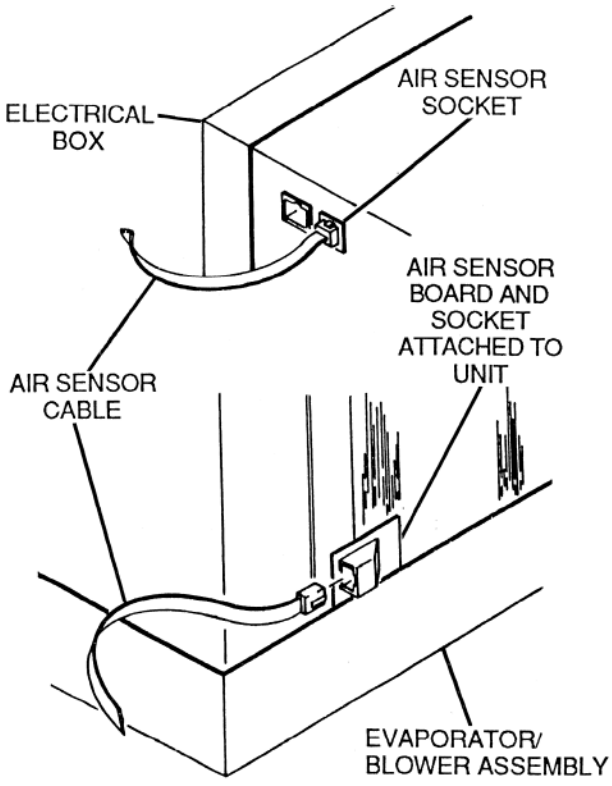
DISPLAY AND AIR SENSOR CABLES (Continued)



The **self contained system's air sensor** consists of a thermistor potted inside a conductive tube and attached to a six (6) conductor cable (standard length 7') with a modular phone jack on the end. The thermistor is factory installed with a non-conductive mounting clip that is attached to the unit.

— Clip the tie-wrap around the coiled cable.
— Route the cable properly and securely to the remote electrical box.
— With the protective label covering the female sockets removed, plug the jack into the appropriate socket (**air sensor**). Make sure the polarized key on the jack is locked into place.





The **central systems's air sensor** consists of a thermistor and female socket attached to a small circuit board card, and a 6 conductor cable with two (2) modular phone jacks, one on each end (standard length - 30'). The thermistor card is factory installed on the evaporator blower assembly.

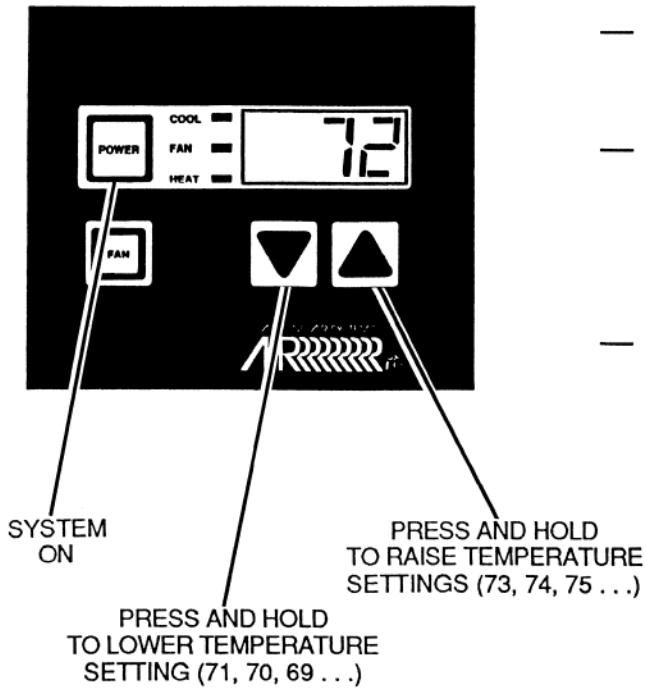
— Route the air sensor cable properly and securely, leaving enough slack at each end to make serviceable connections.
— With the protective label removed, plug the jack into the appropriate socket (**air sensor**) on the remote electrical box at or near the condensing unit.
— Plug the other end into the female connector on the air sensor card at the evaporator/ blower assembly.

When power is supplied to the vessel with the circuit breaker 'On' to any air conditioning unit, the controller will respond according to its programmed settings.

FACTORY SETTINGS:

On/Off Selection	—	OFF
Temperature Set Point	—	72°F
Fan Speed Selection	—	A (Automatic)
Temperature Display	—	Fahrenheit
Fan Speed Calibration	—	± 0
Temperature Calibration	—	± 0
Compressor Staging - Time Delay	—	60 seconds
Fan Motor Option	—	0 (Shaded Pole)

TEMPERATURE SET POINT



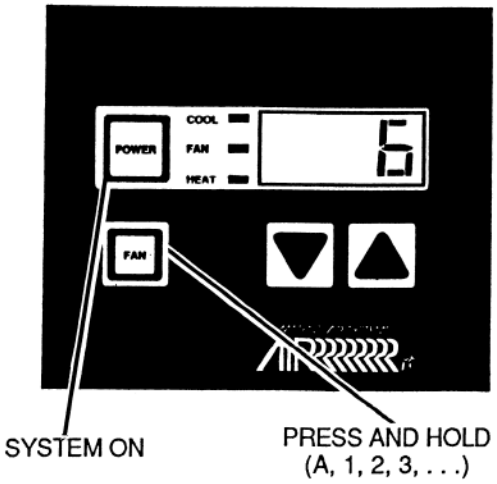
With the system on:

— Press either temperature key **(lower or raise)** to read the temperature set point.

— To change the set point, press and hold the appropriate key. The temperature will change one degree per second. When the desired setting is reached, release the key.

— As the cabin temperature rises or falls 2°F from the set point, the mode light (**cool/ heat**) will illuminate, the compressor will energize and the unit will operate and condition the cabin or area as desired.

FAN SPEED SELECTION

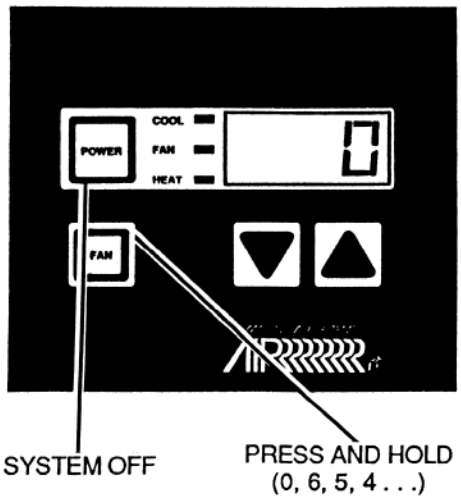


With the system on:

— Press and hold the **fan** key.
- The display panel will read **'A'**.
- The **fan** indicator light will be illuminated.
- The display will scroll continuously **A, 6, 5, 4, 3, 2, 1** in descending order.

— When the desired speed is reached, release the key. The fan speed number will turn off. The **fan** light will remain illuminated if left in a manual fan speed selection.

FAN ONLY (AIR CIRCULATION)

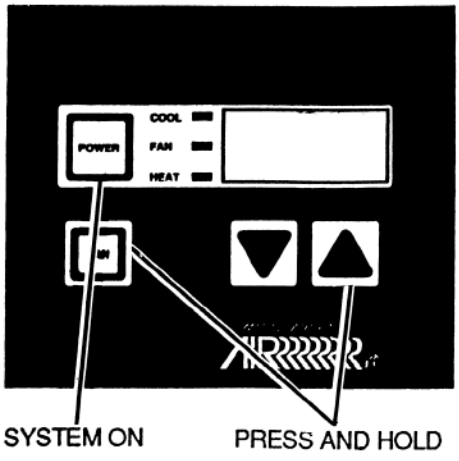


With the system off:

— Press and hold the **fan** key.
- The display panel will read zero ('**0**').
- The **fan** light will be illuminated.
- The display window will scroll continuously the numbers '**6**' through '**0**' in descending order.

— When the desired speed is reached, release the key.
- The fan speed number will turn off.
- The **fan** indicator light will remain illuminated.
- The cabin temperature will not be displayed.

BLANK THE DISPLAY



To turn off or blank the display lights while the system is on:

— Press the **fan** and **raise** keys simultaneously. The display lights will turn off while the system continues to operate.

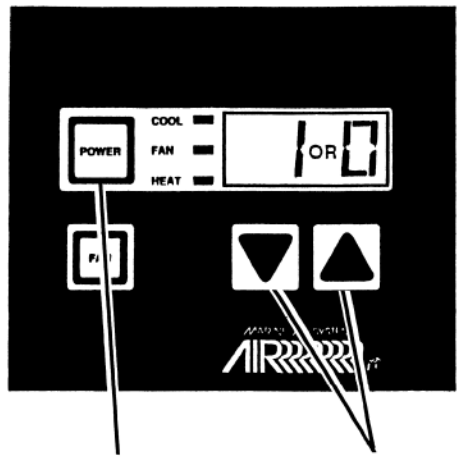
— Press any key to re-illuminate the display

NOTE: In the **fan only** mode, the **fan** light can not be blanked or turned off.

Pressing the fan and lower keys simultaneously, all display lights except for the fam lights will shut off.

PROGRAMMABLE FUNCTIONS

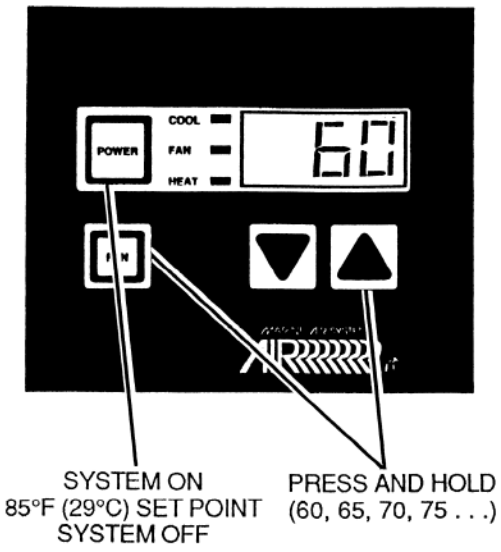
FAHRENHEIT/CELSIUS DISPLAY



To program the controller for Fahrenheit or Celsius degrees:

— Turn the system 'On' (**Power** key).
— Raise the temperature set point to **85°F** (29°C).
— Turn the system 'Off' (**Power** key).
— Press and hold the **raise and lower** keys simultaneously.
  • The numbers **'1'** and **'0'** will scroll continuously.
  • Release the key at **'0'** to display Fahrenheit degrees.
  • Release the key at **'1'** to display Celsius degrees.
— Turn the system"On' (Power key).
— Press and hold **lower** key and readjust temperature set point to desired setting.

COMPRESSOR STAGING — TIME DELAY



Multiple unit applications require staging of the compressors during start-up to avoid high amperage surges and nuisance tripping of circuit breakers.

— Turn the system 'On' (**Power** key).
— Raise the temperature set point to **85°F.**
— Turn the system 'Off' (**Power** key).
— Press and hold the **fan** and **raise** keys simultaneously. The numbers **60** seconds through **135** seconds will scroll continuously in 5 second increments.
— When the desired time delay is displayed, release the keys.
— Turn the system 'On' (**Power** key).
— Press and hold the **lower** key and re-adjust the temperature set point to the desired setting.

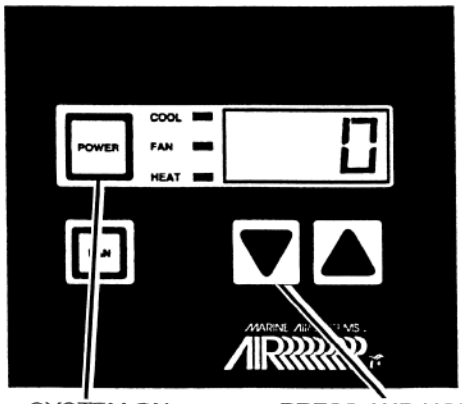
CYCLED/CONTINUOUS FAN

In 'Off' Mode, press Power and Down simultaneous to toggle between '**0**' and '**1**'. 0=Continous; 1=Cycled.

HUMIDITY MODE

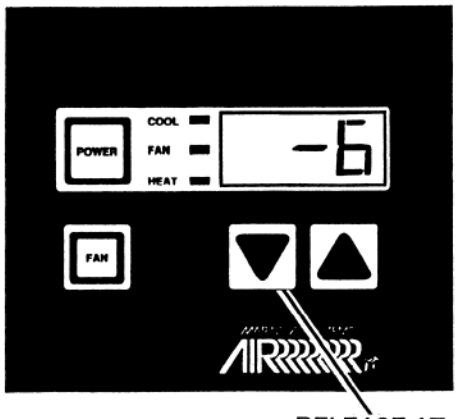
In 'On" Mode, press Power and Fan simultaneously to change into Humidity Mode.

TEMPERATURE CALIBRATION



SYSTEM ON
85°F (29°C) SET POINT
SYSTEM OFF

PRESS AND HOLD
LOWER KEY
(0, 1, 2, . . ., -9, -8, -7 . . .)

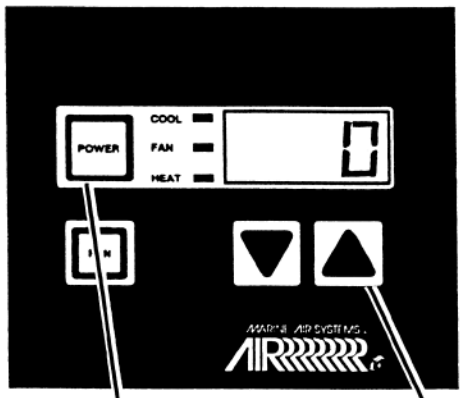


RELEASE AT
DESIRED SETTING

The cabin temperature reading displayed can be compensated by ± 9 degrees. This allows for adjustment to a controller's air sensor located in an area that is affected by excessive conditions (cold or hot area, sunlight, heat, etc.). **To re-calibrate the temperature display:**

— Turn the system 'On' (**Power** key).
— Raise the temperature set point to **85°F** (29°C).
— Turn the system 'Off' (**Power** key).
— Press and hold the **lower** key. The numbers **'0'** thru **'9'**, then **'-9'** thru **'0'** will scroll continuously.
— When the desired degree compensation is reached, release the keys.
Example: To reduce a temperature reading from 78°F to 72°F, select **'-6'** in the display window. This would allow a reading consistent with the average cabin temperature displayed (72°F) on other controls.
— Turn the system 'On' (**Power** key).
— Press and hold the **lower** key and readjust temperature set point to desired setting.

FAN SPEED CALIBRATION



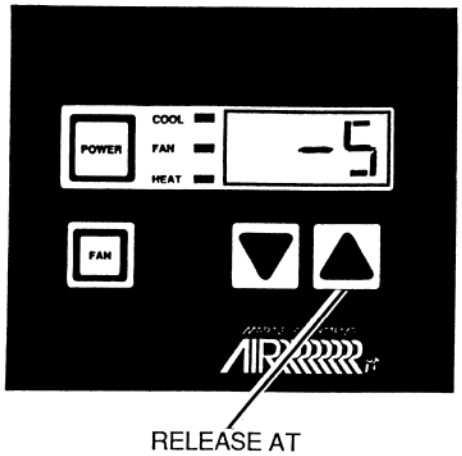
SYSTEM ON
85°F (29°C) SET POINT
SYSTEM OFF

PRESS AND HOLD
(0, 1, 2, . . ., -9, -8, -7 . . .)

Fan speeds can be compensated by ± 9 VAC. This allows for adjustment to various fan motors in order to maintain proper high-low ranges. **To re-calibrate the fan speed:**

— Turn the system 'On' (**Power** key).
— Raise the temperature set point to **85°F** (29°C).
— Turn the system 'Off' (**Power** key)
— Press and hold the **raise** key. The numbers **'0'** through **'9'**, then **'-9'** through **'0'** will scroll continuously in the display window.

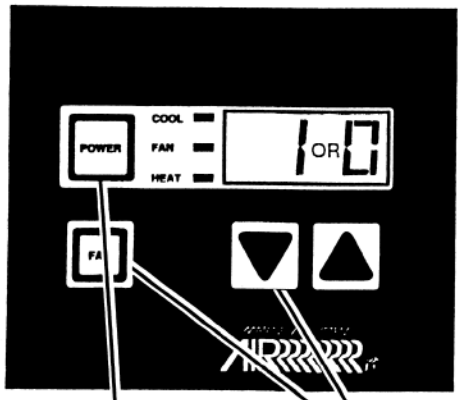
FAN SPEED CALIBRATION (Continued)



RELEASE AT DESIRED SETTING

— When the desired compensation voltage is reached, release the keys.
Example: To reduce each fan speed by 5 volts, select **'-5'** in the display window. This will reduce voltage in each fan speed except high speed, which will always remain line voltage.
— Turn the system 'On' (**Power** key).
— Press and hold the **lower** key and readjust temperature set point to desired setting.

FAN MOTOR OPTION



SYSTEM ON
85°F (29°C) SET POINT
SYSTEM OFF

PRESS AND HOLD
(1, 0, 1, 0 . . .)

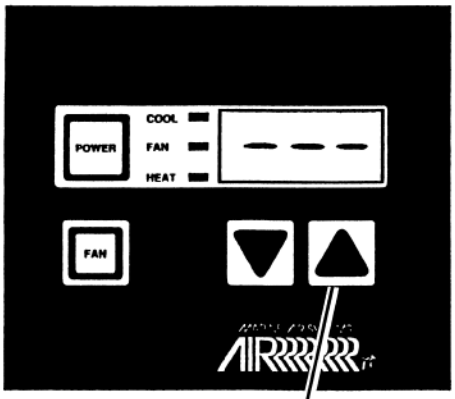
Fan speed regulation varies between a shaded-pole motor and a split capacitor motor.
To select the proper mode for any fan motor:

— Turn the system 'On' (**Power** key).
— Raise the temperature set point to **85°F** (29°C).
— Turn the system 'Off' (**Power** key).
— Press and hold the **fan** and **lower** keys simultaneously. The numbers **1** and **0** will scroll continuously.
— Release the key at **1** for split capacitor motor operation.
— Release the key at **0** for shaded-pole motor operation.
— Turn the system 'On' (**Power** key).
— Press and hold the **lower** key and readjust the temperature set point to the desired setting.

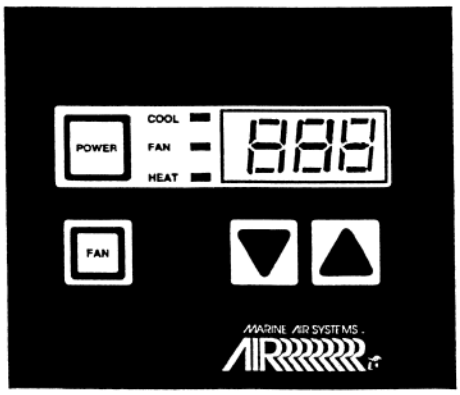
NOTE: Controllers are pre-programmed at the factory to match their type of fan motor.

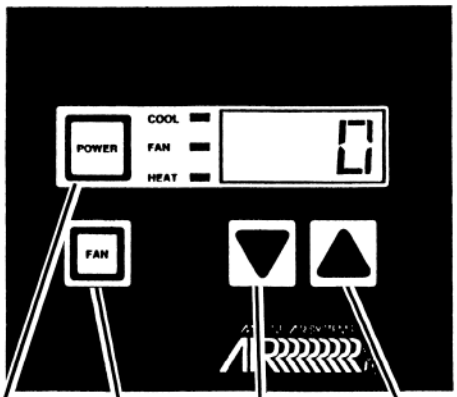
SELF-DIAGNOSTIC TEST MODE

SYSTEM OFF
AT CIRCUIT BREAKER



PRESS AND HOLD
TURN CIRCUIT BREAKER ON





1 DISPLAYS 9

4 DISPLAYS 1

3 DISPLAYS 4

2 DISPLAYS 6

This test electronically checks all circuits, keys and air sensor for proper operation. **With the system Off at the circuit breaker:**

— Press and hold the **raise** key.
— Turn the power 'On' at the circuit breaker. Random numbers will appear.
— Release the **raise** key and the following sequence will occur:

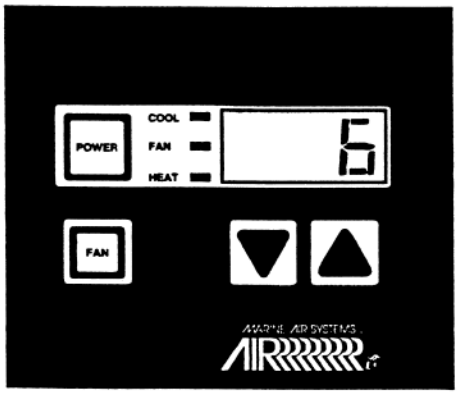
1. Three (3) dashes will appear (**- - -**) indicating the controller's memory is good.
2. The air sensor is tested and its reading is displayed, preceded by a one (1) , i.e. **177**.
3. All seven segment displays are illuminated (**888**) along with the **Cool, Fan** and **Heat** light for two (2) seconds.
4. The cabin temperature is displayed and the heat fan and cool lights are illuminated one at a time successively.
5. All display lights are illuminated (same as 3. above).
6. A zero (**0**) is displayed.

— To continue, test the keys in the order as follows:

1. Press **Power** — Displays **9**.
2. Press **Raise** — Displays **6**.
3. Press **Lower** — Displays **4**.
4. Press **Fan** — Displays **1**.

— The fan test begins in high speed (**6**) and runs each fan speed for five seconds in descending order . The fan light remains illuminated during this test.

SELF DIAGNOSTIC TEST MODE (CONTINUED)



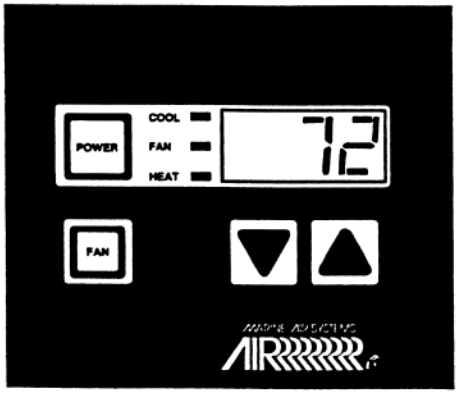
FAN SPEEDS DISPLAYED DURING TEST (6, 5, 4, 3, 2, 1, 0, OFF)

— The fan turns off and the display reads zero (**0**).
— The following sequence occurs:

1. The reversing valve is energized (5 seconds).
2. The seawater pump is energized (5 seconds).
3. The compressor is energized (5 seconds).

The display reads cabin temperature during the above.

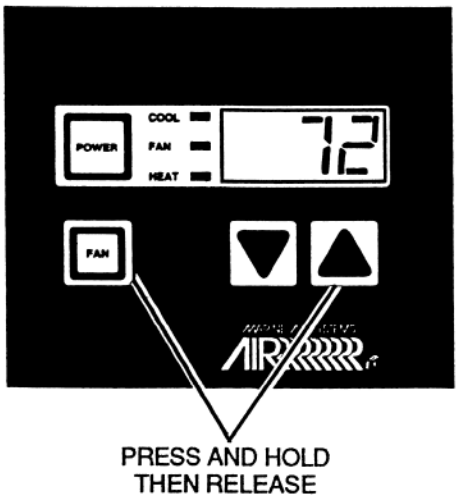
— The systems turns 'Off', displaying only the cabin temperature.



CABIN TEMPERATURE DISPLAYED

This is the end of the self-diagnostic test. Power must be turned **'Off'** at the circuit breaker to exit this test.

MICRO PROCESSOR RESET



PRESS AND HOLD THEN RELEASE

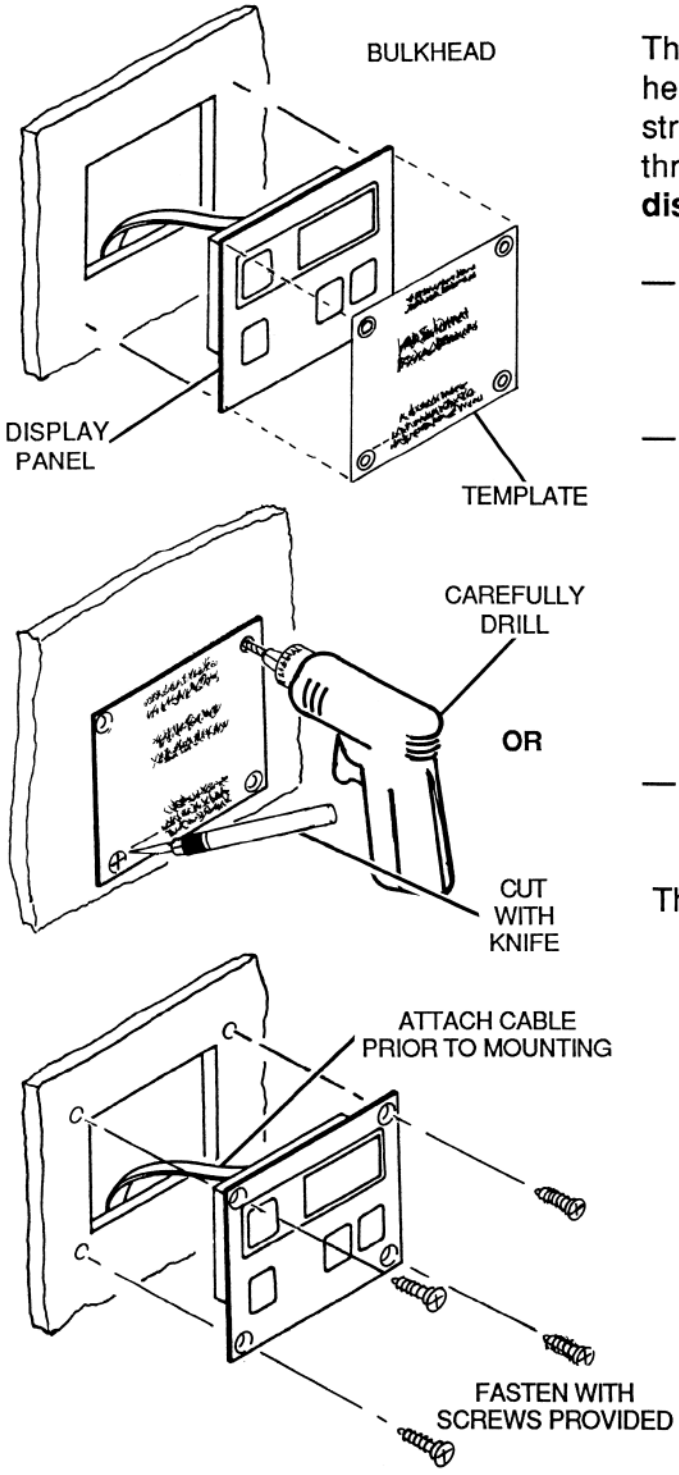
The controller's memory may be reset to its default values (factory settings) at the end of the self-diagnostic test. **With the cabin temperature displayed at the end of the test above:**

— Press and hold the **Fan** and **Raise** keys simultaneously.

— Release the keys.

The control will reset to its factory settings.

DISPLAY PANEL MOUNTING



The display panel can be attached to a bulkhead by using the factory affixed adhesive strips or by using the screws provided to fasten through the panel to a bulkhead. **To fasten a display panel using screws:**

— Place the ECU template provided on top of the Lexan panel. It should fit snug inside the bezel.

— Using a low speed drill motor (or variable speed motor) and a 1/8" drill bit, carefully drill through the template and panel to access the mounting holes in the bezel.

NOTE: Pull the drill back out carefully after piercing the Lexan to prevent tearing or ripping of the panel.

— Place the panel through the bulkhead cut-out and mount level with screws provided.

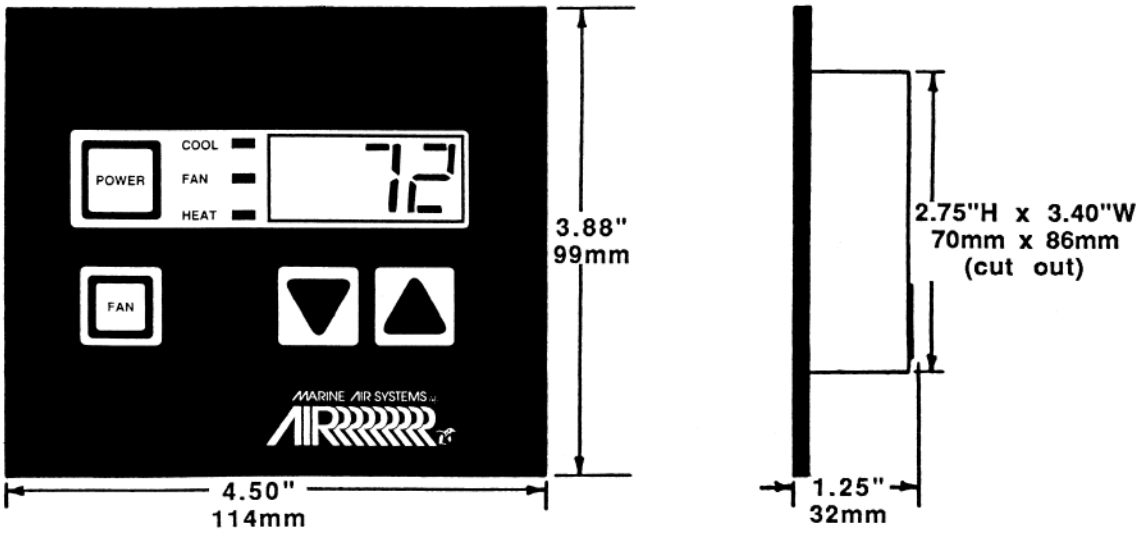
The mounting holes can also be accessed by:

— Placing the template in the bezel as above.

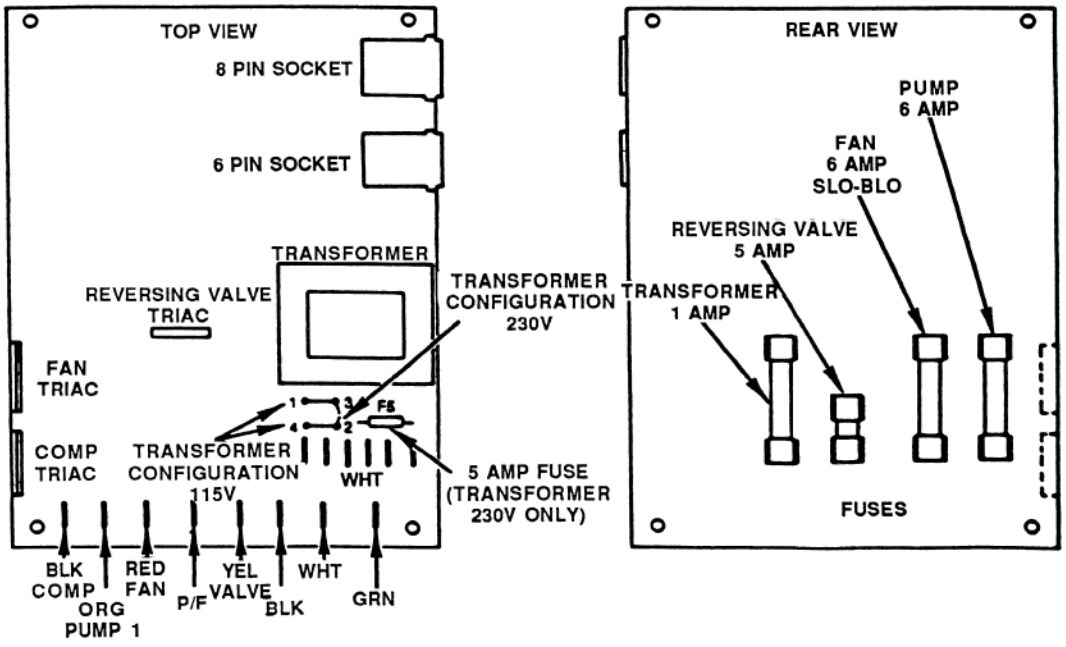
— Using a sharp razor knife (X-acto® type), cut a small hole or a set of cross slits through the template and panel.

— Proceed as above.

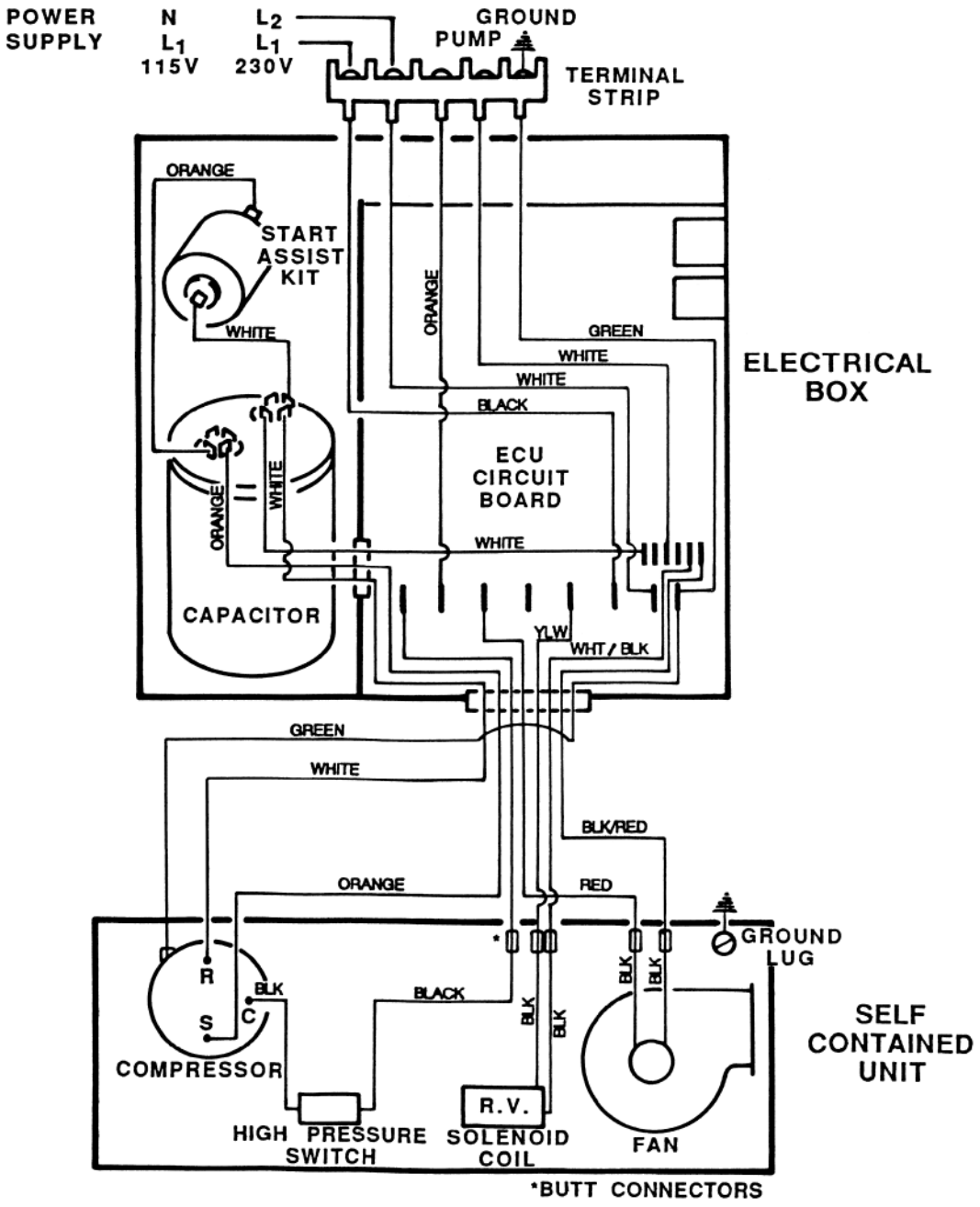
ECU
DISPLAY PANEL
DIMENSIONS



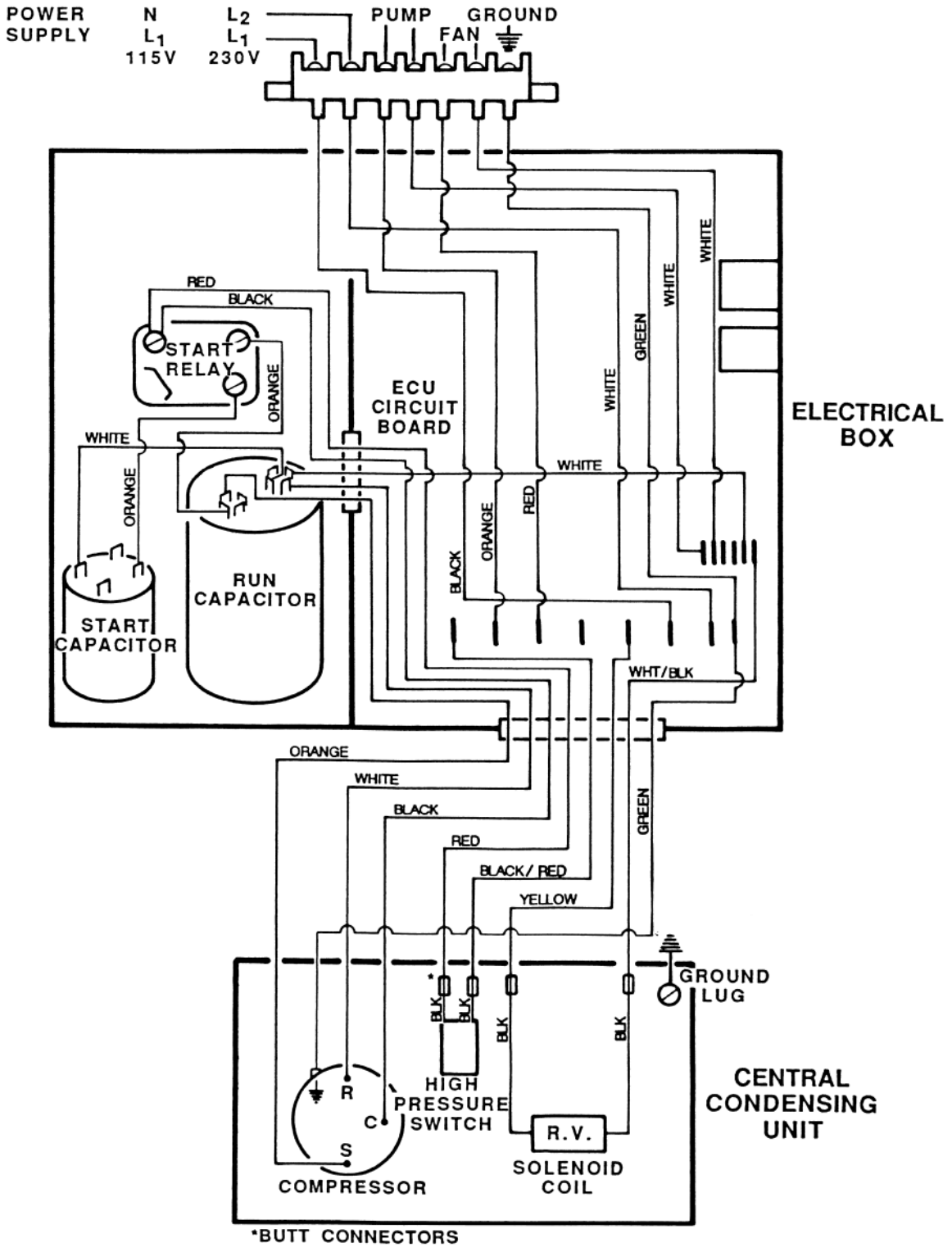
CIRCUIT BOARD
COMPONENTS/FUSES



SELF CONTAINED SYSTEMS
WIRING DIAGRAM
WITH ENVIRONMENTAL CONTROL UNIT (ECU)

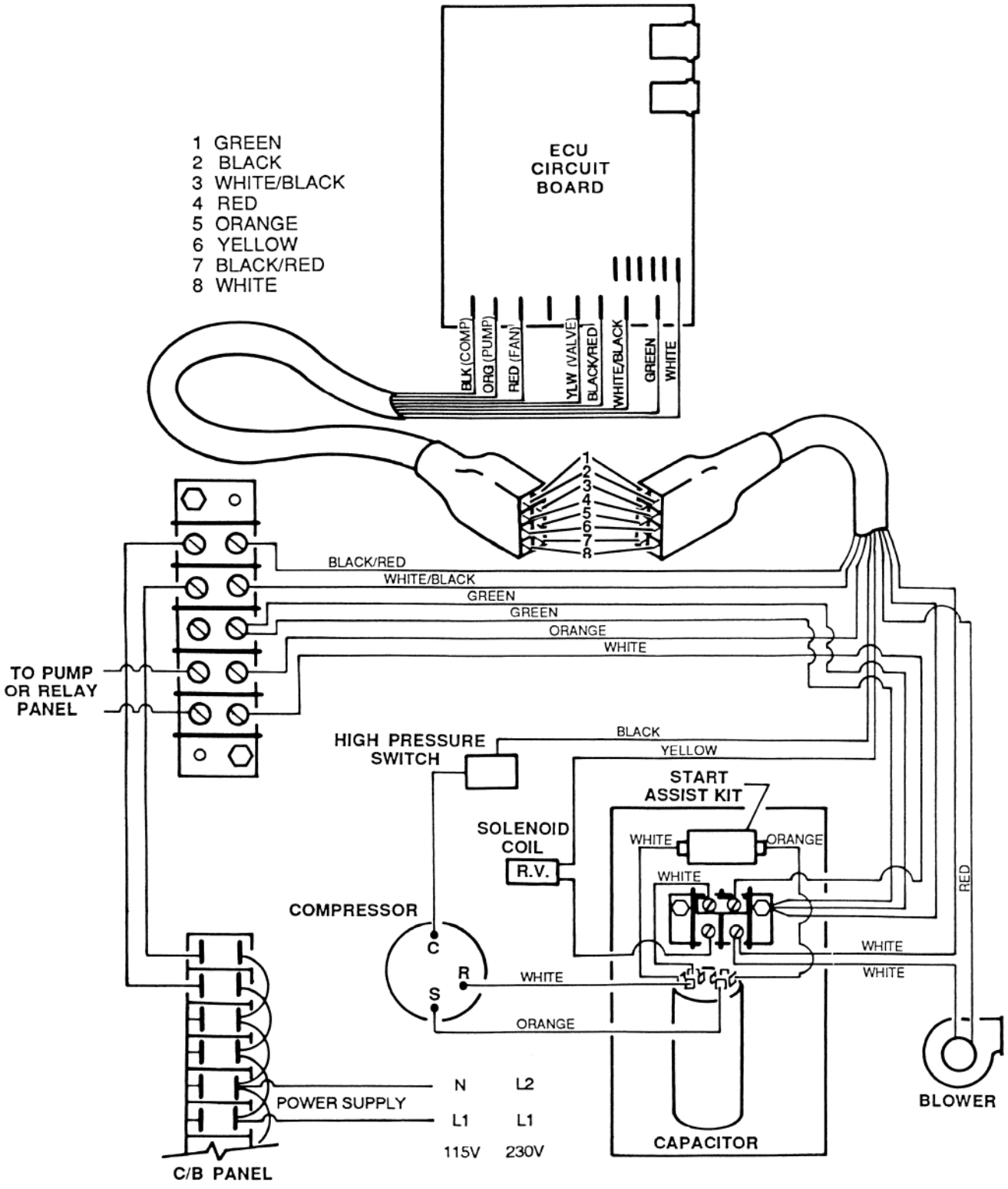


CENTRAL SYSTEMS
WIRING DIAGRAM
WITH ENVIRONMENTAL CONTROL UNIT (ECU)



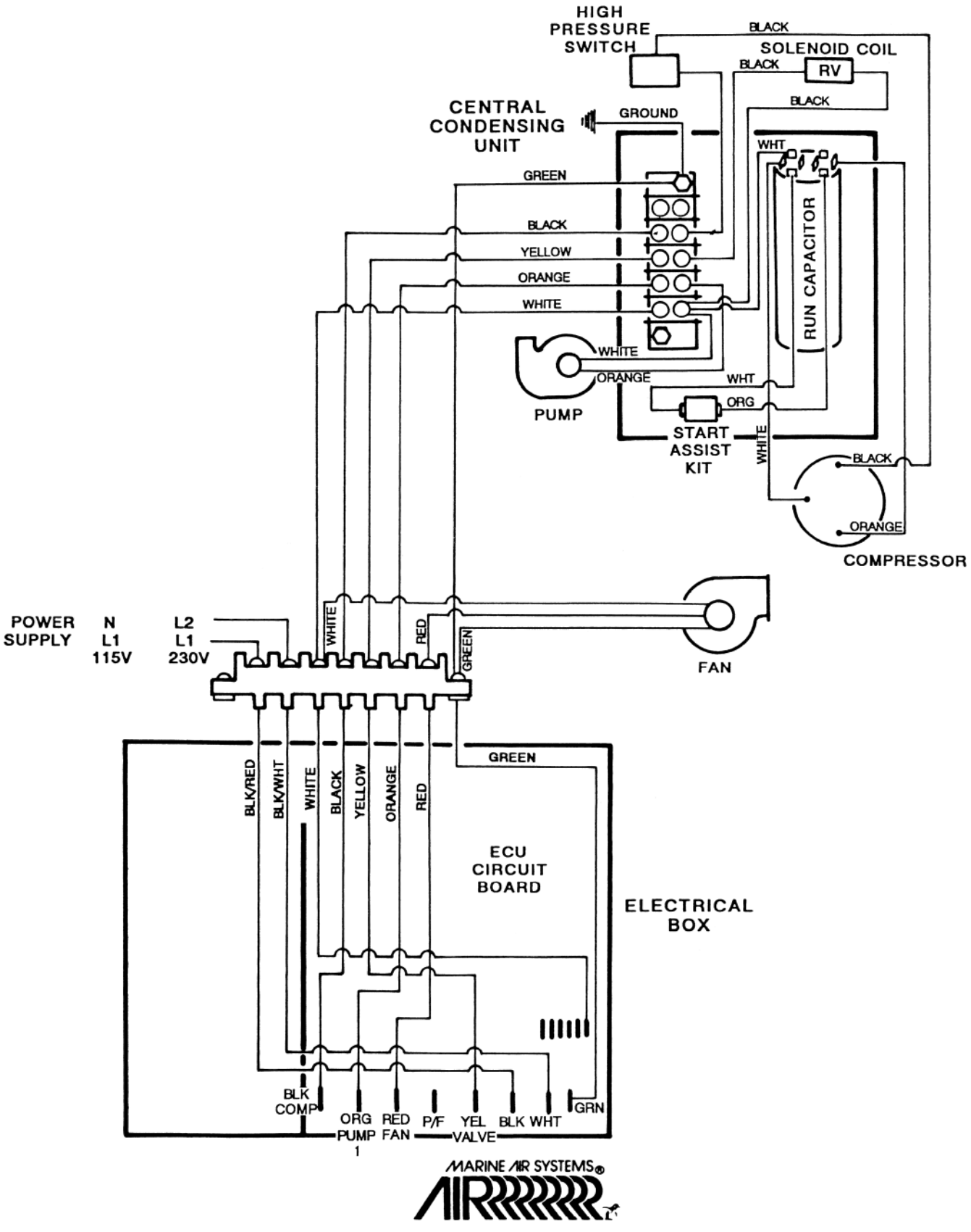
MARINE AIR SYSTEMS®

SELF CONTAINED SYSTEMS
WIRING DIAGRAM
WITH ENVIRONMENTAL CONTROL UNIT (ECU)
RETROFIT



MARINE AIR SYSTEMS®
AIRRRRRR

CENTRAL SYSTEMS
WIRING DIAGRAM
WITH ENVIRONMENTAL CONTROL UNIT (ECU)
RETROFIT



IMPORTANT - Power should be disconnected before removing any electrical covers or wiring.

FAULT	POSSIBLE REASON	CORRECTION
System will not start/ Display is not illuminated	• Air conditioning C/B is off	• Turn C/B on at ship's panel
	• Wiring at terminal strip is mis-wired	• Check wiring diagram; correct if necessary.
	• M.O.V. is blown on control module	• Circuit board must be repaired/replaced. Call for service. Check for proper line voltage, voltage surges, etc. before re-power.
	• Transformer fuse is blown on control module circuit board	• Replace fuse. Check wiring connections and wiring diagram before re-power.
	• 8-pin display cable plugs are not making contact (unplugged, dirt, bent or broken pins)	• With POWER OFF at the circuit breaker, remove Telco connectors and inspect. If damaged, replace connector or entire display cable.
	• Power button is defective	• Press button several times to CLEAR. With POWER OFF at the circuit breaker, exchange display panels.
	• Input line voltage is 65 volts or less on 115VAC control/130V or less on 230VAC control	• Check power source (shore/generator) for proper voltage. Check wiring and terminals for proper sizes and connections.
System starts; display is illuminated. No Compressor	• Improper temperature settings — cool or heat light off	• Temperature set-point is equal to or 1°F from ambient readout on display panel. Use raise or lower buttons and adjust ±2°F from display panel readout.
	• Compressor triac has failed in an open position	• Defective part. Repair/replace circuit board. Call for service.
System starts and operates; display is not illuminated	• Unit is in its blanked mode (lights turned off)	• Press any key to re-illuminate.
	• Wiring is incorrect	• Check wiring diagram; correct if necessary.
	• Display cable is defective	• With POWER OFF at the circuit breaker, remove Telco connectors and inspect. If damaged, replace connector or entire display cable.
	• Display panel is defective	• With POWER OFF at the circuit breaker, remove display panel and exchange with an operable one.
System starts — display is illuminated No fan	• 6.25 amp Slo-Blo fuse is blown on control circuit board	• Replace fuse. Check wiring connections and wiring diagram before re-power.
	• Harness wiring is incorrect	• Check wiring diagram. Correct if necessary.
	• Fan triac has failed in an open position	• Defective part. Repair/replace circuit board. Call for service.

FAULT	POSSIBLE REASON	CORRECTION
System starts; display is illuminated No pump	• 6 amp normal fuse is blown on control circuit board • Harness wiring is incorrect	• Replace fuse. Check wiring connections and wiring diagram before re-power. • Check wiring diagram. Correct if necessary.
Pump Relay Panel has failure	• Circuit breaker for pump is off	• Turn on C/B marked 'A/C Pump' Relay Panel at ships panel.
	• 10 amp normal fuse is blown in the pump relay panel	• Replace fuse. Check wiring connections and wiring diagram before re-power.
	• Pump relay panel wiring is incorrect	• Check pump relay panel wiring diagram. With unit breakers and A/C pump breaker on, check input voltage to relay panel. If voltage is not present, a wiring problem exists back to the ship's panel. With unit on, check voltage at signal terminals (1A & 1B, 2A & 2B, etc.) If voltage is not present, a wiring problem exists back to the unit. With voltage present at both locations above, check output terminals to sea water pump. If voltage is not present either: 1. Signal circuit is defective. Move to a spare circuit if available. 2. Triac is defective on sea water pump circuit. • Replace circuit board if above does not correct problem.
System runs continuously	• Improper air sensor location	• Check air sensor. Relocate and properly fasten as per drawings.
	• Set-point temperatures are improperly set	• Check temperature set-point using raise/lower buttons. If setting is extreme (55°F—85°F) for conditions, reset to cycle compressor. Check cabin temperature.
Component(s); Compressor, Fan, Pump, Reversing Valve — will not turn off with power button	• Triac is shorted input to output	• Defective part. Repair/replace circuit board. Call for service.
	• Harness wiring is incorrect	• Check wiring. Correct if necessary.
	• Pump does cycle off 30 seconds after power button is off	• No problem.
	• Reversing valve does cycle off 35 seconds after power button is off	• No problem.
Compressor short cycles	• Air sensor is improperly located or against a highly conductive surface	• Check sensor location. Properly re-locate if necessary.
	• No or poor water flow, compressor is cycling on high pressure switch	• Check sea water systems — thru-hull fitting, sea cock, and strainer; clean if obstructed. Check sea water pump amperage for proper operation. Inspect pump wet-end assembly. Check for air lock due to installation error. Correct as necessary.

FAULT	POSSIBLE REASON	CORRECTION
Sporadic flashing of LED lights	• Poor display cable connections	• With C/B power OFF, remove and inspect all connections. Clean, correct as necessary and re-attach. Check input voltage.
	• Defective display panel	• With power OFF, replace display panel to check.
Display panel 'lights up'; all indicator lights on will not change with key pads	• Microprocessor loose, incorrectly installed or damaged	• With power at C/B OFF, remove cover on control module and inspect microprocessor. Look for loose or bent pins. Check notch to see that it matches notch screened on circuit board. If above is correct, push down with both thumbs to reconnect pins in socket if loose. Replace microprocessor if necessary.
Ship's panel circuit breakers trip when changing from shore power to generator or generator to shore power	• Improper wiring connectors • Compressor time delay program has not been staged or delays are not long enough	• Check wiring connections and wiring diagram. • Access time delay program. Set time delays longer or farther apart.

MARINE AIR SYSTEMS®

AIRRRRRRRR

MARINE AIR SYSTEMS INC. □2000 N. ANDREWS AVENUE EXT., POMPANO BEACH, FL 33069 □PHONE 800-327-3137
TELEX: 203635 □ FAX: 305/979-4414