ECU-Maxx
Operations Manual

MODE
- AUTO
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- HEAT
- MOISTURE CONTROL

FAN SPEED
- AUTO
- MANUAL

POWER

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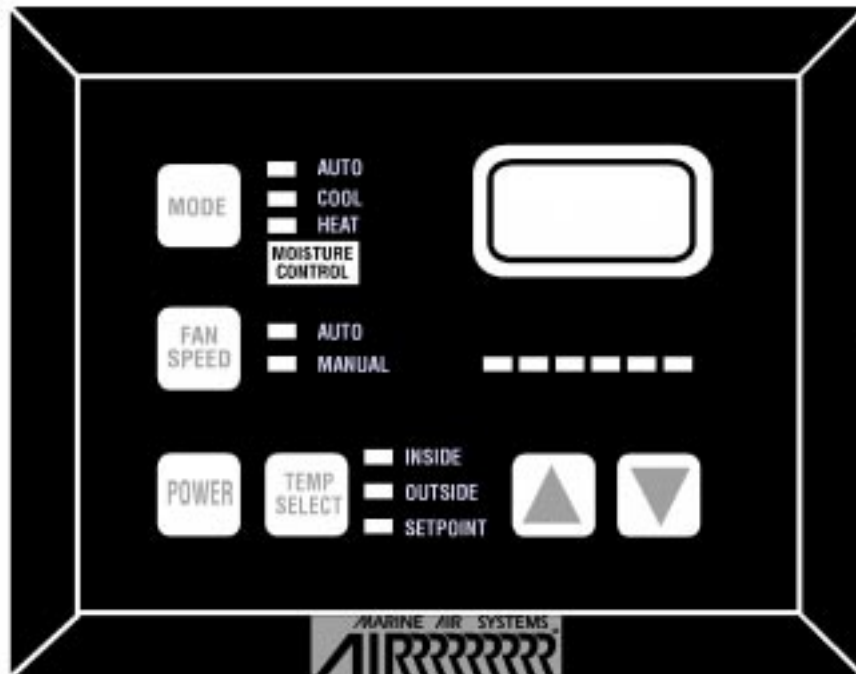
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Table Of Contents

The ECU-Maxx (Environmental Control Unit) is a full featured reverse cycle heat pump controller for marine HVAC. The unit consists of one display control head and a remote high voltage system control module. The system has been designed for easy installation and solid state operation. The following pages describe both operation and user-defined parameters available on the ECU-Maxx.

SYSTEM FEATURES

AC Voltmeter

The ECU-Maxx's hardware includes an AC voltmeter which is used to monitor and display line voltage. These readings represent the <u>voltage at the control module</u>, not at the electrical panel. The line voltage feature is the first item accessed in the **View Mode**.

AC Amp Meter

The ECU-Maxx's hardware includes an AC Amp meter to monitor power consumption. Sudden changes in power requirements (current) usually indicate problems with the system. For instance, increased current draw can mean a loss of cooling water, compressor or electrical problems. The system amperage is the second item accessed in **View Mode**.

Dual Voltage Capability

Line voltage is recognized on power-up by the ECU-Maxx and the unit automatically adapts to the voltage applied. This feature eliminates the need to stock two separate voltage controls.

WARNING! Dual voltage only applies to the control unit itself, ***not*** to the equipment it is connected with. The system or cooling assembly must match the line voltage supplied.

Start Capacitor Relay

The ECU-Maxx provides circuitry to simplify the connection of the compressor **start capacitor** to the system. This feature eliminates the complicated wire harness and relay associated with conventional start capacitor and relay circuits.

Face Plate Air Sensor

The ambient air temperature sensor is located in the display panel. This face plate air sensor produces the best results in most installations; however, the display must be located on an inside wall at eye level.

NOTE: The display should **not** be subjected to direct sunlight. The alternate (remote) air sensor should be used if these conditions cannot be met.

Ambient Light Sensor

The display panel is equipped with an ambient light sensor (photodiode) which automatically controls the display brightness. This feature allows maximum visibility in very bright conditions while maintaining adequate but subdued brightness in the dark.

Non-Volatile EEPROM Memory

Operating and programmed parameters are entered into nonvolatile memory. If power is lost for any reason, all settings and parameters are retained indefinitely, with no battery or electrical power required. When AC power is restored, the ECU-Maxx will resume operation exactly where it left off, even if it is years later.

Fan Speed Compensation

When AC line voltage falls, the lower fan speeds are gradually increased to prevent fan motor stalling. This option helps maintain constant fan speeds during low dock voltage conditions.

Power Failure Recovery

The ECU-Maxx features automatic shutdown and restart during "brown out" conditions. The system is programmed to shut down after 5 (five) minutes of continuous low line voltage. The unit will automatically restart when the line voltage returns to normal.

Compressor Soft Start

The ECU-Maxx may be configured with an optional **Compressor Soft Start** feature. The compressor soft start feature has been developed in order to reduce the starting load placed on the electrical system by the compressor. This option is installed at the factory and must be ordered specifically.

Solid State Fuses

The ECU-Maxx monitors the system current *before and during* any electrical component used to protect all systems from shorts or excessive loading. The solid state fuse system is capable of automatic recovery from electrical problems. This eliminates the need to manually replace fuses. The circuitry also protects the components from problems relating to high current, such as: a locked rotor, loss of cooling water, or other compressor-related problems.

Please refer to *Figure 1,* below, for the location of the buttons and displays listed on the following pages:
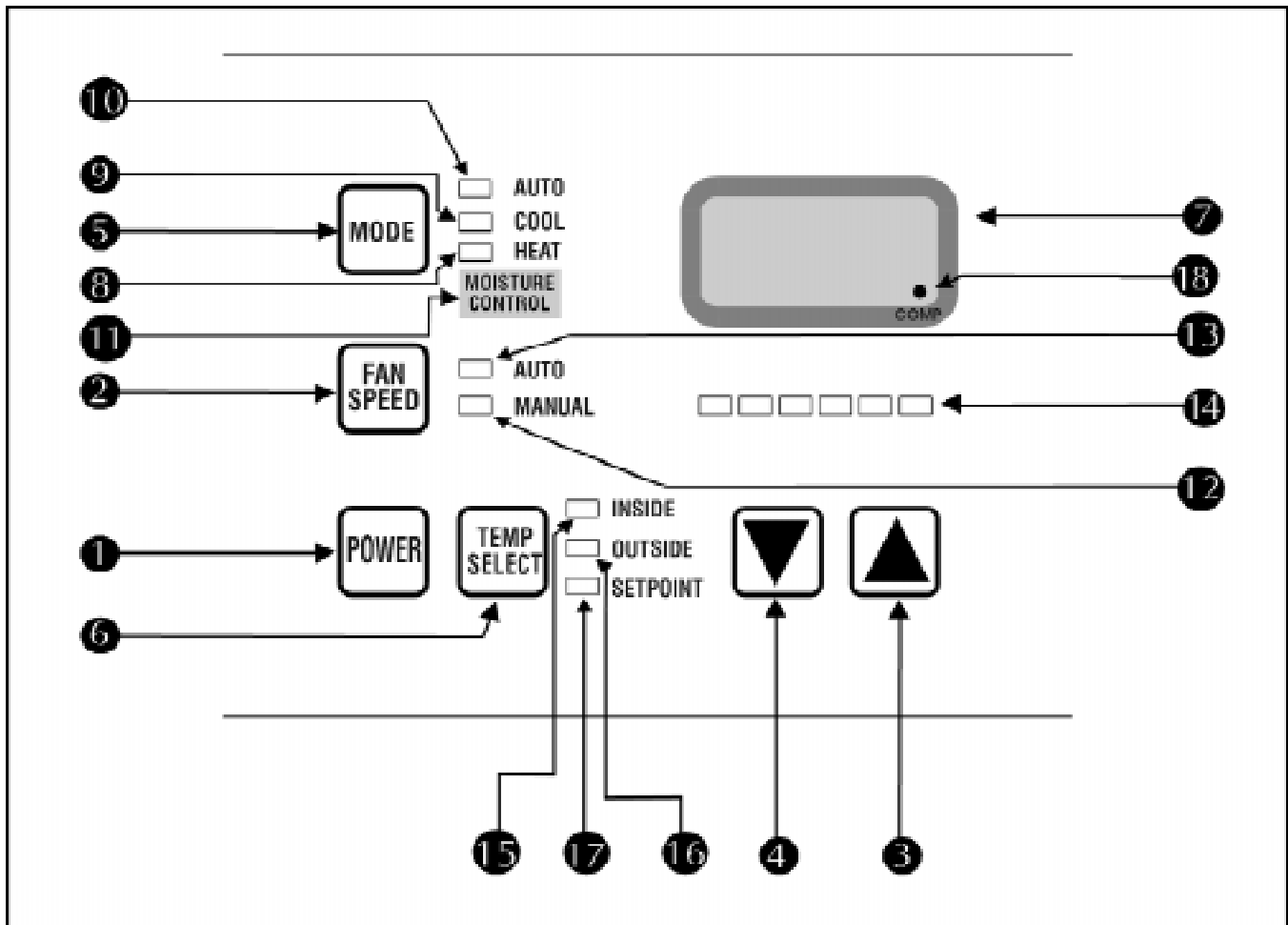
Figure 1: ECU-Maxx Control Buttons and Indicator Displays

1. POWER button

The power button is used to switch the ECU-Maxx between **Off Mode** and **On Mode,** enter **Program Mode** and reset the Factory Default Values for the programmable parameters.

2. FAN SPEED button

The fan speed button is used to switch between the automatic and manual fan features and is also used to select the fan speed when in **Manual Fan Mode**.

3. UP button

The Up button is used to increase the temperature **set point** value, and to increase the value of programmable parameters when the ECU-Maxx is in **Program Mode**.

4. DOWN button

The Down button is used to decrease the temperature **set point** value, and to decrease the value of programmable parameters when the ECU-Maxx is in **Program Mode.**

5. MODE button

The Mode button is used to switch between the various modes of operation of the ECU-Maxx. The modes are AUTO, HEAT, COOL and MOISTURE CONTROL. This button is also used to scroll up through the programmable features in **Program Mode.**

6. TEMPERATURE SELECT button

The Temperature Select button is used to choose which temperature will be displayed on the 3-digit LED Display. It is also used to enter the **View Mode** and to scroll down through the programmable features in **Program Mode.**

7. Three Digit Display

This 3-digit 7-segment LED display is used to display temperature information, program information, voltage, current or fault codes, depending upon the mode selected by the user or the fault detected by the ECU-Maxx. The decimal point to the far right on this display is used to indicate when the compressor is on.

8. HEAT MODE light

The heat mode indicator LED will be lit when **Heat Mode** has been selected.

9. COOL MODE light

The cool mode indicator LED will be lit when **Cool Mode** has been selected.

10. AUTOMATIC MODE light

The automatic mode indicator LED will be lit when **Auto Mode** has been selected. Auto Mode allows for automatic heating and cooling.

11. MOISTURE CONTROL MODE light

The moisture control indicator light will be illuminated when **Moisture Control Mode** has been selected

12. MANUAL FAN light

The Manual Fan indicator LED will be lit when **Manual Fan Mode** has been selected.

13. AUTOMATIC FAN light

The Automatic Fan indicator LED will be lit when **Automatic Fan Mode** has been selected.

14. FAN SPEED INDICATOR BAR GRAPH display

The Fan Speed indicator bar graph is composed of six LEDs. These LEDs are lit in direct proportion to the fan speed, with 1 LED on being Lowest Fan speed and all LEDs on being Highest Fan speed. This display is operational in both Auto and Manual Fan modes.

15. INSIDE AIR TEMPERATURE light

When the Inside Air Temperature indicator LED is lit, the 3-digit display will provide a readout of the inside air temperature as detected by the inside air sensor (located on the face plate unless the alternate air sensor is installed).

16. OUTSIDE AIR TEMPERATURE light

When the Outside Air Temperature indicator LED is lit, the 3-digit display will provide a readout of the outside air temperature as detected by the outside air sensor.

17. SET POINT light

When the Set Point indicator LED is lit, it indicates that the 3-digit display is showing the current temperature set point. This value can be adjusted with the **Up** and **Down** buttons.

18. COMPRESSOR ON light

When the last decimal point of the 7-segment LED display is lit, it indicates that the compressor output is active.

MODES OF OPERATION

Off Mode

When the ECU-Maxx is in the **Off Mode**, all control outputs will be turned off. All programmed parameters and user settings will be saved in nonvolatile memory. **Program Mode** can only be accessed in the **OFF Mode.**

On Mode

When the ECU-Maxx is in the **On Mode,** power will be supplied to the appropriate control outputs, and the displays will indicate the current state of operation. This was the state stored the last time the unit was on.

Note: If the unit is being turned on after an interruption of power, this is considered a **power-on reset** condition. All lights on the display will flash for one second before normal operation is resumed.

Cool Only Mode

When the ECU-Maxx is configured to be in **Cool Only Mode**, only the cooling system will be used as needed.

Heat Only Mode

When the ECU-Maxx is configured to be in the **Heat Only Mode**, only the heating system will be activated as necessary.

Automatic Mode

When the ECU-Maxx is configured to be in the **Automatic Mode**, both heating and cooling will be supplied as needed. (The HEAT and COOL indicator LEDs will be lit, showing which system is currently in operation.)

Temperature Hysteresis

Temperature is automatically maintained within the programmed temperature range of the **set point.** For example, the factory default value for the temperature hysteresis is 2º: When the temperature requirement has been satisfied, a 2º shift is required to establish demand. A 4º shift is required to change from one mode to the other. Once the required heating or cooling mode has been established, the hysteresis remains 2º.

Moisture Control Mode

When the ECU-Maxx is configured for **Moisture Control Mode**, the system maintains a preset temperature and humidity range. These ranges are programmable.

FAN OPERATION

Auto Fan Mode

Automatic fan mode allows the ECU-Maxx to determine the fan speed based on ambient room temperature. The closer the temperature is to the set point, the slower the fan speed. This permits a balance between the most efficient temperature control and slower (quieter) fan speeds.

Manual Fan Mode

Manual fan mode allows the customer to set the fan speed manually.

View Mode

View Mode is one of the **Service Modes.** View mode allows the user to examine system voltage, current, inlet water temperature, total compressor run time, HI and LO Pressure Switch status and the AC line Hz.

Program Mode

Program Mode is one of the **Service Modes**. Program mode allows the user to change any of the 34 program settings.

To Turn the Unit On

POWER

Press the **Power Button** once. This toggles the ECU-Maxx from **Off Mode** to **On Mode**. The panel displays will light, indicating that the unit is ready for operation. If the unit is being turned on after an interruption of power, all lights on the display panel will turn on for 1 second prior to resuming normal operation.

To Turn the Unit Off

Press the **Power Button** once to toggle the ECU-Maxx from **On Mode** to **Off Mode.**

NOTE

Note: The fan will remain on for 4 (four) minutes after the ECU-Maxx is turned off *if* heat was being supplied by the **Optional CAL Rod Heater.**

Selecting Cool Only Mode

Repeatedly press the **Mode button** *until the* **Cool Mode** *indicator LED is on*, and cooling will be supplied when required.

Selecting Heat Only Mode

Repeatedly press the **Mode button** *until the* **Heat Mode** *indicator LED is on*, and heating will be supplied when required.

Note: If the water temperature is below the low water limit, the valve and compressor will turn off and heat will be supplied by the optional CAL rod heater, if installed.

Setting Automatic Mode

Repeatedly pressing the **Mode button** *until the* **Auto Mode** *indicator LED is on* places the ECU-Maxx in **Automatic Mode,** and heating or cooling will be supplied as needed. In addition to the **Auto** mode LED, the **Cool** and **Heat** LEDs will be lit when the unit is cooling or heating.

Setting Moisture Control Mode

By repeatedly pressing the **Mode button** *until the* **Moisture Control** *indicator is on* places the ECU-Maxx in the **Moisture Control Mode**. Minimum and maximum temperatures as well as humidity levels are controlled in this mode. All parameters are user-programmable.

Adjusting the Set Point

The **Set Point** should be set to the desired room temperature, as the ECU-Maxx will maintain temperature to within two degrees of the set point. The maximum setting for the set point is 85º F. The minimum setting for the set point is 60º F.

To change the Set Point:
Pressing the **Up** or **Down buttons** when the ECU-Maxx is in the **On Mode** forces the display to show the set point (the Set Point indicator LED will be lit) and will raise or lower the set point. The speed at which the set point changes increases with the time the button is held down. The numbers change slowly at first, then rapidly increase as the button remains depressed. When the up or down button is released, the display will return to its previous state.

Fan Operation

The Fan Control maintains 6 (six) fan speeds, which are indicated by the Fan Speed Bar Graph on the control panel. The fan speeds are equally divided with 1 LED lit being **Low Fan** and 6 LEDs lit being **High Fan.**

When the ECU-Maxx is placed in **Automatic Fan Mode**, the fan speeds will vary according to the difference between room temperature and set point. The farther room temperature is from the set point, the faster the fan will run. As the set point is approached, the fan speeds are reduced, culminating in low fan speed at the set point. A 6º spread between set point and room temperature produces high fan speed. The fan speed is reduced one number for every 1º reduction in

temperature differential. This speed reduction does not take place until the temperature differential between the ambient temperature and the set point is less than 6º (six degrees).

INFO

The maximum temperature differential may be increased from 6º to 12º by changing the programmable parameter **Automatic Fan Speed Spread**. The increase in the spread from 6º to 12º results in one fan speed reduction for every 2º decrease in temperature. When programmed in this mode, high fan speed is used only in extremely hot conditions. Once the room is cooled down, conditions requiring high fan speed are less likely to recur.

Setting Automatic Fan Mode

FAN SPEED

To place the fan in **Automatic Mode**, *press and release* the **Fan Speed button** until the **Auto** indicator LED is turned on.

Setting Manual Fan Mode

FAN SPEED

To place the fan in **Manual Mode,** *press and release* the **Fan Speed button.** This toggles the fan control from Automatic to Manual modes. *Pressing and holding* the **Fan Speed button** will cause the fan speed lights to scroll 1 (one) through 6 (six) and then back to 1. *Releasing* the **Fan Speed button** when one of these fan speed lights are on will set the fan speed to that number.

Example: Releasing the button when the third LED is on will set a Manual fan speed of 3 or medium.

NOTE

Note: Selecting 1 through 6 results in a manual fan speed setting and lights the manual lamp. The fan speed will not vary from this setting but will be corrected for low line voltage.

Setting Fan Only Mode

FAN SPEED

With the ECU-Maxx in **OFF Mode**, *press and release* the **Fan Speed button** to turn the fan on. *Press and hold* the **Fan Speed Button** to set the desired fan speed as indicated on the Fan Speed Bar Graph. The ECU-Maxx will enter **Fan Only** or Circulation Mode. Only the Fan Speed Bar Graph is illuminated during Circulation Mode. *Pressing the* **Fan Button** *cancels the* **Fan Only Mode** *and returns the unit to the* **OFF Mode.**

NOTE

Note: Automatic fan speeds are not available in Fan Only Mode. Manual fan speeds selected pertain to the **Fan Only Mode** and do not affect the pre-selected fan speeds in **Heat, Cool** or **Auto Modes.**

Entering View Mode

TEMP SELECT

Press and hold the **Temp Select button** for 2 (two) seconds, *then release the button*. Use the **Up** and **Down** buttons to scroll through the various items that may be viewed. A mnemonic code for the value being displayed is flashed along with the value in view mode. The following items are available for display in **View Mode:**
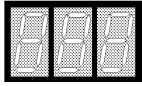
1. AC Line Voltage (Voltmeter) (code **"AC"**)
2. AC Amperage (Ammeter) (code **"cur"**)
3. Water Sensor (code **"H2O"**)
4. Total Compressor Run Time (in hours) (code **"crt"**)
5. Freon Low Pressure (code **"L-P"**)
6. Freon High Pressure (code **"H-P"**)
7. AC Line Frequency (50 or 60 Hz) (code **"FrE"**)

Exit **View Mode** by *pressing the Temp Select Button*. This will return the unit to normal operation. The ECU-Maxx will exit View Mode automatically if no buttons are pressed for 1 (one) minute.
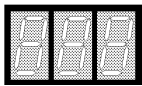
PROGRAM MODE

Program Mode is a mode in which many of the operating parameters may be adjusted. The ECU-Maxx is shipped with **Factory Default** settings of these programmable parameters (see Factory Default Settings section) which are stored in permanent memory, and can be recalled at any time.

Note: Severe electrical disturbances can sometimes upset the ECU-Maxx's operating sequences. Operator confusion related to program parameters can also cause what seem to be operational problems.

Whenever there is any doubt as to the proper operation of the ECU-Maxx control unit, factory default parameters should be initialized.

Entering Program Mode

Program Mode can only be entered from **OFF Mode.** From Off Mode, *press and hold* the **Power button** for 5 (five) seconds until a **"P"** appears in the display. *Release the Power button* and the characters **"P-1"** followed by a parameter value will appear in the display. The ECU-Maxx is now in program mode.

Note: The ECU-Maxx will exit program mode and return to the **OFF Mode** if no programming is attempted for 1 (one) minute.

Restoring Factory Default Settings
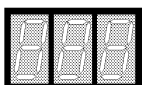
Initialize **Factory Default Settings** by *pressing and holding* the **Power button** *for 10 (ten) seconds* when the ECU-Maxx is in the **OFF Mode**.

Five (5) seconds after the button is pressed, **"P"** appears in the display. At 10 (ten) seconds, the letters **"IP"** appear, indicating the initialization process has been completed. Releasing the button momentarily displays the **Software Version Number** (for example **"A0.X"**). The ECU-Maxx will return to the **OFF Mode.**

Using Program Mode

MODE

TEMP SELECT

The program parameters are displayed by pressing the **Mode button** or the **Temp select button**. Program parameters are designated by **"P-nn"** in the display, where "nn" is a number from 1 to 34. Pressing the **Mode** button repeatedly will cause the display to scroll <u>up</u> through all the program parameters. Pressing the **Temp Select** button will cause the display to scroll <u>down</u> through all the program parameters.

The **Up** and **Down buttons** are used to select the data or set the desired limits for the parameter being programmed.

Select **Option ON** or **Option OFF** using the **Up** and **Down** buttons. This method is followed throughout Program Mode; however, special instructions are included in the section **Programmable Parameters** for individual functions that require them.

Exiting Program Mode

POWER

There are two methods to exit program mode. *Press the* **Power** *button* and the ECU-Maxx returns to the **OFF Mode**. Not pressing any button for 60 (sixty) seconds will cause the control unit to exit Program Mode.

Software Identification
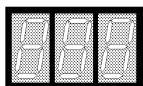
The software version is identified for 1 (one) second prior to the exit from **Program Mode**. The software number will appear in the display for one second, then the display turns off.

PROGRAMMABLE PARAMETERS

The 34 programmable parameters along with their **Factory Default Settings** are listed in at the end of this section. The following are definitions and operating theory for all the programmable functions of the ECU-Maxx.

P-1: Moisture Control Mode Dehumidification Level

Moisture Control Mode contains a dehumidification cycle to help prevent mildew and conserve energy.

Example of Dehumidification Level 1: Every 4 hours, the fan is started and air is circulated for 30 minutes. The air temperature is sampled and re-membered. Cooling is started and will continue until the temperature is lowered 2º. Four hours later, the cycle starts over. However, this cycle does not conflict with the minimum or maximum temperature settings.

The Humidity cycle will not start until the maximum or minimum temperature requirements have been sat-

ECU-Maxx Program Setting	Reduction in Temp Before Cooling is Stopped
1	2°F
2	4°F
3	6°F

isfied. Dehumidification can be programmed at one of three levels, as shown in **Table 2**, above. The factory default setting for this function is **Level 1 (2°).**

P-2: Moisture Control Mode High Temp Set Point

This function sets the minimum cooling temperature that will be maintained in **Moisture Control Mode**. The range for this value is between 95º F and 77º F. The room temperature where the ECU-Maxx display panel is located (unless a remote air Temp. Sensor has been installed) will not be allowed to exceed the temperature selected by this set point. Use the **Up** and **Down** buttons to select the temperature. The factory default value of this setting is 85º F.

P-3: Moisture Control Mode Low Temp Set Point

This function sets the maximum heating temperature that will be maintained in **Moisture Control Mode**. The range for this value is between 50º F and 69º F. The room temperature where the ECU-Maxx display panel is located (unless a remote air temperature sensor has been installed) will not be allowed to go below the temperature selected by this set point. Use the **Up** and **Down** buttons to select the temperature. The factory default value of this setting is 55º F**.**

P-4: Cycle Pump With Compressor

The pump output can be configured in one of two ways:

Off selects **continuous operation** of the pump when the ECU-Maxx is on.

On selects the function to allow the pump to **cycle with the compressor**. This setting reduces pump wear by cycling the pump with the heating or cooling demand only (factory default setting). In this mode the pump will continue to run for 2 minutes after the compressor cycles off.

P-5: Temperature Display Units

Program mode **ºF** selects degrees **Fahrenheit** (ºF).
Program mode **ºC** selects degrees **Celsius** (ºC).

IMPORTANT! *All* temperature functions will be based on whatever system (F or C) is selected. ºF is the factory default setting.

P-6: Temperature Calibration

Use this feature to calibrate the air sensor within a range of ±10º.

Enter **Program Mode** and the current calibration offset will be displayed. Use the **Up** and **Down** keys to set the desired number.

P-7: Cycle Fan With Compressor

Normally, the fan remains on all the time; however, this option allows the fan to cycle off when the demand for heating or cooling is satisfied.

Off selects **continuous operation** of the fan (factory default)

On selects **cycle fan with compressor.** In this mode the fan will shut off 5 to 135 seconds after the compressor, depending on the value for the compressor start delay.

P-8: High Fan Speed Limit

The upper limit of the fan speed can be reduced to tailor the fan output for various motors. The range of values for the high fan speed are 50 through 80 in arbitrary units. The high fan limit is not permitted above 220 VAC to prevent excessive fan noise.

Use the **Up** and **Down** buttons to select the fan speed preset. The factory default setting of this function is **70.**

P-9: Low Fan Speed Limit

The low fan limit determines the lowest output allowed for Low Fan speed. The range of values for the low fan speed are 25 through 49 in arbitrary units.

Use the **Up** and **Down** buttons to select the fan speed preset. The factory default value of this function is **40.**

P10: Fan Motor Select

The fan motor select option provides separate low line voltage corrections for two basic types of motors used in most systems. This option does not select the fan speed tables for fan speeds 1-6. High and low fan speed limits must be adjusted for each fan.

SP selects the **shaded pole** fan option (factory default)

SC selects the **split capacitor** type fan.

P11: Automatic Fan Speed Spread

Automatic fan speeds are directly related to temperature reduction in cooling and temperature increases in heating. There are two options available: 1° spread per fan speed or 2° spread per fan speed. In cooling, the fan speeds increase as the temperature exceeds the set point. In heating, the fan speed increases as the temperature decreases in relation to the set point. In both cases, the fan speed increases as the temperature differential between set point and room temperature increases.

1 programs 1° per fan speed. This will bring the fan up to high speed when the set point is 6° from the room temperature. This is the factory default setting.

2 programs 2° spread per fan speed. High fan will be generated at an 12° difference between set point and actual temperature.

NOTE

Note: High fan speed is not likely to recur after the set point has been reached on initial start-up in mode 2. This option is provided to help reduce overall system noise by minimizing operation at or near high fan speed.

P12: Automatic Fan Speed Heating Option

Because of the many installation variables, high head pressure can be a problem in the heating mode. To help reduce head pressure, the automatic fan speed operation can be reversed in the heating mode. In other words, the fan speed *increases* as the set point is approached in heating mode. The fan speed spread option applies to this option.

P13: High Water Limit
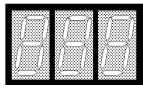
The high water limit defines the availability of cooling water for the condenser coil. The water pump and compressor are not allowed to operate above the high water limit. High water temperatures at the condenser inlet usually indicate a lack of cooling water. Temperatures at or above the high water limit are indicated by alternately flashing **"H-I"** and then **"H2O"** in the display. Fail-safe protection levels apply to the high water limit.

The range of the high water limit is 100º F to 150º F, with 140°F being the factory default value. Use the **Up** and **Down** buttons to select the high water limit.

NOTE High water limit readings are taken with the compressor running and are compensated for sensor location which is outside the Freon circuit. Since cooling water flows inside the Freon circuit, the settings must be appropriately high.

P14: Low Water Limit
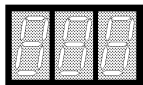
The low water limit defines the availability of heat in the condenser water. Heating can only occur at temperatures above the low water limit. The compressor and water pump are not allowed to operate below the selected low water limit. Temperatures at or below the low water limit are indicated by alternately flashing **"L-O"** then **"H2O"** in the display. Fail-safe protection levels apply to the low water limit.

If the optional CAL rod heater is installed, the ECU-Maxx will automatically switch to the CAL rod heater when the water temperature is below the limit. The **LO / H2O** warning will not be displayed when the **CAL rod heater** is installed!

The range for the low water limit setting is 40º F through 60º F. 50°F is the factory default setting for this function. Use the **Up** and **Down** buttons to select the low water limit.

NOTE Low water limit readings are taken with the compressor running and are compensated for sensor location which is outside the Freon circuit. Since cooling water flows inside the Freon circuit, the settings must be appropriately low.

P15: Service / Water Sensor Option
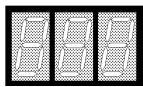
The Service / Water Sensor is used to monitor the Water Temperature going through the compressor condenser coils. The Service / Water Sensor jack is located on the 416 Option Board and must be programmed **ON** if it is installed. P13 and P14 require the Service / Water Sensor be installed!

P16: High Pressure Switch Option

The circuit board is equipped with a pair of Fastons for a high-pressure Freon switch. This software option can be turned off when the switch is not used or for trouble shooting purposes.

P17: Low Pressure Switch Option

INFO A pair of Fastons are supplied for an optional low Freon pressure switch. This software option can be turned off when the switch is not used or for trouble shooting purposes.

P18: High Pressure Freon Switch Disable

This option has been provided to disable High Pressure Faults in heating mode only, since high head pressure can be an acceptable occurrence while heating. This function is only valid if P16 is enabled.

P19: Low Pressure Freon Switch Hold-Off Delay

Low Freon pressure conditions can occur during normal operation. To prevent erroneous LP faults from occurring a hold-off delay is provided. A low Freon pressure event that lasts longer than the delay time will cause a Low Pressure fault to occur.

The minimum delay is 60 seconds. The delay range is 1 to 15 minutes, in 1 minute increments. Use the **Up** and **Down** buttons to program the desired hold-off delay. The factory default setting is ten [10] minutes.

P20: CAL Rod Heater Option

Optional output is provided for an electric strip heater which is placed in the blower housing. This strip heater is referred to as a **CAL rod heater**. This software option is provided to turn the output on when the heater is installed.

P21: Compressor Start Delay

The compressor start delay is included for use in installations where more than one system is being operated from the same power source. The start delay can be set at different intervals for each control to allow only one compressor to start at a time. The units should be staged *at least* 5 seconds apart.

The minimum delay is 5 seconds. The maximum delay is 135 seconds. Use the **Up** and **Down** buttons to set the delay.

P22: Low Voltage Threshold

The Low Voltage Threshold defines the voltage where the compressor is turned off. The fault code **"L-O"** then **"A-C"** will flash alternately with the line voltage in the display.

This function allows the ECU-Maxx to be used on a wide variety of line voltages. The allowable low voltage threshold range is 75 VAC through 100 VAC for 115 Volt units, and 175 VAC through 200 VAC for 220 Volt units. Use the **Up** and **Down** buttons to select the low voltage threshold. The voltage will appear in the display and represents the actual line voltage.

P23: Sustained Low Voltage Shut Down

OFF - A continued low line voltage condition for 15 seconds will cause the compressor to turn off while the fault code "LO-AC" alternately flashes with the line voltage in the display. After 4 successive failures, the system requires a manual restart. (See Fail-safe Chart for each level action)

ON - A continued low line voltage condition for 5 minutes will cause the compressor to turn off while the fault code "LO-AC" flashes with the line voltage in the display. After 4 successive failures the system requires a manual restart. (All Fail-safe Levels)

Failsafe Protection Level	Action	Description of Action Taken by ECU-Maxx
1	Display fault only!	MINIMUM PROTECTION LEVEL: Air Sensor Fault: Heating/Cooling immediately suspended; normal operation not resumed until fault cleared. Fault display: "AIR" Low Voltage Fault: ECU-II will react according to how Low Voltage Shutdown programmed. NO OTHER FAILSAFE PROTECTION PROVIDED.
2	Display fault & shut down compressor with continuous restarts.	INTERMEDIATE PROTECTION LEVEL: All actions taken in Failsafe Protection Level 1 Plus: In addition, the FAULT CODE message will be displayed but NO ACTION WILL BE TAKEN by the ECU-II.
3	Display fault & require manual reset after 4 failures.	MAXIMUM PROTECTION LEVEL: FAULT CODE messages are displayed and the appropriate action is taken, according to the problem encountered.

To restart ECU-Maxx manually, *press the Power button* to reset the unit to the **OFF Mode.**

P24: Fail-safe Protection Level

Fail-safe protection is offered at three levels, as enumerated in the table above.

Example: If the ECU-Maxx is in cooling mode and the high water limit is exceeded for more than 10 seconds, the pump and compressor will be shut down to prevent burning the motors out.

Note: Four consecutive shutdown events will lead to a **sustained system shutdown.** The ECU-Maxx can be reset to the **ON Mode** by *pressing the Power button* once.

P25: Temperature Hysteresis

Temperature Hysteresis is defined as the difference allowed between set point and actual room temperature. When this difference is exceeded, the ECU-Maxx will call for heating or cooling as required.

The 4º spread required to switch from automatic heating or cooling is not affected by this option. The 4º spread is provided to prevent the control from oscillating between heating and cooling while in **Auto Mode**.

The ECU-Maxx can be configured to provide 2º, 3°, 4º, 5° or 6º of hysteresis.

P26: System Current Limit

The ECU-Maxx limits the current supplied to the components attached to it. This parameter sets the maximum current available to the power outputs. The valid range of values is 5 to 40 Amperes. The factory default is 35 Amperes. If the unit is operating at 220 VAC, current limit is half the displayed value.

P27: Soft Start Ramp Delay

The compressor soft start feature is a factory-installed option on the ECU-Maxx, developed to reduce the electrical loading placed on the system when the compressor starts up. If soft start has been installed on your system, the **Soft Start Ramp Delay Option** will adjust the ramp time from 0 to 5 seconds (see system timing diagram in the **System Control algorithm** section). The factory default setting is 2 seconds.

Use the **Up** and **Down** buttons to adjust this setting.

P28: Self Test

The diagnostic self test is included to help verify proper operation of the ECU-Maxx. Upon entering the **Test Mode**, the following items are checked in the order shown. During the output checks, "**P-28**" and "**ON**" will flash in the display

Select ON to enter Test Mode. The following items are performed in the order below. During the test, "P-28" and "ON" will flash in the display.

1. **EEPROM Memory test:** Should this test fail, all dashes: **"- - -",** will be displayed and the test will not continue.

2. **Air Sensor Test:** The face plate air sensor is tested and the temperature displayed. If the sensor is defective, **"AIR"** will flash continuously in the display. A good sensor will display the correct ambient temperature.

3. **Lamp Test:** All LEDs are turned in for 3 seconds and then turned off.

4. **Alternate Air Sensor Test:** If installed, the alternate air sensor is tested in the same manner as the face plate sensor.

5. **Water Inlet Sensor Test:** The water inlet temperature sensor is checked and should display the correct water temperature, assuming that it has been properly installed. A failed water sensor test will continuously flash **"H2O"** in the display.

6. **Fan Test:** The fan is started and brought up to speed. Each fan speed is tested for 5 seconds.

7. **Valve Test:** The valve is cycled on for 5 seconds and then turned off.

8. **Pump Output Test:** The pump is turned on for 5 seconds and then turned off.

9. **Compressor Test:** The compressor output is turned on for 10 seconds and then turned off.

10. **Firmware Version** will be displayed and then the display will blank out.
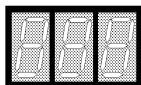
POWER

Self test can be cancelled at any time by *pressing the Power Button.* When the **Self test** is completed ECU-Maxx will exit to the **OFF mode**.

P29: Outside Air Option

When this option is turned **ON**, the **Alternate Air** input jack is used as an outside air sensor input.

P30: Station ID Number

Used to identify the control's placement when connected with the Lan-Maxx network option.

P31: Winterization System Option

This option is used when there is no sea water available. With this option ON, the sea water pump is disabled and Heat is provided by an Electric Heater ONLY. Provides electric heat in colder climates or when the boat is out of the water.

P32: No Reverse Cycle Heating

This option is for cooling only units without reversing valves. An optional electric heater (**CAL Rod Heater**) must be installed if heating is required.

P-33: De-Icing

This option is designed to periodically deice the evaporator coil when low fan speed has been selected. A two minute De-Icing Cycle is performed each hour the thermostat does not detect reduction in cabin temperature. Once the first cycle is initiated low fan speed is increased by one number to help prevent further icing.

P-34: Outside Air Temperature Sensor Calibration

This feature is used to calibrate the outside air sensor plus or minus 10 degrees Fahrenheit.

Temperature Control Algorithm

Note: Heating mode shown with automatic fan speeds reversed, i.e. P-12 ON … fan speed increases as set point is approached.
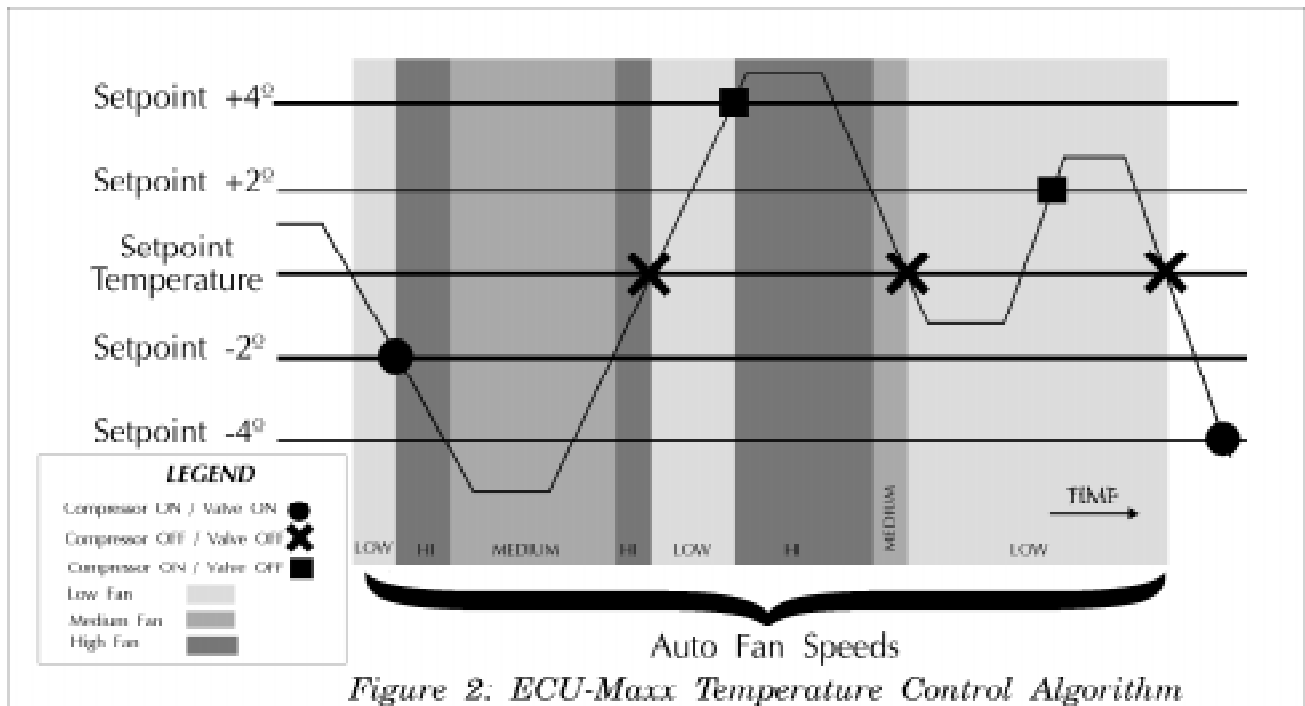

Figure 2: ECU-Maxx Temperature Control Algorithm

Prog Num	Programmable Parameter	Factory Default Settings	Permitted Values or Ranges
P-1	Moist Cntrl Mode Dehumidification Level	Level 1	1,2 or 3
P-2	Moist Cntrl Mode High Temp Set Point	85° F	77°F to 95°F / 23°C to 35°C
P-3	Moist Cntrl Mode Low Temp Set Point	55° F	50° F to 69°F
P-4	Cycle Pump With Compressor Off = Continuous On = Pump Cycles With Comp.	On = Pump w/Comp.	On = Pump With Comp. Off = Continuous Pump
P-5	Temperature Display °F or °C	°F	°F / °C
P-6	Temperature Calibration (Used to Cal. Inside Air Sensor)	0°	-10° to +10°
P-7	Cycle Fan With Compressor On = Fan With Compressor Off = Continuous Fan	Off = Continuous Fan	On = Fan Cycles With Comp. Off = Continous Fan
P-8	High Fan Speed Limit (arbitrary units)	70	50 to 80
P-9	Low Fan Speed Limit (arbitrary units)	40	25 to 49
P10	Fan Motor Select SP = Shaded Pole SC = Split Capacitor	Shaded Pole SP	SP or SC
P11	Automatic Fan Speed Spread (Speed Change per °F)	1°	1° or 2°
P12	Reverse Automatic Fan Speeds During Heating On = Fan Speed Increases as Set Point is Approached in Heating	Off = Normal Operation	On / Off
P13	High Water Limit (Compressor must be running!)	140° F	100°F to 150°F 37.8° C 65.6°C
P14	Low Water Limit (Compressor must be running!)	50° F	40° to 60° F 4.5° to 15.5°C
P15	Water Sensor Option (Option Board Required)	Off	On / Off
P16	High Pressure Switch Option (Compessor must be running!)	On	On / Off
P17	Low Pressure Switch Option (Compressor must be running!)	On	On / Off
P18	High Pressure Freon Switch Disable [Heating Mode Only]	On	On / Off
P19	Low Pressure Freon Sw. Hold-Off Delay	10 min	1 to 15 Minutes
P20	Cal Rod Heater Option (Option Board Required)	Off	On / Off
P21	Minimum Compressor Start Delay	5 seconds	5 sec. - 135 sec.
P22	Low Voltage Threshold Protect	85V (110VAC) 185V (220VAC)	75 - 100 VAC 175 - 200 VAC
P23	Sustained Low Voltage Shutdown Off = 15 Second Delay On = 5 Minute Delay	Off	On / Off
P24	Failsafe Level	3	1, 2 or 3
P25	Temperature Hysteresis	2° F	2°, 3°, 4°, 5° or 6° Fahrenheit
P26	System Curent Limit	35 Amps	5 - 40 Amps
P27	Compressor Soft Start Delay (Factory Installed Option)	2 sec	0 - 5 sec
P28	Self Test	Off	On / Off
P29	Outside Air Sensor Option	Off	On = Air Sensor Installed Off = No Sensor Installed
P30	Station ID # for Lan-Maxx Network	0	0 - 40
P31	Winterized Allows Electric Heat Operation Without Sea The Water Pump	Off = Normal Operation	On / Off
P32	No Reverse Cycle Heating Use In Cold Water Where CAL Rod Electric Heat Is Installed	Off = Reverse Cycle Heating	On = No Reverse Cycle Heat Off = Reverse Cycle Heating
P33	Anti Icing Cycle (Periodic Reverse Cycle Operation Prevents Ice From Forming On Evaporator Coil)	Off	On = Anti Icing Enabled Off = Anti Icing Disabled
P34	Calibrate Outside Air Sensor	0°F	-10°F to +10°F

ECU-Maxx System Timing

The following discussion explains the steps the ECU-Maxx control takes at the beginning of a heating or cooling cycle. There are two different start-up protocols: timed start and soft start. Soft start has been developed to reduce the starting load placed on the electrical system by the compressor. It is an optional feature and must be installed by the factory. Timed start does not provide the load limiting features of soft start. System timing diagrams appear on the next page.

Timed Start Timing

The need for heating or cooling is determined by the ECU-Maxx. This determines the Valve logic; for instance, the Valve is energized in heating mode. The ECU-Maxx executes the following timed steps:

1. The Fan turned On with the Power Button.
2. The Pump is turned on 6 seconds before the compressor is started.
3. The Valve is shuttled to release residual head pressure.
4. The Start Capacitor is switched on five seconds later.
5. The compressor is enabled at full voltage.
6. The Start Capacitor is switched off immediately after the compressor rotor is spinning.

The system is now up and running, and will remain running until temperature requirements are met. The system shuts down by first turning off the compressor. The Reversing Valve remains energized until the next cycle if the system was in heating. Two minutes after the compressor turns off, the Pump turns off and the Fan is set to Low Speed.
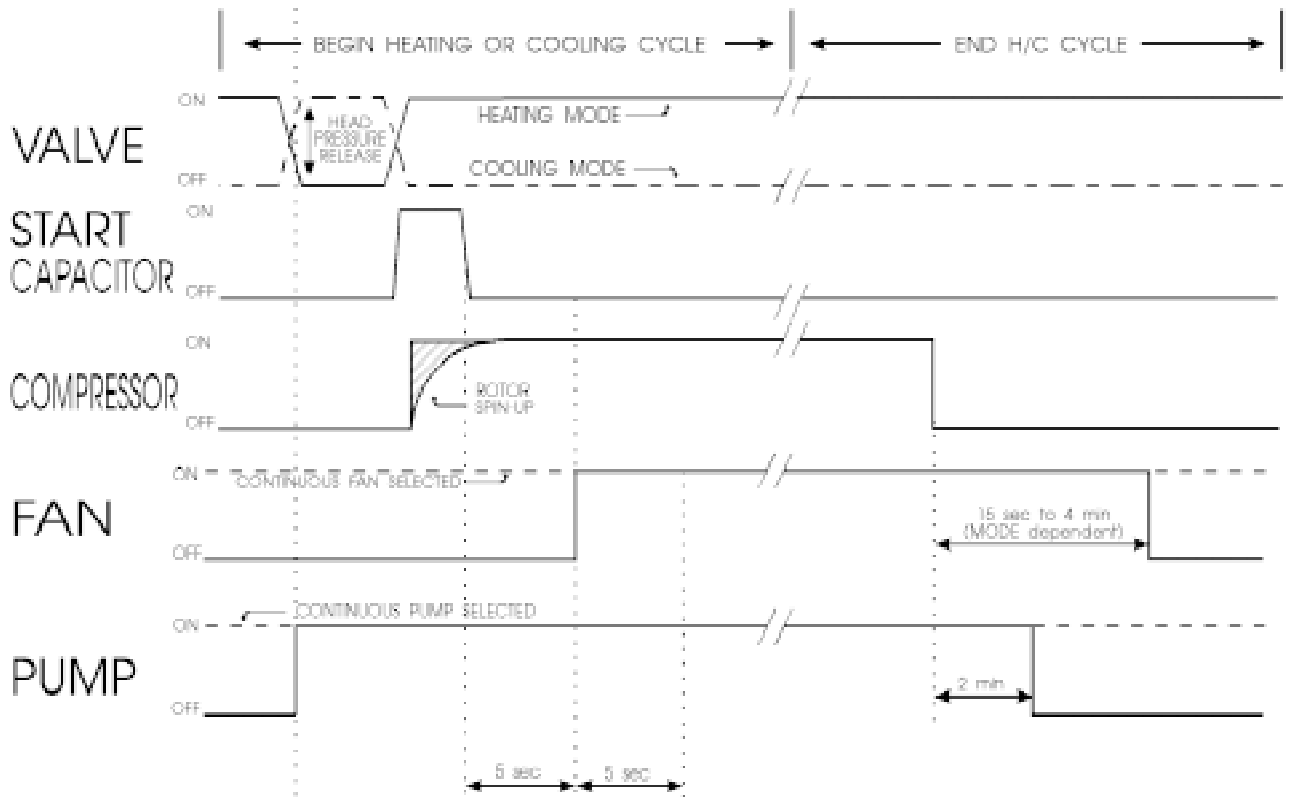
Soft Start Timing

The soft start feature has been developed to reduce the starting load on the electrical system. Soft start is an optional feature on the ECU-Maxx. The soft start ramp delay is programmable from 0 to 5 seconds. This delay may need adjustment for optimal results with your particular system.

When Soft Start is enabled and the ECU-Maxx senses the need for heating or cooling, the following actions are taken:

1. The Fan speed is reduced to Speed 1.
2. The Pump is enabled when the system calls for heating or cooling.
3. The Valve is shuttled to release residual head pressure.
4. The Start Capacitor is enabled.
5. The Compressor voltage is ramped up to full potential.
6. Once the compressor rotor reaches 75% of rated speed (in other words, the soft start circuit senses the correct drop out voltage), the Start Capacitor is released.
7. Two (2) seconds later, the Fan is set to the correct speed.

The system remains up and running until the temperature requirements are satisfied. The shut down sequence is identical to the timed start shutdown sequence.

Timed Start Sequence Timing Diagram
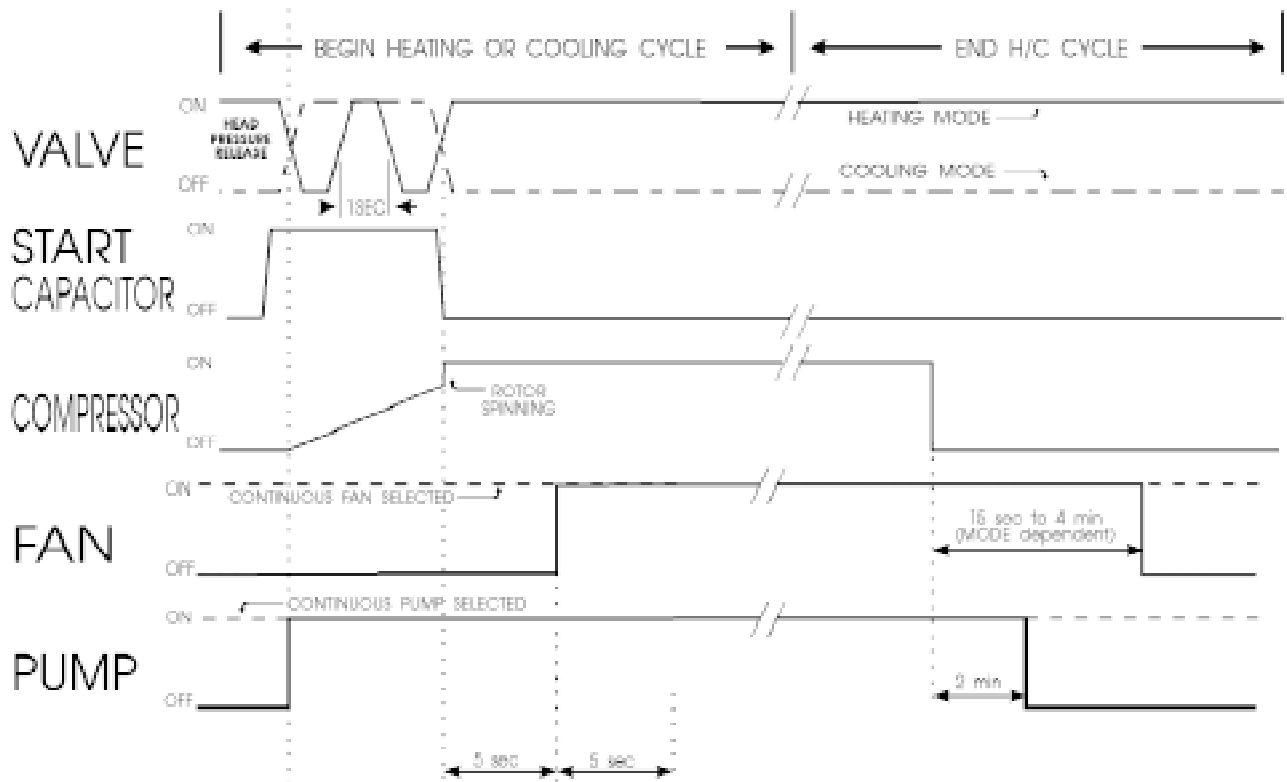
Soft Start Sequence Timing Diagram

Internal Sensor Inputs

The ECU-Maxx has four internal sensors:

1. Control Panel Air Temperature Sensor
2. Control Panel Ambient Light Sensor
3. AC Line Voltage
4. System Amperage

External Sensor Inputs

The standard ECU-Maxx has inputs for three external sensors. Please refer to *Figure 3* for a graphic representation of where these inputs are.

1. Alternate Air / Outside Air Temperature Sensor
2. High Freon Pressure Input (Optional)
3. Low Freon Pressure Input (Optional)

System Outputs

FAN

The fan motor is connected to this output. Varying the output voltage controls fan speeds. The fan can be configured for two different modes of operation:

1. On continuously when the system is on.

2. On when the compressor is running and off when the compressor is not running. Note that the fan shuts off 15 seconds after the compressor during normal heating and cooling. If the CAL Rod Heater is installed, the fan runs for 4 minutes after the heater is turned off. The fan also has a 4 minute shut-off delay in moisture control mode.

PUMP

This output can be configured for two different modes of operation:
1. On continuously when the system is on and the fan is operating.
2. On when the compressor is **ON** and **OFF** when the compressor is **OFF**. This setting reduces pump wear. The pump will cycle off 2 minutes after the compressor in this mode.

VALVE

The valve output is turned on when the control senses the need for heating. The water temperature must be greater than the low water limit to activate the valve, if the optional CAL rod heater has been installed.

COMP.

The compressor output is on when the ECU-Maxx is calling for heating or cooling. The compressor is not on in the heating mode if heat is being supplied by the optional electric CAL rod heater.

HEATER

The heater output is on when heat is called for and the water temperature is equal to or less than the low water limit, and the heater is installed. Low sea water temperature will cause the unit to switch to the electric heater (if installed). When the heater option is selected, the water inlet option should also be installed.

START RELAY

The compressor start relay is included in the control outputs. The ECU-Maxx monitors compressor starting time and run current to assure proper operation of the relay and efficient compressor start-up. Low line voltage cannot cause the relay to reenergize accidentally as happens with conventional start relays. A start relay malfunction will cause compressor shut down and lock out to prevent compressor failure.
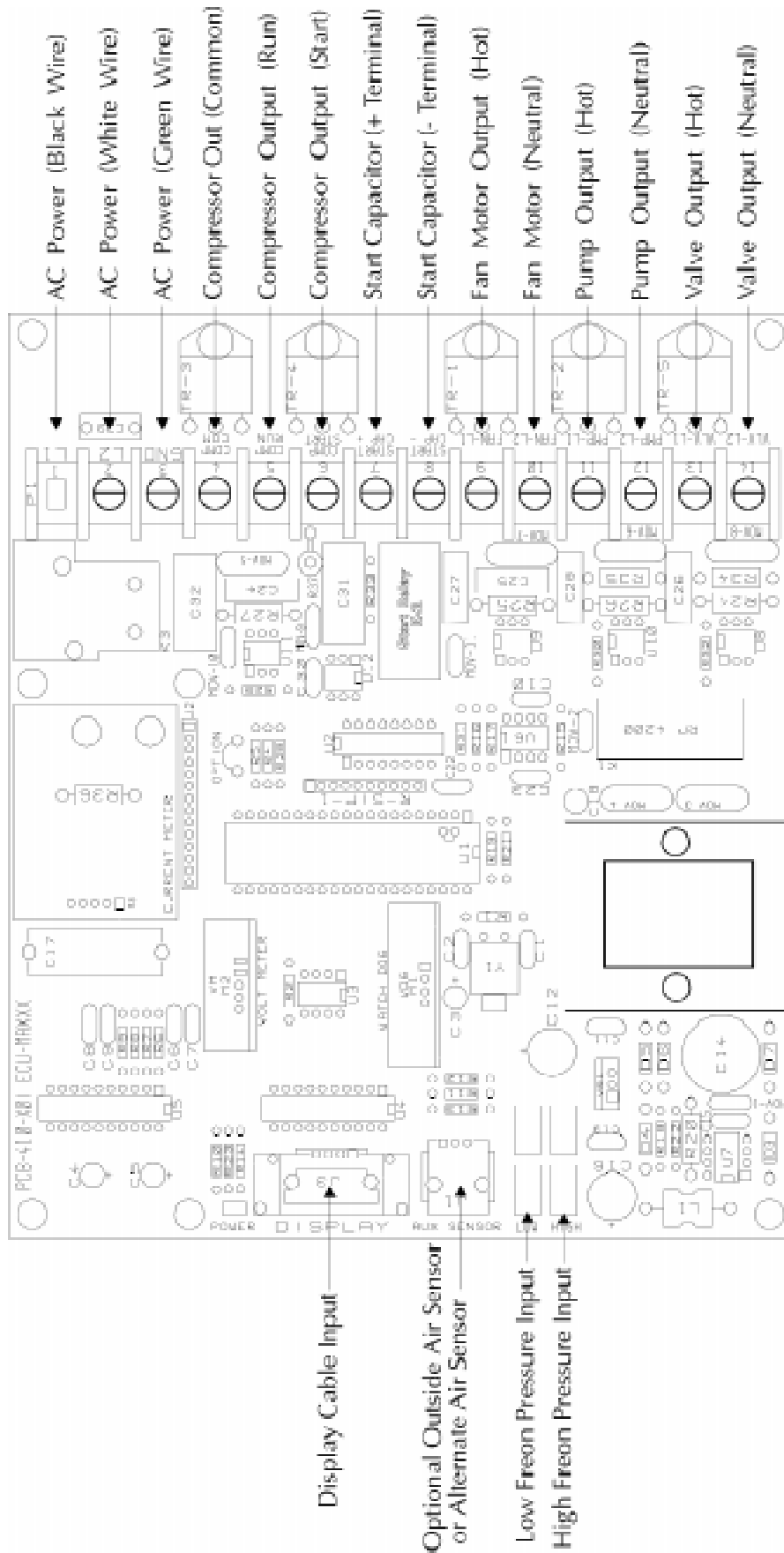
Figure 3: ECU-Maxx Control Board Inputs and Outputs

Fault	Code	Action Taken by ECU-Maxx	Level 1	Lev
Air Sensor Fault	**AIR**	Complete shutdown until the fault is cleared.	**YES**	**YE**
Water Sensor Fault	**H2O**	Shutdown of water pump until the fault is cleared.	**NO**	**YE**
High Pressure Fault	**H-P**	Shutdown of compressor until the fault is cleared.	**NO**	**YE**
Low Pressure Fault	**L-P**	Shutdown of compressor until the fault is cleared.	**NO**	**YE**
Sustained Low Line Voltage Fault Shutdown OFF	**L-O A-C**	Unit will continue to operate. System shutdown will occur after 15 SECONDS of continuous low voltage. Requires a manual restart after 4 consecutive failures	**YES**	**YE**
Sustained Low Line Voltage Fault Shutdown ON	**L-O A-C**	Unit will continue to operate. System shutdown will occur after 5 MINUTES of continuous low voltage. Requires a manual restart after 4 consecutive failures	**YES**	**YE**
Electrical Shorts on Power Output LInes install problems	**SHO**	All electrical outputs are turned off. Fault code indicates which output is shorted. PU=Pump, rE=Reversing Valve, FA=Fan, CO=Compressor. Requires Power Removal to Clear!	**YES**	**YE**
High Current Fault	**H-C**	System shutdown for 15 seconds. If high current still detected, system will shut down again. If system shuts down 4 times, manual restart is necessary.	**YES**	**YE**
Compressor Load Fault	**CLF**	Activated by high head pressure switch or klixon. System shuts down for 15 seconds and restarts. After 4 consecutive failures manual restat is required.	**YES**	**YE**
Start Capacitor or Start Relay Failure	**Scr**	Sticking start relay or defective start capacitor will initiate complete system shutdown after 4 consecutive failures. Scr displayed and manual restart required.	**YES**	**YE**

NOTE: See pages 16 and 25 for more detailed descriptions of fail-safe protection levels.

Fail-Safe

There are three levels of fail-safe protection. Level 1 is the lowest. In this level, the sensors are not monitored for faults. In the two other levels, the sensor is monitored for faults. In level 2, if a fault is detected, the fault code is displayed, but no other action is taken. In level 3, the fault is displayed and the compressor is shut down.

Lockout

Lockout occurs if *three level 4 faults are detected within a heating/cooling cycle.* Lockout causes the system to shut down. Lockout can only be cleared by going to the **OFF Mode** and back to the **ON Mode** using the **Power Button**.

Fault Display

When a fault occurs, a fault code is flashed on the display. The flashing can be removed from the display by pushing and releasing the **Power button** to reset the control. This resets the control but does **not** remove the fault!

Electrical Short Faults

When a short is detected on one of the system output terminals, the ECU-Maxx will display the fault code **"SHO"** followed by another code indicating which output is shorted:

"CO" indicates a Compressor short.

**"FA"** indicates a Fan short.

"PU" indicates a Pump short.

"rE" indicates a Valve short.

Failsafe Protection Level	Action	Description of Action Taken by ECU-Maxx
1	Display fault only!	MINIMUM PROTECTION LEVEL: Air Sensor Fault: Heating/Cooling immediately suspended; normal operation not resumed until fault cleared. Fault display: "AIR" Low Voltage Fault: ECU-II will react according to how Low Voltage Shutdown programmed. NO OTHER FAILSAFE PROTECTION PROVIDED.
2	Display fault & shut down compressor with continuous restarts.	INTERMEDIATE PROTECTION LEVEL: All actions taken in Failsafe Protection Level 1 Plus: In addition, the FAULT CODE message will be displayed but NO ACTION WILL BE TAKEN by the ECU-II.
3	Display fault & require manual reset after 4 failures.	MAXIMUM PROTECTION LEVEL: FAULT CODE messages are displayed and the appropriate action is taken, according to the problem encountered.

An **Optional Accessory Board** may be ordered for the ECU-Maxx [Part Number: **416-X0A**]. This board provides inputs for the following features:

• Auxiliary Heater (CAL Rod Heater)

• Outside Air Sensor

• Service / Water Sensor
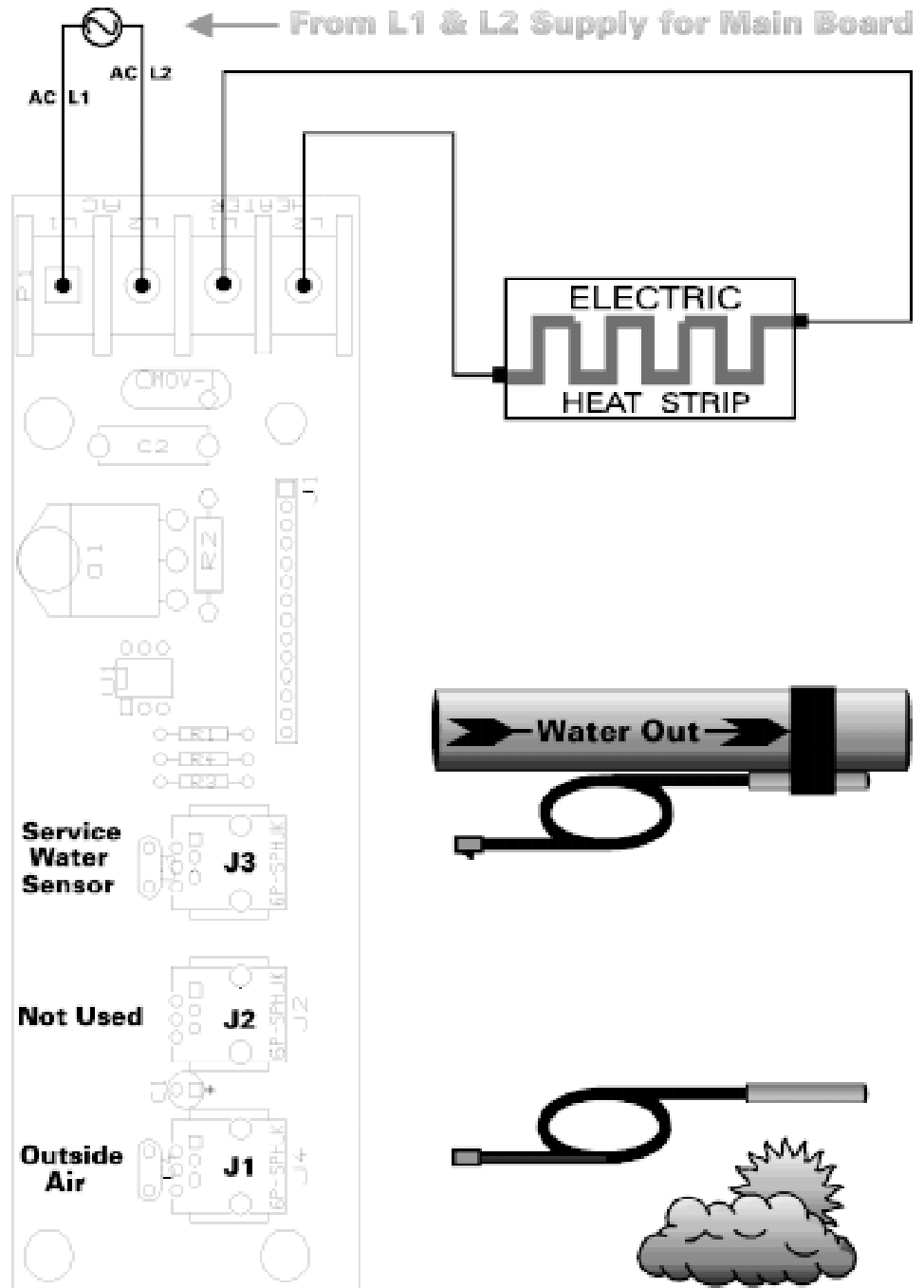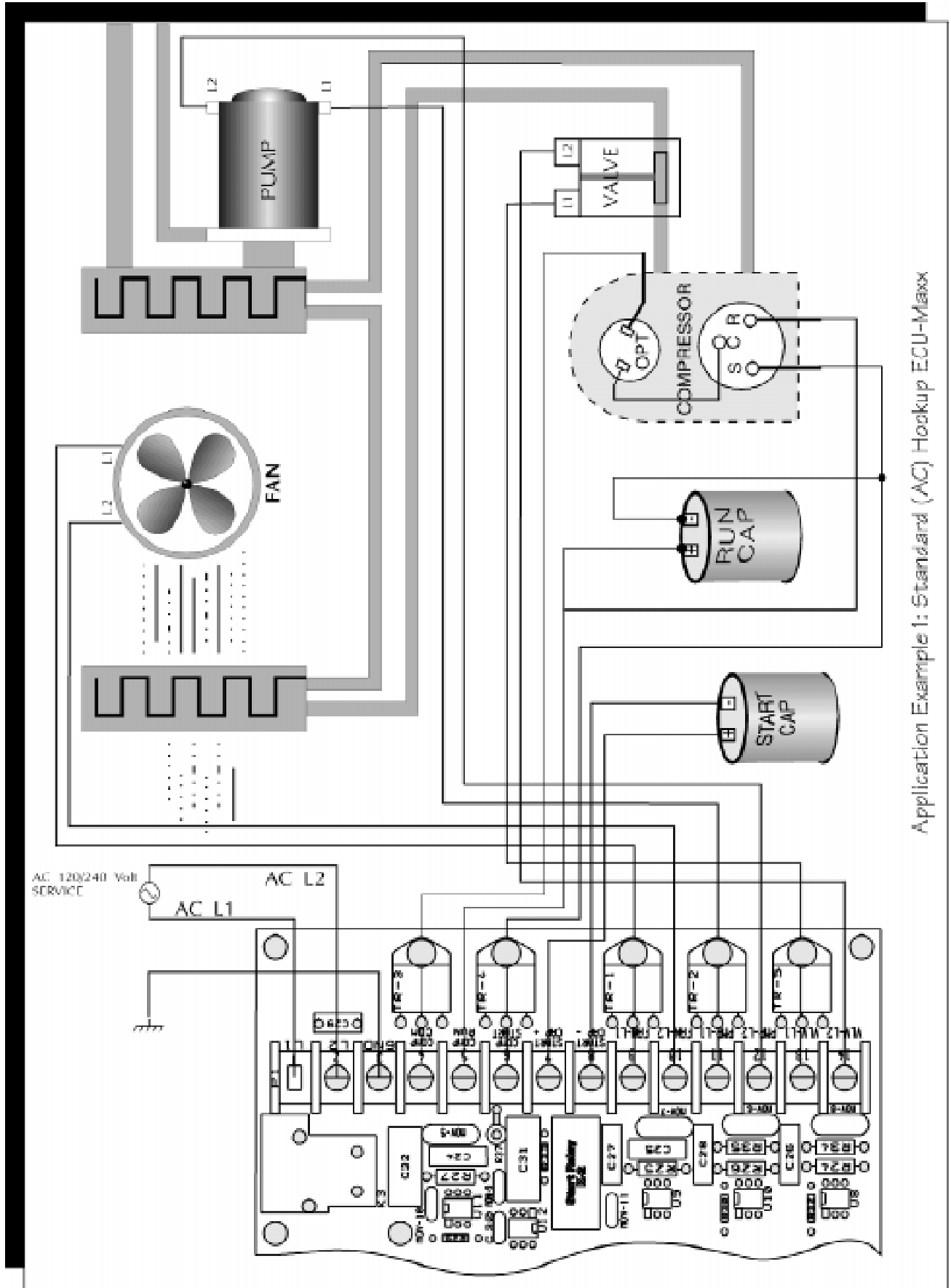
Application Example 1: Standard (AC) Hookup ECU-Maxx

SPECIFICATIONS

SET POINT RANGE	**60° F to 85° F**
DISPLAY TEMP RANGE	**ZERO (0) to 160° F**
LOW VOLTAGE DETECTION Programmable	**115 VOLT UNITS 85 VAC** **220 VOLT UNITS 185 VAC**
SENSOR ACCURACY	**± 2° F at 77° F**
FUSING	**ELECTRONIC**
VOLTAGE	**110 or 220 VAC at 50 or 60 Hz**
FAN OUTPUT	**25 AMPS at 220 VAC**
VALVE	**25 AMPS at 220 VAC**
PUMP	**25 AMPS at 220 VAC**
COMPRESSOR	**40 AMPS at 220 VAC**
CAL ROD HEATER (416 Option Board Required)	**30 AMPS at 220 VAC**

Enter the factory program mode by first entering the programming mode then pressing the power and fan buttons simultaneously. Use the mode button to move forward and the Temp select button to scroll back through the factory program items. Once in the factory mode the following program changes can be made:

F-1: Voltage Calibration

The systems volt meter can be adjusted plus or minus 10 volts AC. Use this item to calibrate the voltmeter.

F-2: Calibrate the Current Meter

The systems current meter can be adjusted plus or minus 10 amps. This item is used to calibrate the systems current meter.

F-3: Compressor Run Time Low Range

The compressor run time can be reset should the compressor have to be replaced. F-3 covers the range 1 through 999 hours run time.

F-4: Compressor Run Time High Range

F-4 is used to reset compressor run times from 999 through 10,000 hours. Ten thousand hours would be displayed 10.0 in the display window.

F-5: Short Circuit Test

The short circuit test is normally Off, however, while the unit is being installed the short circuit test can be turned On. Once the system is installed and no short circuits are detected the Short Circuit Test should be turned Off. Turning off the test will speed the cold boot-up time from the AC power off condition.

F-7: Reserved For Future Use

F-7 is a blank memory location reserved for future use.

F-6: Compressor Load Fault Message (CLF) Normally On

Compressor load fault (CLF) occurs when the KLIXON or high head pressure switch opens causing an interruption of power to the compressor. Typical causes would be loss of cooling water or high Freon head pressure. The CLF can be turned off during trouble shooting sessions but should be turned on for normal operation.

F-8: Start Cap Relay Supervisory Circuit (SCR)

The operation of the systems start capacitor and relay are monitored and the compressor is shut down if either item fails. A sticking or failed start component will cause the compressor to fail. Shutting down the compressor and flashing SCR saves unnecessary compressor burnouts. **SCR** is **NORMALLY ON** and can be temporarily turned off for trouble shooting, however, SCR should be turned on after the problem is resolved.

NOTE

Revision: 08 First revision from Wendy's original manual. Update from original ECU-Maxx to Software versions 2.7 through 3.5. Corrected wiring diagrams, program tables and general contents.

Revision: 09 Changed page 28 typical application to reflect new PC board. Changed P16 and P17 descriptions to include default settings to ON. Boards are supplied with jumpers on the high and low Freon switches and factory defaults allow switches ON.

Revision: 10 Install new routine for short circuit test in 220 volt mode to reduce false messages on 220 applications. Update and correct Factory Default Table on page 20. Miscellaneous typing, grammar and spelling corrections. Update master copy for Russell's manual file.

Revision: 10a Changes for Version 45 including dropping Bimini Relay and integrating all daughter boards onto the motherboard. Software and hardware changed to incorporate all known improvements including simplifying the voltmeter and using the Passport-II power supply. Short circuit test is turned off and may be turned on prior to installation. Pc Board is set up for future networking via option board if required. Miscellaneous typing, grammar and spelling corrections. Board Revision Level is **"I"** and should be the final revision.