

# ***ENERGY MANAGEMENT UNIT 2 (EMU2)***

## **SERVICE MANUAL**

### **PRODUCT DESCRIPTION**

**EMU2** is an energy management system that is intended to be used in RV's that have two, 120 volt, roof top air conditioners. It is designed to shed the air conditioners, as needed, to keep the total current draw below the 30 Amp level allowed by the shore power cord. The power switching for the air conditioners is done through relays contained in the controller. These relays are controlled by energy management system as well as externally mounted wall switches that are used to select which of the air conditioners will operate. The logic prevents both air conditioners from operating from shore power, but allows them both to run when operating from the generator, which can provide enough power. It also includes timing to prevent an air conditioner from turning on in less than two minutes after it was turned off to prevent it from being "short cycled".

The external switching is done utilizing Intellitec's MONOPLEX<sup>®</sup> technology. To utilize this function, three low voltage wires (two switch and ground) are run throughout the RV with a number of momentary switches connected. In this way, switching of the AC's can be done from multiple locations within the RV.

### **HOW IT WORKS**

The EMU assumes the current available to the coach is 30 Amps. It also assumes that the current drawn by the air conditioners is approximately 15 Amps. EMU monitors the current drawn by all the loads in the RV, whether built-in or owner supplied, and shuts off the air conditioner in order to keep the current draw to less than 30 Amps. Since the air conditioners are the largest and the most shed-able loads in the RV, they are the most logical to be shed.

When the total current falls below 15 Amps, EMU will turn the A/C unit back on, if it has been off for at least two minutes. EMU will always wait the two minutes to insure the compressor is prepared to start.

The air conditioners are switched by five relays, one relay switches the line side of the front air and the other four are used to switch both the line and neutral leads of the rear air, between the shore power source and the generator's output.

Total current draw is measured by using a magnetically coupled current transformer that is mounted in the load center, where the main power feed wire is passed through it. The signal from this sensor is fed into the EMU2 box by a low current, two wire cable.

#### **CAUTION:**

Note: EMU2 is used to control the 120 volt roof top air conditioners of an RV. Both 120 volt line voltage and 12 volt battery voltage are connected to this unit. Inadvertent shorts or contact with these wires could result in shock, damage, and/or injury.

All servicing of the system should be done only by a qualified technician.

Tools required: Low current, 12 volt test light, DC voltmeter, AC voltmeter, and an AC Ammeter

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### **CHECKING THE SYSTEM**

After being sure all connections are made and correct, apply 12 volt and 120 volt power to the unit.

### **POWERING UP**

When 12 volt power is first applied to the unit, there is a two minute time delay imposed on operating either air conditioner. An air conditioner selected during this period will not operate, but the LED indicator on the switch will blink, indicating the system is imposing the delay. (If power has been applied to the unit for more than two minutes, the air conditioner should begin to operate as soon as one of the switches is pressed.)

If the LED doesn't come on, check the +12 volt supply feeding the EMU2 at pin 1 of the plug and the ground connection at pin 7 of the plug. Check the 5 Amp fuse F1 on the EMU board.

### **CHECKING SWITCHES**

If the LED's don't come on and the 12 volt and ground connections are good, check the voltage at the two switch wires of the EMU, with a voltmeter, at pins 5 and 6. These voltages should be between 1.7 and 7.5 volts. If they aren't, disconnect the switch wires coming from the switches and check the voltage again.

If it is not in the normal range, the switch wires are probably shorted or a switch is stuck closed. Check for continuity to ground between the switch wires and ground, with an ohmmeter. The resistance should be over 5,000 ohms.

### **CHECKING THE AIR CONDITIONERS AND POWER FEEDS**

At the end of the two minute time delay, the EMU will turn on the selected air conditioner, as indicated by the LED being on steady. If the air conditioner is not running at this time, first check to be sure that the controls on the air conditioner are set to operate normally. If they are, check the circuit breaker feeding the air conditioners to be sure it is set. Then be sure that the coach is plugged into an operating outlet. (Usually the simplest way to check this is to momentarily turn on the microwave oven or coffee maker. If they operate, there is power applied to the coach.) The EMU electronics is powered by the 12 volt coach system. The switching and LED's will work normally without the 120 volts applied to the coach.

Turn the other air conditioner on by pressing the EMU switch. The first air conditioner should go off and the selected one should come on.

### **CHECKING OVER LOAD SHUT DOWN**

With an air conditioner running, apply 20 to 25 Amps of additional 120 volt loads. (Usually this can be the microwave oven and a heater/hair dryer). Within five seconds, the air conditioner should shut off. The LED's on the switches should be blinking to indicate the over load. If the air conditioner doesn't shut off, check to be sure that the current sensor is plugged into the EMU at positions 8 and 9. Next check in the load center to be sure that the main power feed wire is passing through the current sensor. Unplug the current sensor from the EMU and measure it's resistance. It should be approximately 40 ohms. If it is far from this value, replace it.

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Turn off the loads and wait for the two minute time delay. At the end of the two minutes, the air conditioner should come and the LED will be on steady.

### **CHECKING OPERATION FROM GENERATOR**

Start the generator. Select both air conditioners by pressing their EMU switches. The LED's should both be blinking, indicating that they are waiting for the time delay. At the end of the two minutes, the first air conditioner should start. In about 10 seconds later, the second air conditioner should also start, leaving the first one running.

#### **PROBLEM**

Air won't come when button is pressed. LED's aren't on.

Air won't come on when button pressed. LED's on.

Air conditioners go on or off when other 12 volt load is turned on or off.

Air won't go off with over load.

Both air's won't operate when gen-set is running. LED's off.

Both air's won't operate when gen-set is running. LED's on.

#### **POSSIBLE CAUSE/SOLUTION**

Check circuit breakers.

Check for power coming in to the coach.

Check for 12 volt power coming to J2, pin 1.

Check switch wiring.

Check 5 Amp fuse inside EMU

Check settings on air conditioner to be sure they are set for cooling.

Check circuit breakers.

Check for power coming in to the coach.

Check for good grounds at switches. Run separate grounds to switches from EMU.

Current sensor not feeding signal to EMU.

Check that main line feed wire is going through current sensor in load center.

Be sure current sensor is plugged into EMU.

Gen-Set running signal not coming to EMU. Check for 12 volt signal at J2, pin 3.

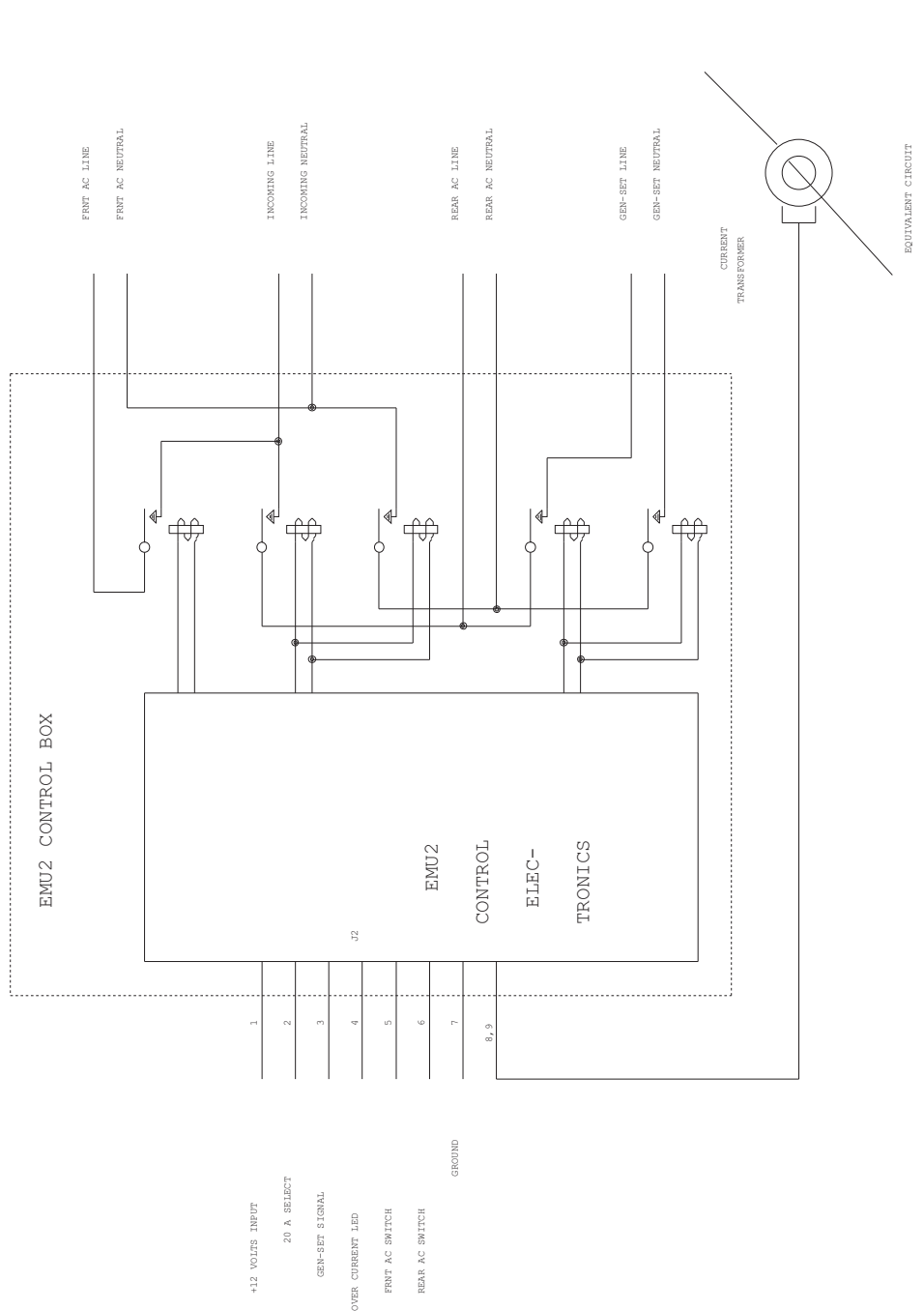
Check circuit breakers on gen-set.

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**FIGURE 1**