

50 AMP Smart Energy Management System™ Model 900

INSTALLATION & SERVICE MANUAL

PRODUCT DESCRIPTION

The **50 Amp Smart EMS™ Model 900** consists of two elements: the **Display Panel** and the **Distribution Panel**. The Display Panel is mounted on a wall or suitable surface, remotely from the Distribution Panel and convenient to the user. The Distribution Panel is a completely self-contained 120/240 volt power distribution and energy management system intended to be used in recreational vehicles. The Distribution Panel is housed in a sheet metal enclosure with removable front panel. It provides circuit protection for all the 120 VAC loads in the RV and a system of energy management to minimize the over-loading and tripping of circuit breakers.

Circuit Protection

The **50 Amp Smart EMS™ Model 900** Distribution Panel offers slots for eight single or dual, standard 120 volt circuit breakers. Two of these breakers, located in the two center stab positions, must be 50 Amp units that act as a main input protection for each of the lines supplying the remainder of the branch breakers (up to 12).

Energy Management

The **50 Amp Smart EMS™ Control Module 900** automatically senses the available power to the vehicle. It determines whether it is connected to a 120 VAC - 30 Amp shore power source, 240 VAC - 50 Amp shore power source, or generator source. Depending upon available power, it controls the operation of 6 possible loads that may include the front and rear air conditioner fan, compressor using low voltage switching, and other 120 Volt loads (such as the refrigerator, water heater, washer/dryer, or other large appliances). These appliances may be any type load, but are typically heavier loads, those whose use can be "postponed" until a time when current is available for their use.

System Communications

The **50 Amp Smart EMS™ Control Module** utilizes Intellitec's RV Multiplex/PMC (Programmable Multiplex Control) System as the communications link between the **Display Panel** and the **Distribution Panel**. As an additional diagnostic feature, the system includes two Communication Status LED's on the Control Module. In normal operation, when the **Control Module** is configured in the Stand-Alone Mode, or as the RV Multiplex system, the green "IPX OK" LED should be lit and the red "IPX Fail" LED should not be lit.

Utilizing the RV Multiplex/PMC system, the Smart EMS System can:

- 1) Operate as a Stand-Alone system.
- 2) Operate as a RV Multiplex System master in a RV Multiplex System allowing other devices such as inverter/converters, input and output modules, and switch panels, to communicate with each other and the Smart EMS System.
- 3) Operate as a PMC Transceiver with the addition of a PMC Central Processing Unit (CPU).

Circuit Protection

Circuit protection for ALL the 120 VAC loads is offered by standard, reset-able circuit breakers, provided by the installer. There are eight positions available for circuit breakers. The breakers located in the two center stab positions must be 50 Amp breakers to act as the main breakers for the entire system. These breakers back-feed power into the circuit breaker bus to feed power to the branch breakers. The remaining six positions may be occupied by single, or dual units. All the loads in the RV are fed from the branch breakers.

Energy Management

NOTE - Energy Management is only enabled if 240 VAC Service is not available. When connected to 240 VAC Service, the Energy Management features of the unit are disabled and the unit switches all controlled loads "ON".

The main neutral line is routed through the magnetically coupled current sensor, which measures the current flowing through the neutral line. This is the total amount being drawn by all the 120 volt appliances in the RV when the available power service is 120 VAC. When this current exceeds the "shore" service rating of 30 Amps (20 Amps if the threshold has been set lower, or the generator service rating and 240 VAC service is not available, the **50 AMP SMART EMS™** will turn off the controlled loads in an effort to bring the total current to the limit of the incoming service.

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Controlled Loads

The system offers control of up to six powered loads, each one connected to one of the relay circuits of the **50 AMP Smart EMS™ Model 900** system. Four of these relays, Relays 1, 2, 3, and 4, are 30 Amp relays with normally-open contacts used to interrupt the 120 volt power to the loads. These circuits are intended to control 120 volt appliances, such as; refrigerator, water heater, washer/dryer, coffee maker, etc.

For the 120 VAC switched loads, power is routed from the individual branch circuit breakers to one of these 120 VAC relays on the Control Module. The controlled load is then fed from that relay. The remainder of the relays, Relay 5 and 6, are intended to switch low voltage loads. Relays 5 and 6 are single-pole, double-throw relays, with all contacts available. These relays are intended to control air conditioners, or other appliances equipped with low voltage controls, or thermostats. The contacts of the relays are typically wired in series with the low voltage controls, or thermostats of air conditioners, so the **EMS** turns off only the compressor, or the compressor and fan. These circuits could also control other 120 volt appliances, if an additional control relay is added externally.

OPERATION IN VEHICLES USING AVAILABLE SERVICE

The **EMS** is turned on by the presence of 120VAC, or 240VAC at the L1 or L2 inputs (J6, pin 3 and 1 respectively). This feature is intended to prevent the **EMS** from drawing excessive current from the +12 VDC battery supply when not in operation.

When 120 VAC or 240 VAC power is applied, the system automatically powers up and determines the nature of the power source. There is a **two-minute start-up delay** built into the system to prevent short-cycling of motor driven loads. **Any time that the system detects a change in the power source, i.e; 120 VAC Shore Power, 120 VAC Gen-set Power, or 240 VAC Service it will disconnect all loads and enter the two-minute start-up delay.** During this delay period, the Load Meter display will exhibit rotating segments, indicating to the user that the system is in the delay mode. After the initial two-minute delay, the unit will apply power to controlled loads sequentially, with a one-second delay between each load to prevent power surges generated by simultaneous application of all loads.

If the generator is running, a +12 VDC signal will be present at J2 pin 2 on the Control Module.

240 VAC 50A Service

If 240 VAC exists between the L1 and L2 inputs, the energy management feature is disabled and all control relay contacts are closed, energizing all of the controlled loads. The Control Module sends a signal to the Display Module which causes the load meter to go blank, and all power status indicators to light. If the generator is running, the GEN SET service indicator on the Display Module will light, otherwise the 50A service indicator will light.

120 VAC Gen-set Service

If the L1 and L2 inputs are at the same voltage (0 Volts between L1 and L2 and 120 VAC between either L1 or L2 and Neutral) The Control Module sends a signal to the Display Module causing the load meter to display actual load current and the GEN SET service indicator to light. If the Genset EMS feature is not enabled (default) all loads will be turned on, independent of the load rating of the generator, and all power status indicators will light. If the Genset EMS featured is enabled (installers option), loads will turn on until the load rating of the generator is reached, and the status indicators for those loads will light.

120 VAC Shore Power

If 120 VAC is present at the L1 and L2 inputs and no +12 VDC signal is present at J2 pin 2 on the Control Module, the **EMS** will assume that 120 VAC, 30 Amp shore power is available and the energy management feature will be enabled. If only 20 Amp service is available, the user must select the 20 AMP service mode by momentarily pressing the 20/30 Amp select switch on the Control Panel.

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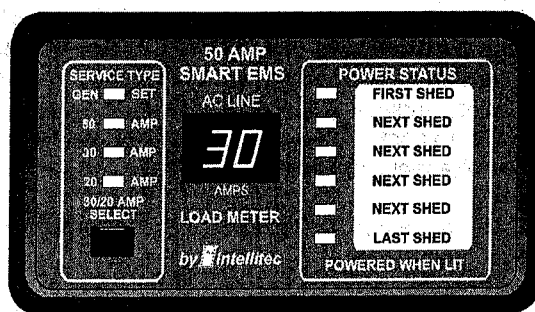
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Initially, the control turns all loads on with a one-second interval and the total current is monitored. If the total current should exceed the service limit, the system will turn off the first load in the shedding table. As it turns the loads off, it calculates the amount of current that was removed, which is the value for that load. This value is placed in memory. If the current remains above the service limit, the system will turn off the next load in the shedding table. Again, it calculates the amount of current that was removed and places the value for that load in memory. The system continues to turn off loads until the total current falls below the service limit, or all of the six controlled loads have been shed. Through this process, the system has "learned" the amount of current that each particular load draws. This feature compensates for the differences in current draw over a range of line voltage and ambient temperature, by re-learning the load each time it is turned off, or "shed".

The 50 Amp Smart EMS™ now waits until the total current is lower than the service limit and enough current is available (as compared with the amount in memory for the last load shed) before it will turn that load back on. This assures that there is sufficient current to operate the load.

NOTE There is a **two-minute minimum delay** period after a load is shed before the load can be turned back on again, to prevent air conditioners from turning on with a head of pressure. During this delay period, if there is enough current available to energize the load, the LED status indicator for that load will flash. After the delay period expires, the load will be energized and the indicator will turn on.

DISPLAY PANEL

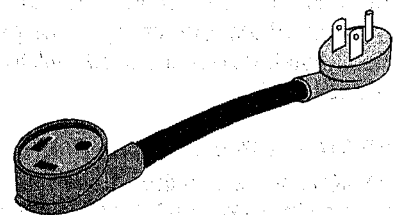


The Display Panel can be mounted remotely and connects to the main unit with a light gauge, three-wire cable. Six Power Status LED's indicate power is applied to those loads. These LED's are on when the power is applied. If 120 VAC service is available, the Load Meter has a two-digit display to **indicate the amount of current actually being drawn** by all the appliances in the coach. If 240 VAC service is available, the two-digit load meter goes blank.

Four Service Type LED's indicate the source for 120/240 VAC power. Three of these sources are automatically detected and indicated by the **EMS**, namely: Gen Set service, 50 Amp 240 VAC service, and 30 Amp 120 VAC service.

When 120 VAC shore power is first applied, the system will always be in the 30 Amp mode. The 30/20 Amp indicator LED will be on when the system is in the 30 Amp mode. The 20 Amp service mode is not automatically detected; the operator must manually select the 20 Amp mode, when 20 Amp service is available. The Service Select button allows the current threshold to be set to either 30 Amps, or 20 Amps, to match the incoming service.

If the pictured adaptor is used on the incoming service, press the service select button to select the 20 Amp mode. Momentarily pressing this button again will switch the system back to the 30Amp mode.



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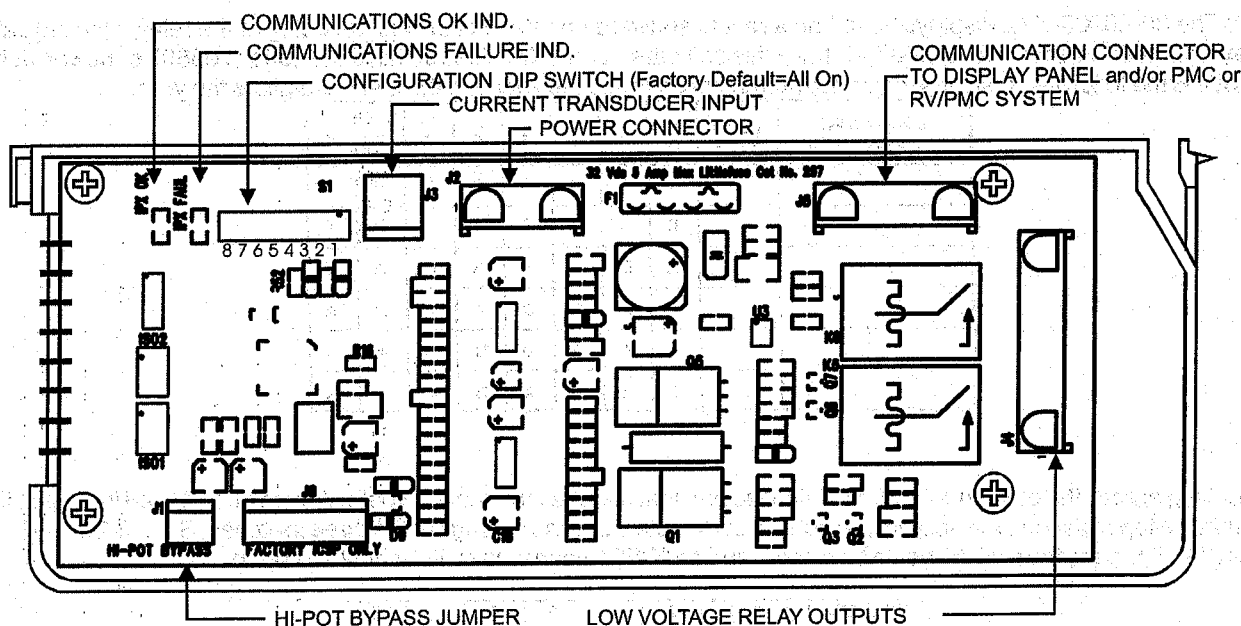
The Display Panel can also be used to display the **value of current stored in memory** for each of the six loads. To display the values of current stored in memory for each of the six loads, push and hold the "Service Select" button. The uppermost LED will illuminate and the stored value will appear on the Load Meter. Pushing "Service Select" again, will cycle to the next load. After the last stored value has been displayed, or if the Service Select button has not been pressed during a five second period, the Load Meter will return to normal operation and display total current draw.

INSTALLATION

The Control Module

The first step when installing an EMS, is to determine which loads will be controlled and in what order they will be shed. A typical scheme would be to control the two air conditioners, the water heater and the washer/dryer. With these loads, the first load to be shed should be the water heater, as it's loss of operation would be the least noticed (*it would switch to operate on gas, if needed*). The next would be the bedroom air, the third, the washer dryer and finally the main air. Choosing this sequence would provide the least inconvenience to the occupants. User discretionary loads, such as microwave ovens, coffee pots, hair dryers, etc. *should never be considered as EMS controlled loads*.

The EMS Control Module has an eight position dip-switch on the board to configure the features active in the system. The switches in positions 1 thru 3 determine the order of shedding of the loads (*See figure below*). The switch in position 4 determines if the Gen set EMS feature is enabled. The switch in position 5 establishes the rating of the generator. Additional switches in positions 6 thru 8 are reserved for future control configurations.



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These dip-switches are all preset to "ON" at the factory. Changing the setting of S1-1, S1-2, or S1-3 will alter the order of shedding to suit the particular need of the installation. The tables below will assist in determining the proper settings for S1 thru S3. Dip-switch S4 determines if energy management is enabled when 120 VAC Gen-Set service is available. If S4 is in the "on" position, energy management will be disabled, but the Display Panel will still display total system current. If S4 is in the "off" position, energy management will be enabled and the current rating of the Gen-Set needs to be selected using dip-switch S5. With S5 set to the "on" position, system current drawn from the generator will be limited to 45 Amps. With S5 set to the "off" position, system current drawn from the generator will be limited to 60A.

Shedding Order Determination:

The first step is to fill in the blanks with the names of the loads you want the system to shed, in the order they are to be shed, with the first to be shed at the top. Then, fill in the second "Load Type" column with an "A" or a "D". "A" for a 120 VAC controlled load such as a washer/dryer; or "D" for DC controlled load, such as a thermostat wire. You can select a maximum of 4 AC and 2 DC relays.

Starting February 23, 2007 (Julian date code 05407), position 7 has been defined for a 3rd air option feature (previously a reserved position). When position 7 is in the off position, the 3rd air option is enabled. When position 7 is in the on position, the 3rd air option is disabled. When the 3rd air option is enabled, the functionality of this option is as follows:

When service is 30Amps or less, relay 1 is disabled (off state) where relay 1 has been wired for a 3rd air conditioning unit. Also, the LED on the display unit will be off for relay 1.

NOTE: The 00-00903-XYZ displays have had a recent software update to allow the decoding of the relay 1 led indicator. Displays date coded after Feb. 5, 2007 will have this software update. Intellitec Julian Date code of 03607 or newer. Julian date code is the following: first three digits are number of days into the year and the last two digits is the year.

LOAD NAME (First to Shed at Top)	LOAD TYPE	1	2	3	4	5	6	7	8
		D	A	A	A	A	D	A	A
		D	D	A	A	A	A	D	A
		A	D	D	A	A	D	A	D
		A	A	D	D	A	A	D	A
		A	A	A	D	D	A	A	D
		A	A	A	A	D	A	A	A

Next, looking across the other eight columns, find the one that matches the "Load Type" column you just filled in. Using the number at the top of the column, look in the table below to determine the settings of the three switches, S1-1, S1-2, and S1-3. An "ON" means the switch should be closed and an "OFF" means the switch should be open.

COLUMN NUMBER	1	2	3	4	5	6	7	8
S1-1	ON	OFF	ON	OFF	ON	OFF	ON	OFF
S1-2	ON	ON	OFF	OFF	ON	ON	OFF	OFF
S1-3	ON	ON	ON	ON	OFF	OFF	OFF	OFF
RELAY	6	4	4	4	4	6	4	4
SHED	5	6	3	3	3	4	6	3
ORDER	4	5	6	2	2	5	3	6
(Top is	3	3	5	6	1	3	5	2
First Shed)	2	2	2	5	6	2	2	5
	1	1	1	1	5	1	1	1

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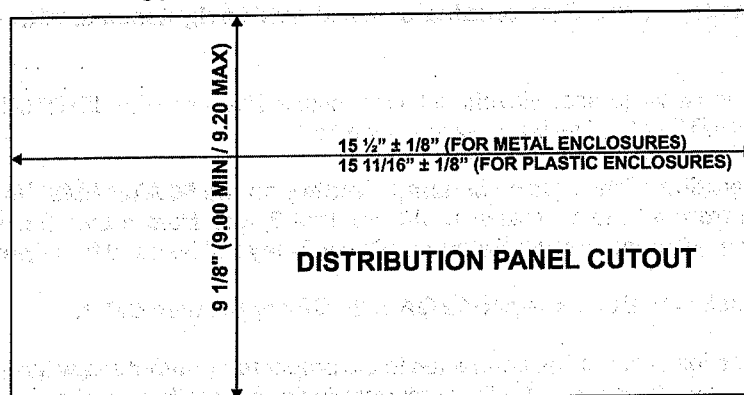
At the bottom of each column is the Relay Shed Order. This determines which relays will be used for each load. The one at the top of the column is first to be shed. The one below it will turn off next, and so forth. The loads **MUST** be wired in this order for the system to operate as desired.

Finally, the number and size of the circuit breakers should be selected to meet the needs of the installation. The breakers can be either single or dual types. Two of these breakers **MUST** be 50 Amp units to act as the Main breakers. The breakers must be obtained and then installed in the box. (See information on breaker types later in this manual.)

Distribution Panel

The EMS Distribution Panel should be installed in a convenient location where it can get air circulation to keep it from overheating. There should be a minimum of 7" of depth behind the mounting surface to provide enough room for the box and wiring.

A hole should be cut in the mounting panel as shown:



This opening must be cut carefully to be sure the mounting screws will have enough wood to hold and there is enough clearance around the box for the front cover screws.

The wiring to the box should be routed through the holes in the back and secured using approved cable connectors. The wires should be copper conductors **ONLY**, with the appropriate size and insulation to meet N.E.C. requirements.

The main supply cable should be brought through the large hole in the lower center of the box and secured with an appropriate connector. The "LINE 1" and "LINE 2" supply mains should be connected to the corresponding main breaker. The main ground lead should be connected to the nearest GROUND bar terminal strip. The current sensor should be mounted in a knock-out hole near the insulated NEUTRAL block, so that the signal leads from the current sensor exit the rear of the box. These signal wires should be routed through the lower right hole into the low voltage section of the EMS and connected to J3, a 2 pin connector on the low voltage side of the Control Module.

The main NEUTRAL wire should be routed through the CURRENT SENSOR and connected to an appropriate position on

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the insulated NEUTRAL block.

There are 8 positions for the circuit breakers in the box. The circuit breakers can be single or dual types. The breakers in the two center positions must be 50 Amp to be used as the Main Breakers.

The following breakers are suitable for MAIN and BRANCH breakers:

Bryant - BR, BD, GFCB, Filler Plate FP-1B
ITE Gould - QP, QT, Filler Plate QF3

The replacement circuit breakers must be of the same type and rating.

Branch circuit wires should be routed through the remaining knock-out holes in the back of the box. The wires should be stripped and the ground wire of each cable connected to the GROUND bar terminal strip. The white, or neutral wires should all be connected to the NEUTRAL bar terminal strip. The black, or "hot" leads of all the uncontrolled loads should be connected to their associated breakers. **Each terminal screw should be tightened to 16 in.-lb. of torque.** (See the box drawing.)

If removed during installation, the white jumper wire should be re-installed between the NEUTRAL block and J6, terminal 5 of the EMS module labeled "NEUTRAL". (See box drawing, page 15.)

NOTE To insure proper operation of the source sensing circuitry on the 50 AMP EMS™ Model 700, jumper wires must always be connected from a Line 1 breaker to J6 terminal 3, and from a Line 2 breaker to J6 terminal 1. These connections must be made even though Relay 1 or Relay 2 may not be used for controlled loads.

NOTE J6 and J7 terminal blocks - Will accept up to 12 GA or 14 GA copper wire **ONLY**.

The black wires to the controlled loads should be connected to the proper relay output screw terminals of J6 and J7 on the EMS control module. Be sure these wires are under the screw terminals and that they are tight.

The connections are as follows:

<u>J6 Terminal</u>	<u>Function</u>	
1	From Circuit Breaker for Relay 2	(Must be connected to a LINE 2 Breaker)
2	Output of Relay 2	
3	From Circuit Breaker for Relay 1	(Must be connected to a LINE 1 Breaker)
4	Output of Relay 1	
5	Neutral	
<u>J7 Terminal</u>	<u>Function</u>	
1	Output of Relay 3	
2	From Circuit Breaker for Relay 3	
3	Output of Relay 4	
4	From Circuit Breaker for Relay 4	

~~The 12 VDC voltage connections are made through J2, a 3-pin Mate-N-Lok connector on the low voltage side of the~~

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Control Module. The +12 volts should be supplied from a source fused at 3 Amps minimum and capable of delivering up to 1 Amp of AVERAGE current. Protecting this connection with a higher rated fuse is acceptable since the EMS is internally protected with a 3 Amp fuse.

The connections are as follows:

J2 Pin Function

1	+ 12 Volts
2	Gen Set Run Input
3	Ground

The low voltage controlled load connections are made through J4, a 6 pin Mate-N-Lok connector on the low voltage side of the control module.

The connections are as follows:

J4 Pin Function

1	Relay 5 Normally Open
2	Relay 5 Common
3	Relay 5 Normally Closed
4	Relay 6 Common
5	Relay 6 Normally Closed
6	Relay 6 Normally Open

NOTE:

Relay 5 & 6 ARE energized during the 2 minute start-up delay period. After the 2 minute delay cycle, the EMS will de-energize Relay 5 & 6, moving their contacts back to the Normally Closed positions; J4 pins 2 & 3, J4 pins 4 & 5.

The low voltage controlled load relay connections are typically made to the thermostat wires of the air conditioners. The normally open contacts are wired in "series" with the thermostat. This means that the thermostat wire is cut and the two ends are wired to the Common and the Normally Open contacts of the relay/s. In this way, the EMS can interrupt the operation of the compressor just as the thermostat does. The low voltage wires are brought into the box through the large hole in the lower right-hand corner of the back of the box.

There are several methods to utilize Relay 5 and 6 connections for controlling air conditioner systems with the EMS:

- 1) If only the compressors of the front and rear A/C's are to be controlled, connections are typically made to the low voltage compressor control wires of the air conditioners. The normally closed contacts are wired in "series" with the compressor control lead. This means that the compressor control wire is cut and the two ends are wired to the Common and the Normally Closed contacts of Relay 5, or 6. In this way, the EMS can interrupt the operation of the compressor, just as the thermostat does.
- 2) If both the compressors and fans of the front and rear A/C's are to be controlled, connections are typically made to the low voltage thermostat control wires of the air conditioners. The normally closed contacts are wired in "series" with each thermostat control lead. This means that the thermostat control wire is cut and the two ends are wired to the Common and the Normally Closed contacts of Relay 5 or 6. In this way, the EMS can interrupt the operation of the compressor and fans, just as the thermostat does.
- 3) If the compressor and fan for one of the A/C systems are to be controlled individually, connections are typically made to the individual low voltage thermostat control wires for the fan and compressor of the air conditioner. The Relay 6 connections are typically made to the low voltage compressor control wires of the air conditioner to control the compressor. The Normally Closed contacts are wired in "series" with the compressor control lead. This means that the low voltage compressor control wire is cut and the two ends are wired to the Common and the Normally Closed contacts on Relay 6. The Relay 5 connections are typically made to the low voltage thermostat control wires of the air conditioner to control the fan. The Normally Closed contacts are wired in "series" with the thermostat control lead. This means that the low voltage thermostat control wire is cut and the two ends are wired to the Common and the Normally Closed contacts on Relay 5. In this way, the EMS can interrupt the operation of the fan, just as the thermostat does.

Finally, on the Control Module, there is a small 2-pin plug, labeled J1, which is only used for the High Pot Test on the

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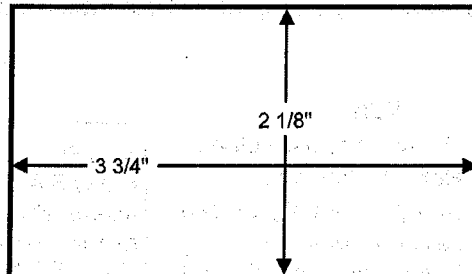
system. When the two pins are shorted together, the EMS will operate without the presence of 120 VAC.

Now the **EMS** should be moved into the mounting hole, being careful not pinch any of the wires. It should be screwed in place using four # 8, round head screws into the 4 holes in the side flanges. The front cover should be secured into place with the 6 screws provided in the holes in the top and bottom flanges.

Display Panel:

Select a convenient location for the panel, where it can be easily viewed by the owner.

Cut a hole for the panel as shown:



Remote Panel Cutout

The Display Panel is equipped with a six inch long pigtail with a 3-pin Mate-N-Lock female connector. An extension harness, up to 100 feet long can be attached between the Display Panel and the EMS Control Module, with a 3-pin male Mate-N-Lock plug at the Display Panel end and a 4-pin male Mate-N-Lock plug at the Control Module end. **The wiring of the plug at the Control Module end determines the system configuration as follows:**

- 1) Stand-Alone Mode - Pins 1 thru 3 on the 3-pin plug connect to the corresponding pins on the 4-pin plug. In addition, pin 4 on the 4-pin plug should be connected to pin 2.
- 2) RV Multiplex Master Mode - Pins 1 thru 3 on the 3-pin plug connect to corresponding wires in the RV Multiplex system and the corresponding pins on the 4-pin plug. In addition, pin 4 on the 4-pin plug should be connected to pin 2.
- 3) PMC Mode - Pins 1 thru 3 on the 3-pin plug connect to the corresponding pins on the 4-pin plug. No connection should be made to 4 on the 4-pin plug.

The Display Panel should be plugged onto the mating three-pin Mate-N-Lock connector in the harness, insuring that it is fully seated and locked. The panel should then be installed in the hole and screwed in place using two # 6, flat head screws through the holes in the panel. A white function label should be lettered to correspond to the order of load shedding and installed behind the cover label. The cover label should be placed against the front panel and the trim bezel snapped on to hold the label in place.

Plug the 4-pin plug into J5 on the EMS Control Module, insuring that it is fully seated and locked.

PERFORMANCE TEST

The system is now ready for testing.

HI-POT TEST:

At the installers preference, to assure there are no potential shorts, a Hi-Pot test can be performed on the installation. To do this, +12 volts must be applied to the system. A jumper wire must be installed to tie the two pins of the "Hi-Pot Test" plug, J1, to turn the system on without the presence of 120 volt power. This plug is located on the right side of the EMS Control Module. After the initial **two-minute start-up delay**, the relays on the module should be heard clicking as they pull in. On the Display Panel, the LED's should light and the numeric display should read "0". The Hi-Pot test should now be conducted in accordance with standard procedures for the tester being used. Assuming the system passes, the covers should be taken off and the jumper removed from J1. *If not, the problem must be corrected before proceeding further.*

SYSTEM TEST

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All the 120 volt loads should be turned off or disconnected. Both 120VAC 30 Amp shore power (*an adapter must be used to connect the 30A source*) and 12 volt DC power should now be applied to the system. **Initially, there will be a two-minute start-up delay.** When this is done, the relays should be heard pulling in at approximately one second intervals. On the Display Panel, the numeric display should read "0", the six Power Status LED's should come on and the "30 Amp" Service Type LED should light. A clamp-on type ammeter should be used to measure the current being supplied by the 30 Amp shore power cord.

Connect, or turn on, one of the controlled AC loads. It should operate and the numeric display or the clamp-on ammeter, should show the amount of current that load is drawn. Turn that appliance off and repeat this with each of the others.

To test the load shedding, turn on all the controlled appliances. The total current drawn should exceed 30 Amps. (If not, add additional loads to the non-controlled receptacles.) When the total amount of current exceeds 30 Amps, the loads should begin to turn off to bring the total below 30 Amps.

FUSES

F1 - 5 Amp ATO type, for EMS Control Module circuitry only. **DO NOT replace with a fuse of higher rating.**

This could result in severe damage to the circuitry or create a possible fire hazard.

EMS CONTROL MODULE PLUGS, PINS, AND FUNCTIONS

J1 = 2 pin Molex KK-100 connector - HI-POT TEST Power Up

Pin	Function
1	Hi-Pot Override
2	Hi-Pot Override

J2 = 3 pin Amp Mate-n-Lok Connector - Power Connector

Pin	Function
1	+12 Volts Supply
2	+12 Volts Gen-Set Run Input
3	Chassis Ground

J3 = 2 pin Molex KK-156 - Current Sensor Connector

Pin	Function
1	Current Sensor Input
2	Current Sensor Input

J4 = 6 pin Amp Mate-n-Lok connector - Control Relays 5 & 6 contacts

Pin	Function
1	Relay 5 N.O.
2	Relay 5 COM.
3	Relay 5 N.C.
4	Relay 6 COM.
5	Relay 6 N.C.
6	Relay 6 N.O.

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EMS CONTROL MODULE PLUGS, PINS, AND FUNCTIONS (continued)

J5 = 4 pin AMP Mate-n-Lock - Communications Connector to Display Panel and/or external PMC or RV/PMC Systems.

Pin	Function
1	Power
2	Data In
3	Ground
4	RV/PMC Master Out

J6 = 5 Position Terminal Block

Term	Function
1	From Circuit Breaker for Relay 2 (Must be connected to a LINE 2 Breaker)
2	Output of Relay 2
3	From Circuit Breaker for Relay 1 (Must be connected to a LINE 1 Breaker)
4	Output of Relay 1
5	Neutral

J7 = 4 Position Terminal Block

Term	Function
1	Output of Relay 3
2	From Circuit Breaker for Relay 3
3	Output of Relay 4
4	From Circuit Breaker for Relay 4

NOTE: J6 and J7 terminal blocks - Will accept up to 12 GA or 14 GA copper wire ONLY.

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Trouble Shooting

If the following problems occur, proceed with analysis in the order in which these steps are listed.

I. No 120 volt appliances working.

A. Check incoming power source.

1. Make sure the shore power cord is plugged into the outlet.
2. Check the circuit breaker at the shore power outlet to be sure it is set. Turn it off and then back on to be sure.
3. Check the 50 Amp Main circuit breakers in the EMS Distribution Panel to be sure they are set. Turn them off and then back on to be sure.
4. Using a circuit checker, be sure the 30 Amp shore power outlet has 120 volts available.

B. Check Change-Over relay, if so equipped.

1. Measure the voltage at the incoming side of the Main 50 Amp breaker. If voltage is NOT the same as the incoming line, repair the change-over. (Refer to the change-over service literature for trouble shooting.)

II. 120 volts available at non-controlled appliances and receptacles. Controlled appliances do not operate.

A. Check the 12 volt power to the EMS module.

1. Check 12 volt, 3 Amp fuse on EMS Control Module. Replace if necessary.

B. Check 120 volt circuit breakers in EMS.

1. Reset circuit breakers if necessary.
2. Check for presence of voltage at branch circuit breakers with voltmeter.
3. Check for presence of voltage at EMS terminals with voltmeter.
4. Check wire from EMS Control Module to neutral bar is installed.

III. Some controlled appliances turn on, others do not.

A. Reduce total current, appliance may be shed.

B. Check wiring to and from EMS Control Module.

1. Check wiring from circuit breakers to EMS Control Module.
2. Check wiring from EMS Control Module to controlled appliance.
3. Check for power at associated EMS relay terminal.

IV. Branch circuit breaker trips when power is applied.

A. Check wiring for shorts.

V. Air conditioner doesn't work.

A. Check thermostat wiring and settings.

B. Check air conditioner

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VI. Shedding order incorrect.

- A. Check dip-switch setting per Figure on page 5 and Tables on page 6.
- B. Check relay wiring per Table on page 6.

VII. Remote Display out or strange characters are displayed.

- A. Check the green "IPX OK" and red "IPX Fail" LED indicators on the Control Module. If communications is present at the Control Module the "IPX OK" indicator will be lit, and the "IPX Fail" indicator will be extinguished. The wiring should be checked for continuity between J5 on the EMS Control Module and the Display Panel.
- B. If communications is not present at the Control Module the "IPX OK" indicator will be extinguished, and the "IPX Fail" indicator will be lit. The wiring between J5 on the EMS Control Module and the Display Panel should be checked for shorts to ground and other circuits.
Correct voltages are indicated in the table below:

Pin	Function	Voltage
1	Power	12V
2	Data In	Approx. 9V
3	Ground	Ground
4	RV/PMC Master Out	Approx. 9V

NOTE: Both the EMS Control Module and Display Panel have internal protection. Shorts or mis-wiring should not cause the units to fail.

VIII. Remote Display does not indicate "GEN SET" service source when generator is running.

- A. Check wiring between generator run light circuit and J2 pin 2 on EMS Control Module. J2, pin 2 should measure +12VDC or greater when generator is running and 0 VDC; otherwise.
- B. If "50 Amp" service is indicated, the generator is producing 240 VAC; that service takes priority.

VIX. Remote Display does not indicate "50 AMP" service source when 50 Amp 240 VAC shore power is connected.

Check to make sure that jumpers are present between any LINE 1 breaker and J6 terminal 3, and any LINE 2 breaker and J6 terminal 1. Also check that the "NEUTRAL" jumper is in place, between J6 terminal 5 and a position on the NEUTRAL block.

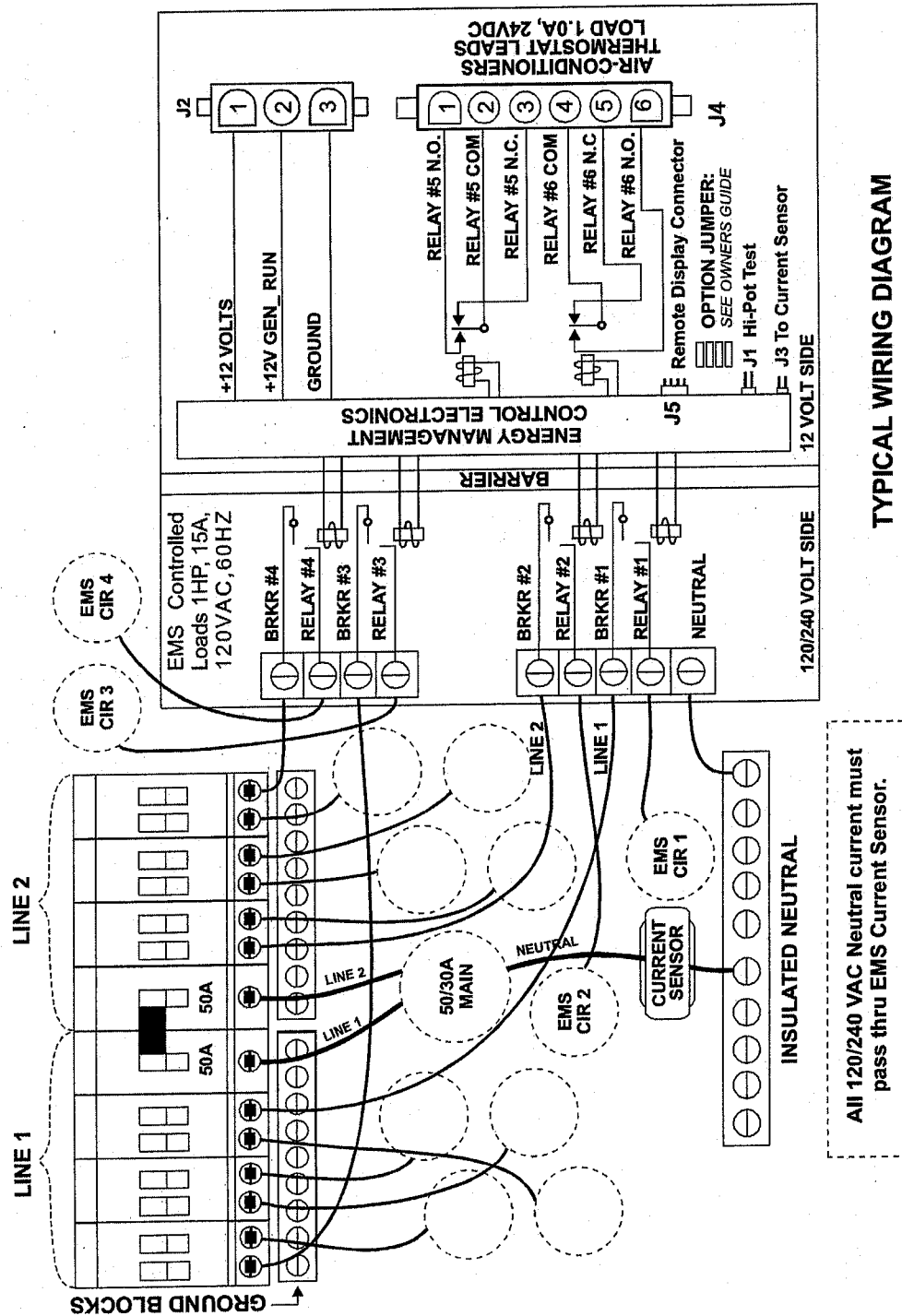
With "50 Amp" service available the voltage between J6-3 and J6-1 should measure 240 VAC. With any other source the voltage between J6-3 and J6-1 should measure 0 VAC. In addition, the voltage measured between J6-3 and J6-5 should be 120 VAC and the voltage measured between J6-1 and J6-5 should be 120 VAC.

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TYPICAL WIRING DIAGRAM

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THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

RESEARCH REPORT
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A
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