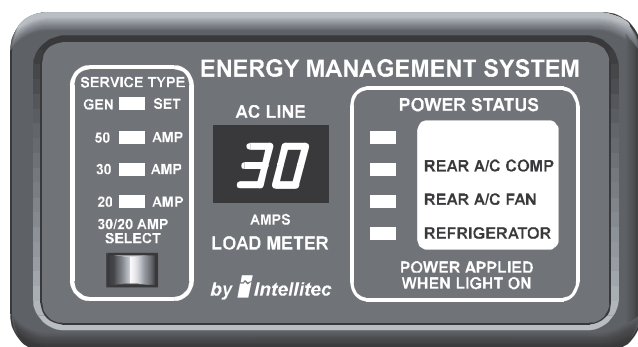


# SMART ENERGY MANAGEMENT SYSTEM

MODEL 600

## OWNERS GUIDE

The **Smart EMS Model 600 Module** (Energy Management System) is a fully automatic system that oversees the usage of 120 volt electric power, and controls the rear air conditioner and refrigerator, minimizing the nuisance of circuit breaker tripping. It will not require much attention from you, but you may want to know what it is doing and how it works. If you do, please read on to become fully familiar with its operation.



Display Panel

### Operating From the Generator

When the generator is running, the **EMS** will *not* control the loads. The Load Meter will illuminate and display the total amount of current being drawn by all the loads in the coach (except the rear A/C. The Gen-Set LED will light to show the system "knows" that it is being supplied from the generator.

**Operating From 50 Amp Service** (if unit is equipped with this feature)

When the coach is plugged into 50 Amp service there is enough power available to operate all the appliances at the same time; so the **EMS** is *not* operative. The 50 Amp LED on the Display Panel will be lit to show the system "knows" that it is being supplied 50 Amp service. **The Load Meter display will not be illuminated.**

### Operating From 30/20 Amp Service

In an RV, the amount of 120 volt electric power is limited by the shore power cord and the outlet into which it is plugged. Some campground sites offer 50 Amp service, which actually provides up to 100 Amps (50 Amps on

each of the 2 lines). The most popular campground outlet size is 30 Amps; some have only 20 Amps available. (In a typical home 200 Amps is available.) When plugged into a 30 Amp outlet without an energy management system, if more than 30 Amps is drawn, the campground circuit breakers will trip.

This limited amount of power is usually enough for an RV when averaged over a longer period; although, it falls short of being able to supply enough current if too many appliances are operated at one time. The **EMS** "manages" the amount of current being drawn, at any one time, by delaying the usage of certain "postpone-able" appliances until the use of "on-demand" appliances is complete. Examples of postpone-able loads are air conditioners, electric power for the refrigerator, electric water heaters, etc. Usage of these appliances is important, but can be delayed or powered by an alternate power source, while other more important (on-demand) appliances are being used. On-demand appliances are those you want to use "immediately", such as the microwave, toaster, or hair dryer. All this usually happens so automatically you won't notice that it is working; when the toast pops up, the air conditioner will come back on again.

When the coach is plugged into 30 Amp or 20 Amp service, via an adapter, the EMS will automatically turn on and control the loads. The Power Status LED's will begin to turn on, from the bottom to the top, as those corresponding loads are turned on. The Load Meter will illuminate and display the total amount of current being drawn by all the loads in the coach.

The 30 Amp LED will light to show the system "knows" that it is being supplied with 30 Amp service. (If you are connected to a 20 Amp service, you will have to press the Selector button on the display panel to switch the system to 20 Amp operation.)

The **EMS** Control Module is located inside the main 120 volt power distribution panel. It can be identified by the array of circuit breakers on it's front panel. These breakers are for all 120 volt appliances in the RV. The EMS provides electronically operated switching of the rear air conditioner and the refrigerator.

**Intellitec**

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#### How It Works

When the coach is plugged into a 30 Amp or 20 Amp outlet, the **EMS** constantly monitors the total amount of current being drawn by all the loads in the RV. If the value exceeds 30 Amps (or 20 Amps - if selected) the **EMS** begins to turn off the postpone-able loads, one at a time, until the total current draw is less than 30 Amps. When the current drops below a point that would allow another appliance to operate, the **EMS** will turn that appliance on again.

The following table lists some major appliances found in an RV, and the approximate amount of current they draw.

High Efficiency Roof-Top A/C	12 Amps *
Electric water heater	11.5 Amps
Microwave oven	10 Amps
Coffee Maker	11 Amps
Hair Dryer	10 Amps
Toaster	9 Amps
Popcorn Maker	10 Amps
Washer/Dryer	13 Amps
Converter	4 Amps
Refrigerator	2 - 6 Amps

\*Depending upon the ambient temperature.

#### Typical Example

Let's consider an example:

It's a warm day and you have your air conditioner on. The converter and refrigerator are also on. The total current being drawn is then:

High Efficiency Roof-Top A/C	12 Amps
Converter	4 Amps
Refrigerator	<u>3 Amps</u>
Total	19 Amps

At this point, there is 11 Amps of current ( $30 - 19 = 11$ ) remaining to operate other appliances. Now you turn on the coffee maker to make some coffee. This adds 11 Amps more to the load, bringing the current up to the limit of 30 Amps.

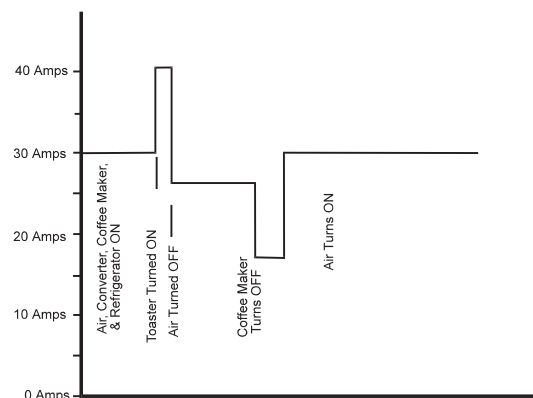
High Efficiency A/C	12 Amps
Converter	4 Amps
Refrigerator	3 Amps
Coffee Maker	<u>11 Amps</u>
Total	30 Amps

Adding any additional draw will overload the circuit breakers normally causing them to trip. Now you decide to make toast. You turn the toaster on and it draws an additional 9 Amps. This makes the total load 39 Amps, exceeding the trip point of the circuit breaker.

At this point, the EMS senses this overload. Before the breakers trip, the EMS will turn off a controlled appliance (the air conditioner). In this example, turning off the rear air conditioner will remove 12 Amps of draw, dropping the total draw to 27 Amps ( $39 - 12 = 27$ ). If this did not reduce the current enough, the EMS would turn off the next appliance in the series.

As it does this, the system detects the amount of current turned off and records this amount in its memory. In this way, it "learns" the amount of current each appliance needs to operate.

Now the EMS waits until the current draw drops below the point that will allow the air conditioner to operate again. In this example, that point would be 18 Amps, since the system "knows" the air conditioner draws 12 Amps.



**Sequence of events as described above.**

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## MODEL 600

### OWNERS GUIDE

#### Two Minute Timer

The **EMS** also includes a timer to prevent appliances from turning off and then immediately back on again. This timer will prevent any of the controlled appliances from being turned back on in less than two minutes from the time it was shut off.

#### Three Hour Averaging

To minimize the possibility of over-heating the electrical equipment, the **EMS** also includes a long term current *averaging* feature. This feature continuously monitors the total amount of current drawn by all the appliances in the RV and calculates an average value. If the average current after any three hour period exceeds 80% of the 30 Amp service (24 Amps), the system will automatically shut down appliances until the three hour average current is less than 24 Amps. The system indicates it switched to this mode by showing a decimal point after the second digit. It will then switch back to the normal 30 Amp limit and the decimal point on the display will turn off.

#### Display Panel

The display panel indicates the functions of the system. It includes a digital display of the total amount of current being drawn by all the appliances, a series of LED's which indicate power being applied to the particular appliances, and an electrical service, power selector switch.

#### Digital Display

The digital display indicates the total amount of current being drawn by all the appliances in the RV. This display will help you understand the amount of current drawn by each appliance and why certain ones cannot be operated simultaneously.

This display can also be used to show the amount of current stored in the memory for each of the learned loads. To do this, press and hold the Service Selector button until only the top Power Status indicator LED turns on. The number in the digital display is the value of current held in the memory of the system for that load. Releasing the button and pressing it again will light the

next LED and the display will show the amount of current in the memory for that load. Repeating this will show the values for the other two loads. If the system has not shut a load down since it had power applied, the value in the memory will be zero. If the system is in the Three Hour Averaging Mode (a fifth reading) the calculated average is displayed.

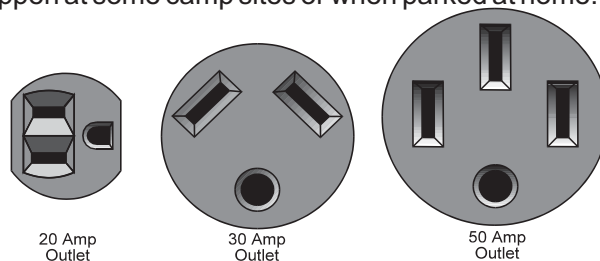
After reading all the loads, or not pressing the button for five seconds the display will return back to normal operation.

#### Power Status Indicators

The Power Status LEDs indicate when the system is applying power to those appliances. When the power is first applied to the RV, the Power Status LEDs will begin to turn on from the bottom to the top, indicating power is being applied to each of the loads. The digital display indicates the total amount of current being drawn by all the loads. If this total goes above 30 Amps, the system will shut down the last load that was turned on. If any of these indicators are not lit, that appliance is not being powered. To get power to any of those appliances, other appliances will have to be turned off.

#### Service Type Display and Selector

The Electrical Service Display shows what electrical service is supplying the system. The selector button allows you to set the system to operate from a 20 Amp service, when a 30 Amp is not available. This might happen at some camp sites or when parked at home.



To "tell" the system you are connected to 20 Amp service, momentarily press the selector button. When the button is released, the 30 Amp indicator LED will go out. When the system is set in this mode, it will begin to turn off appliances if the total current exceeds 20 Amps.

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# **SMART ENERGY MANAGEMENT SYSTEM**

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### **TROUBLESHOOTING**

Should you incur any troubles with the system - the following should be checked before contacting a qualified Service Technician for help.

#### **Air conditioners and other appliances won't operate.**

- Be sure RV is plugged into "live" outlet.
- Check all circuit breakers and reset if necessary.
- Wait for two minute time delay.
- Check 12 volt fuse feeding EMS & fuse on EMS printed circuit board.  
If either is open, replace.

#### **Some or one of the appliances/air conditioners won't operate.**

- Check control settings of those appliances. Be sure they are turned on.
- Check all circuit breakers, reset if necessary.
- There may not be enough current available. Turn off other appliances.  
Check Power Status LEDs.
- Less than two minutes since the appliance/air conditioner was shut off.  
Wait two minutes.

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