CHAPTER 6

ELECTRICAL SYSTEM

There are two interrelated electrical systems used in your motor home. The 12 volt DC supply system; and the 120 volt AC supply system. The 12 volt DC system is divided into several branches, or zones, each functioning from the common 12 volt battery source. One branch provides the 12 volts required for the automotive starting, ignition and lighting systems; remaining branches supply those motor home circuits and appliances which require 12 volts DC for operation.

The 120 volt AC system includes those motor home appliances which require 120 volts for their operation, supplied from either the internal generator, or from the external 120 volt AC (or a split 240 volt AC) supply, via the shoreline hookup. The inverter will supply 120 volt power from the coach batteries to selected circuits.

12 VOLT DC SUPPLY SYSTEM

Wiring diagrams of the 12 volt supply and distribution system are included in the Illustrations & Diagrams Section. (* These did not come with the coach when bought)

The 12 volts supplied to all motor home appliances, outlets and accessories, is routed from the buffers through a main 12 volt master switch (A/T) and routed through busses to the individual branches, or zones, that are serviced from this supply. Circuit breakers are located behind the pilot’s overhead compartment, lower front load center (behind removable panel outside front of coach) and at each of the zones. The circuits supplied and fuse or circuit breaker protection at each zone are shown on the diagrams. (*These are the large sheets of diagrams rolled up.)

ALTERNATOR

A 160 Amp belt driven Delco Alternator with an internal regulator, supplies all 12 Volt coach requirements as well as charging the batteries. While the engine is running, the green light on the lower dash upper right corner will show, thus indicating that both battery banks are being charged. This is an automatic feature. When the engine is stopped, the green light should go out, thereby breaking the connection between the two battery banks.

COACH BATTERIES

Four (4) 12 volt Marine-RV deep cycle batteries are located on a roll-out tray in the road side front compartment. These will provide 8.4 hours of operation, at a 25 ampere rate, when a charging source is not available.

ENGINE BATTERIES

Two 12 Volt, group 31, 1000 CCA (cold cranking amps @ 0º F) Batteries are the starting bank for the engine. Hooked in parallel, they go through an ON-OFF cut-off switch and supply 2000 amps for engine starting.
BATTERY CHARGING

The 12 volt coach battery supply is maintained fully-charged by either the engine alternator (when engine operates); or by battery charger. The engine battery system is normally charged by the alternator only. The coach and engine battery systems are separated by a relay to prevent deterioration of voltage in the event of one or the other Battery Bank becoming defective.

In the event of a failure of either battery system, the systems may be tied together through the above relay by the aux. Battery switch on the lower dash. The momentary position of the switch should be used for cranking engine. The ON position should only be used for charging engine batteries by the battery chargers.

Batteries can become discharged because of coach 12 volt loads, while parked, without a 120 volt AC source. For overnight stops this presents no problem, with judicious use of 12 volt service, because the engine alternator will recharge the batteries rapidly during the next day’s travel. When operating from shoreline or generator power, the batteries obtain the major portion of the charge during sleeping time, while coach loads are low, so that the battery charger can “top off the batteries”.

If it is planned to leave the coach parked without exterior power for two days or longer, turn off the Electronic Master Switch located on the Left Side Overhead Battery Monitor Panel in addition to the A/T Switch.

While in transit, the DC volts gauges on the upper dash panel should reflect an alternator regulated setting of 14 volts + 0.5. When parked, with 120 volt source supplied, the DC VOLTS COACH gauge should read between 12.5 and 14.0 volts depending upon load. When parked, without 120 volt source, do not permit voltage to drop below 11.5 Volts.

After a trip, ALTERNATOR/CHARGER AMPS ammeter may show some discharge reading even when 120 volt source is supplied, if there is a load on the 12 volt coach circuits. The Float type battery charger operates in the 12-14 volt range when there is a load.

AC SUPPLY SYSTEM

Motor home AC-operated appliances are supplied from either an external shoreline hookup or from the on-board generator. Selection of shoreline or generator power source is determined automatically by a remote changeover switch located adjacent to the 120 VAC breaker/distribution panel. The 120 VAC circuits are normally supplied by the shoreline power cable. Whenever the generator is started, the automatic changeover switch will detect the generator voltage and will switch to the generator in approximately 25 seconds.

NOTE

It is a good practice to manually select the source of 120 VAC and not rely on the automatic relay switch over. If the relay ever fails, two separate sources of 120 VAC could be introduced to the coach at different phases. This would fry almost all the electronics in the coach. (I.E. Disconnect External - Then start Generator; and vice versa.)
POWER LINE MONITORS

Dual power line monitors are located on the right hand overhead dash panel, to monitor the voltage and amperage in both legs of the AC shoreline supply (or generator supply). The monitors have a polarity and ground detector circuit to indicate possible electrical hazards due to incorrect hookups. An additional power line polarity monitor is located in the shoreline/utility box.

AC CIRCUIT BREAKER AND DISTRIBUTION PANEL

The main AC Distribution Panel is located in the forward end of the kitchen base cabinet adjacent to the entrance door.

INVERTER

A 1800 watt inverter provides auxiliary power to operate ice maker, rear television, one kitchen receptacle, and optional electric drapes from the Batteries 12 V DC source. It is located in the curb side R H Front Electric compartment. (HIGH VOLTAGE)
LOAD MANAGEMENT (see right page for the 5 gauges involved)

There are five important 12V system gauges located in the driver’s area which, if properly understood and occasionally monitored, will ensure proper operation and prevent an inconvenient and possibly damaging situation of discharged batteries.

On the Right Hand Overhead Dash are:
- **DC amperage gauge (labeled CHARGE)** shows net output from the battery charger or alternator to the batteries.
- **DC amperage gauge (labeled COACH LOAD)** shows the amount of 12 volt current being consumed by coach systems. The sum of these two readings should approximate the alt/charger amp reading. Be sure, with load management techniques that coach load does not exceed charger capacity. This is easily determined by ensuring;
  1. DC amperage (charge) gauge shows positive reading, and
  2. upper dash coach volt gauge does not drop below 11.5 volts. Should battery voltage fall below this range, remember:
     1. The auxiliary battery switch on lower dash may be helpful in starting the engine or the generator as needed.
     2. Battery voltage below 9 volts will damage fluorescent light bulbs and possibly the light ballast. Turn off fluorescent lights with low battery voltage!

On the Upper Dash are:
- Engine volt gauge for two engine batteries. Coach volt gauge for four coach batteries. Proper charger operation while parked will keep batteries between 12.5 and 14.0 volts depending on load.

Alternator/Charger Amp gauge shows alternator output while driving; while parked with 120 VAC service from shoreline or generator.
RIGHT HAND OVERHEAD PANEL

BATTERY CHARGE       COACH LOAD

D.C. AMPERAGE

UPPER DASH PANEL

ALT CHARGER AMPS       DC VOLTS COACH       DC VOLTS ENGINE

A/T                    ENGINE ALARM          HEADLIGHT ALERT
STORING THE COACH

If you plan to store your coach without 120V power for (2) days or longer, be sure to turn off your master (A/T) switch, the electronic master in the pilot’s overhead compartment1 and inverter at both shifter panel and inverter switches. Your objective is to minimize power drain.

With both masters off, you can still expect a battery discharge of 2-4 amps because of non-mastered circuits to refrigerator, and engine transmission control circuits.

For storage over a three (3) week time period, disconnect your batteries if there is no shore power available for the battery charger.

The best storage technique is to turn off both master switches, turn off the inverter at both switch locations and run your battery charger 24 hours per week. This procedure will keep batteries up but avoid a damaging overcharge condition.

POWER CORDS & HOOK UP

Your coach is supplied with a permanently attached 50 amp power supply cord, in the utility compartment (road side rear), for hook up to an external power source.

In addition, a single 30A twist lock connection is supplied to provide two 30A 120 vac lines (from separate external circuits in conjunction with the 50A fixed cord and 50A/30A adapter). This will permit use of all motor home appliances without overloading the supply lines. The total cord complement is as follows:

- 50A male (1) fixed (permanent Power Cord)
- 50A female to 30A male (1)
- 50A male to 30A female
- 50A Surge protector (50A in / 50A out)
- 30A female to 30A male 30 ft (Primary Extension Power Cord)
- 30A female to 30A male extension, (Auxiliary or Secondary Power Cord)
- 30A female to 20A male adapter (2)
- 30A male to 20A female adapter (2)

An Emergency Only 30A male to 30A female with ground disconnected internally, use only with 30A GFI outlets. Regular cord trips C/B always.

(An alternate 30 ft power cord extension with a special male plug for odd outlets)

Note that each cord has a ground pin which provides proper electrical system grounding. The ground pin is your personal protection from electrical shock hazards. Do not use any adapter, cheater, or extension cord that will break the continuity of the grounding circuit. Never remove the grounding pin for convenience of being able to make a connection to a non-grounded receptacle!

Never operate your coach with a “hot skin”! If you can feel even a slight “tingling” shock from touching the coach body while standing outside on the ground, immediately disconnect the electrical hookup until the trouble is located. This fault is usually caused by a break in the grounding circuit, which should be continuous from the coach skin or frame to the distribution panel board to the ground pin on the power supply cord, and from there to the park receptacle and earth ground.
SHORELINE OPERATION (COMMERCIAL POWER)

**CAUTION**

Your motor home has been wired in accordance with the National Electrical Code. All 120 volt AC wiring is two-wire service with ground; all 240 volt wiring is three-wire service with ground. For personal safety, check the polarity detector indicators on the power line monitors to be sure that lines are properly connected and grounded.

**CAUTION**

During thunderstorms, lightening strikes may detrimentally impact the electrical system of your coach just as it would your home. To avoid potential catastrophic damage to sensitive electronic devices in your coach, disconnect shore power and cable television service prior to electrical storms reaching maximum intensity.

**CAUTION**

If the ground pin is used as a starting point for insertion of the 50 amp plug, the possibility exists that an over voltage condition will occur on the 120 volt lines, i.e., the neutral pin of the plug will not make contact at the same time the two 120 volt pins and thus, without the neutral pin making contact as a voltage reference 240 volts may be presented to the 120 volt appliances. Therefore, to reduce the possibility of over voltage, switch off the 50 amp main breakers located in the 120 volt AC load center prior to insertion and removal of the 50 amp plug. In addition, insert and remove the 50 amp plug straight into the receptacle instead of tilting the plug.

For purposes of safety, observe all precautions when making Shoreline connections. Poor grounding or incorrectly-wired receptacles can cause personal harm as well as equipment damage or fire hazards. Check reverse polarity indicator in shoreline/utility compartment to verify correct polarity and grounding of hookup.

**30 AMP ADDITIONAL SERVICE HOOKUP**

First, connect the shoreline to the coach (rotate plug clockwise to assure firm connections). The coach receptacle is located in the left side utility compartment. Connect the other end of the shoreline to the power source. Poor grounding or incorrectly wired receptacles can cause personal harm as well as equipment damage or fire hazards. Check reverse polarity indicator in shoreline/utility compartment to verify correct polarity and grounding of hookup.

**NOTE**

Second 30 Amp Powerline will not stay connected when Primary Power line is plugged into a 50Amp receptacle. Only two 30 Amp sources can be used to run the coach on 60 Amp total.
SHORELINE OPERATION TROUBLESHOOTING

Your coach is designed and tested to make sure the 120 volt AC Neutral (white) wire and the Ground (bare copper or green) are not tied together (no continuity). This will prevent any danger of a “hot skin” if the source of power has reversed polarity (red LED lit) as indicated on the polarity indicator panels located on the right hand overhead aux. panel and in the utility compartment.

Problem

Yellow LED’s lit: Normal (desired)
Red LED’s lit: Reversed Polarity at power source. Convince park management to correct or change lot assignment.

Neither Red or Yellow LED lights:
- No ground connection with park service
- Use jumper lead from ground pin on shore cord to service box.

Power source (park) circuit breaker trips:
- Reversed polarity in park and coach neutral and ground tied together. Use on-board generator until qualified electrician can correct coach problem. (Generator polarity is correct).

Yellow LED’s lit plus Red LED’s glow when additional load is turned on (Air Conditioner or Water Heater):
- Poor ground connection at park (floating ground).
- Make sure shoreline plug is fully engaged. Twist locked (clockwise) at coach.

SAFELINE ALARM

This alarm can be either a blinking red to amber light in the upper left overhead panel, or a both blinking and loud buzzer sounding alarm. It comes on when ever the ignition key is turned on and the external power cord is still hooked up to the utility pole. The buzzer can be de-selected with only the blinking lights on as a warning indication.
BATTERY PROTECTION & MAINTENANCE

BATTERY HEATERS

120 volt AC battery heater pads provide faster engine starts during cold weather conditions by increasing the available cold cranking power.

NOTE

To avoid premature deterioration of the batteries, heaters should be used only when the temperature is below 32 degrees F. The battery heater switch is located in the kitchen base cabinet.

BATTERY MAINTENANCE

Your motor home is equipped with separate engine and coach battery systems for greater assurance that there will be sufficient voltage to crank the motor home engine.

Two engine batteries (1000 CCA flooded type) are located in the engine compartment on the road side.

Four coach batteries (105AH AGM non-maintc. type are located in the road side front compartment and are used for coach loads.

The coach batteries are charged from either the alternator or battery chargers. The engine batteries are charged from the alternator (unless the auxiliary battery switch is in the ON position which permits the engine batteries to be charged by the battery chargers.) In order for the battery chargers to operate, either the generator must be running or the coach must be connected to a shoreline supply. To make sure that the batteries are always ready for use, periodically check and charge as necessary.

A dirty battery may eventually dissipate its charge through conductive surface contamination. Clean battery top surface with a damp cloth and dry thoroughly. Check the battery terminals and associated battery jumper terminals are tight and free of corrosion. To clean terminals, neutralize corrosive deposits with a solution of baking soda, rinse with clear water, and dry. Note that commercial type spray-on battery cleaners are available at automotive supply stores. Use as directed to keep the batteries clean. Spray-on cable and terminal protective coatings are also available, easy to use, and effective.

CAUTION

Avoid sparking of any form in the vicinity of the batteries. Do not wear metal rings, watches or jewelry when working on or near the batteries, cables, solenoids, or chassis wiring. These can short out electrical wiring and cause injury.

BATTERY STORAGE IN FREEZING WEATHER

Batteries that are not kept full-charged must be given protection against freezing. Partially-charged batteries will freeze at low temperatures, so batteries must either be left charged or removed from the vehicle and stored in a warm location.

The motor home can be left connected to the shoreline AC supply and the coach battery chargers will keep the coach batteries charged. Note that even in a warm location it is advisable to keep the batteries charged to prevent deterioration.
BATTERY SERVICE

Engine Batteries

Replenish cells of coach batteries with distilled water to 3/8 inch above plates. Coat Battery terminals with lubricant or protective coating.

Coach Batteries

These Batteries are the new AGM type Batteries and require only a cleaning. Cables must be maintained like any other battery system.

"Lifeline" batteries are totally sealed and do not require maintenance. Warranty Claims are rare and when they occur are normally the result of either over or under charging. The best protection from charging damage is the installation of quality charging equipment. Quality chargers provide steady D.C. voltages to the battery regardless of the fluctuating incoming A.C. current or fluctuating amperage draw. They shut amperage off at the specified voltage; ensuring batteries are not overcharged. Multi-step charging is always recommended for deep cycle battery banks due to the increased efficiency and battery protection they provide. Additionally visual and or audio charging alarms are recommended to ensure a warning is given when the charging system fails.

"Lifeline" are advanced 2.37 Volt per cell, sealed, valve regulated, starved absorbent glass mat batteries. Like all led acid batteries it is necessary to properly regulate amperage and voltage during recharge to prevent battery damage. Proper amperage for Lifeline is limited only to the ampere hour capacity of the installed battery/battery bank. Like all batteries, proper charging voltage for a Lifeline is determined by the battery's temperature. For example a hot battery requires much less voltage to reach full charge than a cold battery and Vice Versa. Again, to achieve both long life and full capacity service during each usage cycle all batteries must be properly charged. The battery manufacturer always determines actual charging levels. Lifeline batteries should be charged as indicated below:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Fully Automatic Systems</th>
<th>Manual Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Temperature Compensation via Battery Sensor</td>
<td></td>
</tr>
<tr>
<td>Bulk</td>
<td>14.38V (77°F)</td>
<td>14.4V (Cold) &lt; 70°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.2V (Warm) 80°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.0V (Hot) &gt;100°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>14.6V (Extreme Cold) &lt; 32°F</td>
</tr>
<tr>
<td>Acceptance</td>
<td>14.38 – 13.9</td>
<td>same as Bulk or slightly lower</td>
</tr>
<tr>
<td>Float</td>
<td>13.38V (77°F)</td>
<td>13.5V (Cold) 70°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.2V (Warm) 80°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.0V (Hot) 100°F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>13.5V (Extreme Cold), 32°F</td>
</tr>
</tbody>
</table>
 Conditioning Charge: (Equalization)

Lifeline construction techniques and material selections significantly reduce the possibility of battery damage from sulfating (buildup of hard deposits on the plates). However, like all lead acid batteries sulfating can occur. Additionally, normal battery cycling tends to develop each individual cell slightly different. To correct both minor sulfating and irregular cell development we recommend bringing the battery slightly past its gassing voltage for a short time period on a scheduled basis. This "battery conditioning" is recommended annually and involves charging the battery at 15.5 Volts for 3 hours. If you're charging system will not accommodate this procedure call Lifeline for an alternate recommendation.

Chargers and External three step regulators:

There are many manufacturers of quality chargers. It is therefore impossible to list the settings for each, which would best suite Lifeline. In all cases we recommend reviewing the available settings and selecting the ones which best match the voltages above. When conflict occurs between matching both float and bulk settings, always match the float settings first. Bulk settings are less critical for our product.
12V DC FUSE/BREAKER CIRCUITS

Below is a list of all the fuses and circuit Breakers. The Panels are located as Front panel A& B, Left o’head panel and rear bedroom panel. Fuses and CBs go to their respective relays and some thru terminal strips. If a problem arises, check the fuse/CB first. Then get the diagrams out and look for further paths.

Front Panel B
First panel you see when you open up the Front End Access Plate of Vagabond

SK 1 - ELEC HORN
SK 2 - 12V MASTER SOL
SK 3 - STOP LIGHTS
SK 4 - RACOR FUEL FILTER
SK 5 - HAZARSD LIGHTS
SK 6 - FLASHER/ DIR LIGHTS
SK 7 - 12V FILTER
SK8 - PARKING & TAIL LIGHT
SK 9 - BATT CHGR HI/LO SWITCH
SK10- SUSP DUMP/ PRESS SWITCH LOW FUEL/ H2O IN FUEL
SK11- QUICK START/ KYSOR WNG
SK12- LEVEL JACK WARNING/ BACK UP LIGHTS
SK13- CRUISE CONTROL, RETARDER,(ZF TRANSMISSION)
SK14- CRUISE CONTROL
SK15- ZF ECM CONTROL BOX
SK16- RACOR RELAY/ ENG FAN
SK17- DIR LGTS/ COL SW/ HEATED DRAIN VALVES
SK18- AIR DRYER

BRK1- HEAD LIGHTS/CORN.LITS
BRK2- ZF TRANS IGN FEED

There are 13 Terminal strip circuits and 23 relay circuits K1- K23
Front Panel A

This Panel is behind Panel B in front of Vagabond

SK 1 - HEAD LIGHT ALERT
    OH LD. CTR. IGN. RELAY
SK 2 - LOW WASH/RH W/S WIPER
SK 3 - LH W/S WIPER
SK 4 - RADAR DETECTOR
SK 5 - RH HEAT BLOWER
SK 6 - LH HEAT BLOWER
SK 7 - DEFROST BLOWER
SK 8 - FRT HEAT/ENT. DOOR LOCK/ LIGHT
SK 9 - LWR & UPR DASH 12V IGN
    RH UPR DASH 12V IGN.
SK10- 12V FILTER ELEC. MASTER
SK11- BURGLAR ALARM
SK12- STEP SYSTEM
SK13- GPS/ PHONE PWR. RECPT.
SK14-18 ARE SPARES
SK19- O.S. CMPT. LGTS./INVERTER
SK20- REAR VIEW MONITOR
    ELEC. SEAT LH
SK21- DRIVING LGTS. RH
SK22- CO/FO FLUO. LIGHTS
    ENT. DOOR LOCK
SK23- RH UPR. DASH 12V RECPT.
SK24- LEV. JACKS/ LP HEAT SW.
SK25- O.S.MIRROR HEAT
    O.S.MIRROR REMOTE CTRL
SK26- AUX. AIR COMPRESSOR
SK27- DRIVING LGTS LH
SK28- MARKER LIGHTS
SK29- AMP.LIVINGRM. OH SPKS.
SK30-SK31 ARE SPARES
SK32- ELEC. AIR VALVES FOR AIR VENTS/ SUSP. DUMP
SK33- GENERATOR ACTUATOR
SK34- SK36 ARE SPARES
SK35- C.B. RADIO MEMORY
SK36- C.B. RADIO
SK37- C.B. RADIO MEMORY
SK38- TUNER/CASSETTE & CD PLAYER MEMORY
SK39- STEREO EQUAL. MEMORY
SK40- SK46 ARE SPARES
SK41- CD PLAYER & INTERFACE MODULE
SK42- C.B. RADIO
SK43- SPARE
SK44- MUSICAL HORN
SK45- DIR CTRL. WIPER PWR.
SK46- STEREO CASSETTE
SK47- BEDROOM STEREO
SK48- EQUALIZER

There are 15 Relay Circuits K1-K15 on this Panel
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INTENTIONALLY
REAR BEDROOM PANEL

This panel is in the rear Cabinet over the bed against the rear wall.

SK 1- BEDROOM ALARM CLOCK
SK 2- BEDROOM STEREO MEMRY
SK 3- #11 GRN/WHT PRIMUS PIN1
SK 4- SK 9 ARE SPARES
SK10- WATER BLOWOUT SWITCH
SK11- CAMERA DEFOG
SK12- ENGINE COMPT. LIGHTS/ BEDROOM ANT.CONTROL
SK13- CLOSET LIGHTS
SK14- CEILING LIGHTS
SK15- SPARE
SK16- PRIMUS HEATER (#6 PINK)
SK17- BEDRM TV ANT. MOTOR
SK18- BEDRM. DOOR LOCK SW.
SK19- BEDROOM INDIRECT LIGHT
SK20- BEDRM O'HD. FLUO LIGHT/ TANK FILL SW. POWER
SK21- AISLE LIGHTS
SK22- BEDRM. READING LIGHTS
SK23- SPARE
SK24- SPARE
SK25- PWRS K1 TO R. PARK. LTS
SK26- SPARE
SK27- K3 & H2O PUMP SW PWR

You must use the electric diagram sheets since some of these SKs power relays which in turn power more components.
LEFT OVERHEAD COMPARTMENT

The left front overhead panel is behind the wall of that compartment. These SK’s power relays and only a few direct circuits, so in order to find the fuse you must look on the diagram sheet.

<table>
<thead>
<tr>
<th>CIRCUIT BLOCK A</th>
<th>CIRCUIT BLOCK B</th>
<th>CIRCUIT BLOCK C</th>
</tr>
</thead>
<tbody>
<tr>
<td>SK 1- MICROPHOR TOILET</td>
<td>SK 1- AUX BATT RELAY</td>
<td>SK 1- TERM STRIP 21 &amp; 22</td>
</tr>
<tr>
<td>BATHROOM THERMOSTAT</td>
<td>SK 2- BLANK/SPARE</td>
<td>SK 2- TERM STRIP 32</td>
</tr>
<tr>
<td>SK 2- LVGROOM READING LITES</td>
<td>SK 3- TERM STRIP 24</td>
<td></td>
</tr>
<tr>
<td>SK 3- K-12/PRIMUS A-STAT</td>
<td>SK 4- TERM STRIP 25/26</td>
<td></td>
</tr>
<tr>
<td>ENGINE PRE-HEAT SWITCH</td>
<td>SK 5- TERM STRIP 27</td>
<td>SK 5- TERM STRIP 30</td>
</tr>
<tr>
<td>SK 4- DINETTE FLUO/READ. LGTS</td>
<td>SK 6- TERM STRIP 28/29</td>
<td></td>
</tr>
<tr>
<td>SK 5- K-13/KOOL O MATIC FAN</td>
<td>SK 7- TERM STRIP 30</td>
<td></td>
</tr>
<tr>
<td>LR &amp; KIT. T STATS</td>
<td>SK 8- TERM STRIP 31</td>
<td>SK 7- TERM STRIP 23</td>
</tr>
<tr>
<td>SK 6- LR &amp; DIN T STATS</td>
<td>SK 9- TERM STRIP 31</td>
<td>SK 9- TERM STRIP 23</td>
</tr>
<tr>
<td>SK 7- BATHR &amp; SHOWER LIGHTS</td>
<td>SK 10- TERM STRIP 35</td>
<td></td>
</tr>
<tr>
<td>SK 8- LR ELEC HEAT ENABLE</td>
<td>SK 11- TERM STRIP 34</td>
<td></td>
</tr>
<tr>
<td>SK 9- K-14/LDG LITES RR &amp; RF</td>
<td>SK 12- TERM STRIP 15</td>
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<tr>
<td>SK10- BAY HEATERS</td>
<td>SK 13- DOOR LOCK MOD PWR</td>
<td>SK13- DOOR LOCK MOD PWR</td>
</tr>
<tr>
<td>SK11- BUZZ</td>
<td>SK 14- BATT. CHARGER SELECT</td>
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<tr>
<td>SK12- BUS REAR LOAD CTR SK1-9</td>
<td>SK15- BLANK</td>
<td></td>
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<tr>
<td>SK13- SPARE</td>
<td>SK16- BATT. CHARGER SELECT</td>
<td></td>
</tr>
<tr>
<td>SK14- LWR FRT COMPT PANEL</td>
<td>SK17- OUTSIDE FREEZER</td>
<td></td>
</tr>
<tr>
<td>FUSE BLOCK</td>
<td>SK15- WINDSHIELD/ DEF. FAN</td>
<td></td>
</tr>
<tr>
<td>SK15- DASH CLOCK</td>
<td>SK16- SPOT LT/OFF-FLOOD SEL</td>
<td></td>
</tr>
<tr>
<td>SK16- LPG LEAK DETECTOR</td>
<td>SK17- SPOT LT ROT SPEED CTRL</td>
<td></td>
</tr>
<tr>
<td>SK17- SYST. MON PANEL</td>
<td>SK18- SAT. ACU (2 Wires)</td>
<td></td>
</tr>
<tr>
<td>SK18- K-3/K4/ TERM STRIP</td>
<td>SK18- SAT. ACU (2 Wires)</td>
<td></td>
</tr>
</tbody>
</table>
BATTERY MONITOR
LOCATED ON LEFT UPPER BATTERY MONITOR PANEL
ABOVE CAPT HEAD

Normal Operation
The BatMon displays battery voltage, battery current, and the number of Amp-hours that have been removed from the battery.

**Volts**
The battery voltage is measured from 6 to 19.99 Volts full scale.

**Amp-Hours**
The battery amp-hours are measured to 800 Ah. Amp-hours consumed is displayed as negative, while overcharge Amp-hours is displayed as positive.

**Amps**
The battery amps ranges from +/-199.9 Amps with 0.1 Amps of resolution. Charge current is displayed as positive, while discharge current is shown as negative.

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**NOTE**
Since the BatMon uses about 13.5 mA and the display can only show a resolution of 0.1 Amps, it is normal to see a -0.0 to -0.1 Amp draw on the BatMon with all other loads disconnected from the battery.

**RESET Switch**
The BatMon does not auto-reset when the batteries are completely charged. It is up to the user to monitor the battery voltage and current in order to determine when the batteries are full. Generally, a battery is said to be full when the voltage is maintaining the absorption voltage (usually 14.4 Volts @ 77°F) and the charge current has declined to less than 2% to 5% of the amp-hour capacity of the battery being charged.

If the BatMon does not read zero on the Amp-hours channel when the batteries are full, then the charge efficiency is not adjusted perfectly.

To synchronize the BatMon with the state of charge, use a blunt non-metallic pointer (such as a blunt toothpick) to reset the Amp-hours reading. Insert the pointer through the hole marked RESET, keeping it straight, and depress the switch located on the internal printed circuit board. The unit should now display zero.

The BatMon should be reset whenever power is applied, and whenever the batteries are fully charged and the Amp-hours display is not reading zero.

**Determining the Efficiency**
First fully charge the batteries. Next discharge them to about 50%. Then fully charge the batteries again. If the Amp-hours shows less than zero when the batteries are fully charged, then the efficiency is set too low. If the Amp-hours shows more than zero when the batteries are fully charged, then the efficiency is set too high. Efficiency may have to be re-calibrated as the batteries age.

This procedure is explained in the Maintenance manual – Electric Section.
Troubleshooting-Common Problems

Does Not Appear to Operate.

First Check the BATMON Wiring. Connect the negative probe of a digital voltmeter to the battery negative. Connect the positive to the following tabs:

1. Measure the voltage on the shunt assembly (anywhere on the shunt metallic surface will do). It should be 0 volts DC. If the voltage is not, then the wiring is faulty.

2. Measure the voltage on the fuse holder connected to the BATMON. It should be the same as the battery voltage. If it is different, then check the wiring and in-line fuse (fix/replace if necessary).

Fuses Blow

If any of the fuses are blown, then there is a short-circuit somewhere and it should be found and corrected.

2. If the fuse on the BATMON blows twice in a row, then remove the flat style display cable from the shunt assembly. If the fuse blows again, then the BATMON shunt assembly is damaged. If the fuse does not blow then proceed.

3. If the fuse only blows when the BATMON is properly wired and the display cable is connected, then the display unit is damaged.

AMP-HOURS Channel Drifts to a Large Negative Value

This is caused by extreme heat. The shunt assembly must be mounted in a location that is free of extreme heat. As a rule of thumb, if a human cannot live indefinitely in the heat, neither will the BATMON.
Amp-Hour Meter

Finally, a way to monitor how much power goes in and comes out of batteries. As any motorhommer who has been inconvenienced by dead batteries can testify, the ability to monitor the amount of reserve power remaining in a 12-volt battery would be very nice. Of course, we estimate reserve capacity with an accurate voltmeter or by using a hydrometer, but both are only estimates, and using a hydrometer is messy. What we need is an accurate gauge that measures the amount of power we take from a battery, and the amount we put back in.

Just such a gauge is the Amp-Hour Meter, available from the Cruising Equipment Company of Seattle, Washington. The gauge accurately shows the charge/discharge condition of one or more 12-volt batteries. The designer's intent was to make this instrument as simple as possible for the user, and the effort was successful. There are no switches that need attention, just a digital readout to observe.

A bit of background information is necessary to understand the meter's readings. First, it's necessary to know just what an amp-hour meter is. The term "amp-hour" means 1 amp for 1 hour, or 2 amps for ½ hours or 4 amps for ¼ hour—electrical energy multiplied by time of charging or discharging.

There are "actual" and "potential" amp-hours. The amp-hour meter records actual—the movement of electrical energy. When a battery is fully charged, it has the potential of delivering a specific number of amp-hours of electrical current, and the meter reads zero. When a load is applied and the battery begins discharging, the meter starts counting down—minus amp-hours.

When recharge begins, the meter begins counting back toward zero. If the charging is terminated before the meter reads zero, the battery is not fully charged; the negative number remaining tells us how far we have to go to reach full charge.

If the battery is being overcharged, a positive number appears. But over-charging does not add to the battery's useful capacity, so the meter returns to zero when the discharging begins.

The manufacturer's instructions for the meter state that batteries for deep-cycle service are normally rated at a 20-hour rate, which means that a 100-amp-hour battery will sustain Amps for 20 hours. The company has formulated a mid-capacity rule that suggests avoiding discharging a battery below 50 percent because it will shorten the battery's life. Aside from that, re-charging a partially depleted battery beyond 85 percent takes an excessive amount of time. Consequently about 35 percent of the battery's capacity is realistically all that is normally available for use, according to the company.

A battery's ability to accept current begins to diminish when it's about 85- to 90-percent charged meaning 85 to 90 percent of "full" charge. What constitutes full charge varies with the effectiveness of the charging method.

This 85-percent recharging procedure is well suited for motorhomers that rely on an engine-driven alternator for a short time daily or twice daily to supply 12-volt DC electrical energy needs. For weekenders or people who only want two to three days of
self-containment, the meter is a valuable tool to see how much energy you have left in your battery.

The Amp-Hour Meter is factory adjusted for a charge efficiency of 83 percent. This means that for every 83 amp-hours used from the battery, it must be recharged with 100 amp-hours of energy to return the meter to zero and the battery to the full-charge status. We found this to be amazingly accurate for our big Group 8D (diesel truck) battery. An adjustment is provided if you find your battery’s charge efficiency is more or less than the factory formula. It’s recommended that the battery be cycled a few times as it would be used in the field, before deciding to change the charge efficiency setting.

According to the engineers at Cruising Equipment Company the meter consists of a group of extremely accurate linear amplifiers, a precise timer and display circuitry—reportedly simple and very reliable.

Supplied with the Amp-Hour Meter is a 100-amp, 100-millivolt shunt made specifically for the device. This shunt is installed in the negative lead of the battery or batteries that are to be monitored.

The meter's dimensions are 4.50 x 3 x 1.25 inches, which makes it easy to install. Five wires must be connected, four from the shunt and battery and one for the display back-lighting. The Amp-Hour Meter is priced at $199.50. A 100-amp shunt is priced at $19.95 and 300-amp unit at $39.95.

Cruising Equipment Company,
6315Seaview Avenue NW,
Seattle, Washington 98107
(206) 782-8100.
ELECTRIC DRAW OF VAGABONDS
EQUIPMENT. (12V & 110V)

The following Ampere draw is the consumption in warm weather (70º-80º) F. In cooler weather the consumption goes up.

With everything turned off, the Bat-Mon indicates a –0.04 (Warm) –0.06(Cool) Amp draw.
The Ignition Circuit is armed. With Ignition Key ON, draw is 1.4 Amps/hr
When Dry Camping, use LP- On, Master Switch ON, A/T Switch OFF, and consumption goes to 2.5Amps or approx. 19 – 25 Amps during the night.

<table>
<thead>
<tr>
<th></th>
<th>Warm</th>
<th>Cool</th>
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<tbody>
<tr>
<td>All Switches</td>
<td>-00.4 A</td>
<td>- 00.6 A</td>
</tr>
<tr>
<td>Master Switch</td>
<td>-00.8 A</td>
<td>-01.0 A</td>
</tr>
<tr>
<td>A/T Switch</td>
<td>-02.6 A</td>
<td>-02.9 A</td>
</tr>
<tr>
<td>LP Gas</td>
<td>-03.6 A</td>
<td>-04.0 A</td>
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<tr>
<td>(this is the base configuration load draw)</td>
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</tbody>
</table>

Water Pump (operating) 5.2 Amps
Refrigerator 0.8 “
Gas Furnace (single) 1.9 “
Respective Blower 1.0 “
Radio 1.8 “

Lights
Lower Fluorescent 6.6 “
Dinette Fluor. (Each) 2.1 “
Regular bulbs (each) 1.0 “
Closet Bulbs (each) 1.4 “
Porclight/ Entrance 2.8 “
Security Lights (four) 15.1 “

110 V Items
Inverter ON 3.7 “
Curtains (each) 8.7 “
Upper Fluorescent 16.9 “
Coffee Maker 98.0 “ (uses 18 Amp/hr per 10 cup pot)
TV (each) 10 – 12 A
This type relay is an industry wide standard and shows just what each terminal's function is. Vagabond has a lot of relays for its heavier electric components; see pages 12-17.

This is a ISO style Relay SPDT (single pole, double throw).
Normally open - NO
Normally closed - NC
BASIC 12V DC SCHEMATIC
This is the basic Chassis 12v DC schematic
**120 VOLT A/C CIRCUIT BREAKER PANEL**

Located left side of kitchen sink by entrance steps behind cabinet door.

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<table>
<thead>
<tr>
<th>Main Breaker Leg 1</th>
<th>50A</th>
<th>15A</th>
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<tbody>
<tr>
<td>Main Breaker Leg 2</td>
<td>50A</td>
<td>15A</td>
</tr>
<tr>
<td>Rear A/C</td>
<td>20A</td>
<td>15A</td>
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<tr>
<td>Engine Block</td>
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<tr>
<td>Battery Heat</td>
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<tr>
<td>Heated Hold. Tanks</td>
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<tr>
<td>FRT. &amp; DIN. REC. Freezer</td>
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<td>Micro Wave Oven</td>
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<td>15A</td>
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<tr>
<td>AUX Air Compressor</td>
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<tr>
<td>Bath Recept.</td>
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<tr>
<td>Outside Recept.</td>
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<tr>
<td>Rear Recept. Heat Tape</td>
<td>15A</td>
<td>15A</td>
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<tr>
<td>Refrigration</td>
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<tr>
<td>Electric Heat</td>
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<td>Rear A/C</td>
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<td>Front A/C</td>
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<td>Electr. Heat</td>
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<td>Heat Tape</td>
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<tr>
<td>Battery Charger</td>
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<tr>
<td>Volmeter Leg 1</td>
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<tr>
<td>Instant Hot Heat Tape</td>
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<tr>
<td>Water Heater</td>
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<tr>
<td>Voltmeter Leg 2</td>
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<tr>
<td>Kitchen Recept.</td>
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<tr>
<td>Inverter Recept.</td>
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<tr>
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<tr>
<td>Immersion Heat</td>
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<tr>
<td>Bathroom Electric Heat</td>
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<tr>
<td>Refrigerator</td>
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