PREVOST ELECTRICAL SYSTEMS

Our coaches have a number of systems that seem mysterious. They are mysterious only until we get to know and understand them, at which point we see and appreciate their logic and relative simplicity. What follows is an attempt to provide an overview or a glimpse at the fundamentals of the electrical systems typically found in our coaches. It is not an attempt to be a trouble shooting guide or even to explain some of the nuances of the electrical systems but to help the owner to at least be able to understand how it all works and how to identify when something is not working.

THE CHASSIS

Common to all of our coaches is the chassis (Prevost bus) electrical system. An important thing for all owners to recognize is that there is a point at which the chassis and the house electrical systems come together. For the most part converters limit that merging of the house and chassis to a single point. There are some exceptions and they will not be covered here because they tend to be converter specific and proprietary.

All chassis electric is DC voltage, both 12 volts and 24. The batteries supply both voltages because they are wired such that both voltages can be provided. Our four chassis batteries are wired both in series (two 12 volt batteries in series can provide 24 volts) or in parallel (two 12 volt batteries in parallel provide 12 volts, but the capacity of 2 batteries). They are charged using an engine driven alternator in all cases. Some coaches are provided with auxiliary chassis battery chargers that are powered from the generator or shore power. For now we will focus on the alternator. The battery electrical diagram is located on the RH side door.
This is a large style alternator supplied with Prevost shells. It can be used as the single engine powered battery charging device, or it can be used in conjunction with a second alternator such as shown below.
This is a typical second alternator, engine driven. It can be located near the fan drive, or in this case near the chassis batteries.

Some coaches have a single alternator. It is typically a large alternator with sufficient power output to handle not only the loads of lighting, AC systems, and battery charging, but the single alternator will also be used to maintain the charge on the house batteries. When one alternator is used to charge both the house and the chassis batteries the power from the alternator will pass through some means of isolating the two sets of batteries so the discharge of one set will not cause a discharge of the other set. That device to keep the two sets of batteries independent of one another may be an “isolator” (clever of someone to name it that) or it may be a device such as a solenoid relay that closes only when the alternator is functioning. It is important to understand the chassis batteries and the house batteries are to be independent of each other and they are only “joined” electrically when receiving a charge from the engine driven alternator.
Two different ways to isolate the house and chassis batteries. Both will not allow either set of batteries to discharge and pull the other set’s voltage down at the same time.
Since the bus chassis alternator is 24 volts, and since the batteries are wired to provide both 12 and 24 volts there must be a means of insuring the batteries are charged in such a way as to insure a 12 volt load will not pull down some of the batteries in the set and not others. To accomplish this there is a device that insures the batteries receive an equal charge. Based on previous knowledge about how the isolator was named you can safely assume the means of equally charging both the 12 and 24 volt battery banks will be via a device called an “equalizer.” Seeing that some of the devices used in our electrical systems have descriptive names like isolator and equalizer I wonder why the device that charges our batteries is called an alternator?
Some coaches have two equalizers, but later model coaches have a single isolator such as the two shown above.

Already this is starting to sound complicated, but let’s peel back the layers and look only at the basics. First and most important we need to know when everything is working and how to verify it. Start with the alternator. Every Prevost owner needs to own a decent quality multimeter and at least have an understanding of how to read voltages and how to check for open or closed circuits. I am going to assume here that
will be the case. If you are unfamiliar with the use of a multimeter, or a multitester this would be a good opportunity to review its manual.

It is important for owners to be very clear on the electrical circuits and whether those circuits are chassis or house. The chassis circuits are associated with the bus only. They are for exterior lighting such as headlights and brake lights and clearance lights. Other exterior lights such as those that are used to light the area beneath the awning however would likely be house electrical circuits. The chassis electrical system will be used to power the engine and transmission computers, the bus heating and AC systems, dash lighting, and the engine starting system. To learn what electrical circuits are associated with the chassis the listing of relays, circuit breakers and wires on the doors of the front and rear electrical compartments is an excellent source of information.

Somewhere in your coach there is a gauge that tells you your chassis voltage. I have no idea how it will be labeled or where it will be. If I were to guess it will not show a voltage until you turn on the ignition key. With the key on, but the bus not running the displayed chassis voltage should be around 24 or 25 volts DC. That is direct current, not to be confused with alternating current found in the house, such as for the outlets, or the TV or the microwave. Once you have found the chassis voltage and it is around the range specified you are verifying your batteries have a charge and everything appears OK. Now start the bus and see the voltage change. With the bus running the chassis battery voltage displayed on the gauge should be around 27 or 28 volts. Now you have verified the alternator is working. If the voltage did not rise you have a problem.
This pair of gauges is located on the dash. The LH gauge shows the chassis voltage (the key is off so no information is displayed), and the RH gauge shows the house battery voltage. The voltage displayed is approximately 27.2 volts DC.

You can do the same system check with your multimeter. Connect the black lead to a bare metal spot on the chassis. Connect the red lead to a 24 volt post on the bank of chassis batteries (refer to the wiring diagram on the inside of the RH side chassis door). Your multimeter used in this fashion is going to give you precise readings. The gauge inside the coach may be less precise because there is a current drop when the voltage passes through a long run of wire.

If your chassis batteries with the coach engine off are anywhere between 24.5 volts DC and 25.8 your batteries are likely in good shape. When you start the bus engine the voltage should now read between 26.5 volts on the low side to 28.5 volts on the high side. Anything lower or higher is an indication there may be a problem. Keep in mind however these values are for the chassis when the bus is not connected to shore power or the generator is not running. These are also voltage values taken at the batteries with an accurate multimeter. (Note, being connected to shore power or having the generator run may not change the values listed above, but in some coaches the presence of shore or generator power automatically powers a
Already you know what values to expect for your bus or chassis batteries and charging system. You know what to expect when the engine is not running (and you have not run down the batteries), and you know that the voltage will increase to a different value to indicate the charging system, including the alternator, the isolator and the equalizer are working. If you compare the multimeter voltage reading taken at the batteries with the gauge reading from inside the coach you will know if there is a difference between the two and you can mentally adjust the inside reading to compensate for the probable voltage drop.

The chassis voltage is something that must be monitored. It is as important as oil pressure or temperature or air pressure. If it is too low you may not be able to start the coach, or if the coach is running the computers may shut the coach down due to low voltage. Conversely, voltage that is too high can damage not only the batteries, but it can also damage other devices and possibly create a fire hazard. Personally I consider voltages lower than 12 volts per battery (or 24 volts) or higher than 14.3 volts (28.6 volts) to be cause for concern. These are my values, and depending on your coach, your specific type of chassis batteries, and how your coach is set up your values may be a little different.

What if the chassis voltage gauge shows a value approaching or out of the limits of the normal operating range? The answer is simple. Something is wrong. The first action to be taken is to decide if the problem is serious enough to shut down the bus, or if you can safely get the coach to a service facility. Different types of problems require different actions.

High voltage is an indication there is a problem with the alternator, or the voltage regulator if the device is external to the coach. High voltage is dangerous and it requires the alternator rendered inoperative by removing the alternator drive belt, or if the voltage regulator is external, by removing the field wire from the alternator or the regulator. You cannot and should not continue to allow an over voltage situation to occur.
In some cases the coach is equipped with a device such as this monitor that will light warning lights on the dash to alert the driver to abnormal chassis electrical conditions. Note, this is not used to monitor the house DC electrical system.

Low voltage is an indication you are not charging the chassis batteries, and in some cases it is an indication you are not charging the house batteries also. Let’s presume you notice while driving that the voltage with the engine running is lower than normal. The gauge shows the batteries are not receiving a charge. Depending on the voltage displayed you can drive a considerable distance as long as you can minimize electrical loads on the chassis. For example, if you can drive without lights
or the AC system working you will go much greater distances than if you have to have lights on and the AC system functioning. If you have an auxiliary chassis battery charger you can maintain a charge by running the generator. But once your chassis voltage starts to drop below 24 volts you need to consider getting off the road.

Many owners have had an alternator or alternator control unit (voltage regulator) fail. If it has not happened in their bus it may have happened in a car, boat or plane. As long as the failure is not an over voltage type failure it is usually safe to drive the coach, especially if the coach is equipped with a generator or shore power charger.

When the electric stops in the bus charging system it is sometimes easily repaired. As an owner you at least should be able to isolate the problem. If you are going to make the repairs yourself or if you are going to arrange for service you should know what has failed. Start with the obvious and the easy stuff to diagnose or repair and move towards the more complex causes.

If the alternator is belt driven check the belt and check to see the belt is tight. If the alternator has a good belt and the belt is not slipping check to see if the alternator is putting out voltage. Attach the black multimeter lead to a good ground and check the voltage at the heavy wire output terminal. If the alternator is not producing charging current it will be zero volts or close to it at this terminal. If the alternator has voltage at this point go to the next device in line with the red lead on the multimeter (or multimeter, the names being interchangeable). If the coach uses a single alternator to charge both the house and chassis batteries that next device will be the isolator. Verify it has current to the center terminal, or the input. If it does, check for current at the house and chassis outputs. If the coach uses a solenoid relay type of isolator and the solenoid has current at the coil posts (the smaller posts), then check to see if the solenoid has current passing through the relay. If it is passing current it will be at both posts.

If you have an external voltage regulator you can further narrow your search for the problem. An external voltage regulator typically has a wire called the “field” wire going to the alternator. This wire is the key to regulating the voltage regulator output. In order for an alternator to create voltage, the alternator requires some current input. This current is essential and in the case of completely dead batteries even if the engine is started the alternator will still not function because there is no power available to “excite” the windings. A regulator functions by alternately supplying power to the alternator windings via the field wire, and when the voltage reaches the set limit, it removes power from the field wire which causes the voltage to drop back within range, at which point it builds until it exceeds the set point and the regulator again removes field wire current.
This is an external alternator voltage regulator. Some are smaller and have a different appearance. Some are internal to the alternator and are not repairable or adjustable.

This alternating application and removal of power to the field wire happens so frequently it appears the voltage is a constant. To determine if the cause of an apparent alternator failure is the regulator or the alternator, disconnect the field wire from the regulator, and either directly or using a short jumper connect the field wire directly to the 24Volt post of the chassis batteries. If the alternator is functioning you will note the engine (which must be running) will lug slightly, but perceptibly, and the
voltage to the batteries will begin ramping up and will be able to go higher than the safe range. By hooking the alternator field wire directly to a 24Volt power source such as the batteries you have created an unregulated power supply. Monitor the alternator output at the 24 volt battery posts using your multimeter. Obviously either disconnect the wires or shut the engine down as soon as it is determined the alternator is capable of creating voltage. Failure to do so could result in damage to the batteries and chassis electrical components.

If voltage goes up using this method the regulator has failed, and if it does not the alternator has failed.

**THE HOUSE**

Like the chassis the house portion of the conversion uses another set of batteries as part of the house electrical system. The batteries may share a charging alternator with the chassis, or the chassis and the house may have dedicated alternators. Each converter has a different approach to charging the house batteries and some use the single chassis alternator, and some use a dedicated alternator to charge the house batteries. Often the house batteries are charged using a smaller alternator, but not always. There is no standard and as an owner you should make an effort to learn which alternator charges the house batteries and which charges the chassis batteries. Merely guessing is not an acceptable way to make the determination. The reason for determining how the house batteries are receiving their charge is to make trouble shooting when the time comes easier. Once you know (on a two alternator bus) which alternator supplies power to the house the trouble shooting steps are the same as for the chassis.

Unlike the chassis batteries which may not have a separate means of charging, the batteries when the engine is not running, the house batteries will always have an alternate means of maintaining a charge. Whatever device is used for maintaining a charge on the house batteries, it will require a connection to shore power or it will require the generator to be operating. On some coaches the house battery charging system is automatically operational and on some the owner has to manually engage switches to engage the chargers.

Older vintage coaches (preceding the early nineties) usually used charger/converters and the owner had to manually select the available power source. The power to the chargers was then switched on, usually via a circuit breaker in the 120 volt AC electric panel. (For those not familiar with the difference between 120 volt AC electric power and the 12 or 24 volt DC electric power discussed previously, think of 120 volt AC power as the electric used in our homes. When we plug something into an outlet, such as a lamp or the TV or a small appliance that is the
electricity used. The 12 or 24 volt DC power we have been discussing is low voltage direct current power and it is a higher voltage version of the type of electric power typically found in a flashlight. The two types of electric power are never mixed usually having even their wires isolated from one another. There are a few devices that can operate on DC and AC power, such as some small TV sets designed to operate on batteries or plugged into a wall outlet, usually through an adapter.)

Later model coaches use automatic transfer switches which recognize the availability of AC power sources and automatically select the source to use based on a priority established by the converter. For example, in the absence of shore or generator power sources a typical coach automatically creates 120 volt AC power for the various house devices such as the refrigerator, outlets, the TV, etc by converting battery DC voltage to 120 volt AC power by means of inverters. Inverters, in the absence of 120 volt AC input power (such as shore or generator power) automatically convert the available battery power to 120 volt AC current.

Inverters have different appearances and are located in various places in the coach. Some are accessible by opening a bay door, and others are hidden behind panels or under cabinetry. The inverter shown is a combination inverter/charger which has become the most common type.

But when those same inverters are provided with 120 volt AC input power, they cease converting the electrical current, and pass that input power into a battery
charger section of the inverter to restore or maintain fully charged house batteries, and they also automatically provide output power by instead passing the input voltage directly to the loads stated above. A transfer switch senses the presence of shore or generator power and no action is required by the owner.

As an owner it is important to monitor the house systems. The first priority is to verify the house batteries are being charged or maintaining a charge. When the coach engine is not running and the coach does not have electrical input from shore power or generator the house batteries are expected to be within a range of 12 volts to 12.7 volts (or 24 to 25.4 volts). When the coach has input to the inverters or chargers the expected voltage range will be 13 plus volts (or 26 plus volts). The lack of specificity here is because house batteries can be wet cell, AGM, or Gel cell and each different type has its own range of acceptable voltages.

It is necessary to insure the house batteries are charged and maintained in accordance with the manufacturer’s specifications. Here are some excellent sites to learn about your specific type batteries:
http://www.windsun.com/Batteries/Battery_FAQ.htm#Gelled%20electrolyte

When monitoring the house battery state of charge it needs to be recognized that the voltages are going to vary and that as long as you keep the voltages well within the range specified by the battery manufacturer everything is working as designed. When the coach was converted the house battery charging system was built for the types of batteries originally installed. Years ago the only type of battery installed in our coaches was the conventional wet cell lead acid battery. Newer coaches were equipped with AGM or Gel cell batteries, and their charging systems were set up for the charging protocols and voltages those types of batteries required. To get the maximum battery life it is important for an owner to verify the converters or inverters are set to properly charge the specific house batteries that are installed. When monitoring the house battery voltages note that the range of voltages observed is within an acceptable range for the type battery installed.

But what if the voltages are on the low end of the scale and dropping even though the coach is connected to shore power or the generator is running? The problem may relate to the loads on the batteries. Are the loads greater than the ability of the chargers to maintain battery voltage? Shed load to see if the battery voltage starts to increase. If it does increase it may be possible one of the (generally) two chargers is not functioning. Turn off the chargers one at a time. If one of the two chargers is not functioning a voltage drop on the house batteries will be noted.

Generally speaking it is a good practice to occasionally verify the proper
operation of the house battery chargers by alternately turning one then another off so if one has failed you will be aware of it before the loss of a charger becomes a crisis. It is recommended that like the chassis batteries you monitor the house battery voltages at the battery posts using a good quality multimeter and compare the readings with the readings shown inside the house at the house battery voltage gauge.

By monitoring voltages, and alternately cycling chargers or inverters on and off and verifying voltage readings at the house batteries you are going to be aware of a failure, and what has likely failed. However, before repairing or replacing chargers or inverters it is worthwhile to check battery post connections to insure they are clean and tight. Lastly, before sending off that inverter check the batteries individually to verify they have not failed and that they are not falsely indicating the charging system has failed.

CHECKING BATTERIES

Today there are some great products available that are light and easy to use to verify the condition of batteries. This is just one example:

http://www.usatoolwarehouse.com/usatoolwarehouse/ATM-SB-300.html

A search of the web will find many others that can easily be carried in the coach. A battery can also be tested without a tester. I have charged batteries in a set, and then disconnected the cables so they are isolated electrically from one another. After several hours with no load and no connection to other batteries I check the voltages of each battery individually. Good batteries will be at about 12.7 to 12.8 volts and they will hold that voltage for days. A battery that starts losing voltage almost immediately is almost sure to be bad.

If a battery tests bad it is probable that it is also pulling down the other batteries in the house or chassis groups. Batteries can fail due to age, but also due to lack of maintenance or failure to observe the proper charging procedures. I suggest that anytime a battery tests bad, especially if it is less than five years old the entire charging system should be checked to verify it is charging batteries according to the requirements of the battery manufacturer.

When a battery has failed it generally means the entire set has to be replaced. Replacing a single battery in a multiple battery set often leads to other problems and creates issues with charging the batteries equally.

AC CIRCUITS
AC current (or alternating current) is the type of power we get from shore power or when we run our generator. It is not to be confused with battery power which is direct current. Our AC power is typically 120 volts although there may be some circuits that are 240 volts AC.

Somewhere within our coaches is a display or a gauge that shows the AC voltage. The standard for an acceptable range is 120 volts, plus or minus 10%. That means we could see a voltage reading as low as 108 volts, or as high as 132 volts. Neither end of the so called acceptable range is really good, but since the electric industry has set the standards, that is the range we have to learn to live with. With shore power we have to accept what we get within that range. Our generator or inverters however should provide 120 volt power much closer to the nominal voltage. If not they should be adjusted by a technician to an acceptable level.

This house 120 volt AC panel shows that the incoming shore power is at 117 volts, and the load on the leg shown is 36.9 amps. Although it cannot be seen due to the quality of the photo, the status light shows this power is shore power on the port side.

Our inverters have a limited power output expressed in watts. An inverter with
a 2500 watt rating can supply up to that wattage continuously. As an adjunct to the voltage display, the house AC electrical panel should also display the load expressed in amps. An ampere is a function of the watts divided by the voltage. It sounds scientific, but for nominal voltages of 120, each 120 watts equals an amp. A 1200 watt device will draw 10 amps. If the voltage is higher than 120 volts the amperage will be a little less and if the voltage is lower it will draw a little more amperes. That is an important concept to understand because at lower voltages the amperage loads increase. The reason for this understanding is to be able to manage your power.

Since everything in our coach or associated with our coach has limits, it will be necessary to manage power consumption. For example, if dry camping and not running the generator, the maximum available 120 volt AC power is limited by the inverter rating (and battery capacity). If you have two 2500 watt inverters and the inverters supply the house outlets, the TV, the refrigerator, an auxiliary air compressor, the water pump, and a trash compactor you have 5000 watts or 41.6 amps available. If the refrigerator uses 7 amps (840 watts) and the TV uses 5 amps (600 watts) you have roughly 3500 watts or a little over 29 amps still available.

So far so good. But what if you plug in a 2000 (16.6 amps) watt coffee maker, start to take a shower which kicks on a 10 amp water pump, and the auxiliary air compressor which uses 7 amps starts to run? You have just exceeded your available power by a wide margin and something has to shut down. Monitoring the loads becomes second nature after a while, but until you reach the point where you intuitively know what loads to turn off when the power available is limited it is worthwhile to record the load for each device and consider if you have the power available for the load before you turn on the switch or device. Every coach has “key off” or phantom loads. These are current drawing devices that are out of sight or out of mind. You as an owner can determine what they are by turning every 120 volt AC circuit off, leaving the house battery chargers (inverters) on, and once the house batteries are fully charged, note the current draw in amps. On my coach it is about 3 amps. This value has to be taken into consideration when managing your available power.

But what if you are connected to shore power? Depending on the circuit capacity you could be connected to 20 amp, 30 amp or 50 amp service. These are industry standard descriptions, but they are confusing. 20 amp service is the availability of 20 amps (2400 watts) of 120 volt AC power. 30 amps service is the availability of 30 amps (3600 watts) of 120 volt AC power. So far that seems to make perfect sense.

However 50 amp service is actually two 50 amp (6000 watt) 120 volt AC circuits for a total of 100 amps of 120 volt AC power. But wait. There’s more. The
circuit breakers rated at 20, 30 and 50 amp are only required by the electrical standards to handle a continuous load of 80% of their rated capacity, or 16 amp, 24 amp or 40 amp. So when you are connected to shore power keep in mind that you can safely consume power up to the 80% value of the breaker. Beyond that, if the breaker does not trip consider it a bonus.

Even if we have 50 amp service shore power available, and even if the breakers do not trip until a continuous 50 amp load (per leg) has been applied we still need to manage our electrical loads to insure we do not exceed the shore power limits. A coach with four air conditioners, a hot water heater, inverter chargers pulling a heavy load, a refrigerator, an aux air pump, and the TV’s turned on can easily exceed the available shore power. The loads I described above, even if perfectly balanced would add up to about 45 amps per leg. If I wanted a cup of coffee or wanted to grill some hot dogs or my wife wanted to use a hair dryer we would trip the circuit breakers. So again, like when using inverters we need to be aware of the loads and to observe the amperes as well as the voltage.

The running of the generator is the largest source of electric power. In my coach I have a maximum capacity of 12,000 watts on shore power, but I have a 20,000 watt capacity on the generator. My energy management concerns almost disappear when I am running the generator. The house 120 volt AC electrical system is quite reliable, and as an owner your main concerns will be understanding the limits depending on your power source.

**INVERTERS**

There is no standard relative to how a converter sets up the electrical system employing inverters. To add to the lack of uniformity there are numerous models of inverters used. An owner needs to develop an understanding of three things relating to his inverters. The first and most critical is understanding is what devices are on each inverter circuit, and the capacity of the inverter powering those devices. For example an inverter can have a 3500 Watt rating and it may have an air conditioner, a refrigerator and some outlets on its circuit. A typical air conditioner may draw 13 amps (1560 watts), the refrigerator may draw 7 amps (840 watts), thus leaving only about 9 amps (1100 watts) available for the outlets. You won’t be making toast or coffee if the air conditioner is running.

The second thing to understand is how the inverters have been set up for battery charging. The charging protocol for the batteries must be followed or the batteries can be damaged very quickly. The best way to insure the inverters are properly set up is to compare the settings using the inverter operating manual as a guide to the charging procedures and voltage limits called for by the battery
manufacturer. Even if the coach is new to you as an owner, unless the coach is brand new, just delivered by the converter, you need to do this. Each type of battery has different charging procedures and limits and the failure to adhere to the limits will result in the premature failure of very expensive batteries.

But in addition to setting the inverters for the specific charging parameters the owner should consider how the coach is used and set the inverter chargers for the rate of charge. For example it is possible to set inverters to a maximum charge rate so they can fully charge a set of discharged batteries in a couple of hours. For someone who dry camps and runs the generator to recharge the house batteries this may be the ideal way to set the inverters. This setting may cause the inverters to draw 10 or 15 amps, but since a generator has ample electrical power this is not a problem. On the other hand someone who has limited shore power available, and can tolerate it taking all night to recharge the house batteries the inverters might be set at the lowest possible charge rate, such as 5 amps so managing power on a 30 amp shore power circuit is not impossible.

The third understanding an owner must develop is what occurs in the event of an inverter failure on his coach. Since coaches and their systems are different the result of an inverter failure may vary from coach to coach. In the absence of 120 volt AC power (shore or generator) an inverter converts the available battery power to 120 volts AC to power the circuits to which it is attached. The power output side of the inverter is connected to those specific circuits. When there is 120 volt AC power to the input side of the inverter, the inverter changes its function and becomes a battery charger while simultaneously connecting the input power to its power output side.

But an inverter can fail in numerous ways. If it fails such that the input power is not connected to the output side (by means of its own internal switching) then those 120 volt AC circuits may not be powered. This bears repeating because it is a potentially serious concern. If the failure of an inverter does not allow input electrical power to reach the circuits which it powers, those electrical circuits are effectively dead and out of service until repairs can be made. In the event of an inverter failure not all coaches act this way. Some automatically by-pass a failed inverter and the electrical circuits served by the inverter can get power to them via shore power or the generator. But if your coach does not have a means to by-pass a failed inverter with shore or generator power the time to understand how you will deal with that situation is before it ever occurs.
These inverters are located in a very difficult place to access, and as the labels show there are critical items powered by them. They did not have a by-pass so one was added so the failure of an inverter would not ruin a vacation.

There is little that can be more frustrating than to have a failed inverter, and a refrigerator full of expensive foods and no way to get power to the refrigerator circuit due to a failed inverter, even with the coach connected to shore power or the generator is running.

This third item to understand about your inverters is something that may require a call to your converter or a study of your coach inverter set up. Inverter failures are not very common, and not all inverter failures or problems are critical. With two inverters for example the failure of the charging ability on one still leaves one inverter available to maintain the charge on the house batteries. But the failure of the inverter such that electric power cannot by-pass the inverter is a more serious issue depending on which devices and which circuits are affected.

As a precautionary note there are ways to make temporary repairs or alterations to the coach and inverters to deal with an inverter failure if necessary. These repairs or alterations should not be done without a full understanding of the consequences.
of those repairs or alterations. Electrical power is dangerous, and inverter circuits are isolated so there are no phase issues. AC power is alternating current and it has a frequency of 60 Hz. Attaching two unrelated power sources to the same circuit will almost certainly create phase issues as well as other problems.

**SUMMARY**

By taking the time to know and understand the basics of your coach and its various electrical systems you will realize that while it seems sophisticated and complex, in reality the coach consists of separate easily understood systems that are not difficult to learn. When you know what constitutes normal operating ranges, and how to identify the existence of a problem you will also become more confident in the operation of your coach. The starting point in the development of an understanding should be knowing what components are part of the chassis and what are part of the house and how to read the gauges that display the condition of those systems. After a while verifying everything is within normal limits becomes second nature, and spotting a problem before it become a crisis is easy.

If you are not sick of reading by now, here are a few things to either read or to store away for future reference:

- [http://phrannie.org/battery.html](http://phrannie.org/battery.html)
- [http://phrannie.org/surge.html](http://phrannie.org/surge.html)
- [http://autorepair.about.com/cs/electrical/a/aa122700a_2.htm](http://autorepair.about.com/cs/electrical/a/aa122700a_2.htm)

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