

Power Related Problems

❑ Over-voltage (Surges)

Power surges are a result of a temporary over-voltage in the AC power line. This can result in severe damage to electronic equipment. Surges can occur for several reasons, but occurs frequently when line power is disrupted and then re-established - the sudden recharge creates a power surge. Lightning induced surges are more common during the spring and summer storm season.

❑ Under-voltage

Under-voltage conditions are responsible for many computer related malfunctions. These include:

- ◆ Blackout
- ◆ Sag
- ◆ Brownout
- ◆ Chronic low-line voltage

A *blackout* is a complete loss of AC power. If not protect by an uninterruptable power supply (UPS) the computer equipment will abruptly shut off.

Brownouts are a reduction of line voltage for periods of minutes to days and are usually caused by heavy electrical demand at the power company. Many power companies will intentionally reduce the line voltage as a way to reduce power consumption in times of power shortages.

Under a brownout, computers may reset or act erratically.

A *sag* is a momentary reduction in AC voltage that normally lasts less than a few seconds.

Chronic low-line voltage is a result of insufficient AC line voltage that is continuous.

❑ Line Noise

Nearby electrical sources can contribute to excess signals on the same AC power lines. This is known as “line noise”. Electric motors are a common source of line noise. These devices can interfere with normal operation conditions for computers and other sensitive devices. Common sources of line noise are fans, air conditioners, freezers, microwave ovens, and even television sets.

Protecting Valuable Equipment

Genesys Micro recommends that all business computer equipment be installed on a separate circuit. This will help prevent problems associated with undervoltages and line noise. High current devices can cause a drain on the AC circuits located within the same building. When possible, do not share computers with these circuits. If this is not possible, then be prepared for power-associated malfunctions that may be difficult to diagnose.

Surge Suppressors

These devices are the most common form of power protection. However, most AC problems are not associated with line surges, but with undervoltage conditions. Surge suppressors are designed to provide a degree of protection against dangerous overvoltages that occur during lightning storms and line recharges. They do not protect against all types of line problems. Also, be aware that some devices look like surge suppressors, but are only power strips- they provide no power protection. To be effective, surge suppressors must be grounded (3-prong electrical outlets).

Surge suppressors are rated as follows:

- Joules**
- Let-through voltage**
- Response time**

Joule is the amount of energy that can be absorbed before the built-in circuitry self-destructs. In other words, the surge will give up its life in order to protect your equipment when the total power surge is greater than its energy rating. Surge suppressors with higher joule ratings (and higher price) will continue to operate within its energy rating range without any damage to the surge suppressor itself.

Let-through voltage is the total amount of voltage that the surge suppressor will allow to pass above its normal rating, and is usually listed as a percentage. The lower the percentage the better the surge suppressor will protect your equipment.

Response time is the rated time that the suppressor will respond to a surge. Look for units that are rated as “instant” response time.

When purchasing a surge suppressor, look for these features:

Energy Rating (joules)- The higher the number, the longer the surge suppressor will last, especially after repeated “killer surges”

Let Through Voltage- The smaller the number, the better the overall protection against high voltage surges

Response time- The lower the number the better the protection. Look for “instant” response times.

Multiple Stage MOV's- These are the components that protect against high voltages. Although MOV's don't last forever, having multiple MOV's will protect all three AC lines (Hot, Neutral, and Ground).

Fast Acting Fuses- These provide some protection against lightning. However, if you suspect that a unit received a strike and the fuse is blown, do not attempt to replace it. Instead, replace the entire unit.

Large Inductors- These components help to reduce line noise and absorb low impact surges.

Circuit Breaker- A quality unit will also include a 15 AMP circuit breaker to help prevent overloading.

Telephone Line Suppression- Telephone lines can introduce dangerous voltages into you computer via the modem. If you have a modem, use a surge that includes this feature, or use a separate one designed for telephone line protection.

Cable Line Suppression – Just as telephone lines, cable service can also be a rare source of power surges. To protect valuable AV and computer equipment (cable modems), be sure to look for a unit that provides this protection.

Equipment Protection Warranty- Most quality units now include some form of equipment protection warranty. Note that you may need to ship the damaged equipment to the company for verification.

Diagnostic LED's – High-quality units will provide visual indication on the current line condition and the power protection status of the suppressor. Units that indicate some kind of fault should be replaced promptly. In some instances the diagnostic LED's may indicate the need for an electrician to help diagnose more serious line problems.

For more information on protecting your equipment from lightning related surges, see our article “Protecting Your Computer Equipment From Lightning”.

Power Conditioners

Power conditioners are surge suppressors plus undervoltage step-up transformers. These units will automatically correct the voltage during temporary sags and brownouts (within certain limits). When a low in-line voltage is detected, built-in transformers convert line current into extra voltage. As a result, the output current is temporarily reduced. This technique is not recommended for devices that draw a lot of current. Most desktop computers do not draw more than 8 Amps. Devices such as power saws, air conditioners, and copying machines should not be used with these devices unless specifically rated for high current use (greater than 15 Amps).

Battery Backup Units

Quality battery backup units incorporate a surge suppressor, power conditioner, plus standby battery power supplies. Commonly known as uninterruptible power supplies (UPS's) these units provide AC electrical power in the event of total power failure. This is extremely important for critical computing such as servers and database processing. However, because small UPS's are very affordable, many companies use them in place of standard surge suppressors. This helps to keep the computer running (and error free) in the event of a short power failure. Look for units with all of the ratings of surge suppressors plus power conditioning. Different brands refer to power conditioning by various trade names. American Power Conversion calls this “smart boost” and works by switching to battery power (while sounding an audible alarm) when the voltage goes below a minimum threshold. If the alarm sounds frequently, you may want to contact an electrician to find the cause of your under-voltage problems.

UPS's are rated by:

- Power- (in Volts-Amps- which is the voltage multiplied by the amps)
- Run-time- The total time the UPS will power the attached equipment under a certain load
- Sine Wave Output- The type of wave form that is a characteristic of AC power
- On-Line vs. Switched- Continuously powered by the battery or switched.
- Response Time- How quickly the unit switches to battery power.

How to Properly Size a UPS:

A “typical computer system” will have a total *maximum* power output of approximately 500 Watts (400 Watt power supply plus a 100 Watt monitor); some systems will have less, and some will have more, but on average around 500 watts maximum. Most manufacturers rate their smaller UPS units by VA (volt-amps) and not by the more common power rating of Watts. This can lead to consumer confusion when selecting the proper size UPS for your particular equipment (see the appendix for more information about VA and Watt ratings). Because computers are rated in watts, you will need to learn how to convert from VA to watts.

Here is the formula and an example:

What is the VA rating for a system with a maximum of 500 watts?

$$\text{VA} = \text{Watts} / .6$$
$$\text{Watts} = \text{VA} \times .6$$

So, 500 Watts = 833VA, since $500 / .6 = 833$

As you can see, a typical computer system should have a UPS with a VA rating around 833.

It is important that you select a unit that meets your system's total wattage requirements. Genesys Micro LLC recommends a minimum of 800VA for computers with a 400 watt power supply and a 40 watt LCD monitor. Larger monitors and computer power supplies require a larger rated UPS.

General Rule 1: A properly sized UPS will provide at least 15-20 minutes of run-time under ½ the maximum rated load. This will give you enough time to complete your work and properly shut-down your computer in the event that an extended power outage should occur.

In the example above, if a power outage occurs, at the maximum power rating of 500 watts, an 800VA UPS will run this system for about 5-8 minutes, and at ½ load (250 watts) for about 15-20 minutes. If you choose a lower rated unit, the run-time will be considerably less, or none at all.

General Rule 2: Never select a UPS that is rated for less than the wattage requirements of your computer system. During a power outage, the UPS will detect an overload, and will not provide any standby power. NEVER plug a laser printer or any high wattage equipment in to your UPS unless it is specifically rated to handle the load— otherwise it will cause the UPS to overload, trip its internal circuit breaker, and not function during a power outage. It is always better to have a slightly over-sized UPS than to have an under-sized unit, as these may result in overloads and/or much shorter run-times.

Note that the higher the VA rating, the longer the run-time that the UPS will provide standby power to your equipment. A 1000VA unit for a 500 watt system will provide standby power for at least 30 minutes, and a 2000VA for about 2hrs. Also, the size of the battery within the UPS unit, will have a direct effect on how long the run-time will actually be. Most manufacturers of UPS systems have an on-line guide to help you select ("size") the correct models that will meet your system requirements.

Other Considerations:

Higher quality UPS's provide true sine-wave output when switched to standby power. A pure sine wave is the signature of AC power. Cheaper units use a square wave to convert from battery power to AC output, which can result in damage to your computer's power supply over a long period of use. Simply, if you anticipate that your system will run on standby power frequently, be sure to select a UPS that uses pure sine-wave output.

Some UPS's provide continuous power; that is they are on-battery all the time (known as "on-line power"). This feature is of great benefit since the power output from these units is completely conditioned. The more conventional units only switch to battery when the voltage exceeds or is less than the rated thresholds (known as "switched or standby power"). On-line units cost a premium and are highly recommended for servers.

Obviously, if the UPS is on-line continuously, there is no switching time required. The units that do switch will have a "clamping response time" rating. Units with a faster response time are better. Many are instant (switch-time is less than 1 nano-second).

There are other features that are mostly important to networks, server, and telecommunications. For these computing environments, please contact a computer professional for help in selecting the correct type of unit.

Links to Power Protection Manufacturers-

American Power Conversion- www.apcc.com

Tripp Lite- <http://www.tripplite.com/>

Tripp Lite makes the excellent “Isobar”™ model of surge suppressors.



These units incorporate most of the advance features that Genesys Micro recommends, including diagnostic LED's and noise filtering. The unit shown above has a 2700-joule rating and an all-metal housing. Click here for more information: <http://www.tripplite.com/products/product.cfm?productID=101&print=yes>

Appendix:

VA (Volt-Amps), Wattage, and Power Factor:

For most personal computer equipment, VA or volt-amps, is a ratio derived from the power used (watts) plus the loss which occurs as a result of the conversion of AC (from your power company) to DC current (used by computers). This “efficiency” is called the “power factor”, and is almost always less than 1.0. Personal computers, with *capacitor input* power supplies, have a typical power factor of .6 (60%). This is a result of the power supply's inability to totally convert household AC current in to DC current required for the computer system. In the mid 1990's the power factor corrected (PFC) power supply was introduced with the advantage of having a power factor of 1 (100%). Because it is not possible to easily determine your kind of power supply, it is recommended that you assume a power factor of .6 (60%) for all personal computers. Eventually, all power supplies will be the PFC type, but this will take many more years before this becomes a reality.

Power conditioning equipment companies use Volt-Amps instead of Watts on smaller UPS units because of the differences that directly relate to power factor on different equipment (i.e. capacitor input power supplies vs. PFC power supplies). If you attach personal computers to a UPS, to calculate Watts, you must multiply the VA rating by the power factor of .6, thus a 800VA unit is rated for *around* 480 Watts (+- 10%) - a little less than the *maximum* wattage rating for a typical personal computer. Servers, with many hard drives, processors, and host adapters, will require more power. As a result, your particular system may require more or less power. Genesys Micro LLC can determine your power requirements by connecting a special wattage monitor, or by simply adding up the wattage for all the equipment that will be attached to the UPS.

Need more Information? Contact the technical support representatives at Genesys Micro LLC, at (304) 267-0433.

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