SELECTING THE PROPER UNINTERRUPTIBLE POWER SUPPLIES (UPS)

General

This document is meant to address selection of UPS for process control or SCADA applications. There are numerous other applications for UPS for example, datacenters and hospitals that are not covered by this document.

Needs Assessment

It is first important to define and detail the needs that are to be satisfied by the UPS. After the needs are defined, the various types of UPS systems available can be evaluated to determine which provides the best fit solution.

Asking yourself a few questions will help identify your needs. These questions would include:

- Do I need to keep the PLC or control system operating during a power outage?
- Does the entire system need to be powered during a power outage, or can the processor (only), or a portion of the system be powered?
- Am I trying to protect against a power failure or against irregular power conditions (under voltage, overvoltage, etc.)?
- Can I tolerate a brief loss of power or must the system be powered continuously with no transition?
- What is the duration of power outage the alternate power (UPS) is expected to support? How frequently will the UPS be expected to provide this support?

Other questions may be added to the list above to help define the detailed requirements for a UPS.

Types of UPS Systems.

We divide UPS systems into a few basic types:

- On-line UPS
- Line-interactive UPS or
- Standby UPS

Other types of UPS such as flywheel UPS are not usually appropriate for the needs of process control and SCADA systems.

On-line UPS systems continuously convert incoming AC power to DC power and then convert the DC power back to regulated AC output power. This continuous double-conversion operation isolates connected equipment from transients on the AC line, including undervoltage, overvoltage, surges, line noise, harmonic distortion, and frequency variations. On-line UPS systems typically regulate voltage within a couple percent. These UPS systems generally provide some surge protection and noise filtering. All on-line UPS provide pure sine wave output which results in maximum stability and superior compatibility with sensitive equipment. On-line UPS systems do not have a transfer time because the inverter is already supplying power to the connected equipment load when an outage occurs. Typically, this is the most expensive of the UPSs considered in this document.

Line-interactive UPS system maintains the inverter in line when operating from the ac line (i.e. when not operating from battery). They generally allow for more variation in voltage output than on-line UPS systems. They will typically regulate output within 10 or 15% of the nominal voltage. Line-interactive UPS systems may do some voltage regulation to correct abnormal voltages without switching to battery. (Regulating voltage by switching to battery drains your backup power.) The UPS detects when voltage crosses a preset low or high threshold value and electrically adjust the voltage to return it to the acceptable range. During a power outage, line-interactive UPS systems typically transfer from line power to battery-derived power within a few milliseconds. A determination must be made on a case by case basis to determine if this is fast enough for your particular application.

Standby UPS are lowest in cost and provide the least amount of back up and protection. Utility power is provided to the load during normal operation. Line voltage and frequency changes are not regulated by the UPS and pass through to the equipment. When voltage or frequency changes exceed limits, the UPS converts DC battery power to AC to power the load.

Generally, Standby and Line interactive UPS systems are available in smaller sizes up to a few kVA. Line-interactive and on-line UPS systems are available up to a few kVA. On-line systems are manufactured to serve the larger systems (above a few kVA).

Other Considerations

Other considerations include how long of an outage the UPS is expected to mitigate. The battery operating times advertised by UPS manufacturers are only a part of what must be considered. The battery recharge time must also be considered. Battery recharge times are often many hours. Therefore a UPS that provides 15 minutes of Battery power at full load, may only recharge to a portion of its capacity after several hours. Repeated outages or line fluctuations may be too much for the system to contend with when the battery has not been fully recharged.

It is important to assess what portion of the system needs to be supported by the UPS. In some situations, just providing back up power to a PLC may satisfy the needs of the system. This means other components like the operator interface will not be a burden on the system. They will also be unavailable during a power failure.

When selecting a UPS, be careful to verify what loads are connected to the UPS. SCADA panels often have heaters, fans, lamps, convenience receptacles, etc. If these types of loads are not intended to be backed up by the UPS, it is important to verify that they are not on the load side of the UPS circuit.

Facilities with emergency generators should not be excluded from consideration. The time between the power failure and the time that the generator is able to support loads may be too long to meet the needs of your system. In these situations a UPS can be used to bridge the short period of time utility power is not available.

UPSs can be used to filter power at facilities where power quality is poor. Even if back up is not necessary, the filtering provided by the UPS may satisfy system needs.

When identifying system needs, be careful to consider that if you need to provide uninterrupted monitoring of specific parameters, all of the devices and instruments in that loop must be powered. Things like sensors, and recorders should be evaluated to make sure that the loss of power to one of the devices does not result in lost data collection and storage.

In some instances, 24 volt power supplies make sense. These can be purchased as a system of configured from components such as inverters, batteries, etc. Making a battery charging system with back up can result in uninterrupted power to devices that can be powered from low voltage DC.

The need to monitor the UPS and its health may be an important factor in selecting the UPS. Not all UPS systems provide easy to use monitoring. Others provide networked system monitoring.

UPS systems are often installed and forgotten. Systems need to be tested and batteries or the entire unit replaced as necessary.

Conclusion

After identifying the needs of a system, the task of selecting the appropriate back up is often simple and straightforward. Once the UPS is selected and commissioned, maintaining the system is critical if it is expected to provide reliable operation when needed.

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