Application Note

2500 Series®
Programmable Automation Control System

Using UPS Systems for PLC Power Backup

Figure 1 shown on page 2 shows a typical wiring circuit when using a UPS system in the power circuit of a PLC. The UPS can be used for 2 purposes:

- Feeding the power supply of the PLC
- Feeding the power supply for the control circuits that are wired to the I/O cards of the PLC.

Which solution(s) are adopted in an application depends on the requirements of the application and also on the specifications and performance of the UPS.

UPS solely used to feed the PLC power supply.

This configuration will safeguard the PLC from shutting down when there is a power failure. This may have some advantages since the PLC will remain in its last state, all the internal variables in RAM memory will keep their actual values and when the mains power comes back up the process will resume from the state where it was stopped before the power failure. This may be particularly of importance in batch processes

where the user would want to avoid that the process starts again from its initial state after power comes back on.

Nevertheless there is a major disadvantage to this configuration. That is, the power on all the input and output signals will be lost. The fact that all input signals will drop to zero will cause a flood of system alarms. Also all the outputs will be deactivated and hence the production unit will come to a shutdown.

When we look at the wiring scheme it shows that an external power source needs to supply the power for the input and output control circuits. Indeed, it is not the PLC power supply that feeds the control circuits; the PLC power supply solely generates the voltages to power the internal electronics of the PLC cards. The internal power for the electronics circuits and the power used in the control circuits are electrically completely separated.

In general the PLC Power Supply Module will be fed by a 24VDC or 110/220 VAC power source. It is the role of the PLC Power Supply to transform the input voltage to the different voltages that are used by the

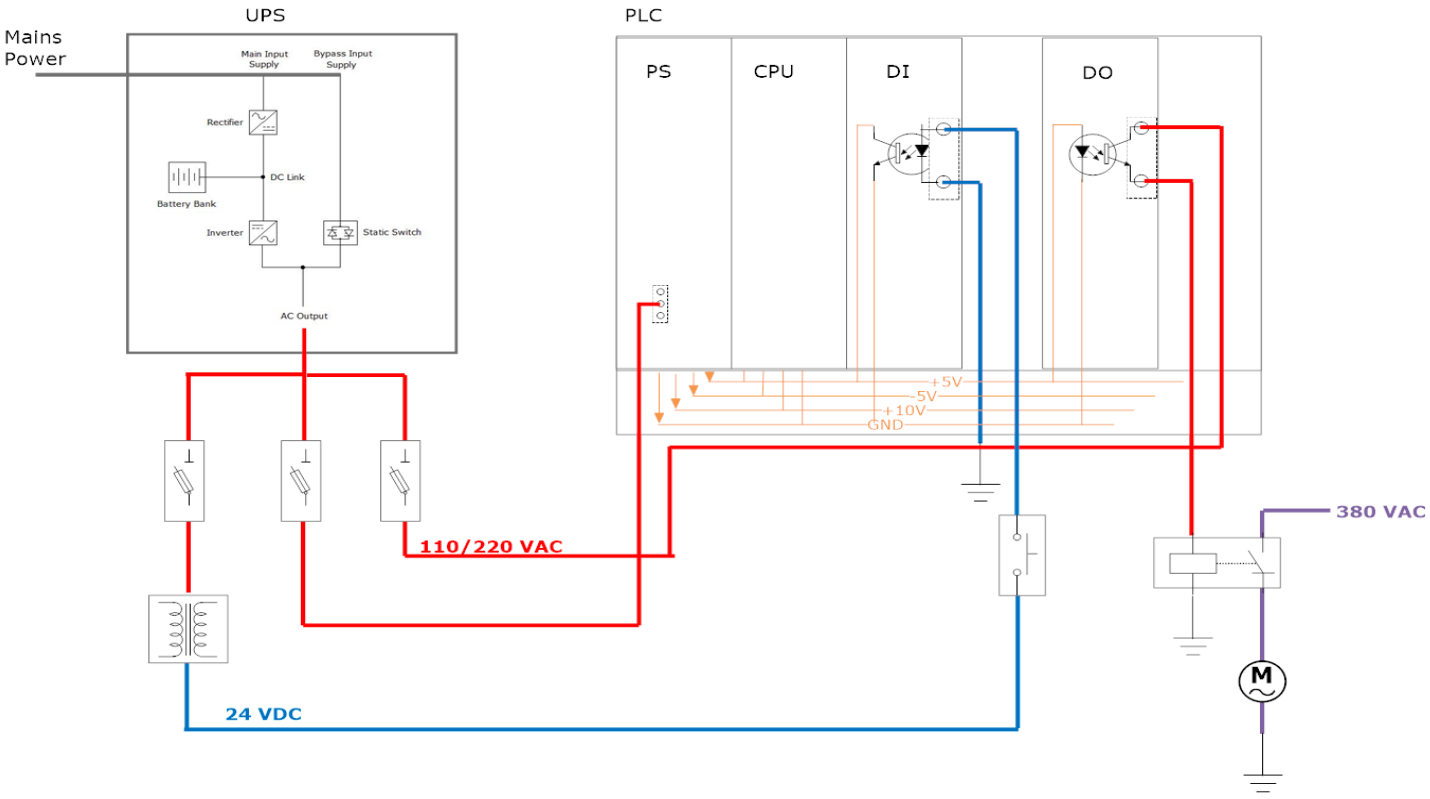

Figure 1: Typical USP wiring for a PLC System

electronic components on the PLC cards. The internal voltages are much lower and are distributed to all the cards in the base, including the CPU, via the PLC backplane.

The CTI Power Supplies are designed to withstand voltage drops (within specification) or glitches on the input voltage of the Power Supply. As such they assure that the PLC continues to function normally when a voltage drop on the input power occurs. However the time lapse of the voltage drop that can be bridged is in the order of magnitude of a few milliseconds. Taking this fact into account, they cannot be considered as UPS systems

by themselves, since a UPS will have the capability to bridge power outages in the order of magnitude of minutes or tens of minutes. This configuration can be achieved with a relatively small and inexpensive UPS, since it only needs to supply the current for the PLC Power Supply module.

UPS used to feed the PLC Power supply and the I/O control circuits

In this case the power supplied by the UPS, in addition to feeding the PLC Power Supply Module, will also feed the I/O control circuits. This solution will provide all the advantages as described above, that is the PLC will continue to function normally, but additionally the I/O control circuits will continue to function; the PLC will continue to control the process as if there were no power failure. In the vast majority of the cases, when a power failure occurs, the duration of a power failure cannot be predicted.

Since the UPS has only limited capacities to supply the required current for a limited period of time, one would typically want to avoid that the process continues running until the UPS power is completely depleted and power will shut off at the UPS output. In this case, it is good practice to wire a signal from the mains power line to a digital input from the PLC. The PLC will in this way be informed that mains power has dropped and intrinsically knows that it is running on UPS Power. The PLC can then decide to take appropriate actions such as stopping certain utilities or bringing the complete process to a controlled shutdown.

More sophisticated UPS system will interface with the PLC and send a signal that informs the PLC of the time left before the UPS will be depleted. This allows the PLC to take appropriate action when the UPS comes close to depletion.

This type of configuration will require a much more powerful UPS system then solution #1 since the UPS also needs to supply power to energize all the PLC outputs which may have relatively high power consumption.

The impact of the UPS system on the availability of the PLC system.

The UPS system can largely improve the availability of the PLC in case of power failure. Scenario #2 described above is certainly the best solution in terms of availability of the PLC system since it allows to continue production without interruption, when a power failure occurs. That is, as long as the UPS system can supply the necessary power to energize the whole system and this mainly depends of the characteristics of the UPS system. However it is also the most expensive solution since a much more performant UPS system will be required.

Figure 2: CTI 2500-R11A base with 2 x 2512-A Redundant Power Supplies and CTI CPU

A final consideration: the UPS does not protect against a failure of the PLC Power Supply Module. When a defect occurs in the PLC Power Supply Module, the module will cease to supply the required voltages to the internal electronics of the PLC, which will lead to a shutdown of the PLC and implicitly to a shutdown of the production unit. To avoid this and to further increase the availability of the PLC system, the CTI PLC's offer the possibility to use Redundant Power supplies in the PLC. This requires a special rack

of type 2500-R11A where 2 slots are reserved to mount 2 power supply modules. Two Power Supply modules of type 2512-A or 2515-A specifically designed for redundancy support will be installed in the base. Both Power Supply modules will be fed continuously and in parallel. Both modules can supply enough power to energize all the cards in the base. When one of the two Power supplies fails, this has no impact on the functioning of the PLC and the PLC will continue to control the process without interruption. A failure of one of the redundant Power Supplies can be detected in the internal status words that are available in the CPU and for ex. made visible on an HMI or SCADA system.

Control Technology Inc.
5734 Middlebrook Pike, Knoxville, TN 37921-5962
Phone: +1.865.584.0440 Fax: +1.865.584.5720
www.controltechnology.com