

Opto 22 Technical Note

TN9602

Power Supplies for Optomux and Pamux Systems

The power supply or power supplies are one of the most basic elements of any digital logic-based control or data acquisition system. This is especially true when a distributed system, such as Opto 22's Optomux or Pamux, are in use. Power supply problems are the cause of a large number of operational problems or failures of these systems. There are a number of good design, wiring, and installation practices that can greatly reduce the chance of equipment problems or failures related to the power supply.

First, it is extremely important that the power supply to each element of an Optomux or Pamux system be regulated to 5 volts plus or minus 0.1 volts, or regulated to within 2 percent of 5 volts as referenced to the power supply common, period. Analog I/O racks will also require plus and minus 15-volt supplies. There is no allowance for surges or dropouts of any time period, long or extremely short, within this specification. Under- and over-voltages are known to cause system resets and potentially garbled data. When checking the voltage supplied to an Optomux or Pamux unit, it is important to check the voltage at the unit itself, perhaps across a capacitor on the board, not at the power supply. There may be severe line losses between the power supply and the powered board, leading to acceptable measurements at the source, but unacceptable measurements at the field location.

A power supply that has adequate voltage regulation and current sourcing capacity is vital to the whole system power scheme. Opto 22 generally recommends linear power supplies over switching power supplies, because they offer both superior line and load regulation. Switching supplies typically offer good line (voltage) regulation, but have poor load (current) regulation, potentially leading to current surges. These, coupled with load impedance, can cause supply voltage problems on the load end. Linear supplies generally offer good line and load regulation due to the filter capacitance on the input side of the voltage regulator. This capacitance acts as a buffer against current and voltage surges. In general, a linear supply with an adequate current rating (500 mA minimum per supplied Optomux or Pamux unit, plus module and terminator power requirements), as well as line and load regulation within 0.2%, each is good for use with Opto 22 equipment.

Power supplies that feature external voltage monitoring are also nice; connect the monitoring terminals to the most distant device in a chain, or to the largest load device in a star. Please note that the addition of additional filter capacitors across the supply lines is not recommended, as this will stress the transformer of a linear supply, or the output and regulator stage of a switching supply with excessive current draw during both turn-on and normal operation. This can lead problems from blown fuses to fires.

Never use transformerless power supplies, as they represent a large shock hazard—they don't isolate your equipment from line problems either. If the power supply is going to be switched on and off, and resides on the same supply line as other power supplies, computers, or other electronic equipment, try to find a power supply that has an RC snubber built into the line side. If a switch is added externally, the addition of 0.1 microfarads in series with 100 Ohms across the transformer primary will help eliminate inductive transients, which might otherwise cause problems for other equipment on the line. Power supplies for logic boards should always be independent of supplies used to drive inductive loads like solenoids or DC motors; never use the same supply for logic. Also keep in mind that the benefits of photo-isolation from the field side to the logic side of a control system are lost if the same power supply is used to provide power to field devices, including the isolated side of DC I/O modules.

The way in which a power supply is wired plays as much of a role in a system as the power supply itself. In general, it is recommended that all components sharing a common power supply be connected in a star configuration. Other potential configurations are the chain and the ring; these require less wiring, but

force that same wiring to carry more current (the first link in a chain carries all the current drawn by all the devices!), potentially reducing power quality. A ring is twice as good as a chain, but still not recommended. Also make sure that the conductors used for supply wiring are of adequate size to carry the largest potential load current with a low enough loss that the supply voltage specifications will still be met given worst-case regulation at the power supply itself. Remember that minor line losses are much greater of a concern at low voltages (5VDC) than at high ones (120VAC).

A system with multiple power supplies for remote Optomux or Pamux units presents its own set of problems. Ideally, the common terminal of all the supplies should be connected in a low-loss manner. This is especially true for Pamux systems; fortunately, with a maximum bus length of 500 feet and a 50-conductor ribbon cable going everywhere, connecting the commons common on the power supplies is practical—it's just another wire. With Optomux, connecting the commons is normally not practical, but the RS-422/485 serial link implementation in Optomux takes station isolation into account by requiring a fifth wire (common) in the communications link. Connecting the common references on multiple power supplies forces them to reference the same point to define the supply voltage; floating supplies will be needed to achieve this. AC grounds, especially in single-phase power systems, are notorious for inconsistencies across multiple circuits. This is because most one-phase AC systems are wired in such a way the neutral terminal and the ground are connected together at some point. Because the ground (Earth) does not have a zero source impedance, the neutral, and thus the AC ground, can float from point to point and circuit to circuit (Product Support has measured ground potential differences as high as 40V on receptacles in the same room!). If all the power supplies are on the same circuit however, the common reference (connection of the commons together) is probably not necessary. Vendors on the list below are known by Opto 22 to manufacture supplies meeting the requirements of Opto 22 systems.

Condor Electronics
580 Weddel Drive
Sunnyvale, CA 94089
(408) 745-7141

Power-One Linear Products
740 Calle Plano
Camarillo, CA 93012
(800) 678-9445

Sola
1717 Busse Road
Elk Grove Village, IL 60007
(800) 879-7652

Unipower
3900 Coral Ridge Drive
Coral Springs, FL 33065
(305) 346-2442