Power Supply Protection... What are the Rules?

Figuring out what type of protection is required for any control device can be confusing. A novice only has to take a look at the National Electrical Code (NEC) or UL 508 to be intimidated much less navigate through all the references to the various paragraphs and articles. This addition of The PULS Advantage will address some of the questions regarding power supply protection, but it is not meant to be used as an expert opinion or substitution for the NEC code or UL 508 standard.

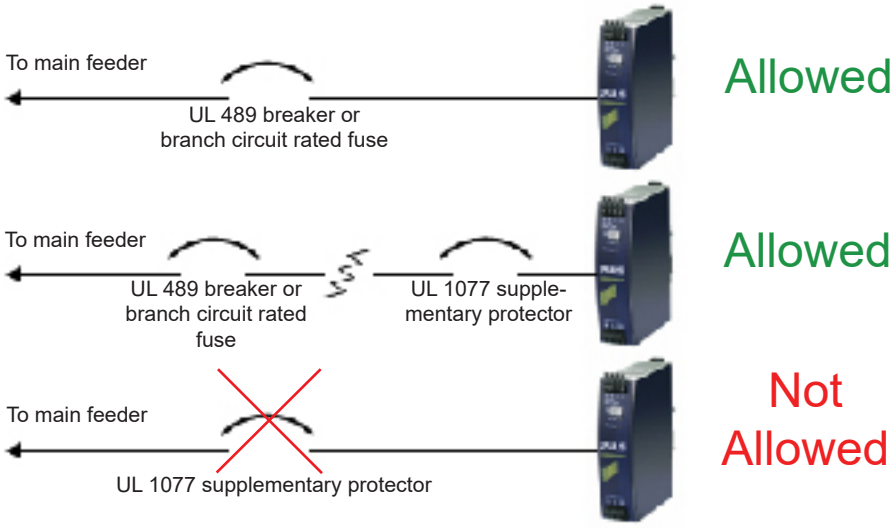
Branch Circuit:
The NEC defines branch circuit as "The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s)". If we were to expand this term to UL 508, branch circuit is defined as "The conductors and components following the last overcurrent protective device protecting a load". For an industrial panel using a power supply, the power supply is considered the load as defined by UL 508, so the unit as well as the wires connected to it are considered a branch circuit and therefore certain rules must be followed.

Branch Circuit Protection:
Both the NEC and UL 508 requires that each branch circuit be protected by an inverse-time or instantaneous circuit breaker that meets the requirements of UL 489. Where a fuse is used instead, the fuse must be rated for branch circuit like CC, J or R to mention a few.

Confusion on Internal Fusing:
Many power supplies have internal input fuses incorporated into the design which can be misleading to users in the US. Because of their size, glass fuses are used because they utilize very little space on the PC board. Although these fuses are used as input protection in Europe, they do not meet the requirements of a branch circuit protective device per the NEC or UL. When a power supply is used in an industrial control environment the input protective device must be rated for branch circuit. These branch circuit rated fuses or circuit breakers will protect the branch from short circuits as well as overcurrent.

Supplementary Protectors:
UL 1077 supplemental protective devices have grown in popularity over the past few years but many users still misapply their usage. A UL 1077 circuit breaker can be used as added protection for equipment such as power supplies, but there must be a UL 489 circuit breaker or appropriate branch circuit fusing upstream from this device. The UL 1077 circuit breaker can not be used if it is the only protective device on any particular branch circuit.

Output Protection:
Although the output of a power supply is designed to protect itself during no load, overload and short circuits, the output equipment and conductors attached are



Samples of Input Protection for a Power Supply

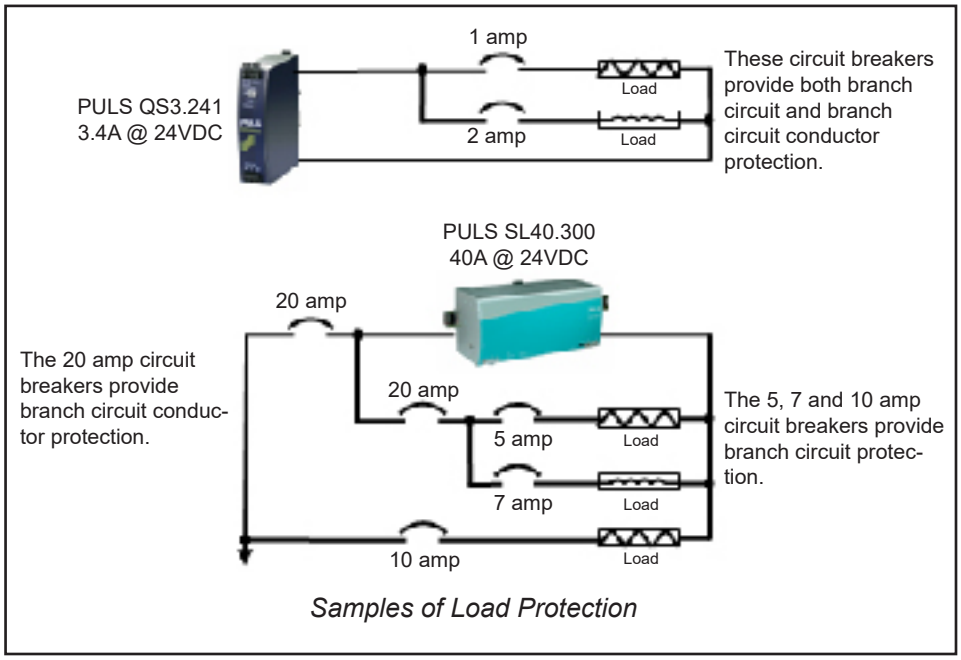
considered a branch circuit and require overcurrent protection. There are many ways to wire the output side of the power supply depending on the number of loads connected. In each case, the individual loads and conductors must be protected from overcurrent. On smaller power supplies with only an individual load connected, it may be possible to use one protective device to protect both the load and the conductors. Or the smaller power supply may have multiple loads connected where the individual overcurrent protection is still sufficient to protect the load and wires. However, when a larger power supply is used with multiple loads connected, it may be necessary to provide circuit protection for the wires and other protection for the individual loads. See the diagram shown below for a better illustration.

Trip Curves:

It is important if using supplementary protectors to pick the appropriate trip curve for the load. There are four trip characteristics; A, B, C, and D where A is the fastest tripping and D is the slowest. The A devices are used to protect sensitive electronics, B devices are used in European residential applications, C units are used in general control circuits and D is used to protect high inrush components. The PULS MiniLine and SilverLine power supplies typically recommend using 10 amp B trip characteristics circuit breakers because it is not known into what environment the power supplies will be installed. Temperature plays a significant factor in how much inrush current is developed when the AC is turned on. Both the MiniLine and SilverLine supplies use a design called NTC (Negative Temperature Coefficient) to control the inrush of the supply. The component used is a thermally sensitive resistor (thermistor) in which the resistance changes as does the temperature. A power supply that is installed in a colder environment will have a lower inrush than one that is installed in a hotter climate. This is the reason a larger circuit breaker is recommended for these two families of supplies, because if a smaller circuit breaker is utilized in a warmer environment, some nuisance tripping could occur. Typical control wiring used in most panels (16-12AWG) is rated for at least 10 amps.

The PULS Advantage

With the Dimension family of power supplies, choosing input and output protection is made even easier. The patented input design allows the Q series to have virtually zero AC inrush, which means that the input fuse or circuit breaker can be sized for the nominal input current of the device. With near zero inrush the worry of nuisance tripping is eliminated. With the firmware controlled output, overloads are handled differently than other power supplies. Even under a short circuit condition the Output Power Manager will taper back the output current to near nominal current, protecting your output load and conductors.



Samples of Load Protection