ELTROL CORPORATION

APPLICATION NOTE SUPPLEMENTARY FUSE PROTECTION

An amplifier uncontrolled failure or configuration errors can result in overcurrents. The user should protect the amplifier and any external circuits by fusing the input power connection. Fuse selection is based on the application requirement for peak and continuous current. See the amplifier data sheet for peak current rating. It will show a peak value with a time limit. The continuous current depends on the maximum amplifier power dissipation. Ambient operating temperature, motor winding resistance, and heat sink airflow determine amplifier power dissipation. With the peak and continuous current defined, the final fuse selection can be derived from the fuse manufactures data sheet. A time-lag fuse is usually a good choice for the input power bus. The fuse rating should be less than the amplifier’s peak current rating. For example the amplifier can have a peak current specification of 10 amps for 1 second. A typical time lag fuse with a 10 amp rating will open after 10 seconds at 20 amps. This magnitude of current versus time will not provide the desired protection.

The fuse current rating should be 35% greater than the application’s continuous or average current requirement. Typical applications require a pulse current to accelerate the load, and then the current decreases to maintain constant velocity or to hold a steady state position. The specification for the fuse Melting Integral I2t (A2*Sec.) should be greater than the I2t value of the pulse current.

Example:
Peak current for acceleration = 10A for 100 msec
Average (continuous) operation current = 3A
Fuse rating = 1.35*3A = 4A
Pulse current is a square wave 10A peak for 100 msec
Pulse I2t = 102(.1) = 10
Worst case is using amplifier specification of 10A for 1 second
Worst cast I2t = 102(1) = 100 A2*Sec.
From a typical time lag fuse manufacturers data sheet a 5 amp rated fuse has an I2t of 140 A2*Sec. The average time current curve shows it will open after 10 seconds at 10 amps or 1 second at 18 amps.

The final value should be tested under worst-case conditions to verify that no false tripping occurs.

A fuse in the motor phase connections will protect the motor. Linear motors are very susceptible to damage from overheating. They have less thermal capacity than rotary motors. Motor phase fuse selection requires thorough analysis of the application's heat generation. Current magnitude and duty cycle determine heat generation. Since the sum of the amplifier output phase currents is zero, only two fuses are necessary to protect the motor. Three fuses should be used if it is possible to short one of the motor's phases to ground. Generally, fast acting fuses are a good choice. Fuse size depends on the lesser current rating of the motor or amplifier. Note in contrast to a time lag fuse a 5 amp fast acting fuse has an average time current curve that shows it will open at 8 amps after 10 seconds or 1 second at 10 amps.

Once the application's peak and rms current requirements are known, final fuse selection is based on the fuse power dissipation, ambient temperature, rated voltage and current, breaking capacity, time-current characteristics, along with the I2t value.

The final value should be tested under worst-case conditions to verify that no false tripping occurs.