Motor Controller FAQ's

Q: Do I need a speed control or a torque control amplifier?

A: In an application where you are looking for servo-like response from the motor, quick and controlled motor reversal, and very tight control around the zero movement point, then a torque controller is recommended. If the system requirement is for controlling speed and positional requirements are not very stringent, then a speed control may suffice.

Q: What is meant by peak current?

A: When pulsing a voltage waveform into an inductive load, as in a PWM controller, the resulting current wave form has a triangle-like shape. In a torque amplifier, it uses average current feedback, so it averages the triangle waveform to use for control. In a low inductance, low resistance load, the peaks of the triangle can reach quite high. In MSK's motor control amplifiers, the peak current limiting circuit is set to allow about 25% - 50% higher current peaks than what the average current is. This peak current is what is specified in the data sheet, because allowing the peak current is necessary because of the nature of the waveform.

Q: Can I get a higher peak current from a torque amplifier than what the design continuous rating is?

A: A torque control amplifier controls the torque of the motor by controlling the current going through the winding of the motor. A voltage is applied to the command input, and the amplifier control loop sets up a controlled current through the motor. The controller will output exactly what is commanded of it. However, there are limits. The main limit is the acceptable command range of the device. If the device is designed and rated for a 10 amp limit, then asking 15 amps of the device will not work. The circuitry is designed to have a maximum control range. If that is exceeded, the loop can no longer maintain control. The current may go higher, but it won't be under control. MSK's torque controllers have current limits built in for that reason. Otherwise, the current could continue to rise to an unacceptable level, destroying the output stage.

Q: How does a torque amplifier get applied?

A: A torque amplifier is the device that does the driving of the motor. It controls the current flowing through the motor. There is a control loop that does the controlling function in the amplifier. The amplifier voltage input is a current command signal. The amplifier closes the loop between the command and the actual current through the motor. Another control loop outside the current or torque loop is the speed or velocity loop. This control loop controls the speed of the motor by using a tachometer or encoder for the feedback. The outer control loop is the position loop. This loop gets the actual position feedback signal from a positioning potentiometer or an LVDT. As a position needs changing, the position loop commands the velocity loop to speed up the motor. The velocity loop commands the torque loop to drive more current into the motor to make it speed up.

Q: What does 60 degree or 120 degree commutation mean?

A: In a brushless motor there are hall sensors positioned at key spots in the motor such that when the magnet on the rotor is in correct alignment with one of the windings in the motor, the hall sensor turns on. The torque amplifier uses this hall signal to know when to turn this winding on. In a brushless motor there are three windings positioned in the motor. There are usually several magnet poles in a rotor. As one of those magnet poles gets into position, the motor controller turns on that particular winding. Depending on the positioning of the windings and the hall sensors, there can be either 60 degree phasing or 120 degree phasing. Each phasing type has a certain sequence for turning on the various windings in the motor.

Q: What is the correct wiring sequence for the motor windings and the hall sensors?

A: There is no universal standard for wiring brushless motors. Every manufacturer has their own way of doing things. Each application has to be tested with a motor to determine which hall and winding phasing is correct. Usually, there is one combination of hall signals and windings that make the motor run at it's best level, with the least current draw and power consumption, and in a desired rotor direction.

Q: Can I use a brushless motor torque controller to run a brushed DC motor?

A: Yes. A 3 phase brushless motor drive output stage is 3 sets of half bridges. Any 2 half bridges that are activated will result in an H bridge output stage. The third half bridge will remain off. By hardwiring the hall sensor inputs in a given pattern, one output half bridge will be sourcing current and one output half bridge will be sinking current. Those outputs are where the DC brushed motor should be connected to be operated by the torque amplifier. The rest of the operation of the amplifier will be identical.