The BECO 298

CNC Controller

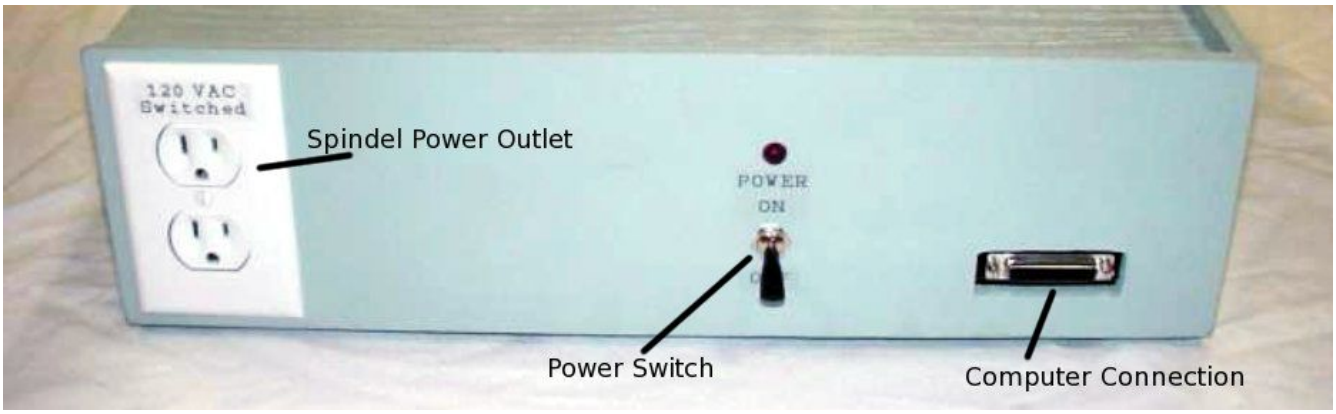
The BECO 298 CNC controller was designed and built in the U.S.A. It was designed with the hobbyist CNC user in mind. It is able to control 4 stepper motors at up to 2 Amp maximum current per motor phase. It has bipolar control circuitry and is able to use 4 wire motors. You may also use 6 wire and 8 wire motors, however **5 wire motors** are not recommended.

The BECO 298 CNC controller is of a modular design. There are separate driver boards for each motor. Each driver board is connected to the Mother Board (also called a breakout board). The Power Supply provides 36 volts at 10 amps to power the motors.

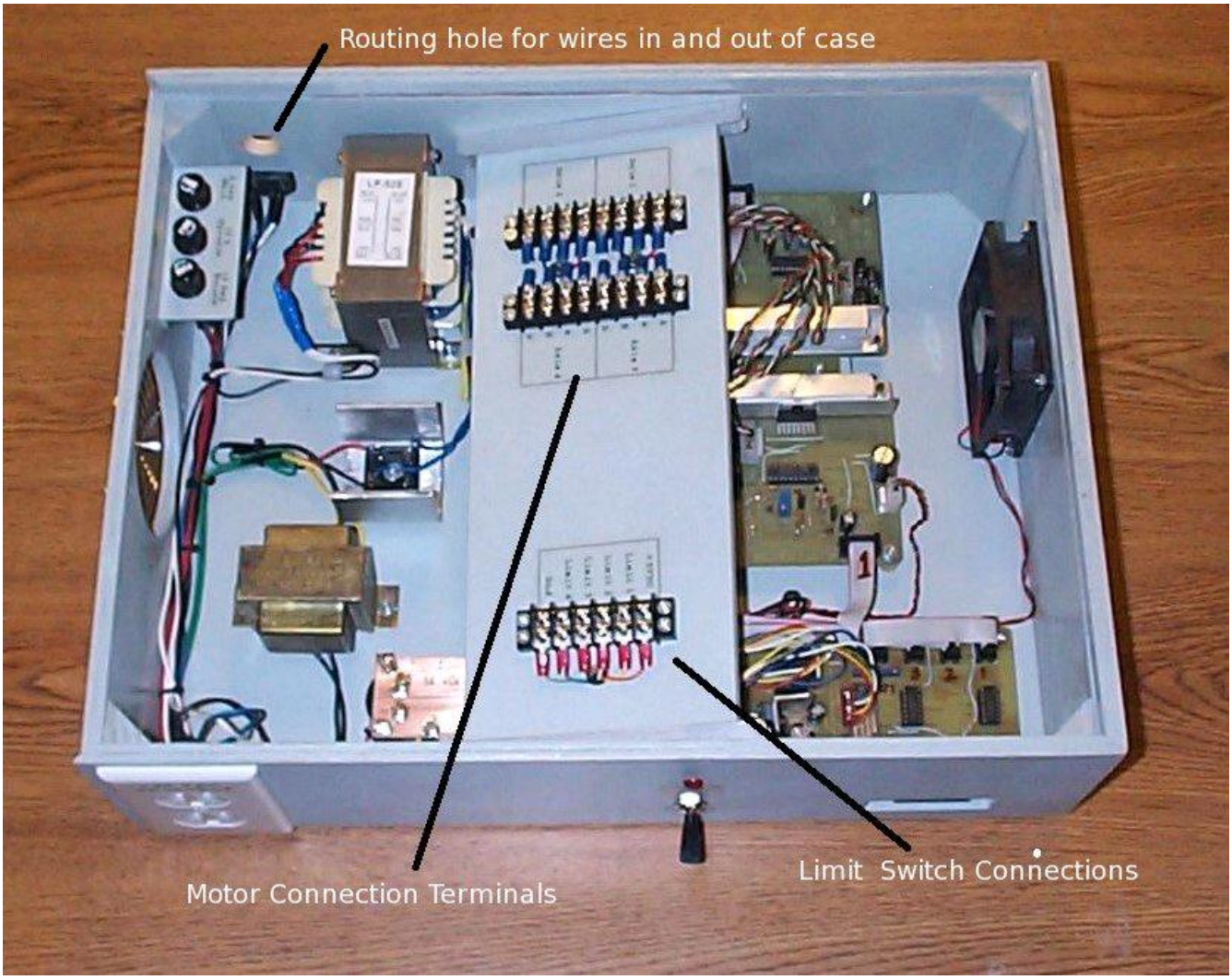
The BECO 298 is configurable for 3 axis use with spindle control and motor enable control. You can also slave the 4th axis to the 3rd axis and still use the spindle and enable controls.

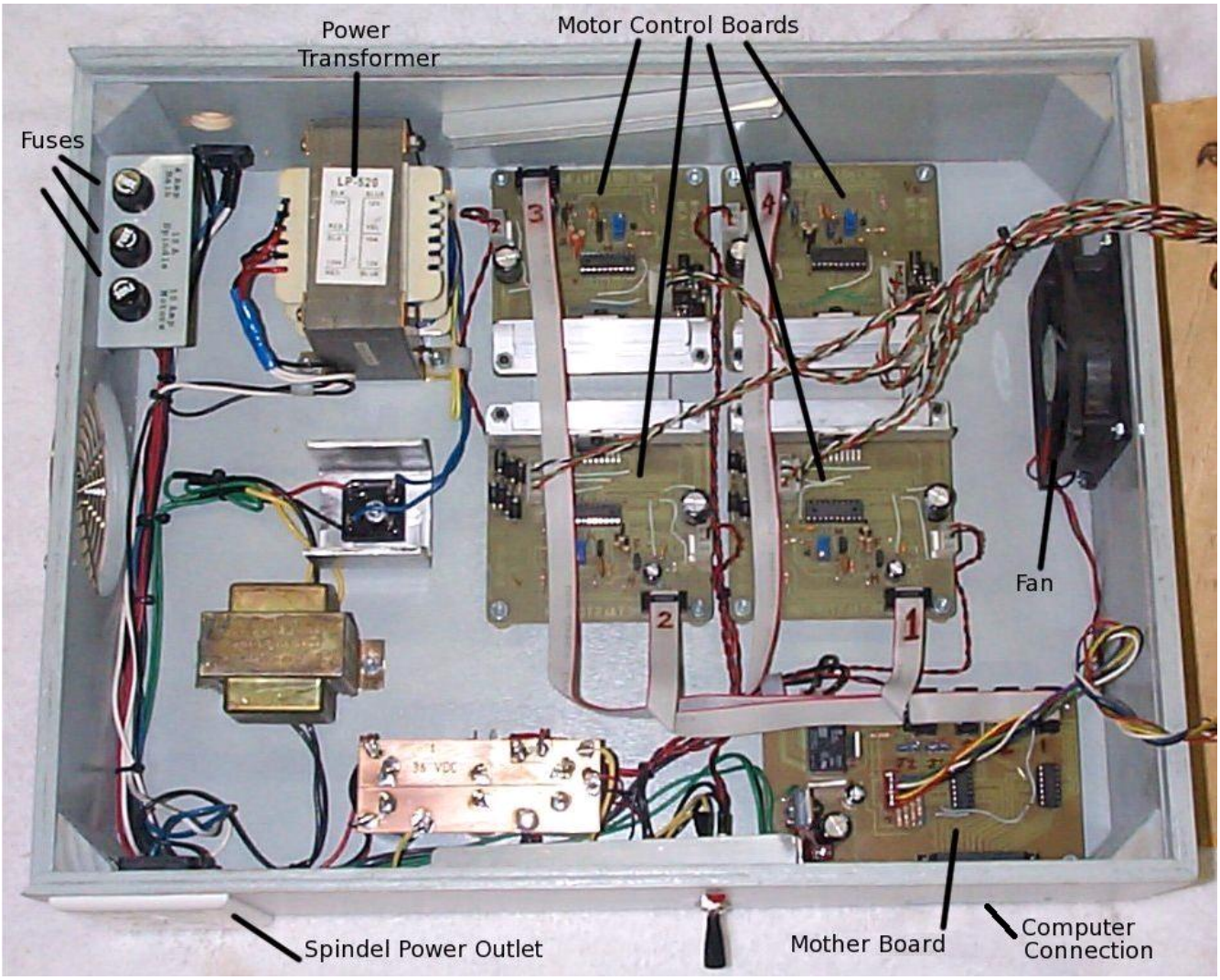
Note: The spindle and enable controls are not available when using 4 separate axis.

Note: Never connect or disconnect any motor while the power switch is in the on position. Even when unplugged from the wall, the power supply can retain a charge for a long period of time. When a motor is connected or disconnected and there is power available, there can be damage to the motor driver circuit. The power switch, in the OFF position, enables a discharge circuit that will quickly drain the power. Always turn the power switch to the OFF position before connecting or disconnecting a motor.
Failure to turn the power switch off before connecting or disconnecting motor connections can result in permanent damage to the motor driver circuits.



The Front Panel





Controller with top cover removed

The Mother Board

Description

The mother board brings the control signals from the computer and distributes them to each motor controller board. It also has connections for Home/Limit switches (the 6 pin connector near the center of the board).

All signals from the computer are buffered by 74LS14 Schmitt Triggers, to help eliminate signal error.

The mother board gets 6 – 9 volts AC power from a transformer and has an on board rectifier and 5 volt regulator. The mother board supplies 5 volt DC power to all of the motor driver boards via the signal connector, it also supplies power for the cooling fan. The mother board receives the **sync signal** from the **master motor controller** and distributes this signal to all of the other motor controllers.

When using the **spindle relay** (jumper J2 set to left side), the axis 4 step signal is intercepted and routed to a transistor that controls the relay. The **step signal** is no longer sent to axis 4.

When using the **motor enable** signal, (jumper J1 is set to the left side), the axis 4 **direction signal** is routed to the **motor enable** on all of the motor controller boards. The Axis 4 direction signal is no longer sent to Axis 4.

Axis 4 **direction signal** can be **slaved** to axis 3 by setting a jumper at J1 right side. This connects both the Axis 3 motor controller and the Axis 4 motor controller to the Axis 3 **direction** signal signal

When Jumper J2 is set to the right side, the axis 3 **step signal** is also connected to axis 4 (This enables the slave step signal).

Limit Switch Inputs

The mother board has 4 buffered inverting inputs for limit switches. These inputs are pulled to logic 1 by 4.7K resistors. To use these inputs all you need to do is connect a switch from the signal pin to ground. Since all signals are buffered (using inverting buffers), when an input pin is grounded, there will be a logic 1 sent to the computer.

Configuration

4 Axis -

To use four separate axis, you must set jumper J1 to the center position. Also set jumper J2 to the center position.

When using 4 axis, you can not use the **spindle relay** or the **motor enable**.

3 Axis with a 4th axis slaved to the third axis.

Set jumper J1 to the right position.

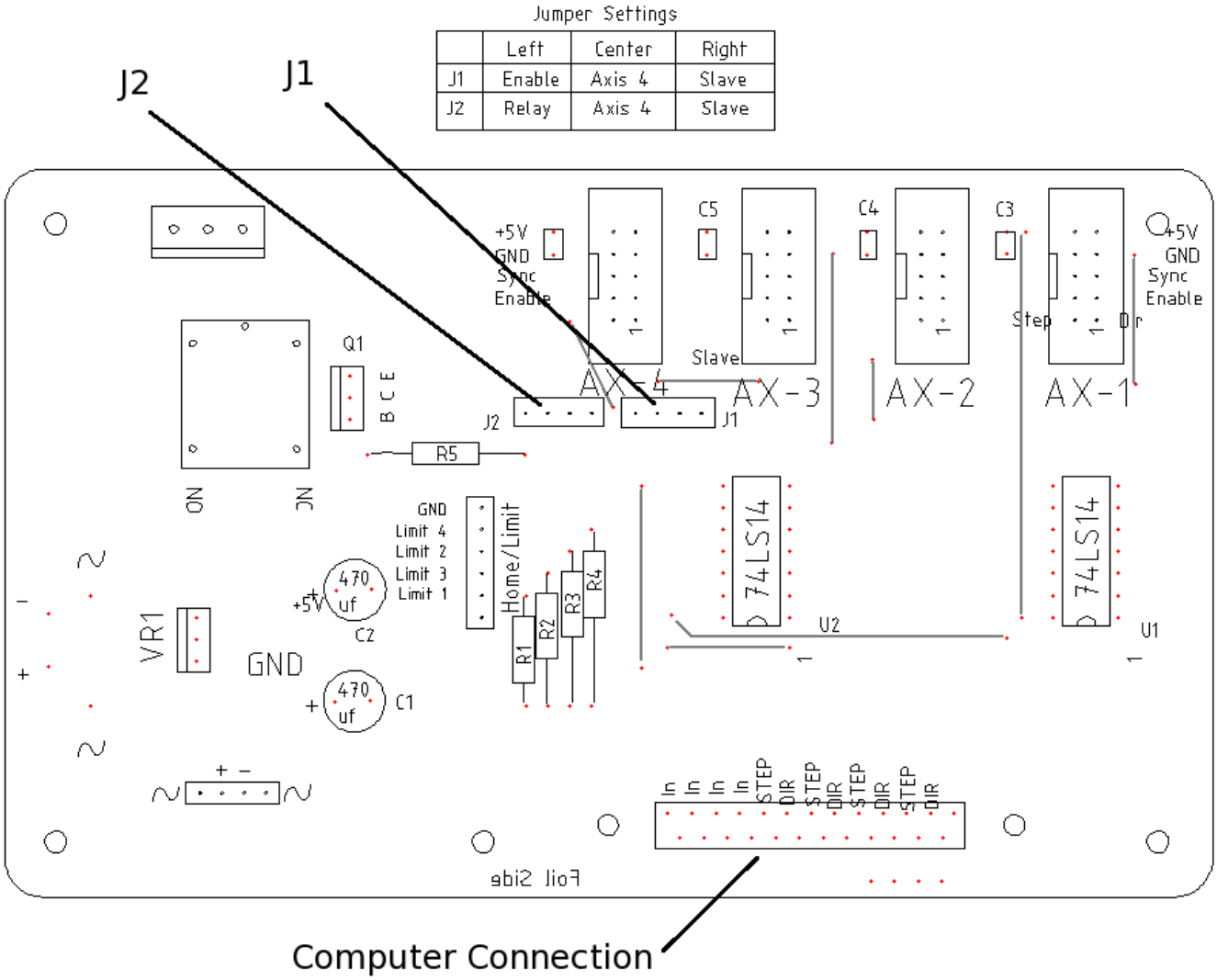
Set jumper J2 to the right position.

This connects the step and direction signals from axis 3 to axis 4 also. (2 motors driven from one set of signals)

When using a slaved axis, you may also use the **spindle relay** and the **motor enable**.

To use the **motor enable**, install a jumper on J1 in the left position.
To use the **spindle relay**, install a jumper on J2 in the left position.

When using a slaved axis with **motor enable** and **spindle relay**, there will be 2 jumpers on J1, and 2 jumpers on J2.



The Mother Board

The Motor Controller Board

Description

The motor controller board receives a step and direction signal from the computer via the mother board. It takes the signals and sends the appropriate power signals to the motor. The motor controller board requires 36 volt DC power to operate the motors and 5 volt DC to operate the logic. The 5 volts is supplied by the signal connector and the 36 volts is supplied by it own separate connection.

The controller has settings for Full step or Half step. There is also a setting for Master or Slave.

In master configuration, the sync signal (used by the logic circuits) is **generated** and sent out to the other motor controller boards.

In Slave configuration, the sync signal is not generated, but is received onto the board via the signal cable from the master motor controller board. There **must** be one (and only one) motor controller board configured as a Master.

There is a variable resistor (VR1) that controls the current flow to the motor.

Configuration

Half/Full – Set jumper J1 to the top side (F) for full step. For half step, which is the recommended setting, set J1 to the lower position (H).

Master/Slave – For the first motor controller in your system, set the jumper J2 to the top position (M). For all other motor controller boards set the jumper J2 to the lower position (S). There **must** be one (and only one) motor controller board configured as a Master. This has no relation to using two motors slaved together. This is for the clock signal that is used in the current limit function. The signal from the Master is shared via the Motherboard. If there are two boards configured as Master, there will be a conflict of the signals, resulting in improper operation.

Motor Current Adjust – VR1 is the current control. Connect a DC Volt meter to TP1 and GND. Adjust VR1 for your motors current.

> Stepper motors need to be run at 10-20 times their name-plate voltage. If the label or name-plate on your stepper, reads, for instance, 3 volts, you'd run it at about 30 to 60 volts. The motor control board will send whatever voltage the power supply outputs, which is 36 volts, to your motor.
>
> The motor **VOLTAGE** is not adjustable. The current, (amps), IS adjustable, via the VR1 adjustment trim pot. Even though you are reading a VOLTAGE measurement when adjusting these pots, it is just a REFERENCE voltage, used to INDICATE the output current, (amps).
>
> It is suggested that you set the output current to about 70% of the motor's name-plate current rating (amps). For example: If the name-plate states 1.6 amps, you would adjust VR1 to obtain 1.12 amps (70 % of 1.6 amps = 1.12 amps).

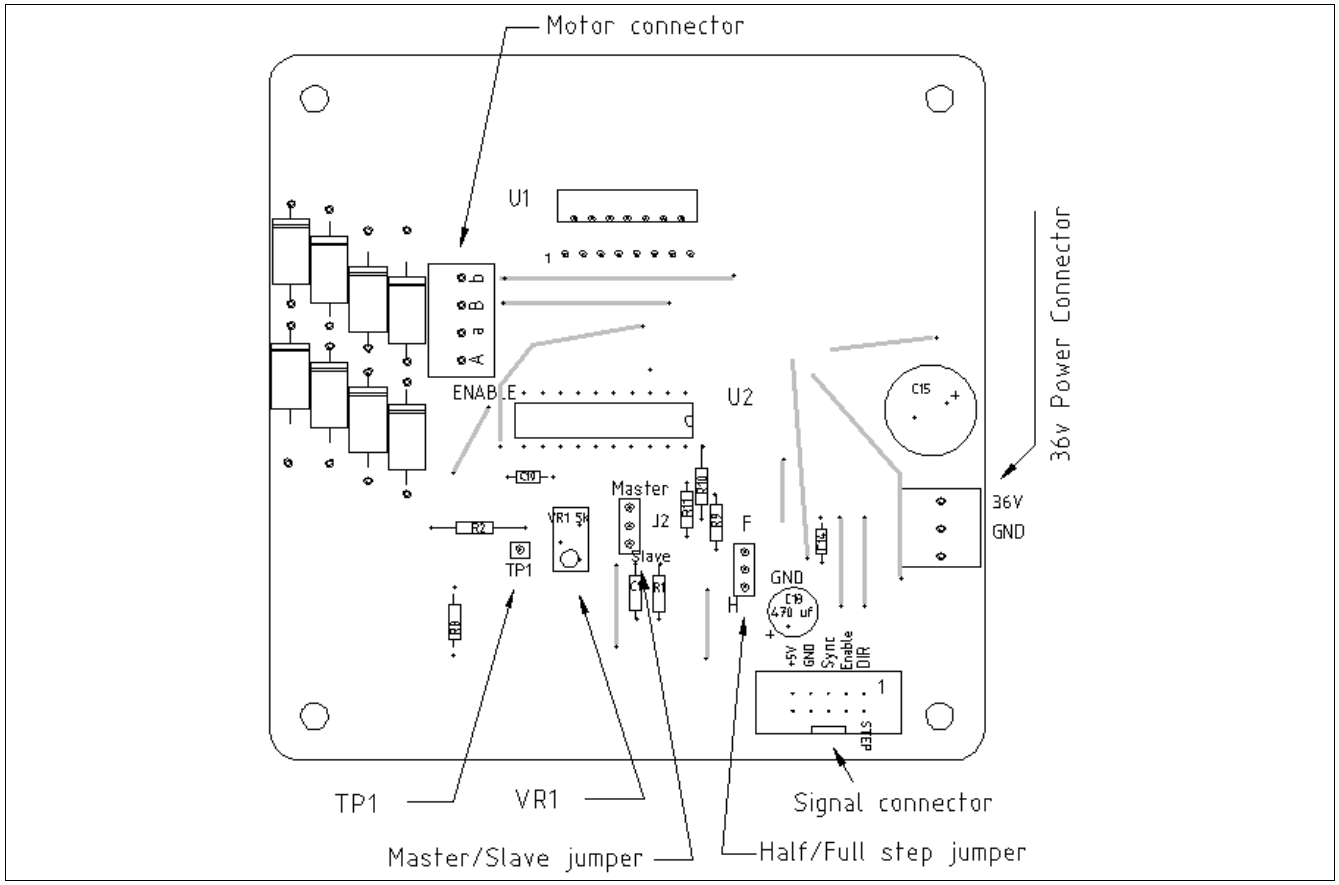
A REFERENCE voltage (at TP1) of 0.56 volts will equal 1.12 amps motor current.

The reference voltage **multiplied** by two is the amps.

or -

The motor current **divided** by two is the Reference voltage.

The reference voltage (at TP1) should be between 0.05 and 1.00 volt. Never more than 1.00. This gives a current range of 0.10 to 2 amps maximum.



The Motor Controller Board