USB Step and Direction Pulse Generator

User Manual

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WARNING: Improper operation of CNC equipment can result in severe injury. Keep hands, fingers, loose clothing, long hair and all other body parts a safe distance away from moving parts.

Parts List

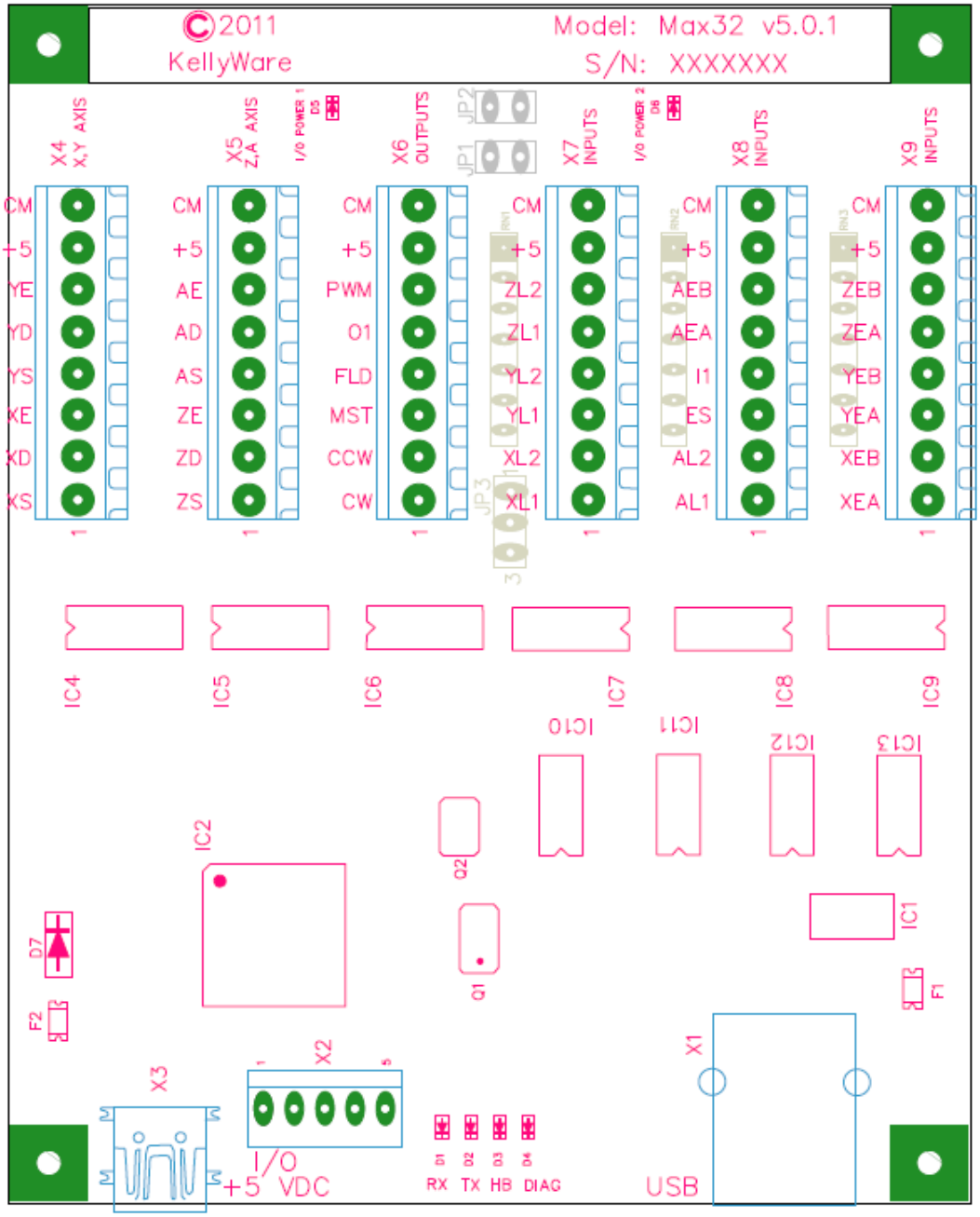
Max32 board
USB A to USB B Cable
5.25 VDC 3 Watt Mini USB AC Power Adaptor

Key Features

- 32 bit Processor for ultra fast motion
- Serial commands through USB Port
- 24-bit motion commands; up to 16,777,215 steps per motion
- 77 Hz to 140 KHz adjustable step rate with 1 Hz resolution
- Four-axis linear interpolation
- Hardware linear ramping in 1 to 10 Hz increments (user adjustable)
- User adjustable ramp up/down for fast sequences
- 3k motion command buffer for fast sequences of motion
- Dual limit switch inputs per axis (TTL or pull-up)
- E-stop input (TTL or pull-up) for instant stop
- Spindle clockwise and counter-clockwise digital outputs for solid state relays
- Flood and mist coolant digital outputs for solid state relays
- User-configured digital output for solid state relays
- One pulse-width modulated or 0-5VDC (un-buffered) analog spindle speed output for spindle motor speed control
- One auxiliary digital input (TTL 5 VDC) for monitoring
- KCam 4 compatible
- X,Y,Z,A Axis outputs: Step, Direction, Enable
- X,Y,Z,A Axis inputs: Forward Limit Switch, Reverse Limit Switch
- Stable motion with any operating system including Win98-Windows 7 32/64-bit
- Output frequency is smooth and consistent regardless of PC operating system load
- All inputs and outputs isolation interface ICs with a 1KV rating for protection between the I/O terminals and the controller/PC for noise immunity and safety
- 32 bit Hardware Quadrature Encoder Counters for all four axis to verify position

Introduction

Max32 is a PC-controlled USB step and direction pulse generator that provides exceptionally smooth operation at a reasonable price. It interfaces a PC running Microsoft Windows and a set of four stepper motor drivers, and uses a microcontroller to convert USB serial commands to pulses. MaxStepper can control auxiliary devices such as relays. It has inputs for monitoring devices or auxiliary switches. Encoders may be used to verify motor position on each axis.



Installation

1. Connect the USB A to B cable to an open USB port at the rear of the PC.
2. Plug in the mini USB AC power adapter to a wall outlet and to Max32's I/O +5 VDC connector.
3. Connect the stepper motor drivers to the X, Y, Z and A axis terminals.
4. Connect the E-Stop switch to the terminals

Setup

1. Start the KCam software.
2. From the **Setup** menu, select **Port Setup**.
3. Select **Serial Port (Max32 v5.xx** (Figure 1).

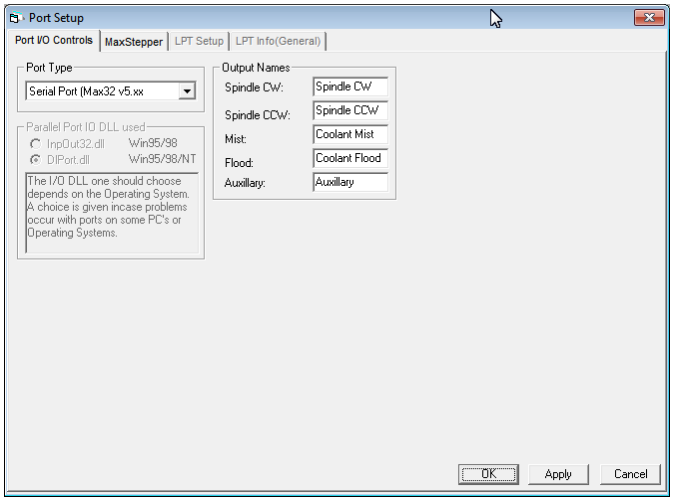


Figure 1

5. Select the **MaxStepper** tab (Figure 2).

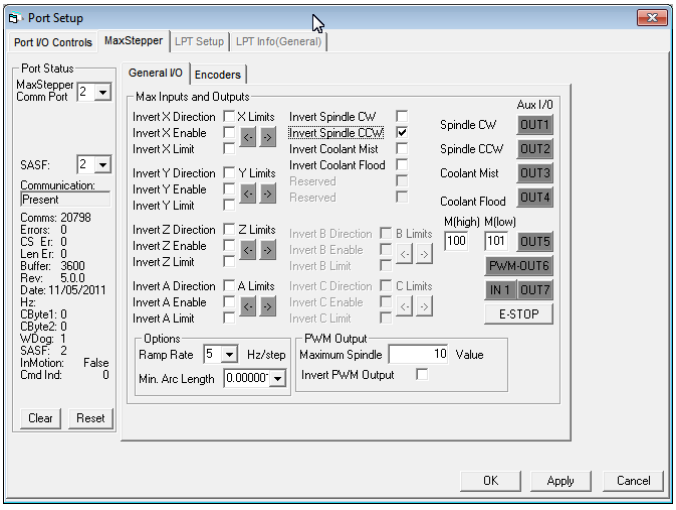


Figure 2

6. Under **Port Status**, select the MaxStepper Comm Port that Microsoft Windows created when the USB cable was connected to Max32. You may need to open Microsoft Device Manager to determine the port number.

7. Make appropriate adjustments to the **Max Inputs and Outputs** and **Encoders** to suit your stepper motor driver requirements.
8. Click **Apply** to save your parameters.
9. You should see the MaxStepper firmware **Rev** and **Date** information in the **Port Status** group.

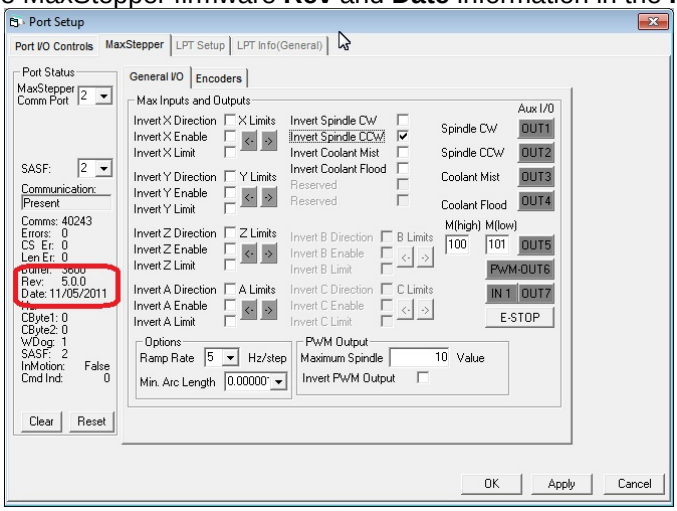


Figure 3

10. Close the **Port Setup** window.

11. From the **View** menu, select **CNC Controls**, and test the motors with the jog buttons. The motors should move as the jog buttons are pressed.

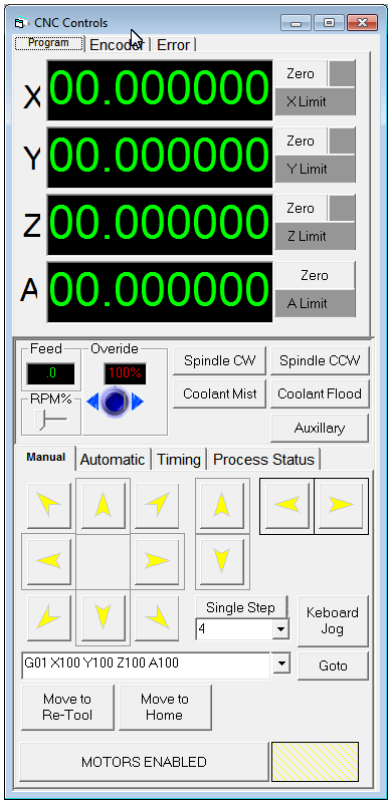


Figure 4

Setup is complete, and you are now ready to use KCam.

Wiring Diagrams

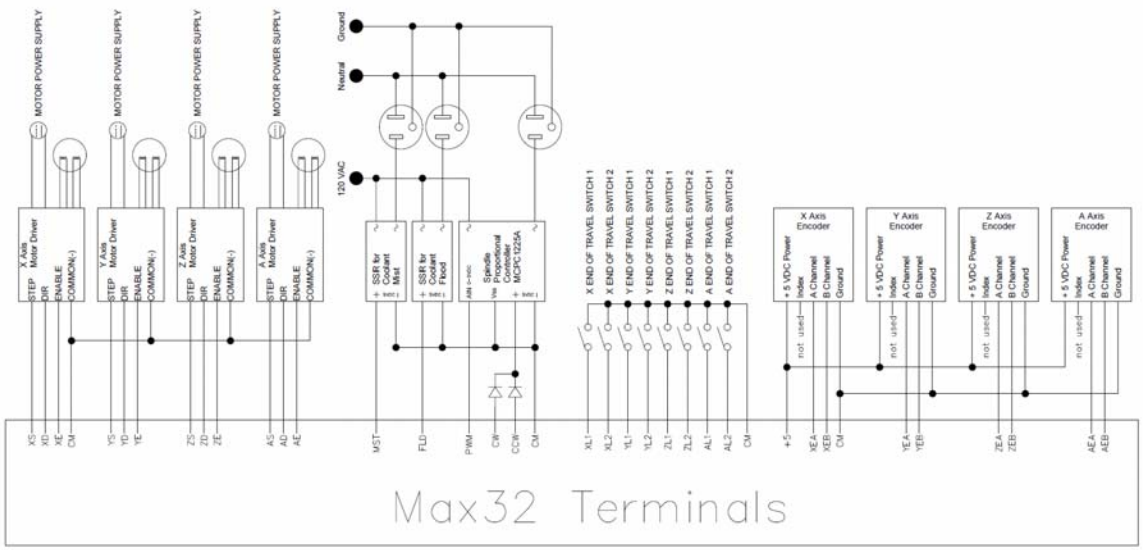


Diagram 1 - Typical Motor Connection

Note: If your motor drivers do not have an enable input, leave the Max32 Enable outputs unused.

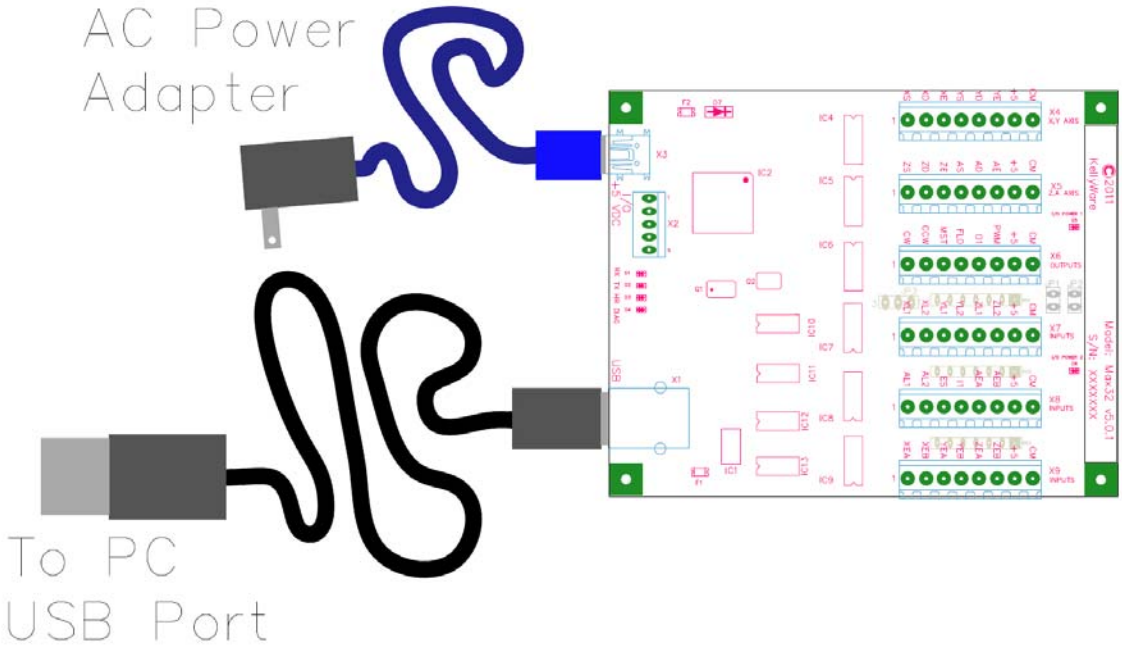


Diagram 2 – PC USB Port and Power Supply Connection

Circuit Board Mounting Pattern

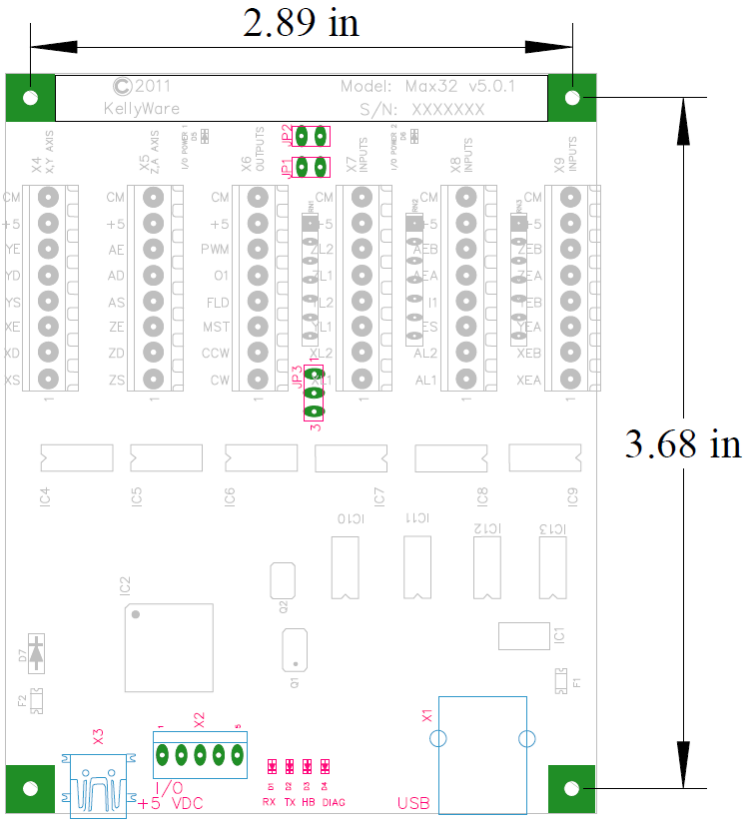
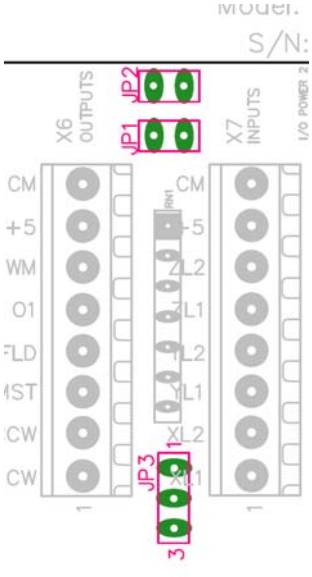


Diagram 3 - Mounting Pattern

Jumper Settings



Jumpers JP1 and JP2 should both have shunts in place when using the supplied AC Adapter to power the Isolated Inputs and Outputs. If you wish to power the Inputs from a separate power supply than the Outputs, remove the shunts from JP1 and JP2 and connect a separate +5 VDC power supply to X7's +5 and CM terminals. Note that the +5 and CM terminals are bussed between X4, X5 and X6. They are also bussed between terminals X7, X8 and X9. Jumpers JP1 and JP2 connect the two busses together. One or Two external power supplies connected to the X4 and X7 terminals may also be used if the supplied AC adapter is not desired.

Jumper JP3 allows removal of the filter capacitor and resistor from the PWM output. When the shunt is placed across Pins 1 and 2, the PWM output is converted to a 0 to 5VDC analog signal. When the shunt is placed across pins 2 and 3, the PWM output is not filtered and can be sent to a device requiring a digital signal. Note that the 0-5 volt filtered analog signal is not buffered. It will not source low impedance loads.

Encoder Parameters

Read Enable option will turn on the encoder software in Max32

Stop on Fault option will cause Max32 to halt motion operations when the encoder position error exceeds the **Max Error**.

Mode parameter sets the encoder quadrature count mode. Typically 1X mode is used.

- **1X** quadrature count mode (one count per quadrature cycle).
- **2X** quadrature count mode (two counts per quadrature cycle).
- **4X** quadrature count mode (four counts per quadrature cycle).

C. Factor is a multiplier used to recalculate the Encoder Counts so that Encoder CPR will match Step Counts. The Encoder Counts = C.Factor x Encoder Pulses.

Max Error is the maximum allowed error between the encoder position and the step count before a position fault is set. Position faults are latched on and must be cleared manually. Position faults can be cleared by setting the axis position, setting the encoder position or homing the table.

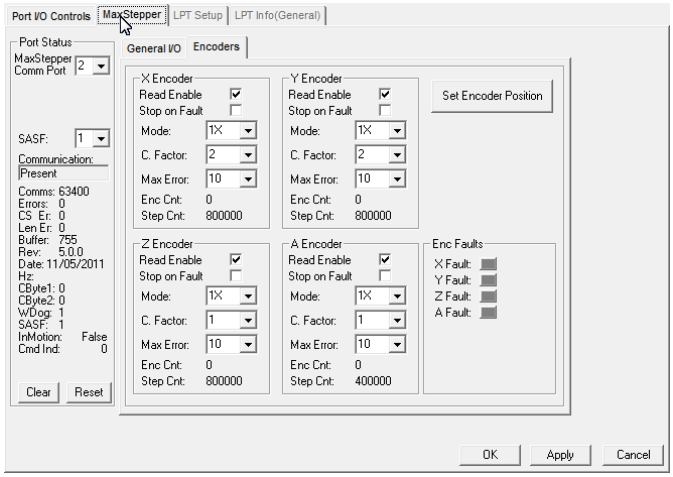


Figure 5

Example 1:

Stepper Motor Axis Specs: full step mode, 200 Steps per Rev, 2000 SPI
Encoder Specs: 200 CPR in 1X mode
Mode=1X, C. Factor = Motor SPR / Encoder CPR = 200/(200*Mode) = **1**
Max Error = 10 (steps) , (10+1)//2000 = .0055”

Example 2:

Stepper Motor Axis Specs: ¼ step mode, 800 Steps per Rev, 8000 SPI
Encoder Specs: 1000 CPR in 1X mode
Mode=1X, C. Factor = Motor SPR / Encoder CPR = 800/(1000xMode) = **.8**
Max Error = 10 (steps) , (10+1)//8000 = .001375”

Example 3:

Stepper Motor Axis Specs: ¼ step mode, 800 Steps per Rev, 8000 SPI
Encoder Specs: 1000 CPR in 1X mode
Mode=4X, C. Factor = Motor SPR / Encoder CPR = 800/(1000xMode) = **.2**

Max Error = 10 (steps) , (10+1)/8000 = .001375”

Troubleshooting

Problem	Solution
I just installed Max32. The Status bar shows “**MaxStepper Failure**” and the Port Setup Window shows an increasing number in the Error status.	Make sure Max32 is connected properly to a working USB port on the PC. Verify and correct the KCam communication port configuration that matches the port in the Microsoft Device Manager.
When I press the jog buttons, the position displays show change, but the motors do not move.	• Check and correct any mistakes with the wiring to the stepper motor drivers. • Is the enable wire connected? Drivers may need this to operate the motors. • The enable output may be inverted. If so, reverse the setting in the **Port Setup** window. • Make sure power is applied to the stepper motor drivers. • If the axis limit switches are displayed as set and limits are not engaged, reverse the **Invert *Axis* Limit** as needed. • Check the E-Stop switch circuit. It should be closed during normal operation.
The stepper motors move, but one or more are running backwards.	Reverse the **Invert *Axis* Direction** in the **Port Setup** window as needed.
The stepper motors move, but one or more do not stop with limit switches.	Verify the Limit Switch wiring by manually testing the switches and reviewing the limit buttons in the Port Setup window. Reverse the **Limit Switches Disabled** in the **Table Setup** window.
The stepper motors move, but one axis occasionally goes in the wrong direction.	Swap the step and direction wires to the stepper motor driver for that axis.
The spindle speed output does not work with my Solid State Relay (SSR).	A special type of SSR is required for spindle speed control. A Crydom MCPC1225A Proportional Controller SSR or similar model along with JP3 set correctly will convert the PWM signal on terminal X6 to a variable 110 VAC power source for a spindle motor or Dremel tool.
A “**Max Fault**” occurs when jogging	Turn off the **Stop on Fault** option in the **Port Setup** window until encoder feedback is verified or increase the **Max Error** parameter. Encoder feedback can be corrected by adjusting the **C. Factor** until **Enc. Cnt** matches the **Step Cnt** when jogging. Use the **Set Encoder Position** or axis **Zero** button prior to jog tests to match the step and encoder values.