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## The Z-Bot Jog Dial

The Jog Dial is a manual pulse generator (MPG) used to jog any axis on CNC mills through a PC controller. It hooks up through standard interface pins to any PC based controller software that supports MPGs. The dial is indexed with 100 detents per revolution. As the dial is turned, an internal optical encoder generates precise pulses which are interpreted by the software for distance and direction. Typically, each detent is assigned a jog distance of 0.001", making a full rotation of the dial 0.1".

These instructions describe how to hook up the Z-Bot Jog Dial with Mach3 CNC Control Application software. The Z-Bot Jog Dial works with any PC based controller software that supports MPGs. If you don't use Mach3, you will need to do the same things described in these instructions, but adapted for your software.

Manual pulse generators typically send coded signals to the controller through pins in the parallel port. Each Jog Dial you use will require two input pins; one for the A channel and one for the B channel. When operating, the Jog Dial pulses each of these channels in such a way as to allow the software to determine the direction and distance the dial has moved. Each click of the dial's detent mechanism generates a fixed number of combined pulses on the A and B channels. Typically configured, each click of the dial will jog a selected axis a designated distance.

### Requirements

To hook up a Jog Dial you will need the following:

A 5v dc power supply	Many parallel port breakout boards have an auxiliary +5v DC power supply that you can use for the Jog Dial. If you don't have one of these, check your old cell phone wall chargers; many of these are 5v. Or, take a trip to Radio Shack and pick up an inexpensive 5v DC plug-in power supply to use for the Jog Dial.
Two available parallel port input pins	There are five input pins on parallel port 1 (pins 10, 11, 12, 13, 15) and also on port 2 if you have one. Additionally, you can configure pins 2-9 on port 2 to be inputs in Mach3.
Configuration information	You need to know the input port and pin numbers you are using for channels A and B. The Jog Dial generates 4 counts per unit.
Wire hook-ups	There are a variety of ways to connect wires into a parallel port. Many stepper and servo controller boards already have

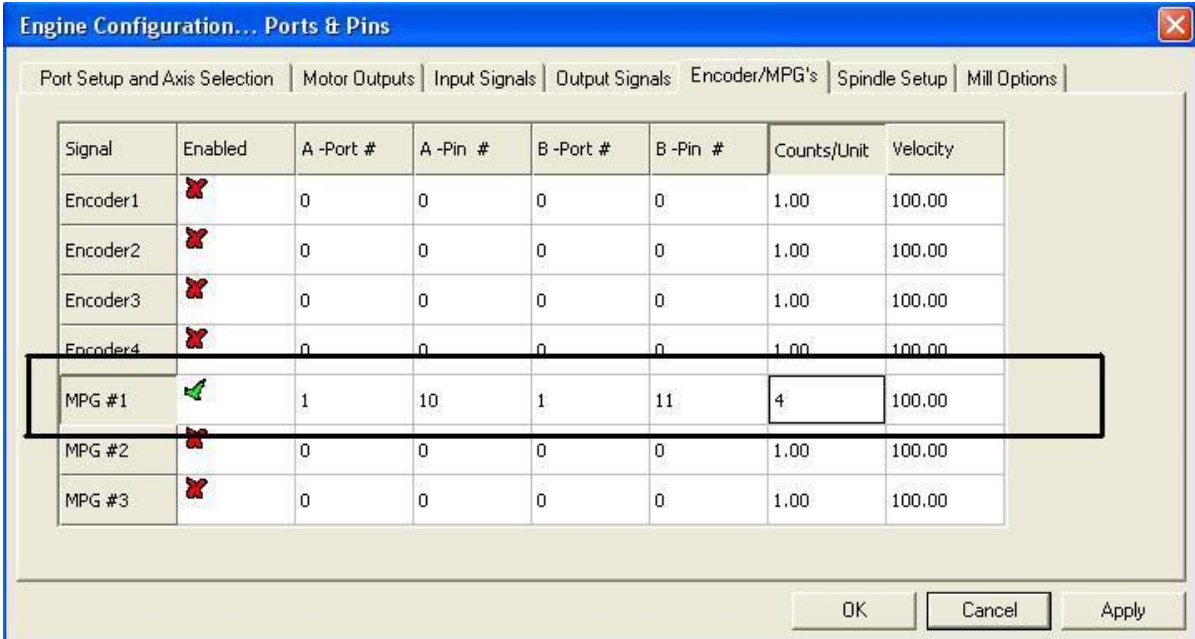
screw-down connectors for unused parallel port pins. Breakout boards also supply screw-down connectors for wire leads. The cheapest and sloppiest way is to simply tap into the cable and find the wires for the pins you want to use. A continuity tester, or battery and bulb will help you find the right wires. If you look closely, most DB-25 connectors for parallel ports have labeled pin numbers on them.

### Installing the Z-Bot Jog Dial with Mach3 and a Parallel Port

Follow these steps to configure Mach3 and connect the Z-Bot Jog Dial to a parallel port.

#### Configure Ports & Pins

1. In the Mach3 CNC Control Application, on the Config menu, choose Ports and Pins. The Engine Configuration Ports & Pins dialog appears.
2. Click the Encoder/MPG's tab.



3. On the MPG #1 line, click in the Enabled box. The red X turns into a green check mark.
4. On the MPG #1 line, enter the port and pin numbers that you have selected for the A and B channels. In the example dialog box above, channel A is on pin 10 of parallel port 1 and channel B is on pin 11 of parallel port 1. Enter your values into these boxes.
5. On the MPG #1 line, in the Counts/Unit box, enter 4.
6. Click Apply and then click OK to close the dialog box.

## Configure the MPG jog parameters

1. In the Mach3 CNC Control Application, press the Tab key. The MPG Mode software pendant appears on the right side of the screen.
2. Click the Jog Mode button. The yellow software LED above MPG lights as shown. If the LED does not light, there is a problem with the configuration. Go back and check steps 1 through 6.
3. Notice the MPG Axis settings in the middle of the software pendant. Each time you press Alt-A or click the Alt A button the axis that the Jog Dial controls will change to the next axis you have available. Click the Alt A button to set this to the axis you want to test. The example is set for the X axis.
4. Click the Mode button in the upper left of the software pendant to set the Jog Mode to Multistep. Now each time the dial is turned one detent the axis will move by the amount showing in the Cycle Jog Step box. Leave this at 0.0010 for now.

Tip: You can configure the Cycle Jog Step from the Config->State menu if you want to change the increments you can choose from when you toggle through the selections.

## Mounting the Jog Dial

The Jog Dial can be mounted on a control panel or used as a pendant.

## Mount the Jog Dial to a Control Panel

The Jog Dial mounts to a control panel using M4x5 machine screws.

1. Mark out the hole locations on a clear area of the control panel. Use the drawing at the end of this document to locate the holes.
2. Drill 4.4 mm (0.173") diameter holes at the three marked locations around the perimeter. A number 17 drill is the correct size.



3. Drill a ¼” hole at the position marked below and to the left of center for the wires to pass through.
4. Pass the wires through the clearance hole and mount the Jog Dial using three M4x5 machine screws.

### Configure the Jog Dial as a Pendant

To use the Jog Dial as a pendant you must add a shielded multi-wire cable.

1. Fasten a 4-position terminal barrier strip to the back of the Jog Dial. The part of the dial under the engraved numbers around the perimeter is solid Delrin and is suitable for drilling, tapping, and mounting. Do not drill in any part of the back of the Jog Dial that is under the dial as it will interfere with the electronics and/or the detent mechanism.
2. Connect the wires from the Jog Dial to the cable wires using the terminal barrier strip. Connect the cable shield to the brown ground wire from the Jog Dial.
3. Ensure that there is a good mechanical connection between the shielded cable and the Jog Dial so that tension is not taken by the conductors.



### Hook up the Jog Dial leads



A simplified hookup is shown here to illustrate the proper connections. It shows a very simple breakout board and a 5V plug-in power supply from a cell phone. This breakout board simply has screw downs for each pin on the parallel port. Most CNC breakout boards have a +5V power supply (and lots of other safety factors) integrated into them.

Lead Color	Function
Orange	+5v
Brown	0v (ground)
Blue	A channel
Yellow	B channel

1. Hook the blue lead from the Jog Dial to the pin on your parallel port breakout board that you selected for channel A in Mach3.
2. Hook the yellow lead from the Jog Dial to the pin on your parallel port breakout board that you selected for channel B in Mach3.
3. Hook the brown wire to the minus (-) or 0V terminal of the power supply and the ground terminal on your parallel port breakout board.

Note: Tying all the grounds together is very important so that the PC and the Jog Dial share a common ground.

4. Hook the orange wire to a source of +5v.

TIP: If you are using a plug-in power supply (or cell-phone charger), it will have two leads, one is +5V and the other is ground or 0V. Most (but not all) plug-in power supplies are tip positive, meaning that the wire that goes to the center of the barrel connector is the +5V wire. Check the diagram on the unit, or use a volt meter to be sure. Many times the ground wire is braided around an insulated core wire. Pull the braid apart and then twist it together. The +5V wire connects to the orange Jog Dial wire. The ground wire connects to the brown Jog Dial wire.

### **Testing the Jog Dial**

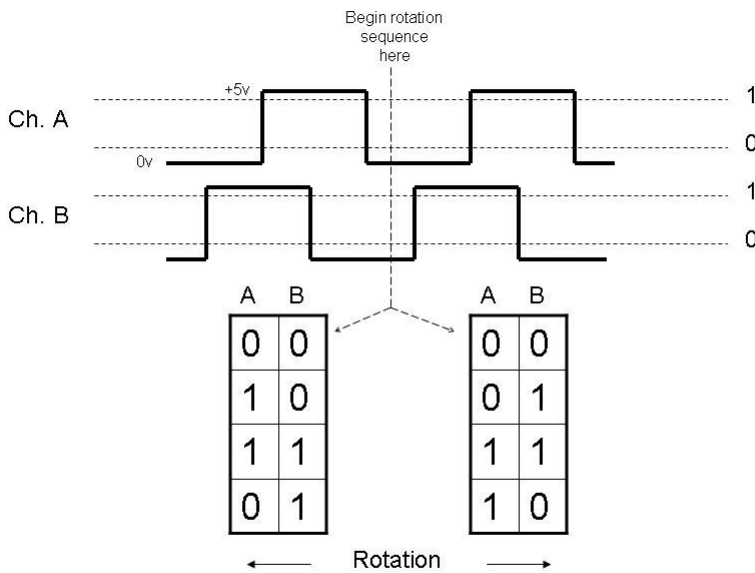
1. Apply power to the Jog Dial and your CNC system.
2. If the configuration settings are as shown above, the X axis will move 0.001" per click as you turn the Jog Dial. Turn the Jog Dial clockwise. The X axis moves in the positive direction.  
Tip: If it moves the wrong way, simply switch the yellow and blue wires to correct it.
3. Look at the DRO on the Mach3 CNC Control Application as you turn the Jog Dial. It changes 0.001 for each click of the Jog Dial. If it doesn't, check the following settings.

Setting	Value	Where
Counts/Unit	4	Ports & Pins, Encoder/MPG's tab
Cycle Jog Step	0.0010	Software pendant
Mode	Multi-Step	Software pendant

4. Press Alt-A to change to the next axis in your setup. Turn the Jog Dial clockwise and ensure that the axis moves in the positive direction.

### How the Jog Dial works

An MPG such as the Z-Bot Jog Dial is a digital device, which means that the electrical signals being transmitted are interpreted as either a value of 0 or a value of 1 by the computer. Voltage levels determine whether the computer will see a signal as a 1 or a 0. Inside the Jog Dial there are electronics synchronized with the dial and detent that generate two signal streams known as square waves. These are termed Channel A and Channel B. Each of these channels transmits an identical square wave, but (this is the important part) one of the channels is offset so that clockwise and counter-clockwise movement generate different data streams of ones and zeros when you look at channel A and channel B together as the dial is turned.



As you can see from the illustration above, both the left side and right side data streams start at a point when A and B are both zero. When the dial is turned in one direction, say to the left arrow on the diagram, A goes high (or to 1) before B. If you turn the dial the other way, say to the right, B goes high before A. In fact, you can start at any common point in the signal path, and the next set of values to the right will differ from the next set of values to the left. You will also notice that there are four different values that A and B together can make (00, 01, 10, or 11). For this reason this method is known as quadrature encoding. Each time one of the values changes, it is interpreted as a pulse by Mach3. The Jog Dial generates 4 pulses as the dial goes from detent to detent, or click to click.

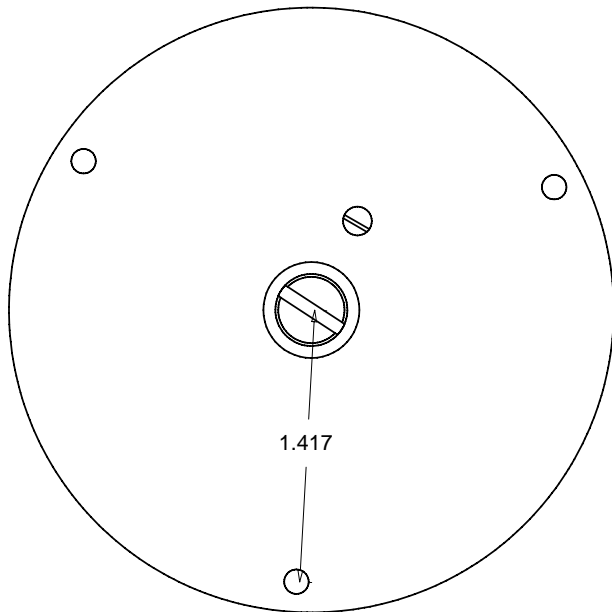
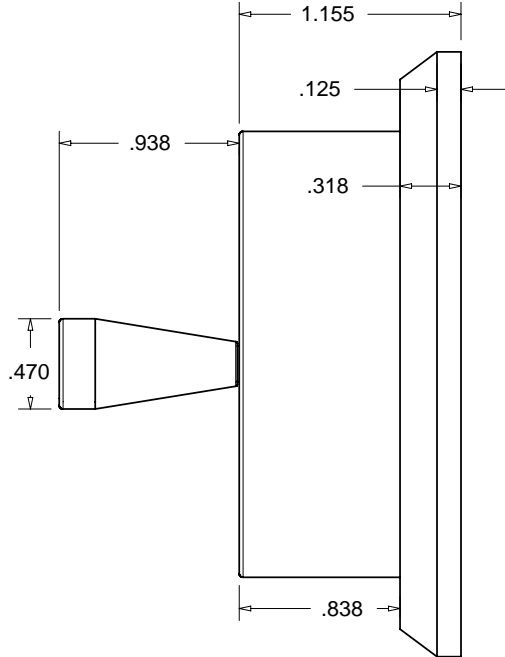
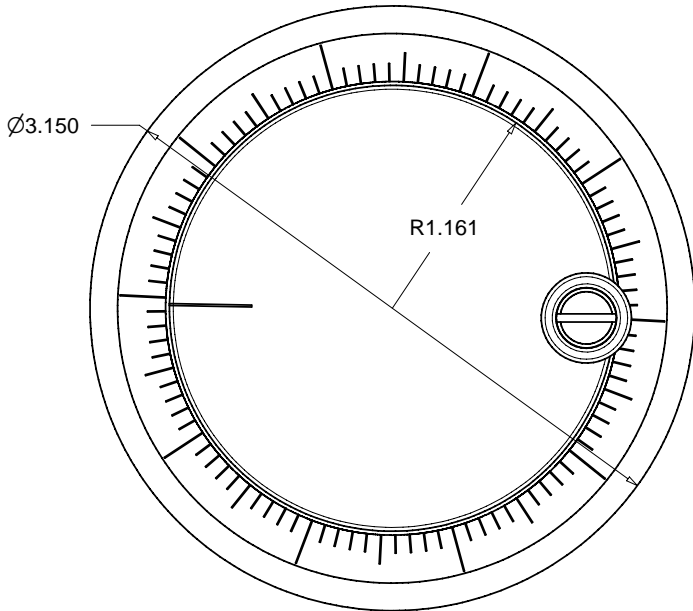
If you are confused or your questions are not answered in these instructions, please email your questions to [support@homecncontrol.com](mailto:support@homecncontrol.com).

# The Jog Dial

## Preliminary Data Sheet

Manufactured by:  
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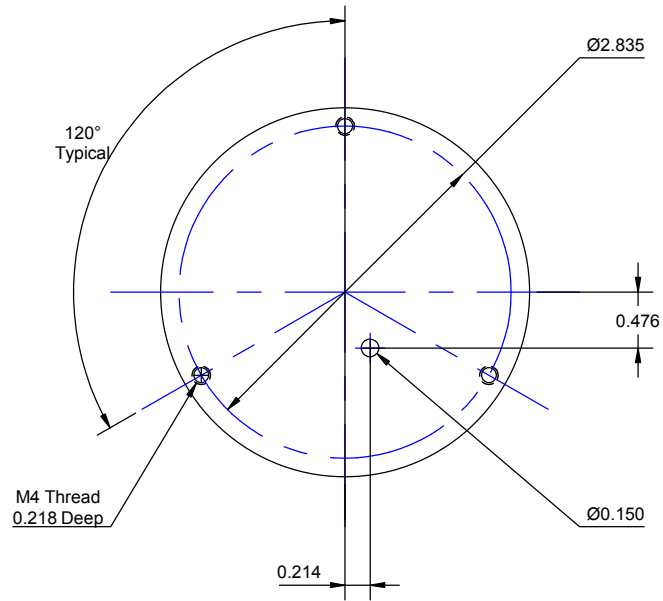
Rear Mounting screw template  
 drawn to scale

### Spec Summary

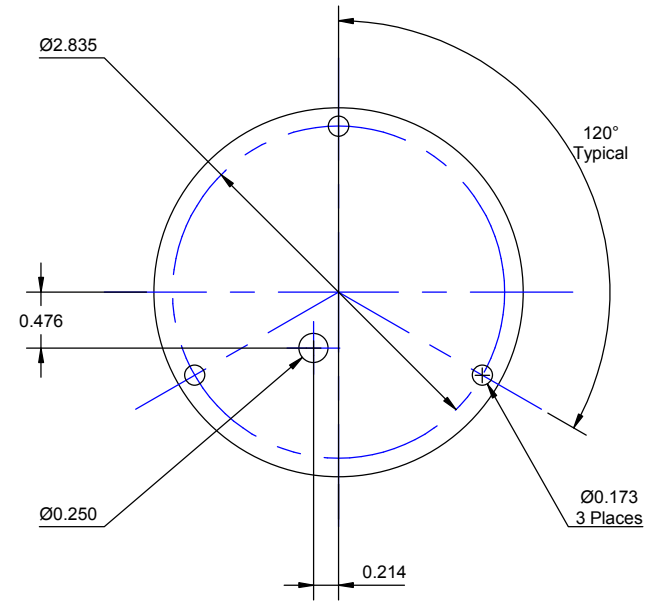
<b>Material :</b>	<b>Black Delrin</b>
<b>Cycles per Revolution :</b>	<b>100</b>
<b>Counts per Revolution:</b>	<b>400</b>
<b>Counts per Unit:</b>	<b>4</b>
<b>Detents per Revolution:</b>	<b>100</b>
<b>Detent Mechanism:</b>	<b>Mechanical</b>

<b>Wire Leads:</b>	<b>Orange</b>	<b>+5v</b>
	<b>Blue</b>	<b>A quadrature</b>
	<b>Orange/White</b>	<b>0V</b>
	<b>Blue/White</b>	<b>B Quadrature</b>





**Back of Jog Dial**



**Mounting hole pattern**

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**Jog Dial Mounting**

Revision 0

**2938**

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