



# Quadra-Step<sup>®</sup> Setup Guide



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# Conventions & Terms

System refers to the software and stepper amplifier, or QC4000 or QC5000 and any associated measuring devices.

### Icons

This guide uses the following icons to highlight information:

#### WARNING



The raised hand icon warns of a situation or condition that can lead to personal injury or death. Do not proceed until the warning is read and thoroughly understood. Warning messages are shown in bold type.

#### CAUTION



The exclamation point icon indicates a situation or condition that can lead to equipment malfunction or damage. Do not proceed until the caution message is read and thoroughly understood. Caution messages are shown in bold type.

#### NOTE



The note icon indicates additional or supplementary information about an activity or concept. Notes are shown in bold type.

## Safety & Maintenance

General safety precautions must be followed when operating the system. Failure to observe these precautions could result in damage to the equipment, or injury to personnel. It is understood that safety rules within individual companies vary. If a conflict exists between the material contained in this guide and the rules of a company using this system, the more stringent rules should take precedence.

Metronics strongly recommends that you read all parts of this guide and keep it in a convenient location for future use.



#### WARNING

To reduce the risk of electrical shock, do not remove the amplifier cover. There are no user-serviceable parts inside. Please refer servicing to qualified personnel.

Unplug the unit before cleaning. The surfaces should be free of dust, dirt and oil. Use only a cloth dampened with non-abrasive detergent for cleaning the exterior surfaces.

Place the unit on a stable, reliable surface. If the unit should fall, it could become seriously damaged and more importantly could cause injuries to the user.



### **WARNING**

**This unit is equipped with a 3-wire power plug that includes a separate ground connection. Always connect the power plug to a 3-wire grounded outlet. The use of 2-wire power plug adapters or any other connection accessories that remove the third grounded connection create a safety hazard and should not be permitted. If a 3-wire grounded outlet is not available, ask your electrician to provide one.**

Do not locate the unit where the power cord can be walked on or create a tripping hazard.

Unplug the unit from the wall outlet and seek the assistance of a qualified service technician if:

- The power cord is frayed or damaged or the power plug is damaged
- Liquid is spilled or splashed onto the enclosure
- The stepper amplifier has been dropped or the exterior has been damaged
- The stepper amplifier exhibits degraded performance or indicates a need for service some other way

Contact your Metronics dealer for service.

### **Important FCC Notice**

FCC Rule NP15R, Rev. 23 Jun. 89

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Shielded cables must be used with this unit to ensure compliance with Class A FCC limits.

**This Class “A” digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations**

**Cet appareil numérique de la classe “A” respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.**

## Guide Part Number

Guide Part Number: 11A10475

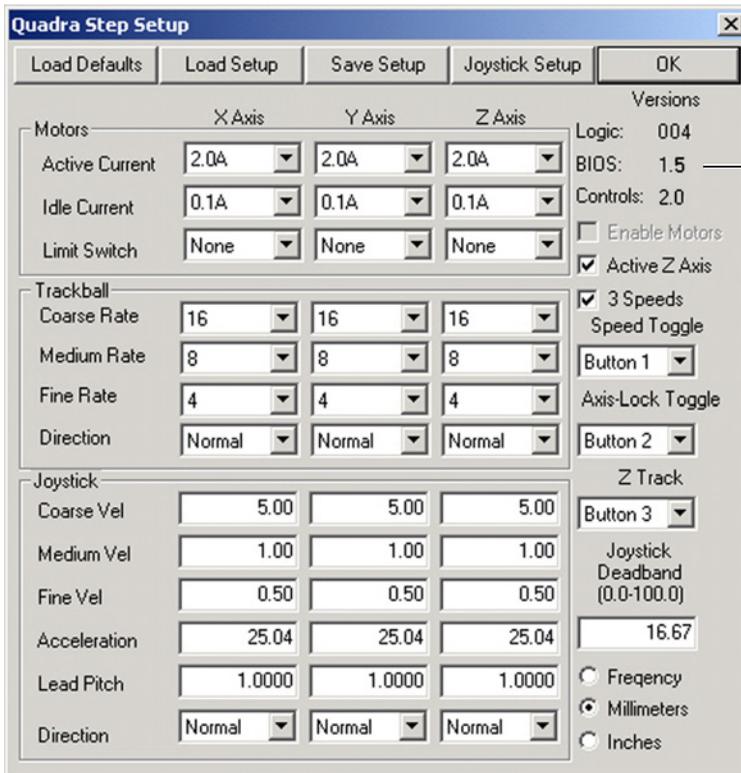
## Guide Printing History

First printing: Revision 3 May, 2003

## Software Version

Quadra-Step Software Version: 2.00

This version of software is intended for Windows 95 and newer operating systems and Quadra-Step amplifier BIOS versions 1.4 and 1.5.



The Quadra-Step amplifier BIOS version is identified in the Quadra-Step Setup dialog box.

Quadra-Step amplifier BIOS version



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## Setup Instructions

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# Setup instructions

This section contains step-by-step instructions for the setup of the stepper amplifier box for use with a QC4000 or QC5000. You can create different setups for different machines or use a setup that you previously created to setup many systems.

Step 1  
Turn the system OFF.

Step 2  
Make sure the power switch on the Stepper Amplifier Box is in the OFF position.

Step 3  
Connect one end of the cable to the I/O port in the back of the QC-4000 or QC5000.

Step 4  
Connect the other end of the cable to the RS-232 port on the back of the amplifier box.

Step 5  
Power up the QC-4000 or QC5000.



## NOTE

**If you have the QC-4000 or QC5000 in your start-up window you will need to Exit to the Windows program manager.**

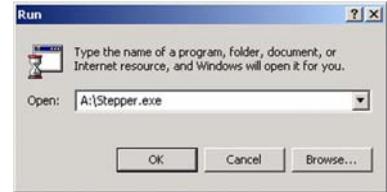
Step 6  
Turn on the Stepper Amplifier Box.

Step 7  
Insert the Quadra-Step diskette into the floppy drive

Step 8  
Select Run from the File menu. The Run dialog box will appear

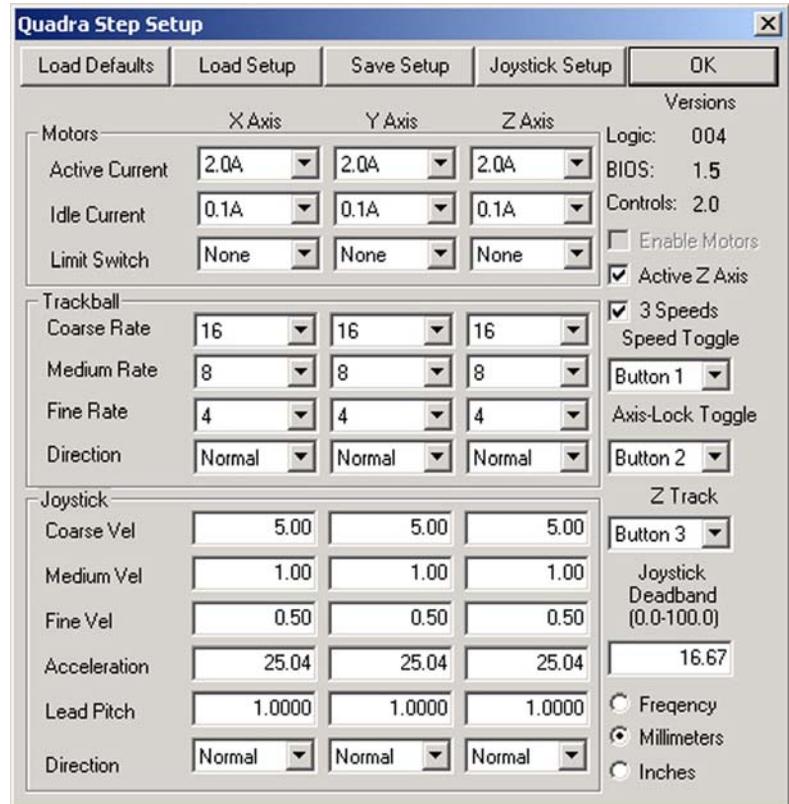
Step 9  
Type a:stepper.exe  
(or b:stepper.exe) and press OK.

The following screen will appear:



### NOTE

Your parameters may appear different than pictured below.



### NOTE

If you have a previously created Setup, select Load Setup, then select and load the appropriate configuration. Skip steps 10 through 21 and go directly to step 22.

Step 10

If necessary, disable the motors by left clicking on the *Enable Motors* box. Make sure there is no check in the box.

Step 11

Select the units of measure (Frequency Millimeters or Inches.)

Step 12

Enter the Pitch of the Lead screw.

Step 13

If you have a Z axis, Enable Z Axis by left clicking on the blank box. A check mark in the box indicates Z is enabled.

Step 14

If you want to cycle through three speeds (Coarse, Medium, Fine) rather than two (Coarse, Fine), enable the three speed option by placing a check in the blank box. A check indicates that your Quadra Step is set for three speeds. Both the joystick and trackball will be three-speed enabled.

Step 15

Enter the Current Rating of your motors in the *Active Current boxes*. (Motors are usually labeled with this information.)

Step 16

Enter the amount of Current needed to keep the motors in a holding position in the *Idle Current boxes*. This should always be set to a very low number, (0.1A) unless a higher number is needed.



**CAUTION**

**Setting your Idle Current too high, could cause severe damage to your motors.**

Step 17

If your system includes limit switches, set the switches for *Normally Low* or *Normally High*.



**NOTE**

**Selecting the wrong limit switch will not harm your system. If your limit switch is set incorrectly, your motors may not work. Select the other one and try your motors again.**

Step 18

If your system is equipped with a trackball, set the Coarse Rate, Medium Rate, Fine Rate and Direction.

Step 19

**Set joystick** — Enter in the appropriate Velocity, Acceleration and Direction for your joystick.



**NOTE**

**If your QC-4000 or QC5000 was purchased with Quadra-Step installed, you might need to calibrate your joystick. If you have recently purchased Quadra-Step, you will need to calibrate your joystick. Please refer to *Joystick Setup* later in this document.**

Step 20

**Enable Speed Toggle**

This allows you to set the joystick button(1,2,3) for toggling between speeds. If “3 speeds” is enabled, then you can toggle between three speeds; if “3 speeds” is not enabled, you will only be able to toggle between two speeds (Coarse, Fine).



**NOTE**

**After exiting the Quadra-Step, you will need to set the same joystick button in your QC-4000 or QC5000. The Button setup is located under Button in the Supervisor Setup Menu.**

Step 21

**Enable Axis Lock**

This allows you to set the joystick button (1, 2, 3) for toggling the axis lock on and off. When the axis lock option is toggled on, only one axis can be in motion at any one time.

Step 22

**Enable Z Track**

This allows you to set the joystick button (1, 2, 3) for toggling the Z track on and off. When the Z track is toggled on, the track ball will move the Z axis. To deactivate the Z track: toggle the button again OR move the joystick (this will deactivate the Z track).

Step 23

**Save Setup**

Select the “Save Setup” button. Using the keyboard, enter a file name with a **.cfg** (configuration) extension. The file will be saved to the chosen directory and can be loaded by selecting the “Load Setup” button.

Step 24

Turn motors **ON**

Left click on the Enable Motors. A check mark in the box indicates motors are on.

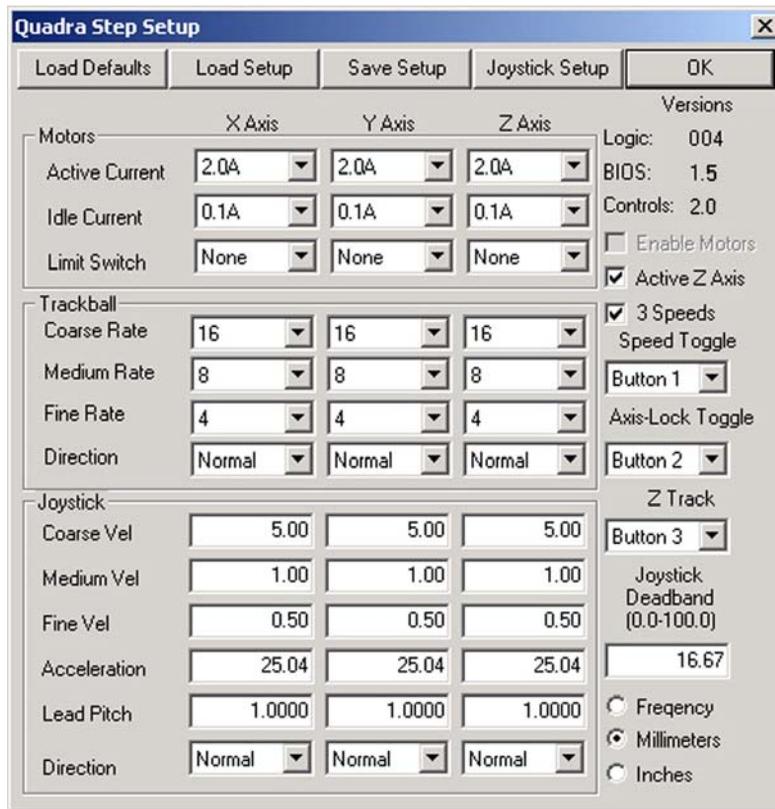
Step 25

Exit Quadra Step setup screen by clicking on the **OK** button.

The configuration of your amplifier box is now complete. Please see the next page for the Joystick calibration as well as more in-depth information of the Quadra Step Setup Screen.

# Setup functions

Quadra-Step setup functions are performed by clicking buttons across the top of the setup screen or by entering configuration parameters into data fields.



The image shows a software dialog box titled "Quadra Step Setup". At the top, there are five buttons: "Load Defaults", "Load Setup", "Save Setup", "Joystick Setup", and "OK". The dialog is organized into several sections:

- Motors:** A table with columns for X Axis, Y Axis, and Z Axis. Rows include "Active Current" (set to 2.0A), "Idle Current" (set to 0.1A), and "Limit Switch" (set to None).
- Trackball:** A table with columns for X Axis, Y Axis, and Z Axis. Rows include "Coarse Rate" (16), "Medium Rate" (8), "Fine Rate" (4), and "Direction" (Normal).
- Joystick:** A table with columns for X Axis, Y Axis, and Z Axis. Rows include "Coarse Vel" (5.00), "Medium Vel" (1.00), "Fine Vel" (0.50), "Acceleration" (25.04), "Lead Pitch" (1.0000), and "Direction" (Normal).
- Right Panel:** Contains "Versions" (Logic: 004, BIOS: 1.5, Controls: 2.0), checkboxes for "Enable Motors" (unchecked) and "Active Z Axis" (checked), "3 Speeds Speed Toggle" (checked) with "Button 1" selected, "Axis-Lock Toggle" with "Button 2" selected, "Z Track" with "Button 3" selected, and "Joystick Deadband (0.0-100.0)" set to 16.67. At the bottom are radio buttons for "Frequency", "Millimeters" (selected), and "Inches".

### Loading previous configurations

Click the Load Setup button to select a previously created Quadra-Step configuration. Press OK to automatically insert the setup parameters into a new setup.

### Saving new configurations

Click the Save Setup button to save the current setup parameters shown on the screen. When the Save As dialog box appears, type a name in the File Name box then click OK. The setup parameters will be saved to a configuration file.

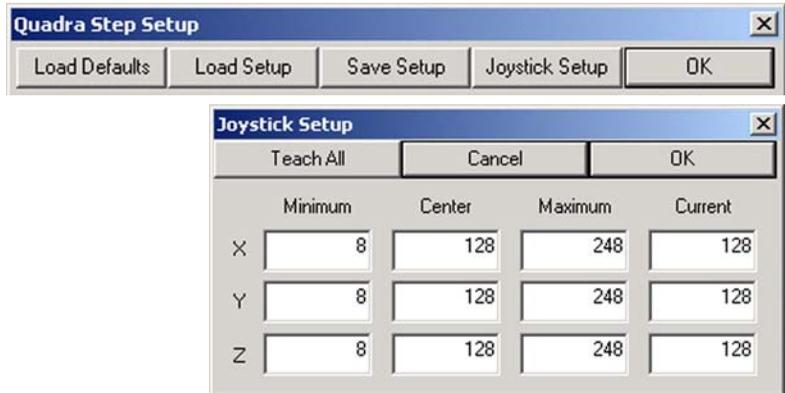
**Loading the factory default configuration**

Click the Load Defaults button to reset all parameters to the factory defaults. Be sure that your current setup is saved if you intend to use it again.

**Joystick setup**

Before using the joystick, it is necessary to calibrate or “Teach” your joystick. Calibrating the Joystick will send the stepper amplifier the electronic “Signature” of the particular joystick you are using.

Click the Joystick Setup button to display the Joystick Setup dialog box.

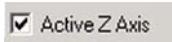


- Click the **Teach All** button and follow the instructions to calibrate your joystick.
- Move joystick to the **RIGHT**, then press **OK**
- Move joystick to the **LEFT**, then press **OK**
- Move joystick **UP**, then press **OK**
- Move joystick **DOWN**, then press **OK**
- Move Z-axis joystick to the **MAXIMUM**, then press **OK**
- Move Z-axis joystick to the **MINIMUM**, then press **OK**



**NOTE**

Z-axis calibrations are only necessary when the **Active Z-Axis** box is checked.



- Center Joystick, then press **OK**.

## Setup Instructions

### Motor configuration

Motor configuration parameters for the X, Y and Z axes are entered into the Active Current, Idle Current and Limit Switch data fields of the Motors group.

Motors	X Axis	Y Axis	Z Axis	
Active Current	2.0A	2.0A	2.0A	Logic: 004
Idle Current	0.1A	0.1A	0.1A	BIOS: 1.5
Limit Switch	None	None	None	Controls: 2.0
				<input type="checkbox"/> Enable Motors
				<input checked="" type="checkbox"/> Active Z Axis

Active current

Enter the Current Rating of your motors. (Motors are usually labeled with this information.)

Idle current

This is the amount of Current needed to keep the motors in a holding position. This should always be set to a very low number, (0.1A) unless a higher number is needed.



#### CAUTION

**Setting your Idle Current too high, could cause severe damage to your motors.**

Limit switch

If your system includes limit switches, set the switches for *Normally Low* or *Normally High*.



#### NOTE

**Selecting the wrong limit switch will not harm your system. If your limit switch is set incorrectly, your motors may not work. Select the other one and try your motors again.**

Enable motors

This will turn the axis motors off or on. You must turn the motors OFF when setting your parameters. After parameters are set, check the Enable Motors box.

## Trackball configuration

The Trackball or Digital Positioner as some people call it, is independent of the joystick inputs. It is possible to have both a joystick and trackball installed in the QC4000 or QC5000.

Trackball configuration parameters for the X, Y and Z axes are entered into the Coarse Rate, Medium Rate and Fine Rate data fields of the Trackball group.

Coarse rate

Controls the coarse rate of movement with the trackball. The number indicates, in stepper motor steps, the distance that a single pulse from the trackball will move the stage along the selected axis. For a coarser rate of travel increase this number; for a finer rate of travel decrease this number.

Medium rate

Used to control medium movement with the trackball. The 3 speed box must be checked.

Fine rate

Used to control extra fine movement with the trackball.

Direction

This is used to specify whether the trackball will move in the direction of the stage or the direction of the Crosshair.

Speed toggle and 3 speed checkbox

This allows the user to toggle between normal velocity, medium velocity and fine positioning modes.

Z track

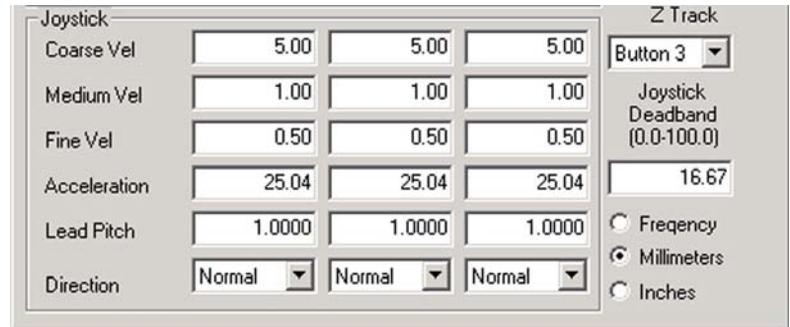
If you enable this option by assigning it to a button, and then toggle the selected button, the Z axis (and only the Z axis) can be controlled with the track ball.

## Setup Instructions

### Joystick configuration

The joystick controls the motion of each axis. The response to joystick movement can be tailored. The setup screen allows you to specify the direction of movement, and velocity at different amounts of joystick displacement.

Joystick configuration parameters for the X, Y and Z axes are entered into the Coarse Vel, Medium Vel, Fine Vel, Acceleration, and Lead pitch data fields of the Trackball group.



Joystick			Z Track
Coarse Vel	5.00	5.00	5.00
Medium Vel	1.00	1.00	1.00
Fine Vel	0.50	0.50	0.50
Acceleration	25.04	25.04	25.04
Lead Pitch	1.0000	1.0000	1.0000
Direction	Normal	Normal	Normal

Button 3

Joystick Deadband (0.0-100.0)  
16.67

Frequency  
 Millimeters  
 Inches

Coarse velocity

This controls the coarse rate of motion of each axis. This feature is dependent on such things as Lead pitch, stage mechanics and motor amplifiers. You should already have some idea of what speed your motors are capable of traveling. Start by setting the velocity at half of that your machine velocity will be.

Medium velocity

This controls the medium rate of motion of each axis. The 3 speed box must be checked.

Fine velocity

This is used to control extra fine motion of each axis.

Acceleration

This is used to control the acceleration of each axis.

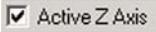
Lead pitch

Enter in the pitch of your lead screw. The pitch can be entered in Inches or Millimeters between threads. Clicking the Frequency radio button displays the motor-drive pulse frequency that corresponds to the current lead pitch setting.

Direction

This is used to specify whether the joystick will move in the direction of the stage or the direction of the crosshair.

**Axis-lock toggle** If you enable this option by assigning it to joystick a button, and then toggle the selected button, only one axis will move at any given time. You will be unable to move axes in conjunction.

**Active Z axis** When this option is selected you will be prompted to  “teach” the Z axis during joystick setup.

**Joystick deadband** A deadband of joystick inactivity can be specified around the joystick’s rest position to provide noise immunity for certain resistive joystick circuits. This deadband was permanently set to 16.67 in previous versions of this software; it can now be adjusted from 0 to 100 to accomodate various joystick requirements.

**BIOS version** This is the current version of Quadra Step amplifier software. Your version of **Logic, BIOS, and Controls** may be different than shown below.

Versions	
Logic:	004
BIOS:	1.5
Controls:	2.0

**Saving settings and closing the Quadra-Step Setup application** The Quadra-Step amplifier settings will be saved, and the application will be closed when the OK button or the Close box at the top-right of the dialog box is clicked.





# Appendix A: Specifications

## Stepper amplifier specifications

Input Voltage Range: 88 to 132 vac or 176 to 264 vac auto-sensing  
 3.15 amp max at 120.  
 1.6 amp max at 240.

Input Frequency: 50Hz to 60Hz

Fuse 3.15 amp, 250 vac, slow-blow, 5x20 mm  
 1.6 amp, 250 vac, slow-blow, 5x20 mm



### CAUTION

Replacement fuse **MUST** match the specified voltage and current ratings for continued protection against fire.

### Environmental Conditions

Temperature: 0°C TO 45°C  
 (32° F to 113° F) non-condensing

Humidity: 90% relative humidity

Altitude: 2000 meters

Pollution Degree: 2

Installation Category: II

Dimensions: 3.0in (76.2mm) high  
 13.1in (333mm) deep  
 10.5in (267mm) wide

Weight: Approximately 13 pounds

Output Signals: Stepper Motor Power

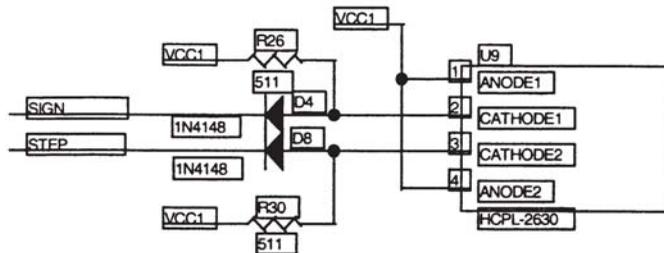
Resolution: Software adjustable with default of 25,600 steps per revolution

Max motor output: 4.0 amps +/- 10%

The output current can be set using the Metronics Quadra-Step Software.  
 The range for output current is 0.1 amp to 4 amps in 0.1 amp increments.  
 The range for standby current is 0.1 amp to 1.7 amps in 0.1 amp increments.

There are Four Panel LED's

X	FAULT
Y	FAULT
Z	FAULT
I	Power on



## Stepper amplifier pin definitions and specifications

### *X Motor Output Cable*

#	Name	Function	Notes
1	Phase (A)	Phase A motor coil lead	
2	Phase (B')	Phase B' motor coil lead	
3	Phase (B)	Phase B motor coil lead	
4	Phase (A')	Phase A' motor coil lead	
5	Shield	Case shield	
6	X Negative Limit	Negative limit switch input	
7	X Positive Limit	Positive limit switch input	
8	X Limit Ground	Ground for limit switches	

### *Y Motor Output Cable*

#	Name	Function	Notes
1	Phase (A)	Phase A motor coil lead	
2	Phase (B')	Phase B' motor coil lead	
3	Phase (B)	Phase B motor coil lead	
4	Phase (A')	Phase A' motor coil lead	
5	Shield	Case shield	
6	Y Negative Limit	Negative limit switch input	
7	Y Positive Limit	Positive limit switch input	
8	Y Limit Ground	Ground for limit switches	

### *Z Motor Output Cable*

#	Name	Function	Notes
1	Phase (A)	Phase A motor coil lead	
2	Phase (B')	Phase B' motor coil lead	
3	Phase (B)	Phase B motor coil lead	
4	Phase (A')	Phase A' motor coil lead	
5	Shield	Case shield	
6	Z Negative Limit	Negative limit switch input	
7	Z Positive Limit	Positive limit switch input	
8	Z Limit Ground	Ground for limit switches	

*Joystick Input*

#	Name	Function	Notes
1	X Joy	X Joy stick input	0-5 volt input
2	Y Joy	Y Joy stick input	0-5 volt input
3	Z Joy	Z Joy stick input	0-5 volt input
4	Input 1	Joy stick button 1	0-5 volt input
5	Input 2	Joy stick button 2	0-5 volt input
6	Input 3	Joy stick button 3	0-5 volt input
7	VCC	+5 volts	@ (300ma)
8	+12v	+12 volts	@ (250ma)
9	GND	Ground	Digital ground
10	XDP0	X digital positioner Phase (A)	Quadrature input (TTL)
11	XDP90	X digital positioner Phase (B)	Quadrature input (TTL)
12	YDP0	Y digital positioner Phase (A)	Quadrature input (TTL)
13	YDP90	Y digital positioner Phase (B)	Quadrature input (TTL)
14	ZDP0	Z digital positioner Phase (A)	Quadrature input (TTL)
15	ZDP90	Z digital positioner Phase (B)	Quadrature input (TTL)

*QC-4000 Input*

#	Name	Function	Notes
1	X SIGN	Direction bit closed loop	See Note 1
2	Y SIGN	Direction bit closed loop	See Note 1
3	Z SIGN	Direction bit closed loop	See Note 1
4	Y Joy	Y Joy Stick Input	0-5 volt input
5	No Connection	*	*
6	Input 2	Joy stick button 2	0-5 volt input
7	XDP90	X digital positioner Phase (B)	Quadrature input (TTL)
8	YDP90	Y digital positioner Phase (B)	Quadrature input (TTL)
9	ZDP90	Z digital positioner Phase (B)	Quadrature input (TTL)
10	X STEP	X Clock for Stepper Drive	See Note 1
11	Y STEP	Y Clock for Stepper Drive	See Note 1
12	Z STEP	Z Clock for Stepper Drive	See Note 1
13	X Joy	X Joy stick input	0-5 volt input
14	Z Joy	Z Joy stick input	0-5 volt input
15	Input 1	Joy stick button 1	0-5 volt input
16	XDP0	X digital positioner Phase (A)	Quadrature input (TTL)
17	YDP0	Y digital positioner Phase (A)	Quadrature input (TTL)
18	ZDP0	Z digital positioner Phase (A)	Quadrature input (TTL)
19	*RESETIN	Reset input	ACTIVE LOW
20	OUTPUT	Input to amplifier box from QC4000	Low = closed loop control High = open loop control

## Setup Instructions

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### *QC-4000/QC-5000 Input (continued)*

#	Name	Function	Notes
21	GND	Ground	Digital ground
22	GND	Ground	Digital ground
23	VCC1	+5 volts from QC4000	Opto-isolater source voltage
24	Input 3	Joy stick button 3	0-5 volt input
25	VCC1	+5 volts from QC4000	Opto-isolater source voltage
26	GND	Ground	Digital ground

### *RS232 Input*

#	Name	Function	Notes
2	RX	Receive Data	Serial Data
3	TX	Transmit Data	Serial Data
5	GND	Ground	Digital ground
7	RTS	Ready to Send	Handshake Line
8	CTS	Clear to Send	Handshake line

### *Limit Switch Input*

#	Name	Function	Notes
1	X Negative Limit	Negative limit switch input	Comparator input
2	X Positive Limit	Positive limit switch input	Comparator input
3	Y Negative Limit	Negative limit switch input	Comparator input
4	Y Positive Limit	Positive limit switch input	Comparator input
5	Z Negative Limit	Negative limit switch input	Comparator input
6	Z Positive Limit	Positive limit switch input	Comparator input
7	VCC	+5 volts	@ (300ma)
8	VCC	+5 volts	@ (300ma)
9	Limit Ground	Ground for limit switches	
10	Limit Ground	Ground for limit switches	

## Appendix B:

## Changing the amplifier fuse

### Step 1

Turn the amplifier OFF.

### Step 2

Unplug the amplifier from its power source.

### Step 3

Locate the small fuse panel on the rear panel of the amplifier next to the three pronged plug. Notice the notch on the left side of the fuse panel.

### Step 4

Pry the fuse panel open with a small screwdriver (or similar tool). The fuse panel and fuse will pop out of the socket as a single unit.

### Step 5

Remove the old fuse from the unit. Replace with a new fuse. Use the appropriate fuse listed in the [Appendix A: Specifications](#).

### Step 6

Clip the fuse panel (fitted with the new fuse) back into the fuse socket. It should reattach with minimal pressure.

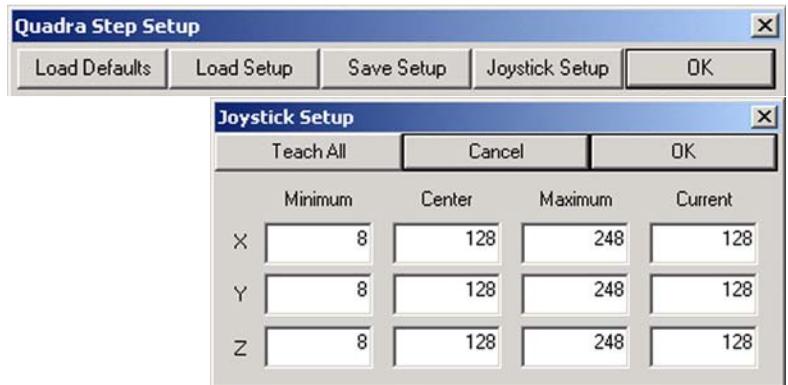


## Appendix C:

# Joystick setup for 2-axis system with a trackball

Before using the joystick, it is necessary to calibrate or “Teach” your joystick. Calibrating the Joystick will send the stepper amplifier the electronic “*Signature*” of the particular joystick you are using.

Click the Joystick Setup button to display the Joystick Setup dialog box.



- Select the Teach All button and follow the instructions to calibrate your joystick.
- Move joystick to the RIGHT, then press OK
- Move joystick to the LEFT, then press OK
- Move joystick UP, then press OK
- Move joystick DOWN, then press OK
- Move Z-axis joystick to the MAXIMUM, then press OK
- Move Z-axis joystick to the MINIMUM, then press OK
- Center Joystick, then press OK.
- For 2 axis systems with trackball you MUST enter values for the “Z” axis.
- Make the center “Z” value the same as the current value.
- Make the maximum “Z” value twice the current value.
- Make the minimum “Z” value half the current value.



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