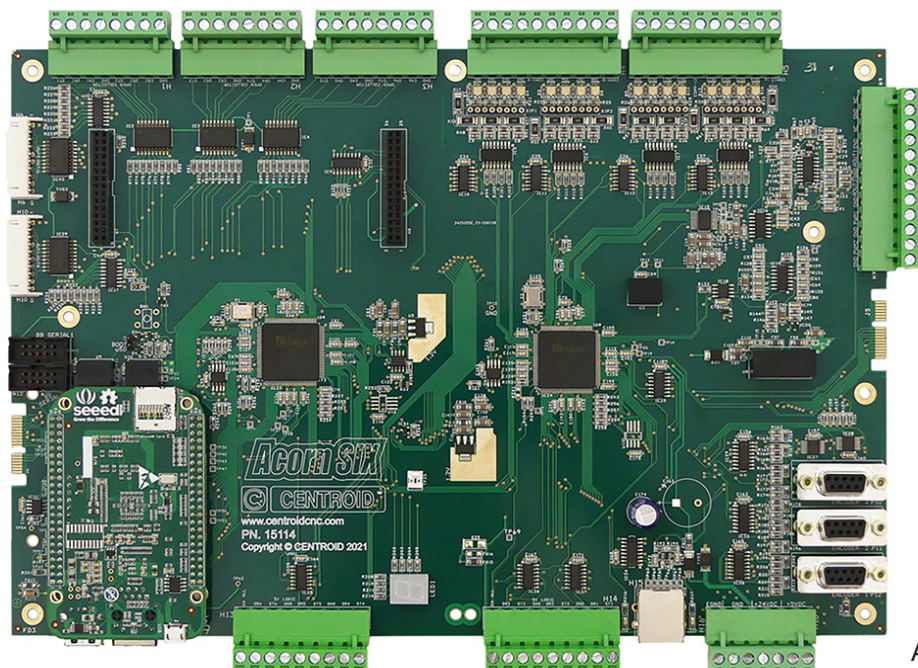




Centroid AcornSix CNC Controller Installation Manual

CNC Software version: CNC12 V.5.08+

Models: AcornSix



Before you Begin **7**

Acorn CNC Control Kit **9**

Bench Test Hardware setup **10**

Windows 10/11 config for CNC use **14**

Acorn Communications Bench Testing **26**

Spindle Bench Testing Procedure **30**

Electrical Cabinet Layout **33**

Electrical Component Wiring **36**

Home and Limit Switches **43**

CNC configuration Wizard **50**

Appendix A: Error Code Troubleshooting **114**

Appendix B: AcornSix Specifications Manual **115**

Table of Contents

Introduction.....	2
Basic Safety Procedures and Best Practices.....	2
Before You Begin.....	7
Useful Resources.....	7
Chapter 1 AcornSix Controller.....	9
1.1 AcornSix.....	9
Chapter 2 Bench Test Hardware Setup.....	10
2.1 Introduction to Bench Testing.....	10
2.2 AcornSix Communications Bench Setup.....	11
Chapter 3 CNC12 Software.....	14
3.1 Windows 10/11 Software Pre-installation Requirements.....	14
3.2 CNC12 Software Installation.....	15
Chapter 4 Bench Testing.....	23
4.1 CN12 Software Configuration.....	23
4.2 AcornSix Communications Stress Test.....	26
4.3 AcornSix Analog Spindle Output Test “Spindle Bench Test”.....	30
4.4 Load an AcornSix License.....	32
Chapter 5 Cabinet Wiring.....	33
5.1 Introduction to Electrical Cabinet Wiring Layout.....	33
5.2 AcornSix Inputs.....	36
5.3 AcornSix Outputs.....	37
5.4 Wiring Axis Drives.....	39
5.5 Wiring E-Stop Circuit.....	40
5.6 Testing Limit and Home Switches.....	43
5.7 Wiring the Spindle.....	46
Chapter 6 CNC12 Software Configuration using the Wizard.....	50
6.1 Introduction to Software Configuration.....	50
6.2 Primary System (Drive Type and I/O Definitions).....	51
6.3 Axis Configuration.....	54
6.4 Axis Homing and Travel.....	56
6.5 Axis Motor Software Pairing.....	58
6.6 Axis (Advanced).....	60
6.7.1 Spindle Setup.....	61
6.7.2 Spindle Setup 2.....	62
6.8 Rigid Tapping.....	63
6.9 PWM Setup.....	64
6.10 Lathe-Specific Setup.....	65
Chapter 7 Accessory Setup.....	66
7.1 Touch Devices: Touch Probe.....	66
7.2 Touch Devices: Tool Touch Off.....	68
Chapter 8 Control Peripheral Setup.....	70
8.1 Input Devices Setup.....	70
8.2 Hardwired MPG Setup.....	71
8.3 Wireless MPG Configuration.....	72
Appendix A LED Error Codes.....	75

Introduction

WARRANTY DOES NOT COVER DAMAGE BY FAULTY WIRING OR IMPROPER INSTALLATION.

The information provided by CENTROID relating to wiring, installation, and operation of CNC components is intended only as a guide, and in all cases a qualified technician and all applicable local codes and laws must be consulted. CENTROID makes no claims about the completeness or accuracy of the information provided, as it may apply to an infinite number of field conditions.

As CNC control products from CENTROID can be installed on a wide variety of machine tools NOT sold or supported by CENTROID, you **MUST** consult and follow all safety instructions provided by your machine tool manufacture regarding the safe operation of your machine and unique application.

Basic Safety Procedures and Best Practices



CNC SAFETY WARNINGS

WHEN A CNC IS OPERATING, HIGH VOLTAGE LEVELS COULD BE PRESENT THAT ARE LETHAL FOR PEOPLE IF THEY COME INTO CONTACT WITH IT. It is important to always keep in mind that voltage levels present on a CNC equipped machine tool can be lethal, mistakes in wiring can be catastrophic. In addition to dangerous lethal voltages CNC machines have powerful motors and resulting dangerous unexpected forceful motion of dangerous cutters and fast moving heavy machine parts.

Installation of a CNC controller should be performed only by individuals trained and qualified to do the task. Before installation procedure and working with the equipment it is required to read and understand the user and installation manuals of all the components and equipment being used. It is necessary to be completely sure of and have full understanding possible dangers and also completely assured that installation can be performed in a safe manner. Any schematics or wiring hookup instructions presented on Centroid's website or in the online forums are incomplete educational examples for discussion only. The user, DIY'er is creating his/her own CNC device, which may include dangerous lethal voltages, powerful motors and resulting dangerous unexpected forceful motion of dangerous cutters and fast moving heavy machine parts. The information provided by CENTROID relating to wiring, installation, and operation of CNC components is intended only as a guide, and in all cases a qualified technician and all applicable local codes and laws must be consulted. CENTROID makes no claims about the completeness or accuracy of the information provided, as it may apply to an infinite number of field conditions. CNC control products from CENTROID can be installed on a wide variety of machine tools in combination with 3rd party components NOT sold or supported by CENTROID, you **MUST** consult and follow all safety instructions provided by your machine tool manufacturer and electrical components regarding the safe operation of your machine and unique application. If you are not qualified to accept all responsibility and/or you do not agree, **DO NOT PROCEED** and request a refund.

AcornSix CNC LIMITED WARRANTY

By accepting delivery or operating this product, you the buyer accept all of the terms of this warranty. If you do not wish to accept the terms of this agreement, immediately call to make arrangements for the return of the product.

Centroid warrants to the original purchaser that any part of its product purchased will be free of defects in workmanship and parts for a period of twelve (12) months from the date of delivery (hereinafter "Warranty Period"). During the Warranty Period, Centroid will, at its option: (1) provide replacement parts necessary to repair the product; (2) replace the product with a comparable product; or (3) refund the amount customer paid for the product upon its return. Replacement parts or products will be new or serviceability used, comparable in function and performance to the original part or product, and warranted for the longer of thirty days for the US or the remainder of the warranty period. Any additional purchases or upgrades will not extend this warranty. This product warranty covers normal use only. This product warranty does not cover damage caused during shipment and any damage caused by: actions that are beyond Centroid's control, including without limitation, impacts, fluids, fire, flood, wind, earthquake, lightning or similar disaster, war, lockout, epidemic, destruction of production facilities, riot, insurrection, or material unavailability; unauthorized modifications, attachments or peripherals; improper use, environment, installation or electrical supply; improper maintenance; any other misuse, abuse or mishandling. Except for the warranties expressed in this agreement, Centroid disclaims all other warranties, either express or implied, including implied warranties of merchantability or fitness for a particular purpose, other than those warranties implied by and incapable of exclusion, restriction or modification under the applicable law. The term of any implied warranties that cannot be disclaimed are limited to the term of this agreement. Centroid's and customer's maximum liability to the other is limited to the purchase price customer paid for products or services plus interest as allowed under the applicable law. Neither customer nor Centroid will be liable to the other for property damage, personal injury, loss of use, interruption of business, "down time", customer's time, loss of use of related equipment, lost profits, lost data or other consequential, incidental, punitive or special damages, however caused, whether for breach of warranty, contract, tort (including negligence), absolute or strict liability or otherwise, other than those damages that are incapable of limitation, exclusion or restriction under the applicable law. Acorn CNC is an educational DIY (do-it-yourself) product. Centroid makes no warranties or claims of safety or suitability for any application. Any schematics or wiring hookup instructions presented on Centroid's website or in the online forums are incomplete educational examples for discussion only. The user, DIY'er is creating his/her own CNC device, which may include dangerous voltages, powerful motors and resulting dangerous unexpected forceful motion, of dangerous cutters and fast moving heavy machine parts.

If you are not qualified to accept all responsibility and/or you do not agree, DO NOT PROCEED and request an RMA# for a full refund.

Care and Handling of CNC components

For Motors

Be safely dressed when handling a motor. Wear safety shoes and gloves. Avoid loose clothing which can get caught on the motor. Be careful not to let hair get caught in the rotary section of the motor. Do not handle the motor with wet hands.

Shut off the power before working on a motor. Wait at least 5 minutes after the motor is shut off before touching any power terminals.

Ensure that the motor and motor related components are mounted securely. Ensure that the base or frame to which the motor is mounted to is strong enough.

Do not touch the rotary section of the motor when it is running, unless specifically instructed to do so.

When attaching a component having inertia to the motor, ensure any imbalance between the motor and component is minimized.

Be sure to use a key when the motor has a keyed shaft.

Use the motor in appropriate environmental conditions. Do not store flammables in close proximity to the motor. When not in use, store the motor in a dry location between 0° to 40° C.

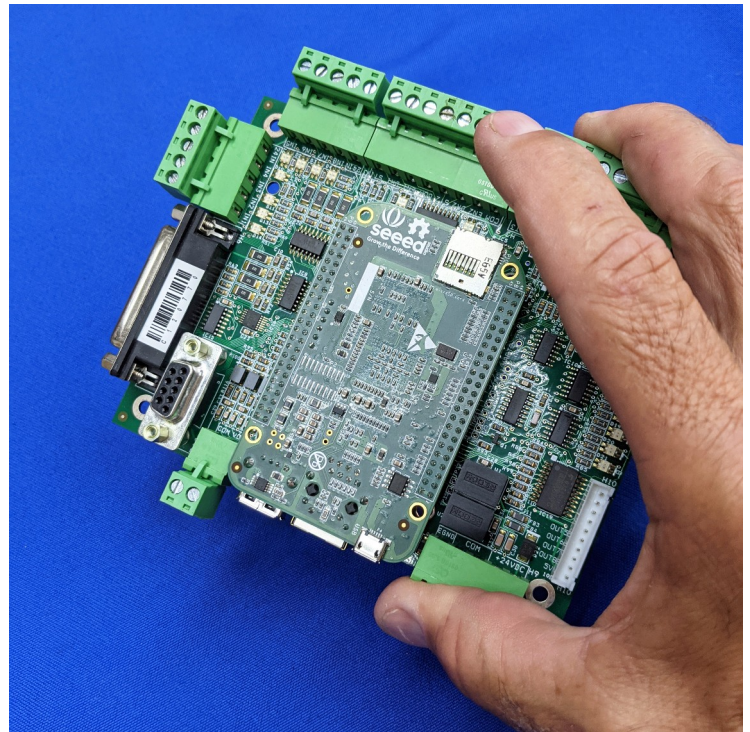
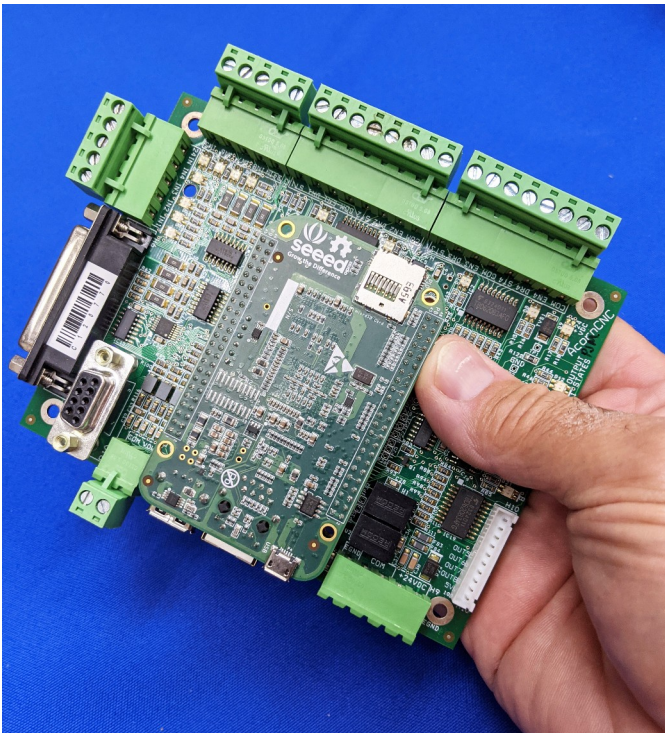
Do not remove the nameplate from a motor.

Never use a hammer or other impact device on the motor shaft for any reason.

For Circuit Boards

Minimize handling circuit boards as much as possible. If you must hold a circuit board, grasp it by the edges as shown below.

- Before picking up a circuit board, always discharge any static buildup you may have by touching a grounded surface.
- Avoid touching any of the circuit traces, components, or component leads. Improper handling can lead to ESD (electrostatic discharge) which may damage the PCB, or shorten its lifespan.
- Keep the work area FREE from STATIC generating materials such as: Styrofoam, Vinyl, Plastic, and Fabrics. A wood bench top surface works best for bench testing.



About This Manual

This manual describes how to install the Centroid CNC AcornSix Step and Direction Motion Controller. The AcornSix system provides up to six axes of step and direction interpolated motion, controlled by industry standard G-Codes.

AcornSix can be used for the CNC control of milling machines, routers, lathes, engravers, flame cutters, plasma cutters, laser cutters, water jet cutters, drill presses, grinders, and other specialized applications using step and direction axis drives.

This installation manual covers the most common AcornSix hardware setups.

This manual links to relevant technical resources such as: forum posts, detailed PDF documentation and videos which appear throughout the manual.

Documentation

Document your installation!

It is highly recommended that you document the parts used in your conversion. Once parts are installed you may not be able to read the nameplates or identification markings on the part(s).

- Photograph motor nameplates
- Photograph controllers and circuit boards (especially Model, Revision and Serial)
- Download and save documentation for all parts used for future reference
- Keep a log of the various switch/jumper settings and electronic configurations
- Use a labeler to mark any relays or modules is always a good idea
- Create and/or update a system schematic
- Save a Report after every configuration change. See 3.3 Software Backup for thoughts on an offline backup

Before You Begin

Before getting started, please take the time to familiarize yourself with the schematics, manuals, and installation instructions which can be found [here](#).

While doing the installation, it is very important that you follow the instructions exactly and in order. Doing the installation incrementally and testing as you go will allow you to immediately isolate the cause of any problems that may occur. Additional troubleshooting resources are included in the Appendices.

Useful Resources

All Acorn Documentation link

<https://centroidcncforum.com/viewtopic.php?f=60&t=3397>

AcornSix Schematics: Type in “AcornSix” in the search bar.

https://www.centroidcnc.com/centroid_diy/schematics/pbrowse.php#

Centroid’s YouTube Channel: Centroid CNC Technical Support

<https://www.youtube.com/user/CentroidSupport/videos>

Free Centroid Community CNC Support Forum <https://centroidcncforum.com/viewforum.php?f=20>

Centroid CNC Tech Bulletins: http://www.centroidcnc.com/centroid_diy/tech_bulletins/browse.php

Centroid AcornSix and Accessories:

<https://shopcentroidcnc.com/acornsix-cnc-controller/>

Acorn Knowledge base Videos: <https://centroidcncforum.com/viewforum.php?f=61>

Acorn CNC Tech Tips Knowledge: <http://centroidcncforum.com/viewforum.php?f=63>

Where to find support

Sign up for free tech support here: <https://centroidcncforum.com/viewtopic.php?f=60&t=3498>

Post your question on the forum by clicking "new topic"

The screenshot shows the Centroid Community CNC Support Forum. At the top is a blue header with the Centroid logo and the forum name. Below this is a navigation bar with links for Quick links, FAQ, ACP, MCP, and a notification bell. A breadcrumb trail shows the path: Board index > Centroid Community CNC Support Forum > Centroid Acorn CNC Controller. The main heading is 'Centroid Acorn CNC Controller' with a moderator 'cnckeith'. Below this is a table of forum topics. The table has three columns: FORUM, TOPICS, and POSTS. There are two rows of topics. Below the table is a 'New Topic' button and a search bar. At the bottom is an 'ANNOUNCEMENTS' section with three entries, each showing an icon, title, author, date, and a table of replies and views.

FORUM	TOPICS	POSTS
Acorn CNC Knowledge Base Videos Moderator: cnckeith	50	102
Acorn CNC Tech Tips Knowledge Base, Look Here! before posting Moderator: cnckeith	90	864

ANNOUNCEMENTS	REPLIES	VIEWS
The AcornSix CNC controller kit has been released! by cnckeith » Fri Oct 21, 2022 4:44 pm	24	747
Acorn CNC12 v4.80 has been released. (8-12-22) by cnckeith » Mon Jun 20, 2022 8:28 am	70	8192
ALL Acorn Documentation by cnckeith » Wed Aug 14, 2019 12:11 pm	0	45552

Please read the posting guidelines linked below, before making a post. Always search the forums for your problem first. Somebody may have already experienced the issue you are having.

When you post to the forum, your question will be seen by many users. Possibly getting you more than one solution to your problem. Your post can be helpful others in the future.

Forum Posting Guidelines: <https://centroidcncforum.com/viewtopic.php?f=60&t=1043>

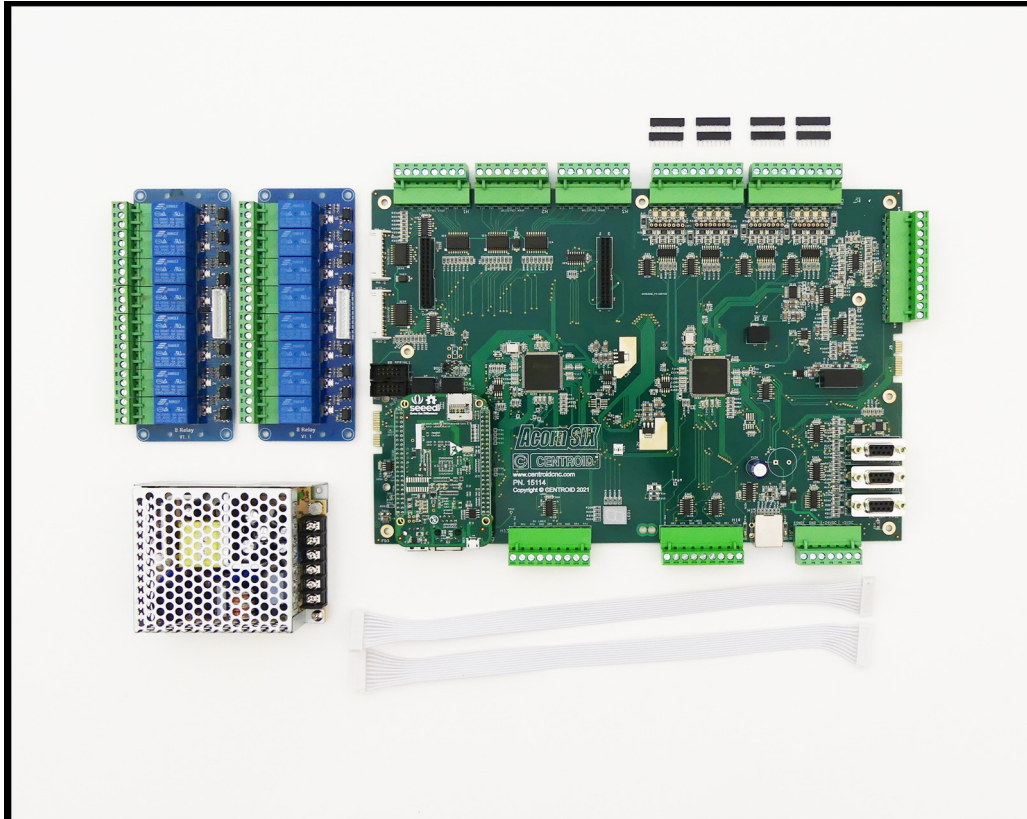
Factory Direct technical support is available in 1 hour blocks. Purchase here:
<https://shopcentroidcnc.com/centroid-factory-direct-11-technical-support/>

Chapter 1 AcornSix Controller

1.1 AcornSix

Congratulations on your AcornSix purchase!

AcornSix is a step and direction motion control solution, providing up to 6 axes of step and direction signal outputs and full Programmable Logic Controller (PLC). Make sure your kit is complete and has not been visibly damaged in shipment.



- The following components are included with your AcornSix CNC Controller Kit Part #15136
- AcornSix Board Part #15114
- AcornSix Component Bag #15211
- (2) 8 Relay Boards #9091
- (2) Ribbon Cables Part #9053
- Meanwell RD-35B Power Supply Part # 8903
- 15ft Shielded Cat5E Ethernet Cable Part# 7269
- Riser Mounting Pan

Chapter 2 Bench Test Hardware Setup

2.1 Introduction to Bench Testing

The first step in installing your new system is performing a Communications Bench Test and then individual component bench test. “Bench test” means connecting electronics to the AcornSix on the bench to test them before installing the system in a machine. Then adding one component at a time will save you time and make things much easier to debug and configure.

The bench test allows you to:

- Find problems before spending a lot of time wiring your machine or cabinet.
- Troubleshoot hardware and software problems early on, before they can cause permanent damage to the system.
- Identify missing or defective hardware before installing the system
- Allows for greater visibility and ease of access when troubleshooting than being installed in an electrical cabinet.
- Should a serious issue arise, it gives the user a knowledge base that allows technical support to more quickly and efficiently solve the problem.

Tools and Equipment Needed

- A good location – A bench test needs to be performed on a large surface with good lighting and easy access to electrical outlets. Do not use metal or plastic surfaces or surfaces that may contain metal scraps or shavings, as we will be resting powered circuit boards on the surface. Do not use fabric covered surfaces as it may cause ESD (electrostatic discharge) damage. A wooden surface is an ideal test bench location.
- A PC or a Centroid console unit which comes with [CNC12 installed](#). The PC must meet the specifications listed in Technical Bulletin #273, which can be found here:
https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/273.pdf
- A small screwdriver set.
- A digital multi-meter

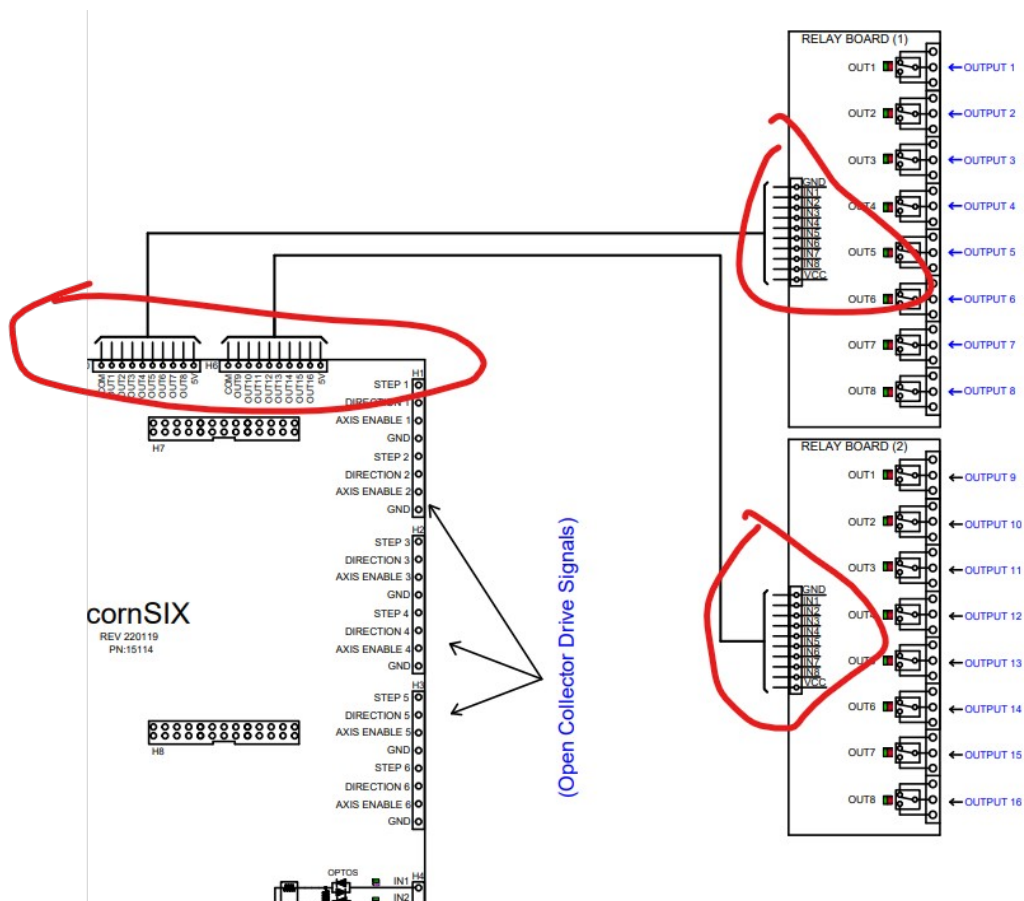
2.2 AcornSix Communications Bench Setup

The very first step is to verify that there is good communications between the CNCPC, CNC12 and the AcornSix.

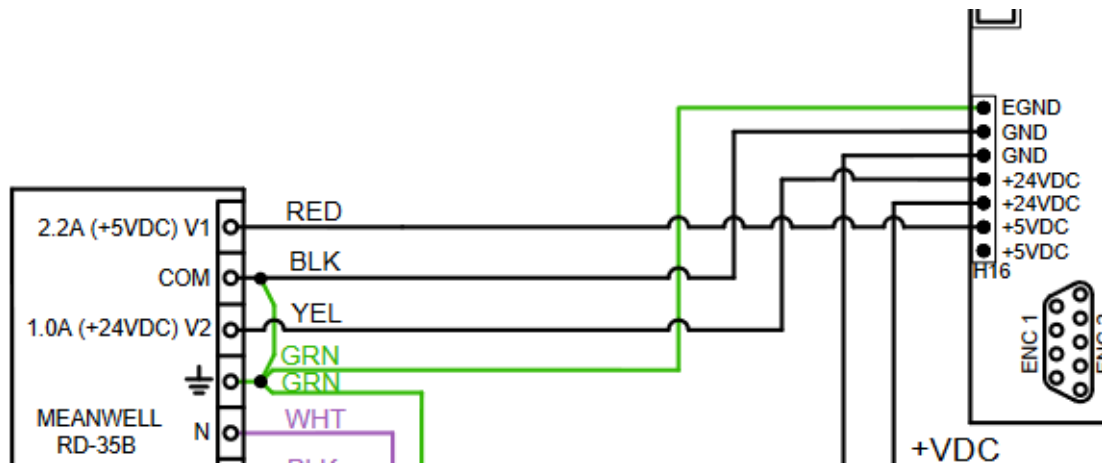
- 1.) Wire the AcornSix on the bench following [Schematic S15148 "AcornSIX. BASIC POWER AND COMMUNICATION CONNECTIONS. Bench Test"](#)
- 2.) Prepare the CNC PC for CNC control use.
- 3.) Configure Windows for CNC use.
- 4.) Install AcornSix CNC12 software.
- 5.) Perform the communications Stress Test.

Lets get started.

1. Connect the relay boards: Use the included flat white 10 conductor cable to plug the relay boards into the AcornSix.



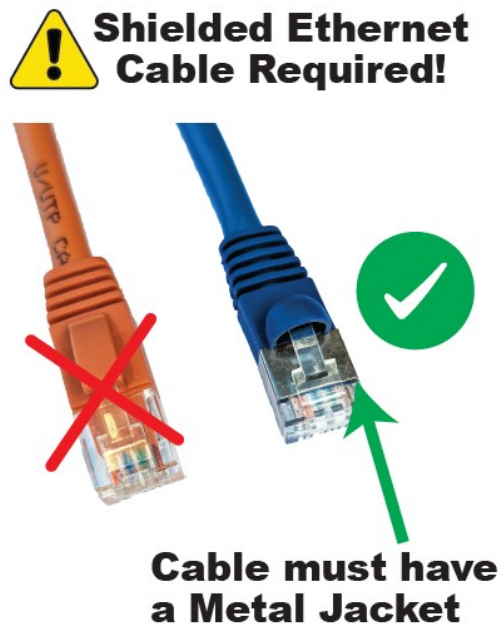
2. Wire the provided Logic power supply to AcornSix following the bench test schematic. Leaving the Meanwell power supply disconnected from 110VAC, wire the power connections to H16 on the AcornSix. Note: Included Power supply will also run on 240VAC.



3. Connect the Ethernet Cable: Connect a shielded Ethernet cable to your PC. Connect the other end to the AcornSix. A shielded Ethernet cable will have a metal clip around the RJ-45 connector it as shown by the blue cable in Figure 2.2.1. One part #7269 15ft Shielded Ethernet cable is included with the AcornSix kit. Centroid also stocks part #6143 25ft Shielded Ethernet cable.

Note: An unshielded cable can result in intermittent PC Data receive errors in the software due to electronic noise and interference. See TB270:

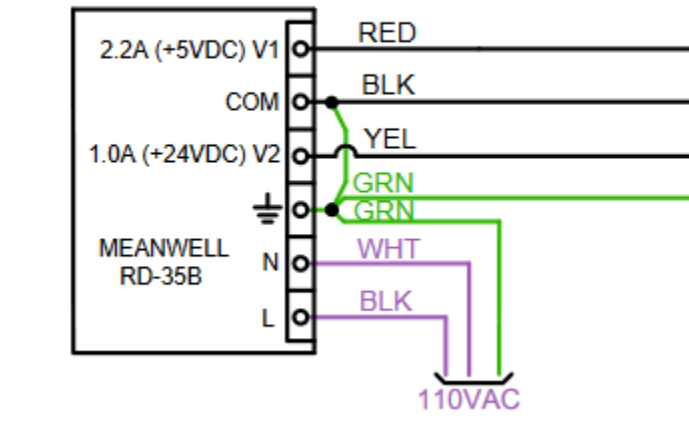
https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/270.pdf



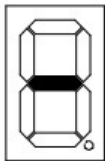
See Tech Bulletin #270
www.centroidcnc.com

Note: The Ethernet cable from the AcornSix must be connected directly to the PC through a built in Ethernet connector or a PCI/PCI-E network adapter card that has been installed in the PC. Some computer systems ship with an Ethernet adapter that connects to a USB port. This type of connector (Ethernet though USB) may be used for Internet access but must not be used for CNC control with the Centroid AcornSix.

4. Connect incoming power to the Meanwell RD-35B. Note that the power supply accepts up to 240VAC.

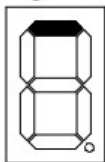


6. The AcornSix will power up and goes thru a booting process. **It takes about 15 seconds** for the AcornSix to boot. Unlike the Acorn4 board the heartbeat on the BBG is not the sole indicator of the AcornSix being booted and ready to go. The AcornSix is equipped with an on-board seven-segment LED number display, this will indicate that the AcornSix is booted when you see the horizontal LED bar moving from top to bottom in a scrolling fashion on the display. This means all is good and AcornSix is ready to connect to CNC12 software.

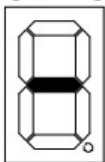


Ready, but not running

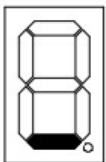
Center segments lighting in a scrolling pattern indicates normal operation.



->



->



Running normally

Chapter 3 CNC12 Software

3.1 Windows 10/11 Software Pre-installation Requirements and the Centroid PC Tuner

Only Microsoft Windows 10/11 (Home or Professional) is supported with CNC12. Older versions of Microsoft Windows, Mac OS, or Linux are not supported.

1. If you have purchased a console unit or computer from Centroid, it comes with Windows properly configured and the CNC12 software already installed. If you bought or built your own computer, it must meet the prerequisites listed on the Centroid Website here and to be configured for CNC use follow the steps below.

https://www.centroidcnc.com/cnc_pc_performance_requirements.html

2. Before installing CNC12, **all anti-virus, anti-malware, and 3rd party firewall software should be uninstalled (not disabled) and your computer rebooted.**

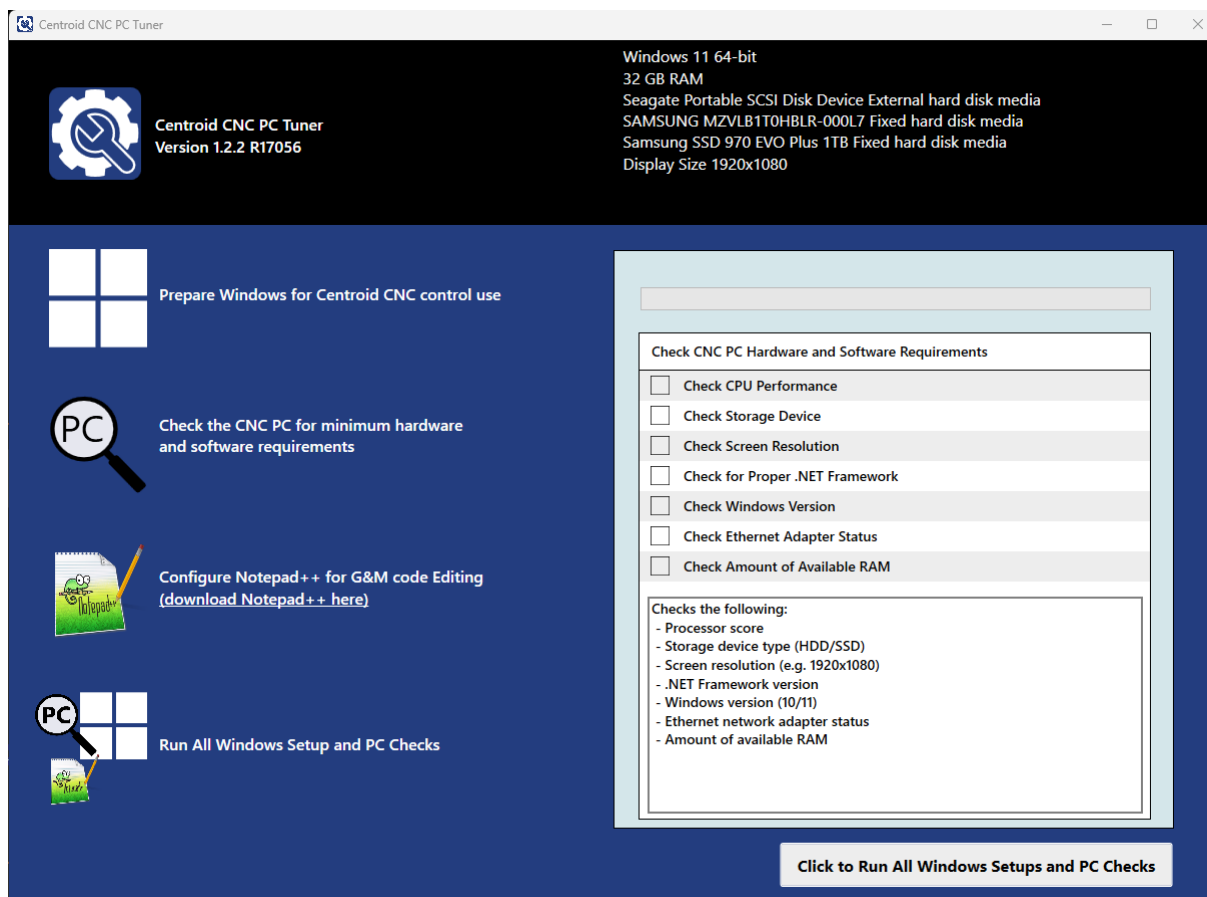
3. Use the Centroid CNC PC Tuner App *in conjunction with Tech Bulletin 309*

(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/309.pdf) to configure the PC for CNC use.

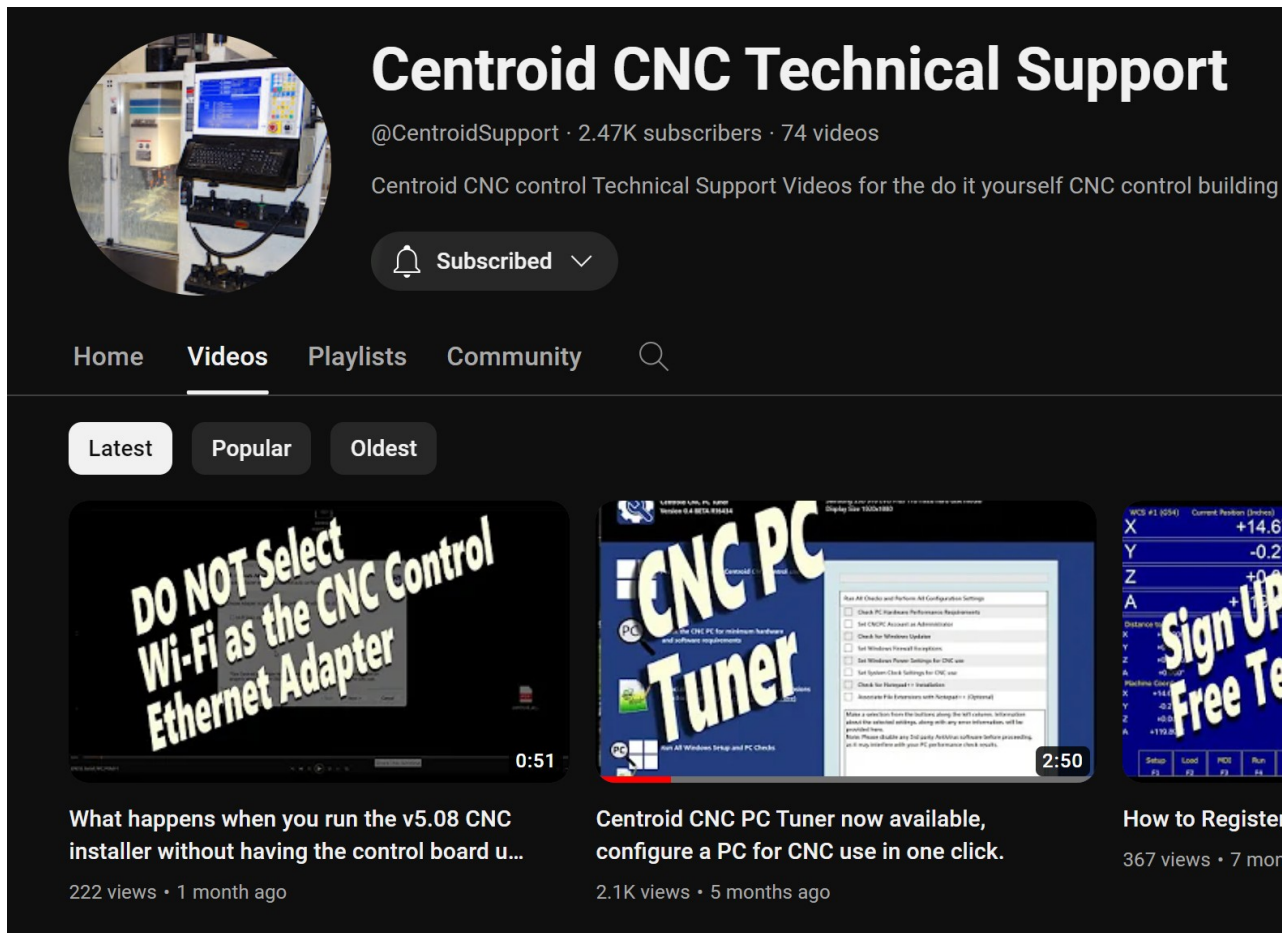
The CNC PC Tuner App will handle **most** of the Windows 10/11 configuration for you including checking for updates, setting firewall exceptions, configuring power settings, etc. TB309 has instructions for the items you must configure by hand.

The PC Tuner App can be downloaded here:

https://www.centroidcnc.com/centroid_diy/centroid_cnc_software_downloads.html



Centroid CNC PC Tuner introduction video. <https://youtu.be/bOZVMMdzOj8?si=SIFVshBwu5eZ6lNC>



The image shows the YouTube channel page for "Centroid CNC Technical Support". The channel has 2.47K subscribers and 74 videos. The bio states: "Centroid CNC control Technical Support Videos for the do it yourself CNC control building". The page features a circular profile picture of a CNC machine. Below the channel name are tabs for Home, Videos, Playlists, and Community. There are buttons for "Latest", "Popular", and "Oldest" video sorting. Three video thumbnails are visible:

- Video 1:** "DO NOT Select Wi-Fi as the CNC Control Ethernet Adapter". Duration: 0:51. Description: "What happens when you run the v5.08 CNC installer without having the control board u...". Views: 222 views • 1 month ago.
- Video 2:** "CNC PC Tuner". Duration: 2:50. Description: "Centroid CNC PC Tuner now available, configure a PC for CNC use in one click.". Views: 2.1K views • 5 months ago.
- Video 3:** "Sign Up Free Te". Duration: 0:51. Description: "How to Register". Views: 367 views • 7 months ago.

Nearly all major communication problems between CNC12 and the AcornSix are caused by anti-virus and 3rd party firewall software. Virus software works by stopping unusual or suspicious behavior in software, and will almost always detect the interaction between the AcornSix and the PC as unusual/suspicious and interfere with the operation of CNC12. Firewalls work by blocking certain communication ports, and often these ports are needed for the operation of CNC12. The default firewall built into Microsoft Windows will work fine with CNC12 if you allow access as specified in this manual. For the communications bench test however it is best to disable the Windows firewall you can always turn it back on after verifying good AcornSix communication.

See Tech Bulletin #270 for details on how to fix hard to solve PC to CNC communication errors.

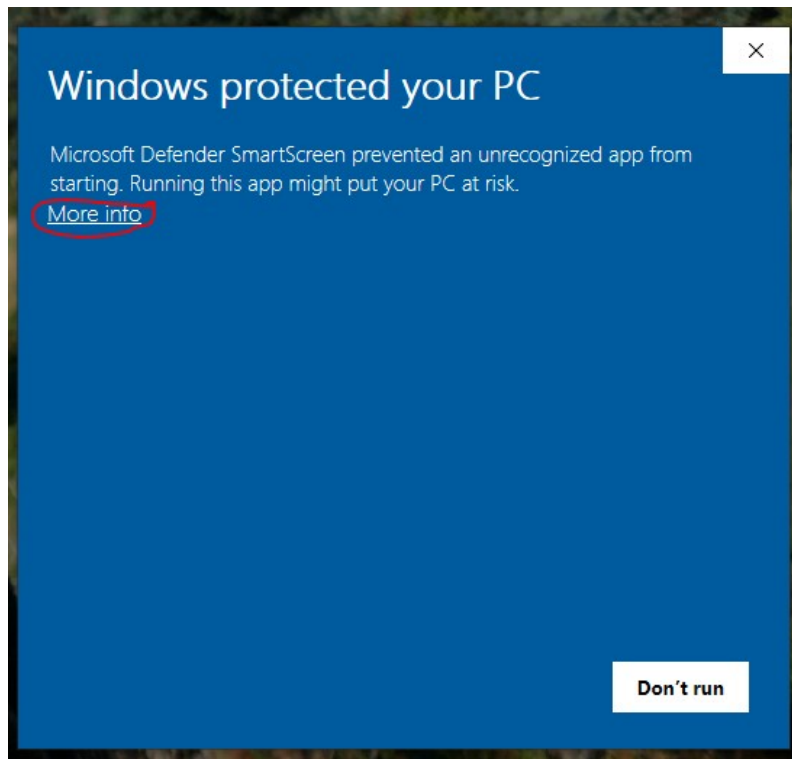
https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/270.pdf

If your corporate policy requires anti-virus software, a third-party firewall, or that certain Windows security features be enabled to connect to the network, then Centroid recommends that you keep any computers with CNC12 installed disconnected from the network.

3.2 AcornSix CNC12 Software Installation

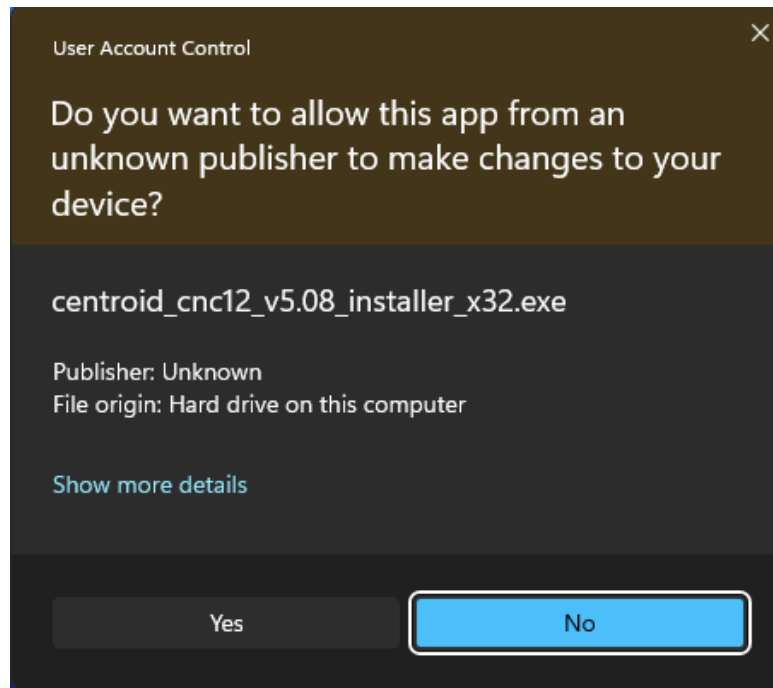
With the bench configuration completely powered as described in [Section 2.2](#) and your PC powered up, install the Centroid CNC12 Software as follows:

1. The download to the latest version of the CNC12 software located on the Centroid Software Downloads web page. https://www.centroidcnc.com/centroid_diy/centroid_cnc_software_downloads.html
2. Navigate to the CNC12 Software you just downloaded. Depending on your Windows settings, the file you downloaded will be displayed as “centroid_cnc12_v5.xx.zip” or similar. Unzip it.
3. With the AcornSix powered up and connected to the CNCPC, Double click the executable. (.exe). NOTE: The AcornSix must be powered on and connected to the CNCPC via the provided Ethernet Cable. If your PC uses an Ethernet connection for Internet access, ensure to install the software with the Ethernet for Internet **disconnected**.
4. Windows 10/11 systems may pop up a Windows Defender SmartScreen showing “Microsoft Defender SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk”. Click “More info”, Then Click “Run anyway”.

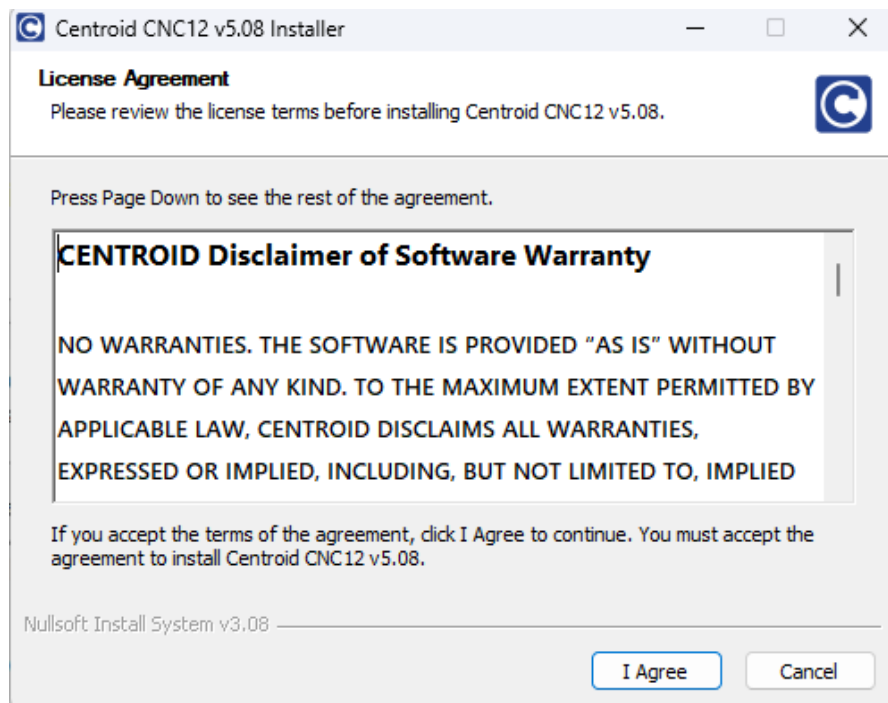


Microsoft Defender Smartscreen

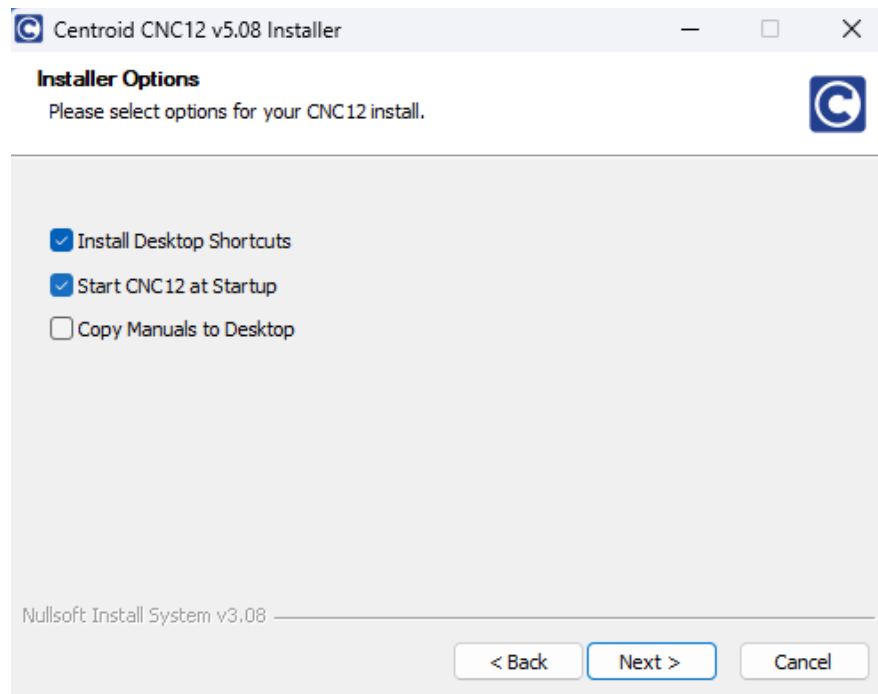
5. Depending on your Windows settings you might also get a prompt asking if you want allow the application to make changes to your device. Click “Yes”.



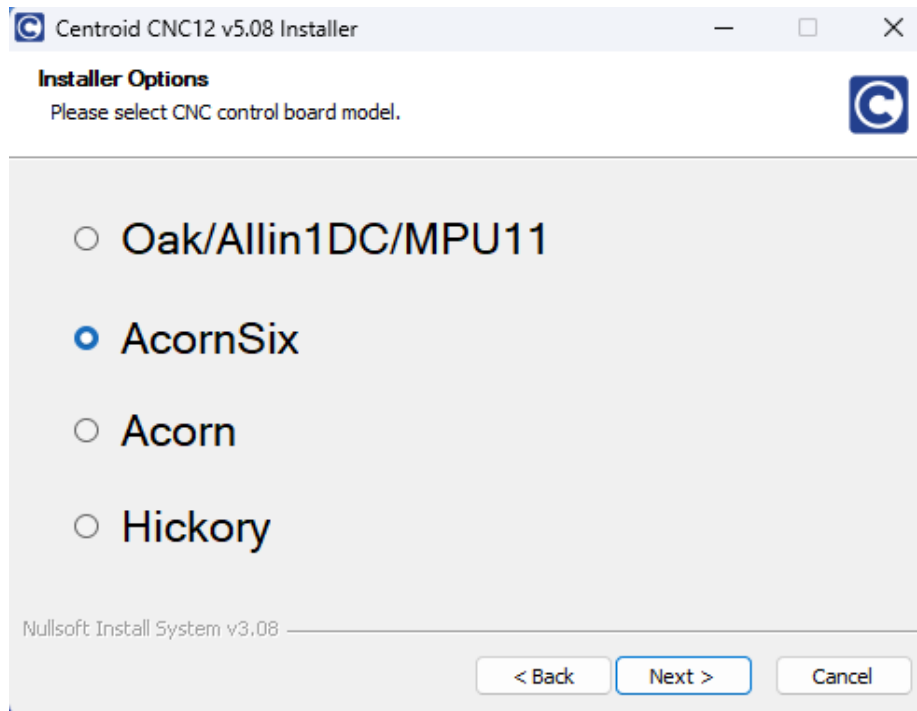
6. Read the Centroid Disclaimer of Software Warranty and if you agree click on “I Agree”.



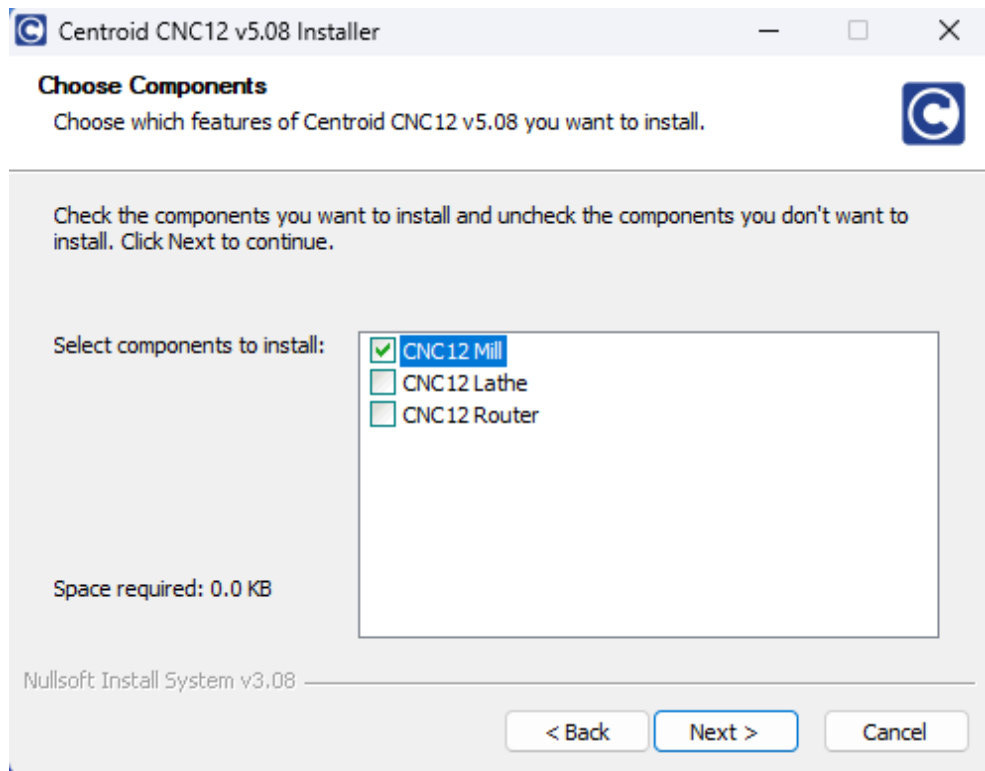
7. Select to “Install Desktop Shortcuts”. Selecting “Start CNC12 at Startup” is very useful to select as well if this is a dedicated CNC setup where the PC power is turned on when machine power is turned on. Select “Next” to continue.



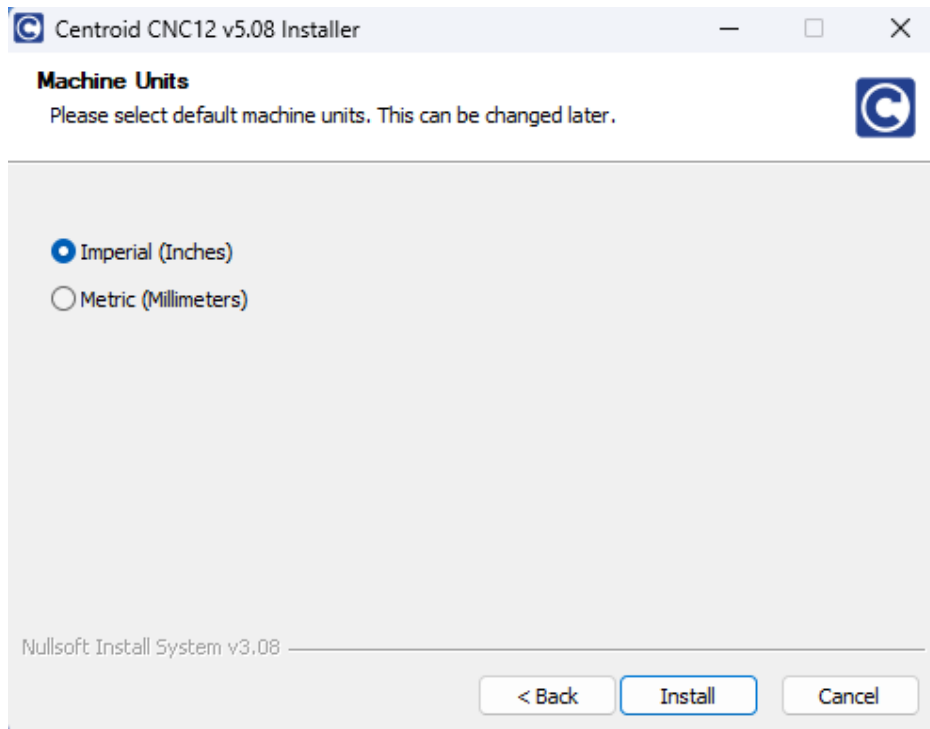
8. Select AcornSix as the control option and then select “Next” to continue.



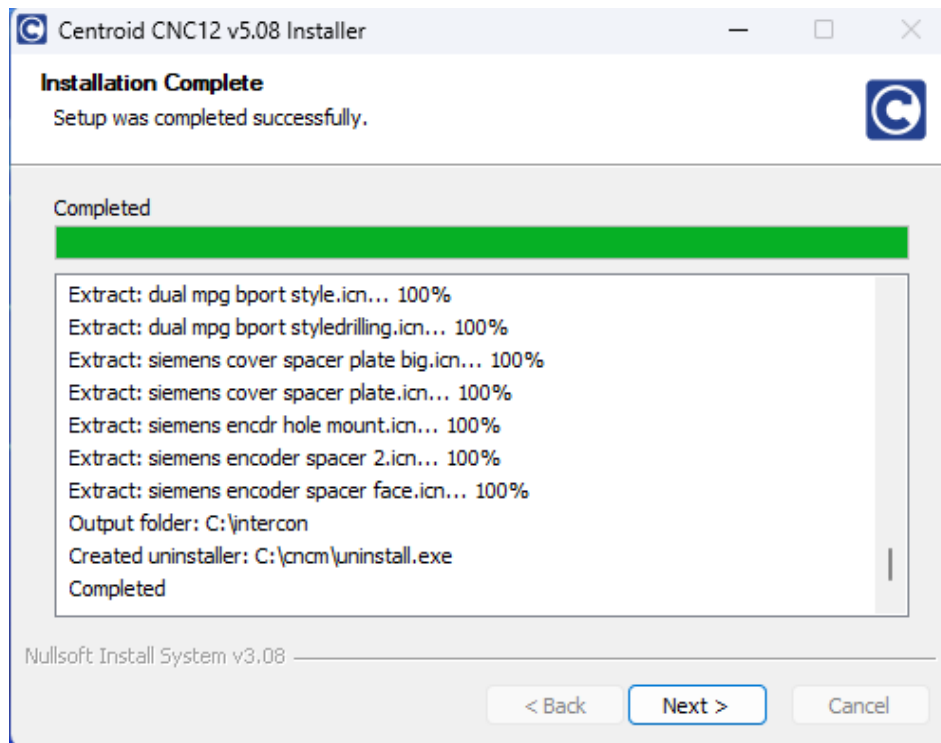
9. Select the version of software for your machine. Select “Next” to continue.



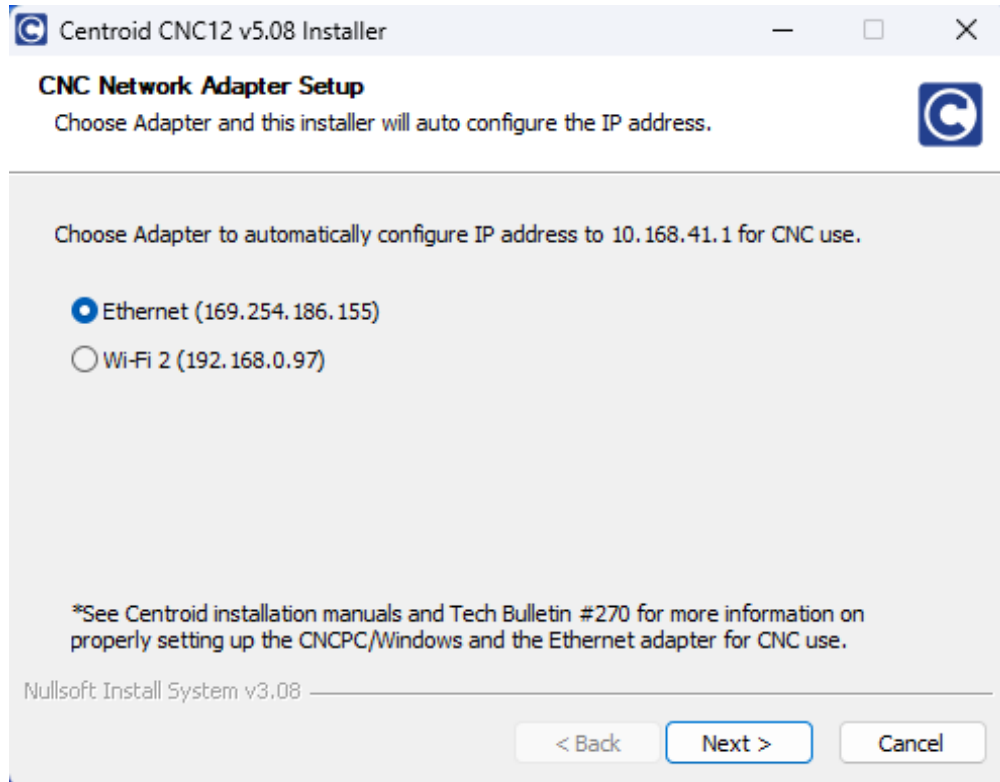
10. Choose between Imperial (Inches) and Metric (Millimeters) as the default units. This is to help with initial setup and can be changed at any time later in the software. Select “Install” to continue.



11. After seeing the “Setup was completed successfully.” screen select “Next” to continue.



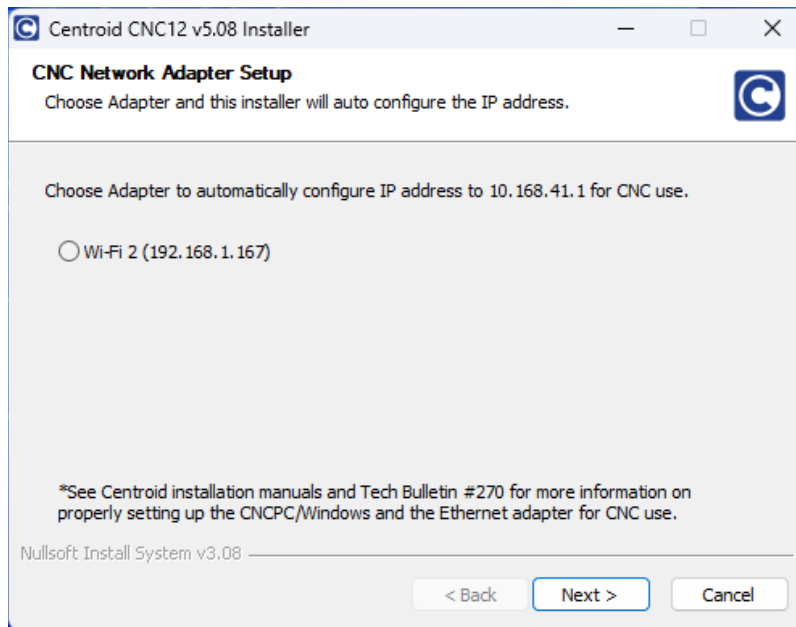
12. Network Adapter Setup: (**IMPORTANT:** During the software installation AcornSix is required to be powered up and connected to the CNC PC via the provided Ethernet Cable). You will be presented with all the Network connection options your computer has. Select the one that the AcornSix is connected to as the one that the static IP will be applied to by the installer. The adapter will always be an Ethernet adapter; if you see a Wi-Fi adapter, **do not select this adapter**.



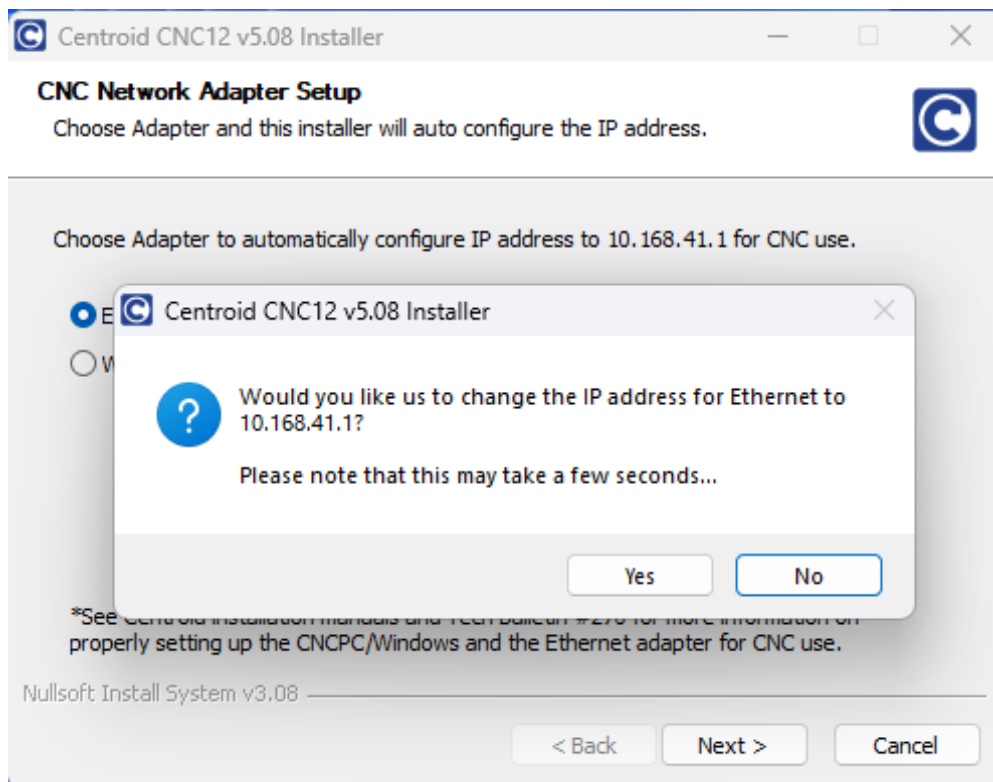
NOTE: Centroid recommends using a computer with two Ethernet ports. Alternatively one Ethernet port and one Wi-Fi adapter is also acceptable. That way one Ethernet port is used for the AcornSix, and the second wired Ethernet port can be used to access the internet or a LAN. If you do have two Ethernet ports, install the CNC12 software with the Ethernet port that connects to the LAN/internet disconnected. This way the CNC12 installer will install to the correct Ethernet port.

NOTE: Your IP address will differ from those shown in the picture.

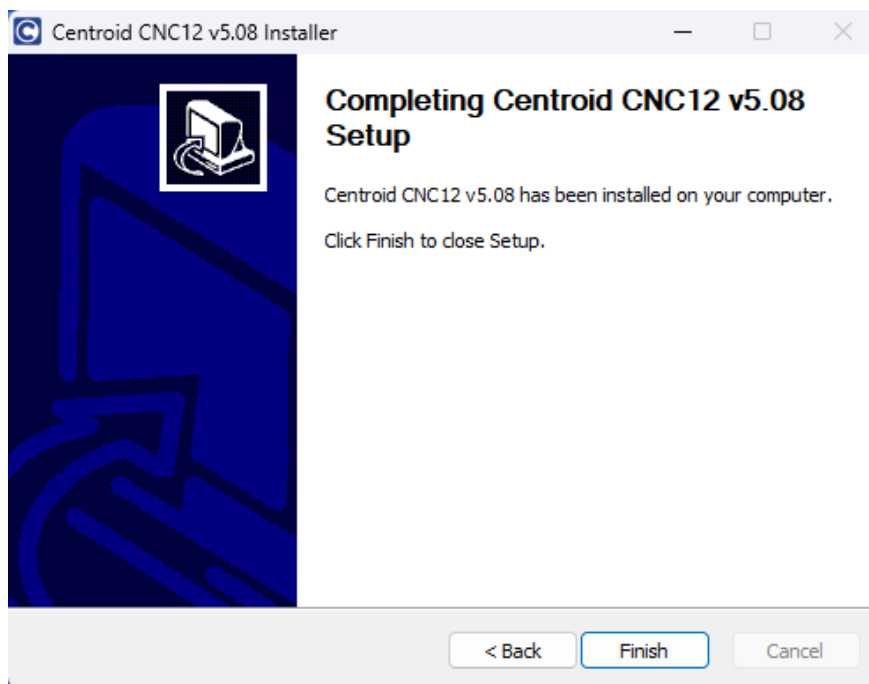
13. If the Network Adapter Setup screen does not show an Ethernet option, that means that the installer does not detect the CNC control board Ethernet connection to the PC. **If you see this screen STOP, select "Cancel",** and ensure that the control board is powered on and connected to the PC via Ethernet. Then retry the installation. If the issue persists, go back to [Section 3.1](#) and check the Windows 10/11 configurations are setup properly for CNC control use.



14. Confirm that the Ethernet selected is the correct one and select "Yes" to proceed.



15. Click “Finish” to complete CNC12 software installation.



Chapter 4 Bench Testing

4.1 CN12 Software Configuration

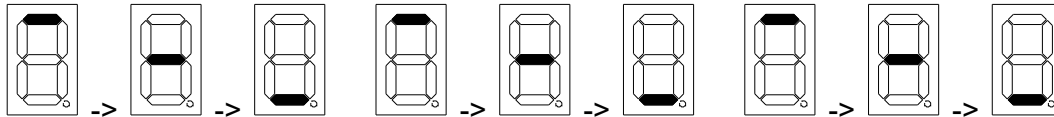
Before starting the AcornSix CNC12 software verify that the AcornSix CNC control is powered on and the Ethernet cable connected to the CNC PC. The LED on the AcornSix will be a continuous scrolling sequence when it is in a ready state (if you see a number it is an error code). For a list of error codes see Appendix B.

AcornSix on board LED1 Operation

The seven-segment display (LED1) is used to display status.

At startup, LED segments will light up in a fast rotating pattern during boot up process and continue until initialization is complete. The Initialization (booting) takes about 15 seconds.

Center segments lighting in a scrolling pattern indicates AcornSix has booted and is running normally.



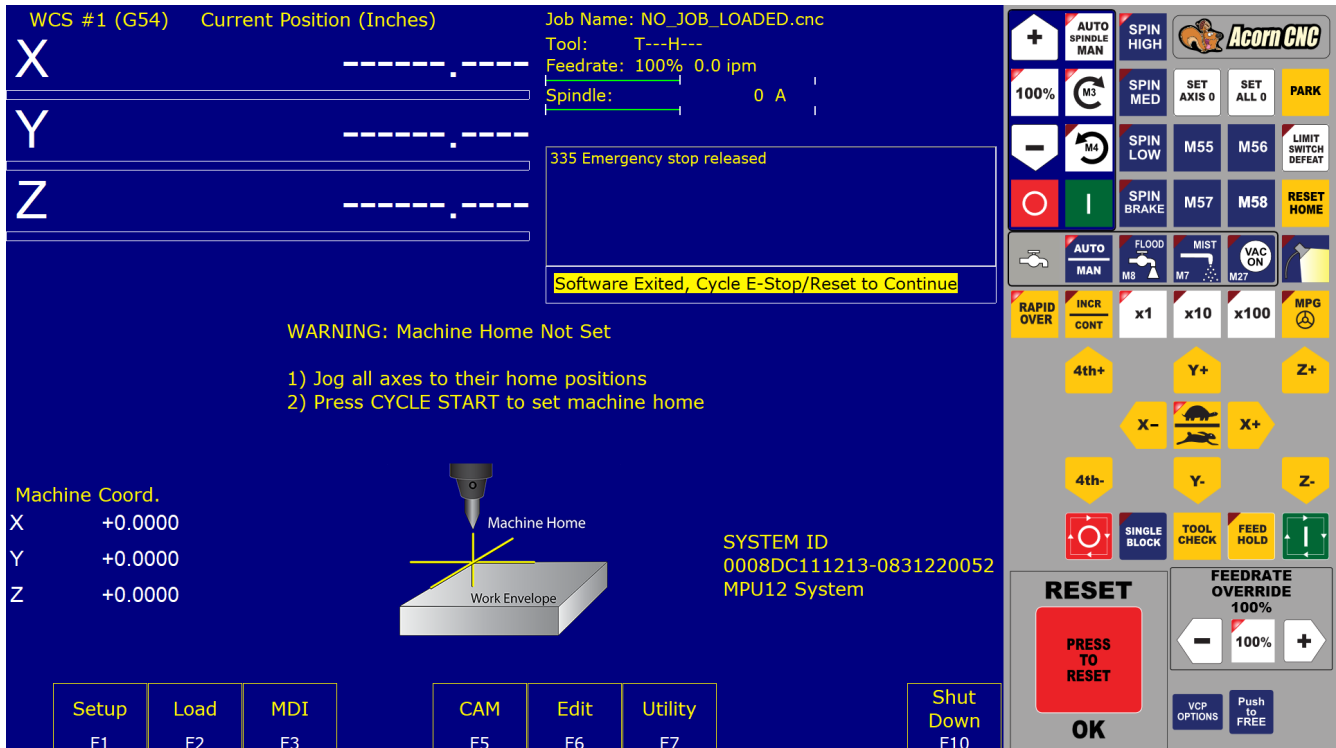
Errors are indicated by a flashing number with the decimal point lit continuously. See “LED1 Error Codes” chart for error descriptions.



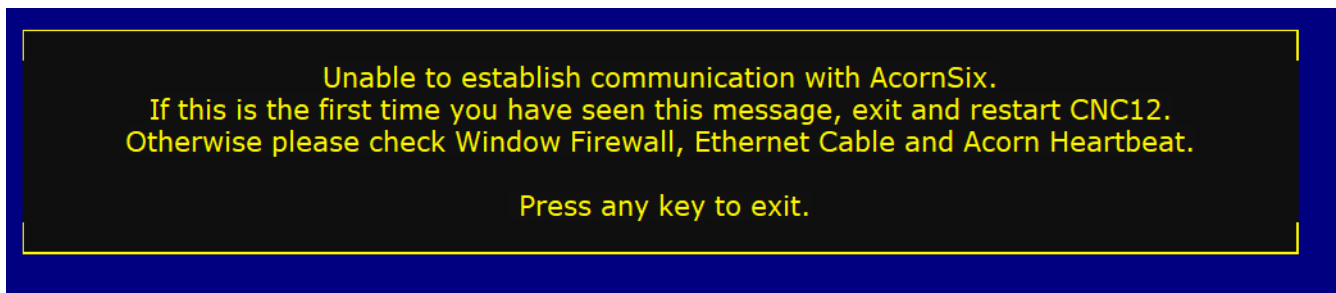
Double click the CNC12 Mill (or Lathe or Router) icon on the desktop.

The main screen of CNC12 will appear. You have successfully connected CNC12 and AcornSix.

Note CNC12 is designed for a monitor resolution of 1920x1080, set the monitor resolution to 1920x1080 for best results.



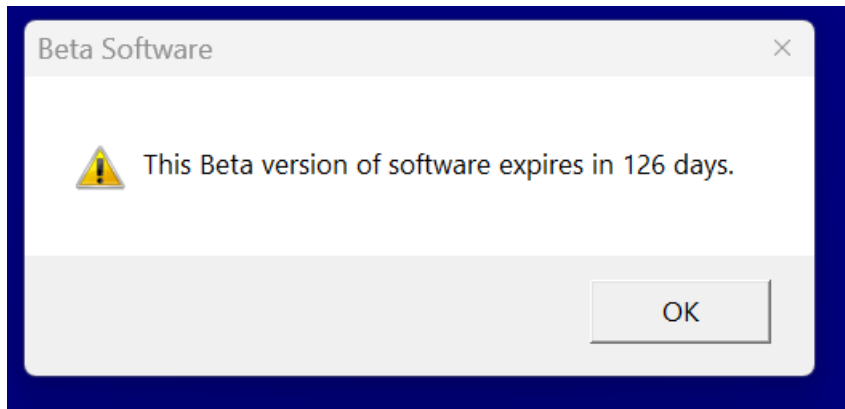
If CNC12 does not start and you receive this message.



Press any key to close and then try again, Double click the CNC12 Mill (or Lathe or Router) icon on the desktop. If this message persists review the IP settings, Virus and Firewall see Tech Bulletin 270 for more information.

https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/270.pdf

Notes on Beta Software: when running beta software this message will appear on start up.



If you see this message, please STOP and download the latest released version of CNC12 found on our website. Do Not use any BETA software versions on a production machine.

Released version of CNC12 can be found here.

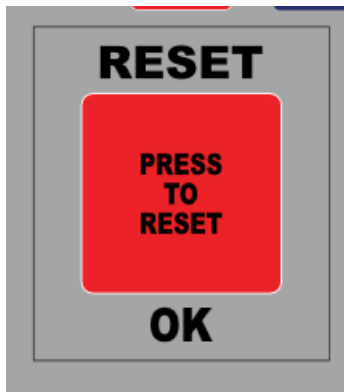
https://www.centroidcnc.com/centroid_diy/centroid_cnc_software_downloads.html

If you want to participate in CNC12 Beta software testing more info can be found here.

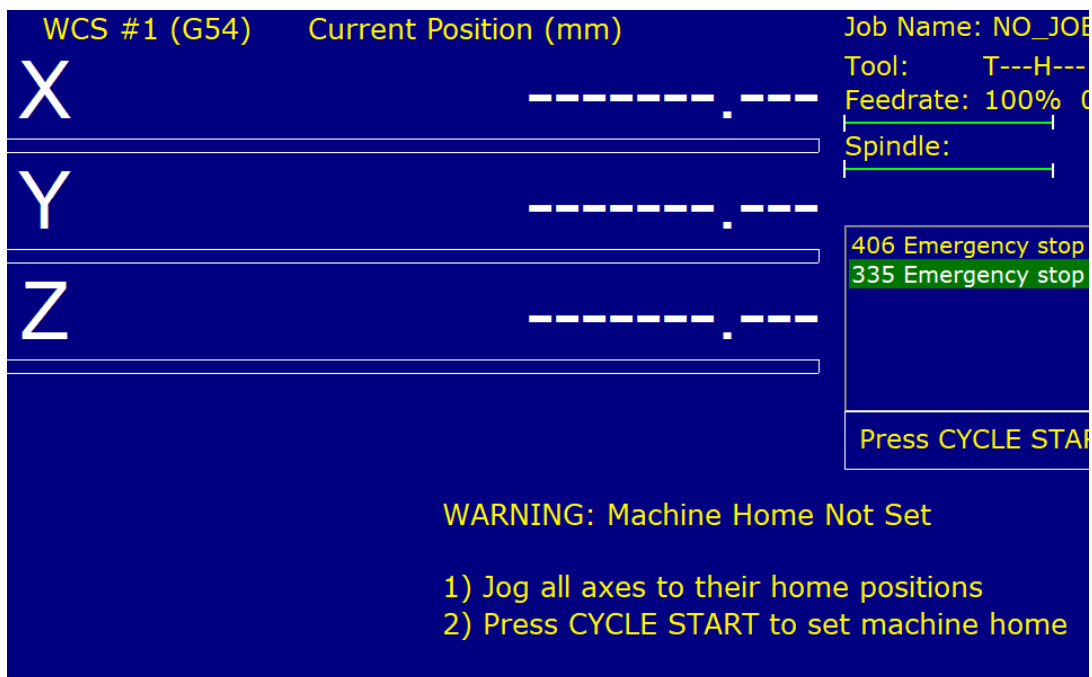
<https://centroidcncforum.com/viewforum.php?f=67>

4.2 AcornSix Communications Stress Test

1. Start CNC12 with AcornSix Powered up.
2. Click/press the “PRESS to RESET” twice to clear any message in the message window.



- 3.) Set Home. You'll notice the DRO (Digital Read Out) is full of dashed lines.



Press the “Cycle Start Button” to set the Home position.



The DRO will now read 0.0000

WCS #1 (G54) Current Position (mm)

X

+0.0000

Y

+0.0000

Z

+0.0000

Dist to Go

X +0.0000

Y +0.0000

Z +0.0000

Machine Coord.

X +0.0000

Y +0.0000

Z +0.0000

Setup

F1

Load

F2

MDI

F3

Run

F4

Share this window

F5

Edit

F6

Utility

F7

Graph

F8

Digitiz

F9

Shut Down

F10

Job Name: NO_JOB_LOADED.cnc

Tool: T---H---

Feedrate: 100% 0.0 mm/m

Spindle: 0 A

406 Emergency stop detected

335 Emergency stop released

Press CYCLE START to start job

+

100%

-

○

AUTO SPINDLE MAN

M3

M4

○

100%

○

○

○

SET WCS XY0

SET WCS Z0

Laser Set XY

PopUp PINS

AUTO MAN

DUST Collector

RAPID OVER

INCR CONT

x1

x10

x100

4th+

Y+

Z+

X-

Y-

Z-

4th-

○

SINGLE BLOCK

TOOL CHECK

FEED HOLD

○

Acorn CNC

Auto Z to PLATE

PARK

RE-PAIR AXES

GOTO WCS XY0

LIMIT SWITCH DEFEAT

GOTO Machine XY0

M58

RESET HOME

Hold Down VAC

Air Blow

MPG

RESET

PRESS TO RESET

OK

FEEDRATE OVERRIDE

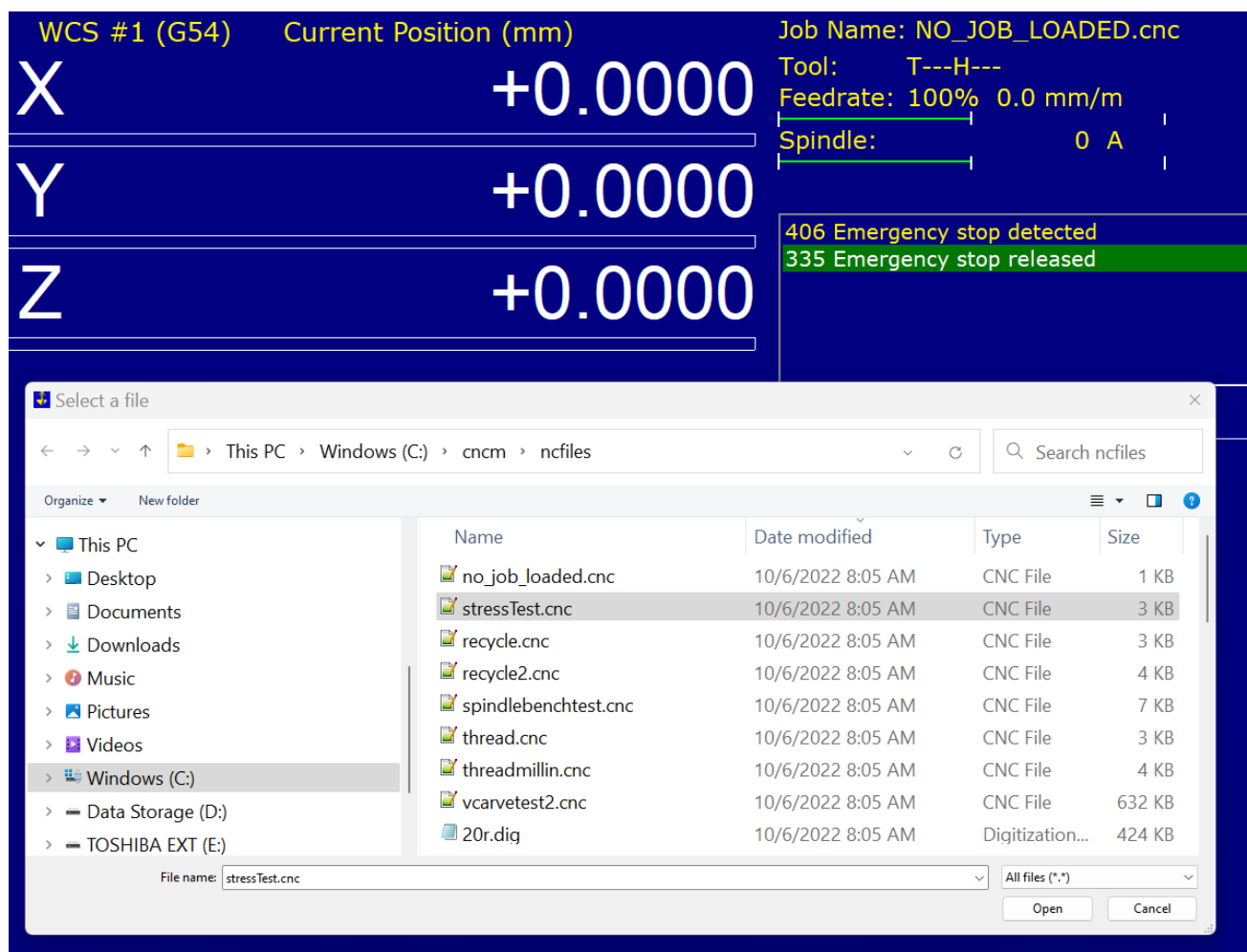
100 %

100%

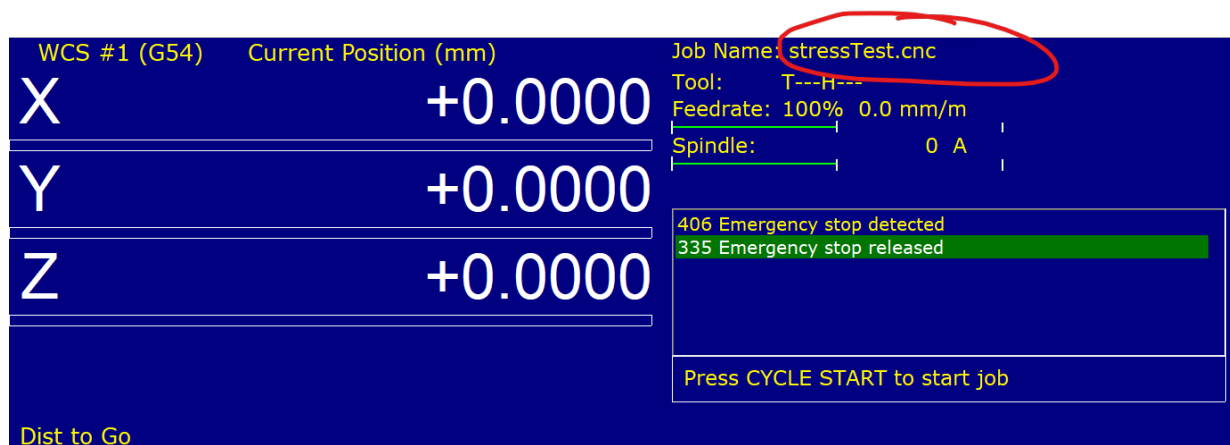
VCP OPTIONS

Push to FREE

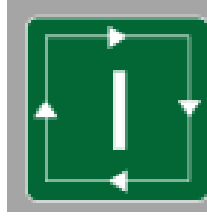
4.) Press F2 “Load” and navigate to the communications stress test program.



stressTest.cnc will appear beside “Job Name:”



5.) Press cycle start to run the communications stress test.



This message will appear indicating the start of the stress test.

**Communications Stress Test will start after
this message disappears, Please Wait for results**

Then the results.

**Communications Stress Test
PASSED
max. errors acceptable = 5
Results:
Packets Resent: 0
Generic Communication Errors: 0
Packets Out of Order: 0
NAcks Packets Sent: 0
NAcks Packets Recieved: 0**

If the stress test fails. See Tech Bulletin #270 for details on how to fix hard to solve PC to CNC communication errors. https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/270.pdf

For detailed discussion see this post <https://centroidcncforum.com/viewtopic.php?f=61&t=1451>

4.3 AcornSix Analog Spindle Output Test “Spindle Bench Test”

Test the Analog output for Spindle control.

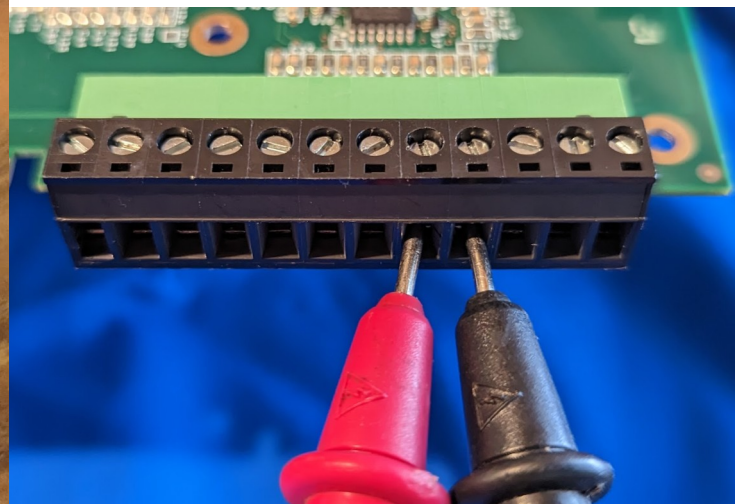
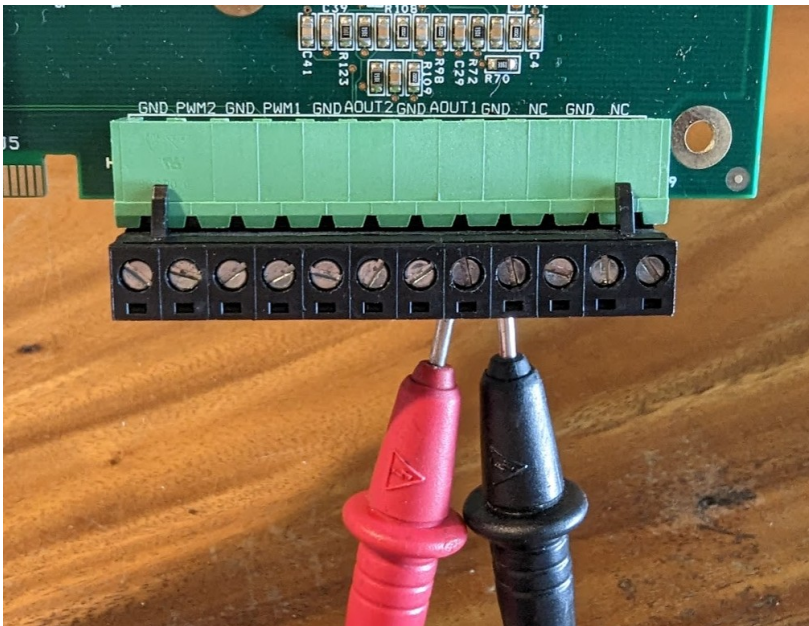
Load spindlebenchtest.cnc: From the main menu press F2-Load. Scroll down in necessary and click on the file “spindlebenchtest.cnc”, then click open.

Spindlebenchtest.cncn appears as the job name at the upper right corner of the CNC12 window. Press Cycle Start (Keyboard shortcut alt-s) to start the Spindle Bench test program. If the Digital Read Output (DRO) does not display when you press alt-s, you likely encountered a fault. See clearing faults is covered in section [4.2.3](#)

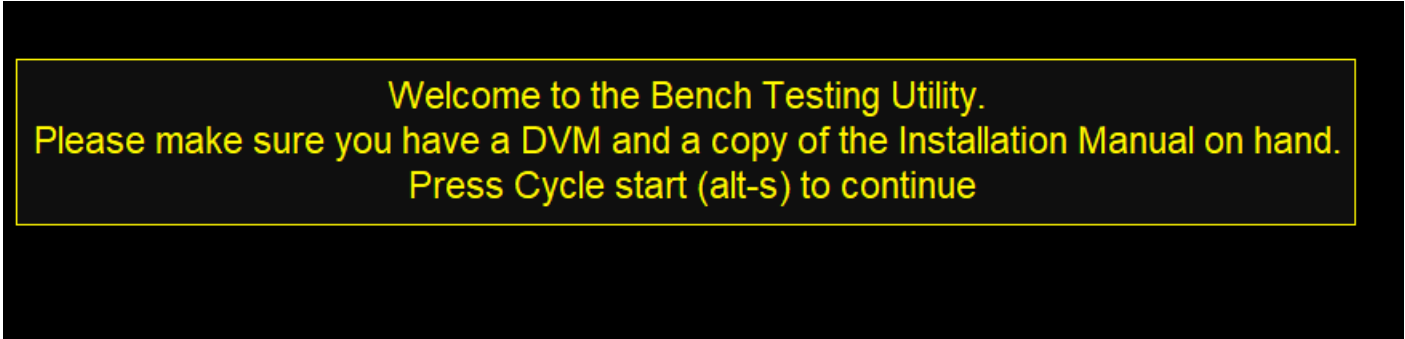
Testing the analog output for the spindle: AcornSix provides a 0 to +10VDC analog output to provide programmable spindle speed control using a VFD (variable frequency drive). The default maximum spindle speed specified in the Control Configuration is 3000rpm. This configures the control to scale the 0 to +10VDC from 0-3000rpm. A spindle speed command of S1500 will therefore output +5VDC, a command of S1000 will output +3.33VDC and so on.

1. Set a digital voltage meter to VDC
2. Connect the seven pin terminal block into connector H9
3. Insert the digital voltage meter leads into ANALOG OUT1 and GND (any of the grounds on H9 will work).

Tighten down the screw terminals to firmly grip the probes.

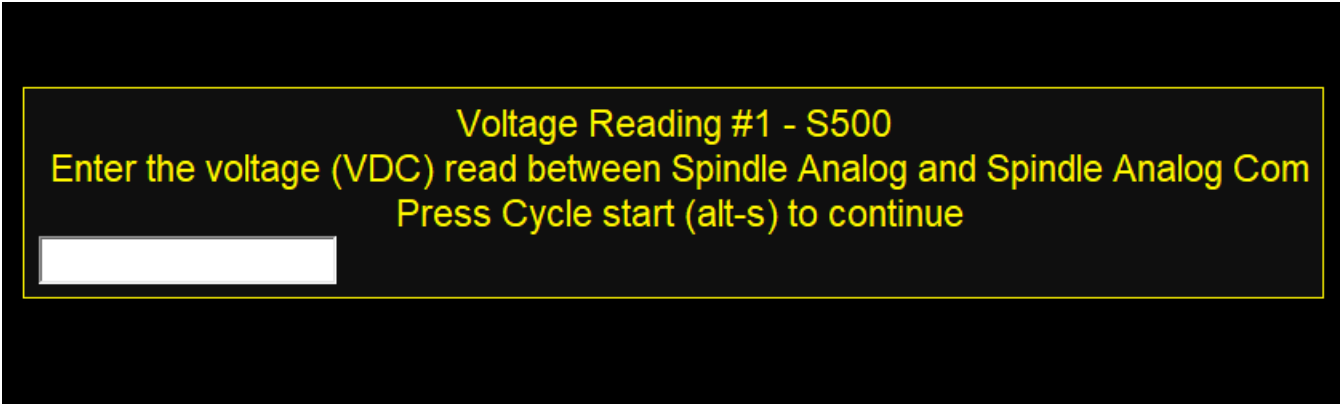


4. With spindlebenchtest.cnc loaded, press Cycle start to begin. The following screen will be displayed: (You may have to press Cycle start twice)



Welcome to the Bench Testing Utility.
Please make sure you have a DVM and a copy of the Installation Manual on hand.
Press Cycle start (alt-s) to continue

5. Enter the voltage readings as pictured below and press Cycle Start to continue.
Spindlebenchtest.cnc will throw an error if the spindle does not output as expected. Continue to press cycle start as requested until the program is finished. The program will exit and the status window will say "Job finished" after a successful completion.



Voltage Reading #1 - S500
Enter the voltage (VDC) read between Spindle Analog and Spindle Analog Com
Press Cycle start (alt-s) to continue

4.4 Load an AcornSix License

Centroid Community CNC Support Forum: AcornSix CNC12 software License ordering process explained <https://centroidcncforum.com/viewtopic.php?f=61&t=3570>

Centroid Community CNC Support Forum: Video: How to install an AcornSix CNC12 License <https://centroidcncforum.com/viewtopic.php?f=61&t=3345>

AcornSix License Installation Instructions:

- 1) Download and save the email attached license.dat file to the CNC PC desktop using a Windows PC. (Note: Mac or any Apple computers, will corrupt the .dat file attached)
- 2) With AcornSix powered up and running, Start the CNC12 software.
- 3) Press "F7" Utility menu.
- 5) Choose the "F8" Import License function. This will open a file dialog. Navigate to the desktop (or the location where the license file attachment was saved) and select the license.dat file. Click "Open". CNC12 will then respond with a message stating that the license was successfully imported.

Trouble shooting License Issues:

TB325: Licensing Issues and Troubleshooting
https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/325.pdf

Centroid Community CNC Support Forum: Error "Serial number and license file does not match this system" <https://centroidcncforum.com/viewtopic.php?f=63&t=3882>

Chapter 5 Cabinet Wiring

5.1 Introduction to Electrical Cabinet Wiring Layout

Now that you are finished with the board level test it is time to think about electrical cabinet installation. This chapter will go into detail about how to wire the various systems into your cabinet. During cabinet wiring, it is important that you follow the schematic examples provided by Centroid.

Schematic sets may be found here:

https://www.centroidcnc.com/centroid_diy/schematics/pbrowse.php

Centroid Community CNC Support Forum: Control Box Building Tips

<https://centroidcncforum.com/viewtopic.php?f=61&t=2443&sid=00f5418e46966cadb26ca1f3b6567b17>

Solid Models and CAD Files for cabinet layout:

https://www.centroidcnc.com/centroid_diy/downloads/acorn_documentation/acornsix_cover.dxf

Minimize Electrical Noise and EMI Interference

- Keep sensitive electronics away from noisy equipment. Install high voltage transformers, contactors, and other electrically noisy equipment as far away from low voltage circuit boards as practical. For example, it would be a bad practice mount a contactor block or large transformer directly underneath the AcornSix. See TB270 for more information on solving Communication errors.

https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/270.pdf

- Keep high voltage power lines far away from low voltage signal lines. Keep the high-voltage AC power lines and motor power lines as far away from low voltage logic signals as practical.
- Grounding Principle. Wire the incoming chassis (earth) ground lug directly to a single ground bus bar. Wire all cabinet doors, power supply chassis grounds, and other equipment chassis ground to one single ground bus bar. What you should NOT do is have several different grounding points throughout the cabinet, as this could increase electrical noise and interference.
- Leave plenty of space between wire ducts and components. Keep wire ducts at least 2" away from circuit boards when practical.
- Use Snubbers on Contactors. Contactor blocks and relays need a snubber across the coil. Centroid recommends using Quencharc snubber networks (Centroid PART# 1819). This reduces electrical noise. If you are new to using snubbers more information can be found in Technical Bulletin #206, the latest version can be found here.
 - http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/206.pdf
- Keep wires short Keep all cabinet wiring under 6ft.

Keep the cabinet maintainable and easily serviceable.

- Centroid can provide electrical cabinet materials such as contactors blocks, time delay contactor blocks, relays, fuse blocks, din rails, overload relay with fuses, din rail end stops, terminal blocks, etc. We only carry the part if it has a Centroid part number on the schematic. Call Centroid for with the part # ready for pricing and availability.
- For wire management use PVC wire ducts (such as Panduit Panduct) to keep your wires neat and organized.
- Use DIN rails for mounting relays, contactors, terminal blocks, circuit protection blocks, disconnects, etc.
- Leave a little bit of slack in the wire. Take all corners in the wiring ducts as wide as possible to leave a small amount of slack in the wires.
- Keep all the wiring in neat horizontal and vertical lines. Never run wires diagonally.
- Label **EVERYTHING**. Label everything so that it matches the labels on your schematic. This includes labeling each individual wire at both ends, circuit boards, relays, contactors, etc.
- Keep the schematic attached to the cabinet somewhere so it does not get lost.

Use the correct wire gauge.

- 22 Gauge stranded is suitable for signal wires such as limit switches and VFD inputs and outputs. A twisted pair cable is ideal of devices with like limit switches with one signal and one return run.
- 18 Gauge stranded can is used for 5V, 12V, 24V low current power wires. 18 gauge is used to power the Acorn and control devices connected to the outputs.
- 16, 14, 12 gauge should be used for Power wires connected to Axis drives, contactors, spindle drive, pumps and other higher current accessories. Consult the drive manual to determine current requirements. If a drive can accept 110VAC or 220VAC, Wiring for 220VAC will reduce the required current.
- Stranded wire in these gauges can be purchased from most home improvement centers in the electrical section and from automotive suppliers for automotive wiring.

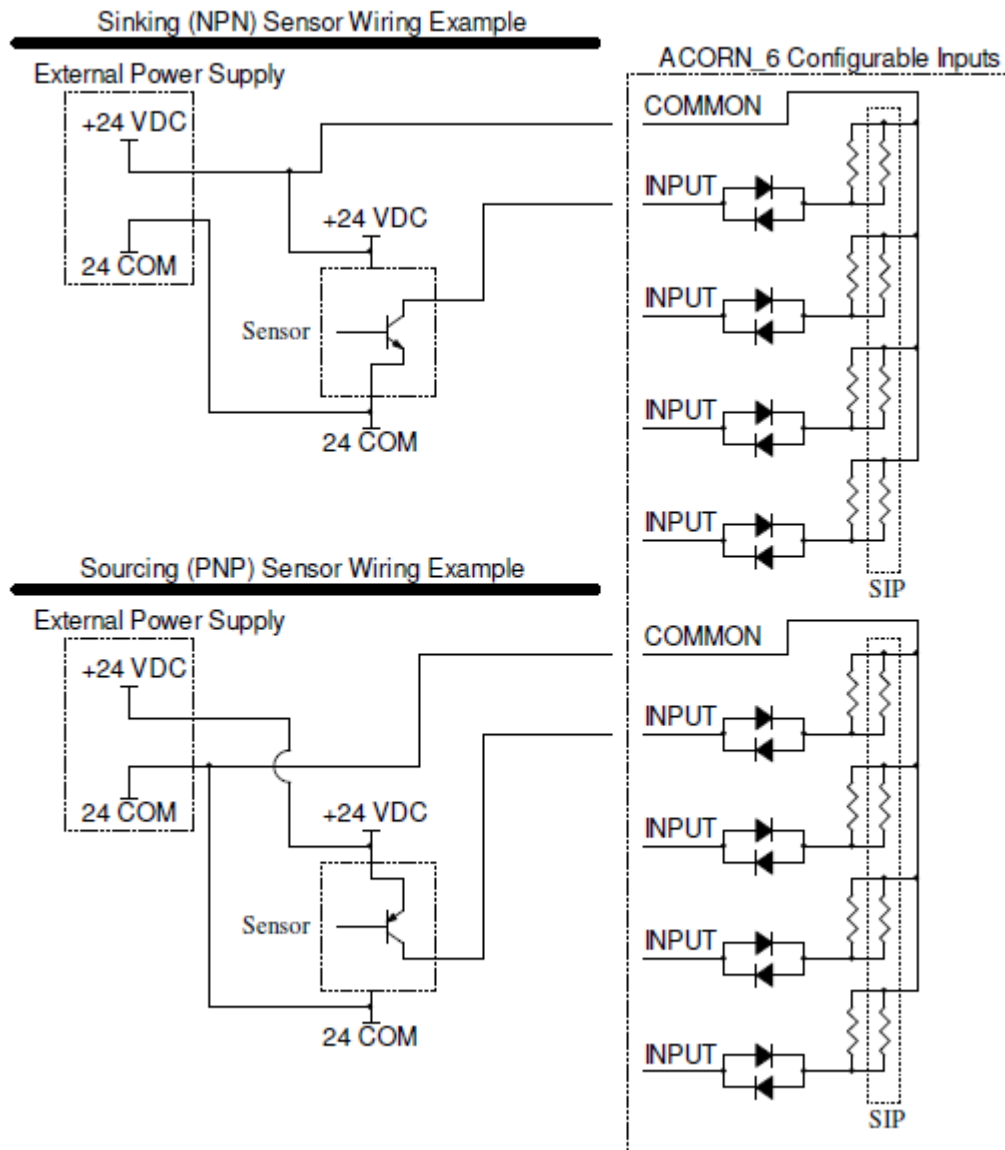
Common Wiring Problems

The following information covered in Technical Bulletin #78 which can be found here:

(https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/78.pdf)

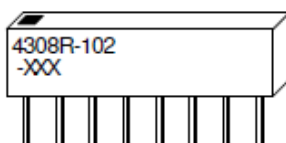
5.2 AcornSix Inputs

The AcornSix is equipped with 16 optically-isolated inputs. Inputs can be wired for either Sourcing or Sinking. This is determined by wiring the common terminal for the bank to supply positive (Sinking), or supply common (Sourcing). Inputs are divided in banks of four.



Voltages can be selected by installing the appropriate SIP. Without a SIP installed (default configuration when shipped from Centroid) the voltage is set to 24V. Optional SIPs (included in the AcornSix component bag) can be installed to use 12V or 5V input voltage.

SIP Identification - XXX Indicates Value



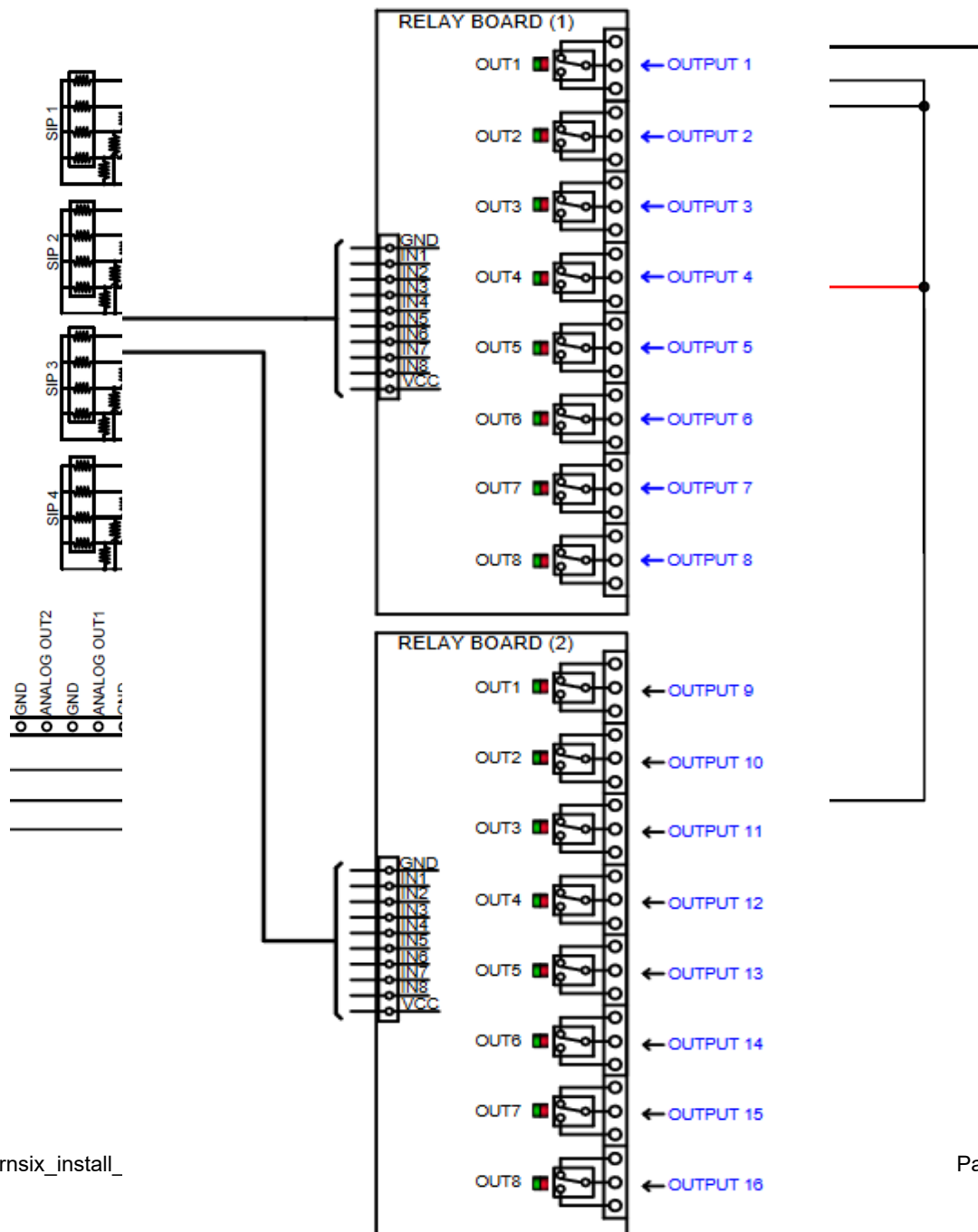
SIP Input Voltage Selection

SIP Value Marking	Resistor Value (Ohms)	Input Voltage
221	220	5
102	1.0k	12
None	None	24

VDC is supplied via Common (1-4, 5-8, 9-12, 13-16) on H4 and H5. These terminals are NOT connected internally. An example showing Home All, Limit All, Drive OK, and E-Stop is below.

5.3 AcornSix Outputs

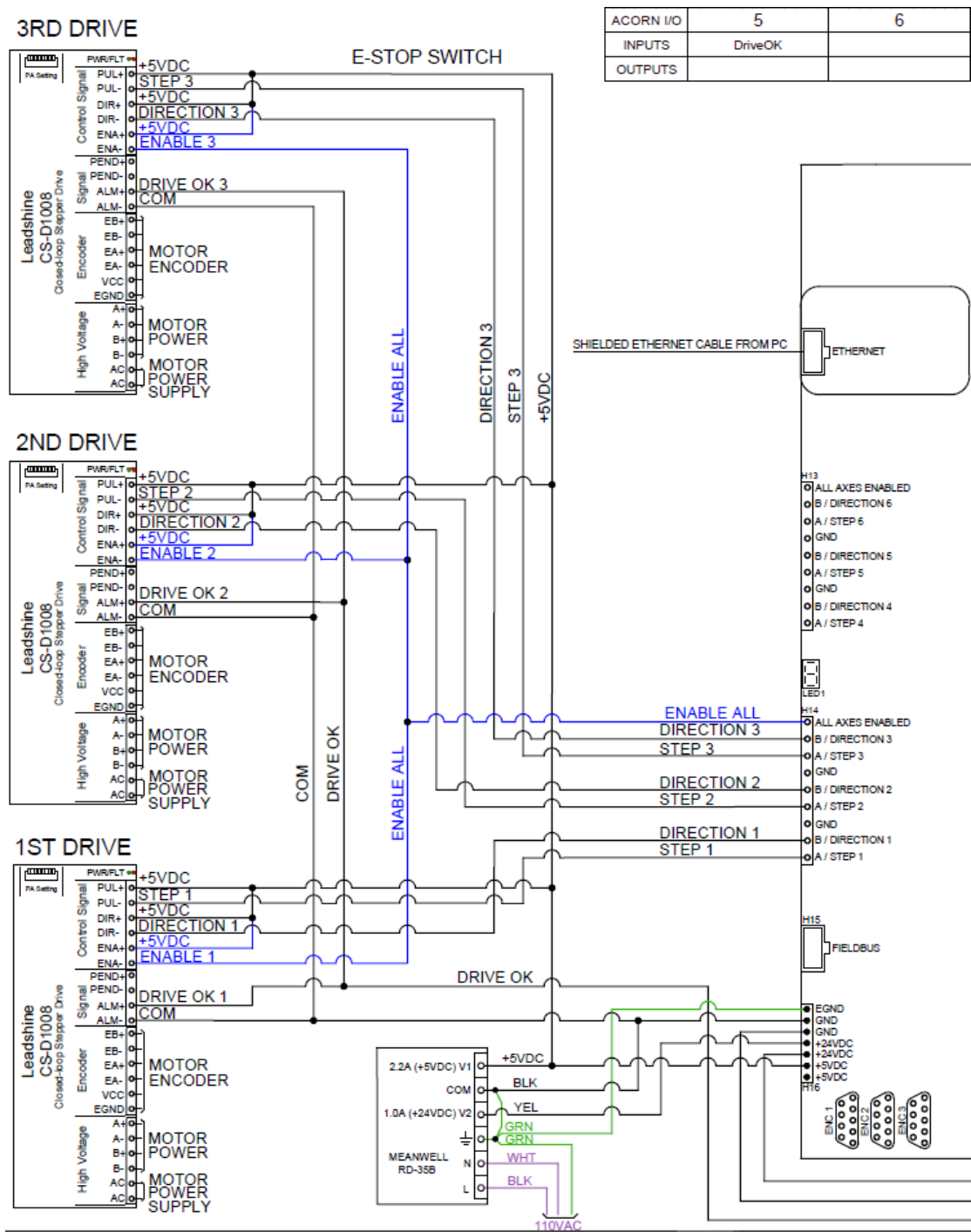
The AcornSix is equipped with a total of 16 relayed outputs via (2) 8 relay boards. The relay boards come equipped with LEDs showing output status.



5.4 Wiring Axis Drives

The AcornSix has 6 drive interfaces and supports a wide variety of axis drives that accept standard step and direction input (some drive manufactures also use the term “pulse and direction”).

An example of drive wiring is below. Please consult your schematic for drive specific wiring.



5.5 Wiring E-Stop Circuit

A general guide to E-Stop wiring and motor power troubleshooting is contained in Technical Bulletin #286 which is located here.

(https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/286.pdf)

E-Stop Wiring

- The emergency-stop (or E-Stop) is a safety mechanism used to shut off the machine during an emergency.
- The switch should be closed when the machine is in its operational state.
- **NOTE:** Wiring E-Stop in a normally open configuration is dangerous as it will not stop the machine in the event of a wire break. It also prevents noise from causing spurious faults because the signal is being electrically held at the operational level.
- For additional safety, multiple E-Stops can be added to a machine, but they all must be wired in series.

E-Stop Switch

- Use a double pole single throw (DPST), normal closed, twist to release, emergency stop switch. Such as Centroid part number #1009 used with #5934
- AcornSix E-Stop – There are two E-Stop signals, one input and one output.
- Input 8 is typically assigned to the E-Stop. Input 8 on header H1 needs to be routed in series with any E-Stop switches, so that if any of the E-Stop switches are tripped the PLC knows the E-Stop is engaged as seen in
- Output 1 (AKA drive fault relay) The E-Stop contactor must be routed in series with output 1 and any E-Stop switches, so that if any of the E-Stop switches are tripped the power is removed from the contactor block.
- The AcornSix output 1 relay is rated for up to 10 amps at 125 VAC or up to 5 amps at 30 VDC. Please use the lowest voltage practical, as a high voltage can result in excessive noise that will create undesirable effects. Centroid recommends using 24 VAC.

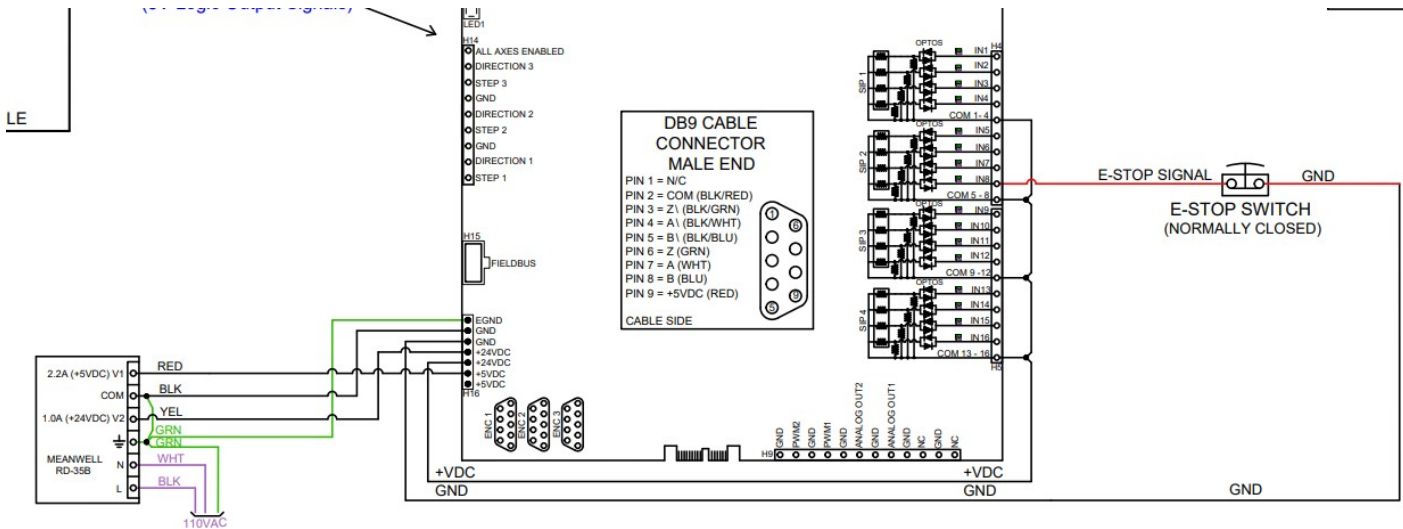
Contactor

- A contactor is an electrically controlled switch. It can be thought of like a higher current relay.
- These are used to turn on and off power to the main spindle and the axis drive. The Centroid recommendation for contactors is a 24VAC type, although 24VDC and 110VAC contactors are available.
- If you are not using a contactor with a built-in or add-on snubber, a snubber needs to be placed across the contactor(s). Centroid recommends using Quencharc snubber networks (Centroid PART# 1819). This reduces electrical noise when the servo motor power is cycled on and off.
- For larger machines with AC servos, Centroid recommends using a Schneider Electric/Telemecanique LC1DT40B7A or similar device for the E-Stop contactor (Centroid PART# 14374). This Contactor assembly includes snubber assembly and uses 24VAC to control it.

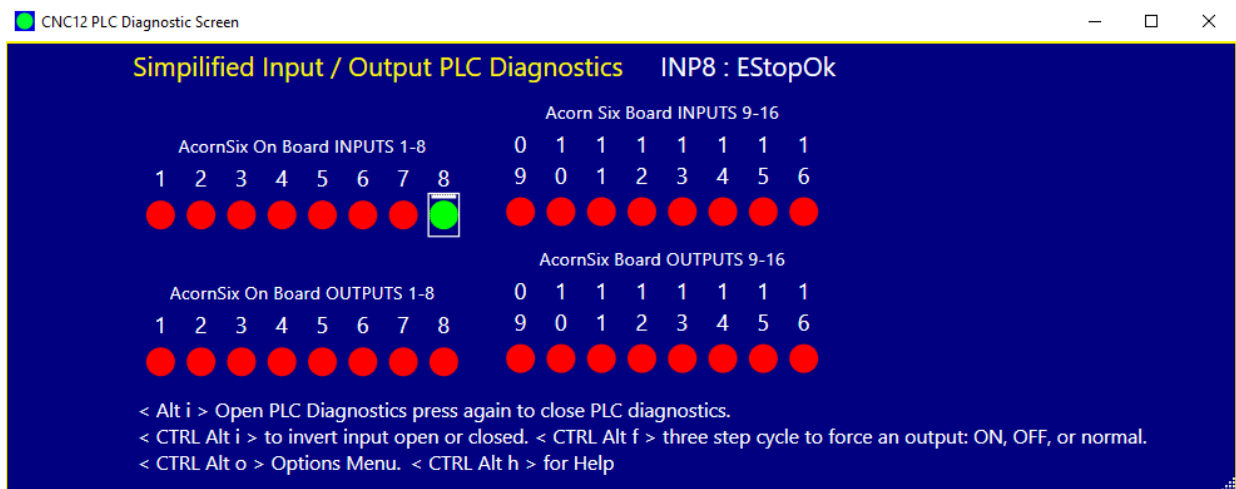
- For smaller desktop machines with steppers and small spindle motors, The LC1K0610B7 24VAC Flood Contactor w/snubber (#14377 from Centroid) can be used. This contact is also useful on all machines for turning on and off accessories like spindle, pumps, vacuums and other high current accessories.

Testing the E-Stop Switch

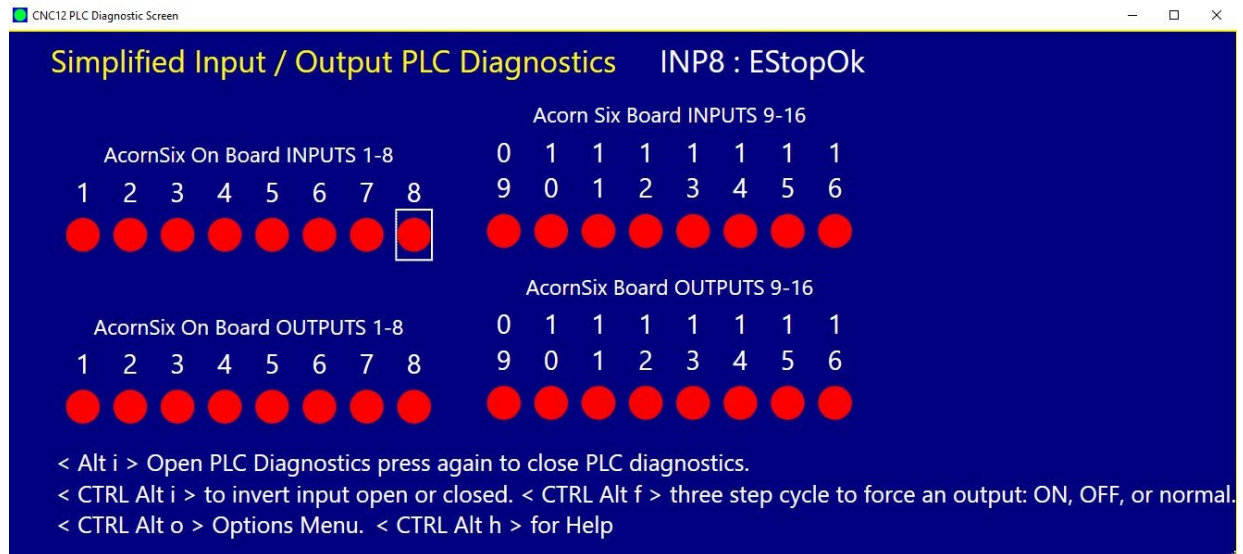
- Wire a Normally Closed E-Stop switch to the AcornSix following E-Stop examples on any of the AcornSix schematics.



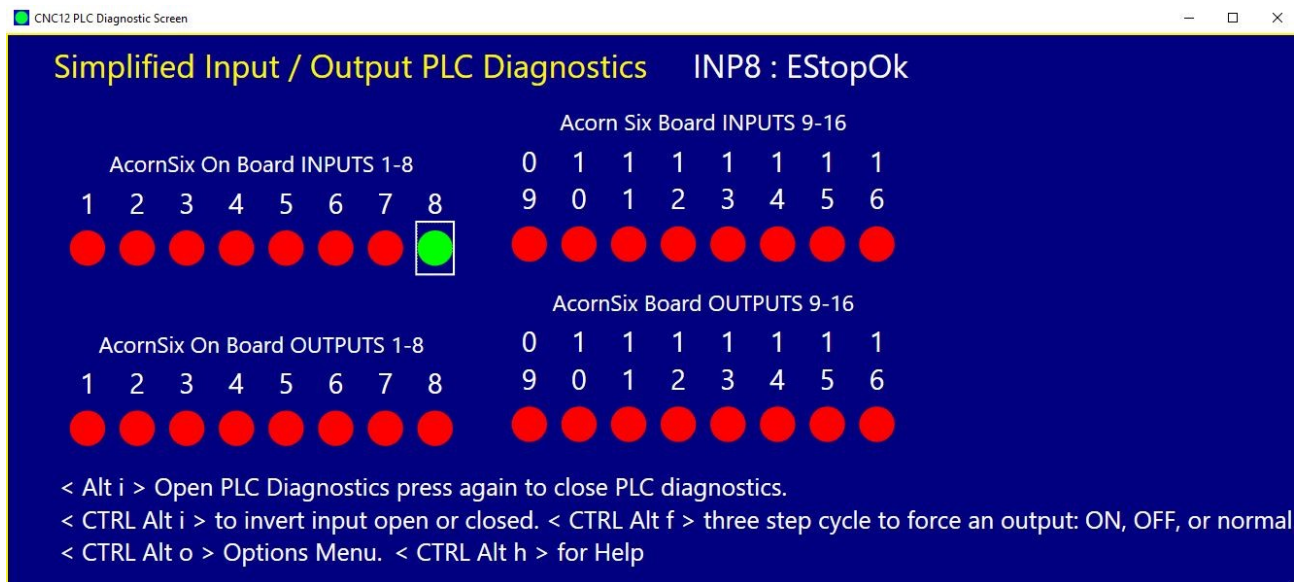
- Power up the system
- Start CNC12
- CNC12 initially starts with the E-Stop input inverted for bench testing up to this point. The inverted E-Stop input #8 allows CNC12 to run without a physical stop switch connected to the AcornSix. The inversion is indicated by the horizontal white bar above the Virtual LED for input 8.



- Remove the inversion on input #8. In the main menu press <alt + i> to bring up the real time I/O display. Click on input 8. Press the <ctrl-alt-i> keys simultaneously to remove the bar over the input in the display, setting the E-Stop for normally closed operation.



- Confirm that there is not bar over input 8. Toggle the E-Stop. Observe that input 8 is green when the E-Stop is released (not tripped), and red when E-Stop is depressed.



5.6 Testing Limit and Home Switches

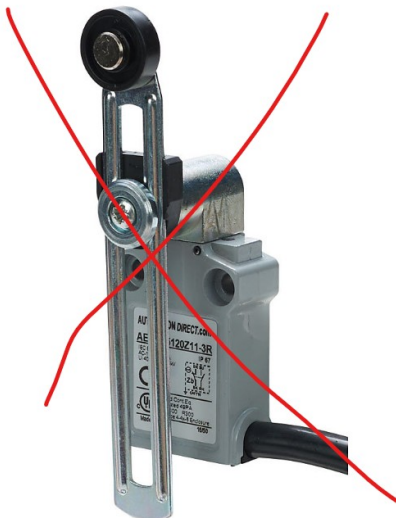
All inputs used for Limit and Home switches should be wired in a normally closed configuration. Normally Closed (NC) means that the switch should be **closed** when the machine is in its **normal** operational state. This is the CNC industry standard way of doing things.

While there are situations when a Normally Open configuration would be used, in general a Normally Open (NO) setup is dangerous as the machine will not stop in the event that a wire breaks or switch failure/damage etc. Using Normally Closed switches (and other devices) prevents noise from causing spurious faults because the signal is being electrically held at the operational level.

“Regular” switches (aka dry contact) can be utilized as well as 3 wire NPN proximity switches.



Avoid long throw limit switches commonly used on conveyor belts and heavy equipment.

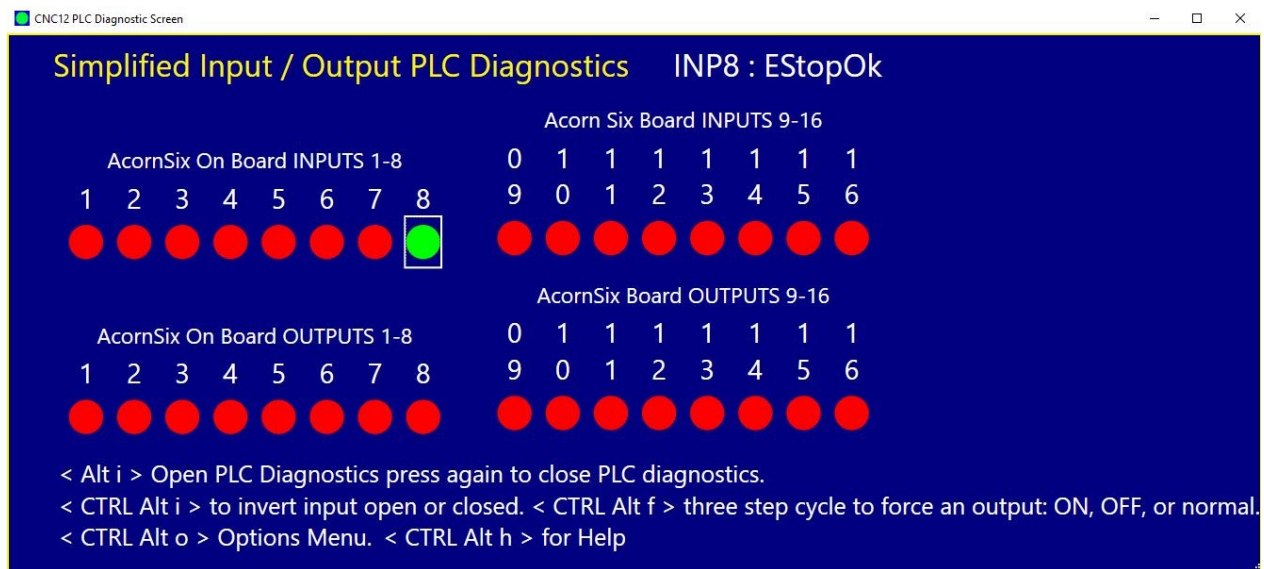


Connect limit/home switches as shown in the AcornSix schematics.

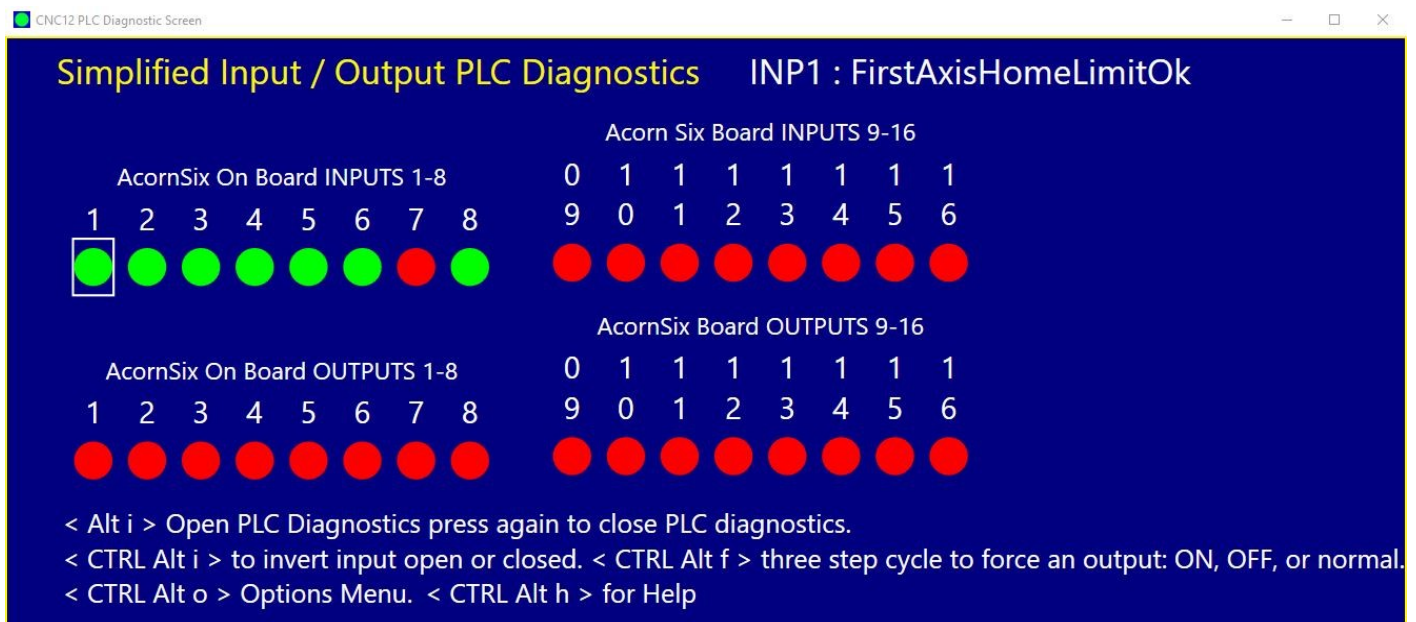
Note: Home and Limit switches can be run in series to save on inputs, In the Wizard and on the AcornSix schematics this is called “HomeAll” and “LimitAll”. Limit and Home switches can also be connected to individual AcornSix inputs.

Use the PLC diagnostic menu to verify Limit / Home Switch Wiring and Functionality.

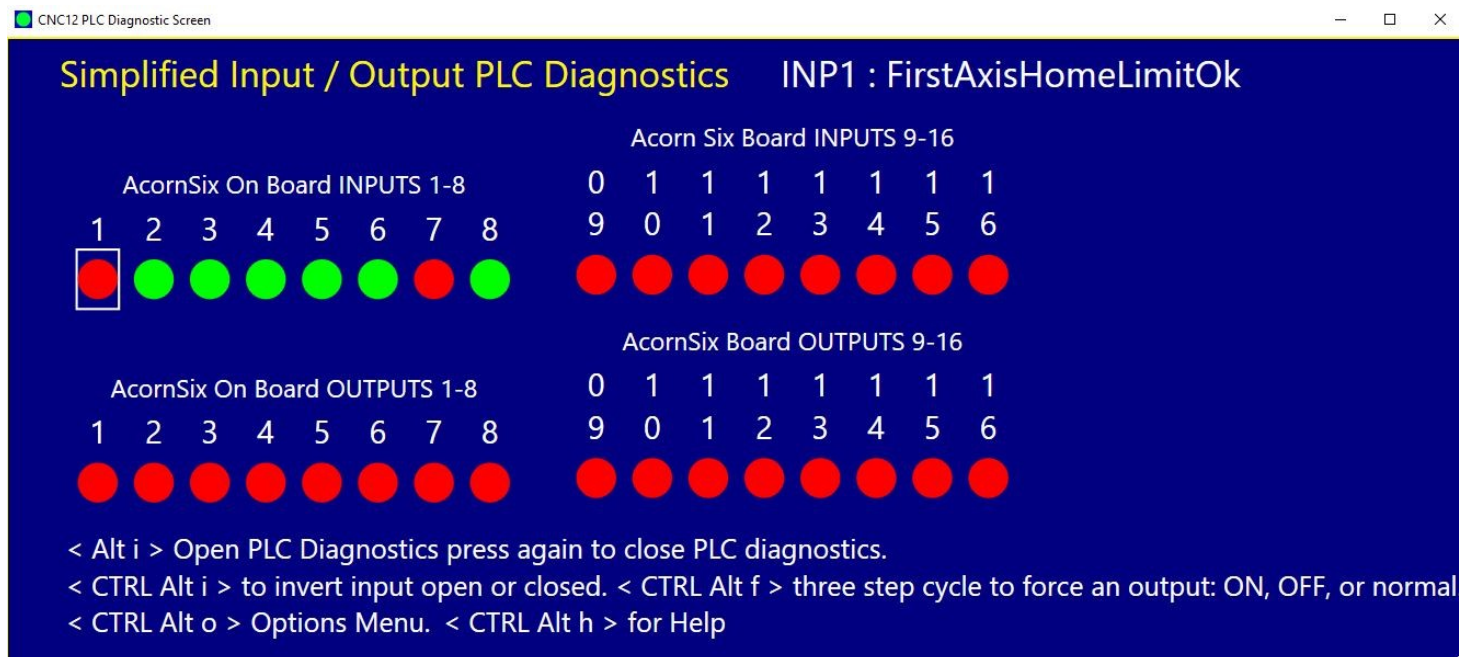
1. Power up AcornSix wait for boot to complete
2. Start CNC12.
3. From the main menu on CNC12 press **<alt + i>** to bring up the PLC diagnostic menu, this menu displays real time I/O state.



4. Confirm that all limit switches are green when no switch is tripped.



5. Confirm that the correct input turns red when the switches are manually tripped.



5.7 Wiring the Spindle

STOP! Before wiring up the spindle make sure that you tested the spindle analog output as described earlier in this manual.

There are two main methods of wiring a spindle motor to AcornSix. 1.) Use a VFD 2.) Use Contactors

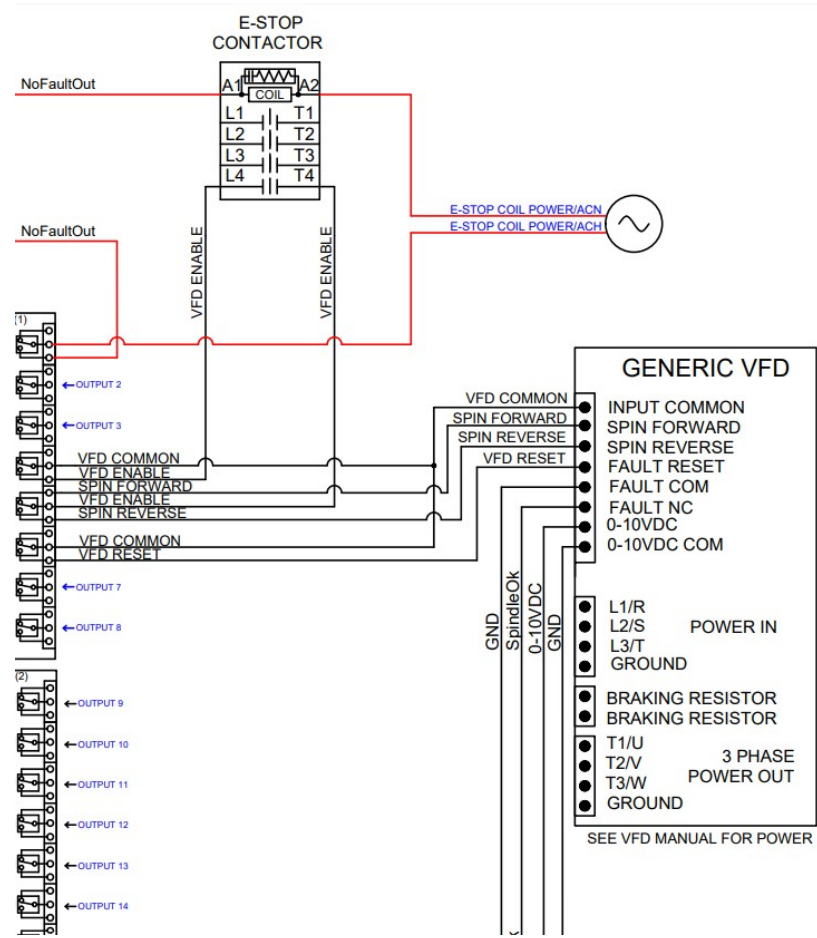
1.) Using a spindle controller. Both PWM output and Analog output on the AcornSix is available for spindle motor speed control. Typically analog output is used with VFD's and AC induction motors while PWM output is used with DC motor controllers.

The terms VFD aka "inverter" (short for power inverter), aka "AC Drive", and aka Variable Frequency Drive all refer to a AC induction motor spindle controller.

Centroid does not provide VFDs and recommends using Delta VFDs, Automation Direct GS2, GS3, and GS4 AC drives, as well as Hitachi and Yaskawa VS (Varispeed) Inverters. While Centroid does publish parameters for popular VFD's that we have used and recommend it is the responsibility of the technician installing to consult the spindle controller manufacturer for support or post a question on the Free Centroid Tech Support Forum.

Wire a VFD following the schematic and set the inputs and outputs required with the AcornSix Wizard. All schematics detail both the wiring and the AcornSix Wizard I/O definitions that correspond to the schematic.

For example: AcornSix schematic #15158

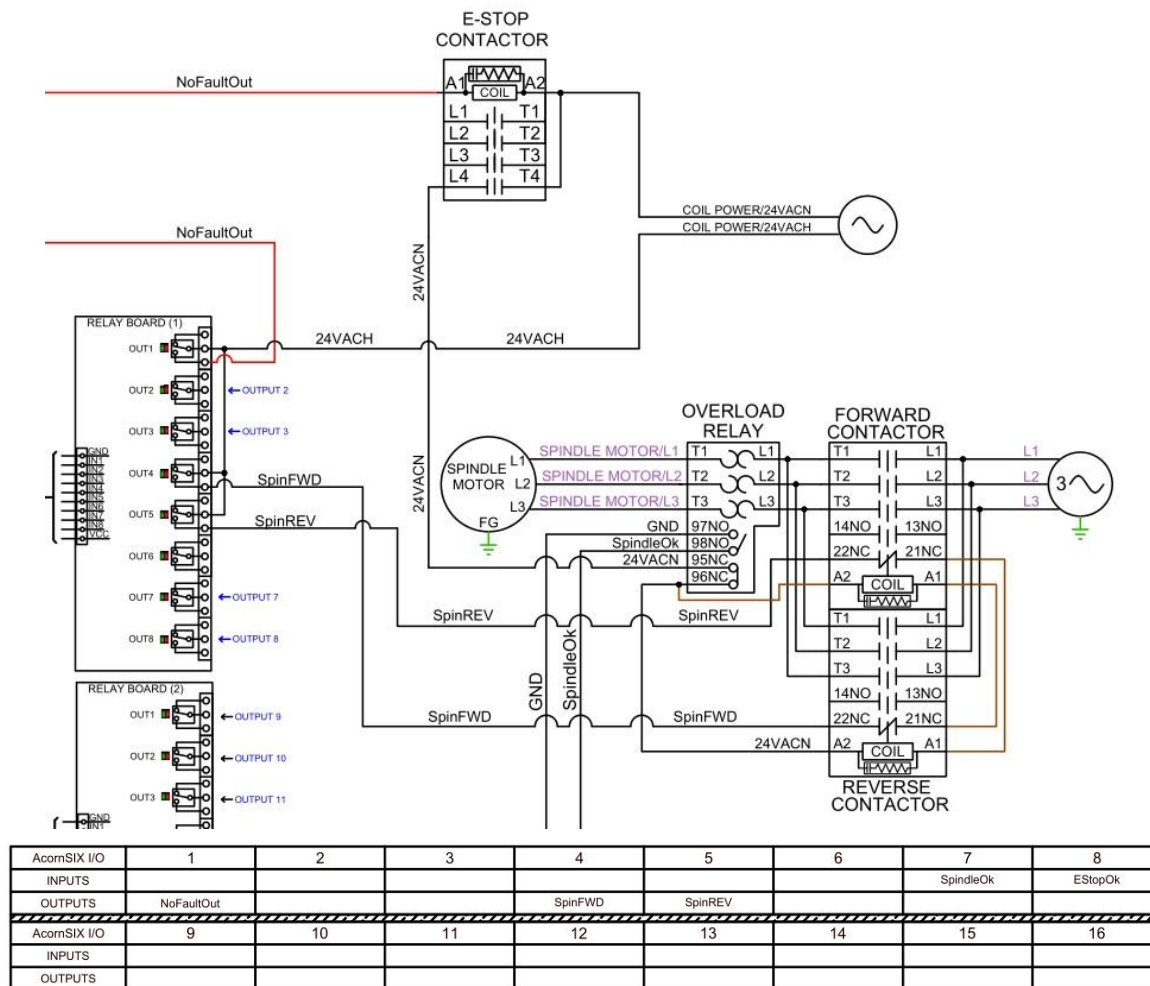


AcornSIX I/O	1	2	3	4	5	6	7	8
INPUTS							SpindleOk	EStopOk
OUTPUTS	NoFaultOut			VFDenable	VFDDirection	VFDResetOut		
AcornSIX I/O	9	10	11	12	13	14	15	16
INPUTS								
OUTPUTS								

- Input 7 is SpindleOK
- Input 8 is E-StopOK
- Output 1 is NoFaultOut
- Output 4 is VFDEnable
- Output 5 is VFDDirection
- Output 6 is VFDResetOut

2) Using Contactors to control the power going to the spindle motor. These contactors are then controlled using AcornSix's relays. These contactors directly connect power to the induction spindle motor

For example: AcornSix schematic #15158



- Input 7 is SpindleOK
- Input 8 is EStopOK
- Output 1 is NoFaultOut
- Output 4 is SpinFWD
- Output 5 is SpinREV

This method is simple but prevents the Centroid CNC software from being able to control the speed of the spindle. When using contactors the spindle speed will have to be adjusted by mechanical methods.

A contactor can be used to turn the spindle on and off with the software.

A reversing contractor with snubber #14375 from Centroid can be used to change direction.

All contactors need snubbers! Centroid recommends using the Quencharc snubber network (Centroid PART# 1819) on the coil of the contactor. This reduces electrical noise when the spindle is turned off and on.

Spindle Encoder: For spindle slaved movements such as rigid tapping, the spindle encoder needs to be connected to the AcornSix. The spindle encoder must meet the Centroid encoder type requirements to be compatible with AcornSix. See this post. <https://centroidcncforum.com/viewtopic.php?f=63&t=921>

Rigid tapping should be enabled last, after the spindle is tested and calibrated. More information on how to set up rigid tapping is found later in this document via the Wizard and also contained in your CNC12 operator's manual and Technical Bulletins. See TB304 for more info.

https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/304.pdf

When making your own cables or using your own encoders, make sure they adhere to the guidelines listed below:

Spindle Encoder Cable:

- Encoder cable **MUST** be twisted pair shielded cables.
- The shield wire of the encoder cable is grounded to the metal shield of the DB-9 connector
- If the D-sub connector does not provide a method of attaching the shield wire, the shield wire should to be soldered to the metal shield DB-9 connector.
- **NOTE:** Failure to ground the cable shield may cause encoder errors in the software.

Encoder Output:

- Compatible Encoder type: RS422 type (differential) quadrature outputs with A, B, and Z channels to work with AcornSix.
- A low encoder count creates poor performance and accuracy.
- Centroid recommends a 1000 to 2000 line encoder (4,000 to 8,000 encoder counts per revolution)
- revolution)The encoder must be rated for the RPM of the Spindle (since it must be mounted 1 to 1)
- The outputs have additional voltage level requirements described in this table:

Characteristic	Typical	Minimum	Maximum	Unit
Encoder channel low level	0.0	0.3	0.5	V
Encoder channel high level	3.0	3.5	5.0	V

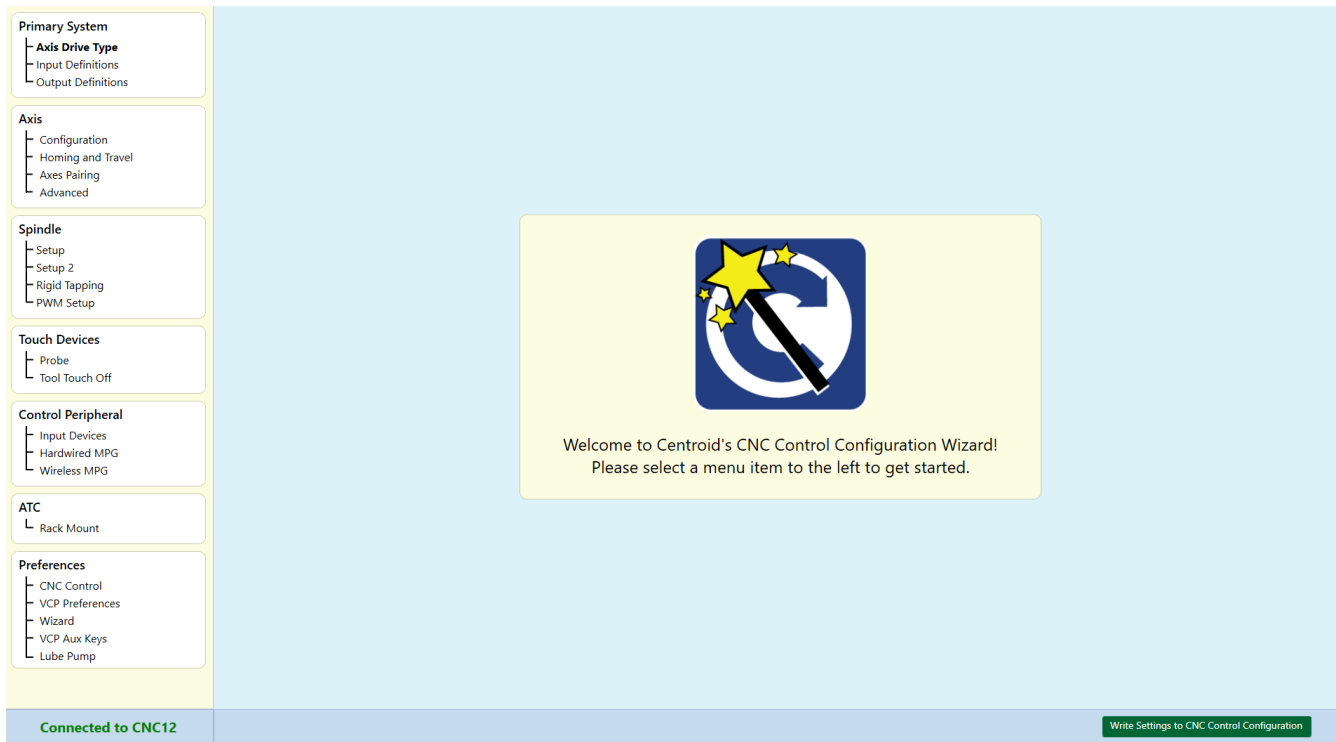
Centroid sells 2000 line encoders in multiple shaft sizes as well as encoder cables (plug and play between the encoder pigtail and the AcornSix) in 12' and 16' lengths. These encoders should be installed on a jack shaft and be protected from the environment. AutomationDirect sells enclosed sealed encoders of many types and sizes.

Chapter 6 CNC12 Software Configuration using the Wizard

6.1 Introduction to Software Configuration

This chapter assumes that you have completed the board level test and have built up a level of confidence with the hardware and software.

CNC12 provides a “WIZARD” for setting the parameters needed for proper CNC Control of the machine. It allows the user the ability to select AXIS Drive Type, assign Inputs and Outputs, Machine Turns Ratio, Axis direction reversal, Motor steps per revolution, Travel Limits, Homing routines, Axis Pairing, Step Rate, Spindle configuration, Touch Device (Tool Touch off Probes and Probes), Input Devices such as Wireless Manual Pulse Generator (MPG), Keyboard Emulators, CNC Control and Wizard Preferences.



We will start at the top of the Navigation tree and work our way down through it. To access the Wizard Screen, from Main Screen F7 (Utility) > F10 (Wizard).

6.2 Primary System (Drive Type and I/O Definitions)

This screen allows you to manage drive types, by default a new installation of CNC12 will select “Bench Test ‘Screw Terminal’” as the drive type. The drive type that matches the drive on your system should be used, simply click on a drive type and click “Load Drive”.

The screenshot displays the 'Primary System' configuration interface. On the left is a sidebar with a tree view containing: Primary System (selected), Axis Drive Type, Input Definitions, Output Definitions, Axis (Configuration, Homing and Travel, Axes Pairing, Advanced), Spindle (Setup, Setup 2, Rigid Tapping, PWM Setup), Touch Devices (Probe, Tool Touch Off), Control Peripheral (Input Devices, Hardwired MPG, Wireless MPG), ATC (Rack Mount), and Preferences (CNC Control, VCP Preferences, Wizard, VCP Aux Keys, Lube Pump). The main area is titled 'Select a Axis Motor Drive Configuration'. It shows 'Currently Loaded Axis Motor Drive: Bench Test 'Screw Terminal''. Below this, it instructs to 'Select a Drive Type from list then click on "Load Drive" to install the pre configured parameters for a particular Drive Type.' and provides a link to 'Acorn Hookup Schematics'. A list of drive types is shown with 'Bench Test 'Screw Terminal'' selected. To the right, the settings for this drive type are displayed: Connection: Screw Terminal; Step Rate: 100,000 Hz; Steps per Rev: Axis 1 = 1,600, Axis 2 = 1,600, Axis 3 = 1,600, Axis 4 = 1,600, Axis 5 = 1,600, Axis 6 = 1,600; Inputs: 8 = EStopOk; Outputs: 1 = OUTPUT1, 2 = OUTPUT2, 3 = OUTPUT3, 4 = OUTPUT4, 5 = OUTPUT5, 6 = OUTPUT6, 7 = OUTPUT7, 8 = OUTPUT8; Step Signal Inverted: Axis 1 = False, Axis 2 = False, Axis 3 = False, Axis 4 = False, Axis 5 = False, Axis 6 = False; Direction Signal Inverted: Axis 1 = False, Axis 2 = False, Axis 3 = False, Axis 4 = False, Axis 5 = False, Axis 6 = False; Enable Signal Inverted: Axis 1 = False, Axis 2 = False, Axis 3 = False, Axis 4 = False, Axis 5 = False, Axis 6 = False; Axis Motor Drive Fault Delay: 1,000 ms. At the bottom are buttons: Delete, Overwrite, Import..., Export..., Create new..., and Load Drive. A status bar at the very bottom shows 'Connected to CNC12' and a button 'Write Settings to CNC Control Configuration'.

As a convenience, loading a drive type will pre-populate the I/O map and some other screens of the Wizard. Select the appropriate schematic to follow when wiring the control for the particular drive type being used.

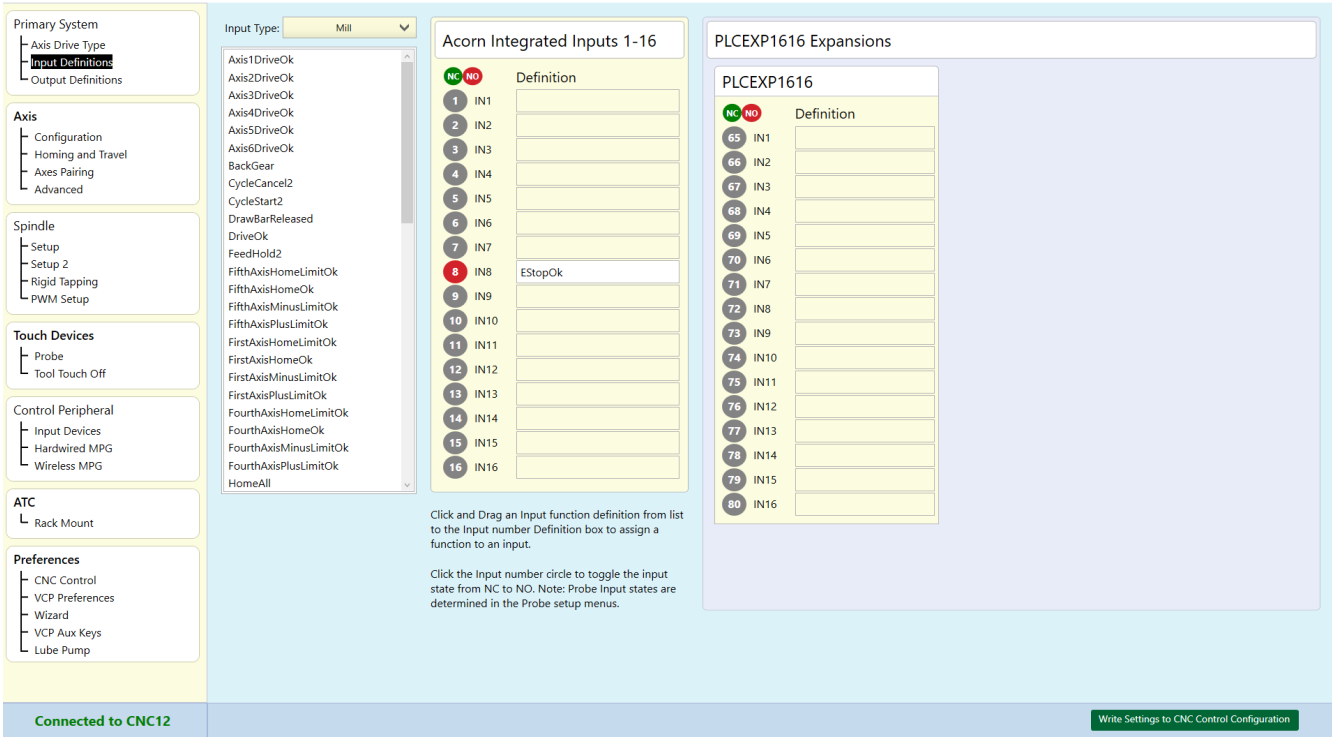
The AcornSix Schematics may be found by pressing Acorn Hookup Schematics link on this page (Internet Connection Required). Link: https://www.centroidcnc.com/centroid_diy/schematics/pbrowse.php

You may make modifications to the pre-populated screens as necessary to suit your application.

If a drive type doesn't exist to match the axis motor drives being employed then simply create your own. The “Create new...” button will create a “Custom” Drive type with currently selected settings in the wizard. These Drive Types can be Exported and Imported using the available buttons on screen.

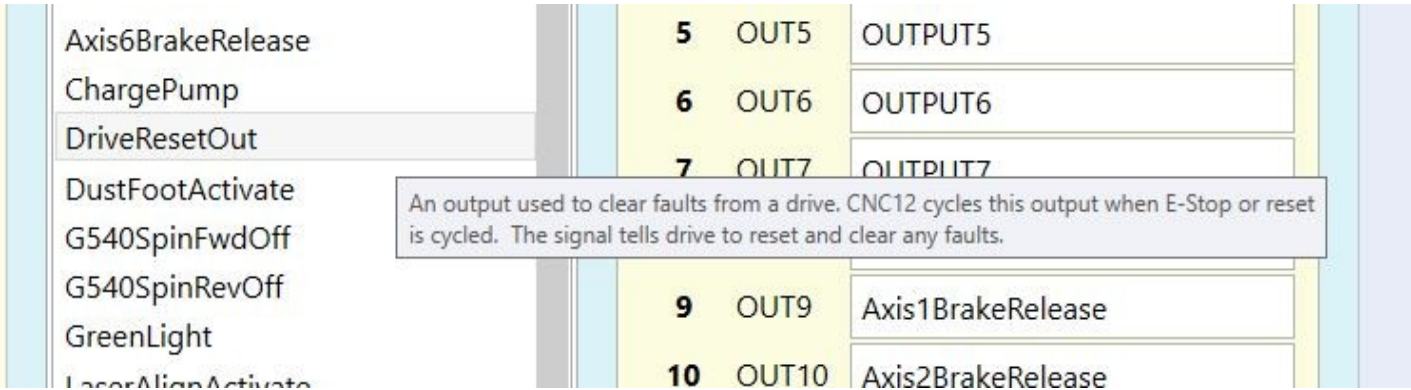
The Wizard I/O definition tabs allows you to choose ‘canned’ functions desired for each input and output.

The input and output numbers corresponds to the terminal numbers on AcornSix and will also show the I/O for the PLCEXP1616 expansion boards if so equipped.



Inputs are found on H4 and H5. Outputs are found on H6 and H10.

Inputs and Outputs can be easily added or removed by drag and drop method. Clicking on an Input or Output in the list will display a tool-tip on the functionality of the Input/Output.



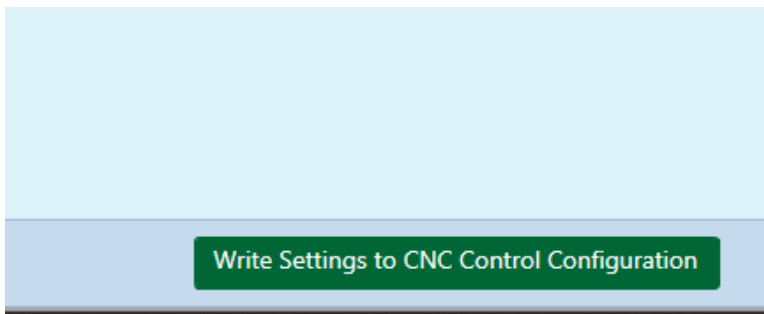
Inputs can also be toggled between NC (Normally Closed) which shows as Green

	NC	NO	Definition
1			IN1
2			IN2
3			IN3
4			Axis1DriveOk
5			IN5
6			IN6
7			IN7
8			EStopOk
9			IN9
10			IN10
11			IN11
12			IN12
13			IN13
14			IN14
15			IN15
16			IN16

or NO (Normally Open) which shows as Red.

	NC	NO	Definition
1			IN1
2			IN2
3			IN3
4			Axis1DriveOk
5			IN5
6			IN6
7			IN7
8			EStopOk
9			IN9
10			IN10
11			IN11
12			IN12
13			IN13
14			IN14
15			IN15
16			IN16

IMPORTANT: When you have completed any or ALL changes done in the Wizard pages, click “**Write Settings to CNC Control Configuration**” for the changes to be written and to take effect.



Follow any on screen prompts to complete the changes.

6.3 Axis Configuration

The Axis Configuration Menu defines movement of the machine tool.

Primary System

Axis Drive Type

Input Definitions

Output Definitions

Axis

Configuration

Homing and Travel

Axes Pairing

Advanced

Spindle

Setup

Setup 2

Rigid Tapping

PWM Setup

Touch Devices

Probe

Tool Touch Off

Control Peripheral

Input Devices

Hardwired MPG

Wireless MPG

ATC

Rack Mount

Preferences

CNC Control

VCP Preferences

Wizard

VCP Aux Keys

Lube Pump

Axis Configuration

	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Linear or Rotary	Linear	Linear	Linear	Rotary	Linear	Linear
Label	X	Y	Z	N	N	N
Steps / Revolution	1600	1600	1600	1600	1600	1600
Overall Turns Ratio <small>turns/in. or rev/deg</small>	5	5	5	0.25	5	5
Lash Comp. <small>inches</small>	0	0	0	0	0	0
Max Rate <small>in/min or deg/min</small>	50	50	50	360	200	200
Fast Jog Plus Direction <small>in/min or deg/min</small>	50	50	50	360	200	200
Fast Jog Minus Direction <small>in/min or deg/min</small>	50	50	50	360	200	200
Slow Jog <small>in/min or deg/min</small>	10	10	10	36	50	50
Accel / Decel <small>seconds</small>	0.5	0.5	0.5	0.5	0.5	0.5
Direction Reversal	N	N	N	N	N	N
Drive Enable Delay <small>milliseconds</small>	250	250	250	250	250	250
x1 Linear Jog Increment <small>inches</small>	0.001					
x1 Rotary Jog Increment <small>degrees</small>	0.01					

- **LINEAR** defines whether an axis moves left/right or up/down
- **ROTARY** defines if an axis rotates (such as a rotary table).
- **LABEL** definitions allow you to choose the axis labels that will appear on the main screen Digital Read Outs (DROs)
- **STEPS/REVOLUTION**: Defines ONLY the number of steps it takes to turn your axis motor ONE revolution. Most stepper motors turn 1.8 degrees per step. It takes 200 FULL steps to turn the motor 360 degrees.

Many stepper drives have a feature called micro-stepping. If your drive allows for micro-stepping follow the drive instructions and enter the number of MICRO-STEPS it takes to turn the motor one full revolution. For example, if a drive can micro-step 10X, then you would enter a value of 2000 (200 steps per revolution X 10) in the Steps/Revolution field.

If your drive uses an ENCODER, you would enter the encoder line count multiplied by 4 in the Step/Revolution field. For example, if you have a 1000 line encoder, in quadrature (X4) you would enter 4000 in the Steps/Revolution field. Consult your drive manufacturer's manual.

It is important to note, ONLY the number of steps it takes to turn your motor ONE full revolution goes in the Steps/Revolution Field! It is not to take into account pulley reduction or lead screw pitch. See this related post. "Don't Do it like Mach did it"

<https://centroidcncforum.com/viewtopic.php?f=63&t=1801>

- **OVERALL TURNS RATIO:** This field is where you define your machine's axis reduction. If you know your machine's lead screw pitch and pulley reduction ratio (Number of teeth on the axis drive motor pulley and number of teeth on the axis lead screw pulley, you may enter it here.

For example, if we have a lead screw that requires 5 turns to move the axis 1 inch, and 10 teeth on the axis drive motor pulley, along with 20 teeth on the lead screw pulley you would enter 10. The axis pulley reduction is $20/10=2$ times the lead screw pitch of 5 or $2*5=10$.

See related post. <https://centroidcncforum.com/viewtopic.php?f=63&t=1801>

- **LASH COMP:** This is the **LAST** thing you should setup once your machine is fully configured and operational. Leave this at zero for now.

The purpose is for the control to "compensate" for mechanical backlash. It cannot cure mechanical lash. It is very important that every effort is made to take out mechanical backlash.

Follow this Technical Bulletin: https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/37.pdf

- **MAX RATE:** This is the maximum rapid rate (G0 Move) that the axis is allowed to travel. This number is heavily dependent on many factors.

Correctly sizing the motor and drive to your machine is important as is the voltage supplied.

As a general starting point on an open loop stepper machine start this number low and work your way higher until you see or hear the stepper stall and then reduce that number by 30-40%.

You can also use the following equation to get an estimation: (maximum motor rpm / motor revolutions per inch) * 0.85 = maximum feed rate

- **FAST JOG:** This is the fastest the axis will move when in the RAPID (Hare) Continuous Jog mode.
- **SLOW JOG:** This is the slowest the axis will move when in the SLOW (Tortoise) Continuous Jog mode. It is also the speed the machine will home at.
- **ACCEL/DECEL:** Acceleration is the time for the axis to reach maximum velocity.

An acceleration rate of 0.1 second is very fast, where an acceleration rate of 1.0 will be considered very slow.

CNC12 defaults to an acceleration of 0.5. Deceleration is the opposite.

Acceleration tuning is a fairly subjective process. What might be acceptable for one person might be unacceptable for another person.

Often the limiting factors are the amount of mechanical stress that the machine can handle and the amount of current that can be provided to the motors. Quick acceleration numbers can lead to jerking of the machine.

- **DIRECTION REVERSAL:** Change this from No to Yes if you need to reverse the direction of the axis motor in order to move the machine in the PROPER direction.
- **DRIVE ENABLE DELAY:** This is the amount of time the control allows your drive to "come online" and ignores the DRIVE FAULT input (If used in the I/O map). Generally, this can be left at the default value.

6.4 Axis Homing and Travel

This menu is used to setup how the machine will:

- Home
- The directions in which it will Home
- Software Travel Limits that will be used to prevent over-travel
- Machine Parking action

HOME PROGRAM:

Home File: CNC12 Generates a .hom file automatically. IF you have a custom .hom file, then change Home file to: Custom User Defined. Otherwise leave it to the default of Wizard Generated. Note: The .hom file is simply a g code file and is user editable. Most users will not need to customize the Wizard generated .hom file.

HOMING TYPE:

- Set to home at jog position or home to switch.
- Selecting “Automatic Homing” will display additional homing options for Automatic Homing.
- **Homing Direction:**
 - If the machine axis must move in the positive direction to seek the home switch, then use +(M92).
 - If it must move in the negative direction to seek the home switch, then use –(M91).
 - Set Homing Direction for each axis.

Homing Sequence:

- Sets the order in which the axis is homed.
- By default the order is 3rd axis, 2nd axis, 1st axis, and 4th axis in sequence.

SOFTWARE TRAVEL LIMITS:

- Travel Limit (+) is used if the home switch is on the NEGATIVE end of the axis. The value entered here would be a positive number. The number will be distance between the home switch and the end of the axis travel.
- Travel Limit (-) is used if the home switch is on the POSITIVE end of the axis. The value here would be a negative number.

For example, the home switch is on the Y Positive end of the travel. If there is 12.2" of travel on Y. The value entered would be -12.2.

MACHINE PARKING:

- This is a unique feature. When you "Shut Down" your machine, you can have all axis travel to a predetermined position.
- By default, "**PARKing**" the machine will send all axis near, but not tripping, the home switch so that the next time the machine is powered up, it will not take so long for the machine to find its home position.
- You can edit the Parking Macro to do a custom move before shutting down the machine.
- For a milling machine for example, you can send Z up near its +Z axis Home switch, and you can send the Y axis near its Home switch. But you could center the X axis so the table isn't hanging off to one size.
- The feature's intent is two-fold. To speed up the Homing routine the next time the machine is started by not having to travel so far at a slow rate to reach the home switch and/or to put the machine in a convenient position when shutting down.
- The PARK feature can be reached by pressing F10 SHUT DOWN and F1 PARK.
- To EDIT the default park.mac click on the EDIT button.

6.5 Axis Motor Software Pairing

AcornSix supports two sets of software paired axis drives.

Primary System

- Axis Drive Type
- Input Definitions
- Output Definitions

Axis

- Configuration
- Homing and Travel
- Axes Pairing**
- Advanced

Spindle

- Setup
- Setup 2
- Rigid Tapping
- PWM Setup

Touch Devices

- Probe
- Tool Touch Off

Control Peripheral

- Input Devices
- Hardwired MPG
- Wireless MPG

ATC

- Rack Mount

Axes Pairing

CNC12 Pro or Digitizing bundle is required for Software Axes Pairing. A restart of CNC12 is required for changes to take effect.

Axis to pair with 4th axis Not Paired

Reverse direction of 4th axis motor relative to the paired axis? No

Axis to pair with 5th axis Not Paired

Reverse direction of 5th axis motor relative to the paired axis? No

Paired Axes Homing

Paired axes squaring/alignment Manual Axis Squaring/Alignment

Paired axis to auto square Axis 4

Master Axis squaring/alignment distance 0.025

Home switch Deadband Distance 0

Master Axis Home Switch PLC Input =

Slave Axis Home Switch PLC Input =

* Defined in the I/O table in the Primary Configuration Menu

Note: When Auto Squaring is selected, the Auto Square Homing Sequence defaults to:
1: Z axis, 2: non paired Axis, 3: Paired Axes.

[Axes Pairing and Homing Manual \(PDF\)](#)

Axis to pair with 4th Axis

- Select axis for Software Pairing.

Reverse direction of 4th axis motor

- Setting this to “Yes” will reverse the direction of the 4th axis motor relative to its “master”.

Same options for the 5th Axis

Paired axes squaring/alignment

- Select between Manual and Automatic Squaring/Alignment.

Master Axis squaring/alignment distance

- Maximum independent movement distance of the master axis during home program. This is always away from the master home switch and typically close to the value of the slave switch offset from square.

Feedrate of Homing Movements

- The speed in which the home program will move the axis to seek home switches.

Home Switch Deadband Distance

- The amount of travel the home program will move into the home switch once the home switch has been triggered to eliminate switch flicker (deadband).
- Note: Typically, cheaper switches have more deadband.

Master Axis Home Switch PLC Input

Shows the input for the Master Home switch as set in Input Definitions.

Slave Axis Home Switch PLC Input

- Shows the input for the SlavedHomeInput as set in the Input Definitions.

For more information on proper pairing techniques, check out the Axis Paring and Squaring Acorn Guide.

https://www.centroidcnc.com/centroid_diy/downloads/acorn_documentation/paired_axes_acorn_user_guide.pdf

6.6 Axis (Advanced)

This menu contains Advanced settings for axis motor drive signal. If you used one of the Centroid provided Drive Types do not change anything in this menu.

In this menu axis motor drive signal can be inverted, the Step Frequency adjusted and the Axis motor Drive Fault delay timer adjusted.

Primary System

- Axis Drive Type
- Input Definitions
- Output Definitions

Axis

- Configuration
- Homing and Travel
- Axes Pairing
- Advanced**

Spindle

- Setup
- Setup 2
- Rigid Tapping
- PWM Setup

Touch Devices

- Probe
- Tool Touch Off

Advanced Axis Configuration

Axis Signal Inversion

Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Step <input type="checkbox"/>	Step <input type="checkbox"/>	Step <input type="checkbox"/>	Step <input type="checkbox"/>	Step <input type="checkbox"/>	Step <input type="checkbox"/>
Direction <input type="checkbox"/>	Direction <input type="checkbox"/>	Direction <input type="checkbox"/>	Direction <input type="checkbox"/>	Direction <input type="checkbox"/>	Direction <input type="checkbox"/>
Enable <input type="checkbox"/>	Enable <input type="checkbox"/>	Enable <input type="checkbox"/>	Enable <input type="checkbox"/>	Enable <input type="checkbox"/>	Enable <input type="checkbox"/>
Quadrature <input type="checkbox"/>	Quadrature <input type="checkbox"/>	Quadrature <input type="checkbox"/>	Quadrature <input type="checkbox"/>	Quadrature <input type="checkbox"/>	Quadrature <input type="checkbox"/>

Step Rate

Maximum number of steps that can be pulsed per second

100,000 steps/second

Axis Motor Drive Fault

Axis Motor Drive fault delay time

1000 milliseconds

Axis Signal Inversion

- Invert the Step, Direction, Enable or Quadrature signal for each individual axis. Required depending on type of drives used. Do not invert the direction signal to reverse the direction of an axis. Direction reversal of an axis is done in the Axis configuration menu!

Step Rate

- Maximum steps per second for drives.

Axis Motor Drive Fault

- Fault Delay for when DriveOK input is not active.

6.7.1 Spindle Setup

AcornSix supports Analog outputs for two paired spindles. (Note: Future Two independent spindle support will be added.)

Setup options for Spindle 1

Primary System

- Axis Drive Type
- Input Definitions
- Output Definitions

Axis

- Configuration
- Homing and Travel
- Axes Pairing
- Advanced

Spindle

- Setup**
- Setup 2
- Rigid Tapping
- PWM Setup

Touch Devices

- Probe
- Tool Touch Off

Spindle Setup

Spindle Encoder (Encoder port #1)

Spindle Encoder counts

Spindle max speed in high range

Spindle min speed in high range

Medium range Spindle Speed ratio

Low range Spindle Speed ratio

Limit Spindle Analog Output to 0-5 volts

Spindle RTG Display

SpindleOk delay timer milliseconds

Spindle Encoder

- Is there a Spindle Encoder connected to AcornSix.

Spindle Encoder Counts

- Encoder Counts per Revolution of the spindle.

Spindle max speed in high range

- Maximum speed in rpm for spindle in high range gear

Spindle min speed in high range

- Minimum speed in rpm for spindle in high range gear.

Medium range spindle speed ratio

- Medium gear ratio (Medium max RPM divided by High max RPM). If the gear reverses spindle direction then make ratio a negative value.

Low range spindle speed ratio

- Low gear ratio (Low max rpm divided by high max rpm). If the gear reverses spindle direction then make ratio a negative value.

Limit Spindle Analog Output to 0-5 volts (wording in Wizard needs changed to Spindle Analog output range)

- Default is 0 to +10V, you can choose between 0 to +5V, -5 to +5V, or -10 to +10V, if your spindle uses one of those ranges instead.

Spindle RTG Display

- Select the Real Time Graphic Display, default is Programmed Gcode Speed. If a Spindle Encoder is installed the additional options of “Actual Encoder Speed” or “Both” will also be available.

SpindleOK delay Timer

- Select the delay in milliseconds for the SpindleOK signal. Default is 0 milliseconds.

6.7.2 Spindle Setup 2

Setup options for Spindle 2. Pair a second spindle to the first.

Primary System

- Axis Drive Type
- Input Definitions
- Output Definitions

Axis

- Configuration
- Homing and Travel
- Axes Pairing
- Advanced

Spindle

- Setup
- Setup 2**
- Rigid Tapping
- PWM Setup

Second Spindle Setup

Enable Second Spindle

Limit Spindle Analog Output to 0-5 volts

SpindleOk delay timer milliseconds

Enable Second Spindle

- Enables the Second Spindle on the AcornSix.

Limit Spindle Analog Output to 0-5 volts (wording in Wizard needs changed to Spindle Analog output range)

- Default is 0 to +10V, you can choose between 0 to +5V, -5 to +5V, or -10 to +10V, if your spindle uses one of those ranges instead.

SpindleOK delay Timer

- Select the delay in milliseconds for the SpindleOK signal. Default is 0 milliseconds.

6.8 Rigid Tapping

Setup options for Rigid Tapping, note these settings are for Spindle 1.

Please see [Tech Bulletin 304 – Acorn Rigid Tapping Setup](#). For detailed information on Rigid Tapping.

Primary System

- Axis Drive Type
- Input Definitions
- Output Definitions

Axis

- Configuration
- Homing and Travel
- Axes Pairing
- Advanced

Spindle

- Setup
- Setup 2
- Rigid Tapping**
- PWM Setup

Touch Devices

- Probe
- Tool Touch Off

Control Peripheral

- Input Devices
- Hardwired MPG
- Wireless MPG

ATC

Rigid Tapping Configuration

Please Select From the Following Options For Rigid Tapping.

Please See Tech Bulletin #304 For More Information.

Enable Rigid Tapping	<input type="radio"/> No	(P36)
Minimum Rigid Tapping RPM	<input type="text" value="640"/>	(P68)
Duration For Min. Rigid Tapping RPM (Seconds)	<input type="text" value="1.75"/>	(P69)
Spindle Drift (Degrees)	<input type="text" value="500"/>	(P82)
Spindle Accel/Decel Time	<input type="text" value="3"/>	(P37)
M Func To Run At Bottom Of Hole G84 Tapping	<input type="text" value="M4"/>	(P74)
M Func To Run At Top Of Hole For G74 Counter Tapping		
M Func To Run At Bottom Of Hole G74 Tapping(Left Hand Taps)	<input type="text" value="M3"/>	(P84)
M Func To Run At Top Of Hole For G84 Counter Tapping		
Rigid Tapping Accel Distance For Tapping and Threading	<input type="text" value="0.1"/>	(P240)
Rigid Tapping Z Axis Sync Distance	<input type="text" value="20"/>	(P241)
Allow Spindle Override	<input type="radio"/> No	(P36)
Do Not Wait For Index Pulse	<input type="radio"/> No	(P36)

Not Recommended. Choosing This Option Eliminates The Ability To Re-enter Hole.

Ensure that the Spindle was connected to the AcornSix spindle encoder port prior to powering up the control. If not, stop, power down AcornSix, the CNC PC, connect the encoder, and power AcornSix and the CNC PC back up and Start CNC12.

1. From the main menu press F7-Utility → F10 AcornSix Wizard. Then go to SPINDLE and under it, SETUP. Make sure the proper Spindle Encoder Counts value is entered. (Encoder counts per revolution X 4)
2. From the main menu press F1-Setup → F3-Config. The password is 137. Press F4- PID.
3. Manually spin the encoder by hand counter-clockwise. Confirm that absolute position (Abs Pos) counts up as the motor is rotated.
4. Manually rotate the encoder one full revolution. Record how much the motor has counted. (This value is to be placed in the WIZARD Spindle Encoder Field)

6.9 PWM Setup

Two PWM outputs are provided on AcornSix.

PWM outputs are commonly used for DC motor controllers and Laser Power modulation.

See TB 326 on Acorn/AcornSix Laser Setup:

https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/326.pdf

Primary System

- Axis Drive Type
- Input Definitions
- Output Definitions

Axis

- Configuration
- Homing and Travel
- Axes Pairing
- Advanced

Spindle

- Setup
- Setup 2
- Rigid Tapping
- PWM Setup**

Touch Devices

- Probe
- Tool Touch Off

PWM Setup

PWM Enable ☒ Yes

Base Frequency (Hz)

PWM S command range: 0-1000 or 0-100 ☒ 1000

PWM minimum S command power level to start Laser

Inverse Output ☐ No

Common J Tech Laser Configuration Presets

I will configure the pwm outputs myself ☒ Yes

Jtech Laser (Dedicated Laser Machine, No spindle motor) ☐ No

Jtech Laser with PWM BLDC spindle ☐ No

Jtech Laser with analog output AC spindle motor controlled by VFD ☐ No

PWM (Pulse Width Modulation)

- Select Yes to enable PWM.

Base Frequency (Hz)

- The base frequency of the PWM output, the default is 4883Hz.

PWM S command range: 0-1000 or 0-100

- Select between 1000 or 100 as the range for the PWM S command.

PWM minimum S command power level to start Laser

- The default is 0, increase if you don't want to have the laser turned on until a higher PWM is commanded.

Inverse Output

- Inverse the PWM output. The default is "No".

Common J Tech Laser Configuration Presets

- Select from a set of common options when using a J Tech Laser

6.10 Lathe-Specific Setup

Lathe Orientation

- Designate lathe as horizontal or vertical.

Tool orientation

- Front or Rear. This will reverse the X axis direction.

Chapter 7 Accessory Setup

7.1 Touch Devices: Touch Probe

Using this menu to configure CNC12 for use with Touch Probes commonly used for part zero location finding and digitizing. Centroid recommends the use of the KP-3 Touch Probe.

https://www.centroidcnc.com/centroid_diy/kp-3_cnc_touch_probe.html



Probe Configuration						
Probe PLC input	<input type="text"/>					
Probe type	Mechanical <input type="button" value="v"/>					
Input state when tripped <small>*Probe Setup Documentation (PDF)</small>	<input checked="" type="checkbox"/> Closed* <input type="checkbox"/>					
Probe tool number	<input type="text" value="10"/>					
Fast probe rate	<input type="text" value="12"/>					
Slow probe rate	<input type="text" value="5"/>					
Recovery distance	<input type="text" value="0.05"/>					
Maximum probing distance	<input type="text" value="10"/>					
Probe Protection Enabled	<input checked="" type="checkbox"/> Yes <input type="checkbox"/>					
Inhibit Spindle when Detect is on (Green)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/>					
Display Warning to Verify that Probe or TT is functioning properly	<input checked="" type="checkbox"/> Yes <input type="checkbox"/>					
	Axis 1	Axis 2	Axis 3	Axis 4	Axis 5	Axis 6
Probe Slow Jog <small>(in/min)</small>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="10"/>	<input type="text" value="10"/>
Probe Fast Jog (-) <small>(in/min)</small>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>
Probe Fast Jog (+) <small>(in/min)</small>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>	<input type="text" value="50"/>

Probe PLC Input

- The AcornSix input number used as the ProbeTripped input, as set in the Input Definitions.

Probe type

- Choose the type of probe being used. Centroid DP-4, Centroid KP-3, or 3rd party Mechanical/Conductive.

Input state when tripped

- The state of the input when the probe is tripped, refer to probe setup guide for more info. (Centroid's probes are closed when tripped)

Probe tool number

- The tool number assigned to the probe, used to look up the length offset and tip diameter of the probe from the CN12 tool library.

Fast probe rate

- Used for positioning moves and initial surface detection, this parameter is determined by machine response and permitted probe deflection as well as desired accuracy tolerance.
- Default is 10 ipm (10 to 30 inches per minute is typical for milling machines and 20 to 40 inches per minute for most CNC routers, adjust as needed).

Slow Probe rate

- Used for final measuring moves for maximum accuracy, this parameter value is determined by speed/accuracy trade off.
- Default is 3 inches per minute which is a typical rate for milling machines, routers can use faster rates.
- Adjust this value as needed for tolerance.
- Warning: setting this parameter to very slow rates will often cause issues with "double triggers".

Recovery Distance

- The additional distance the probe moves off of a surface after contact is broken, before attempting to traverse parallel to the surface.

Maximum Probing Distance

- The Maximum distance that a probing cycle "searches" for a surface in a given direction if travel limits have not been entered.

Probe Protection when using VCP Jog Buttons

- This determines if Jog Panel moves from the VCP are probe protected. If set to No, VCP Jogging is no longer protected and the machine will continue to move even when probe is tripped.

Inhibit the Spindle from moving when probing

- Determines if spindle is allowed to spin while probe is detected.
- This requires the probe to have a detect signal and the input Probe Detect assigned in Input Definitions.
- By default it is set to "Yes" for Mills and "No" for Lathes.

Each axis can be further configured individually for Probe Slow Jog, Probe Fast Jog (-) and Probe Fast Jog (+). Fast Jog in the (-) is when movement is in the negative direction and Probe Fast Jog (+) is when moving the positive direction.

For more information on setting up your probe, check out the Probe Setup Guide.

(https://www.centroidcnc.com/centroid_diy/downloads/acorn_documentation/acorn_probe_setup.pdf)

7.2 Touch Devices: Tool Touch Off

Use this menu to configure CNC12 for use with Tool Touch Probes commonly used for setting tool heights automatically. Centroid recommends the use of the TT-4, TT-2 or TT-1 Tool Touch off Probes.



Tool Touch Off Configuration	
Touch Off Tool PLC input	<input type="text" value="Input 10"/>
Tool Touch Off type	<input type="text" value="Mechanical"/>
Input state when triggered *Probe Setup Documentation (PDF)	<input checked="" type="checkbox"/> Closed*
Subtract height of Tool Touch Off device	<input checked="" type="checkbox"/> Yes
Tool Touch Off/Surface Plate: Height for setting part zero <small>*a value other than zero will result in CNC12 looking for TT inputs when setting Part Zero's automatically.</small>	<input type="text" value="2.25"/>
Use Tool Touch Off device to set Z Reference	<input checked="" type="checkbox"/> Yes
Inhibit Spindle when Detect is on (Green)	<input type="checkbox"/> No

Tool Touch Off PLC Input

- The AcornSix input number used as the ToolTouchOffTriggered input, as set in the Input Definitions.

Tool Touch Off Type

- Choose the type of TT being used. Centroid's TT-1, TT-2, TT-4, or 3rd party Mechanical/Conductive.

Input state when triggered

- The state of the input when the tool touch off device is triggered
- Refer to Probe Setup Guide for more info.
- Centroid's tool touch offs are closed when tripped

Subtract height of tool touch off device

- When using Auto Part Z zero probing cycle with TT device, subtract the height of the TT device when setting Z part zero.
- Used when TT is sitting on top of the material you wish to set zero for.

Tool Touch off/ Surface Plate: Height for Setting Part Zero

- Value is taken into account when the TT device is being utilized with auto part Z zero location probing cycle.
- This height value is typically the distance from the top to the bottom of the TT device.

Use Tool Touch Off device to set Z reference

- Use the top of the TT device as the Tool Height measurement reference location when measuring tool heights automatically.
- Typically used when top of TT is a fixed Z position to measure all tool heights from. Commonly found on routers and bed mills. Is not used for Knee Mill Applications.

Inhibit the Spindle from moving when probing with ToolTouch

- Determines if spindle is allowed to spin while TT is detected.
- This requires the TT to have a detect signal and the input ToolTouchOffDetect assigned in Input Definitions.
- By default, this is set to “No” on Mills and “Yes” on Lathes.

For more information on setting up your Tool Touch Device, check out the Probe Setup Guide.

(https://www.centroidcnc.com/centroid_diy/downloads/acorn_documentation/acorn_probe_setup.pdf)

Chapter 8 Control Peripheral Setup

8.1 Input Devices Setup

The screenshot displays the 'Input Devices Setup' configuration window. On the left, a sidebar lists various system components for setup. The 'Control Peripheral' section is expanded, and 'Input Devices' is the active selection. The main panel shows three specific settings: 'Touch Screen' is set to 'Yes', 'USB Operator Control Pad' is set to 'None', and 'Virtual Control Panel' is set to 'On'.

Input Devices Setup	
Touch Screen	<input checked="" type="button" value="Yes"/>
USB Operator Control Pad	<input type="button" value="None"/>
Virtual Control Panel	<input checked="" type="button" value="On"/>

Touch Screen

- Select Yes or No if the screen is a Touchscreen. The default is Yes.

USB Operator Control Pad

- Allows the use of option 3rd party control pads. Default is No. Other options are Xkeys or similar, ShuttleXpress, or PC Keyboard.

Virtual Control Panel

- Controls if the Virtual Control Panel is displayed or not. The default is “On”.

8.2 Hardwired MPG Setup

AcornSix supports up to (3) Hardwired MPGs via the built in (3) encoder inputs.

Hardwired MPGs	
Set Encoder Port 1 for MPG use	<input type="button" value="No"/>
MPG 1 set to Axis	<input type="button" value="Choose Axis"/>
MPG 1 Detents per revolution	<input type="text" value="100"/>
MPG 1 Counts per revolution	<input type="text" value="100"/>
Set Encoder Port 2 for MPG use	<input type="button" value="No"/>
MPG 2 set to Axis	<input type="button" value="Choose Axis"/>
MPG 2 Detents per revolution	<input type="text" value="100"/>
MPG 2 Counts per revolution	<input type="text" value="400"/>
Set Encoder Port 3 for MPG use	<input type="button" value="No"/>
MPG 3 set to Axis	<input type="button" value="Choose Axis"/>
MPG 3 Detents per revolution	<input type="text" value="100"/>
MPG 3 Counts per revolution	<input type="text" value="400"/>

Each Hardwired MPG has same but separately controlled options.

Set Encoder Port 1 for Hardwired MPG use

- Select Yes or No if Encoder Port 1 is used for an MPG. If you have already selected Encoder Port 1 for Spindle Encoder this option will be grayed out as the same encoder input can't be used both for an MPG encoder and Spindle encoder input.

MPG 1 set to Axis

- Choose which axis will be controlled by MPG 1.

MPG 1 Detents per revolution

- Number of detents / steps per revolution of the MPG.

MPG 1 Counts per revolution

- Number of counts (of the encoder) per revolution of the MPG.

8.3 Wireless MPG Configuration

AcornSix supports the Centroid WMPG-6 Wireless control pendant.

Note: Pro or Ultimate License is required.



Wireless MPG Configuration

A restart of CNC12 is required for changes to take effect.

Centroid Wireless MPG	WMPG-6
MPG Performance	Quick Response
Inhibit MPG Z axis fast movement. Z axis x100 = x10	On

Macro Button Configuration

MPG Macro Button 1	Edit MPG macro 1
MPG Macro Button 2	Edit MPG macro 2
MPG Macro Button 3	Edit MPG macro 3
MPG Macro Button 4	Edit MPG macro 4

Centroid Wireless MPG

- Select the Wireless MPG type. None, CWP-4, WMPG-4, or WMPG-6

MPG Performance

Choose between different types of responses for the MPG. Quick Response is typical.

Inhibit x100 (very fast) Z axis movement with the MPG Wheel. On/Off. **“ON” is recommended.**

Macro Button Configuration

- Edit the Macro for each of the four Macro Buttons on the MPG to customize them to your application. See “Introduction to Centroid CNC Macro Programming”
https://www.centroidcnc.com/centroid_diy/downloads/acorn_documentation/centroid_cnc_macro_programming.pdf

CNC12 and Wizard configuration Backup

Once you start having some time and energy into configuring the CNC control system it is suggested that you create a backup of the CNC configuration settings on a USB memory stick. This is easily accomplished with the Centroid “Create Report” feature found in the CNC12 Utility Menu.

Keep making new report.zip files as you go along the CNC control setup process that way if you dig yourself a hole you can simply use the “Restore Report” feature also found in the Utility menu to drop back to the last know ‘good’ report file.

The report.zip file is also used to quickly setup a new computer so you don’t have to go into the Wizard or CNC control configuration and type everything back in. This is very convenient when a hard drive or computer crashes. If you made a report.zip when everything was running good and stored it in a safe place and made copies of it.

It is a 5 second operation to restore the CNC12 configuration back to the day the machine was commissioned on a new hard drive or PC.

This Memory Stick should contain:

- The installer.exe file that you just used to install CNC12
- The ‘final’ good reportxxxxx.zip file
- any license key files
- Copy of the entire working good cncm (or cnct) directory (optional)

NOTE: It is a very good idea to keep the USB memory stick in a safe location. See this post on the forums about USB backups: <https://centroidcncforum.com/viewtopic.php?f=63&t=5667>

Appendix A: AcornSix LED Error Codes

LED1 Error Codes

Error #	Meaning	Cause	Corrective Action
6	Voltage failure	Power was lost	If error appears briefly at startup, it is normal, otherwise check for loose power connections
7	Communication out of sync	Data in and out are not locked together in a synchronous relationship	Internal error, contact Centroid
8	Too many counts per interrupt requested (>511) or too many steps per interrupt (based on p968 rate)	Communication error or too fast movement requested by CNC12	Cycle E-Stop to clear. Maximum rate may need to be lowered.

AcornSix Specification Manual

Overview

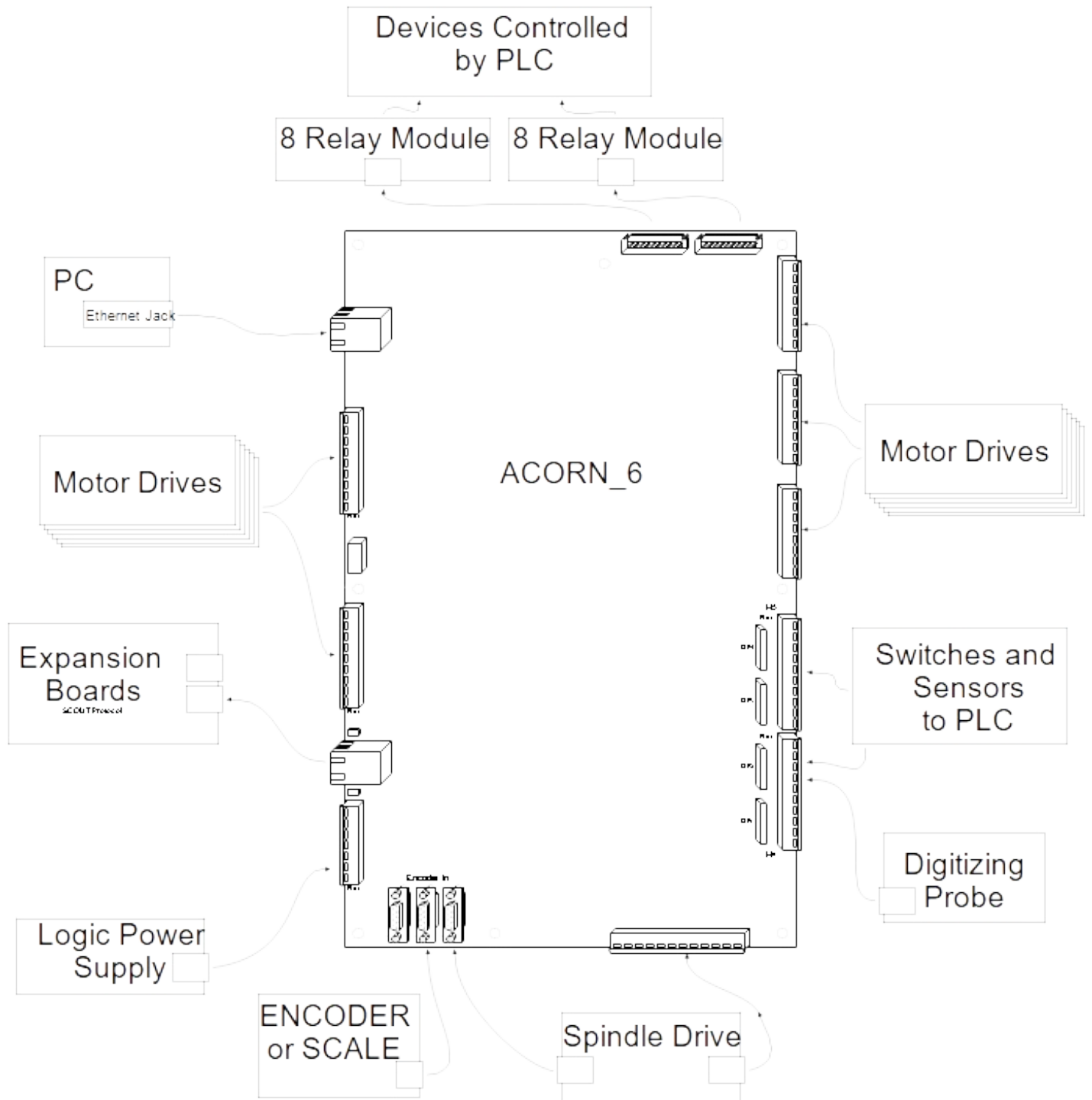
The ACORNSIX is an all in one CNC control board with integrated PLC and on board motion control processor. ACORNSIX interfaces to axis motor drives with open collector, 5V logic, or differential signals (optional). Motor drives may be servo or stepper type. Encoder feedback is not connected to ACORNSIX from the drives. AcornSix can operate in Open Loop, Hybrid Closed Loop and Scales for position feedback and correction Closed Loop.

Communication with a host PC is performed over Ethernet. Three encoder inputs are available through DB9 connectors for functions such as MPG handwheels and spindle encoder. The integrated PLC includes 16 digital inputs and 16 digital outputs for general purpose use. Two analog outputs with PWM option for outputs are provided (see "PLC Section" for details). An additional expansion device can be added through the SCOUT protocol fieldbus port H15. This device may be any of the SCOUT protocol expansion devices.

The built in motion control processor section is code named MPU12. The MPU12 section has increased processing power over MPU11 by up to 4 times. The additional speed can be appreciated by those running complex 5 or more axis programs.

Function:	Motion Control Processor, PLC, and Drive Interface
Maximum number of Axes:	6
Encoder and Scale Inputs:	3 Incremental Encoders (A, B, and Z channels)
Control Interface:	100 Mb/s Ethernet to PC
Digital PLC Inputs:	16
Digital PLC Outputs:	16
Analog or PWM Outputs:	2
Analog Output resolution:	Up to 16 bits
Dimensions (W*D*H):	8 * 12 * 0.75 inches

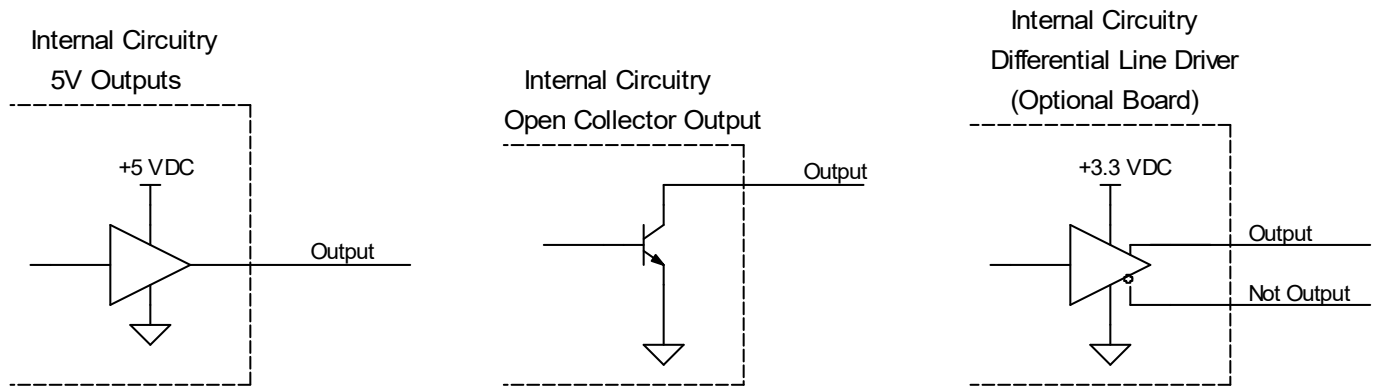
ACORNSIX Typical Connection Overview



Drive Interface Section

ACORNSIX has 6 interfaces to motor drives. The interfaces are duplicated in both open collector and 5V logic output signals. An expansion board is available to also output RS422 compatible differential signals. Output signals to the drives can be switched between step and direction and A/B quadrature pulse forms.

Each axis interface has 3 control signals. A or step, B or direction, and enable. Use “SV_DRIVE_CONTROL_x Bits” “Quad or step out” bit to change between quadrature and step and direction output format. The open collector and differential output headers (optional) have individual enable signals for each axis. 5V output headers have one enable for all axes for a reduced pinout. This “Enable All” signal will activate when any axis on the ACORN_6 is enabled. “SV_DRIVE_CONTROL_x Bits” can be used to invert A/step, B/direction, or enable signals by axis. Enable all signal will be inverted based on the inversion setting of the first axis.

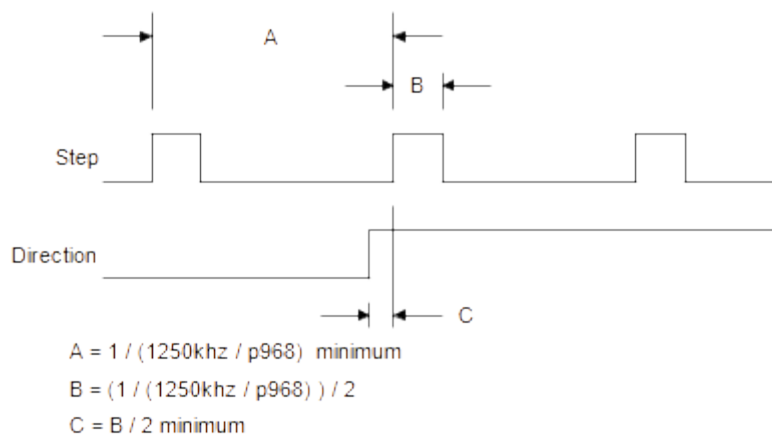


Some parameter setup is required for CNC12 control software to control ACORNSIX axis drives. Drive and encoder mapping does not change for ACORNSIX, so it may be entered directly from the following chart. A step rate must be selected for step and direction output mode. This will specify the maximum possible step rate, and therefore the width of the step pulse. Step rate is $1250\text{kHz} / (\text{parameter } 968)$. A parameter 968 value of 0 will be changed to 6 internally. Nominal values for parameter 968 are listed in the CNC12 parameter screen.

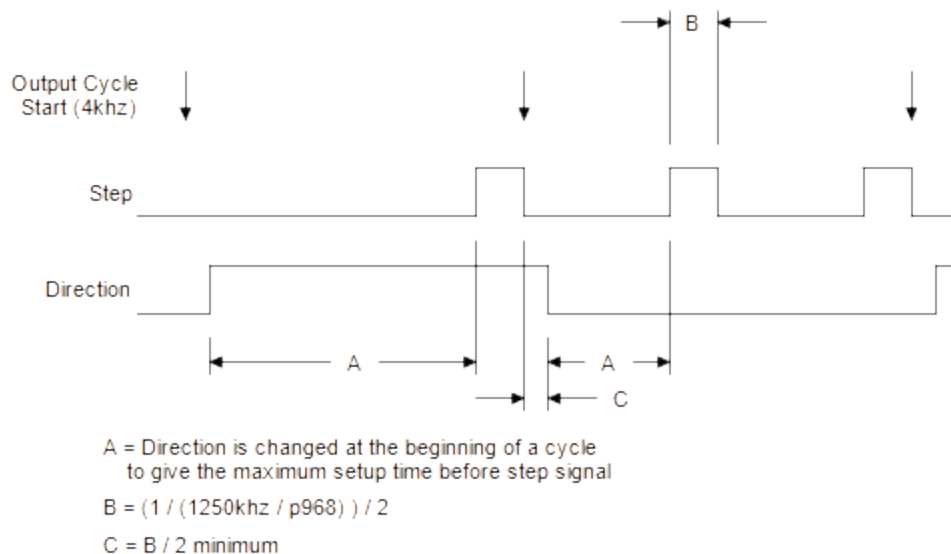
CNC12 Parameters for ACORNSIX

Parameter	Description	Value
300	CNC11 axis 1 assignment	1
301	CNC11 axis 2 assignment	2
302	CNC11 axis 3 assignment	3
303	CNC11 axis 4 assignment	4
304	CNC11 axis 5 assignment	5
305	CNC11 axis 6 assignment	6
308	CNC11 encoder 1 assignment	7
309	CNC11 encoder 2 assignment	8
310	CNC11 encoder 3 assignment	9
311	CNC11 encoder 4 assignment	10
312	CNC11 encoder 5 assignment	11
313	CNC11 encoder 6 assignment	12
968	Step Rate	0 to 127

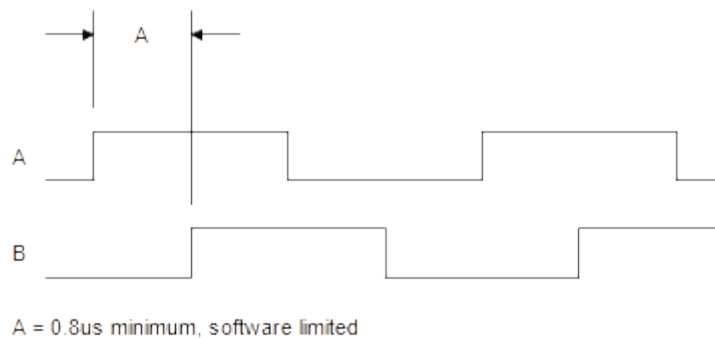
Step and Direction Output Waveforms



Typical Direction Setup Waveforms



Typical Quadrature Output Waveforms



Axis setup can be accessed from the PLC program. An error bit is available in SV_DRIVE_STATUS_1 - SV_DRIVE_STATUS_6 and outputs must be written through SV_DRIVE_CONTROL_1 - SV_DRIVE_CONTROL_6.

SV_DRIVE_STATUS_x Bits		Description
0	Reserved	
1	Reserved	
2	Reserved	
3	Quadrature generator error	Too many counts per interrupt requested (LED1 error 8)
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Reserved	

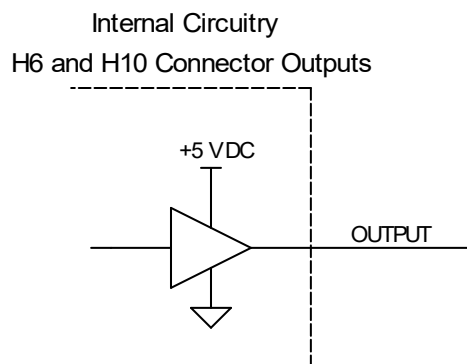
SV_DRIVE_CONTROL_x Bits		Description
0	A / step invert	Signal Invert (1 = invert, 0 = normal)
1	B / direction invert	Signal Invert (1 = invert, 0 = normal)
2	Z / enable invert	Signal Invert (1 = invert, 0 = normal)
3	Quad or step out	Output Form (1 = quadrature, 0 = step and direction)
4	Reserved	
5	Reserved	
6	Reserved	
7	Reserved	
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	axis enable	***Axis Enable (1 = enable, 0 = disable)

*** This bit is controlled by the MPU12 firmware. Do not attempt to change it in the PLC program.

PLC Section

Digital Outputs

Sixteen 5 volt logic outputs are available on the ACORNSIX. The outputs are intended to be used with external 8 relay modules. The default (off) logic state is high. A low level will activate a relay on the external board.



Analog Outputs

ACORNSIX is equipped with two analog outputs. One is normally used as a speed request to the spindle drive, while the other is free for special applications. The analog outputs also output a 5V PWM signal. For example, PWM 1 and Analog Out 1 can both be connected on H9, but they are controlled by the same PLC output bits.

Four voltage output ranges are available on the analog output. Mode bits are used to select the output range. The analog output is factory trimmed for high accuracy, and will not require adjustment when changing ranges.

The mode bits also change the PWM frequency to match different applications. For example, laser power controllers often take around 1 kHz and hobby servos can be controlled with 40 to 200 Hz

The analog ground is connected internally to other ACORN_6 GND pins. However, for best wiring results, use the GND pin adjacent to the analog output pin for analog connections. Do not share analog ground wires or connect multiple wires from different devices to an analog GND pin.

Analog Output Ranges

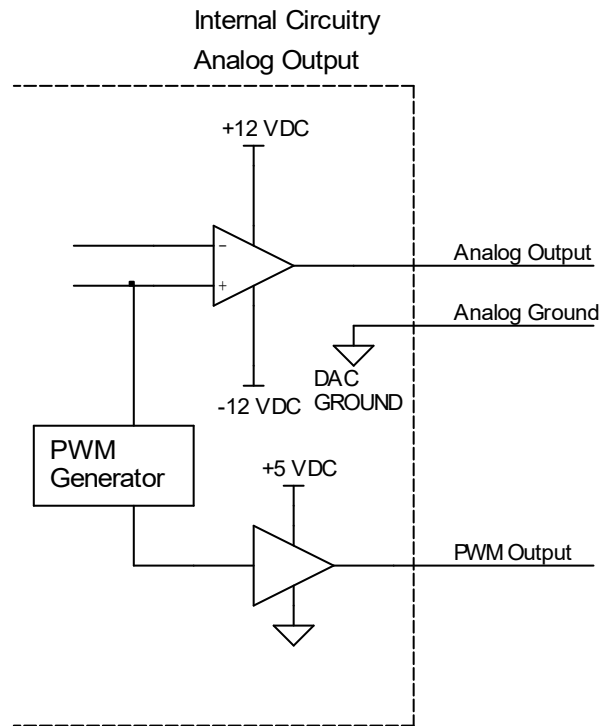
Mode Bit A	Mode Bit B	Range	Resolution
1	1	-10 to 10	16 bits
0	1	-5 to 5	15 bits
1	0	0 to 5	14 bits
0	0	0 to 10	15 bits

PWM Output Frequencies

Mode Bit A	Mode Bit B	Frequency (Hz)	Resolution
1	1	76	16 bits
0	1	610	16 bits
1	0	1221	16 bits
0	0	4883	14 bits

Analog Output Bits

Analog Output	Output Bits	Mode Bit A	Mode Bit B
1	17 - 32	49	50
2	33 - 48	51	52



Analog Output Calculations

0 to 5V Range

$$\text{output voltage} = \frac{\text{Analog Request}}{65536} * 5$$

-5 to 5V Range

$$\text{output voltage} = \left(\frac{\text{Analog Request}}{65536} * 10 \right) - 5$$

0 to 10V Range

$$\text{output voltage} = \frac{\text{Analog Request}}{65536} * 10$$

-10 to 10V Range

$$\text{output voltage} = \left(\frac{\text{Analog Request}}{65536} * 20 \right) - 10$$

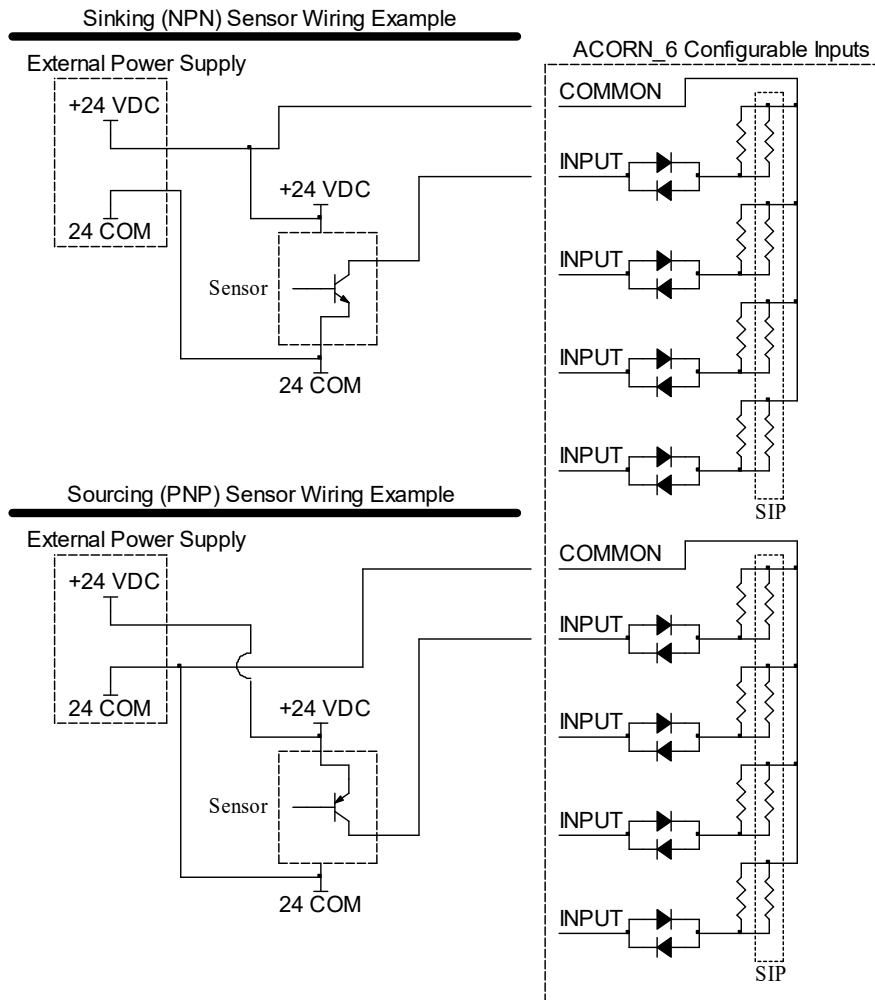
PWM Output Calculations

PWM output can be calculated using the following equation with one exception. Analog request of 65535 will output continuous 5VDC (100% duty cycle, not 99.998%).

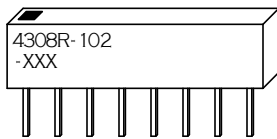
$$\text{PWM duty cycle (\%)} = \frac{\text{Analog Request}}{65536} * 100$$

Digital Inputs

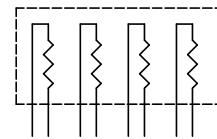
ACORNSIX has 16 optically isolated inputs. Inputs are divided into banks of four. Each bank is configurable for various voltages and sinking or sourcing polarity. Voltage may be selected by installing the appropriate value resistor pack or SIP into a socket for each bank. Without a SIP installed, input voltage is set to 24V. Optional SIPs may be installed to use 12V or 5V input voltage. Polarity is determined by wiring the common terminal for the bank to the supply positive or supply common.



SIP Identification - XXX Indicates Value



SIP Internal Wiring / Pinout



SIP Input Voltage Selection

SIP Value Marking	Resistor Value (Ohms)	Input Voltage
221	220	5
102	1.0k	12
None	None	24

Communication

ACORNSIX uses the SCOUT protocol to communicate with accessories over H15 with RJ45 shielded twisted pair (Ethernet) cables. The communication update cycle is 4000 times per second.

Internally, the I/O section of ACORNSIX is connected over SCOUT. This assigns ACORNSIX to the beginning of I/O space, as discussed below. An additional accessory can be connected with header H15. PLC expansion devices will map their I/O after ACORNSIX on board I/O. JOGBRD12 jog panel controller is assigned a fixed area in memory, so its position in the communication chain is not important for I/O mapping.

Servo drives are assigned in sequence, with the 6 on ACORNSIX first in the communication chain. If a drive device is used with the expansion header, its drive channel(s) will start at 7. See parameters 300 to 307 in the Operator's Manual to map a drive channel to an axis in the CNC12 software.

Accessory Device Memory Assignments

Accessory devices are assigned space based on their connection order. The amount of space required varies depending on the device. Devices may request input and output space in 16 bit increments, which are referred to as slots. The number of input slots must be equal to the number of output slots for all devices.

Jog panel, MPG, and probe devices always map to the same memory areas. These special cases allow for better compatibility with all PLC programs. The location of this I/O is always known. Only one Jog Panel, MPG, and probe expansion device may be used on a system because of the fixed locations for data. The only expansion device expected to be used is the JOGBRD12 jog panel controller. Normally, the probe is wired to ACORNSIX inputs and the wireless MPG uses a USB data path to the PC. Therefore, the mention of probe and MPG expansion devices only applies to special applications.

PLC Program INP / OUT, Slot, and I/O Area Relationship

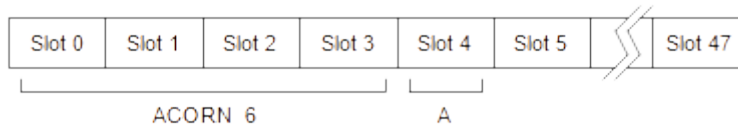
INP / OUT 1 to 16	INP / OUT 17 to 32	INP / OUT 33 to 48	INP / OUT 49 to 64	INP / OUT 65 to 80	INP / OUT 81 to 96	INP / OUT 97 to 112	INP / OUT 113 to 128		INP / OUT 753 to 768
Slot 0	Slot 1	Slot 2	Slot 3	Slot 4	Slot 5	Slot 6	Slot 7		Slot 47

Assignment of I/O slots occurs in a linear fashion starting with the on board I/O. ACORNSIX I/O is the first device in the communication chain. In the following general example, the ACORNSIX I/O takes the first 4 slots. Other devices may change locations if they are plugged into the communication chain in a different order. Additional PLC devices will be assigned starting at the slot marked "A". ACORNSIX is normally equipped with only one accessible expansion port (5), so the expansion mapping is simplified.

Since I/O space must be reserved in 16 bit increments, some I/O space may be lost if a device has an I/O count that is not a multiple of 16. For example, ACORNSIX output 64 is not used, but must be reserved to match the 16 bit boundary. Input and output space must be reserved in the same quantity. If a device has 16 inputs and no outputs, one slot must be still be reserved in both the input and output space.

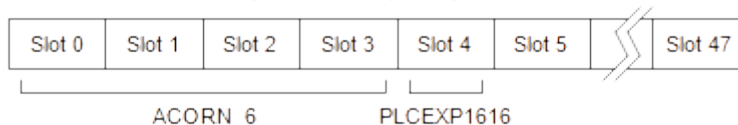
PLC Expansion Location Assignment General Example

Input and Output Space



PLC Expansion Example with PLCEXP1616

Input and Output Space



PLC I/O Slot Requirements

	Function	Slots Used
Total Available	Any	48
ACORNSIX	Digital and Analog I/O	4
PLCEXP1616	Digital I/O	1

Expansion Board

An expansion board code named ACORN6EXP can be plugged into the top of ACORNSIX. This board provides RS422 differential outputs for drive interfacing. See “Drive Interface Section” for more details.

Four SCOUT protocol expansion ports are also included on the ACORN6EXP. See “PLC Section” “Communication” for details of expansion with this protocol.

PLC I/O Map

Input Specification			Input Location	
Number	Function	Type	Connector	Pin
1	General Purpose	Sink / Source	H4	1
2	General Purpose	Sink / Source	H4	2
3	General Purpose	Sink / Source	H4	3
4	General Purpose	Sink / Source	H4	4
5	General Purpose	Sink / Source	H4	6
6	General Purpose	Sink / Source	H4	7
7	General Purpose	Sink / Source	H4	8
8	General Purpose	Sink / Source	H4	9
9	General Purpose	Sink / Source	H5	1
10	General Purpose	Sink / Source	H5	2
11	General Purpose	Sink / Source	H5	3
12	General Purpose	Sink / Source	H5	4
13	General Purpose	Sink / Source	H5	6
14	General Purpose	Sink / Source	H5	7
15	General Purpose	Sink / Source	H5	8
16	General Purpose	Sink / Source	H5	9
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Output Specification			Output Location	
Number	Function	Type	Connector	Pin
1	General Purpose	5V Logic	H10	2
2	General Purpose	5V Logic	H10	3
3	General Purpose	5V Logic	H10	4
4	General Purpose	5V Logic	H10	5
5	General Purpose	5V Logic	H10	6
6	General Purpose	5V Logic	H10	7
7	General Purpose	5V Logic	H10	8
8	General Purpose	5V Logic	H10	9
9	General Purpose	5V Logic	H6	2
10	General Purpose	5V Logic	H6	3
11	General Purpose	5V Logic	H6	4
12	General Purpose	5V Logic	H6	5
13	General Purpose	5V Logic	H6	6
14	General Purpose	5V Logic	H6	7
15	General Purpose	5V Logic	H6	8
16	General Purpose	5V Logic	H6	9
17	Spindle Analog b0	Analog	H9	5,9
18	Spindle Analog b1	Analog		
19	Spindle Analog b2	Analog		
20	Spindle Analog b3	Analog		
21	Spindle Analog b4	Analog		
22	Spindle Analog b5	Analog		
23	Spindle Analog b6	Analog		
24	Spindle Analog b7	Analog		
25	Spindle Analog b8	Analog		
26	Spindle Analog b9	Analog		
27	Spindle Analog b10	Analog		
28	Spindle Analog b11	Analog		
29	Spindle Analog b12	Analog		
30	Spindle Analog b13	Analog		
31	Spindle Analog b14	Analog		
32	Spindle Analog b15	Analog		
33	Analog2 b0	Analog	H9	7,11
34	Analog2 b1	Analog		
35	Analog2 b2	Analog		
36	Analog2 b3	Analog		
37	Analog2 b4	Analog		
38	Analog2 b5	Analog		
39	Analog2 b6	Analog		
40	Analog2 b7	Analog		
41	Analog2 b8	Analog		
42	Analog2 b9	Analog		
43	Analog2 b10	Analog		
44	Analog2 b11	Analog		
45	Analog2 b12	Analog		
46	Analog2 b13	Analog		
47	Analog2 b14	Analog		
48	Analog2 b15	Analog		
49	Analog Out 1 setup A	Internal		
50	Analog Out 1 setup B	Internal		
51	Analog Out 2 setup A	Internal		
52	Analog Out 2 setup B	Internal		
53				
54				
55				
56				

PLC I/O Map (continued)

Input Specification			Input Location	
Number	Function	Type	Connector	Pin
57				
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63				
64				

Output Specification			Output Location	
Number	Function	Type	Connector	Pin
57	Step rate b0	Internal		
58	Step rate b1	Internal		
59	Step rate b2	Internal		
60	Step rate b3	Internal		
61	Step rate b4	Internal		
62	Step rate b5	Internal		
63	Step rate b6	Internal		
64				

ACORNSIX Specifications

Characteristic	Min.	Typ.	Max.	Unit
24 Volt Supply Current	0.75	-	-	A
5 Volt Supply Current	1.75	-	-	A
Input Pullup Voltage (V _{inp})	4	-	30	VDC
Input On Voltage*	V _{inp} -1.25	-	-	VDC
Input Off Voltage*	-	-	1.25	VDC
Input Operating current	9	14	21	mA
Analog Output Current	0	1	10	mA
Analog Output Voltage	-10	-	10	V
Analog Output Resolution	-	16	-	bits
Analog Output Error	-	< 0.1	-	%
Open Collector Output Current	0	10	50	mA
Open Collector Output Voltage	0	24	30	VDC
5V Output High Voltage	4.4	4.9	VCC	VDC
5V Output Low Voltage	0	0.1	0.44	VDC
5V Low Level Output Current	0	3	20	mA
5V High Level Output Current	0	3	20	mA
Encoder channel input low	0	-	0.5	V
Encoder channel input high	3.5	-	5	V
Encoder input frequency low speed**	0	-	1200	khz
Encoder input frequency high speed**	0	-	6000	khz
Size: 12 * 8 * 1 (W*D*H)				Inches

* Inputs may be wired either polarity. Input "on" and "off" ratings in the chart refer to the absolute difference between the input terminal and common terminal. Input devices must meet these specifications for long term reliability.

** Frequency of A or B channel. See parameter 323 for switching encoder filter speed

VCC is supply voltage into H16 pins 1 and 2, 4.5V < VCC < 5.5V

8 Relay Board Specifications

Characteristic	Min.	Typ.	Max.	Unit
5 Volt Supply Current	0.576	-	-	A
Relay Output Current (resistive load)	0.01	-	7	A @ 240VAC
Relay Output Current (resistive load)	0.01	-	7	A @ 28VDC
Relay Output Current (inductive load)	0.01	-	3	A @ 120VAC
Relay Output Current (inductive load)	0.01	-	3	A @ 28VDC

ACORNSIX Troubleshooting

Symptom	Possible Cause	Corrective Action
LED1 out	Power loss	Check 24V wiring to H16
	Power supply overloaded	Check external loads connected to supply and ACORN_6
LED1 segments not scrolling	Offline	Start CNC12 software. Check communication cables.
Encoders or relays not working	Power loss	Check 5V wiring to H16
	Power supply overloaded	Check external loads connected to supply and encoder or relay connectors
Input doesn't work with sensor	Incorrect wiring	Correct wiring for sensor type (sinking or sourcing), check that SIP values are appropriate for the input voltage
	Voltage drop across sensor is too high	Use 3-wire sensors with lower voltage drop spec.

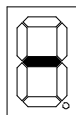
LED1 Error Codes

Error Number	Meaning	Cause	Corrective Action
1			
2			
3			
4			
5			
6	Voltage failure	Power was lost	If error appears briefly at startup, it is normal, otherwise check for loose power connections
7	Communication out of sync	Data in and out are not locked together in a synchronous relationship	Internal error, contact Centroid
8	Too many counts per interrupt requested (>511) or too many steps per interrupt (based on p968 rate)	Communication error or too fast movement requested by CNC12	Cycle Estop to clear. Maximum rate may need to be lowered.
9			

LED1 Operation

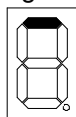
A 7 segment display (LED1) is used to display status. At startup, all number segments will light in a rotating pattern until initialization is complete. Initialization takes several seconds.

After initialization, one segment will light if ACORN_6 is ready, but not enabled. Usually the ACORN_6 is only briefly in this state immediately after initialization.

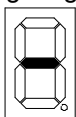


Ready, but not running

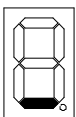
Center segments lighting in a scrolling pattern indicates normal operation.



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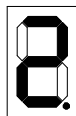


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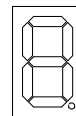


Running normally

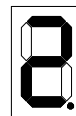
Errors are indicated by a flashing number with the decimal point lit continuously. See "LED1 Error Codes" chart for error descriptions.



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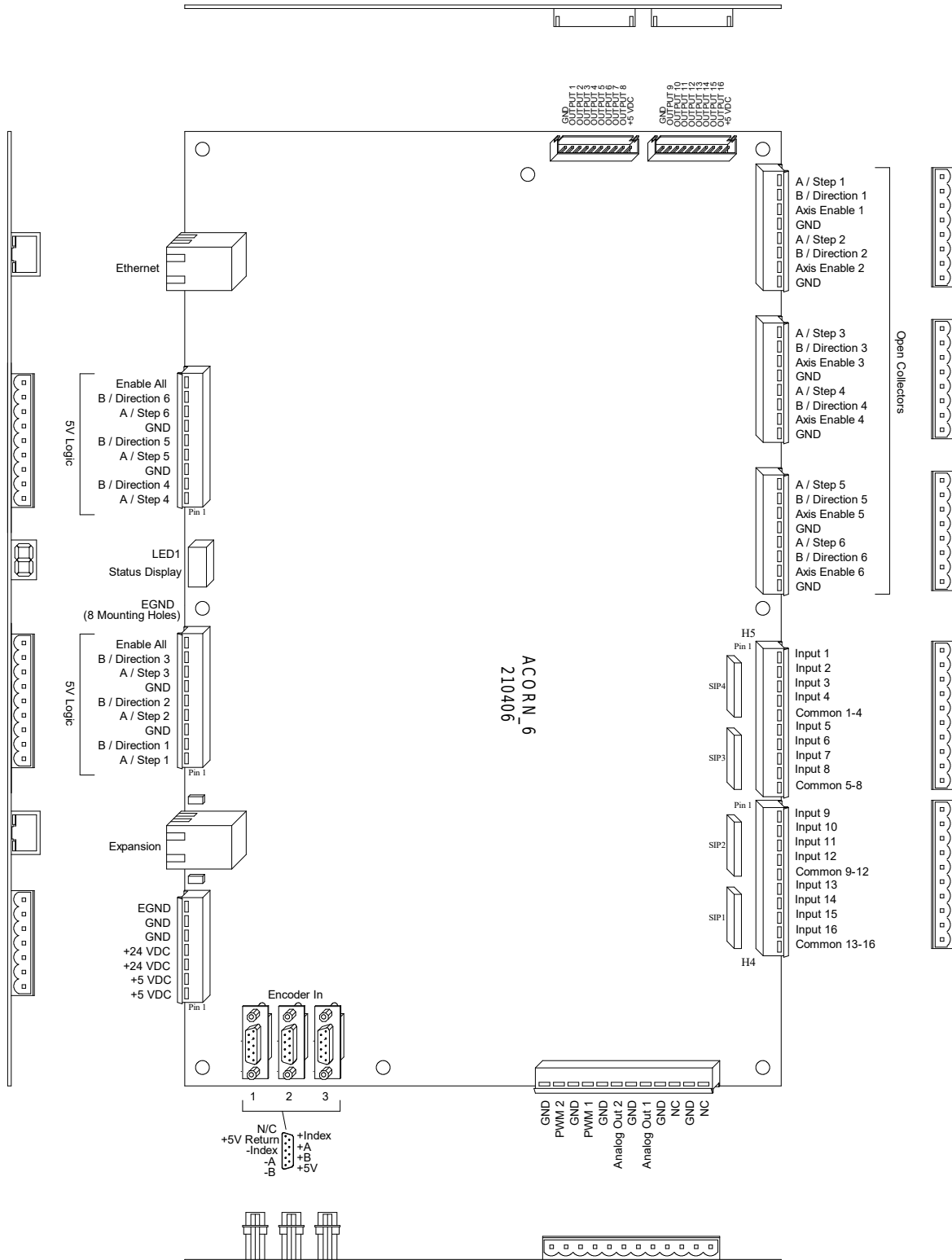


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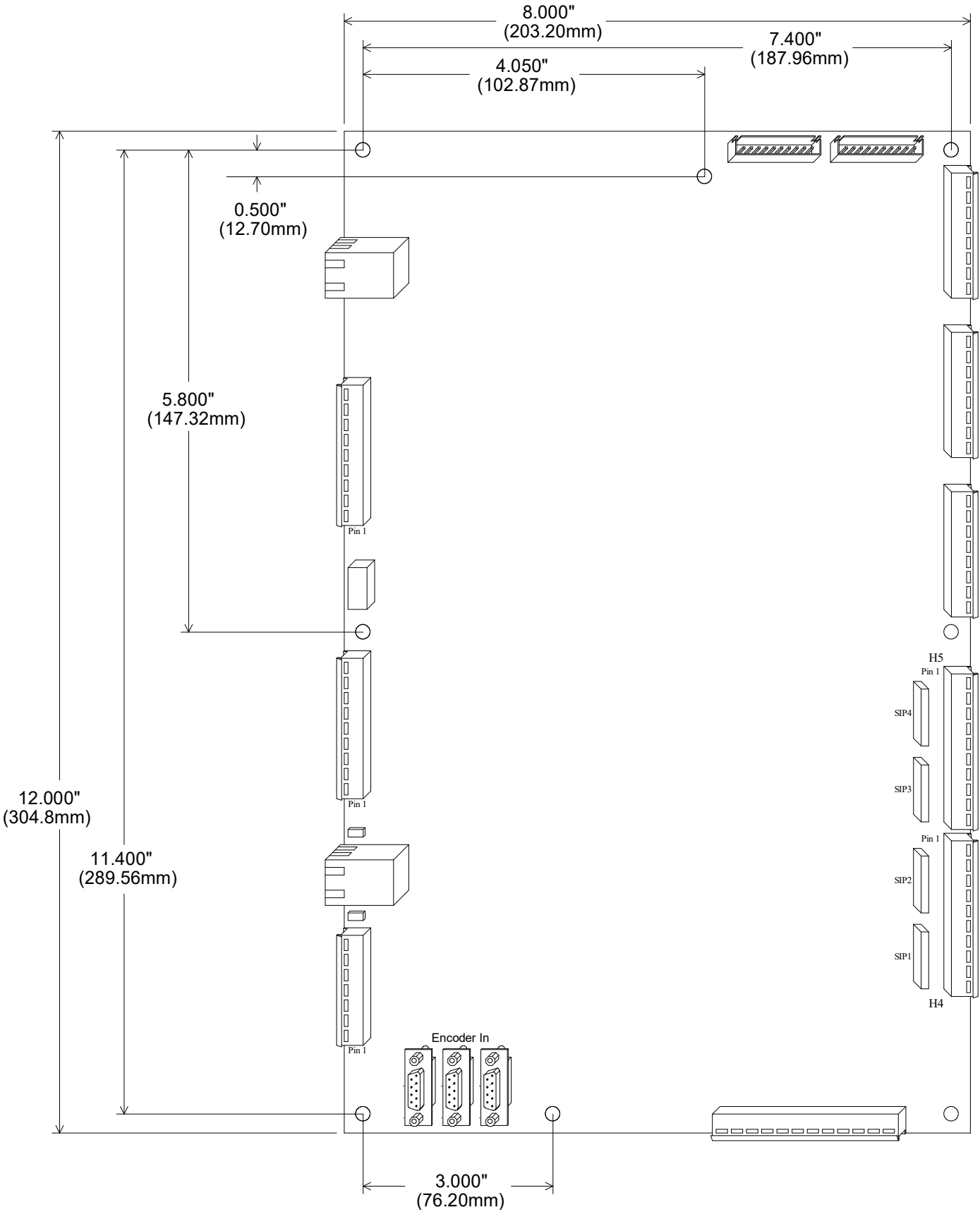


Flashing number indicates an error

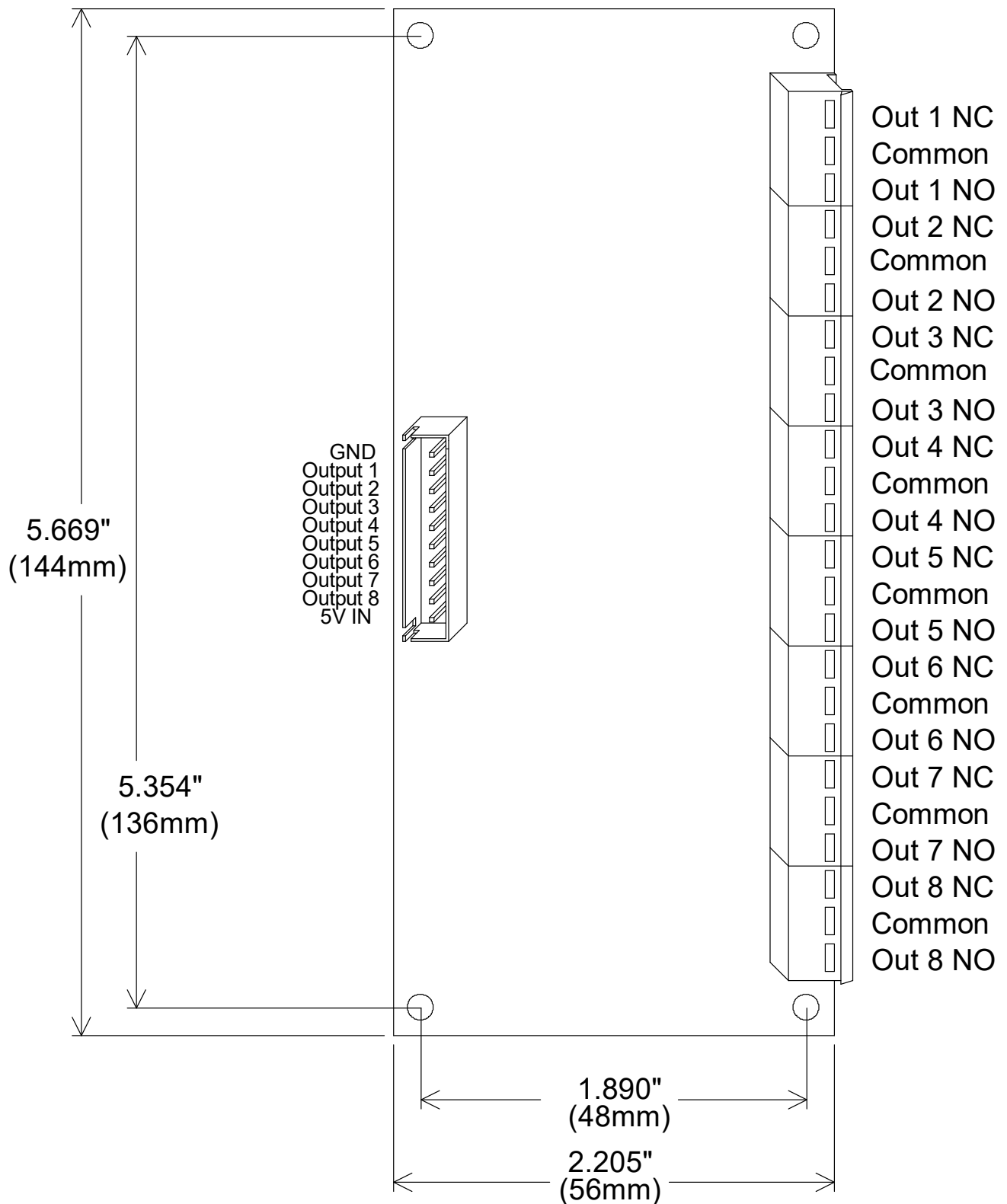
ACORNSIX Connections



ACORNSIX Mounting Dimensions



8 Relay Module Connections and Mounting Dimensions



ACORN6EXP Connections Optional Expansion Board

