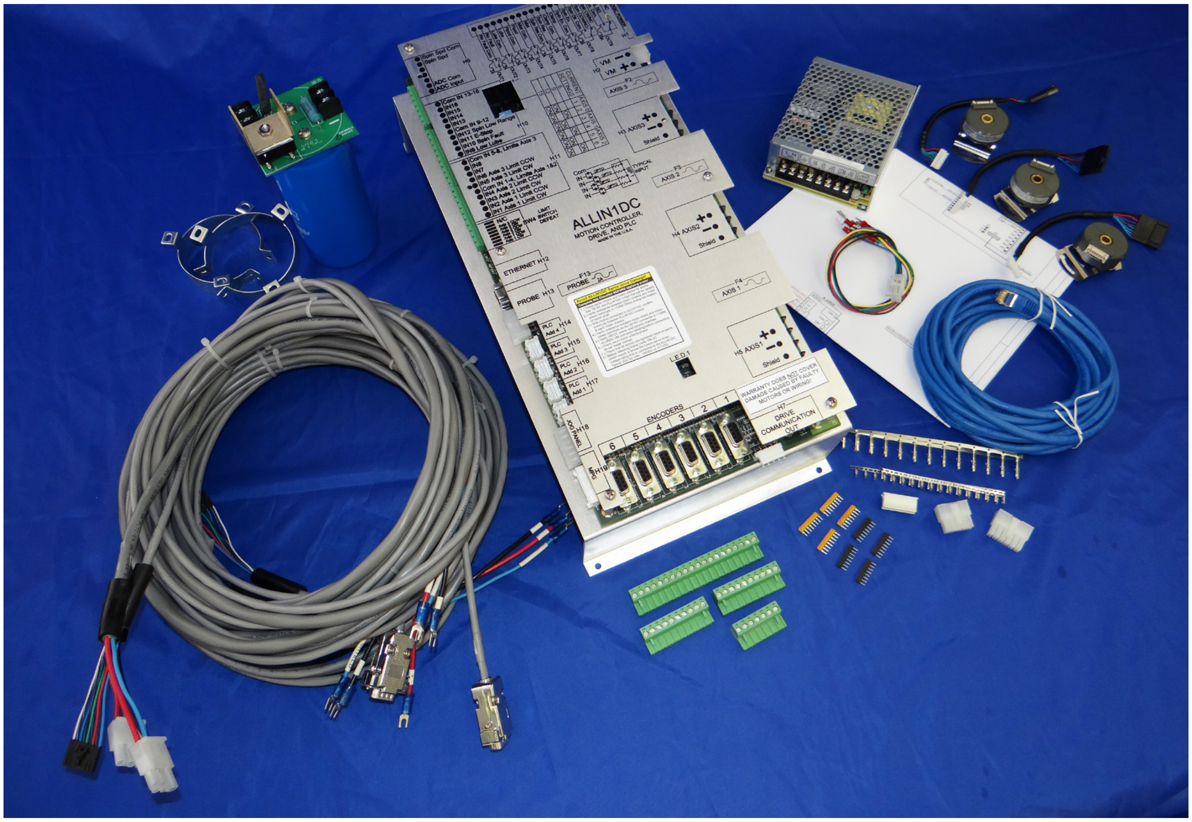
CENTROID™

Allin1DC CNC control

Centroid Allin1DC CNC Control Installation Manual

CNC CPU combination DC Servo drive w/ PLC and Spindle control
CNC12 v5.08+



www.centroidcnc.com

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CENTROID™
159 Gates Road, Howard, PA 16841 USA
(814) 353-9290
www.centroidcnc.com

"All-In-1-DC" CNC Controller: A complete CNC control contained on one printed circuit board. All you need for a typical mill, router or lathe.

Includes **built-in 3-axis Digitial DC Servo drive**, preconfigured CNC PLC with 16 IN and 9 Relay Out, and Analog out Spindle Control.
Optional Expansion boards for more complex machines with automatic tool changers, 4,5,6 axis, slaved axes and multi spindles.
Allin1DC eliminates cables, connectors and power supplies and simplifies installation while providing robust performance..
Runs with CENTROID Mill or Lathe CNC software on a Windows 7 or 8 PC*

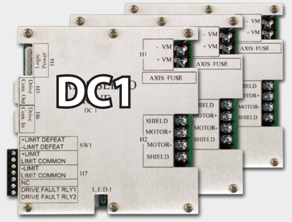

Operator's Control Panel Plug and Play


Optional **Wired** Manual Pulse Generator (MPG) Plug and Play


Optional Touch Probes, Plug and Play

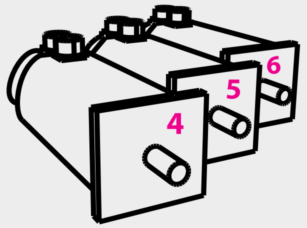

Optional **Wireless** MPG Control Pendant

Six Servo Motor Encoder Inputs. Direct Encoder feeback to Motion Control CPU and DC Servo Drive for true closed loop CNC control operation.
Any spare inputs can be used with Spindle Encoder for Rigid Tapping and Constant Surface Speed, Scales, Dual MPG's etc.



Optional DC1:
Single Axis DC Servo Drive.
Add up to three DC1's for a total of 6 axes

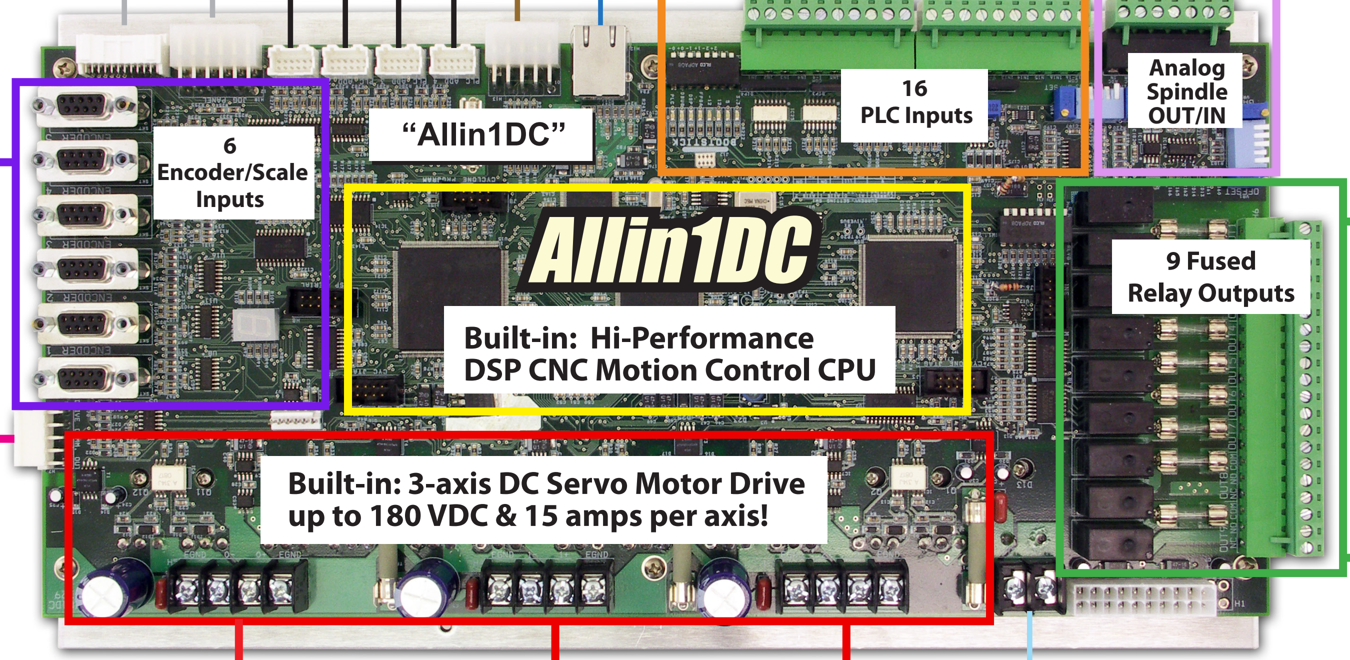
Plug and Play Digital Drive Communication



Ethernet Cable to Windows PC*

16 PLC Inputs, preprogrammed for typical CNC machine tool inputs such as: Limit Switches, Home Switches, Gear range indicators, Hi/Lo range indicator, E stop, Lube level sensor, Spindle Fault, etc. User definable and editable for custom installations. User configurable voltage and polarity.

Allows fully programmable spindle speed control with a simple connection to a wide variety of AC motor Inverters. User selectable: 0-5, 0-10, +-5, +-10 vdc output. User selectable 4 range Analog Input .

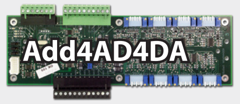


Preprogrammed Relay Outputs greatly simplify CNC control machine tool integration and reduce wiring, connections and asscociated parts and labor cost. Use our standard included PLC programs or create/ modify your own for limitless custom applications. Preprogrammed for a wide variety of typical cnc machine tool functions such as: Lube pump control, Flood pump, mister solenoid, and anything you want to control automatically with G&M codes.

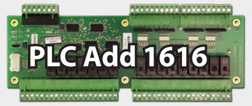
Optional I/O Expansion Boards

Add up to 4 in any combination Up to 80 In / 73 Out

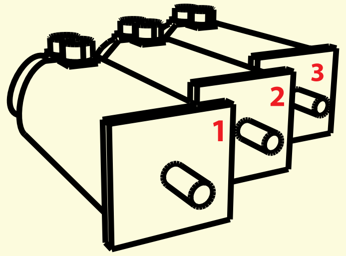
Note: The All-in-One DC includes enough preconfigured I/O for typical milling machine/router/lathe applications,optional expansion boards are available for complex retrofits requiring additional I/O above and beyond the included I/O.



4 Digital to Analog Outputs
4 Analog to Digital Inputs



16 Inputs (5, 12, 24 VDC)
16 Relay Outputs

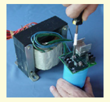


Centroid's renowned Digital DC Servo motor drive has been combined with Centroid's MPU11 DSP CNC motion control CPU along with integrated PLC and Spindle control into one powerful compact CNC motion controller: The "All-in-One-DC"

Control a wide variety of DC Servo motors rated anywhere from 20 to 180 VDC max voltage and from 6-15 amps (continuous). With user selectable, per axis: 6, 9, 12, or 15 amp limit.

Use exisiting DC Servo Motors when upgrading older CNC machinery OR Use new CENTROID DC Servo Motors. Encoder upgrade kits available for older Servo Motors.

DC OUT



110, 220
380, 440
VAC IN

DC Servo Motor Power Supply: Reuse existing DC servo motor power transformer OR directly rectify 110 VAC when using Centroid DC Servo Motors, eliminating need for transformer when 110 VAC is available. Convenient "CAP and Bridge" power combo board available for either case.

Copyright © 2012-24 CENTROID. rev15 1-19-24 allin1dc_overview_rev15.indd
All prices and specifications subject to change without notice.
* must meet minimum Centroid PC requirements.

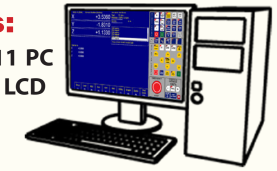
CENTROID™
159 Gates Road, Howard, PA 16841 USA
(814) 353-9290
www.centroidcnc.com

"All-in-1-DC" Single Board DC Servo CNC Controller

Includes Motion Control CPU, **On-board 3-axis DC servo motor drive** (expandable to 6 axis total) , 16 IN 9 Relay OUT CNC PLC and Spindle Control
CNC software sold separately, Centroid "Pro" CNC12 license $549, "Ultimate" $995, see website for details.

CNC PC choices:

Use your Windows 10/11 PC and your Touch Screen LCD



*must meet minimum performance requirements, you install software.

OR:

All-in-One Touchscreen PC #15022
Windows 10/11 pre configured, & CNC12 "Free" installed.

OR:

#15023
Centroid NUC CNC PC
Windows 10/11 pre configured, & CNC12 "Free" installed.

& your Touch Screen LCD display

OR: **Touch Screen CENTROID CNC Console**

Two console variations to choose from
- CNC console w/ built-in NUC CNCPC (#13181)
- Panel Mount w/ NUC CNCPC (#13934)
See console brochure for list of options and accessories: www.centroidcnc.com/downloads.htm

Optional Operator's Control Panel #11077)

Optional **Wireless** MPG Control Pendant (#8928) Requires v4.16+ and Pro License

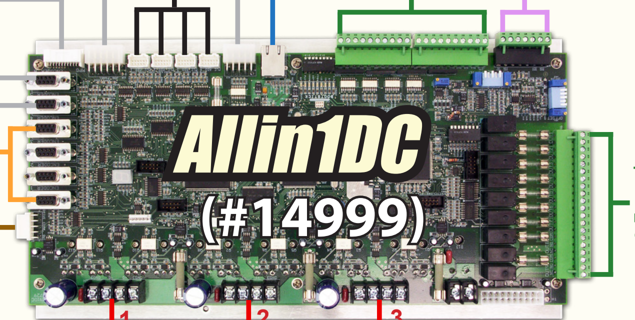
Optional **Wired** Manual Pulse Generator (MPG) (#11069)

Additional Encoders or Scales

Ethernet Cable to PC

16 PLC Inputs

Spindle Control



9 Fused Relay Outputs

1 2 3 Servo Motor Cables

Encoder Cables

Touch Probe
KP-3 (#14944)

Auto Tool Set
- TT-4 (#15134)
- TT-1 (#15207)

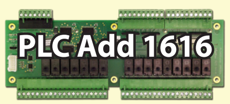
Centroid CNC Control Software
CNC12 Mill(#15002) or Lathe(#15003) Pro License
CNC12 Mill(#15004) or Lathe(#15005) Ultimate License
Console, Display, & Cabinet opt. mounting hardware
6' Conduit and Cable package* for console (#11028)
Custom Length Console Cable for over 6ft **call** (#14025)
Console mounting arm kit (2,3,4,5' Straight or 2.5 Z) (#13933)
Console to Arm mounting hardware w/swivel mount (#14752)
Console to Arm mounting hardware (direct mount) (#13932)
Console Rolling Floor Stand (#8445)
Related Hardware and Cable kits
Operators Pendant mounting hardware (#10491)
MPG internal cable 20' w/bulkhead con. (#11086)
Probe internal cable 6' w/bulkhead con. (#11211)
Operators control panel internal cable 20' (#11029)
OEM/DIY console cable connector set (#13138)

* Pre assembled, standard length: 6 ft. of conduit combined with 16' of cable.

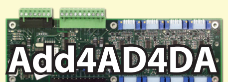
Optional I/O Expansion Boards

Add up to 4 in any combination
for up to **272 IN / 272 OUT**

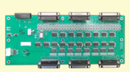
Note: The Allin1DC includes enough pre configured I/O for typical milling machine/lathe applications,optional expansion boards are available for complex retrofits requiring additional I/O above and beyond the included I/O.



16 Inputs (5, 12, 24 VDC)
16 Relay Outputs
(#11025)



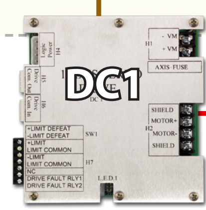
4 Digital to Analog Outputs
4 Analog to Digital Inputs
(#11141)

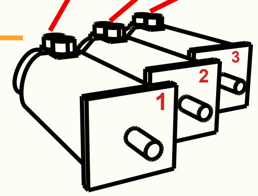


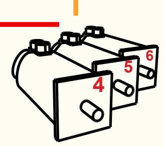
PLCAdd6464
(#11212)

64 Inputs 5V non isolated
64 Outputs Open Collector

Optional DC1
Single Axis DC Servo Drive
Add a 4th, 5th or 6th axis!
For up to 6 axes total
(#11112)







Use your DC Servo Motors
Up to 40 in lb (4.52 Nm)
-OR-

Add CENTROID DC Servo motors
(encoders and cable installed, 180 VDC max)
No transformer needed
- 16 in-lb w/16ft cable: (#10667)
- 29 in-lb w/16ft cable: (#10816)**
- 40 in-lb w/16ft cable: (#10935)**
- Motor Cable (custom lengths over 16ft (4.8m)):
- 7 in-lb, 10 in-lb and 40 in-lb w/brake also available, call for $

Encoders for existing motor encoder upgrade or replacement use
- 2000 line (8000 counts per rev.) differential quadrature encoders available sizes: fits over 6mm, 1/4", 3/8", 1/2" shaft:
- 10,000 line (40,000 counts per rev.) differential quadrature encoders: fits over 6mm shaft

DC Power Supply "Cap and Bridge combo" (No Transformer, use your own):
110 VAC (#10766), 220VAC/440VAC (#10767), 220 VAC 3 Phase
110 VAC to 117 VDC Power Supply with Transformer (#10537)
220 / 440 VAC to 117 VDC Power Supply (#10010)

Effective 6-16-22

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All prices and specifications subject to change without notice.
**direct wired
This price sheet supersedes all previous pricing.

SERVO DRIVE WARRANTY DOES **NOT** COVER DAMAGE BY FAULTY MOTORS OR WIRING.

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 support 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.**

Servo Motor Handling

When working with servo motors:

·**NEVER pick up or carry the motor by the cables or the shaft. (Always carry by the frame.) Use a crane or lift to move the motor when necessary.**

·**NEVER drop or subject the motor to impact. The servo motor is a precision device.**

·**NEVER set heavy or sharp objects on the motor or cables. Do not step or sit on the motor or cables.**

·**NEVER use a metal hammer on any part of the motor. If it is absolutely necessary to use a hammer, use a plastic hammer.**

Keep the motor properly secured and away from the edge of the work area when servicing the motor, as a dropped motor could cause personal injury or destroy the motor.

Basic Safety Procedures and Best Practices

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 instructed to.

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

Be sure to attach a key to a motor with 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.

For Circuit Boards

Minimize handling circuit boards as much as possible. If you must hold a circuit board, grab it by the edges as shown below in figure 2. Avoid touching any of the circuits, components, or component leads. Improper handling lead to ESD (electrostatic discharge) which can damage the PCB, and shorten the operational lifespan.

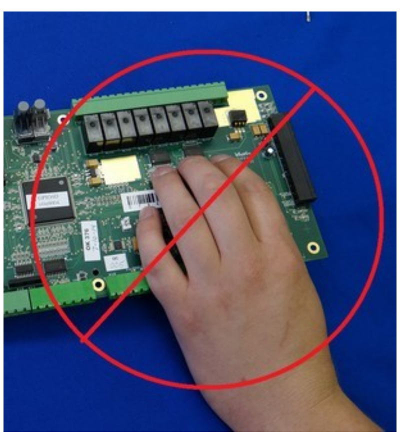


Figure 1.
Improper PCB Handling

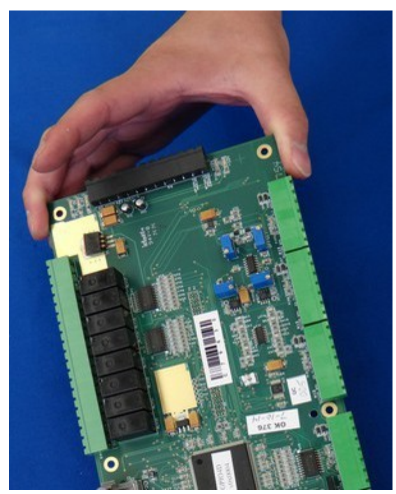


Figure 2.
Proper PCB Handling

Keep the work are free from static generating materials such as Styrofoam, vinyl, plastic, and fabrics.

Table of Contents

Introduction

This manual describes how to install the Centroid CNC (Computer Numerical Control) system with an ALLIN1DC servo drive. The PC based system provides up to three axes of closed loop servo interpolated motion, controlled by industry standard G-Codes.

The ALLIN1DC can be used for the CNC control of milling machines, routers, lathes, flame cutters, plasma cutters, laser cutters, water jet cutters, drill presses, grinders, and other specialized applications.

This installation manual covers the most common ALLIN1DC hardware setups. For the rest of the manual, we will assume the installation is a three axis mill.

Before You Begin

Before getting started, please take the time to familiarize yourself with the schematics, manuals, and installation instructions.

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 you may run into. Additional troubleshooting is included in the appendices.

Useful Resources

Centroid Product Manuals: http://www.centroidcnc.com/centroid_diy/centroid_manuals.html

ALLin1DC Standard Schematics: http://www.centroidcnc.com/downloads/allin1dc/centroid_allin1dc_schematic_set.zip

All Centroid schematics can be found here. https://www.centroidcnc.com/centroid_diy/schematics/pbrowse.php
use the search bar, type in “allin1dc”

Centroid’s YouTube Channel: Centroid CNC Technical Support

martyscncgarage YouTube video series: Centroid All in One DC Control - Knee Mill Retrofit.

Free community support: Centroid Community CNC Support Forum

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

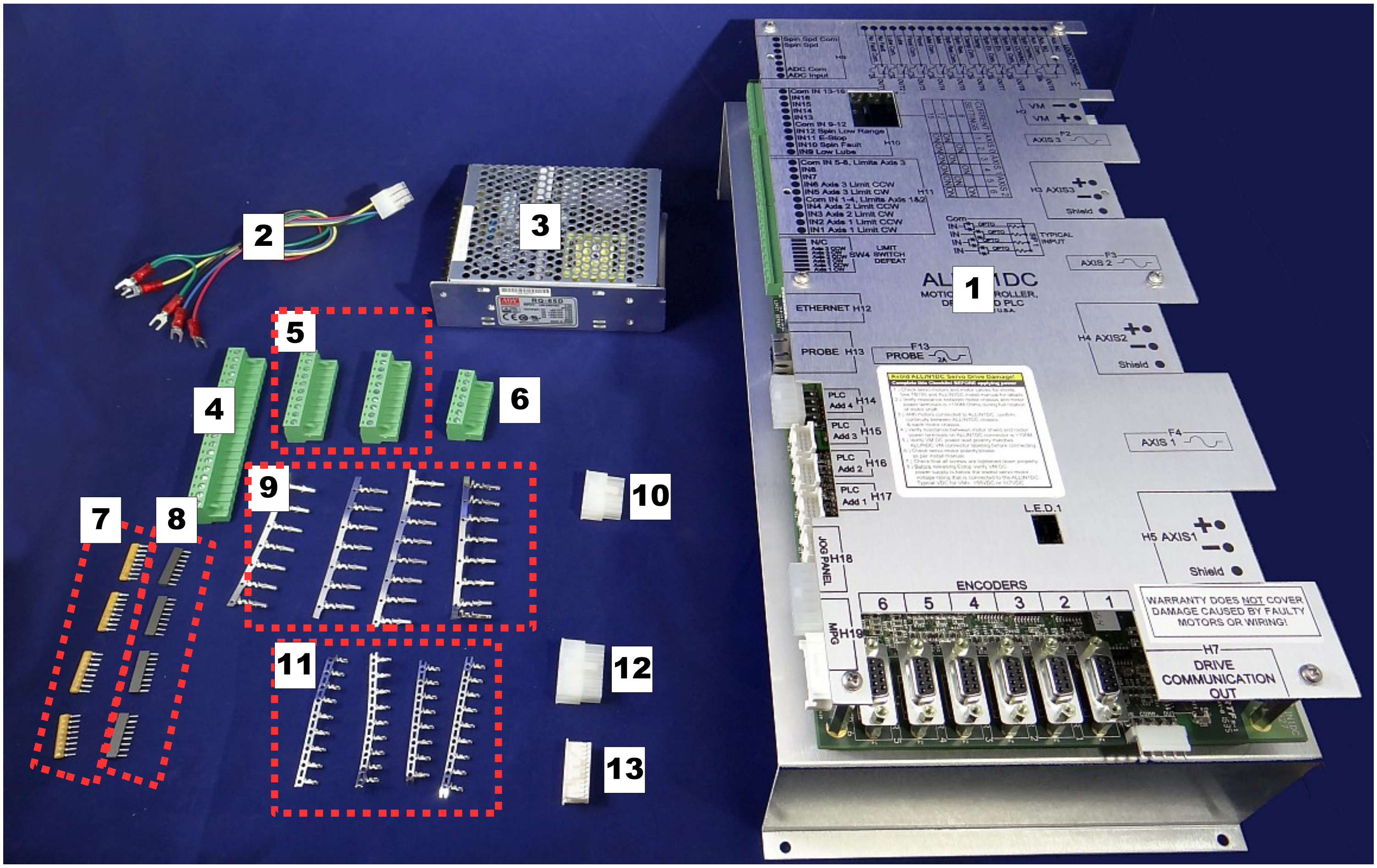
Centroid Allin1DC and Accessories: https://shopcentroidcnc.com/allin1dc-cnc-controller/

Typical ALLin1DC Installation Photo Album https://photos.app.goo.gl/7iGrzZT3bpyhD6VF9

Chapter 1
What's Included

1.1 ALLIN1DC

The ALLIN1DC is a complete motion control solution, providing a 3-axis servo drive and full PLC. Make sure your kit is complete and has not been visibly damaged in shipment.



The following components are included with your ALLIN1DC [1]

1. ALLIN1DC .... Part Number 11144
2. DC Logic Power Cable........ Part Number 13106
3. Meanwell RQ-65D........ Part Number 7820
4. Twenty position terminal block........ Part Number 3450
5. 2 Ten position terminal blocks........ Part Number 3904
6. Seven position terminal block........ Part Number 2611
7. 4 Twenty four volt SIPS (color and appearance may vary)........ Part Number 4152
8. 4 Five volt SIPS (color and appearance may vary)........ Part Number 3956
9. 24 Crimp pins for jog panel connector and probe connector........ Part Number 5511
10. Ten pin probe connector........ Part Number 5918
11. 26 Crimp pins for MPG connector........ Part Number 5983
12. Twelve pin jog panel connector........ Part Number 5919
13. Twenty four pin MPG connector........ Part Number 5984

[1] The list above contains the **minimum** quantity that should be included in each parts bag. Some parts bags may have a few extra items.

Crimp Pin Part Number 5511 (Used for making jog panel and probe cables)
The appropriate hand crimpers are available from TE Connectivity as “*PRO-CRIMPER III Hand Tool Assembly 91387-1 with Die Assembly 91387-2 (26-22 AWG)*” or “*PRO-CRIMPER III Hand Tool Assembly 91388-1 with Die Assembly 91388-2 (22-18 AWG)*”. These tools are sold separately and can be purchased from most major electronics components distributors such as Digi-Key.

Fully assembled cables for jog panels and probes can be bought through Centroid.

Crimp Pin Part Number 5983 (Used for making MPG cables)
The appropriate hand crimpers are available from JST as “YRS-245”. These tools are sold separately and can be purchased from most major electronics components distributors such as Digi-Key.

Fully assembled cables can purchased through Centroid using these part numbers:
#11211 6’ Internal Probe Cable.
#11086 up to 20’ MPG cable
#11029 up to 20’ Jog Panel Cable
#10830 up to 16’ DC encoder Cable. DB9 to DC encoder flat connector

Chapter 2
Bench Test Hardware Setup

2.1 Introduction To Bench Testing

The first step in installing your new system is performing a bench test. A “bench test” is connecting all of the electronics together to test them **before** installing the system in a machine. This test is usually done on a work bench, hence the name. A bench test allows you to:

- 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 when troubleshooting than 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.

The bench test **ALWAYS** needs to be performed **BEFORE** applying **HIGH VOLTAGE** to the servo drive. Applying high voltage to an improperly configured system could cause permanent damage to the hardware and physical harm to the technician or operator. Figure 2.1.1 below shows an example of an ALLIN1DC system set up for a level test. In the following pages we will guide you step-by-step through the setup and execution of a bench test.

Tools and Equipment Needed

- **Picking a good location –** A bench test needs to be performed on a large table or desk with good lighting and easy access to electrical outlets. The surface should **NOT** be made out of metal or contain metal scraps or shavings, as we will be resting powered circuit boards on the surface. Do not use fabric covered surfaces because they put the PBC high risk for ESD (electrostatic discharge) damage. Anti-static mats are normally conductive and make a poor surface for powered boards. Plastic is acceptable, but could put the board at risk for static damage. **A wooden surface is an ideal test bench location.**
- A PC with an internet connection, or a Centroid console unit (comes with CNC12 already installed). The PC must meet the specifications listed in **Technical Bulletin #273** (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/273.pdf)
- A small screwdriver set.
- A digital multimeter

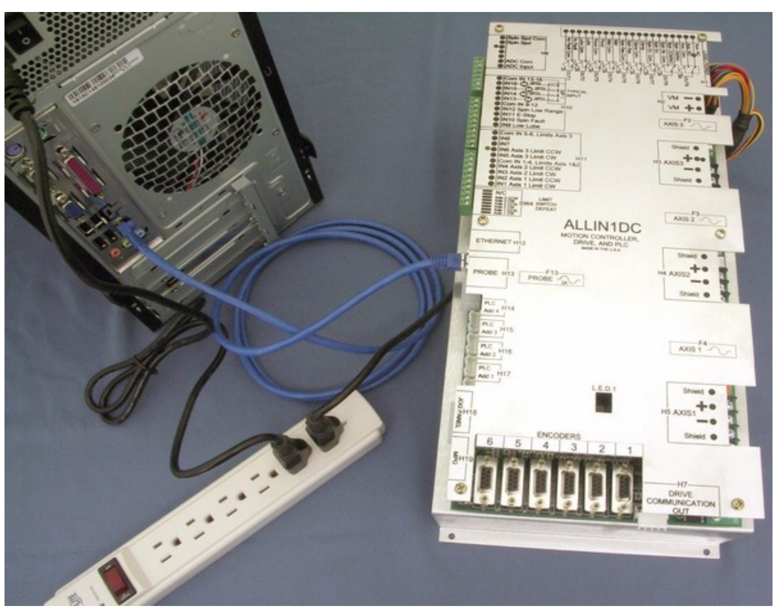


Figure 2.1.1
Example of equipment set up for a board level test.

2.2 ALLIN1DC Setup

1. **Configure the CNC PC for use with a CNC controller follow instructions on TB309** **https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/309.pdf**

2. **Provide power:** Connect the supplied DC Logic Power cable to the Mean Well power supply and then plug it into H1 on the ALLIN1DC. Splice a 110 V power cord to the power supply's AC input. **Live to L, Neutral to N, and Ground to ground.**

3. **Connect the Ethernet Cable:** Connect a shielded Ethernet cable from your ALLIN1DC to the PC. A shielded Ethernet cable will have a metal clip around the RJ-45 connector it as shown by the blue cable in Figure 2.3.9 Centroid recommends using snagless patch cables from StarTech. **StarTech ID# S45PATCH25BL.** This information is outlined in **Technical Bulletin #251**, the latest version can be found here**.** (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/251.pdf)

    1. **NOTICE**: An unshielded cable can cause intermittent PC Data receive errors in the software due to electronic noise and interference.

Figure 2.2.1
Unshielded Ethernet cable (gray) compared to Shielded Ethernet cable (blue)

4. **Connect Any Accessories:** If you have any accessories such as an MPG, jog panel / pendant, or DC1 servo drives. When you are finished, the ALLIN1DC should be wired as shown in the diagram in Figure 2.2.2. (next page) and the picture in Figure 2.1.1 (previous page).

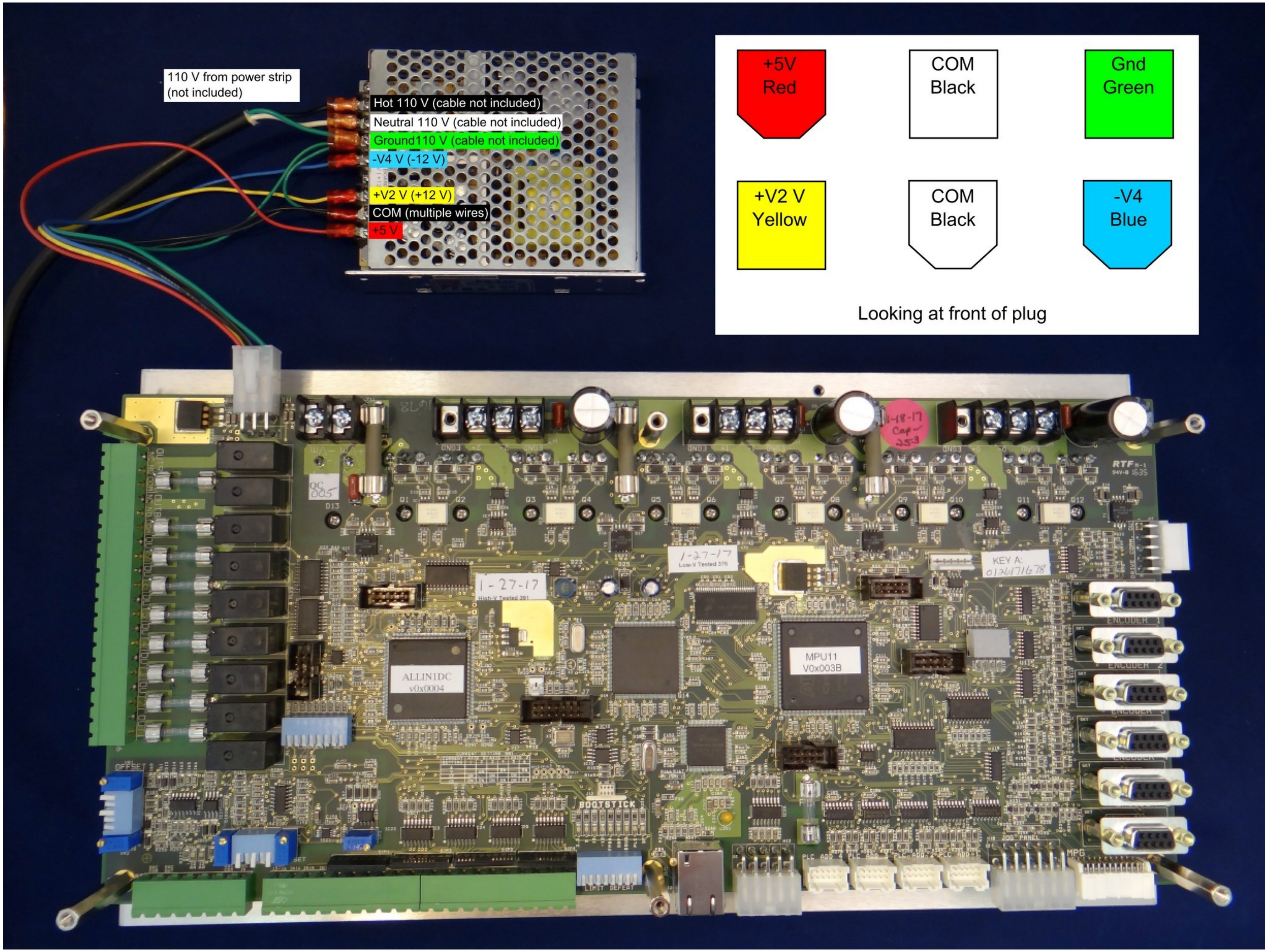


Figure 2.2.2
ALLIN1DC Wiring

2.3 Encoder Requirements

1. The ALLIN1DC uses DC incremental quadrature encoders. Please connect your encoders to the ALLIN1DC, starting at encoder 1 for the first axis. Do not hook up the motor power wires at this time.

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

   1. **Encoder Cables:** The encoder cables **MUST** be twisted pair shielded cables. The shield wire of the encoder cable needs to be grounded to the metal shield of the DB-9 connector as seen in figure 2.3.1. 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.

      1. **NOTE:** Failure to ground the cable shield may cause encoder errors in the software.

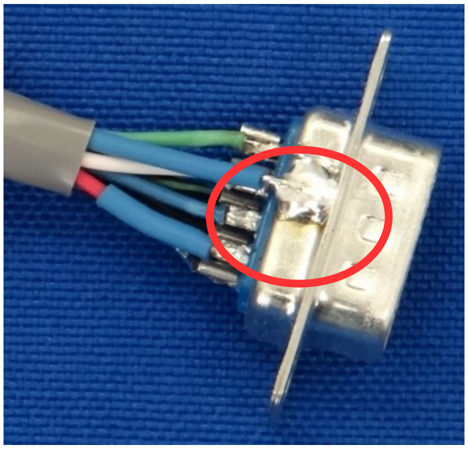


Figure 2.3.1
Cable shield ground attached using solder to the metal shield of the D-sub connector.

   2. **Encoder Output:** Encoders must have RS422 type (differential) quadrature outputs with A, B, and Z channels to work with ALLIN1DC. A low encoder count creates poor performance and accuracy. Centroid supplies and recommends 2000 line to 10,000 line encoders for most applications. Ex: 2000 lines = 8000 counts/rev.
      Tips for choosing an Encoder: Optimal performance requires at least 20,000 Encoder Counts per inch. (Encoder Lines * 4 * ball screw Turn ratio = Counts/Inch)
      -Knee mills with a typical turn ratio of 5 turns/inch work well with 2000 line encoders. (2000*4*5=40,000 counts/inch)
      -Routers with Rack and pinion axis with a typical 1 turn/inch ratio need minimum 5000 line encoders (5000*4*1=20,000 counts/inch

      The following link lists encoders and premade encoder cables available though Centroid.
      http://www.centroidcnc.com/centroid_diy/cnc_components.html

      Related Reading “Encoder Basics” https://centroidcncforum.com/viewtopic.php?f=64&t=4

3. The outputs have additional voltage level requirements described in the table below:

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

4. **Wiring Code:** Wire the encoder according to the figure 2.3.2 and the table shown below. Refer to the encoder manufacturers data sheet for the wiring color code.

   1. **Note**: The +5V is an output provided by the ALLIN1DC.

Pin	Quadrature
1	Not used
2	Common (ground)
3	Z-
4	A-
5	B-
6	Z+
7	A+
8	B+
9	+5V

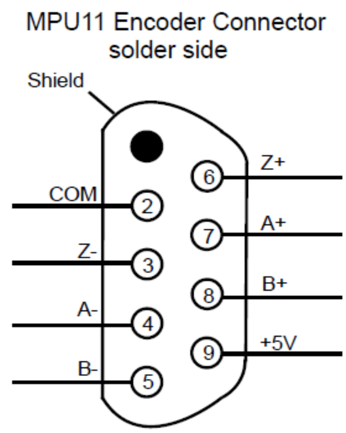


Figure 2.3.2

2.4 ALLIN1DC LED States

Power up the ALLIN1DC

Wait approximately 30 seconds after starting up the ALLIN1DC before checking the status of the LEDs. The first group of LED are located behind the limit switch header as shown in Figure 2.4.1. A second set of LED's are located in the top corner of the board next to the analog section as shown in Figure 2.4.2. You do not need to remove the cover, but pictures with the cover removed are included for your reference. Check to see that all LED's initialized as defined below in the table of LED states. If any of the LEDs are not initialized properly, check Appendix C for troubleshooting help.

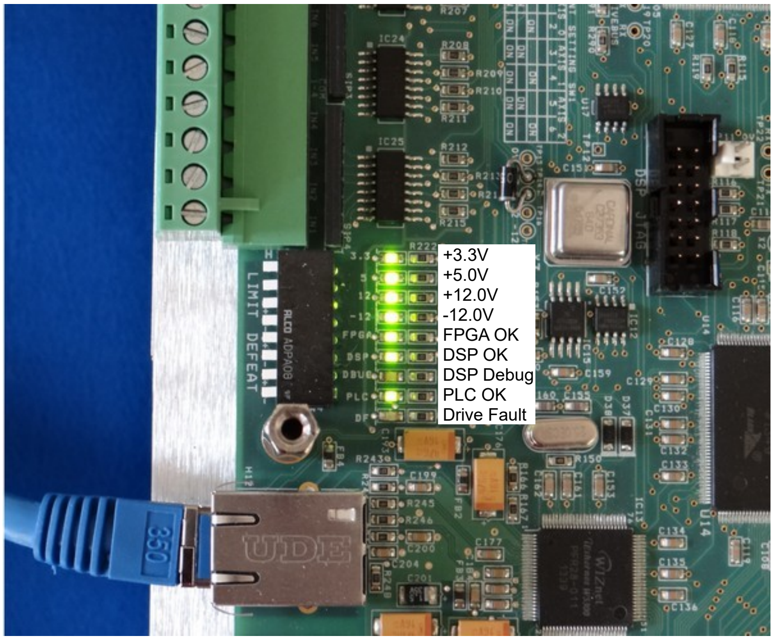


Figure 2.4.1
LEDs showing the status of the Allin1DC

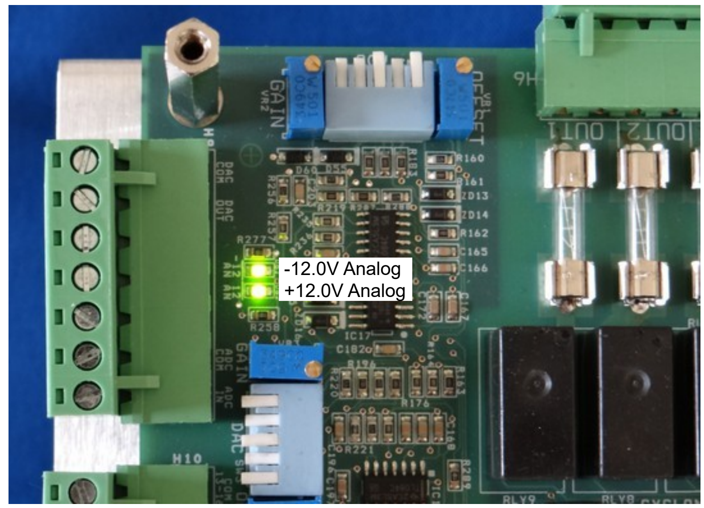


Figure 2.4.2
Two additional LEDs are located in the top corner of the board next to the analog section.

LED States

LED Name	LED Function	Nominal State
+12V Analog	The drive has +12.0 volt power to analog circuitry	Solid Green
-12V Analog	The drive has -12.0 volt power to analog circuitry	Solid Green
+3.3V	The drive has +3.3 volt power	Solid Green
+5.0V	The drive has +5.0 volt power	Solid Green
+12.0V	The drive has +12.0 volt power	Solid Green
-12.0V	The drive has -12.0 volt power	Solid Green
FPGA OK	The FPGA is working correctly	Solid Green
DSP OK	The DSP is working correctly	Solid Green
DSP Debug	Multiple functions, for full description see Appendix C	Flashing 1 time per second
PLC OK	PLC is working correctly	Solid Green
Drive Fault	Status of the drive fault relay	Turns on after communication is established with the software and all faults are cleared.

Wait approximately 15-30 seconds after the ALLIN1DC has started up. LED1 will display a number. If the seven segment display is displaying a solid number without a decimal point, it indicates the Drive Bus order as seen in Figure 2.4.3. If LED1 is flashing with a decimal point, it indicates an error as shown in Figure 2.4.4.

If you have a blinking “4”, that means the ALLIN1DC is not seeing the limit switches. Since we have not hooked up limit switches yet, you can disable them using SW4 as pictured in Figure 2.4.5. Move the limit switched from the down position to the up position if the switch is black and from the up position to the down position if the switch is blue. If done correctly, your ALLIN1DC will all be displaying it's order in the drive bus chain. For users running an ALLIN1DC without a DC1 drive attached, LED1 will always display a “1”. A table of other drive errors and their definitions is provided below.

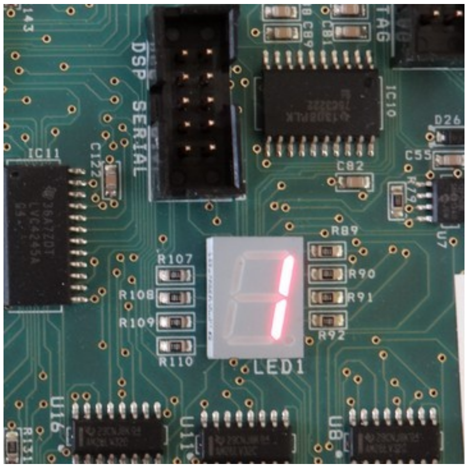


Figure 2.4.3
LED1 showing the Drive Bus number

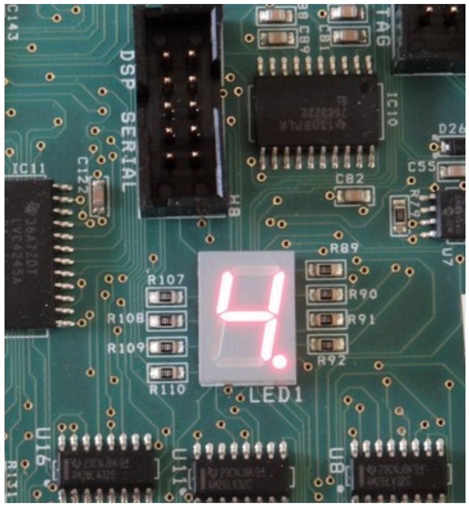


Figure 2.4.4
LED1 showing error number “4”.
Please note the decimal point.

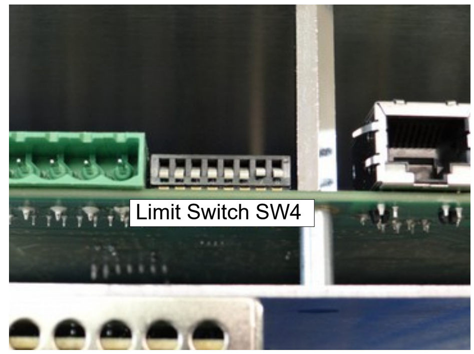


Figure 2.4.5
Limit switches

LED1 (seven segment display) States

Error Number	Meaning	Cause	Corrective Action
1	Power Failure (Revision 100315 and earlier only)	The logic power supply is indicating to the ALLIN1DC that is operation out of specification.	Check power supply wiring. Replace power supply.
2	15A Not Available	Only applies to “Low Power” versions of the ALLIN1DC. The current select switches on any axis are set to 15A, but the servo drive is not equipped with the appropriate FETs for long term use at 15A, so the servo drive will drop back to 12A	Select 12A or lower current settings or use a “regular” ALLIN1DC.
3	Null Error	The self adjustment routine has detected too large an offset on the current feedback. Usually indicates a failure of the ALLIN1DC's current sensors.	
4	Limit Tripped	Any limit switch is tripped.	Move away from the limit, check limit switch wiring, or use limit defeat switch if a limit switch is not required.
Single dash (-) or other unusual behavior	ALLin1DC Logic problem	ALLin1DC Board logic not starting correctly.	Check Logic Power supply or Contact Centroid Support for RMA number. Send the servo drive back for repair.

Chapter 3
Software Installation

3.1 Windows Software Preinstallation Requirements

1. If you have purchased a console unit or computer from Centroid, it already 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 http://www.centroidcnc.com/cnc_pc_performance_requirements.html and Tech Bulletin 273 - Centroid CNC PC Minimum Hardware and Benchmark Requirements

2. To configure your own computer running Microsoft Windows 10/11, setup the CNC PC following the instructions in TB309 https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/309.pdf

   Note: Microsoft Windows 10 and 11 are supported with CNC12. Microsoft Windows 8.1, 7 and older versions of Windows are not supported. Mac OS and Linux operating systems are also not supported.

   Run the Centroid PC Tuner and have the PC Tuner do most of the work for you.
   Download the PC Tuner here https://www.centroidcnc.com/centroid_diy/centroid_cnc_software_downloads.html

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

   1. **Nearly 100% of all communication problems between CNC12 and the ALLIN1DC 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 ALLIN1DC 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.

   2. 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 CNC12 Software Installation

With your bench configuration completely powered as described in Section 2.4 and your PC powered up, install the CNC12 Software as follows:

1. **Download the latest CNC12 Software version.** It is important that you download the latest version of the Centroid CNC12 software before continuing. Click on the link to download the latest version of CNC12 software: Centroid Software

2. **Navigate to the CNC12 Software you just downloaded.** Depending on your Windows settings, the file you downloaded will be displayed as "centroid_cnc12_v5.08_installer_x64.zip". Double click this zip folder.

3. **Drag the installation folder from the compressed file to your desktop as shown below in Figure 3.2.1.** The folder in this example is called centroid_cnc12_v5.08_installer_x64.zip, your version may be newer but the name will be the same other than the "v5.08" which signifies the CNC12 version. Alternatively, you may extract the .zip folder to your desktop.

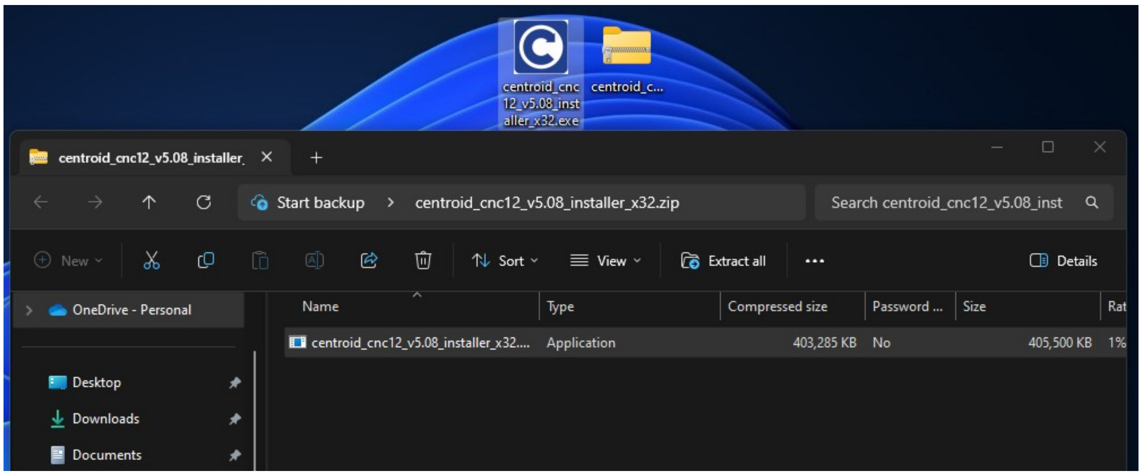


Figure 3.2.1
Copy Installer to Desktop

4. **Double click the install application to begin CNC12 install.** NOTE: The AllinOneDC MUST be powered on and connected to the PC via Ethernet cable before running the installer.

5. If "**User Account Control**" is enabled, Windows will ask **"***Do you want to allow the following program from an unknown publisher to make changes on this computer?***"**. Click "**Yes**". Windows 10 systems may pop up a Windows Defender SmartScreen showing "Windows Defender SmartScreen prevented an unrecognized app from starting. Running this app might put your PC at risk". Click "More info", Then Click "Run anyway"

6. **Read License Agreement** Read the Software license agreement for using the CNC12 Software. If you accept the terms of the agreement, click "I Agree" to continue, Otherwise, click "Cancel" as seen in figure 3.2.2.

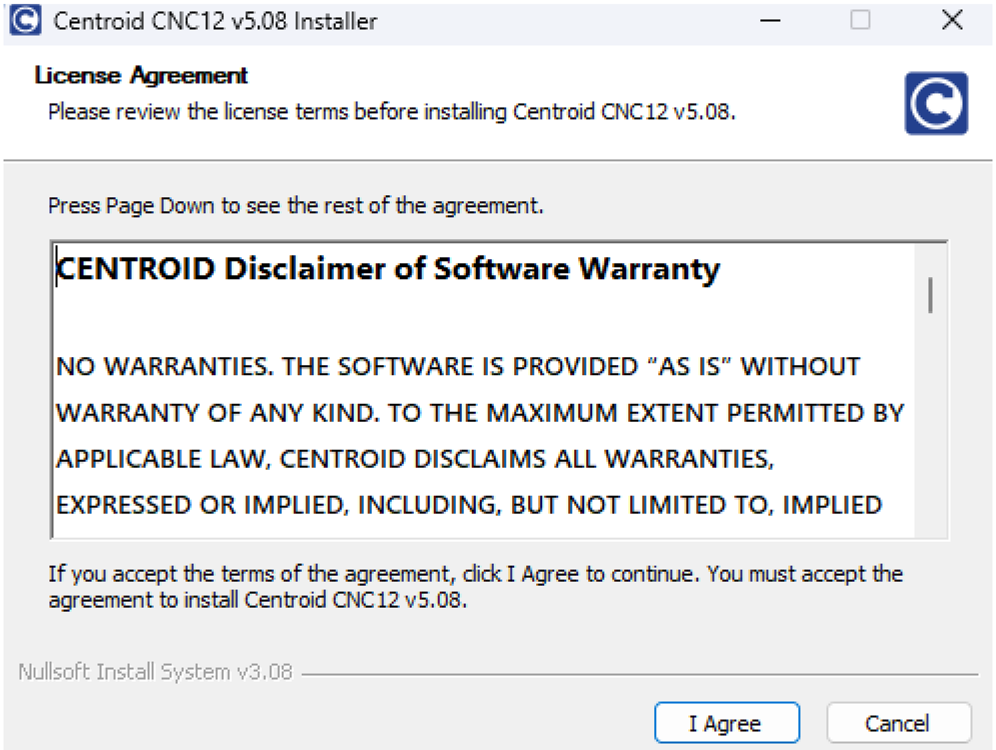


Figure 3.2.2
License Agreement

7. **Installer Options.** Select the option to Install Desktop Shortcuts shown in Figure 3.2.3. If desired, also select the option to Start CNC12 at Startup. Click "Next" to continue.

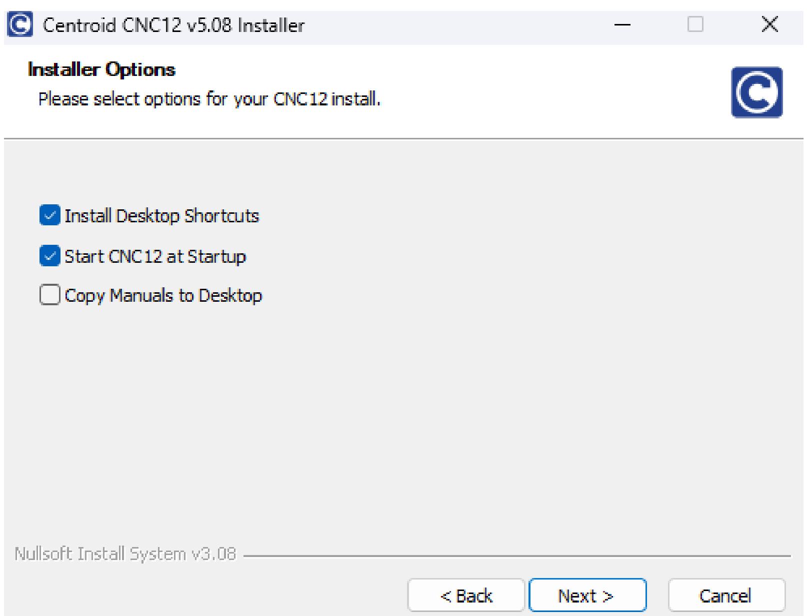


Figure 3.2.3
Installer Options

8. **Installer Options – Control board model.** Select “Oak/Allin1DC/MPU11” component of CNC12 shown in Figure 3.2.4.

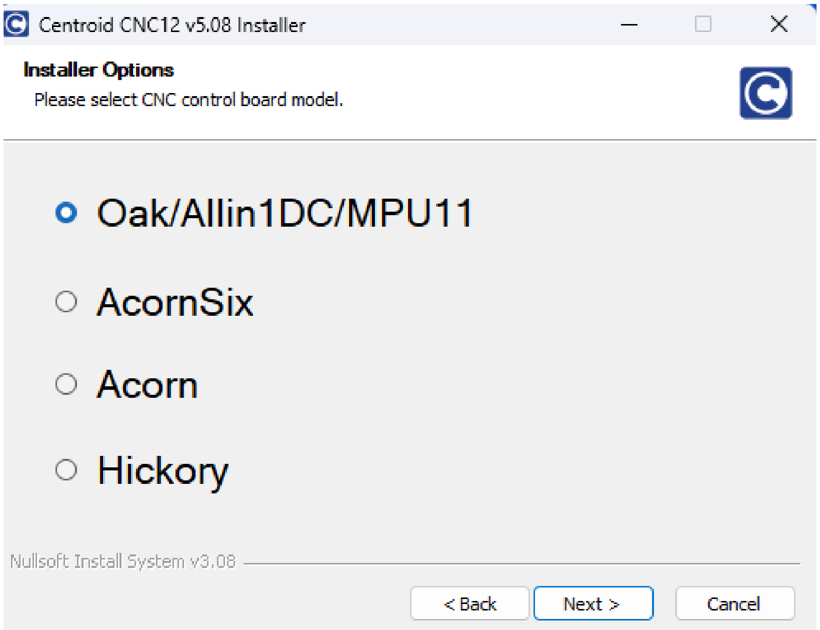


Figure 3.2.4
Select CNC control board model

9. Select **CNC12 Mill** for a Mill installation as shown in Figure 3.2.5.

   Select **CNC12 Lathe** for a Lathe installation. For the remainder of this document we will assume the system is being installed on a mill.

   Click “Next” to continue.

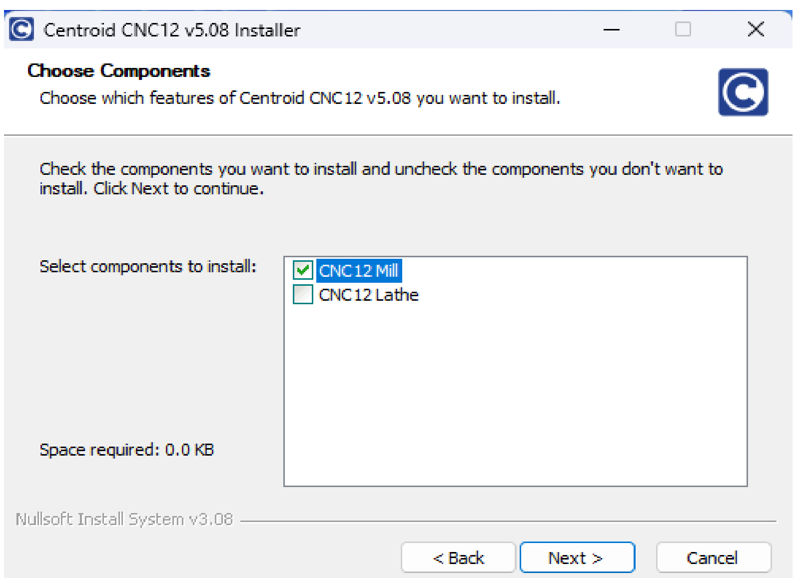


Figure 3.2.5
Choose Components

10. **Select Units.** Select the default units used by CNC12, either "Imperial" or "Metric" (Figure 3.2.6). Click "Install" to begin the installation.

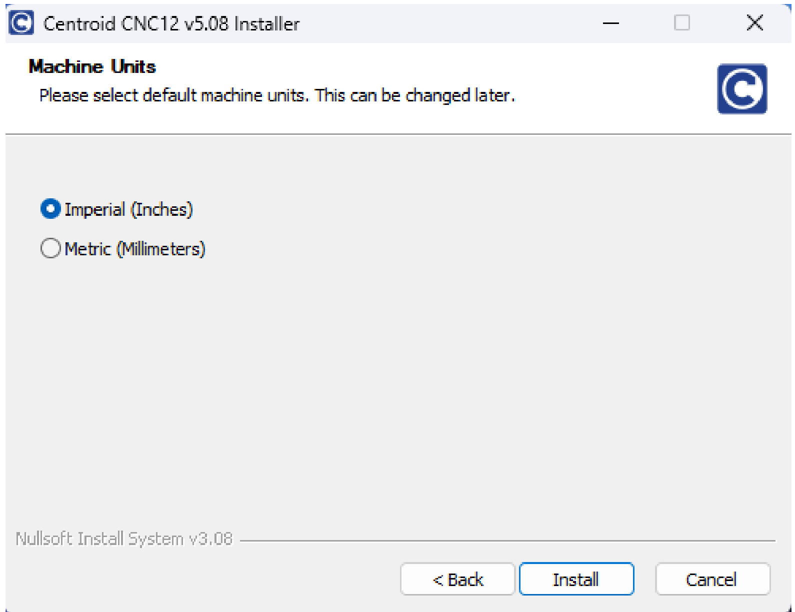


Figure 3.2.6
Select Units

11. **Installation**. The CNC12 files will now be installed, and the "**Installation Complete**" screen (Figure 3.2.7) should appear when it finishes. Click "Next" to continue.

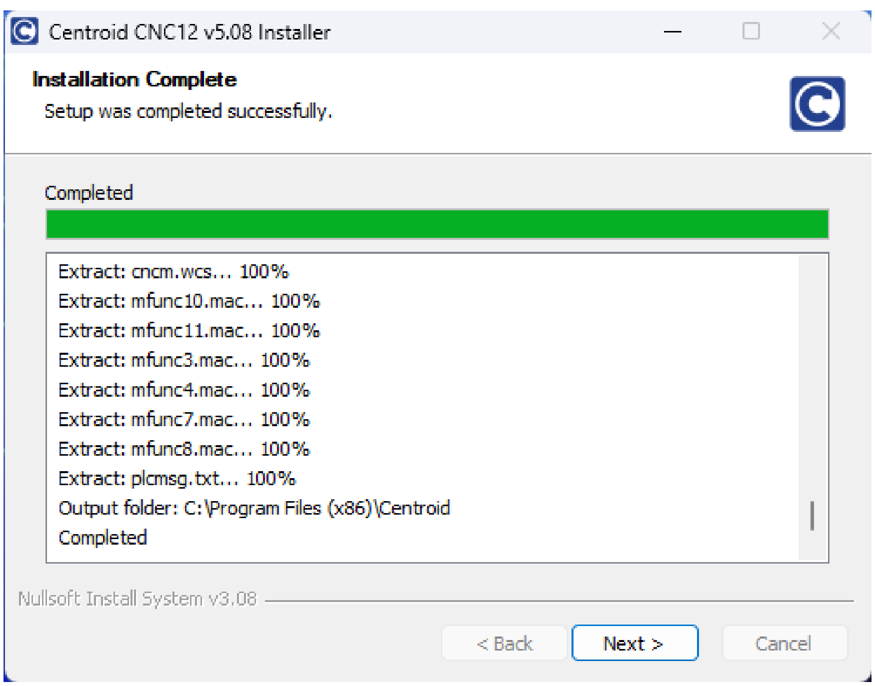


Figure 3.2.7
Installation Complete

12. **Network Adapter Setup: (REMINDER**: Allin1DC needs to be powered up and connected to the CNC PC via the provided Ethernet Cable).
   1. If the Ethernet Adapter has already been set up for CNC use, you will see a screen as shown in Figure 3.2.8. Select “Yes” to continue.

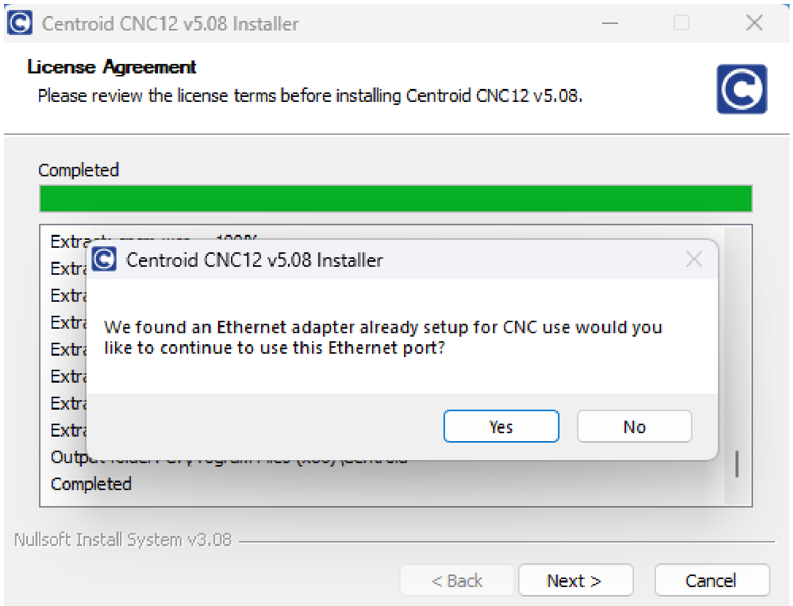


Figure 3.2.8
Network Adapter Setup

   2. If the Ethernet Adapter has not yet been set up for CNC control, you will see a screen as shown in Figure 3.2.9. Select the Ethernet option to automatically configure the IP address for CNC use and click “Next”. **DO NOT** select the Wi-Fi option.
   A prompt will appear asking if you want to change the IP address of the Ethernet adapter. Select “Yes”.

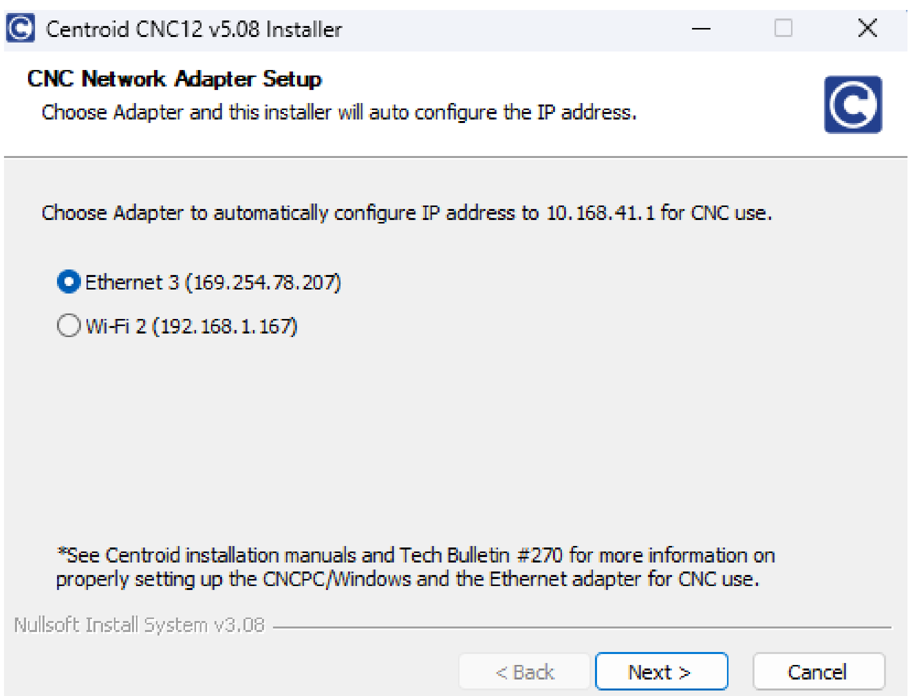


Figure 3.2.9
Ethernet Adapter Setup

3. 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.

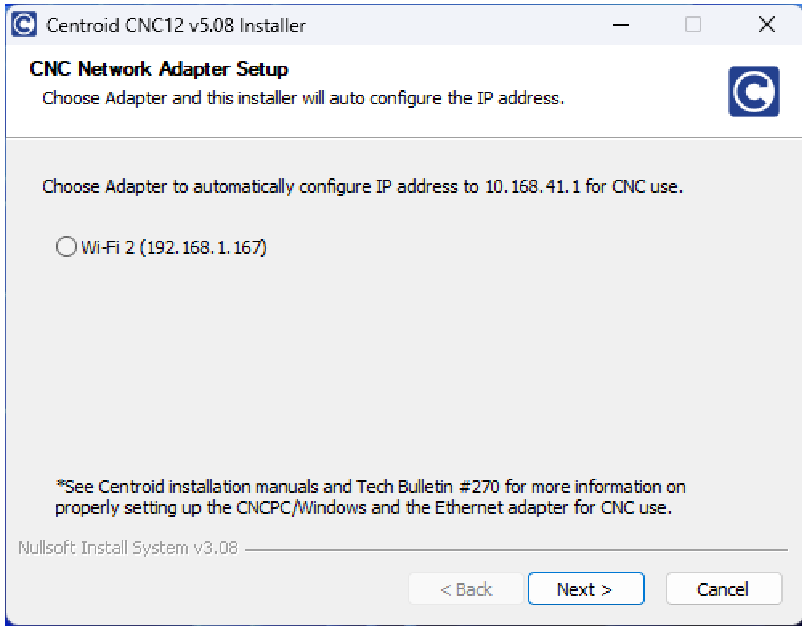


Figure 3.2.10
No Ethernet Adapter

4. **NOTE**: Centroid recommends using a computer with two Ethernet ports. One Ethernet port and one Wi-Fi adapter is also acceptable. That way one Ethernet port is used for the ALLIN1DC, 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 software will install to the correct Ethernet port.

5. **NOTE**: Your IP address will differ from those shown in the pictures.

13. **Installing a PLC program:** After the CNC12 software has been installed, the installer will prompt you to install a PLC program, select "**Yes**". This will open the PLC installer. Click on the "+" signs next to Mill and ALLIN1DC. Click on "**_Centroid_Standard**", then click "**Install**" as shown in Figure 3.2.11.

    1. **NOTE**: If you have a Lathe the path is _Lathe → _ALLIN1DC → _Centroid_Standard. Make sure to select the correct PLC for your machine.

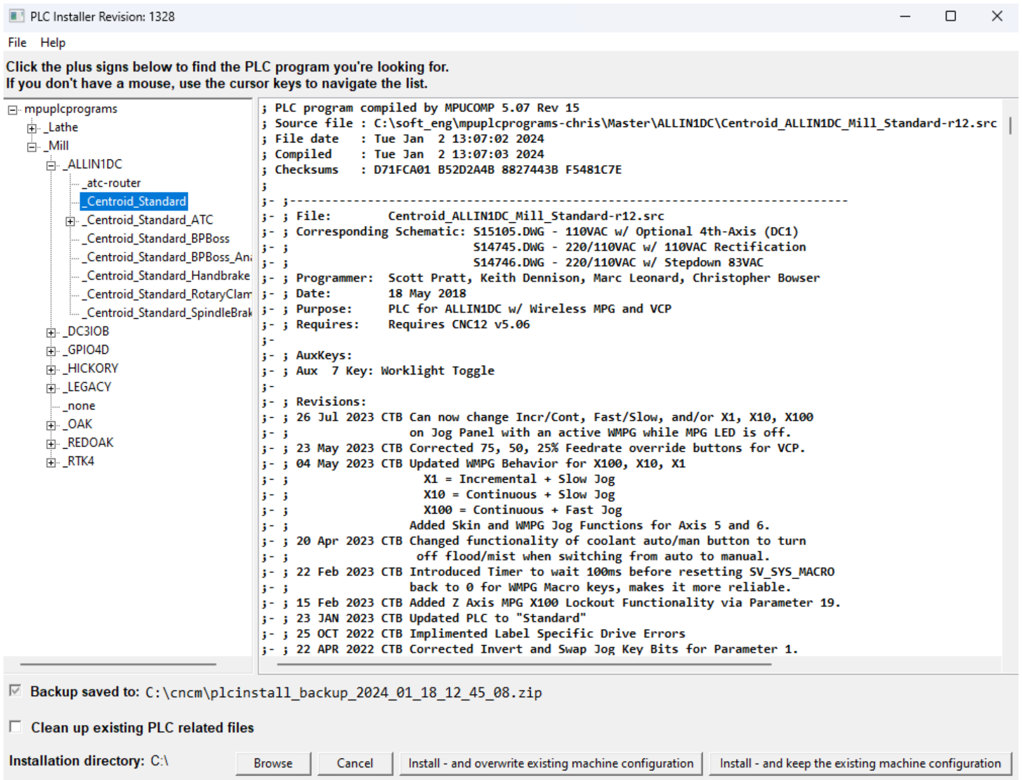


Figure 3.2.11
Install the PLC program

    2. **NOTE:** The following is a quick reference explaining each PLC program and which schematics work with the program. The Standard ALLin1DC schematics can be downloaded here: Allin1DC DIY CNC System hookup schematics
    The latest version of the Chart is available as Tech bulletin 312 – Standard PLC Program Quick Reference

TB312 (Rev 0) – Standard PLC Program Quick Reference

Purpose: Provide a quick reference of all Centroid Standard PLC programs so end users can choose an appropriate program that matches the system schematic

Machine Type	Control Type	Machine Features	Feature Type	PLC Program	Purpose	Schematic
Mill	ALLin1DC	Standard		Centroid-Mill-Standard-ALLIN1DC-r2.src	PLC for ALLIN1DC w/ wireless MPG and VCP	S14745, S14746, S14747, S14748, S14749, S14750, S14751, S14752, S14753, S14754, S14760
		Standard_ATC	Swingarm			
			Umbrella	Centroid-Mill-Standard-ALLIN1DC-ATC-Umbrella.src	PLC for MPU11 and allin1dc, 16/16 umbrella atc	S14817
			umbrella_no_throwaway-std-io	Centroid-Mill-Standard-ALLIN1DC-ATC-Umbrella-Skip-First-Count.src	PLC for MPU11 and allin1dc, standardized I/O, 16/16 umbrella atc with no throwaway count on carousel reversal	
		Custom	BP-Boss	Centroid-Mill-Standard-ALLIN1DC-BP-Boss-r2.src	PLC for ALLIN1DC w/ wireless MPG and VCP	S14755, S14756, S14757
Lathe	ALLin1DC	Standard		Centroid-Lathe-Standard-ALLIN1DC-r2.src	PLC for ALLIN1DC w/ wireless MPG and VCP	S14758, S14761, S14762
Machine Type	**Control Type**	**Machine Features**	**Feature Type**	**PLC Program**	**Purpose**	**Schematic**
Mill	Oak	Standard		Centroid-Mill-Standard-OAK-r2.src	PLC for OAK w/ VCP and wireless mpg	S14765, S14773, S14774, S14775, S14776, S14783, S14784, S14785,
		Standard_ATC	Umbrella	Centroid-Mill-Standard-OAK-ATC-Umbrella.src	PLC for OAK Board and umbrella ATC	S14798, S14804
Lathe	Oak	Standard		Centroid-Lathe-Standard-OAK-r2.src	PLC for ALLIN1DC w/ wireless MPG and VCP	S14777, S14778, S14780, S14786, S14787, S14788
		Custom	8 Tool electric turret	oak-lathe-8te-v2.src	Basic Lathe PLC program for OAK with 8-tool turret	S14789, S14791,

14. **Click "Finish" to complete CNC12 software installation**. After the PLC program installation has completed, click "Finish" to complete the installation.

15. **Power off the computer and ALLIN1DC, then restart everything.**

16. Confirm that CNC12 start up correctly. Close CNC12 and continue on to the next step.

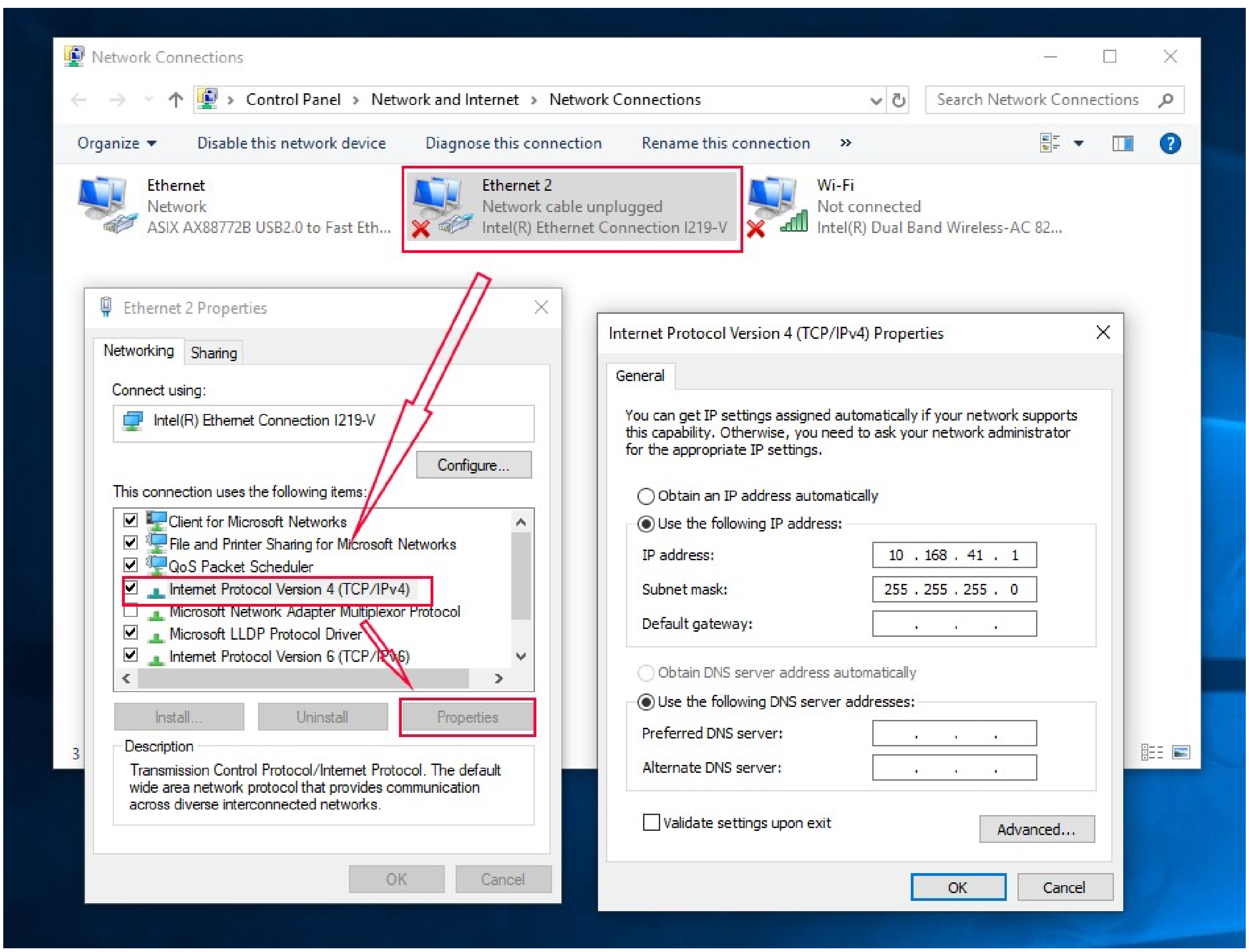
    1. **NOTE** On wide screen monitors, CNC12 will only take up 2/3rds of the monitor screen while running in "full screen". Turning on Virtual Control Panel will fill the rest of this space.

Troubleshooting
If you clicked on the CNC12 icon to start the software and you are getting "**Timeout: MPU11 not responding**" errors, you most likely didn't have the right Ethernet port configured correctly.

Check your Ethernet card to make sure it is configured properly.
Go to "**Control Panel**", select "**Network and Internet**", and then "**Network and Sharing Center**". Click on "**View network computers and devices**", Click on the "**Ethernet _**" for the connection being used by the ALLIN1DC, select "**Properties**".
Highlight "**Internet Protocol Version 4 (TCP/IPv4)**", then click "**Properties**" again.
Select "**Use the following IP address**" then set the IP address and Subnet mask to:

IP address: 10.168. 41.1
Subnet mask: 255.255.255.0

Click **OK** and then try to start the CNC12 software again.
For more in troubleshooting see Appendices C.



4.1 CNC12 Software Configuration

If your software has been configured correctly, you should see the screen below, Figure 4.1.1. If CNC12 does not start because it timed out waiting for the MPU11, see the troubleshooting listed above and **Appendix C**.

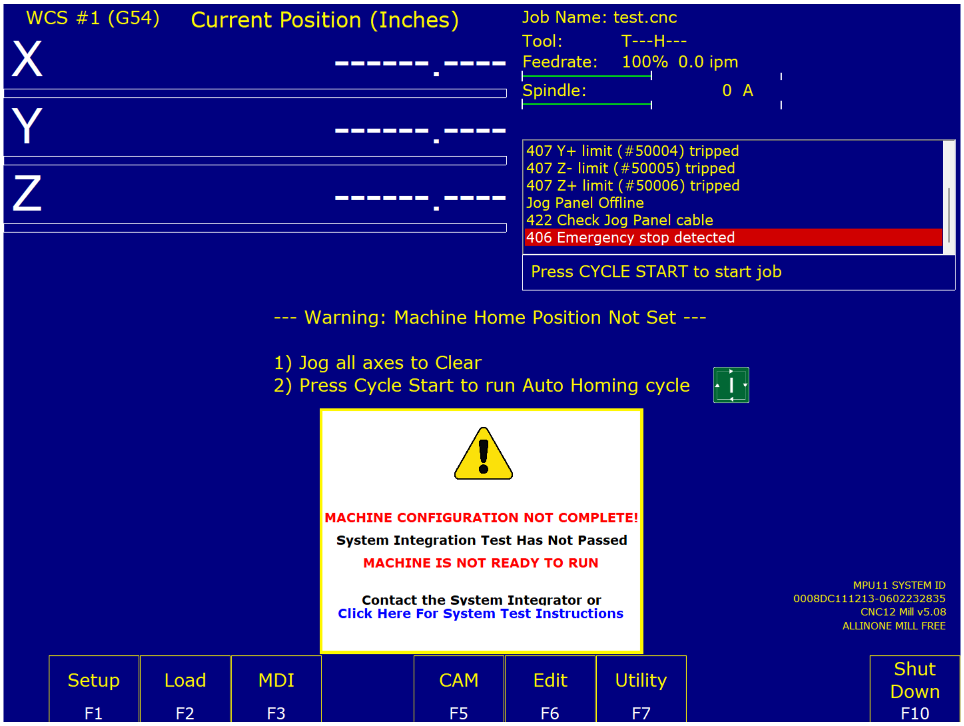


Figure 4.1.1
Initial CNC12 Startup

CNC12 can be run using the default free version, but certain software capabilities are locked unless a Pro or Ultimate license is purchased. For an overview of the features included with the Pro and Ultimate licenses, or to purchase a license visit https://shopcentroidcnc.com/shop/cnc-software/cnc12-mill-cnc-software-license/ for a mill license or https://shopcentroidcnc.com/shop/cnc-software/cnc12-lathe-cnc-software-license/ for a lathe license.

If you have already purchased a license, follow the instructions below for importing the license.

1. From the main startup screen, press **F7 – Utility** to enter the Utility Menu. Then press **F8 – Option**.

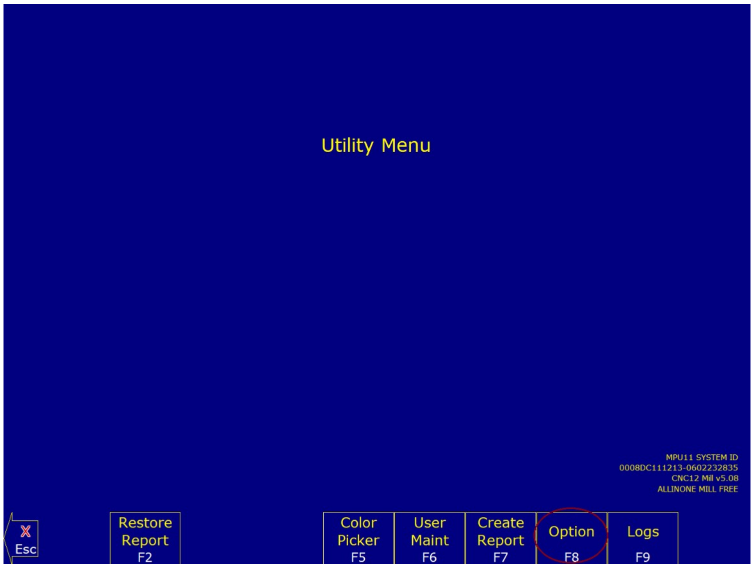


Figure 4.1.2
Utility Menu – F8 Options

2. You should now see a screen that lists the current software level, plugins, PLC type, and system ID. Press **F2 – Import License**. A Windows file dialog will open.

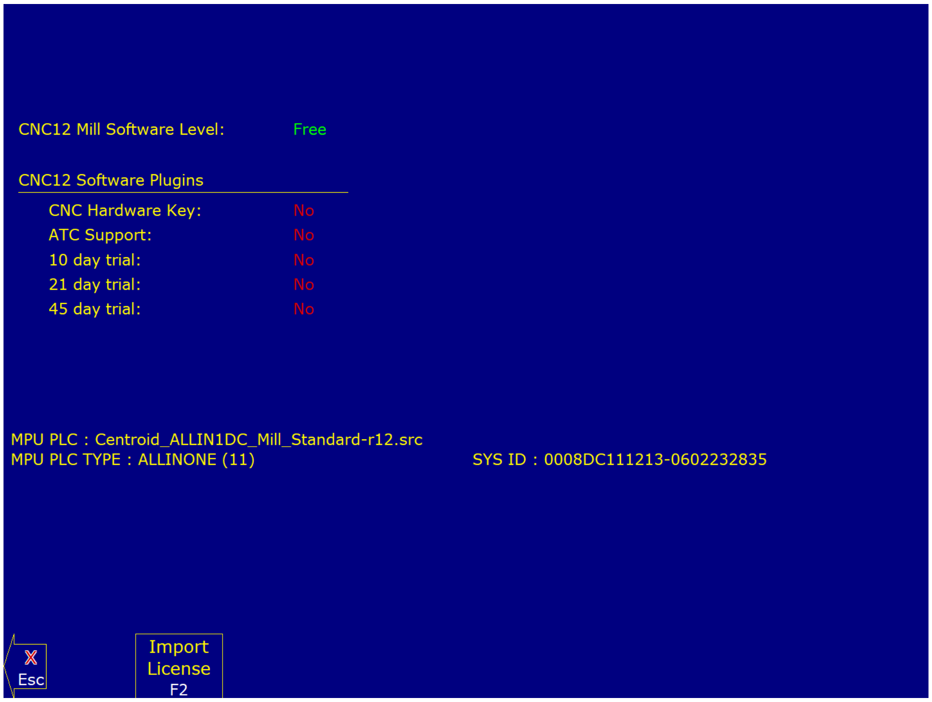


Figure 4.1.3
Software Options Menu

3. Navigate to the location where you downloaded the license hardware key .dat file provided by Centroid. It is usually advised that the license be downloaded to the Desktop for easy access. Select the license file and click "Open".
4. The license file will be loaded and you should see a pop-up saying "License successfully imported", the Software Level should match the license type, and CNC12 Hardware Key should say Yes. If you receive any other message, consult TB 325 - Licensing Issues and Troubleshooting for guidance on solving this issue.

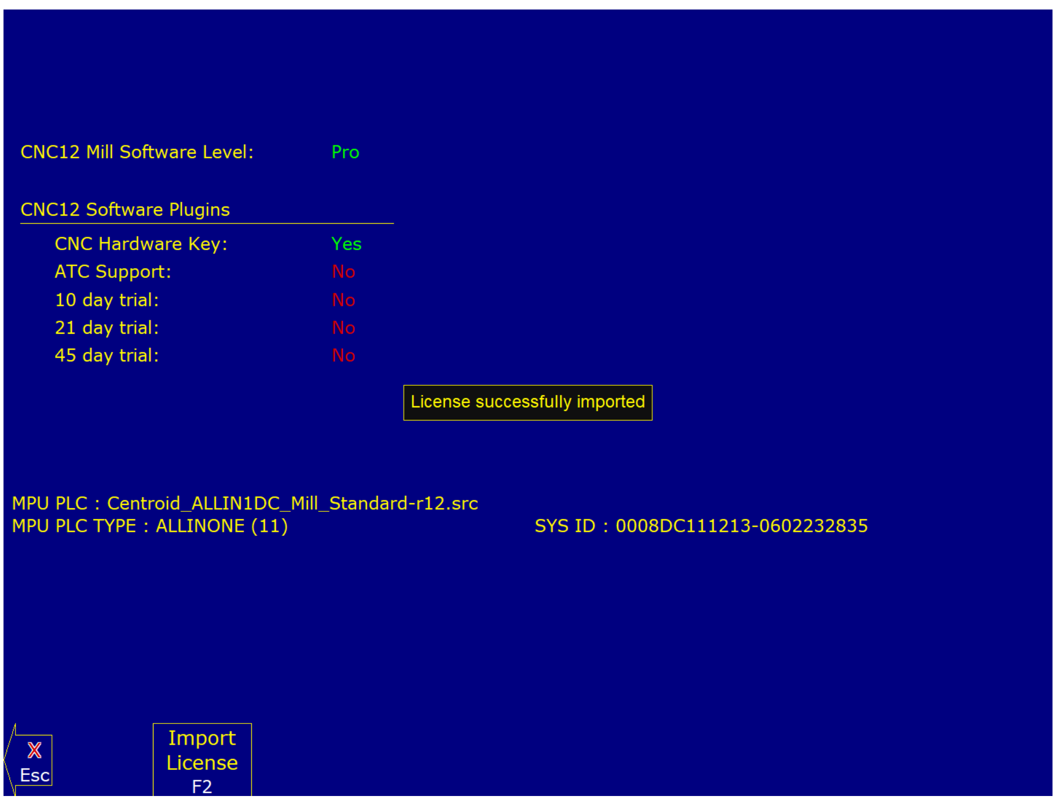


Figure 4.1.4
License successfully imported

The ESC key can be used to move up one menu level. Press ESC until you reach the main screen again.

In the following pages we will be temporarily disabling the fault logic built into your MPU11 based CNC system. CNC12 monitors the signal levels of hardware such as jog panels and encoder inputs, and will generate a fault if any hardware does not respond as expected. In addition, the Centroid_ALLIN1DC_Mill_standard.src PLC program contains default logic that monitors the inputs for Limit Switches (inputs 1-8), Lube Fault (input 9), Spindle Fault (input 10), Estop (input 11), and Axis Drive Faults (inputs 17-20). If ANY of these inputs are open a fault will be issued.

1. **Change Machine Home Type** Navigate to the “**Control Configuration**” screen as seen in Figure 4.1.5. From the main screen press **F1-Setup** → **F3 -Config.** The password is **137**. Then press **F1 Contrl.** Using the keyboard space bar change “**Machine home at power up**” to “**Jog**”. Press **F10-Save**

    1. **TROUBLESHOOTING TIP** If you cannot save any of your changes in CNC12, close CNC12 by pressing **F10-Shut Down** →**F9 Exit CNC12**. Right click on CNC12 desktop shortcut. Select **properties.** Click on the **Compatibility** tab. Check the box labeled “**Run this program as an administrator**”. Click “**Apply**”. Click “**OK**”. Start the CNC12 software and try again.

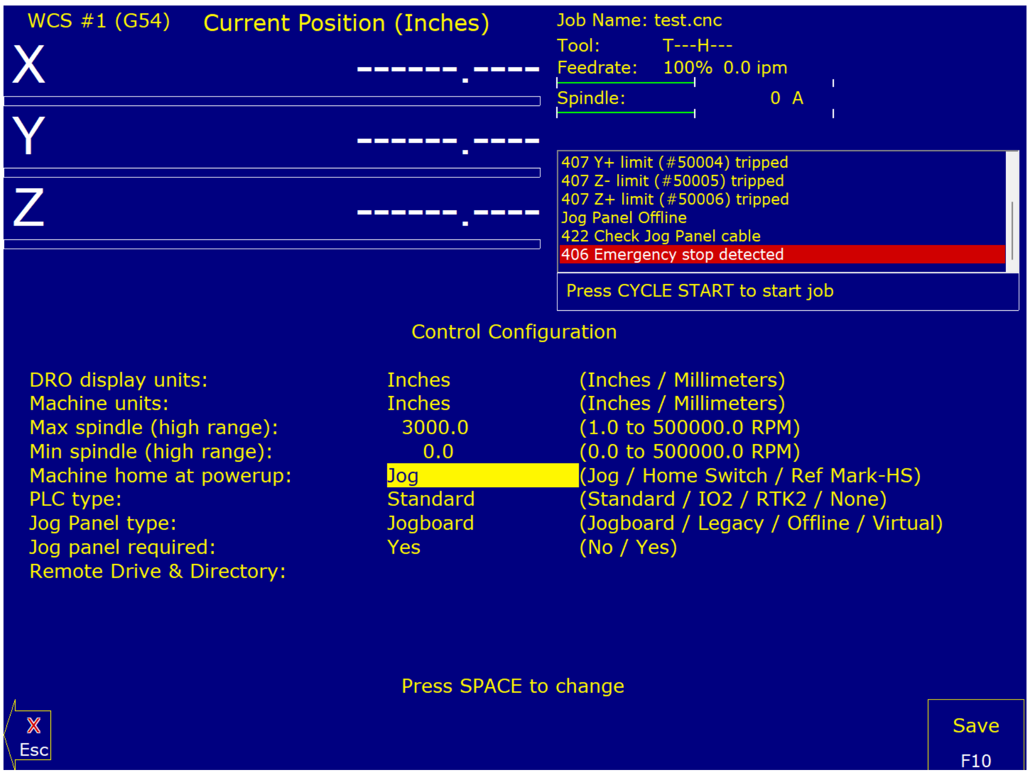


Figure 4.1.5
Changing machine home at powerup to disable limit switches

2. **Disable Jog Panel Communication Faults** *(If you have a jog panel or pendant, connect it and skip this step.)* Disable Jog Panel communication faults as seen in Figure 4.1.6. Use the arrow keys to select “Jog Panel Required” in the Control Configuration and press the space bar to toggle to “**No**”. Press **F10-Save**.

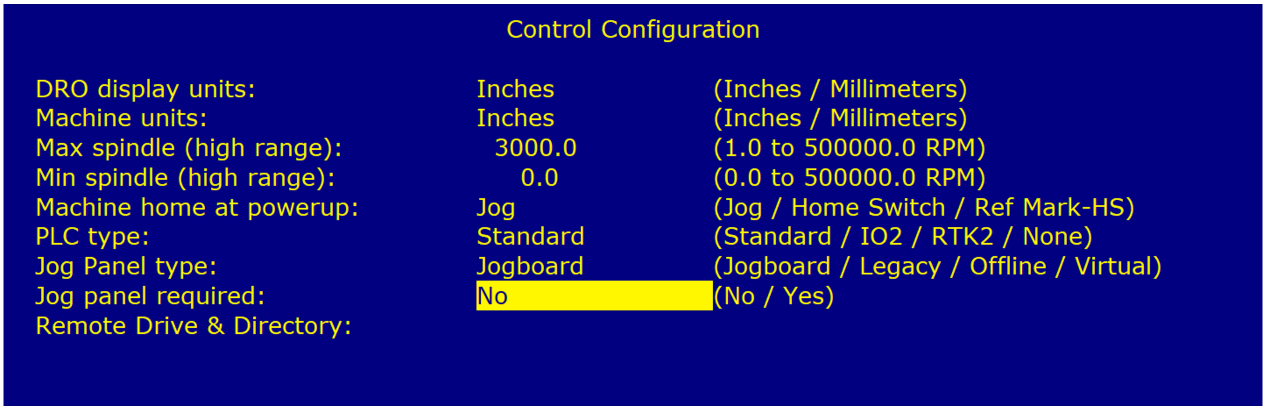


Figure 4.1.6
Disabling jog panel

After saving, press **ESC** to go back to the Main Screen. Press **F10-Shutdown**, → **F2 Power Off.** After the computer shuts down, cut the power to the ALLIN1DC and the PC via switching off your outlet strip. Wait 30 seconds and power everything back up.

3. **Disable PLC faults for Limit Switches, Lube, Spindle, E-Stop and Axis Faults.** At the main screen press **alt + i** to bring up the real-time I/O display as shown in Figure 4.1.7. Using the arrow keys, move the selection box to the top left of the inputs. The screen should read “INP1 : Ax1_MinusLimitOk_I”. Press the **ctrl, alt,** and **i** keys simultaneously to invert this input.

   You will notice that the LED will turn from red to green and a line will be drawn over the top to indicate that it the state of the input has been programmatically inverted. Repeat the process until inputs 1-11 are **green** as shown below. If the input is already green, leave “as is” and don't invert. When you’re done, press **alt** and **i** again to exit the PLC diagnostic menu.

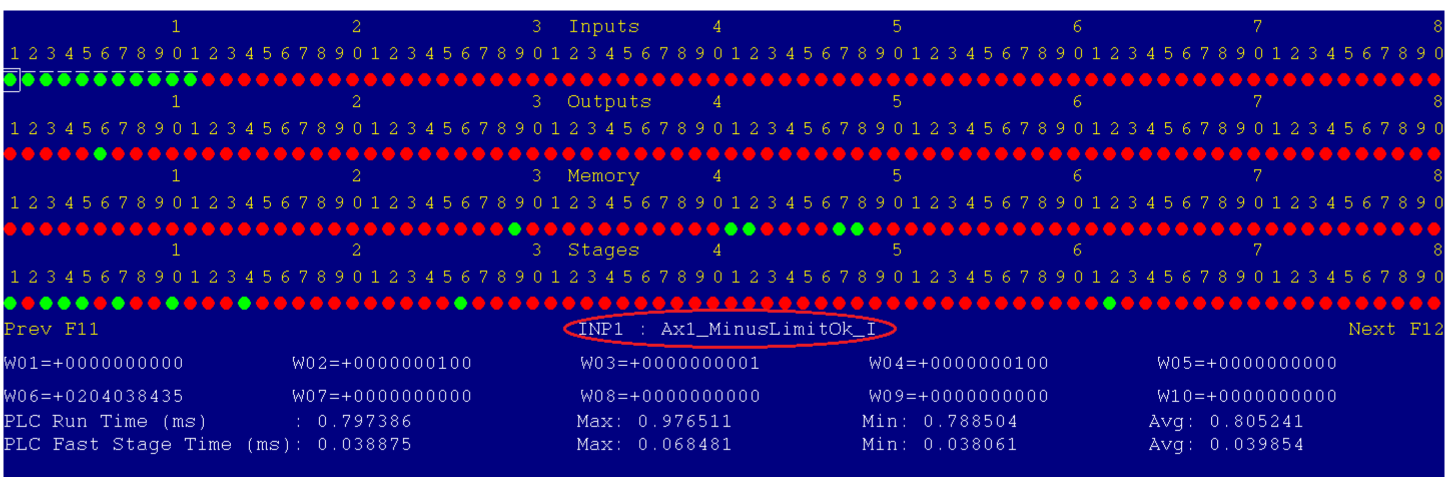


Figure 4.1.7
Disabling inputs PLC Diagnostic menu

4. **Label the Axes:** From the main menu, press **F1 – Setup** → **F3 – Config.** The password is **137**. Press **F2 – Mach** → **F2 – Motor**. Under "**Label**" configure the software for the correct number of axes and label them appropriately. Typical set up for a mill is axis 1 labeled X, axis 2 labeled Y, axis 3 labeled Z. Any unused axes should be set to "**N**" to disable the axis as seen in Figure 4.1.8. The Spindle Axis will be set up in section 6.4.

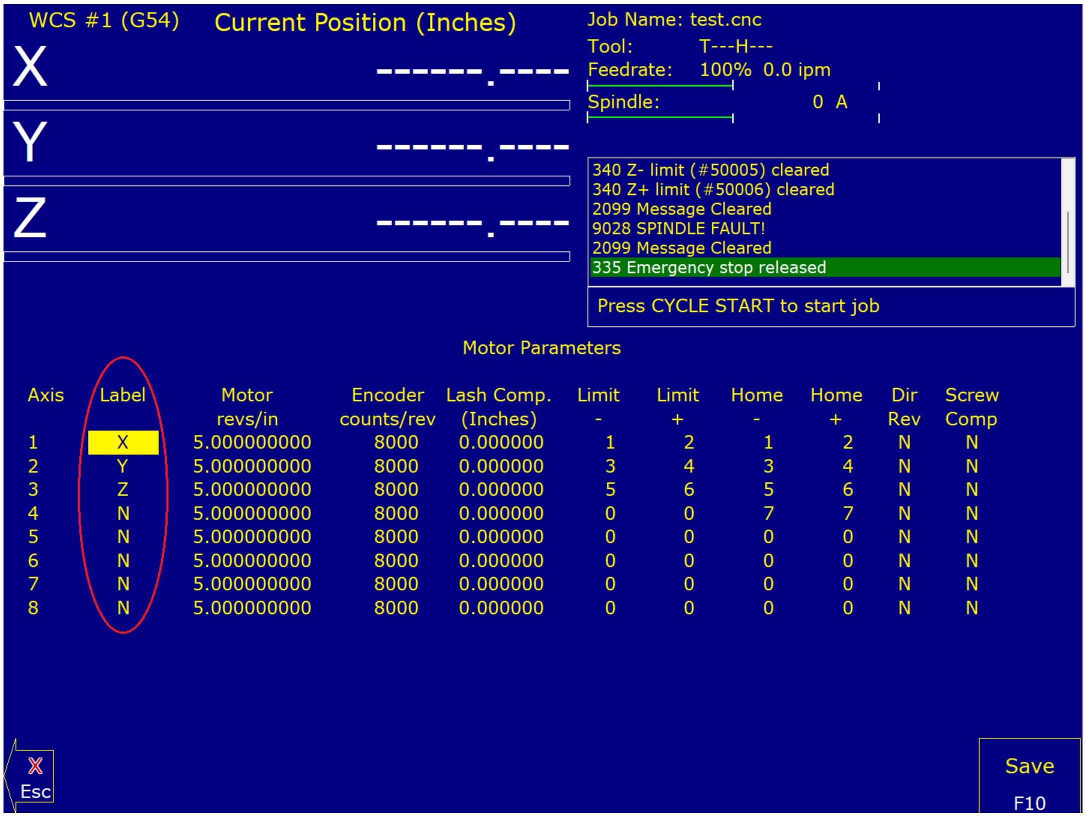
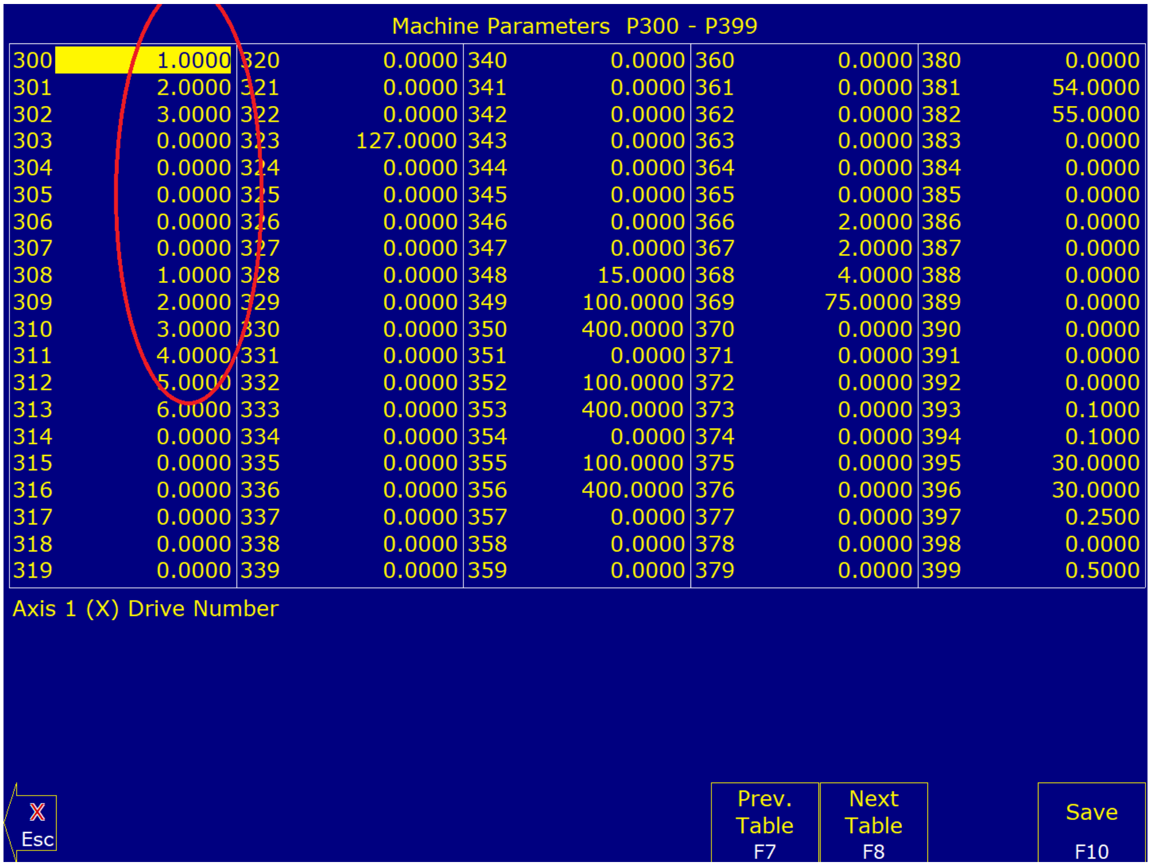


Figure 4.1.8
Labeling the axes.

5. **Configure Drive Bus Assignment** – The CNC12 software needs to be configured to know where each axis of the ALLIN1DC is. The ALLIN1DC using something called “Drive Bus” to communicate with the CNC12 software. For a three axis mill, ALLIN1DC **axis 1** *(labeled axis 1 on the ALLIN1DC drive cover)* should be configured as **drive bus channel 1**, ALLIN1DC **axis 2** should be configured as **drive bus channel 2**, etc...

   These parameters can be reached by pressing **F1 – Setup** → **F3 – Config** from the main menu**.** The password is **137**. Press **F3-Parms** then **F8-Next Table** multiple times until parameter 300 – 307 is displayed. Typical configuration for a three axis CNC is to set parameter 300 = 1, 301 = 2, 303 = 3 as seen in Figure 4.1.9. **Unused axes need to be set to zero, or errors will occur!**


Machine Parameters P300 - P399

300	1.0000	320	0.0000	340	0.0000	360	0.0000	380	0.0000
301	2.0000	321	0.0000	341	0.0000	361	0.0000	381	54.0000
302	3.0000	322	0.0000	342	0.0000	362	0.0000	382	55.0000
303	0.0000	323	127.0000	343	0.0000	363	0.0000	383	0.0000
304	0.0000	324	0.0000	344	0.0000	364	0.0000	384	0.0000
305	0.0000	325	0.0000	345	0.0000	365	0.0000	385	0.0000
306	0.0000	326	0.0000	346	0.0000	366	2.0000	386	0.0000
307	0.0000	327	0.0000	347	0.0000	367	2.0000	387	0.0000
308	1.0000	328	0.0000	348	15.0000	368	4.0000	388	0.0000
309	2.0000	329	0.0000	349	100.0000	369	75.0000	389	0.0000
310	3.0000	330	0.0000	350	400.0000	370	0.0000	390	0.0000
311	4.0000	331	0.0000	351	0.0000	371	0.0000	391	0.0000
312	5.0000	332	0.0000	352	100.0000	372	0.0000	392	0.0000
313	6.0000	333	0.0000	353	400.0000	373	0.0000	393	0.1000
314	0.0000	334	0.0000	354	0.0000	374	0.0000	394	0.1000
315	0.0000	335	0.0000	355	100.0000	375	0.0000	395	30.0000
316	0.0000	336	0.0000	356	400.0000	376	0.0000	396	30.0000
317	0.0000	337	0.0000	357	0.0000	377	0.0000	397	0.2500
318	0.0000	338	0.0000	358	0.0000	378	0.0000	398	0.0000
319	0.0000	339	0.0000	359	0.0000	379	0.0000	399	0.5000

Figure 4.1.9
Setting up the Drive Bus and encoders

6. **Configure Encoder Assignment** – Just like in the previous step, the CNC12 software needs to be configured to know where each encoder of the ALLIN1DC is. Unlike the previous step, the ALLIN1DC does not use “Drive Bus” to allow the encoder to communicate. Instead, the ALLIN1DC uses the on board MPU11 encoder channels via parameters 308 – 315. For a three axis mill parameter 308 = 1, 309 = 2, 310 = 3. Unused encoders axes can be left “as is”, they do not need to be set to zero.

7. **Configure Encoder Counts per Revolution** The encoders need to be set up for the correct number of counts per revolution. A quadrature encoder line count is multiplied by 4 to get the counts per revolution. For older Centroid DC servo motors with 2,000 line encoders, the correct setting is 8,000 counts per revolution. Current Glentek DC motors sold by Centroid come equipped with 5,000 line encoders or 20,000 counts/rev. “High resolution” encoders (10,000 line) are 40,000 counts/rev. From the main menu, press **F1 – Setup** → **F3 – Config.** The password is 137. **F2 – Mach** → **F2 – Motor.** Enter the counts into the “Encoder counts/rev” field corresponding to your encoder counts. Repeat this for each axis.

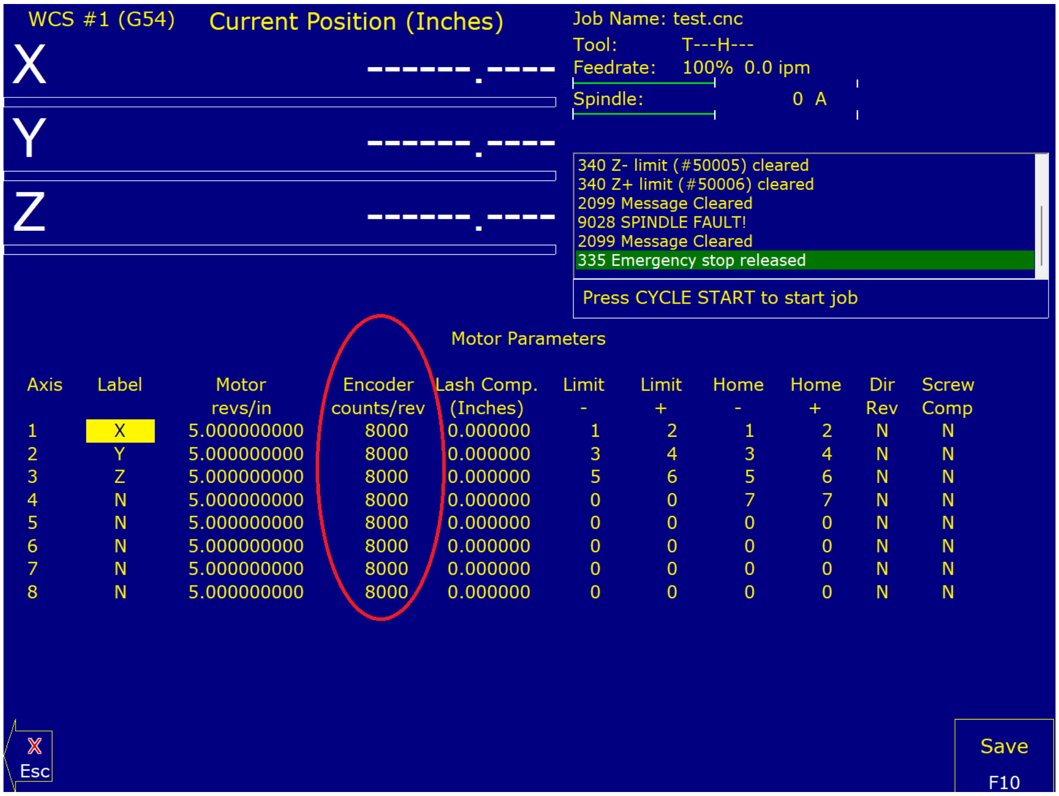


Figure 4.1.10
Encoder Counts/Rev

8. Disable Stall Detection – Stall detection must be disabled from the PID menu. From the main menu, press **F1 – Setup** → **F3 – Config.** The password is 137. Press **F4 – PID**. Press **ctrl + v** keys simultaneously to disable stall detection. If done correctly text saying “**Stall detection disabled**” will appear right below the status window.

   1. **NOTE**: Every time you restart the ALLIN1DC, you will have to disable stall detection again.

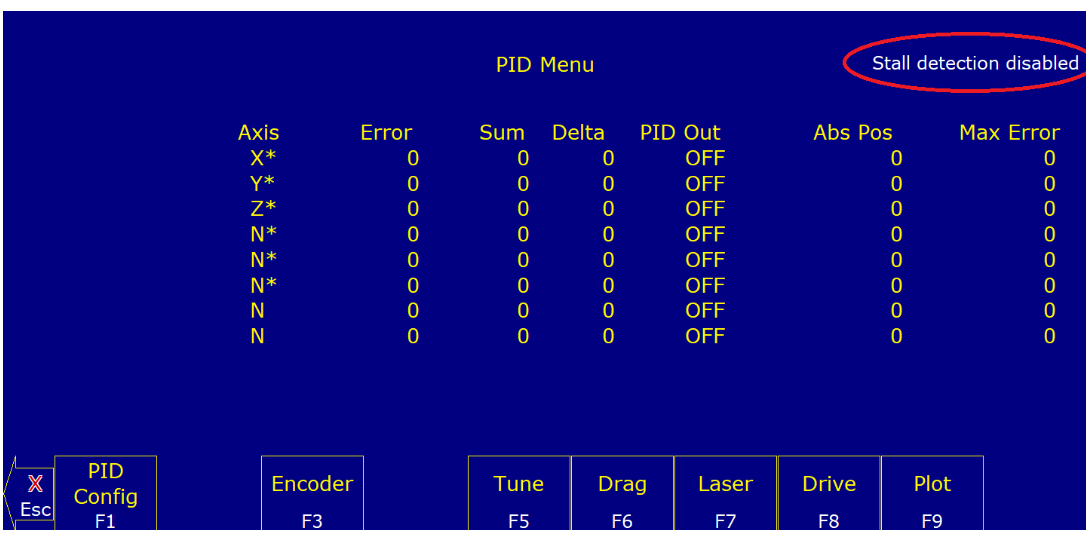


Figure 4.1.11
Disabling Stall Detection

9. **Clear Software Ready Faults** Anytime the CNC12 software has been exited and restarted without the hardware also being powered off and restarted, the CNC12 software will report a "**Software Exited**" fault as demonstrated below in Figure 4.1.12. A "Software Exited" fault like spindle, lube, encoder and position fault is a "**stop fault**". A "stop fault" removes power from all servo motors, prevents program or MDI operation, turns off all drive and spindle enables, and requires that the E-Stop input MUST be cycled in order to clear the fault. During the bench test we will trick the software into thinking we cycled the E-Stop (not connected yet), by toggling the input 11.

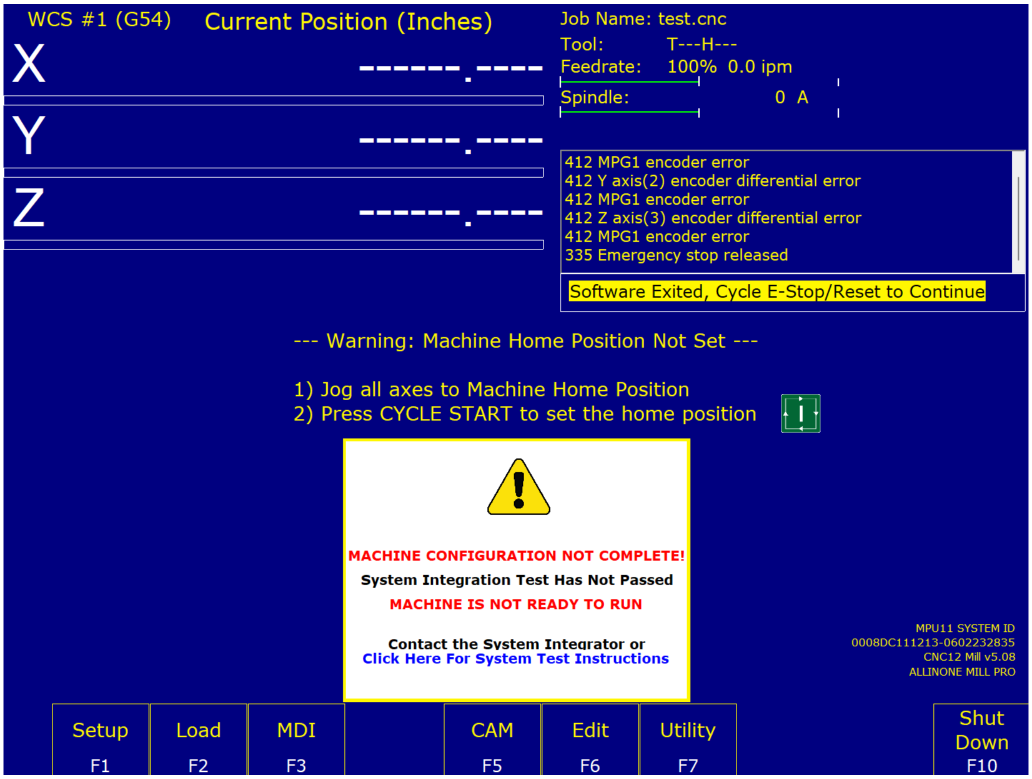


Figure 4.1.12
Software Exit Fault

To clear a stop fault, press the alt-i keys to bring up the real-time I/O screen. Use the arrow keys on the keyboard to select the "*INP11 " EStopOK_I*" as shown below in Figure 4.1.13. Press the ctrl, alt, and i keys to toggle the E-StopOK_I input until it turns red then green.

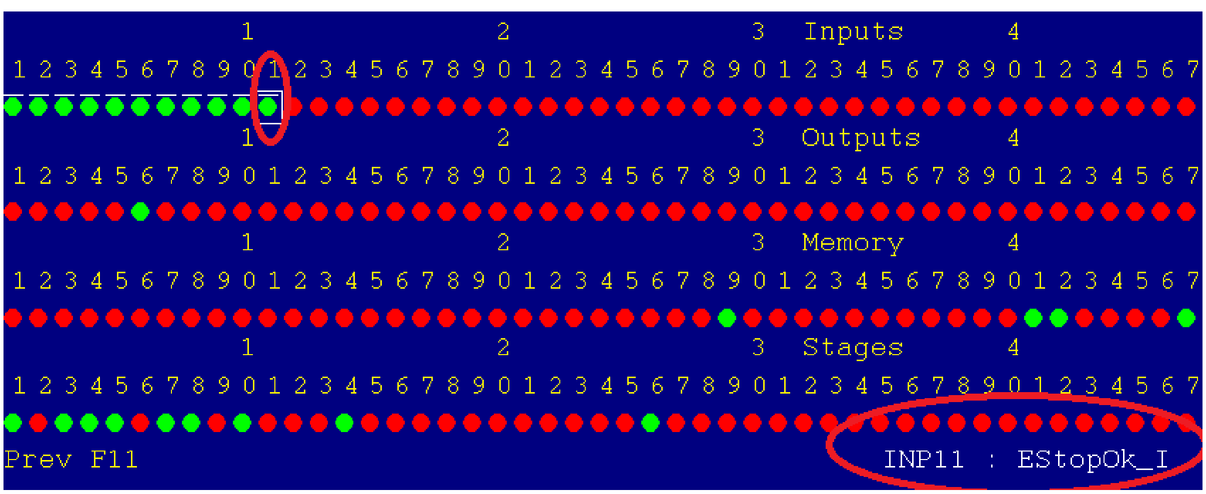


Figure 4.1.13
Toggling E-stop

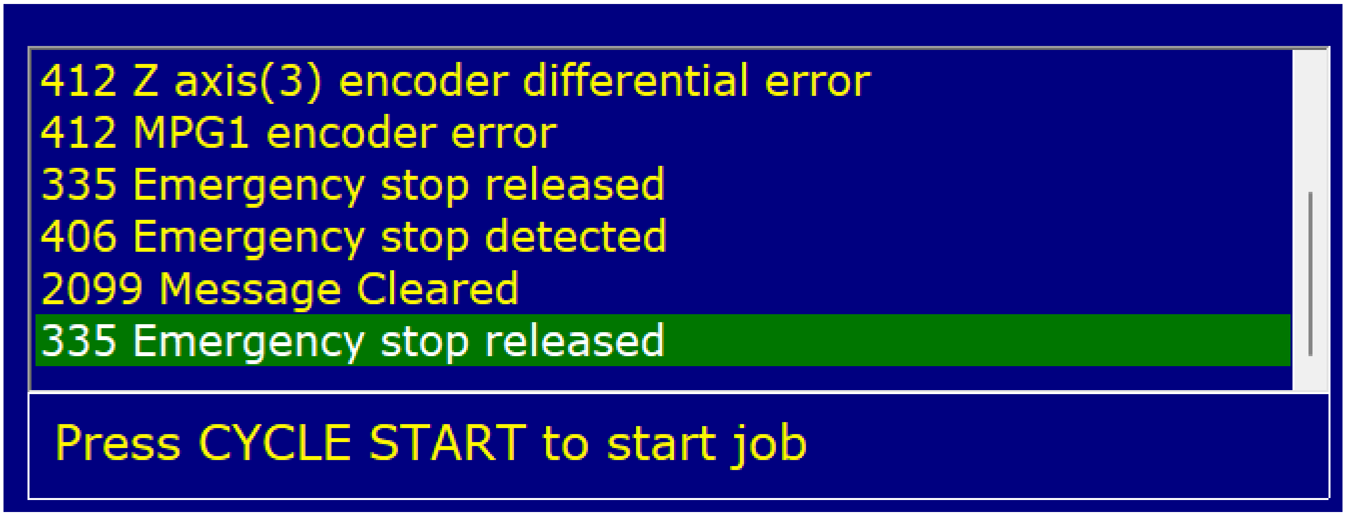


Figure 4.1.14
Status window showing the emergency
stop clearing faults.

Notice that as you toggle the EStopOk_I input to red "*406 Emergency Stop Detected*" is displayed in the status window. When the emergency stop is pressed notice how "*2099 Message Cleared*" is displayed. Toggling *EStopOK_I* back to green displays "*335 Emergency Stop Released*".

10. **Clear Any Existing Faults Before Beginning Bench Testing.** To confirm that all faults have been cleared before continuing, press **F3 – MDI** from the main menu. If all faults have been cleared correctly, the screen should look like Figure 4.1.15.

    If the screen shown in Figure 4.1.14 is not displayed, there is an existing fault. Please check the status window to determine the cause of the fault and then cleared of faults. Confirm that all parameters are set as required and that all inputs (1-11) are in the correct state.

    Troubleshooting Tip: CNC12 keeps a log file containing all errors and faults, along with the time and date that these errors occurred at. You can access this log from the main menu by pressing **F7 – Utility** → **F9 – Logs** → **F1 – Errors**.

    All faults shown in Figure 4.1.16 (as well as other faults) are "Stop Faults". Stop faults cancel existing jobs, prevent new jobs from being started, stop the spindle, prevent motion, and require that the E-Stop PLC input be cycled (opened and closed) to clear the fault(s) before continuing. If you have any stop faults, they will have to be removed then E-Stop will have to be toggled as shown in the previous step.

Figure 4.1.15
MDI Command Mode

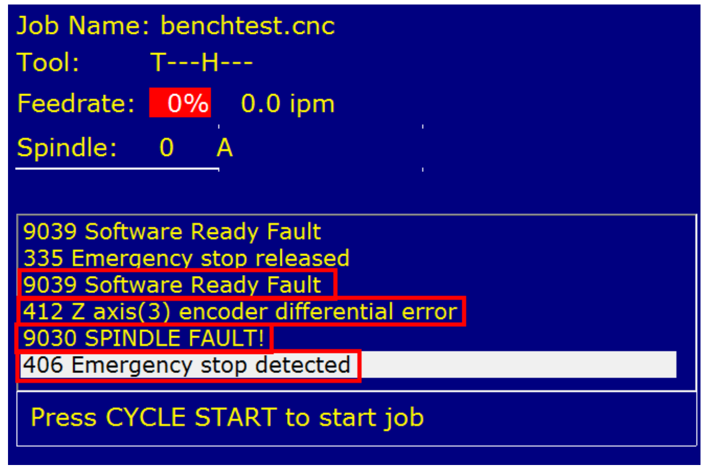


Figure 4.1.16
Faults detected

11. **Set up Virtual Control Panel (VCP).** This option can be selected if the use of a physical jog panel is not necessary or desired. The virtual control panel can be reached by accessing the control options menu. Select **F1 – Setup** → **F3 – Config** from the main menu**.** The password is **137**. Press **F1 – Contrl**. Use the arrow keys to navigate down to the Jog Panel Type field. Click the **spacebar** until Virtual is selected, then **F-10 save**.

12. **Set up Wireless MPG.** Use of a Wireless MPG requires at least a Pro License. If you haven't already follow the instructions at the beginning of this chapter to install your license file. Go to **F1 – Setup** → **F3 Config** from the main menu. The password is **137**. Press **F3 – Parms** and set MPG CNC12 parameter #218 = 15 for 4 axis Mills/Routers, #218=7 for 3 axis Mills/Routers and #218 = 3 for Lathes. (MPG Type) Set MPG CNC12 parameter #348 = 15 (MPG ON) and #350 = 100 (100 steps per rev). Shut down and restart CNC12 for new parameters to take effect.

13. **New Features.** As new features and parameters are defined, these will be documented in the CNC12 Mill and Lathe manuals as well as in Tech Bulletin 313 - Centroid CNC12 New Parameter Quick Reference

4.2 ALLIN1DC Bench Test

Bench testing the ALLIN1DC will confirm that the ALLIN1DC is operational and that the software has been properly configured to begin the installation process. Bench Testing is **required** as it provides a known base configuration that our support engineers can refer to when trying to diagnose any issues that may arise. To complete Bench Testing, a DVM (Digital Volt Meter) is required.

1. **Set Home and load spindlebenchtest.cnc:** Home the machine by pressing start. From the main menu press **F2-Load.** Use the arrow keys to select the file spindlebenchtest.cnc
    1. **If spindlebenchtest.cnc is not present in the c:\cncm\ncfiles directory it can be downloaded here: [spindlebenchtest.cnc](http://centroidcnc.com/usersupport/support_files/benchtest/spindlebenchtest.cnc)** (http://centroidcnc.com/usersupport/support_files/benchtest/spindlebenchtest.cnc)
    2. Download spindlebenchtest.cnc If your web browser does not provide an option to download spindlebenchtest.cnc and instead displays a bunch of code, copy the code from your web browser into your default text editor (such as notepad++). Save the file as spindlebenchtest.cnc in the CNC12 root directory (see next step).
    3. Place spindlebenchtest.cnc in your CNC12 root directory.
        1. Right click on your CNC12 shortcut
        2. Click **properties** as shown in figure 4.2.1.
        3. A window will pop up, go to the "shortcut" tab and click "**open file location**" as shown in Figure 4.2.2.
        4. Open the folder labeled "ncfiles". Paste spindlebenchtest.cnc into the ncfiles directory.
        5. In the load menu of CNC12 press **F5-refresh**.
2. With spindlebenchtest.cnc highlighted, press **F10 Accept**. If the DRO does not display when you press alt-s, you likely encountered a fault. See clearing faults is covered in section 4.2.3

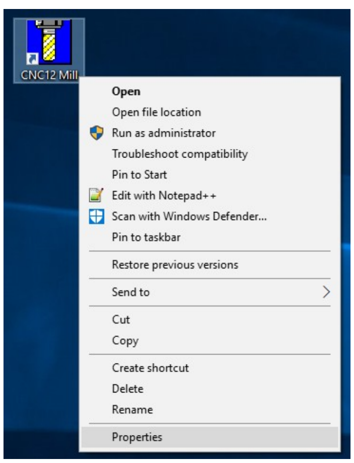


Figure 4.2.1
Right click on CNC12 and click "properties"

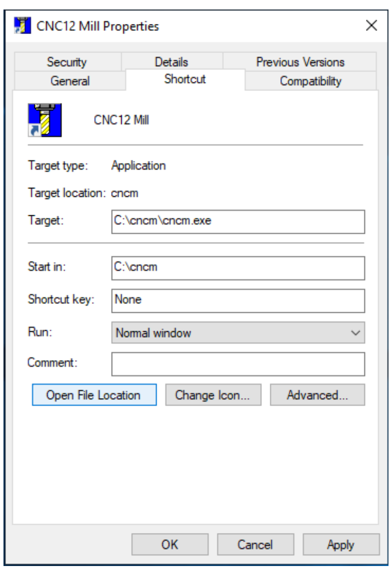


Figure 4.2.2
Select the "shortcut" tab and click "Open File Location"

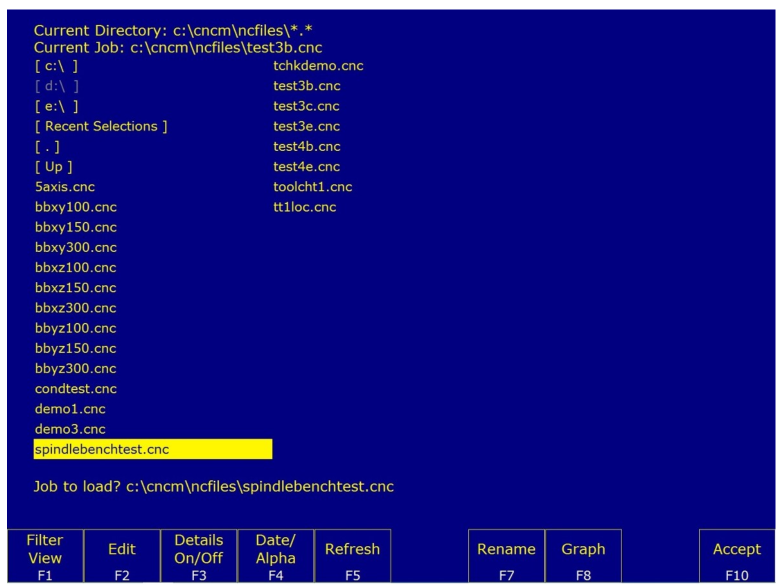


Figure 4.2.3
Selecting spindlebenchtest.cnc

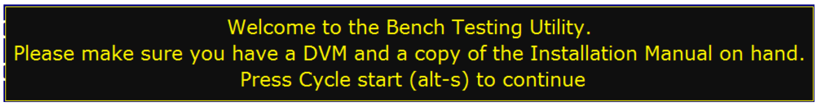
Testing the analog output for the spindle: The Alin1DC provides a 0 to +10VDC analog output to provide programmable spindle speed control using a VFD (variable frequency drive). The default maximum spindle speed specified in the Control Configuration is 3000rpm. This configures the control to scale the 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

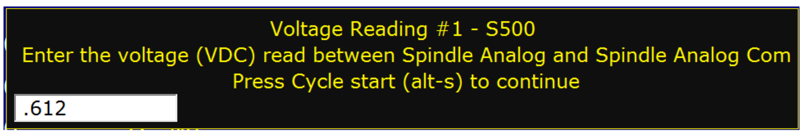
2. Connect the seven pin terminal block into connector H9

3. Insert the digital voltage meter leads into H9 as shown in Figure 4.2.4. Tighten **down the screw terminals to firmly grip the probes.**

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



5. Enter the voltage readings as pictured, 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.



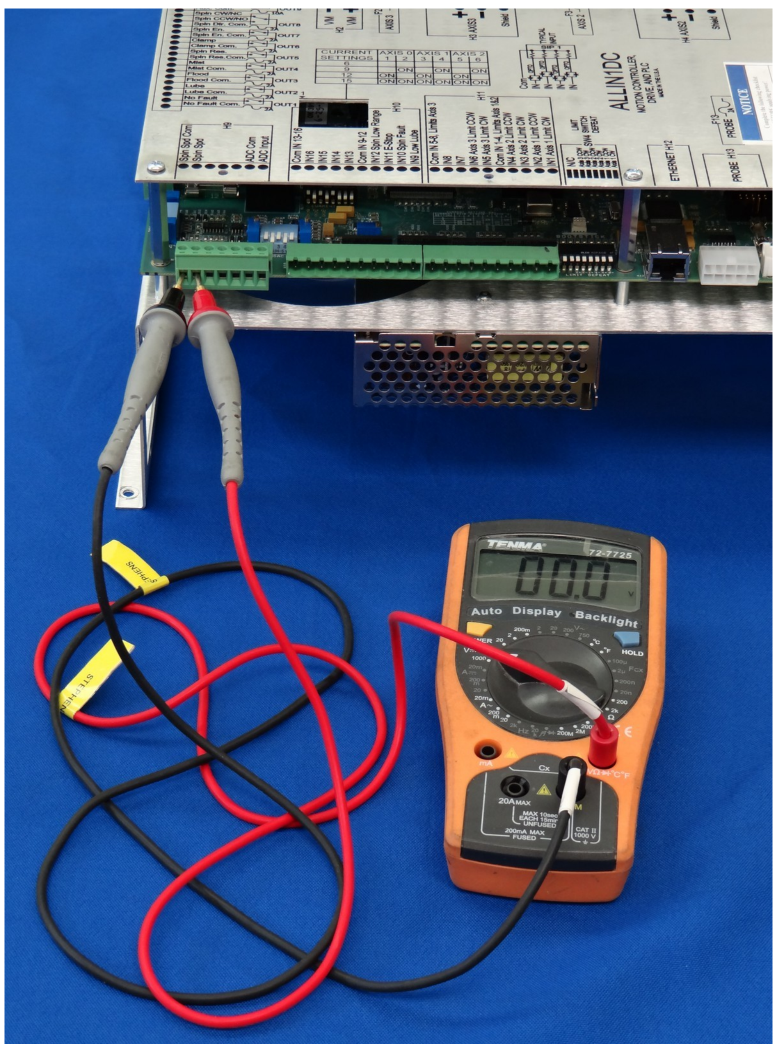


Figure 4.2.4
Testing the spindle

Spindle bench test trouble shooting: If unexpected voltages are output during the spindle bench test, verify that the DAC dip switches are set correctly. The spindle bench test program is setup for a 0-10Volt operation. The DAC dip switches should be set to 1 = Up, 2 = Down, 3 = Up, 4 = Down, 5 = up for 0-10v operation. More information can be found on page 7 of 17 of the Allin1DC Technical component manual found at the end of this document.

1. **Encoder Test**

   1. Make sure the encoders are connected to the ALLIN1DC
   2. From the main menu press **F1 – Setup** → **F3 – Config**. The password is **137**. Press **F4 – PID.**
   3. Manually spin the output shaft of the servo motor counter-clockwise as shown in Figure 4.2.5. In the PID menu, confirm that absolute position (Abs Pos) counts up as the motor is rotated as shown in Figure 4.2.6. Repeat for each axis.

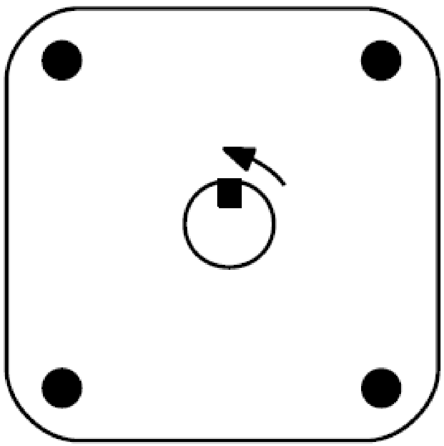


Figure 4.2.5
Motor Rotation

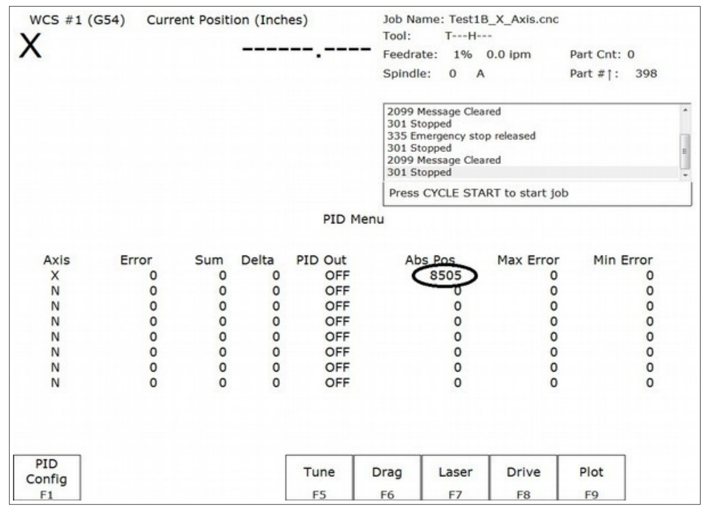


Figure 4.2.6
Absolute Position

   4. Manually rotate the motor one full revolution. Record how much the motor has counted.
   5. From the main menu press **F1 – Setup** → **F3 – Config**. The password is **137**. Press **F2-Mach** → **F2 Motor**. The number you recorded as the number of counts per revolution should approximately match the number you entered for encoder counts per revolution.

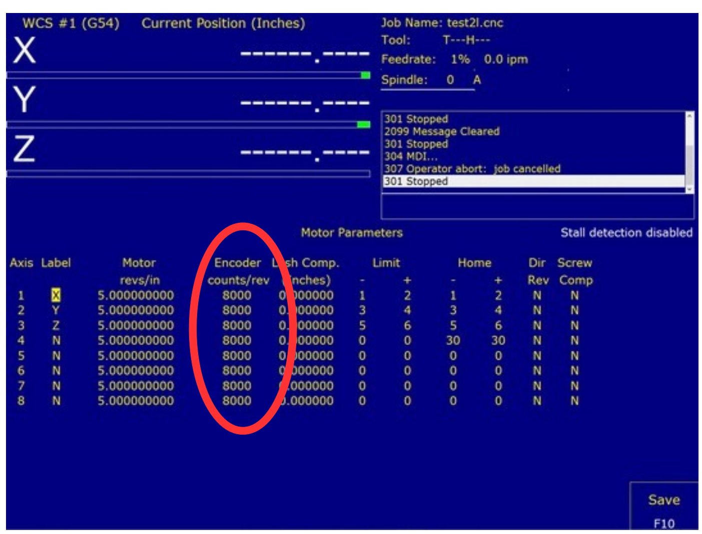


Figure 4.2.7
Encoder Counts Per Revolution

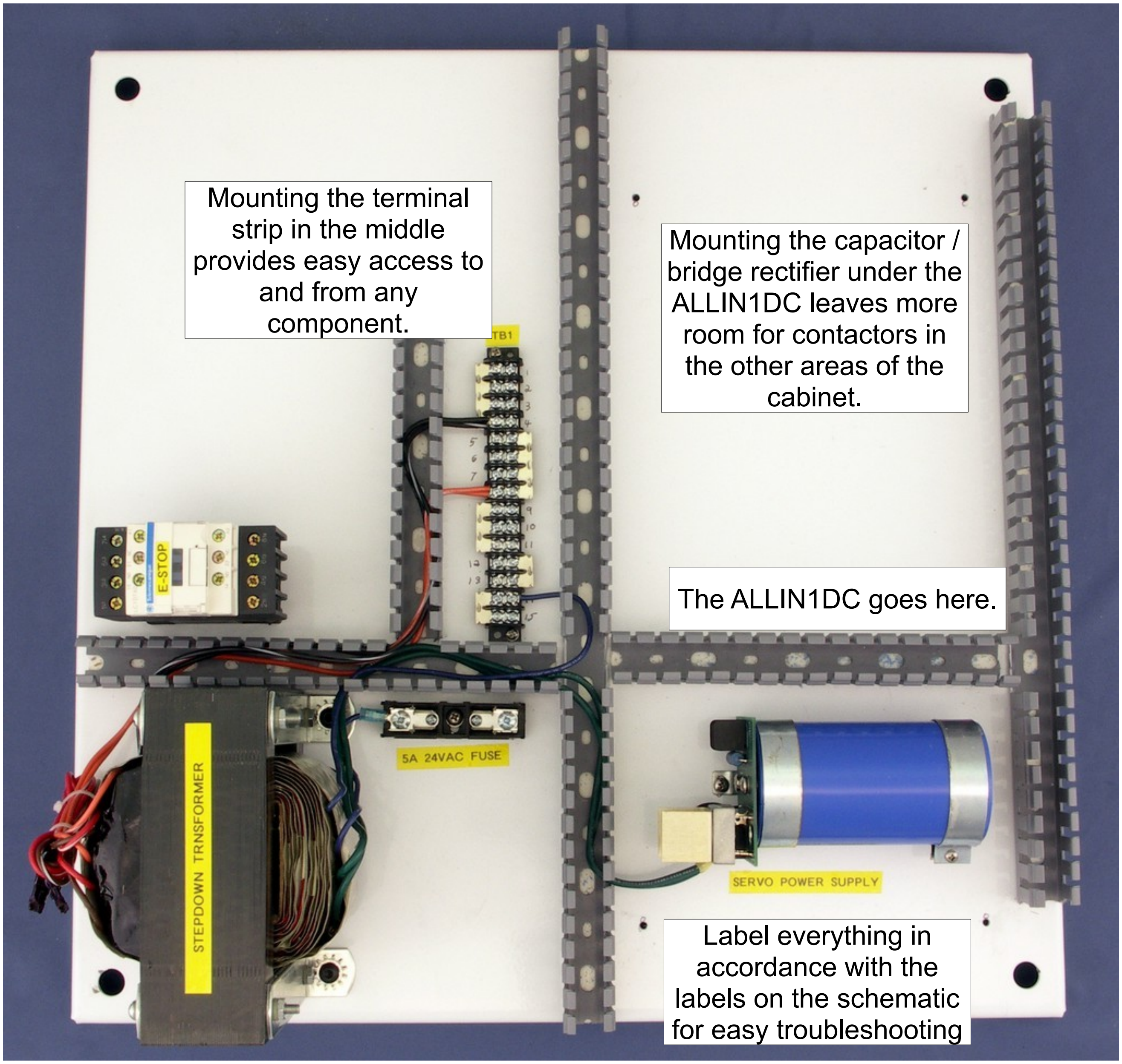
Chapter 5
Cabinet Wiring

5.1 Introduction to Electrical Cabinet Layout

Now that you are finished with the board level test it is time to think about electrical cabinet installation. In this chapter of the manual we 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 provided by Centroid.

Relevant martyscncgarage video: Backpanel part 1, Backpanel Part 2, Backpanel part 3

Below is a suggested layout for the major components on your electrical panel.



For more detailed wiring instructions, please see the schematic that was shipped with your kit, Additional Schematics are found here. http://www.centroidcnc.com/downloads/allin1dc/centroid_allin1dc_schematic_set.zip

Best Practices

- **Minimize Noise and 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 ALLIN1DC.
  - **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. Call Centroid for details.
  - **Wire management** Use PVC wire ducts (such as Panduit Panduct) to keep your wires neat and organized.
  - **Use DIN Rails** 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. Always leave a little bit 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.
  - **Don't lose the schematic.** Keep the schematic attached to the cabinet somewhere so it does not get lost.
- **Use the correct AWG** Below is the **minimum** AWG for the ALLIN1DC.

Minimum Wire Gauge (AWG)[1]

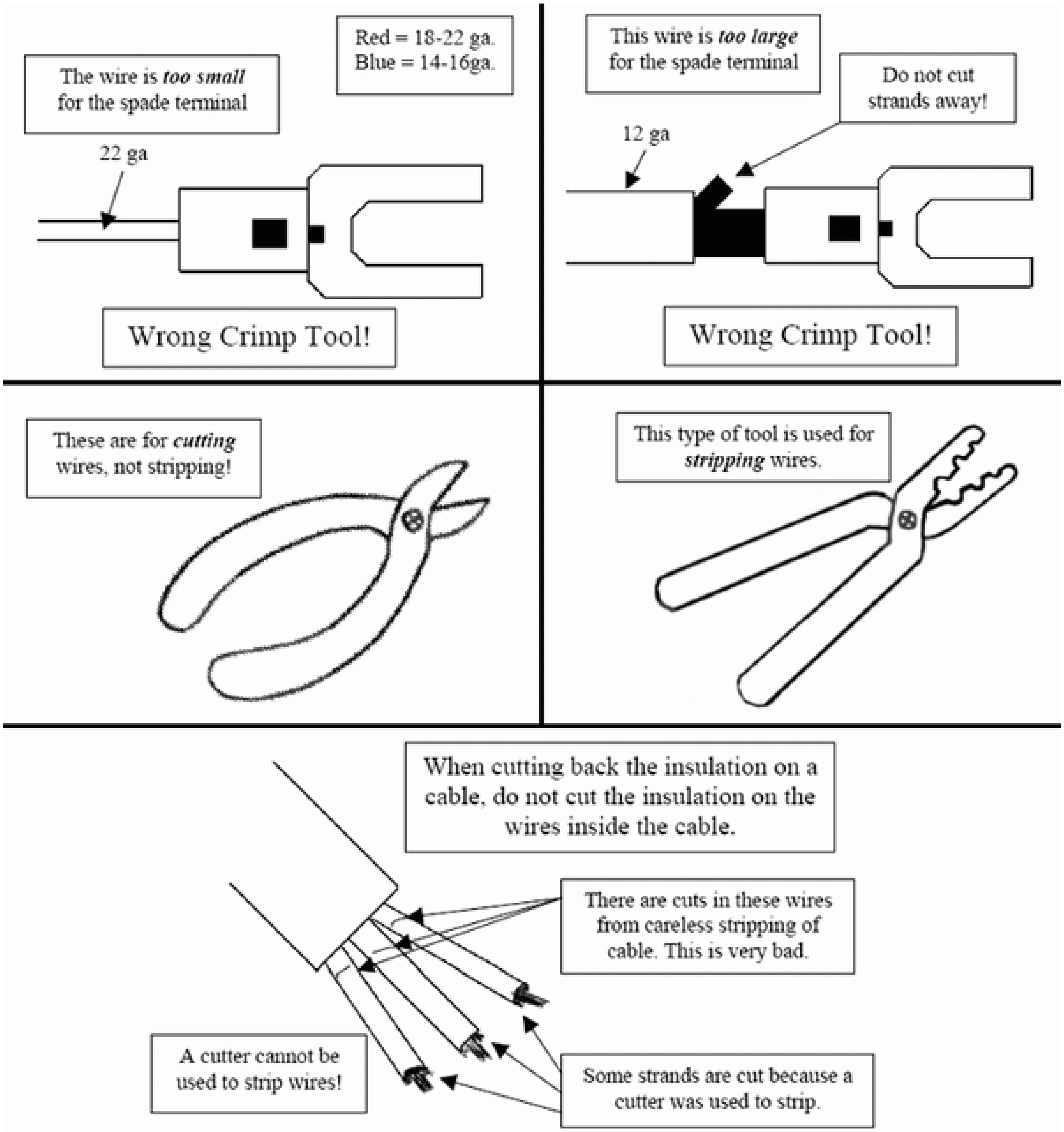
	VM+. VM-	Motor
Low power ALLIN1DC[2]	16	18
ALLIN1DC with Centroid single phase rectifier (Part number 12726)	14	16
ALLIN1DC with Centroid two phase rectifier (Part number 10767)	12	14

1. **Minimum Wire Gauge:** Recommendations for typical applications – cable lengths, drive current setting, and motor loads may change requirements. Always follow the electrical code. This chart assumes multi-stranded copper wire is used.

2. **Low power ALLIN1DC:** A specialized low power version of the ALLIN1DC is available that supports extremely small motors from 5 to 9 amps.

Common Wiring Problems

The following information is also covered in **Technical Bulletin #78** which can be found **[here](http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/78.pdf)**.
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/78.pdf)



5.2 Electrically Configuring Inputs on the ALLIN1DC

The inputs of the ALLIN1DC can be configured for either 5, 12, or 24 volts DC. The input voltage is changed by changing the resistance of the SIP (single inline package) resistor.

The SIP resistance is the defined by the last three numbers of the manufacturers part number as shown in Figure 5.2.1. Of the last three numbers, the first two digits signify the value of the resistance. The last digit signifies the number of zeros after the value. For example if the manufacturers part number is “4308R-102 LF – 222”, the values 222 define the resistance. The resistance is 22 plus two zeros, so the final value is 2200 Ohms. The chart next to Figure 5.2.1 defines which resistors are needed for which voltages. Allin1DC Controls ship with the 2.2K Ohm Sips installed for 24VDC operation.

Voltage Level	Centroid SIP Part #	SIP Value
5VDC	3950	470 Ohm(471)
12VDC	4152	1K Ohm(102)
24VDC	1548	2.2K Ohm(222)

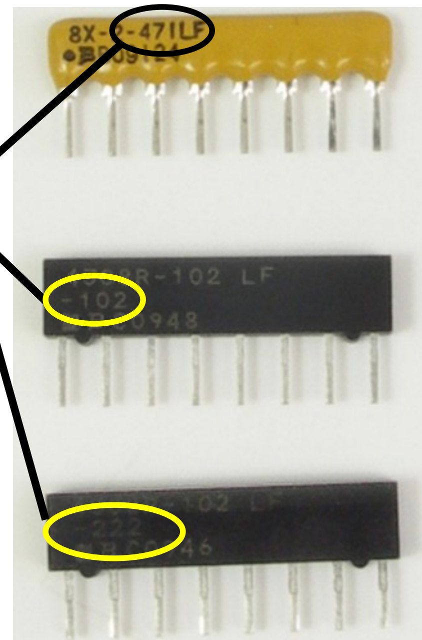
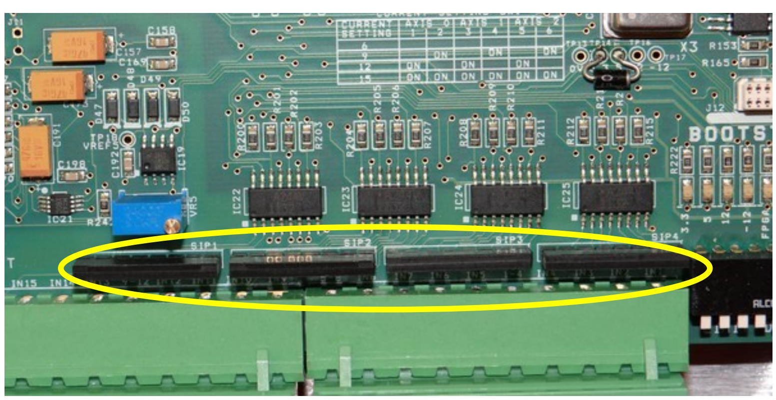


Figure 5.2.1
Reading SIPs

Looking closely at the ALLIN1DC, the silkscreen is labeled “SIP1, SIP2, SIP3, and SIP4” as shown in Figure 5.2.2. Each SIP controls a group of I/O as demonstrated by the table below.

Input Group	SIP Number
Inputs 1-4	4
Inputs 5-8	3
Inputs 9-12	2
Inputs 13-16	1

Figure 5.2.2
Location of SIPs



All inputs on the ALLIN1DC can be configured for sourcing or sinking operation using either 5, 12 or 24 volts DC. The inputs are arranged in groups of four with a common shared by each input in a group.

There are two ways to wire I/O on the ALLIN1DC:

- **Sourcing** Connecting the inputs to power is sourcing. The negative lead of the power supply must be connected to common. This is demonstrated on inputs 1-4 in Figure 5.2.3.
- **Sinking** By connecting the inputs to ground is sinking. The positive lead of the power supply must be connected to common. This is demonstrated on inputs 5-8 in Figure 5.2.3

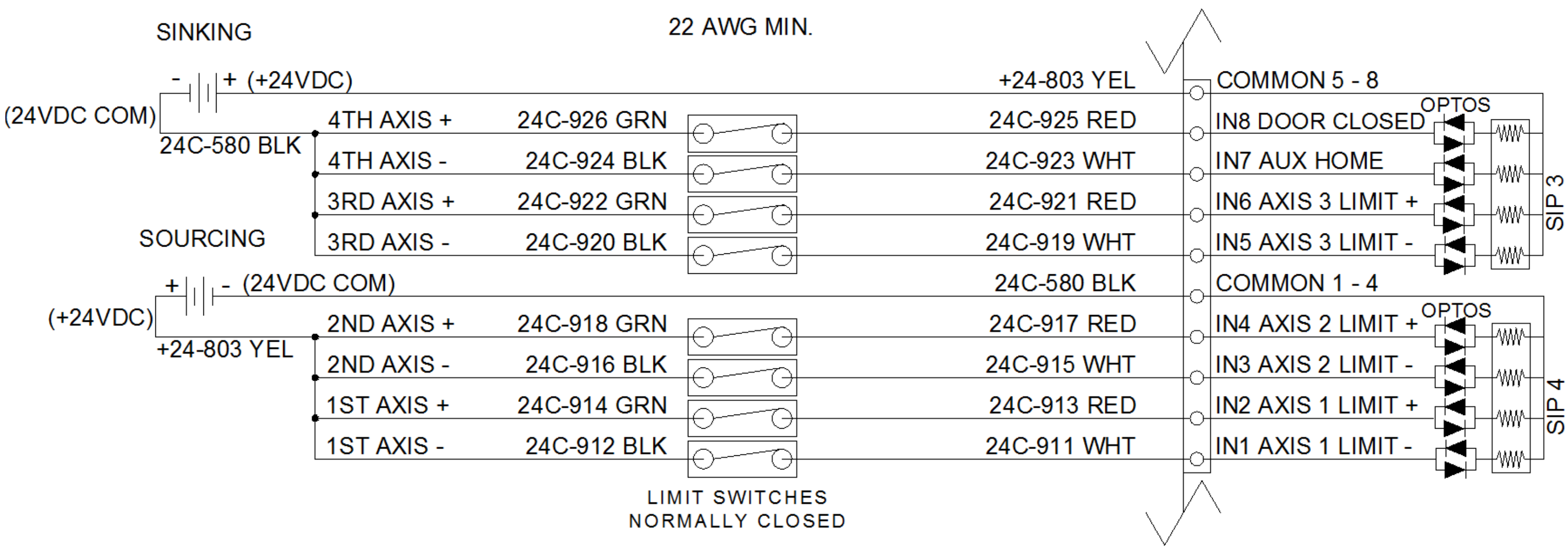


Figure 5.2.3
Sourcing and Sinking

5.3 Wiring VM

This information is also contained in **Technical Bulletin #286** contained **here**.
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/286.pdf)

DANGER: It is important that the ALLIN1DC, the rectifier, and all other hardware is powered off before wiring or troubleshooting. The reservoir capacitor must be given adequate time to discharge before wiring or troubleshooting. The DC output of the rectifier will measure less than 10VDC if the reservoir capacitor is adequately discharged.

The ALLIN1DC controls DC(direct current) servo motors. VM, is the voltage coming from the DC rectifier, though the contactor and into the ALLIN1DC. The actual motor output of the ALLIN1DC is a pulse-width modulated, PWM, signal but the VM voltage is what is connected between VM+ and VM- on the ALLIN1DC. Typically, motors will have a nameplate on the motor stating the maximum rated DC voltage of that motor as shown in the photo below. VM Voltage should not exceed the rated motor voltage.

If the motor doesn't have a nameplate, as long as the model number is known, a datasheet of that model motor should contain that information. An AC-to-DC converter known as a rectifier turns AC power into DC power. This rectifier is sometimes called a “Cap board” because it contains an extremely large reservoir capacitor. At the time of this writing there are two rectifier options to choose from:

Rectifier Part #	PCB Name	Input	Output
12726 & (10537 with transformer)	CAPBRDLO	125 VAC Max, single phase	180 VDC Max (155 VDC typical for an 110 VAC input)
10767 & (10010 with transformer)	CAPBRDHI	240 VAC Max, two phase	180 VDC Max (155 VDC typical for a 220 VAC input)

The DC voltage out of the rectifier circuit must **NEVER** exceed the maximum voltage rating of any of the motors that are to be controlled by the ALLIN1DC. The DC voltage generated by the rectifier circuit can be determined using the following formula.

Rectified DC Output Voltage = 1.414 * AC Rectifier Input Voltage

If 110VAC is being connected to the rectifier circuit, it will produce roughly 156VDC. If the motors that are to be controlled by the ALLIN1DC have a maximum rated voltage lower than 156VDC, then a step-down transformer **MUST** be used in order to lower the rectified DC output voltage. The transformers mentioned above take the incoming AC voltage and step it down to approximately 83VAC which produces a rectified DC output voltage of approximately 117VDC. To determine the maximum AC input voltage that is needed to connect to the rectifier circuit for the motors that are installed onto the ALLIN1DC, the following formula is to be used.

AC Rectifier Input Voltage = Rectified DC Output Voltage / 1.414

Centroid recommends using a Scheneider Electric/Telemecanique LC1DT40B7A or similar device for the E-stop contactor (Centroid PART# 14374). This Contactor includes snubber assembly and uses 24VAC to control it. **Both** the VM- and VM+ go through the E-stop contactor.

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.

The E-stop wiring is covered in-depth during section 5.6.

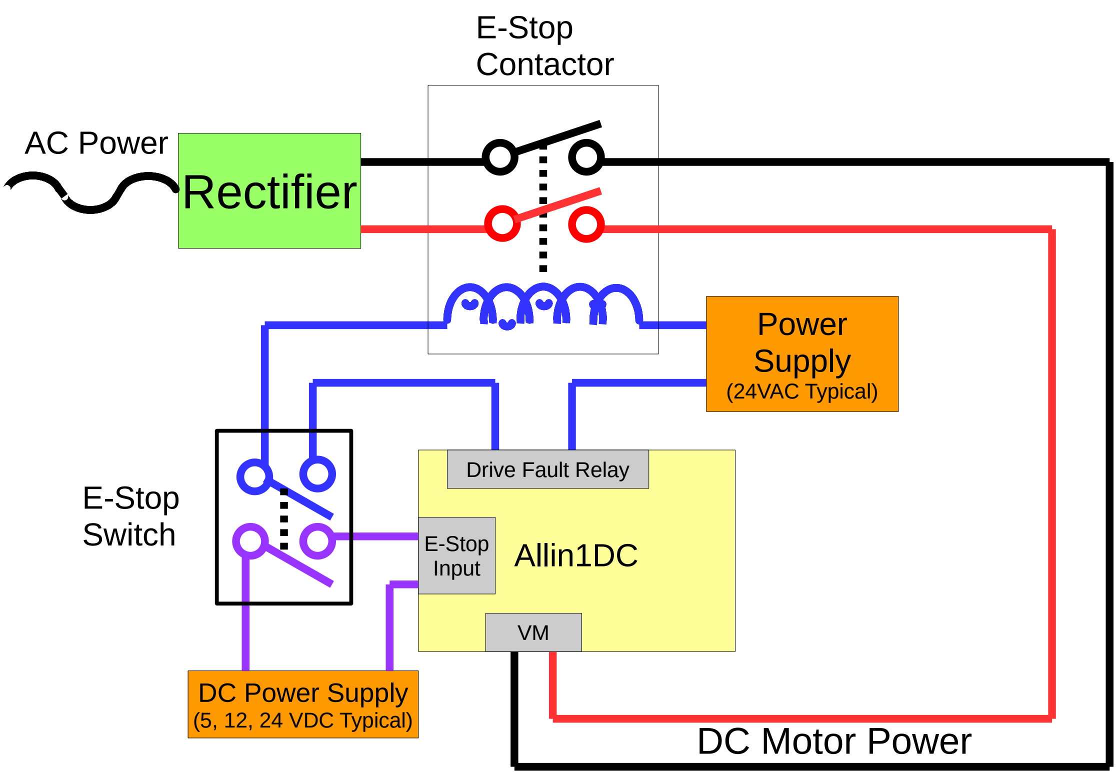


Figure 5.3.1
Simple Illustration depicting
Allin1DC VM and Estop Circuit

5.4 Wiring Servo Motors

The ALLIN1DC supports a wide variety of DC motors. Information on supported motors is provided in Appendix D. The ALLIN1DC must be powered off before attempting to wire motors. **DO NOT PROVIDE POWER TO THE MOTORS UNTIL INSTRUCTED TO DO SO.** Do not mechanically connect the motors to the machine until told to do so. **Check Servo motors before connecting to ALLin1DC.** A bad servo motor will damage the ALLin1DC. Follow Tech Bulletin 155 – Quick Checks for Servo Motors.

Relevant martyscncgarage video: Backpanel part 4 & Motor/Encoder hookup & Servo motor current setting

Motor Installation Procedure

1. With the servo motor disconnected from the ALLIN1DC, check for >100 MΩ between the motor chassis, and the motor power terminals.
2. With the servo motor disconnected from the ALLIN1DC, check for >100 MΩ between the ALLIN1DC chassis and the ALLIN1DC motor power terminals.
3. Wire the servo motors to the servo drive.
    1. Connect the motor power to the ALLIN1DC as shown below in Figure 5.4.1.
    2. Connect the shield ground from the motor cable to either of the two shield terminals on the ALLIN1DC.

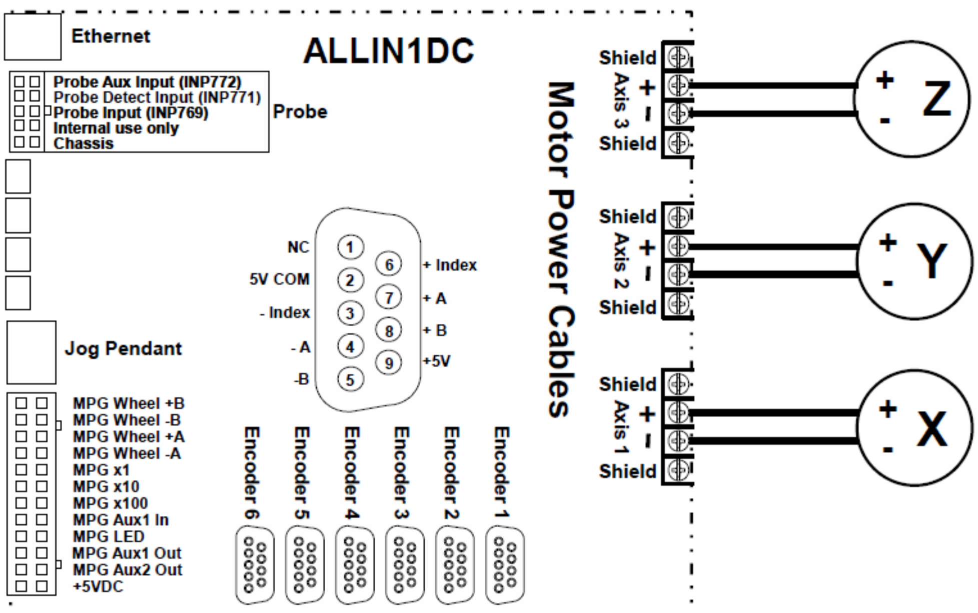


Figure 5.4.1
Motor Wiring

4. With the servo motors connected, confirm continuity between motor chassis and the ALLIN1DC chassis using a DVM/multimeter.
    1. **DANGER** An ungrounded servo motor is an electrocution hazard. Always confirm continuity with a multi-meter!
5. **NOTICE:** Never remove the brushes from a DC motor. They do not wear out and more costly damage may result by removing them unnecessarily.
6. Connect each encoder cable to the proper ALLIN1DC encoder input. The “Encoder 1” input corresponds with Axis 1, Encoder 2 corresponds with Axis 2, etc.
    1. **NOTE**: Encoders 4, 5, and 6 are for accessories. They can be used to connect additional servo drives to the ALLIN1DC (such as a DC1), add extra encoders to reduce error, custom MPG's, etc. These advanced uses will not be covered in this manual.

5.5 Setting Current Limiting

The ALLIN1DC has a switch that limits that maximum amount of current to the servo motor. The purpose of this feature is to prevent the ALLIN1DC from burning up the servo motor. A hole in the cover is provided to allow users to adjust the maximum current without having to remove the servo drive cover as shown in Figure 5.5.1. For your reference, a close up picture of the current selector switch is shown in 5.5.2. If the switch is black, ON is away from the PCB while OFF is towards the PCB. If the switch is blue, ON is towards the PCB while OFF is away from the PCB. Use the tables below to set the current correctly.

<u>Use Appendix C to to determine the correct current settings for your motor</u>. For optimal performance, the current settings on the ALLIN1DC need to be set at a higher value than the current rating on the motor.

NOTICE: When adjust the current, push carefully on the switch! The switch levers are plastic and can easily brake off if too much force is used.

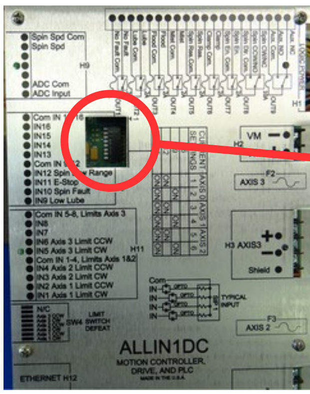


Figure 5.5.1
Location of Current Switches

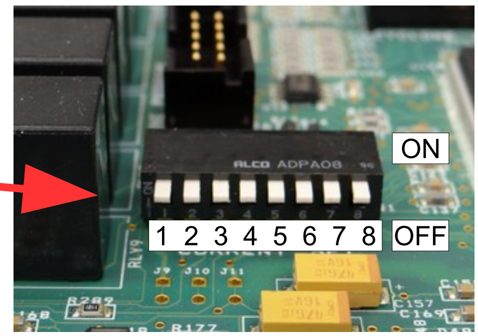


Figure 5.5.2
Old Style Black Current Switches

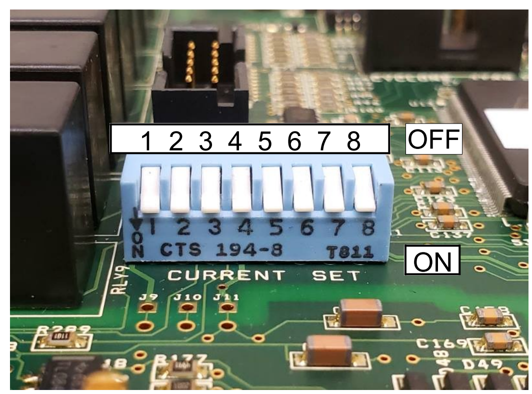


Figure 5.5.3
New Style Blue Current Switches

ALLIN1DC Drive Current Settings						
Current Setting	Axis 1		Axis 2		Axis 3	
	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
6 Amps	OFF	OFF	OFF	OFF	OFF	OFF
9 Amps	OFF	ON	OFF	ON	OFF	ON
12 Amps	ON	OFF	ON	OFF	ON	OFF
15 Amps	ON	ON	ON	ON	ON	ON

Low Power ALLIN1DC Drive Current Settings						
Current Setting	Axis 1		Axis 2		Axis 3	
	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
5 Amps	OFF	OFF	OFF	OFF	OFF	OFF
6 Amps	OFF	ON	OFF	ON	OFF	ON
7 Amps	ON	OFF	ON	OFF	ON	OFF
9 Amps	ON	ON	ON	ON	ON	ON

Common Current Settings for Stock Centroid Motors	
Motor Size	Setting
10 in-lb motors	6 Amps
16 / 17 in-lb motors	9 Amps
29 in-lb motors	12 Amps
40 in-lb motors	15 amps

Notice: Additional information for 3rd party motors available in Appendix C and Tech Bulletin 288.

5.6 Wiring E-Stop

(refer to the picture on the next page and the picture in 5.3.1)

A general guide to E-stop wiring and motor power troubleshooting is contained in **Technical Bulletin #286** which is located **here**. (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/286.pdf)

Relevant martyscncgarage video: PID, Estop, Limit Switch, Lube & Final Encoder Testing

1. **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 it's operational state. Wiring E-stop in a normally open configuration is dangerous as it will not stop the machine in the event that a wire breaks. 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.
    1. **E-Stop Switch** – Use a double pole single throw (DPST), normal closed, twist to release, emergency stop switch. Such as Centroid part number #14534
    2. **ALLIN1DC E-Stop** - There are two E-stop signals, one input and one output.
        1. **Input 11** Input 11 on header H1 needs to be routed in series with any E-stop switches (such as a jog panel or pendant), so that if any of the E-stop switches are tripped the PLC knows the E-stop is engaged as seen in Figure 5.5.1. Please note that SIP1 sets the E-stop input voltage to either 5V, 12V, or 24V. **Failure to install the proper SIPS to match the voltage levels being used will damage the ALLIN1DC.** Setting SIP1 correctly is outlined in Section 5.2.
        2. **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 as seen in Figure 5.5.2. The ALLIN1DC's 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.
            1. **NOTE:** If additional servo drives axis are added using a the Centroid DC1, all drive fault relays need to be wired in series with the ALLIN1DC output1. This makes it so that if one drive throws a drive fault, ALL the servo drives are stopped simultaneously.
    3. **Contactor –** Centroid recommends using a Scheneider Electric/Telemecanique LC1DT40B7A or similar device for the E-stop contactor (Centroid PART# 14374). This Contactor includes snubber assembly and uses 24VAC to control it. A snubber needs to be placed across the contactor(s). Centroid offers Quencharc snubber networks (Centroid PART# 1819) for use with other contactors. This reduces electrical noise when the servo motor power is cycled on and off. It is best practice to run both the VM- and VM+ through the E-stop contactor. See **Tech Bulletin 206** on use of snubbers
2. **Testing E-Stop Wiring**
    1. Power up your system.
    2. Start CNC12 and press F10 to continue to the main screen
    3. Enable the E-stop (which was inverted during board level testing). In the main menu press alt + I to bring up the real time I/O display. Click on input 11. Press the ctrl-alt-i keys simultaneously to remove the bar over the input in the display, enabling your E-stop.
    4. Provide AC power to the E-stop contactor.
    5. Toggle the E-stop. Confirm that there is not bar over input 11. Check that input11 is green when the E-stop is released (not tripped), and red when E-stop is pressed. Refer to **Technical Bulletin #286** for troubleshooting if necessary.

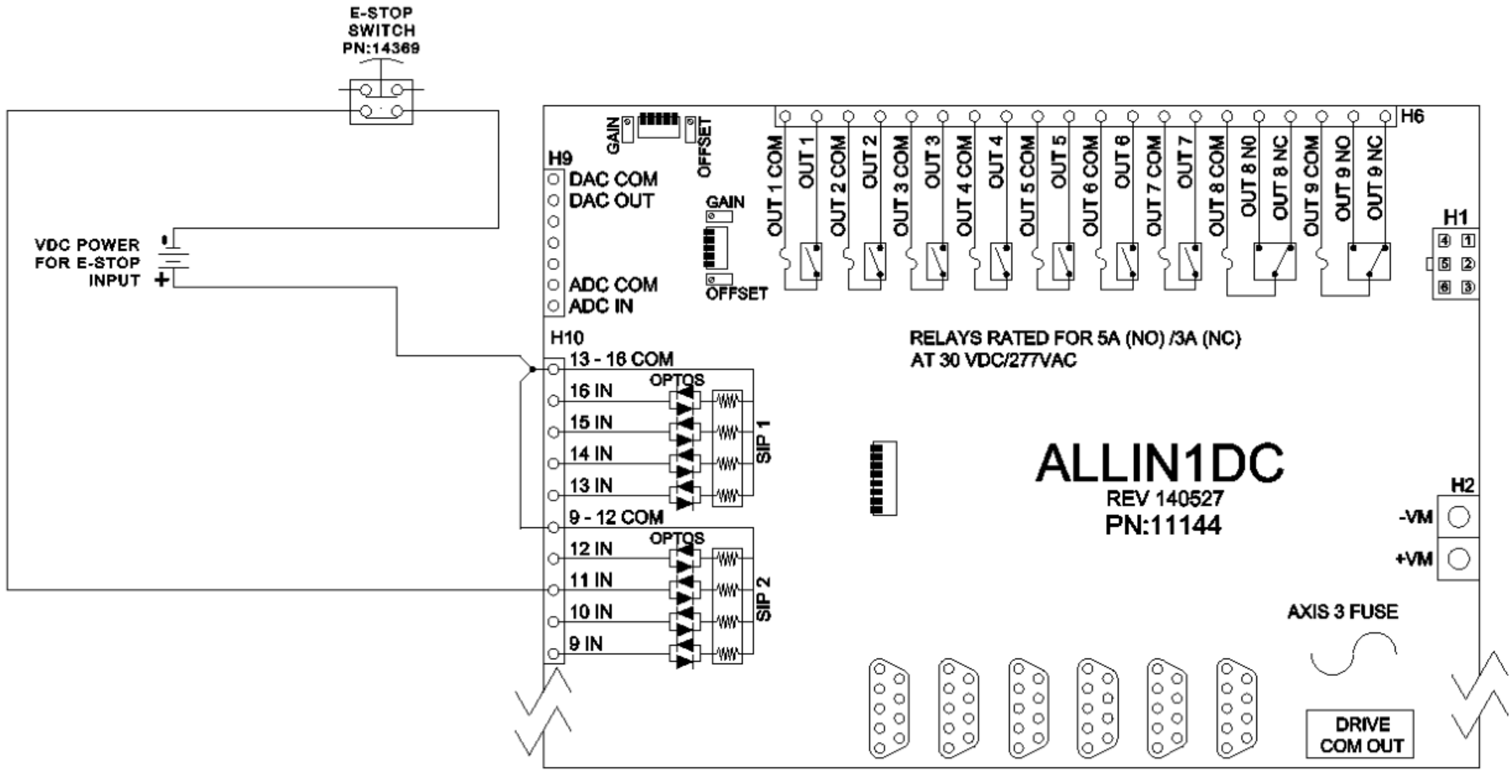


Figure 5.6.1
Example of E-Stop Input Wiring

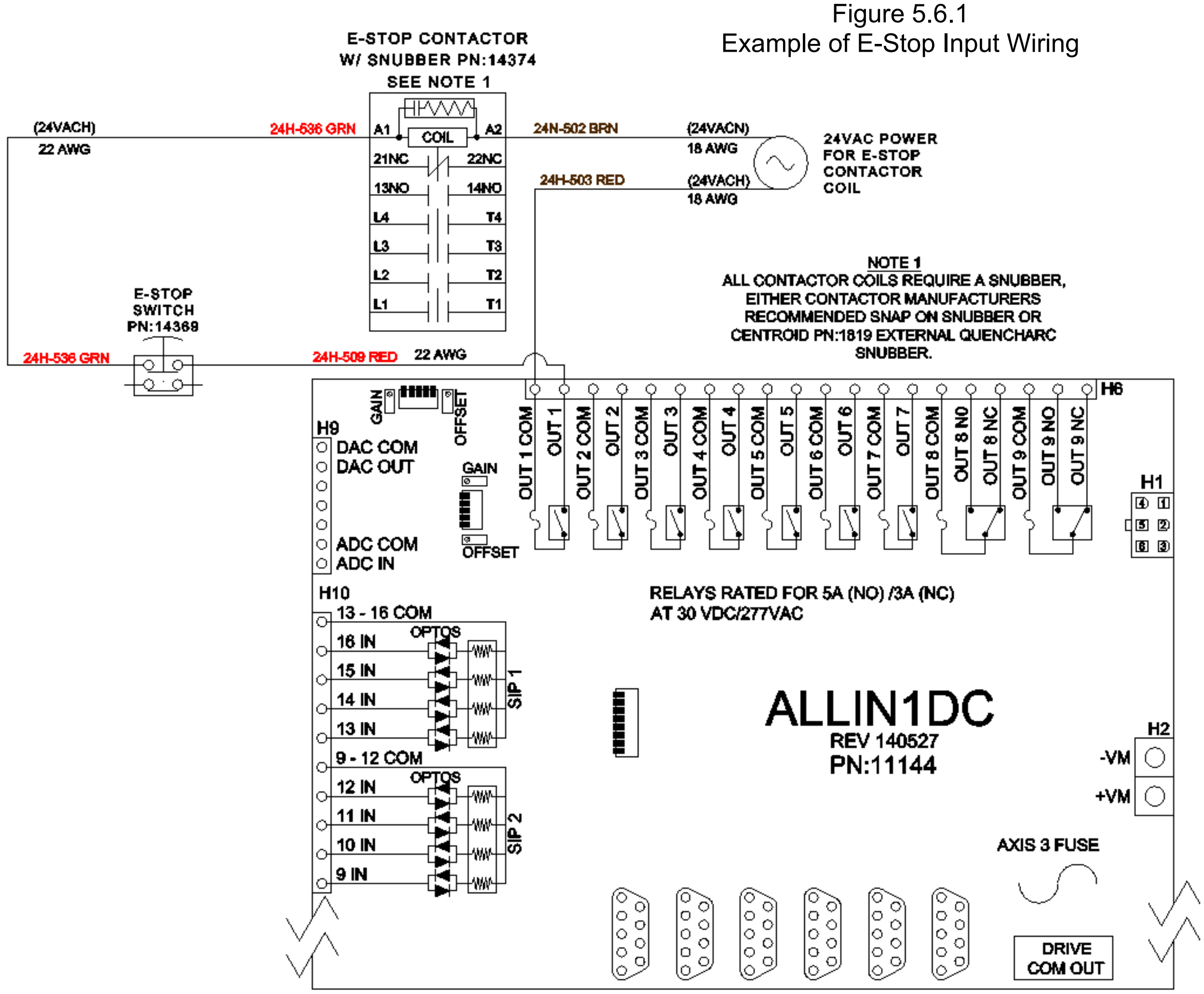


Figure 5.6.2
Example of E-Stop output Wiring

5.7 Wiring Limit Switches

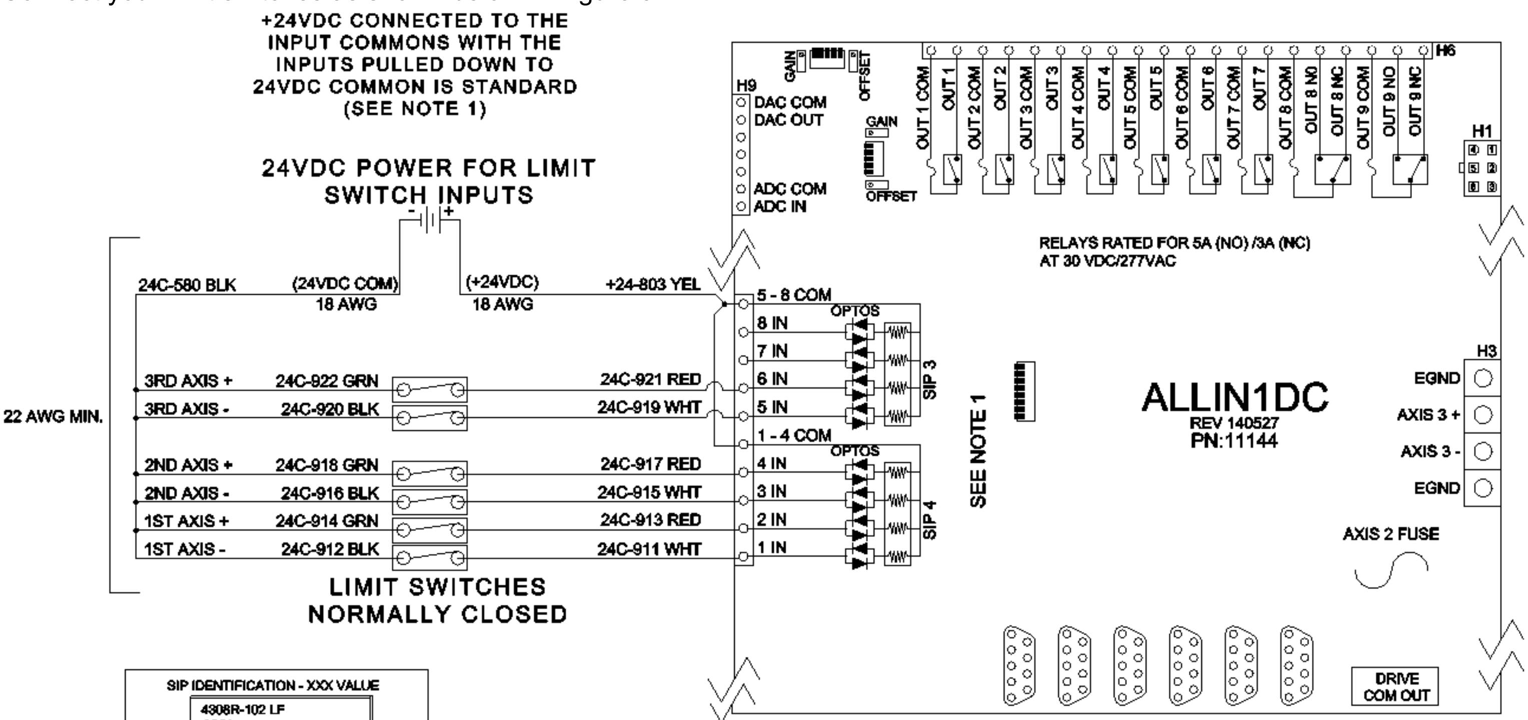
All inputs used for Limit switches must be wired in normally closed configuration. The switch should be closed when the machine is in its operational state. Wiring any of these inputs in a normally open configuration is dangerous as the machine will not stop in the event that a wire breaks. It also prevents noise from causing spurious faults because the signal is being electrically held at the operational level.

The I/O configuration on every machine is different. While the examples below assume dry contact type switches and utilize 24VDC, your machine may utilize different voltage levels and different type devices devices such NPN or PNP proximity sensors. If your devices are proximity sensors, they MUST be 3-wire sensors, **2-wire sensors will not work reliably**. Make sure the SIPS you installed in section 5.2 match the voltage levels for your devices.

The limit switch defeaters (SW4) on the ALLIN1DC need to be pointed DOWN if SW4 is black and UP if SW4 is blue to be able to use the limit switches.

Failure to install the proper SIPS to match the voltage levels being used will damage the ALLIN1DC.

Connect your limit switches as shown below in Figure 5.7.2.



SIP IDENTIFICATION - XXX VALUE

4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1
INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

Testing Limit Switch Wiring

1. Power up your system.
2. Start CNC12.
3. Invert the limit switches (which were inverted during board level testing). In the main menu press alt + I to bring up the real time I/O display.
4. Select the appropriate limit switch input (input 1 – 8), and press the ctrl-alt-i keys simultaneously to remove the bar over the input in the display. This will enable that limit switch.
5. Confirm that all limit switches are are green when nothing is tripped. Confirm that the correct input turns red when the switch is tripped.

5.8 Wiring Lube Pump

(refer to the picture on the next page)

The typical lube pump circuit consists of two parts: The first part is the control of the lube pump itself which is controlled by **output 2** sending 110VAC to the lube pump. The second part is the low lube alarm signal which gets wired to **input 9**. The low lube signal tells the control to produce a "**405 Low lube**" alarm which inhibits the control from starting a new job until the lube pump is refilled and the alarm is cleared.

Failure to install the proper SIPS to match the voltage levels being used on Inputs 9-12 will <u>damage</u> the ALLIN1DC. Spindle Fault, E-Stop Input, and Lube Fault all have to be wired to run off the same input voltage using the default PLC program

Keep in mind that the ALLIN1DC output relay is rated for up to 5 amps DC or 10 Amps AC. If your lube pump draws more current you will need to install a contactor.

When wiring your lube pump it is important to know which type of lube pump you have so that you configure it correctly. Typically lube pumps come in one of 3 types:

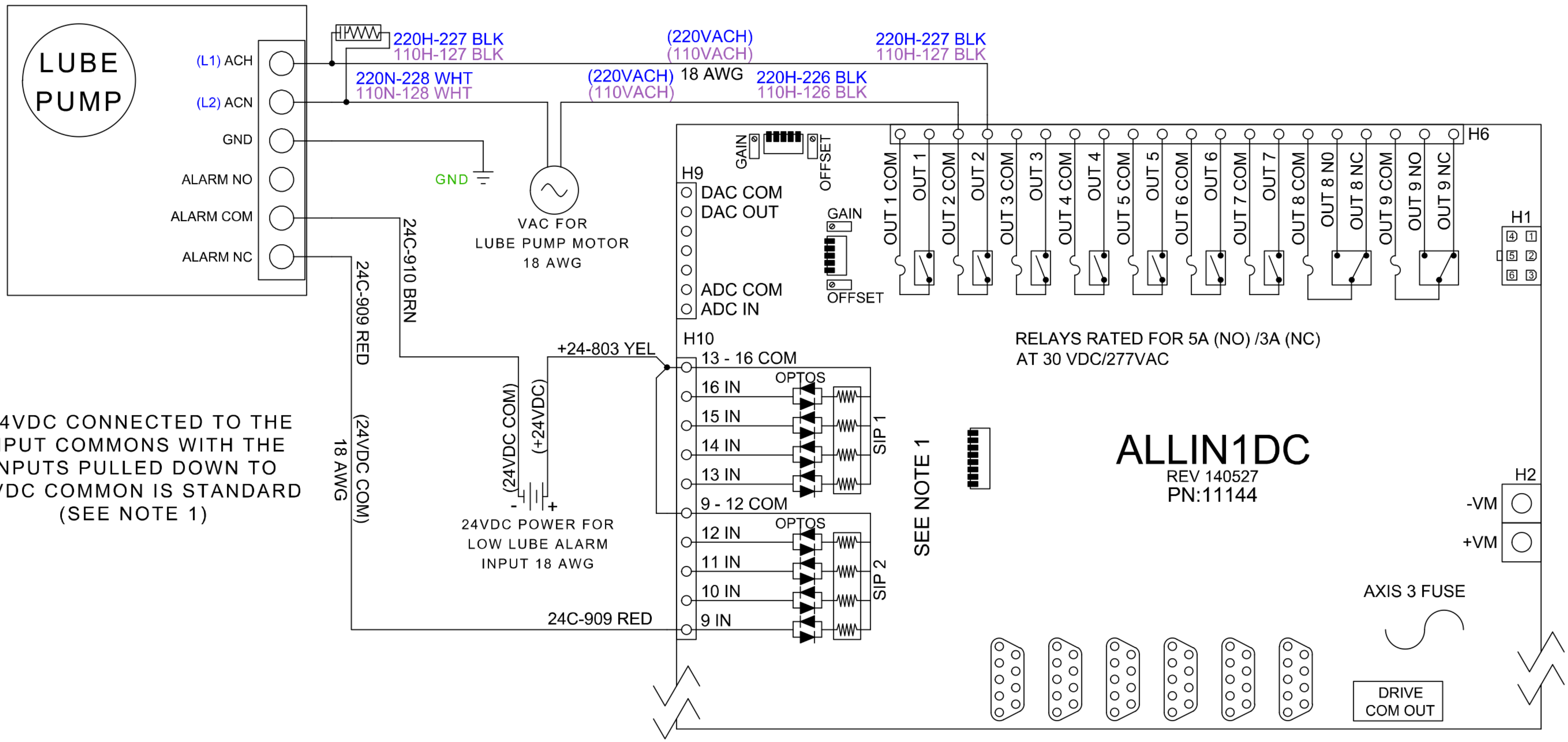
- **Mechanical Cam Actuated Lube Pump:** This pump is based on a simple mechanical plunger riding on a clock motor driven cam. The advantage of this type of lube pump is that it is reliable and it remembers where it was and how much run time has been accumulated even between power cycles. So that you actually get lube for 5 seconds every 10 minutes of machine use.

- **Electronic Lube Pumps:** These pumps try to imitate the mechanical cam pumps but often forget where in sequence they were when powered off. There are two types of Electronic lube pumps, "lube first" which pumps lube immediately after power on. This typically results in too much lube. The second type is "lube last", this type waits a set amount of time before lubing the machine. The problem with this type is on small jobs your machine may never get any lube, possibly damaging the machine. To avoid this some people wire the lube last type to get power all the time which results in too much lube.

- **Direct controlled lube pumps:** These pumps are controlled by the control via the PLC program and the software. With this type the lube pump is not responsible for the timing of the pump actuation. **This method is the best for reliable and even lubing of your machine.** Centroid Users see Tech Bulletin #171 and Parameter 179 in the operators manual for further explanation.

Enabling Lube Inputs

1. Power up your system.
2. Start CNC12 software.
3. Invert the lube fault input (which was inverted during board level testing). In the main menu press alt + I to bring up the real time I/O display.
4. Click on input 9, and press the ctrl-alt-i keys simultaneously to remove the bar over the input in the display. This will enable your lube fault input.
5. Confirm that input 9 is green while the pump has lube. If the pump has a low lube alarm, confirm that the correct 9 turns red when the pump is low on lube.



+24VDC CONNECTED TO THE INPUT COMMONS WITH THE INPUTS PULLED DOWN TO 24VDC COMMON IS STANDARD (SEE NOTE 1)

5.9 Wiring Coolant Pump

By default ALLIN1DC **output 3** is the coolant flood pump output and **output 4** is the default output for a coolant mist pump. If you have a custom PLC program your I/O may be different.

This sub-circuit shows how to hook up a 3 phase Flood Pump. Because the pump in this example draws more power than the ALLIN1DC is rated for, a Flood Contactor (Centroid PART# 3959) is needed.

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 flood coolant is cycled on and off. A thermal overload is also shown, this part protects the pump motor by opening the circuit if it stalls for any reason, such as metal chips in the pump.

Centroid recommends a thermal overload protector. The example below diagram depicts the 24VAC wired through the NC contacts on the overload section of the contactor. The overload protection circuit on your existing contactor may be labeled differently or there may be no overload protection.

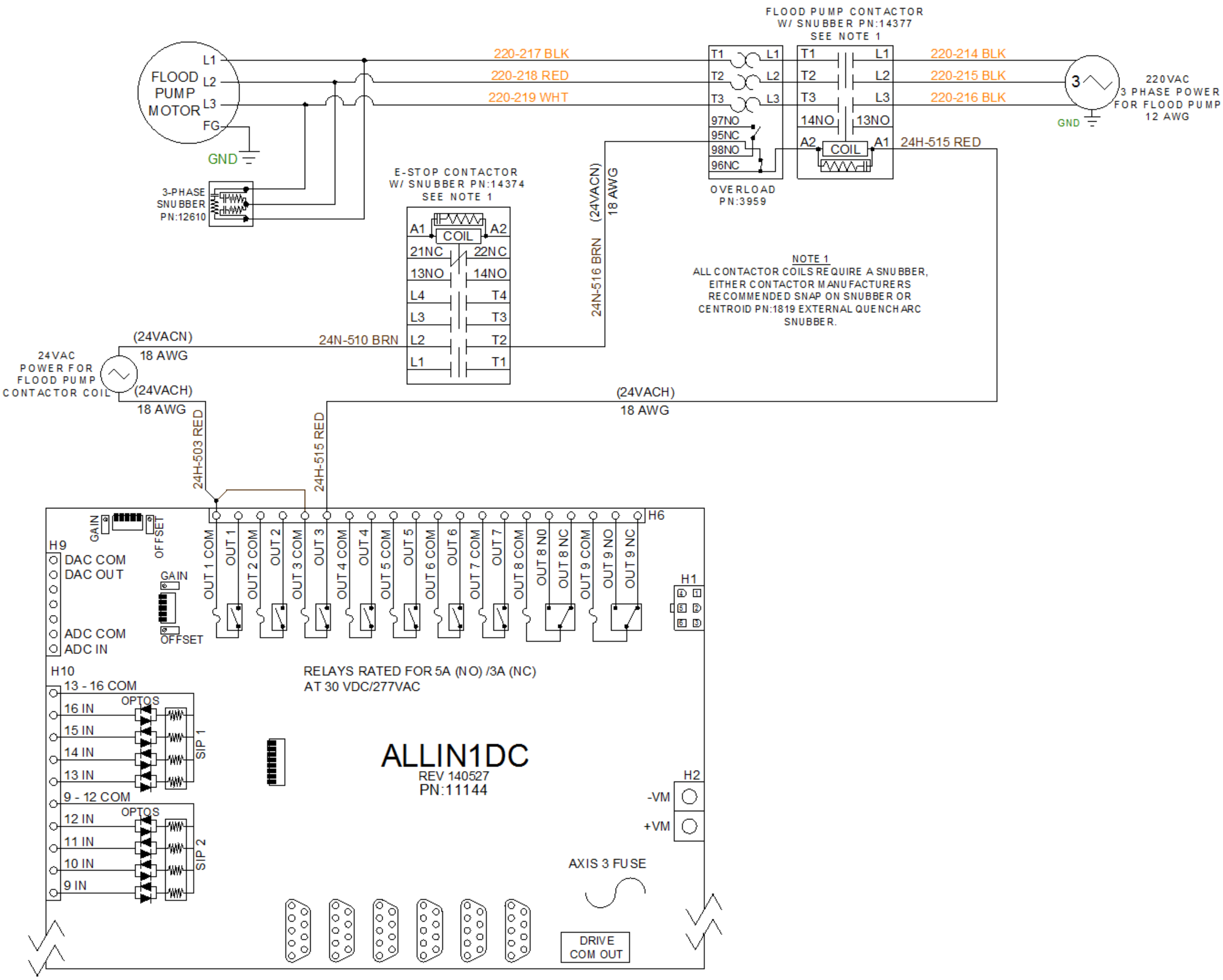


Figure 5.9.1
Sample Flood Pump Circuit

5.10 Wiring Spindle

STOP: Before wiring up the spindle make sure that you already tested the spindle as directed during the board level tests.

There are two methods of wiring a spindle:

1. Connect three phase directly to an induction spindle motor (shown on the next page in Figure 5.10.1). Hooking the three phase directly saves costs, but prevents the Centroid CNC software from being able to control the speed of the spindle. The spindle speed will have to be controlled by mechanical methods such as pulleys.

2. Use a spindle controller. (A sample using a GS2 inverter is shown on the following pages in Figure 5.10.2). The terms “inverter” (short for power inverter), “AC Drive”, and “VFD” (Variable Frequency Drive) can all refer to the spindle controller. Centroid does **not** provide spindle controllers and recommends using Delta Products VFDs, Automation Direct GS2 and GS3 AC drives, as well as Yaskawa VS (Varispeed) Inverters. It is the responsibility of the technician installing to consult their spindle controller manufacturer for support.

With the default PLC program, several of the I/O are decided for use with a spindle. **Input 10** is the spindle fault input. **Output 7** is the spindle fault output. **Output 5** is the inverter fault reset. **Output 8** is the inverter direction. **Output 10** is for a spindle cooling fan. Always refer to your schematic.

Failure to install the proper SIPS to match the voltage levels being used on Input 9-12 will damage the ALLIN1DC. Spindle Fault, E-Stop Input, and Lube Fault all have to be wired to run off the same input voltage using the default PLC program.

A thermal overload protector is recommended. It should be wired in series with the spindle enable as shown below in Figure 5.10.1, so that both the ALLIN1DC and the overload protector can stop the spindle.

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.

For spindle slaved movements such as rigid tapping, the spindle encoder needs to be connected to the ALLIN1DC. The spindle encoder must meet the prerequisites listed in section 2.3. Rigid tapping should be enabled last, after the spindle is functioning. A multitude of software parameters need to be set up for rigid tapping, which is beyond the scope of this document. More information on how to set up rigid tapping is contained in your CNC12 operators manual and Technical Bulletins.

See: TB123 Rigid Tapping Setup (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/123.pdf)

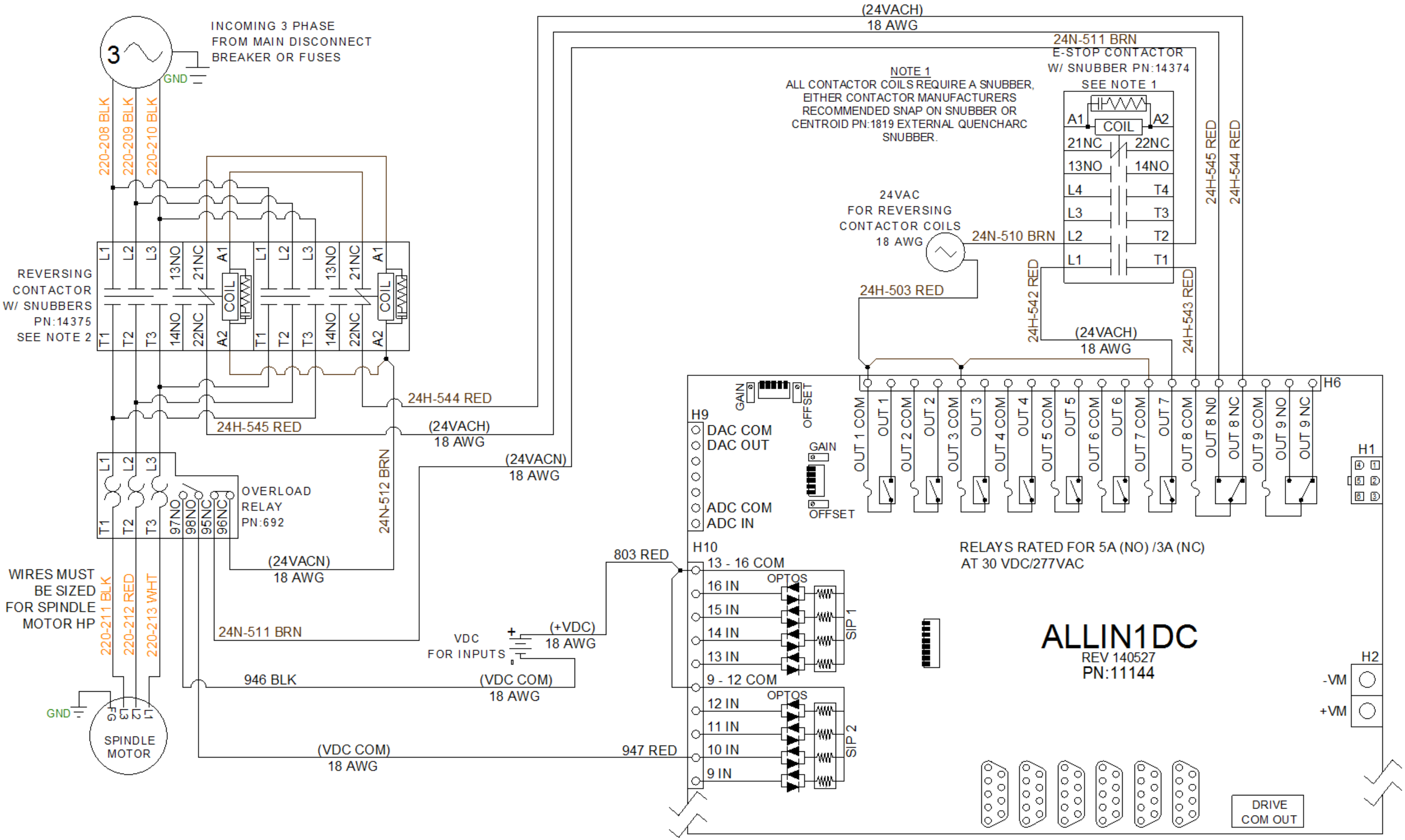


Figure 5.10.1
Sample Spindle Wiring

ALLIN1DC Wiring For Inverter			
ALLIN1DC I/O	**Function**	**ALLIN1DC I/O**	**Function**
OUT 5	Spindle Fault Reset	OUT 8 NO (Normally Open)	Spindle Reverse
OUT 7	Spindle Enable	IN 10	Spindle Fault
OUT 8 NC (Normally Closed)	Spindle Forw ard	DAC OUT	Spindle Speed
		ADC IN	Spindle Load

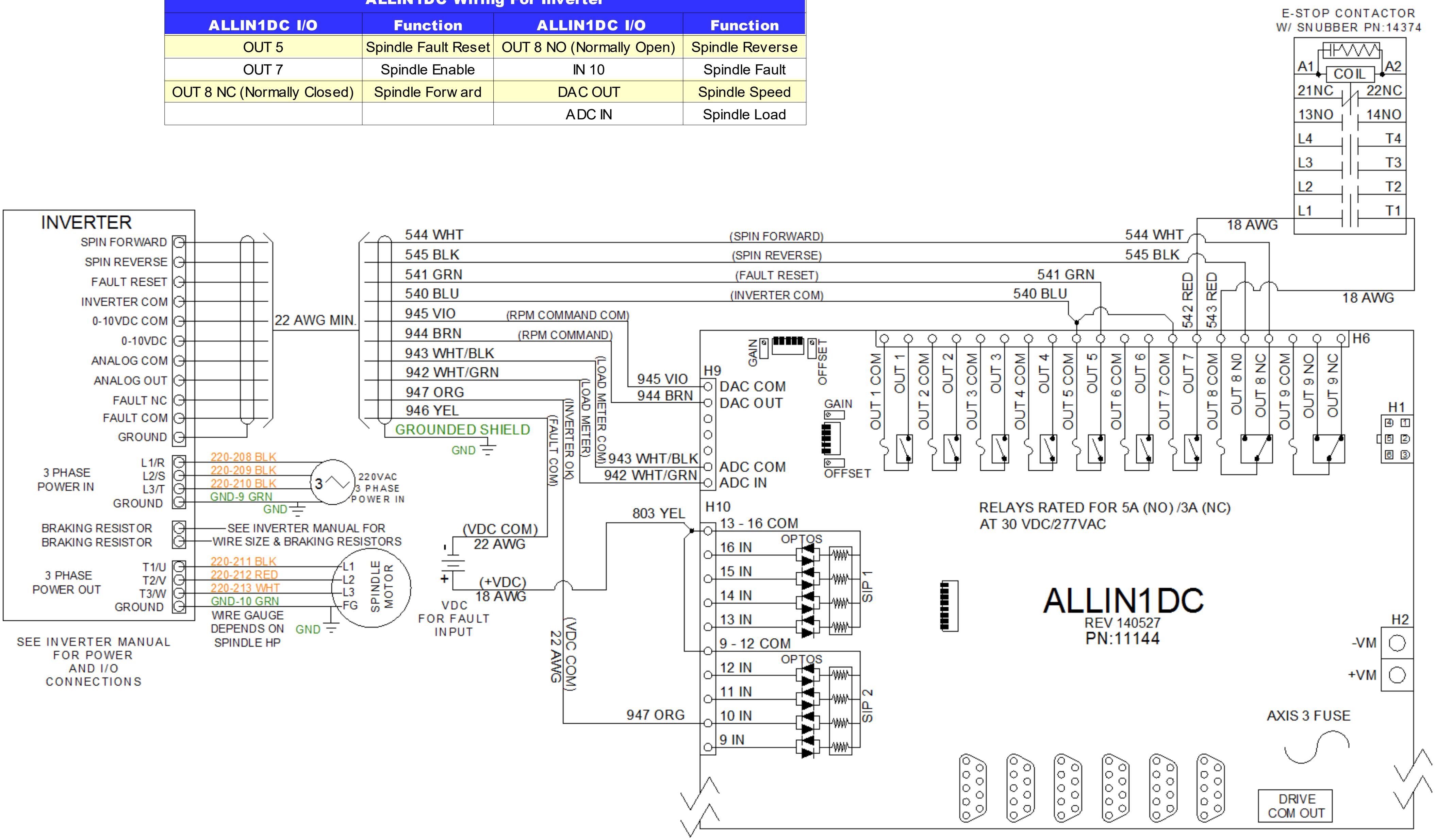


Figure 5.10.2
Sample Inverter Spindle Wiring

Chapter 6
Final Software Configuration

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. The PID settings and appropriate CNC12 parameters for the ALLIN1DC need to be entered into the software as described during the board level test before continuing with chapter 6.

Clear Any Existing Faults Before Continuing. To confirm that all faults have been cleared before continuing, press **F3 MDI** from the main menu. If all faults have been cleared correctly, the screen should look like Figure 4.1.10. See Appendix C for troubleshooting.

Figure 6.1.1
MDI mode, indicating that all faults have been cleared.

6.2 Confirm Encoder Communication

This section assumes encoders are already set up, which was done during section 4.1.

1. **DANGER: MECHANICALLY DISCONNECT THE SERVO MOTORS FROM THE MACHINE.** The servo motors need be able to move freely. Failure to disconnect the motors from the machine could result in personal injury or damage to the machine.

2. **Confirm Encoder Feedback on all axes**

    1. From the main menu, press **F1 – Setup** → **F3 – Config**. Password is **137**. Press **F4 PID**

    2. Manually rotate each motor while watching the abs pos field (circled below) for that axis as seen in Figure 6.2.1. Confirm that you have smooth feedback on all axes and that X updates the X DRO, Y updates Y DRO etc.

    3. Confirm that the absolute position increases for while rotating the shaft counter clockwise as shown below in Figures 6.2.1 and 6.2.2.

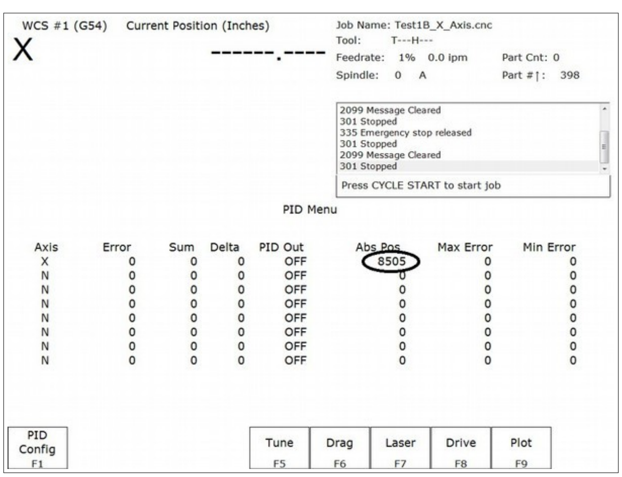


Figure 6.2.1
Confirm encoder rotation

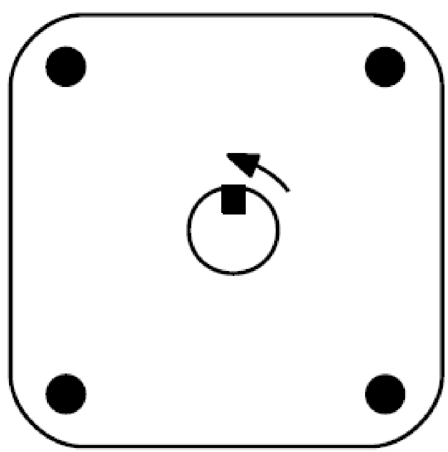


Figure 6.2.2
Encoder counting up when the motor shaft is rotated counter clockwise.

6.3 Motor Software Setup

1. CNC12 supports velocity, torque, and precision mode. The ALLIN1DC is designed to run only in torque mode. Make sure the ALLIN1DC is set to torque mode pressing **Setup (F1)** → **Config (F3)** (**Password 137**) → **Parms (F3)**. Repeatedly hit Next Table (F8) to bring up parameter 256. Parameter 256 should be set to 0.

2. In the PID menu, enter the servo motor parameters menu as shown below in Figure 6.3.1. Press **Setup (F1)** → **Config (F3)** (**Password 137**) → **PID (F4)** → **PID Config (F1)**. Consult Appendix C for the proper PID settings.

Figure 6.3.1
PID Configuration Menu

3. Enter in Kp, Ki, Kd and Limit. Kg, Kv1, Ka and Accel will be automatically filled out by autotune performed later in this chapter.

4. Press Save & Exit (F10). Return to the main menu.

   1. Do not have **stall detection disabled** for the rest of this manual. (Section 4.1)

5. Release E-stop to clear all errors and **provide VM power to the servo motors**.

6. Set the feedrate to around 10%

7. Jog each servo motor while it is disconnected from the machine if you have not already done so. Use the arrow keys on the jog panel or MDI commands to confirm that the motors are moving correctly. While jogging, disable increment mode by making sure the button on your jog panel labeled '**Incr Cont**" is not lit up.

   1. **DANGER:** The first time jogging the servo motor, best practice is to have it disconnected from the machine. *(Either by physically removing the motor, or removing a gear or drive belt.)* This way if something goes wrong, there is a minimal risk of mechanical damage to the machine. If one of the parameters or settings was entered incorrectly during the setup, the motor may oscillate violently or move out of control.

   2. **NOTE:** After jogging, when the motor stops moving a little bit of "rumbing" noise from the motors is considered normal. This is just the sound of the motors trying to hold position.

   3. **TROUBLESHOOTING TIP #1:** If movement does not occur, check for errors in the "status" window.

   4. **TROUBLESHOOTING TIP #2:** If during jogging or while holding position the motors are visibly oscillations during, there is most likely a problem with your PID settings. Manual tune the motor. Use **Technical Bulletin #260** which can be found **here**. (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/260.pdf)

   5. **TROUBLESHOOTING TIP #3**: During the troubleshooting process if you want the motors to stop holding position issue a M93 command using the MDI terminal.

   6. **TROUBLESHOOTING TIP #4:** If the motors "take off" or "run away" or start spinning and then fault out with "SV_ Stall Error", this is due to the control not seeing the proper encoder signals. Check to see that the encoders are

configured correctly. This would also occur if the motor power leads were reversed. The control would be commanding one direction while the encoder is reporting the other direct leading to a “run away”

8. After successful servo motor movement, power down the system.

9. Manually move all axes to the **center of their travel** to provide **safe clearance** when the motors are connected to the machine.

10. Mechanically connect the servo motors to the machine, allowing the motors to control the movement of the machine.

Manual Tuning – Manual tuning of the Kp, Ki, and Kd can be performed to reduce motor movement errors. In most cases this is unnecessary. Users experiencing excessive servo motor “whine” or “singing”, difficulty with motors holding position, or motor oscillations should manually tune their values. Additionally, in some cases users may get a very small accuracy increase by manual tuning. Manual tuning is covered in **Technical Bulletin #260** which can be found **here**.
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/260.pdf)
Further instructions can be found in the following video: Centroid CNC control DC Servo Motor PID Tuning Procedure
Settings for 3rd party Servo manuals can be found in TB288 – Allin1DC Settings for 3rd Party Servo Motors

11. Power up the machine. Release E-stop to provide power to the servo motors.

12. **Check home configuration** During the board level test in Section 4.1 we changed the machine home at power up to jog. Double check to make sure it is still set to jog as demonstrated in figure 6.3.2.

    1. **DANGER:** Since your limit switches have not been configured correctly yet, homing to limit switches right now could cause physical damage to your machine.

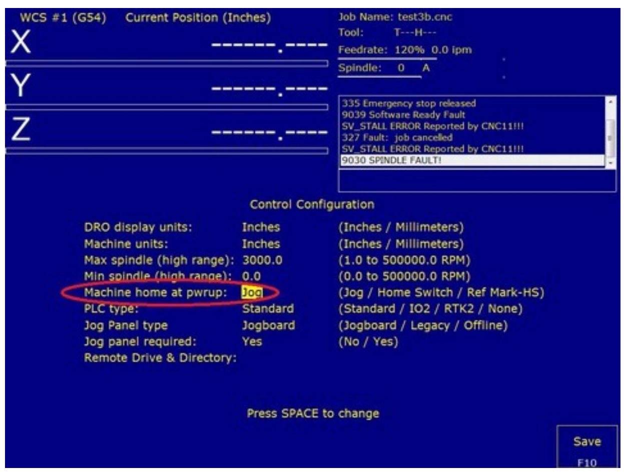


Figure 6.3.2
Checking home configuration

13. Make sure the feedrate is turned down to around 10%

14. Press the Start button on the jog panel, or Alt+S from the keyboard. This will cause the machine to set home right where it is.

15. Slow jog each of the servo motors, checking that each axis of the machine can move.

16. **Configure servo motors to move in the correct direction** Mechanically connect the motors to the machine. It is important to understand that correct servo motor direction is determined by the motion of the tool relative to the part. This is not necessarily the same as the motion of the table. More information on this procedure is also covered in **Technical Bulletin #137**, which can be found **here**. (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/137.pdf)

    Relevant martyscncgarage videos: Checking Axis Direction Movement on the Knee Mill and Properly Reversing an Axis with Centroid CNC All in One DC

    For axes that move the table while the tool remains stationary such as the X & Y axes on a typical Bridgeport type knee mill, the table motion is the opposite of the "tool motion". For axes that move the tool, such as the quill on a knee mill, axis motion is the same as the tool motion. The Figures 6.3.3 and 6.3.4 below describe this concept.

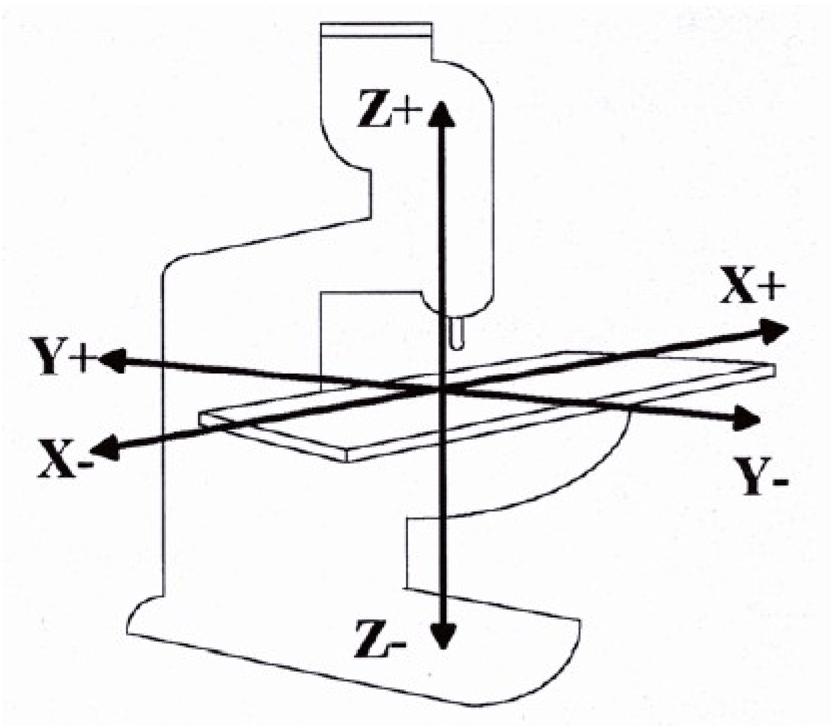


Figure 6.3.3
Difference between table motion and tool on a knee mill.

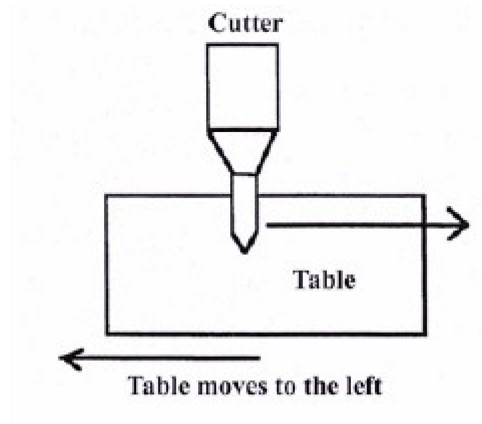


Figure 6.3.4
Table verses tool movement
In the above illustration 6.3.4, the tool is moving in the X+ direction relative to the part while the table moves to the left.

Related reading CNC Machine Tool Coordinate and Axis conventions
https://centroidcncforum.com/viewtopic.php?f=64&t=3638

Configuring motors to move in the correct direction (continued)
Use MDI to move each axis and determine if the axis is moving in the correct direction. To determine this, observe that the DRO counts more positive while moving an axis in the positive direction and that it counts more negative while moving in the negative direction. To correct for an axis that is moving in the wrong direction, from the main menu press **F1 -Setup** → **F3 Config**. The password is **137**, Press enter. Press **F2 Mach** → **F2 Motor**. Use the arrow keys to select the "**Dir Rev**" field for the axis that needs to be corrected and press the space bar to toggle it's current state as seen in Figure 6.3.5.

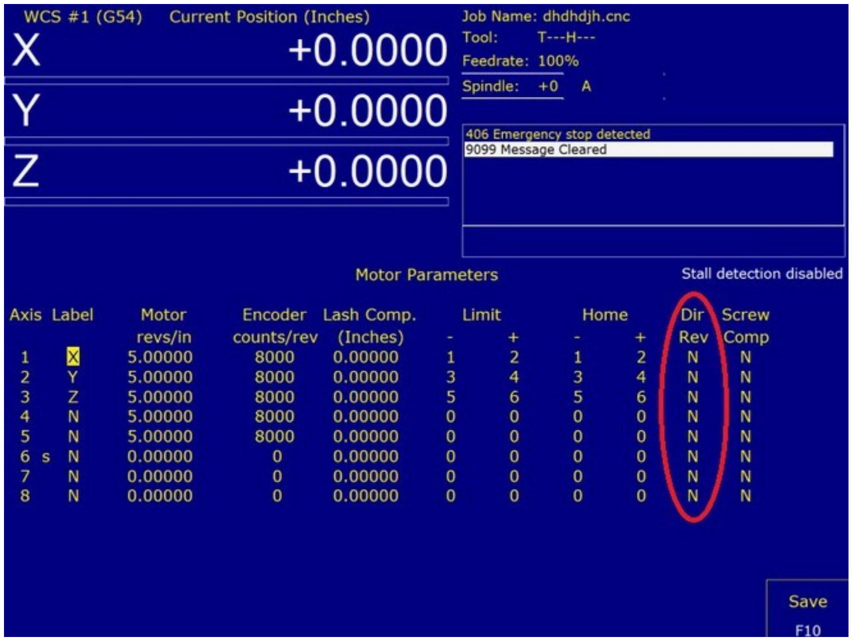
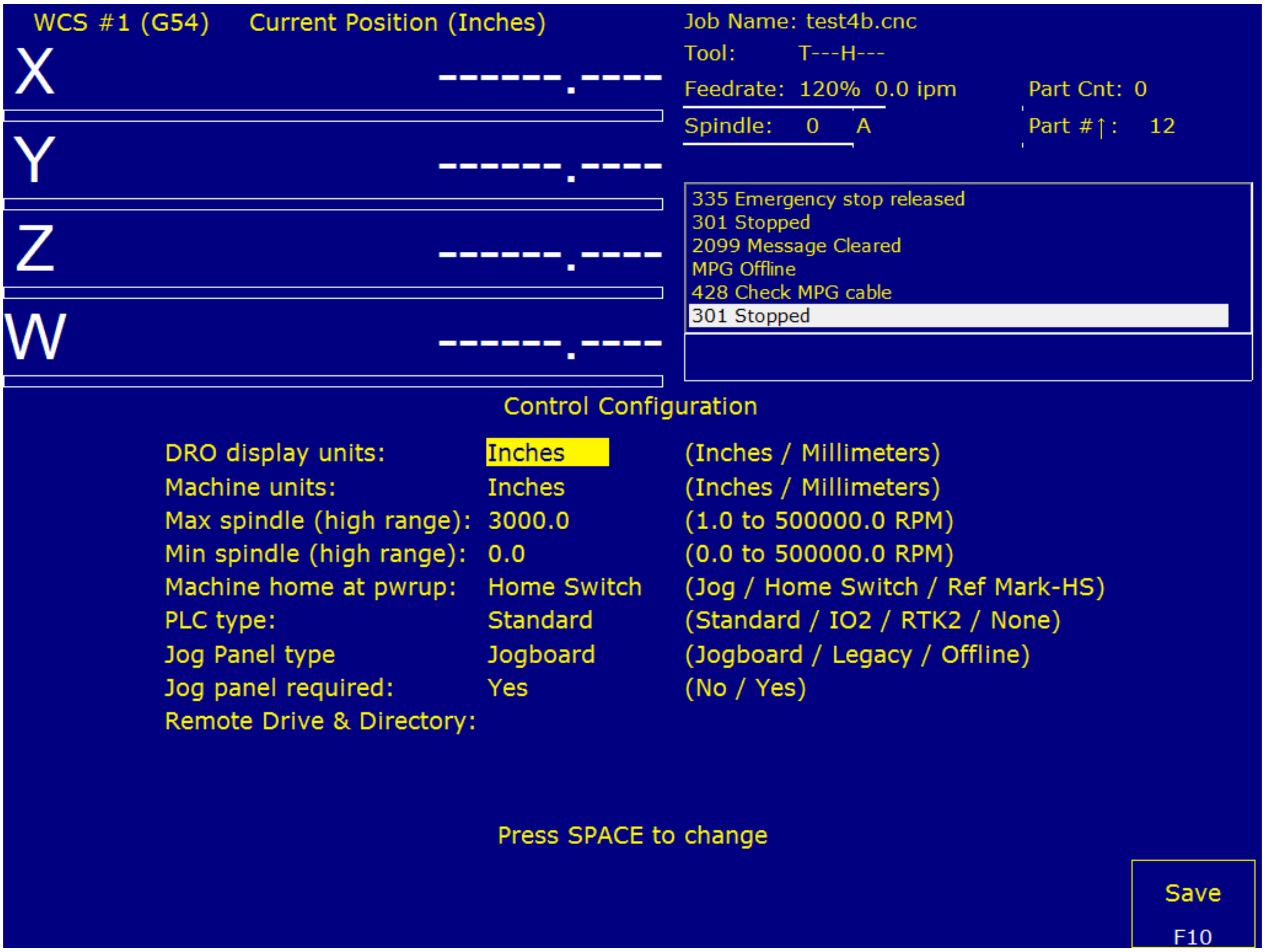


Figure 6.3.5
Direction reversal

6.4 Spindle Setup

From Main Screen **Setup (F1)** → **Config (F3) (Default Password = 137)** → **Contrl (F1)**



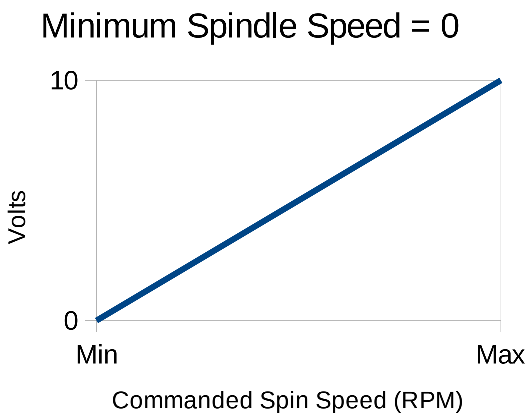
The Control Configuration screen provides you with a method of changing controller dependent data.
If you wish to change a field, use the up and down arrow keys to move the cursor to the desired field. Type the new value and press <ENTER>. When you are done editing, press <F10> to save any changes you have made. If you wish to discard your changes and restore the previous values, press <ESC>.

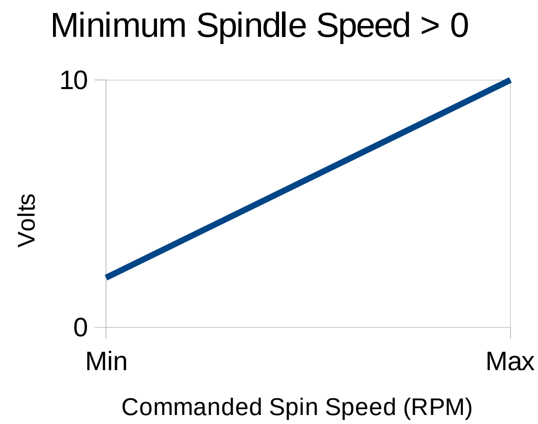
Maximum Spindle Speed (High Range)

This field sets the high range maximum spindle speed for those machines that have a variable frequency spindle drive (VFD). All spindle speeds entered in a CNC program are output to the PLC as percentages of this maximum value.
If your machine is equipped with a dual range spindle, see the Parameters 65-67 section below.

Minimum Spindle Speed (High Range)

This parameter sets the minimum spindle speed when in high range. If minimum spindle speed is set to a value greater than zero, the spindle voltage will output the minimum voltage equivalent until the commanded spindle speed is greater than the minimum spindle speed. The values stored can range from 0 to 500000.0 RPM.





Enabling The Spindle Fault Inputs

If the spindle fault circuitry is used, invert the spindle fault input (which was inverted during board level testing). In the main menu press alt + I to bring up the real time I/O display. Press the ctrl + alt + I keys simultaneously to remove any bars over the input in the display. This will enable the spindle inputs.

Enable Spindle Encoder Parameters

If a spindle encoder is being connected to the ALLIN1DC, modify the following parameters as specified in the CNC12 Operator's Manual.

Parameter	Description	
34	Spindle Encoder Counts/Rev	Dependent on Line Count of Spindle Encoder (Line x 4)
35	Spindle Encoder Axis Number	6
78	Spindle Speed Display and Operations	1

If the spindle is counting in the wrong direction, invert parameter 34. Example: Change Pr 34 = 4000 to Pr 34 = -4000

Parameters 65-67 – Spindle Gear Ratios

These parameters tell the control the gear ratios for a multi-range spindle. Up to four speed ranges are supported; high range is the default. Parameters 65-67 specify the gear ratio for each lower range, relative to high range. For example, if the machine is a mill with a dual range spindle, and the spindle in low range turns 1/10 the speed it turns in high range, then parameter 65 should be set to 0.1.

Parameter 65 is the low range gear ratio.
Note: Some machines use a Back Gear, if one is in use then the low range gear ratio will need to be a negative value.

Parameter 66 is the medium-low range gear ratio.

Parameter 67 is the medium-high range gear ratio.

These parameters work in conjunction with the PLC program, which uses the states of INP63 and INP64 to signal to the CNC10 software which range is in effect, according to the table below.

	High Range	Medium High Range	Medium Low Range	Low Range
INP63	0	1	1	0
INP64	0	0	1	1

6.5 Coarse Adjustment of DRO Position

(Coarse Adjustment of Machine Rev's Per Inch / MM)

NOTE: An alternative method is to use math to get a course estimation. This is described in the first part of **Technical Bulletin #36**, which can be found **here**. (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/36.pdf)

The value being displayed by the DRO screen is calculated from knowing how much the servo motor moved, and the motor revolutions per inch/mm (usually controlled by the ball screw). Before we can fine tune the DRO to an exact number, we need a course estimate to get us close.

Later in this chapter after tuning the servo motor, we will perform a fine adjustment on the motor revs/in (mm/rev for metric systems) to calculate an exact value.

1. **Jog the machine** Jog the machine so that the spindle is in the center of the table.

2. **Zero the software** From the main menu, press **F1 – Setup** → **F1 Part** → **F10 Set Zero** as shown below in Figure 6.4.1.

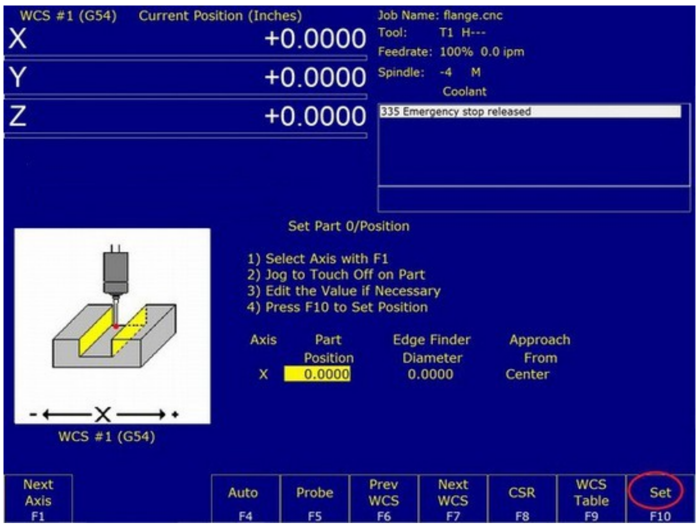


Figure 6.4.1
Setting Part Zero

3. **Set Up a Tape Measure on the Table** Set up a tape measure on the table so that 0" is lined up under the center of the spindle.

4. **Command the machine to move.** The longer the move the more accurate your final calculation will be. It is recommended that you move the machine at least 1 foot. Use the MDI command. From the main menu, press F3 MDI. If we were testing the X axis for example we could type "X 12".

    1. **WARNING**: Turn the feed rate down and be prepared to hit E-stop. Since your limit switches have not been completely configured it is possible to crash the machine if it moves too far.

5. **Calculate the value** Enter into the servo motor parameters menu. From the main menu press **F1 -Setup → F3 Config**. The password is **137**, Press enter. Press **F2 Mach → F2 Motor**.

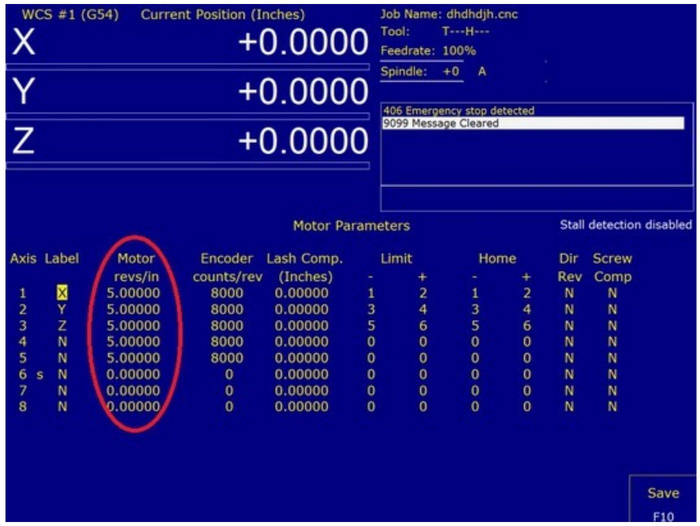


Figure 6.4.2
Adjusting motor revs/in or mm/rev

1. **Imperial Units** To calculate the value to be entered in the revs/inch field. Divide the distance moved (DRO value) by the distance that the axis actually moved (measuring tape). Multiply this result by the current value in the rev/inch field as circled in Figure 6.4.2.. This the new value that you will enter in the revs/inch field. If the axis traveled 6", but the command was 7.5" 7.5/6 = 1.25, if the current revs/inch is 5.000 * 1.25 = 6.25 is the new value to enter in the revs/inch field.

2. **Metric Units** To calculate the value to be entered in the mm's/revs field. Divide the distance that the axis actually moved (measuring tape) by the distance commanded (DRO value). Multiply this result by the current value in the mm's/rev field as circled in Figure 6.4.2. This the new value that you will enter in the mm's/rev field. If the axis traveled 150mm", but the command was 175mm, 150/175 = .85714, if the current mm's/rev is 5.08 * .85714 = 4.35428 is the new value to enter in the mm's/rev field.

6. Repeat the test as needed until the DRO matches the measuring tape.

7. Repeat the test for each axis.

6.6 Homing the Machine

This same procedure is outline in **Technical Bulletin #22**, the latest version can be found **here**.
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/22.pdf)

1. **Creating and Editing the Homing File**

   Your software comes with a default homing file that will work for most cases. If you have a machine with an unusual number of axes (such as a rotary table, CNC controlled grinder, CNC controlled drill press, extra lathe axes, etc..) or an unconventional limit switch configuration editing the home file will be necessary. If you do not need to edit your home file, skip to the next page.

   1. Exit CNC12.
   2. **Right click** on your **CNC12** desktop shortcut.
   3. Select **properties** as shown in Figure 6.5.1.
   4. In the shortcut tab, click on "**Open File Location**" as shown in Figure 6.5.2.
   5. Windows explorer will open up in a new window showing the contents of your CNC12 directory *(The directory will be called "CNCM" or "CNCT" depending on weather you have a mill or a lathe)*.
   6. If "***cncm.hom***" ("***cnct.hom***" for lathes) is present, double click on it. If not the file present, it will have to be created. To create this file, right click on **cncm** folder in the Windows File Explorer. (**cnct** for lathes). Select "**new**", then select "**text document**". A file will be created named "**New Text Document.txt**". Rename this file "**cncm.hom**" ("**cnct.hom**" for lathes).
      1. **TIP** Centroid recommends using Notepad++ as your default text editor. Notepad++ can be downloaded here. (http://notepad-plus-plus.org/)
   7. Edit the file as needed as seen in Figure 6.5.3. There should be the correct number of axes defined in this file, and they should be listed in the correct order.
      1. **Centroid recommends that the Z positive axis is always homed first to prevent damage to the machine!**
   8. Make sure to save any changes that you make.

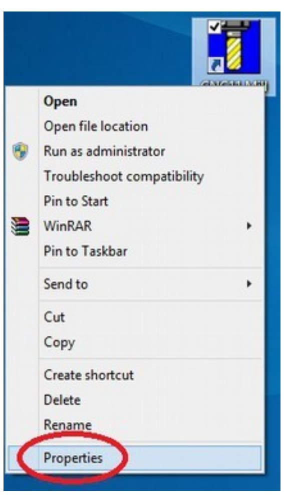


Figure 6.5.1
Steps 2 and 3

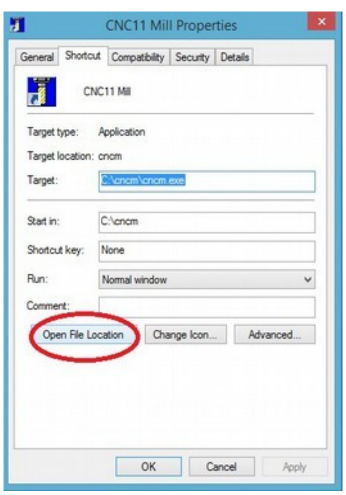


Figure 6.5.2
Step 4

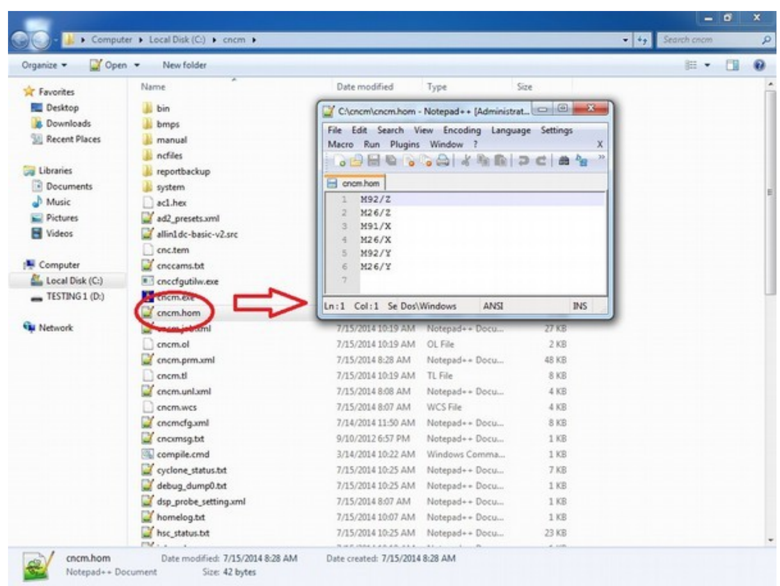


Figure 6.5.3
Steps 5, 6, and 7

2. **Start CNC12**

3. **Configure Limit Switches**

    1. **NOTE:** More information on Limit switches can be found in **Technical Bulletin #127**, which can be found here. (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/127.pdf)

    2. **Prerequisite:** The servo motor movement direction (discussed in Section 6.3) must be configured correctly before testing the limit switches! Move the machine so that the spindle is in the center of the table.

    3. **Enter the motor parameters menu.** From the main menu press **F1 -Setup** → **F3 Config**. The password is **137**, Press enter. Press **F2 Mach** → **F2 Motor**.

    4. Manually trip the minus limit switch for the X axis by physically pressing it / blocking it. Try to jog the machine. It should only move in the plus direction. If it does not, change the limit switch in software as shown below in Figure 6.5.4.

        1. **NOTE:** If you disabled the limit switches earlier by using ctrl+alit+I on inputs 1-6 (limit switches), you will need to re-enable them by pressing alt + I to bring up the I/O screen and ctrl + alt + I to “undo” and limit switch inputs with a bar above them.

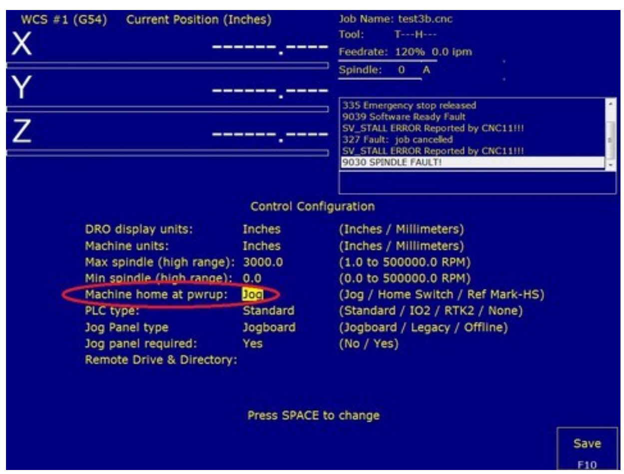
    5. Repeat the previous setup for each of the home switches.

Axis	Label	Motor revs/in	Encoder counts/rev	Lash Comp. (Inches)	Limit -	Limit +	Home -	Home +
1	X	2.000000000	8000	0.000000	1	2	1	2
2	Y	2.000000000	8000	0.000000	2	4	3	4

Figure 6.5.4
Reversing limit switches in software

4. **Change the home type** From the main screen press press **F1-Setup** → **F3 -Config.** The password is 137. Then press **F1 Control.** Using the keyboard space bar change “**Machine home at power up**” to “**Limit Switch**” as shown in 6.5.5.

Figure 6.5.5
Enabling homing off limit switches



5. **Restart the Machine**

6. **Home the Machine:** From the main menu. When the machine asks you to home, press “start” on the jog panel or “Alt+S” to home the machine. The machine should move slowly towards each jog switch.

    1. **DANGER:** Adjust the feedrate as needed so that the machine moves slowly. Be prepared to press E-stop if anything unexpected occurs.

    2. **NOTE:** If the machine stops homing and the main menu says “**Warning: Machine not homed**” a limit switch was pressed in the wrong order and the machine faulted out. Please check the order of your limit switches as shown above.

6.7 Tuning Maximum Feedrate

Exit to the main menu. Enter the maximum feed rate in the Jog Parameters menu (**F1 – Setup**, **F3 – Config,** Password 137**, F2 – Mach.**, and then **F1-Jog**.)

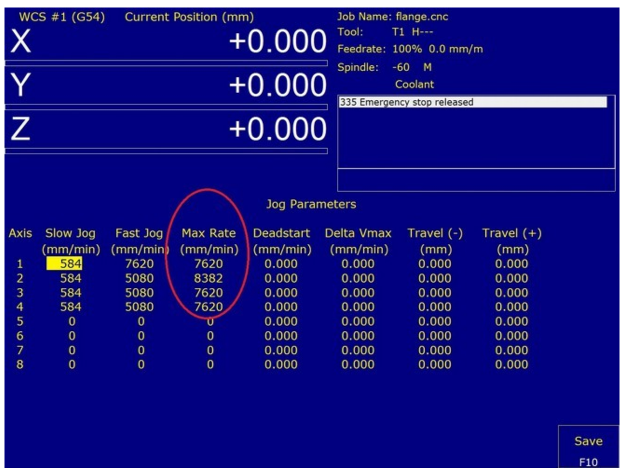
Use the following equation to get an estimation: **(maximum motor rpm / motor revolutions per inch) * 0.85 = maximum feed rate**.

The calculated maximum feedrate may be too high due to variations in supply voltage and load. Use MDI commands to test the calculated machine maximum feed rate. Gradually issue faster feed commands until the maximum is determined. If the machine is displaying the following symptoms the maximum feed rate is too fast and should be decreased:

- The load bar graph in the DRO display of the main menu is red, indicating excessive load on the motors
- The software is giving errors such as position errors.
- Motors are overheating.

Troubleshooting TIP: The autotune tool can can automatically adjust the maximum feed rate and acceleration for the servo motors. The autotune tool will set the servo motors to the maximum performance that they are capable off. In many cases, the machine can not handle the mechanical stress of running at such high speeds and acceleration rates. Therefore it is recommended that you do not use autotune, but manually tune the maximum feed rate and acceleration for best performance.

If you desire to go the autotune route, from the main menu autotune can be found at **F1- Setup** → **F3 – Config.** The password is **137. F4 – PID** → **F5 – Tune**.)



6.6.1
Adjusting maximum feed rate

6.8 Manually Tune the Acceleration

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. We are going to create a "worst case scenario" test program and manually decrease the acceleration until the machine starts to approach its limits.

Acceleration tuning is a fairly subjective process. What is 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.

Using the jog panel, move the machine so that the axes are in the middle of their travel. **Make sure the real time I/O display is <u>not</u> showing in the main menu** (press alt + I to toggle the real time I/O display). Check to make sure the machine feed rate override on the job panel/pendant is set to it's maximum value (typically 120%).

Creating a the Test Program From the main menu press **F1 – Setup → F3 – Config.** The password is 137. Press **F4 – PID → F1 – PID CONFIG → F1-Edit Program**. We are going to adjust **PID_Collection_Moves.txt** to test our acceleration values.

Adjust the Feedrate First, we need to adjust the feed rate of PID_Collection_Moves.txt so that it reflects the maximum feed rate calculated in the previous step. For example, if the maximum feedrate was calculated to be 500 inches per minute we would change the default program from "F100" to "F500.

Adjust the Movement Second, we need to adjust the movements of the test program. A "good" test program should generally move the machine as follows:

1. Wait stopped for 0.1 to 1 seconds
2. Accelerate the machine up to it's maximum speed
3. Run at maximum feed rate for 0.5 to 1 seconds
4. Decelerate from maximum feed rate to a compete stop
5. Wait stopped for 0.1 to 1 seconds
6. Accelerate to maximum speed again, but this time going the opposite direction
7. Run at maximum feed rate (going the opposite direction) going back to where the program started
8. Decelerate from maximum feed rate to a compete stop
9. Repeat at step 1

A sample mill program is below:...

```
G20; Inch mode
G90; Absolute positioning mode
F500; Set the feedrate to the maximum feedrate
G4 P0.5; Delay for 0.1 second
G1 X0.0; Move to our starting position
G4 P0.5; Delay for 0.1 second
G1 X3; Execute a short move. We want this move to allow the machine to reach maximum speed for 0.5 -1 seconds.
G4 P0.5; Delay for 0.1 second
M102; Rerun the program, repeating infinately
```

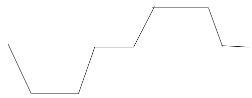
Save your changes to the program when you are finished editing it. **Press F2-Run Program** to test out your changes. Press **F7 – Zoom All** to get a clearer graph on the right side of the screen. If done correctly, your program will look similar to the Figure 6.7.1 on the next page.

Troubleshooting Tip: The program is suppose to run infinitely. If the screen says "**Finished Running Program**" or if no motors are moving exit to the main menu. There is likely an error on the status menu.

What's going on here?

"**VAbs**" and "**ErrAbs**" are the only values we care about while adjusting acceleration.

Vabs: (graphed in green on Figure 6.7.1) is the velocity of the motor. The Y axis indicates how fast the motor is going. A large positive number corresponding to a fast movement in the positive direction, a large negative number corresponding to a fast moment in the negative direction, and a zero value indicates that the axis is not moving. A "slope" indicates that the motor is accelerating, where as a straight line indicates no acceleration. If you program is adjusted correctly the Vabs graph should look similar to this:



ErrAbs: (orange in Figure 6.7.1). The Y axis indicated the amount of error position of the servo motor measured in encoder counts. The "**Value**" column next to **ErrAbs** indicates the error in inches or mm. In the figure below the error is 0.00003". It is impossible to have an error of zero. The error should be acceptable (15 encoder counts is typical) before continuing with acceleration tuning. If the error is excessive, manually tuning of the PID loop will have to be performed.

How To Tune

1. **Run the test program**
    1. Check that:
        1. The ErrAbs is showing an acceptable amount of error (typically over 15 encoder counts).
        2. The acceleration rate is not causing shock or vibration as the machine moves.
        3. The machine movement is not becoming becomes bumpy, rough, or jerky.
        4. The machine is not creating unusual or loud noises such as thunks or rapping noises.
        5. The software is not giving errors such as position errors.
    2. If any of these problems are showing acceleration rate is too fast, stop the test program. Slightly decrease the acceleration rate (by increasing the accel value). Run the test program again. If the problem goes away you are at your maximum acceleration value.
    3. If no problems are found, stop the test program. Increase the acceleration rate (by decreasing the acceleration time). Repeat process.
    4. Repeat the process for each axis by editing PID_Collection_Moves.txt

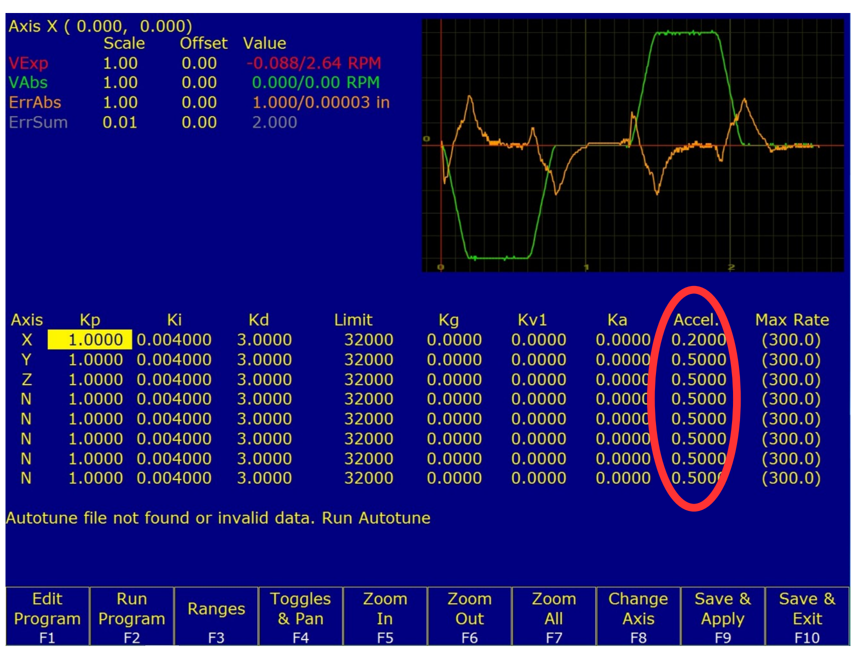


Figure 6.7.1
Acceleration tuning

6.9 Fine Adjustment of DRO Position

(Fine Adjustment of Machine Rev's Per Inch / MM)

This method is also described in Method 2 of **Technical Bulletin #36**, the latest version can be found **here**. (http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/36.pdf)

Relevant martyscncgarage video: Fine DRO Adjustment & Measuring Overall Turns Ratio

For **imperial** machine configurations the number of motor revolutions required to move 1” must be calculated.

For **metric** machine configurations the number of mm's traveled during one revolution of the motor must be calculated.

3. **Attach a dial indicator:** Attach a dial test indicator *(also known as a lever arm test indicator or a finger indicator)* to the spindle.
    1. **NOTE**: If you purchased a probe from Centroid, there is an easier method of adjusting the DRO position. Use of the probe will not be covered in this document.
4. **Create a Test Fixture:** Create an “L” shaped block of material to act as a reference for measurement as seen in Figure 6.8.1. The material should be appropriately 6 inches to 12 inches in length. A longer material will give you better accuracy. The **exact** length of the “long” part of the “L” needs to be known. A gauge block attached to another gauge block is recommended. An example test fixture is shown below.

The long part of the “L” is from is guage block measuring 12.000”

Figure 6.8.1
Example test fixture

5. **Secure the test fixture** Attach the test fixture to your machine so that it runs parallel to the axis being tested.
6. **Move the dial indicator into position:** Start from away from the block and jog towards the top of the “L”. Set jog panel mode to incremental when you get close. Move the spindle so that the dial indicator is reading as close to “0” as possible as demonstrated in Figure 6.8.2.
    1. **NOTE:** Only jog towards the block. If you jog too close and have to back up slightly, backlash will be introduced into your measurement. In that case you will have to start the test again.

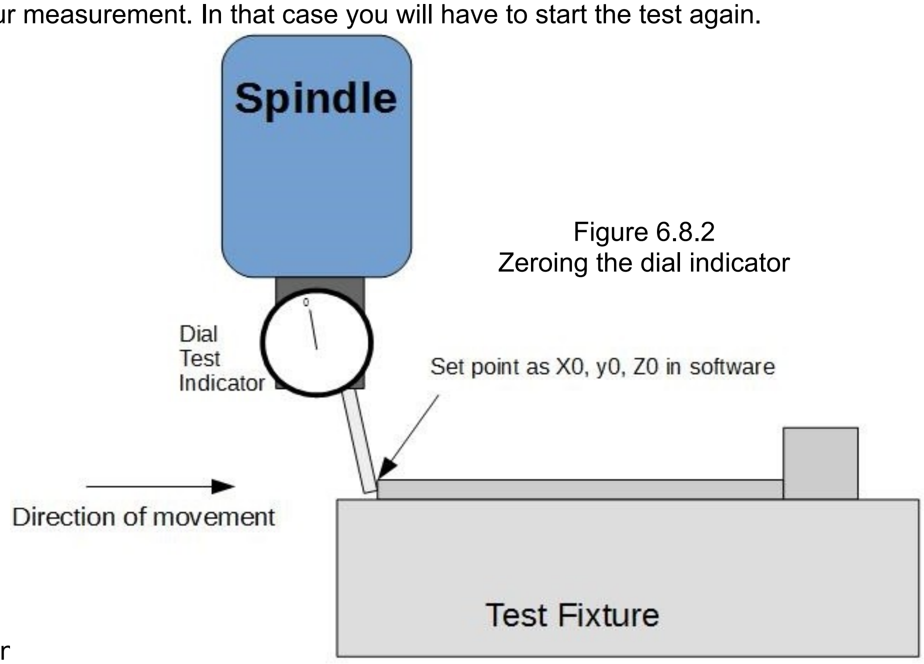


Figure 6.8.2
Zeroing the dial indicator

7. **Zero the software** From the main menu, press **F1 – Setup** → **F1 Part** → **F10 Set Zero** as shown below in Figure 6.8.3.

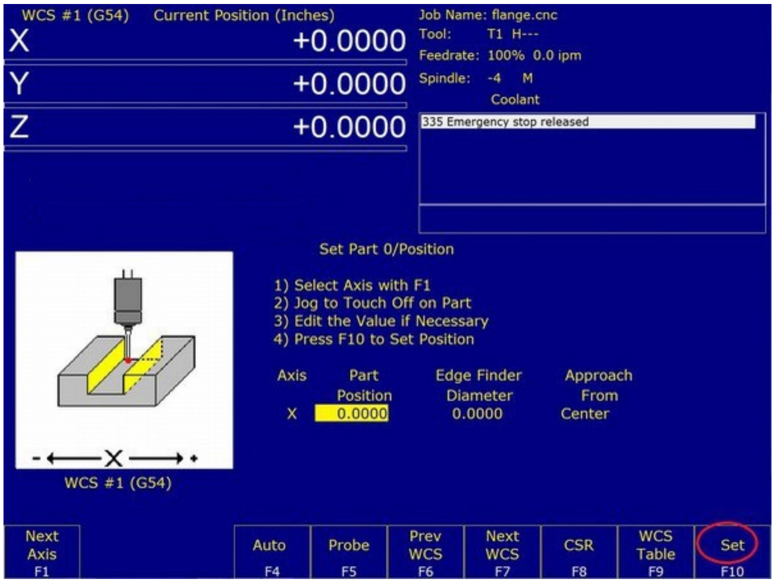


Figure 6.8.3
Setting part zero

8. **Raise the spindle:** Move the spindle so that it is away from the text fixture. If we are configuring the X or Y axes we need to the raise the Z-axis.

9. **Move to the base of the "L":** Jog towards the base of the "L". Set jog panel mode to incremental when you get close. Move the spindle so that the dial indicator is reading as close to "0" as possible as shown in Figure 6.8.4.

    1. **NOTE:** Only jog towards the block. If you jog too close and have to back up slightly, backlash will be introduced into your measurement. In that case you will have to start the test again.

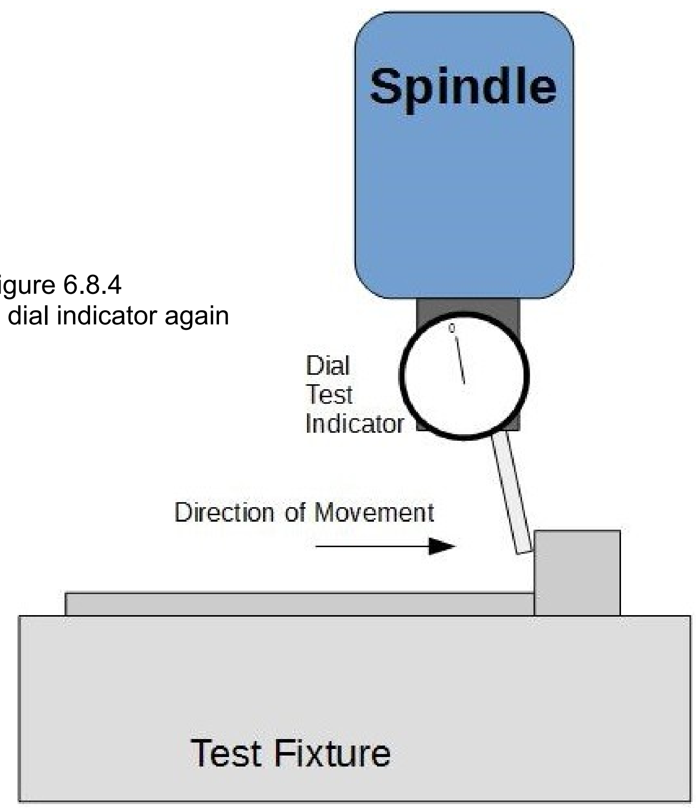


Figure 6.8.4
Zeroing the dial indicator again

10. **Calculate Values:** Go into the motor parameters menu. From the main menu press **F1 -Setup → F3 Config**. The password is **137**, Press enter. Press **F2 Mach → F2 Motor**.

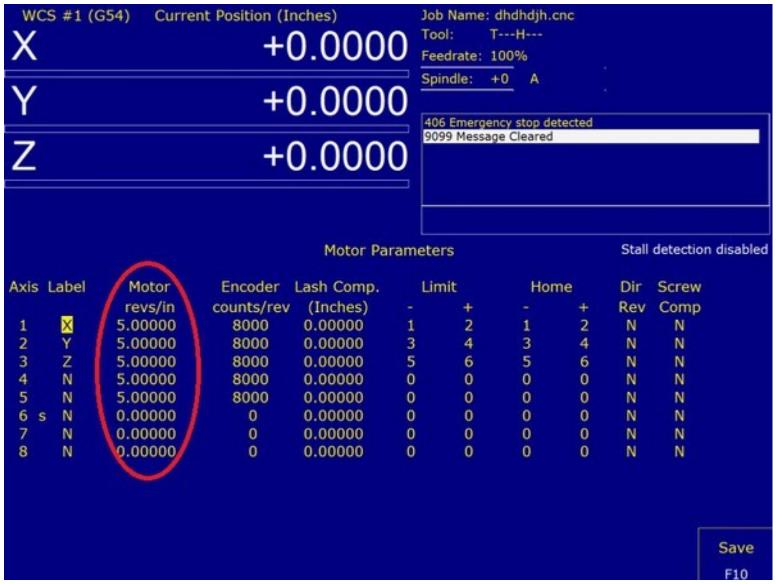


Figure 6.8.5
Fine adjustment of motor res/in or mm/rev

1. **Imperial Units:** To calculate the value to be entered in the revs/inch field. Divide the distance moved (DRO value) by the distance that the axis actually moved. Multiply this result by the current value in the rev/inch field. This the new value that you will enter in the revs/inch field. If the axis traveled 6”, but the command was 7.5” 7.5/6 = 1.25, if the current revs/inch is 5.000 * 1.25 = 6.25 is the new value to enter in the revs/inch field.

2. **Metric Units:** To calculate the value to be entered in the mm's/revs field. Divide the distance that the axis actually moved by the distance commanded (DRO value). Multiply this result by the current value in the mm's/rev field. This the new value that you will enter in the mm's/rev field. If the axis traveled 150mm”, but the command was 175mm, 150/175 = .85714285, if the current mm's/rev is 5.08 * 0.85714 = 4.35428 is the new value to enter in the mm's/rev field.

11. Repeat the test as needed until the DRO measures the same as the gauge block.

12. Repeat the test for each axis.

6.10 Backlash Compensation

This same procedure is outlined in **Technical Bulletin #37**, the latest version can be found here.
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/37.pdf)

1. **Adjust Mechanical Lash:** **Before** configuring the "electronic" backlash compensation in the control, every effort should be made to reduce the mechanical lash in your machine to less than **0.001**". (Use the test below to verify your backlash is less than 0.001). The electronic backlash compensation provided by the control will help, especially in point to point moves, but the overall accuracy of your machine is determined purely by the amount mechanical lash in the machine.

2. **Attach a dial indicator:** Attach a dial test indicator *(also known as a lever arm test indicator or a finger indicator)* to the spindle.

    1. **NOTE**: If you purchased a probe from Centroid, there is an easier method of performing this test. Use of the probe to perform software backlash compensation will not be covered in this document.

3. **Zero Previous Backlash Values:** Enter into the motor parameters menu. *(From the main menu press **F1 Setup** → **F3 Config**. The password is **137**, Press enter. Press **F2 Mach** → **F2 Motor**.)* Zero out any backlash that was previously entered into the control.

4. **Secure a Test Fixture:** Mount a piece of metal to the machine to act as a reference. A gauge block recommended. You may re-use the test fixture you created for configuring your motors to move the correct distance.

5. **Move the dial indicator into position:** Start from away from the block and jog towards it. Set jog panel mode to incremental when you get close. Move the spindle so that the dial indicator is reading as close to "0" as possible as demonstrated in Figure 6.9.1.

    1. **NOTE:** Only jog towards the block. If you jog too close and have to back up slightly, backlash will be introduced into your measurement. In that case you will have to back way up and start again.

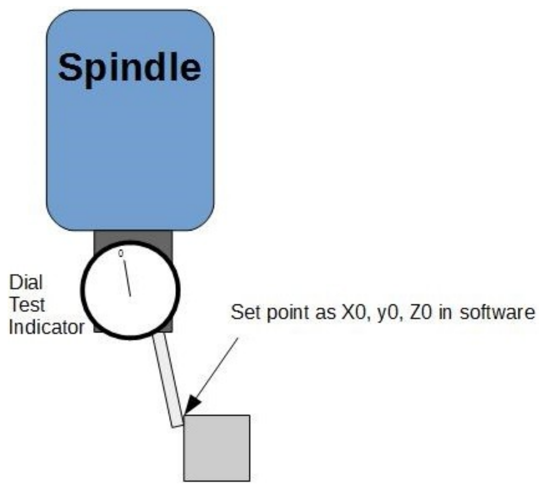


Figure 6.9.1
Zeroing the dial indicator

6. **Zero the software** From the main menu, press **F1 – Setup** → **F1 Part** → **F10 Set Zero** as shown below in Figure 6.9.2.

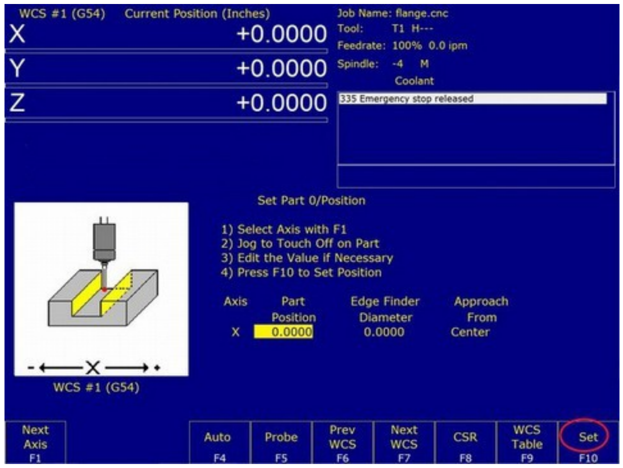


Figure 6.9.2
Setting part zero

7. Back the spindle 0.025 away from the gauge block at a feedrate of 0.5 inches per minute. This can be done by using the MDI menu (F3 from the main menu) and typing "**G1 X- 0.025 F0.5**" for the X axis.

   1. **NOTE:** Is is important that you use extremely slow feedrates. Faster feedrates will introduce inconsistencies due to the inertia of the table.

8. Move the axis back to the zero position. Type "**G1 X0 F.5**" in the MDI screen.

9. If the number is less that 0.001", enter the value shown into the "**Lash Compensation**" section of the motor parameters menu as shown below in Figure 6.9.3. (from the main menu press **F1 Setup** → **F3 Config**. The password is **137**. Press **F2 Mach**. → **F2 Motor**.) If the number is greater than 0.001", there is a mechanical accuracy problem with your system. Reduce the mechanical lash before adjusting the backlash compensation.

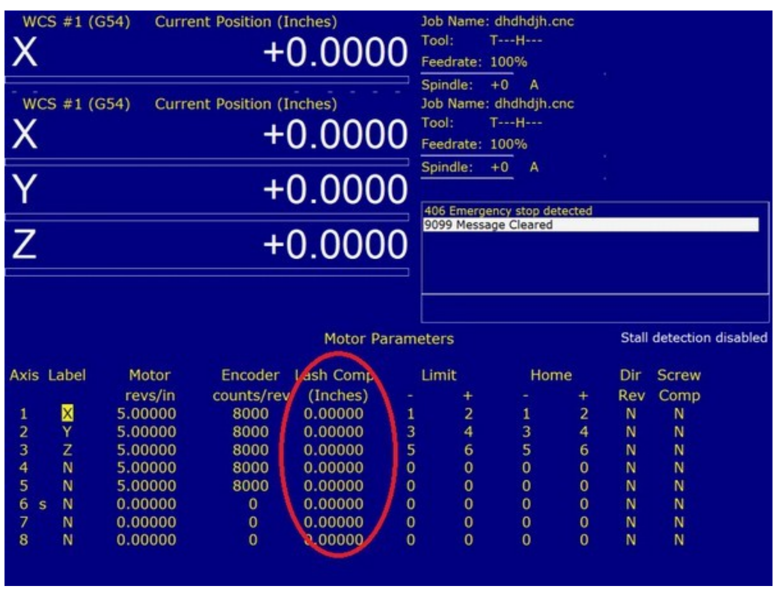


Figure 6.9.3
Adjusting backlash compensation

6.11 Software Travel Limits

This information is also contained in **Technical Bulletin # 289**, the latest version can be found **here**.
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/289.pdf)

Relevant martyscncgarage video: Setting Software Travel Limits

NOTICE: Without software travel limits the machine can go maximum speed until a limit is tripped as shown in Figure 6.10.1. Often times, there is not enough time to decelerate the axis after the limit switch is tripped causing the machine to crash into the hard stop. **This collision may cause serious damage to the damage to both the mechanical and electrical system.**

Setting software travel limit will automatically decelerate the axis right before it reaches the limit switch, preventing possible damage to the machine as shown in Figure 6.10.2. Additionally, the CNC12 software will throw an error and stop the machine if a G code requests the machine to move past the software travel limit.

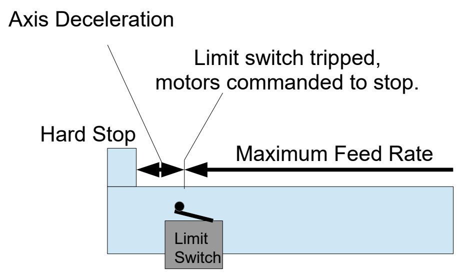


Figure 6.10.1
Machine without software travel limits.

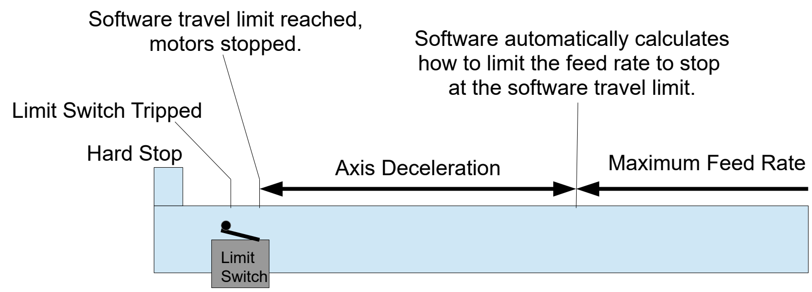


Figure 6.10.2
Machine with software travel limits.

1. **Prerequisites:** Before starting machine revs per inch / mm (DRO) needs to be calibrated correctly, the limit switches need to be functioning, and the maximum feed rate and acceleration should be correctly set up. Restart the machine and home it before continuing with this procedure.

2. Make sure your looking at the machine position and not the part position. From any menu, press the "**alt**" key and "**D**" key simultaneously until "**machine**" is displayed in the top left corner of the DRO as shown in Figure 6.10.3.

3. Put the machine into "**Slow jog**" mode and turn the feed rate **down**. Slowly moves the axis away from home toward the limit switch on the opposite end of the axis until the limit switch trips. The status screen will display message such as "**407 ## limit (#50004) tripped**".

4. Put the jog panel into **incremental mode**. Slowly increment to away from the limit switch until the limit switch is cleared. The status screen will display a message such as "**340 ## limit (#5003) cleared**".

5. From the main menu, press **F3 MDI** and issue a command to move another 0.1 inches (2.5 millimeters) away from the limit switch. This DRO position will be our software travel limit.

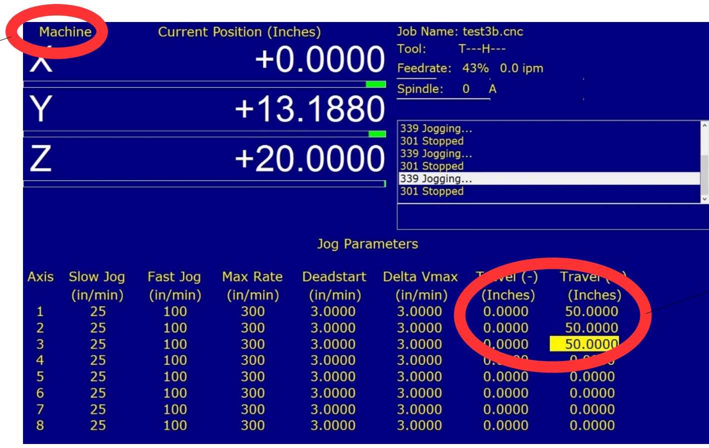
6. From the main menu, press **F1 – Setup** → **F3 - config**. The password is **137**. Press **F2- Mach.** → **F1-Jog**. In the jog parameters menu. Enter the position for the software travel limit into the appropriate "**Travel (-)**" or "**Travel (+)**" box.

    1. **NOTE:** When both the Travel(-) limit and the Travel(+) limit are set to zero, software travel limits are disabled. As soon as **one** of the two values change to a non-zero value, **both** limits are enabled. This can be seen in figure 6.10.3. Since everything is referenced to machine position, the side of each axis that you "home to" should be left at zero.

7. Repeat for each axis.

8. Test by manually jogging each axis toward the limit switch. Watch that the software automatically stops the axis at the software travel limit **before** the limit switch is tripped. Use the **F3 – MDI** menu to issue a G-code that asks the software to move just beyond the software travel limit, if set up correctly the CNC12 status window will throw an error such as "**907 # axis travel exceeded, 325 Limit: job canceled**"

"alt" + "D" to toggle the DRO mode to display the machine cordinates.



Set up software travel limits here.

Figure 6.10.3
Setting Software Travel Limits

6.12 Deadstart

Deadstart is located in the jog parameters menu and has to do with direction reversal of an axis. The deadstart usually doesn't have to be changed from the default value on a Milling machine. Sometimes very light wood routing tables with very low friction and low inertia can benefit from a deadstart change along with other "hand tuning." Call in if you have this case.

6.13 Performing a System Test

In some versions of CNC12 software, when finished, the main menu will display a message saying *"**Machine Setup Not Completed. Machine Is Not Ready To Run. Contact Your Dealer**"* as shown below.

At this point you will need to run the **System Test** to clear this message. Documentation on how to perform a system test is detailed in Tech Bulletin 327.

The following video by martyscncgarage is also a useful reference Centroid CNC System Test

If the instructions outlined in system test do not apply to your system, contact technical support.

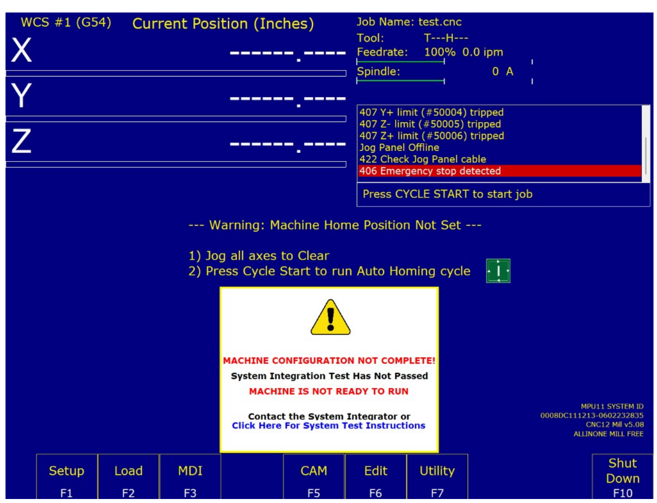


Figure 6.12.1
Machine Requiring a System Test

CHAPTER 7
APPENDICES

Appendix A – Windows 10 Configuration

This procedure is outlined in Technical Bulletin #309. the latest version can be found here:
http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/309.pdf

martyscncgarage: Centroid Acorn CNC Basics - Win 10 PC Setup and benchtest

Centroid CNC Technical Support: Windows 10 configuration for use with Centroid CNC software and hardware

Status LED Troubleshooting

(See Section 4.2 for a description of the LEDs and where they are located)

Symptom	Possible Cause	Corrective Action
All status LEDs are out	Logic power not applied	Measure the AC power coming into the logic supply. Measure the DC power going out of the logic supply. Check the logic power wiring.
Some (but not all) of the status power LEDs are out. (+3.3V, +5.0V, +12.0V, or -12.0V LED are out.)	Power supply failure or wiring problem.	
Analog +12.0V or Analog -12.0V LEDs out.	Loss of power to the analog section of the ALLIN1DC.	If the other LEDs are lit (+3.3V, +5.0V, +12.0V, and -12.0V), the analog section is most likely damaged. Return for repair.
FPGA OK LED not lit	ALLIN1DC not ready or internal fault	Wait for ALLIN1DC to start and enter run mode. If after 1 minute the ALLIN1DC does not enter run mode, then a hardware failure is likely. Return for repair.
DSP OK LED not lit	ALLIN1DC is booting up.	Wait for the ALLIN1DC to detect hardware and start run mode.
DSP Debug LED is flashing fast	ALLIN1DC is detecting hardware	Waiting for the ALLIN1DC to finish detecting hardware and enter run mode.
DSP Debug LED is flashing one time per second.	Using MPU11 drive protocols	None.
DSP Debug LED is flashing two times per second.	Using Legacy drive protocols.	Internal fault. Return for repair.
Drive Fault LED is out	The drive fault relay is open (see section 4.1, 5.3, and 5.6 for details). The ALLIN1DC is not able to communicate with the PC or a drive fault was detected.	Confirm that the ALLIN1DC can communicate with the PC by toggling an input (such as E-stop). If the input was not detected by the PC, then it is a communication error. If input was detected correctly, press MDI and check the status menu of the software for errors.
PLC OK LED is out	The motion control procession has not booted.	Restart the CNC12 software and wait for the main screen to load. If the PLC OK LED is still out, return for repair.
LED1 is displaying a flashing number with a decimal point.	See the table below.	See table below

LED1 (Seven Segment Display) Troubleshooting

(See Section 4.2 for a description of the LEDs and where they are located)

Error Number	Meaning	Cause	Corrective Action
1	Power Failure (Revision 100315 and earlier only)	The logic power supply is indicating to the ALLIN1DC that is operation out of specification.	Check power supply wiring. Replace power supply.
2	15A Not Available	The current select switches on any axis are set to 15A, but the drive is not equipped with the appropriate FETs for long term use at 15A, so the drive will drop back to 12A	Select 12A or lower current settings or use a normal ALLIN1DC.
3	Null Error	The self adjustment routine has detected too large an offset on the current feedback. Usually indicates a failure of the ALLIN1DC's current sensors.	Send the drive back for repair.
4	Limit Tripped	Any limit switch is tripped.	Move away from the limit, check limit switch wiring, or use limit defeat switch if a limit switch is not required.

Misc Troubleshooting

Symptom	Possible Cause	Corrective Action
Input does not work with a 3-wire sensor	Voltage drop across sensor is too high.	Voltage drop across sensor is too high.
When attempting to move the motor getting "Full Power Without Motion" error.	CNC12 is unable to see the encoder move when the software orders the motor to move.	Make sure the correct encoder is plugged into the correct axis. Make sure the axis and encoders are assigned correctly in software (Parameters 300-315). Check for blown fuses. Check for the motor polarity being reversed or the encoders counting the wrong direction. Check encoder wiring.

Additional ALLIN1DC Problems and Common Solutions

Troubleshooting General Problems

Motor doesn't move and there is no error or fault. See **Technical Bulletin #285**
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/285.pdf)

No power to the drive VM terminals when E-Stop is released. See **Technical Bulletin #286**.
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/286.pdf)

Encoders not counting or DRO not updating. See **Technical Bulletin #281**
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/281.pdf)

Troubleshooting Software Errors

"Jog Panel Communication Fault" errors. See **Technical Bulletin #282**
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/282.pdf)

"Quadrature errors" or "Differential Encoder errors". See **Technical Bulletin #280**
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/280.pdf)

"**Error Initializing MPU 11**". See **Technical Bulletin #279**
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/279.pdf)
and TB309 https://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/309.pdf

"PC Data Receive Errors". See **Technical Bulletin #270**
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/270.pdf)

Accuracy Problems

Accuracy problems with the DRO display of the machine. See sections 6.7 and 6.8.

ALLIN1DC Settings for 3rd Party Servo Motors

This information is also contained in **Technical Bulletin #288** contained **here**:
(http://www.centroidcnc.com/dealersupport/tech_bulletins/uploads/288.pdf)

Current Settings for 3rd Party Motors

<table>
<tr><th rowspan="2">Motor Constant Current Rating
or
Motor Constant Stall Rating</th><th colspan="4">Recommended ALLIN1DC Current Setting</th></tr>
<tr><th>6</th><th>9</th><th>12</th><th>15</th></tr>
<tr><td>3 Amps</td><td rowspan="2">Recommended</td><td rowspan="2">Maximum Current</td><td rowspan="2" colspan="2">Not Recommended</td></tr>
<tr><td>4 Amps</td></tr>
<tr><td>5 Amps</td><td rowspan="2">Good Performance</td><td rowspan="2">Recommended</td><td rowspan="2">Maximum Current</td><td rowspan="2">Not Recommended</td></tr>
<tr><td>6 Amps</td></tr>
<tr><td>7 Amps</td><td rowspan="2">Not Recommended</td><td rowspan="2">Good Performance</td><td rowspan="2">Recommended</td><td rowspan="2">Maximum Current</td></tr>
<tr><td>8 Amps</td></tr>
<tr><td>9 Amps</td><td rowspan="2" colspan="2">Not Recommended</td><td rowspan="2">Good Performance</td><td rowspan="2">Recommended</td></tr>
<tr><td>10 Amps</td></tr>
<tr><td>11 Amps</td><td rowspan="5" colspan="3">Not Recommended</td><td rowspan="5">Good Performance

“AC/DC 30” recommended</td></tr>
<tr><td>12 Amps</td></tr>
<tr><td>13 Amps</td></tr>
<tr><td>14 Amps</td></tr>
<tr><td>15 Amps</td></tr>
<tr><td>16 Amps or more</td><td colspan="4">Not Recommended, use “AC/DC 30” or “AC/DC 60” drive</td></tr>
</table>

Current setting limited by swtich1 as described in section 5.5

Not Recommended – The ALLIN1DC will provide too much or too little power to the motor.

Good Performance – The ALLIN1DC will provide good acceleration and good peak torque to the motors.

Recommended – Centroid recommended settings. Most likely to provide the best a balance between performance and motor heating.

Maximum Current – The ALLIN1DC will provide maximum acceleration and maximum peak torque to the motors. Motor could overheat!

Motor tuning: CNC12 software supports velocity, torque, and precision mode. The ALLIN1DC is designed to run only in torque mode. Make sure the ALLIN1DC is set to torque mode pressing Setup (F1) → Config (F3) (Password 137) → Parms (F3). Repeatedly hit Next Table (F8) to bring up parameter 256. Parameter 256 should be set to 0.

Enter PID parameters into the PID menu by pressing **Setup (F1) → Config (F3) (Password 137) → PID (F4) → PID Config (F1)**. This is explained in section 6.3.Parameter 256 should be set to 0. Kp = 1.00, Ki = 0.004, Kd = 3.0. This is subject covered in more detail in section 6.3.

Settings for Centroid and Fanuc Servo Motors

Stock Centroid Servo Motors								
Name	Model	ALLIN1DC Current Setting (Switch1)	Torque Mode PID Parameters				Maximum RPM	Maximum Bus Voltage
			Kp	Ki	Kd	Limit		
Glentek 10 in-lb	GM3320-22	6 Amps	0.50	0.004	0.5	32,000	4,650	180 VDC
Glentek 16 in-lb	GM3340-30	9 Amps	1.00	0.004	2.0	32,000	3,200	180 VDC
Redcom 17 in-lb	82SYXB-17	9 Amps	0.50	0.004	1.0	32,000	2,300	120 VDC
Glentek 29 in-lb	GM4030-41	12 Amps	1.00	0.004	3.0	32,000	3,500	180 VDC
Glentek 40 in-lb	GM4050-60	15 Amps	1.00	0.004	3.0	32,000	2,200	180 VDC

<table>
<tr><th colspan="10">Fanuc Retrofit Servo Motors[1]</th></tr>
<tr><th rowspan="2">Family</th><th rowspan="2">Name</th><th rowspan="2">Model</th><th rowspan="2">ALLIN1DC Current Setting (Switch1)</th><th rowspan="2">Maximum Bus Voltage</th><th colspan="4">Torque Mode PID Parameters</th><th rowspan="2">Maximum RPM</th></tr>
<tr><th>Kp</th><th>Ki</th><th>Kd</th><th>Limit</th></tr>
<tr><td rowspan="2">Black End Caps</td><td>Black Cap 00</td><td>A06B-0631-B0xxx</td><td>12 Amps</td><td rowspan="2">See motor nameplate</td><td rowspan="5">1</td><td rowspan="5">0.004</td><td rowspan="5">3.0</td><td rowspan="5">32,000</td><td rowspan="5">2,000</td></tr>
<tr><td>Black Cap 0</td><td>A06B-0613-B0xx</td><td>15 Amps</td></tr>
<tr><td rowspan="3">Yellow End Caps</td><td>Yellow Cap 00M</td><td>A06B-0632-Bxxx</td><td>9 Amps</td><td>50 VDC</td></tr>
<tr><td>Yellow Cap 0M</td><td>A06B-0641-Bxxx</td><td>12 Amps</td><td>90 VDC</td></tr>
<tr><td>Yellow Cap 5M</td><td>A06B-0642-Bxxx</td><td>15 Amps</td><td>150 VDC</td></tr>
</table>

1. **Fanuc Retrofit Servo Motors** – See the Fanuc Retrofits Installation Manual for more details. Using an AC/DC30 guarantees maximum acceleration and maximum peak torque with the Fanuc Black Cap 0 and Yellow Cap 5M. Fanuc motors larger than a Fanuc Black Cap 0 and Yellow Cap 5M are compatible with the ALLIN1DC, but would have a very noticeable decrease in the acceleration rate and peak torque. Keep in mind that if different types of Fanuc motors are used, they will all have to run at the same bus voltage.

Definition of terms used in the above tables

Switch1 – Referring to the current limiting switch SW1. Explained in more detail in section 5.5.

Torque Mode – CNC12 supports velocity, torque, and precision mode. The ALLIN1DC is designed to run only in torque mode. Make sure the ALLIN1DC is set to torque mode pressing Setup (F1) → Config (F3) (Password 137) → Parms (F3). Repeatedly hit Next Table (F8) to bring up parameter 256. Parameter 256 should be set to 0.

PID Parameters – Enter PID parameters into the PID menu by pressing Setup (F1) → Config (F3) (Password 137) → PID (F4) → PID Config (F1). This is subject covered in more detail in section 6.3.

Maximum RPM – This information is provided for reference only. Do not use the maximum RPM parameters (357-364) to limit the speed of your drive. Use the maximum jog rate to limit the speed of your drive. Set the maximum jog rate by pressing Setup (F1) –> Config (F3) (Password 137) → Mach. (F2) → Jog (F1). Enter the maximum rate under “Max Rate”.

Heating and Cooling Parameters for Servo Motors

Fanuc and 3rd Party Servo Motors

Heating and cooling parameters are not available for third party motors. The table below contains suggested values used for Centroid motors. Find the motor that is closest to your motor. Set the parameters as described below.

Since the temperature coefficients we used are the "best guess" based on your torque rating, it is necessary to run the machine at maximum feed rate and acceleration using a test program then physically measure the surface temperature of the servo motors. Make sure the servo motors do not overheat. Adjust the heating and cooling coefficients if needed to get an accurate temperature estimation.

If the motor occasionally overheats, adjust the values for feedrate and acceleration as needed to prevent the motor from overheating.
If the motor consistently overheats, turn the current limit down one setting using Switch1.

Centroid Servo Motors

Centroid servo motors have heating and cooling temperature coefficients that allow CNC12 to estimate the temperature of the motor. Enter the suggested values into the indicated parameters.

Servo Drive Model		16 / 17 in-lb Switch1 set to 9	29 in-lb Switch1 set to 12	29 in-lb Switch1 set to 15	40 in-lb Switch1 set to 15
Parameter	**Axes**	**Value**	**Value**	**Value**	**Value**
21-24 [1]	1-4	0.028	0.02	0.027	0.03
25-28 [2]	1-4	0.68	0.68	0.68	0.68
20 [3]	Applies to all axes	72 / 22	72 / 22	72 / 22	72 / 22
29 [4]		150 / 65	150 / 65	150 / 65	150 / 65
30 [5]		180 / 82	180 / 82	180 / 82	180 / 82

1. **Parameters 21-24** – These are the servo motor heating coefficients. A higher number will cause the CNC12 software to "estimate" the motors temperature to be a higher temperature while the motor is under load.

2. Parameter 25-28 – These are the motor cooling coefficients. A higher number will cause the CNC12 software to "estimate" that the motor has cooled off quicker while not under load.

3. Parameter 20 – Set to the "average" ambient temperature of the machine shop during a hot day. On system using inches as the default units, this defaults to 72ºF. On systems using millimeters as the default units, this defaults to 22ºC.

4. Parameter 29 – Set to the temperature at which the CNC12 software should display the "**motor overheat warning**" software message. Using Centroid motors with inches as the default units, this setting defaults to 150ºF. Using Centroid motors with millimeters as the default units, this setting defaults to 65ºC.

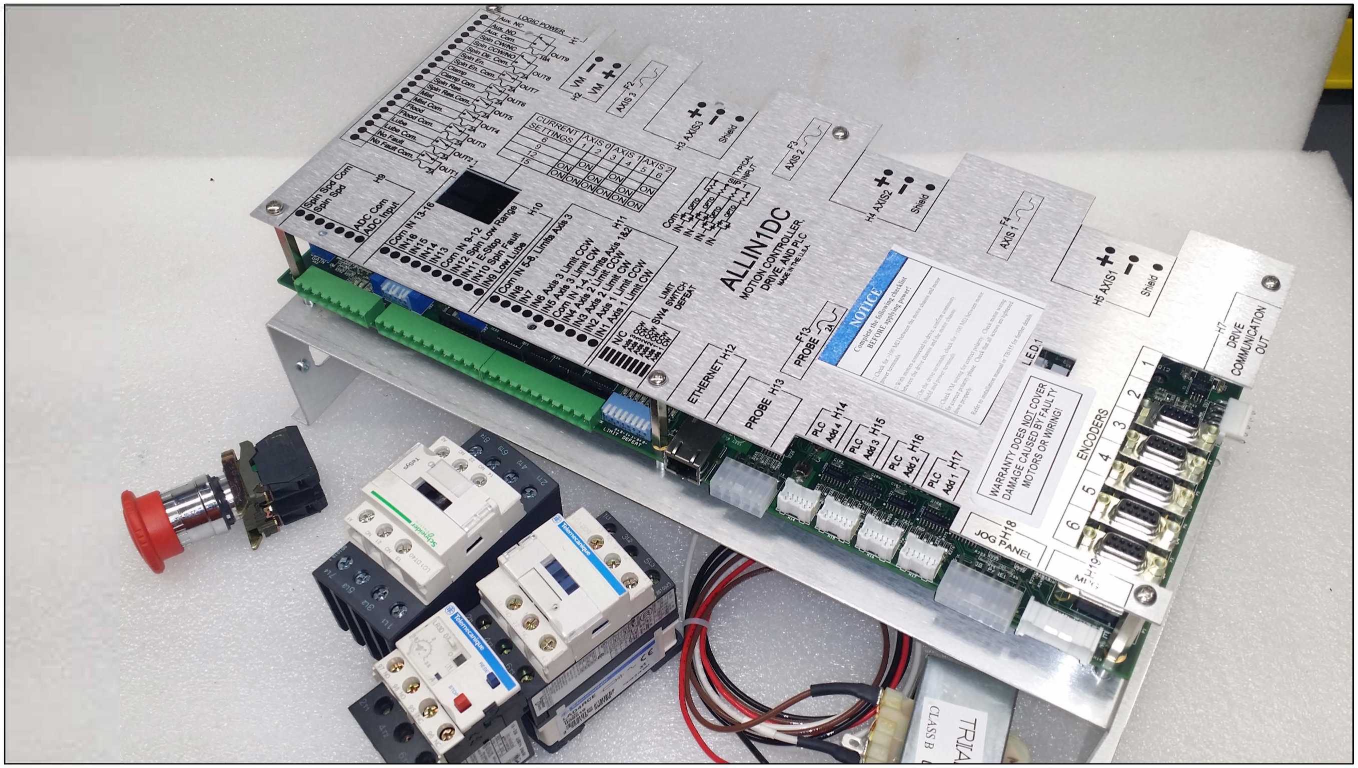
5. Parameter 30 – Set to the temperature which the CNC12 software should stop the machine from running due to motor overheating.. Using Centroid motors with inches as the default units, this setting defaults to 180ºF. Using Centroid motors with millimeters as the default units, this setting defaults to 82ºC.

A B C D

CENTROID

Appendix D http://www.centroidcnc.com/downloads/allin1dc/centroid_allin1dc_schematic_set.zip

ALLIN1DC Individual Circuit Schematic Set



INDEX

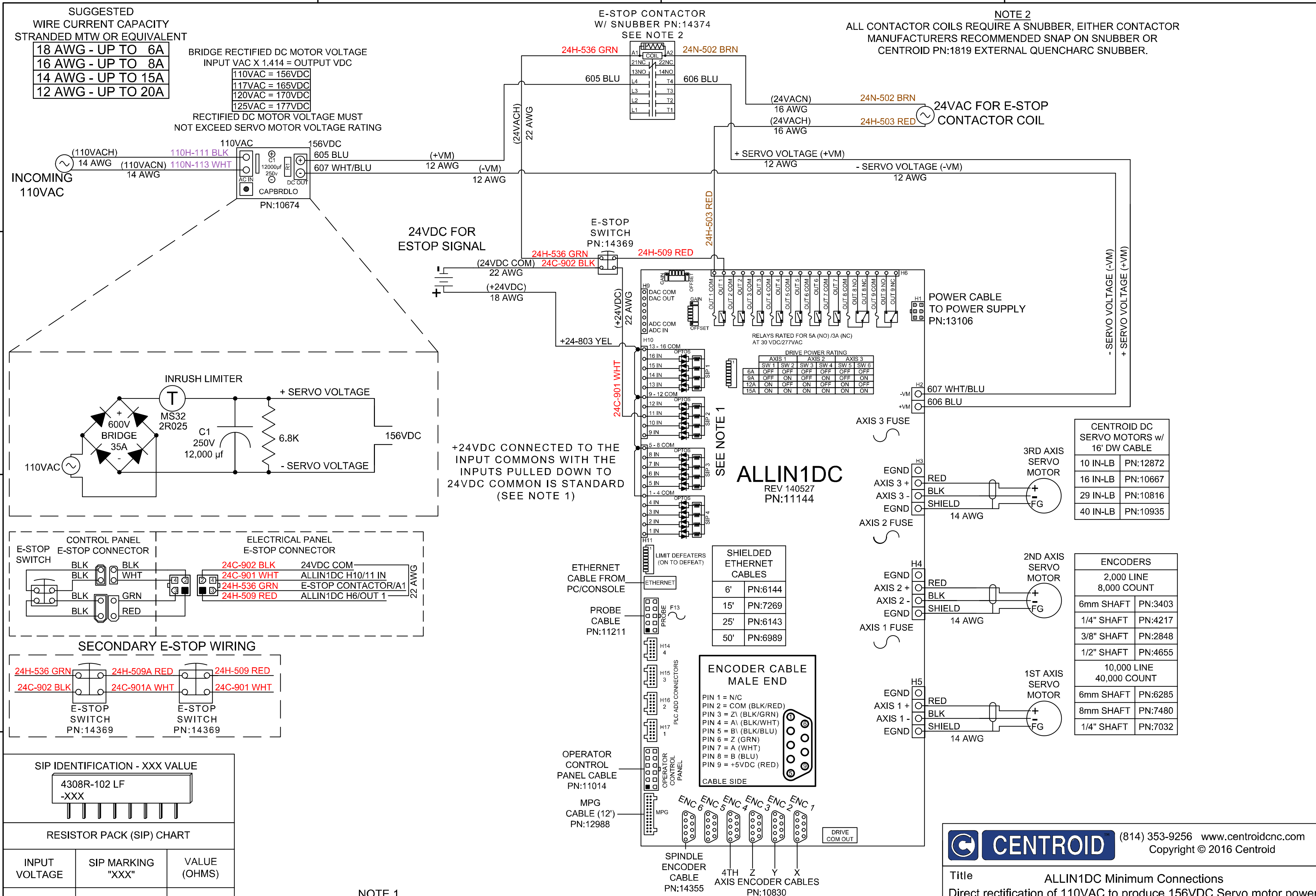
TITLE	SHEET	TITLE	SHEET
TITLE PAGE	1	2ND E-STOP	11
110VAC DIRECT RECTIFICATION	2	CABLES	12
110VAC STEPDOWN	3	OPERATORS PANEL	13
220VAC STEPDOWN	4	LIMIT SWITCH	14
110VAC POWER RECTIFICATION	5	LUBE PUMP	15
220/440VAC POWER RECTIFICATION	6	MISTER	16
INVERTER	7	PLCADD1616	17
1 PHASE FLOOD	8	SPINDLE CONTACTOR	18
3 PHASE FLOOD	9	BRAKING MOTOR	19
1 TO 3 PHASE FLOOD	10	4TH AXIS DC1	20

REV	DATE	DESCRIPTION	BY
1	5-4-2016	INITIAL RELEASE	SPM
2	6-8-2016	CHANGED TITLE/LOGO LAYOUT	SPM

CENTROID (814) 353-9256 www.centroidcnc.com
Copyright © 2016 Centroid

Title	ALLIN1DC INDIVIDUAL CIRCUIT SCHEMATIC SET		
Size A	Serial Number		Rev 2
Date	160715	Drawn by	SPM
Filename	ALLIN1DC SET.dwg	Sheet	1 of 20

A B C D



SUGGESTED WIRE CURRENT CAPACITY STRANDED MTW OR EQUIVALENT

18 AWG - UP TO	6A
16 AWG - UP TO	8A
14 AWG - UP TO	15A
12 AWG - UP TO	20A

NOTE 2

ALL CONTACTOR COILS REQUIRE A SNUBBER, EITHER CONTACTOR MANUFACTURERS RECOMMENDED SNAP ON SNUBBER OR CENTROID PN:1819 EXTERNAL QUENCHARC SNUBBER.

CENTROID DC SERVO MOTORS w/ 16' DW CABLE

10 IN-LB	PN:12872
16 IN-LB	PN:10667
29 IN-LB	PN:10816
40 IN-LB	PN:10935

SHIELDED ETHERNET CABLES

6'	PN:6144
15'	PN:7269
25'	PN:6143
50'	PN:6989

ENCODERS

2,000 LINE 8,000 COUNT	
6mm SHAFT	PN:3403
1/4" SHAFT	PN:4217
3/8" SHAFT	PN:2848
1/2" SHAFT	PN:4655
10,000 LINE 40,000 COUNT	
6mm SHAFT	PN:6285
8mm SHAFT	PN:7480
1/4" SHAFT	PN:7032

ENCODER CABLE MALE END

PIN 1 = N/C
PIN 2 = COM (BLK/RED)
PIN 3 = Z\ (BLK/GRN)
PIN 4 = A\ (BLK/WHT)
PIN 5 = B\ (BLK/BLU)
PIN 6 = Z (GRN)
PIN 7 = A (WHT)
PIN 8 = B (BLU)
PIN 9 = +5VDC (RED)
CABLE SIDE

SIP IDENTIFICATION - XXX VALUE

4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

REV	DATE	DESCRIPTION	BY
1	5-4-2016	INITIAL RELEASE	SPM
2	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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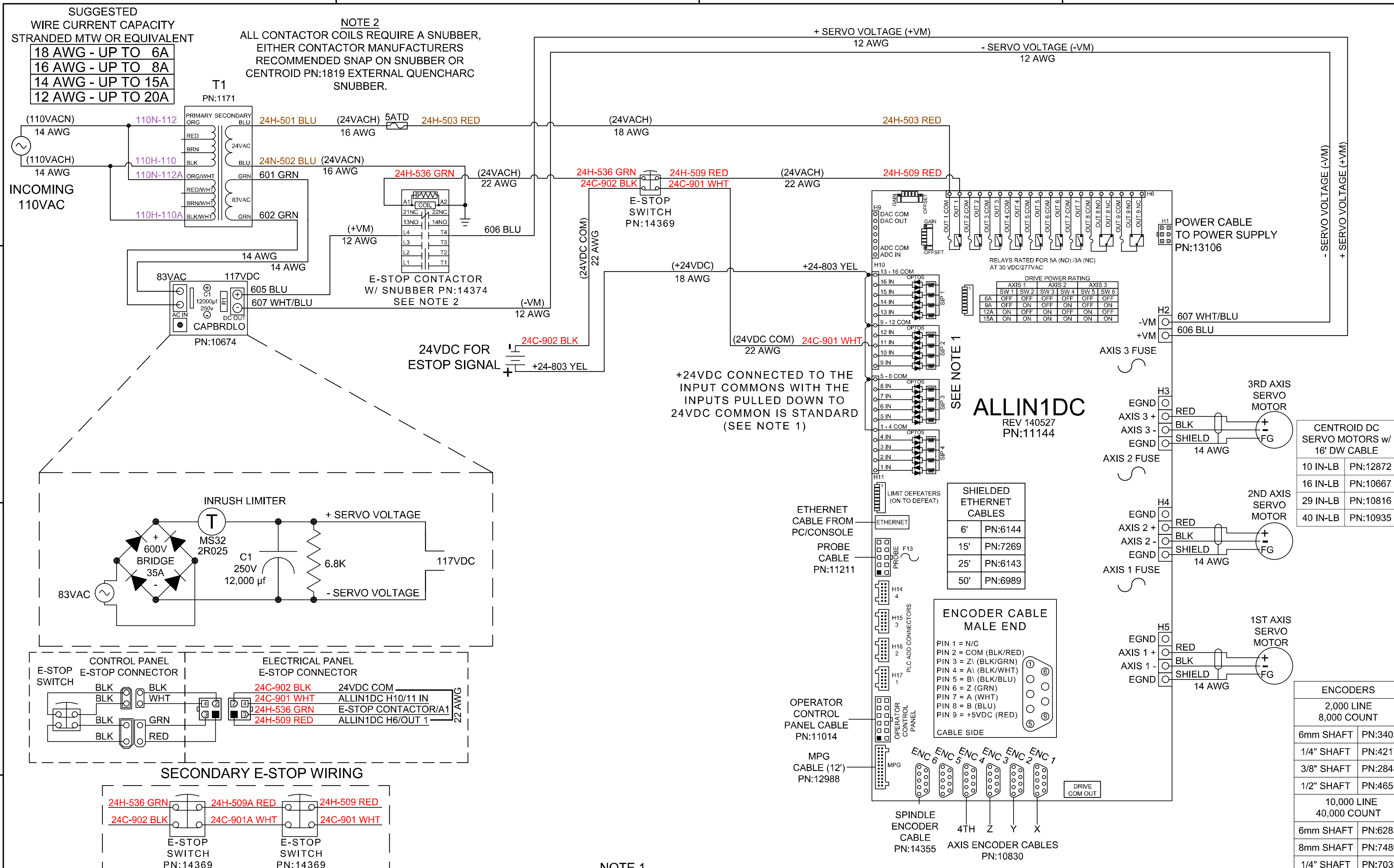
Title ALLIN1DC Minimum Connections
Direct rectification of 110VAC to produce 156VDC Servo motor power

Size A	Serial Number		Rev 2
Date 160715		Drawn by SPM	
Filename ALLIN1DC SET.dwg		Sheet 2 of 20	

SUGGESTED
WIRE CURRENT CAPACITY
STRANDED MTW OR EQUIVALENT

18 AWG - UP TO 6A
16 AWG - UP TO 8A
14 AWG - UP TO 15A
12 AWG - UP TO 20A

NOTE 2
ALL CONTACTOR COILS REQUIRE A SNUBBER, EITHER CONTACTOR MANUFACTURERS RECOMMENDED SNAP ON SNUBBER OR CENTROID PN:1819 EXTERNAL QUENCHARC SNUBBER.



DRIVE POWER RATING

	AXIS 1		AXIS 2		AXIS 3	
	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6
6A	OFF	OFF	OFF	OFF	OFF	OFF
9A	OFF	ON	OFF	ON	OFF	ON
12A	ON	OFF	ON	OFF	ON	OFF
15A	ON	ON	ON	ON	ON	ON

CENTROID DC SERVO MOTORS w/ 16' DW CABLE	
10 IN-LB	PN:12872
16 IN-LB	PN:10667
29 IN-LB	PN:10816
40 IN-LB	PN:10935

SHIELDED ETHERNET CABLES	
6'	PN:6144
15'	PN:7269
25'	PN:6143
50'	PN:6989

ENCODER CABLE MALE END
PIN 1 = N/C
PIN 2 = COM (BLK/RED)
PIN 3 = Z\ (BLK/GRN)
PIN 4 = A\ (BLK/WHT)
PIN 5 = B\ (BLK/BLU)
PIN 6 = Z (GRN)
PIN 7 = A (WHT)
PIN 8 = B (BLU)
PIN 9 = +5VDC (RED)
CABLE SIDE

ENCODERS	
2,000 LINE 8,000 COUNT	
6mm SHAFT	PN:3403
1/4" SHAFT	PN:4217
3/8" SHAFT	PN:2848
1/2" SHAFT	PN:4655
10,000 LINE 40,000 COUNT	
6mm SHAFT	PN:6285
8mm SHAFT	PN:7480
1/4" SHAFT	PN:7032

NOTE 1
INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

SIP IDENTIFICATION - XXX VALUE
4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

REV	DATE	DESCRIPTION	BY
1	5-9-2016	INITIAL RELEASE	SPM
2	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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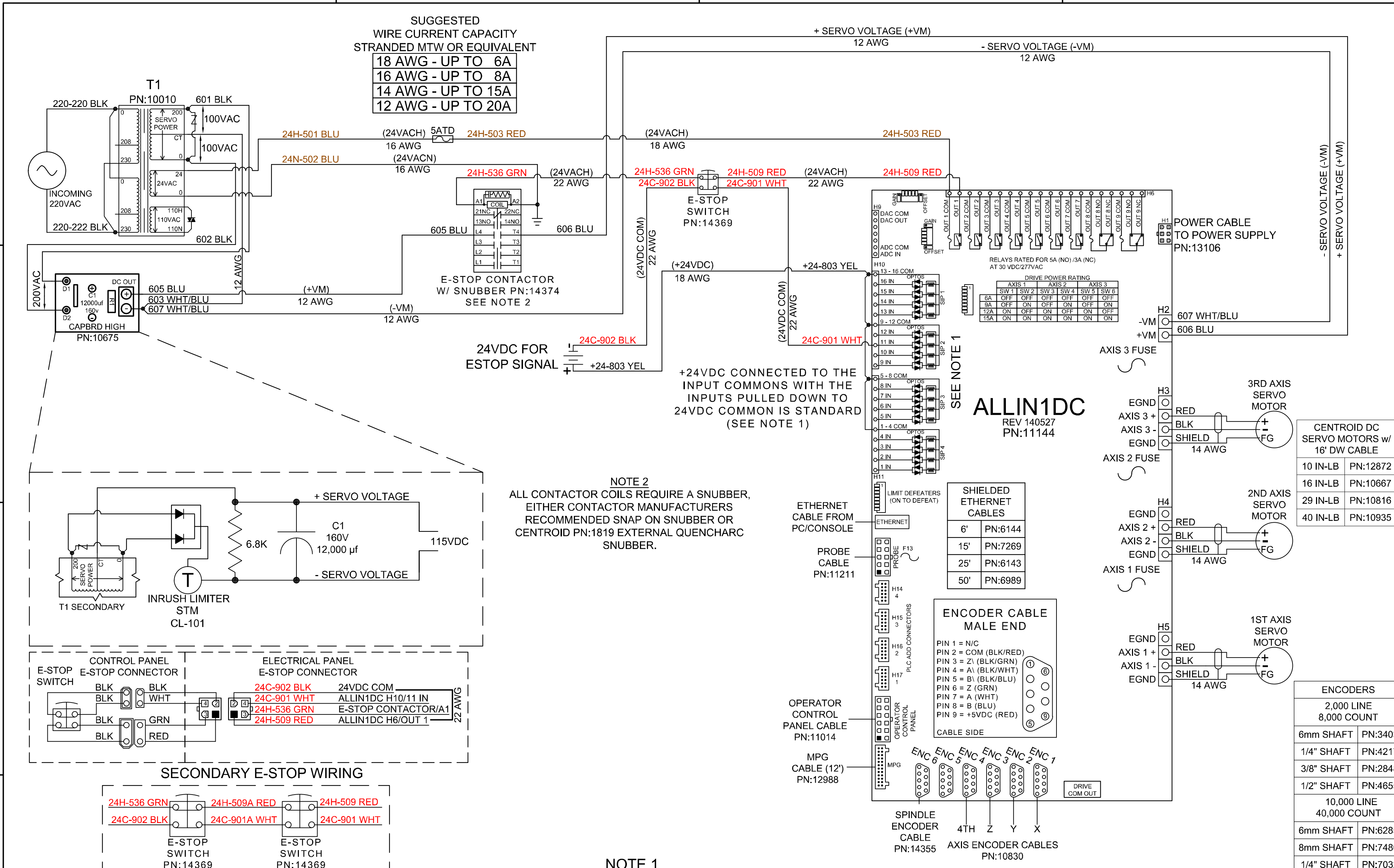
Title: ALLIN1DC Minimum Connections with 83VAC Step Down Transformer

Size: A | Serial Number | Rev: 2
Date: 160715 | Drawn by: SPM
Filename: ALLIN1DC SET.dwg | Sheet 3 of 20



NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

SIP IDENTIFICATION - XXX VALUE

4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

REV	DATE	DESCRIPTION	BY
1	5-9-2016	INITIAL RELEASE	SPM
2	5-24-2016	ADDED VOLTAGE ACROSS CENTER TAP	SPM
3	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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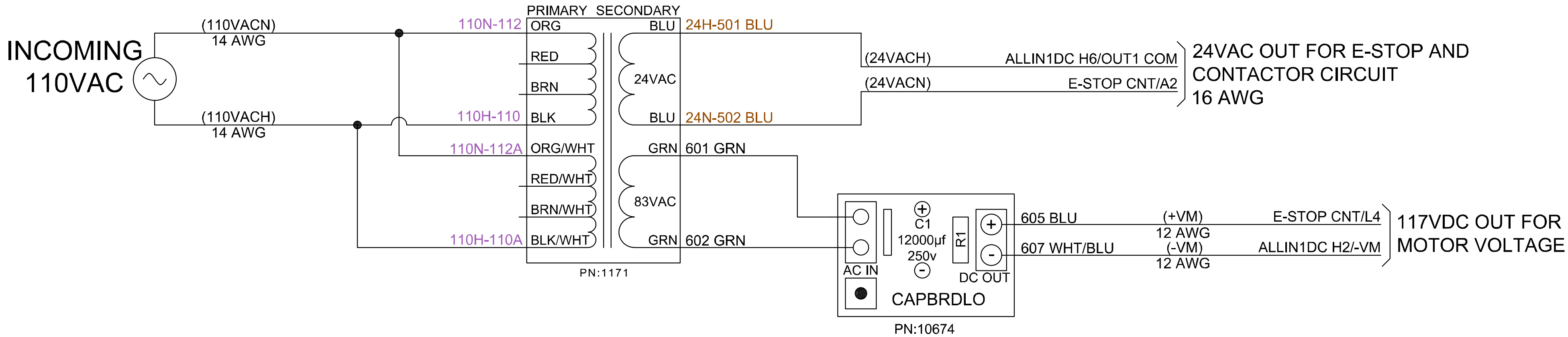
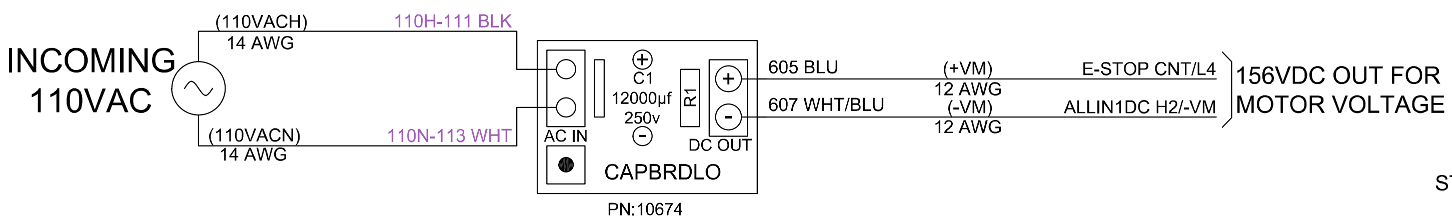
Title ALLIN1DC MINIMUM CONNECTIONS WITH 220VAC STEP DOWN TRANSFORMER

Size A	Serial Number		Rev 3
Date 160715		Drawn by SPM	
Filename ALLIN1DC SET.dwg		Sheet 4 of 20	

DC SERVO POWER RECTIFIER WITH 110V STEP DOWN TRANSFORMER



DC SERVO POWER RECTIFIER WITHOUT STEP DOWN TRANSFORMER, DIRECT RECTIFICATION OF 110 VAC



SUGGESTED
WIRE CURRENT CAPACITY
STRANDED MTW OR EQUIVALENT

18 AWG - UP TO 6A
16 AWG - UP TO 8A
14 AWG - UP TO 15A
12 AWG - UP TO 20A

BRIDGE RECTIFIED DC MOTOR VOLTAGE
(INPUT)VAC X 1.414 = (OUTPUT)VDC

110VAC = 156VDC
117VAC = 165VDC
120VAC = 170VDC
125VAC = 177VDC

RECITFIED DC MOTOR VOLTAGE MUST
NOT EXCEED SERVO MOTOR VOLTAGE RATING

REV	DATE	DESCRIPTION	BY
1	3-15-2016	INITIAL RELEASE	DRS
2	4-15-2016	UPDATED PER GUIDELINES	SPM

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Title: DC SERVO POWER RECTIFICATION FROM INCOMING 110VAC

Size A | Serial Number | Rev 2

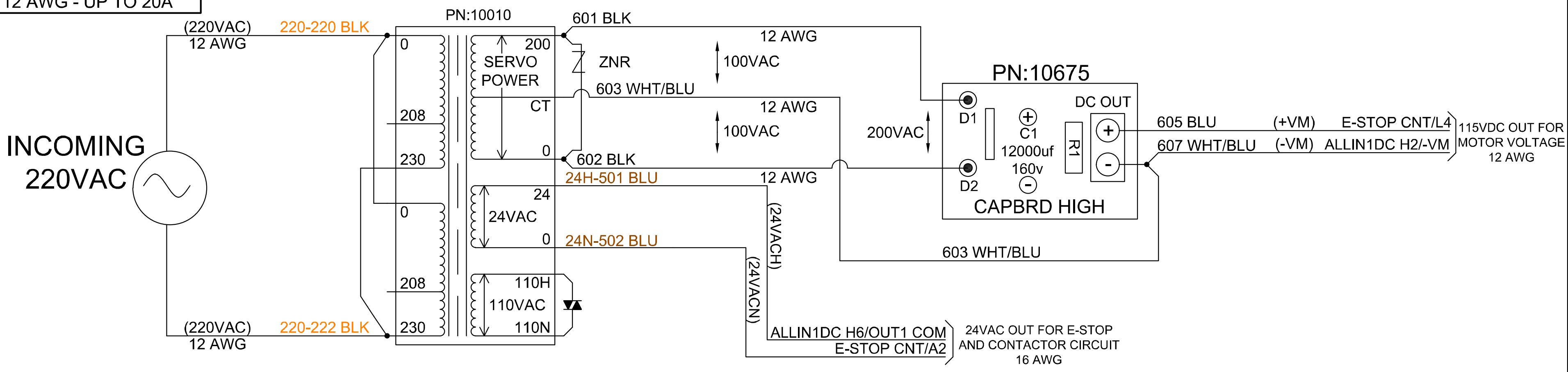
Date 160715 | Drawn by SPM

Filename ALLIN1DC SET.dwg | Sheet 5 of 20

DC SERVO POWER RECTIFICATION WITH 220 OR 440 STEP DOWN TRANSFORMER

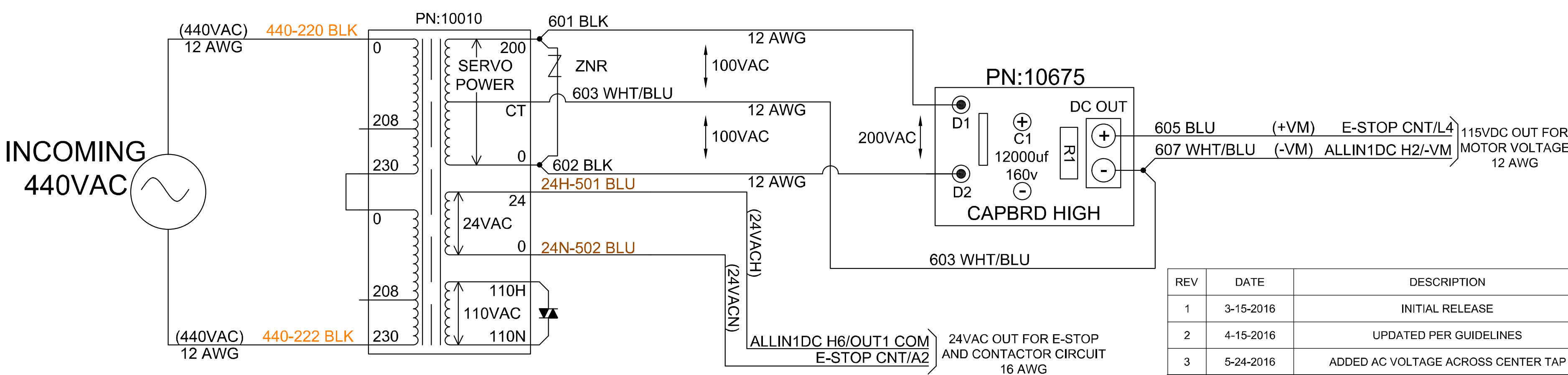
SUGGESTED
WIRE CURRENT CAPACITY
STRANDED MTW OR EQUIVALENT

18 AWG - UP TO 6A
16 AWG - UP TO 8A
14 AWG - UP TO 15A
12 AWG - UP TO 20A



220VAC RECTIFICATION

440VAC RECTIFICATION



REV	DATE	DESCRIPTION	BY
1	3-15-2016	INITIAL RELEASE	DRS
2	4-15-2016	UPDATED PER GUIDELINES	SPM
3	5-24-2016	ADDED AC VOLTAGE ACROSS CENTER TAP	SPM

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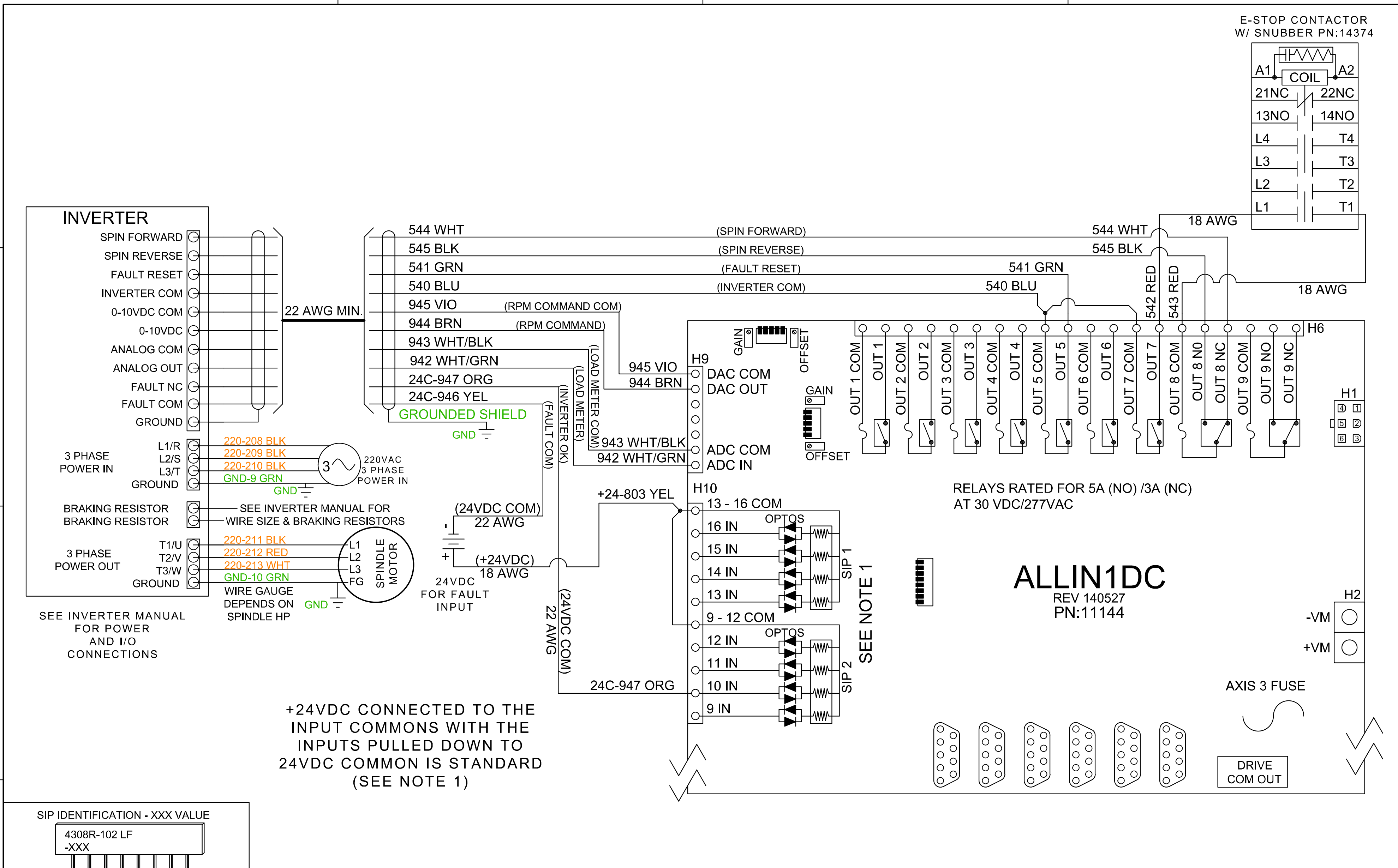
Title DC SERVO POWER RECTIFICATION
220/440VAC STEPDOWN TRANSFORMER

Size A | Serial Number | Rev 3

Date 160715 | Drawn by SPM

Filename ALLIN1DC SET.dwg | Sheet 6 of 20



RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

REV	DATE	DESCRIPTION	BY
1	3-15-2016	INITIAL RELEASE	DRS
2	4-15-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM
4	6-28-2016	CHANGED WIRE LABELS	SPM

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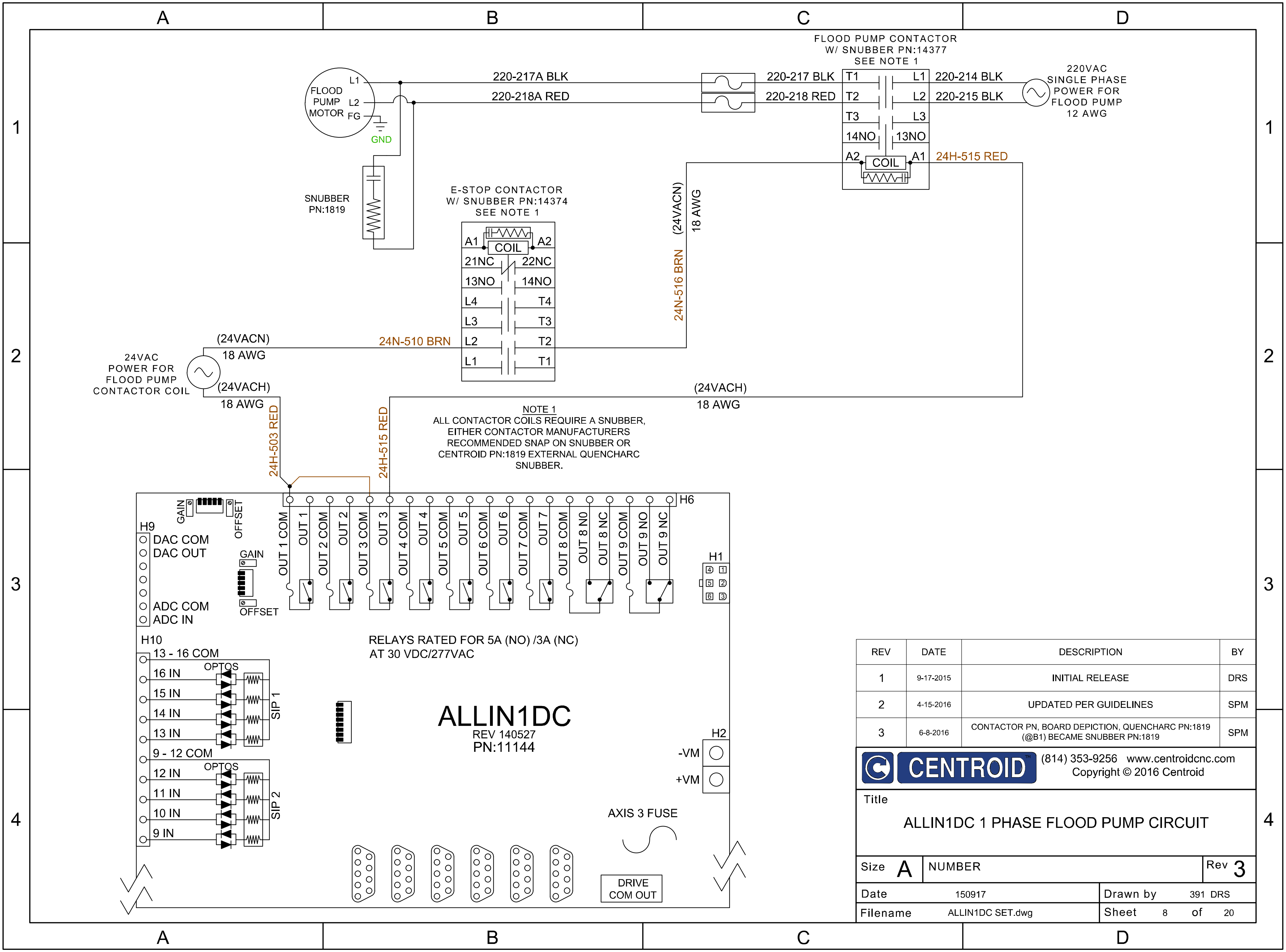
Title ALLIN1DC INVERTER CONTROL CIRCUIT

Size A | Serial Number | Rev 4

Date 160315 | Drawn by DRS

Filename ALLIN1DC SET.dwg | Sheet 7 of 20



REV	DATE	DESCRIPTION	BY
1	9-17-2015	INITIAL RELEASE	DRS
2	4-15-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CONTACTOR PN, BOARD DEPICTION, QUENCHARC PN:1819 (@B1) BECAME SNUBBER PN:1819	SPM

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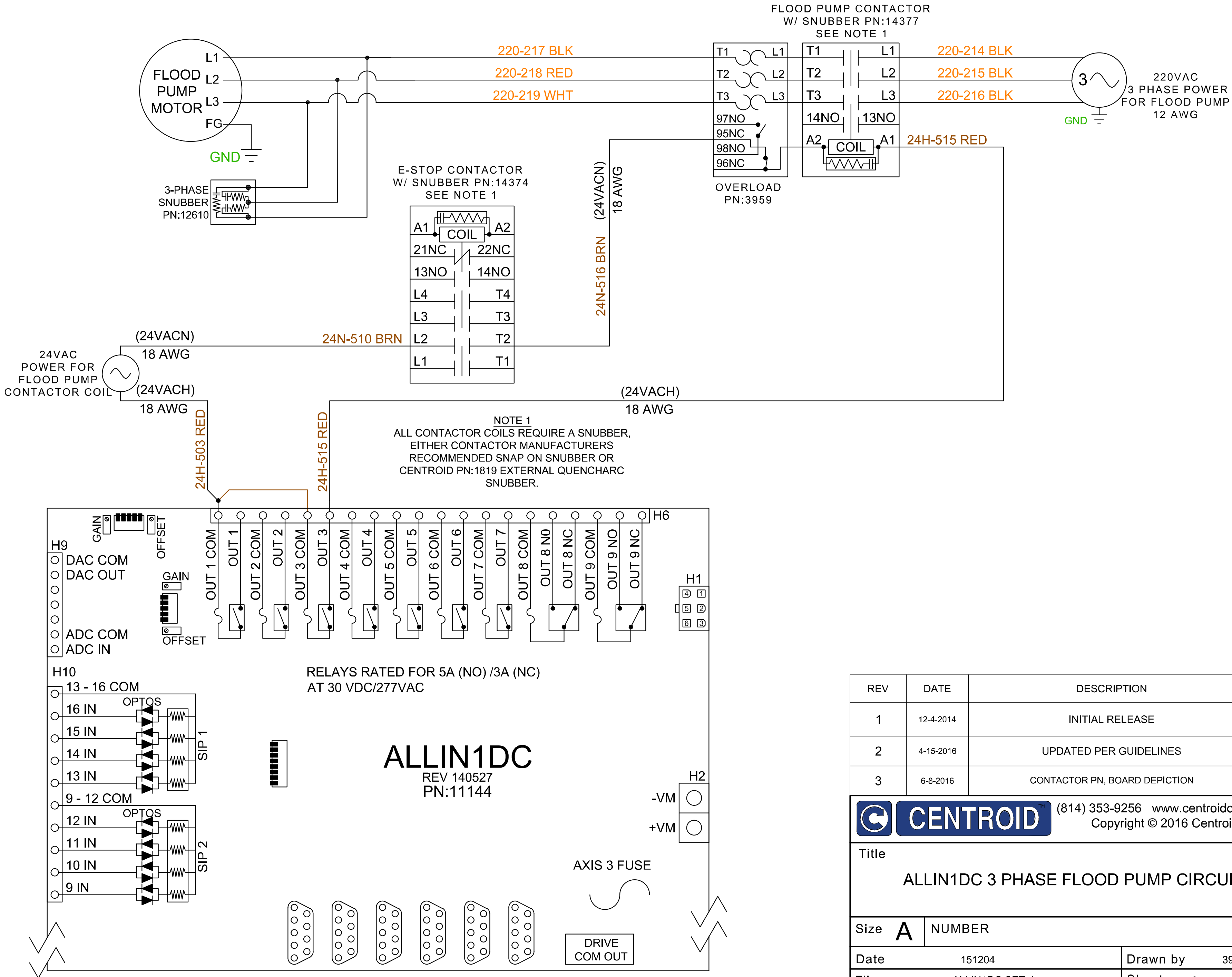
Title

ALLIN1DC 1 PHASE FLOOD PUMP CIRCUIT

Size A	NUMBER		Rev 3
Date 150917		Drawn by 391 DRS	
Filename ALLIN1DC SET.dwg		Sheet 8 of 20	



REV	DATE	DESCRIPTION	BY
1	12-4-2014	INITIAL RELEASE	DRS
2	4-15-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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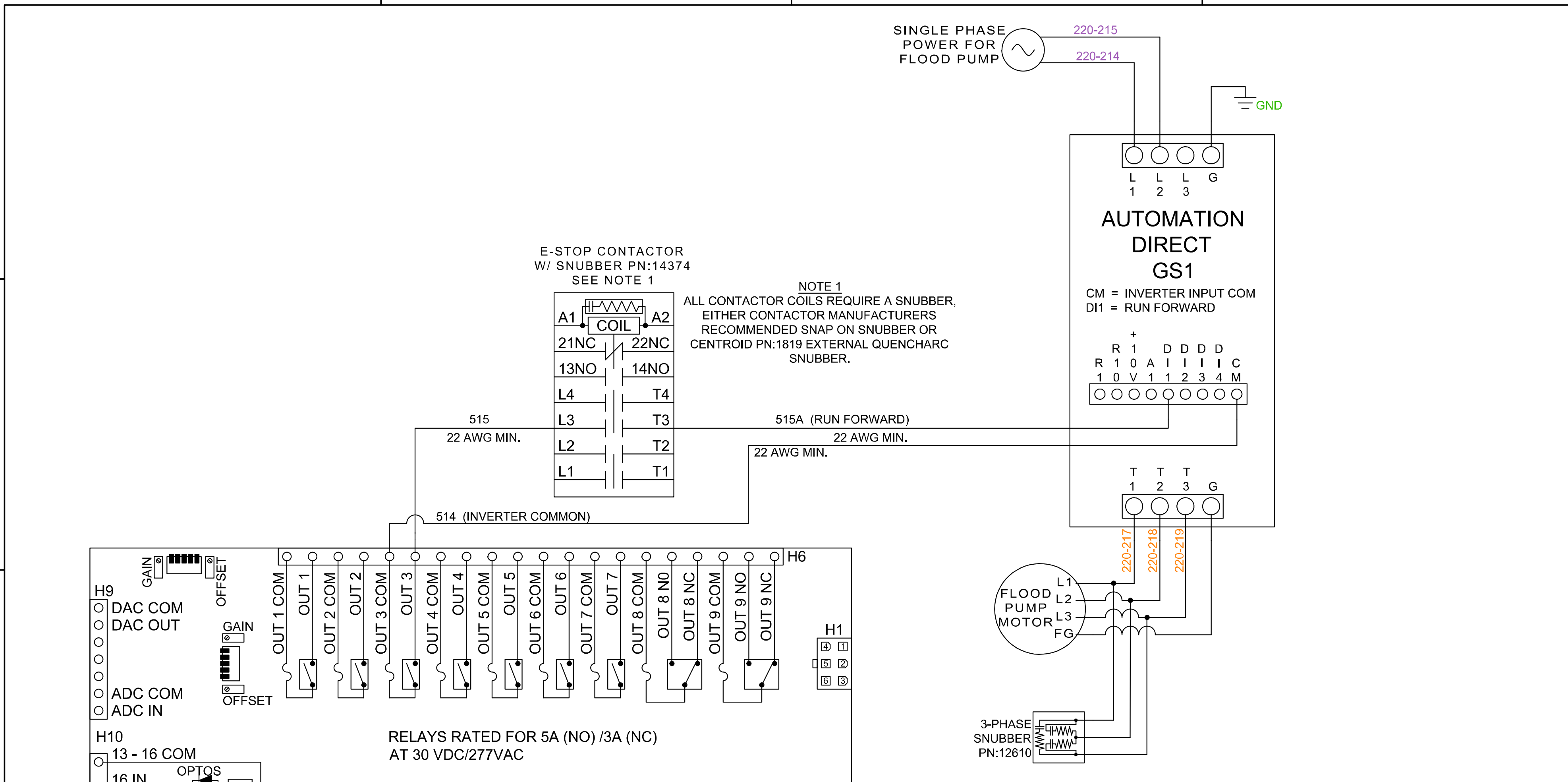
Title

ALLIN1DC 3 PHASE FLOOD PUMP CIRCUIT

Size A	NUMBER		Rev 3
Date	151204	Drawn by	391 DRS
Filename	ALLIN1DC SET.dwg	Sheet	9 of 20



REV	DATE	DESCRIPTION	BY
1	9-16-2015	INITIAL RELEASE	DRS
2	4-26-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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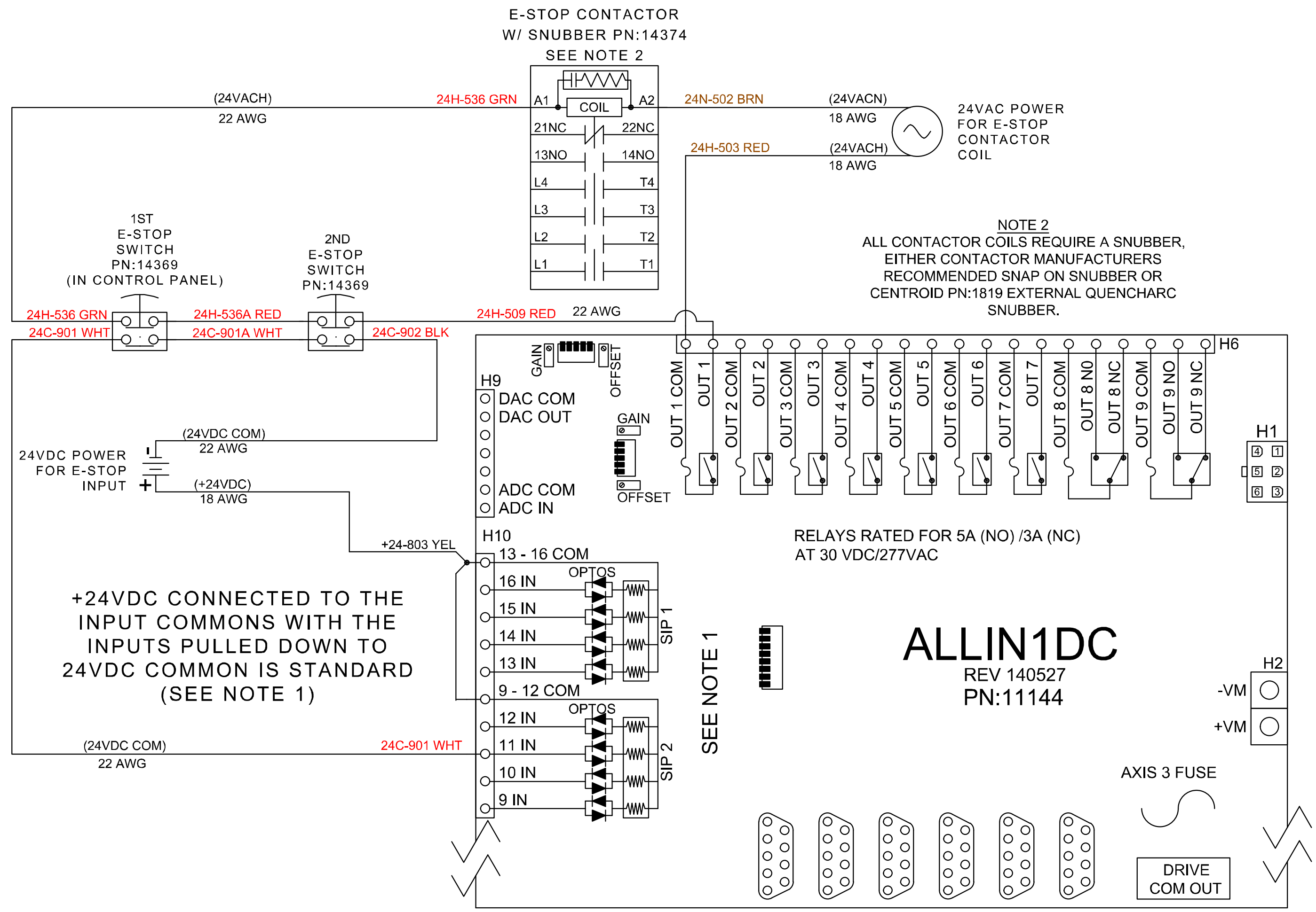
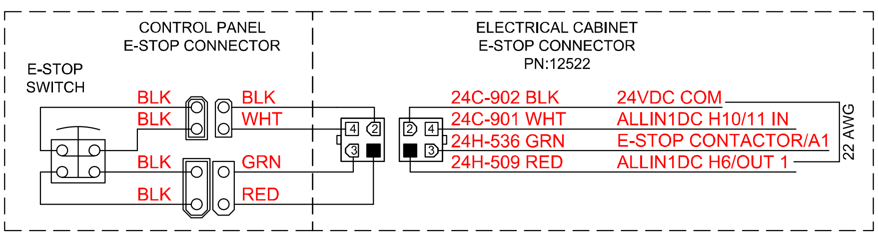
Title
ALLIN1DC 1 PHASE TO 3 PHASE FLOOD PUMP CIRCUIT

Size A | NUMBER | Rev 3

Date 151204 | Drawn by DRS

Filename ALLIN1DC SET.dwg | Sheet 10 of 20





NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

SIP IDENTIFICATION - XXX VALUE

4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

REV	DATE	DESCRIPTION	BY
1	9-17-2015	INITIAL RELEASE	DRS
2	4-15-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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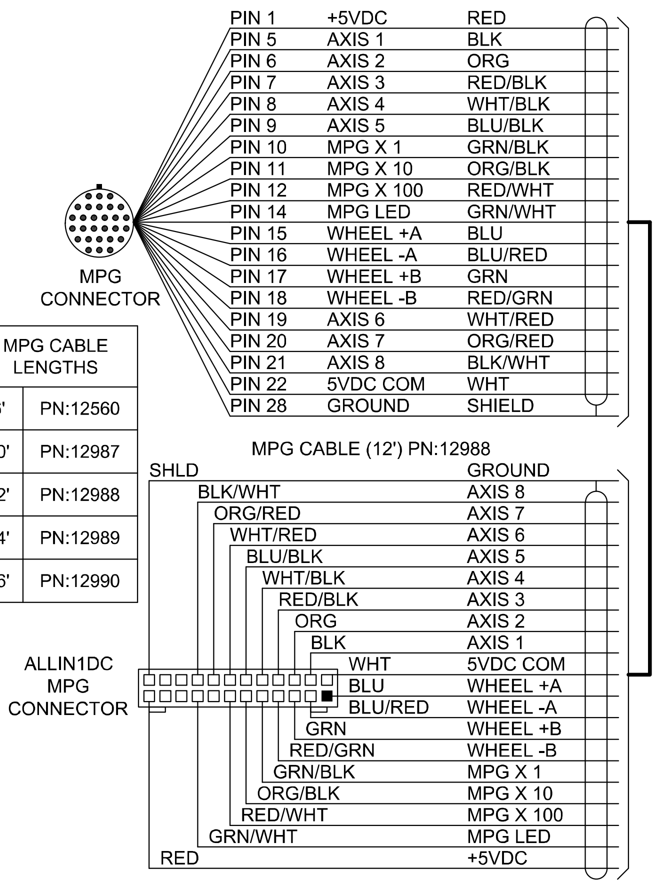
Title

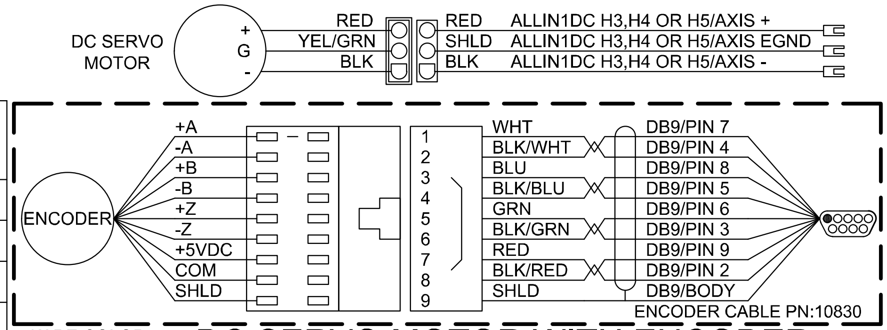
ALLIN1DC 2ND E-STOP CONNECTION CIRCUIT

Size A	NUMBER		Rev 3
Date 150917		Drawn by DRS	
Filename ALLIN1DC SET.dwg		Sheet 11 of 20	



MPG CABLE LENGTHS	
6'	PN:12560
10'	PN:12987
12'	PN:12988
14'	PN:12989
16'	PN:12990

CENTROID DC SERVO MOTORS w/ 16' DW CABLE	
10 IN-LB	PN:12872
16 IN-LB	PN:10667
29 IN-LB	PN:10816
40 IN-LB	PN:10935

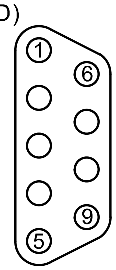


DC SERVO MOTOR WITH ENCODER

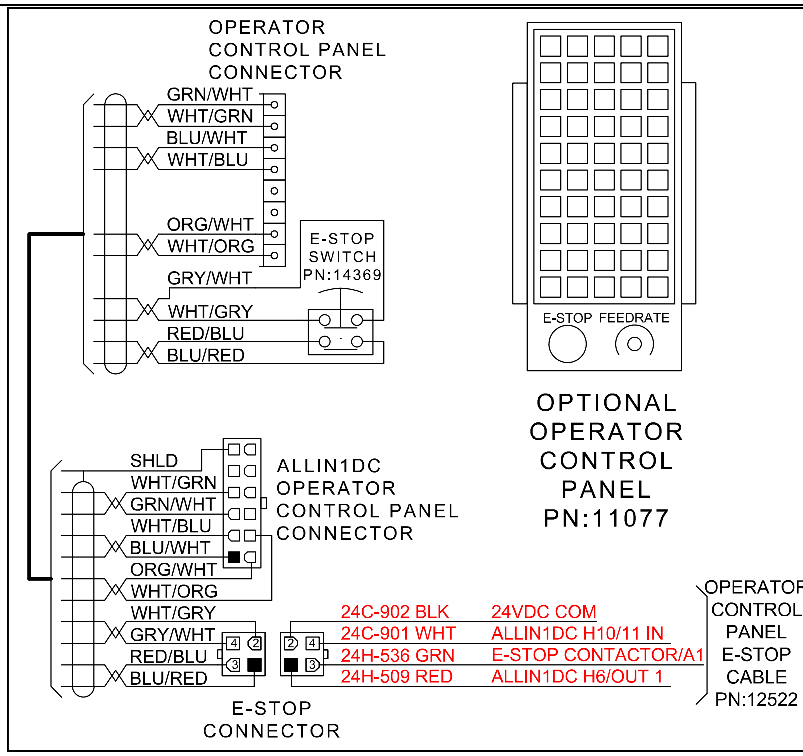
COMPLETE CABLE PN:10694

ENCODER CABLE DB9 END

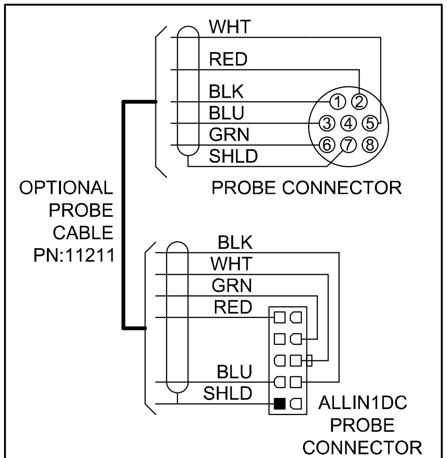
PIN 1 = N/C
PIN 2 = COM (BLK/RED)
PIN 3 = Z\ (BLK/GRN)
PIN 4 = A\ (BLK/WHT)
PIN 5 = B\ (BLK/BLU)
PIN 6 = Z (GRN)
PIN 7 = A (WHT)
PIN 8 = B (BLU)
PIN 9 = +5VDC (RED)

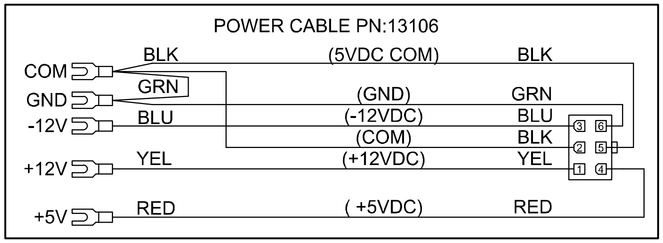


CABLE SIDE



OPTIONAL OPERATOR CONTROL PANEL PN:11077





REV	DATE	DESCRIPTION	BY
1	9-17-2015	INITIAL RELEASE	DRS
2	4-26-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CHANGES TO STANDARD	SPM

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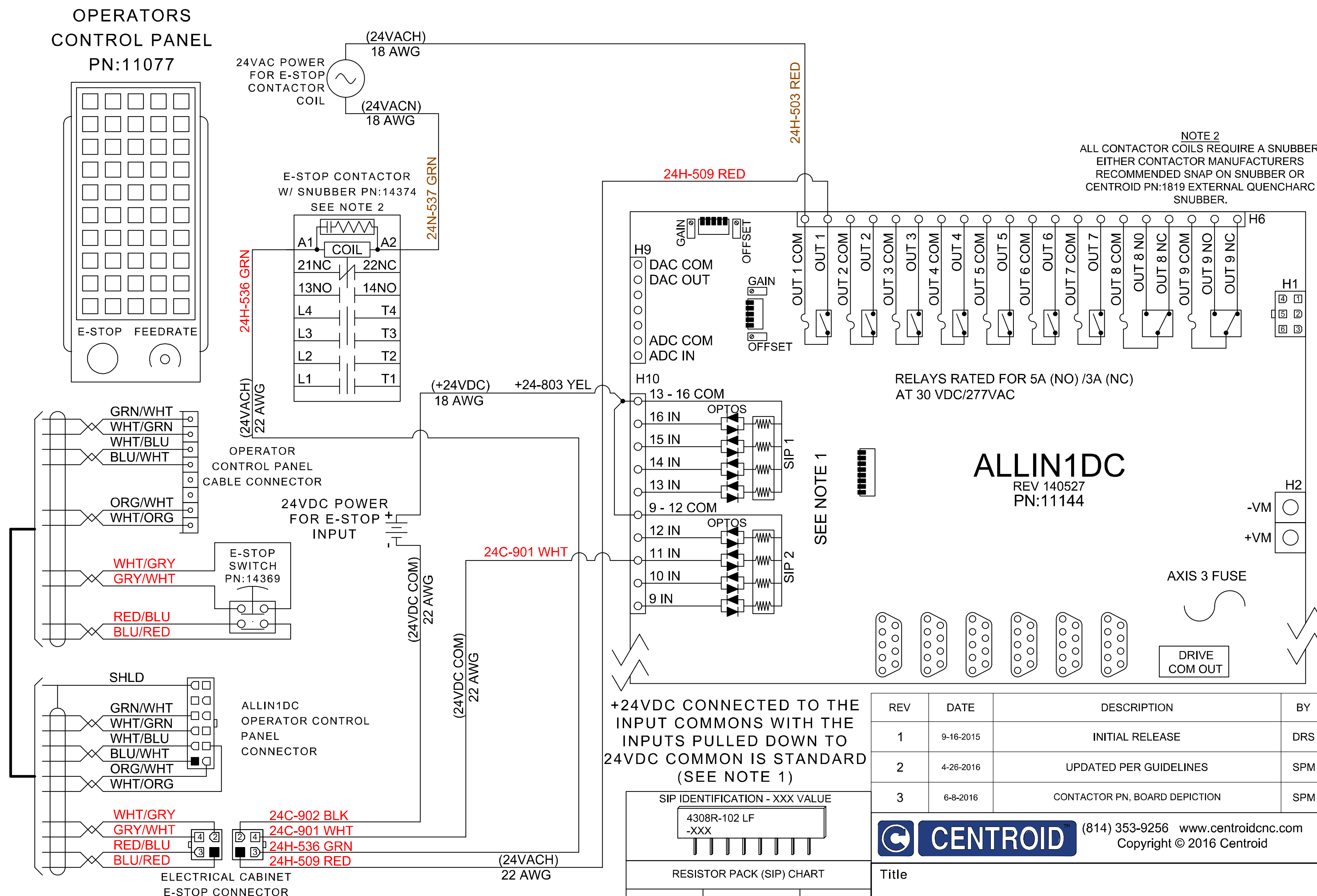
Title	ALLIN1DC CABLES		
Size A	NUMBER		Rev 3
Date	150917	Drawn by	391 DRS
Filename	ALLIN1DC SET.dwg	Sheet	12 of 20



+24VDC CONNECTED TO THE INPUT COMMONS WITH THE INPUTS PULLED DOWN TO 24VDC COMMON IS STANDARD (SEE NOTE 1)

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

SIP IDENTIFICATION - XXX VALUE

4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

REV	DATE	DESCRIPTION	BY
1	9-16-2015	INITIAL RELEASE	DRS
2	4-26-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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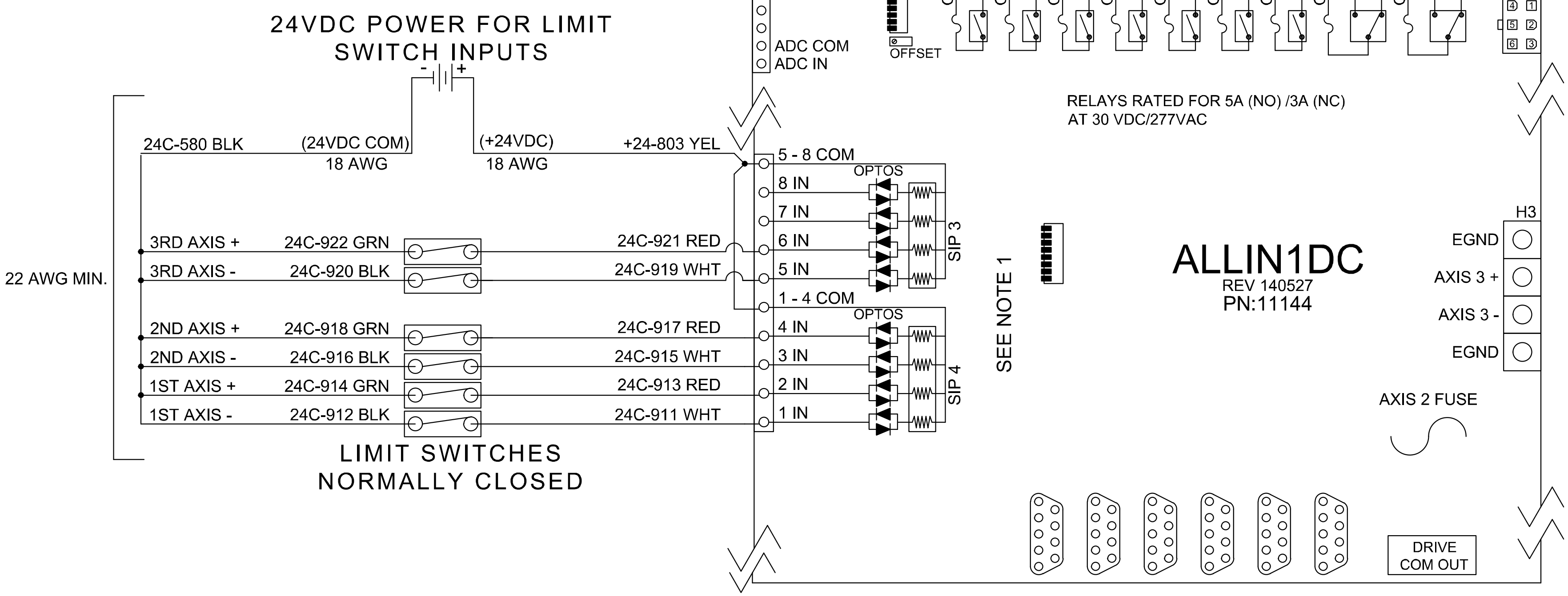
Title

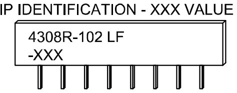
ALLIN1DC OPERATOR CONTROL PANEL CIRCUIT

Size A	NUMBER		Rev 3
Date 150916		Drawn by DRS	
Filename ALLIN1DC SET.dwg		Sheet 13 of 20	

+24VDC CONNECTED TO THE INPUT COMMONS WITH THE INPUTS PULLED DOWN TO 24VDC COMMON IS STANDARD (SEE NOTE 1)



SIP IDENTIFICATION - XXX VALUE



RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

REV	DATE	DESCRIPTION	BY
1	9-16-2015	INITIAL RELEASE	DRS
2	4-26-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CHANGES TO BOARD DEPICTION, SWITCH ALIGNMENT	SPM

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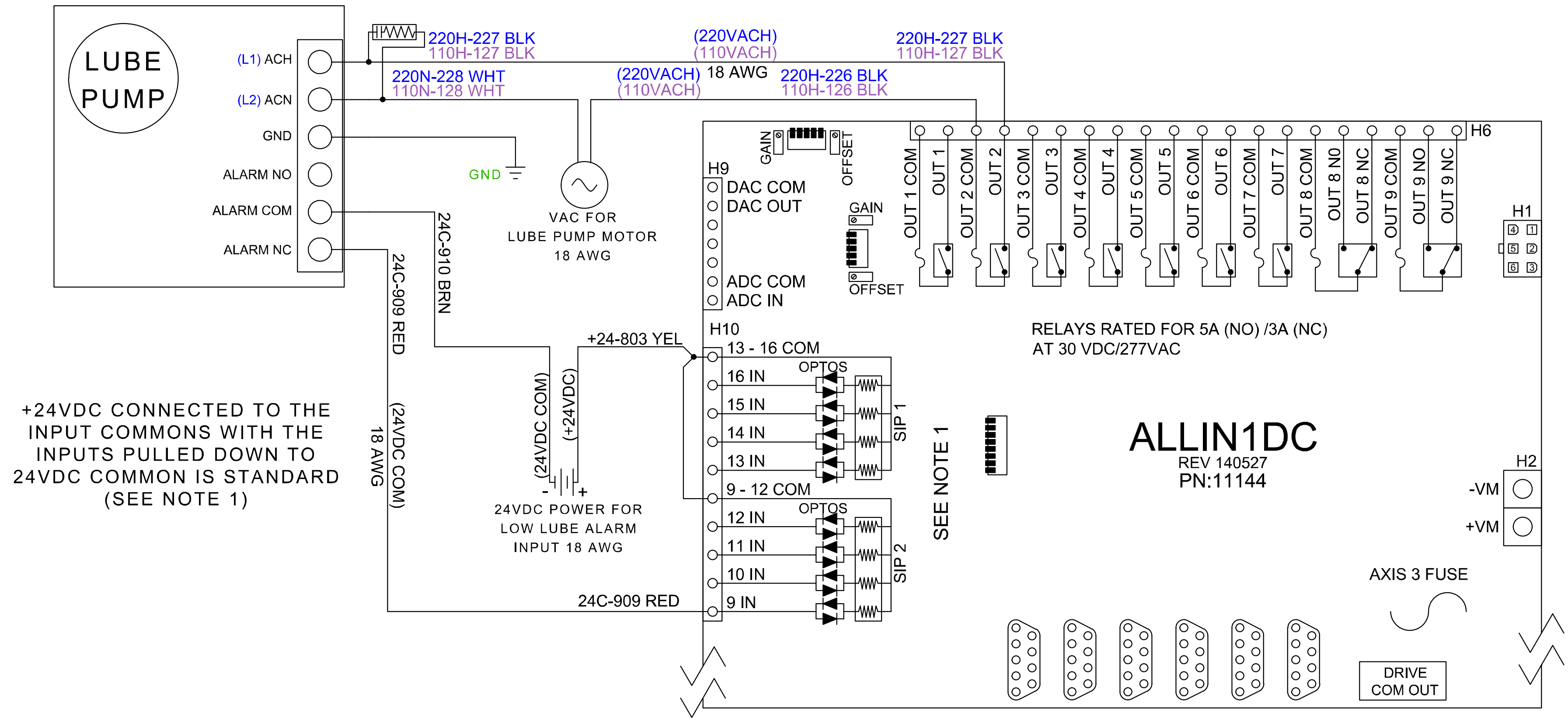
Title

ALLIN1DC LIMIT SWITCH CIRCUIT

Size A	NUMBER		Rev 3
Date 160916		Drawn by DRS	
Filename ALLIN1DC SET.dwg		Sheet 14 of 20	

A	B	C	D



SIP IDENTIFICATION - XXX VALUE		
4308R-102 LF -XXX		
RESISTOR PACK (SIP) CHART		
INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

REV	DATE	DESCRIPTION	BY
1	12-4-2014	INITIAL RELEASE	DRS
2	4-26-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CHANGES TO BOARD DEPICTION	SPM

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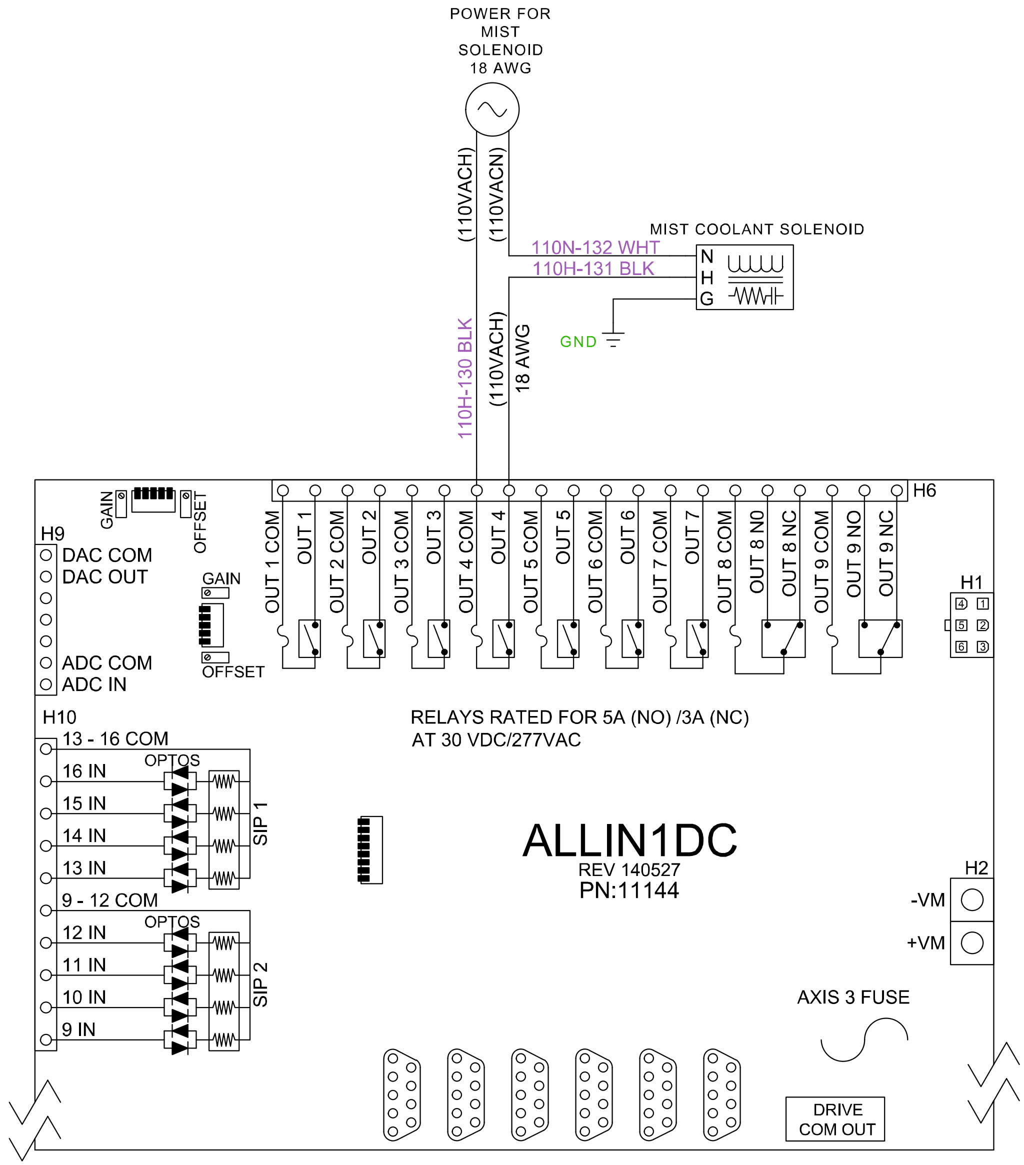
Title	ALLIN1DC LUBE PUMP CIRCUIT		
Size A	NUMBER		Rev 3
Date	141204	Drawn by	DRS
Filename	ALLIN1DC SET.dwg	Sheet	15 of 20

A	B	C	D



REV	DATE	DESCRIPTION	BY
1	9-16-2015	INITIAL RELEASE	DRS
2	4-26-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CHANGES TO BOARD DEPICTION	SPM

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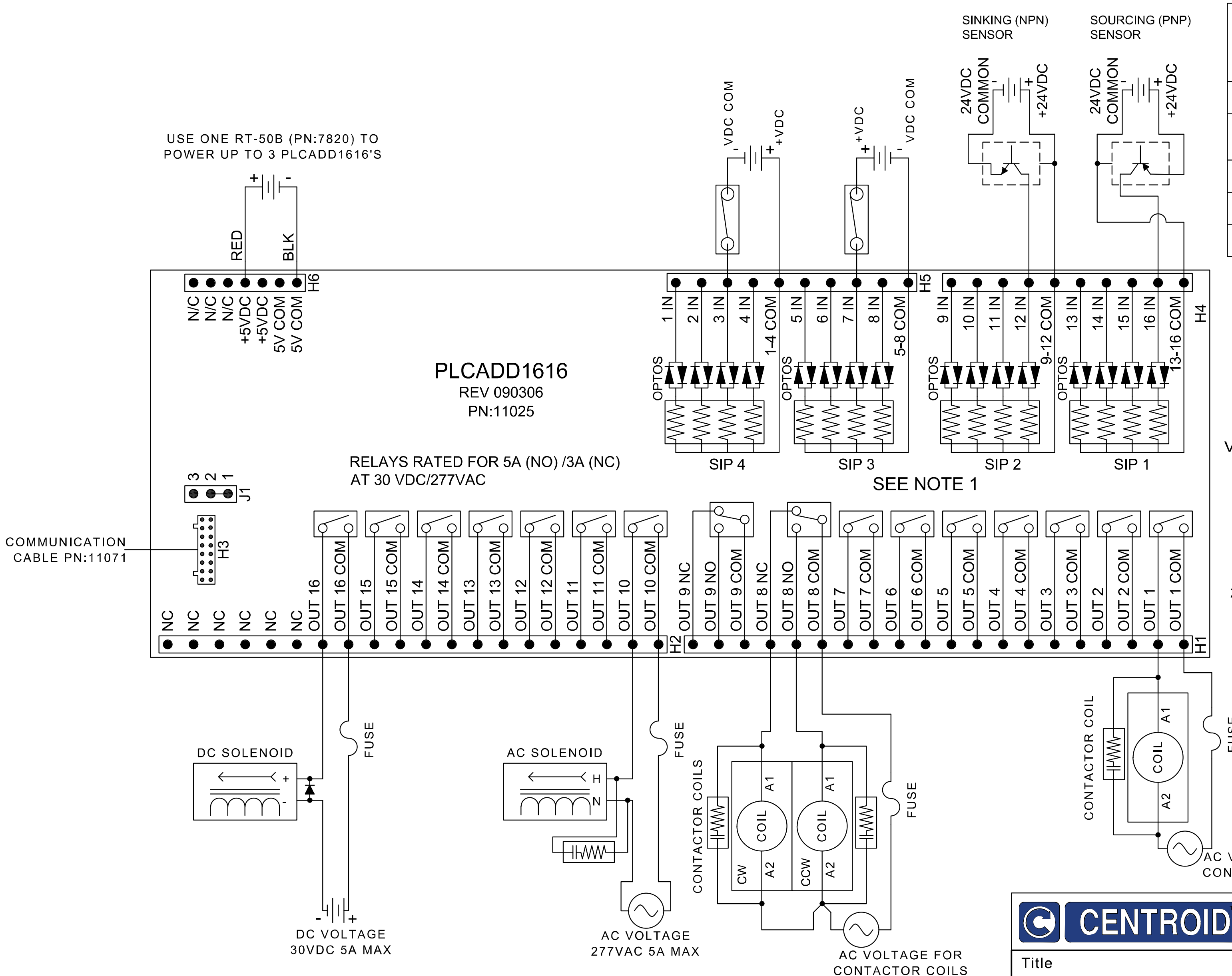
Title

ALLIN1DC 110VAC MIST COOLANT CIRCUIT

Size A	NUMBER		Rev 3
Date	150916	Drawn by	DRS
Filename	ALLIN1DC SET.dwg	Sheet	16 of 20



SIP IDENTIFICATION - XXX VALUE		
4308R-102 LF -XXX		
RESISTOR PACK (SIP) CHART		
INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY.
POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED.
SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

+24VDC CONNECTED TO THE INPUT COMMONS WITH THE INPUTS PULLED DOWN TO 24VDC COMMON IS STANDARD (SEE NOTE 1)

REV	DATE	DESCRIPTION	BY
1	9-16-2015	INITIAL RELEASE	DRS
2	4-29-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CHANGES TO BOARD DEPICTION	SPM

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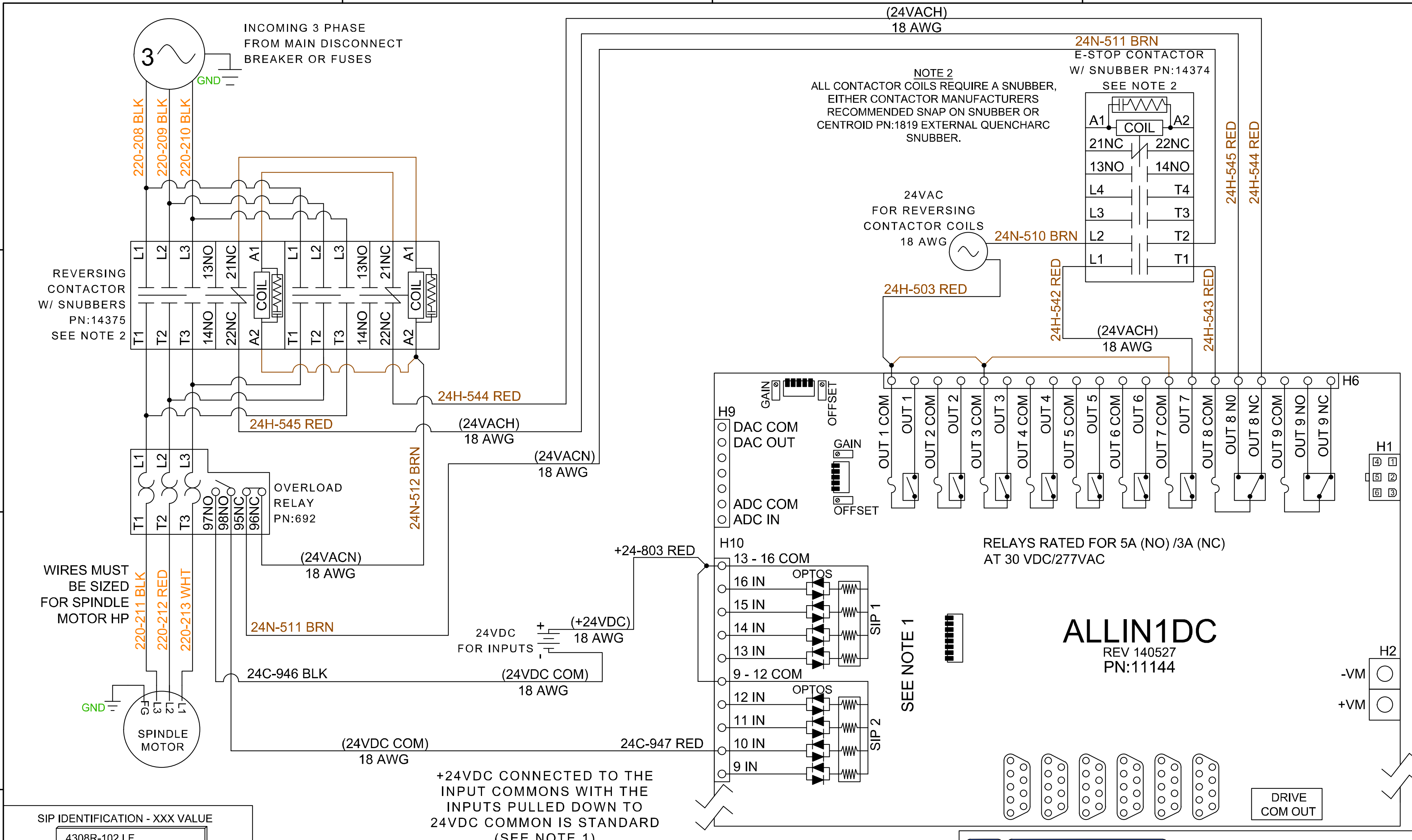
Title	PLCADD1616 CIRCUIT EXAMPLES		
Size A	NUMBER		Rev 3
Date 150916		Drawn by DRS	
Filename ALLIN1DC SET.dwg		Sheet 17 of 20	



SIP IDENTIFICATION - XXX VALUE

4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

REV	DATE	DESCRIPTION	BY
1	9-16-2015	INITIAL RELEASE	DRS
2	4-30-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CONTACTOR PN'S, BOARD DEPICTION	SPM

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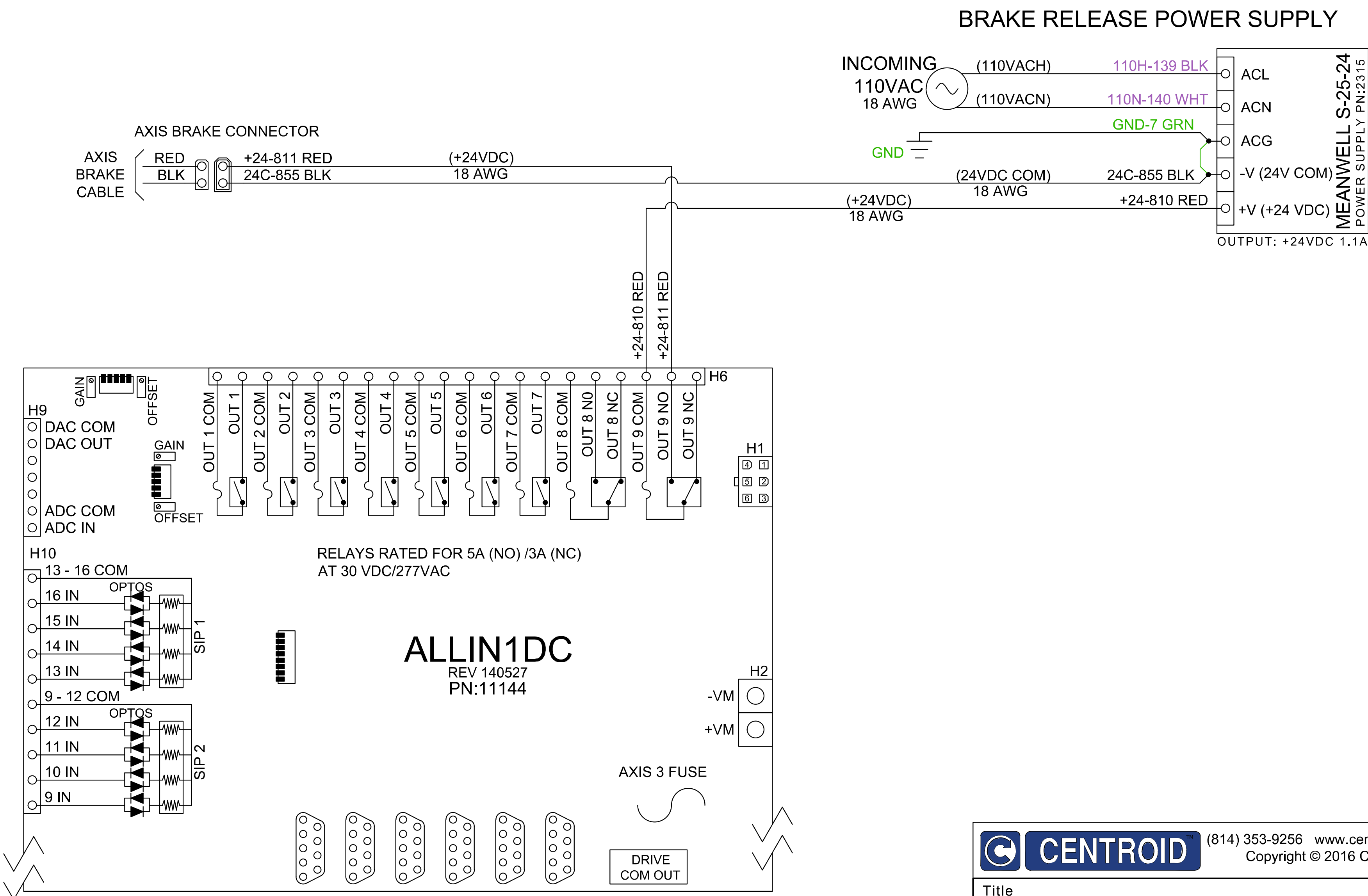
Title
ALLIN1DC SPINDLE CONTACTOR CIRCUIT

Size A	NUMBER		Rev 3
Date 150916		Drawn by DRS	
Filename ALLIN1DC SET.dwg		Sheet 18 of 20	



REV	DATE	DESCRIPTION	BY
1	9-16-2015	INITIAL RELEASE	DRS
2	4-30-2016	UPDATED PER GUIDELINES	SPM
3	6-8-2016	CHANGES TO CONNECTION DEPICTION	SPM

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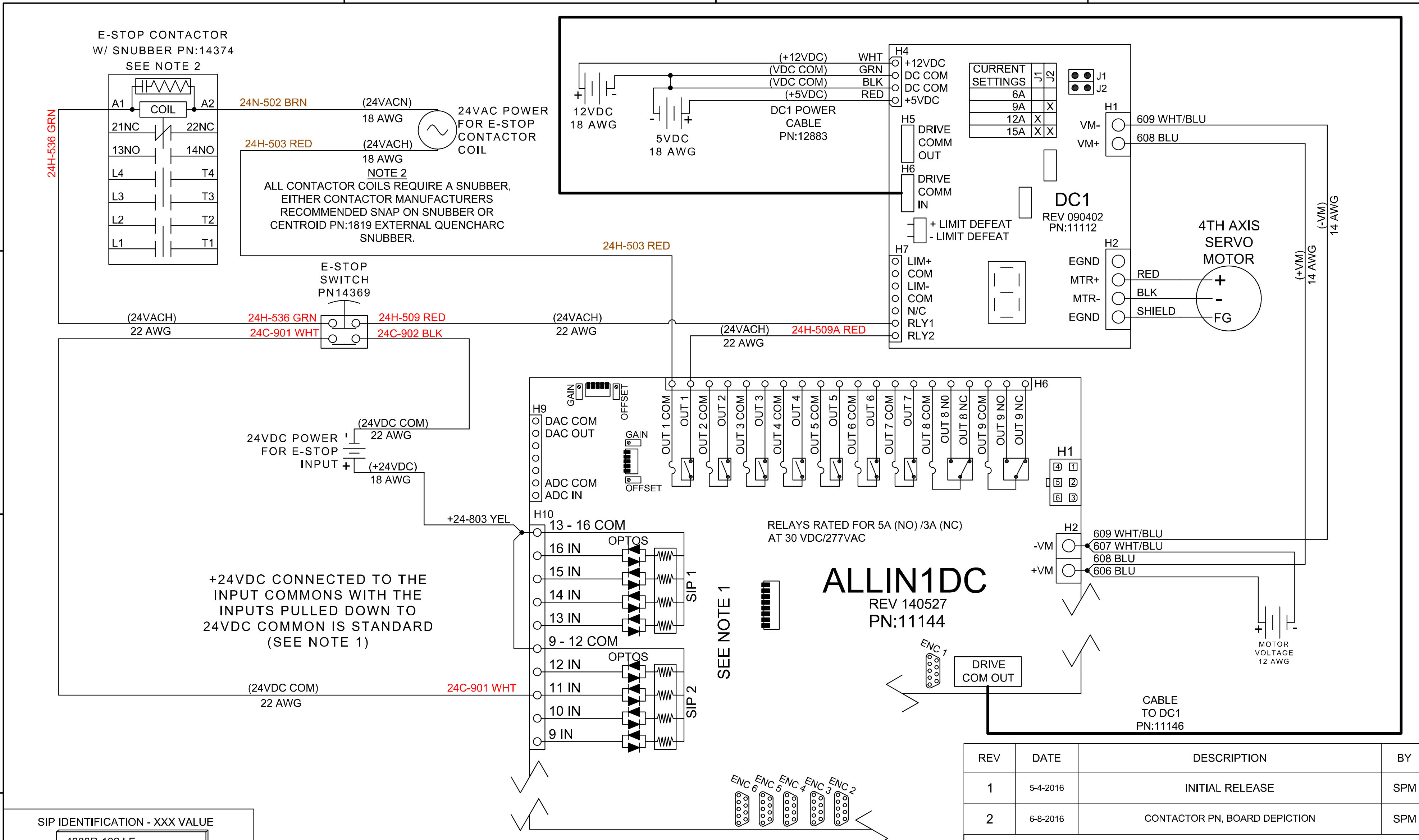
Title
ALLIN1DC BRAKING MOTOR CIRCUIT

Size A	NUMBER		Rev 3
Date 150916		Drawn by DRS	
Filename ALLIN1DC SET.dwg		Sheet 19 of 20	



SIP IDENTIFICATION - XXX VALUE

4308R-102 LF
-XXX

RESISTOR PACK (SIP) CHART

INPUT VOLTAGE	SIP MARKING "XXX"	VALUE (OHMS)
5	471	470
12	102	1.0K
24	222	2.2K

NOTE 1

INPUTS REQUIRE 5, 12, OR 24VDC EXTERNAL POWER SUPPLY. POWER SUPPLY FOR ALLIN1DC DRIVE CAN BE USED. SIP RESISTOR VALUE MUST BE APPROPRIATE FOR INPUT VOLTAGE USED FOR EACH BANK OF 4 INPUTS. (SEE CHART)

REV	DATE	DESCRIPTION	BY
1	5-4-2016	INITIAL RELEASE	SPM
2	6-8-2016	CONTACTOR PN, BOARD DEPICTION	SPM

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Title

ALLIN1DC 4TH AXIS DC1 CONNECTIONS

Size A	NUMBER		Rev 2
Date 160504		Drawn by SPM	
Filename ALLIN1DC SET.dwg		Sheet 20 of 20	

ALLIN1DC User Guide

For Revisions 091117, 100316, 140317, and 140527

Updated 2-9-17

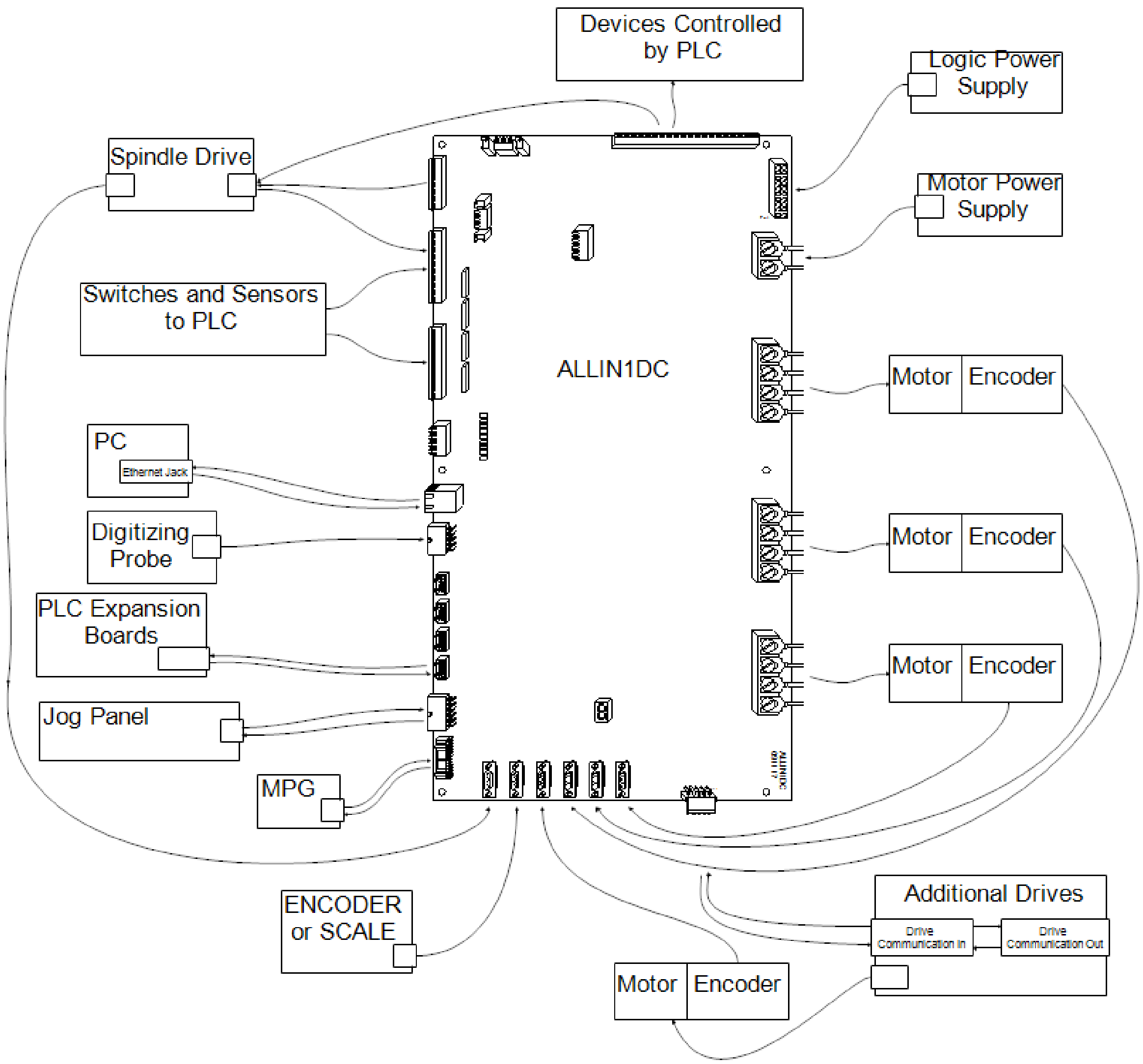
Overview

The ALLIN1DC is a three axis DC brush motor drive with an integrated PLC and motion control processing. Centroid's DC3IOB and MPU11 technology have been integrated into one unit to provide a highly functional, yet compact motion control product. Communication with a host PC is performed over Ethernet. Six encoder inputs are available for motor control or scale input. A range of motor drive currents are selectable with jumper blocks. The integrated PLC includes 16 digital inputs, 9 relay outputs, one analog input, and one analog output for general purpose use (see "PLC Section" for details).

Features

Function:	Motion Control Processor, PLC, and Servo Drive
Maximum number of Axes:	8
Encoder and Scale Inputs:	6 Incremental Encoders (A, B, and Z channels)
PLC Protocol Support	PLCbus protocol up to 768in / 768 out miniPLC protocol with 4 expansion ports
Drive Protocol Support	DriveBus Protocol
Jog Panel Protocol Support	JogLink Protocol
MPG Support	Differential encoder and discrete inputs (no serial MPG support)
Control Interface:	100 Mb/s Ethernet to PC
Drive Application:	DC Brush Motors
Number of Axes:	3
Current rating per axis:	6 to 15 Amps
Motor Voltage:	20 to 180 Volts
Digital PLC Inputs:	34
Digital PLC Outputs:	12
Analog Output resolution:	12 bits
Analog Input resolution:	12 bits
Dimensions (W*D*H):	16 * 8 * 5.25 inches

Typical Connections



Logic Power Connection for Revision 100316 and Older

An ATX style PC power supply provides voltage for ALLIN1DC logic circuits. The power supply connector may have 20 pins or 24 pins on units equipped with an ATX 2.2 compatible supply. The -5V and +5VSB pins are not used by the ALLIN1DC, but all other pins should be checked if troubleshooting a supply problem.

ATX 2.0 Power Connector (H14)

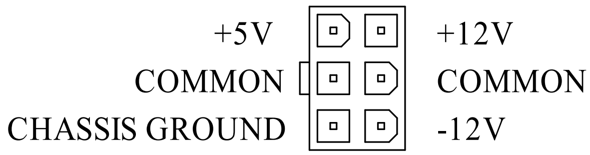
+3.3V	11	1	+3.3V
-12V	12	2	+3.3V
COMMON	13	3	COMMON
/POWER ON	14	4	+5V
COMMON	15	5	COMMON
COMMON	16	6	+5V
COMMON	17	7	COMMON
-5V	18	8	POWER OK
+5V	19	9	+5VSB
+5V	20	10	+12V

Optional ATX 2.2 Power Connector (H14)

+3.3V	13	1	+3.3V
-12V	14	2	+3.3V
COMMON	15	3	COMMON
/POWER ON	16	4	+5V
COMMON	17	5	COMMON
COMMON	18	6	+5V
COMMON	19	7	COMMON
	20	8	POWER OK
+5V	21	9	+5VSB
+5V	22	10	+12V
+5V	23	11	+12V
COMMON	24	12	+3.3V

Newer ALLIN1DC units regulate +3.3 VDC on board, allowing for a different power supply. The power connector has been simplified as part of the upgrade.

Revision 140317 Power Connector (H1)



Servo Drive Section

The ALLIN1DC drive section is based on Centroid's proven DC brush motor drive technology. Several built in features allow for easy integration with a variety of hardware.

Each axis can be built with a range of current ratings determined by DIP switch settings and drive hardware. Current ratings of 6, 9, 12, and 15 amps can be provided on the ALLIN1DC. The following chart shows the various current settings available by changing settings on DIP switch block SW1.

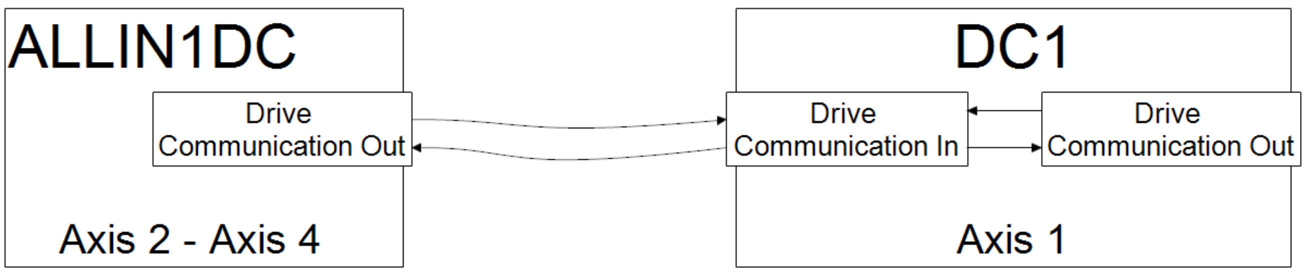
Drive Current Settings

	Axis 0		Axis 1		Axis 2	
Current Setting	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5	Switch 6
6	OFF	OFF	OFF	OFF	OFF	OFF
9	OFF	ON	OFF	ON	OFF	ON
12	ON	OFF	ON	OFF	ON	OFF
15	ON	ON	ON	ON	ON	ON

Additional axis drives may be connected to the ALLIN1DC through the “Drive Communication Out” connector. LED1 status display will show the base or first axis number for the drive. For example, an ALLIN1DC that is running as axes 2, 3, and 4 will display 2 on LED1 as long as no error codes are present. The axis farthest from the ALLIN1DC in the communication chain will always be axis 1. Axis numbers increase along the chain toward the ALLIN1DC. To find the axis number of a particular motor connector on ALLIN1DC, add the base axis number to the labeling for the motor connector. If LED1 displays 2, “0+” and “0-“ motor terminals are for motor 2, “1+” and “1-“ go to motor 3, and “2+” and “2-“ go to axis 4. These axis numbers correspond to software parameters that can be used to rearrange the order of display on the DRO.

If error codes exist, the decimal point on LED1 will light and an error number will flash. See the “LED1 Error Codes” chart for information on error codes.

Drive Communication Connection for ALLIN1DC and DC1

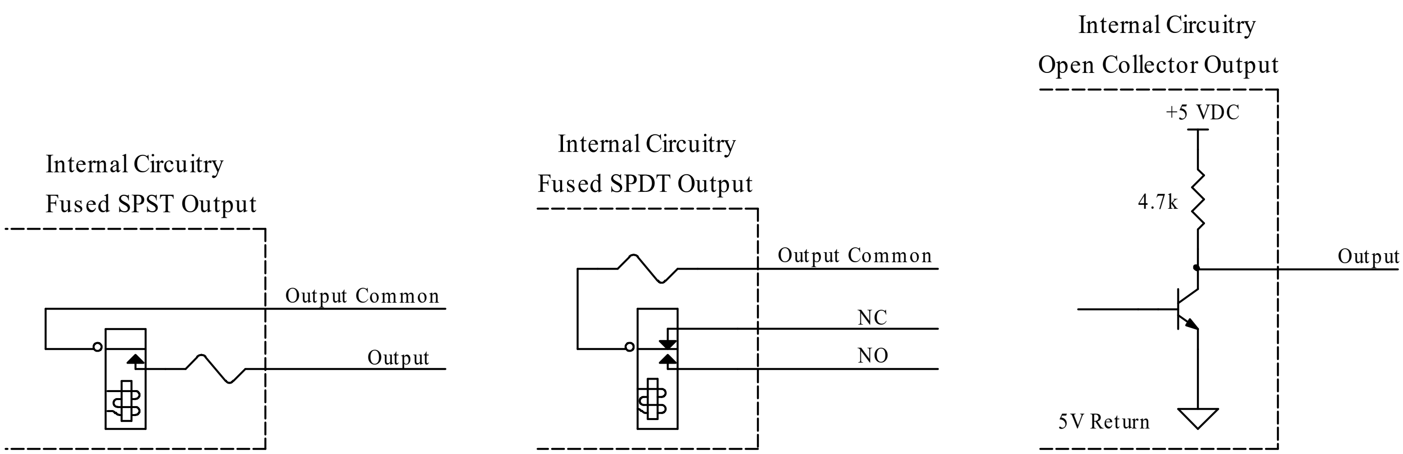


PLC Section

The ALLIN1DC has 34 digital inputs, 12 digital outputs, one analog input, and one analog output. Some I/O is dedicated to a particular function. Inputs 1 through 6 are axis limit switch inputs that inhibit motion at the hardware level. Four inputs are dedicated to supporting the digitizing probe, and 11 inputs and 3 outputs are used for MPG support. The remaining 10 configurable, optically isolated inputs and 9 fused relay outputs are available for general purpose use. Check the "ALLIN1DC I/O Map" and "ALLIN1DC Specifications" sections to determine I/O type and capability. Accessory boards can be connected to increase I/O capacity. See the "PLC Expansion" section for details.

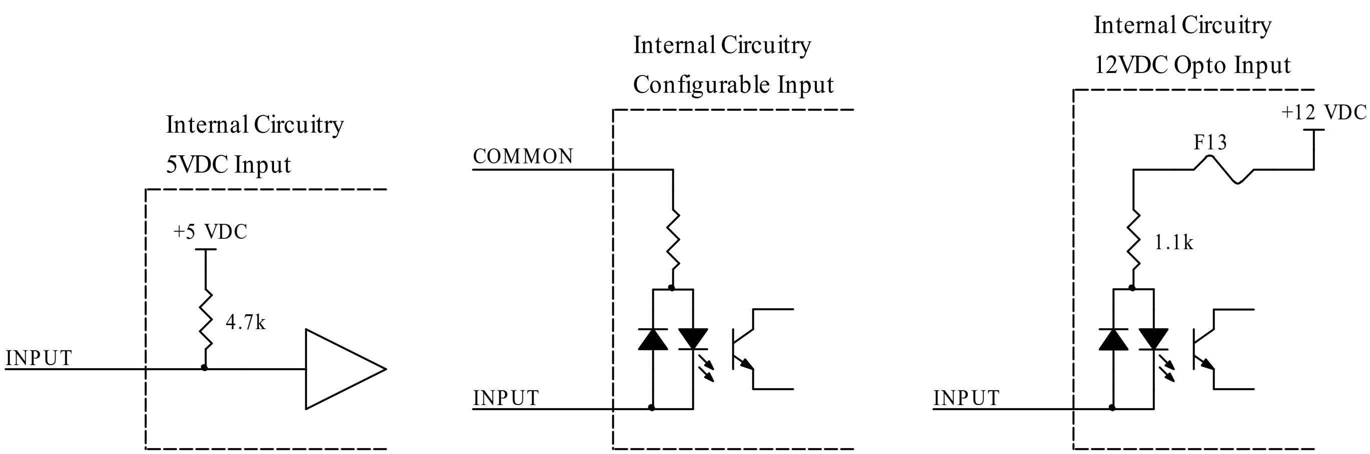
Digital Outputs

Two SPDT and 7 SPST fused outputs are available on board, as well as 3 open collector outputs designed to connect to the MPG.

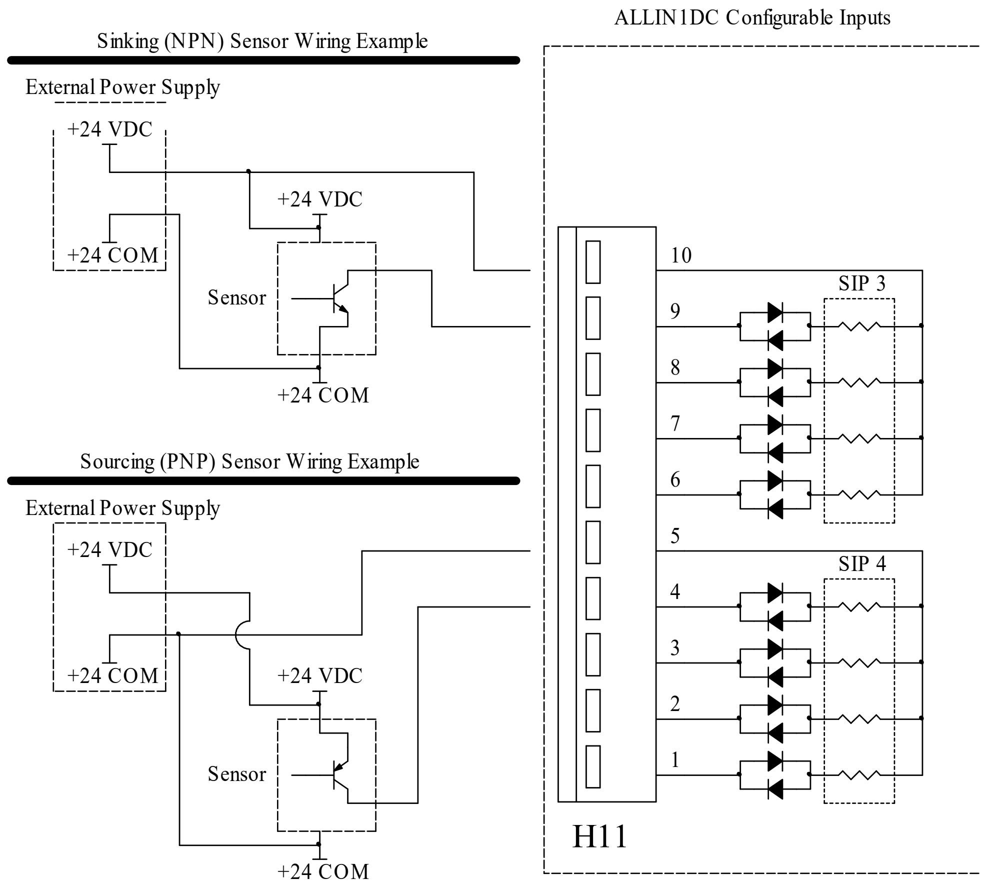


Configurable Inputs

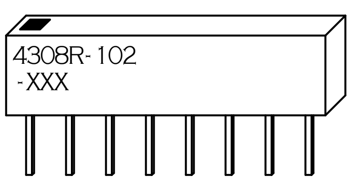
Configurable inputs are used for general purpose inputs. These inputs can be used with 5, 12, or 24 VDC sensors or switches. Compare the specifications of sensors to the "ALLIN1DC Specifications" chart to ensure reliable operation. Inputs are arranged into banks of 4 that can be individually configured for voltage and polarity. Resistor packs SIP1, SIP2, SIP3, and SIP4 must be changed to match the input voltage for each bank of inputs. Sinking or sourcing operation is determined by the wiring configuration.



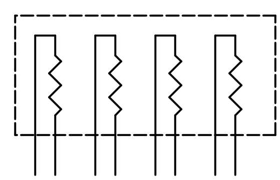
Configurable Input Connection Examples



SIP Identification – XXX Indicates Value



SIP Internal Wiring / Pinout



SIP Input Reference

SIP Designator	Related Inputs
SIP1	13,14,15,16
SIP2	9,10,11,12
SIP3	5,6,7,8
SIP4	1,2,3,4

SIP Resistor Values

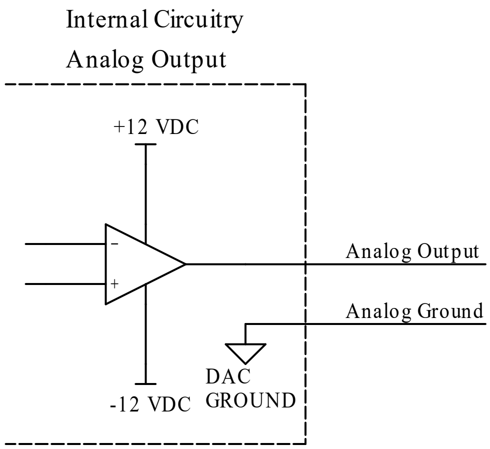
SIP Value Marking	Resistor Value (Ohms)	Input Voltage
471	470	5
102	1.0k	12
222	2.2k	24

Dedicated I/O

Several inputs and outputs are dedicated to particular functions and route directly into the MPU11 processor section of the ALLIN1DC. As can be seen in the "ALLIN1DC I/O Map" section, these I/Os are mapped after normal PLC space, and start at location 769. Probing and MPG functions use the dedicated I/O.

Analog Output

Four voltage output ranges are available on the analog output. A block of five DIP switches (SW3) must be set according to the following chart to get the desired output range.



Analog Output Range Selection

Voltage Range	Switch Number				
	1	2	3	4	5
0 TO 5	OFF	ON	ON	ON	ON
0 TO 10	OFF	ON	OFF	ON	OFF
-5 TO 5	ON	ON	OFF	ON	OFF
-10 TO 10	ON	OFF	OFF	OFF	OFF

Analog Output Calculations

Analog outputs use a 12 bit digital to analog converter (DAC) to generate analog from the DAC request sent from the PLC program. The 12 bit value allows a DAC request of 0 to 4095, which corresponds to 0 to 9.998 volts in the 0 to 10V range.

0 to 5V Range

$$\text{output voltage} = \frac{\text{DAC Request}}{4096} * 5$$

-5 to 5V Range

$$\text{output voltage} = \left(\frac{\text{DAC Request}}{4096} * 10\right) - 5$$

0 to 10V Range

$$\text{output voltage} = \frac{\text{DAC Request}}{4096} * 10$$

-10 to 10V Range

$$\text{output voltage} = \left(\frac{\text{DAC Request}}{4096} * 20\right) - 10$$

Analog Output Wiring

Analog outputs should be wired using a shielded twisted pair for best results. The analog output terminal is paired with a common terminal for direct wiring of the signal, common, and shield. In most cases, it is best to connect the shield to the common only at the ALLIN1DC. Routing analog cables away from power wires and other noise sources is also critical for good performance. See “ALLIN1DC Connections” section for terminal locations.

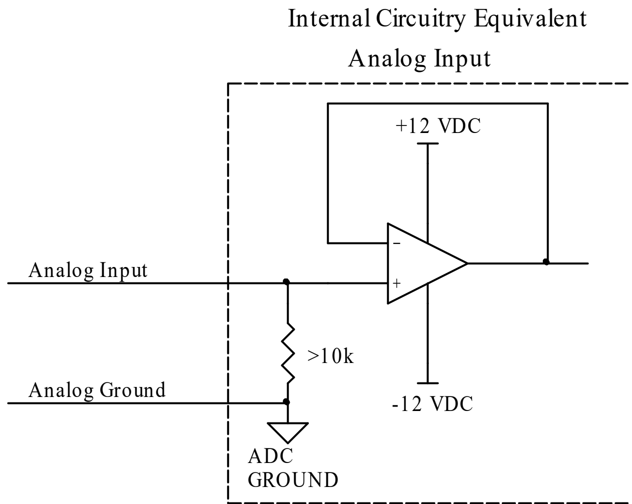
Analog Output Trim

The analog output is factory trimmed for the 0 to 10V scale. If a different output range is used, it will be necessary to trim the output for best results. The following procedure is used to trim the analog output:

1. Request 0V
2. Adjust offset POT until 0V is output
3. Request maximum output
4. Adjust gain POT until maximum is output (depends on range)
5. Repeat steps 1-4 until readings are consistent and correct

Analog Input

Like the analog output, the input has four ranges available. Set the corresponding block of five DIP switches (SW2) according to the following chart to accept the required input range.



Analog Input Range Selection

Voltage Range	Switch Number				
	1	2	3	4	5
0 TO 5	OFF	OFF	OFF	X	X
0 TO 10	OFF	ON	OFF	X	X
-5 TO 5	ON	ON	OFF	X	X
-10 TO 10	ON	ON	ON	X	X

X = don't care

Analog Input Calculations

The analog input uses a 12 bit analog to digital converter (ADC) to generate a digital ADC result from an analog signal. The 12 bit result allows an ADC result of 0 to 4095, which corresponds to 0 to 9.998 volts in the 0 to 10V range.

0 to 5V Range

$$\text{ADC result} = \frac{4096 * \text{Input Voltage}}{5}$$

-5 to 5V Range

$$\text{ADC result} = \left(\frac{4096 * \text{Input Voltage}}{10}\right) + 2048$$

0 to 10V Range

$$\text{ADC result} = \frac{4096 * \text{Input Voltage}}{10}$$

-10 to 10V Range

$$\text{ADC result} = \left(\frac{4096 * \text{Input Voltage}}{20}\right) + 2048$$

Analog Input Wiring

The analog input should be wired using a shielded twisted pair for best results. The analog input terminal is paired with a common terminal for direct wiring of the signal, common, and shield. In most cases, it is best to connect the shield to the common only at the ALLIN1DC. Routing analog cables away from power wires and other noise sources is also critical for good performance. See “ALLIN1DC Connections” section for terminal locations.

Analog Input Trim

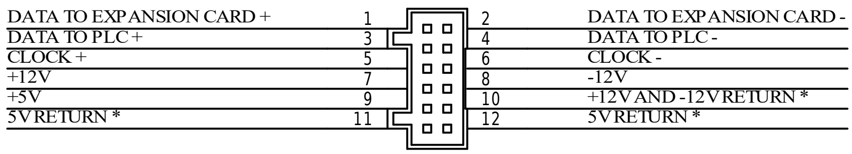
The analog input is factory trimmed for the 0 to 10V scale. If a different input range is used, it will be necessary to trim the input for best results. The following procedure is used to trim the analog input:

1. Input 0V in bipolar modes, or slightly above 0V in unipolar modes
2. Adjust offset POT until the reported voltage matches the actual voltage
3. Input a voltage slightly below the maximum (depends on range)
4. Adjust gain POT until the reported voltage matches the actual voltage
5. Repeat steps 1-4 until readings are consistent and correct

PLC Expansion

PLC I/O expansion is possible through the four “PLC ADD” connectors. Each PLC expansion port can accept 16 – 128 inputs, outputs, or inputs and outputs in 16 bit increments. This allows for digital I/O, DACs, ADCs, or other devices to be added to the system as needed.

PLC ADD 1 – 4 Connector Pinouts



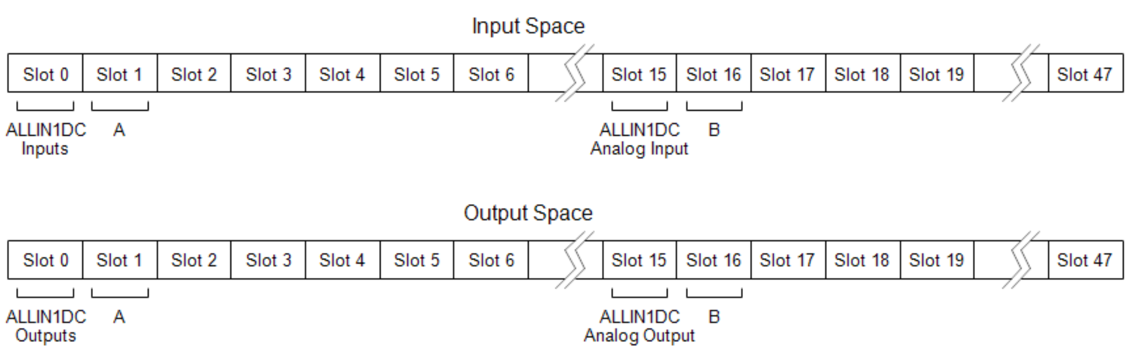
* +12V AND -12V RETURN and 5V RETURN are connected on the ALLIN1DC

PLC Expansion Memory Assignments

PLC I/O is arranged in 16 bit groups or slots. As a general rule, slots 0-14 are used for individual I/Os such as switches and have a programmable debounce time for the inputs. Slots 15-47 are reserved for ADCs, DACs, or other devices that do not require debounce. Every device using I/O space must use space in 16 bit multiples by reserving slots. An ALLIN1DC uses 2 slots for its inputs and 2 slots for outputs.

Assignment of I/O slots occurs in a linear fashion starting at the ALLIN1DC, then “PLC ADD” port 1, “PLC ADD” port 2, etc. In the following general example, the ALLIN1DC I/O is shown in its fixed location, which can not be changed. Devices plugged into the “PLC ADD” ports that require debounce will be assigned starting at the slots marked “A”, while devices that do not require debounce will start being assigned at the slots marked “B”.

PLC Expansion Location Assignment General Example



The remaining examples show how specific devices will map into the PLC under certain conditions. PLC Expansion devices have a variety of memory requirements, which are summarized in the following chart for devices used in the examples.

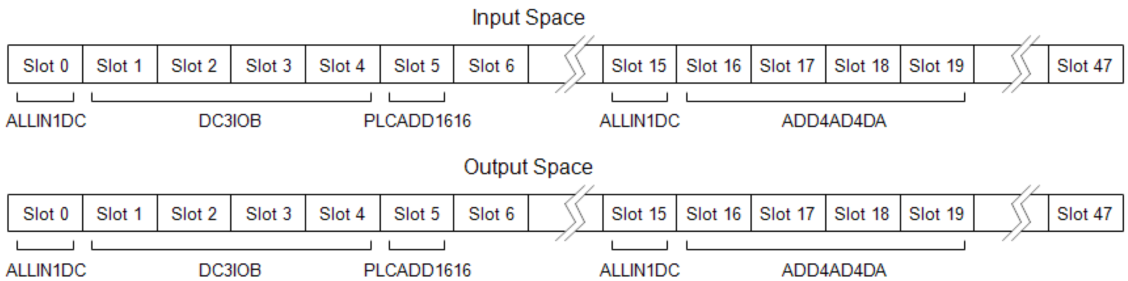
PLC I/O Slot Requirements

	Function	Input Debounce Slots Used	Input Non-Debounce Slots Used	Output Debounce Slots Used	Ouput Non-Debounce Slots Used
Total Available		15	33	15	33
ALLIN1DC	Digital and Analog I/O	1	1	1	1
DC3IOB as expansion	Digital and Analog I/O	4	0	4	0
PLCADD1616	Digital I/O	1	0	1	0

ADD4AD4DA	Analog I/O	0	4	0	4

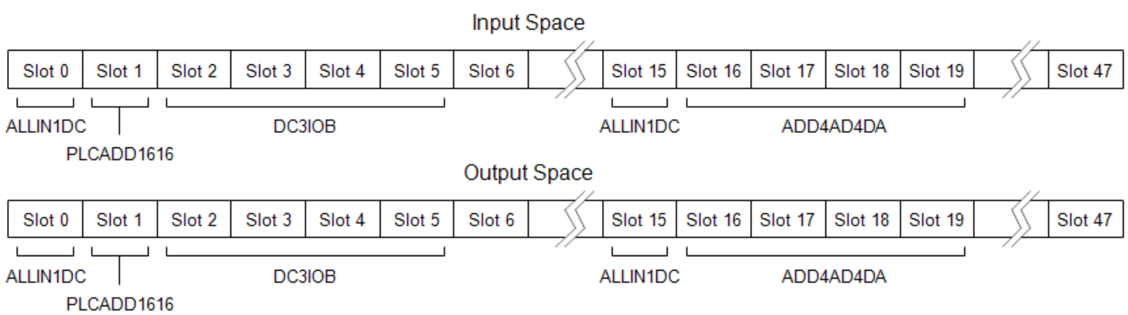
Example 2 illustrates I/O assignments on a system that has an ALLIN1DC main PLC, a DC3IOB plugged into "PLC ADD 1", a PLCADD1616 to "PLC ADD 2", and an ADD4AD4DA expansion card plugged into PLC ADD 3. Note that the ADD4AD4DA is and ADC/DAC expansion card and is assigned starting at slot 16 since it does not require debounce.

PLC Expansion Example 2



Example 3 shows the results of plugging an ADD4AD4DA into "PLC ADD 1", a PLCADD1616 into "PLC ADD 2", and a DC3IOB into "PLC ADD 3". The location of the ADD4AD4DA expansion card I/O is unaffected since it is the only expansion device in the example that does not require debounce. The PLCADD1616 and DC3IOB have changed locations since the PLCADD1616 is plugged into a lower number "PLC ADD" port and is therefore assigned I/O locations before the ALLIN1DC.

PLC Expansion Example 3



ALLIN1DC I/O Map

Input Specification			Input Location	
Number	Function	Type	Connector	Pin
1	Axis Limit 0-	Configurable	H11	1
2	Axis Limit 0+	Configurable	H11	2
3	Axis Limit 1-	Configurable	H11	3
4	Axis Limit 1+	Configurable	H11	4
5	Axis Limit 2-	Configurable	H11	6
6	Axis Limit 2+	Configurable	H11	7
7	General Purpose	Configurable	H11	8
8	General Purpose	Configurable	H11	9
9	General Purpose	Configurable	H10	1
10	General Purpose	Configurable	H10	2
11	General Purpose	Configurable	H10	3
12	General Purpose	Configurable	H10	4
13	General Purpose	Configurable	H10	6
14	General Purpose	Configurable	H10	7
15	General Purpose	Configurable	H10	8
16	General Purpose	Configurable	H10	9
241-252	Analog in	12 bit ADC	H9	1
253-256	Forced to 0			
769	Mechanical Probe	12VDC Opto	H13	6
770	DSP Probe	12VDC Opto	H13	4
771	Probe Detect	12VDC Opto	H13	8
772	Probe Auxiliary	12VDC Opto	H13	10
773	MPG x1	5VDC	H19	9
774	MPG x10	5VDC	H19	11
775	MPG x100	5VDC	H19	13
776	MPG Axis 1	5VDC	H19	4
777	MPG Axis 2	5VDC	H19	6
778	MPG Axis 3	5VDC	H19	8
779	MPG Axis 4	5VDC	H19	10
780	MPG Axis 5	5VDC	H19	12
781	MPG Axis 6	5VDC	H19	14
782	MPG Axis 7	5VDC	H19	16
783	MPG Axis 8	5VDC	H19	18
784	MPG Aux 1	5VDC	H19	15
785	MPG Aux 2	5VDC	H19	20
786	MPG Aux 3	5VDC	H19	22

Output Specification			Output Location	
Number	Function	Type	Connector	Pin
1	General Purpose	Relay SPST	H6	1,2
2	General Purpose	Relay SPST	H6	3,4
3	General Purpose	Relay SPST	H6	5,6
4	General Purpose	Relay SPST	H6	7,8
5	General Purpose	Relay SPST	H6	9,10
6	General Purpose	Relay SPST	H6	11,12
7	General Purpose	Relay SPST	H6	13,14
8	General Purpose	Relay SPDT	H6	15,16,17
9	General Purpose	Relay SPDT	H6	18,19,20
241-252	Analog out	12 bit DAC	H9	6
253-256	Forced to 0			
769	MPG LED	Open Collector	H19	17
770	MPG Aux 1	Open Collector	H19	19
771	MPG Aux 2	Open Collector	H19	21

*Open Collector outputs are pulled up to 5V

*5 VDC inputs are not isolated

ALLIN1DC Specifications

Characteristic	Min.	Typ.	Max.	Unit
3.3 Volt Supply Current	1.9	-	-	A
5 Volt Supply Current	2.4	-	-	A
12 Volt Supply Current	0.5	-	-	A
-12 Volt Supply Current	0.1	-	-	A
Input Pullup Voltage (Vinp)	4	-	30	VDC
Input On Voltage	Vinp-1.25	-	-	VDC
Input Off Voltage	-	-	1.25	VDC
Relay Output Current	0.1	-	10	A @ 125VAC
Relay Output Current	0.1	-	5	A @ 30VDC
Open Collector Output Current	-	10	90	mA
Open Collector Output Voltage	-	5	5	VDC
Input Operating current	9	11	15	mA
Motor Output Current Settings	6	12	15	A
Motor Supply Voltage	20	115	180	VDC
Analog Output Current	0	1	10	mA
Analog Output Voltage	-10	-	10	V
Analog Output Resolution	-	12	-	bits
Analog Output Error	-	< 0.2	-	%
Analog Input Current	-	-	1	mA
Analog Input Voltage	-10	-	10	V
Analog Input Resolution	-	12	-	bits
Analog Input Error	-	< 0.1	-	%
PLC ADD Port 5V Current Output*	0	-	0.5	A
PLC ADD Port 12V Current Output*	0	-	1	A
PLC ADD Port -12V Current Output*	0	-	1	A
Encoder channel input low	0	-	0.5	V
Encoder channel input high	3.5	-	5	V
Encoder input frequency low speed (per channel)**	0	-	1200	khz
Encoder input frequency high speed (per channel)**	0	-	6000	khz
Size: 16 * 8 * 5.25 (W*D*H)				Inches

*PLC ADD Port Current is a total for all 4 ports in any combination. Voltage drop may increase too much beyond this rating, requiring external power wiring to the expansion boards.

**FPGA Firmware versions below 0.56 limited encoder input frequency to 800khz.

**See parameter 323 for switching to low speed filter on MPU11 FPGA versions 0.59 and newer.

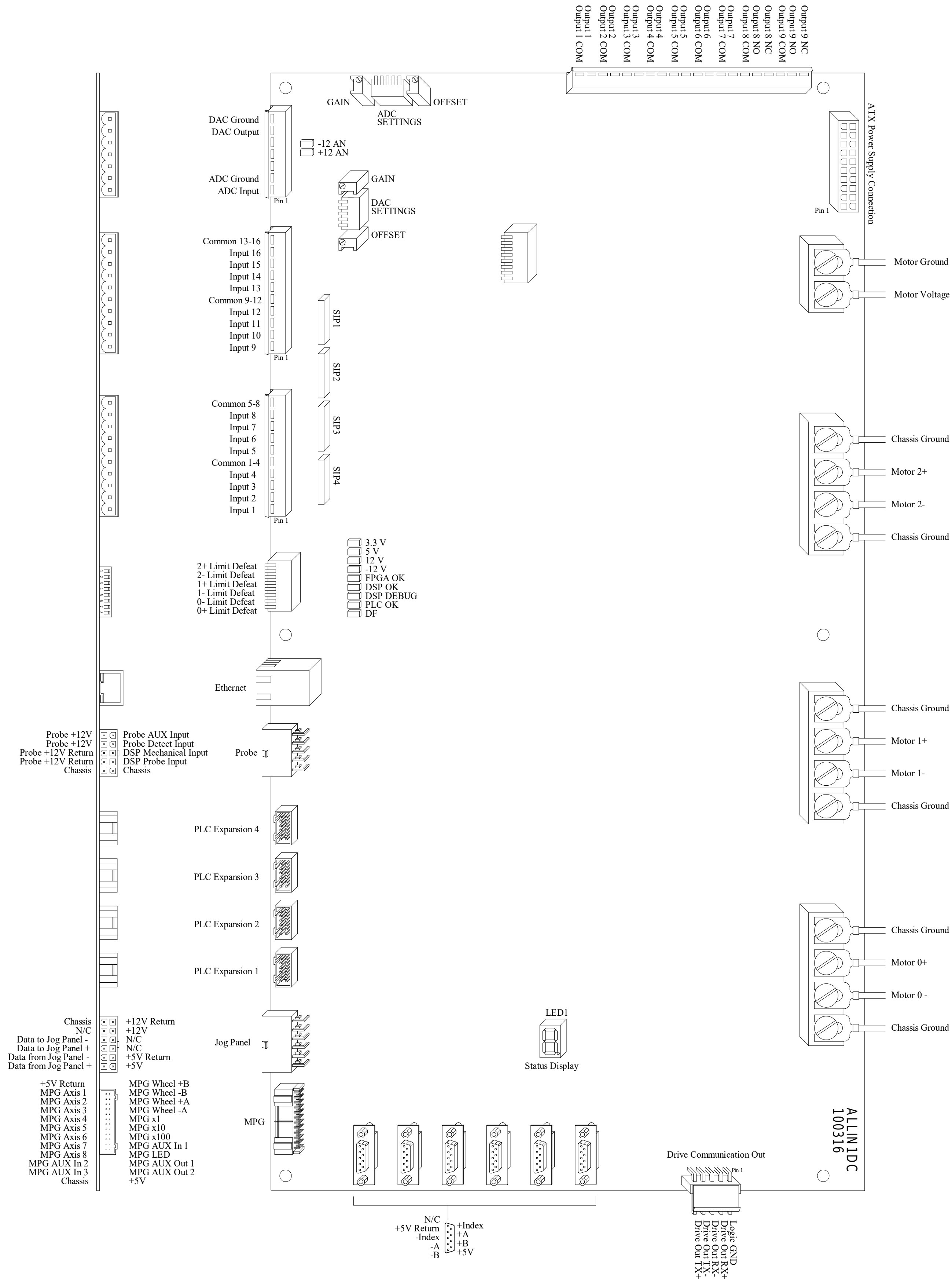
LED1 Error Codes

Error Number	Meaning	Cause	Corrective Action
1	Power Failure (revision 100316 and earlier)	the logic power supply is indicating to the ALLIN1DC that it is operating out of specification	Check power supply wiring (the grey wire and AC input in particular), replace power supply
2	15A Not Available	current selection switches on any axis are set to 15A, but the drive is not equipped with the appropriate FETs for long term use at 15A, so the drive will drop back to 12A	Select 12A or lower current settings or use a high power ALLIN1DC
3	Null Error	the self adjust routine has detected too large an offset on the current feedback	Send the drive back for repair. There is likely an internal failure causing the large offset
4	Limit Tripped	any limit switch is tripped	move away from the limit, check limit switch wiring, or use the limit defeat switches if a limit switch is not required

ALLIN1DC Troubleshooting

Symptom	Possible Cause	Corrective Action
All status LEDs out	Logic power not applied	Measure AC coming into power supply, correct wiring or supply problems
5, 3.3, 12, or -12 LED out	Power supply or connection problem	Measure AC coming into power supply, correct wiring or supply problems
AN +12V or AN -12V LED out	Analog section power loss	If other power LEDs are lit, the analog section has probably been damaged by incorrect connection, return for repair
FPGA LED not lit	MPU11 not ready	Wait for MPU11 to start and enter run mode
	Internal Fault	Return for repair
DSP LED not lit	MPU11 is booting up	Wait for MPU11 to detect hardware and start run mode
DSP DEBUG LED flashing fast	MPU11 is detecting hardware	Wait for MPU11 to detect hardware and start run mode
DSP DEBUG LED flashing one time per second	New drive protocols active	None
DSP DEBUG LED flashing two times per second	Legacy drive protocols active	Internal fault, only new protocols should be in use, return for repair
Encoder connection bad	Bad encoder or wiring	Check or replace encoder and cable
	Return not connected	Connect return line. If the encoder is not powered by ALLIN1DC's +5V, this is sometimes overlooked.
DF LED out	Motion control processor section hasn't booted up	Start software, wait for the main screen to load
	"Servo Power Removed" due to fault	Restart system to reset runaway or other serious fault condition
PLC OK LED out	Motion control processor section hasn't booted up	Start software, wait for the main screen to load
LED1 display flashing with decimal point lit	An error condition has been detected	See the "LED1 Error Codes" section for details on the error
LEDs on, but motor doesn't run	Axis Fuse blown	Check fuses with a meter, replace as necessary
	Limits tripped	Check limit switch wiring or pull up the limit defeat switches
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.
9023 PLC Communication Out Fault (Fiber 1)	Revision 100316 and older: The power supply may have lowered "Power OK" (grey wire) momentarily.	Change power supply.

ALLIN1DC Connections



Note: Revision 140317 and newer will have a 6 pin connector in place of the ATX power connector, but is otherwise equivalent.

ALLIN1DC Mounting Footprint