

TB278 (Rev1) – Setting up Control Techniques “SP” Spindle Drive

Purpose:

This document explains how to setup a Control Techniques SP spindle drive.

Requirements:

- Optional CT-USB cable to connect from Windows7 Centroid console or Windows7 PC to spindle drive which can be purchased here <http://www.galco.com/buy/Control-Techniques/CT-USB-CABLE>. **Note:** Setup can be completed using the keypad.
- USB flash drive containing the CTSOft software version CTSOft_V01_15_04 which can be downloaded at <http://www.emersonindustrial.com/en-US/controltechniques/downloads/userguidesandsoftware/Pages/softwaretools.aspx>.
- USB flash drive containing default configuration file if you have one (optional). Parameters can also be entered manually.
- Mouse for easy navigation

Procedure:

CTSOft Software Installation

1. Verify that all wiring on the spindle drive is completed and correct.
2. Plug in USB cable from Centroid console or PC to the spindle drive shown in Figure 1. If not using the USB cable and CTSOft software, skip to **Keypad Setup** located on page 13.

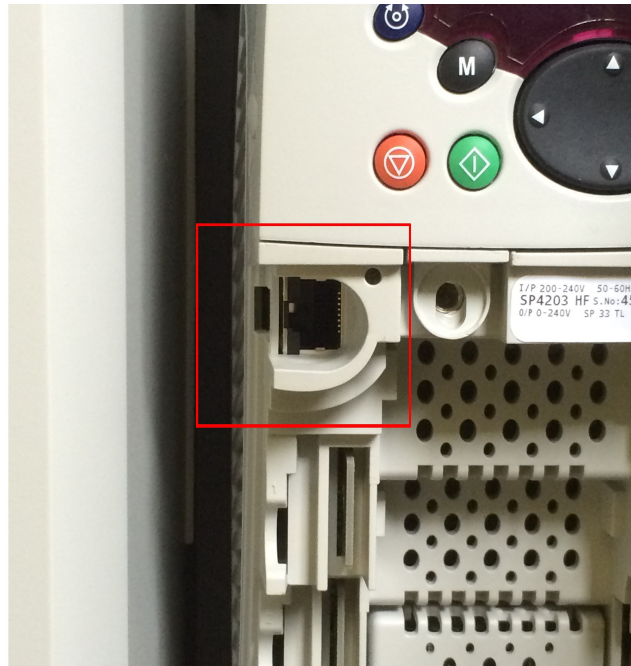


Figure 1

3. Insert USB flash drive with the CTSOft_V01_15_04 software.

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4. If connecting to the Centroid control, press **F10(Shut Down)**->**F9(Exit CNC11)**.
5. Double-click the **My Computer** icon located on the desktop.
6. Double-click the USB drive, typically **d:**.
7. Double-click the CT Soft folder.
8. Double-click the CTSOft_V01_15_04.exe file as shown in Figure 2 and follow the installation prompts.

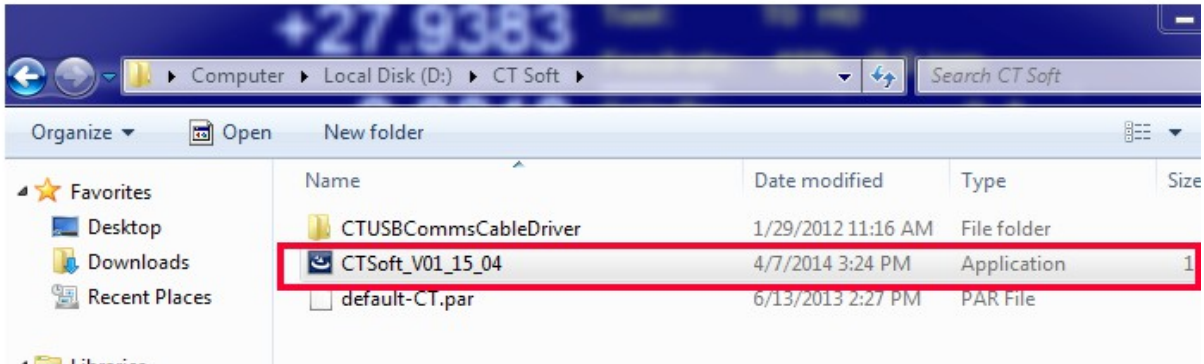


Figure 2

9. Click on the **Start** button and click on Control Panel.
10. Click on **Hardware and Sound** and click on **Device Manager**.

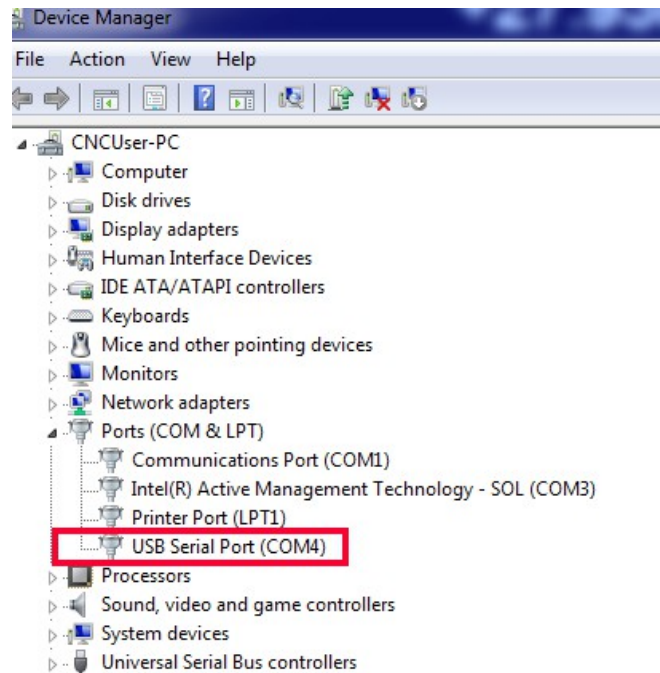


Figure 3

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11. Click the triangle to the left of **Ports (COM & LPT)**. There will be a **USB Serial Port (COMx)** as shown in Figure 3 where x is the number of the COM port that is being used. Jot down the COM number as it will be used later in the setup process.
Note: If the driver files did not install correctly, they will need to be manually installed.

Running CTSOft

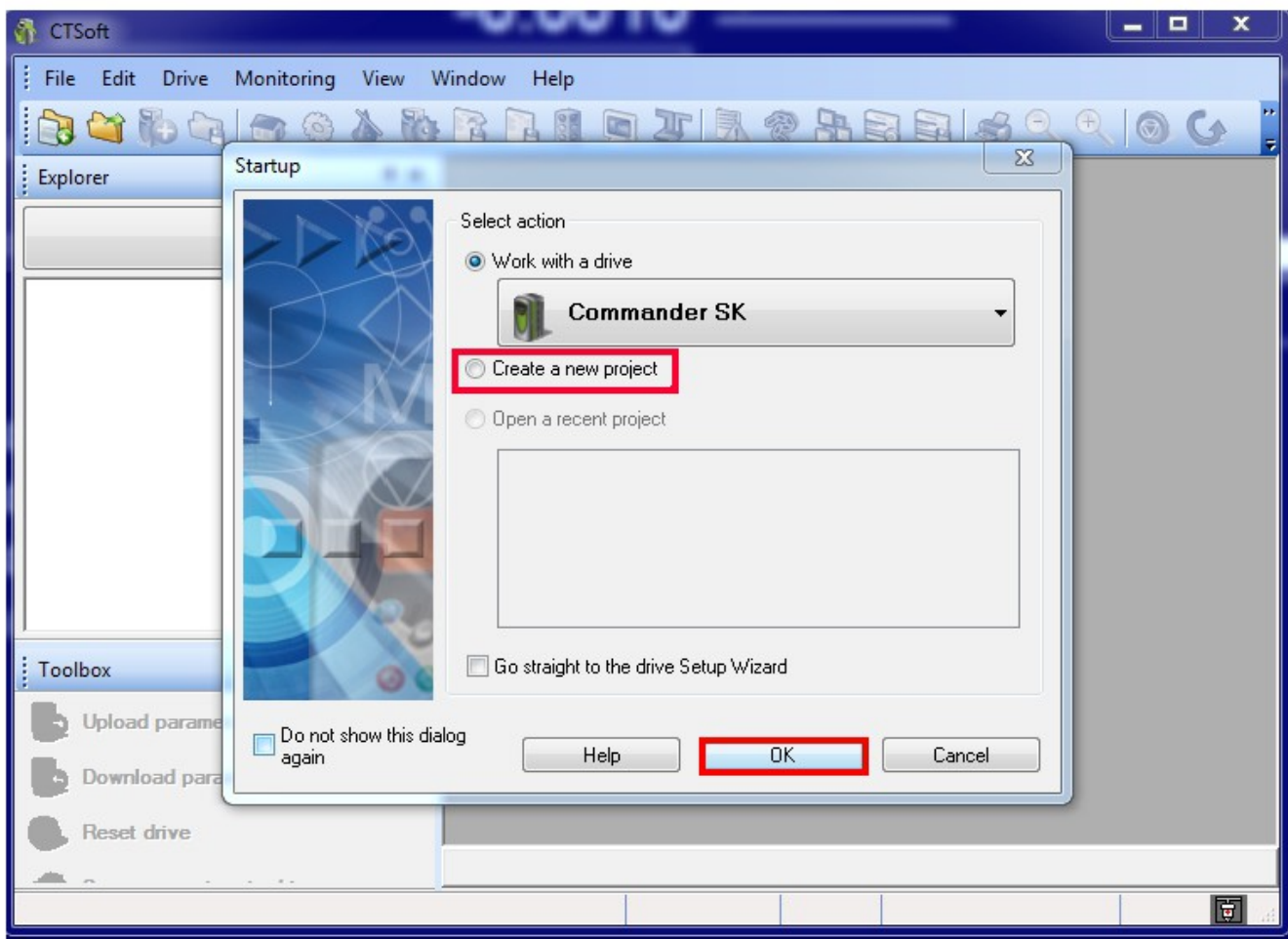


Figure 4

1. Click on the **Start** button and double-click **CTSoft**.
2. Select **Create a new project** and click **OK** as shown in Figure 4.

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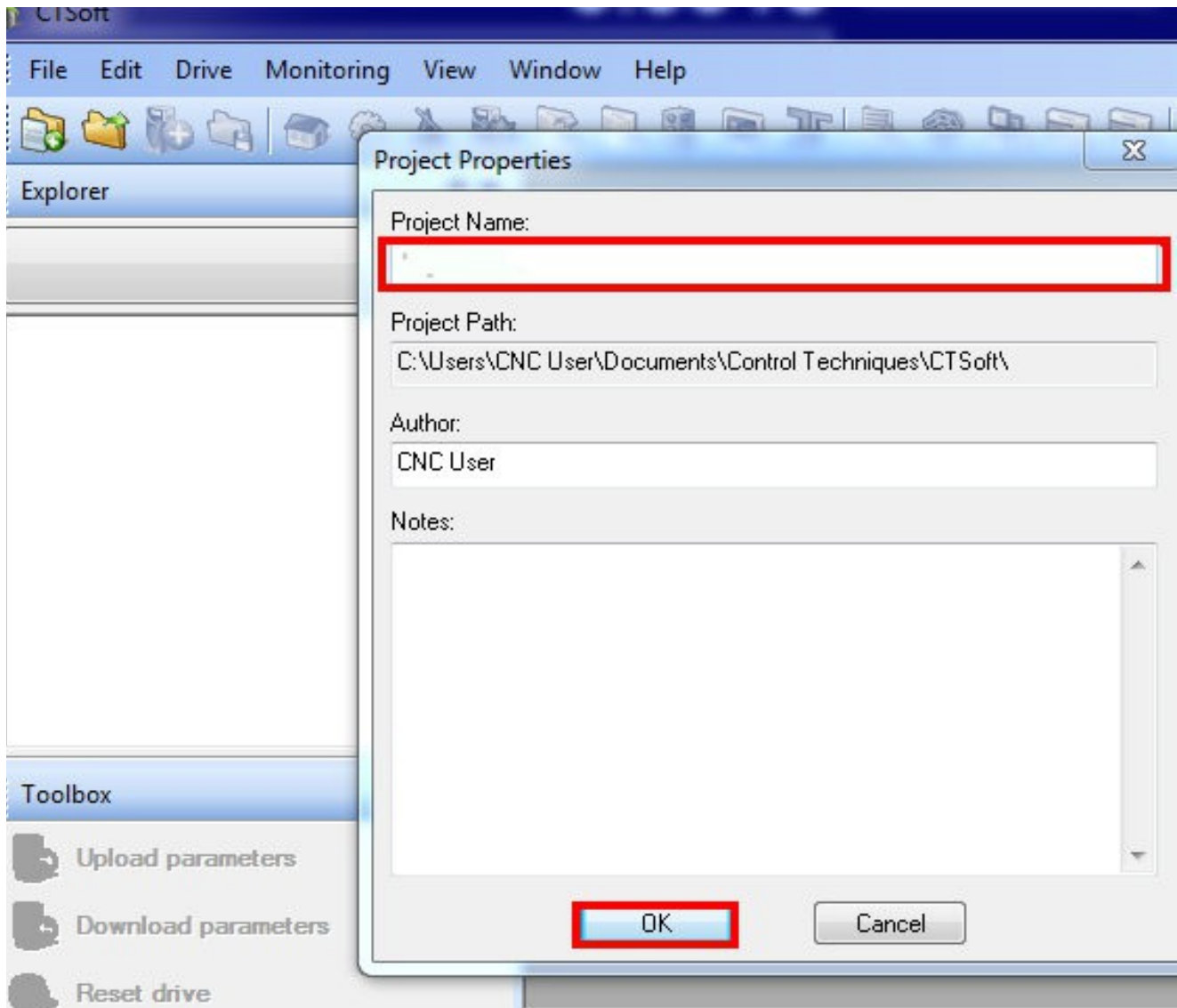


Figure 5

3. In **Project Properties** define the **Project Name** as shown in Figure 5 as the serial number of the Centroid control and click **OK**.

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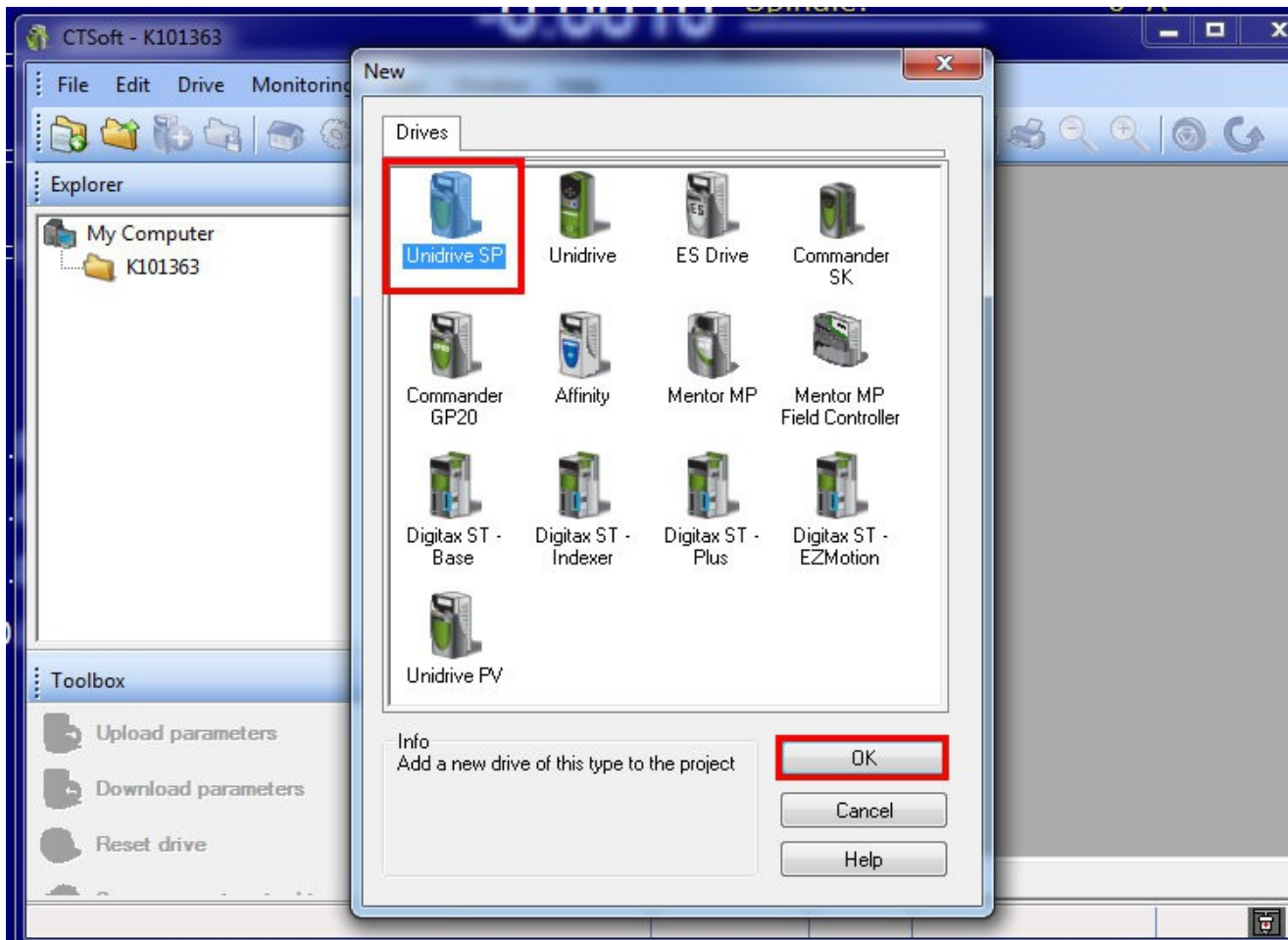


Figure 6

4. Select **Unidrive SP** and click OK.

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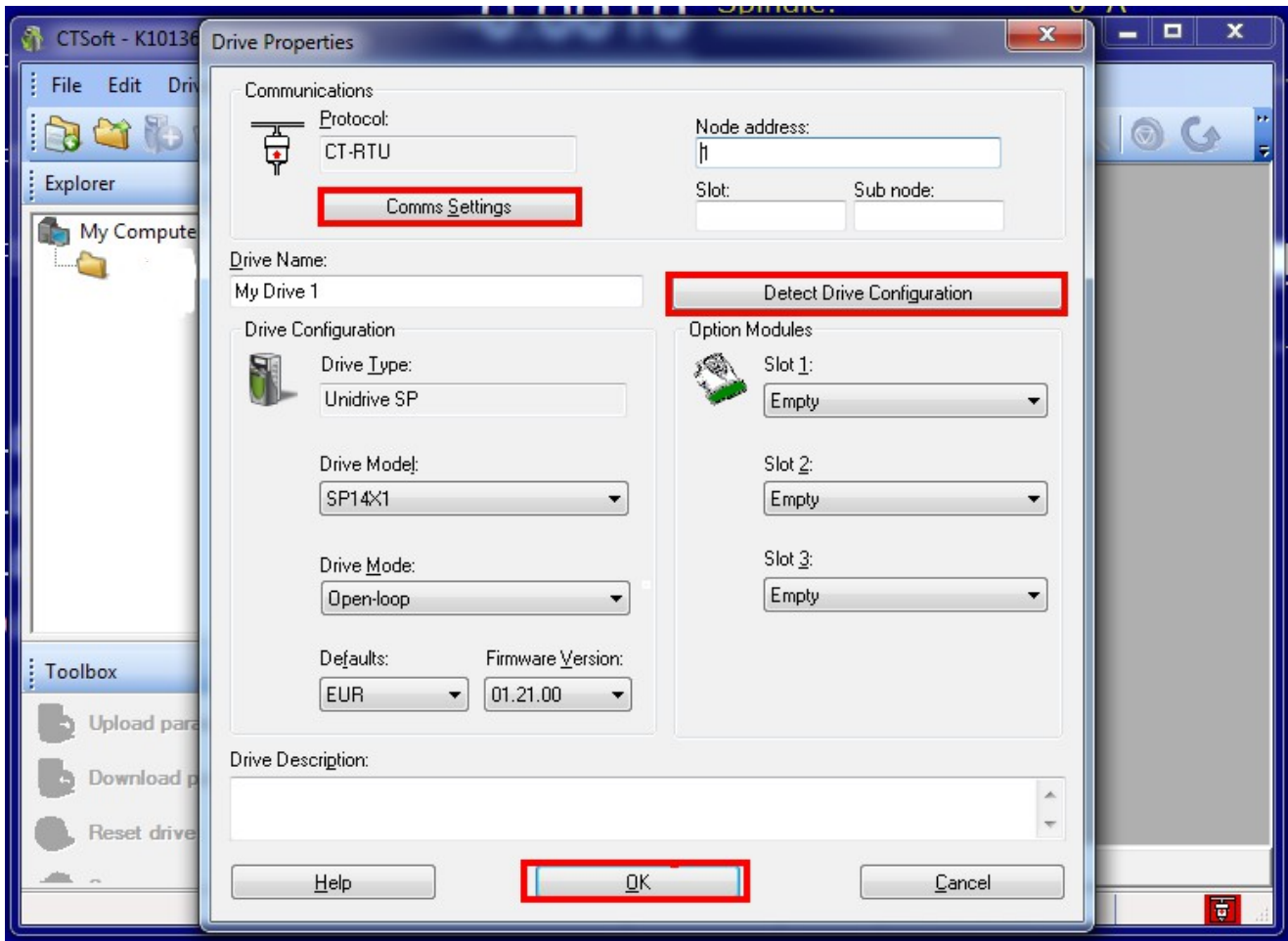


Figure 7

5. In the **Drive Properties** window, click **Detect Drive Configuration**.
Note: If a communication error window pops up as shown in Figure 8, click **OK**, then click **Comms Settings**.

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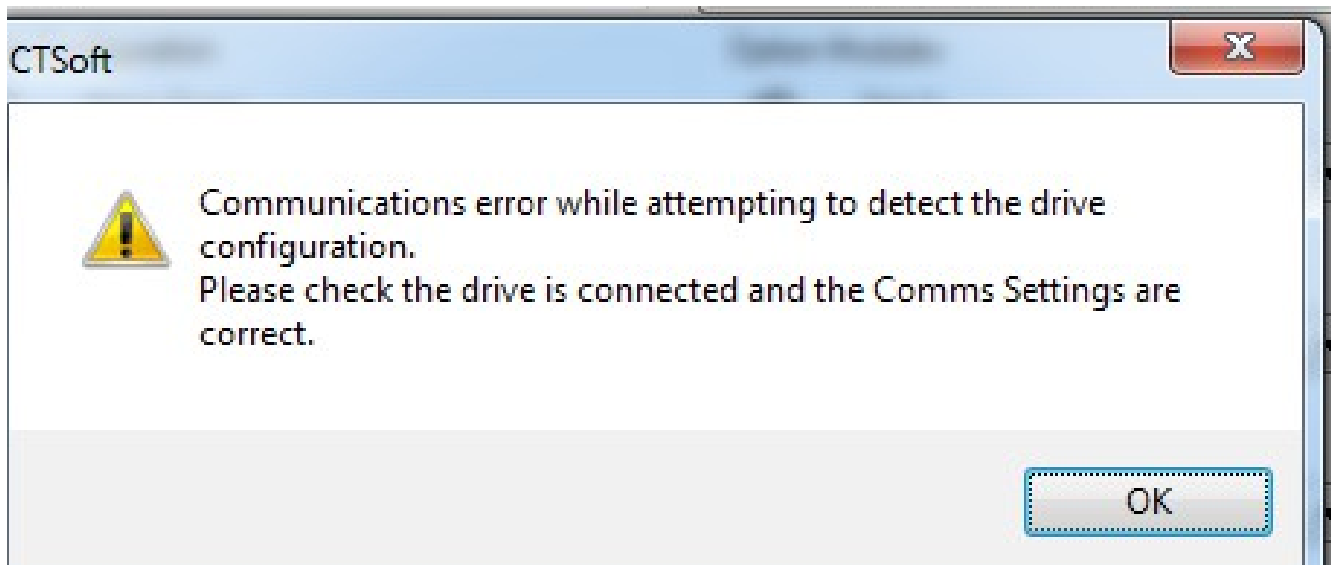


Figure 8

6. Verify that **Protocol** is set to **CT-RTU** and **Hardware** is set to COMx as defined in step 11 of **CTSoft Software Installation** as shown in Figure 9.

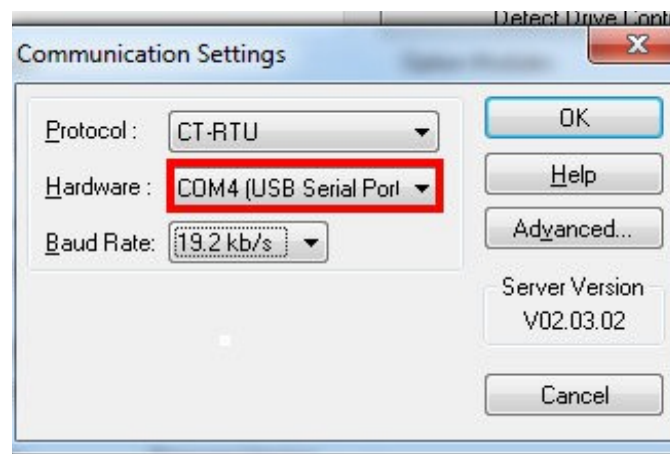


Figure 9

7. Click **OK** and click **Detect Drive Configuration** again. A window should appear stating that the settings were successfully read from the selected drive. Click **OK**.
8. Click the **Drive** menu and click **Online** as shown in Figure 10.

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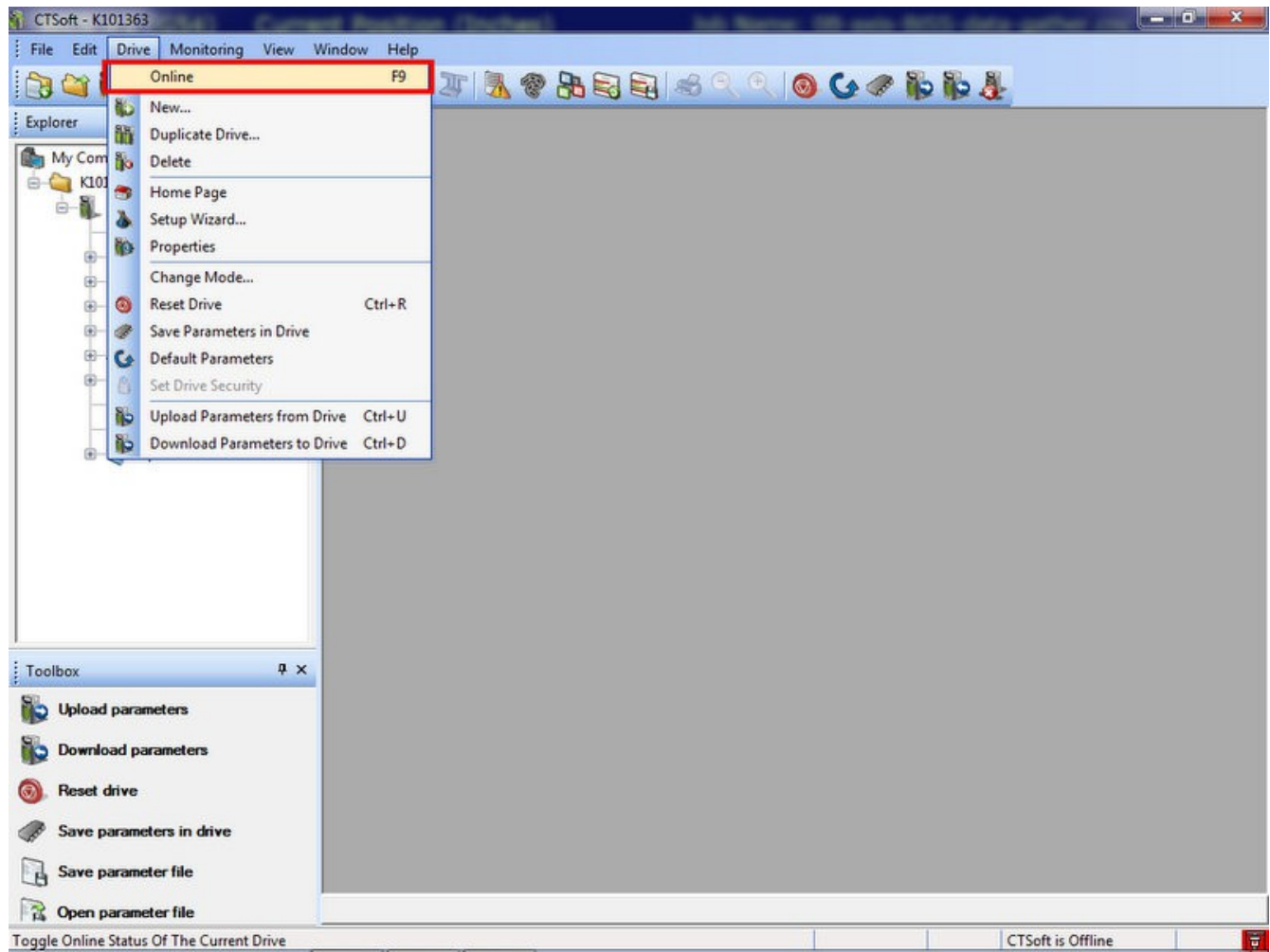


Figure 10

9. Verify that the bottom right hand corner has changed from red to green and shows **My Drive 1 is Online** as shown in Figure 11. It will also show **TRIPPED**.
10. If there is a default parameter file to load, such as default-CT.par, select Open Parameter File or else enter the parameters manually as defined in Figure 14.
11. A window will pop up asking if you want to load file. Click yes.
12. Window will pop up asking if you want to download parameters to drive now. Click yes.

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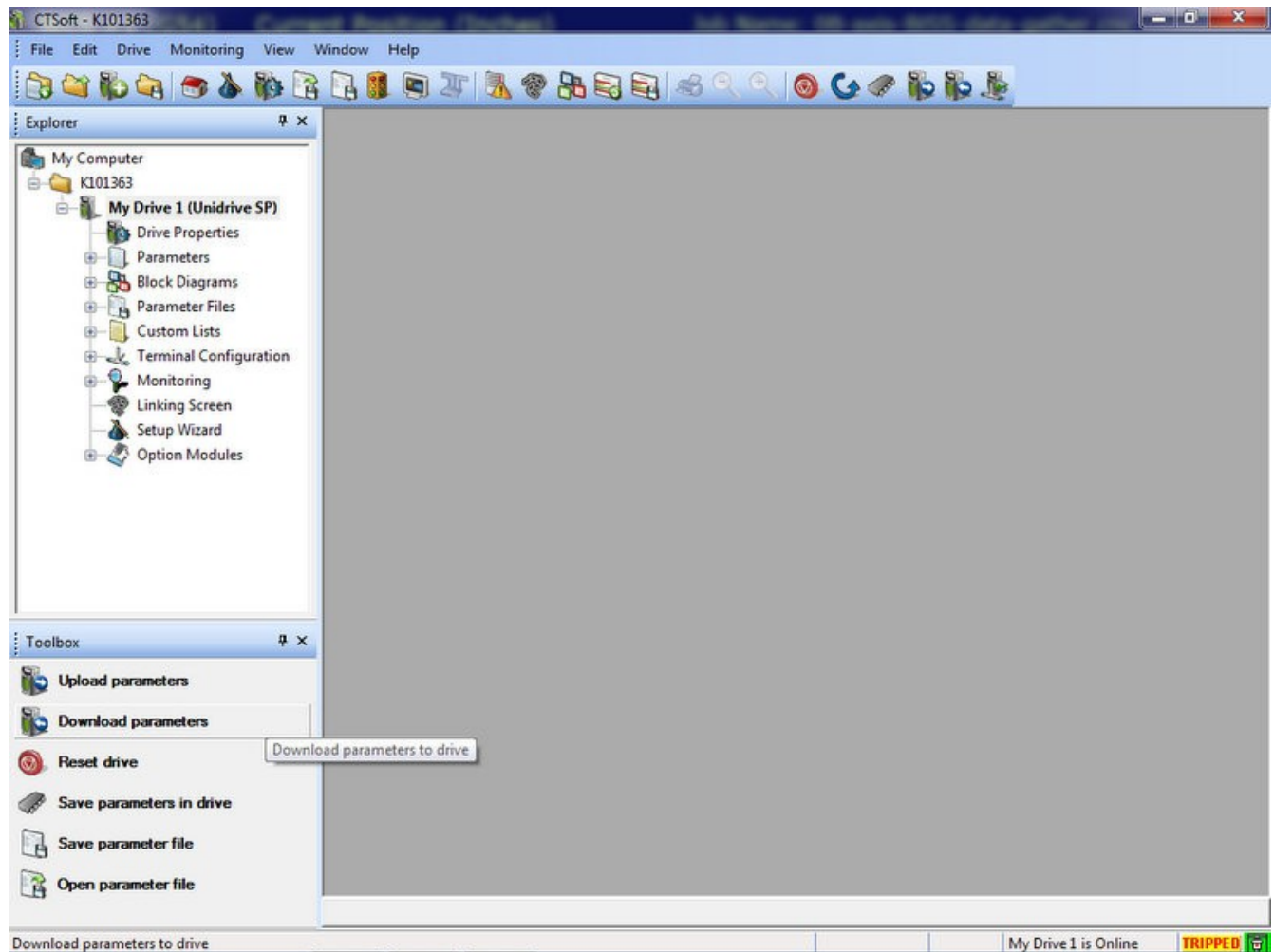


Figure 11

13. Once the parameters are downloaded to the drive, select **No** when asked to reset the drive. The green light at the bottom right corner will remain but the fault will have disappeared since the parameters are now set.
14. Click Save parameters to drive.
15. Now you will reset the drive by selecting Reset drive in the toolbox.

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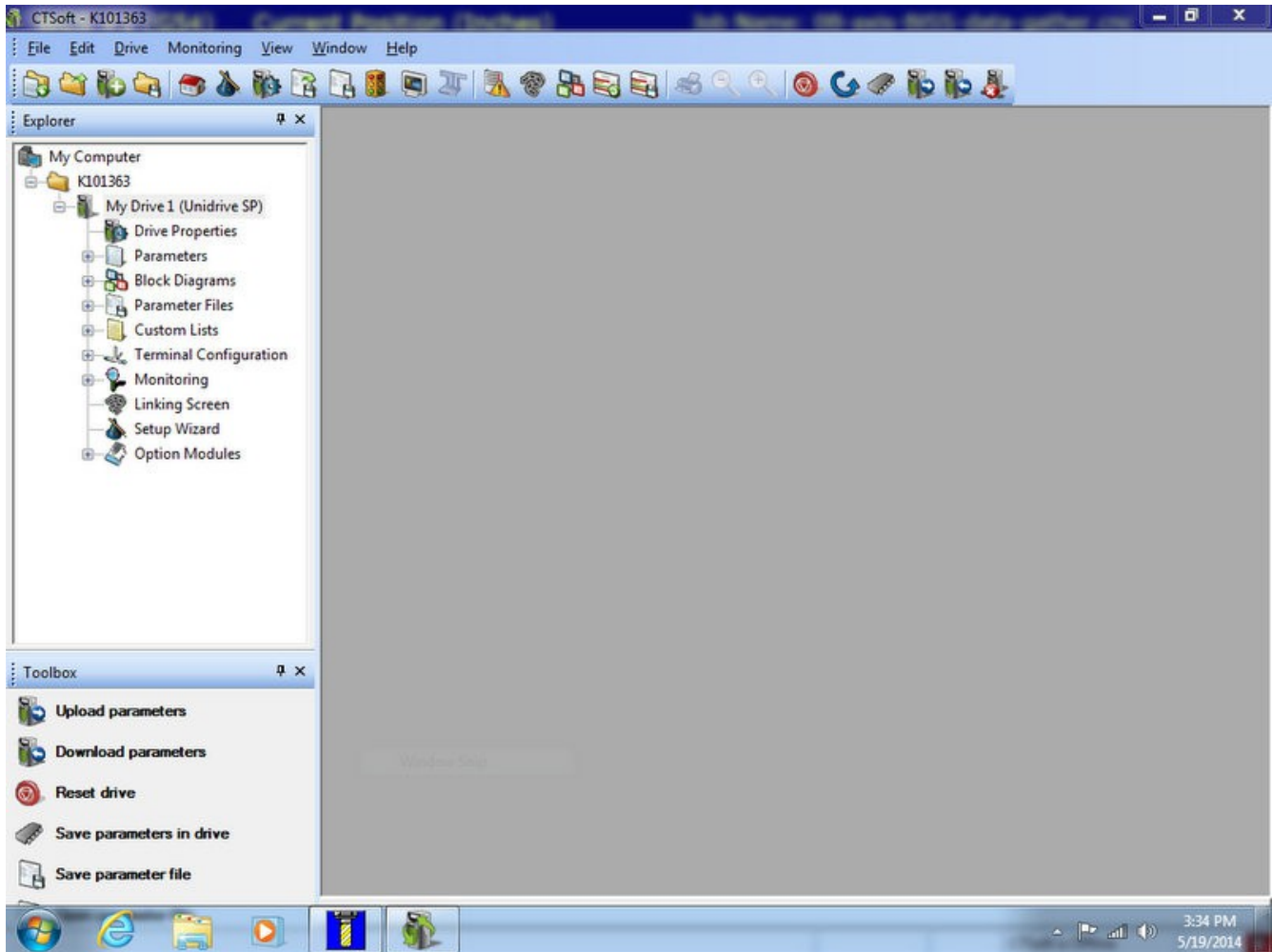


Figure 12

16. Now in the explorer section maximize the parameters section to see the loaded parameters. The ones highlighted in pink are the ones that have been changed from the default setting. Double check to make sure these are all set to the desired values outlined in figure 15. To change parameters you must double click the individual parameter menu groups to open them and make changes.

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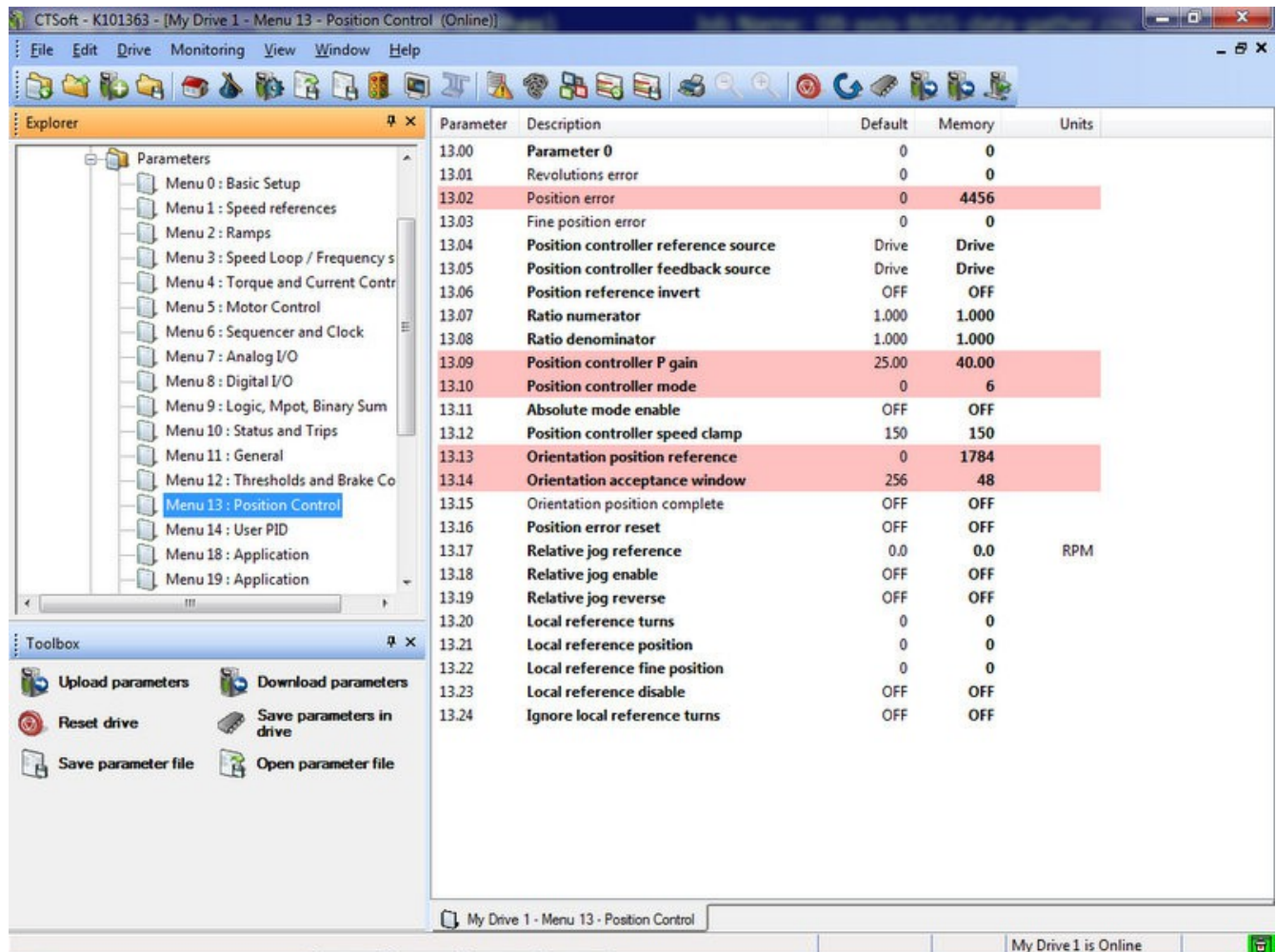


Figure 13 Parameters Menu

17. Finally we want to check to make sure we are getting spindle encoder feed back on the control.
18. To do this in the control software select **F1 Setup** then **F3 Config** then **F4 PID**. Manually turn the spindle slowly and watch on the screen that the ABS position for the spindle axis is changing while the spindle is moving.

Parameters

CT SP4203 and Cells Spindle HFS-170G Settings

| Parameter | Description | Default | Memory | Units |
|-----------|------------------------------------------------|---------|--------|------------|
| 1.06 | Maximum reference clamp | 1800 | 20000 | RPM |
| 2.04 | Ramp mode select | Std | FASt | |
| 2.11 | Acceleration rate 1 | 2 | 0.3 | s/1000 RPM |
| 2.21 | Deceleration rate 1 | 2 | 0.5 | s/1000 RPM |
| 3.23 | Hard speed reference selector | OFF | On | |
| 3.32 | Drive encoder marker flag | OFF | On | |
| 4.13 | Current controller Kp gain | 75 | 59 | |
| 4.14 | Current controller Ki gain | 1000 | 585 | |
| 5.06 | Rated frequency | 60 | 200 | Hz |
| 5.07 | Motor rated current | 80 | 72 | A |
| 5.08 | Rated load rpm / rated speed | 1770 | 5875 | RPM |
| 5.09 | Rated voltage | 230 | 220 | V |
| 5.1 | Rated power factor | 0.85 | 0.835 | |
| 5.11 | Number of motor poles | Auto | 4 pole | |
| 5.17 | Stator resistance (see user guide for scaling) | 0 | 0.075 | scaled Ohm |
| 5.18 | Maximum switching frequency | 3 | 8 | kHz |
| 5.24 | Transient inductance (sLs) | 0 | 0.323 | mH |
| 5.25 | Stator inductance (Ls) | 0 | 3.51 | mH |
| 5.29 | Motor saturation breakpoint 1 | 50 | 67 | % |
| 5.3 | Motor saturation breakpoint 2 | 75 | 92 | % |
| 6.08 | Hold zero speed | OFF | On | |
| 7.15 | T8 analog input 3 mode | th | Volt | |
| 8.11 | T24 digital I/O 1 invert | OFF | On | |
| 8.13 | T26 digital I/O 3 invert | OFF | On | |
| 8.23 | T26 digital I/O 3 source/destination | 6.3 | 13.15 | menu.param |
| 8.24 | T27 digital input 4 destination | 6.32 | 6.3 | menu.param |
| 8.25 | T28 digital input 5 destination | 1.41 | 6.32 | menu.param |
| 8.33 | T26 digital I/O 3 output select | OFF | On | |
| 8.39 | T28 & T29 digital input auto-selection disable | OFF | On | |
| 10.3 | Full power braking time | 0.09 | 4 | s |
| 10.31 | Full power braking period | 3.3 | 5 | s |
| 11.44 | Security status | L1 | L2 | |
| 13.09 | Position controller P gain | 25 | 40 | |
| 13.1 | Position controller mode | 0 | 6 | |
| 13.13 | Orientation position reference | 0 | 1784 | |
| 13.14 | Orientation acceptance window | 256 | 48 | |

Figure 14

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2.0 - Keypad Setup:

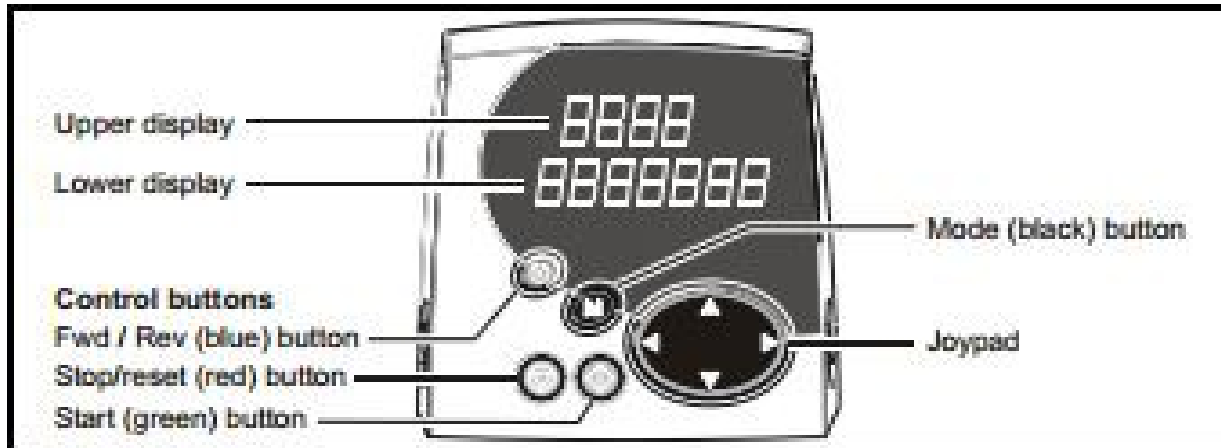


Figure 16 Keypad Layout

The Keypad consists of:

- Joypad – used to navigate the parameter structure and change parameter values.
- Mode Button – used to change between the display modes – parameter view, parameter edit, and status.
- Three Control Buttons – used to control the drive if keypad mode is selected.
- Two line LCD display.

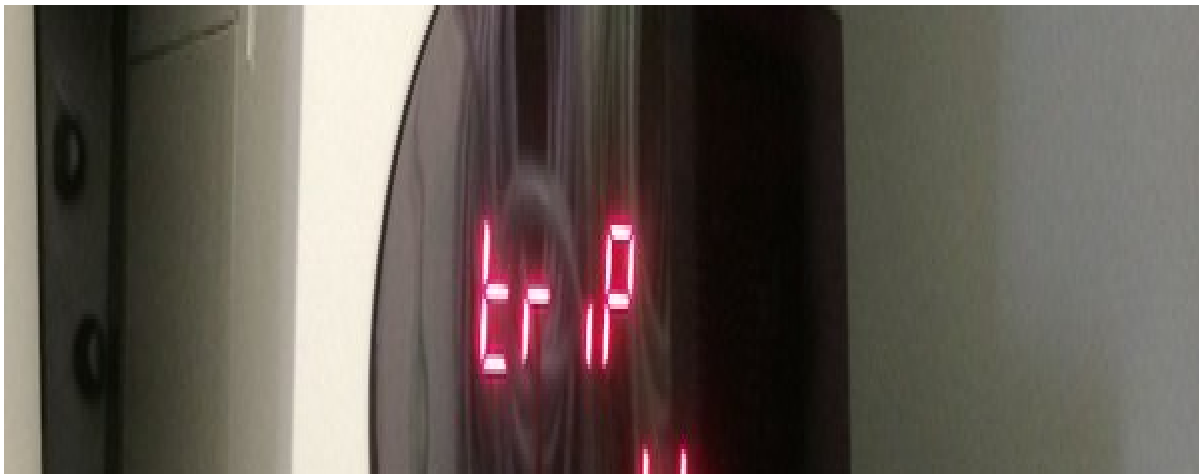


Figure 17 LCD Readout upon initial start up

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Keypad Setup:

1. To enter the menu screen press the black mode button (M). Once in the menu screen the upper display will be flashing. You can navigate through the various menus by pressing the left and right arrows on the joypad. To change to different parameters in a menu press the mode button again. The parameter value in the lower display will begin flashing then use the up and down arrows of the joypad to change the value.
(Figure 19,20)
2. First the Operating Mode must be changed from Open Loop to Closed-Loop Vector. To do this press the mode then navigate to parameter 0.00 with the joypad and press the mode button again to edit parameter value. Change the value of 0.00 from 0 to 1254 for USA spec 60Hz AC supply frequency or 1253 for EUR spec 50Hz AC supply frequency using the joypad. **Note:** that you do not need to go from 0 to 1254 by pressing the up arrow 1254 times but can use the left to right arrows on the joypad to change each place. So to change a parameter from 0 to 1000 u can simply press the left arrow 3 times and the up arrow once to produce the value of 1000.
3. Press mode again so upper display is flashing and navigate to parameter 0.48 using the joypad. Press mode to change parameter from OPEn LP to CL VECT.
4. To complete the Operating Mode change press the red stop/reset button to complete this change. When reset there will be an audible click and ensure that parameter 0.00 has change back to a value of 0.
5. We need to change from level one to level 2 access to be able to change all parameters. To do this change parameter 0.49 from L1 to L2 and press mode button to save this change.
6. Using the parameters from Figure 15 navigate through the menus and change the parameters listed except for parameter except for parameter 8.25. Once all other parameters are changed go to paramter 0.00 and change from 0 to 1000. This is needed to save the advanced parameter changes. Now go to console and power off console and reset power to the machine and wait until CT Drive lights are off before turning power back on.
7. Once everything powers back up go back and change parameter 8.25. Also go back to parameter 0.00 and set to 1000 again. Repeat the process again to power off the system.

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Figure 18 Readout in Normal Operating State

8. Once the system is powered back up the display should now read as shown in Figure 18. Which is the normal operating display.

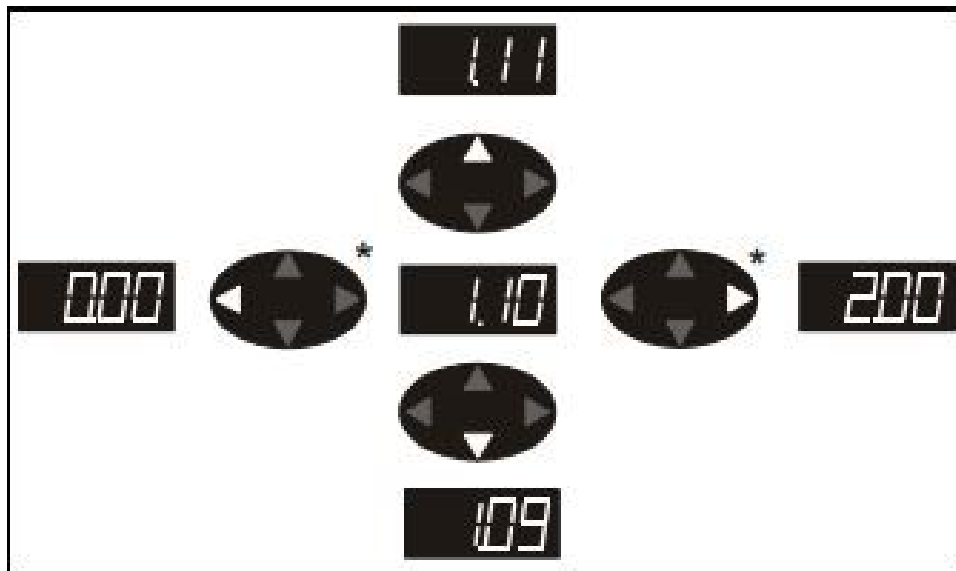


Figure 19

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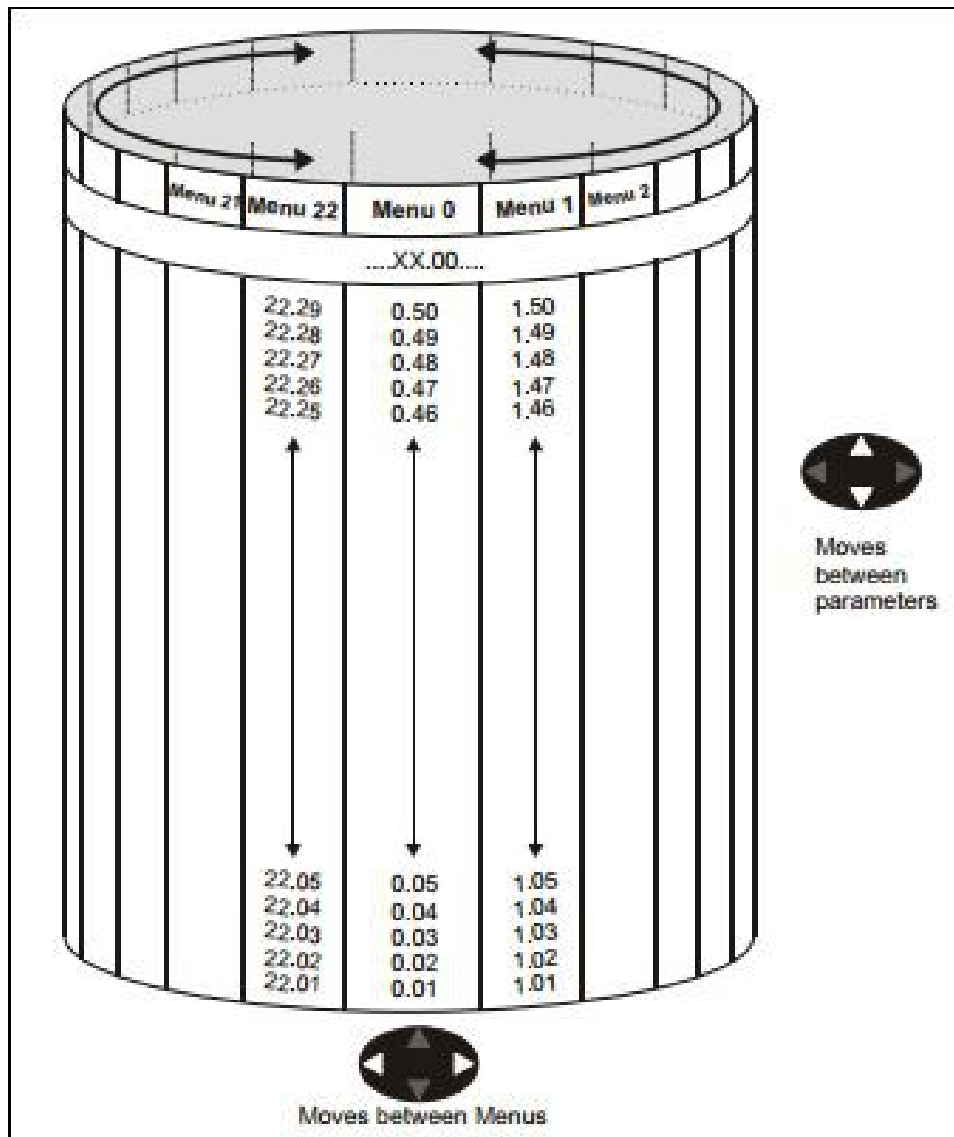


Figure 20

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2.1 - Tuning:

1. To start the tuning process first set parameter 0.40 to 2 either using the CT Soft software by manually changing in parameters (Figure 14) and selecting apply or the key pad by pressing the mode button and navigating to 0.40 and changing to 2 ensuring to press mode again to save change.

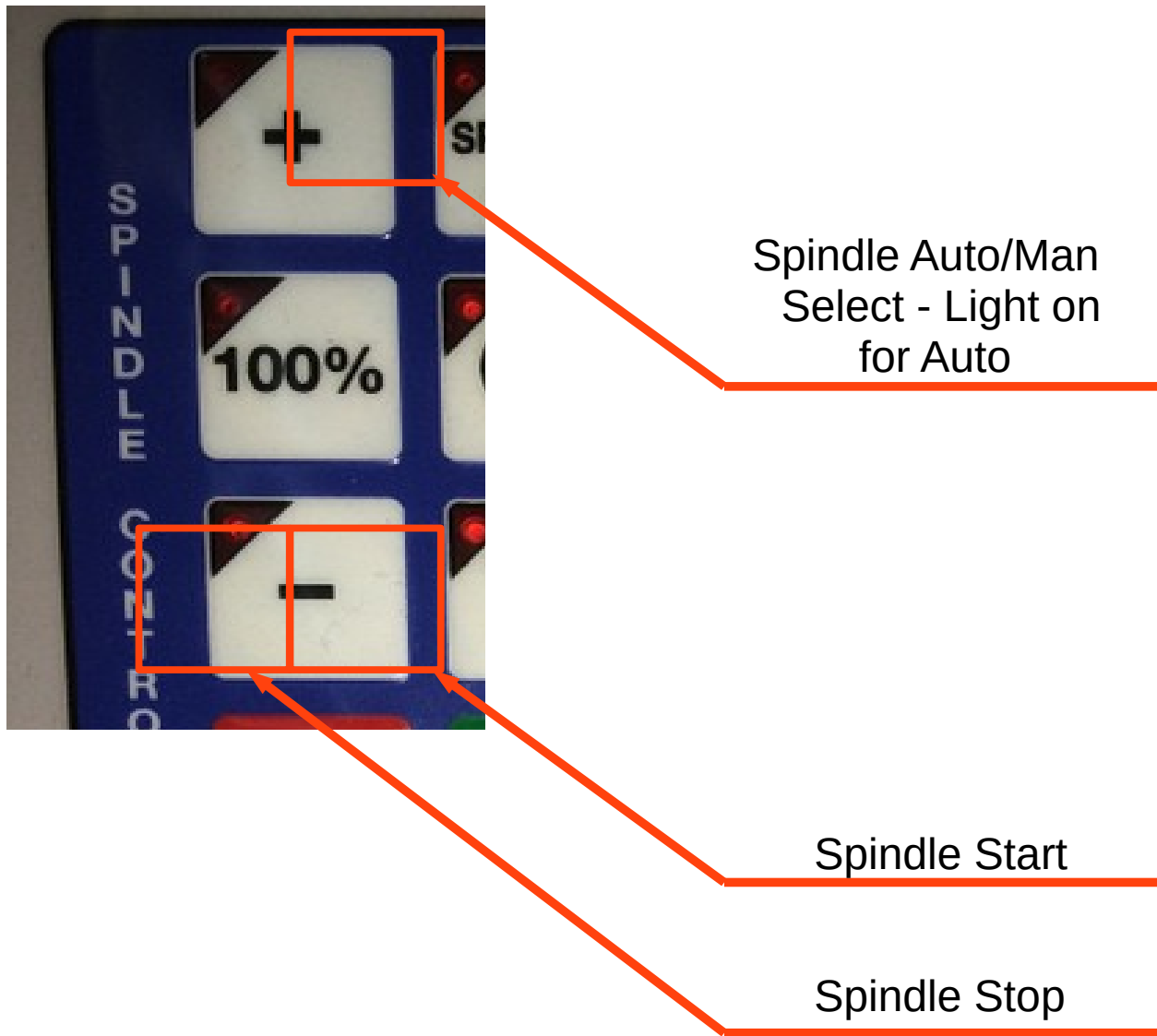


Figure 21

2. Next on the console put the spindle into manual mode using the spindle mode select button.
3. Press the green spindle start button to start the auto tune process.
4. The spindle will spin up to 4000rpm then stop and coast down to 0rpm. Do not stop spindle manually and make sure it is completely stopped.

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5. Once the spindle is at 0rpm press the red spindle stop button and return the spindle to auto mode.
6. Finally save parameters in drive either using the CT Soft software or using the keypad to change 0.00 to 1000 and resetting the power.

2.2 - Orient Position:

1. To set orient position put a tool into the spindle. Position tool changer arm to align with notch in tool holder.
2. Open CT Soft software and enable drive online. Open parameters and select menu 13.
3. With your hand manually turn the tool to one side of the notch.
4. Set parameter 13.13 to 0 and select apply.
5. Note the value in parameter 13.02. Move the tool to the other side of the notch and note the value in 13.02 again.
6. Take both numbers added together and divide by two.
7. If the number you get is negative then put the positive value of that number in parameter 13.13 and apply. Example if the value you get is -2500 then enter 2500 in parameter 13.13.
8. If the number you get is positive then take the 65535 minus the number and enter that into 13.13. Example if the value is 2500 then take $65535 - 2500 = 63035$, then enter 63035 in parameter 13.13 and hit apply.
9. Now when the tool is moved from side to side the value should be close to the same positive and negative. Example one side of notch will say -500 and the other side will say 500. this will orient the spindle in the center of the notch.
10. To set orient position using the control keypad repeat steps 1 through 3. Navigate to menu 13 and set parameter 13.13 to 0.
11. Now navigate to parameter 13.02 and move spindle to one side of notch and check value on LCD display. Move spindle to other side and record position.
12. Use those numbers to find the value needed in 13.13. Check now that the values in 13.02 are close to the same positive and negative.
13. Now go to parameter 0.00 and enter 1000. then shut down and restart control.
14. Return the tool changer to its normal position.
15. MDI command M19 and check spindle position appears correct.

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Parameter Description Default Memory Units

| | | | | |
|-------|--------------------------------------|-------|-------|-----|
| 13.00 | Parameter 0 | 0 | 0 | |
| 13.01 | Revolutions error | 0 | 0 | |
| 13.02 | Position error | 0 | 104 | |
| 13.03 | Fine position error | 0 | 0 | |
| 13.04 | Position controller reference source | Drive | Drive | |
| 13.05 | Position controller feedback source | Drive | Drive | |
| 13.06 | Position reference invert | OFF | OFF | |
| 13.07 | Ratio numerator | 1.000 | 1.000 | |
| 13.08 | Ratio denominator | 1.000 | 1.000 | |
| 13.09 | Position controller P gain | 25.00 | 40.00 | |
| 13.10 | Position controller mode | 0 | 6 | |
| 13.11 | Absolute mode enable | OFF | OFF | |
| 13.12 | Position controller speed damp | 150 | 150 | |
| 13.13 | Orientation position reference | 0 | 62712 | |
| 13.14 | Orientation acceptance window | 256 | 48 | |
| 13.15 | Orientation position complete | OFF | OFF | |
| 13.16 | Position error reset | OFF | OFF | |
| 13.17 | Relative jog reference | 0.0 | 0.0 | RPM |
| 13.18 | Relative jog enable | OFF | OFF | |
| 13.19 | Relative jog reverse | OFF | OFF | |
| 13.20 | Local reference turns | 0 | 0 | |
| 13.21 | Local reference position | 0 | 0 | |
| 13.22 | Local reference fine position | 0 | 0 | |

Figure 22

Parameter: 13.13

Range: 0 - 65535

Default: 0

Orientation position reference

62712

Buttons: OK, Apply, Close, Parameter Help, Help

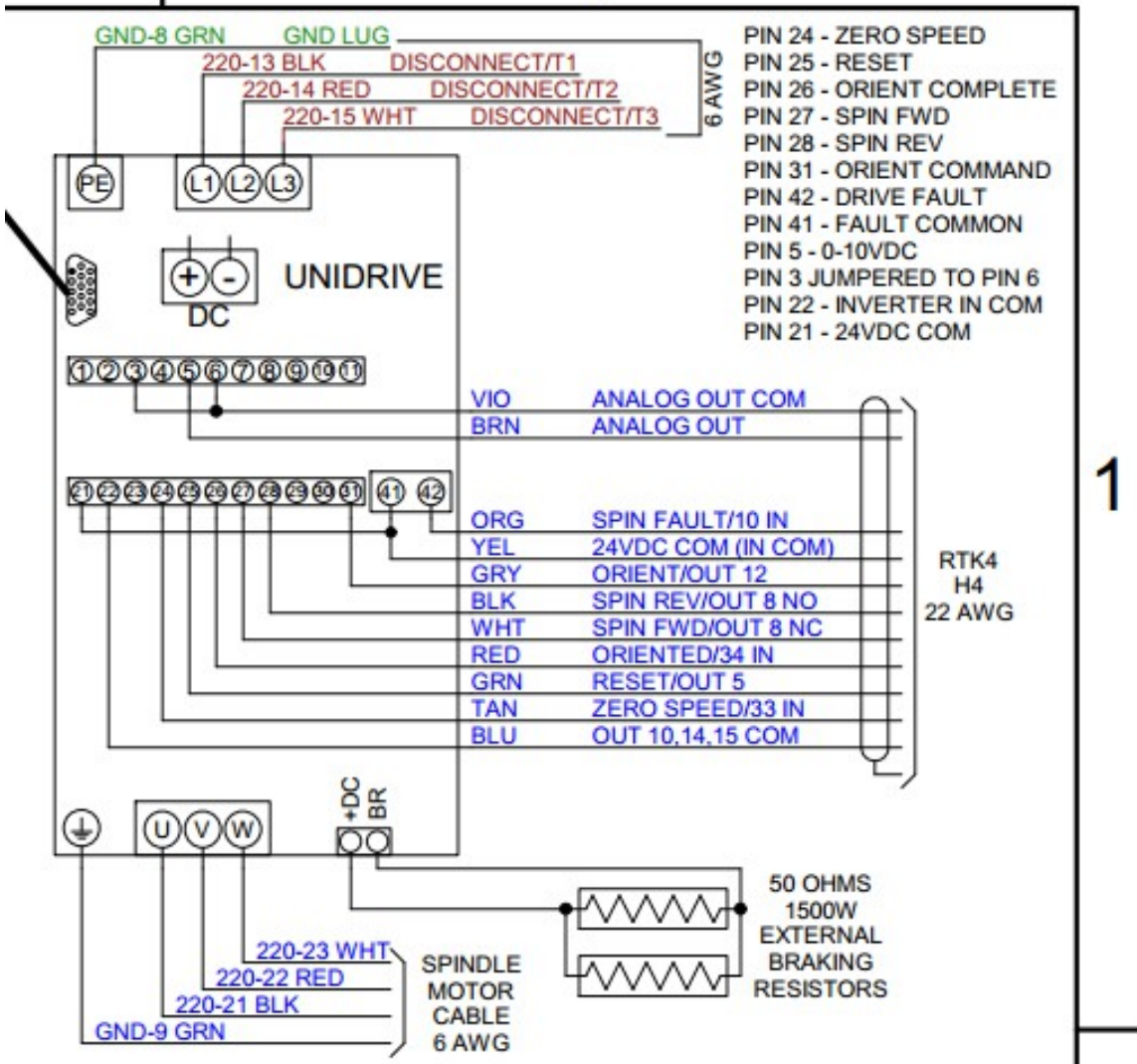
Figure 23

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3.0 - Control Techniques SP Drive Wiring:

- The following signals are wired up to the Cells Spindle Drive:

| Terminal Number | Function | PLC Wiring |
|-----------------|-----------------|-----------------------|
| 3,6 | Analog Common | Spindle Analog Common |
| 5 | Analog Out | Spindle Analog Out |
| 21,41 | 24VDC Common | 24VDC Common |
| 22 | Output Common | Output Common |
| 24 | Zero Speed | Zero Speed Input |
| 25 | Reset | Spindle Reset Out |
| 26 | Orient Complete | Orient Complete Input |
| 27 | Spin Forward | Spindle Forward |
| 28 | Spin Reverse | Spindle Reverse |
| 31 | Hardware Enable | Orient Request Out |
| 42 | Drive Fault | Spindle Fault Input |



Typical A560 CT Spindle wiring

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3.1 - PLC Functions:

- The following table is the outputs each mode of spindle operation.

| Output | Spindle Off (M5/M20) | Spindle FWD (M3) | Spindle REV (M4) | Spindle Orient (M19) |
|-----------------|----------------------|------------------|------------------|----------------------|
| Spindle FWD | OFF | ON | OFF | OFF |
| Spindle Reverse | OFF | OFF | ON | OFF |
| Request Orient | OFF | ON | ON | ON |