# TB252 (Rev1) - CNC11 Yaskawa Sigma5 Drive Setup

**Overview:**

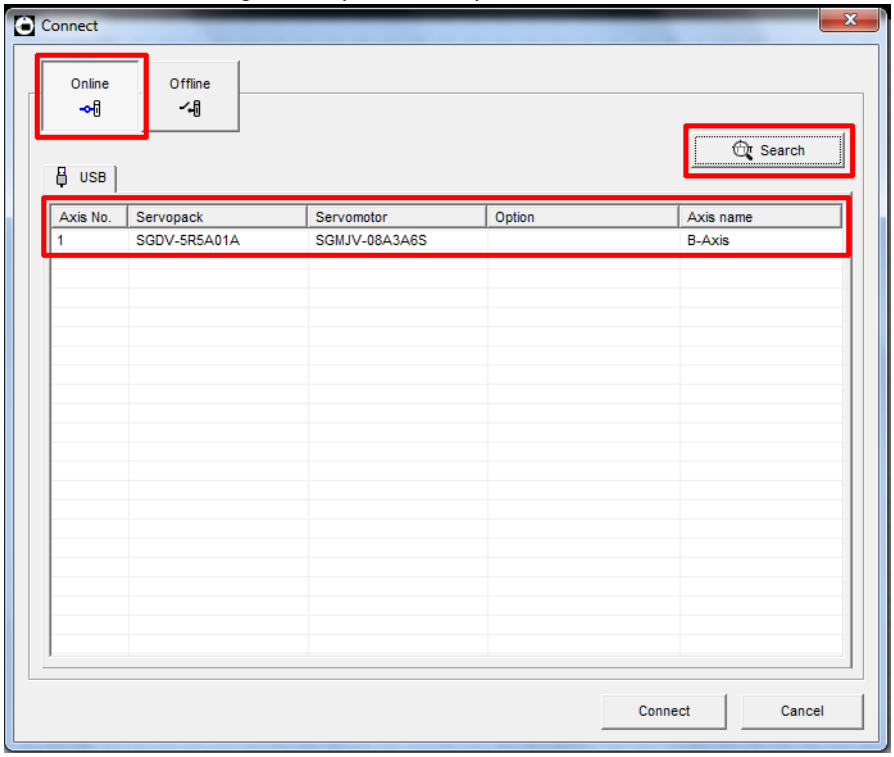
This document will walk you through the process of configuration and tuning of a Yaskawa Sigma V Servo Drive Pack and motor with a centroid CNC11 based control.

**Prequisites:**

The following items are needed:

- Laptop computer with the Yaskawa SigmaWin+ software installed.
- A to Mini-B type USB cable (Yaskawa part number JZSP-CVS06-02-E) ? connected between the laptop and the Yaskawa drive you wish to setup.

**ServoPack Configuration Process:**

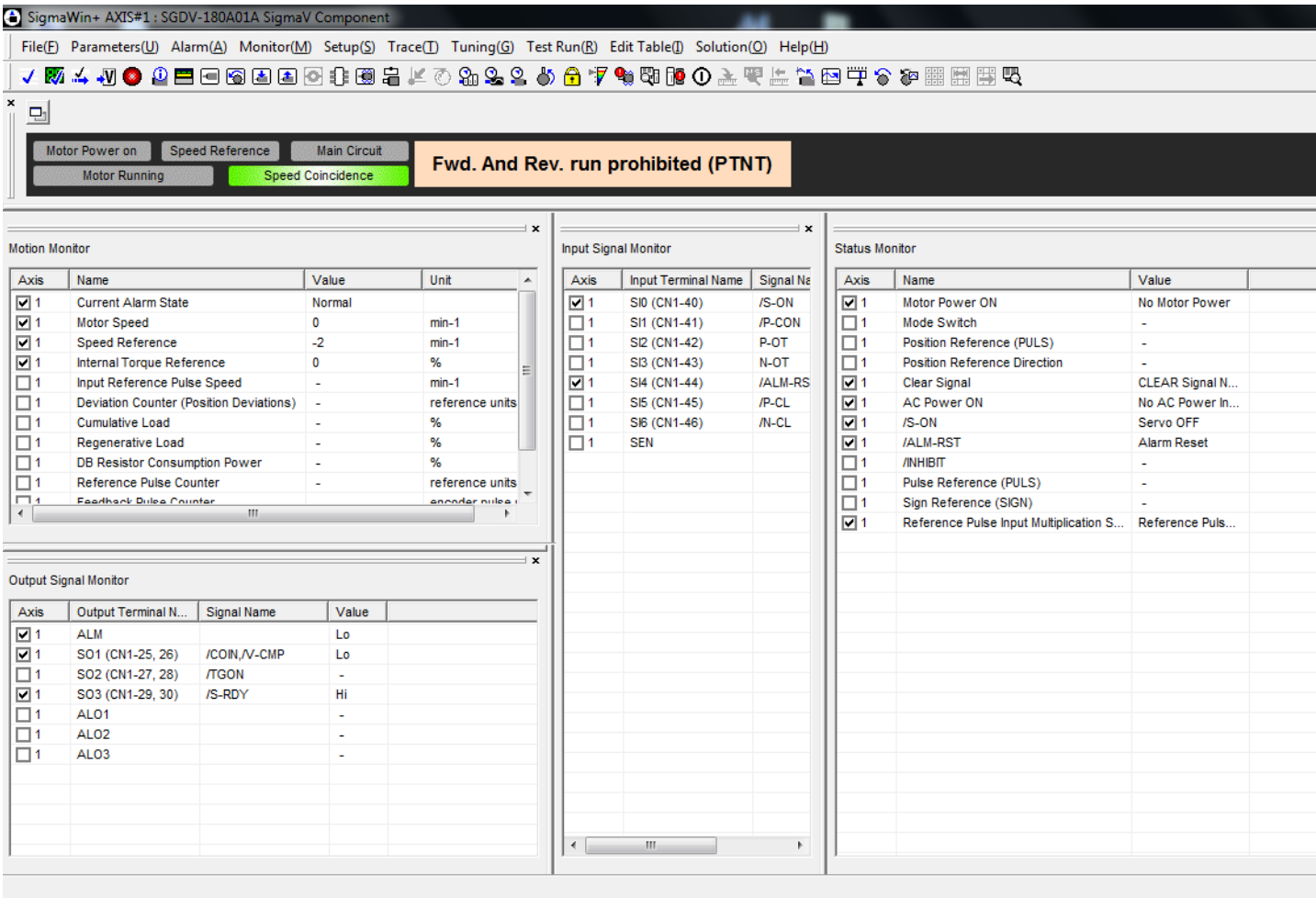
- Launch the Yaskawa WigmaWin+ software.
- You will see the following screen (Illustration 1):
- 

- Ensure "Online" is selected as shown above

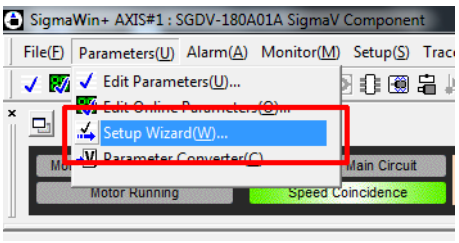
- Select "**Search**" and make sure "?5 drives" are selected. This search should be done every time you power up the software or connect to a different ServoPack because the SigmaWin+ software remembers the last drive that was connected to it and displays that rather than what is currently connected.

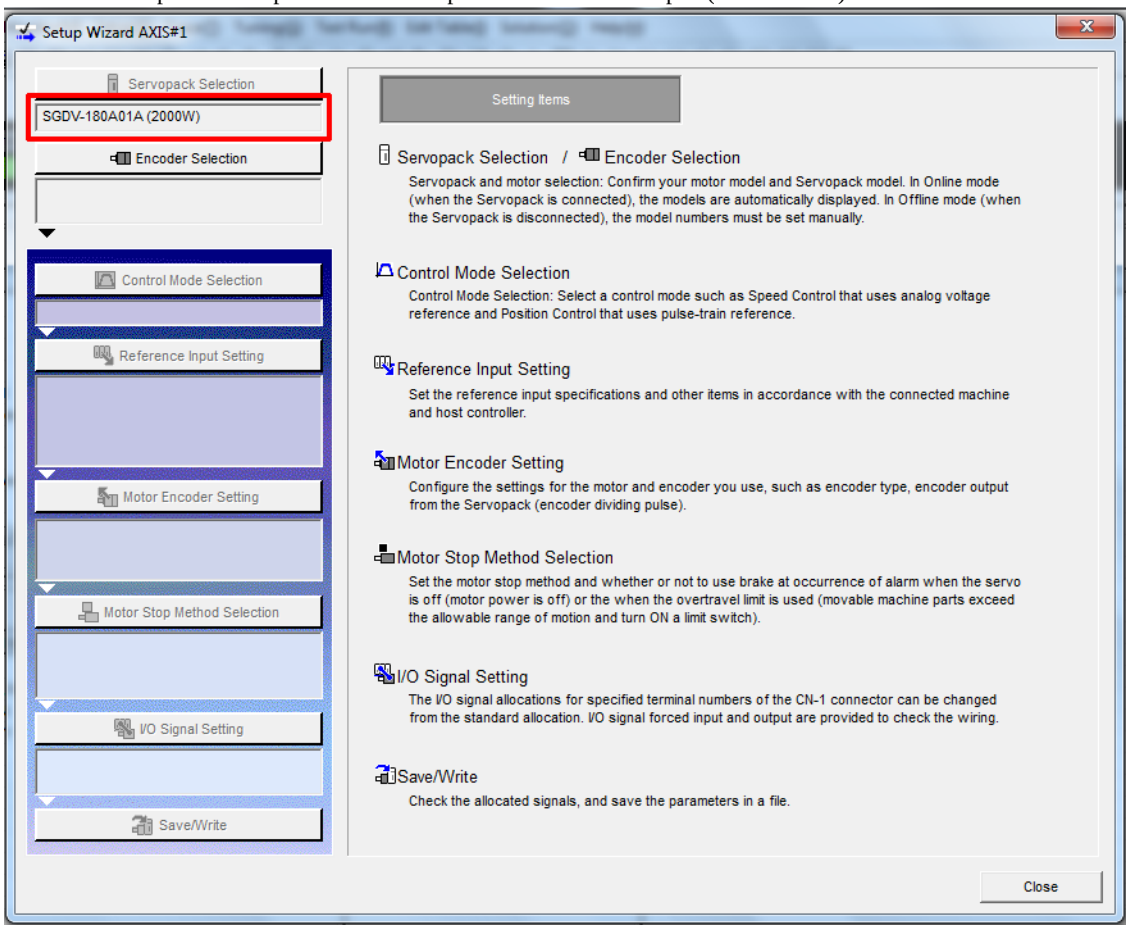
- Select the drive that appears and click "**Connect**".

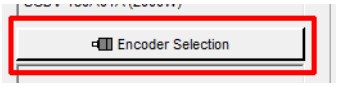
- SigmaWin+ will then open to the main screen as shown below (Illustration 2):

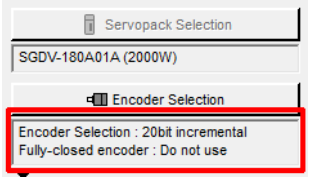



- The best way to configure the ServoPack is by using the Setup Wizard, it is located under the Parameter's menu option as shown below (Illustration 3):

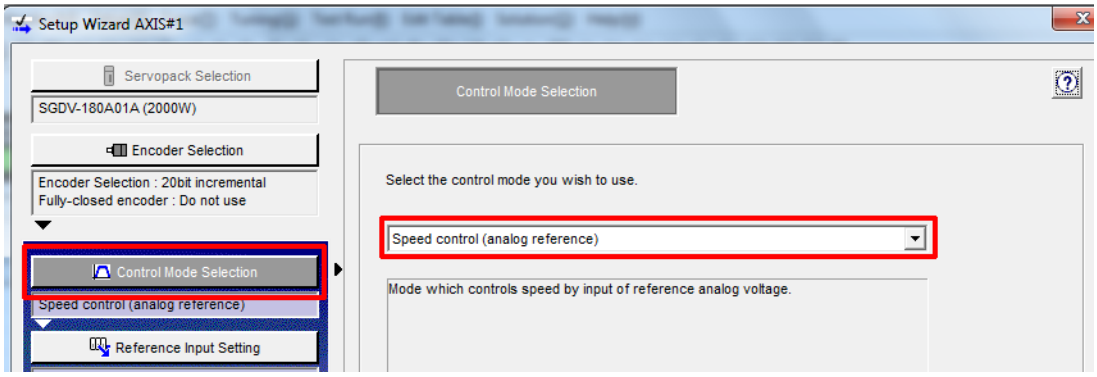


- Select the "Setup Wizard" option and the Setup Wizard shown will open (Illustration 4):
- 

- Click "**Encoder Selection**".
- 

- The Encoder should be automatically selected at this stage and you only need to click on "**Apply**" at the lower right have corner.
- The Encoder type will then be shown under the Encoder Selection button.
- 

- Click "**Control Mode Selection**".
- Select "Speed Control (analog reference)" from the drop down menu:

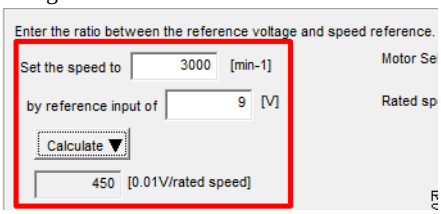
- 


- Click "**Apply**".

- Click "**Reference Input Setting**
" ? Note: that the Control Mode setting will be highlighted in green, as you complete each section it will show green.

- Enter the Max RPM of the motor ? 3000 RPM in this example.

- Enter "9" for the Reference by input of ___ V, click "**Calculate**".

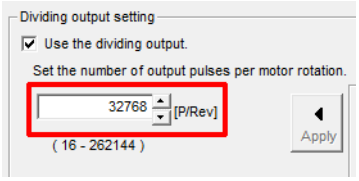
- The SigmaWin+ software will then calculate the RPM per Volt for the motor as shown below:
- 


- Enter "10" for the Speed Coincidence Signal Output Width, click "**Next**".

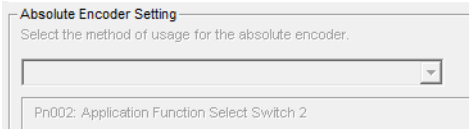
- Enter "0" for both "Soft Acceleration Time" and "Soft Deceleration Time", click "**Apply**".

- Reference Input settings will now be green.

- Click "**Motor Encoder Settings**".

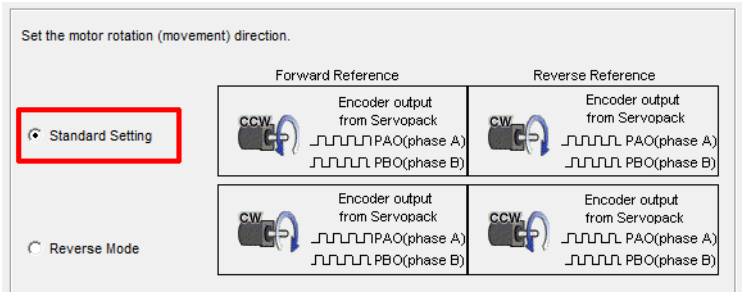
- Enter "32768" for the number of Encoder Pulses ? This will yield 131072 Encoder counts per revolution of the motor:
- 


- It is possible that you have gotten a motor with an absolute encoder if lead times are short and incremental encoders are not available. To use an absolute encoder the drive setting must be changed to use the encoder as an incremental encoder. This motor has an incremental encoder so it is not an option you can adjust even:

- 


- Click "**Next**".

- Select "Standard Setting":

- 

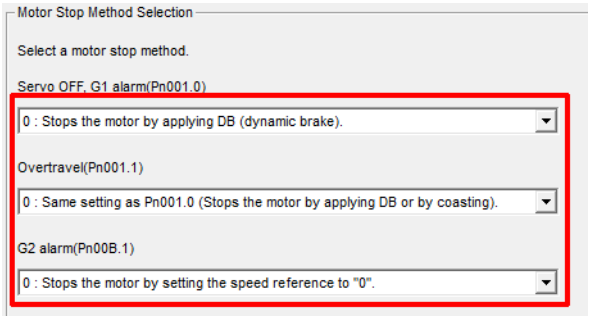

- Click "**Apply**".

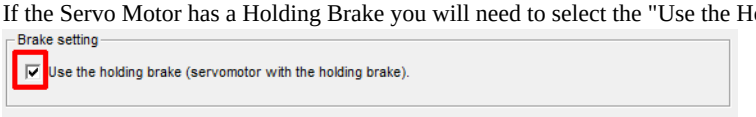
- You will be returned back to the Setup Wizard main screen, and the Encoder Settings section will now also be green.

- Click "**Motor Stop Method**" Selection.

- Set "Servo Off" to "0 - Stops motor by applying Dynamic Brake".

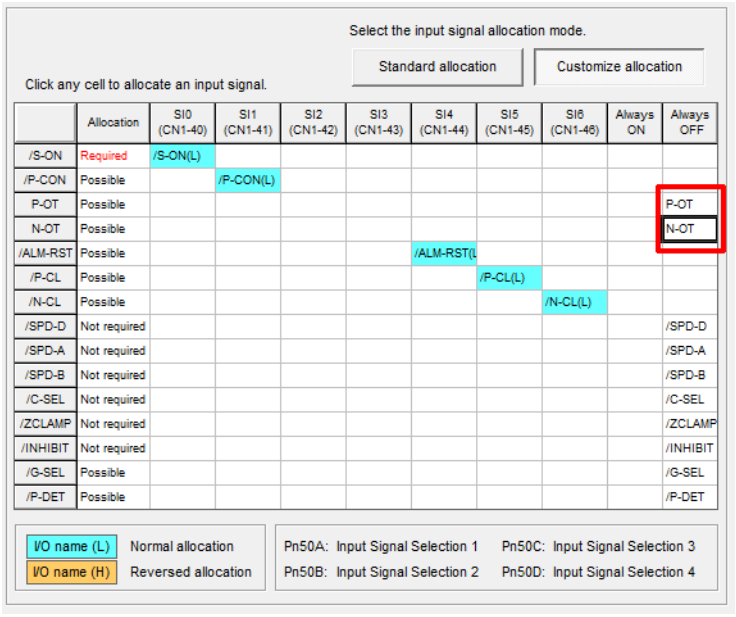
- Set "Overtravel" to "0 - Stops motor by applying Dynamic Brake".
- Set "G2 Alarm" to "0 ? Stops the motor by setting the speed reference to 0".

- 


- If the Servo Motor has a Holding Brake you will need to select the "Use the Holding brake"option as shown below:
- 

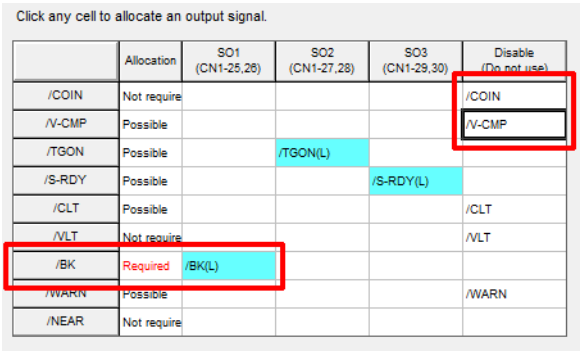

- Click "**Apply**".

- Click "**IO Signal Settings**", then click "**Input Signal Settings**".

- Disable "N-OT" by clicking in the "**Always OFF**" column as shown below.
- Disable "P-OT" by clicking in the "**Always OFF**" column as show below.
- 


| | Allocation | SI0 (CN1-40) | SI1 (CN1-41) | SI2 (CN1-42) | SI3 (CN1-43) | SI4 (CN1-44) | SI5 (CN1-45) | SI6 (CN1-46) | Always ON | Always OFF |
|---|---|---|---|---|---|---|---|---|---|---|
| /S-ON | Required | /S-ON(L) | | | | | | | | |
| /P-CON | Possible | | /P-CON(L) | | | | | | | |
| P-OT | Possible | | | | | | | | | P-OT |
| N-OT | Possible | | | | | | | | | N-OT |
| /ALM-RST | Possible | | | | | /ALM-RST(L | | | | |
| /P-CL | Possible | | | | | | /P-CL(L) | | | |
| /N-CL | Possible | | | | | | | /N-CL(L) | | |
| /SPD-D | Not required | | | | | | | | | /SPD-D |
| /SPD-A | Not required | | | | | | | | | /SPD-A |
| /SPD-B | Not required | | | | | | | | | /SPD-B |
| /C-SEL | Not required | | | | | | | | | /C-SEL |
| /ZCLAMP | Not required | | | | | | | | | /ZCLAMP |
| /INHIBIT | Not required | | | | | | | | | /INHIBIT |
| /G-SEL | Possible | | | | | | | | | /G-SEL |
| /P-DET | Possible | | | | | | | | | /P-DET |

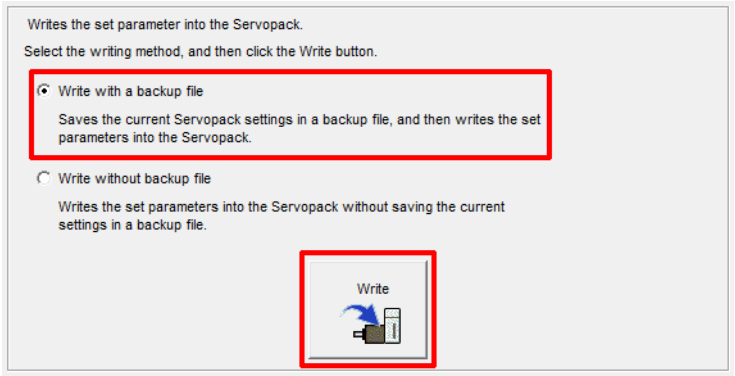
- Click "**OK**".
- Click "**Output Signal Settings**".
- For motors without Holding Brake the standard output settings is correct.
- For motors with a Holding Brake you must set "/COIN" and "/V-CMP" to "Always OFF".
- For motors with a Holding Brake you must also set "/BK" to "SO1 ? Output 1" as shown: below:




| | Allocation | SO1 (CN1-25,26) | SO2 (CN1-27,28) | SO3 (CN1-29,30) | Disable (Do not use) |
|---|---|---|---|---|---|
| /COIN | Not require | | | | /COIN |
| /V-CMP | Possible | | | | /V-CMP |
| /TGON | Possible | | /TGON(L) | | |
| /S-RDY | Possible | | | /S-RDY(L) | |
| /CLT | Possible | | | | /CLT |
| /VLT | Not require | | | | /VLT |
| /BK | Required | /BK(L) | | | |
| /WARN | Possible | | | | /WARN |
| /NEAR | Not require | | | | |

- Click "**OK**".
- You will then be returned to the IO Signal Settings screen, hit "**Apply**" to save the settings and then click "**Save/Write**".
-

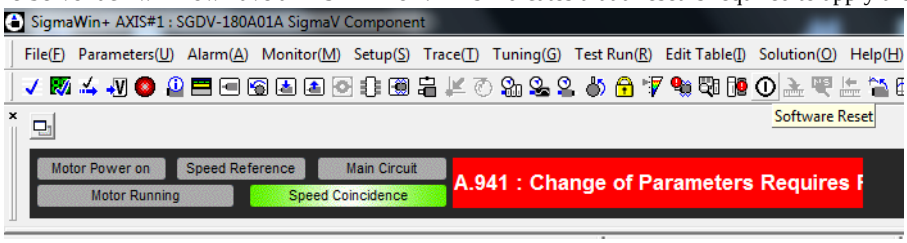
Check "Write with a backup file" this will save the current configuration and then write the current configuration fo the ServoPack:



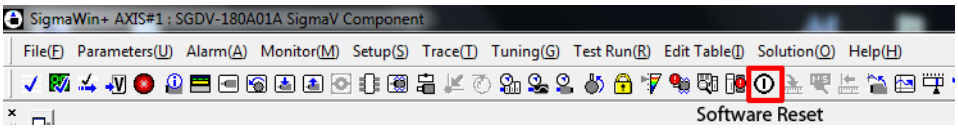

- Click "**Finish**".

- Click "**Yes**" when prompted to complete the Setup Wizard.

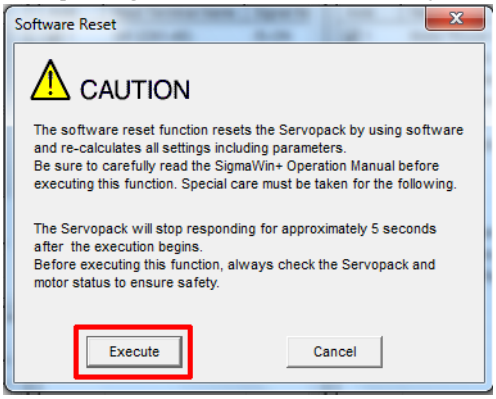
- The ServoPack will now have an A941 Error ? This indicates that a reset is required to apply the configuration changes.




- To Reset the ServoPack you must click the "Software Reset" button in SigmaWin or remove power from the ServoPack. The Software Reset button is indicated below:




- After pressing the "**Software Reset**" button you will receive a warning, simply click "**Execute**" to continue:




- Then click "**Execute**" at the next screen that pops up to confirm reset of the ServoPack.

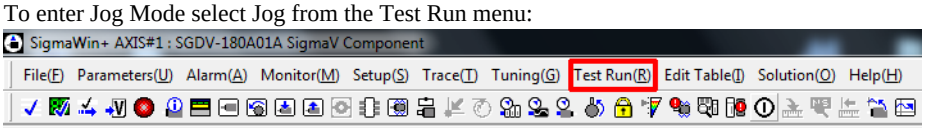
- Every time the Drive is Reset you will normally get an error on the Centroid Control. Simply cycle **ESTOP**to clear the error message.

- Once the drive is reset you will have a "Motor Base Blocked - bb" message displayed on the ServoPack itself. This message means everything is OK.

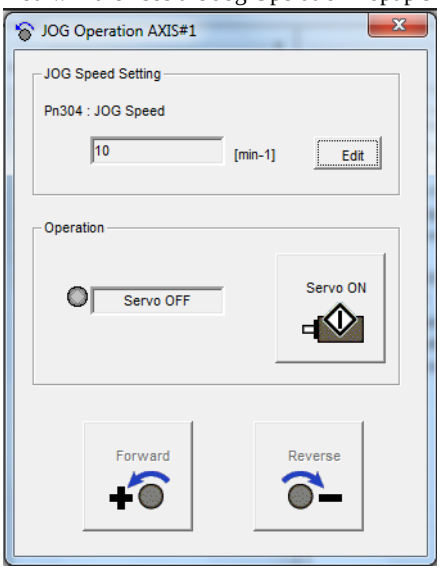
**Test Run:**

We are now ready to perform a test run of the ServoPack and motor. This test run will be performed from the SigmaWin software using the Jog system.

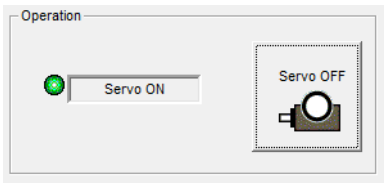
- To enter Jog Mode select Jog from the Test Run menu:




- You will then see the Jog Operation Popup shown below:




- Click "**Edit**" to change the JOG Speed. "10 RPM" is a good safe starting point.
- Release **ESTOP**on the Centroid Control.
- Click "**Servo ON**" to enable the ServoPack Motor Power.
- The screen should then show "Servo ON" as shown below:




- You can now jog the motor by pressing and holding either the Forward or Reverse buttons
-

If everything is workign correctly you should have smooth motion of the Servo Motor. Simple close the Test Jog popup to exit Jog Mode, the cycle ESTOP on the Centroid Control

**ServoPack Tuning:**

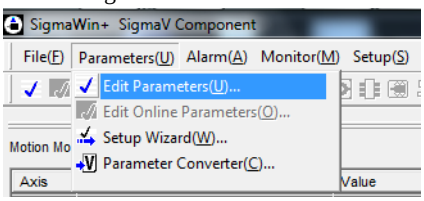
We are now ready to tune the Yaskawa ServoPack. There are two main options for tuning of the drive:

- "Tune Less Mode" ? this is the default mode for the ServoPack, it obtains a stable response without adjustment.
- "Autotuning" ? In this mode the ServoPack will attmept to tune itself to the dynamics of the system, saving the parameters for use after that.

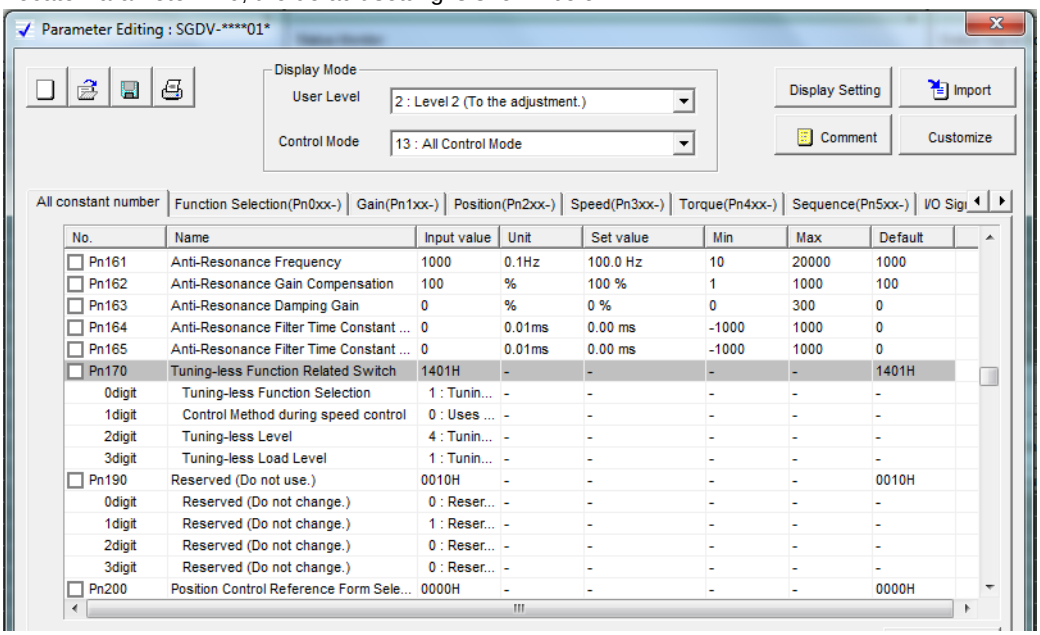
Note: Most ServoPack / Motor combinations seem to perform better once they have been Autotuned, so we will focus the rest of the time using that feature.

**Manually Disabling Tuning Less (If not Autotuning):**

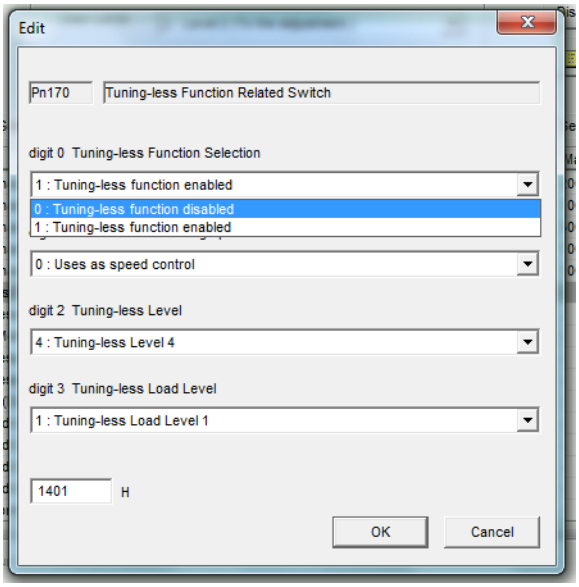
- Enter "Edit Parameters" from the Parameters menu:
- The Tuning function is located under the Tuning menu:



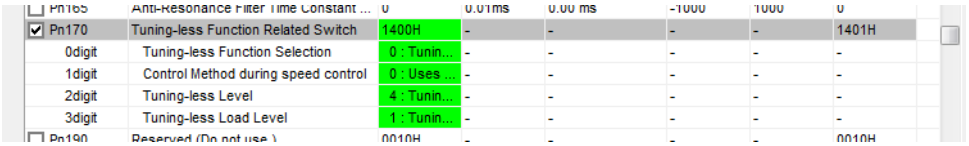

- Locate Parameter 170, the default setting is shown below:




- Click edit on Parameter 170 and change the setting to Tuning-less function disabled:



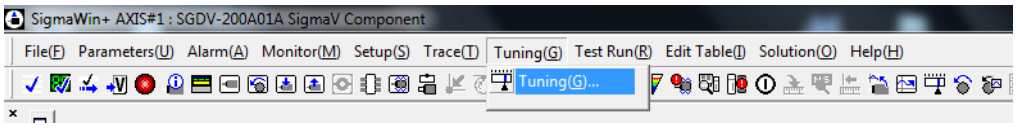

- Hit OK, you will then see the changed parameters highlighted green, Press Write to send the changed parameters to the Drive.



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Pn170 | Tuning-less Function Related Switch | 1400H | - | - | - | - | 1401H |
| 0digit | Tuning-less Function Selection | 0 : Tunin... | - | - | - | - | - |
| 1digit | Control Method during speed control | 0 : Uses ... | - | - | - | - | - |
| 2digit | Tuning-less Level | 4 : Tunin... | - | - | - | - | - |
| 3digit | Tuning-less Load Level | 1 : Tunin... | - | - | - | - | - |

- The drive will need to be reset to apply the changes made.

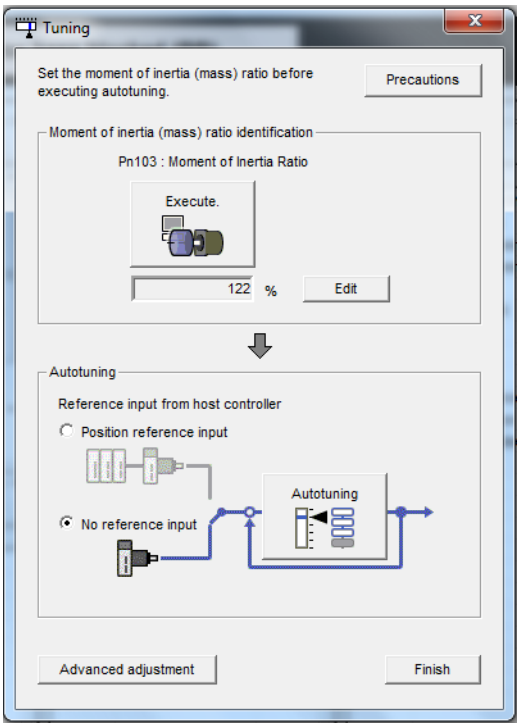
**Autotuning procedure:**

- The Tuning function is located under the Tuning menu:
- 

- You will then see a safety warning about the use of Tuning ? simply press "Execute" to continue.

  Note: If Tuning Less mode is enabled you will be prompted to disable tuning less in order to run Autotune.

- You will then see the following Tuning Screen:



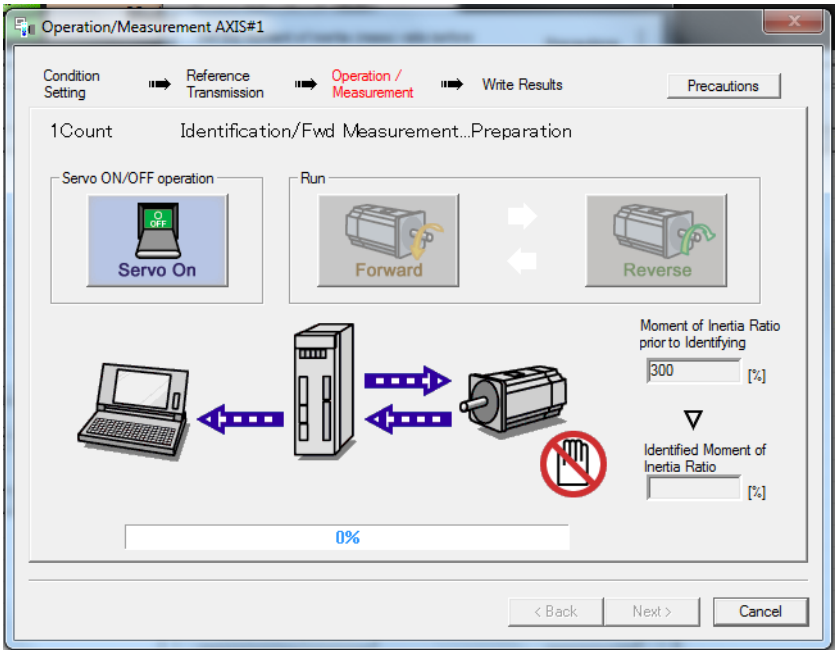

- Click "**Execute**" ? this will begin the process to calculate the Moment of Inertia for the Motor system.

- You will then see the Condition Setting screen, click "**Next**".

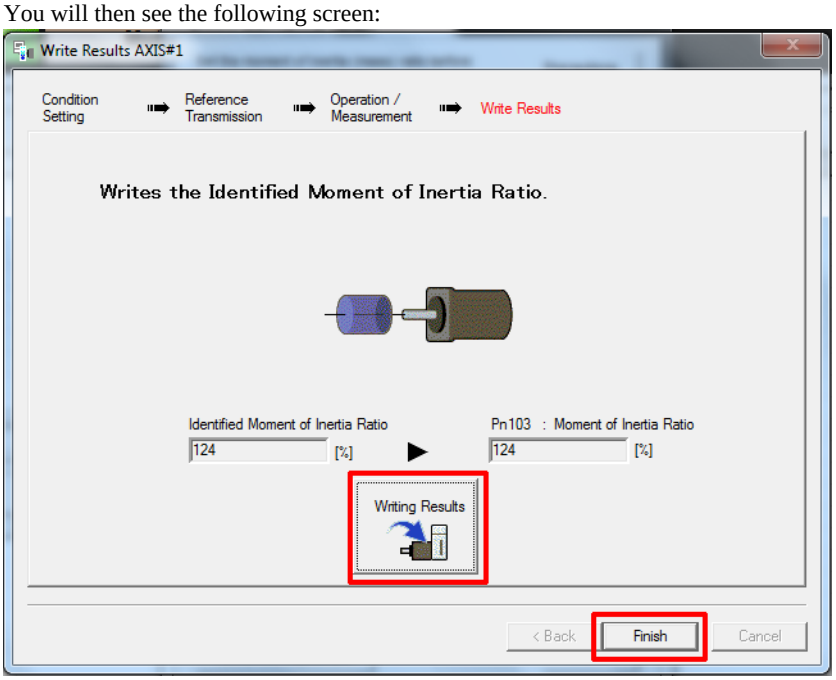
- Click "**Start**" to transfer reference conditions to the ServoPack

- Click "**Next**".

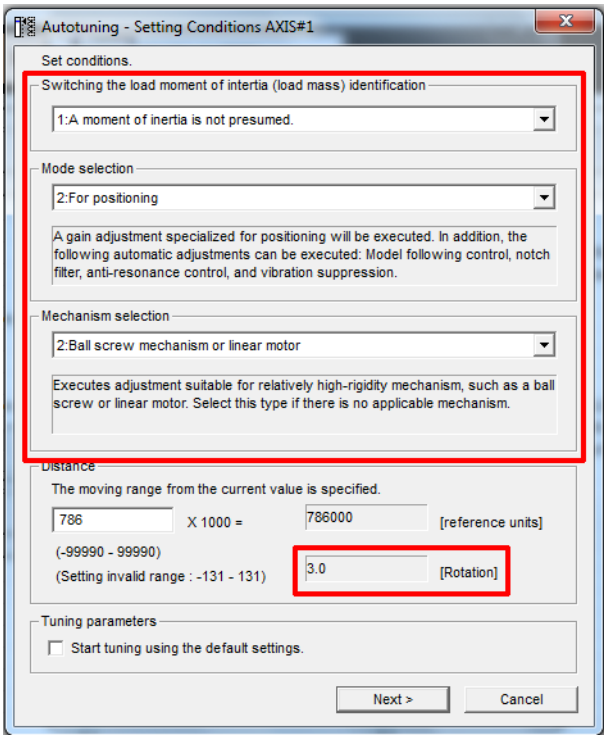
- You will then see the Moment of Inertia calculation screen shown below:



- Release **ESTOP**on the Centroid Control.
- Click "**Servo ON**" to apply power to the ServoPack Motor.
- Alternatingly click "**Forward**", then "**Reverse**
" until the SigmaWin software will no longer allow you to press either one, signifying the completing of the movements.
- Click the "**Next**" button.
- You will then see the following screen:

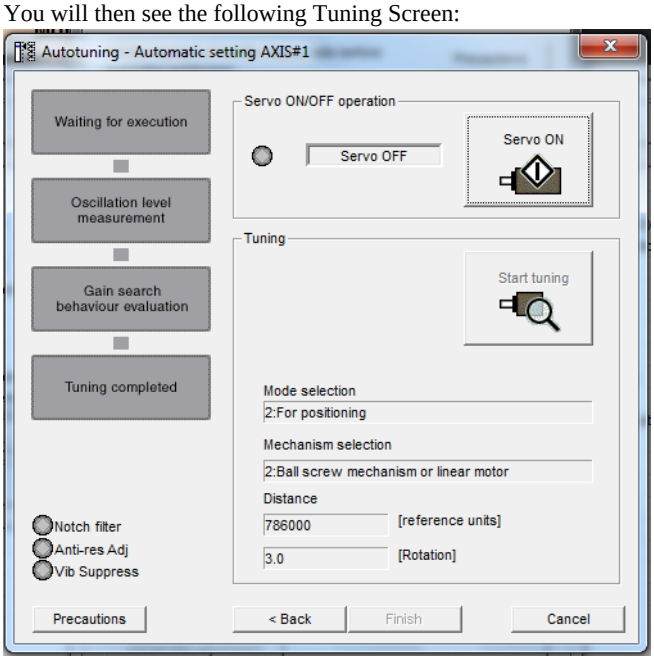



- Click the "**Writing Results**" button shown above to send the results to the ServoPack.
- Click "**Finish**".
- You will be prompted to Execute a ServoPack software Reset.
- Cycle **ESTOP**on the Centroid Control to clear any error messages generated by the ServoPack reset.
- You will then be returned to the Tuning screen.
- Click "**No Reference Input**" to ensure the correct mode during tuning, then click "**Autotuning**".
- You will then see the following Autotuning Set Conditions screen:




- Set "Switching the moment of inertia" to "1: A moment of inertia is not presumed".
- Set "Mode Selection" to "2: For Positioning".
- Set "Mechanism Selection" to "2: Ballscrew mechanism".
- Ensure the Moving Range is set to "3.0" rotations, click "**Next**".
- You will receive another warning ? click "**Yes**" to send parameters to the drive.

- You will then see the following Tuning Screen:




- Click "**Servo ON**".

- Click "**Start Tuning**", the ServoPack will then tune itself.

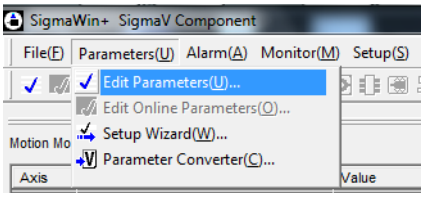
- Click "**Finish**" when tuning is complete.

- At this point the ServoPack and motor are tuned. Execture a Software Reset to be sure everything is back in good operation

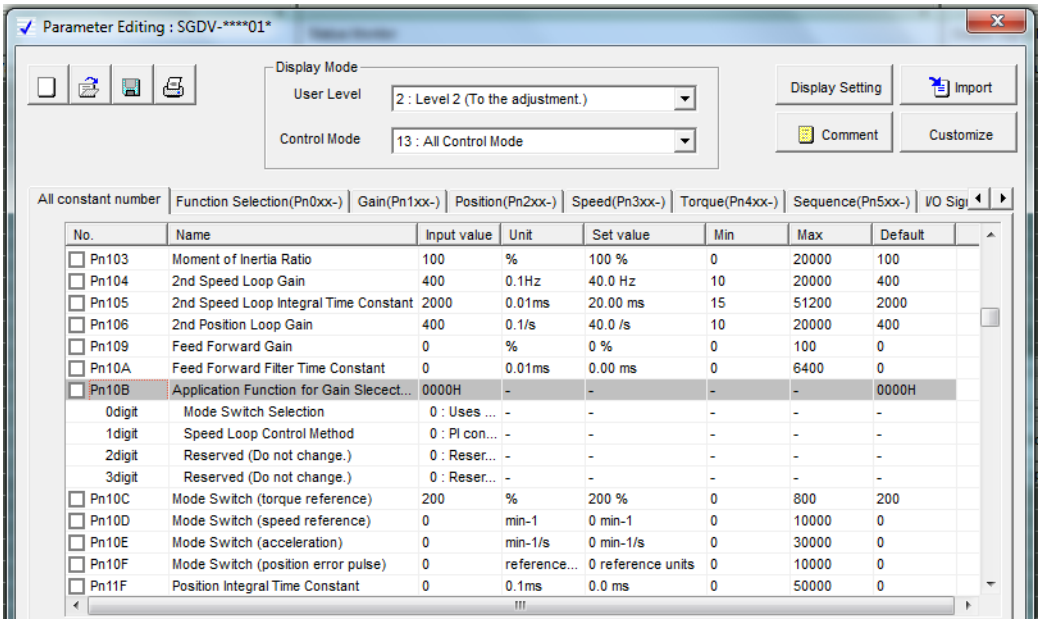
**Mode Switch:**

By default the Yaskawa drive will change modes of operation at 200% of rated torque. This will result in a sudden change in drive behaviour, which we do not want. Centroid recommends Mode Switch is disabled under normal running. The steps to disable Mode Switch are detailed below.

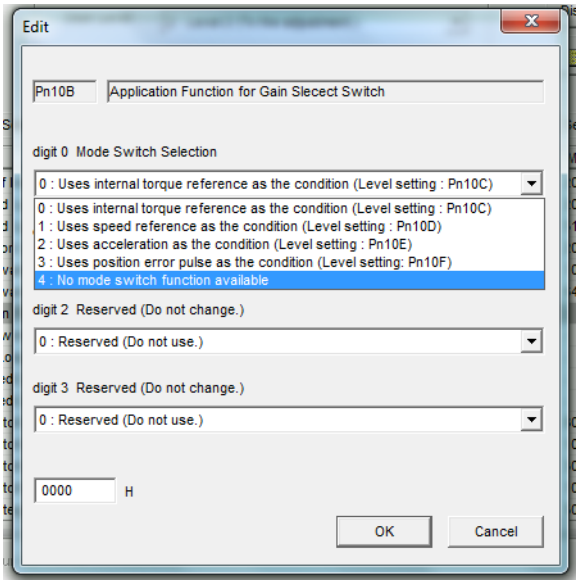
- Enter "Edit Parameters" from the Parameters menu:



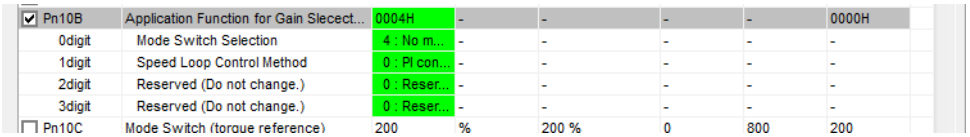

- Locate Parameter 10B, the default setting is shown below:




- Click edit on Parameter 10B and change the setting to : No mode switch function available as shown below:




- Hit OK, you will then see the changed parameters highlighted green, Press Write to send the changed parameters to the Drive.




- The drive will need to be reset to apply the changes made.

**Centroid Configuration:**

Once the Yaskawa is setup, there are certain parameters on the Centroid control that need set. These are detailed below.

Centroid Parameter Configuration:

Control Parameters 357 through 364 are the Drive Max RPM settings. They must match the maximum RPM of the Drive / Motor configuration for each axis. They will typically be set to 3000

Centroid Jog Configuration:

The Max Rate needs to be set under the Jog Parameters screen. To calculate max rate you should multiply the maximum theoretical speed of the axis by 0.85 to maintain some overhead for control. The following formula should be used:

***(Max Motor RPM / Turns Ratio) * 0.85***

Centroid PID Configuration:

We are now ready to start tuning the PID on the Centroid side. This should be tuned as per any velocity mode drive on CNC11. The recommended starting PID values for Yaskawa drives are as follows:

| Kp | Ki | Kd | Limit | Kg | Kv1 | Ka | Accel |
|---|---|---|---|---|---|---|---|
| 0.0400 | 0.0001 | 0.0000 | 256000 | 0.0000 | 80.0000 | 0.0000 | 0.7000 |

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**Document History**

Rev1 Created on ***2011-11-07*** by ***#358***