TB297 - Yaskawa Sigma5 Step and Direction Setup for Acorn CNC Controller

Overview:

This document will walk you through the process of configuring and tuning a Yaskawa Sigma V Servopack and Servomotor with a Centroid Acorn based control.

The following items are needed:

- 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 SigmaWin+ software.
- You will see the following screen:

Online	Offline ~-[]			F
₿ USB				C Search
Axis No.	Servopack	Servomotor	Option	Axis name
1	SGDV-5R5A01A	SGMJV-08A3A6S		B-Axis

- Ensure "Online" is selected as shown above
- Select "Search" and make sure "Σ5 drives" are selected. This search must 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:

Motor Power on Speed Reference Main Circuit Motor Running Speed Coincidence Fwd.	And Rev. run	n prohibited (PTN Signal Monitor	T) ×				
Motor Power on Speed Reference Main Circuit Fwd. Motor Running Speed Coincidence Fwd. Speed Coincidence Fwd. Speed Reference Unit Motor Speed 0 min-1 Speed Reference -2 min-1 I Internal Torque Reference 0 %	And Rev. rui	n prohibited (PTN Signal Monitor	T) ×				
Motor Power on Speed Reference Main Circuit Fwd. Motor Running Speed Coincidence Fwd. stion Monitor Axis Name Value Unit 1 Current Alarm State Normal min-1 1 Speed Reference -2 min-1 1 Speed Reference -2 min-1 1 Internal Torque Reference 0 %	And Rev. run	n prohibited (PTN	т) ×				
Motor Running Speed Coincidence otion Monitor	input	Signal Monitor	×				
Axis Name Value Unit 1 Current Alarm State Normal min-1 1 Motor Speed 0 min-1 1 Speed Reference -2 min-1 1 Internal Torque Reference 0 %	Axis	Signal Monitor	×				
Axis Name Value Unit I Current Alarm State Normal min-1 I Motor Speed 0 min-1 I Speed Reference -2 min-1 I Internal Torque Reference 0 %	× Input	Signal Monitor	×				
Name Value Unit Axis Name Value Unit 1 Current Alarm State Normal min-1 1 Motor Speed 0 min-1 1 Speed Reference -2 min-1 1 Internal Torque Reference 0 %	Axis	Signal Monitor		Sector Contractor			
Axis Name Value Unit ✓ 1 Current Alarm State Normal min-1 ✓ 1 Motor Speed 0 min-1 ✓ 1 Speed Reference -2 min-1 ✓ 1 Internal Torque Reference 0 %		- I have the second second		Status M	lonitor		
Value Value Vina 1 Current Alarm State Normal 1 Motor Speed 0 min-1 1 Speed Reference -2 min-1 1 Internal Torque Reference 0 %			Signal Na	Avie	Nama	Value	
I Content Analmisate Norman 11 Motor Speed 0 min-1 11 Speed Reference -2 min-1 11 Internal Torque Reference 0 %			/S ON		Native Rower ON	No Motor Dowor	
Image: Speed Reference -2 min-1 1 Internal Torque Reference 0 %		SII (CN1-41)	/P-CON		Mode Switch	NO INCLUSI FOWER	
I Internal Torque Reference 0 %		SI2 (CN1-42)	P-OT		Position Reference (PULS)	-	
		SI3 (CN1-43)	N-OT		Position Reference Direction	-	
1 Input Reference Pulse Speed - min-1		SI4 (CN1-44)	/ALM-RS		Clear Signal	CLEAR Signal N	
1 Deviation Counter (Position Deviations) - reference	e units	SI5 (CN1-45)	/P-CL	1	AC Power ON	No AC Power In	
1 Cumulative Load - %		SI6 (CN1-46)	/N-CL	1	/S-ON	Servo OFF	
1 Regenerative Load - %		SEN		1	/ALM-RST	Alarm Reset	
1 DB Resistor Consumption Power - %					/INHIBIT	23	
1 Reference Pulse Counter - reference	ce units				Pulse Reference (PULS)	10	
1 Feedback Dulee Counter encoder	nulear				Sign Reference (SIGN)	-	
				1	Reference Pulse Input Multiplication S	Reference Puls	
utruit Signal Monitor	×						
Axis Output Terminal N Signal Name Value							
1 SOT (CN1-25, 26) /CON/V-CMP L0							
1 SO2 (CN1-27, 26) // GON -				II			
1 AL02 -							
1 AL03 -							
	1000						

• The best way to configure the Servopack is by using the Setup Wizard which is located under the Parameters menu option as shown below:



• Select "Parameters(U)" then click "Setup Wizard(W)" to start the wizard. The "Setup Wizard(W)" window is shown below:

Setup Wizard AXIS#1	And tertaining training react	X
Servopack Selection	Setting items	
Encoder Selection	Servopack Selection / I Encoder Selection Servopack and motor selection: Confirm your motor model and Servopack model. In Online mode (when the Servopack is connected), the models are automatically displayed. In Offline mode (when the Servopack is disconnected), the model numbers must be set manually.	
Control Mode Selection	Control Mode Selection Control Mode Selection: Select a control mode such as Speed Control that uses analog voltage reference and Position Control that uses pulse-train reference.	
Reference Input Setting	Reference Input Setting Set the reference input specifications and other items in accordance with the connected machine and host controller.	
Motor Encoder Setting	Motor Encoder Setting Configure the settings for the motor and encoder you use, such as encoder type, encoder output from the Servopack (encoder dividing pulse).	
Motor Stop Method Selection	Motor Stop Method Selection Set the motor stop method and whether or not to use brake at occurrence of alarm when the servo is off (motor power is off) or the when the overtravel limit is used (movable machine parts exceed the allowable range of motion and turn ON a limit switch).	
NO Signal Setting	The VO Signal Setting The VO signal allocations for specified terminal numbers of the CN-1 connector can be changed from the standard allocation. VO signal forced input and output are provided to check the wiring.	
Save/Write	Save/Write Check the allocated signals, and save the parameters in a file.	
	C	ose

- To run the setup wizard you will click on the buttons at the left of the window. Starting at the top and working down the list.
- Start by clicking the "Encoder Selection" button.

	1
Encoder Selection	

- Nothing is displayed in the window under "Encoder Selection" until you click on "Apply" at the lower right corner.
- The encoder type will then be shown under the Encoder Selection button.

Ī	Servopack Selection
SGDV-180A0	1A (2000W)
-0	Encoder Selection
Encoder Sele Fully-closed e	ction : 20bit incremental encoder : Do not use

- Click "Control Mode Selection".
- Select "Position Control (pulse train reference)" from the drop down menu:

oni 🛣 Setup Wizard A	XIS#1			
SGDV-7R6A01A (1	pack Selection	Control Mode	Selection	
ere CEncoder Selection :	der Selection	Select the control mode y	you wish to use.	
Fully-closed encode	r : Do not use	Position control (pulse tr	rain reference)	•
Control	Mode Selection	Mode which controls pos	sition by pulse train input reference.	

- Click "Apply".
- Click "Reference Input Setting". Note: the "Control Mode Selection" setting is now highlighted in green, signifying that it has been completed.
- Select "SIGN + PULSE" and click "Next".
- You will then need to select pulse configuration logic type.
- Select "Negative logic" as shown below:

lect one pulse configurati	on logic type	
	Forward Reference Reverse Reference	3
C Positive logic		
Negative logic	PULS PULS SIGN "L"	_
]

- Click "Next".
- You will then be asked to Select the electronic gear setting method. Select "Enter the electronic gear ratio directly" as shown below:



- Click "Next".
- You will then need to enter the gear ratio. Enter **1048576** on top and **4096** on bottom as shown in the image below:
- Verify the "Positioning Completed Width" is set to 7 and click "Apply".
- The "Reference Input Setting" will now be green.
- Click "Motor Encoder Settings".

Setup Wizard		22
Servopack Selection SGDV-****01* (750W)	Reference Input Setting - Position Control	<u>()</u>
Encoder Selection Encoder Selection Encoder Selection : D 20-bit incremental Fully-closed encoder : Do not use	Enter Electronic gear ratio. Electronic Gear Ratio =	Information Electronic gear ratio setting range: 0.001 <= Electronic gear ratio <= 1000
Control Mode Selection Position control (pulse train reference) Reference Input Setting	Pn20E : Electronic Gear Ratio (Numerator) (Denominator) (1 - 1073741824) (1 - 1073741824)	If the setting is out of the above range, the parameter setting error (A.040) will be output, and the Servopack will not operate correctly.
Reference Pulse Configuration : Sign + Pulse Electronic gear ratio : 4 / 1 Positioning Completed Width : 7 [reference u	Enter Positioning Completed Width. Positioning Completed Width 7 [reference units]	Reference Motor speed
Motor Encoder Setting Output pulses : 2048 [P/Rev] Absolute Encoder Usage : Uses absolute en Rotation (movement) direction setting : Stanc	Pn522 : Positioning Completed Width (0 - 1073741824)	Error pulse
- Motor Stop Method Selection		

• On the right side of the screen you will see the option "Set the dividing output according to the electronic gear ratio" as shown below. Click "**Apply**" to set the number of output pulses per motor rotation to **1024**.



• Sometimes due to availability, you may receive a servomotor with an absolute encoder instead of an incremental encoder. The wizard will detect this and allows you to set the following option. If the servomotor does have an absolute encoder installed the "Absolute Encoder Setting" must be changed to "Uses absolute encoder as an incremental encoder." as shown below:

bsolute Encoder Setting	
elect the method of usage for the absolute encoder.	
ses absolute encoder as an incremental encoder.	-

Note: The "Absolute Encoder Setting" option is grayed out if you have an incremental encoder.

- Click "Next".
- Select "Standard Setting".

	Forward Reference	Reverse Reference
Standard Setting	Encoder output from Servopack JULI PAO(phase A) JULI PBO(phase B)	Encoder output from Servopack
C Reverse Mode	Encoder output from Servopack 	Encoder output from Servopack

• Click "Apply".

- The "Motor Encoder Settings" will now also be green.
- Click "Motor Stop Method".
- Pn001.0 should be set by default to the settings in the picture below. If not, make sure they are set accordingly.
- Set "Servo OFF" to "0 : Stops the motor by applying DB (dynamic brake).".
- Set "Overtravel" to "0 : Same setting as Pn001.0 (Stops the motor by applying DB or by coasting).".
- Set "G2 alarm" to "**0** : Stops the motor by setting the speed reference to "**0**".".

Select a mater stop mathod	
Servo OFF G1 alarm(Pn001 0)	
0 : Stops the motor by applying DB (dynamic brake).	-
Overtravel(Pn001.1)	
0 : Same setting as Pn001.0 (Stops the motor by applying DB or by coasting).	-
G2 alarm(Pn00B.1)	
0 : Stops the motor by setting the speed reference to "0".	-

• If the Servomotor you are setting up has a brake, you will need to check the "Use the Holding brake" option as shown below:

		1000 C C C C C C C C C C C C C C C C C C	
Bra	ke	settin	g

Use the holding brake (servomotor with the holding brake).

- 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 shown below.

Click an	y cell to alloc	ate an inp	ut signal.		Stan	dard allocat	tion	Customi	ze alloca	tion
	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)						52	
P-OT	Possible		2							P-OT
N-OT	Possible									N-OT
ALM-RST	Possible					/ALM-RST(L	2			
/P-CL	Possible						/P-CL(L)			
/N-CL	Possible			9	1. I.			/N-CL(L)	2	
/SPD-D	Not required							-	1	/SPD-D
/SPD-A	Not required	-								/SPD-A
/SPD-B	Not required									/SPD-B
/C-SEL	Not required									/C-SEL
ZCLAMP	Not required									/ZCLAM
INHIBIT	Not required									/INHIBIT
/G-SEL	Possible									/G-SEL
	Possible			9			S - 2			/P-DET

- Click "OK".
- Click "Output Signal Settings".
- You must set "/COIN" and "/V-CMP" to "Disable (Do not use)" as shown below:
- For motors with a brake you must also set "/BK" to "SO1 (CN1-25,26)" 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".
- Select "Write with a backup file" then press "Write". This will save the current configuration and then write the current configuration to the Servopack:



- Click "Finish".
- Click "Yes" when prompted to complete the Setup Wizard.
- The ServoPack will now have an A941 error as shown below. 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. Before clicking the "Software Reset" button push in the E-stop button on the control. This avoids putting the control into an error state when the drive and motor go offline. The Software Reset button is shown below:

👌 SigmaV	Vin+ AXIS#1 : S	GDV-180A	01A SigmaV (Compone	nt					
File(<u>F</u>)	Parameters(<u>U</u>)	Alarm(<u>A</u>)	Monitor(<u>M</u>)	Setup(<u>S</u>)	Trace(<u>T</u>)	Tuning(G)	Test Run(<u>R</u>)	Edit Table(])	Solution(O)	Help(<u>H</u>)
V 🕅 .	🎿 🞝 🔕 🚨		8 🛓 🙆 🧿	0	\$8 ₩ ₹	8. 9. 9	. 🎳 🔂 🌾	7 👒 🖏 📴	0 🛬 🖳	🗄 🎦 🖼 🎹
×								Softwa	are Reset	

• After pressing the "**Software Reset**" button you will receive a warning. Simply click "**Execute**" to continue as shown below:



- Click "Execute" at the next screen that pops up to confirm reset of the Servopack.
- Every time the Yaskawa Servopack is reset, you will normally get an error on the Centroid control. Having the E-stop button pressed will avoid getting that error message.
- Once the Servopack is reset, you will have a "Motor Base Blocked bb" message displayed on the Servopack. This message means that everything is OK.

Test Run:

We are now ready to perform a test run of the Servopack and Servomotor. This test run will be performed from the SigmaWin+ software using the Jog Mode.

•	To enter Jog	g Mode s	elect "Jog	" from t	he "Tes	t Run " m	enu as sho	own below		
🖨 Sigma	Win+ AXIS#1:	SGDV-180A	01A SigmaV (Componer	nt		;;			
File(F)	Parameters(<u>U</u>)	Alarm(<u>A</u>)	Monitor(<u>M</u>)	Setup(<u>S</u>)	Trace(T)	Tuning(G)	Test Run(<u>R</u>)	Edit Table(])	Solution(O)	Help(<u>H</u>)
1	i 🎿 📲 🔕 🚨		6 🛓 🛋 🖸		5¥ ₽	9 9 9 9	. 🎳 🔂 🦻	7 🎭 🖏 📴	0 2 4	± 🎦 🖾

• You will then see the Jog Operation window as shown below:

S JOG Operation AXIS#1	X
Pn304 : JOG Speed 10	[min-1] Edit
Operation Servo OFF	Servo ON
Forward	Reverse

- Click "Edit" to change the "JOG Speed" setting. 50rpm is a good safe starting point.
- Verify that the E-stop button is released.
- 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 working correctly you should have smooth motion of the Servomotor. Simply close the Jog Operation window to exit Jog Mode. Cycle the E-stop button.

Servopack Tuning:

We are now ready to tune the Yaskawa Servopack. There are two main options for doing this:

- 1. "Tune Less Mode" This is the default mode for the Servopack. It obtains a stable response without adjustment.
- 2. "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/Servomotor combinations seem to perform better once they have been Autotuned, so that is the option in which we will proceed.

• Select "Tuning(G)" then "Tuning(G)" as shown below:

SigmaWin+ AXIS#1 : SGDV-200A01A SigmaV Component	
File(F) Parameters(U) Alarm(A) Monitor(M) Setup(S) Trace(T) Tuning(G) Test Run(R) Edit Table(I) Solution(O) Help(H)
/ 🕅 🎿 📲 🚇 🔁 🖃 🖓 😫 🗮 🖊	🤊 🎹 Tuning (G 🔽 🐬 🦦 🖏 🐌 🕐 🚵 🖤 👫 😵 🖗 🛛
× _	

- You will then see a safety warning about the use of Tuning. Simply press "Execute" to continue.
- You will then see the following Tuning window:

Set the moment of inertia (mass) ratio before executing autotuning.	Precautions
Moment of inertia (mass) ratio identification Pn103 : Moment of Inertia Ratio Execute.	
Autotuning	
Reference input from host controller Position reference input No reference input	

- Click "Execute". This will begin the process to calculate the Moment of Inertia for the Servomotor.
- You will then see the Condition Setting window as shown below. Click "Next".
- Click "Start" to transfer reference conditions to the Servopack and then click "Next".
- You will then see the Moment of Inertia calculation as shown below:



- Verify that the E-stop button is released.
- Click "Servo On" to apply power to the Servomotor.
- Alternatingly, click "Forward" then "Reverse" until the SigmaWin software will no longer allow you to press either one, signifying that the process is complete.
- Push in the E-stop button and click "Next".

• You will then see the window as shown below:

📲 Write Results AXIS#	1		-		
Condition 🛶	Reference Transmission	Operation / Measurement	Write Results		
Writes ⁻	the Identified I	Woment of In	ertia Ratio.		
	14	(D.103 M		
	124		Ph 103 : Mo 124	[%]	
			esults		
			< Back	Finish	Cancel

- Click "Writing Results" to send the results to the Servopack.
- Click "Finish".
- You will be prompted to execute a **Software Reset** on the Servopack.
- You will then be returned to the Tuning window.
- Under the "Autotuning" section, click "No Reference Input" to ensure the correct mode during tuning. Click "Autotuning".
- You will then see the following Autotuning Set Conditions window:

Set conditions.	laad mamaat of intertia //r	ad mapp) identifie	ation
switching the i	load moment of Intertia (it	Jao mass/ identific	auon
1:A moment	of inertia is not presume	d.	
Mode selection	i		
2:For positio	ning		
A gain adjust following aut filter, anti-res	ment specialized for pos comatic adjustments can l conance control, and vibr	itioning will be exe be executed: Mode ation suppression	cuted. In addition, the el following control, noto
Mechanism sel	lection		
2:Ball screw	mechanism or linear mo	tor	
Executes adj screw or line	ustment suitable for relat ar motor. Select this type	ively high-rigidity r e if there is no app	- nechanism, such as a b licable mechanism.
Executes adj screw or line Distance The moving ra	ustment suitable for relat ar motor. Select this type ange from the current va	ively high-rigidity r if there is no app lue is specified.	- nechanism, such as a b licable mechanism.
Executes adj screw or line Jistance The moving ra	ange from the current va	ively high-rigidity r if there is no app lue is specified. 786000	nechanism, such as a b licable mechanism. [reference units]
Executes adj screw or line Distance The moving ra 786 (-99990 - 99 (Setting inva	ustment suitable for relat ear motor. Select this type ange from the current va X 1000 = 990) lid range : -131 - 131)	ively high-rigidity r e if there is no app lue is specified. 786000 3.0	mechanism, such as a b licable mechanism. [reference units] [Rotation]
Executes adj screw or line Distance The moving ra 786 (-99990 - 99 (Setting inva	ustment suitable for relat ear motor. Select this type ange from the current va X 1000 = 990) lid range : -131 - 131) ters	ively high-rigidity r e if there is no app lue is specified. 786000 3.0	mechanism, such as a b licable mechanism. [reference units] [Rotation]
Executes adj screw or line Distance The moving ra 786 (-99990 - 99 (Setting inva Funing parame	ange from the current va X 1000 = 990) lid range : -131 - 131) ters	ively high-rigidity r e if there is no app lue is specified. 786000 3.0 gs.	mechanism, such as a b licable mechanism. [reference units] [Rotation]
Executes adj screw or line Distance The moving ra [786 (-99990 - 99 (Setting inva Funing parame [Start tunin	ange from the current va X 1000 = 990) lid range : -131 - 131) ters	ively high-rigidity r e if there is no app lue is specified. 786000 3.0 gs.	nechanism, such as a b licable mechanism. [reference units] [Rotation]

- The following settings should be set by default, verify that they match the following settings:
 - Set "Switching the load moment of inertia (load mass identification)" to "1: A moment of inertia is not presumed.".
 - Set "Mode selection" to "2: For positioning".
 - Set "Mechanism selection" to "2:Ball screw mechanism or linear motor".
 - Ensure the "Moving Range" is set to "**3.0**" rotations.
- Click "Next".
- You will receive another warning. Click "Yes" to send the parameters to the Servopack.
- You will then see the Autotuning Automatic setting window as shown below:

Waiting for execution	Servo ON/OFF operation
wanning for execution	Servo ON
Oscillation level measurement	
	_ Tuning
	Start tuning
Gain search behaviour evaluation	-
	<u> </u>
Tuning completed	Mode selection
	2:For positioning
	Machaniam adaption
	mechanism selection
	2:Ball screw mechanism or linear motor
	2:Ball screw mechanism or linear motor Distance
Notch filter	2:Ball screw mechanism or linear motor Distance 786000 [reference units]

- Verify that the E-stop button is released.
- Click "Servo ON".
- Click "**Start tuning**". The Servopack will then tune itself. Sometimes the autotune will fault. This can usually be fixed by performing a **Software Reset** and re-starting the Autotune.
- Click "Finish" when tuning is complete.
- At this point the Servopack and servomotor are tuned. Exectue a **Software Reset** to be sure everything is back in good operation.
- Run Acorn Setup Wizard and set Steps/Rev to 4096