## **Overview:**

This document will walk you through the process of configurating and tuning a Yaskawa Sigma V Servo Drive Pack and motor with a centroid CNC11 based control, running in Precision Mode. Centroids Precision Mode can provide very good resolution and high feedrates, but the following maximums should not be exceeded:

#### MPU11 max Counts/min = 72,000,000

This maximum is derived from the maximum counts per interrupt 300 counts/int \* 4000 int/sec \* 60 seconds

Drive max command counts per second that the drive can accept (1,200,000/s)

The following table shows examples of resolutions resulting from selected encoder counts per rev and ballscrew pitch.

Encoder Counts/Rev Yielding Resolution and Speeds.

12mm Pitch	Counts/Rev	Resolution	MaxRPM	Max Speed	Max Speed
		("/Count)		("/Min)	(mm/Min)
	8192	0.000058	8789	4152	49828
	16384	0.000029	4395	2076	24914
See Notes*	24000	0.000020	3000	1417	17008
	32768	0.000014	2197	1038	12457

16mm Pitch	Counts/Rev	Resolution	MaxRPM	Max Speed	Max Speed
		("/Count)		("/Min)	(mm/Min)
	8192	0.000077	8789	5536	88583
	16384	0.000038	4395	2768	44291
See Notes*	24000	0.000026	3000	1890	30236
	32768	0.000019	2197	1384	22146

\*Yaskawa Sigma Series 5 Motors (SG-MGV) Maximum RPM = 3000

The 8192 default value referred to in the Tech Bulletin and manual refers to 8192 lines= 32768counts per rev.

# **Prerequisites:**

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

-~1	~-1			Gr Search
	Conversely	Concernation	Option	Line come
AXIS NO.	SGDV-5R5A01A	SGMJV-08A3A6S	Option	B-Axis

Illustration 1: Yaskawa SigmaWin+ Launch Screen

- Ensure "Online" is selected as shown above
- Select "Search" and make sure " $\Sigma$ 5 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 (Illustration 2):

	otor Power on Spe Motor Running	eed Reference	Main Circuit	/ 전 왜 왜 오 4	5 🔂 🎲	👒 🖏 🍺 🛈 法 🕯	4 🗠 🕍				
lotion M	onitor			i <b>x</b>	Input Sig	nal Monitor	×	Status N	lonitor		
Axis	Name		Value	Unit 🔺	Axis	Input Terminal Name	Signal Na	Axis	Name	Value	
<b>7</b> 1	Current Alarm State		Normal		1	SI0 (CN1-40)	/S-ON	1	Motor Power ON	No Motor Power	
1	Motor Speed		0	min-1		SI1 (CN1-41)	/P-CON		Mode Switch	-	
1	Speed Reference		-2	min-1		SI2 (CN1-42)	P-OT		Position Reference (PULS)		
1	Internal Torque Refe	erence	0	%		SI3 (CN1-43)	N-OT		Position Reference Direction	-	
1	Input Reference Pul	se Speed	-	min-1	1	SI4 (CN1-44)	/ALM-RS	1	Clear Signal	CLEAR Signal N	
1	Deviation Counter (F	Position Deviations)	-	reference 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 Consur	nption Power	2	%					/INHIBIT	2	
1	Reference Pulse Co	unter	3	reference units				01	Pulse Reference (PULS)	2	
1	Feedback Dules Cou	inter		encoder nulee i					Sign Reference (SIGN)	-	
								1	Reference Pulse Input Multiplication S	Reference Puls	
					d						
utput S	ignal Monitor			×							
Axis	Output Terminal N	Signal Name	Value								
1	ALM		Lo								
1	SO1 (CN1-25, 26)	/COIN,/V-CMP	Lo								
1	SO2 (CN1-27, 28)	/TGON	-								
1	SO3 (CN1-29, 30)	/S-RDY	Hi								
1	AL01		-								
1	AL02		-								
_1	AL03		-								
					1	III	÷.				

Illustration 2: Yaskawa SigmaWin+ Main Screen

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



llustration 3: Setup Wizard Menu

• Select the "**Parameters(U**)" menu then click on "**Setup Wizard(W**)" to start the wizard. The "**Setup Wizard(W**)" window is shown in illustration 4.



Illustration 4: Setup Wizard

- 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 on the "Encoder Selection" button.



- 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.



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

oni Rel	🖧 Setup Wizard AXIS#1	
	Servopack Selection SGDV-7R6A01A (1KW)	Control Mode Selection
ere	Encoder Selection	Select the control mode you wish to use.
	Control Made Selection	Position control (pulse train reference)
	Speed control (analog reference)	Mode which controls position 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 "phase A + phase B" and click "Next".
- You will then need to select how far the servomotor will move in response to a one-pulse input.
- Select "4 times (multiple)" as shown below:

Select how far the serve	omotor will move	in response to a one-pulse	input reference.
C 1 time (multiple)	Number of Servomotor move pulses		
C 2 times (multiple)	Number of Servomotor move pubes	O Input reference pulse	Information When a multiple of 1 is selected, the servomotor movement will be or
4 times (multiple)	Number of Servomotor move pulses		pulse for each reference input pulse

• Click "Next".

• You will then be asked to Select the electronic gear setting method, select "Enter the electronic gear ratio directly" as shown below:

8 Servaneck Selection	
SGDV-7R6A01A (1KW)	Position Control
e e e e e e e e e e e e e e e e e e e	
Encoder Selection : 20bit incremental Fully-closed encoder : Do not use	The electronic gear function allows you to set the distance that the servomotor moves per input reference pulse to the desired value. The host controller generating the reference pulse can carry out control without being aware of machine gear ratio or number of encoder pulses.
Control Mode Selection  Position control (pulse train reference)  Reference Input Setting  Reference Pulse Configuration : Sign + Pulse Electronic gear ratio : 4 / 1 Positioning Completed Width : 1000 [reference  Motor Encoder Setting  Note: Setting Sett	When the Electronic Gear Is Not Used Workpiece Workpiece No.of encoder pulses: 32768 Ball screw pitch: 6mm (0.24 in) To move a workpiece 10mm (0.39 in): 1 revolution is 6mm. Therefore, 10+6-1.6666 revolutions 32768×4 pulses is 1 revolution. Therefore, 1.6666×32768×4=218445 pulses 218445 pulses are input as reference pulses. The equation must be calculated at the host controller. When the Electronic Gear Is Used Workpiece Workpiece Workpiece Mort encoder pulses: 32768 Ball screw pitch: 6mm (0.24 in) To move a workpiece 10mm (0.300 µm), 1 pulse=1µm, so 10000/1=10000 pulses. Input 10000 pulses as reference pulses.
Absolute Encoder Usage : Uses absolute en Rotation (movement) direction setting : Stanc Motor Stop Method Selection Servo OFF, G1 alarm : Makes the motor coas Overtravel : Same setting as Pn001.0 (Stops G2 alarm : Same setting as Pn001.0 (Stops th	Select the electronic gear setting method. C Set the electronic gear details. C Enter the electronic gear ratio directly.

- Click "Next"
- You will then need to enter the gear ratio. Enter **1048576** on top and **32768** on the bottom as shown in the image below:

Servopack Selection	Reference Input Setting - Position Control	C
Encoder Selection Encoder Selection : 20bit 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 <= 4000
Control Mode Selection Position control (pulse train reference)	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 : 1000 [referenc	Enter Positioning Completed Width. Positioning Completed Width 7 [reference units]	Reference Motor speed
Output pulses : 32768 [P/Rev] Absolute Encoder Usage : Uses absolute en Rotation (movement) direction setting : Stanc	Pn522 : Positioning Completed Width ( 0 - 1073741824 )	Error pulse

- Verify the Positioning Completed Width is set to 7 and click "Apply".
- Reference Input settings will now be green.

### Click "Motor Encoder Settings".

• On the right side of the screen you will see the option to Set the dividing output according to the electronic gear ratio, as shown below. Click on the "Apply" arrow button to set the number of output pulses per motor rotation to **8192**.



• Some times due to availability you may receive a motor with an absolute encoder instead of an incremental encoder. The wizard will detect this and allow you to set the following option (shown below). The "Absolute Encoder Setting" must be changed to use the absolute encoder as an incremental encoder.:

osolute Encoder Setting	
elect the method of usage for the absolute encoder.	
ses absolute encoder as an incremental encoder.	<b>T</b>

- Note: The "Absolute Encoder Setting" option is grayed out if you have an incremental encoder.
- Click "Next".
- Select "Standard Setting":



• Click "Apply".

The "Motor Encoder Settings" section will now also be green.

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

Coloria materiales mathed	
Select a motor stop method.	
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 Servo Motor you are setting up has a brake you will need to check the "Use the Holding brake" option as shown below:

Brake setting	
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 show below.

Click any	iy cell to allocate an input signal.				Stan	dard alloca	tion	Customize allocation		
	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)	8	
/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									/INHIBI
/G-SEL	Possible									/G-SEL
	Possible			0						/P-DET

- Click "OK".
- Click "Output Signal Settings".
- 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:

•	Write with a backup file Saves the current Servopack settings in a backu parameters into the Servopack.	up file, and then writes t	ie set
0	Write without backup file Writes the set parameters into the Servopack wit settings in a backup file.	thout saving the current	

- 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.

Sigma	Win+ AXIS#1:	SGDV-180A	01A SigmaV	Compone	nt					
File(E)	Parameters(U)	Alarm(A)	Monitor(M)	Setup( <u>S</u> )	Trace(T)	Tuning(G)	Test Run(R)	Edit Table(])	Solution(O)	Help(H)
1	🎿 📲 🔕 🔒		6 🛓 🛓 🧟		₩₹₹	S Su Sa S	2 🎳 🔂 🎁	7 🎭 🖏 📴	0 2 4	1 1
× 🚽									Software	Reset
Mot	tor Power on	Speed Ref	erence	Main Circui	A 9	41 : Cha	inge of Pa	arameters	Require	s F
	Motor Running		Speed Co	bincidence			goon			

• 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 press the Estop button the control, this avoids putting the control into an error state when the drive and motor go offline. The Software Reset button is indicated below:



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

	CAUTION		
The soft and re-c Be sure executin	ware reset function r calculates all settings to carefully read the ng this function. Speci	resets the Servopad including parameter SigmaWin+ Operational care must be take	ck by using software s. on Manual before en for the following.
The Ser after the Before e motor st	vopack will stop resp e execution begins. executing this functior atus to ensure safety	onding for approxim 1, always check the	ately 5 seconds Servopack and

- 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. Really having the control estopped will avoid the error message.
- Once the drive is reset you will have a "Motor Base Blocked bb" message displayed on the ServoPack. 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:

C	SigmaWin+ AXIS#1 : SGDV-180A01A SigmaV Component										
	File( <u>F</u> )	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> )
	v 🗤	🛃 🔊 🔕 🚨		8 🛓 🙆 🧿	1 🕄	<b>a</b> # 7	8. 😪 🖓	. 🎳 🔂 🎁	7 👒 🖏 📴	0 2 4	± 🎦 🖾

• You will then see the Jog Operation Pop-up shown below:

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

- Click "Edit" to change the JOG Speed. "50 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 working correctly you should have smooth motion of the Servo Motor. Simply 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:

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

• The Tuning function is located under the Tuning menu:

SigmaWin+ AXIS#1 : SG	DV-200A01A SigmaV Component		
File( <u>F</u> ) Parameters( <u>U</u> ) A	Alarm( <u>A)</u> Monitor( <u>M</u> ) Setup( <u>S</u> )	Trace(T) Tuning(G) Test Run(R)	) Edit Table(]) Solution(O) Help(H)
🗸 👿 🎿 🔊 🔕 🚇	=	🗎 🕊 🦲 🎹 Tuning( <u>G</u> )	P 🎭 🖓 📅 🕐 🚣 🖤 📇 🐨 🐺 😵 🕅
× _			

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

• You will then see the following Tuning Screen:

executing autotuning.	Precautions
-Moment of inertia (mass) ratio identification	
Pn103 : Moment of Inertia Ratio	
Execute	
122 % <u>E</u>	dit
Ļ	
- Autotuning	
Reference input from host controller	
Position reference input	
	ng
No reference input	

- 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 and 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 process is complete.
- Press Estop and click the "Next" button.

You will then see the following screen:

Write Result	s AXIS#1	-		-	-			11		X
Condition Setting	■ Refe Tran:	ence mission	••	Operation / Measurement	•	Write Resul	ts			
Wr	ites the I	dentifie	ed Mo	ment of	Inerti	a Ratio.				
			_		5					
	lden	tified Mome	nt of Ine	ertia <mark>Ra</mark> tio		Pn103 :	Moment	of Inertia Ratio	)	
	124			[%]	•	124		[%]		
				·····		-				
				Writing	Results					

- 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.
- You will then be returned to the Tuning screen.
- Under the Autotuning section click "No Reference Input" to ensure the correct mode during tuning, then click the "Autotuning" button.
- You will then see the following Autotuning Set Conditions screen:

Set conditions.		
Switching the load moment of intertia (lo	ad mass) identificat	on
1:A moment of inertia is not presumed	d.	2
Mode selection		
2:For positioning		3
A gain adjustment specialized for posi following automatic adjustments can b filter, anti-resonance control, and vibr	itioning will be execu be executed: Model f ation suppression.	ted. In addition, the ollowing control, notc
Mechanism selection		
2:Ball screw mechanism or linear mot	tor	
Executes adjustment suitable for relat screw or linear motor. Select this type	ively high-rigidity me e if there is no applic	- chanism, such as a b able mechanism.
Executes adjustment suitable for relat screw or linear motor. Select this type Distance The moving range from the current va	ively high-rigidity me if there is no applic lue is specified.	- chanism, such as a b able mechanism.
Executes adjustment suitable for relat screw or linear motor. Select this type Distance The moving range from the current va 786 X 1000 =	ively high-rigidity me if there is no applic lue is specified. 786000	chanism, such as a b able mechanism. [reference units]
Executes adjustment suitable for relat screw or linear motor. Select this type Distance The moving range from the current va 786 X 1000 = (-99990 - 99990) (Setting invalid range : -131 - 131)	ively high-rigidity me s if there is no applic lue is specified. 786000 3.0	chanism, such as a b able mechanism. [reference units]
Executes adjustment suitable for relat screw or linear motor. Select this type Distance The moving range from the current va 786 X 1000 = (-99990 - 99990) (Setting invalid range : -131 - 131) Tuning parameters	ively high-rigidity me e if there is no applic lue is specified. 786000 3.0	chanism, such as a b able mechanism. [reference units]
Executes adjustment suitable for relat screw or linear motor. Select this type Distance The moving range from the current va 786 X 1000 = (-99990 - 99990) (Setting invalid range : -131 - 131) Tuning parameters Start tuning using the default settin	ively high-rigidity me e if there is no applic lue is specified. 786000 3.0 gs.	chanism, such as a b able mechanism. [reference units] [Rotation]

- The following settings should be set by default, verify they match these settings.
- 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:

	Servo ON/OFF operation	
Waiting for execution		Servo ON
	Servo OFF	
Oscillation level		4 <b>×</b>
measurement		
	Tuning	
Gain search		Start tuning
behaviour evaluation		
Tuning completed	Node selection	
Tuning completed	Mode selection 2:For positioning	
Tuning completed	Mode selection 2:For positioning Mechanism selection	
Tuning completed	Mode selection 2:For positioning Mechanism selection 2:Ball screw mechanism or linea	r motor
Tuning completed	Mode selection 2:For positioning Mechanism selection 2:Ball screw mechanism or linea Distance	r motor
Tuning completed	Mode selection 2:For positioning Mechanism selection 2:Ball screw mechanism or linea Distance 786000 [reference	r motor units]
Tuning completed	Mode selection 2:For positioning Mechanism selection 2:Ball screw mechanism or linea Distance 786000 [reference 3.0 [Rotation]	r motor units]

- Release Estop.
- 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 motor are tuned. Execture a Software Reset to be sure everything is back in good operation

## **Centroid PID Configuration:**

Centroid Control Parameter 256 must be set to 2 to let the control know we are in Position Mode. When using Position Mode the Centroid PID values should all be zerod out as shown below:

Кр	Ki	Kd	Limit	Kg	Kv1	Ka	Accel.
0	0	0	2560000	0	0	0	0.500

The Axis Encoder Counts on the Centroid must be set to the value that we used on the Yaskawa – 32768 in this case.

Use the Yaskawa software to jog the motors (shown in the **Test Run** section above) In the PID menu, confirm that the Abs Pos field is increasing when the shaft is moving counter clockwise. If it is counting backwards or not counting, the encoders are wired incorrectly or drive mapping is not set.



For a standard 3-axis system parameters 300 -302 should be set to 1, 2, 3, and parameters 308-310 should be set to 7, 8, 9. Also parameters 357 -359 should be set to 3000.

**\*\*\***After the Yaskawa drives have been configured and tuned or any time you have changed any settings on the drive(s) a Precision Mode Autotune must be performed on the control. This is done by selecting **F5-Tune** from the PID menu. Make sure all axes can move the specified amount without running into anything or runnig up against a limit.

# **Braking Resistors:**

If the Yaskawa drive is wired to use an external braking resistor you must set Parameter 600 (Regenerative Resistor Capacity) on the Yaskawa to be equal to 20% of the wattage of the braking resistor.

 Document History

 Rev4 Created on 2015-05-03 by #240

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