TB231 (Rev3) - Delta AB and A2 Drive Setup for CNC11 Systems

This document describes how to setup the Delta Servo drive parameters for use with a CNC11 system running a GPIO4D or Optic4. The Delta drive should be setup first based on the following table of parameters. After the parameters are set, a Jog trial should be done to make sure the drive can run the motor correctly.

Modifying Delta drive parameters

- Press the **MODE** key to enter parameter mode.
- Press the **SHIFT** key to select the parameter group you need.
- Use the **UP** and **DOWN** keys to select parameter numbers.
- Press the **SET** key to enter the parameter.
- Press the **UP** or **DOWN** keys to change the parameter value.
- Press the **SHIFT** key to shift the cursor to the left one place.
- Press **SET** to save the parameter or when finished press **MODE** to exit parameter mode.

Delta A2/AB Drive Parameters

P02-10	101	DIO1 - Drive Enable
P02-11	0	DIO2 - not used
P02-12	0	DIO2 - not used
P02-13	0	DIO3 - not used
P02-14	102	DIO5 - Reset Servo Drive
P02-15	0	Disable + limit switch
P02-16	0	Disable - limit switch
P02-17	0	Disable EMGS function
P02-21	108	DO4-Motor Brake Output
P02-66	4	Auto-reset Undervolt error
P01-00	0	Encoder is AB Pulse output
P01-01	2	Velocity Mode control
P01-40	*	Motor Max Commanded RPM
P01-41	200	Max Analog Torque command
P01-46	1, 40000**	Encoder output pulses**
P01-55	*	Max allowed RPM of motor

*Important: The value for Parameter 01-40 should be set to 10% over the max rate that CNC11 will command at 10VDC on the analog output. This means that if the motor will be commanded at 3000 RPM, this parameter should be set to about 3300 RPM. Also, Parameter 01-55 should be set about 5% above Parameter 01-40, or 3450 RPM in this example, to avoid issues at max rate. This parameter sets the absolute max rate the motor is allowed to spin.

** 1 is the default output value for the Delta AB drive encoder emulation output. On the AB drives leave this parameter at 1 to get 2500 ppr or 10000 counts per revolution. On the A2 drives set this parameter to 16384 ppr to get 65536 counts per revolution.

Some of these parameters cannot be set when "Drive Enable" is on. A message flashes after pressing **SET** if the Delta drive inhibits the parameter change.

There are some parameters that will not take effect until the servo drive is restarted. It is recommended to restart the servo drive after parameters are changed. Please refer to the Delta servo drive operator manual for more details on the parameters.

To reset all parameters to factory default, change **P02-08** to **10** and save, then power cycle the drive.

JOG trial run with Delta drive

- This is a test of the Delta drive using the internal jogging commands. CNC11 is completely out of the loop at this point in the test.
- **Warning:** The motor should be secured before running this trial. One option is to mount it to the machine, but leave the motor shaft uncoupled. There should not be a load on the motor for this test.
- First, the drive must be enabled. The recommended way is to remove CN1 and release E-Stop from the drive and set **P02-30** to **1** which forces the drive to be enabled regardless of the Enable input.
  Note: P02-30 is reset when the drive is powered off.
- Set **P4-05** to the desired speed of the motor in RPM. Press the **UP** or **DOWN** arrow keys to set the desired jogging speed.
  Note: this parameter can only be set when Drive Enable is on.
- Press **SET** to enter jogging mode. The LED display shows "JOG" after the **SET** key is pressed.
- Press the **UP** key for CCW or **DOWN** key for CW.
- Once the trial is complete push the **MODE** key to exit jogging mode.

Auto-Tune Delta drive to load

The Delta drives should be tuned to the actual load that they are driving to allow the best control and smoothness of operation. The information here is a quick setup guide to the tuning proceedure used for the Delta drive. It is not meant to be an exhaustive treatment of tuning and specifically does not cover using the keypad to tune the drives as it is much less automated than using the PC software. See the Trial Jog and Tuning chapter in the appropriate Delta manual for instructions on how to tune the drive with the keypad and a detailed explanation of what the parameters affect.

**Note: Images forthcoming

- Download the correct version of Delta's Software for the drives you are using. Version 4.03 is for ASDA-A2/B2 drives and 3.02 is for ASDA-AB drives. This link goes to the download page for Delta software. Unzip the file to a folder and run the setup.exe file.
- Connect a USB-A to USB-B cable to a PC running Windows XP/Vista/7 and a Delta drive. The USB driver should automatically install. Open the ASDA Software and Click OnLine, then Connect if a device shows up.
- Make a backup of the parameters before modifying anything on the drive.
- Start Auto Gain-tuning menu and Enable Auto Gain Tuning. Download the preset values and click Enable Amp. Jog with the arrow keys back and forth, setting position 1 and 2 as far apart as possible, but within the intended software travel limits.
- Click Start and the motor will move back and forth to determine the estimated Inertia for the system. Let the move occur 5-10 times before stopping the move and clicking the Set J button. This calculates parameters that then appear on the left.
- Download the values and then increase the jog speed from 200 RPM to 500 RPM and repeat the proceedure, increasing the speed until it is at the maximum that will be run on the system. This is typically 2000-3000 RPM.
- Once tuning is done at the maximum rate, try increasing the bandwidth by 10Hz at a time until high frequency oscillations are heard. Back off until they disappear and the drive tuning is complete.
- Open the Parameter menu and re-apply what is found in the amp. Save a copy for future use if the drive is ever replaced.

Integration with CNC11

Now we are ready to put the whole system together.

- Wire the Delta drive into either the GPIO4D or Optic4 based on the following schematic. All that is technically required to make the motor turn is Drive Enable and analog voltage.
- Enter the correct motor counts/revolution in the Motor Parameters screen.
- Check that the motor encoder counts count down when the motor is turned CW when looking at the shaft. If the counts do not go down, then the A and B channels are swapped coming into the encoder header. Direction reversal will not fix this problem.
- Enter the Drive Map parameters based on which drive is being used from the table in the User's Manual.

- Enter PID values for Torque or Velocity Mode.

	Velocity Mode	Torque Mode
Kp	0.04	4
Ki	0.0006	0.0156
Kd	0	12.5
Limit	2560000	100000
Kg	0****	
Kv1	80	
Ka	0****	
Accel	0.3	0.3

****warning: Do no change Ka and Kg away from zero in velocity mode. While the Scope Tuning screen may show an improvement, adding Ka and Kd cause very erratic motion when arcs and spindle-slaved moves are commanded.

- The given PID values require CNC11 V3.03 Rev 61 and later.
- Check the values by running gathers and optimize Kv1, Kp, Ki and Accel time if apropriate for the control mode.
- Note that the tuning values will vary according to the set max rate in the drive and CNC11. If they are changed, the PID must be re-tuned.
- Continue with standard machine integration. This should include testing the fault output from the Delta drive to make sure CNC11 throws an error. You need to determine if a drive fault from the Delta drive can be recovered from with a simple E-Stop cycle. We recommend not allowing that because something is seriously wrong with the Delta drive if a fault occurs and needs to be investigated.
- The PID vaules will change when the encoder counts per revolution change. These values are only valid for the specified encoder counts listed above.

Resonance Supression

If there is a sustained resonance, whether at hold or during motion of some kind, the Delta drive has a parameter P2-47, that can detect this resonance and damp it out. Reproduce the resonance and then change P2-47 to a 1 and hit the SET key. If the drive can suppress the resonance, it will be done right away.

Diagnostics

Parameter **P04-07** can be displayed on the parameter menu to show the state of the Digital Inputs. The lowest bit is one when **DI1** is set and the highest bit is one when **DI7** is set. Checking this parameter will tell if the Fault Reset or Drive Enable signals are being set. Similarly **P04-09** can be displayed to show the state of the Digital Outputs. Bit 2 shows the state of the fault output signal going to the Centroid part of the system.

Optic4/GPIO4D schematic

Coming Soon

Document History

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