HYPERTHERM®
A Hypertherm Associates Brand

Delta EtherCAT® Drives Supported by EDGE® Connect/T/TC CNCs

Application Note

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Environmental stewardship is one of Hypertherm's core values. www.hypertherm.com/environment

Introduction

The information that follows is given to Hypertherm channel partners for reference only, to help you select and configure an EtherCAT drive that is supported by EDGE Connect CNCs.

Work in partnership with your drive manufacturer to select and configure the drives for your cutting system. Refer to your drive manufacturer's drive documentation for technical information about the drives. Make sure to follow the guidelines and instructions supplied by the drive manufacturer.

When possible, the information that follows is given to support integration of the drives with the cutting system and the CNC.

- Drive model supported
- Firmware revision supported
- Example drive amplifier file
- Setup and parameter notes

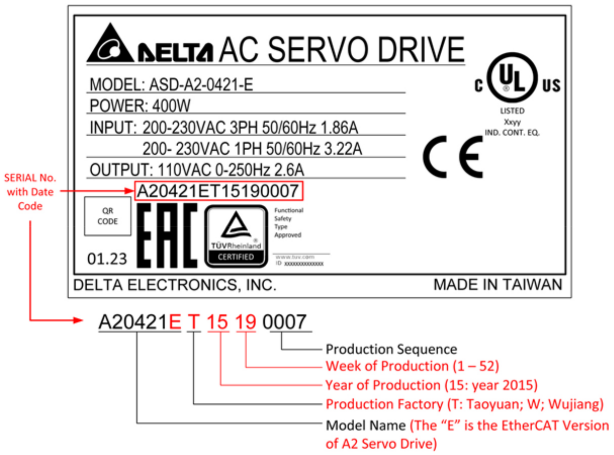
Setup files and parameters from Hypertherm can be used for the initial machine setup. We expect these files and parameters to be modified by the installer for the cutting system configuration and necessary performance.

Supported Delta drives

Series	Model	Firmware	Notes
ASDA-A2	ASD-A2-E series (with ASD-A2-*XXXX*-E part numbers)	1.643.366 and newer. Required for using parameters to change motor direction.	▪ Use firmware for ASDA drives only. ▪ 7 digital inputs per drive amplifier are supported. ▪ CNC control of the drive's digital outputs is not supported. ▪ Only use drives manufactured after April 20, 2018 with cutting systems in environments with potential high frequency. See Figure 1 on page 4 for information about the date code.
ASDA-B3	ASD-B3-*XXXX*-E	Firmware version 1.0533 or newer.	▪ Use firmware for ASDA drives only. ▪ 4 digital inputs per drive amplifier are supported. ▪ CNC control of the drive's digital outputs is not supported.
ASDA-B3A	ASD-B3A-*XXXX*-E	Firmware version 1.0533 or newer.	▪ Use firmware for ASDA drives only. ▪ 4 digital inputs per drive amplifier are supported. ▪ CNC control of the drive's digital outputs is not supported.

Delta has made improvements to drives manufactured after April 20, 2018 to make newer drives more robust to EMI and RF. The manufacture date can be identified by the date code on the drive. The date code should be greater than 1816 (18 is the code for 2018 and 16 is the code for week 16). See the example shown in Figure 1 below.

Figure 1 – Example Delta AC servo drive data plate



- To check a drive's firmware version, use the ASDA-Soft drive software provided by Delta.
- Mixing different brands of drives in one system is not supported.
- All drives must support and be configured for a 1 ms update rate.
- The need for more I/O depends on the total number of I/O and the I/O style required. For a list of supported I/O modules, see the *EtherCAT® Drives and I/O Modules Supported by EDGE® Connect CNCs* Application Note (809660). Technical documentation is available at www.hypertherm.com/docs.

Setup and parameters

This section helps with setting up the drive parameters. Work in partnership with your drive manufacturer to set up the drives for your cutting system. Refer to your drive manufacturer's drive documentation for more technical information about the drives.

Also refer to the following sections of the *EDGE® Connect Installation and Setup Manual* (809340).

- Section 3: Machine stop strategies and table hardware, for information about:
  - How the CNC enables and disables the drives, and stops motion
  - Drive enable signals
  - Drive Enable output and Drive Disabled input
  - Overtravel limits
  - Safety circuit
- Section 5: Machine Axes, for information about:
  - Axis orientation and positive motion
  - Axis assignment and setup
- Section 7: I/O – Inputs and Outputs, for information about:
  - How Phoenix® assigns I/O
  - Digital I/O and assignment
  - Analog I/O and assignment

Technical documentation is available at www.hypertherm.com/docs.

Drive setup overview

From a high level, the process of setting up your drives is as follows.

1. Make sure that the correct firmware is installed. If an update is needed, contact the drive manufacturer. Hypertherm is not currently providing firmware updates.
2. Set up the drive parameters per the drive manufacturer's instructions.
3. Make sure the drives are communicating on the network.

Make sure you can remove power, including control (logic) power, from all drives. Refer to your drive manufacturer's drive documentation for more information.

All drives must be set up as linear axes.

All drives must support and be configured for a 1 ms update rate.

Parameters in ASDA-Soft

Set/verify the following settings using the Delta ASDA-Soft software.

Table 1 – Parameters supported with Delta's ASDA-A2 drive series

Parameter	Value
P1-01 Input Setting of Control Mode EtherCAT	0x000C
P2-10 DI1 Functional Planning Disabled	0x0100
P2-11 DI2 Functional Planning Disabled	0x0100
P2-12 DI3 Functional Planning Disabled	0x0100
P2-13 DI4 Functional Planning Disabled	0x0100
P2-14 DI5 Functional Planning Disabled	0x0100
P2-15 DI6 Functional Planning Disabled	0x0100
P2-16 DI7 Functional Planning Disabled	0x0100
P3-18 EtherCAT Special Function Switch	0x1000

Table 2 – Parameters supported with Delta's ASDA-B3 and ASDA-B3A drive series

Parameter	Value
P1.01 Input Setting of Control Mode EtherCAT	0x000C
P2.10 DI1 Functional Planning Disabled	0x0100
P2.11 DI2 Functional Planning Disabled	0x0100
P2.12 DI3 Functional Planning Disabled	0x0100
P2.13 DI4 Functional Planning Disabled	0x0100
P3.18 EtherCAT Special Function Switch	0x1000

Parameters for changing motor direction

To set drive direction, refer to the user manual provided by Delta. The information below is provided by Hypertherm for reference only.

ASDA-A2

For ASDA-A2-E Delta drive models, firmware version 1.643.366 and newer is required for using parameters to change motor direction.

For clockwise motor direction	
Parameter	**Value**
P1-01	010C
P3-12	0100

For counterclockwise motor direction	
Parameter	**Value**
P1-01	000C
P3-12	0000

ASDA-B3 and ASDA-B3A

For ASD-B3-*XXXX*-E and ASD-B3A-*XXXX*-E Delta drive models, use the following parameters to change motor direction.

For clockwise motor direction	
Parameter	**Value**
P1.001	010C

For counterclockwise motor direction	
Parameter	**Value**
P1.001	000C

Drive inputs and outputs

Drive inputs

Set up the drive inputs and outputs as described in the *Delta Servo Drive User Manual*. On the initial install, the default values will be set as follows:

- A2 drives: DI1-DI7
- B3 drives: DI11-DI14

ASDA-A2

Phoenix maps 7 digital inputs for the ASDA-A2-E drive models.

Digital inputs	Description
DI1	CN1-7
DI2	CN1-8
DI3	CN1-9
DI4	CN1-10
DI5	CN1-11
DI6	CN1-12
DI7	CN1-13

ASDA-B3 and ASDA-B3A

Phoenix maps 4 digital inputs for ASD-B3-*XXXX*-E and ASD-B3A-*XXXX*-E drive models.

Digital inputs	Description
DI11	CN6
DI12	CN7
DI13	CN8
DI14	CN9

Supported encoder counts

Phoenix does not support the EU numbering format of using decimal points (periods) as numerical separators. **Using decimal points as numerical separators will result in incorrect settings.**

Example:

- Correct – 200,000.00 = Two hundred thousand
- Incorrect – 200.000,00 = Two hundred

Drive model	Supported encoder counts per revolution
ASDA-A2-E	1.280.000 (1,280,000)
ASD-B3-*XXXX*-E	16.777.216 (16,777,216)
ASD-B3A-*XXXX*-E	16.777.216 (16,777,216)

The CNC has a maximum encoder input rate of 32.767 counts per millisecond – metric (32,767 counts per millisecond – English).

The OEM or system integrator must set the drive's encoder scaling parameter, so that the CNC's maximum encoder input rate is not exceeded at the table's designed maximum speed.

Parameter	Value
0x6093:1 Electronic Gear Ratio Numerator	Set by the OEM or system integrator.*
0x6093:2 Electronic Gear Ratio Denominator	Set by the OEM or system integrator.*

* **In Phoenix 10.21 and earlier,** the default Electronic Gear Ratio numerator is set to 0x04 by the Hypertherm EtherCAT slave information (ESI) and cannot be changed. With an Electronic Gear Ratio of 4, there are 320.000 counts per revolution – metric (320,000 counts per revolution – Imperial) available over the EtherCAT network. Use this value to calculate encoder counts per mm (inch) and maximum machine speed.

Encoder counts per mm (inch)

Linear axis example – Metric

In this example the linear axis has the following machine characteristics.

- Gear box ratio: 5:1
- Lead screw pitch: 150 mm/revolution

Use these values with the following formula to calculate encoder counts per mm, as shown.

$$\frac{320.000 \text{ encoder counts}}{1 \text{ motor revolution}} \times \frac{5 \text{ motor revolutions}}{1 \text{ pinion revolution}} \times \frac{1 \text{ pinion revolution}}{150 \text{ mm (pitch)}} = 10.666{,}67 \text{ encoder counts per mm}$$

Linear axis example – English

In this example the linear axis has the following machine characteristics.

- Gear box ratio: 5:1
- Lead screw pitch: 5.91 inch/revolution

Use these values with the following formula to calculate encoder counts per mm, as shown.

$$\frac{320{,}000 \text{ encoder counts}}{1 \text{ motor revolution}} \times \frac{5 \text{ motor revolutions}}{1 \text{ pinion revolution}} \times \frac{1 \text{ pinion revolution}}{5.91 \text{ inch (pitch)}} = 270{,}727.58 \text{ encoder counts per inch}$$

Maximum machine speed per minute

There is a limit to the maximum encoder feedback on the EDGE Connect. The CNC's maximum encoder input rate is 32.767 counts per millisecond – metric (32,767 counts per millisecond – English). The drive's encoder scaling parameter needs to be adjusted, so that the CNC's maximum encoder input rate is not exceeded at the table's designed maximum speed. Use the calculated encoder counts from the example on page 10 with the following formula to calculate the maximum machine speed.

Metric example:

$$\frac{\text{32.767 (Maximum encoder counts per ms)} \times \text{60.000 (ms per minute)}}{\text{10.666,67 encoder counts per mm}} = \text{184.314,32 mm/min Maximum machine speed}$$

English example:

$$\frac{\text{32,767 (Maximum encoder counts per ms)} \times \text{60.000 (ms per minute)}}{\text{270,727.58 encoder counts per inch}} = \text{7,261.99 in./min Maximum machine speed}$$