Hypertherm®

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

Application Note

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One of Hypertherm's long-standing core values is a focus on minimizing our impact on the environment. Doing so is critical to our, and our customers', success. We are always striving to become better environmental stewards; it is a process we care deeply about.

Introduction

The following information is provided to Hypertherm channel partners for reference only, to help you select and configure an EtherCAT drive that is supported by EDGE Connect/T/TC 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.

When possible, the following information is provided 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 provided by Hypertherm can be used for the initial machine setup. We expect these files and parameters to be modified by the installer for the specific cutting system configuration and desired performance.

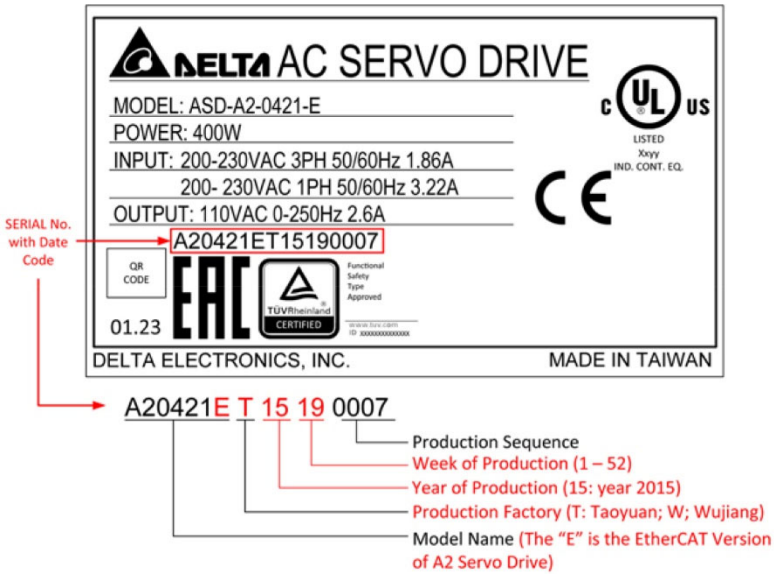
> **NOTE:** Make sure to follow the guidelines and instructions provided by the drive manufacturer.

Supported Delta drives

Series	Model	Firmware	Notes
ASDA-A2	ASDA-A2-E	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 the example below for information about the date code.

NOTE:

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 below.



NOTE:

- 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 additional 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/T/TC CNCs* Application Note (809660).

Setup and parameters

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

1. Install the firmware using the drive software.
2. Set up the drive parameters per the drive manufacturer's instructions.
3. Make sure the drives are communicating on the network.

In addition to this application note, 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

NOTE:

- 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.

Parameter	Value
P1-01 Input Setting of Control Mode “EtherCat”	0x000C
P2-10 DI1 Functional Planning “Disabled”	100
P2-11 DI2 Functional Planning “Disabled”	100
P2-12 DI3 Functional Planning “Disabled”	100
P2-13 DI4 Functional Planning “Disabled”	100
P2-14 DI5 Functional Planning “Disabled”	100
P2-15 DI6 Functional Planning “Disabled”	100
P2-16 DI7 Functional Planning “Disabled”	100
P3-18 ECATO EtherCat Special Function Switch	0x1000

Parameters for changing motor direction

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

Drive inputs

Phoenix maps 7 digital inputs.

NOTE: To use Delta digital inputs, set them for general purpose use.

Digital inputs	Description
DIN1	CN1-7
DIN2	CN1-8
DIN3	CN1-9
DIN4	CN1-10
DIN5	CN1-11
DIN6	CN1-12
DIN7	CN1-13

Supported encoder counts

NOTE: 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

The ASDA-A2-E model drive supports 1.280.000 encoder counts per revolution – metric (1,280,000 encoder counts per revolution – English). The CNC has a maximum encoder input rate of 32.767 counts per millisecond – metric (32,767 counts per millisecond – English).

The drive's encoder scaling parameter is adjusted so that the CNC's maximum encoder input rate is not exceeded at the table's designed maximum speed. (Refer to *Maximum machine speed per minute* below for more information.) This scaling is done in the Hypertherm EtherCAT slave information (ESI) file for Delta drives, which sets the default Electronic Gear Ratio numerator to 0x04 and cannot be changed.

Parameter	Value
0x6093:1 Electronic Gear Ratio Numerator	0x04
0x6093:2 Electronic Gear Ratio Denominator	0x01

With an Electronic Gear Ratio of 4 there are 320.000 counts per revolution – metric (320,000 counts per revolution – English) 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 in./revolution

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

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

Maximum machine speed per minute

Use the encoder counts per mm (inch) with the following formula to calculate the maximum machine speed. Note that the maximum encoder counts per ms in Phoenix is fixed at 32.767 – metric (32,767 – English).

Metric example:

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

English example:

$$\frac{32{,}767 \text{ (max. encoder counts per ms)} \times 60{,}000 \text{ (ms per minute)}}{270{,}727.58 \text{ encoder counts per inch}} = 7{,}261.99 \text{ ipm Maximum machine speed}$$