



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

Application Note

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**Hypertherm Inc.**

Etna Road, P.O. Box 5010  
Hanover, NH 03755 USA  
603-643-3441 Tel (Main Office)  
603-643-5352 Fax (All Departments)  
info@hypertherm.com (Main Office Email)

**800-643-9878 Tel (Technical Service)**

technical.service@hypertherm.com (Technical Service Email)

**800-737-2978 Tel (Customer Service)**

customer.service@hypertherm.com (Customer Service Email)

**866-643-7711 Tel (Return Materials Authorization)****877-371-2876 Fax (Return Materials Authorization)**

return.materials@hypertherm.com (RMA email)

**Hypertherm México, S.A. de C.V.**

Avenida Toluca No. 444, Anexo 1,  
Colonia Olivar de los Padres  
Delegación Álvaro Obregón  
México, D.F. C.P. 01780  
52 55 5681 8109 Tel  
52 55 5683 2127 Fax  
Soporte.Tecnico@hypertherm.com (Technical Service Email)

**Hypertherm Plasmatechnik GmbH**

Sophie-Scholl-Platz 5  
63452 Hanau  
Germany

00 800 33 24 97 37 Tel  
00 800 49 73 73 29 Fax

**31 (0) 165 596900 Tel (Technical Service)****00 800 4973 7843 Tel (Technical Service)**

technicalservice.emea@hypertherm.com (Technical Service Email)

**Hypertherm (Singapore) Pte Ltd.**

82 Genting Lane  
Media Centre  
Annexe Block #A01-01  
Singapore 349567, Republic of Singapore  
65 6841 2489 Tel  
65 6841 2490 Fax  
Marketing.asia@hypertherm.com (Marketing Email)  
TechSupportAPAC@hypertherm.com (Technical Service Email)

**Hypertherm Japan Ltd.**

Level 9, Edobori Center Building  
2-1-1 Edobori, Nishi-ku  
Osaka 550-0002 Japan  
81 6 6225 1183 Tel  
81 6 6225 1184 Fax  
HTJapan.info@hypertherm.com (Main Office Email)  
TechSupportAPAC@hypertherm.com (Technical Service Email)

**Hypertherm Europe B.V.**

Vaartveld 9, 4704 SE  
Roosendaal, Nederland  
31 165 596907 Tel  
31 165 596901 Fax  
31 165 596908 Tel (Marketing)  
**31 (0) 165 596900 Tel (Technical Service)**  
**00 800 4973 7843 Tel (Technical Service)**  
technicalservice.emea@hypertherm.com  
(Technical Service Email)

**Hypertherm (Shanghai) Trading Co., Ltd.**

B301, 495 ShangZhong Road  
Shanghai, 200231  
PR China  
86-21-80231122 Tel  
86-21-80231120 Fax  
**86-21-80231128 Tel (Technical Service)**  
techsupport.china@hypertherm.com  
(Technical Service Email)

**South America & Central America: Hypertherm Brasil Ltda.**

Rua Bras Cubas, 231 – Jardim Maia  
Guarulhos, SP – Brasil  
CEP 07115-030  
55 11 2409 2636 Tel  
tecnico.sa@hypertherm.com (Technical Service Email)

**Hypertherm Korea Branch**

#3904. APEC-ro 17. Heaundae-gu. Busan.  
Korea 48060  
82 (0)51 747 0358 Tel  
82 (0)51 701 0358 Fax  
Marketing.korea@hypertherm.com (Marketing Email)  
TechSupportAPAC@hypertherm.com  
(Technical Service Email)

**Hypertherm Pty Limited**

GPO Box 4836  
Sydney NSW 2001, Australia  
61 (0) 437 606 995 Tel  
61 7 3219 9010 Fax  
au.sales@Hypertherm.com (Main Office Email)  
TechSupportAPAC@hypertherm.com  
(Technical Service Email)

**Hypertherm (India) Thermal Cutting Pvt. Ltd**

A-18 / B-1 Extension,  
Mohan Co-Operative Industrial Estate,  
Mathura Road, New Delhi 110044, India  
91-11-40521201/ 2/ 3 Tel  
91-11 40521204 Fax  
HTIndia.info@hypertherm.com (Main Office Email)  
TechSupportAPAC@hypertherm.com  
(Technical Service Email)

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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

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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.

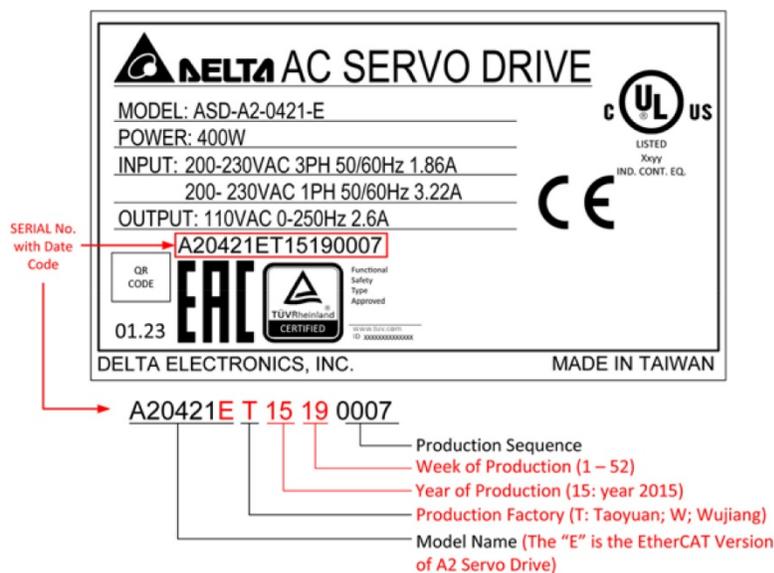
**NOTE:** Make sure to follow the guidelines and instructions provided by the drive manufacturer.

## Supported Delta drives

| Series  | Model     | Firmware   | Notes   |
|---------|-----------|--|---|
| ASDA-A2 | ASDA-A2-E | 1.643.366 and newer.<br>Required for using parameters to change motor direction. | <ul style="list-style-type: none"> <li>Use firmware for ASDA drives only.</li> <li>7 digital inputs per drive amplifier are supported.</li> <li>CNC control of the drive's digital outputs is not supported.</li> <li>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.</li> </ul> |

### 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

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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

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:**

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