HYPERTHERM®
A Hypertherm Associates Brand

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

Application Note

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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 Leadshine drives

Series	Model	Firmware	Notes
EL8-EC AC Servo Drive Series	EL8-EC400F	3.0 or newer.	■ Use firmware for Leadshine drives only. ■ Inputs and outputs supported for each drive amplifier ❑ Digital: 8 inputs, 3 outputs ❑ Analog: 1 input

- To check a drive's firmware version, use the MotionStudio Version 2.2.6.720 or greater drive software from Leadshine.
- Mixing different brands of drives in one system is not supported.
- Set the operating mode in all drives to Cyclic Synchronous Position (CSP) at 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 MotionStudio 2.2.6

Set/verify the following settings using the Leadshine MotionStudio Ver 2.2.6.720 or greater software.

Table 1 – Parameters supported with Leadshine's EL8-EC400F drive

Parameter	Value
PA4.00 Input selection DI1	0x0
PA4.01 Input selection DI2	0x0
PA4.02 Input selection DI3	0x0
PA4.03 Input selection DI4	0x0
PA4.04 Input selection DI5	0x0
PA4.05 Input selection DI6	0x0
PA4.06 Input selection DI7	0x0
PA4.07 Input selection DI8	0x0
PA4.10 Output selection D01	0x0
PA4.11 Output selection D02	0x0
PA4.12 Output selection D03	0x0
PA5.21 Torque limit selection	2

Parameters for changing motor direction

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

Leadshine's EL8-EC drive series

For clockwise motor direction	
Parameter	**Value**
PA0.06 Command polarity inversion	0

For counterclockwise motor direction	
Parameter	**Value**
PA0.06 Command polarity inversion	1

Drive inputs and outputs

Drive inputs

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

Phoenix maps 8 digital inputs for the EL8-EC drive models.

Digital inputs	Description
DI-COM	CN1 Pin 6
DI1	CN1 pin 5
DI2	CN1 pin 7
DI3	CN1 pin 8
DI4	CN1 pin 9
DI5	CN1 pin 10
DI6	CN1 pin 11
DI7	CN1 pin 12
DI8	CN1 pin 13

Phoenix maps 2 analog inputs for the EL8-EC drive models.

Analog inputs	Description
AI1+	CN1 Pin 14
AI1-	CN1 Pin 15
AI2+	CN1 Pin 23
AI2-	CN1 Pin 24

Drive outputs

Phoenix maps 3 digital outputs for the EL8-EC drive models.

Digital outputs	Description
DO1+	CN1 Pin 1
DO1-	CN1 Pin 2
DO2+	CN1 Pin 25
DO2-	CN1 Pin 26
DO3+	CN1 Pin 3
DO3-	CN1 Pin 4

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
EL8-EC400F	2,097,152 encoder counts per revolution

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.

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 7 with the following formula to calculate the maximum machine speed.

Metric example:

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

English example:

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