Hypertherm®

Yaskawa Sigma-5 EtherCAT® Drives Supported by EDGE® Connect/T/TC CNCs

Application Note

809580 | Revision 1 | July 2017

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)

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 purposes only, to help you select and configure an EtherCAT drive that is supported by EDGE Connect/T/TC CNCs.

> **NOTE:** 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 Yaskawa Sigma-5 drives

Series	Model	Firmware	Notes
Sigma-5	SGDV	• 5.0 • 5.04 • 6.00	• Analog input is not supported on the drive. An I/O module is required.

NOTE:

- Mixing different brands of drives in one system is not supported.
- All drives must support and be configured for a 1 ms update rate.
- Many drive amplifiers have I/O available for use. The need for additional I/O modules 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).
- Analog input and Analog output is not supported on the drive. An I/O module is required.

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.

This section provides assistance 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

NOTE:

- All drives must be set up as linear axes.
- All drives must support and be configured for a 1 ms update rate.
- Sigma-5 provides 12 digital inputs and 3 digital outputs
- The drive amplifier firmware can be updated via Hypertherm EtherCAT Studio or TwinCat. Please work with your Yaskawa representative.
- Sigma-5 does NOT support analog outputs or analog inputs

Parameters in Drive using Sigma-Win Software

There is a limit to the maximum encoder feedback on the edge connect. The following is an example of how to determine the maximum speed vs resolution for your system.

Encoder counts/inch = 1,000,000 Calculated Maximum Speed = 1966 IPM

Encoder counts/inch = 1,500,000 Calculated Maximum Speed = 1310 IPM

Encoder counts/inch = 500,000 Calculated Maximum Speed = 3932

Maximum Axis Speed = (32767*60000)/Encoder Counts per User Unit

Sigma-Win software for Sigma-5 drives, Use the object editor to set the Motor revolutions object to allow the motor to reach maximum RPM. Then save to EEPROM.

When using Ethercat the SGDV drives encoder resolution is set to 20 bits for all encoders.

Entering a 4 into Motor Revolutions Parameter will divide the 1048576 counts/rev by 4 to give 262144 counts/rev over the EtherCat network.

Parameter	Value
PnB02 Encoder Scaling Numerator	4
Pn002 Disable Absolute Encoder (optional)	X1XX
Pn50A Test Run without any external safety I/O Pn50B	8881 8888

Calculating encoder counts per mm (inch)

Encoder counts are a position scaling factor used by Phoenix. Refer to the drive manufacturer documentation for specific scaling information required by the drive.

In general, to determine the encoder counts per mm (inch), you need to know the following:

- Counts per revolution of the motor
- Gear ratio
- Distance of travel in one revolution of the pinion gear
- Diameter of the pinion gear when it engages the rack

Metric example:

Below is an example using more specific sample Yaskawa data.

- Yaskawa drive with 1.048.576 encoder counts per revolution of the motor
- 15:1 gear ratio
- 101,6 mm pitch

$$\frac{\frac{1.048.576 \text{ encoder counts}}{1 \text{ motor revolution}} \times \frac{15 \text{ motor revolutions}}{1 \text{ pinion revolution}} \times \frac{1 \text{ pinion revolution}}{101{,}6 \text{ mm (pitch)}}}{} = 154.809{,}449 \text{ encoder counts per millimeter}$$

English example:

Below is an example using more specific sample Yaskawa data.

- Yaskawa drive with 1,048,576 encoder counts per revolution of the motor
- 15:1 gear ratio
- 4.0 in. pitch

$$\frac{\frac{1{,}048{,}576 \text{ encoder counts}}{1 \text{ motor revolution}} \times \frac{15 \text{ motor revolutions}}{1 \text{ pinion revolution}} \times \frac{1 \text{ pinion revolution}}{4.0 \text{ in. (pitch)}}}{} = 3{,}932{,}160 \text{ encoder counts per inch}$$

DRIVE INPUTS

Phoenix maps 12 digital inputs.

NOTE: To use Yaskawa drive digital I/O, set it for general purpose use.

Digital inputs	Description
DIN1	Negative limit switch
DIN2	Home switch
DIN3	Positive limit switch
DIN4	SI0: CN1-13 pin
DIN5	SI1: CN1-7 pin
DIN6	SI2: CN1-8 pin
DIN7	SI3: CN1-9 pin
DIN8	SI4: CN1-10 pin
DIN9	SI5: CN1-11 pin
DIN10	Pin 21
DIN11	HWBB1 not useable as GPIO
DIN12	HWBB2 not useable as GPIO

DRIVE OUTPUTS

Phoenix maps 3 digital outputs.

NOTE: To use Yaskawa digital I/O, set it for general purpose use.

Digital outputs	Description
DOUT1	SO1: CN1 1-2 pin
DOUT2	SO2: CN1 23-24 pin
DOUT3	SO3: CN1 25-26 pin