Hypertherm®

Panasonic EtherCAT® Drives Supported by EDGE® Connect 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 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 Panasonic drive

Series	Models	Firmware	Notes
Minas-A5B	• See the Supported A5B drives listed alphabetically table for a list of supported drives.	• 1.01	• 5 digital inputs and 1 Digital Output are supported.
Minas-A6B	MADLN01BE MADLN11BE MADLN05BE MADLN15BE MBDLN21BE MBDLN25BE MCDLN31BE MCDLN35BE MDDLN45BE MDDLN55BE MEDLN83BE MEDLN93BE MFDLNA3BE MFDLNB3BE MADLT15BF	• 1.01	• 5 Digital Inputs and 1 Digital Output are supported

Supported A5B drives listed alphabetically

MADHT1105B01	MBDHT2110BA1	MDDHT2412B91	MEDHT7364B91	MGDHTB4A2B01
MADHT1105B91	MBDHT2110BL1	MDDHT2412BA1	MEDHT7364BA1	MGDHTB4A2B91
MADHT1105BA1	MBDHT2510B01	MDDHT2412BL1	MEDHT7364BL1	MGDHTB4A2BA1
MADHT1105BD1	MBDHT2510B91	MDDHT3420B01	MFDHT5440B01	MGDHTB4A2BL1
MADHT1105BL1	MBDHT2510BA1	MDDHT3420B91	MFDHT5440B91	MGDHTC3B4B01
MADHT1107B01	MBDHT2510BL1	MDDHT3420BA1	MFDHT5440BA1	MGDHTC3B4B91
MADHT1107B91	MCDHT3120B01	MDDHT3420BL1	MFDHT5440BL1	MGDHTC3B4BA1
MADHT1107BA1	MCDHT3120B91	MDDHT3530B01	MFDHTA390B01	MGDHTC3B4BL1
MADHT1107BL1	MCDHT3120BA1	MDDHT3530B91	MFDHTA390B91	MHDHTB4A2B01
MADHT1505B01	MCDHT3120BL1	MDDHT3530BA1	MFDHTA390BA1	MHDHTB4A2B91
MADHT1505B91	MCDHT3520B01	MDDHT3530BL1	MFDHTA390BL1	MHDHTB4A2BA1
MADHT1505BA1	MCDHT3520B91	MDDHT5540B91	MFDHTA464B01	MHDHTB4A2BL1
MADHT1505BL1	MCDHT3520BA1	MDDHT5540BA1	MFDHTA464B91	MHDHTC3B4B01
MADHT1507B01	MCDHT3520BL1	MDDHT5540BL1	MFDHTA464BA1	MHDHTC3B4B91
MADHT1507B91	MDDHT2407B01	MEDHT4430B01	MFDHTA464BL1	MHDHTC3B4BL1
MADHT1507BA1	MDDHT2407B91	MEDHT4430B91	MFDHTB3A2B01	
MADHT1507BL1	MDDHT2407BA1	MEDHT4430BA1	MFDHTB3A2B91	
MBDHT2110B01	MDDHT2407BL1	MEDHT4430BL1	MFDHTB3A2BA1	
MBDHT2110B91	MDDHT2412B01	MEDHT7364B01	MFDHTB3A2BL1	

NOTE:

- To check a drive's firmware version, use the PANATERM drive software provided by Panasonic.
- 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 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
  - Analog 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.

Drive inputs

Phoenix maps 5 digital inputs and 1 digital output.

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

Digital inputs	Description
DIN1	SI-MON 1/EXT1
DIN2	SI-MON 2/EXT2
DIN3	SI-MON 3
DIN4	SI-MON 4
DIN5	SI-MON 5

Drive outputs

Digital outputs	Description
DOUT 1	SO2/EX-OUT1

Additional information about parameters

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 following information is about parameters that may need to be modified for some user's configurations. Please review the drive's user manual for details on these settings.

Motor Direction/Encoder Polarity

- To reverse motor direction, you can use Panaterm to edit the EtherCat object and save it to EEPROM.
    - Set object 0x607E = 0x0 for normal direction and 0x607E = 0xE0 for reverse direction

THC setup

- During IHS the drive amplifier may get an error 27.4 **Position deviation excess setup.** To suppress this error change 0x3722, Bit5 = 1. If the original value was 0 then writing 0x20 to the object will set Bit5.
- A starting point for the Sensor THC using a MHMF022L1V2M motor with an A6 amplifier.
    - THC settings Servo error tolerance = 0.150
    - Stall force = 0.010
    - Encoder counts/inch = 1331691(for 262144 counts/rev)
    - 5% torque limit for IHS, 50 mg, 150 ipm, 50 ipm, 5 ipm

Output Bit Mask

- In addition to assigning the output to pins 25 and 26 on the drive amplifier, the EtherCAT object 0x60FE:2 = 0x10000 must be set for the output to function properly from the Edge Connect.

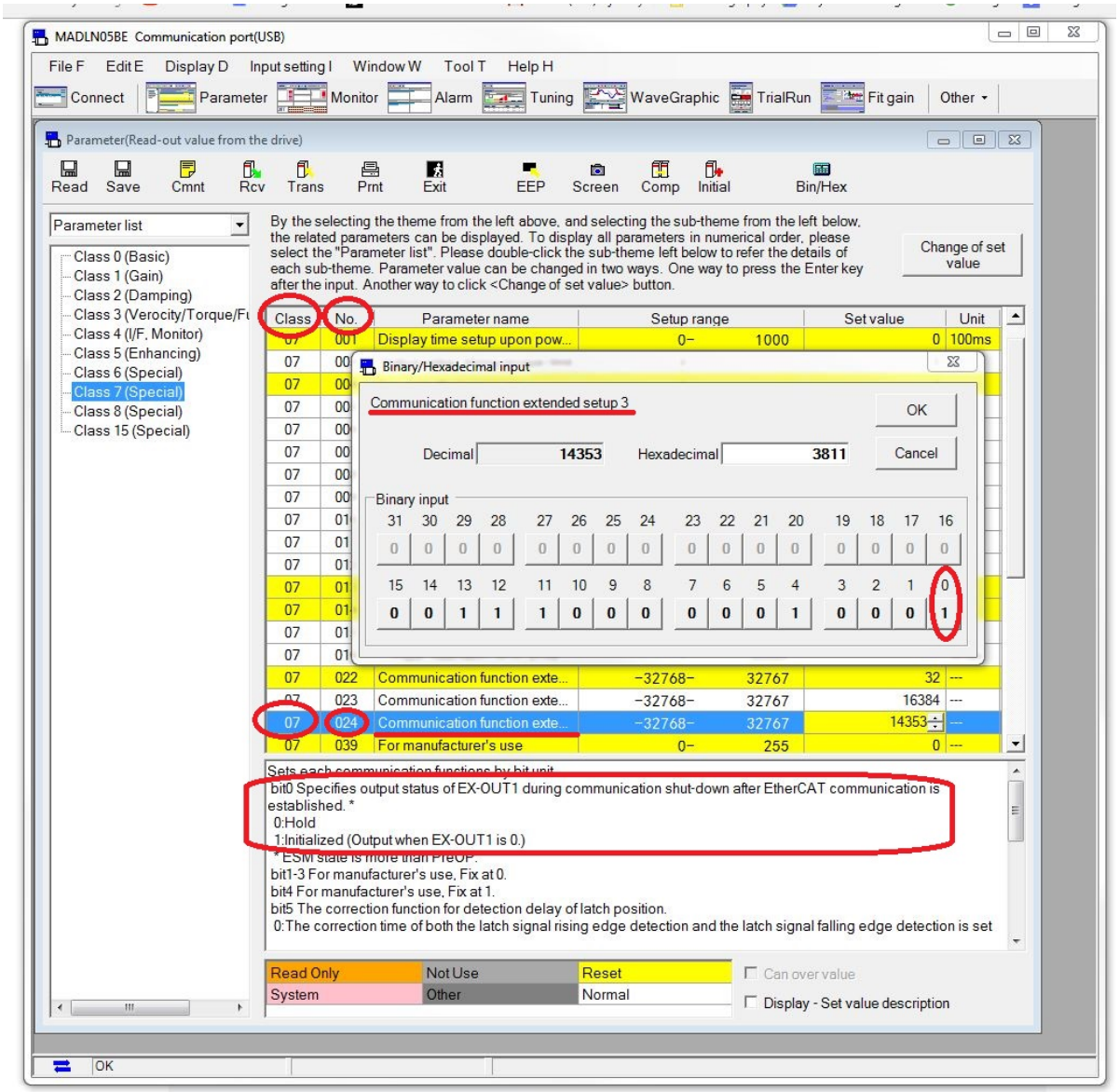
Absolute Encoder Configuration

- When using an absolute encoder, it must be configured to ignore the multi-turn over counter. To understand how this effects homing for the Edge Connect, see the application note Absolute Positioning for Homing (809870) in the Hypertherm Document Library at www.hypertherm.com/docs.

- Drive Parameter P0.15 must be set to 2
- Drive Parameter P0.15 must be set to 1 to set encoders to incremental mode

Set I/O behavior for when EtherCAT communication is lost

- Use the Panaterm software to set the following parameter to make the I/O default to off or stay in the current state when EtherCAT communication is lost to the drives. To set the I/O to turn off when communication is lost:
    - Set bit number 0 to a value of 1 for Class 7, Number 24 (Communication function extended setup 3)



Supported encoder counts

The Minas-A5B series drives support 1.048.576 encoder counts per revolution – metric (1,048,576 encoder counts per revolution – English). 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. (Refer to *Maximum machine speed per minute* below for more information.)

In the Panasonic PANATERM software, use the Object Editor to set the 0x6091 Motor Revolutions object to 0x000004. Then save to EEPROM.

Parameter	Value
0x6091:1 Motor Revolutions	0x000004
0x6092:1 Feed	• Set to the value to 0x100000 if you want to have 262144 counts/revolution over ECAT Note: For absolute encoders you may want to use largest possible number based on table size

With this parameter set to 4 the encoder counts per revolution will be 262.144 – metric (262,144 – English). 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.

$$\frac{262.144 \text{ encoder counts}}{1 \text{ motor revolution}} \times \frac{5 \text{ motor revolutions}}{1 \text{ pinion revolution}} \times \frac{1 \text{ pinion revolution}}{150 \text{ mm (pitch)}} = 8.738{,}13 \text{ encoder counts per mm}$$

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.

$$\frac{262{,}144 \text{ encoder counts}}{1 \text{ motor revolution}} \times \frac{5 \text{ motor revolutions}}{1 \text{ pinion revolution}} \times \frac{1 \text{ pinion revolution}}{5.91 \text{ in. (pitch)}} = 221{,}780.03 \text{ encoder counts per inch}$$

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:

$$\frac{32.767 \text{ (max. encoder counts per ms)} \times 60.000 \text{ (ms per minute)}}{8.738{,}13 \text{ encoder counts per mm}} = 224.993{,}22 \text{ mmpm Maximum machine speed}$$

English example:

$$\frac{32{,}767 \text{ (max. encoder counts per ms)} \times 60{,}000 \text{ (ms per minute)}}{221{,}780.03 \text{ encoder counts per inch}} = 8{,}864.73 \text{ ipm Maximum machine speed}$$