



Bosch Rexroth 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 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 Bosch Rexroth drives

Series	Model	Firmware	Notes
IndraDrive C	HCS02.1E-W0XXX	MPE-18v20 — MPE-20v16	<ul style="list-style-type: none"> • Requires Generation 2 control section and optional ET card. • One analog input per drive amplifier is supported.
IndraDrive Cs	HCS01.1E-W00XXX	MPE-18v20 — MPE-20v16	<ul style="list-style-type: none"> • Basic version is supported. • One analog input per drive amplifier is supported.
IndraDrive Cs Economy	HCS01.1E-W00XXX	MPE-20V24 or newer ONLY	<ul style="list-style-type: none"> • Basic version is supported. • One analog input per drive amplifier is supported.

NOTE:

- Mixing different brands of drives in one system has not been tested and is not recommended.
- 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).

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 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

NOTE:

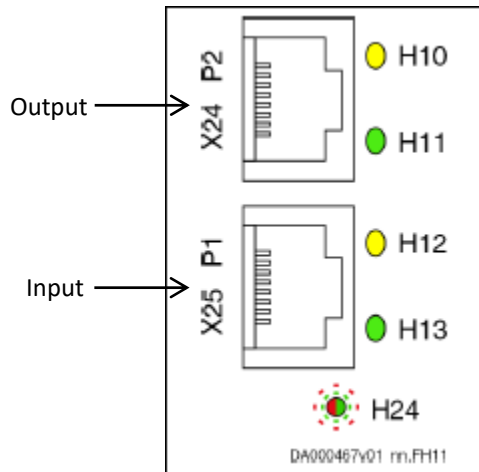
- [Download](#) and install version 14V16P1 or later of IndraWorks Ds on your Edge Connect CNC.

NOTE: For the fastest download and the least drive space usage, we recommend that you download the “without online help” version.

- All drives must be set up as linear axes.
- All drives must support and be configured for a 1 ms update rate.
- For proper scaling of following error and proper operation with Phoenix, all drives should be set to 16-bit encoder feedback resolution.

Port Connection

The port connection location on the drive is important for addressing. The X25 P1 Ethernet port on the drive is the input port from the CNC. The X24 P2 Ethernet port is the output port.



Ethernet over EtherCAT (EoE)

EoE is supported for drive setup using IndraWorks. This is useful when you are setting up IndraWorks with a new machine configuration over EtherCAT for the first time, and you want to be able to connect reliably in the future.

This procedure lets you to set up a "remembered" connection and force IndraWorks to skip the Connection Selection dialog.

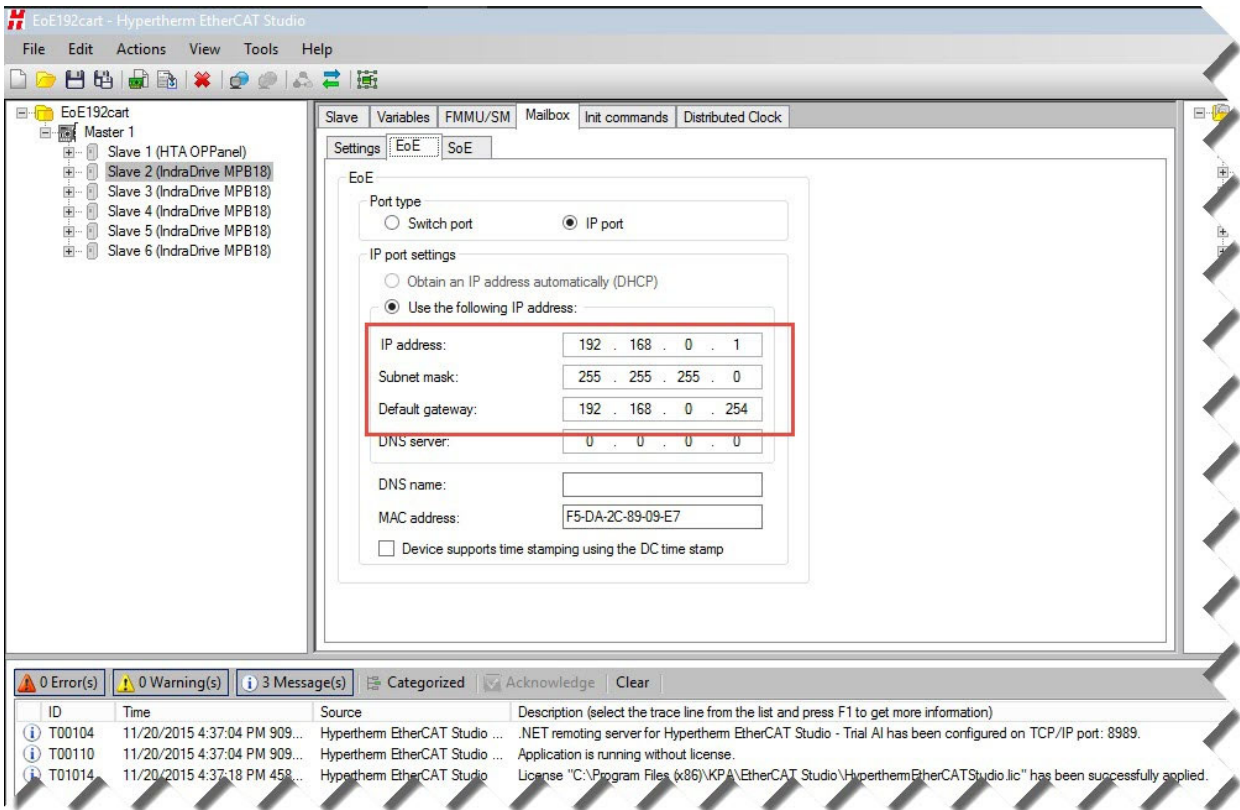
Before you begin

1. Make sure that Phoenix is not running.
2. Make sure that the EtherCAT network has been prevented from getting to Operational since the last CNC power cycle.
3. Make sure you are running with Windows 10 Image 6 or later.
4. If you have not already done so, [download](#) and install version 13V16_P2 or later of IndraWorks Ds on the Edge Connect/T/TC CNC.

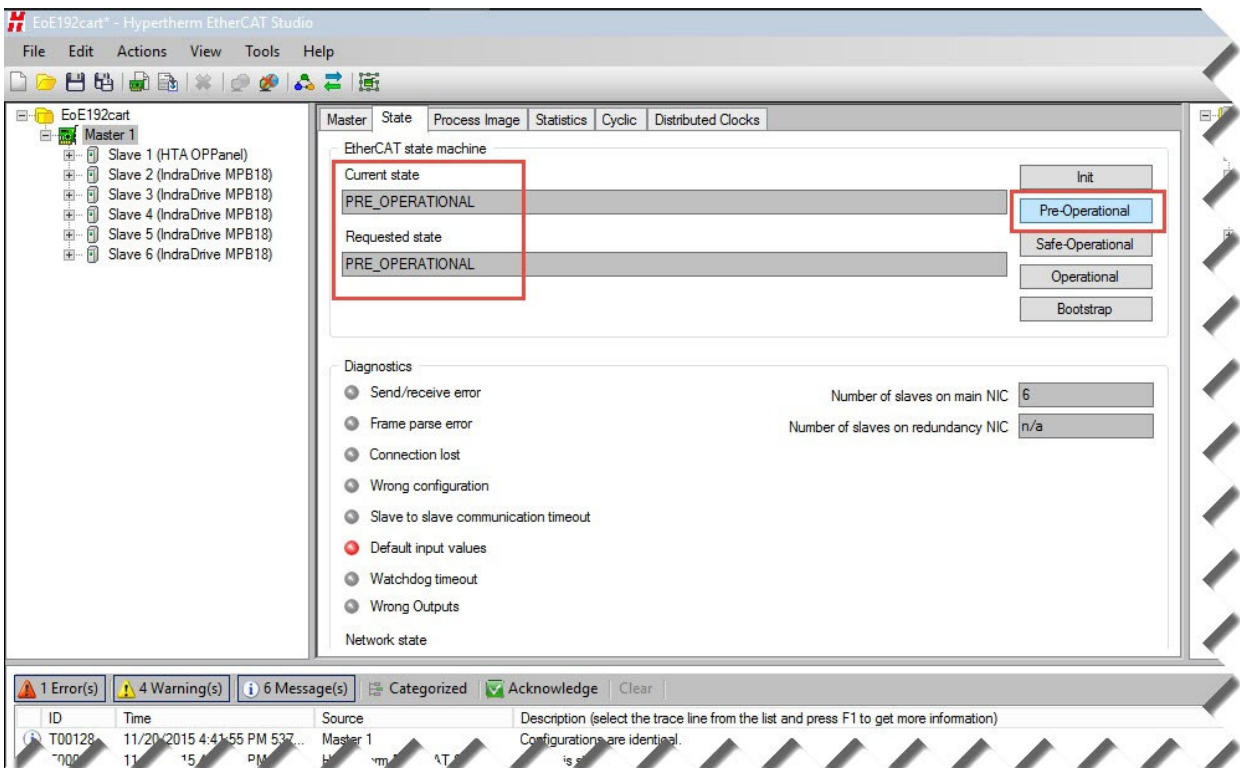
NOTE: For the fastest download and the least drive space usage, we recommend that you download the "without online help" version.

5. Open Hypertherm EtherCAT Studio.
6. Open the cutting system's EtherCAT Studio project (*.ecsn) file.
7. Set the **IP address**, **Subnet mask**, and **Default gateway** details for each drive.

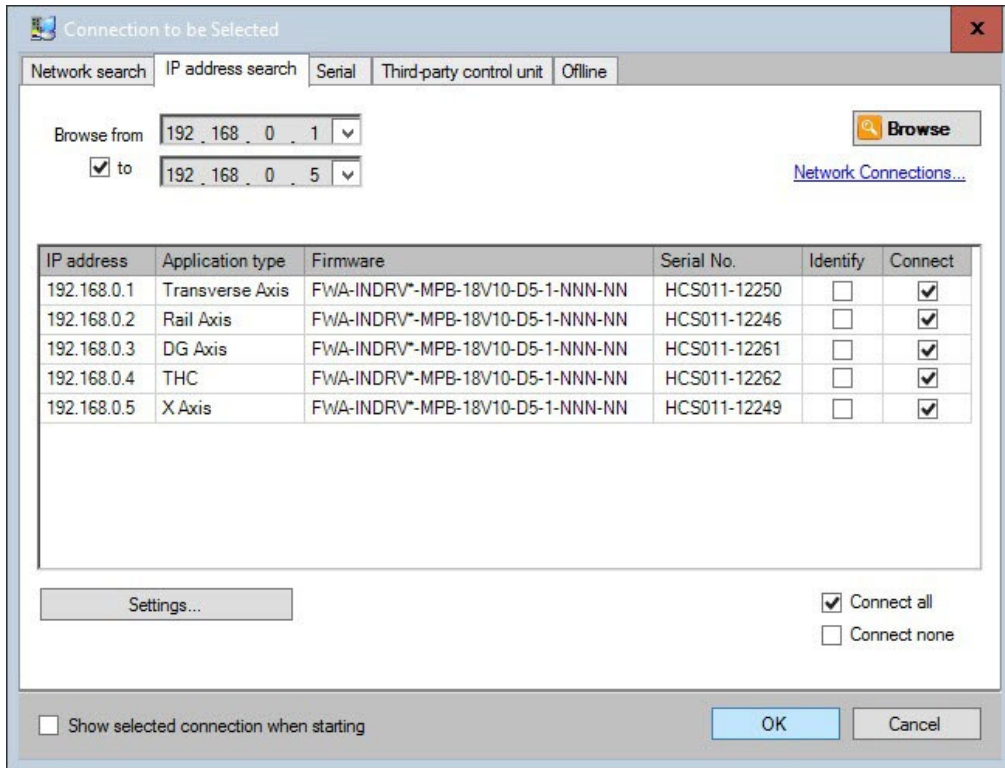
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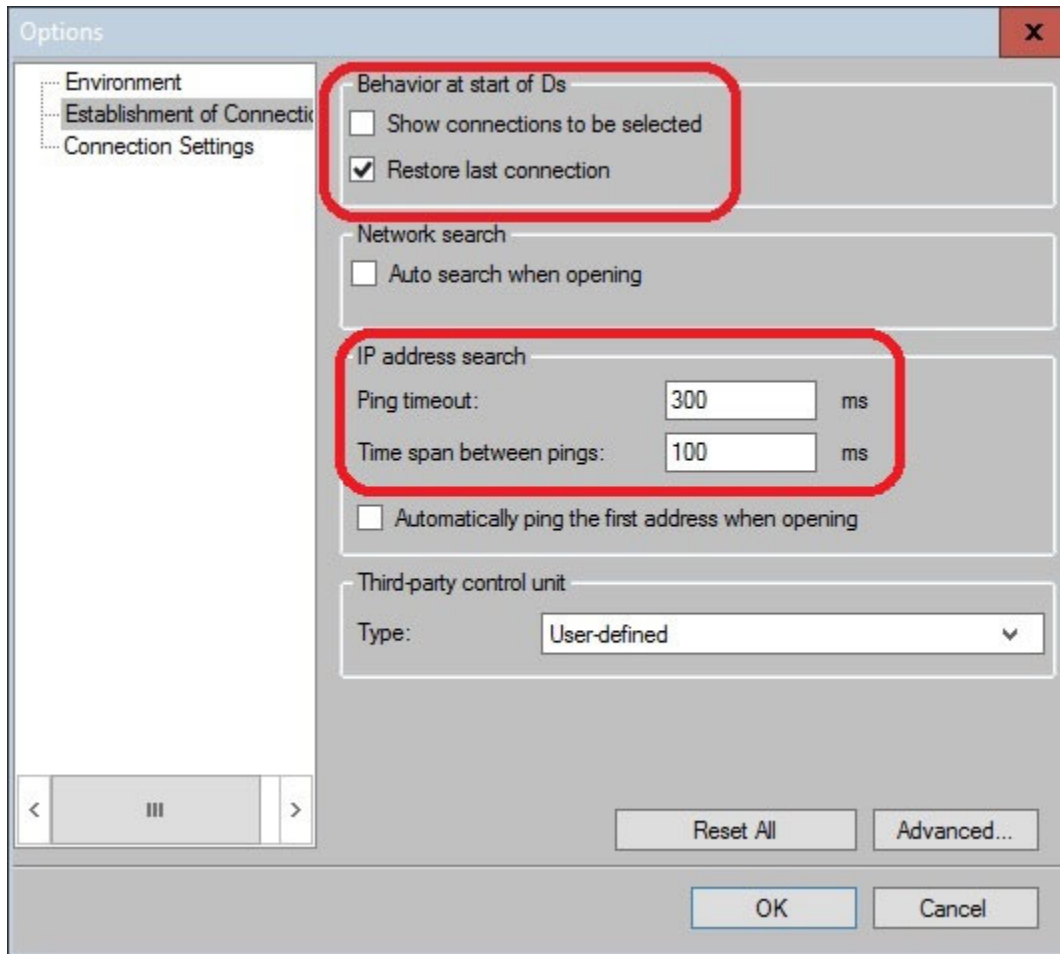
8. Export the XML file for use at Phoenix startup.
9. Bring the Master to **Pre-Operational** to set the IP addresses within the drives.



10. Verify that each drive has the correct IP address by pressing **Enter** 3 times on each drive.
11. Cycle power on the drives to make sure IP addresses are retained.
12. Bring the Master back to **Pre-Operational** as per step 9 above.
13. Launch the IndraWorks **Connection Selection** and then **Browse** for drives.



14. Click **OK** once the drives are found.



15. Once you have a good connection to all the drives, make the following changes in IndraWorks to make sure that you get all the drives connected later when Phoenix is running:

- Turn off the **Show connections to be selected** option.
- Increase the **Ping timeout** to **300** ms. If necessary, increase **Ping timeout** to **500** ms.

16. Close Hypertherm EtherCAT Studio and IndraWorks Ds.

17. Start Phoenix and bring the EtherCAT network to **Operational**, then disable the drives.

18. Open IndraWorks Ds. The drives will now automatically connect to IndraWorks Ds every time.

If you still have problems

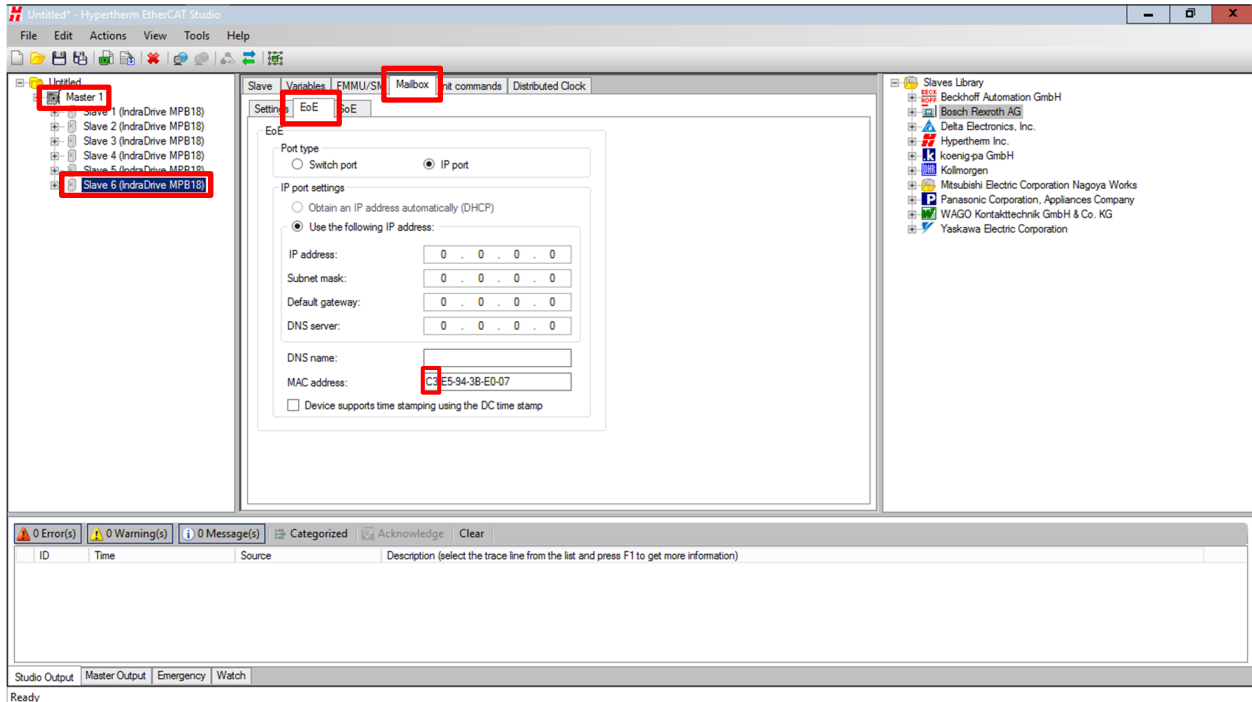
- It can be helpful to reset the drive(s) by powering down and rebooting (and unplugging the fuses for the drive(s) that do not connect), and then re-connecting.
- After a clean boot, do not run Phoenix until the connection has been established with Hypertherm EtherCAT Studio and IndraWorks Ds as shown above.
- Do not proceed past the Pre-Operational state until the connection has been fully established via IndraWorks Ds and saved as outlined above.

EoE reliability fix

The Hypertherm EtherCAT studio randomly assigns a mac address to each EoE slave. Unreliable operation will occur if an odd number is assigned to the first octet because an odd number in the first octet indicates a multicast address.

For reliable operation set the first Octet to an even number such as 02. You can set the upper octet for each drive to the same even number.

1. Open Hypertherm Studio



2. Under the master, select the slave you want to change
3. Click the mailbox tab
4. Click the EoE tab
5. Under MAC address, change the first octet from an odd number to an even number
6. Repeat this process for any other slaves where the first octet is an odd number
7. To save the changes, create your XML file and export it to the C:/Phoenix directory

Example:

If the MAC address is 0B-05-F7-F9-89-9C, the first octet 0B is an odd number. 0B in hexadecimal is 11 in decimal, so the slave might not respond. If you changed the first octet to 0C (12) that would make this MAC address functional. A simple way to do it is make all the MAC addresses start with 02 for each slave and keep the remaining numbers that were auto assigned.

Scaling and units settings

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

For Bosch drive setup, first you enter your desired **Encoder Counts per mm (inch)** in Phoenix. Based on your desired encoder counts, you calculate the position resolution for the drives. Then you use the Bosch Rexroth IndraWorks Ds software to program the drives with the mechanical characteristics of the cutting machine.

In this example, your desired encoder counts are 5.000 counts per millimeter (100,000 counts per inch).

In IndraWorks, set the following parameters on the **Scaling / Units Extended** screen:

Scaling Parameter	Settings	
Position	<ul style="list-style-type: none"> Linear Absolute Load reference User-defined 	<ul style="list-style-type: none"> Resolution / Unit: 0,0002 mm (0.00001 in. for English) Factor: 2 for metric (1 for English) Exponent: -7 for metric (-5 for English)
Velocity	<ul style="list-style-type: none"> Linear Load reference User-defined 	<ul style="list-style-type: none"> Resolution / Unit: 0,002 mm/min (0.0001 in./min for English) Factor: 2 for metric (1 for English) Exponent: -6 for metric (-4 for English)
Acceleration	<ul style="list-style-type: none"> Linear Load reference User-defined 	<ul style="list-style-type: none"> Resolution / Unit: 0,02 mm/s² (0.001 in/s² for English) Factor: 2 for metric (1 for English) Exponent: -5 for metric (-3 for English)

NOTE:

- Once you enter Resolution / Unit, IndraWorks calculates Factor and Exponent for you.
- To determine the position Resolution / Unit, take the inverse (1/X) of the desired encoder counts.
 - Metric example: If you want 5.000 encoder counts per mm, the position resolution is 0,0002 (1/5.000=0,0002)

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- English example: If you want 100,000 counts per inch, the position resolution is 0.00001 (1/100,000=0.00001)
- We recommend you set the velocity resolution to the position resolution multiplied by 10.
 - Metric example: 0,0002 X 10 = 0,002
 - English example: 0.00001 X 10 = 0.0001
- We recommend you set the acceleration resolution to the position resolution multiplied by 100.
 - Metric example: 0,0002 X 100 = 0,02
 - English example: 0.00001 X 100 = 0.001

The Transverse axis has the following machine characteristics:

Gear box ratio: 50:1

Rack pitch diameter: 57,15 mm
(2.25 inches)

In IndraWorks Ds, set the following parameters in the **Mechanical Gear** screen:

Position data in: absolute format

Feed constant k: Pitch diameter X π = feed constant
57,15 mm X 3,14159 = 179,542 mm
(2.25 inches X 3.14159 = 7.068 inches)

Input revolutions of load gear n1: 50

Output revolutions of load gear n2: 1