PD60-4H-1461-CoE Hardware Manual

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PD60-4H-1461-CoE is a single axis stepper motor servo drive for up to +48V supply voltage and up to 3Nm torque. A built-in magnetic encoder is used for closed loop operation of the motor. The module communicates using the CANopen over EtherCAT® protocol. The PD60-4H-1461-CoE comes with a housing and can be interfaced with M8 type connectors.

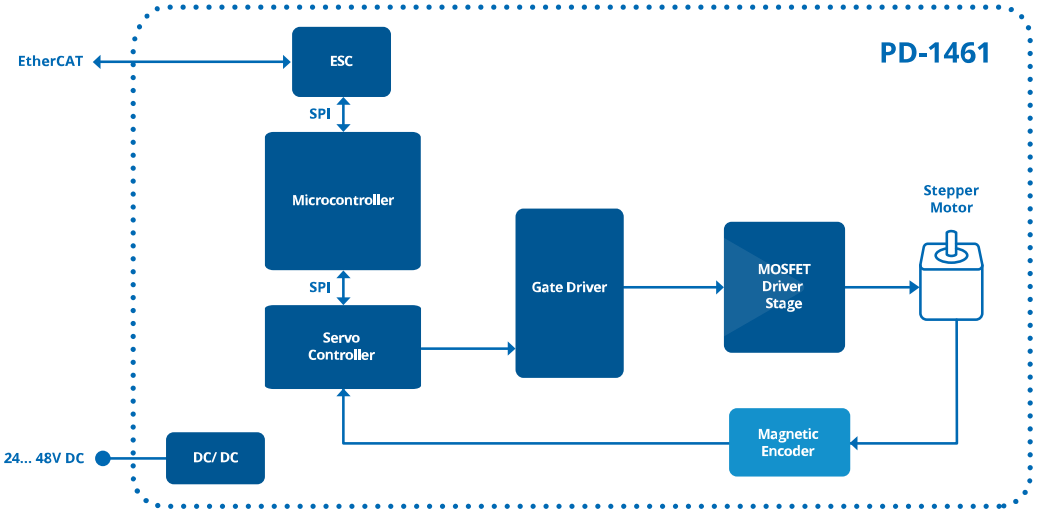
Features

- Supply Voltage +24 to +48V DC
- Up to 3Nm
- Field Oriented Control (FOC) of the stepper motor
- Integrated position feedback
- EtherCAT® interface
- CoE protocol
- NEMA24 size stepper motor
- Housing

Applications

- Lab-Automation
- Manufacturing
- Robotics
- Factory Automation
- CNC

Simplified Block Diagram



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Contents

1 Features

PD60-4H-1461-CoE is a single axis stepper motor servo drive for up to +48V supply voltage and ca. 3Nm torque. A built-in magnetic encoder is used for closed loop operation of the motor. The module communicates using the CANopen over EtherCAT® protocol. The PD60-4H-1461-CoE comes with a housing and can be interfaced with M8 type connectors.

Controller & Driver

- Motor current: up to 9A RMS
- Supply voltage: +24…+48V DC (nominal)
- Closed loop / FOC stepper motor operation
- Integrated Hall position sensor with a resolution of 16384
- Temperature rating: -30…+60° (standard version)

Interface and IO

- 1x M8 power input connector
- 1x EtherCAT interface
  - 1x M8 EtherCAT IN port
  - 1x M8 EtherCAT OUT port

Mechanical data

- Max. dimension: 152.5mm x 64mm x 73mm (L/W/H)
- Weight: ca. 1.6kg
- NEMA24 sized stepper motor with up to 3Nm
- Forced cooling via housing and motor

Software

- CANopen-over-EtherCAT (COE) with DS402 standard protocol stack. Please see PD60-4H-1461-CoE COE firmware manual for more details.

2 Order Codes

Order Code	Description	Size (LxWxH)
PD60-4H-1461-CoE	Stepper Motor Servo Drive, CANopen-over-EtherCAT firmware, housing, M8 connectors, Weight: ca. 1.6kg	152mm x 64mm x 73mm

Table 1: PD60-4H-1461-CoE Order Codes

A cable loom set is available for this module:

Order Code	Description
PD60-4H-1461-Cable	Cable loom for PD60-4H-1461-CoE : • 1x M8 cable for connecting to master (M8-RJ45) • 1x M8 cable for connecting multiple M8 drives (M8-M8) • 1x M8 cable for power (M8-open leads)

Table 2: PD60-4H-1461-CoE Cable Loom

3 Mechanical and Electrical Interfacing

3.1 Module Size

The PD60-4H-1461-CoE comes potted inside an aluminum housing with an overall size of 152.5mm (overall length including shaft) x 64mm (width) x 73mm (height).

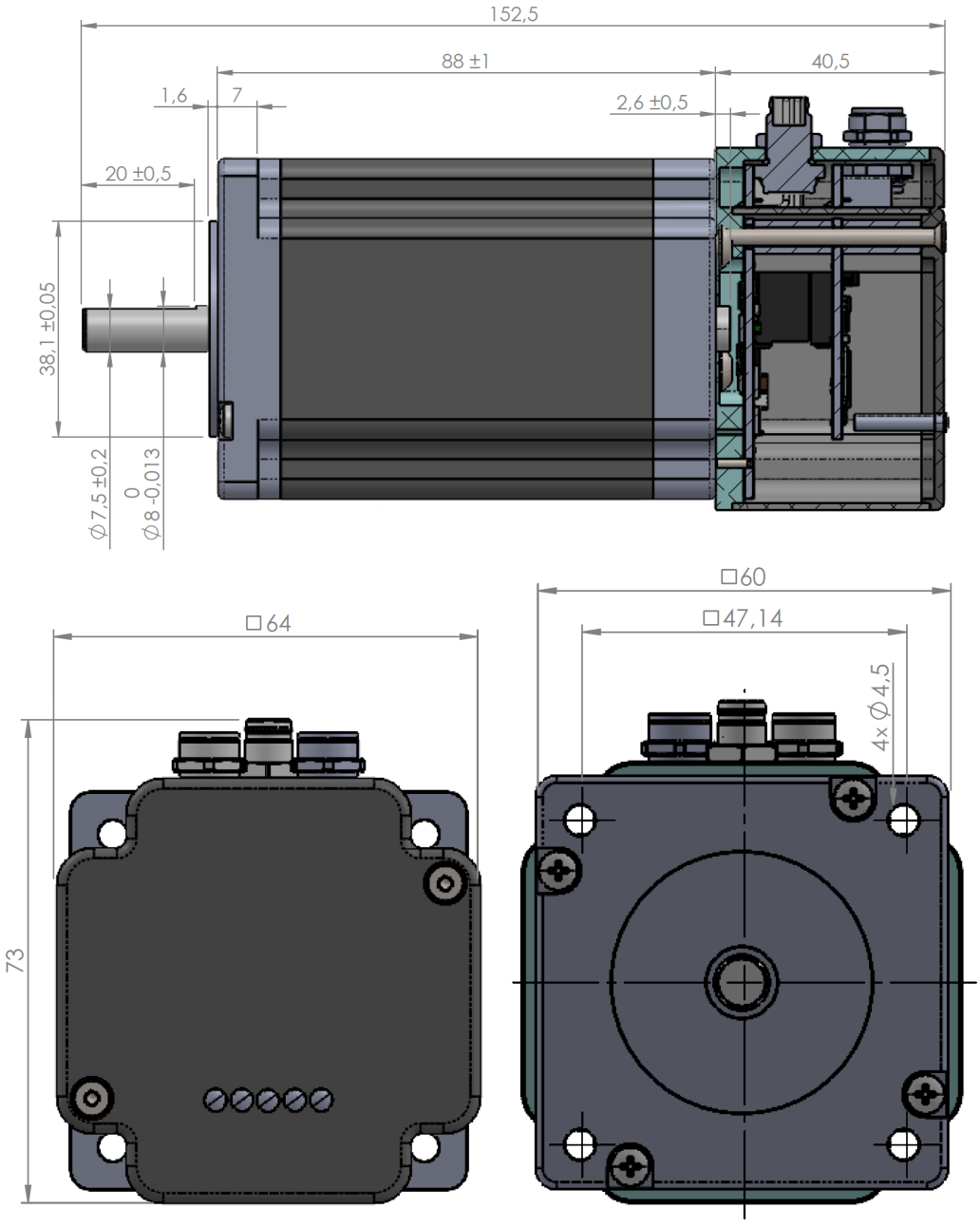

Figure 1: PD60-4H-1461-CoE Dimensions (all values in mm. Not for scale!)

3.2 Supply Buffering

PD60-4H-1461-CoE includes limited onboard capacitance of ca. 450uF. Depending on your application and power supply make sure to add sufficient capacitors to the driver input to stabilize supply.
Low ESR electrolyte caps are recommended to be connected to the power supply lines as close as possible to the drives.
Rule of thumb for sizing the capacitance: $C = 1000\frac{\mu F}{A} * I_{SUPPLY}$ with $I_{SUPPLY} = I_{rms} * \sqrt{2}$
The capacitors should be selected with regard to high ripple current rating and providing enough headroom regarding the voltage rating. In addition to power stabilization (buffer) and filtering this added capacitor will also reduce any voltage spikes which might otherwise occur from a combination of high inductance power supply wires and the ceramic capacitors. In addition, it will limit slew-rate of power supply voltage at the module.

In addition, a regulated power supply is highly recommended.

4 Connectors and Signals

The PD60-4H-1461-CoE has 3 connectors altogether.

NOTICE

Start with power supply OFF and do not connect or disconnect motor during operation! Motor cable and motor inductance might lead to voltage spikes when the motor is (dis)connected while energized. These voltage spikes might exceed voltage limits of the driver MOSFETs and might permanently damage them. Therefore, always switch off / disconnect power supply or at least disable driver stage before connecting / disconnecting motor.

NOTICE

Take care of polarity, wrong polarity can destroy the board!

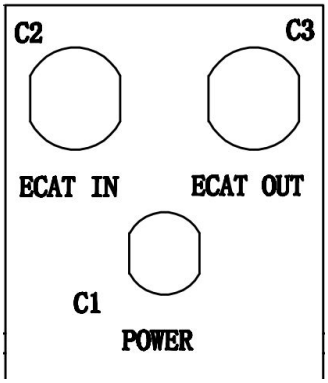

Figure 2: PD60-4H-1461-CoE side connectors (M8 type)

Connector	Description	Type
C1	Power supply	M8, 4-pin, male, A-coding, Binder Series 718, PN 866319112100004
C2	EtherCAT IN port	M8, 4-pin, female, A-coding, Binder Series 718, PN 866618112100004
C3	EtherCAT OUT port	M8, 4-pin, female, A-coding, Binder Series 718, PN 866618112100004

Table 3: PD60-4H-1461-CoE connectors

4.1 Supply Connector C1

Type: M8, 4-pin, male, A-coding
Manufacturer: Binder
PN: 866319112100004, Series 718

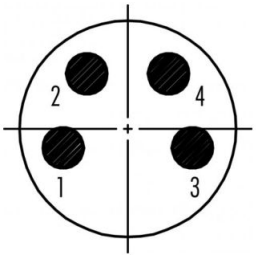

Figure 3: M8 power connector pins

Pin	Signal	Description
1	GND	Supply ground
2	GND	Supply ground
3	+VM	Main drive supply, +24V…+48V DC
4	+VM	Main drive supply, +24V…+48V DC

Table 4: Supply connector C1

4.2 EtherCAT IN Port Connector C2

Type: M8, 4-pin, female, A-coding
Manufacturer: Binder
PN: 866618112100004, Series 718

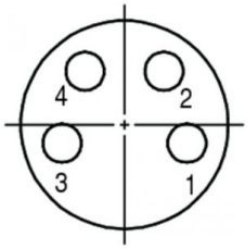

Figure 4: M8 EtherCAT IN pins

Pin	Signal	Description
1	TD+	Transmit Data Plus, positive signal for the TD differential pair
2	RD+	Receive Data Plus, positive signal for the RD differential pair
3	RD-	Receive Data Minus, negative signal for the RD differential pair
4	TD-	Transmit Data Minus, negative signal for the TD differential pair

Table 5: EtherCAT IN connector C2

4.3 EtherCAT OUT Port Connector C3

Type: M8, 4-pin, female, A-coding
Manufacturer: Binder
PN: 866618112100004, Series 718

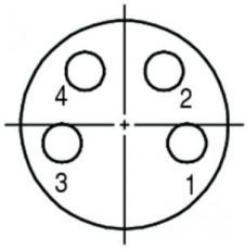

Figure 5: M8 EtherCAT OUT pins

Pin	Signal	Description
1	TD+	Transmit Data Plus, positive signal for the TD differential pair
2	RD+	Receive Data Plus, positive signal for the RD differential pair
3	RD-	Receive Data Minus, negative signal for the RD differential pair
4	TD-	Transmit Data Minus, negative signal for the TD differential pair

Table 6: EtherCAT OUT connector C3

4.4 LEDs Signals

The PD60-4H-1461-CoE has 5 LEDs on the top side of the housing as given in the following drawing.

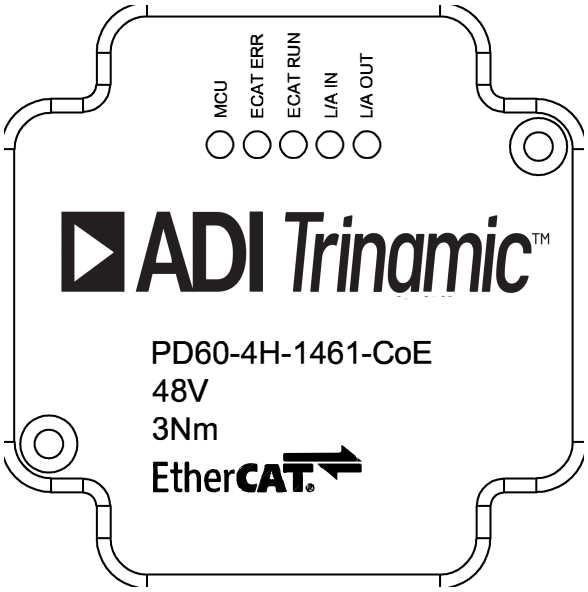

Figure 6: PD60-4H-1461-CoE LEDs

LED Name	Description	Comment
MCU	MCU status LED / heart beat	Green LED
L/A IN	EtherCAT link IN status and activity	Green LED
L/A OUT	EtherCAT link OUT status and activity	Green LED
ECAT RUN	EtherCAT state machine RUN LED	Green LED
ECAT ERR	EtherCAT state machine ERR LED	Red LED

Table 7: PD60-4H-1461-CoE LEDs

5 Operational Ratings and Characteristics

5.1 Absolute Maximum Ratings

Parameter	Symbol	Min	Abs. Max	Unit
Driver supply voltage	$+VM$	-0.5	+56	V
Working temperature range	T_A	-30	+60	° C
Storage temperature range	T_S	-30	+60	° C

Table 8: Absolute maximum ratings

NOTICE Stresses above those listed under "'Absolute Maximum Ratings"' may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

5.2 Operational Ratings (Ambient Temperature 25°C)

Parameter	Symbol	Min	Typ	Max	Unit
Driver supply voltage	$+VM$	+24		+48	V
Ambient temperature	T_A		+25		° C

Table 9: Operational ratings

5.3 Other Requirements

Specifications	Description or Value
Cooling	Free air or heat sink mounted depending on application and duty cycle
Working environment	Avoid dust, water, oil mist and corrosive gases, no condensation, no frosting

Table 10: Other requirements and characteristics

[1] This is the maximum current rating. This is not for continuous operation but depends on duty cycle, ambient temperature, and cooling.

5.4 Torque curve

The maxmimum torque of ca. 3 Nm can be reached in standstill operation.

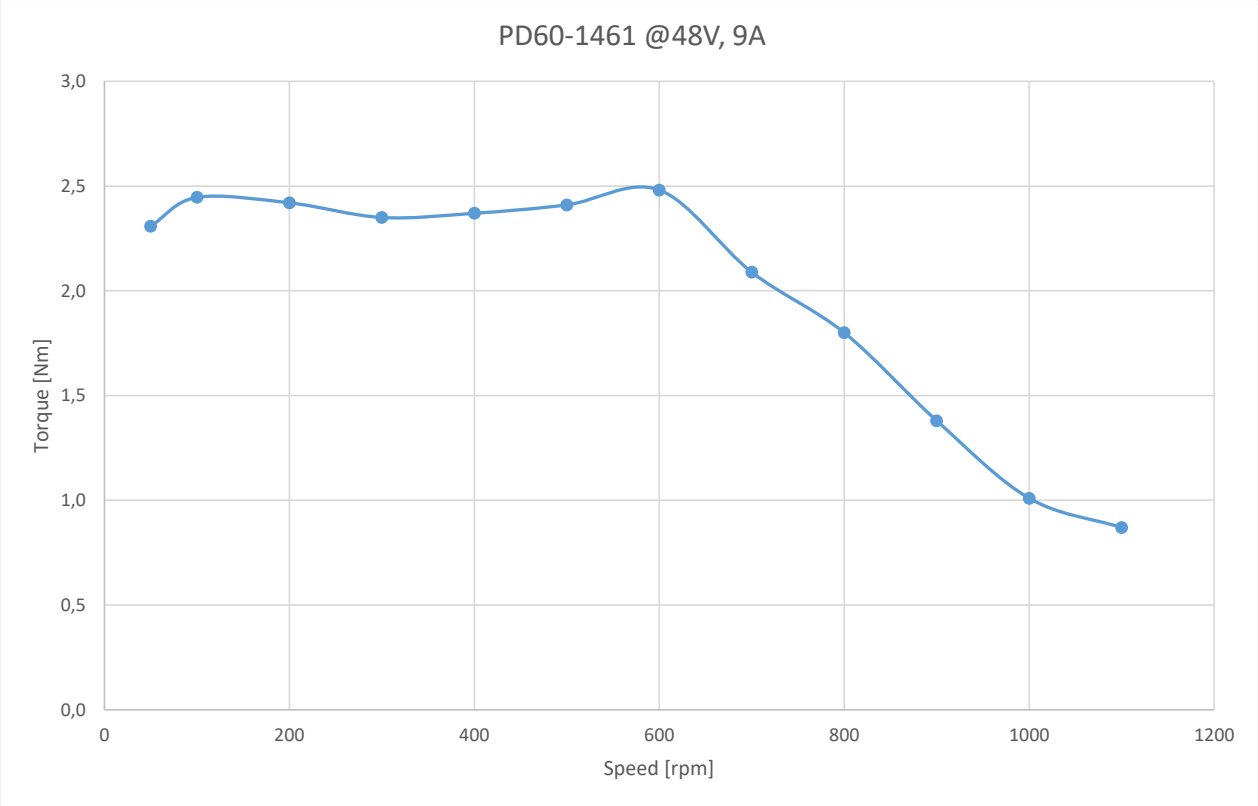

Figure 7: PD60-4H-1461-CoE Torque curve closed-loop at 48V and 9A.

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8 Supplemental Directives

8.1 Producer Information

8.2 Copyright

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9 Revision History

9.1 Hardware Revision

Version	Date	Author	Description
V1.10	2021-JAN-10	MM/SK	Release Version

Table 11: Hardware Revision

9.2 Document Revision

Version	Date	Author	Description
V1.00	2022-JAN-04	SK	First release.
V1.10	2022-JUL-19	FV	Updated Features, Drawing and Torque curve.
V1.20	2022-SEP-14	FV	Updated product picture.
V1.21	2023-MAR-09	OK	Updated cable order code (table 2).

Table 12: Document Revision