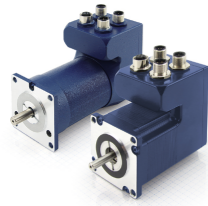


PD4-E-MA CANopen



Short instructions
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Introduction

The *PD4-E-M* is a brushless motor with integrated controller in protection class IP65. The integrated absolute encoder makes immediate operation possible in *closed loop* mode without homing.

This instruction describes the installation and commissioning of the motor. You can find the detailed documentation for the product and motor data sheets on us.nanotec.com. The short instructions do not replace the *technical manual* of the motor.

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Intended use

The *PD4-E-M* motor with integrated controller is used as a component of drive systems in a range of industrial applications.

Use the product as intended within the limits defined in the technical data (in particular, see) and the approved **Environmental conditions**.

Under no circumstances may this Nanotec product be integrated as a safety component in a product or system. All products containing a component manufactured by Nanotec must, upon delivery to the end user, be provided with corresponding warning notices including instructions for safe use and safe operation. All warning notices provided by Nanotec must be passed on directly to the end user.

Warranty and disclaimer

Nanotec is not liable for damage and malfunction from installation errors, failure to observe this document, or improper repair. Responsible for the selection, operation, use of our products is the plant engineer, operator and user. Nanotec accepts no liability for product integration in the end system. The general terms and conditions at www.nanotec.com apply (customers of Nanotec Electronic USA please see us.nanotec.com). **Note:** Product modification / alteration is illicit.

Target group and qualification

The product and this documentation are directed towards technically trained specialists staff such as: development engineers, plant engineers, installers/service personnel, and application engineers.

Only specialists may install, program and commission the product. Specialist staff are persons who

- have appropriate training and experience in working with motors and their control,
- are familiar with and understand the content of this technical manual,
- know the applicable regulations.

EU directives for product safety

The following EU directives were observed:

- RoHS directive (2011/65/EU, 2015/863/EU)
- EMC directive (2014/30/EU)

Other applicable regulations

In addition to this technical manual, the following regulations are to be observed:

- Accident-prevention regulations
- Local regulations on occupational safety

Safety and warning notices

NOTICE

Damage to the controller!

Changing the wiring during operation may damage the controller.

- ▶ Only change the wiring in a de-energized state. After switching off, wait until the capacitors have discharged.

NOTICE

Damage to the controller due to excitation voltage of the motor!

Voltage peaks during operation may damage the controller.

- ▶ Install suitable circuits (e. g., charging capacitor) that reduce voltage peaks.

NOTICE

Damage to the electronics through improper handling of ESD-sensitive components!

The device contains components that are sensitive to electrostatic discharge. Improper handling can damage the device.

- ▶ Observe the basic principles of ESD protection when handling the device.

NOTICE

Damage to the electronics if the supply voltage is connected with reversed polarity!

Polarity reversal results in a short-circuit between supply voltage and GND (earth) via the power diode.

- ▶ Install a line protection device (fuse) in the supply line.

Technical details and pin assignment

Environmental conditions

Environmental condition	Value
Protection class	IP65 (except for shaft output)
Ambient temperature (operation)	-10 ... +40°C
Air humidity (non-condensing)	0 ... 85%
Max. Altitude of site above sea level (without drop in performance)	1500 m
Ambient temperature (storage)	-25 ... +85°C

Electrical properties and technical data

Technical data – motor

	PD4-E	PD4-EB
Type	Stepper motor	BLDC
Operating voltage	12 - 48 V DC ±5%	12 - 48 V DC ±5%
Rated current rms	4.2 A	6 A
Peak current rms for 5 s	5.5 A	18 A

Technical data

Operating modes	<i>Profile Position Mode, Profile Velocity Mode, Profile Torque Mode, Velocity Mode, Homing Mode, Interpolated Position Mode, Cyclic Sync Position Mode, Cyclic Sync Velocity Mode, Cyclic Synchronous Torque Mode</i>
Set value setting / programming	<i>CANopen, analog input, NanoJ program</i>
Inputs	6 digital inputs (+5 V/+24 V DC), individually switchable by means of software, factory settings: 5 V 1 analog input 0–10 V or 0–20 mA (switchable by means of software)
Outputs	2 outputs, <i>Open Drain</i> , max. 100 mA
Integrated encoder	Magnetic multiturn absolute encoder, single-turn resolution: 17 bit (131072 per revolution), multiturn resolution: 16-bit (+/-2 ¹⁵ revolutions)

Protection circuit

Overvoltage and undervoltage protection

Overtemperature protection (> 68° Celsius on rear cover)

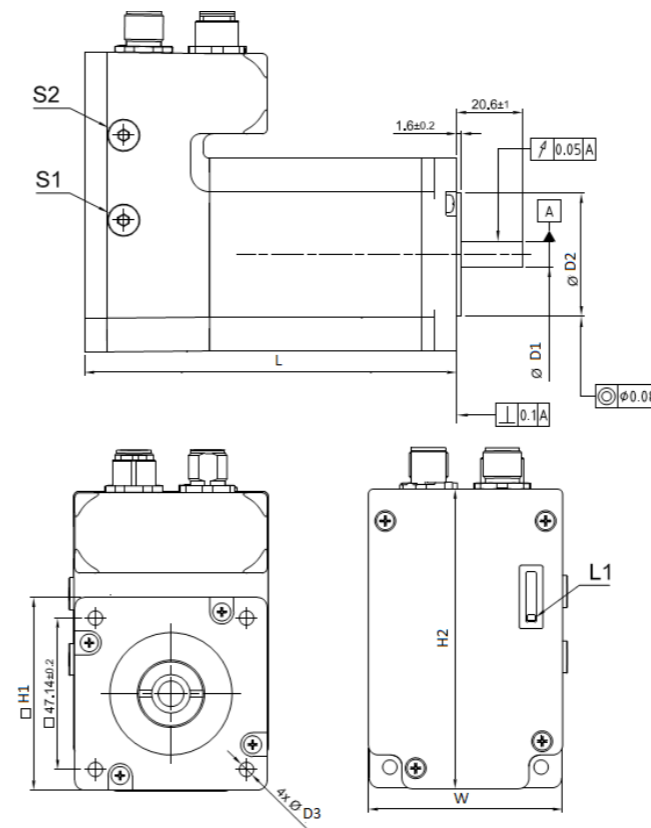
Polarity reversal protection: In the event of a polarity reversal, a short-circuit will occur between supply voltage and GND over a power diode; a line protection device (fuse) is therefore necessary in the supply line. The values of the fuse are dependent on the application and must be dimensioned

- greater than the maximum current consumption of the controller,
- less than the maximum current of the voltage supply.

If the fuse value is very close to the maximum current consumption of the controller, a medium / slow tripping characteristics should be used.

Dimensioned drawings

All dimensions are in millimeters.



Dimension	Value
L	<ul style="list-style-type: none"> • PD4-E591L42-M-65: 126.5±1 • PD4-E601L42-E-65: 139.5±1 • PD4-EB59CD-M-65: 146.5±1
W	<ul style="list-style-type: none"> • PD4-E591L42-M-65: 57 • PD4-E601L42-E-65: 60.6 • PD4-EB59CD-M-65: 57
H1	<ul style="list-style-type: none"> • PD4-E591L42-M-65: 56.4±0.5 • PD4-E601L42-E-65: 60±0.5 • PD4-EB59CD-M-65: 56.6±0.5
H2	<ul style="list-style-type: none"> • PD4-E591L42-M-65: 89.7 • PD4-E601L42-E-65: 93.3 • PD4-EB59CD-M-65: 89.7
D1	<ul style="list-style-type: none"> • PD4-E591L42-M-65: 6.35⁺⁰_{-0.013} • PD4-E601L42-E-65: 8⁺⁰_{-0.015} • PD4-EB59CD-M-65: 8⁺⁰_{-0.013}

Dimension	Value
D2	<ul style="list-style-type: none"> • PD4-E591L42-M-65: 38.1±0.025 • PD4-E601L42-E-65-2: 38.1±0.05 • PD4-EB59CD-M-65: 38.1⁺⁰_{-0.05}
D3	<ul style="list-style-type: none"> • PD4-E591L42-M-65: 5 • PD4-E601L42-E-65: 4.5^{+0.5}₋₀ • PD4-EB59CD-M-65: 5.2±0.25

Overtemperature protection

Above a temperature of approx. 75°C on the power board (corresponds to 65–72°C outside on the back cover), the power part of the controller switches off and the error bit is set. After cooling down and confirming the error, the controller again functions normally.

LED signaling

Power LED

The power LED indicates the current status.

Normal operation

In normal operation, the green power LED L1 flashes briefly once per second.

Case of an error

If an error has occurred, the LED turns red and signals an error number.

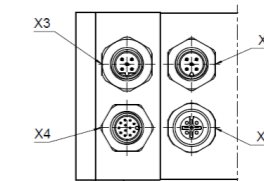
The following table shows the meaning of the error numbers.

Flash rate	Error
1	General
2	Voltage
3	Temperature
4	Overcurrent
5	Controller
6	Watchdog-Reset

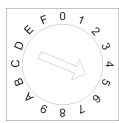
NOTICE

For each error that occurs, a more precise error code is stored in object 1003_n.

Pin assignment



Connector	Function	Pin assignment / description
X1	CANopen IN and external logic supply	<ol style="list-style-type: none"> 1. CAN_SHLD: Shielding 2. +UB Logic: 24 V DC/approx. 39 mA 3. GND: internally connected to all GND pins
X2	CANopen OUT and external logic supply	<ol style="list-style-type: none"> 4. CAN+ 5. CAN-
X3	Voltage supply	<ol style="list-style-type: none"> 1. +Ub 2. +Ub 3. GND 4. GND 5. n.c

Connector	Function	Pin assignment / description															
X4	Inputs/outputs and external logic supply Switching thresholds for digital inputs 1 - 6: 5 V (factory setting): On: >4.09 V; Off: <0.95 V 24 V: On: >14.74 V; Off: <3.78 V	<ol style="list-style-type: none"> GND Digital input 1: 5 V / 24 V, switchable with object 3240_h, max. 1 MHz Digital input 2: 5 V / 24 V, switchable with object 3240_h, max. 1 MHz Digital input 3: 5 V / 24 V, switchable with object 3240_h, max. 1 MHz Digital input 4: 5 V / 24 V, switchable with object 3240_h, max. 1 MHz Digital input 5: 5 V / 24 V, switchable with object 3240_h, max. 1 MHz Digital input 6: 5 V / 24 V, switchable with object 3240_h, max. 1 MHz Analog input: 10 Bit, 0-10 V or 0-20 mA, switchable with object 3221_h Digital output 1: Open drain, max 24 V/100 mA Digital output 2: Open drain, max 24 V/100 mA 5V output: +5 VDC, max. 100 mA +UB Logic: 4 V DC/approx. 39 mA, connected to pin 2 of X1 and X2 															
S1	Hex coding switch for setting the Node-ID und baud rate: 	<table border="1"> <thead> <tr> <th>Value of the switch</th> <th>Node-ID</th> <th>Baud rate</th> </tr> </thead> <tbody> <tr> <td>0_h</td> <td>Object 2009_h</td> <td>1MBd</td> </tr> <tr> <td>1_h-7_h</td> <td>Value of the switch</td> <td>1MBd</td> </tr> <tr> <td>8_h</td> <td>Object 2009_h</td> <td>Object 2005_h</td> </tr> <tr> <td>9_h-F_h</td> <td>(Number of the switch)-8</td> <td>Object 2005_h</td> </tr> </tbody> </table>	Value of the switch	Node-ID	Baud rate	0 _h	Object 2009 _h	1MBd	1 _h -7 _h	Value of the switch	1MBd	8 _h	Object 2009 _h	Object 2005 _h	9 _h -F _h	(Number of the switch)-8	Object 2005 _h
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0 _h	Object 2009 _h	1MBd															
1 _h -7 _h	Value of the switch	1MBd															
8 _h	Object 2009 _h	Object 2005 _h															
9 _h -F _h	(Number of the switch)-8	Object 2005 _h															
S2	DIP switch for 120 Ω termination for CAN-Bus.	OFF: The CAN bus termination is off. ON (left): The CAN bus termination is on.															

If you set 3240_h:07_h to the value "1", three differential inputs are available instead of six single-ended inputs.

NOTICE

- EMC: For a DC power supply line longer than 30 m or when using the motor on a DC bus, additional interference-suppression and protection measures are necessary.
- An EMI filter is to be inserted in the DC supply line as close as possible to the controller/motor.
- Long data or supply lines are to be routed through ferrites.

Commissioning

The *Plug & Drive Studio* software offers you an option for performing the configuration and adapting the motor parameters to your application. You can find further information in document *Plug & Drive Studio: Quick Start Guide* at us.nanotec.com.

Observe the following notes:

CAUTION!

Moving parts can cause hand injuries.

If you touch moving parts during running operation, hand injuries may result.

- Do not reach for moving parts during operation. After switching off, wait until all movements have ended.

CAUTION!

In free-standing operation, motor movements are uncontrolled and can cause injuries.

If the motor is unsecured, it can, e. g., fall down. Foot injuries or damage to the motor could occur.

- If you operate the motor free-standing, observe the motor, switch it off immediately in the event of danger and make certain that the motor cannot fall down.

CAUTION!

Moving parts can catch hair and loose clothing.

During running operation, moving parts can catch hair or loose clothing, which may lead to injuries.

- If you have long hair, wear a hairnet or take other suitable protective measures when near moving parts. Do not work with loose clothing or ties near moving parts.

CAUTION!

Risk of overheating or fire if there is insufficient cooling!

If cooling is insufficient or if the ambient temperature is too high, there is a risk of overheating or fire.

- During use, make certain that the cooling and environmental conditions are ensured.

NOTICE

EMC: Current-carrying cables – particularly around supply cables – produce electromagnetic alternating fields. These can interfere with the motor and other devices.

Suitable measures may be:

- Use shielded cables and earth the cable shielding on both ends over a short distance.
- Keep power supply cables as short as possible.
- Use cables with cores in twisted pairs.
- Earth motor housing with large contact area over a short distance.
- Lay supply and control cables separately.

Establishing communication via CANopen

- Connect the CANopen master to the controller via the CAN_L, CAN_H cables. Check the connection of your CAN-GND and that the necessary S2 – 120 ohm termination resistor is present between CAN_H and CAN_L.

- Supply the controller with voltage.

- Change the configuration values if necessary.

The controller is set per default to node-ID 1, baud rate 1 Mbaud.

- To test the interface, send bytes 40 41 60 00 00 00 00 00 to the controller.

Statusword (6041_h) was read; you receive this response: 4B 41 60 00 XX XX 00 00.

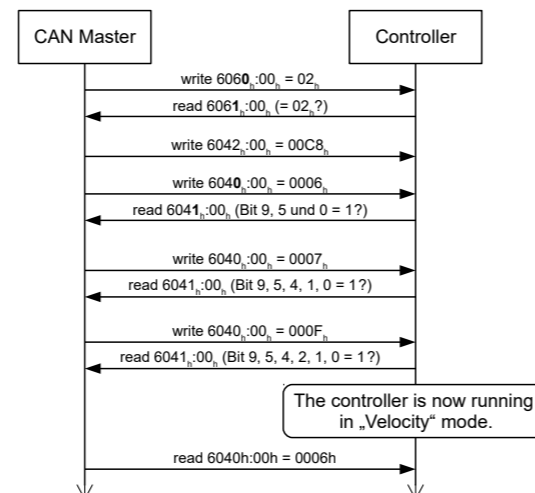
Test run

After configuring and the auto setup, a test run can be performed. As an example, the **Velocity** operating mode is used.

The values are transferred from your *CANopen master* to the controller. After every transfer, the *master* should use the status objects of the controller to ensure successful parameterization.

- Select the *Velocity* mode by setting object 6060_h (Modes Of Operation) to the value "2".
- Write the desired speed in 6042_h.
- Switch the *power state machine* to the *Operation enabled*.

The following sequence starts *Velocity* mode; the motor turns at 200 rpm.



- To stop the motor, set controlword (6040_h) to "6".