

PDx-108-28-SE



Hardware Manual



TRINAMIC
MOTION CONTROL

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1 Features

The PDx-108-28-SE is a full mechatronic device consisting of a NEMA 11 (flange size 28mm) stepper motor, controller / driver electronics and integrated sensOstep™ encoder.

Applications

- Extremely compact and decentralized stepper motor solution
- Position movement applications, where larger motors do not fit and higher torques are not required

Electrical data

- Supply voltage: +9V .. +28V DC
- Motor current: up-to 800mA peak / 560mA RMS (programmable)

Stepper motor data

- NEMA 11 (28mm flange size) two phase bipolar stepper motors
- Please also refer to the associated motor manual for more detailed information [QSH2818]

Interfaces

- 2 general purpose inputs
- 2 general purpose outputs
- RS485 2-wire communication interface

Features

- PD1-108-28-SE: smallest PANdrive available from Trinamic
- High-efficient operation, low power-dissipation
- Uses TMC222-SI highly integrated controller / driver IC
- Up-to 16 microsteps per fullstep
- Integrated sensOstep™ magnetic encoder (max. 256 increments per rotation) for step-loss detection and absolute position information
- Integrated protection: overtemperature / undervoltage

Software

- TMCL remote (direct mode) and stand-alone operation (memory for 64 TMCL commands)
- Fully supported by TMCL-IDE (PC based integrated development environment)

2 Order codes

The combination of motor and motor mounted controller / driver electronic is currently available with two stepper motors (different length and holding torque):

Order code	Description	Dimensions [mm ³]
PD1-108-28-SE (-option)	PANdrive 0.06Nm max. holding torque ^{*)}	
PD3-108-28-SE (-option)	PANdrive 0.12Nm max. holding torque ^{*)}	

^{*)} Max. holding torque of the motor at 670mA RMS rated motor current.

Serial interface option:

Interface option	Communication interface
485	RS485 interface

Table 2.1: Order codes

3 Life support policy

TRINAMIC Motion Control GmbH & Co. KG does not authorize or warrant any of its products for use in life support systems, without the specific written consent of TRINAMIC Motion Control GmbH & Co. KG.

Life support systems are equipment intended to support or sustain life, and whose failure to perform, when properly used in accordance with instructions provided, can be reasonably expected to result in personal injury or death.

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Specifications subject to change without notice.

4 Electrical and Mechanical Interfacing

The PDX-108-28-SE consists of a 28mm / NEMA 11 stepper motor with controller / driver electronics mounted to the back of the motor. In order to make proper use of the integrated sensOstep™ encoder (the sensor IC is placed on the bottom of the pcb) the electronics should not be removed / moved relative to the motor (e.g. mounting it at a different location or with a different distance towards the motor). In case this encoder feature is not used, the electronics may be mounted according to different user requirements.

4.1 Size of board

The board with the controller / driver electronics has a size of 28mm x 28mm in order to fit on the back side of a NEMA11 (28mm flange size) stepper motor.

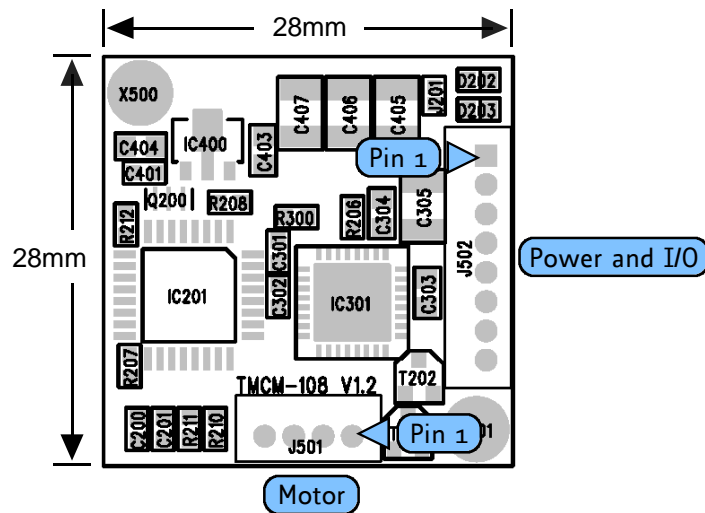


Figure 4.1: top side of board with placement of connectors

4.2 Size of unit

Currently, there is a choice between two 28mm stepper motors of different lengths and different torques. Please also refer to the manuals of the related stepper motors QSH2818-32-07-006 [QSH2818-32-07-006] and QSH2818-51-07-012 [QSH2818-51-07-012].

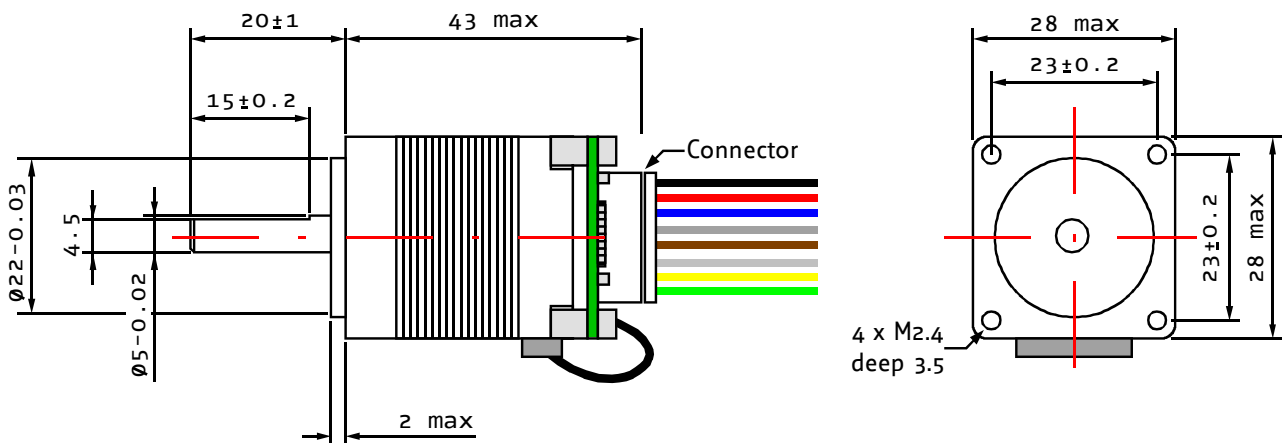


Figure 4.2: PD1-108-28-SE with 2-phase 28mm stepper motor QSH2818-32-07-006

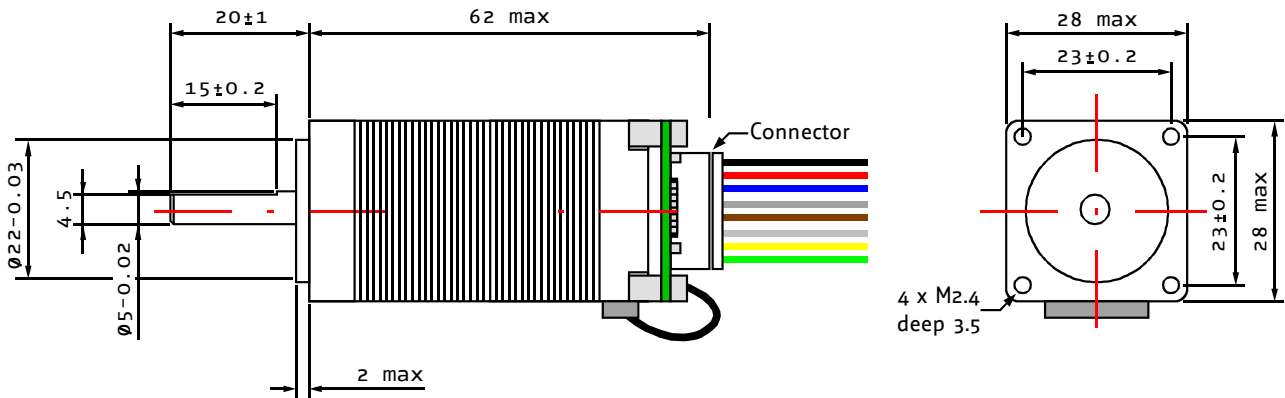


Figure 4.3: PD2-108-28-SE with 2-phase 28mm stepper motor QSH2818-51-07-012

4.3 Connectors

Due to the size of the module the space for connectors is rather limited. The PDx-108-28-SE provides just one connector with 8 pins for power, communication and general purpose inputs and outputs. A second connector with 4 pins is used internally for connecting the motor wires.

4.3.1 Power and I/O connector

An 8-pin JST PH-series 2mm pitch single row connector [JST] is used on the board.

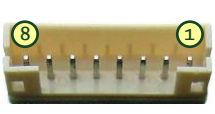
	Pin	Label	Direction	Description
	1	GND	Power (GND)	GND
	2	VDD	Power (Supply)	VDD (+9V...+28V)
	3	RS485A	Bidirectional	RS-485 interface (+)
	4	RS485B	Bidirectional	RS-485 interface (-)
	5	GPIo	Input	Digital (0..+5V, up-to +/-28V), analog (0..+5V)
	6	GPI1	Input	Digital (0..+5V, up-to +/-28V), analog (0..+5V)
	7	GPOo	Output	Open collector, max. , 150mA
	8	GPO1	Output	Open collector, max. , 150mA

Table 4.1: Power and I/O connector

Mating connector from JST: PHR-8 (housing) and SPH-002T-Po.5S (crimp contact for AWG #30 to 24 / 0.05mm² to 0.22mm² wires).

4.3.2 Motor connector

The motor connector is used internally for connecting the four motor wires to the electronics.


	Pin	Label	Direction	Description
	1	OA1	Output	Pin 1, motor coil 1
	2	OA2	Output	Pin 2, motor coil 2
	3	OB1	Output	Pin 1, motor coil 1
	4	OB2	Output	Pin 2, motor coil 2

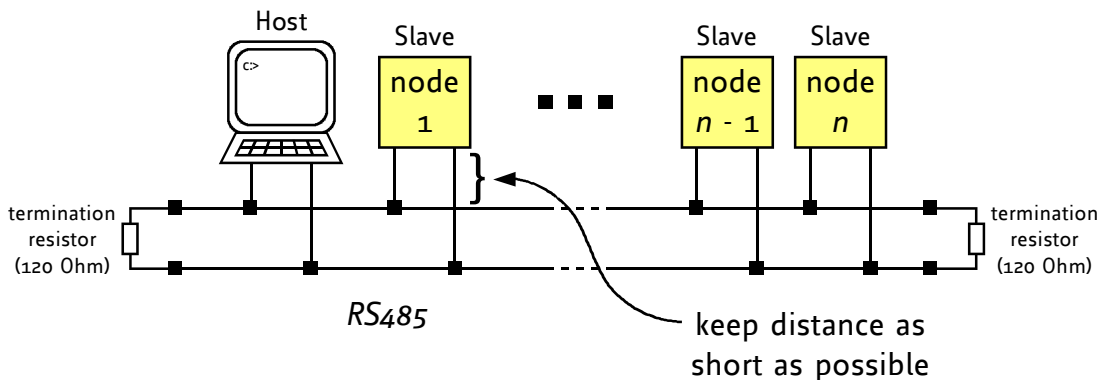
Table 4.2: Motor connector

4.4 Inputs / Outputs

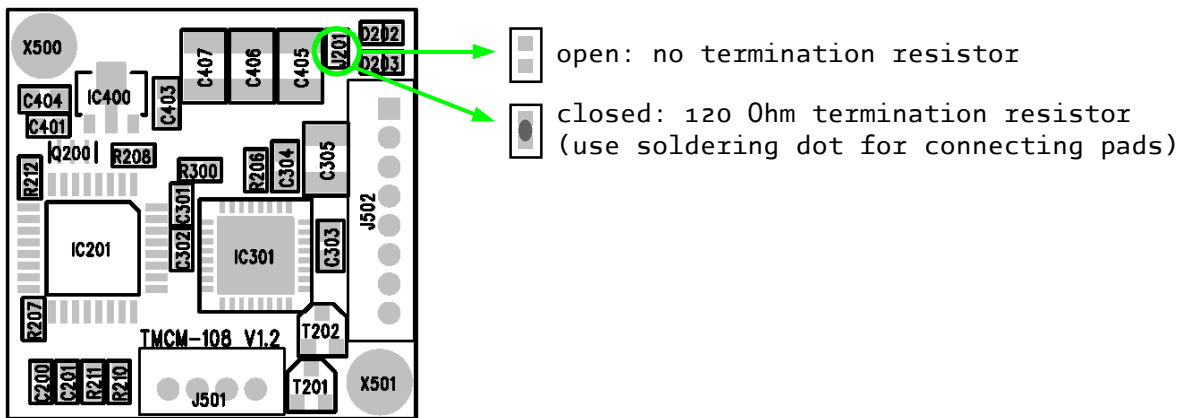
4.4.1 RS485

For remote control and communication with a host system the PDx-108-28-SE provides a two wire RS485 bus interface. For proper operation the following items should be taken into account when setting up an RS485 network:

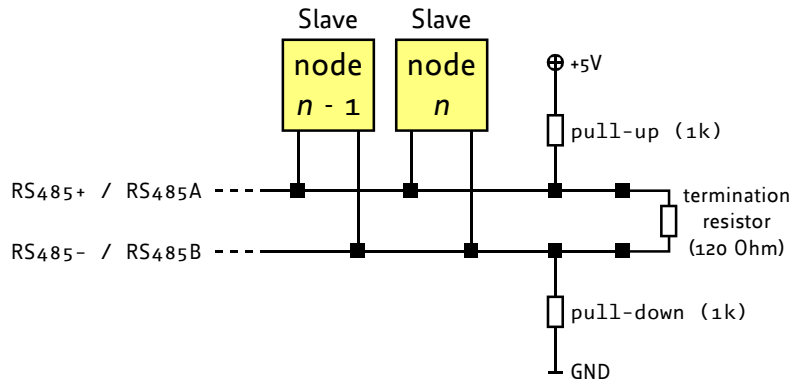
1. **BUS STRUCTURE:** The network topology should follow a bus structure as closely as possible. That is, the connection between each node and the bus itself should be as short as possible. Basically, it should be short compared to the length of the bus.



2. **BUS TERMINATION:** Especially for longer busses and / or multiple nodes connected to the bus and / or high communication speeds, the bus should be properly terminated at both ends of the bus. The PDx-108-28-SE integrates a 120 Ohm termination resistor that can be placed between both RS485 bus wires by shortening two soldering pads on the pcb as shown below:



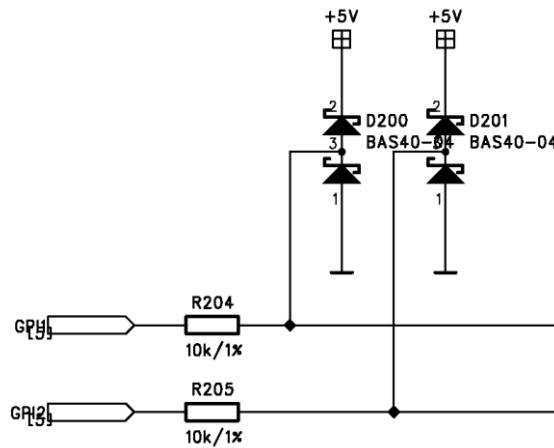
3. **NUMBER OF NODES:** The RS-485 electrical interface standard (EIA-485) allows up-to 32 nodes to be connected to a single bus. The bus transceiver used for the PDx-108-28-SE units (SN65HVD485ED) has just half of the standard bus load and allows a maximum of 64 units to be connected to a single RS485 bus.
4. **NO FLOATING BUS LINES:** Avoid floating bus lines while neither the host / master nor one of the slaves along the bus line is transmitting data (all bus nodes switched to receive mode). Floating bus lines may lead to communication errors. In order to ensure valid signals on the bus it is recommended to use a resistor network connecting both bus lines to well defined logic levels. In contrast to the termination resistors this network is normally required just once for a bus. Certain RS485 interface converters available for a PC already include these additional resistors (e.g. USB-2-485 [USB-2-485]).



4.4.2 General Purpose Inputs

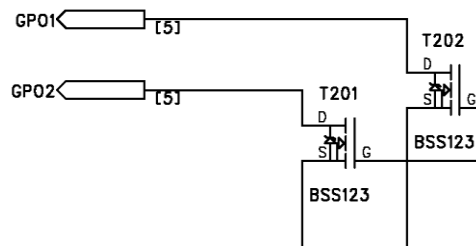
The eight pin connector of the PDx-108-28-SE provides two general purpose inputs. These two inputs can be programmed in order to accept digital signals as well as analogue signals.

Both inputs are protected with 10k series resistors together with limiting diodes against voltages below 0V (GND) and above +5V DC.



4.4.3 General Purpose Outputs

The eight pin connector of the PDx-108-28-SE provides two general purpose outputs. These two outputs are open-collector outputs and can sink up to 150mA each. The N-channel MOSFET transistors used [BSS123] can withstand voltages up to 100V at the outputs when switched off. Nevertheless, the voltages should be normally limited to the supply voltage of the unit.



Please make sure to add an external freewheeling diodes when connecting an inductive load (relays etc.).

5 Operational Ratings

The operational ratings show the intended / characteristic ranges and should be used as design values. In no case shall the maximum values be exceeded.

Symbol	Parameter	Min	Typ	Max	Unit
V_{cc}	Power supply voltage for operation	9	12 ... 24	28	V
I_{COIL}	Motor coil current for sine wave peak (chopper regulated, adjustable via software)	0		800	mA
I_{MC}	Continuous motor current (RMS)	0		570	mA
f_{CHOP}	Motor chopper frequency	18	20	22	kHz
I_S	Power supply current		$\ll I_{COIL}$	$1.4 * I_{COIL}$	A
T_{ENV}	Environment temperature at rated current (no forced cooling required)	-40		45	°C
	Environment temperature at 80% of rated current or 50% duty cycle (no forced cooling required)	-40		60	°C

Table 5.1: General operational ratings of the module

Symbol	Parameter	Min	Typ	Max	Unit
$V_{GPO\ o/1}$	Voltage at open collector output	0		+ V_{cc}	V
$I_{GPO\ o/1}$	Output sink current			150	mA
$V_{GPI_digital\ o/1}$	Input voltage for GPIO and GPI1 when used as digital input	- V_{cc}		+ V_{cc}	V
$V_{GPI_digital_L\ o/1}$	Low level voltage for GPIO and GPI1 when used as digital input	- V_{cc}		1,5	V
$V_{GPI_digital_H\ o/1}$	High level voltage for GPIO and GPI1 when used as digital input	3		+ V_{cc}	V
$V_{GPI_analogue\ o/1}$	Measurement range for GPIO and GPI1 when used as analogue input		0 .. +5		V

Table 5.2: Operational ratings of the general purpose inputs / outputs

Symbol	Parameter	Min	Typ	Max	Unit
N_{RS485}	Number of nodes connected to single RS485 network			64	

Table 5.3: Operational ratings of the RS485 interface

6 Revision History

6.1 Hardware Revision

Version	Date	Description
1.00	2007-01-19	Initial Release
1.10	2007-10-22	Electrolytic capacitor has been replaced by ceramic capacitors
1.20	2008-06-16	Soldering holes for motor wires have been replaced by JST connector

Table 6.1: Hardware Revision

6.2 Document Revision

Version	Date	Author	Description
0.90	2007-01-12	GE	Initial version
0.91	2007-09-06	GE	Major Update
0.92	2008-03-27	GE	TMCL support added
0.93	2008-06-23	GE	RS485 pin assignment corrected + TMCL stand-alone support
0.94	2008-09-01	GE	Separate hardware and TMCL firmware manuals

Table 6.2: Document Revision

7 References

[TMCL]	TMCL Reference and Programming Manual (see http://www.trinamic.com)
[QSH2818-32-07-006]	NEMA11 / 28mm bipolar stepper motor used in PD ₁ (reference manual please download from http://www.trinamic.com)
[QSH2818-51-07-012]	NEMA11 / 28mm bipolar stepper motor used in PD ₃ (reference manual please download from http://www.trinamic.com)
[JST]	JST PH connector (2.0mm pitch, disconnectable crimp style) http://www.jst.com
[USB-2-485]	USB-2-485 interface converter (reference manual please download from http://www.trinamic.com)
[BSS123]	N-Channel Logic Level Enhancement Mode Field Effect Transistor (Fairchild Semiconductor http://www.fairchildsemi.com/)
[TMC222]	TMC222 datasheet (please download latest version from http://www.trinamic.com)