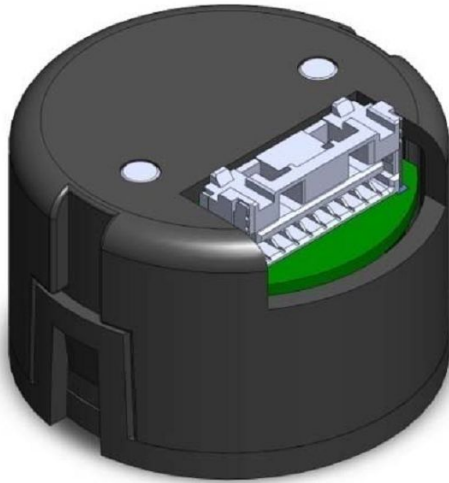# TMCS-28 Hardware Manual

Hardware Version V1.00 | Document Revision V1.70 • 2021-APR-16

TMCS-28 is a low-cost and small-size optical incremental encoder for use with stepper motors and 3-phase PMSM/BLDC motors. It comes with high resolution optical code wheels with a resolution of up to 625 lines (40.000 counts).
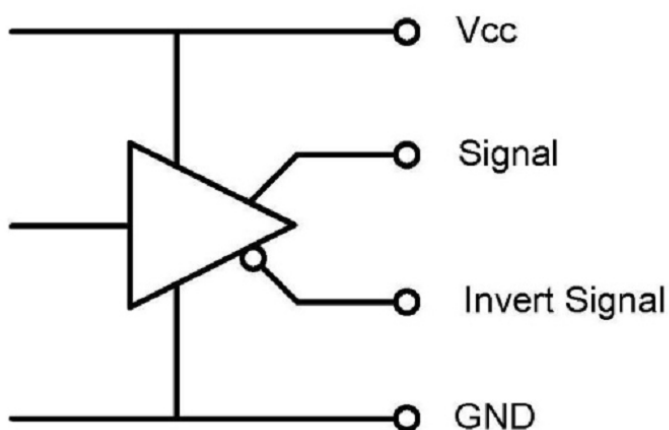
Features

- Low Cost
- High Resolution
- Small Dimension
- Easy Mounting

Applications

- Stepper Motor FOC
- Servo Motors

- Precision Motion Control
- Automated Equipment

- Robotics

Simplified Block Diagram

Read entire documentation.

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Contents

1   Order Codes

Order Code	Old Order Code	Description	Size (LxWxH)
TMCS-28-5-10k-AT-01	TMCS-28-5-10000-AT-01	Encoder Module 28mmm diameter, Resolution of 625lpr (40.000cpr), ABN, 5mm shaft diameter, TTL	28mm x 28mm x 18mm
TMCS-28-6.35-10k-AT-01	TMCS-28-6.35-10000-AT-01	Encoder Module 28mmm diameter, Resolution of 625lpr (40.000cpr), ABN, 6.35mm shaft diameter, TTL	28mm x 28mm x 18mm
TMCS-28-5-1k-AT-01	TMCS-28-5-1024-AT-01	Encoder Module 28mmm diameter, Resolution of 64lpr (4.096cpr), ABN, 5mm shaft diameter, TTL	28mm x 28mm x 18mm
TMCS-28-6.35-1k-AT-01	TMCS-28-6.35-1024-AT-01	Encoder Module 28mmm diameter, Resolution of 64lpr (4.096cpr), ABN, 6.35mm shaft diameter, TTL	28mm x 28mm x 18mm
TMCS-28-10k-KIT	TMCS-28-KIT	TRINAMIC TMCS-28 encoder kit including encoder housing, 1x TMCS-28-5-10k-AT-01, 1x TMCS-28-6.35-10k-AT-01, cable loom and assembly tools	100mm x 150mm x 30mm

| TMCS-28-1k-KIT | TMCS-28-1024-KIT | TRINAMIC TMCS-28 encoder kit including encoder housing, 1x TMCS-28-5-1k-AT-01, 1x TTMCS-28-6.35-1k-AT-01, cable loom and assembly tools | 100mm x 150mm x 30mm |

Table 1: Order codes

Other encoder resolutions, signal output types, and shaft diameters on request.

2   Technical Specifications

2.1   Mechanical and Electrical Parameters

Parameter	Min	Typ	Max	Unit
Supply voltage	4.5	5	5.5	V
Supply current			110	mA
Rise/fall time			10	ns
Frequency			1500	kHz
Output Voltage '"H"'	2.4			V
Input Voltage '"L"'			0.4	V
Max. output current			20	mA
Resolution (TMCS-28-x-10000-AT-01)		625		lpr (lines per rotation)
Resolution (TMCS-28-x-10000-AT-01)		40.000		cpr (increments per rotation)
Resolution (TMCS-28-x-1024-AT-01)		64		lpr (lines per rotation)
Resolution (TMCS-28-x-1024-AT-01)		4.096		increments (increments per rotation)

Table 2: Electrical Characteristics

Parameter	Min	Typ	Max	Unit
Hollow Diameter (symbol D in drawings)		5 / 6.35		mm
Shaft Loading Axial			50	N
Shaft Loading Radial			80	N
Max. RPM			6000	rpm
Net weight		30		g

Table 3: Mechanical Specifications

Parameter	Description
Operating Temperature	-20 – +85°C
Storage Temperature	-20 – +85°C
Operating Humidityl	RH 85% max, non collecting
Shock	490 m/s^2, 3Dx2 times
Vibration	1.2mm, 10-55kHz, 3Dx30min
Protection	IP40

Table 4: Environmental Specifications

2.2 Signals and Connection

Pin Number	Color	Signal Name
1	Red	VCC
2	Black	GND
3	White	A+
4	White/Black	A-
5	Green	B+
6	Green/Black	B-
7	Yellow	Z+
8	Yellow/Black	Z-
9	Blue	Shield

Table 5: Connector and cable pinning and signals

The required encoder cable connector is a Molex type 5023800900 CLIK-MATE™ crimp housing using Molex type 5023810000 CLIK-MATE™ crimp terminals.
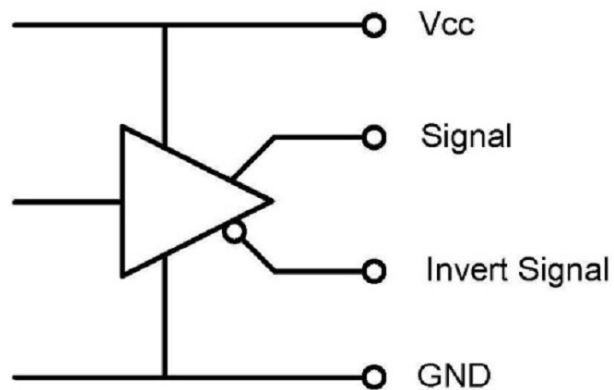

Figure 1: Connection and circuit diagram for the line driver outputs
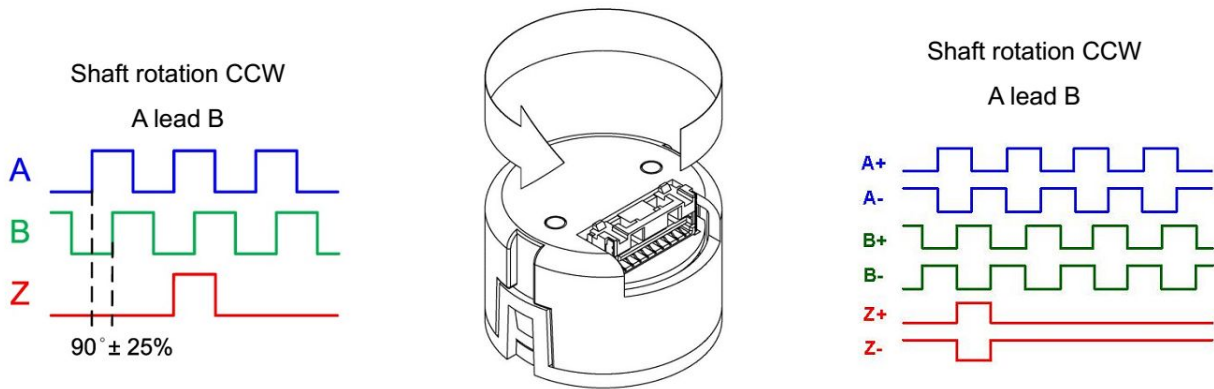
2.3 Wave Form

Figure 2: Example wave form for CCW rotation
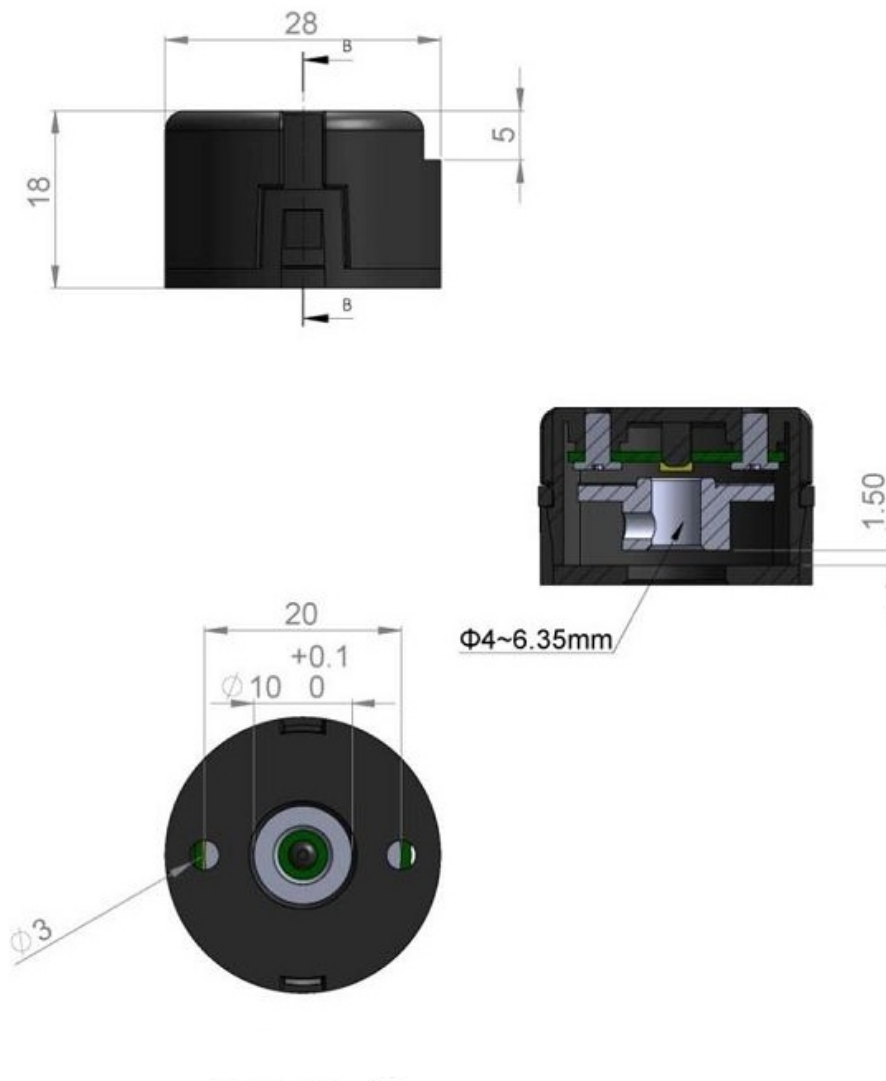
2.4 Mechanical Drawings

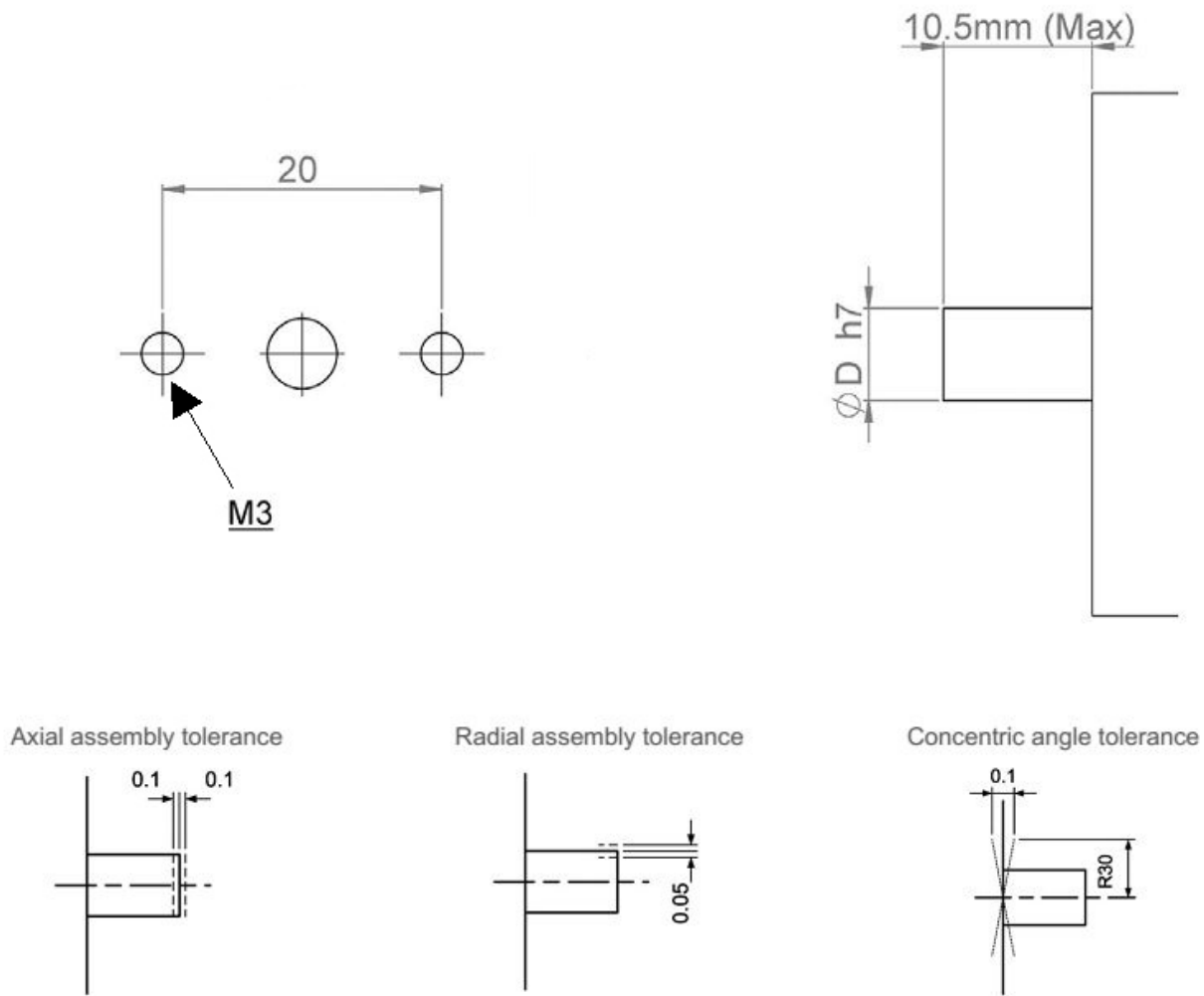*Figure 3: Bottom view, side view, and cut view (units = mm)*

2.5 Motor Assembly

Figure 4: Required dimensions for motor assembly (units = mm) / D = 5mm or 6.35mm

3   Figures Index

4   Tables Index

5 Supplemental Directives

5.1 Producer Information

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5.7   Collateral Documents & Tools

This product documentation is related and/or associated with additional tool kits, firmware and other items, as provided on the product page at: www.trinamic.com.

6 Revision History

6.1 Hardware Revision

Version	Date	Author	Description
1.00	01.03.2017	TMC	Initial release

Table 6: Hardware Revision

6.2 Document Revision

Version	Date	Author	Description
1.00	23.02.2017	SK	Initial release.
1.01	14.08.2017	SK	Correct hollow diameter and resolution on page 4.
1.10	11.10.2017	SK	Electrical ratings updated.
1.11	21.12.2017	OK	Resolution entries clarified.
1.12	27.08.2018	SK	Information on required shaft diameter D added.
1.30	24.09.2018	SK	Added 4.096 resolution versions.
1.31	29.11.2018	SK	Waveform image description updated.
1.32	14.12.2018	SK	Updated order codes.
1.40	01.07.2019	SK	Removed Start Torque Parameter since it is not needed/defined for simply encoder kit without bearing inside.
1.50	23.08.2019	SK	Order Codes updated.
1.60	10.08.2020	SK	Corrected the lpr value.
1.70	16.04.2021	SK	Order codes updated.

Table 7: Document Revision