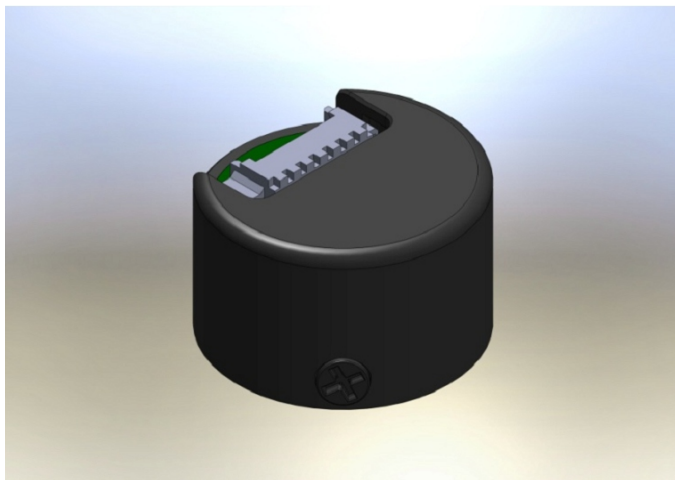


## TMCS-20 Hardware Manual

Hardware Version V1.00 | Document Revision V1.30 • 2019-JUL-01

**TMCS-20 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 8.192 lines (32.768 counts).**



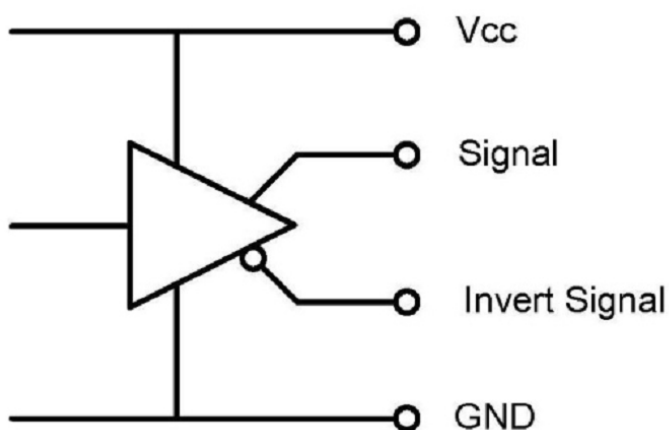
### Features

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

### Applications

- Stepper Motor FOC
- Precision Motion Control
- Robotics
- Servo Motors
- Automated Equipment

### Simplified Block Diagram



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## 1 Order Codes

Order Code	Description	Size (LxWxH)
TMCS-20-4-8192-AT-01	Encoder Module 20mm diameter, Resolution of 8.192lpr (32.768cpr), ABN, 4mm shaft diameter, TTL	20mm x 20mm x 13mm
TMCS-20-KIT	TRINAMIC TMCS-20 encoder kit including encoder housing, all code wheel options, 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			90	mA
Rise/fall time			10	ns
Frequency			1500	kHz
Output Voltage "H"	2.4			V
Input Voltage "L"			0.4	V
Max. output current			5	mA
Resolution lpr		8.195		lpr (lines per rotation)
Resolution cpr		32.768		increments (increments per rotation)

Table 2: Electrical Characteristics

Parameter	Min	Typ	Max	Unit
Hollow Diameter (Symbol D in Drawings)		4		mm
Shaft Loading Axial			25	N
Shaft Loading Radial			40	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 Humidity	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

Connector type on the hub and for the encoder cable is:

- HSUAN MAO TECHNOLOGY CO., LTD.: H9010-XXPWSY00R, SH 1.0mm Housing 1XXXP White single row, ROHS low lead
- HSUAN MAO TECHNOLOGY CO., LTD.: W9110-XXPBTWXS, SH 1.0mm Wafer 1XXXP SMT Side Entry Type tin plated white color, ROHS
- <http://www.hsm.net.tw/index.php>

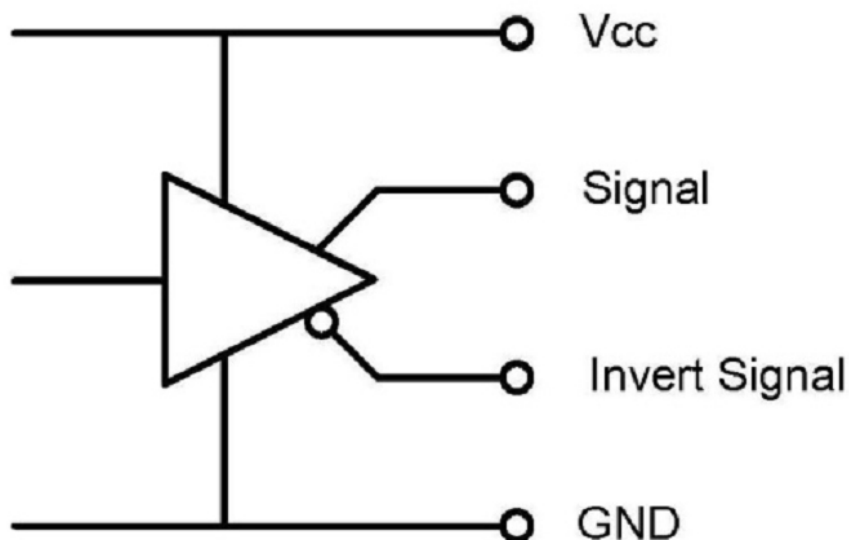


Figure 1: Connection and circuit diagram for the line driver outputs



### 2.3 Wave Form

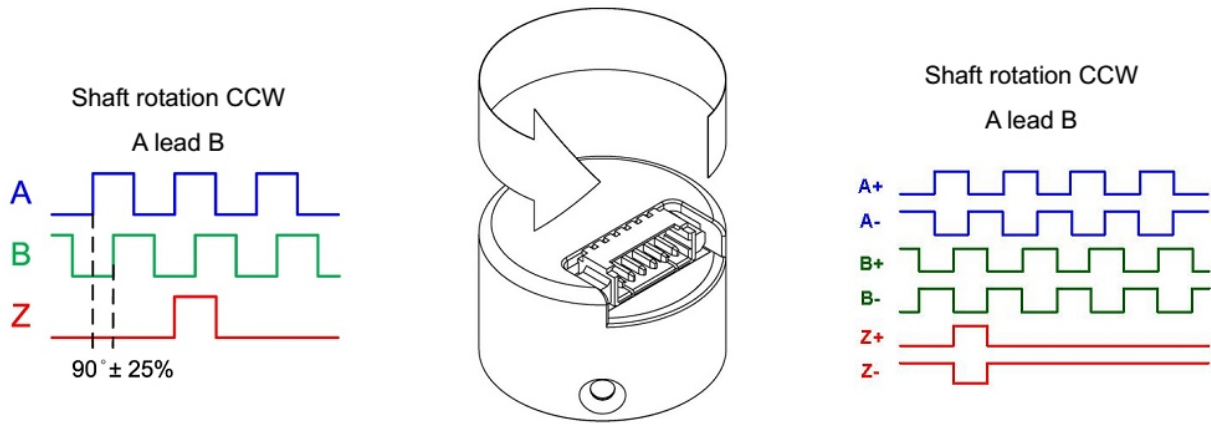


Figure 2: Example wave form for CCW rotation

### 2.4 Mechanical Drawings

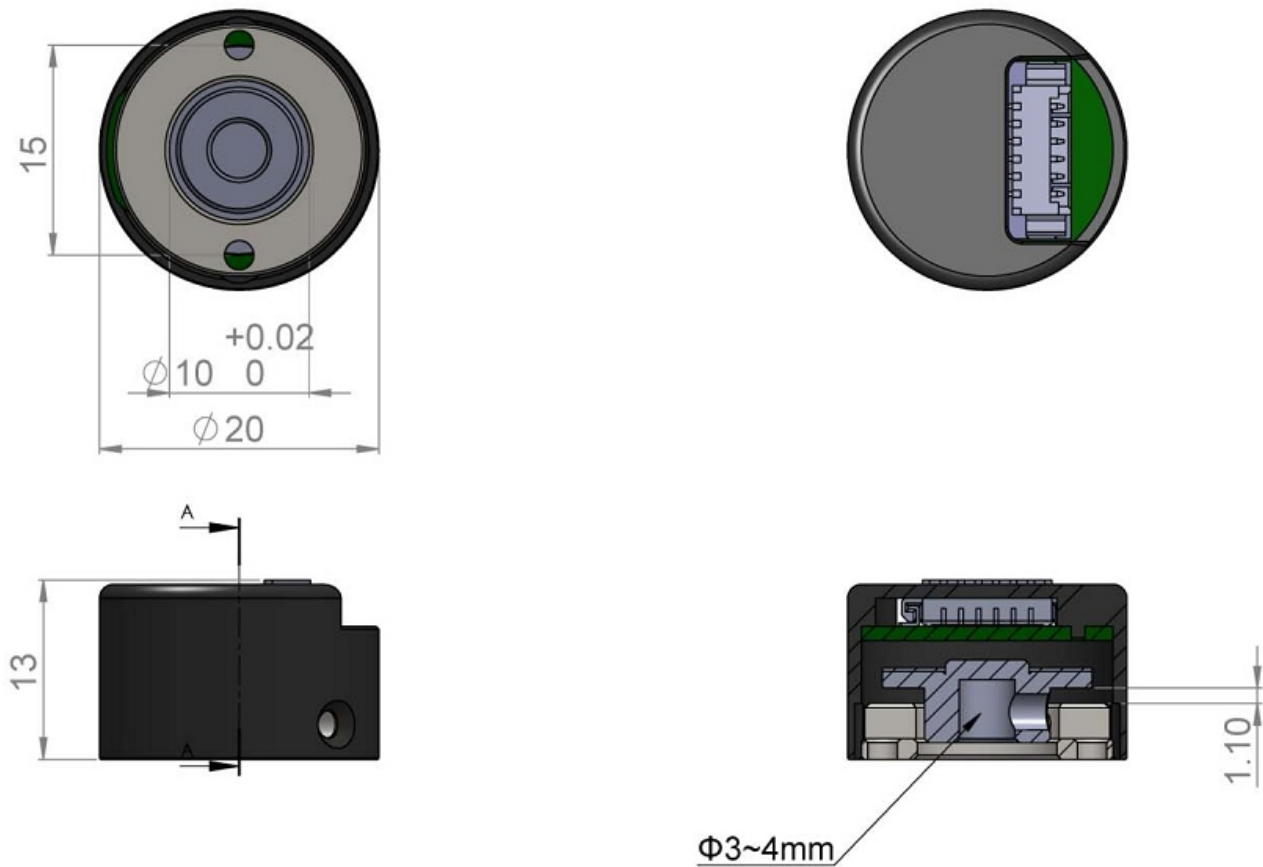
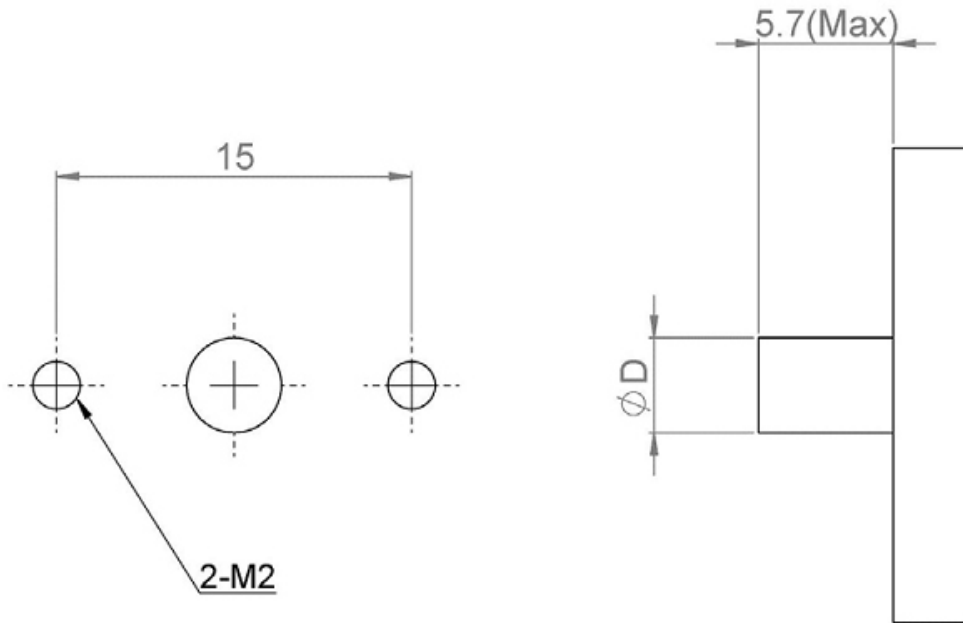


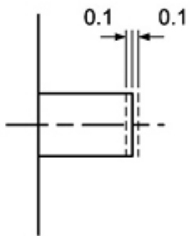
Figure 3: Bottom view, top view, side view, and cut view (units = mm)



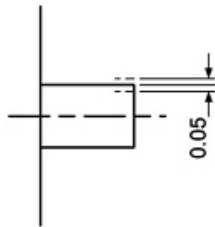
## 2.5 Motor Assembly



Axial assembly tolerance



Radial assembly tolerance



Concentric angle tolerance

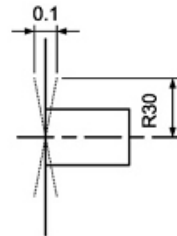


Figure 4: Required dimensions for motor assembly (units = mm) /  $D = 4\text{mm}$



### 3 Figures Index

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## 5 Supplemental Directives

### 5.1 Producer Information

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### 5.4 Target User

The documentation provided here, is for programmers and engineers only, who are equipped with the necessary skills and have been trained to work with this type of product.

The Target User knows how to responsibly make use of this product without causing harm to himself or others, and without causing damage to systems or devices, in which the user incorporates the product.

### 5.5 Disclaimer: Life Support Systems

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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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### 5.6 Disclaimer: Intended Use

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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](http://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	22.02.2017	SK	Initial release.
1.10	11.09.2017	SK	Electrical ratings updated.
1.20	06.11.2017	SK	Added connector specification.
1.21	21.12.2017	OK	Resolution entries clarified.
1.22	27.08.2018	SK	Information on required shaft diameter D added.
1.23	29.11.2018	SK	Waveform image description updated.
1.30	01.07.2019	SK	Removed Start Torque Parameter since it is not needed/defined for simply encoder kit without bearing inside.

*Table 7: Document Revision*

