RoHS compliant

pwb encoders

Absolute Encoder
Multiturn

Features

- Resolution: Singleturn: up to 8,192 (**13 Bit**) steps per revolution
  Multiturn: up to 4,294,967,296 (**32 Bit**) revolutions
- Interface: **SSI** (synchron serial interface) or
  BiSS ® (bidirectional serial synchron)
- Maximum shaft diameter: **3.175 mm**
- Rotation speed: up to **10.000 rpm**
- Single ended data transmission

SSI SYNCHRON SERIELLES INTERFACE

BiSS INTERFACE

Description

The **MEM 16** is available as an absolute **multiturn** encoder in the execution of a kit system. It consists a magnetic hub, a housing unit (including the PCB) and a cable unit. The **MEM 16** is a reliable low cost hollow shaft encoder that can be fixed quickly and easily on different sizes of motor shafts.

The **multiturn** encoder is developed for absolute positioning applications, for brushless motors or servo motors and steppers. The **MEM 16** is a real time system for high speed applications and rough environments. The encoder is available with two different interfaces: SSI or BiSS ®. The transmission is based by two single-ended wires.

The absolute position is detected by means of an electronic gear. The storage of the position data is done using the outsourced backup battery. The cable is thus an existential part of the encoder. Alternatively, the buffering of position data of the encoder can also be done by the customer control.

Dimensions
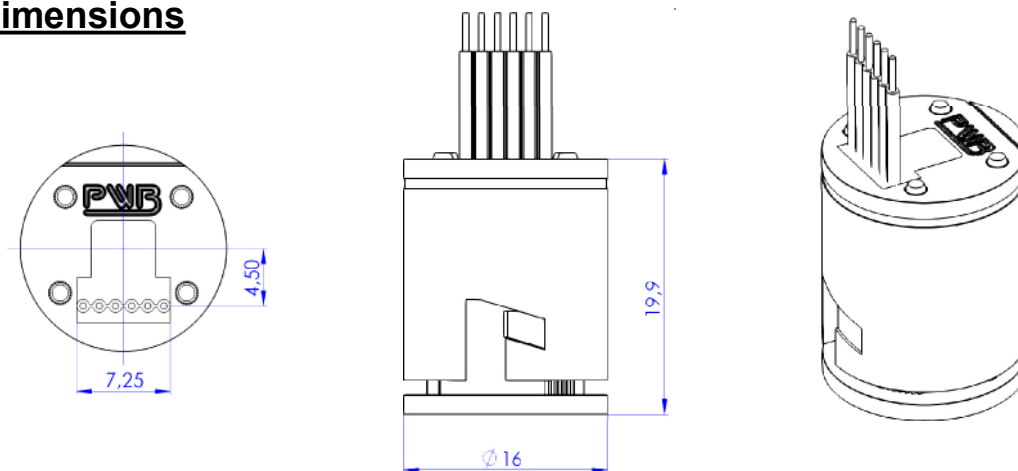
Main characteristics

- Absolute rotary encoder
- Multiturn by electronic gear
- Magnetic sensing
- Single Ended data transmission
- Hollow shaft encoder
- Maximum shaft diameter 3,17 mm (1/8")
- Power supply: 5 VDC.
- Small size: 16.0 mm diameter x 22.6 mm length
- Quick and easy assembly
- Operating temperature: -30 °C to 85 °C
- Compliant EU-directive 2011/65/EG (RoHS)

Recommended operating conditions

Electrical characteristics are only effective for the range of the operating temperatures.
Typical values at 25 °C and V_{CC} = 5 VDC.

| Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply voltage	U_B	4.5	5.0	5.5	V_{DC}	
Supply current	I_{UB}	40	60	80	mA	no load
Reverse polarity protection	U_B	-6.0		0	V_{DC}	
Start up time	t_T			2	ms	
Absolute accuracy			+/- 0.8		°	(after calibration via SW)
Relative accuracy			+/- 1,5		LSB	(after calibration via SW)
Rotation speed	RPM			10,000	U/min	
Acceleration	α_{max}			40	$10^3\,°/s^2$	
ESD voltage	U_{ESD}			2	kV	discharged over 1,5kΩ
SSI / BiSS						
Clock frequency	f	80		10000	kHz	
High level output voltage	V_{oH}	2.0	3.0	5.5	V_{DC}	R_L = 120Ω
Low level output voltage	V_{oL}			0.8	V_{DC}	R_L = 120Ω
High level input voltage	V_{iH}	2.0		5.5	V_{DC}	
Low level input voltage	V_{iL}			0.8	V_{DC}	
Output current per channel	I_{out}	-1.0	30	50	mA	overload protection
Scan ratio of T		40		50 60	%	
Monoflop time	t_m		20 + T/2		µs	adaptive Encoder Timeout
BiSS						
CRC Polynomial			0x43		hex	$x^6 + x^1 + x^0$
CRC Start Value			0x0000		hex	
CRC Bits			6			
CDM						inverted
Environment						
Operating temperature	T_A	-30	25	85	°C	optional 100°C
Storage temperature	T_S	-40		85	°C	
Humidity exposure				90	% RH	not codensing
Vibration				2000	Hz	20 g

The angular accuracy of the datasheet can only be guaranteed by a single calibration after the mechanical assembly (with the PWB encoders Software and the USB converter box).

Mechanical specifications

| Parameter	Value	Tolerance	Unit
Outer dimensions connector version	Ø16.0 x 22.6	-	mm
Shaft diameter $\varnothing$w	1.5 / 2.0 / 2.3 / 2.5 / 3.0 / 3.175	±0.01	mm
Required shaft length L_W	9.5	+ 2.0	mm
Max. allowable axial shaft play of motor	0.3	-	mm
Max. allowable radial shaft play of motor	0.025	-	mm
Mounting screw size (DIN 84)	M1.6	-	-
Tightening torque of the screws	15	-5	Ncm
Pitch circle diameter $\varnothing$c	11.0	±1.0	mm
Flange bore diameter diameter $\varnothing$z	6.02	+0.05	mm
Mounting boss diameter $\varnothing$m	6.02	-0.03	
Max. mounting boss height h_z	1.5	-0.1	mm
Mating connector (Molex)	contact 4x 50079-8000 housing 1x 51021-0400	-	-
Total weight	4	-	g
Moment of inertia of the hub with the code wheel	2.35	±1.0	gmm^2
Protection grade according to DIN 40500	IP50	-	-

Mounting considerations:

The MEM 16 encoder is designed to self align by using a mounting boss. The drawing shows the configuration of the mounting boss along with the location of the mounting screw holes. Shaft diameter and tolerances are given in the above mentioned chart.

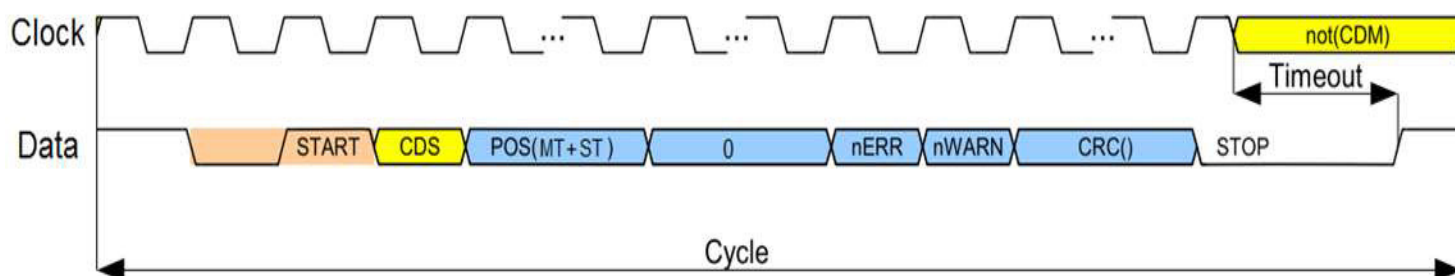SCHNITT C-C

SCHNITT B-B
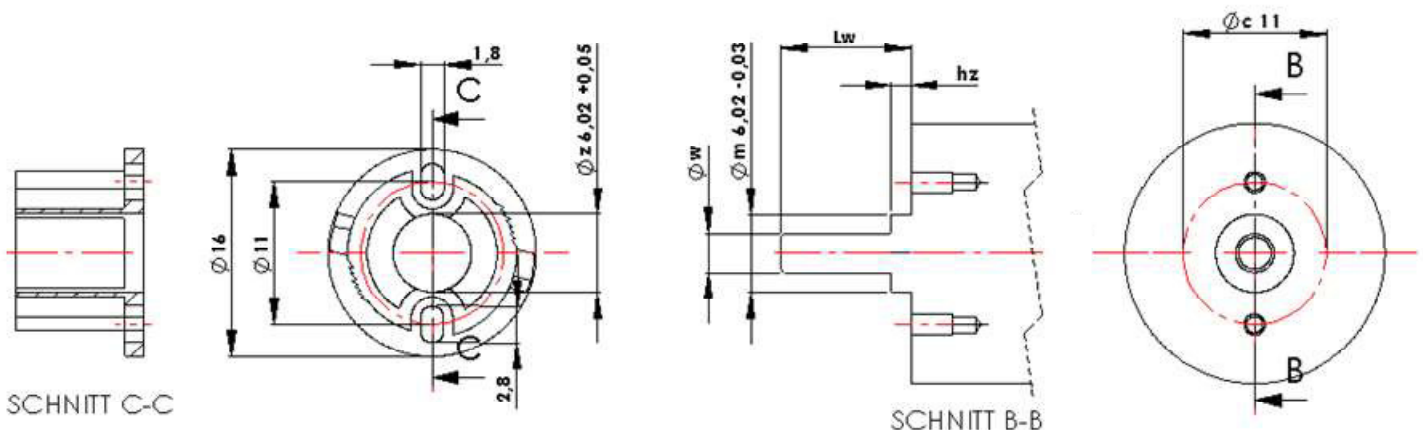
Interface:

Data transfer: SSI   Gray-Code
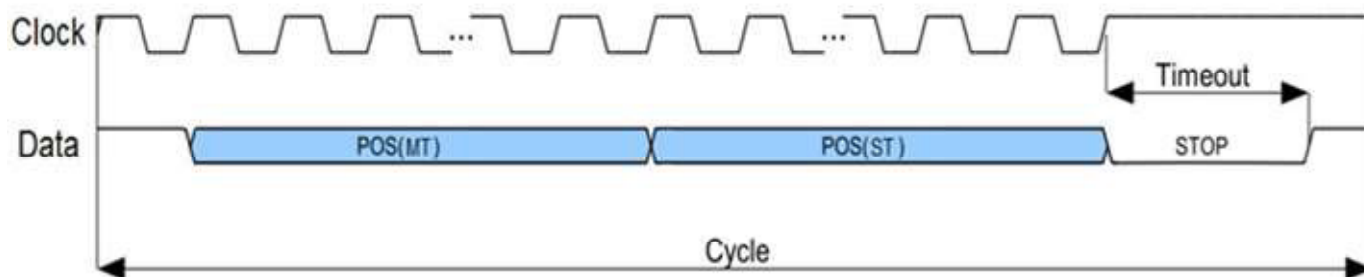
Data transfer: BiSS (C-Mode)   Binary-Code

0:

These are additional bits to refill the singleturn bit length to 12 bit respectively 16 bit. The number of Zero-bits is depended of the Ordering code (see below). The value of these bits is low.

Example:

Ordering code: MEM16 - B 09 / 12 - ….   =>   … + 21 Position bits + 3 x 0 bits + …
                  MEM16 - B 10 / 12 - ….   =>   … + 22 Position bits + 2 x 0 bits + …
                  MEM16 - B 11 / 12 - ….   =>   … + 23 Position bits + 1 x 0 bits + …
                  MEM16 - B 12 / 12 - ….   =>   … + 24 Position bits   + …
                  MEM16 - B 13 / 12 - ….   =>   … + 25 Position bits + 3 x 0 bits + …

For a detailed description of the protocol, see separate interface specification.

Preset and rotation direction are programmable by a BiSS command.

Error monitoring and Error Reset can also controlled and executed by command using BiSS interface.

ESD Warning: Normal handling precautions should be taken to avoid static discharge damage to the sensor.

Electrical interface

Rotation direction clockwise
(count up)

Pin 1
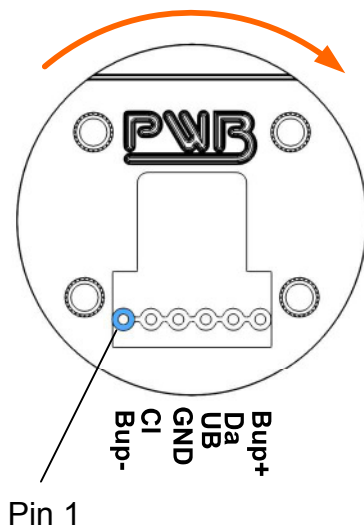
For communication with the MEM16 in SSI or BiSS version, a USB converter box is available from PWB encoders. The software can be downloaded from the website.
This can help for the first use and for visualization of the position data. It is not necessary for operation in the customer application with the customer control.

Cable/wire description

Standard cable without backup: *

Cable Pin	Connector Signal
1	Backup-
2	Clock
3	GND
4	UB
5	Data
6	Backup+

Standard cable with backup: *

Connector Signal	Cable Wire color
Clock	green
GND	blue
UB	red
Data	pink

* on page 10

IMPORTANT NOTICE

The encoder is so designed that it may be assembled only one time, otherwise the guarantee will be voided.
The guarantee will be voided by misuse, accident, modification, unsuitable physical or operating environment, operation in other than the specified operating environment, or failure caused by a product for which *PWB encoders GmbH* is not responsible.
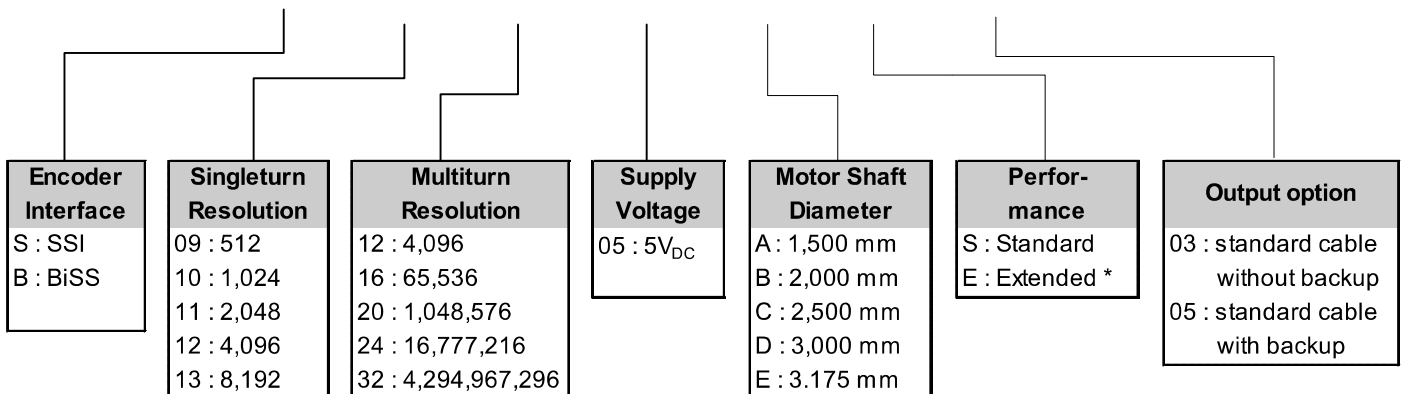
PWB encoders GmbH reserves the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services also datasheets at any time.

Ordering information

Ordering code:

MEM 16 - X - XX / XX - XX - X - X - XX

Encoder Interface	Singleturn Resolution	Multiturn Resolution	Supply Voltage	Motor Shaft Diameter	Perfor-mance	Output option
S : SSI B : BiSS	09 : 512 10 : 1,024 11 : 2,048 12 : 4,096 13 : 8,192	12 : 4,096 16 : 65,536 20 : 1,048,576 24 : 16,777,216 32 : 4,294,967,296	05 : 5V$_{DC}$	A : 1,500 mm B : 2,000 mm C : 2,500 mm D : 3,000 mm E : 3.175 mm	S : Standard E : Extended *	03 : standard cable without backup 05 : standard cable with backup

* customer version

SSI only with gray code
BiSS only with binary code

Selectable and required accessories see page 10:
- cable 300 mm length (UL1061 / AWG28)
- cable 500 mm length
- centering and assembly gauge for different motor shafts
- adapter plates for different motors
- fastening screws DIN 84 M1.6x3 or M1.6x4
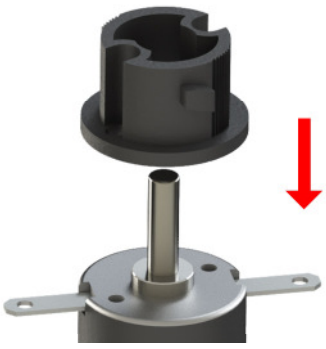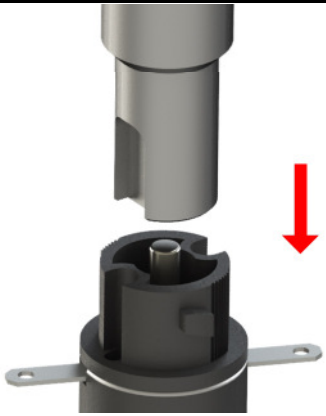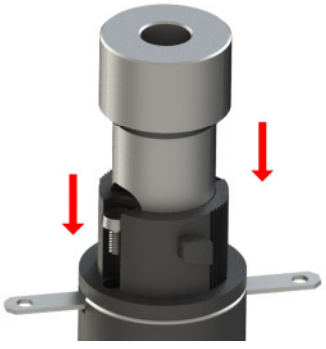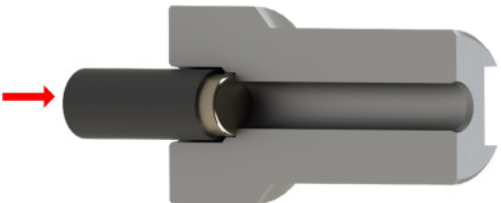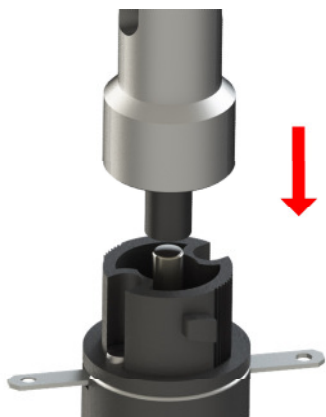
Patents: U.S 5,828,047 ; U.S 5,508,088 ; U.S 5,859,425 ; U.S 6,462,442

## MEM 16 MOUNTING INSTRUCTION

1

Set the base plate onto the motor

2

Align the base plate to the motor shaft by using the centering gauge

3

Afterwards fix the base plate to the motor flange using two screws

4

Remove the centering gauge

5

Set the hub with magnet into the centering gauge

6

Press the hub with magnet onto the motor shaft by the centering gauge

R●HS compliant

MEM 16 MOUNTING INSTRUCTION

7

Press the centering gauge down to the final position

8

Afterwards remove the centering gauge

9

Align the housing to the base plate, slide the housing onto the base plate

10

Press the housing into the final position

11

Turn the housing into its final position, the encoder is now ready for use

12 **WARNING**

Do not rotate and pull out the encoder after assembly or when it is in operation.
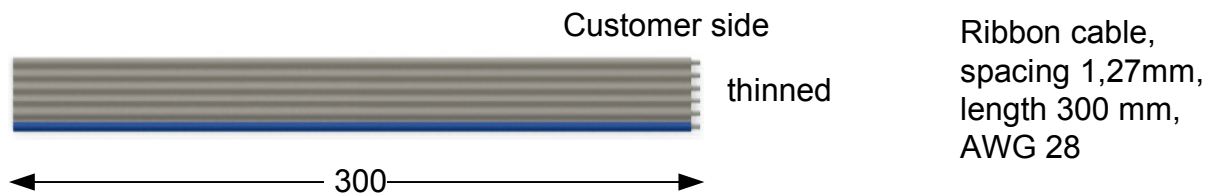
Cable/wire description

Standard cable with backup:

Encoder side

Ø 20

Customer side

thinned

Connection cable 0,14mm²

235 45 180 45

500
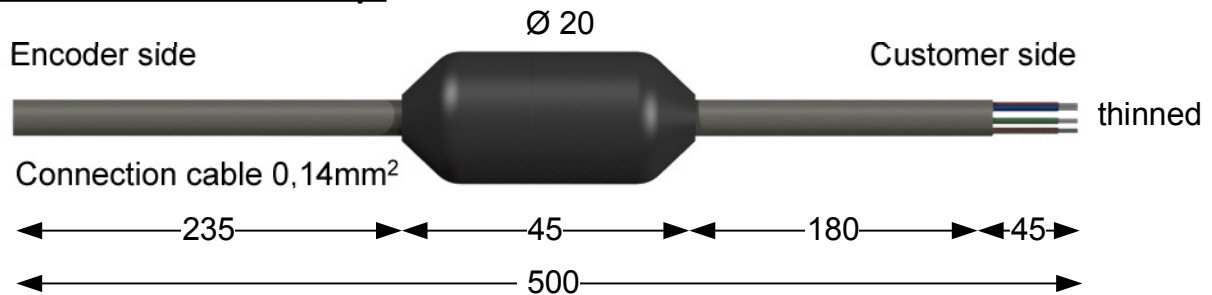
Attention!
Backup battery inside.   No liquid permitted !

Standard cable without backup:

Customer side

thinned

Ribbon cable,
spacing 1,27mm,
length 300 mm,
AWG 28

300
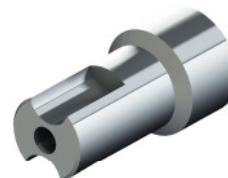
Attention:
Buffering of the encoder position data by the customer.

Available accessories

Centering and assembly gauge for centering
the base plate on the motor flange or an
adapter plate and also positioning the magnet

Customized adapter plate

Screws DIN84 M1.6 X 3 or M1.6 X 4