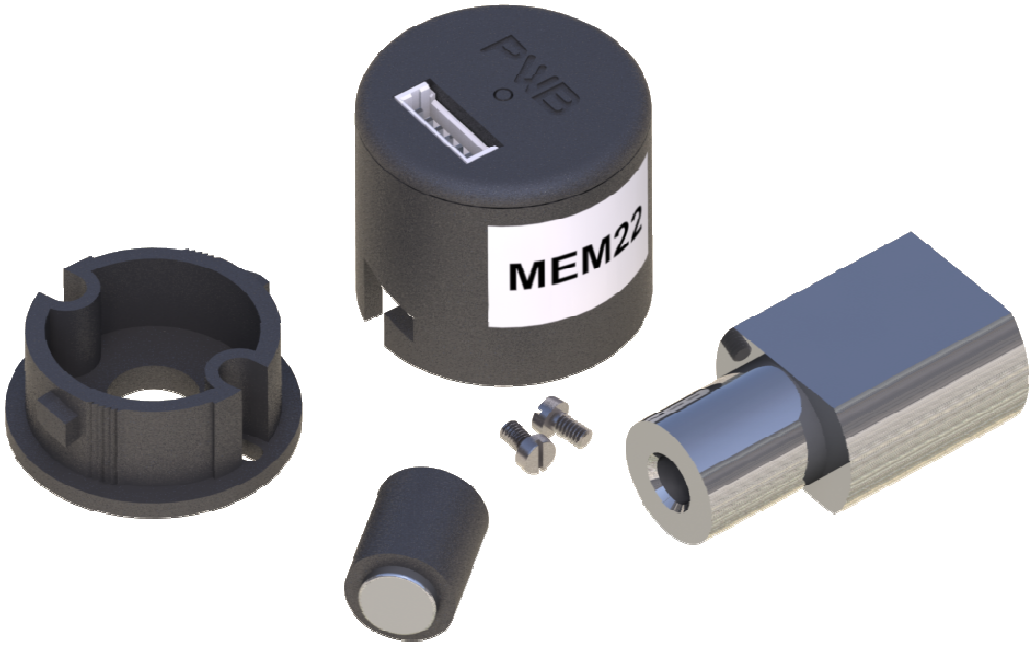
Incremental Encoder

Magnetic



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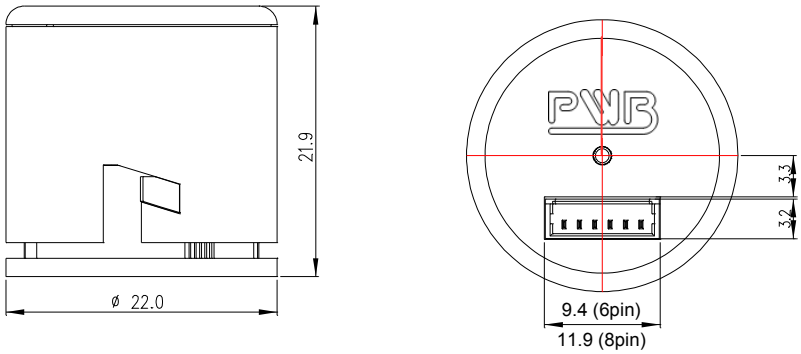
Description

The MEM 22 is a magnetic incremental encoder. He is a reliable low cost hollow shaft encoder that can be fixed quickly and easily on different sizes of motor shafts.
The encoder is developed for brushless motors, motor feedback applications and rotational speed control. The MEM 22 is a real time system for high speed applications and rough environments.
The encoder provides two square wave outputs in quadrature (90 degrees phase shifted) for counting and direction information and one index channel (one pulse per revolution).
The resolution of the encoder is determined by the number of counts per revolution (CPR).
Optionally, the encoder is also available with UVW commutation signals (1, 2 or 4 pole-pairs).
The power supply is selectable in a wide voltage range (5V up to 30V).
Power supply and signals are provided by a 6 pin or a 8 pin Molex connector.

Dimensions



Features

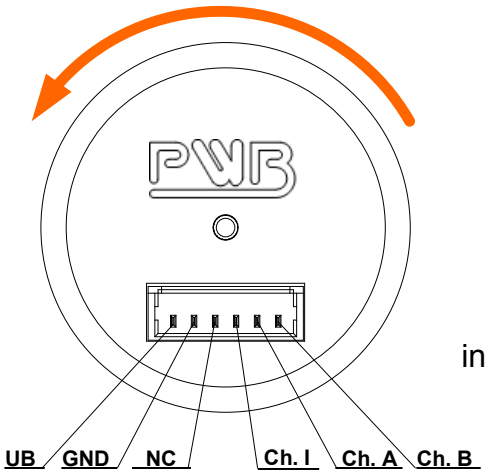
- Output channels: 2 (quadrature) + 1 index-channel
  optionally: UVW commutation signals
- Output type: TTL compatible or HTL compatible
- Resolution: up to 1024 CPR (counts per revolution)
  optionally: up to 4 pole-pairs
- Frequency up to 500 kHz
- Power supply: 5 – 30 VDC
- Quick and easy assembly
- Small size: 22.0 mm diameter x 21.9 mm length
- Maximum shaft diameter: 8.0 mm
- Operating temperature: -40°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 Vcc = 5 VDC.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply voltage	U_B	4.5	5.0	5.5	V_{DC}	
	U_B	8.0	12.0	30.0	V_{DC}	
Supply current	I_{UB}	20	37	44	mA	no load
Reverse polarity protection	U_B	-36		0	V_{DC}	8-30V Version
			None			5V Version
Output current per channel	I_{out}	-1.0		20	mA	
High level output voltage	V_{oH}	2.4		5.5	V_{DC}	TTL output
	V_{oH}	U_B - 3 V		30	V_{DC}	HTL output
Low level output voltage	V_{oL}			0.7	V_{DC}	TTL output
	V_{oL}			1.5	V_{DC}	HTL output
Rise time	t_r	5	15	20	ns	R_T = 120Ω
Fall time	t_f	5	15	20	ns	R_T = 120Ω
Pulse width	P	10:90	50:50	90:10	%	depended on resolution
						± 0,32 e $^{(0,4 * n)}$ [n = bits]
Phase shift			90	± 70	°e	depended on resolution
Absolute angular accuracy				± 0,5	DEG	
Load capacitance	C_T			100	pF	
Count frequency	f			500	kHz	rpm * N / 60 x 10^{-3}
Start up time	t_T			2	ms	
ESD voltage	U_{ESD}			2	kV	discharged over 1,5kΩ
Pole-pair	p	1		4		for block commutation
Environment						
Operating temperature	T_A	-40	25	85	°C	
Storage temperature	T_S	-40		85	°C	
Humidity exposure				90	% RH	not codensing
Vibration				2000	Hz	20 g
Magnet axis displacement				0.1	mm	vs. center of sensor

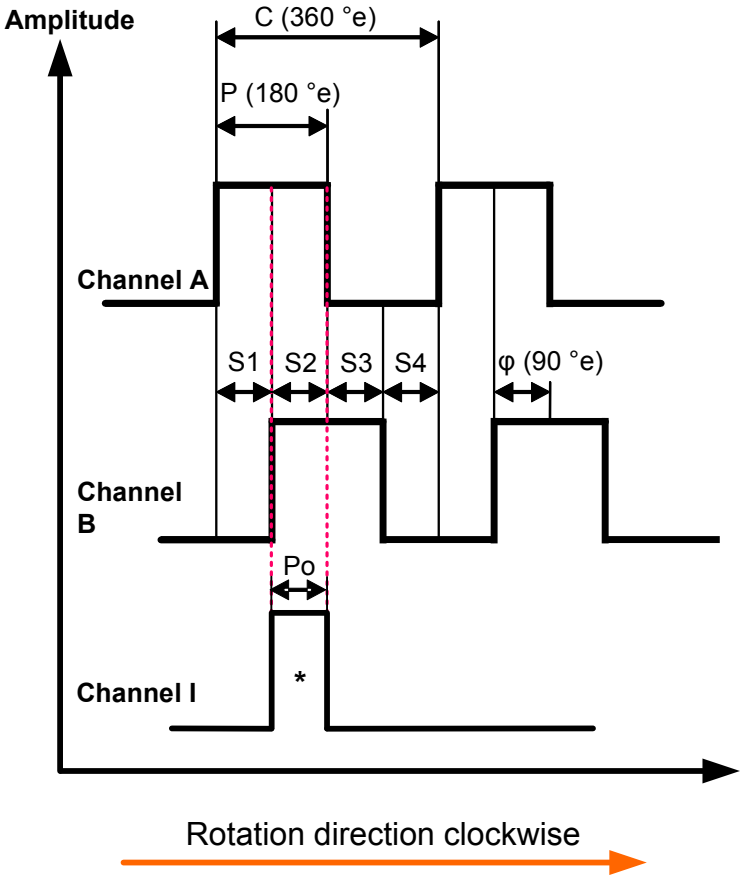
Electrical interface



with ABI
incremental signals

LS version (6 pin)

Connector Pin	Connector Signal	Cable Wire color
1	UB	red
2	GND	purple
3	NC	brown
4	Ch. I	yellow
5	Ch. A	orange
6	Ch. B	black



Definitions

Counts per Revolution (CPR):
The number of increments per revolution.

One Cycle (C):
360 electrical degrees (°e), one period of the signal.

Cycle Error (ΔC): The deviation in electrical degrees of the pulse width from its ideal value. It is an indication of cycle uniformity.

Pulse Width (P): The number of electrical degrees when an output is "HIGH" during one cycle, nominally 180 °e or half a cycle.

Pulse Width Error (ΔP): The deviation in electrical degrees of the pulse width from its ideal value of 180 °e.

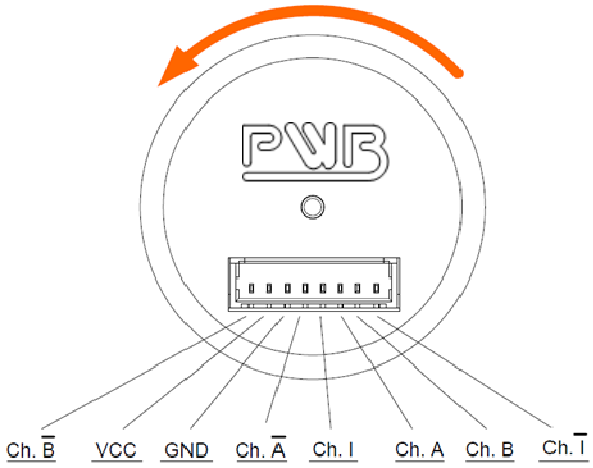
State Width (S): The number of electrical degrees between a transition in the output of channel A and the neighbouring transition in the output of channel B. There are 4 states per cycle, each nominally 90 °e (S1 – S4).

Phase (ϕ): The number of electrical degrees between the centre of the high state on channel A and the centre of the high state on channel B. This value is nominally 90 °e (the signals A and B can be used for quadrature).

Index pulse width (Po): The number of electrical degrees when the index is high during one full shaft revolution.

* Note: Index Channel I = Channel A & Channel B (Standard)
Other combinations are possible on customer request

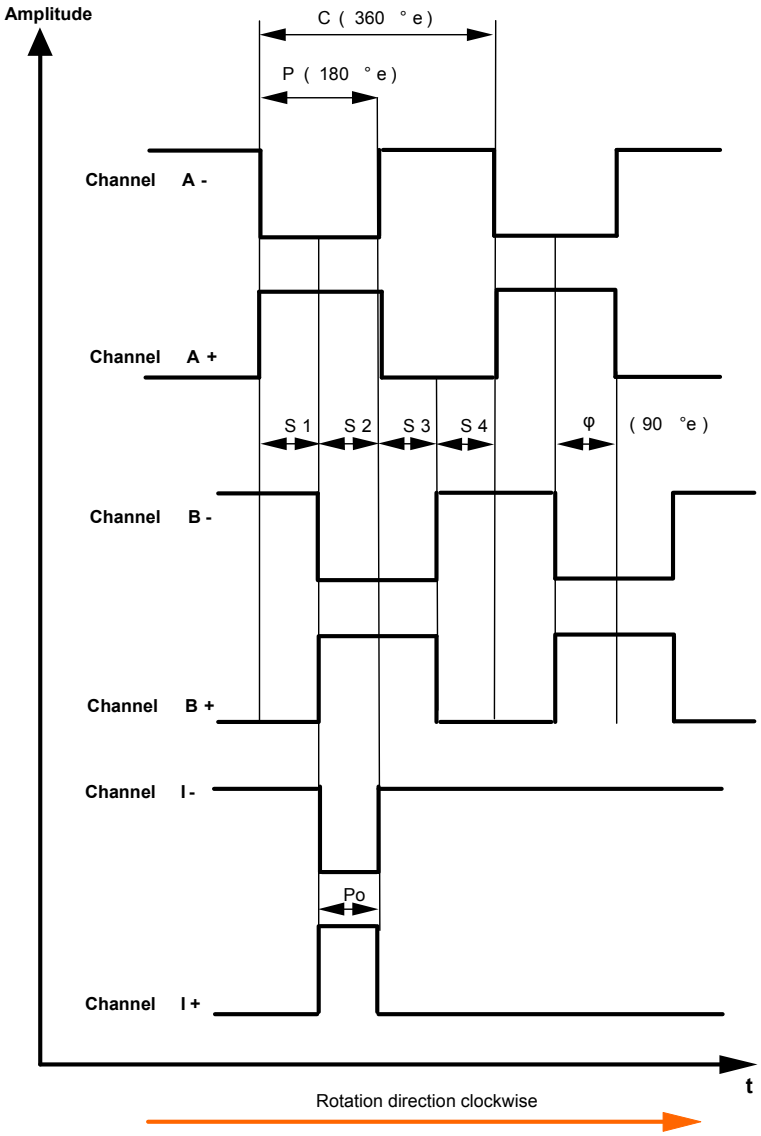
Electrical interface



with ABI
incremental signals

LD version (8 pin)

Connector Pin	Connector Signal	Cable Wire color
1	Ch. B-	red
2	UB	green
3	GND	blue
4	Ch. A-	purple
5	Ch. I+	brown
6	Ch. A+	yellow
7	Ch. B+	orange
8	Ch. I-	black



Definitions

Counts per Revolution (CPR):
The number of bar and window pairs or increments per revolution of the code wheel.

One Cycle (C):
360 electrical degrees (°e), one period of the signal, caused by one pair of bar and window.

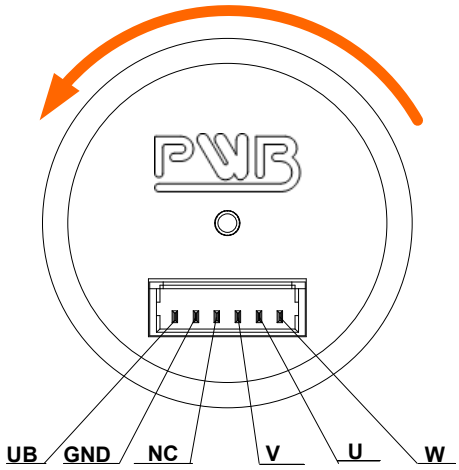
Pulse Width (P):
The number of electrical degrees that an output is high during one cycle. This value is nominally 180 °e.

State Width (S):
The number of electrical degrees between a transition in the output of channel A and the neighbouring transition in the output of channel B. There are 4 states per cycle, each nominally 90 °e.

Phase (φ):
The number of electrical degrees between the centre of the high state of channel A and the center of the high state of channel B. This value is nominally 90 °e.

Position Error (ΔQ):
The angular difference between the actual angular shaft position and the position indicated by the encoder cycle count.

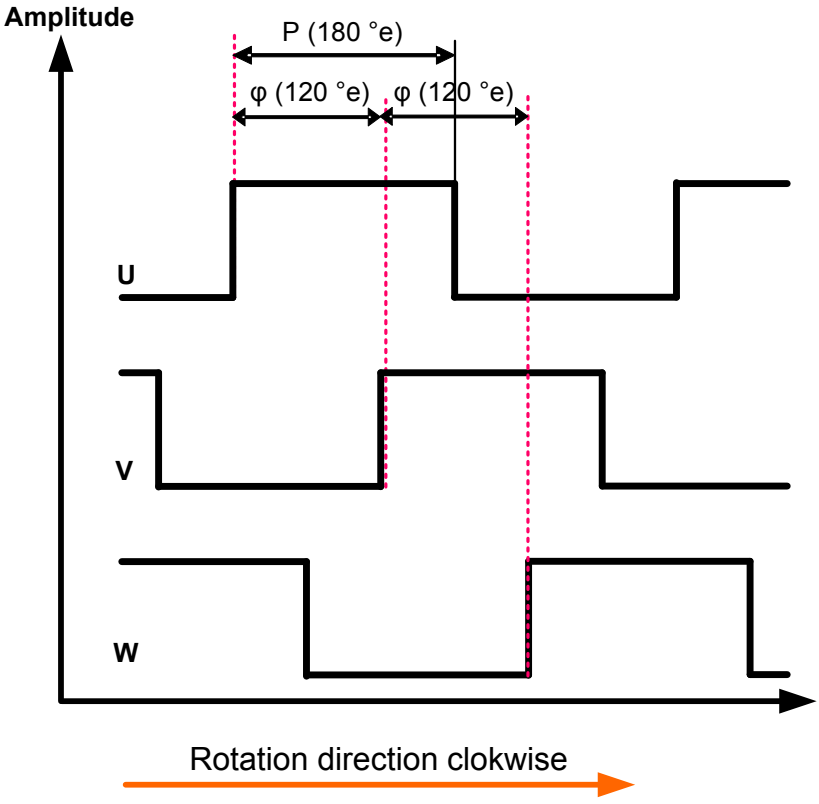
Electrical interface



with UVW
commutation signals

LS version (6 pin)

Connector Pin	Connector Signal	Cable Wire color
1	UB	red
2	GND	purple
3	NC	brown
4	V	yellow
5	U	orange
6	W	black



Definitions

Counts per Revolution (CPR):
The number of pole per revolution.

One Cycle (C):
360 electrical degrees (°e), one period of the signal.

Cycle Error (ΔC): The deviation in electrical degrees of the pulse width from its ideal value. It is an indication of cycle uniformity.

Pulse Width (P): The number of electrical degrees when an output is “HIGH” during one cycle, nominally 180 °e or half a cycle.

Pulse Width Error (ΔP): The deviation in electrical degrees of the pulse width from its ideal value of 180 °e.

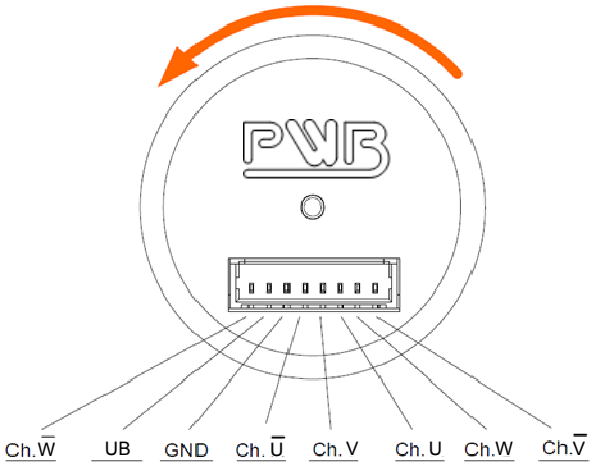
State Width (S): The number of electrical degrees between a transition in the output of channel U and the neighbouring transition in the output of channel V.

State Width Error (ΔS): The deviation in electrical degrees of each state width from its ideal value of 120 °e.

Phase (ϕ): The number of electrical degrees between the centre of the high state on channel U and the centre of the high state on channel V. This value is nominally 120 °e

Phase Error (Δϕ): The deviation in electrical degrees of the phase from its ideal value of 120 °e.

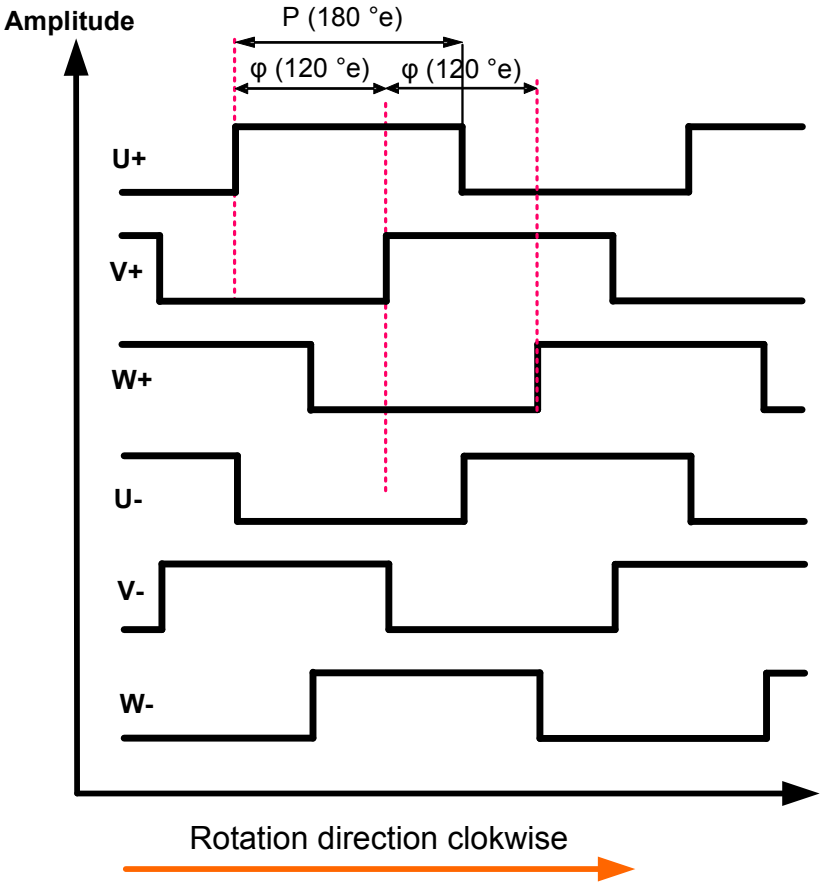
Electrical interface



LD version (8 pin)

Connector Pin	Connector Signal	Cable Wire color
1	Ch. W-	red
2	UB	green
3	GND	blue
4	Ch. U-	purple
5	Ch. V+	brown
6	Ch. U+	yellow
7	Ch. W+	orange
8	Ch. V-	black

with UVW
commutation signals



Definitions

Counts per Revolution (CPR):
The number of pole per revolution.

One Cycle (C):
360 electrical degrees (°e), one period of the signal.

Pulse Width (P): The number of electrical degrees when an output is “HIGH” during one cycle, nominally 180 °e or half a cycle.

State Width (S): The number of electrical degrees between a transition in the output of channel U and the neighbouring transition in the output of channel V.

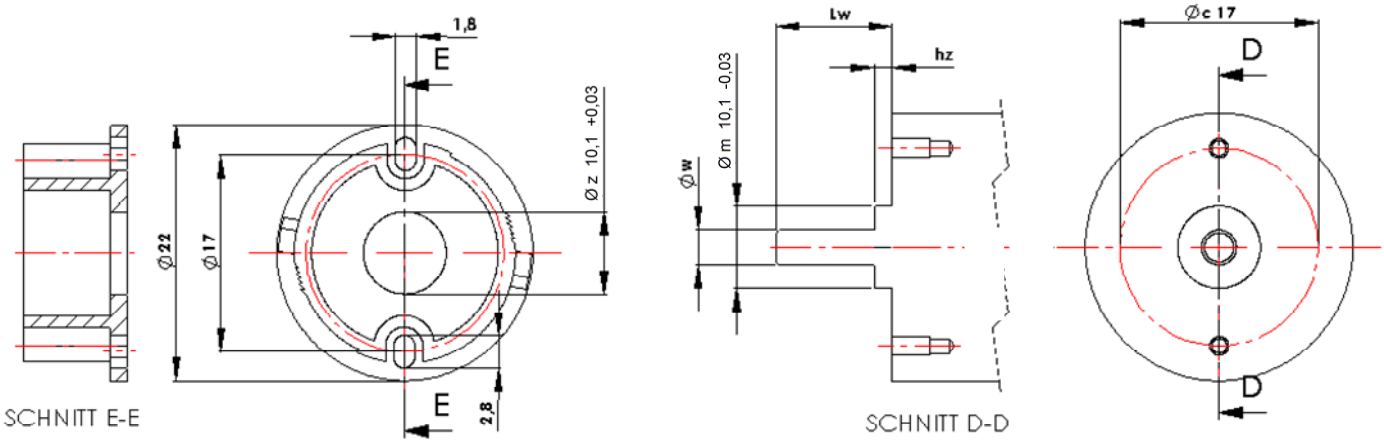
Phase (ϕ): The number of electrical degrees between the centre of the high state on channel U and the centre of the high state on channel V. This value is nominally 120 °e

Mechanical Notes

Parameter	Value	Tolerance	Unit
Outer dimensions	Ø 22.0 x 21.9	-	mm
Shaft diameter **Øw**	2.0 / 2.5 / 3.0 / 4.0 / 5.0 / 6.0 / 6.35 / 8.0	±0.01	mm
Required shaft length L_W	9.5	+1.5	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 **Øc**	17.0	±1.0	mm
Flange bore diameter diameter $Ø_Z$	10.1	+0.03	mm
Mounting boss diameter **Øm**	10.1	-0.03	mm
Max. mounting boss height h_Z	1.5	-0.1	mm
Mating connector (Molex)	contact 6/8 x 50079-8000 housing 1 x 51021-0600/0800	-	-
Total weight	8	-	g
Moment of inertia of the hub with the magnet	6.0	±1.0	gmm^2
Protection grade according to DIN 40500	IP50	-	-

Mounting considerations:

The MEM 22 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.



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Ordering information

Ordering code:

MEM 22 - X - X - XXXX - XX - X - S - XXX

Encoder Output	Number of Channels	Encoder Resolution	Supply Voltage	Motor Shaft Diameter	Operating Temperature	Output option
I : Inkremental	3 : 3 Channel	0001 : 1 cpr	05 : 5V_{DC}	B : 2,000 mm	S : -40 - +85°C	LF : connector 6p without cable
U : Commutation		0002 : 2 cpr	12 : 8-30V_{DC} *	C : 2,500 mm		LS : connector 6p + standard cable
		0003 : 3 cpr	24 : 8-30V_{DC}**	D : 3,000 mm		LD : connector 8p without cable
		0004 : 4 cpr		G : 4,000 mm		LDC: connector 8p + standard cable
		xxxx : n cpr		I : 5,000 mm		
		0125 : 125 cpr		J : 6,000 mm		
		0126 : 126 cpr		K : 6,350 mm		
		0127 : 127 cpr		L : 8,000 mm		
		0128 : 128 cpr				
		0256 : 256 cpr				
		0512 : 512 cpr				
		1024 : 1024 cpr				

Note:
* TTL output
** HTL output

Selectable and required accessories see page 12:
- cable 300 mm length (UL1061 / AWG28)
- centering and assembly gauge for different motor shafts
- adapter plates for different motors
- fastening screws DIN 84 M1.6x3 or M1.6x4

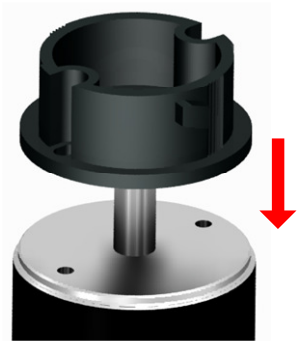
IMPORTANT NOTICE

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.

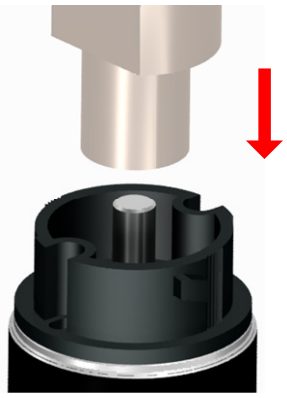
MEM 22 MOUNTING INSTRUCTION

1



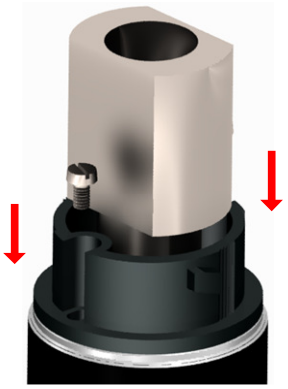
Set the base plate onto the motor

2



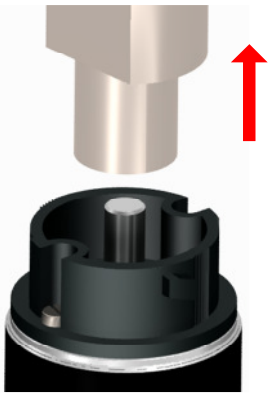
Align the base plate to the motor shaft by using the centering gauge

3



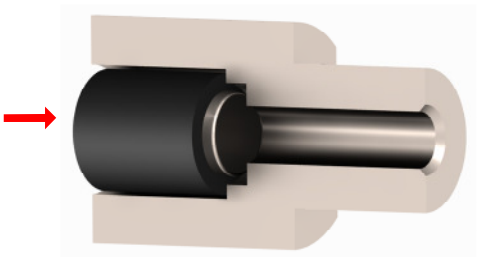
Afterwards fix the base plate to the motor flange using two screws

4



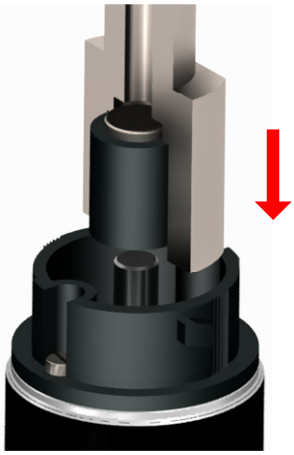
Remove the centering gauge

5



Set the hub with magnet into the centering gauge

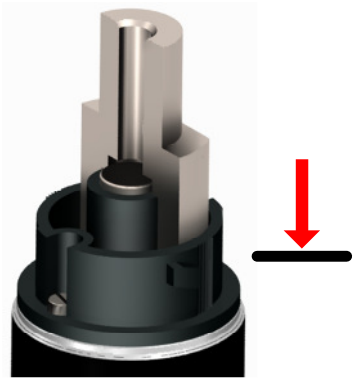
6



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

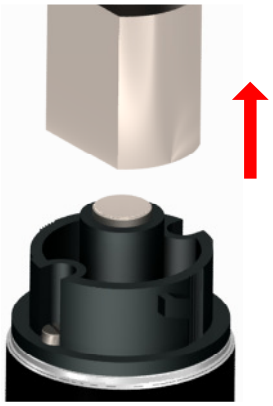
MEM 22 MOUNTING INSTRUCTION

7



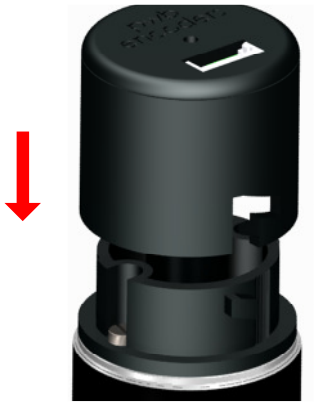
Press the centering gauge down to the final position

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

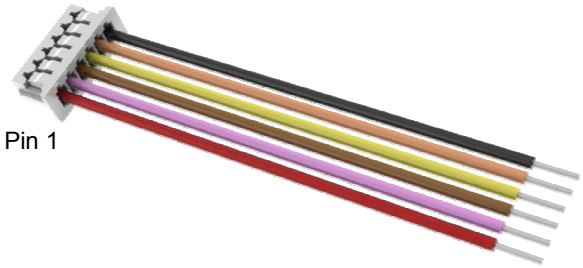
12

WARNING

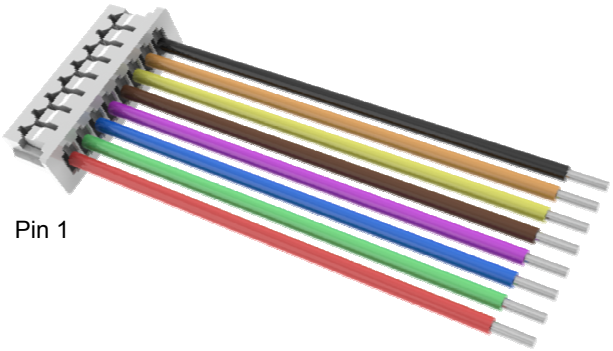
Do not rotate and pull out the encoder after assembly or when it is in operation.

ATTENTION! The encoder is so designed that it may be assembled only one time, otherwise the guarantee will be voided. Note: see IMPORTANT NOTICE (page 9)

Scope of delivery *



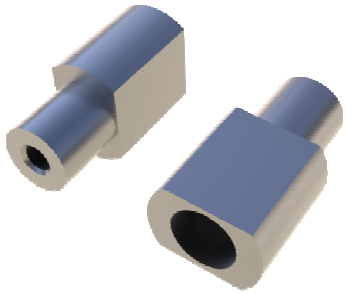
Standard cable length 300 mm
6 wires (LS version)
(UL 1061 / AWG 28)



Standard cable length 300 mm
8 wires (LD version)
(UL 1061 / AWG 26)

* Note: see ordering code LS / LD

Essential assembly tool



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

Available accessories

Customized adapter plate

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

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