

Absolute Encoder Multiturn



Features

- Resolution: Singleturn: up to 16,384 (**14 Bit**) steps per revolution
Multiturn: up to 16,777,216 (**24 Bit**) revolutions
- Interface: **SSI** (synchron serial interface) or
BiSS® (bidirectional serial synchron)
SPI (serial peripheral interface)
- Output: RS 422 transceiver
- Maximum shaft diameter: **6,35 mm**
- Rotation speed: up to **10.000 rpm**
- Preset (for zero position)
- Rotation direction selectable



SPI

Description

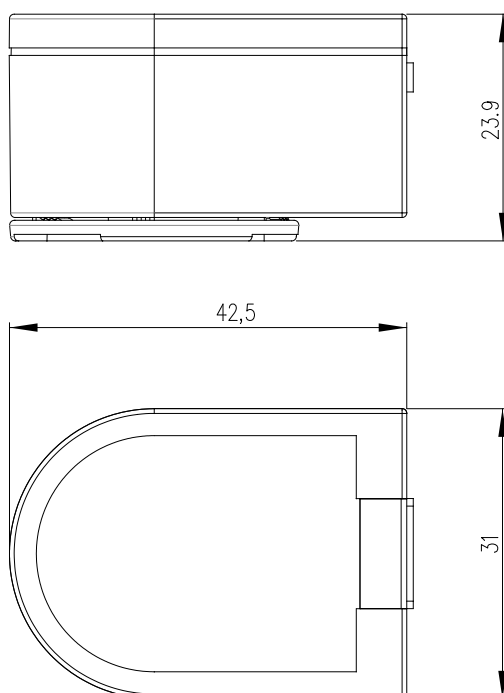
The AEM30 is an absolute magnetic multiturn encoder. It is a reliable low cost hollow shaft encoder which can be fixed quickly and easily onto different sizes of motor shafts. The encoder is developed for absolute positioning, for brushless motors of servo motors and steppers. The AEM30 is a real time system for high speed applications and rough environments.

The encoder is available with three different interfaces: SSI or BiSS ® or SPI. Power supply and signals are provided by a 8 pin Molex connector.

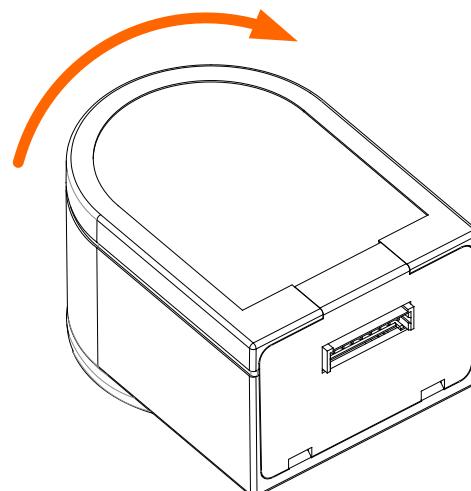
Main characteristics

- Absolute rotary encoder
- Magnetic sensing
- Multiturn by electronic gear
- Hollow shaft encoder
- High performance in compact size
- Robust plastic housing
- Quick and easy assembly
- Several shaft diameter options
- Operating temperature range -40 °C to +85 °C
- Compliant EU-directive 2011/65/EU (RoHS)

Dimensions



Rotation direction clockwise
(count up)



Recommended operating conditions

Typical values at 25 °C.

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	24.0	V_{DC}	
Supply current	I_{UB}	40	60	80	mA	no load
Reverse polarity protection	U_B	-36		0	V_{DC}	8-24V version
		-6		0	V_{DC}	5V version
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			10000	U/min	
Acceleration	α_{max}			160	$10^3 \circ/s^2$	
ESD voltage	U_{ESD}			2	kV	discharged over 1,5kΩ
SSI / BiSS / SPI						
Clock frequency	f	80		5000	kHz	
Scan ratio of T		40	50	60	%	
Monoflop time	t_m		20 + T/2		µs	adaptive Encoder Timeout
High level output voltage	V_{OH}	2.0	3.0	5.5	V_{DC}	$R_L = 120\Omega$
Low level output voltage	V_{OL}			0.8	V_{DC}	$R_L = 120\Omega$
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
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	-40	25	85	°C	optional 100°C
Storage temperature	T_S	-40		85	°C	
Humidity exposure				90	% RH	not condensing
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 characteristics and drawings

Parameter	Value	Tolerance	Unit
Dimensions	42.5 x 31.0 x 23.9 (refer to Page 2)		mm
Weight	37		g
Shaft diameters $\varnothing$	4.0 / 5.0 / 6.0 / 6.35 **	± 0.01	mm
Motor shaft length L	10.5 (see Fig.2 below)	+ 1.5	mm
Max. motor mounting boss diameter D	13.0 (see Fig.2 below)		mm
Max. motor mounting boss height H	2.0 (see Fig.2 below)		mm
Max. motor axial shaft play		± 0.2	mm
Max. motor shaft eccentricity + radial play	0.1		mm
Screws for fixing	2 X M3 (DIN 965) 3 X M2 (DIN 7985)		
Tightening torque of the screws	15	-5	Ncm
Flange print	Refer to Fig.3 below		
Protection class	IP50 (according to DIN 40500)*		

Note: * When the encoder is properly assembled

** Further shaft diameters on request

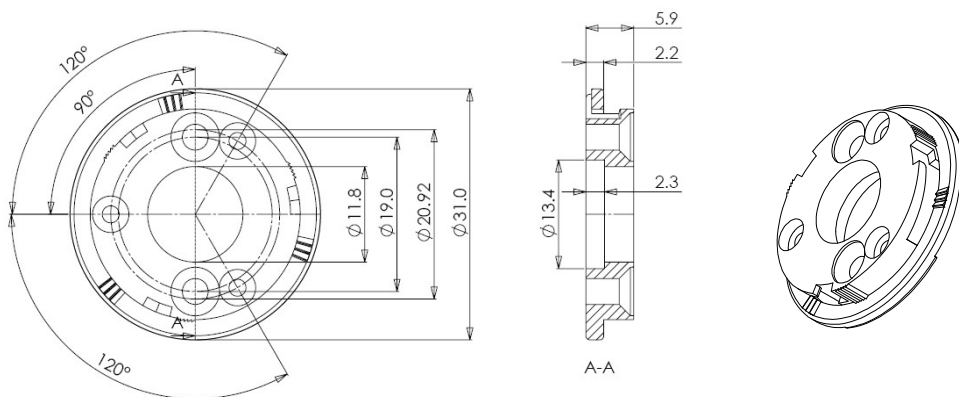


Fig. 1 Flange dimension

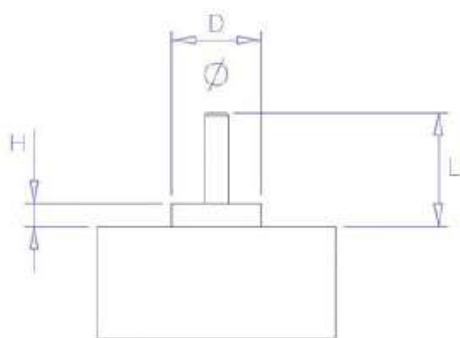


Fig. 2 Motor shaft tip

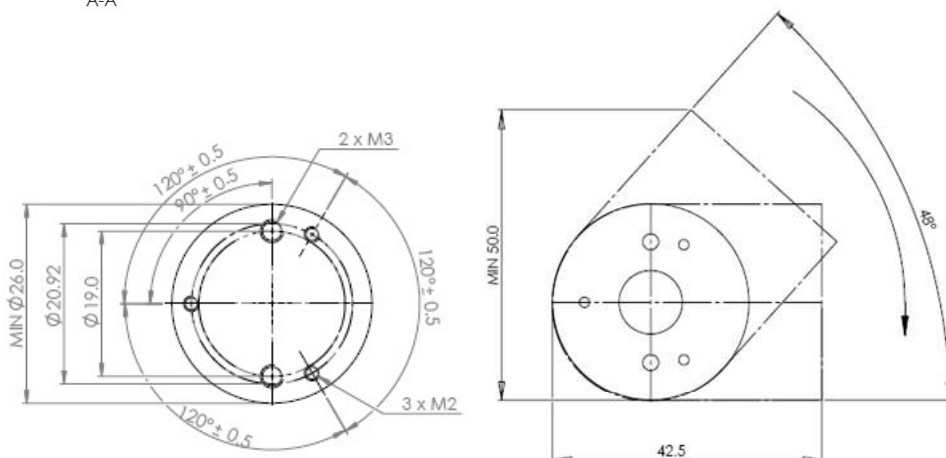
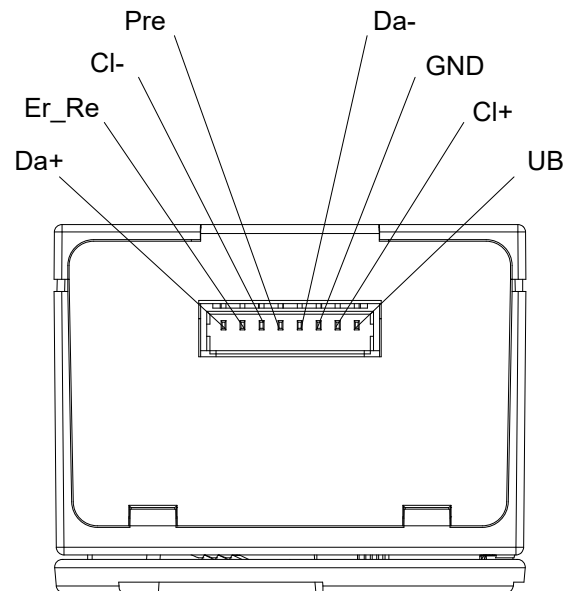


Fig. 3 Flange print

Pin out description SSI & BiSS

Pin	Output pin	Description	Wire colors (UL 1061)
1	UB	Power supply	red
2	Cl+	Clock +	green
3	GND	Ground	blue
4	Da-	Data -	purple
5	Pre	Preset	brown
6	Cl-	Clock -	yellow
7	Er_Re	Error Reset	orange
8	Da+	Data +	black



Encoder header connector: Molex 53048-0810

Description:

The encoder AEM30 is a kit system, consisting a magnetic hub and a housing unit including the PCB. After assembly by the customer (see page 9/10) and after power on, the encoder can indicate the error „magnet lost“. This is caused by missing the magnet during the shipment and the assembly.

For erasing the error, set the Pin „Error Reset“ high by a unique impulse (5VDC, $\geq 100\text{ms}$). Then reboot the encoder by interrupting the power supply.

Error Reset can also executed by command using BiSS interface

To reset the position data to zero, set the Pin „Preset“ high by a unique impulse (5VDC, $\geq 100\text{ms}$).

To suppress interferences in operation, set the Pin „Error Reset“ and „Preset“ to GND. Avoid an open wire on this both pins (influence like an antenna).

Preset and rotation direction are programmable by a BiSS command.

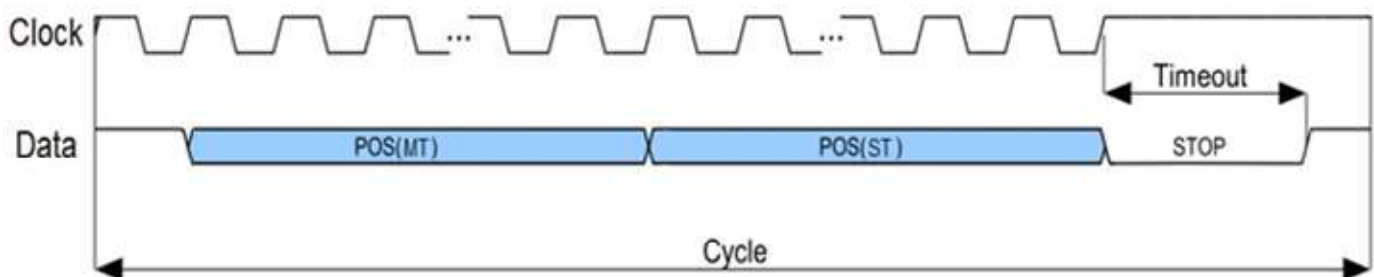
For communication with the AEM30, a USB converter box is available from PWB encoders. The software can be downloaded from the website. This can help for the first use and for visualization of the position data. It is not necessary for operation in the customer application with the customer control.

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

Interface:

Data transfer: SSI

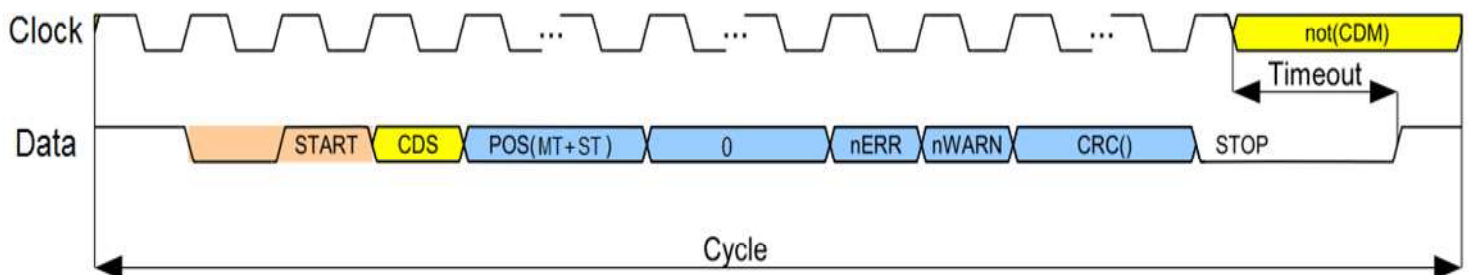
Gray-Code



The position data increases when the shaft rotates in the direction of clockwise

Data transfer: BiSS (C-Mode)

Binary-Code



0:

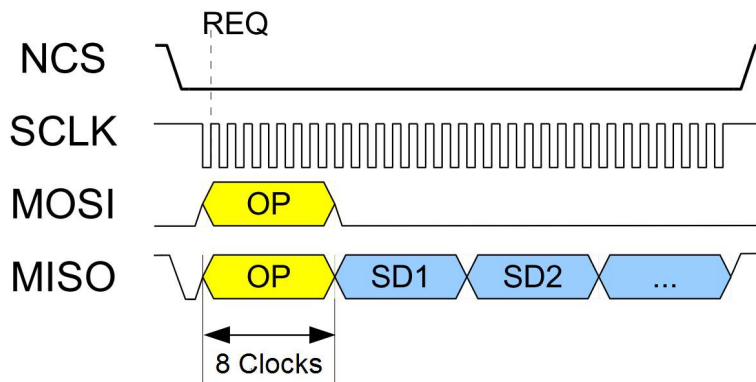
These are additional bits to refill the singleturn bit length to 12 bit or 16 bit. The number of Zero-bits is depended of the Ordering code (see below). The value of these bits is low.

Example:

Ordering code:	AEM30 - B 09 / 12 -	=>	... + 21 Position bits + 3 x 0 bits + ...
	AEM30 - B 10 / 12 -	=>	... + 22 Position bits + 2 x 0 bits + ...
	AEM30 - B 11 / 12 -	=>	... + 23 Position bits + 1 x 0 bits + ...
	AEM30 - B 12 / 12 -	=>	... + 24 Position bits + ...
	AEM30 - B 13 / 12 -	=>	... + 25 Position bits + 3 x 0 bits + ...
	AEM30 - B 14 / 12 -	=>	... + 26 Position bits + 2 x 0 bits + ...

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

Data transfer: SPI



Sensor Data Transmission

Pin out description SPI

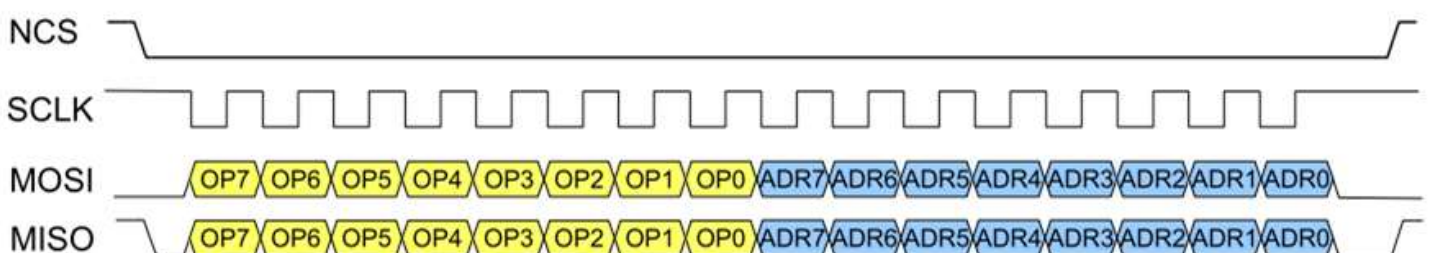
Pin	Output pin	Description	Wire colors (UL 1061)
1	UB	Power supply	red
2	SCLK	SPI Clock	green
3	GND	Ground	blue
4	MOSI	SPI MOSI	purple
5	Pre	Preset	brown
6	NCS	Select	yellow
7	Er_Re	Error Reset	orange
8	MISO	SPI MISO	black

OPCODE	
Code	Description
0xA6	Position Read
0x97	Register Read
0xAD	Read Register Status/Data

OPCODE Table

Reading Sensor Data: The AEM30 latches the absolute position on the first rising edge at SCLK, when NCS is zero. Because AEM30 can output the sensor data (SD) immediately, the master can transmit the SDAD Transmission command directly.

The sensor data in SPI are byte aligned. First comes 0-4 byte multiturn depending on the resolution, second are two bytes singleturn and at last one status byte including one error bit, one warning bit and six bits sign-of-life counter.



SPI Transmission

Ordering code:

AEM30 - X - XX / XX - XX - X - X - XX

Encoder Interface	Singleturn Resolution	Multiturn Resolution	Supply Voltage	Motor Shaft Diameter	Performance	Output option
S : SSI B : BiSS P : SPI	09 : 512 10 : 1,024 11 : 2,048 12 : 4,096 13 : 8,192 14 : 16,384 *	12 : 4,096 16 : 65,536 20 : 1,048,576 24 : 16,777,216	05 : 5V _{DC} 12 : 8-24V _{DC}	G : 4.00 mm I : 5.00 mm J : 6.00 mm K : 6.35 mm	S : Standard E : Extended **	LF : connector without cable LS : connector + standard cable

* 14Bit resolution only for BiSS Interface

** customer version

SSI only with gray code
BiSS only with binary code

Selectable and required accessories see page 11:

- standard cable 300 mm length (UL1061 / AWG26)
- centering and assembly gauge for different motor shafts
- adapter plates for different motors
- fastening screws 3pcs DIN 7985 M2 X 8
- fastening screws 2pcs DIN 965 M3 X 8

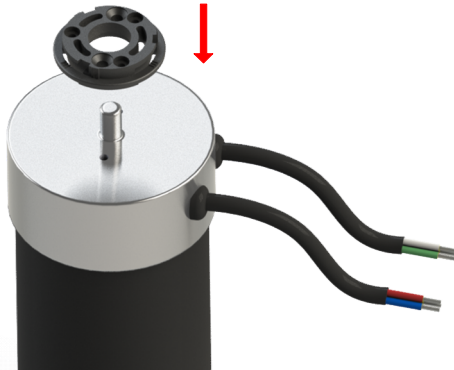
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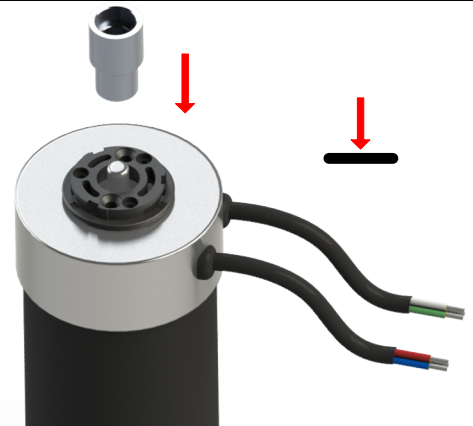
MOUNTING INSTRUCTION

1



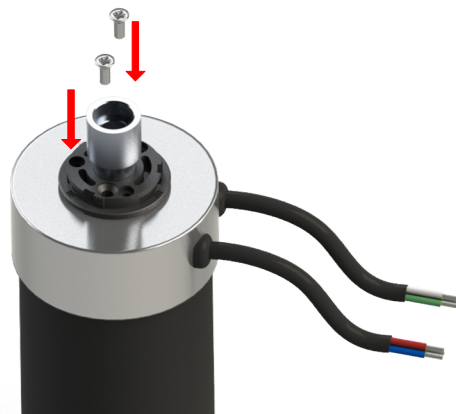
Put the base plate onto the motor

2



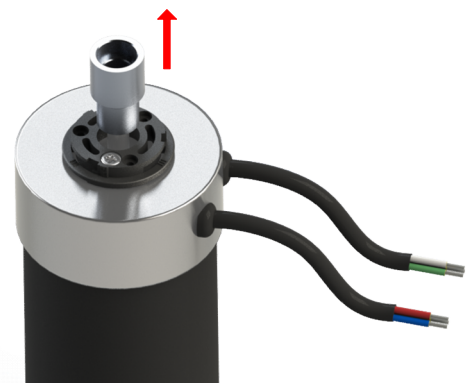
Align the base plate to the motor shaft
by using the centering gauge

3



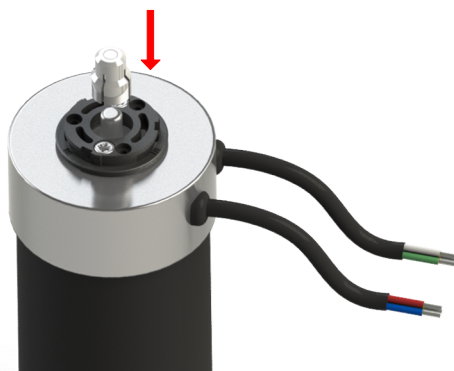
Afterwards fix the base plate to the motor flange with
two screws M3 or three screws M2

4



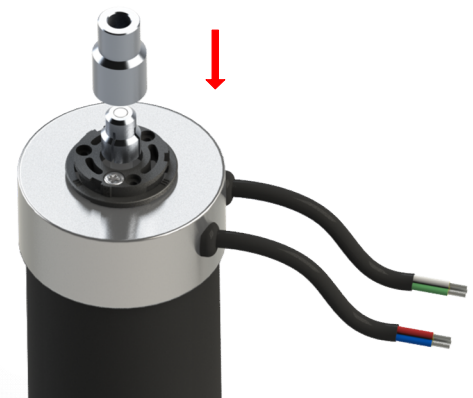
Remove the centering gauge

5



Push the hub a little bit onto the motor shaft

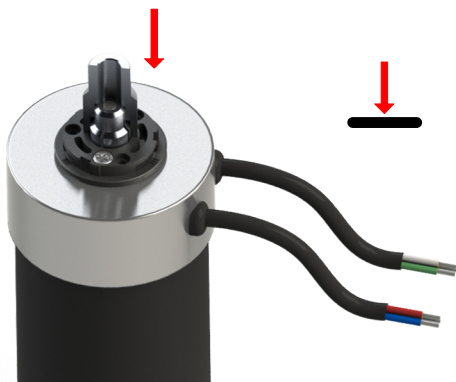
6



Press the hub onto the motor shaft
by using the centering gauge

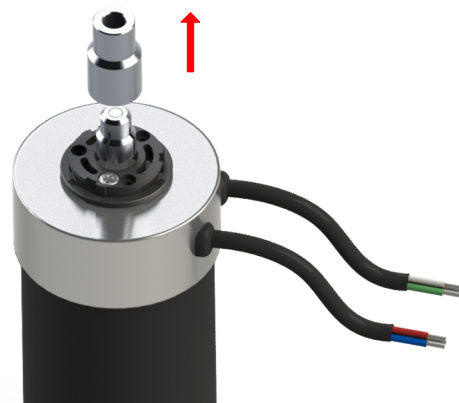
MOUNTING INSTRUCTION

7



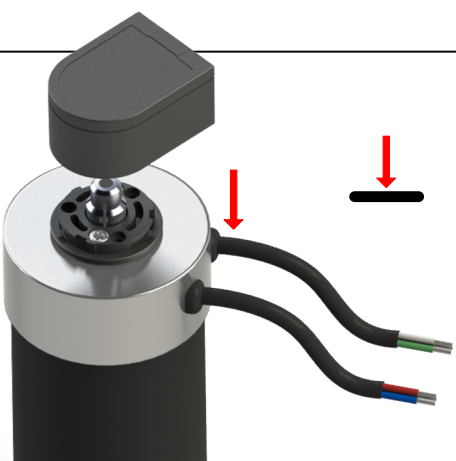
Press the centering gauge down to the final position

8



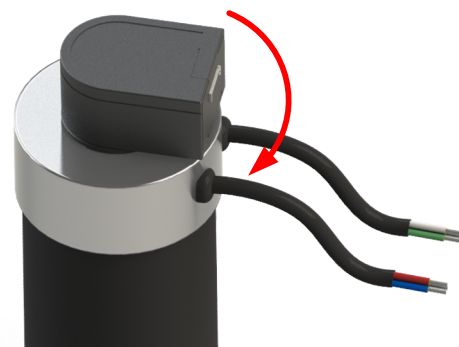
Remove the centering gauge

9



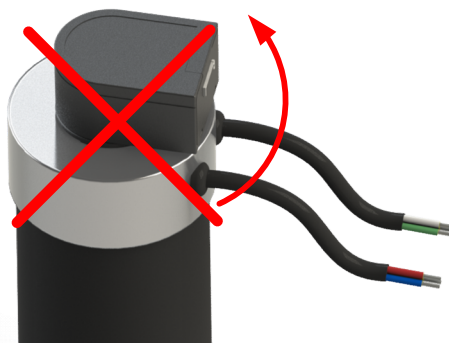
Put the encoder module on the base plate and push the encoder module until it will touch the base plate

10



When the encoder module had touched the flange, rotate the encoder module clockwise in the final position!

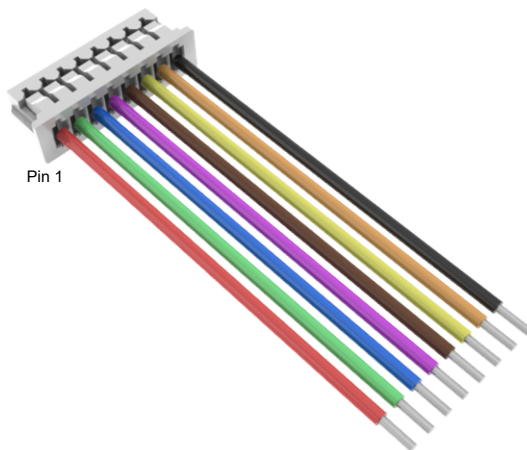
WARNING!!



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

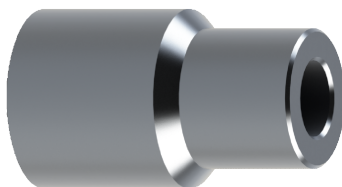
ATTENTION! The encoder is designed to be assembled only one time, otherwise the guarantee will be voided. Note: see IMPORTANT NOTICE (page 10)

Scope of delivery *



Cable 300 mm length UL1061 / AWG26
with female housing connector:
Molex 51021-0800 with 50079-8000 terminals

Essential assembly tool



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

Available accessories



Screws 3 pcs DIN 7985 M2 X 8



Screws 2 pcs DIN 965 M3 X 8

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.

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