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

SSI
BiSS INTERFACE
SPI

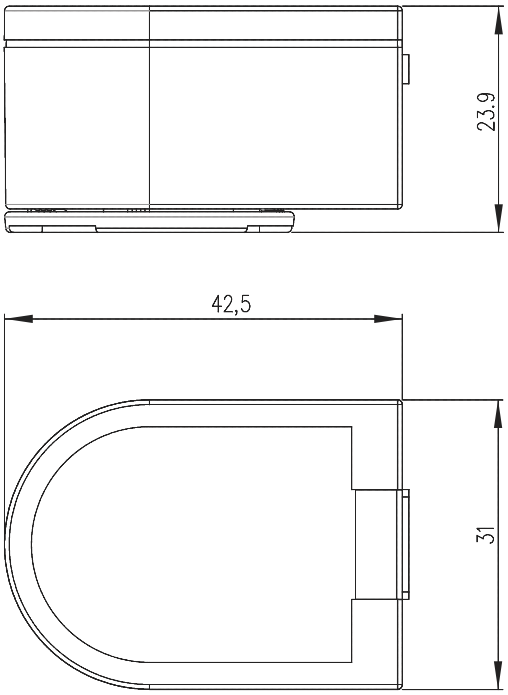
Description

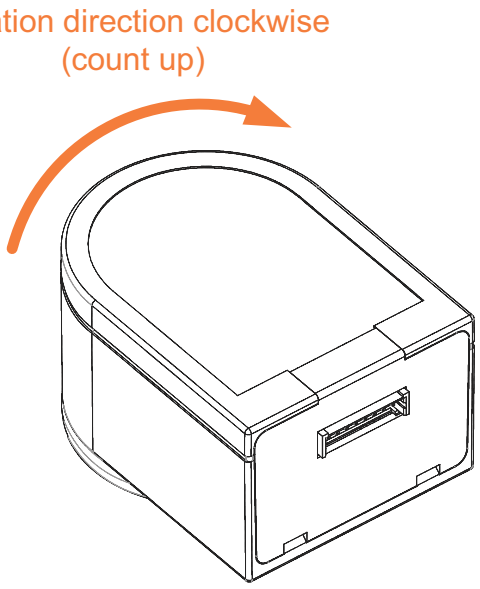
The AEM30 is an absolute magnetic multiturn encoder. It is a reliable low cost hollow shaft encoder which can be fixed quickly and easily onto different sizes of motor shafts.
The encoder is developed for absolute positioning, for brushless motors of servo motors and steppers. The AEM30 is a real time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





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}			40	$10^3°/s^2$	
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 = 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
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 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 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 ø	4.0 / 5.0 / 6.0 / 6.35 ** (see Fig.2 below)	± 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

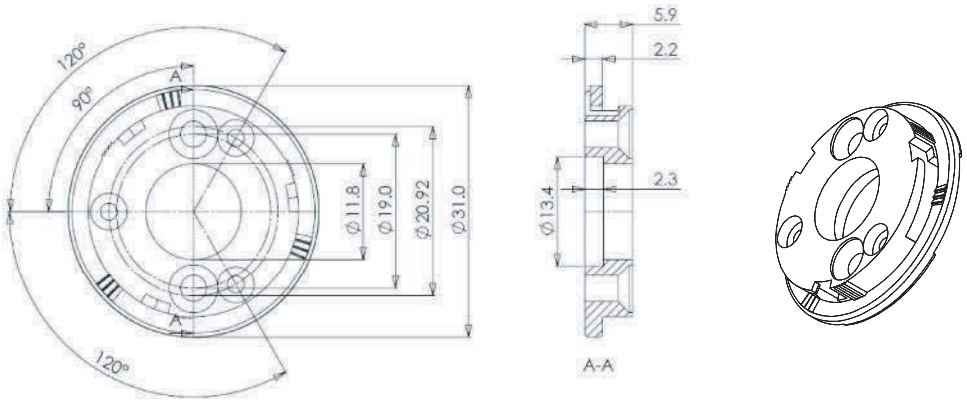


Fig. 1 Flange dimension

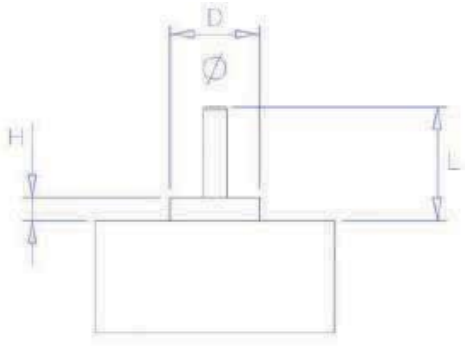


Fig. 2 Motor shaft tip

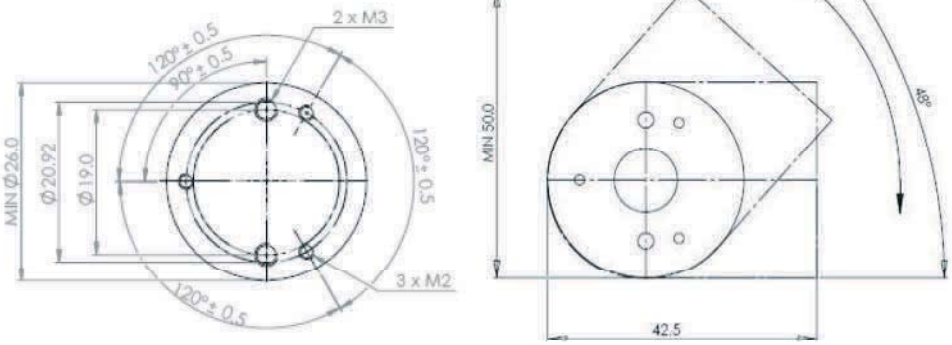
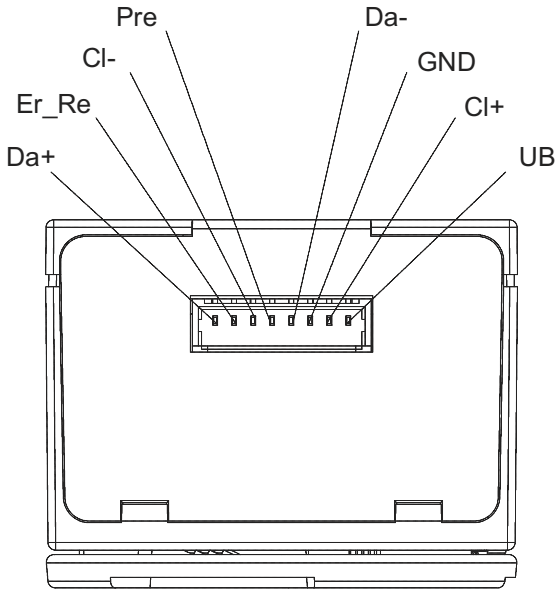


Fig. 3 Flange print

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, $\geq 100\text{ms}$).

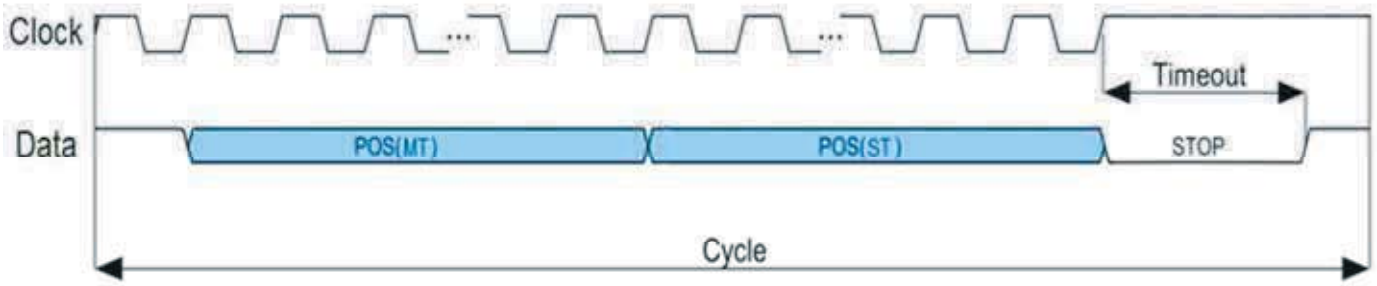
To suppress interferences in operation, set the Pin „Error Reset“ and „Preset“ to GND.
Avoid an open wire on this both pins (influence like an antenna).

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).

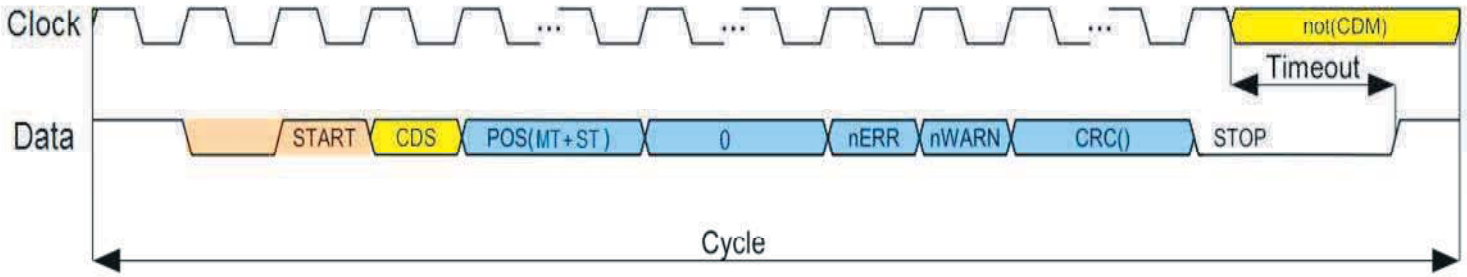
Interface:

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



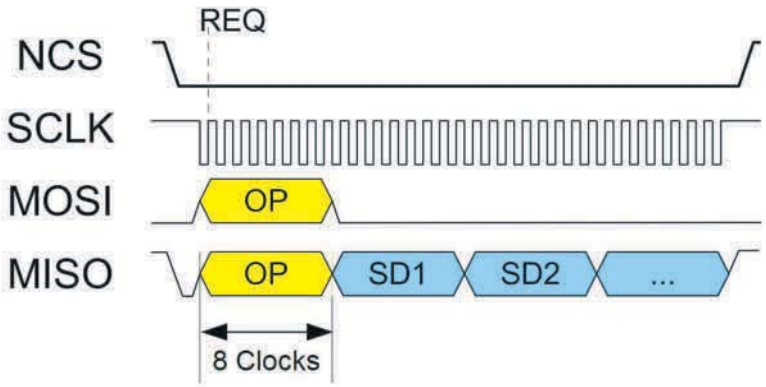
0:
These are additional bits to refill the singleturn bit length to 12 bit or 16 bit. The number of Zero-bits is depended of the Ordering code (see below). The value of these bits is low.

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

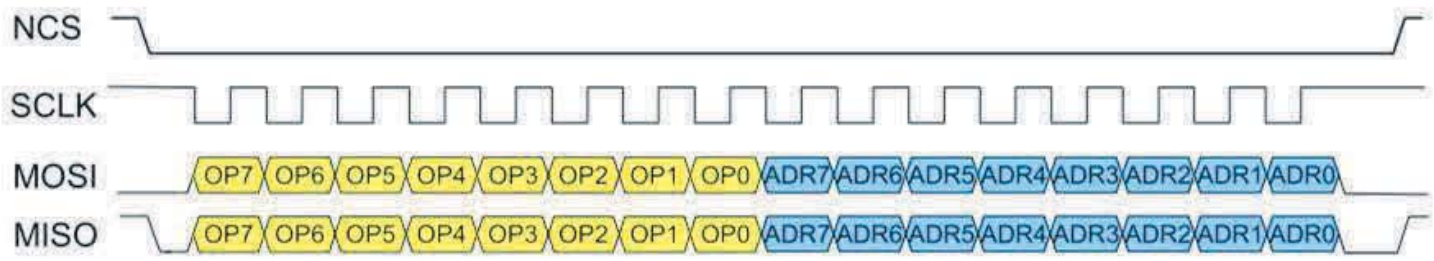
Pin out description SPI

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 MEM22 latches the absolute position on the first rising edge at SCLK, when NCS is at zero. Because MEM22 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