

## Description

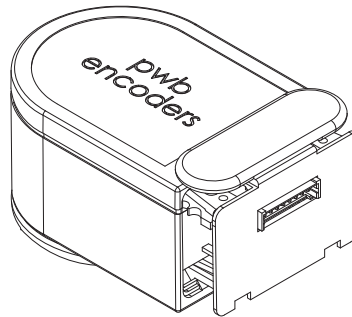
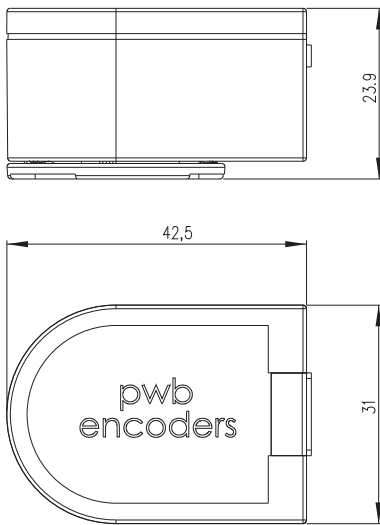
The AE30 is a reliable low cost optical hollow shaft encoder that can be fixed quickly and easily on different sizes of motor shafts.

The AE 30 encoder with RS 422 high speed differential line driver (Texas Instruments AM26C31) provides up to three differential output signals  $A / \bar{A}$  ;  $B / \bar{B}$  (in quadrature 90 degrees phase shifted) and one optional index channel  $I / \bar{I}$  (one pulse per revolution).

The resolution of the encoder is determined by the number of counts per revolution (CPR).

Power supply and signals are provided by an 8 pin Molex connector.

## Dimensions



Encoder Resolution (CPR)
100
200
256
360
400
500
512
1000
1024

## Main characteristics

- Hollow shaft encoder
- High performance in compact size
- Robust plastic housing
- Quick and easy assembly
- Resolutions up to 1024 counts per revolution (CPR)
- Up to 100 kHz output frequency
- Two channel differential line driver output ( $A$  ,  $\bar{A}$  /  $B$  ,  $\bar{B}$ )
- Three channel differential line driver output ( $A$  ,  $\bar{A}$  /  $B$  ,  $\bar{B}$  /  $I$  ,  $\bar{I}$ )
- Max. 20 mA output drive capability
- Operating temperature range  $-40\text{ }^{\circ}\text{C}$  to  $+100\text{ }^{\circ}\text{C}$
- Several shaft diameter options
- No signal adjustment required
- Compliant EU-directive 2002/95/EG (RoHS)

Motor shaft $\varnothing$ Diameter (mm)
A = 1.800
B = 2.000
C = 2.500
D = 3.000
E = 3.175 (1/8")
F = 3.969 (5/32")
G = 4.000
H = 4.763 (3/16")
I = 5.000
J = 6.000
K = 6.350 (1/4")
L = 8.000

## Applications

- For high volume applications like factory and office automation
- Consumer electronics, white goods, automatic handlers, doors and windows controls

## **Absolute maximum ratings**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Storage temperature <sup>M1</sup>	T <sub>S</sub>	-40		100	°C	
Storage temperature <sup>M2</sup>	T <sub>S</sub>	-40		85	°C	
Supply voltage	V <sub>cc</sub>	-0.5		to 7.0	V <sub>DC</sub>	
Output voltage	V <sub>out</sub>	-0.5		to V <sub>cc</sub>	V	
Output current	I <sub>out</sub>			± 20	mA	per Channel

## **Recommended operating conditions**

Encoding characteristics over recommended operating range and recommended mounting tolerances unless otherwise specified.

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Operating temperature <sup>M1</sup>	T <sub>A</sub>	-40		100	°C	
Operating temperature <sup>M2</sup>	T <sub>A</sub>	-40		85	°C	
Supply voltage	V <sub>cc</sub>	4.5	5.0	5.5	V <sub>DC</sub>	Ripple < 100 mV <sub>p-p</sub>
Supply current	I <sub>cc</sub>			110	mA	No load
Load capacitance	C <sub>L</sub>			100	pF	
Count frequency	f			100	kHz	rpm x N / 60 x 10 <sup>-3</sup>

### **Note:**

M1/M2: see ordering codes

The encoder performance is guaranteed up to 100 kHz, higher frequencies are allowed (for details please contact our customer support )

## **Electrical characteristics**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
High Level Output Voltage	V <sub>oH</sub>	2.4			V	I <sub>oH</sub> : - 20mA
High Level Output Current	I <sub>oH</sub>			-20	mA	
Low Level Output Voltage	V <sub>oL</sub>			0.4	V	I <sub>oL</sub> : 20mA
Low Level Output Current	I <sub>oL</sub>			20	mA	
Rise Time	t <sub>r</sub>		120		ns	R <sub>L</sub> : 100 Ω
Fall Time	t <sub>f</sub>		50		ns	C <sub>L</sub> : 15 pF

**Note:** Ch. A & Ch B. quadrature output + Ch. I index output

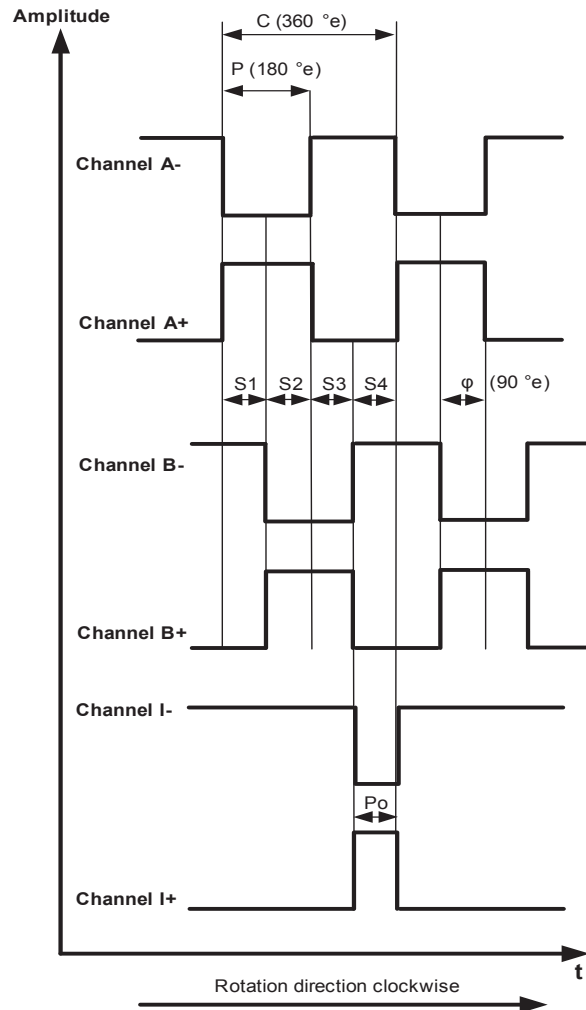
**ESD Warning: Normal handling precautions should be taken to avoid static discharge damage to the sensor.**

## Encoder characteristic

Encoding characteristics over recommended operating range and recommended mounting tolerances unless otherwise specified.

	Parameter	Symbol	Min.	Typ.	Max.	Unit
2 channel + index <sup>M1</sup>	Pulse width error	$\Delta P$		$\pm 7$	$\pm 30$	$^{\circ}e$
	State width error	$\Delta S$		$\pm 5$	$\pm 30$	$^{\circ}e$
	Phase error	$\Delta\Phi$		$\pm 2$	$\pm 15$	$^{\circ}e$
	Index pulse width	$P_0$	60	90	120	$^{\circ}e$
2 channel <sup>M2</sup>	Pulse width error	$\Delta P$		$\pm 7$	$\pm 45$	$^{\circ}e$
	State width error	$\Delta S$		$\pm 5$	$\pm 45$	$^{\circ}e$
	Phase error	$\Delta\Phi$		$\pm 2$	$\pm 20$	$^{\circ}e$

Note: M1/M2: see ordering codes



### Definitions

**Count (N):** The number of bar and window pairs or increments per revolution (CPR) of the code wheel.

**One Cycle C:** One period of the signal, related to 1 bar and 1 window. It is measured in electrical degrees, one cycle is 360 electrical degrees ( $^{\circ}e$ ).

**Cycle Error ( $\Delta C$ ):** 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  $^{\circ}e$  or half a cycle.

**Pulse Width Error ( $\Delta P$ ):** The deviation in electrical degrees of the pulse width from its ideal value of 180  $^{\circ}e$ .

**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  $^{\circ}e$  (S1 – S4).

**State Width Error ( $\Delta S$ ):** The deviation in electrical degrees of each state width from its ideal value of 90  $^{\circ}e$ .

**Phase ( $\phi$ ):** 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  $^{\circ}e$  (the signals A and B can be used for quadrature).

**Phase Error ( $\Delta\phi$ ):** The deviation in electrical degrees of the phase from its ideal value of 90  $^{\circ}e$ .

**Index pulse width ( $P_0$ ):** The number of electrical degrees when the index is high during one full shaft revolution.

## Connector output

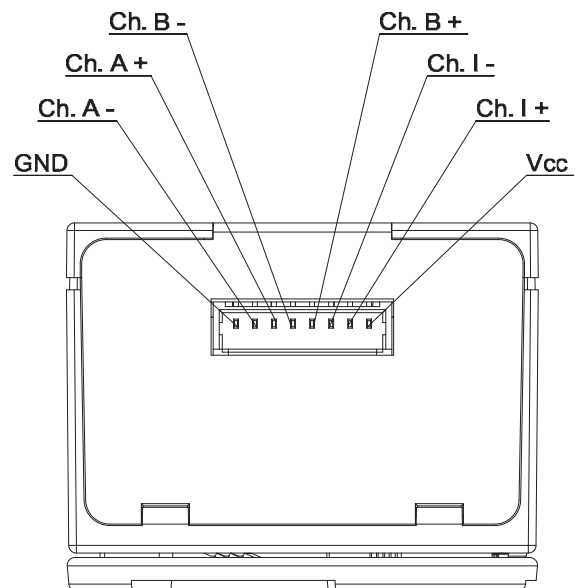
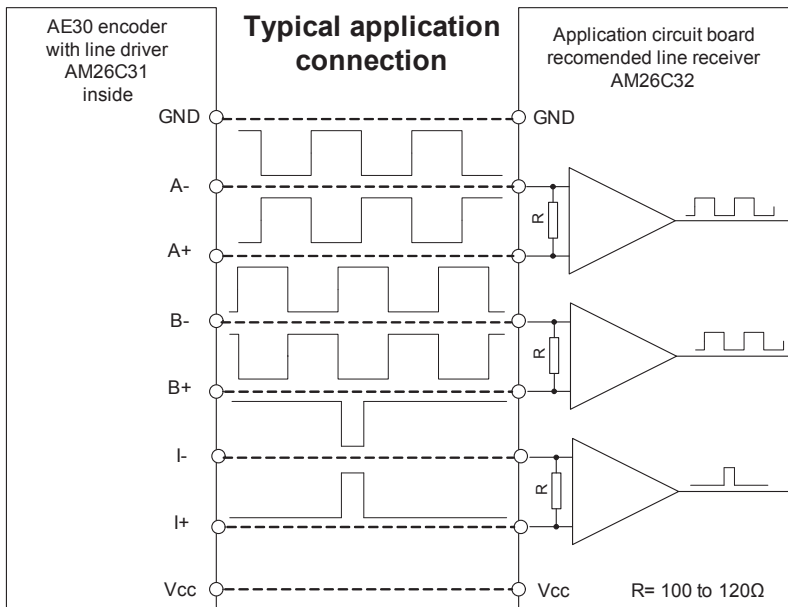
Encoder header connector: Wennmacher CX-W125R-8-DIP <sup>M1</sup>  
Molex 53048-0810 <sup>M2</sup>

Housing connector: Wennmacher CX-H-125-8 with CX-T125F terminals <sup>M1</sup>  
Molex 51021-0800 with 50079-8000 terminals <sup>M2</sup>

## Pin-out description

Pin	Output pin	Description	Wire colors (UL 10002) <sup>M1</sup>	Wire colors (UL 1061) <sup>M2</sup>
1	Vcc	Power supply	red	red
2	I +	Index I+	green	green
3	I -	Index I-	blue	blue
4	B +	Channel B+	purple	purple
5	B -	Channel B -	brown	brown
6	A +	Channel A+	yellow	yellow
7	A -	Channel A -	white	orange
8	GND	Ground	black	black

Note: M1/M2: see ordering codes & cable accessories



## Mechanical characteristics and drawings

Parameter	Value	Tolerance	Unit
Dimensions	42.5 x 31.0 x 23.9 (refer to Page 2)		mm
Weight	17		g
Shaft diameters $\phi$	1.8 / 2.0 / 2.3 / 2.5 / 3.0 / 3.175 / 3.969 / 4.0 / 4.763 / 5.0 / 6.0 / 6.35 / 8.0 (see Fig.2 below)	$\pm 0.01$	mm
Motor shaft length protrusion <b>L</b>	9.5 (see Fig.2 below)	+ 1.5	mm
Max. motor mounting boss diameter <b>D</b>	13.0 (see Fig.2 below)		mm
Max. motor mounting boss height <b>H</b>	2.0 (see Fig.2 below)		mm
Max. motor axial shaft play		$\pm 0.25$	mm
Max. motor shaft eccentricity + radial play	0.05 (eccentricity decreases signal performances)		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 grade	IP50 (according to DIN 40500)*		
Plastic material	PBT, 17% glass fibre reinforced UL 94 V-0		

Note: \* When the encoder is properly assembled

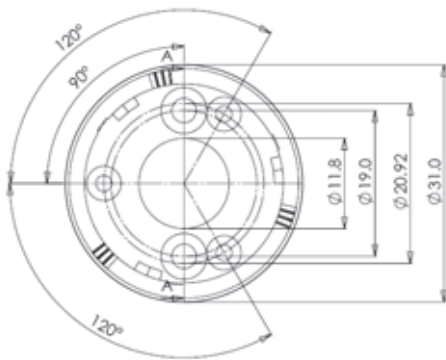


Fig. 1 Flange dimension

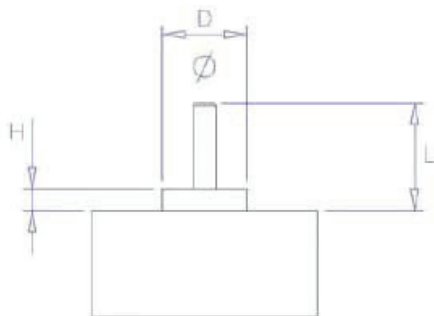
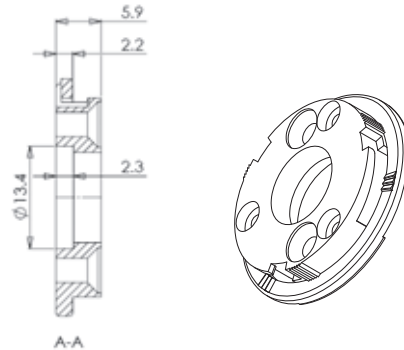


Fig. 2 Motor shaft tip

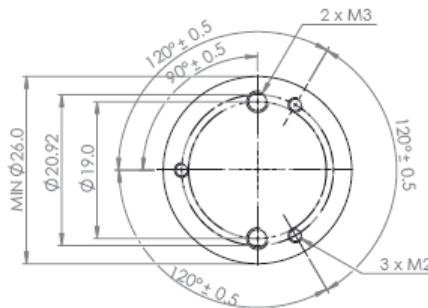
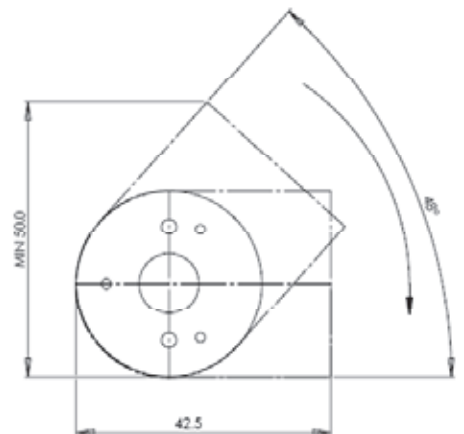


Fig. 3 Flange print



## AE30 MOUNTING INSTRUCTION

1



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

2



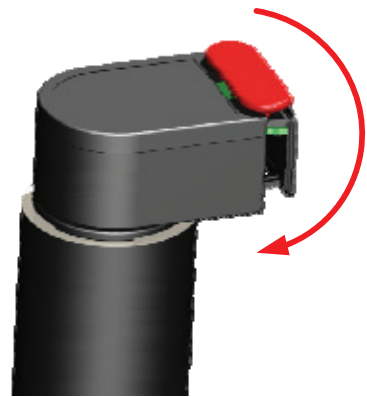
Afterwards fix the base plate to the motor flange using two screws (M3) or three screws (M2)

3



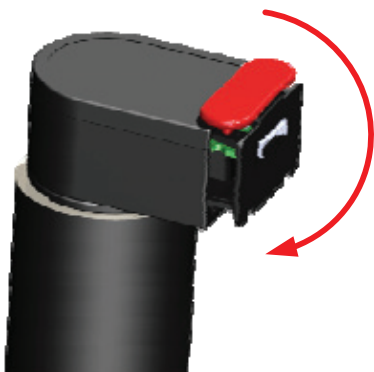
Align the hole of the hub to the motor shaft and push the encoder until it will touch the flange

4



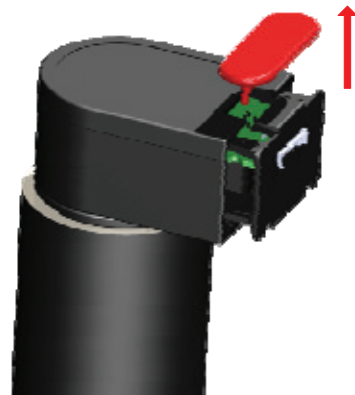
When the encoder fits totally onto the flange, start to rotate the encoder clockwise.....

5



..... until a stop point is reached

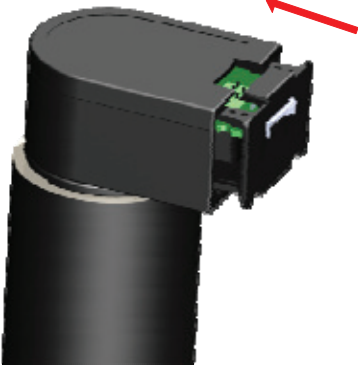
6



After assembling the encoder on the flange, remove the stopper.

## AE30 MOUNTING INSTRUCTION

7



Push the wall into the housing into its final position.

8



Now the encoder is ready for use.

### **WARNING**



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



**Do not pull out the wall after assembly or when it is in operation.**

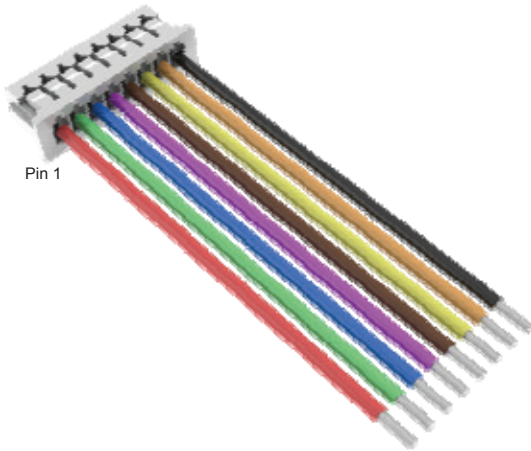
### **ATTENTION!**

The encoder is designed to be assembled only one time, otherwise the guarantee will be voided.

Note: see IMPORTANT NOTICE (page 12)

## Available accessories

### Standard cable

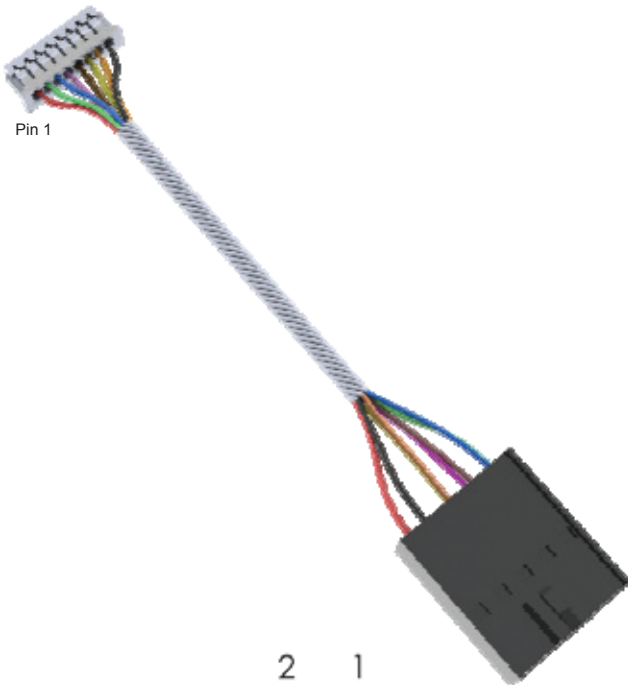


Cable 300 mm length UL 10002 / AWG28 <sup>M1</sup>  
with female housing connector:  
Wennmacher CX-H-125-8 with CX-T125F terminals

Cable 300 mm length UL1061 / AWG26 <sup>M2</sup>  
with female housing connector:  
Molex 51021-0800 with 50079-8000 terminals

**Note: M1/M2: see ordering codes**

### Adapter cable



Twisted adapter cable 500 mm length UL10002 / AWG28 <sup>M1</sup>  
with female housing connector:  
8-pin Wennmacher connector  
(Wennmacher CX-H-125-8 Housing with CX-T125F terminals)  
to a 10-pin Molex connector  
(Molex 90142-0010 Housing with 90119-2121 terminals)

Twisted adapter cable 500 mm length UL1061 / AWG26 <sup>M2</sup>  
with female housing connector:  
8-pin Molex connector  
(Molex 51021-0800 with 50079-8000 terminals)  
to a 10-pin Molex connector  
(Molex 90142-0010 Housing with 90119-2121 terminals)

**Note: M1/M2: see ordering codes**

### Pin-out description 10 pin connector side

Pin	Output pin	Description	Colors
1	N.C.	Not connected	
2	Vcc	Power supply	red
3	GND	Ground	black
4	N.C.	Not connected	
5	A -	Channel A-	orange / white *
6	A +	Channel A+	yellow
7	B -	Channel B-	brown
8	B +	Channel B+	purple
9	I-	Index I-	blue
10	I+	Index I+	green



Connector front view

Note: only for M1 version



**Available accessories**



Customized adapter plate



Centering gauge for different motor shafts



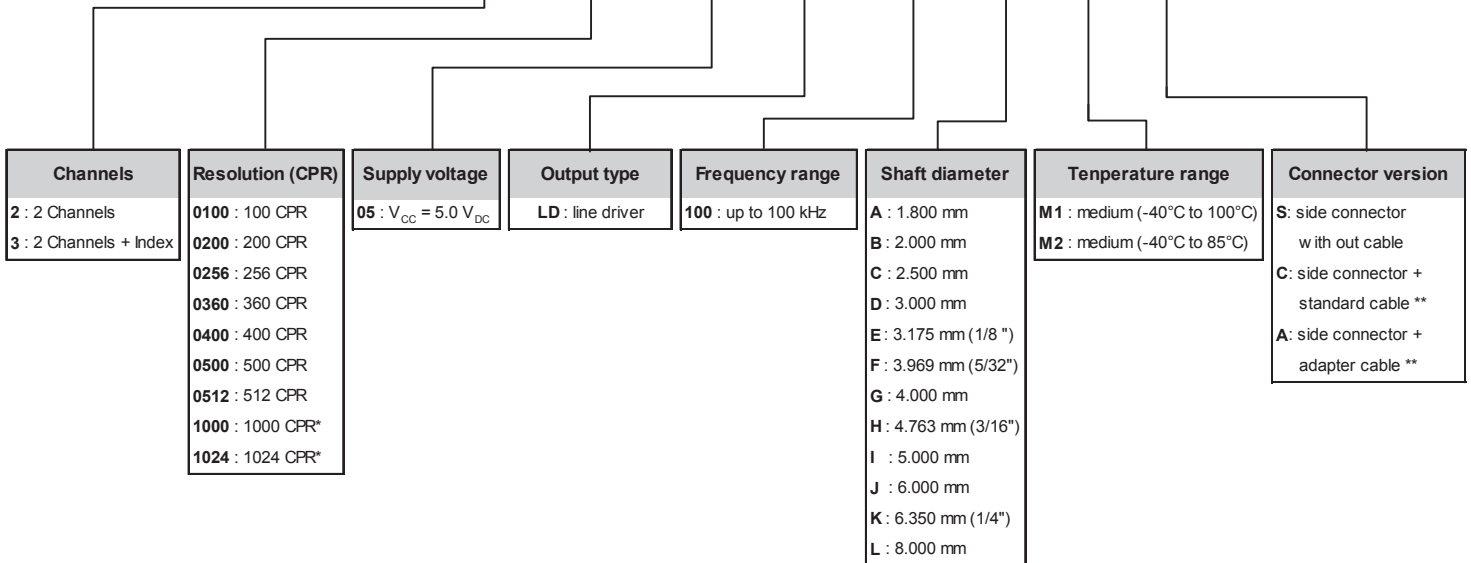
Screws 3 pcs DIN 7985 M2 X 8



Screws 2 pcs DIN 965 M3 X 8

## Ordering codes

**AE30 - X - XXXX - XX - XX - XXX - X - XX - X**



Note:

\* only as 2-channel version available

\*\* see page 9

Available accessories (no parts of standard delivery):

- standard cable 300 mm length
- adapter cable 500 mm length
- adapter plates for different motors
- centering gauge for different motor shafts (highly recommended for correct assembly)
- fastening screws 3pcs DIN 7985 M2 X 8
- fastening screws 2pcs DIN 965 M3 X 8

### **PWB encoders GmbH RESTRICTED**

**THIS DOCUMENT AND ANY ASSOCIATED DATA CONTAIN RESTRICTED INFORMATION THAT IS PROPERTY OF PWB encoders GmbH AND MAY NOT BE DISCLOSED OR DUPLICATED FOR OTHERS EXCEPT AS AUTHORIZED BY PWB**

**INFORMATION CONTAINED IN THIS PUBLICATION MAY BE SUPERSEDED BY UPDATES. IT IS YOUR RESPONSIBILITY TO ENSURE THAT YOUR APPLICATION MEETS WITH YOUR SPECIFICATIONS.**

### 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.