Automotive
Energy & Power Analysis
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DEWE-CA-Angle-Sensor 0.2

Technical Reference Manual

ISO9001

... the precision signal conditioning company

worldwide
DEWETRON
www.dewetron.com

CA-Angle-Sensor

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Printing History

Please refer to the page bottom for printing version.

Safety symbols in the manual

Indicates hazardous voltages.

WARNING	*Calls attention to a procedure, practice, or condition that could cause bodily injury or death.*
CAUTION	*Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.*

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. DEWETRON Elektronische Messgeraete Ges.m.b.H. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as option and will not be shipped as standard parts.

CA-Angle-Sensor 0.2

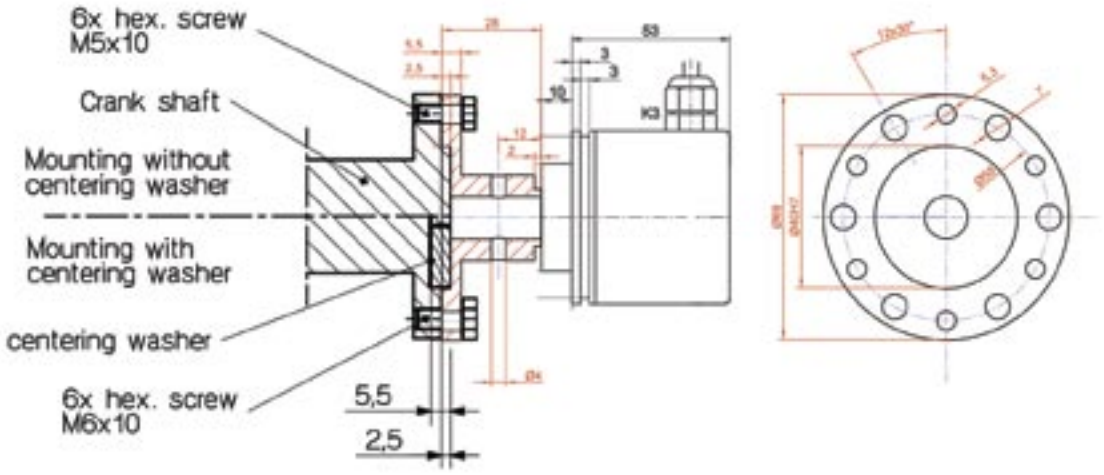
The CA-angle-sensor is an angle encoder. It has an optical encoder system, which provides highest accuracy and long lifetime.

The CA-angle-sensor generates trigger and crank angle signals within a speed of up to 8000 rpm at crank shaft temperatures of -20 °C to +80 °C and vibrations of up to 50 m/s². It delivers the angle position with an accuracy of 0.2 °CA.

Installation of the CA-angle-sensor

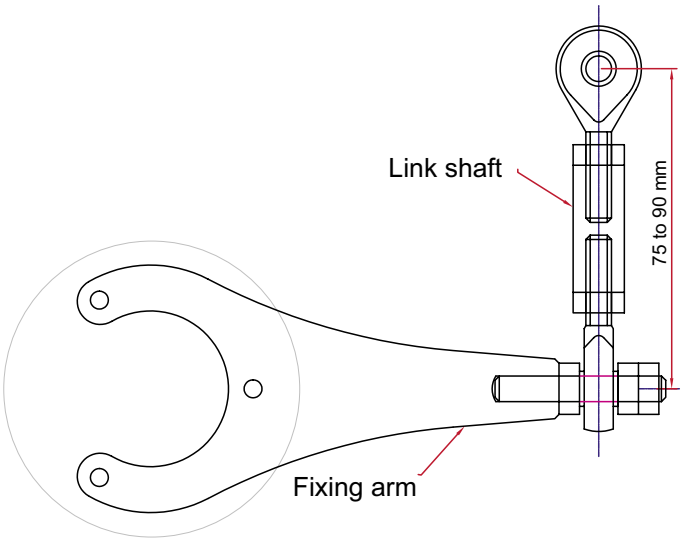
For assembling the CA-angle-sensor it is necessary to fit an adapter to the free end of the crankshaft or to the V-belt pulley mounted on it. This adapter has to have a centering device and six tapped holes so that the flange of the CA-angle-sensor can be bolted on it. In addition to this a really firm location position must be provided on the engine for attaching to it the fixing link that holds the CA-angle-sensor housing in its correct position. If the crankshaft itself cannot be machined as called for, then an adapter has to be provided that meets the mentioned requirements.

The next figure shows the possibilities for mounting the CA-angle-sensor



The sensor will be mounted to the adapter flange by means of six hexagon-headed bolts enclosed with the delivery. After this the fixing link (link shaft) will be fitted between the fixing arm of the CA-angle-sensor housing and the fixed point of the engine. With this the encoder housing is prevented from relative rotation to the engine.

The next figure shows the fixing arm and the link shaft

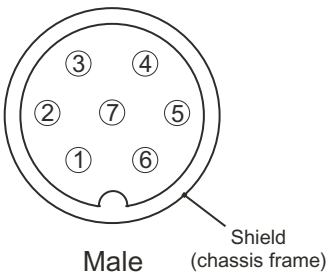


When the nut at the fixing arm is tightened a second spanner should be used on the flats of the fixing arm to avoid twisting of the fixing arm.

Great care must be exercised in the way the crankshaft adaptation and the subsequent assembly of the CA-angle-sensor are carried out, since every inaccuracy leads to eccentric operation and therefore to additional vibrations.

Pin assignment of the CA-angle-sensor

The pin assignment CA-angle-sensor connector is prepared for our DEWE-CA measurement systems. So it is possible to connect it directly to the system, without having any adapter box.



1: n.c.
2: n.c.
3: VDD
4: GND
5. B
6. A (CDM, CAM)
7. N (Trigger)

CA-Angle-Sensor 0.2

Encoder datasheet

- **Rugged industrial standard encoder**
- **Meets to protection class IP67, with shaft sealed to IP65**
- **High noise immunity**
- **Maximum mechanical and electrical safety**
- **High shaft load radial 400N, axial 400N**

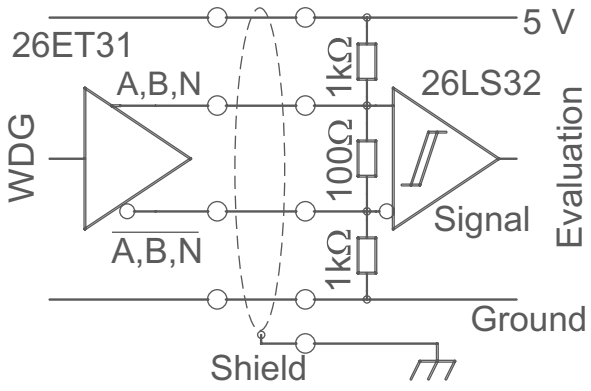
Application fields:

Electric motors, machine tools, weighscales, conveyors, printing machines, drives, textile machines, production lines, injection-moulding machines, test machines, elevators/lifts, doors and gates.

Electrical data:

Design according to:	DIN VDE0160
Power supply:	4,75 - 5,5 VDC
Current consumption:	max. 70 mA
Channels:	
Output:	push-pull
Load:	max. 40 mA
Signal level:	at 20 mA H > 2,5 VDC L < 0,5 VDC
Pulse frequency:	max. 200 kHz
Circuit protection:	no
Early-warning output: (Only G24, I24, G05, I05)	conducting when defective
Cable length:	max. 100 m

Output circuit I05/R05 (RS422 TTL compatible):



Specifications

Pulses Per Revolution PPR: 1800

Mechanical Data

Housing	
- clamp flange:	Aluminium
- Encoder body:	Aluminium, powder coated
- Cam mounting:	pitch Ø 69 mm
Shaft	
- Material:	Stainless steel
- Loading on shaft-end:	max. 400 N radial max. 400 N axial
- Starting torque:	approx. 1 Ncm at ambient temperature
Bearings	
- Type:	2 precision ball-bearings
- Service life:	4 x 10^8 revs. at 100% of full rated shaft load 6 x 10^9 revs. at 40% load 5 x 10^{10} revs. at 20% load
Operating speed:	8.000 rpm
Weight:	approx. 250 g
Connection:	Shielded cable or connector

Optics

Light source:	IR - LED
Service life:	typ. 100.000 hrs.
Scanning:	differential

Accuracy

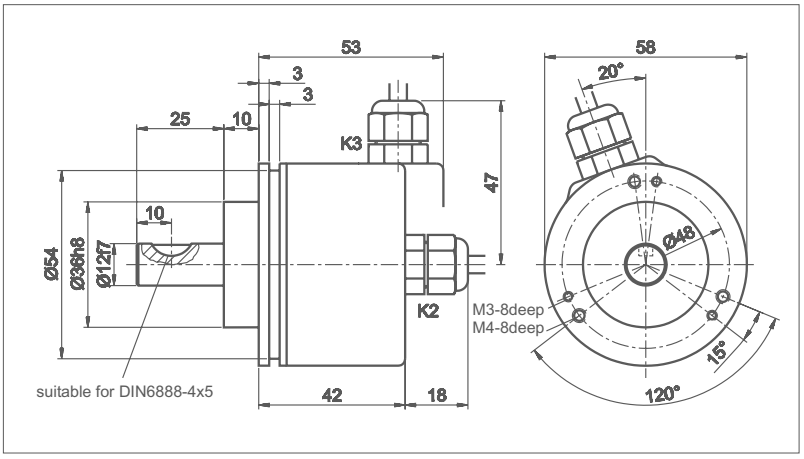
Quadrature phasing:	90° ± 7,5%
Pulse on/off ratio:	50% ± 7%

Environmental Data

Measured mounted and housing grounded.

ESD (DIN EN 61000-4-2):	8 kV
Burst (DIN EN 61000-4-4):	2 kV
Protection rating: (EN 60529)	IP67. Shaft sealed to IP65
Vibration (DIN EN 60068-2-6):	50m/s² (10-2000 Hz)
Shock (DIN EN 60068-2-27):	1000m/s² (6 ms)
Operating temperature:	-20°C to +80°C
Storage temperature:	-30°C to +80°C

Cable connection:



Dimensional drawing WDG 58 D with K2/K3. Dimensional specifications in mm.

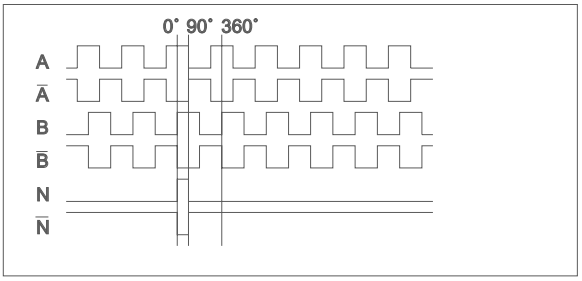
Cable

The connecting cable is a flexible 7-pin control cable (9-pin with complementary/inverted outputs) with the following properties :

Core:	stranded copper wire
Cross-section:	0.34 mm² for power lines
	0.14 mm² for signal lines
Cable cross section:	Circuit G05, G24: 6.3 mm
	Circuit I05, I24: 8.3 mm
Shield:	Tinned braided copper
	Stranded filter wire for simple connection
Outer sheath:	light-grey PVC, 0.6 mm
Bending radius:	
6 - pin:	single bending: min. 31.5 mm
	repeated bending: min. 94.5 mm
9 - pin:	single bending: min. 41.5 mm
	repeated bending: min. 124.5 mm

Line resistance	
for 0.14 mm² :	max. 148 Ω/km
0.34 mm² :	max. 57 Ω/km
Operating capacity	
Core/Core:	140 nF/km
Core shield:	approx. 155 nF/km

Pulse diagram



View from shaft end, rotating clockwise.

Cable connection, 2 m shielded cable

Circuit Function	H24, H05 G24,G05 Colour	R24, R05 I24,I05,245 Colour
Negative	white	white
Positive	brown	brown
A	green	green
B	yellow	yellow
N	grey	grey
Early-warning-Output*	pink	pink
A inv.	-	red
B inv.	-	black
N inv.	-	violet
Shield	braiding	braiding

K2: axial, shield not connected (standard)
L2: axial, shield connected with encoder housing
K3: radial, shield not connected (Standard)
L3: radial, shield connected with encoder housing
* Early-warning output only for G24, I24, G05, I05, 245

Protection from Noise Interference:

We recommend for the effective fault clearance of the complete system:
For the normal application sufficed putting the protection of the encoder cable on earth potential, and taking care that the complete system is grounded low-impedancely merely (e.g. Braided copper) in a single place from encoder and output electronics.
In every case the encoder cables seperate protectedly and locally should be transfered by pieces of equipment and components producing strength current lines and disturbances.
Interference sources like engines, solenoid valves are provided.
In definite applications and in dependence of the earthing concept and the actually available interference fields of the complete area it can be necessary to take up further-reaching fault clearance measures.
E.g. the capacitive cupling of the shield, the installation of a HF lock in the encoder cable or the installation of the transient protective diodes, is part of this.
If these or any other measures are necessary, please contact us.

Accuracy

Shaft encoders have three defined types of accuracy. In each case the accuracy is given as a % of the pulse length, which consists of a pulse and a pause.

The partition error is defined as the deviation of any pulse edge from its exact geometric position and as standard is a max 12%.

The pulse/pause ratio describes the ratio of the pulse/pause deviation from the pulse length.The accuracy value has been given for each encoder and as standard amounts to a max ± 7.5%.

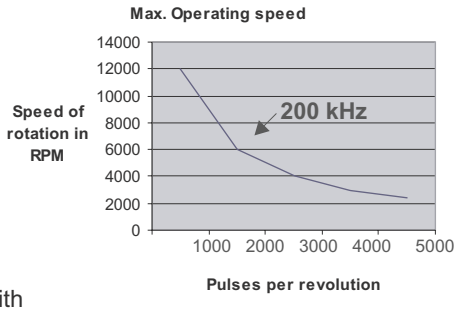
The phase displacement describes the accuracy of two successive edges. The accuracy is given for each encoder and as standard amounts to a max. 7.5% of a pulse length.

Maximum Output Frequency

The maximum output frequency is given for the various encoders. For limiting factors such as cable lengths and diameters, please see the section on cable lengths. When designing the electronic evaluation circuitry for maximum frequencies and noise suppression, tolerances should be taken into account in order to provide a safety margin so as to handle maximum output frequencies which may occur in the specific application.

The maximum occurring frequency $f_{(max)}$ can be calculated using the following formula :

$$\textbf{f(max) in Hz} = \frac{\textbf{(max shaft speed in RPM) x (pulses per revolution PPR)}}{\textbf{60}}$$



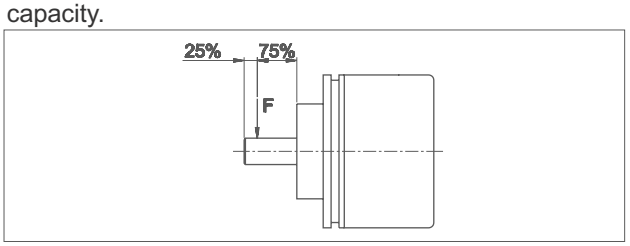
Maximum Operating Speeds

The maximum operating speed is limited by the maximum mechanical operating speed (shaft speed) and by the number of pulses per revolution (PPR). The maximum operating speed is given in the specifications. The maximum speed with relation to the pulse frequency can be expressed as follows :

$$\textbf{Max. speed of rotation RPM} = \frac{\textbf{Max. Frequency of encoder in Hz x 60}}{\textbf{PPR of encoder}}$$

Mechanically rugged

All encoders have double and clearance-free shaft bearings with the maximum possible distance between the bearings, thus obtaining maximum long-term load capacity.



The bearings are treated with a special grease able to withstand extreme temperatures, high speeds and loads, as well as constant operation in reverse. The grease remains stable over a long period of time. The indicated radial-bearing load relates to the point F of the applied force. The useful life of the bearings is stated in the number of revolutions. The life can be converted into hours using the following formula:

$$\textbf{Life in hours} = \frac{\textbf{Number of Revolutions}}{\textbf{RPM x 60}}$$