WACHENDORFF

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Encoder WDG 40 A

C **UL** US
LISTED

- **Robust and economical encoder with small dimensions**
- **Servo flange**
- **Protection to IP67, shaft sealed to IP65**

Application fields:

Food processing and packaging machines , wood processing machines, testing machines and cleaning installations

Specifications

Available Pulses Per Revolution:

4, 9, 10, 15, 20, 25, 28, 30, 40, 50, 60, 90, 100, 120, 125, 128, 150, 160, 180, 200, 235, 250, 300, 314, 318, 360, 400, 500, 600, 625, 635, 720, 900, 1000, 1024, 1080, 1200, 1250, 1500

Mechanical Data

Housing
- Servo flange: Aluminum
- Housing: Aluminum, powder coated
- Cam mounting: pitch $\varnothing$ 51 mm

Shaft
- Material: stainless steel
- Load on   max. 80 N radial
  shaft end: max. 50 N axial
- Torque: approx. 0,2 Ncm at ambient temperature

Bearings
- Type: 2 precision ball bearings
- Service life: 10^9 revs. at 100% of full rated shaft load. 10^{10} revs. at 40% 10^{11} revs. at 20%
Operating speed: max. 12.000 rpm
Weight: approx. 100 g
Connections: Shielded cable or connector

Optics

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

Accuracy

Quadrature phasing: 90° $\pm$ 7.5%
Pulse on/off- ratio: 50% $\pm$ 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 :   IP67. Shaft sealed to
(EN 60529)   IP65.
Vibration
(DIN EN 60068-2-6):   50m/s² (10-2.000 Hz)
Shock
(DIN EN 60068-2-27):   1000m/s² (11 ms)
Operating temperature: -20°C to +80°C
Storage temperature: -30°C to +80°C

Customer-specific adaptions on request.

Electrical Data:

|	H24 / R24 G24 / I24	H05 / R05 G05 / I05
Design according to:	DIN VDE0160	DIN VDE0160
Power supply:	10 - 30 VDC	4,75 - 5,5 VDC
Power consumption:	max. 70 mA	max. 70 mA
Channels:	see pulse diagram	
Output:	push pull	push pull
Load:	max. 40 mA	max. 40 mA
Signal level:	at 20 mA	at 20 mA
	H > U_B- 2,5 VDC	H > 2,5 VDC
	L < 2,5 VDC	L < 1,2 VDC
Pulse frequency:	max. 200 kHz	max. 200 kHz
Circuit protection:	yes	no
Control output:	conducting when defective	
Cable length:	max. 100 m	max. 100 m

Output circuit G24/H24 (HTL):
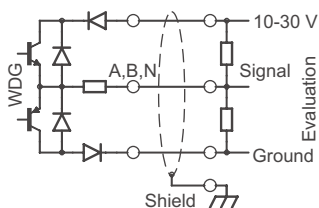
Output circuit G05/H05 (TTL):
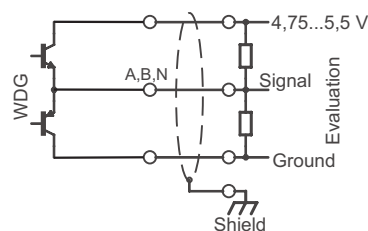
Output circuit I24/R24 (HTL):
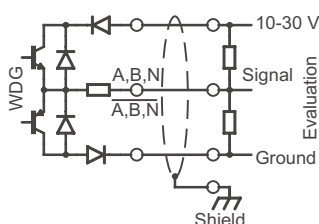
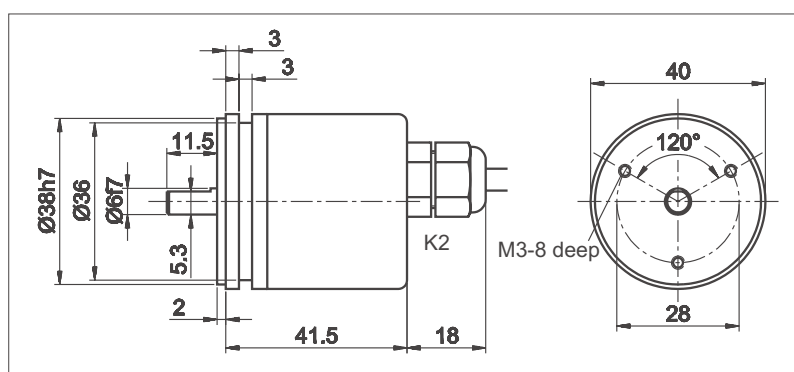**Output circuit I05/R05 (RS422 TTL compatible):**
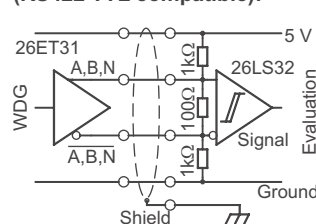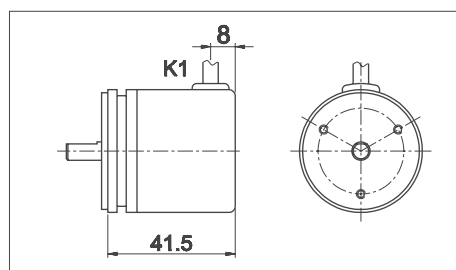
Early Warning Output

Each shaft encoder is supplied with an early warning output, which indicates the impending failure of the encoder signals. This warning is triggered when the LED intensity is about 10% of its original value. The encoder will still function for more than 1000 hours and the encoder can therefore be changed at a scheduled maintenance interval.

Pulse diagram

View from shaft end, shaft rotating clockwise.
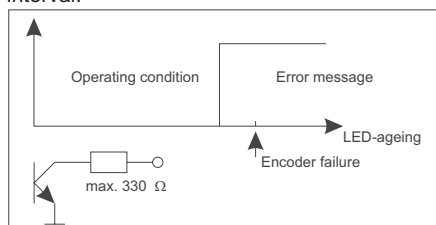
Cable connection:

Dimensional drawing Encoder WDG 40A with K2, L2,dimensional specifications in mm

Cable connection, 2 m shielded cable

| Circuit | H24, H05 | R24, R05 |
| | G24,G05 | I24,I05 |
Function	Colour	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

Circuit Function	G24,G05 Colour
Negative	white
Positive	brown
A	green
B	yellow
N	grey
Early-warning-output*	pink
Shield	braiding

Dimensional drawing Encoder WDG 40A with K1, dimensional specifications in mm

K1: radial, shield not connected (standard), Protection rating IP50
K2: axial, shield not connected (standard)
L2: axial, shield connected to encoder housing
* Early-warning output only for G24, I24, G05, I05

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

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.
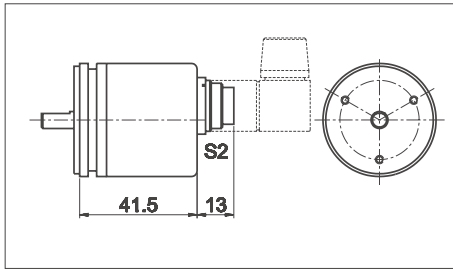E.g. the capacitive cupling of the shield, the installation of a HF lock in the encoder cable or the installation of the transient protective diodes, is part of this.
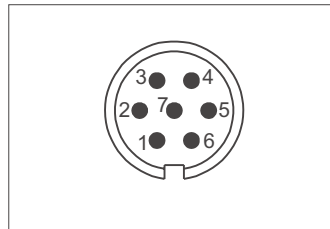If these or any other measures are necessary, please contact us.

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Encoder WDG 40A

Connector:

Connector, 7-pin

S2: axial

Sensor-connector, 4-, 5-, 8-, 12-pin:

SB: axial

All dimensions in mm.

Pin arrangement

Pin arrangement on encoder.

Circuit	H24, H05 G24, G05
Function	Pin
Negative	1
Positive	2
A	3
B	4
N	5
Early-warning-output*	6
N.c.	7

*Early-warning output only for G24, G05

Pin arrangements on encoders.

4-pin

Circuit	H24,H05 R24,R05
Function	Pin
Negative	3
Positive	1
A	2
B	4

5-pin

Circuit	H24,H05 R24, R05
Function	Pin
Negative	3
Positive	1
A	4
B	2
N	5

8-pin

Circuit	H24,H05 R24, R05
Function	Pin
Negative	1
Positive	2
A	3
B	4
N	5
A inv.	6
B inv.	7
N inv.	8
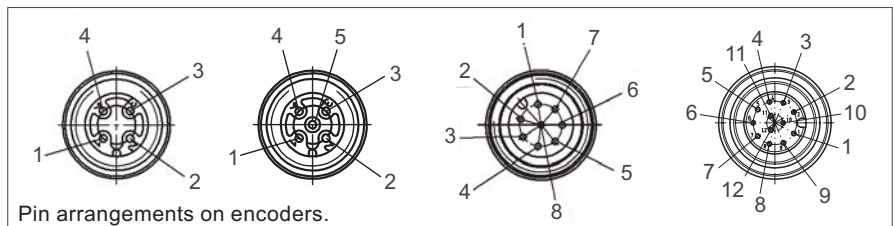
12-pin

Circuit	G/H24, G/H05, I/R24,I/R05
Function	Pin
Negative	3
Positive	1
A	4
B	6
N	8
E.-w.-output*	5
A inv.	9
B inv.	7
N inv.	10
N.c.	2/11/12

*Early warning output only for I/G24, I/G05

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 :

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

Cut-off frequency f_{out} based on cable length, power supply, ambient temperature 25°C and 20 mA load:

Output-circuit Length	G05	I05
100 meter	200 kHz	200 kHz

Output-circuit Length	G24		I24	
	Supply	f_{out}	Supply	f_{out}
10 meter	10-30 V	200 kHz	10-30 V	200 kHz
50 meter	12/24 V	200 kHz	12	200 kHz
	30 V	150 kHz	24 V	100 kHz
			30 V	50 kHz
100 meter	12/24 V	200 kHz	12	200 kHz
	30 V	70 kHz	24 V	50 kHz
			30 V	25 kHz

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Encoder WDG 40 A

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 :

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

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.

Radial bearing load F

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:

$$\text{Life in hours} = \frac{\text{Number of Revolutions}}{\text{RPM} \times 60}$$

Special low-friction bearings

Our WDG encoders are fitted with special sealing rings on the bearings. The corresponding starting torque values are given in the following table or with the appropriate encoder. Should you need a particularly easy-running low-friction encoder, then WDG encoder models 40S, 40A, 58A, 58B and 58D can be ordered as "Low-friction encoders AAC" please note the changes in the specifications.
When ordering a low-friction encoder, please use the appropriate standard encoder order code and add the suffix code -AAC

Example: WDG40A as a particularly low-friction encoder:
WDG40A-100-AB-G24-K3-AAC

Starting-torque	Protecting at shaft
< 0,50 Ncm	IP50

Changed specifications for low-friction encoder

Shafts sealed to IP67

Encoder models WDG 40S, 58B and 90B can be supplied in a full IP67 version. This is achieved using a ring type oil shaft seal. Please note the following specification changes :
When ordering encoders with shaft protection to IP67, please add the suffix code -AAO

Example: WDG with IP67 shaft protection:
WDG 40A-100-AB-G24-K3-AAO

Max. RPM	Permitted Shaft-Loading axial	radial	Max. PPR	Starting-torque
3.500	100 N	45 N	2.500	ca. 4 Ncm

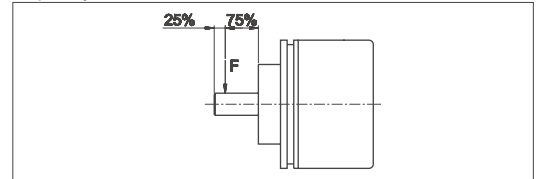Changed specifications for IP67 at shaft

Cable Length

Using Wachendorff encoder cable a cable run of up to 100m is possible (150m for SINUS encoders). However the actual achievable cable length depends on the possible effects of noise interference and should therefore be checked for each individual case.

All WDG encoders can be ordered with different cable lengths. If more than 2m of cable is needed, the standard order code should be extended with a three figure number, which gives the cable length in decimetres.

Example: WDG 40A with side gland and 10m cable:
WDG 40A-100-AB-G24-K3-100

Suitable accessoires can be found on **www.wachendorff.de** or by ordering the Data sheets accessoires for encoders.

Please ask about other available options.

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Encoder WDG 40 A

Order information:

Channels: A, AB, ABN

Pulses per revolution:
4, 9, 10, 15, 20, 25, 28, 30, 36, 40, 50, 60, 90, 100, 120, 125, 128, 150, 160, 180, 200, 235, 250, 300, 314, 318, 360, 400, 500, 600, 625, 635, 720, 900, 1000, 1024, 1080, 1200, 1250, 1500

Output circuit:
G24 = 10 - 30 VDC   G05 = 5 VDC
Only at K2, L2:
I24 = 10 - 30 VDC (inv.)   I05 = 5 VDC (inv.)

Electrical connections:

Cable

K1 = radial, 2 m, shield not connected (Protecting rate IP50)
K2 = axial, 2 m, shield connected to encoder housing
L2 = axial, 2 m, shield connected to encoder housing

Connector: Sensor-connector:

S2 = 7-pin axial   SB4, SB5, SB8, SB12 =
                              4-pin, 5-pin, 8-pin, 12-pin axial

Empty =	without option
Low-friction bearings =	AAC
Shaft sealed to IP 67 =	AAO
Cable length =	in decimeters

Example	WDG 40 A	-	500	-	ABN	-	G24	-	K2	
Your encoder	WDG 40 A	-		-		-		-		