WACHENDORFF
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Encoder WDG 58 B



- **Rugged industrial standard encoder**
- **Meets protection class IP 67, with shaft sealed to IP 65**
- **Maximum mechanical and electrical safety**

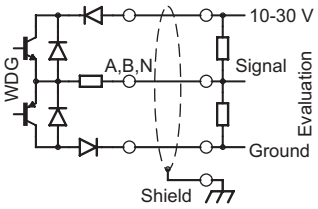
Application fields:

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

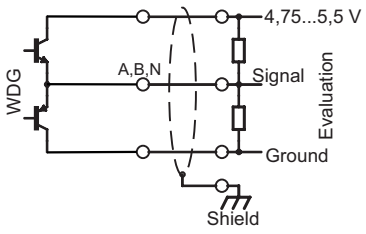
Electrical data:

	H24 / R24 G24 / I24	245	H05 / R05 G05 / I05
Design according to::	DIN VDE0160	DIN VDE0160	DIN VDE0160
Power supply:	10 - 30 VDC	10 - 30 VDC	4,75 - 5,5 VDC
Current consumption:	max. 70 mA	max. 70 mA	max. 70 mA
Channels:		see pulse diagram	
Output:	push-pull	push-pull	push-pull
Load:	max. 40 mA	max. 40 mA	max. 40 mA
Signal level:	at 20 mA	at 20 mA	at 20 mA
	H > U_B- 2,5 VDC	H > 2,5 VDC	H > 2,5 VDC
	L < 2,5 VDC	L < 1,2 VDC	L < 0,5 VDC
Pulse frequency:	max. 200 kHz	max. 200 kHz	max. 200 kHz
Circuit protection:	yes	no	no
Early-warning output: (Only G24, I24, G05, I05)	conducting when defective	conducting when operating	conducting when defective
Cable length:	max. 100 m	max. 100 m	max. 100 m

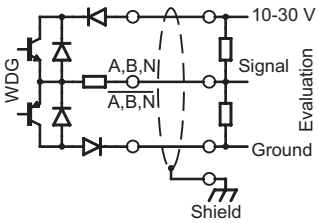
Output circuit G24/H24 (HTL):



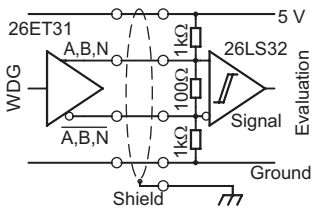
Output circuit G05/H05 (TTL):



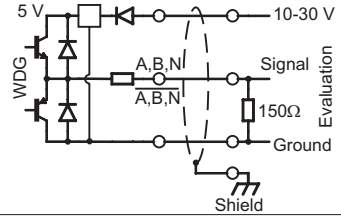
Output circuit I24/R24 (HTL):



Output circuit I05/R05 (RS422 TTL compatible):



Output circuit 245:



Specifications

Available Pulses Per Revolution PPR:

2, 10, 15, 20, 24, 36, 40, 48, 50, 60, 64, 72, 87, 90, 100, 120, 125, 127, 128, 150, 180, 200, 216, 240, 250, 254, 256, 300, 314, 320, 360, 400, 500, 512, 571, 600, 625, 720, 750, 768, 800, 810, 900, 1000, 1024, 1200, 1250, 1270, 1440, 1500,1800, 2000, 2048, 2400, 2500, 3000, 3600, 4000, 4096, 4685, 5000

Mechanical Data

Housing	
- Synchro flange:	Aluminium
- Encoder body:	Aluminium, powder coated
- Cam mounting:	pitch Ø 69 mm
Shaft	
- Material:	Stainless steel
- Loading on shaft-end:	max. 220 N radial max. 120 N axial
- Starting torque:	approx. 1 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% load 10^{11} 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:	-10°C to +70°C
Storage temperature:	-30°C to +80°C

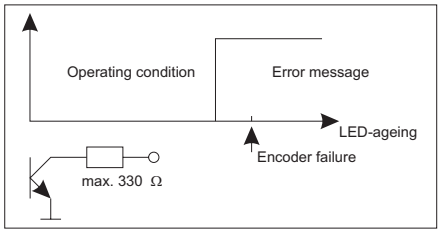
Customer-specific adaptions on request.

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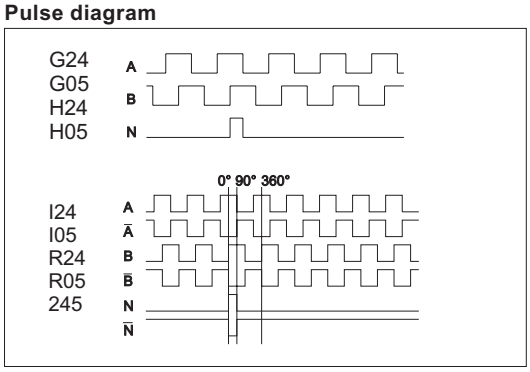
Encoder WDG 58 B

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.

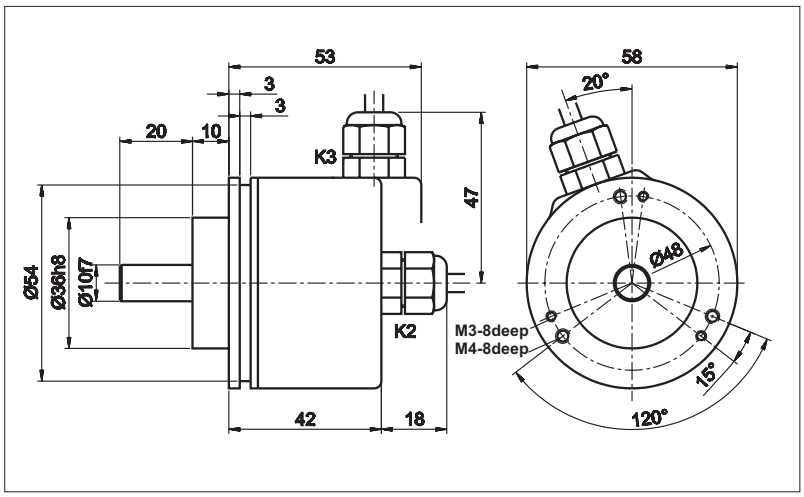


Pulse diagram



View from shaft end, rotating clockwise.

Cable connection:



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

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

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:

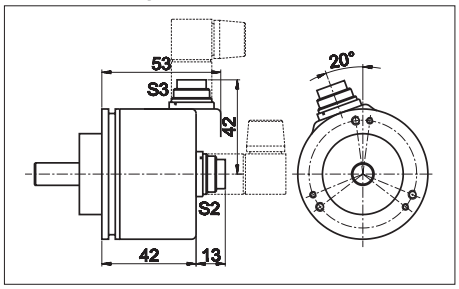
We recommend for the effective fault clearance of the complete system:
For the normal application sufficed putting the protection of the encoder cable on earth potential, and taking care that the complete system is grounded low-impedancely merely (e.g. Braided copper) in a single place from encoder and 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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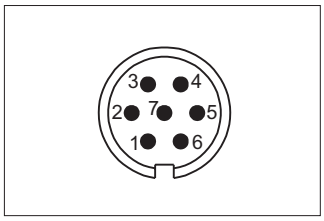
Encoder WDG 58 B

Connector:

Connector, 7-pin



S2: axial, S3: radial



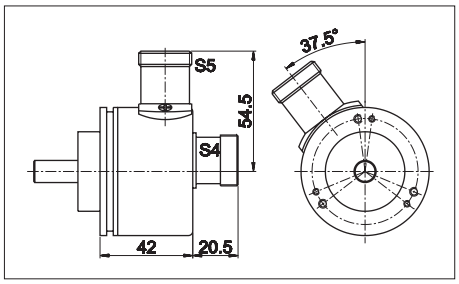
Pin arrangement on encoder.

Pin arrangement

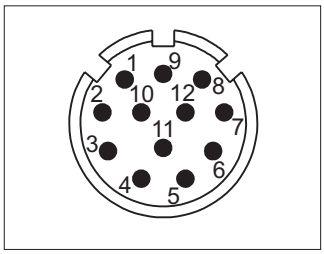
Circuit Function	H24, H05, G24, G05 Pin
Negative	1
Positive	2
A	3
B	4
N	5
Early-warning-Output*	6
n.c.	7

Connector housing electrically connected to encoder housing.

Connector, 12-pin



S4: axial, S5: radial



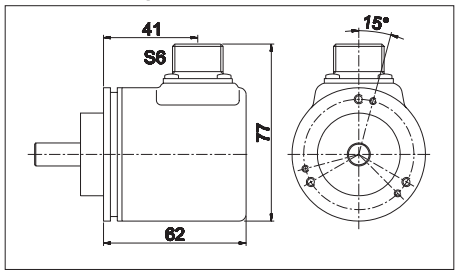
Pin arrangement on encoder.

Pin arrangement

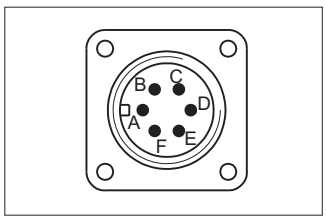
Circuit Function	H24, H05, G24,G05 Pin	R24, R05, I24,I05, 245 Pin
Negative	10	10
Positive	12	12
A	5	5
B	8	8
N	3	3
Early-warn-Output*	11	11
A inv.	-	6
B inv.	-	1
N inv.	-	4
n.c.	1,2,4, 6,7,9	2,7,9

Connector housing electrically connected to encoder housing.

Connector, 6-pin



S6: radial



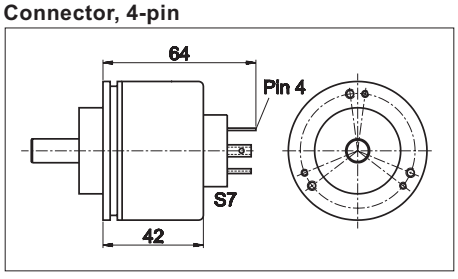
Pin arrangement on encoder.

Pin arrangement

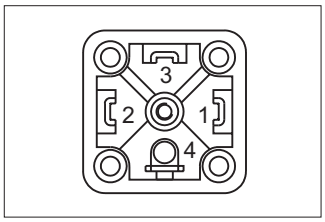
Circuit Function	H24, H05, G24,G05 Pin
Negative	A
Positive	F
A	C
B	B
N	D
Early-warn.-Output*	E

Connector housing electrically connected to encoder housing.

Connector, 4-pin



S7: axial



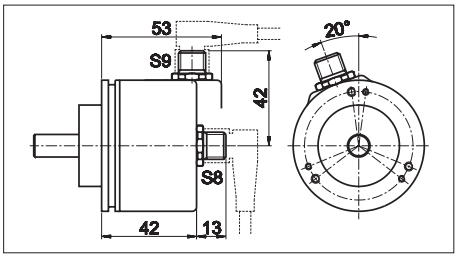
Pin arrangement on encoder.

Pin arrangement

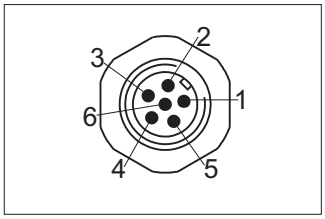
Circuit Function	H24, H05 Pin
Negative	1
Positive	2
A	3
B	4

Plastic connector housing.

Connector, 6-pin



S8: axial, S9: radial



Pin arrangement on encoder.

Pin arrangement

Circuit Function	H24, H05 Pin	Colour
Negative	1	white
Positive	2	brown
A	3	green
B	4	yellow
N	5	grey
Shield	6	braiding

Colour coding for cable KIA-6-67-05
Connector housing electrically connected to encoder housing.

Dimensional specifications in mm.

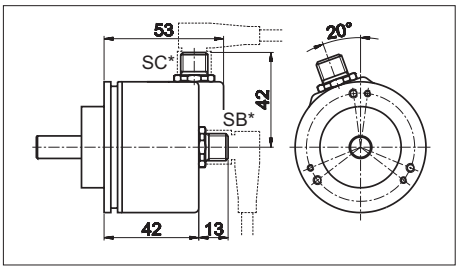
*Early-warning output only for G24, I24, G05, I05, 245

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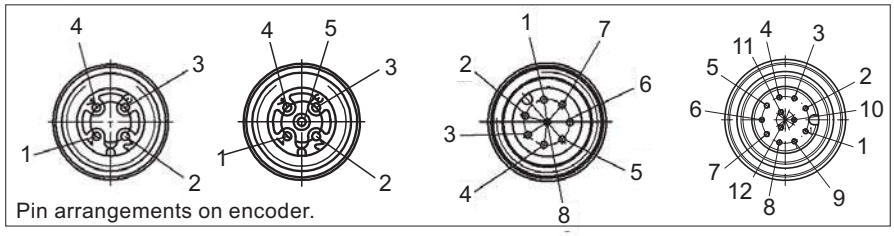
Encoder WDG 58 B

Sensor-connector:

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



SB: axial, SC: radial All dimensions in mm.



Pin arrangements on encoder.

4-pin

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

5-pin

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

8-pin

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

12-pin

Circuit / Function	G/H24, G/H05, 245 I/R24, I/R05 Pin
Negative	3
Positive	1
A	4
B	6
N	8
Early-warn output*	5
A inv.	9
B inv.	7
N inv.	10
N.c.	2/11/12

*Early-warning output only for G24, I24, G05, I05, 245

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.

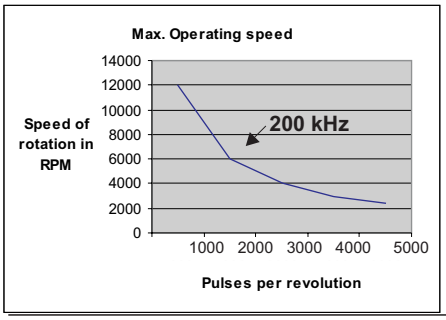
The maximum occurring frequency $f_{(max)}$ can be calculated using the following formula :

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

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 :

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



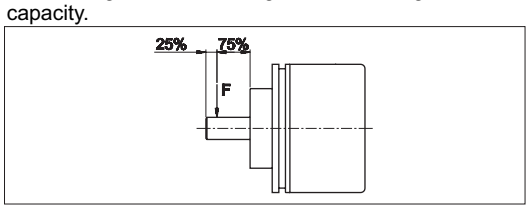
Cut-off frequency f_{out} based on cable length, power supply, ambient temperature 25°C and 20 mA load:

Output-Circuit / Length	G05	I05 245
100 meter	200 kHz	200 kHz

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

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:

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

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Encoder WDG 58 B

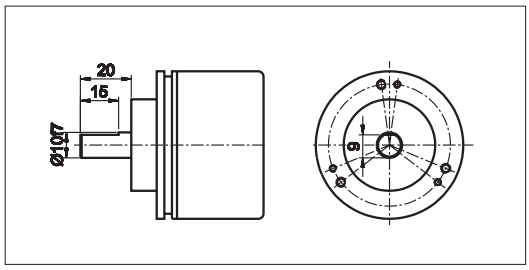
Options:

Shaft with flat

Model WDG 58B has a 10mm shaft. In some cases a flat is needed. This can be ordered in accordance with the drawing below. Should you need alternative dimensions, please call us. We will be pleased to offer you a shaft which meets your requirements.

When ordering a shaft with flat, please add the suffix code -AAF

Example : WDG 58B with flat
WDG 58B-100-AB-G24-K3-AAF



WDG 58 B with flat

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: WDG58B as a particularly low-friction encoder:
WDG58B-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 58B with IP67 shaft protection:
WDG 58B-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 58B with side gland and 10m cable:
WDG 58B-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.

Order information:

Output circuit:
H24/G24 = 10 - 30 VDC H05/G05 = 5 VDC
Only at K2, L2, K3, L3, S4, S5:
R24/I24 = 10 - 30 VDC (inv.) R05, I05 = 5 VDC (inv.)
245 = 10 - 30 VDC Supply, 5 VDC Output

Channels: A, AB, ABN

Pulses per revolution:
2, 10, 15, 20, 24, 36, 40, 48, 50, 60, 64, 72, 87, 90, 100, 120, 125, 127, 128, 150, 160, 180, 200, 216, 240, 250, 254, 256, 300, 314, 320, 360, 400, 500, 512, 571, 600, 625, 720, 750, 768, 800, 810, 900, 1000, 1024, 1200, 1250, 1270, 1440, 1500, 1800, 2000, 2048, 2400, 2500, 3000, 3600, 4000, 4096, 4685, 5000

Other PPR's on request.

Electrical connections:

Cable
K2 = axial, 2 m, shield not connected (standard)
L2 = axial, 2 m, shield connected to encoder housing
K3 = radial, 2 m, shield not connected (standard)
L3= radial, 2 m, shield connected to encoder housing

Connector:

S2 = 7-pin. axial	SB4 = 4-pin. axial
S3 = 7-pin. radial	SC4 = 4-pin. radial
S4 = 12-pin. axial	SB5 = 5-pin. axial
S5 = 12-pin. radial	SC5 = 5-pin. radial
S6 = 6-pin. radial	SB8 = 8-pin. Axial
S7 = 4-pin. axial	SC8 = 8-pin. radial
S8 = 6-pin. axial	SB12=12-pin. axial
S9 = 6-pin. radial	SC12=12-pin. radial

Options:

Empty =	without Option
Shaft with flat =	AAF
Special low-friction bearings =	AAC
Shaft sealed to IP67 =	AAO
Cable length =	in decimeters

Example	WDG 58 B	-	500	-	ABN	-	G24	-	K3	-	
Your Encoder	WDG 58 B	-		-		-		-		-	