Multiturn absolute encoder

ASM58-0
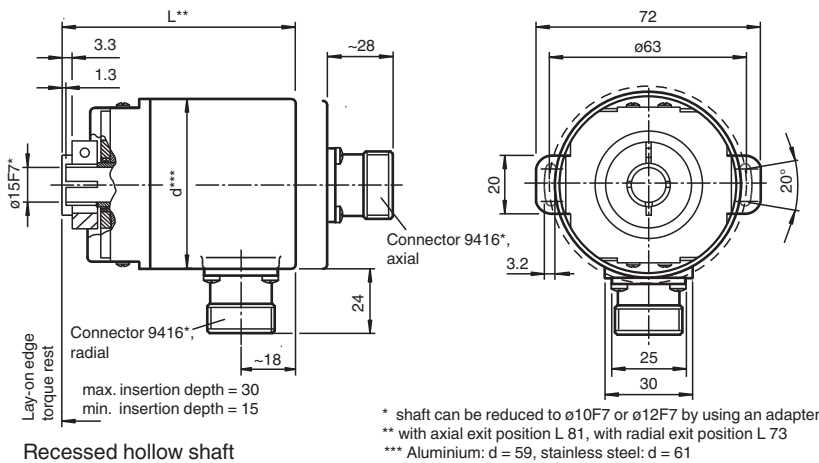
- Industrial standard housing Ø58 mm
- 30 Bit multiturn
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Recessed hollow shaft
- Zero-set function

Function

This multiturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The maximum resolution of the ASM58 is maximum 65536 steps per revolution at 16384 revolutions.
The devices of the ASM58 series are equipped with a microcontroller.
The control module sends a clock bundle to the absolute encoder to obtain position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the following items with function inputs the counting direction and the zero-set function (preset value).
The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a torque rest.
The electrical connection is made by a 12-pin round plug connector. A version with a 1 m cable connector is also available.

Dimensions

Connector 9416*, axial

Connector 9416*, radial

Lay-on edge torque rest

max. insertion depth = 30
min. insertion depth = 15

Recessed hollow shaft

*   shaft can be reduced to ø10F7 or ø12F7 by using an adapter
** with axial exit position L 81, with radial exit position L 73
*** Aluminium: d = 59, stainless steel: d = 61

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Dimensions

Recessed hollow shaft

max. insertion depth = 30
min. insertion depth = 15

Cable gland PG9, axial
Cable gland PG9, radial

Lay-on edge torque rest

* shaft can be reduced to ø10F7 or ø12F7 by using an adapter
** with axial exit position L 81, with radial exit position L 73
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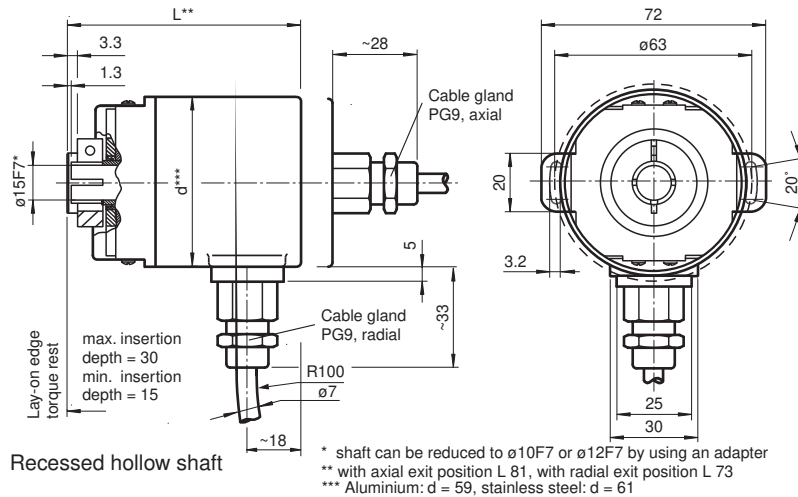
Technical Data

General specifications		
Detection type		photoelectric sampling
Device type		Multiturn absolute encoder
Functional safety related parameters		
$MTTF_d$		150 a
Mission Time (T_M)		20 a
L_{10h}		1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	U_B	4.5 ... 30 V DC
No-load supply current	I_0	max. 180 mA
Time delay before availability	t_v	< 250 ms
Linearity		± 2 LSB at 16 Bit, ± 1 LSB at 13 Bit, ± 0,5 LSB at 12 Bit
Output code		Gray code, binary code
Code course (counting direction)		cw descending (clockwise rotation, code course descending)
Interface		
Interface type		SSI
Monoflop time		20 ± 10 µs
Resolution		
Single turn		up to 16 Bit
Multiturn		14 Bit
Overall resolution		up to 30 Bit
Transfer rate		0.1 ... 2 MBit/s
Voltage drop		U_B - 2.5 V
Standard conformity		RS 422
Input 1		
Input type		Selection of counting direction (cw/ccw)
Signal voltage		
High		4.5 ... 30 V
Low		0 ... 2 V
Input current		< 6 mA
Switch-on delay		< 10 ms
Input 2		
Input type		zero-set (PRESET 1)
Signal voltage		
High		4.5 ... 30 V

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Technical Data

Low	0 ... 2 V
Input current	< 6 mA
Signal duration	min. 100 ms
Switch-on delay	< 10 ms
Connection	
Connector	type 9416 (M23), 12-pin, type 9416L (M23), 12-pin
Cable	Ø7 mm, 6 x 2 x 0.14 mm^2, 1 m
Standard conformity	
Degree of protection	DIN EN 60529, IP65 (without shaft seal) ; DIN EN 60529, IP66/IP67 (with shaft seal)
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	DIN EN 61000-6-4
Noise immunity	DIN EN 61000-6-2
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 ... 2000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source
Ambient conditions	
Operating temperature	-40 ... 85 °C (-40 ... 185 °F)
Storage temperature	-40 ... 85 °C (-40 ... 185 °F)
Mechanical specifications	
Material	
Combination 1	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 2 (Inox)	housing: stainless steel flange: stainless steel shaft: stainless steel
Mass	approx. 460 g (combination 1) approx. 800 g (combination 2)
Rotational speed	max. 12000 min $^{-1}$
Moment of inertia	50 gcm^2
Starting torque	< 5 Ncm
Shaft load	
Angle offset	± 0.9 °
Axial offset	static: ± 0.3 mm, dynamic: ± 0.1 mm
Radial offset	static: ± 0.5 mm, dynamic: ± 0.2 mm

Accessories

	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core
	ACC-PACK-ABS-_S_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
	ACC-PACK-ABS-_S_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
	ACC-PACK-ABS-_S_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
	ACC-PACK-ABS-_S_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

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Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U_b (encoder)	Brown	2	8	Power supply
Clock (+)	Green	3	3	Positive cycle line
Clock (-)	Yellow	4	11	Negative cycle line
Data (+)	Grey	5	2	Positive transmission data
Data (-)	Pink	6	10	Negative transmission data
Reserved	Blue	7	12	Not wired, reserved
V/R	Red	8	5	Input for selection of counting direction
PRESET 1	Black	9	9	zero-setting input
Reserved	Violet	10	4	Not wired, reserved
Reserved	Grey/Pink	11	6	Not wired, reserved
Reserved	Red/Blue	12	7	Not wired, reserved

```
   1 2 11 3 4 5              8 7 11 6 5 4
      (connector           (connector
       diagram)             diagram)
   9 8 10 7 12 6            9 1 12 2 10 3
```

Interface

Description

The Synchronous Serial Interface was specially developed for transferring the output data of an absolute encoder to a control device. The control module sends a clock bundle and the absolute encoder responds with the position value.

Thus only 4 lines are required for the clock and data, no matter what the resolution of the rotary encoder is. The RS 422 interface is optically isolated from the power supply.

SSI signal course Standard

Clock +

Data +

D_n D_{n-1} D_{n-2} D_{n-3} D_2 D_1 S

MSB   LSB
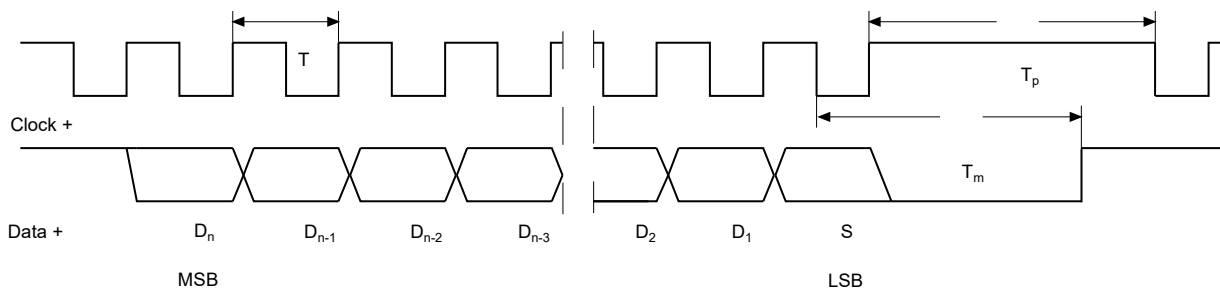
$D_1, ..., D_n$:	Position data		$T = 1/f$:	Duration of period of clock signal $\leq$ 1 MHz
S:	Special bit		T_m:	Monoflop time 10 µs ... 30 µs
MSB:	Most significant bit		T_p:	Clock pause $\geq$ monoflop time ($T_p \geq T_m$)
LSB:	Least significant bit			

SSI output format Standard
- At idle status signal lines "Data +" and "Clock +" are at high level (5 V).
- The first time the clock signal switches from high to low, the data transfer in which the current information (position data (D_n) and special bit (S)) is stored in the encoder is introduced.
- The highest order bit (MSB) is applied to the serial data output of the encoder with the first rising pulse edge.
- The next successive lower order bit is transferred with each following rising pulse edge.
- After the lowest order bit (LSB) has been transferred the data line switches to low until the monoflop time T_m has expired.
- No subsequent data transfer can be started until the data line switches to high again or the time for the clock pause T_p has expired.
- After the clock sequence is complete, the monoflop time T_m is triggered with the last falling pulse edge.
- The monoflop time T_m determines the lowest transmission frequency.

SSI output format ring slide operation (multiple transmission)
- In ring slide operation, multiple transmission of the same data word over the SSI interface makes it possible to offer the possibility of detecting transmission errors.
- In multiple transmission, 25 bits are transferred per data word in standard format.

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- If the clock change is not interrupted after the last falling pulse edge, ring slide operation automatically becomes active. This means that the information that was stored at the time of the first clock change is generated again.
- After the first transmission, the 26th pulse controls data repetition. If the 26th pulse follows after an amount of time greater than the monoflop time T_m, a new current data word will be transmitted with the following pulses.

⚠ If the pulse line is exchanged, the data word is generated offset.
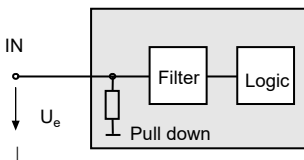Ring slide operation is possible up to max. 13 bits.

Block diagram

Rotary encoder   Interface electronics
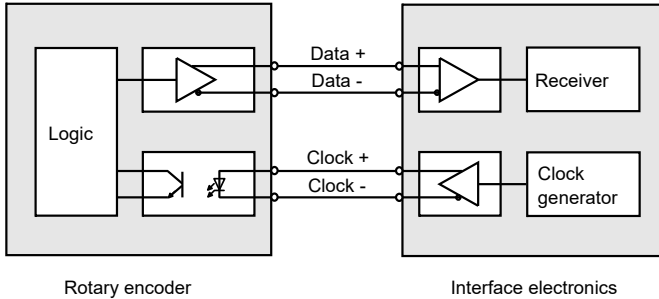
Line length

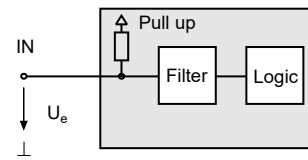| Line length in m	Baudrate in kHz
< 50	< 400
< 100	< 300
< 200	< 200
< 400	< 100

Inputs

The selection of the counting direction input (cw/ccw) is activated with 0-level. The zero-set input (PRESET 1) is activated with 1-level.

zero-set input (PRESET 1)

Input for selection of counting direction (cw/ccw)

Type Code

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Order code

| A | S | M | 5 | 8 | – | | | | | 0 | N | – | | | | |

Number of bits singleturn
12   4096 (standard)
13   8192
16   65536

Number of bits multiturn
12   4096 (standard)
14   16384

Output code
B   Binary
G   Gray

Exit position
A   Axial
R   Radial

Connection type
K1   Cable Ø7 mm, 6 x 2 x 0.14 mm^2, 1 m
AA   Plug connector type 9416, 12-pin
AB   Plug connector type 9416L, 12-pin

Shaft dimension/flange version
F1A   Recessed hollow shaft Ø10 mm x 30 mm
F2A   Recessed hollow shaft Ø12 mm x 30 mm
F3A   Recessed hollow shaft Ø15 mm x 30 mm

Housing material
N   Aluminium, powder coated
I   Inox*
W   Aluminium, powder coated with shaft seal

Principle of operation
M   Multiturn

Shaft version
S   Recessed hollow shaft

Data format
A   SSI (Synchronous Serial Interface)

*Housing material I only available with axial exit position.

Installation

Anti-interference measures

The use of highly sophisticated microelectronics requires a consistently implemented anti-interference and wiring concept. This becomes all the more important the more compact the constructions are and the higher the demands are on the performance of modern machines.

The following installation instructions and proposals apply for "normal industrial environments". There is no ideal solution for all interfering environments.

When the following measures are applied, the encoder should be in perfect working order:
- Termination of the serial line with a 120 Ω resistor (between Receive/Transmit and Receive/Transmit) at the beginning and end of the serial line (e. g. the control and the last encoder).
- The wiring of the encoder should be laid at a large distance to energy lines which could cause interferences.
- Cable cross-section of the screen at least 4 mm^2.
- Cable cross-section at least 0,14 mm^2.
- The wiring of the screen and 0 V should be arranged radially, if and when possible.
- Do not kink or jam the cables.
- Adhere to the minimum bending radius as given in the data sheet and avoid tensile as well as shearing load.

Operating instructions

Every encoder manufactured by Pepperl+Fuchs leaves the factory in a perfect condition. In order to ensure this quality as well as a faultless operation, the following specifications have to be taken into consideration:
- Avoid any impact on the housing and in particular on the encoder shaft as well as the axial and radial overload of the encoder

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shaft.
- The accuracy and service life of the encoder is guaranteed only, if a suitable coupling is used.
- The operating voltage for the encoder and the follow-up device (e. g. control) has to be switched on and off simultaneously.
- Any wiring work has to be carried out with the system in a dead condition.
- The maximum operating voltages must not be exceeded. The devices have to be operated at extra-low safety voltage.

Notes on connecting the electric screening

The immunity to interference of a plant depends on the correct screening. In this field installation faults occur frequently. Often the screen is applied to one side only, and is then soldered to the earthing terminal with a wire, which is a valid procedure in LF engineering. However, in case of EMC the rules of HF engineering apply.

One basic goal in HF engineering is to pass the HF energy to earth at an impedance as low as possible as otherwise energy would discharge into the cable. A low impedance is achieved by a large-surface connection to metal surfaces.

The following instructions have to be observed:
- Apply the screen on both sides to a "common earth" in a large surface, if there is no risk of equipotential currents.
- The screen has to be passed behind the insulation and has to be clamped on a large surface below the tension relief.
- In case of cable connections to screw-type terminals, the tension relief has to be connected to an earthed surface.
- If plugs are used, metallised plugs only should be fitted (such as sub D plugs with metallised housing). Please observe the direct connection of the tension relief to the housing.

| Advantage: shield relief | metalised connector, clamped with the strain clamp |
| Disadvantage: | soldering shield on |
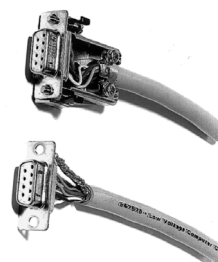
Safety instructions

Please observe the national safety and accident prevention regulations as well as the subsequent safety instructions in these operating instructions when working on encoders.

If failures cannot be remedied, the device has to be shut down and has to be secured against accidental operation.

Repairs may be carried out only by the manufacturer. Entry into and modifications of the device are not permissible.

Tighten the clamping ring only, if a shaft has been fitted in the area of the clamping ring (hollow shaft encoders).
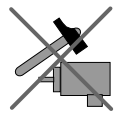
Tighten all screws and plug connectors prior to operating the encoder.
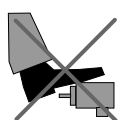
Do not stand on the encoder!

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!

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