## Абсолютные энкодеры

Технические характеристики

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## Absolute encoders ENA58IL-S10C4E-1416B17-RH5

- Solid shaft
- 30 Bit multiturn
- Free of wear magnetic sampling
- High resolution and accuracy
- Mechanical compatibility with all major encoders with fieldbus interface

# CE

### Function

The ENA58IL series are high precision encoders with internal magnetic sampling.

### Dimensions



### **Technical Data**

### General specifications

Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
Functional safety related parameters		
MTTF <sub>d</sub>		130 a at 40 °C
Mission Time (T <sub>M</sub> )		12 a
L <sub>10</sub>		55 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 3 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)

### Absolute encoders

### ENA58IL-S10C4E-1416B17-RH5

Technical Data	
Interface type	
Resolution	
Single turn	up to 16 Bit
Multiturn	up to 14 Bit
Overall resolution	up to 30 Bit
Transfer rate	100 MBit/s
Cycle time	≥1 ms
Connection	
Terminal compartment	Connection cover with radial cable outlet, with 2 threads M20 for cable glands
Standard conformity	
Degree of protection	DIN EN 60529, IP66, IP67
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 1000 Hz
Ambient conditions	
Operating temperature	-40 70 °C (-40 158 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 $\%$ , no moisture condensation
Mechanical specifications	
Material	
Housing	stainless steel V4A
Flange	stainless steel V4A
Shaft	stainless steel V4A
Mass	approx. 1000 g
Rotational speed	max. 3000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N
Radial	110 N

### Accessories

	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
(FF)	9108, 6	Measuring wheel
(F)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm
To la	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

### Absolute encoders

### Connection

Terminal	PWR	Port 2	Port 1
Tx +		Tx +: Transmission Data +	Tx +: Transmission Data +
Rx +		Rx +: Receive Data +	Rx +: Receive Data +
Tx -		Tx -: Transmission Data -	Tx -: Transmission Data -
Rx -		Rx -: Receive Data -	Rx -: Receive Data -
PWR+	Supply voltage+U <sub>B</sub>		
PWR-	0 V		
		Port 2         Port 1         PWR           Tx+         Tx-         Tx-         -           Rx+         Rx-         Rx+         Rx-           -         +         PWR	

### Type Code





### Installation

### ENA58IL-S10C4E-1416B17-RH5

### Absolute encoders

### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 PepperI+Fuchs leaves the factory in a perfect condition. In order to ensure this guality 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 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	metalised connector,	1ª T
relief	clamped with the strain	
Tellel	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!

### Absolute encoders



Do not remachine the drive shaft!

Avoid impact!



Do not remachine the housing!



## Absolute encoders ENA36HD-S10SA9-0413I42-RBD

- Very small housing
- Analog interface
- 13 bit overall resolution
- Free of wear magnetic sampling
- High climatic resistance

### **Function**

This absolute encoder with internal magnetic sampling is available with an analog voltage output or an analog current output. Depending on the model, the analog output provides a voltage value or a current value corresponding to the shaft setting.

### Dimensions





General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Measurement range	min. 0 22.5 ° max. 65536 x 360 ° factory setting: 16 x 360"
Resolution	13 Bit
UL File Number	E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	480 a at 40 °C
Mission Time (T <sub>M</sub> )	20 a
L <sub>10</sub>	10 E+8 revolutions
Diagnostic Coverage (DC)	0 %
Electrical specifications	

Technical Data		
	Ha	8 32 V DC
	OB	typ. 20 mA (with current output)
Input 1		
		lower limit of measurement range
Signal voltage		
High		8 32 V DC
Signal duration		min 1 s
Input 2		
		upper limit of measurement range
Signal voltage		
High		8 32 V DC
Signal duration		min. 1 s
Analog output		
Output type		analog current output
Default setting		rising ramp at ccw rotation
Linearity error		≤ 0.15 %
Load resistor		max. 500 Ω
Connection		
Connector		M12 connector, 5 pin
Standard conformity		
Degree of protection		DIN EN 60529 , IP68 / IP69K
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 g, 11 ms
Vibration resistance		DIN EN 60068-2-6, 30 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 % , no moisture condensation
Mechanical specifications		
Material		
Housing		Steel, corrosion-resistant
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 150 g
Rotational speed		max. 6000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		< 5 Ncm
Shaft load		
Axial		180 N
Radial		180 N

### Connection

Signal	M12 connector
Analog output	1
+V <sub>s</sub> (encoder)	2
GND (encoder)	3
Set 2	4
Set 1	5
Shielding	Housing
Pinout	2 0 4

### Operation

### **Description of rotary encoder functions**

### Default Settings

	Lower measuring range limit	Mid measuring range	Upper measuring range limit
Singleturn absolute rotary encoder	0	180°	360°
Multiturn absolute rotary encoder	0	8 x 360°	16 x 360°

### **Programming Encoders with No Operating Buttons**

### Scaling the measuring range

Use signal inputs "Set 1" and "Set 2" to scale the measuring range (minimum measuring range: 22.5°).

- 1. Connect signal inputs "Set 1" and "Set 2" simultaneously to +U<sub>B</sub> for 15 seconds. The progamming mode is activated now.
- 2. Turn the rotary encoder shaft to position 1 (lower measuring range limit).
- 3. Connect signal input "Set 1" to a high-potential source (+ $U_{B min} \le high potential \le +U_{B max}$ ) for 1 second.
- 4. Connect signal input "Set 1" to ground
- 5. Turn the rotary encoder shaft to position 2 (upper measuring range limit).
- 6. Connect signal input "Set 2" to a high-potential source ( $+U_{B min} \le high potential \le +U_{B max}$ ) for 1 second.
- 7. Connect signal input "Set 2" to ground

The analog output is now scaled to the programmed measuring range and the rotary encoder will operate in normal mode.

### **Resetting to the Default Setting**

1. Connect the two signal inputs ("Set 1" and "Set 2") to a high-potential source  $(+U_{B \min} \le high \text{ potential} \le +U_{B \max})$  for 1 second. The measuring range is then reset to the default setting.

### **Analog Output Properties**

The rotary encoder projects the current angular position of the rotary encoder shaft in an analog current value. The following graphic shows the values the output accepts at the various angular positions:





-							
Encoder type <sup>1)</sup>		Angular position					
	1	2	Mid	3	4	5	

### Absolute encoders

### ENA36HD-S10SA9-0413I42-RBD

Singleturn	Factory default setting	0°	-	180°	-	360°	-
	Scaled	<b>0</b> °	Lower measuring range limit	-	Upper measuring range limit	360°	Lower measuring range limit
Multiturn	Factory default setting	0°	-	2 <sup>4</sup> x 180°	-	2 <sup>4</sup> x 360°	
	Scaled <sup>2)</sup>	<b>0</b> °	Lower measuring range limit	-	Upper measuring range limit	2 <sup>n</sup> x 360°	Lower measuring range limit

n = whole number from 1 to 16

1) See model number

2) Overflow at 360°, 720°, 1440°, 2880°, 5760°, etc. depending on the scale set.

Encoder output type	Analog output value						
	Α	В	Mid	С	D		
4 mA 20 mA	3.6 mA	4 mA	12 mA	20 mA	22 mA		

### Installation

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- Cable cross-section of the screen at least 4 mm<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
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- 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**

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### Notes on connecting the electric screening

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### Absolute encoders

### ENA36HD-S10SA9-0413I42-RBD

Advantage:	metalised connector,	
relief	clamped with the strain	
Teller	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!



## Singleturn absolute encoder AVS58N-011YYRYGN-0014

- YY: Connector 9416L with special assignment
- Y: Power supply 5 V DC
- 14 Bit singleturn
- Hardware encoder
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Clamping flange



### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the AVS58 is maximum 16384 steps per revolution. In contrast to the AVS58 series the encoder does not have a microcontroller. Thus, it is a pure hardware encoder.

The control module sends a clock bundle to the absolute encoder to obtain the position data. The rotary encoder then sends the position data

synchronous to the cycles of the control module. This singleturn absolute encoder is available in clamp flange design with a shaft diameter of 10 mm x 20 mm. The electrical connection is made by a 12-pin round plug connector.

### Dimensions



Functional safety related parameters		
MTTF <sub>d</sub>		170 a
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	U <sub>B</sub>	5 V DC
No-load supply current	I <sub>0</sub>	max. 120 mA
Linearity		$\pm$ 2 LSB at 14 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit
Output code		Gray code

Technical Data	
Code course (counting direction)	cw descending (clockwise rotation, code course descending)
Interface	
Interface type	SSI
Monoflop time	20 ± 10 μs
Resolution	
Single turn	14 Bit
Overall resolution	14 Bit
Transfer rate	0.1 2 MBit/s
Standard conformity	RS 422
Connection	
Connector	type 9416L (M23), 12-pin
Standard conformity	
Degree of protection	DIN EN 60529, IP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 3 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 2000 Hz
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Mechanical specifications	
Material	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Mass	approx. 460 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N
Radial	110 N

### Accessories

Spring-loaded mounting bracket with a diameter of 36 mm

MBT-36ALS

### Connection

Signal	Connector 9416L, 12-pin	Explanation	Pinout
GND (encoder)	12	Power supply	
U <sub>b</sub> (encoder)	10	Power supply	8 7 11 6 5 4
Clock (+)	2	Positive cycle line	$\neg$
Clock (-)	1	Negative cycle line	
Data (+)	3	Positive transmission data	
Data (-)	4	Negative transmission data	
Reserved	11	Not wired, reserved	
Reserved	5	Not wired, reserved	1 / T
Reserved	9	Not wired, reserved	9 1 12 2 10 3
Reserved	8	Not wired, reserved	7
Reserved	6	Not wired, reserved	
Reserved	7	Not wired, reserved	7

### 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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.
- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.

### Singleturn absolute encoder



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

### Block diagram



Line length

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

Rotary encoder

Installation

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### Singleturn absolute encoder

### AVS58N-011YYRYGN-0014

Advantage:	metalised connector,	
relief	clamped with the strain	
Teller	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!



## Singleturn absolute encoder EVS58N-011IZR0BY-0013:01

- Industrial standard housing Ø58 mm
- EtherNet/IP
- 13 Bit singleturn
- Clamping flange
- Compatible with Rockwell/ Allen Bradley/ Schneider control
- Mechanical compatibility with all major encoders with fieldbus interface
- Rotary axis functionality
- Status LEDs

# **C** € ∞ EtherNet/IP

### **Dimensions**



General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	UB	10 30 V DC
Power consumption	P <sub>0</sub>	max. 4 W
Linearity		± 0.5 LSB (12 Bit)
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		EtherNet/IP
Resolution		
Single turn		13 Bit
Overall resolution		13 Bit
Physical		Ethernet
Transfer rate		100 MBit/s

Connection	
Connector	Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity	
Degree of protection	DIN EN 60529, shaft side: IP64 housing side: IP67
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 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	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Mass	approx. 370 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	$\leq$ 3 Ncm (version without shaft seal)
Shaft load	
Axial	40 N
Radial	110 N
Axial Radial	40 N 110 N

### Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -

### Indication

### **Diagnostic LEDs**

LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below

\* flashes with 2 Hz if engineering identification call is activated and link connection is available

Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another deviceCriteria: no data exchange	bus disconnected
		_	<ul> <li>Master not available / switched off</li> </ul>
on	flashes <sup>1)</sup>	Parameterization fault, no data exchange Criteria: data exchange correct. However, the slave did not switch to the data exchange mode.	<ul> <li>Slave not configured yet or wrong configuration</li> <li>Wrong station address assigned (but not outside the permitted range)</li> <li>Actual configuration of the slave differs from the nominal configuration</li> </ul>
on	off	Data exchange. Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds

## Absolute rotary encoder ENA58IL-R15YY5-1212SG1-RBY:01

- SSI interface
- Recessed hollow shaft
- Resolution: 12 singleturn, 12 bit multiturn
- Free of wear magnetic sampling
- High resolution and accuracy



### **Function**

The ENA58IL series are high precision encoders with internal magnetic sampling.

This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module.

### Dimensions



	magnetic sampling
	Absolute rotary encoder
	$\leq \pm 0.1$ °
	E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
UB	4.5 30 V
I <sub>0</sub>	typ. 50 mA
P <sub>0</sub>	approx. 1.5 W
t <sub>v</sub>	< 450 ms
	Gray code
	cw ascending
	SSI
	UB Io Po t <sub>v</sub>

**Technical Data** 

Single turn	12 Bit
Multiturn	12 Bit
Transfer rate	0.1 2 MBit/s
Cycle time	< 100 µs
Standard conformity	RS 422
Connection	
Fixed cable with plug	cable Ø8 mm, 8 x 2 x 0.14 mm <sup>2</sup> , length 300 mm , M12 connector, 8-pin
Standard conformity	
Degree of protection	DIN EN 60529, IP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, flexing: -5 70 °C (23 158 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static
Radial offset	± 0.5 mm static
General information	
Scope of delivery	Spring plate is enclosed as accessory

### Connection

Signal	Connector M12, 8-pin
Not connected	1
+U <sub>B</sub> (rotary encoder)	2
Data (+)	3
Data (-)	4
Clock (+)	5
Clock (-)	6
GND (rotary encoder)	7
Not connected	8

### Interface

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



### 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  $(D_n)$ ) 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<sub>m</sub> 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<sub>n</sub> has • expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.



If the pulse line is exchanged, the data word is generated offset.

### **Block diagram**



### Line length

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

Rotary encoder

Interface electronics

## Absolute rotary encoder ENA58IL-R15YY5-1212SI2-RAY:01

- SSI interface
- Recessed hollow shaft
- Resolution: 12 singleturn, 12 bit multiturn
- Free of wear magnetic sampling
- High resolution and accuracy



### Dimensions



General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder
Linearity error		≤±0.1 °
UL File Number		E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Electrical specifications		
Operating voltage	UB	10 30 V
No-load supply current	I <sub>0</sub>	typ. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	< 450 ms
Output code		Gray code
Code course (counting direction)		cw ascending
Interface		
Interface type		SSI ; SSI + incremental track
Resolution		
Single turn		12 Bit
Multiturn		12 Bit
Transfer rate		0.1 2 MBit/s
Cycle time		< 100 µs
Standard conformity		RS 422

### **Technical Data**

Output	
Output type	Push/pull
Signal output	A+B+Z+/A+/B+/Z
Pulses	2048
Connection	
Fixed cable with plug	cable Ø8 mm, 8 x 2 x 0.14 mm² , length 300 mm , M23 connector, 12-pin , right-rotating
Standard conformity	
Degree of protection	DIN EN 60529, IP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 <i>g</i> , 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, flexing: -5 70 °C (23 158 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static
Radial offset	± 0.5 mm static
General information	
Scope of delivery	Spring plate is enclosed as accessory

### **Connection Assignment**

Signal	M23 connector, 12-pin, clockwise
GND	1
+U <sub>B</sub>	2
Clock (+)	3
Clock (-)	4
Data (+)	5
Data (-)	6
A	7
Z	8
/Z	9
В	10
/A	11
/B	12

### **Connection Assignment**



## Operation

### Signal outputs



### Interface

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



### 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  $(D_n)$ ) 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<sub>m</sub> 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<sub>n</sub> has • expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.



If the pulse line is exchanged, the data word is generated offset.

### **Block diagram**



### Line length

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

Rotary encoder

Interface electronics



## Absolute rotary encoder ENA58IL-S10CA5-0012SY1-RC5:01

- Solid shaft
- SSI interface
- 12 Bit singleturn
- Free of wear magnetic sampling
- High resolution and accuracy



### **Function**

The ENA58IL series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

### **Dimensions**





General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder
Linearity error		≤±0.1 °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Electrical specifications		
Operating voltage	UB	4.5 30 V DC
No-load supply current	I <sub>0</sub>	typ. 50 mA
Power consumption	P <sub>0</sub>	approx. 1 W
Time delay before availability	t <sub>v</sub>	< 450 ms
Output code		Gray code
Code course (counting direction)		adjustable

Interface	
Interface type	SSI
Resolution	
Single turn	12 Bit
Transfer rate	0.1 2 MBit/s
Cycle time	< 100 µs
Input 1	
Input type	Selection of counting direction (cw/ccw)
Signal voltage	
High	4.75 V $U_B$ or unconnected (cw descending)
Low	0 2 V (cw ascending)
Input current	< 6 mA
Switch-on delay	< 250 ms
Input 2	
Input type	zero-set (PRESET 1) with falling edge
Signal voltage	
High	4.75 V U <sub>B</sub>
Low	0 2 V
Input current	< 6 mA
Signal duration	min. 1.1 s
Connection	
Cable	Ø7 mm, 6 x 2 x 0.14 mm² , 5 m
Standard conformity	
Degree of protection	IP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, movable installation: -5 70 °C (23 158 °F), cable, fixed installation: -30 70 °C (-22 158 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g , with cable
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shatt load	
Axial	40 N
Hadial	110 N

### Connection

Signal	Cable	Explanation
GND (encoder)	White	Power supply
+U <sub>B</sub> (encoder)	Brown	Power supply
Clock (+)	Green	Positive cycle line
Clock (+)	Yellow	Negative cycle line
Data (+)	Grey	Positive transmission data
Data (-)	Pink	Negative transmission data
V/R	Red	Input for selection of counting direction
PRESET 1	Blue	Zero-setting input

### Interface

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



### 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<sub>n</sub>)) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.

### Absolute rotary encoder



If the pulse line is exchanged, the data word is generated offset.

### Block diagram



### Line length

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

Rotary encoder

Interface electronics



## Singleturn absolute encoder

## FVS58

- Industrial standard housing Ø58 mm
- 13 Bit singleturn
- Output code: gray and binary
- Short-circuit proof push-pull output
- Inputs for selecting counting direction, LATCH, and PRESET
- Code change frequency up to 400 kHz Servo or clamping flange

### Dimensions



### Dimensions



Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 140 mA
Power consumption	P <sub>0</sub>	$\leq$ 2 W , without output drivers
Linearity		±0.5 LSB
Output code		Gray code, binary code and Gray excess code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending)
Code preparation time		0.3 ms
Interface		
Interface type		Push-pull, parallel, short-circuit protected
Resolution		
Single turn		13 Bit
Load current		40 mA
Voltage drop		≤ 2.5 V
Signal voltage		
High		operating voltage minus voltage drop
Low		≤ 2.8 V
Rise time		300 ns
De-energized delay		300 ns
Code change frequency		400 kHz
Input 1		
Input type		Selection of counting direction (cw/ccw)

Technical Data	
Signal voltage	
High	10 30 V
Low	02V
Input current	< 6 mA
Signal duration	min. 10 ms
Switch-on delay	≥1 ms
Switch-off delay	≥ 1 ms
Input 2	
Input type	Temporary storage (LATCH)
Signal voltage	
High	10 30 V
Low	0 2 V
Input current	< 6 mA
Signal duration	min. 100 μs
Switch-on delay	< 0.1 ms
Switch-off delay	< 0.1 ms
Input 3	
Input type	zero-set (PRESET)
Signal voltage	
High	10 30 V
Low	0 2 V
Input current	< 6 mA
Signal duration	min. 10 ms
Switch-on delay	< 1 ms
Connection	
Connector	type 9424 (M23), 19-pin
Cable	Ø9 mm, 12 x 2 x 0.14 mm <sup>2</sup> , 2 m
Standard conformity	
Degree of protection	DIN EN 60529, IP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 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) cable models: -30 70 °C (rigid wiring) -5 70 °C (flexible wiring)
Storage temperature	-40 85 °C (-40 185 °F) (cable models: -5 70 °C)
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. 200 g (combination 1) approx. 400 g (combination 2)
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	≤ 5 Ncm
Shaft load	

Technical Data					
Axial	40 N				
Radial	110 N				

Acces	Accessories			
~	0000			
0	9203	Angled flange		
Crit	9424	Female cordset		
0	9310-3	Synchro clamping element		
	9300	Mounting bracket for servo flange		
<b>i</b>	KW-10/10	Helical coupling		
<b>i</b>	KW-6/10	Helical coupling		
<b>(</b> )	KW-6/6	Helical coupling		
<b>i</b>	KW-6/8	Helical coupling		
1	9401 10*10	Spring steel coupling		
	9401 10*12	Spring steel coupling		
	9401 6*10	Spring steel coupling		
	9401 6*6	Spring steel coupling		
	9402 6*6	Spring steel coupling		
	9404 10*10	Spring disk coupling		
	9404 6*6	Spring disk coupling		
() (	9409 10*10	Bellows coupling		
	9409 6*10	Bellows coupling		
	9409 6*6	Bellows coupling		

Accessories				
	9409 6*8	Bellows coupling		
O	9410 10*10	Precision coupling		
O	9410 6*6	Precision coupling		
	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm		

### Function

The emphasis for this series is on rapid data transfer. Position data are read directly out of the Gray code disc. The high code switching frequency of 400 kHz is achieved by consciously avoiding the use of a microcontroller.

In terms of the mechanics, designs with clamping flange or servo flange are available for the FVS58 singleturn absolute encoder.

### Connection

Signal	Cable Ø9 mm, 24-core	Connector 9424, 19-pin	Explanation
GND (rotary encoder) White 6		6	Power supply
U <sub>b</sub> (rotary encoder)	Brown	12	Power supply
Data bit 1	Green	1	Data output
Data bit 2	Yellow	2	Data output
Data bit 3	Grey	3	Data output
Data bit 4	Pink	4	Data output
Data bit 5	Blue	5	Data output
Data bit 6	Red	7	Data output
Data bit 7	Black	8	Data output
Data bit 8	Violet	9	Data output
Data bit 9	Grey/Pink	10	Data output
Data bit 10	Red/Blue	11	Data output
Data bit 11	White/Green	13	Data output
Data bit 12	Brown/Green	14	Data output
Data bit 13	White/Yellow	15	Data output
	White/Grey	-	Reserved
	Grey/Brown	19	Reserved
V/R	White/Pink	16	Input for selection of counting direction
LATCH	Pink/Brown	17	Temporary storage input
	White/Blue	-	Reserved
PRESET	Brown/Blue	18	Zero setting input
	White/Red	-	Reserved
	Brown/Red	-	Reserved
		1 13 2 3 4 14 5 18 15 12 6 11 6 17 10 19 9 8 16 7	

### Interface

### Inputs







Input for selection of counting direction (V/R)



### Input for selection of counting direction (V/R)

The counting direction for the absolute value rotary encoder as seen looking on the shaft is defined as right rotating (cw) rising or descending. The counting direction can be reversed with the V/R input. If the input is not used, the counting direction is defined as rising (standard), the level is at "1". Pulse duration T > 10 ms.

Input level: "1" or unused = rising code value with direction of rotation cw.

Input level: "0" = descending code value for direction of rotation cw.

### Input for temporary storage (LATCH)
With LATCH input "active", the position data on the parallel interface are "frozen". This makes it possible to accept position data without errors (especially for binary position data), since any change in the data during the read procedure is prevented. If this input is unused, its value is "0". Pulse duration  $T > 100 \ \mu s$ .

Input level: "1" = position data saved and stable at the output.

Input level: "0" or unused = position data free running at the output.

#### Input zero setting (PRESET)

By means of the PRESET input, the absolute value rotary encoder can be adjusted electronically to position value 0. Pulse duration T > 10 ms.

Input level: "0" or unused = inactive.

Input level: "1" = Data output word is set to 0.

#### **Type Code**





# FSS58

- Industrial standard housing Ø58 mm
- 13 Bit singleturn
- Output code: gray and binary
- Short-circuit proof push-pull output
- Inputs for selecting counting direction, LATCH, and PRESET
- Code change frequency up to 400 kHz
- Recessed hollow shaft

#### **Function**

The emphasis for this series is on rapid data transfer. Position data are read directly out of the Gray code disc. The high code switching frequency of 400 kHz is achieved by consciously avoiding the use of a microcontroller.

The FSS58 singleturn absolute encoder is equipped with a recessed hollow shaft. The encoder housing has a diameter of 58 mm. The recessed hollow shaft is available with diameters of 10 mm, 12 mm and 15 mm.

This version in particular represents a simple and cost-effective mounting solution. The shaft hub connection is already integrated into the rotary encoder. The rotary encoder is held in place by a torque rest.

#### Dimensions



# Technical Data

Electrical specifications		
Operating voltage	U <sub>B</sub>	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 140 mA
Power consumption	P <sub>0</sub>	$\leq$ 2 W , without output drivers
Linearity		± 0.5 LSB
Output code		Gray code, binary code and Gray excess code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending)
Code preparation time		0.3 ms
Interface		
Interface type		Push-pull, parallel , short-circuit protected
Resolution		
Single turn		13 Bit
Load current		20 mA
Voltage drop		≤ 2.5 V
Signal voltage		
High		operating voltage minus voltage drop
Low		≤ 2.8 V
Rise time		300 ns
De-energized delay		300 ns
Code change frequency		400 kHz
Input 1		
Input type		Selection of counting direction (cw/ccw)
Signal voltage		
High		10 30 V
Low		0 2 V
Input current		< 6 mA
Signal duration		min. 10 ms
Switch-on delay		≥ 1 ms
Switch-off delay		≥ 1 ms
Input 2		
Input type		Temporary storage (LATCH)
Signal voltage		
High		10 30 V
Low		0 2 V
Input current		< 6 mA
Signal duration		min. 100 μs
Switch-on delay		< 0.1 ms
Switch-off delay		< 0.1 ms
Input 3		
Input type		zero-set (PRESET)
Signal voltage		
High		10 30 V
Low		02V
Input current		< 6 mA
Signal duration		min. 10 ms
Switch-on delay		< 1 ms
Connection		har 0404 (100) 40 a'r
Connector		type 9424 (M23), 19-pin
		99 mm, 12 x 2 x 0.14 mm², 2 m
Standard conformity		
		DIN EN 60029, IP65
		DIN EN 60000 C 40007
		EN 01000-0-4.2007

Technical Data	
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 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) cable models: -30 70 °C (rigid wiring) -5 70 °C (flexible wiring)
Storage temperature	-40 85 °C (-40 185 °F) (cable models: -5 70 °C)
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. 200 g (combination 1) approx. 400 g (combination 2)
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	≤ 5 Ncm

# Accessories

Chi	9424	Female cordset
°Q	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
20	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

#### Connection

Signal	Cable Ø9 mm, 24-core	Connector 9424, 19-pin	Explanation
GND (rotary encoder)	White	6	Power supply
U <sub>b</sub> (rotary encoder)	Brown	12	Power supply
Data bit 1	Green	1	Data output
Data bit 2	Yellow	2	Data output
Data bit 3	Grey	3	Data output
Data bit 4	Pink	4	Data output
Data bit 5	Blue	5	Data output
Data bit 6	Red	7	Data output
Data bit 7	Black	8	Data output
Data bit 8	Violet	9	Data output
Data bit 9	Grey/Pink	10	Data output
Data bit 10	Red/Blue	11	Data output
Data bit 11	White/Green	13	Data output
Data bit 12	Brown/Green	14	Data output
Data bit 13	White/Yellow	15	Data output
	White/Grey	-	Reserved
	Grey/Brown	19	Reserved
V/R	White/Pink	16	Input for selection of counting direction
LATCH	Pink/Brown	17	Temporary storage input
	White/Blue	-	Reserved
PRESET	Brown/Blue	18	Zero setting input
	White/Red	-	Reserved
	Brown/Red	-	Reserved
		1 13 2 3 4 14 5 18 15 12 7 7 6 11 6 17 10 19 9 8 16 7	

# Interface

#### Inputs

Input for temporary storage (LATCH) Input zero setting (PRESET)





Input for selection of counting direction (V/R)



#### Input for selection of counting direction (V/R)

The counting direction for the absolute value rotary encoder as seen looking on the shaft is defined as right rotating (cw) rising or descending. The counting direction can be reversed with the V/R input. If the input is not used, the counting direction is defined as rising (standard), the level is at "1". Pulse duration T > 10 ms.

Input level: "1" or unused = rising code value with direction of rotation cw.

Input level: "0" = descending code value for direction of rotation cw.

#### Input for temporary storage (LATCH)

With LATCH input "active", the position data on the parallel interface are "frozen". This makes it possible to accept position data without errors (especially for binary position data), since any change in the data during the read procedure is prevented. If this input is unused, its value is "0". Pulse duration  $T > 100 \ \mu$ s.

Input level: "1" = position data saved and stable at the output.

Input level: "0" or unused = position data free running at the output.

#### Input zero setting (PRESET)

By means of the PRESET input, the absolute value rotary encoder can be adjusted electronically to position value 0. Pulse duration T > 10 ms.

Input level: "0" or unused = inactive. Input level: "1" = Data output word is set to 0.

# Type Code

#### Order code

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# EVS58-TZ

- Industrial standard housing Ø58 mm
- Ethernet interface with TCP/IP
- 16 Bit singleturn
- Integrated webserver
- Servo or clamping flange

#### **Function**

- Absolute rotary encoders deliver an absolute step value for each angle setting. The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The Ethernet interface of this absolute encoder supports the TCP/IP protocol. The integrated webserver provides Java applets, which allow the whole parameterisation of the encoder via any web browser. The following operation modes can be selected:
- Polled mode
- · Cyclic mode
- · Change of state mode

The device is designed for shaft mounting and is available in servo flange or clamping flange design.

#### Dimensions





# Dimensions

#### **Clamping flange**



# **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Functional safety related parameters		
MTTF <sub>d</sub>		130 a
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	max. 4 W
Linearity		± 0.5 LSB ( up to 12 Bit ) ± 2 LSB ( up to 16 Bit )
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		TCP/IP
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Physical		Ethernet
Transfer rate		10 MBit/s / 100 MBit/s
Connection		
Connector		Ethernet: 1 socket M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 5-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source

# **Technical Data**

Ambient conditions	
Operating temperature	0 60 °C (32 140 °F) Standard , with Option T -40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Mechanical specifications	
Material	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Mass	approx. 500 g
Rotational speed	max. 12000 min <sup>-1</sup> without shaft seal max. 3000 min <sup>-1</sup> with shaft seal
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	≤ 3 Ncm without shaft seal ≤ 5 Ncm with shaft seal
Shaft load	
Axial	40 N
Radial	110 N

# Accessories

0	9203	Angled flange
	V1SD-G-ABG-PG9	Male connector M12 straight D-coded 4-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
$\geq$	V1SD-G-2M-PUR-ABG- V45-G	Connection cable, M12 to RJ-45, PUR cable 4-pin, CAT5e
	V15-G-YE2M-PVC	Female cordset, M12, 5-pin, PVC cable
	9300	Mounting bracket for servo flange
	V15-G-YE5M-PVC	Female cordset, M12, 5-pin, PVC cable
	V15-G-PG9	Female connector M12 straight A-coded 5-pin, for cable diameter 6 - 8 mm, field-attachable
	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

## Connection

Pin	Male connector M12 x 1, 5-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	+ 24 V	Tx +
2	+ 24 V	Rx +
3	0 V	Tx -
4	0 V	Rx -
5	PE	

# Indication



Voltage supply Ethernet-Port

#### **LED-indicators**

LED	Colour	Meaning			
Rx1	yellow	Data traffic on Port 1			
Link1	green	Connection to an Ethernet device on Port 1			
Col1	red	Bus collision on Port 1			
Err	red	Internal error			
Run	green	Ethernet interface ready to work			
IP address adjustment					

Set switch S2 to position OFF. The IP address can be adjusted now. In switch position ON, the IP address is blocked to avoid unintended change. The rotary switches and switch S1 are without any function.

ir address adjusti

# Type Code



#### Order code



#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,
relief	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!



# ESS58-TZ

- Industrial standard housing Ø58 mm
- Ethernet interface with TCP/IP
- 16 Bit singleturn
- Integrated webserver
- Recessed hollow shaft



#### **Function**

In addition to the CANopen-, DeviceNet-, PROFIBUS- and AS-Interface encoders, we have broadened our product line of bus-capable absolute encoders with the ESS58 for Ethernet.

Absolute rotary encoders deliver an absolute step value for each angle setting.

The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The Ethernet interface of this absolute encoder supports the TCP/IP protocol. The integrated webserver provides Java applets, which allow the whole parameterisation of the encoder via any web browser. In addition to various functions like resolution adjustment, e -mail-services, change of the IP address and many others, the following operation modes can be selected:

- · Polled mode
- Cyclic mode
- Change of state mode

The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a torque rest.

#### **Dimensions**

#### **Recessed hollow shaft**



\* shaft can be reduced to ø10F7 or ø12F7 by using an adapter



#### **Technical Data**

General specifications	
Detection type	photoelectric sampling
Device type	Singleturn absolute encoder
Functional safety related parameters	
MTTF <sub>d</sub>	130 a
Mission Time (T <sub>M</sub> )	20 a
L <sub>10</sub>	1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load

Technical Data		
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	UB	10 30 V DC
Power consumption	P <sub>0</sub>	max. 4 W
Linearity		± 0.5 LSB (12 Bit) ,
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		TCP/IP
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Physical		Ethernet
Transfer rate		10 MBit/s / 100 MBit/s
Connection		
Connector		Ethernet: 1 socket M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 5-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source
Ambient conditions		
Operating temperature		0 60 °C (32 140 °F) Standard , with Option T -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		housing: powder coated aluminum flange: aluminum shaft: stainless steel
Mass		approx. 500 g
Rotational speed		max. 12000 min <sup>-1</sup> without shaft seal max. 3000 min <sup>-1</sup> with shaft seal
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		$\leq$ 3 Ncm without shaft seal $\leq$ 5 Ncm with shaft seal
Tightening torque, fastening screws		max. 1.8 Nm
Shaft load		
Angle offset		± 0.9 °
Axial offset		static: ± 0.3 mm, dynamic: ± 0.1 mm
Radial offset		static: $\pm 0.5$ mm, dynamic: $\pm 0.2$ mm

# Accessories

V15-G-YE2M-PVC	Female cordset, M12, 5-pin, PVC cable
V15-G-YE5M-PVC	Female cordset, M12, 5-pin, PVC cable

# Accessories

	V1SD-G-ABG-PG9	Male connector M12 straight D-coded 4-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
$\sum$	V1SD-G-2M-PUR-ABG- V45-G	Connection cable, M12 to RJ-45, PUR cable 4-pin, CAT5e
	V15-G-PG9	Female connector M12 straight A-coded 5-pin, for cable diameter 6 - 8 mm, field-attachable
ŶQ	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
20	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

S2: IP address ON: locked OFF: adjustable

## Connection

Pin	Male connector M12 x 1, 5-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	+ 24 V	Tx +
2	+ 24 V	Rx +
3	0 V	Tx -
4	0 V	Rx -
5	PE	

# Indication



Voltage supply Ethernet-Port

#### **LED-indicators**

LED	Colour	Meaning				
Rx1	yellow	Data traffic on Port 1				
Link1	green	Connection to an Ethernet device on Port 1				
Col1	red	Bus collision on Port 1				
Err	red	Internal error				
Run	green	Ethernet interface ready to work				
P address adjustment						

Set switch S2 to position OFF. The IP address can be adjusted now. In switch position ON, the IP address is blocked to avoid unintended change. The rotary switches and switch S1 are without any function.

## IP address adjustment

# Type Code

#### Order code



E Ethernet

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	
relief	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!



# ESS58-PN

- Industrial standard housing Ø58 mm
- **PROFINET IRT**
- 16 Bit singleturn
- Recessed hollow shaft
- Network loop through by means of integrated 2 port switch (IRT capable)
- IP address resettable
- No DIP switches for address setting
- Mechanical compatibility with all major encoders with fieldbus interface
- Status LEDs



#### **Function**

In addition to the CANopen-, DeviceNet-, PROFIBUS- and AS-Interface encoders, we have broadened our product line of bus-capable absolute encoders with the ESS58 for Ethernet. Absolute rotary encoders deliver an absolute step value for each angle setting. This device has a maximum basic resolution of 65536 steps per

revolution (16 bits).

The Ethernet interface of this absolute encoder supports the Profinet protocol. The integrated webserver provides Java applets, which allow the whole parameterisation of the encoder via any web browser. In addition to various functions like resolution adjustment, e-mail-services, change of the IP address and many others, the following operation modes can be selected:

- Polled mode
- · Cyclic mode
- · Change of state mode

The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a torque rest.

#### **Dimensions**



#### **Technical Data**

#### **General specifications**

Detection type	photoelectric sampling
Device type	Singleturn absolute encoder
UL File Number	E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
unctional safety related parameters	

#### Functional safety related parameters

Technical Data		
MTTE		130 a
Mission Time $(T_{M})$		20 a
		1.9 E+11 at 6000 rom and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0%
Electrical specifications		
	Un	10 30 V DC
Power consumption	Po	max. 4 W
Linearity	- 0	± 0.5 LSB (12 Bit) .
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		PROFINET IO
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Physical		Ethernet
Transfer rate		100 MBit/s
Cycle time		$\leq$ 1 ms (IRT) ; $\leq$ 10 ms (RT)
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65 Stainless steel version (INOX): completely IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 1		housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 2 (Inox)		housing: stainless steel 1.4305 / AISI 303 flange: stainless steel 1.4301 / AISI 304 shaft: stainless steel 1.4305 / AISI 303
Mass		approx. 360 g (combination 1) approx. 910 g (combination 2)
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		$\leq$ 3 Ncm (version without shaft seal)
Tightening torque, fastening screws Shaft load		max. 1.8 Nm
Angle offset		± 0.9 °
Axial offset		static: ± 0.3 mm, dynamic: ± 0.1 mm

#### **Technical Data**

Radial	offset
i iuuiui	011001

static:  $\pm$  0.5 mm, dynamic:  $\pm$  0.2 mm

## Type Code

Struc	ture of	the ty	pe co	de																		
E	S	S	5	8	(1	)	-	(2)	(2)	(2)	P	•	N	R	0	В	Ν	-	0	0	)	(3) (3)
						· •					·						· · · · ·					
E			1	Data fo	ormat																	
LF				therne	et																	
S				Shaft v	ersion																	
S			F	Recess	ed holl	low sł	naft															
S				unctio	on prir	nciple	•															
S			5	Singletu	Jrn																	
58				lousin	n dian	neter																
58			F	58 mm	ig alan	neter																
00																						
1				lousin	ig mat	erial																
Ν			A	Aluminu	um, po	wder	coate	d														
W			/	Aluminu	um, po	wder	coate	ed with	n shaft	seal												
Ι			3	Stainles	ss stee	I																
(2) (2	2) (2)			Shaft d	limons	ione																
F1A	-/ (-/		F	Recess	ed holl	low st	naft Ø	010 mi	m x 30	) mm												
F2A				Recess	ed holl	low st	naft Ø	) 12 mi	m x 30	) mm												
F3A			F	Recess	ed holl	ow sł	naft Ø	) 15 mi	m x 30	) mm												
PN			(	Conne	ction t	ype /	prot	ocol														
PN			F	Profine	t protoc	col, 1	fema	le con	inecto	r/1 male	e con	necto	r, M12	2 x 1								
B				- vit no	sition																	
R			F	Radial	ontion																	
0			•	Option																		
0			1	Vone																		
B			(	Jutput	code																	
B			-	Rinary	coue																	
				Jintary																		
Ν			1	Гетре	rature																	
Ν			1	Vormal																		
(3) (3	5)			vumbe		ts sir		urn	4)													
10				6 Bito	· 6552		5 (56	anuaro	<i></i>													
1 1 ( )				1011115	. ບບບບກ	u uus																

# Accessories Image: Solid Solid

# Connection

Pin	Voltage supply Male connector M12 x 1, 4-pin, A-coded	Ethernet Female connector M12 x 1, 4-pin, D-coded
1	+VS (15 30 VDC)	Tx +
2	n. c.	Rx +
3	GND (0 V)	Tx -
4	n. c.	Rx -

# Indication

#### Diagnostic LEDs

	1	
LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below
+ (1 1		

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause	
off	off	No power		
on	on	No connection to another device	bus disconnected	
		Criteria: no data exchange	Master not available / switched off	
on	flashes 1)	Parameterization fault, no data	Slave not configured yet or wrong configuration	
		exchange	Wrong station address assigned (but not outside the permitted range)	
		Criteria: data exchange correct.		
			• Actual configuration of the slave differs from the	
		However, the slave did not switch to the data exchange mode.	nominal configuration	
on	off	Data exchange.		
		Slave and operation ok.		

1) flashing frequency 0.5 Hz for at least 3 seconds



# EVS58-PN

- Industrial standard housing Ø58 mm
- **PROFINET IRT**
- 16 Bit singleturn
- Servo or clamping flange
- Network loop through by means of integrated 2 port switch (IRT capable)
- IP address resettable
- No DIP switches for address setting
- Mechanical compatibility with all major encoders with fieldbus interface
- Status LEDs



#### **Function**

In addition to the CANopen-, DeviceNet-, PROFIBUS- and AS-Interface encoders, we have broadened our product line of bus-capable absolute encoders with the EVS58 for Ethernet. Absolute rotary encoders deliver an absolute step value for each angle setting. This device has a maximum basic resolution of 65536 steps per

revolution (16 bits).

The Ethernet interface of this absolute encoder supports the Profinet protocol. The integrated webserver provides Java applets, which allow the whole parameterisation of the encoder via any web browser. In addition to various functions like resolution adjustment, e-mail-services, change of the IP address and many others, the following operation modes can be selected:

- Polled mode
- · Cyclic mode
- · Change of state mode

The device is designed for shaft mounting and is available in servo flange or clamping flange design.

#### Dimensions



#### Dimensions



#### **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		130 a
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	max. 4 W
Linearity		± 0.5 LSB (12 Bit)
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		PROFINET IO
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Physical		Ethernet
Transfer rate		100 MBit/s
Cycle time		≤ 1 ms (IRT) ; ≤ 10 ms (RT)
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65 Stainless steel version (INOX): completely IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz

# **Technical Data**

Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Mechanical specifications	
Material	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 1	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 2 (Inox)	housing: stainless steel 1.4305 / AISI 303 flange: stainless steel 1.4301 / AISI 304 shaft: stainless steel 1.4305 / AISI 303
Mass	approx. 370 g (combination 1) approx. 840 g (combination 2)
Rotational speed	max. 12000 min -1
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	$\leq$ 3 Ncm (version without shaft seal)
Shaft load	
Axial	40 N
Radial	110 N

# Type Code

#### Structure of the type code

E V S	5 8 (1) - (2) (2) (3) P N R 0 B N - 0 0 (4) (4)				
E	Data format				
E	Ethernet				
V	Shaft version				
V	Solid shaft				
S	Function principle				
S	Singleturn				
-					
58	Housing diameter				
58	58 mm				
1	Housing material				
N	Aluminum, powder coated				
W	Aluminum, powder coated with shaft seal				
	Stainless steel				
(2) (2)	Chatt dimensions				
(2) (2)					
01	Shaft Ø10 mm x 20 mm				
03					
(3)	Flange				
1	Clamping flange				
2	Servo flange				
-					
PN	Connection type / protocol				
PN	Profinet protocol, 1 female connector/1 male connector, M12 x 1				
R	Exit position				
R	Radial				
•	Onlien				
0	None				

Type Code			
В	Output code		
В	Binary		
N	Temperature		
N	Normal		
(3) (3)	Number of bits singleturn		
13	13 Bits : 8192 pulses (standard)		
16	16 Bits : 65536 pulses		

# Accessories

9203	Angled flange
9300	Mounting bracket for servo flange
MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

## Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$	

# Indication

#### Diagnostic LEDs

LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below
* flack a soluble O I I if an arise a solution is a stiff a stiff a stiff a stift a st		

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another device	bus disconnected
		Criteria: no data exchange	<ul> <li>Master not available / switched off</li> </ul>
on	flashes 1)	Parameterization fault, no data	<ul> <li>Slave not configured yet or wrong configuration</li> </ul>
		exchange	Wrong station address assigned (but not outside the permitted range)
		Criteria: data exchange correct.	
		However, the slave did not switch to the data exchange mode.	<ul> <li>Actual configuration of the slave differs from the nominal configuration</li> </ul>
on	off	Data exchange.	
		Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds



# **BSS58**

- Industrial standard housing Ø58 mm
- 13 Bit singleturn
- Output code: gray and binary
- Transfer of position data with 4 AS-Interface slaves
- Parameterization and addressing via AS-Interface
- Recessed hollow shaft



#### **Function**

Until now it was necessary to go back to the use of costly conventional wiring when wanting to use absolute encoders. The reason for this was that the handshake mode with the control module of the analogue profile proved to be too slow for positioning tasks. In order to meet the real-time demands of many applications, a multi-slave solution using the BSS58 AS-Interface rotary encoders was created. The position value of 13 Bits in length is transferred within a single cycle via the 4 integrated AS-Interface chips to the master and made available to the PLC.

The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a torque rest. This may simply be a slide-in pin that locks in the plastic receptacle integrated into the flange.

### Dimensions



#### **Technical Data**

General specifications			
Detection type		photoelectric sampling	
Device type		Singleturn absolute encoder	
Electrical specifications			
Operating voltage	$U_B$	29.5 31.6 V DC	
No-load supply current	I <sub>0</sub>	max. starting current 155 mA , operating current max. 85 mA	
Linearity		±1 LSB	
Output code		programmable, Gray code, binary code	
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)	

Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t37281\_eng.pdf

# **Technical Data**

Interface	
Interface type	AS-Interface
Resolution	
Single turn	13 Bit
Overall resolution	13 Bit
Transfer rate	max. 0.167 MBit/s
Standard conformity	AS-Interface
Connection	
Connector	type V1, M12, 4-pin
Standard conformity	
Degree of protection	DIN EN 60529, IP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 11 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 2000 Hz
Ambient conditions	
Operating temperature	-20 70 °C (-4 158 °F)
Storage temperature	-25 85 °C (-13 185 °F)
Mechanical specifications	
Material	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Mass	approx. 330 g
Rotational speed	max. 10000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	≤ 2 Ncm
Tightening torque, fastening screws	max. 1.8 Nm
Shaft load	
Angle offset	1°
Axial offset	max. 1 mm

#### Connection

Signal	V1 connector, 4-pin	Explanation
AS-Interface +	1	
Reserved	2	Not wired
AS-Interface -	3	
Reserved	4	Not wired

#### Interface

#### Addresses

	Slave A	Slave B	Slave C	Slave D
Preset address	1	2	3	4
IO code	7	0	0	0
ID code	F	F	F	F



When readdressing by means of a bus master or a programming device, it is absolutely essential to assign different addresses to the four integrated AS-Interface chips.

#### Parameterization

#### **Parameter bits**

The four parameter bits of slave A are used to set the parameters of the rotary encoder.

The parameter bits of slave B, C and D are not used.

Status of	Slave A										
parameter bit	P0	P1	P2	P3							
0	Gray code	Transfer with flag bits	Descending counting direction for clockwise rotation	Not used							
1	Binary code	Transfer without flag bits	Ascending counting direction for clockwise rotation	Not used							

#### Data bits

#### From the AS-Interface master to the rotary encoder

Data from the AS-Interface master are transferred to the rotary encoder via slave A, which works bidirectionally. Slaves B, C and D work unidirectionally, i.e. they are incapable of receiving data.

Status of	Slave A								
D0/D1 or D2/D3	D0/D1	D2/D3							
00	Normal mode	Position data are not saved!							
01	Rotary encoder is set to 1/4 of the singleturn resolution.	Position data are saved!							
10	Rotary encoder is set to 0.	Position data are saved!							
11	Normal mode	Position data are not saved!							

When a change is made in data bits D2 and D3 from 01 to 10 or vice-versa, position data are resaved in the rotary encoder.

#### From the rotary encoder to the AS-Interface master

Depending on the value of parameter bit P1 of slave A, data transfer to the AS-Interface master takes place with or without flag bits.

#### P1 = 1: Transfer without flag bits

Slave A					Sla	ve B			Sla	ve C		Slave D					
D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3		
Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Bit 9	Bit 10	Bit 11	Bit 12		Not used	ed!		

#### P1 = 0: Transfer with flag bits MA, MB, MC, MD

	Slave A Slave B						Sla	ve C		Slave D					
D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3
Bit 0	Bit 1	Bit 2	MA	Bit 3	Bit 4	Bit 5	MB	Bit 6	Bit 7	Bit 8	MC	Bit 9	Bit 10	Bit 11	MD

#### Interface

#### **Operating modes**

#### Address assignments for the four slaves

The AS-Interface master accesses all slaves one after the other within an AS-Interface cycle in order to transfer output data to slave A or to read in input data from the slaves. The singleturn absolute encoder uses only four AS-Interface chips to transfer the position data that are 13 bits wide, i. e. four slave addresses are assigned.

Since these four slaves are queried one after the other, the data may originate from any one of four different sampling times. To minimise the influence of this effect, sequential addresses (n, n+1, n+2 and n+3) should be assigned to slaves A, B, C and D.

Furthermore, it should be noted that slave A is responsible for controlling the functions of the absolute encoder. If the order of the slaves is changed (D = n, C = n+1, B = n+2, A = n+3), the output word, which is supposed to be transmitted by the function control module of the absolute encoder, will not be transmitted until slaves D, C and B have been read in.

A memory command would thus only take effect for slave A. The command would not take effect for slaves that were already read until the next read cycle. Data consistency would be lost because of the change of order.

#### Temporary storage and transfer with flag bits

If individual telegrams of the four slaves to the AS-Interface master suffer interference, it may happen in spite of temporary storage in the rotary encoder that the data that are transferred to the control module do not all originate from the same position data set.

Transferring one flag bit for each slave makes it possible for the control module to check which position data set an individual data set belongs to by comparing the four flag bits. Data bit D2 is used for this purpose.

Example:

	Slave A	Position data									
Cycle	Data bit D2	Slave A	Slave B	Slave C	Slave D						
1	0	XXX0	XXX0	XXX0	XXX0						
2	1	XXX1	XXX1	XXX1	XXX1						
3	0	XXX0	XXX0	XXX0	XXX0						
4	1	XXX1	XXX1	XXX1	XXX1						
etc.											

Bit D2 is influenced by the control module. Bit 4 of the input data corresponds to the value of this bit for each slave.

D2 is set to 0 in cycle 1. If the value of bit 4 of a slave were "1", that value would be derived from another cycle. This is a simple way to recognise data consistency.

Transferring the flag bits, however, reduces the usable position data from 13 bits to 12. Masking out the fourth bit of each slave increases slightly the effort of putting together the position data set in the control module.

#### Order code

В	S	\$	5	8	Ν	-				Α	V	F	3 (	)	Ν	Ν	I	-									
							_			_																	
																			E	Bit co	mbi	nat	ions				
																			N	/lultit	urn		(see	e tabl	e)		
																		_	S	Singl	eturr	n	0016	6 (16	bit =	65,5	36)
																Op	otic	on 2	2								
																N		NO	tex	pand	ed						
															utp	uτ	CO	ae	-								
													0	N	4	56	elec	ab	ie, i	oinar	y/Gra	ay					
													0	μισι		otic	'n										
	Exit position																										
												R	Ri po Ri	adial	•												
										Co	nnecti	on	tvpe	adiai													
										AV	/ F	lua	conne	ector	M12	2 x	1.4	4-pi	n								
							Sha	aft din	nensio	on/fl	angelv	/ers	ion				.,										
							01 <i>4</i>	A B	lecess	sed h	nollow	shaf	t Ø10	mm	x 21	m	m										
							024	A R	lecess	sed h	nollow	shaf	t Ø12	mm	x 21	m	m										
					Ηοι	using	mate	erial																			
					Ν	Alun	niniu	n, pov	der c	oate	d																
		Pr	inciple	of ope	erati	ion																					
		Μ	Multi	iturn																							
		S	Sing	leturn																							
	Sł	naft ve	ersion																								
	S	Re	cessed	hollow	/ sha	aft																					
Da	ta fo	rmat																									
В	AS	S-Inter	face																								



# **BVS58**

- Industrial standard housing Ø58 mm
- 13 Bit singleturn
- Output code: gray and binary
- Transfer of position data with 4 AS-Interface slaves
- Parameterization and addressing via AS-Interface
- Servo or clamping flange



#### **Function**

Until now it was necessary to go back to the use of costly conventional wiring when wanting to use absolute encoders. The reason for this was that the handshake mode with the control module of the analogue profile proved to be too slow for positioning tasks. In order to meet the real-time demands of many applications, a multi-slave solution using the BVS58 AS-Interface rotary encoders was created. The position value of 13 Bits in length is transferred within a single cycle via the 4 integrated AS-Interface chips to the master and made available to the PLC.

This singleturn absolute encoder is available either in clamping flange design with a shaft 10 mm in diameter x 20 mm or in servo flange design with a shaft 6 mm in diameter x 10 mm.

#### Dimensions



# Dimensions





# **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	$U_B$	29.5 31.6 V DC
No-load supply current	I <sub>0</sub>	max. starting current 155 mA , operating current max. 85 mA
Linearity		±1 LSB
Output code		programmable, Gray code, binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		AS-Interface
Resolution		
Single turn		13 Bit
Overall resolution		13 Bit
Transfer rate		max. 0.167 MBit/s
Standard conformity		AS-Interface
Connection		
Connector		type V1, M12, 4-pin
Standard conformity		
Degree of protection		DIN EN 60529, IP65
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 11 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Ambient conditions		
Operating temperature		-20 70 °C (-4 158 °F)
Storage temperature		-25 85 °C (-13 185 °F)
Mechanical specifications		
Material		housing: powder coated aluminum flange: aluminum shaft: stainless steel
Mass		approx. 330 g
Rotational speed		max. 10000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		≤ 2 Ncm

#### Accessories

9203	Angled flange
9300	Mounting bracket for servo flange
MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm
### Connection

Signal	V1 connector, 4-pin	Explanation
AS-Interface +	1	
Reserved	2	Not wired
AS-Interface -	3	
Reserved	4	Not wired

### Interface

#### Addresses

	Slave A	Slave B	Slave C	Slave D
Preset address	1	2	3	4
IO code	7	0	0	0
ID code	F	F	F	F



When readdressing by means of a bus master or a programming device, it is absolutely essential to assign different addresses to the four integrated AS-Interface chips.

### Parameterization

#### **Parameter bits**

The four parameter bits of slave A are used to set the parameters of the rotary encoder.

The parameter bits of slave B, C and D are not used.

Status of	Slave A									
parameter bit	P0	P1	P2	P3						
0	Gray code	Transfer with flag bits	Descending counting direction for clockwise rotation	Not used						
1	Binary code	Transfer without flag bits	Ascending counting direction for clockwise rotation	Not used						

### Data bits

### From the AS-Interface master to the rotary encoder

Data from the AS-Interface master are transferred to the rotary encoder via slave A, which works bidirectionally. Slaves B, C and D work unidirectionally, i.e. they are incapable of receiving data.

Status of	Slave A							
D0/D1 or D2/D3	D0/D1	D2/D3						
00	Normal mode	Position data are not saved!						
01	Rotary encoder is set to 1/4 of the singleturn resolution.	Position data are saved!						
10	Rotary encoder is set to 0.	Position data are saved!						
11	Normal mode	Position data are not saved!						

When a change is made in data bits D2 and D3 from 01 to 10 or vice-versa, position data are resaved in the rotary encoder.

### From the rotary encoder to the AS-Interface master

Depending on the value of parameter bit P1 of slave A, data transfer to the AS-Interface master takes place with or without flag bits.

### P1 = 1: Transfer without flag bits

	Sla	ve A		Slave B			Slave C			Slave D					
D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3
Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7	Bit 8	Bit 9	Bit 10	Bit 11	Bit 12	Not used!		

#### P1 = 0: Transfer with flag bits MA, MB, MC, MD

	Sla	ve A		Slave B			Slave C			Slave D					
D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3	D0	D1	D2	D3
Bit 0	Bit 1	Bit 2	MA	Bit 3	Bit 4	Bit 5	MB	Bit 6	Bit 7	Bit 8	MC	Bit 9	Bit 10	Bit 11	MD

### Interface

#### **Operating modes**

#### Address assignments for the four slaves

The AS-Interface master accesses all slaves one after the other within an AS-Interface cycle in order to transfer output data to slave A or to read in input data from the slaves. The singleturn absolute encoder uses only four AS-Interface chips to transfer the position data that are 13 bits wide, i. e. four slave addresses are assigned.

Since these four slaves are queried one after the other, the data may originate from any one of four different sampling times. To minimise the influence of this effect, sequential addresses (n, n+1, n+2 and n+3) should be assigned to slaves A, B, C and D.

Furthermore, it should be noted that slave A is responsible for controlling the functions of the absolute encoder. If the order of the slaves is changed (D = n, C = n+1, B = n+2, A = n+3), the output word, which is supposed to be transmitted by the function control module of the absolute encoder, will not be transmitted until slaves D, C and B have been read in.

A memory command would thus only take effect for slave A. The command would not take effect for slaves that were already read until the next read cycle. Data consistency would be lost because of the change of order.

#### Temporary storage and transfer with flag bits

If individual telegrams of the four slaves to the AS-Interface master suffer interference, it may happen in spite of temporary storage in the rotary encoder that the data that are transferred to the control module do not all originate from the same position data set.

Transferring one flag bit for each slave makes it possible for the control module to check which position data set an individual data set belongs to by comparing the four flag bits. Data bit D2 is used for this purpose.

Example:

	Slave A	Position data							
Cycle	Data bit D2	Slave A	Slave B	Slave C	Slave D				
1	0	XXX0	XXX0	XXX0	XXX0				
2	1	XXX1	XXX1	XXX1	XXX1				
3	0	XXX0	XXX0	XXX0	XXX0				
4	1	XXX1	XXX1	XXX1	XXX1				
etc.									

Bit D2 is influenced by the control module. Bit 4 of the input data corresponds to the value of this bit for each slave.

D2 is set to 0 in cycle 1. If the value of bit 4 of a slave were "1", that value would be derived from another cycle. This is a simple way to recognise data consistency.

Transferring the flag bits, however, reduces the usable position data from 13 bits to 12. Masking out the fourth bit of each slave increases slightly the effort of putting together the position data set in the control module.

### Order code





# EVS58-IZ

- Industrial standard housing Ø58 mm
- EtherNet/IP

- Up to 16 Bit singleturn
- Servo or clamping flange
- Network loop through by means of integrated 2 port switch
- IP address resettable
  - No DIP switches for address setting
- Compatible with Rockwell/ Allen Bradley/ Schneider control
- Mechanical compatibility with all major encoders with fieldbus interface
- Rotary axis functionality
- Status LEDs
- Ethernet IP declaration of conformity
- CIP encoder profile

# C € ∞ EtherNet/IP

### **Function**

In addition to the CANopen-, DeviceNet-, PROFIBUS- and AS-Interface encoders, we have broadened our product line of bus-capable absolute encoders with the EVS58 for Ethernet.

Absolute rotary encoders deliver an absolute step value for each angle setting. This device has a maximum basic resolution of 65536 steps per revolution (16 bits). The device is designed for shaft assembly and is available in servo flange or clamping flange design.

### **Dimensions**



## Dimensions



General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Functional safety related parameters		
MTTF <sub>d</sub>		130 a
Mission Time (T <sub>M</sub> )		20 a
L <sub>10h</sub>		1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	max. 4 W
Linearity		± 0.5 LSB (12 Bit) ,
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		EtherNet/IP
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Physical		Ethernet
Transfer rate		100 MBit/s
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65 Stainless steel version (INOX): completely IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source

# **Technical Data**

Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Mechanical specifications	
Material	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 1	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 2 (Inox)	housing: stainless steel 1.4305 / AISI 303 flange: stainless steel 1.4301 / AISI 304 shaft: stainless steel 1.4305 / AISI 303
Mass	approx. 370 g (combination 1) approx. 840 g (combination 2)
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	≤ 3 Ncm (version without shaft seal)
Shaft load	
Axial	40 N
Radial	110 N

# Accessories

9203	Angled flange
9300	Mounting bracket for servo flange
MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

# Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$	

### Indication

### **Diagnostic LEDs**

<u> </u>		
LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another device	bus disconnected
		Criteria: no data exchange	<ul> <li>Master not available / switched off</li> </ul>
on	flashes <sup>1)</sup>	Parameterization fault, no data exchange	<ul> <li>Slave not configured yet or wrong configuration</li> </ul>
		Criteria: data exchange correct. However, the slave did not switch to the data exchange mode.	<ul> <li>Wrong station address assigned (but not outside the permitted range)</li> </ul>
			<ul> <li>Actual configuration of the slave differs from the nominal configuration</li> </ul>
on	off	Data exchange. Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds

# Type Code

### Order code





# ESS58-IZ

- Industrial standard housing Ø58 mm
- EtherNet/IP

- Up to 30 Bit multiturn
- Servo or clamping flange
- Network loop through by means of integrated 2 port switch
- IP address resettable
  - No DIP switches for address setting
- Compatible with Rockwell/ Allen Bradley/ Schneider control
- Mechanical compatibility with all major encoders with fieldbus interface
- Rotary axis functionality
- Status LEDs
- Ethernet IP declaration of conformity
- CIP encoder profile

# <sup>™</sup> EtherNet/IP

### **Function**

In addition to the CANopen-, DeviceNet-, PROFIBUS- and AS-Interface encoders, we have broadened our product line of bus-capable absolute encoders with the ESS58 for Ethernet. Absolute rotary encoders deliver an absolute step value for each angle setting. This device has a maximum basic resolution of 65536 steps per revolution (16 bits).

### **Dimensions**



General specifications	
Detection type	photoelectric sampling
Device type	Singleturn absolute encoder
Functional safety related parameters	
MTTF <sub>d</sub>	130 a
Mission Time (T <sub>M</sub> )	20 a
L <sub>10h</sub>	1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)	0 %
Electrical specifications	

### ESS58-IZ

Technical Data		
Operating voltage	U <sub>B</sub>	10 30 V DC
Power consumption	Po	max. 4 W
Linearity		± 0.5 LSB (12 Bit) ,
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		EtherNet/IP
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Physical		Ethernet
Transfer rate		100 MBit/s
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65 Stainless steel version (INOX): completely IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source
Ambient conditions		
Operating temperature		0 60 °C (32 140 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 1		housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 2 (Inox)		housing: stainless steel 1.4305 / AISI 303 flange: stainless steel 1.4301 / AISI 304 shaft: stainless steel 1.4305 / AISI 303
Mass		approx. 370 g (combination 1) approx. 840 g (combination 2)
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		$\leq$ 3 Ncm (version without shaft seal)
Tightening torque, fastening screws		max. 1.8 Nm
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

°Q

1.7.

ACC-PACK-ABS-\_S\_58 Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm ø15

Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t48722\_eng.pdf

Acces	sories	
20	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
20	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
20	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

# Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$	

### Indication

### **Diagnostic LEDs**

<u> </u>		
LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another device	bus disconnected
		Criteria: no data exchange	<ul> <li>Master not available / switched off</li> </ul>
on	flashes <sup>1)</sup>	Parameterization fault, no data exchange	<ul> <li>Slave not configured yet or wrong configuration</li> </ul>
		Criteria: data exchange correct. However, the slave did not switch to the data exchange mode.	<ul> <li>Wrong station address assigned (but not outside the permitted range)</li> </ul>
			<ul> <li>Actual configuration of the slave differs from the nominal configuration</li> </ul>
on	off	Data exchange. Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds

# Type Code





# Singleturn absolute rotary encoder

# PVS58

- Industrial standard housing Ø58 mm
- PROFIBUS interface
- 16 Bit singleturn
- Speed transfer
- Extended scaling functions
- Programmable limit switches
- Commissioning mode
- Servo or clamping flange



### Function

This series of PROFIBUS rotary encoders is based on the modern fast technology of singleturn sampling. The absolute value rotary encoder corresponds to the PROFIBUS Profile for Encoders, Order No. 3.062. Operation is supported based on Class 1 and Class 2. For operation based on Class 1, position data and diagnostic data bytes 1 ... 16 are available. In addition, the direction of the code can be selected as either cw ascending (clockwise rotation, code course ascending) or cw descending (clockwise rotation, code course descending). If the rotary encoder is operated according to Class 2, additional functions to those from Class 1 are available. These include scaling of the resolution per revolution and the overall resolution, as well as the preset function. In addition, expanded diagnostic reporting is supported. Besides, the rotary encoder offers extended functionalities such as speed transfer, extended scaling functions, programmable limit switches and a commissioning mode.

The removable connecting hood contains a slide switch for setting the terminating resistor and the rotary switches for setting the address. Assign a fixed address and bus termination to the encoder with this switches.

### **Dimensions**



# Dimensions



General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute rotary encoder
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 230 mA at 10 V DC max. 100 mA at 24 V DC
Power consumption	P <sub>0</sub>	max. 2.5 W
Time delay before availability	t <sub>v</sub>	< 1000 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		0.0096 12 MBit/s
Standard conformity		PNO profile 3.062, RS-485
Connection		
Terminal compartment		in removable housing cover
Standard conformity		
Degree of protection		DIN EN 60529, IP65 IP66 (with shaft seal)
Climatic testing		DIN EN 60068-2-30 , no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 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		

Technical Data	
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. 550 g (combination 1) approx. 1100 g (combination 2)
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	$\leq$ 3 Ncm (version without shaft seal)
Shaft load	
Axial	40 N
Radial	110 N
Dimensions	
Diameter	58 mm

### Connection

Terminal	Explanation
$\perp$	Ground connection for power supply
B (left)	Data line B (pair 1), Bus In
A (left)	Data line A (pair 1), Bus In
(-)	0 V
(+)	10 V 30 V
B (right)	Data line B (pair 2), Bus Out
A (right)	Data line A (pair 2), Bus Out
(-)	0 V
(+)	10 V 30 V
	The supply lines only have to be connected once (regardless to which terminal). The outgoing bus is being uncoupled while the terminal resistor is on.

The arrangement of the terminals is shown in the section commissioning.

## Configuration





### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 99, and may only be assigned once.



#### Adjusting the termination resistor

The terminating resistor  $R_T$  (220  $\Omega) can be connected to the circuit by means of the switch:$ 



### **ALED-indicators**

LED red	LED green	Meaning
off	off	No voltage supply
on	on	Encoder ready, no configuration data received.
		possible reasons:
		- wrong address adjusted
		- wrong bus wiring
on	flashing	Parameterising or configuration error. Encoder receives data of incorrect length or inconsistant data.
		possible reason:
		- adjusted encoder resolution exceeds
flashing	on	Encoder ready, no communication with master (i.e. wrong address setting)
on	off	Data timeout (> 40 s). (i.e. data lines interrupted)
off	on	Normal operation, Data Exchange Mode
off	flashing	Installation Mode in Data Exchange Mode.

## **Function Principle**

Principle of data transmission



### **Parameterization**

### Parameter table encoder classes P+F 2.1 and P+F 2.2

enter parameter

Octet number (Byte)	Parameter	Bit number
18	PROFIBUS standard parameters	
9	Direction of rotation	0
	Class 2 functionality	1
	Commissioning Diagnostics	2
	Scaling function	3
	Reserved	4
	Reserved	5
	Activate manufacturer specific parameters (Octet 26)	6
	Reserved	7
10 13	Desired measuring steps (reference: Octet 26, Bit 0 and 1)	
14 17	Overall resolution	
18 25	Reserved	
26	Reference for desired measuring steps	0
		1
	Activate commissioning mode	2
	Reduced diagnosis	3
	Reserved	4
	Activate lower software limit switch	5
	Activate upper software limit switch	6

### Singleturn absolute rotary encoder

	Activation of the parameters from Octet 27	7
27 30	Lower limit switch	
31 34	Upper limit switch	
35 38	Physical measuring steps	
39	Reserved	0
	Rotary encoder type (singleturn or multiturn)	1
	Reserved	2
	Reserved	3
	Selection of the unit for speed transfer	4
		5
	Reserved	6
	Reserved	7

## **Type Code**





# Singleturn absolute rotary encoder

# PSS58

- Industrial standard housing Ø58 mm
- PROFIBUS interface
- 16 Bit singleturn
- Speed transfer
- Extended scaling functions
- Programmable limit switches
- Commissioning mode
- Recessed hollow shaft



### **Function**

This series of PROFIBUS rotary encoders is based on the modern fast technology of singleturn sampling. The absolute value rotary encoder corresponds to the PROFIBUS Profile for Encoders, Order No. 3.062. Operation is supported based on Class 1 and Class 2. For operation based on Class 1, position data and diagnostic data bytes 1 ... 16 are available. In addition, the direction of the code can be selected as either cw ascending (clockwise rotation, code course ascending) or cw descending (clockwise rotation, code course descending). If the rotary encoder is operated according to Class 2, additional functions to those from Class 1 are available. These include scaling of the resolution per revolution and the overall resolution, as well as the preset function. In addition, expanded diagnostic reporting is supported. Besides, the rotary encoder offers extended functionalities such as speed transfer, extended scaling functions, programmable limit switches and a commissioning mode.

The removable connecting hood contains a slide switch for setting the terminating resistor and the rotary switches for setting the address. Assign a fixed address and bus termination to the encoder with this switches.

The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a torque rest.

### Dimensions



General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute rotary encoder
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 230 mA at 10 V DC max. 100 mA at 24 V DC
Power consumption	P <sub>0</sub>	max. 2.5 W

Technical Data	
Linearity	+ 2   SB at 16 Bit + 1   SB at 13 Bit + 0.5   SB at 12 Bit
Output code	binary code
Code course (counting direction)	programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface	
Resolution	
Single turn	up to 16 Bit
Overall resolution	up to 16 Bit
Transfer rate	0.0096 12 MBit/s
Standard conformity	PNO profile 3.062, RS-485
Connection	
Terminal compartment	in removable housing cover
Standard conformity	
Degree of protection	DIN EN 60529, IP65 IP66 (with shaft seal)
Climatic testing	DIN EN 60068-2-30 , no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 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. 550 g (combination 1) approx. 1100 g (combination 2)
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	$\leq$ 3 Ncm (version without shaft seal)
Tightening torque, fastening screws Shaft load	max. 1.8 Nm
Angle offset	± 0.9 °
Axial offset	static: ± 0.3 mm, dynamic: ± 0.1 mm
Radial offset	static: ± 0.5 mm, dynamic: ± 0.2 mm
Dimensions	
Length	87 mm
Diameter	59 mm

### Connection

Terminal	Explanation
$\perp$	Ground connection for power supply
B (left)	Data line B (pair 1), Bus In
A (left)	Data line A (pair 1), Bus In
(-)	0 V
(+)	10 V 30 V
B (right)	Data line B (pair 2), Bus Out
A (right)	Data line A (pair 2), Bus Out
(-)	0 V
(+)	10 V 30 V
	The supply lines only have to be connected once (regardless to which terminal). The outgoing bus is being uncoupled while the terminal resistor is on.

The arrangement of the terminals is shown in the section commissioning.

## Configuration





### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 99, and may only be assigned once.



### Adjusting the termination resistor

The terminating resistor  $R_T$  (220  $\Omega) can be connected to the circuit by means of the switch:$ 



### **ALED-indicators**

LED red	LED green	Meaning
off	off	No voltage supply
on	on	Encoder ready, no configuration data received.
		possible reasons:
		- wrong address adjusted
		- wrong bus wiring
on	flashing	Parameterising or configuration error. Encoder receives data of incorrect length or inconsistant data.
		possible reason:
		- adjusted encoder resolution exceeds
flashing	on	Encoder ready, no communication with master (i.e. wrong address setting)
on	off	Data timeout (> 40 s). (i.e. data lines interrupted)
off	on	Normal operation, Data Exchange Mode
off	flashing	Installation Mode in Data Exchange Mode.

## **Function Principle**

Principle of data transmission



### **Parameterization**

### Parameter table encoder classes P+F 2.1 and P+F 2.2

enter parameter

Octet number (Byte)	Parameter	Bit number
18	PROFIBUS standard parameters	
9	Direction of rotation	0
	Class 2 functionality	1
	Commissioning Diagnostics	2
	Scaling function	3
	Reserved	4
	Reserved	5
	Activate manufacturer specific parameters (Octet 26)	6
	Reserved	7
10 13	Desired measuring steps (reference: Octet 26, Bit 0 and 1)	
14 17	Overall resolution	
18 25	Reserved	
26	Reference for desired measuring steps	0
		1
	Activate commissioning mode	2
	Reduced diagnosis	3
	Reserved	4
	Activate lower software limit switch	5
	Activate upper software limit switch	6

### Singleturn absolute rotary encoder

	Activation of the parameters from Octet 27	7
27 30	Lower limit switch	
31 34	Upper limit switch	
35 38	Physical measuring steps	
39	Reserved	0
	Rotary encoder type (singleturn or multiturn)	1
	Reserved	2
	Reserved	3
	Selection of the unit for speed transfer	4
		5
	Reserved	6
	Reserved	7

## **Type Code**





# DVS58

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Galvanically isolated DeviceNet interface
- Servo or clamping flange

# **C** € ∞ **Device N**et<sup>™</sup>

### **Function**

Absolute encoders deliver an absolute step value for each angle setting. All these values are represented by code samples of one or more code disks. The code disks are screened by an infrared LED and the bit obtained sample is detected by means of an optical array. Its signals are electronically amplified and are forwarded on to the interface for processing.

The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The integrated CAN bus interface of the absolute encoder supports all DeviceNet functions. The following operating modes can be programmed, and can selectively be turned on or off:

- Polled mode
- · Cyclic mode
- · Change of state mode

The device is designed for shaft mounting and is available in servo flange or clamping flange design. The bus electronics module is integrated into the removable housing cover. This makes it possible to mount or replace the new rotary encoders and the matching bus electronics separately during installation or service.

### **Dimensions**



Release date: 2023-02-14 Date of issue: 2023-02-14 Filename: t49156\_eng.pdf

# Dimensions



General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 230 mA at 10 V DC max. 100 mA at 24 V DC
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		DeviceNet
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		max. 0.5 MBit/s
Connection		
Terminal compartment		in removable housing cover
Standard conformity		
Degree of protection		DIN EN 60529, IP65 IP66 (with shaft seal)
Climatic testing		DIN EN 60068-2-30, 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

# **Technical Data**

Combination 2 (Inox)	housing: stainless steel flange: stainless steel shaft: stainless steel
Mass	approx. 550 g (combination 1) approx. 1000 g (combination 2)
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	$\leq$ 3 Ncm (version without shaft seal)
Shaft load	
Axial	40 N
Radial	110 N

# Accessories

	0000	Analod flance
0	9203	Angleu nange
(	AH 58-B1CA-2BW	Connection cover
9	9310-3	Synchro clamping element
	9300	Mounting bracket for servo flange
•	KW-10/10	Helical coupling
<b>i</b>	KW-6/10	Helical coupling
•	KW-6/6	Helical coupling
<b>i</b>	KW-6/8	Helical coupling
0	9401 10*10	Spring steel coupling
	9401 10*12	Spring steel coupling
	9401 6*10	Spring steel coupling
	9401 6*6	Spring steel coupling
	9402 6*6	Spring steel coupling
	9404 10*10	Spring disk coupling
	9404 6*6	Spring disk coupling

Acces	Accessories			
<b>(</b> )	9409 10*10	Bellows coupling		
<b>(</b> )	9409 6*10	Bellows coupling		
()	9409 6*6	Bellows coupling		
<b>()</b>	9409 6*8	Bellows coupling		
O	9410 10*10	Precision coupling		
O	9410 6*6	Precision coupling		
J	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm		

Terminal	Cable	M12 x 1 Connector	Explanation	
$\perp$	-	-	Ground connection for power supply	
(+)	Red	2	Power supply	
(-)	Black	3	Power supply	
CG	-	1	CAN ground	
CL	Blue	5	CAN low	
СН	White	4	CAN high	
CG	-	-	CAN ground	
CL	Blue	-	CAN low	
СН	White	-	CAN high	



# Configuration



### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 63, and may only be assigned once.

### Adjusting the termination resistor

The terminating resistor  $R_T$  (121  $\Omega)$  can be connected to the circuit by means of the switch:





N ON

last participant



### Baud rate adjustment

Baud rate [kBit/s]	Switch position
125	0
250	1
500	2
125	3
reserved	4 9

### **LED-indicators**

LED red	LED green	Meaning
off	off	No voltage supply
off	on	Encoder ready, boot-up message not transmitted, yet. Possible reasons: - no further participant present - wrong baud rate - encoder in prepared status
flashing	on	Boot-up message transmitted, Device configuration possible.
on	on	Normal operation mode, encoder in operational status.

## Parameterization

### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a telegram. The absolute encoder reads in the current position, calculates all parameters that may have been set and then sends back the actual process value.
Cyclic mode	The absolute encoder sends the current process value depending on a programmable timer. This can cause the bus load to be reduced since the member on the network only sends a message after a specific amount of time without a prompt from the master.
Change of state mode	The absolute encoder monitors the current process value and transfers the current value by itself if there is any change in the value. This can cause the bus load to be reduced, since the member on the network only sends a message if there has been a change.

### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will be rising or descending.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to a revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.

#### Order code





# **DSS58**

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Galvanically isolated DeviceNet interface
- Recessed hollow shaft

# **C** € ∞ **DeviceNet**

### **Function**

In addition to the CANopen, PROFIBUS and AS-Interface rotary encoders, we have broadened our product line of bus-capable absolute encoders with the DSS58 for DeviceNet.

Absolute encoders deliver an absolute step value for each angle setting. All these values are represented by code samples of one or more code disks. The code disks are screened by an infrared LED and the bit obtained sample is detected by means of an optical array. Its signals are electronically amplified and are forwarded on to the interface for processing. The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The integrated CAN bus interface of the absolute encoder supports all DeviceNet functions. The following operating modes can be programmed,

and can selectively be turned on or off:

- · Polled mode
- · Cyclic mode
- · Change of state mode

The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a torque rest.

### Dimensions



General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 230 mA at 10 V DC max. 100 mA at 24 V DC

Technical Data		
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		± 2 LSB at 16 Bit, ± 1 LSB at 13 Bit, ± 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		DeviceNet
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		max. 0.5 MBit/s
Connection		
Terminal compartment		in removable housing cover
Standard conformity		
Degree of protection		DIN EN 60529, IP65 IP66 (with shaft seal)
Climatic testing		DIN EN 60068-2-30, 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. 550 g (combination 1) approx. 1100 g (combination 2)
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		$\leq$ 3 Ncm (version without shaft seal)
Tightening torque, fastening screws		max. 1.8 Nm
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

(and	AH 58-B1CA-2BW	Connection cover
°Q	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm

Acces	Accessories				
-	ACC-PACK-ABS- S 58	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm			
° Q	ø12				
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm			

Terminal	Cable	M12 x 1 Connector	Explanation	
$\perp$	-	-	Ground connection for power supply	
(+)	Red	2	Power supply	
(-)	Black	3	Power supply	
CG	-	1	CAN ground	
CL	Blue	5	CAN low	
СН	White	4	CAN high	
CG	-	-	CAN ground	
CL	Blue	-	CAN low	
CH	White	-	CAN high	



# Configuration



### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 63, and may only be assigned once.

### Adjusting the termination resistor

The terminating resistor  $R_T$  (121  $\Omega)$  can be connected to the circuit by means of the switch:





R<sub>T</sub> ON Iast participant



### Baud rate adjustment

Baud rate [kBit/s]	Switch position
125	0
250	1
500	2
125	3
reserved	4 9

### **LED-indicators**

LED red	LED green	Meaning
off	off	No voltage supply
off	on	Encoder ready, boot-up message not transmitted, yet. Possible reasons: - no further participant present - wrong baud rate - encoder in prepared status
flashing	on	Boot-up message transmitted, Device configuration possible.
on	on	Normal operation mode, encoder in operational status.

## Parameterization

### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a telegram. The absolute encoder reads in the current position, calculates all parameters that may have been set and then sends back the actual process value.
Cyclic mode	The absolute encoder sends the current process value depending on a programmable timer. This can cause the bus load to be reduced since the member on the network only sends a message after a specific amount of time without a prompt from the master.
Change of state mode	The absolute encoder monitors the current process value and transfers the current value by itself if there is any change in the value. This can cause the bus load to be reduced, since the member on the network only sends a message if there has been a change.

### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will be rising or descending.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to a revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.

# Type Code
#### Order code





# **CVS58**

- Industrial standard housing Ø58 mm
- Servo or clamping flange
- 16 Bit singleturn
- Galvanically isolated CAN interface
- 2 limit switches
- 8 programmable cams
- Velocity and acceleration output
- Event triggered process data transfer

# 

#### **Function**

Absolute encoders deliver an absolute step value for each angle setting. All these values are represented by code samples on one or more code disks which are sampled by a photoelectric array.

The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The integrated CAN bus interface of the absolute encoder supports all DeviceNet functions. The following operating modes can be programmed, and can selectively be turned on or off: • Polled mode

- · Cyclic mode
- Sync mode

The device is designed for shaft mounting and is available in servo flange or clamping flange design.

The bus electronics module is integrated into the removable housing cover. This makes it possible to mount or replace the new rotary encoders and the matching bus electronics separately during installation or service.

#### **Dimensions**



# Dimensions



# **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 350 mA
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		max. 1 MBit/s
Standard conformity		communication profile: DS 301 Device profiles: DS 406 and DS 417 , programmable according to class 2
Connection		
Terminal compartment		in removable housing cover
Standard conformity		
Degree of protection		DIN EN 60529, IP65 IP66 (with shaft seal)
Climatic testing		DIN EN 60068-2-30 , no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
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		

housing: powder coated aluminum flange: aluminum shaft: stainless steel
housing: stainless steel flange: stainless steel shaft: stainless steel
approx. 550 g (combination 1) approx. 1100 g (combination 2)
max. 12000 min <sup>-1</sup>
30 gcm <sup>2</sup>
≤ 3 Ncm (version without shaft seal)
40 N
110 N

# Accessories

	9203	Angled flange
	AH 58-B1CA-2BW	Connection cover
9	9310-3	Synchro clamping element
	9300	Mounting bracket for servo flange
<b>i</b>	KW-10/10	Helical coupling
<b>i</b>	KW-6/10	Helical coupling
<b>i</b>	KW-6/6	Helical coupling
<b>i</b>	KW-6/8	Helical coupling
1	9401 10*10	Spring steel coupling
1	9401 10*12	Spring steel coupling
() The second	9401 6*10	Spring steel coupling
() The second	9401 6*6	Spring steel coupling
	9402 6*6	Spring steel coupling
	9404 10*10	Spring disk coupling
(?)	9404 6*6	Spring disk coupling

Acces	sories	
<b>(</b> )	9409 10*10	Bellows coupling
<b>(</b> )	9409 6*10	Bellows coupling
()	9409 6*6	Bellows coupling
<b>()</b>	9409 6*8	Bellows coupling
J	9410 10*10	Precision coupling
O	9410 6*6	Precision coupling
J	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

CVS58

# Connection

Terminal	Cable	Explanation
$\perp$	-	Ground connection for power supply
(+)	Red	Power supply
(-)	Black	Power supply
G	-	CAN ground
L	Blue	CAN low
Н	White	CAN high
G	-	CAN ground
L	Blue	CAN low
Н	White	CAN high

#### Configuration

#### Indicating and operating elements





member X

ON

#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 96, and may only be assigned once. The addresses 97 ... 99 are reserved.

#### Adjusting the termination resistor

The terminating resistor  $R_T$  (121  $\Omega$ ) can be connected to the circuit by means of the switch:



x1

R<sub>T</sub>

ON

#### **Baud rate adjustment**

Baud rate [kBit/s]	Switch position	Baud rate [kBit/s]	Switch position
20	0	500	5
50	1	800	6
100	2	1000	7
125	3	reserved	8
250	4	set baud rate by SDO message and LSS	9

#### LED-indicators

CAN Run (green)	State	Description
flickering	AutoBitrate / LSS	Auto-bitrate detection is in progress or LSS services are in progress
blinking	PREOPERATIONAL	Encoder is in state PREOPERATIONAL
single flash	STOPPED	Encoder is in state STOPPED
double flash		reserved
triple flash	Program / Firmware download	a software download is running on the encoder
on	OPERATIONAL	the encoder is in state OPERATIONAL
Err (red)	State	Description
off	no error	the encoder is in working condition
flickering	AutoBitrate / LSS	Auto-bitrate detection is in progress or LSS services are in progress
blinking	invalid configuration	general configuration error
single flash	Warning limit reached	at least one of the error counters of the CAN controller has reached or exceeded the
		warning level (too many error frames)
double flash	Error control event	a guard event (NMT-slave or NMT-master) or a heartbeat event (heartbeat consumer)
		has occured
triple flash	Sync. error	the sync. message has not been received within the configured communication cycle
		period time out (see objekt 1006h)
quadruple flash	Error, event-timer	an expected PDO has not been received before the even-timer elapsed
on	Bus off	the CAN controller is bus off

# Parameterization

#### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
2 limit switches	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
8 cam switches	Up to 8 position values can be programmed as cams. By reaching these values bits in object 6300h Cam state register are set.

#### Order code





# CSS58

- Industrial standard housing Ø58 mm
- Recessed hollow shaft
- 16 Bit singleturn
- Galvanically isolated CAN interface
- 2 limit switches
- 8 programmable cams
- Velocity and acceleration output
- Event triggered process data transfer

# 

#### **Function**

Absolute encoders deliver an absolute step value for each angle setting. All these values are represented by code samples on one or more code disks which are sampled by a photoelectric array.

The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The encoders integrated CAN bus interface supports all CANopen functions. The following operating modes can be programmed, and can be selectively turned on or off:

- Polled mode
- · Cyclic mode
- Sync mode

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 bus electronics module is integrated into the removable housing cover. This makes it possible to mount or replace the new rotary encoders and the matching bus electronics separately during installation or service.

#### **Dimensions**



## **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
No-load supply current	Io	max. 230 mA at 10 V DC max. 100 mA at 24 V DC

Technical Data		
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		± 2 LSB at 16 Bit, ± 1 LSB at 13 Bit, ± 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		max. 1 MBit/s
Standard conformity		communication profile: DS 301 Device profiles: DS 406 and DS 417 , programmable according to class 2
Connection		
Terminal compartment		in removable housing cover
Standard conformity		
Degree of protection		DIN EN 60529, IP65 IP66 (with shaft seal)
Climatic testing		DIN EN 60068-2-30, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
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. 550 g (combination 1) approx. 1100 g (combination 2)
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		$\leq$ 3 Ncm (version without shaft seal)
Tightening torque, fastening screws		max. 1.8 Nm
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

 AH 58-B1CA-2BW
 Connection cover

 Image: ACC-PACK-ABS-\_S\_58
 Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm

0

Acces	Accessories				
° Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm			
20	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm			
20	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm			

# Connection

Terminal	Cable	Explanation
$\perp$	-	Ground connection for power supply
(+)	Red	Power supply
(-)	Black	Power supply
G	-	CAN ground
L	Blue	CAN low
Н	White	CAN high
G	-	CAN ground
L	Blue	CAN low
Н	White	CAN high

#### Configuration

#### Indicating and operating elements





#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 96, and may only be assigned once. The addresses 97 ... 99 are reserved.

#### Adjusting the termination resistor

The terminating resistor  $R_T$  (121  $\Omega$ ) can be connected to the circuit by means of the switch:



ON

#### last participant R<sub>T</sub> ON

x1

x10

#### **Baud rate adjustment**

Baud rate [kBit/s]	Switch position	Baud rate [kBit/s]	Switch position
20	0	500	5
50	1	800	6
100	2	1000	7
125	3	reserved	8
250	4	set baud rate by SDO message and LSS	9

#### LED-indicators

CAN Run (green)	State	Description
flickering	AutoBitrate / LSS	Auto-bitrate detection is in progress or LSS services are in progress
blinking	PREOPERATIONAL	Encoder is in state PREOPERATIONAL
single flash	STOPPED	Encoder is in state STOPPED
double flash		reserved
triple flash	Program / Firmware download	a software download is running on the encoder
on	OPERATIONAL	the encoder is in state OPERATIONAL
Err (red)	State	Description
off	no error	the encoder is in working condition
flickering	AutoBitrate / LSS	Auto-bitrate detection is in progress or LSS services are in progress
blinking	invalid configuration	general configuration error
single flash	Warning limit reached	at least one of the error counters of the CAN controller has reached or exceeded the
		warning level (too many error frames)
double flash	Error control event	a guard event (NMT-slave or NMT-master) or a heartbeat event (heartbeat consumer)
		has occured
triple flash	Sync. error	the sync. message has not been received within the configured communication cycle
		period time out (see objekt 1006h)
quadruple flash	Error, event-timer	an expected PDO has not been received before the even-timer elapsed
on	Bus off	the CAN controller is bus off

# Parameterization

#### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
2 limit switches	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
8 cam switches	Up to 8 position values can be programmed as cams. By reaching these values bits in object 6300h Cam state register are set.

#### Order code





# AVS58-0

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Servo or clamping flange
- Zero-set function



#### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the AVS58 is maximum 65536 steps per revolution. The devices of the AVS58 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). This singleturn absolute encoder is available either in clamp flange design with a shaft diameter of 10 mm x 20 mm or in a servo flange design with a shaft diameter of 6 mm x 10 mm.

The electrical connection is made by a 12-pin round plug connector. A version with a 1 m cable connector is also available.

## Dimensions



\*\* Aluminium: d = 59, stainless steel: d = 61

### Dimensions



# **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	$U_B$	4.5 30 V DC
No-load supply current	I <sub>0</sub>	max. 180 mA
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm2$ LSB at 16 Bit, $\pm1$ LSB at 13 Bit, $\pm0,5$ LSB at 12 Bit

Technical Data	
Output code	Gray code, binary code
Code course (counting direction)	cw descending (clockwise rotation, code course descending)
Interface	G ( , , , , , , , , , , , , , , , , , ,
Interface type	SSI
Monoflop time	20 ± 10 µs
Resolution	· · · ·
Sinale turn	up to 16 Bit
Overall resolution	up to 16 Bit
Transfer rate	0.1 2 MBit/s
Voltage drop	U-25V
Standard conformity	BS 422
Input 1	
	Selection of counting direction (cw/ccw)
Signal voltage	
High	4 5 30 V
low	0.2V
	< 6 mA
Switch-on delay	< 10 ms
Input 2	
	zero-set (PRESET 1)
Signal voltage	
High	4 5 30 V
Low	9.3 50 V
	6 mA
Signal duration	min 100 me
Switch-on delay	
Connection	< 10115
Connector	type 9416 (M23) 12-pin type 94161 (M23) 12-pin
Cable	$(37 \text{ mm} 6 \times 2 \times 0.14 \text{ mm}^2 1 \text{ m})$
Standard conformity	
Degree of protection	DIN EN 60520 (D65 (without shaft cool) : DIN EN 60520 (D66/D67 (with shaft cool)
	DIN EN 600529, IF 05 (without shall seal), DIN EN 600529, IF 00/IF 07 (with shall seal)
Emitted interference	
Noise immunity	DIN EN 61000-6-4
Shock registance	DIN EN 60068 2 27 100 a 6 mc
Vibration resistance	DIN EN 60068-2-6 20 $\alpha$ 10 2000 Hz
Approvals and portificatos	Din Lin 00000-2-0, 20 g, 10 2000 Hz
	cl II us Listed, General Purpose, Class 2 Power Source
Ambient conditions	colus Lisled, deneral i dipose, class 21 owel Source
	-40 85 °C (-40 185 °E)
Storage temperature	40
Matarial	
Combination 1	housing: nowder coated aluminum
Combination	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 <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm

Shaft load

Technical Data		
Axial	40 N	
Radial	110 N	

Acces	sones	
	9203	Angled flange
CI	9416	Female cordset
9	9310-3	Synchro clamping element
	9300	Mounting bracket for servo flange
<b>S</b>	KW-10/10	Helical coupling
<b>S</b>	KW-6/10	Helical coupling
<b>(</b> )	KW-6/6	Helical coupling
<b>i</b>	KW-6/8	Helical coupling
	9401 10*10	Spring steel coupling
1. C.	9401 10*12	Spring steel coupling
1. State	9401 6*10	Spring steel coupling
	9401 6*6	Spring steel coupling
	9402 6*6	Spring steel coupling
	9404 10*10	Spring disk coupling
	9404 6*6	Spring disk coupling
	9409 10*10	Bellows coupling
()	9409 6*10	Bellows coupling
	9409 6*6	Bellows coupling

Accessories				
()	9409 6*8	Bellows coupling		
I	9410 10*10	Precision coupling		
J	9410 6*6	Precision coupling		
	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm		
C. Lar	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core		

#### Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
		9 8 10 7 12 6	8 7 11 6 5 4	

#### 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



#### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, 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

#### 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.





Input for selection of counting direction (cw/ccw)



**Type Code** 

#### Order code







#### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the ASS58 is maximum 65536 steps per revolution. The devices of the ASS58 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 torgue rest.

The electrical connection is made by a 12-pin round plug connector. It is also possible to obtain a version with a 1 m cable connector.

#### Dimensions



#### Dimensions



# **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	UB	4.5 30 V DC (SSI, SSI + RS422) ; 10 30 V DC (SSI + Push/Pull)
No-load supply current	I <sub>0</sub>	max. 180 mA
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 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 ; SSI + incremental track
Monoflop time		20 ± 10 µs
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		0.1 2 MBit/s
Voltage drop		U <sub>B</sub> - 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
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

Technical Data	
Cable	$07 \text{ mm} 6 \times 2 \times 0.14 \text{ mm}^2 1 \text{ m}$
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 <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
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

() III	9416	Female cordset
Chart -	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core
ŶQ	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

#### Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
		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



#### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

#### ASS58-0

#### Singleturn absolute encoder

- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, 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**

#### 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.





Input for selection of counting direction (cw/ccw)



**Type Code** 

**Order code** 

#### 0 Α S S 5 8 0 0 Number of bits singleturn 4096 (standard) 12 13 8192 65536 16 Options Ν Standard 1 Incremental track 1024 pulses, Push/Pull 2 Incremental track 2048 pulses, Push/Pull 3 Incremental track 4096 pulses, Push/Pull 4 Incremental track 1024 pulses, RS422 5 Incremental track 2048 pulses, RS422 6 Incremental track 4096 pulses, RS422 Output code в Binary G Gray Exit position Α Axial R Radial **Connection type K1** Cable Ø7 mm, 6 x 2 x 0.14 mm<sup>2</sup>, 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 Aluminium, powder coated Ν I Inox\* w Aluminium, powder coated with shaft seal **Principle of operation** s Singleturn Shaft version Recessed hollow shaft s Data format

A SSI (Synchronous Serial Interface)

\*Housing material I only available with axial exit position.



# AVS58-K

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Servo or clamping flange
- Zero-set function electrically and by preset key



#### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the AVS58-K is maximum 65536 steps per revolution.

The devices of the AVS58-K 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).

Another feature of this absolute encoder is the built in preset key at the rear housing side. By means of this, the position value can be locally set to zero. For status and diagnosis indication furthermore it is equipped with 2 LEDs.

This singleturn absolute encoder is available either in clamp flange design with a shaft diameter of 10 mm x 20 mm or in a servo flange design with a shaft diameter of 6 mm x 10 mm.

The electrical connection is made by a 12-pin round plug connector. A version with a 1 m cable connector is also available.

## Dimensions



#### Dimensions





\*\* Aluminium: d = 59, stainless steel: d = 61



# **Technical Data**

	photoelectric sampling
	Singleturn absolute encoder
	supply voltage/preset key pressed
	internal diagnostic test failed
UB	4.5 30 V DC
	UB

Technical Data		
Power consumption	Po	≤1W
Time delay before availability	tv	< 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
Overall resolution		up to 16 Bit
Transfer rate		0.1 2 MBit/s
Voltage drop		U <sub>B</sub> - 2.5 V
Standard conformity		RS 422
Input 1		
Input type		Selection of counting direction (cw/ccw)
Signal voltage		
High		4.5 30 V or open input (cw ascending)
Low		0 1 V (cw descending)
Input current		< 6 mA
Switch-on delay		< 10 ms
Input 2		
Input type		zero-set (PRESET 1)
Signal voltage		
High		4.5 30 V
Low		0 1 V or open input
Input current		< 6 mA
Signal duration		min. 100 ms
Switch-on delay		< 10 ms after falling input flank
Connection		
Connector		type 9416 (M23), 12-pin, type 9416L (M23), 12-pin
Cable		Ø7 mm, 6 x 2 x 0.14 mm², 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 <sup>-1</sup>

rechnical Data		
Moment of inertia	< 30 gam <sup>2</sup>	
Storting torque	< 2 Nem (version without shoft seel)	
	< 3 North (Version without shalt sear)	
Shart load	(0.1)	
Axial	40 N	
Radial	110 N	

# Accessories

0	9203	Angled flange
CI	9416	Female cordset
9	9310-3	Synchro clamping element
	9300	Mounting bracket for servo flange
•	KW-10/10	Helical coupling
<b>i</b>	KW-6/10	Helical coupling
•	KW-6/6	Helical coupling
<b>i</b>	KW-6/8	Helical coupling
07	9401 10*10	Spring steel coupling
0	9401 10*12	Spring steel coupling
	9401 6*10	Spring steel coupling
0	9401 6*6	Spring steel coupling
0	9402 6*6	Spring steel coupling
	9404 10*10	Spring disk coupling
	9404 6*6	Spring disk coupling
	9409 10*10	Bellows coupling
() (	9409 6*10	Bellows coupling

Acces	sories	
	9409 6*6	Bellows coupling
()		
()	9409 6*8	Bellows coupling
O	9410 10*10	Precision coupling
O	9410 6*6	Precision coupling
-	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm
Charter of the second s	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core

#### Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
		9 8 10 7 12 6	8 7 11 6 5 4	

#### 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



#### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

#### /S58-K

#### Singleturn absolute encoder

- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> 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**

#### Line length



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

#### Operation

#### Inputs

Input for selection of counting direction (V/R)

Level	counting direction by cw revolution (with view onto the shaft)	Input counting direction (V/R)
High (input open or connected to +UB)	ascending	A Pull up
Low (Input connected to GND)	descending	Filter Logic

#### Zero-set input (Preset)

Level	Funktion	Zara actionut (Dreast)
Low	Output position value	Zero-set input (Preset)
(input open or connected to GND)		
High (Input connected to +U <sub>B</sub> or U <sub>e</sub> > 4,5 V)	Activation with falling edge (min. 100 ms)	IN Filter U <sub>e</sub> L U <sub>e</sub> Filter Full down

#### Indicators/operation means

Preset key LED green	Manually zero setting of the position value. <ul> <li>Lights up with supplied encoder</li> <li>Goes off while preset key is pressed</li> </ul>	Å.
LED red	<ul> <li>Alarm/error indication</li> <li>pre-fault indication (data output ist continued)</li> <li>internal memory error (all data bits are set to high level permanently)</li> </ul>	°G Key

#### Order code




# Singleturn absolute encoder

### ASS58-K

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Recessed hollow shaft
- Zero-set function electrically and by preset key



### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the ASS58-K is maximum 65536 steps per revolution. The devices of the ASS58-K series are equipped with a microcontroller.

The devices of the ASS58-K 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 zeroset function (preset value).

Another feature of this absolute encoder is the built in preset key at the rear housing side. By means of this, the position value can be locally set to zero. For status and diagnosis indication furthermore it is equipped with 2 LEDs. The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a

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. It is also possible to obtain a version with a 1 m cable connector.

### Dimensions



### Dimensions



\* shaft can be reduced to ø10F7 or ø12F7 by using an adapter \*\* Aluminium: d = 59, stainless steel: d = 61

### **Technical Data**

Photoelectric sampling           Detection type         photoelectric sampling           Device type         Singleturn absolute encoder           Indicators/operating means         undicators/operating means           ELD green         supply voltage/preset key pressed           ELD red         Internal diagnostic test failed           Electrical specifications         voltage/preset key pressed           Operating voltage         Ua         Single VID           Output code         Gray volde, binary code         Code course (counting direction)         cw descending (clockwise rotation, code course descending)           Interface         VID         VID         Single VID         VID VID           Resolution         up to 16 Bit         VID         VID         VID           Overal resolution         up to 16 Bit         VID         VID         VID           Voltage drop         Ub voltage 2 V         VID         VID         VID           Single turn         up to 16 Bit         VID         VID         VID           Voltage drop <th< th=""><th>General specifications</th><th></th><th></th></th<>	General specifications			
Device type         Singletum absolute encoder           Indicators/operating means         supply voltage/preset key pressed           LED red         internal diagnostic test failed           Electrical specifications         test specifications           Operating voltage         Us         4.5 30 V DC           Power consumption         Po         ≤ 1 W           Time delay before availability         t, ± 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)         c: w descending (clockwise rotation, code course descending)           Interface type         SSI           Monofop time         20 ± 10 µs           Resolution         up to 16 Bit           Overall resolution         up to 16 Bit           Overall resolution         up to 16 Bit           Transfer rate         0.1 2 MBIt/s           Voltage drop         Up a 2.5 V           Standard conformity         Re Selection of counting direction (cw/ccw)           Signal voltage         10 1 V (cw descending)           High         4.5 30 V or open input (cw ascending)           Low         0 1 V (cw descending)           Input type         Selection of counting direction (cw/ccw) <t< td=""><td></td><td></td><td>nhotoelectric sampling</td></t<>			nhotoelectric sampling	
Bingle Unit absolute encloserBingle Unit absolute encloserIndicators/operating meansLED redsupply voltage/preset key pressedLet rical specificationsOperating voltageUp4.530 V DCPower consumptionPo $\leq 1.1 W$ Time delay before availability $t_v$ $< 250 ms$ Linearity $t_v$ $< 250 ms$ Output codeGrave code, binary codeCode course (counting direction)code descending (clockwise rotation, code course descending)InterfaceInterface typeSIMonoflop time20 ± 10 µsResolutionup to 16 BitOrall resolutionup to 16 BitOrall resolutionup to 16 BitOrall resolutionup to 2 ± 20 ± 10 µsTransfer rate0.12 MBit/sVoltage dropUp to 16 BitOrall resolutionup to 16 BitOrall resolutionup to 2.5 VStandard conformityResolution of counting direction (cw/ccw)Signal voltageUp to 1 2 VIBit/sVoltage colspan="2">Up to 1 2 VIBIt/sUp to 2.5 VStandard conformity <th colspa<="" td=""><td></td><td></td><td>Singleture shoelute encoder</td></th>	<td></td> <td></td> <td>Singleture shoelute encoder</td>			Singleture shoelute encoder
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Operating Voltage         Operation         Pose         S 1 W           Power consumption         Pose         S 1 W           Time delay before availability         t,         <250 ms			4.5 20.1/ DC	
Prover consumption     P <sub>0</sub> \$ I W       Time delay before availability     t,     < 250 ms		UB	4.5 30 V DC	
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Code course (counting direction)       cw descending (clockwise rotation, code course descending)         Interface       SSI         Monoflop time       20 ± 10 µs         Resolution       20 ± 10 µs         Single turn       up to 16 Bit         Overall resolution       up to 16 Bit         Transfer rate       0.1 2 MBit/s         Voltage drop       Ug - 2.5 V         Standard conformity       RS 422         Input 1       selection of counting direction (cw/ccw)         Signal voltage	Output code		Gray code, binary code	
Interface         SSI           Monoflop time         20 ± 10 μs           Resolution         20 ± 10 μs           Single turn         up to 16 Bit           Overall resolution         up to 16 Bit           Transfer rate         0.1 2 MBit/s           Voltage drop         Up - 2.5 V           Standard conformity         RS 422           Input 1         Input type           Input type         Selection of counting direction (cw/ccw)           Signal voltage         Input type           Low         0 1 V (cw descending)           Input current         < 6 mA	Code course (counting direction)		cw descending (clockwise rotation, code course descending)	
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Input 1         Input type       Selection of counting direction (cw/ccw)         Signal voltage       Imput curcent         High       4.5 30 V or open input (cw ascending)         Low       0 1 V (cw descending)         Input current       < 6 mA	Standard conformity		RS 422	
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Low0 1 V (cw descending)Input current<6 mA	High		4.5 30 V or open input (cw ascending)	
Input current       < 6 mA	Low		01 V (cw descending)	
Switch-on delay       < 10 ms	Input current		< 6 mA	
Input 2         Input type       zero-set (PRESET 1)         Signal voltage         High       4.5 30 V         Low       0 1 V or open input         Input current       < 6 mA	Switch-on delay		< 10 ms	
Input type     zero-set (PRESET 1)       Signal voltage     4.5 30 V       Low     0 1 V or open input       Input current     < 6 mA	Input 2			
Signal voltage         High       4.5 30 V         Low       0 1 V or open input         Input current       <6 mA	Input type		zero-set (PRESET 1)	
High     4.5 30 V       Low     0 1 V or open input       Input current     < 6 mA	Signal voltage			
Low     0 1 V or open input       Input current     < 6 mA	High		4.5 30 V	
Input current <6 mA Signal duration min. 100 ms	Low		0 1 V or open input	
Signal duration min. 100 ms	Input current		< 6 mA	
	Signal duration		min. 100 ms	

Technical Data	
Switch-on delay	< 10 ms after falling input flank
Connection	
Connector	type 9416 (M23), 12-pin, type 9416L (M23), 12-pin
Cable	Ø7 mm, 6 x 2 x 0.14 mm <sup>2</sup> , 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 <sup>-1</sup>
Moment of inertia	$\leq 30 \text{ gcm}^2$
Starting torque	< 3 Ncm (version without shaft seal)
Shaft load	
Angle offset	± 0.9 °
Axial offset	static: ± 0.3 mm, dynamic: ± 0.1 mm
Radial offset	static: $\pm 0.5$ mm, dynamic: $\pm 0.2$ mm

### Accessories

Oth	9416	Female cordset
Charter -	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core
ŶQ	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

### Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
		9 8 10 7 12 6	8 7 11 6 5 4	

### 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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

### Singleturn absolute encoder

- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, 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

### Line length



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

### Inputs

Operation

Input for selection of counting direction (V/R)

Level	counting direction by cw revolution (with view onto the shaft)	Input counting direction (V/R)
High (input open or connected to +UB)	ascending	
Low (Input connected to GND)	descending	Filter Logic

#### Zero-set input (Preset)

Level	Funktion	Zara active ut (Dreast)
Low	Output position value	Zero-set input (Preset)
(input open or connected to GND)		
High (Input connected to +U <sub>B</sub> or U <sub>e</sub> > 4,5 V)	Activation with falling edge (min. 100 ms)	IN Filter Logic ↓ U <sub>e</sub> Pull down

#### Indicators/operation means

Preset key LED green	Manually zero setting of the position value. <ul> <li>Lights up with supplied encoder</li> <li>Goes off while preset key is pressed</li> </ul>	
LED red	<ul> <li>Alarm/error indication</li> <li>pre-fault indication (data output ist continued)</li> <li>internal memory error (all data bits are set to high level permanently)</li> </ul>	og og





# Singleturn absolute encoder

### AVS58-H

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Hardware encoder
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Servo or clamping flange
- Up to 4096 pulses on incremental track



### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the AVS58-H is maximum 65536 steps per revolution. In contrast to the AVS58 series the encoder does not have a microcontroller. Thus, it is a pure hardware encoder.

The control module sends a clock bundle to the absolute encoder to obtain the position data. The rotary encoder then sends the position data

synchronous to the cycles of the control module. It is possible to select the counting direction with the function input. This singleturn absolute encoder is available either in clamp flange design with a shaft diameter of Ø10 mm x 20 mm or in a servo flange design with a shaft diameter of Ø6 mm x 10 mm.

The electrical connection is made by a 12-pin round plug connector. It is also possible to obtain a version with a 1 m cable connector.

### **Dimensions**



\*\* Aluminium: d = 59, stainless steel: d = 61

### Dimensions



### **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	UB	4.5 30 V DC (SSI, SSI + RS422) ; 10 30 V DC (SSI + Push/Pull)
No-load supply current	I <sub>0</sub>	max. 180 mA
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit

Technical Data	
Output code	Gray code, binary code
Code course (counting direction)	cw descending (clockwise rotation, code course descending)
Interface	
Interface type	SSI ; SSI + incremental track
Monoflop time	20 ± 10 µs
Resolution	
Single turn	up to 16 Bit
Overall resolution	up to 16 Bit
Transfer rate	0.1 2 MBit/s
Voltage drop	U <sub>B</sub> - 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
Output	
Output type	RS422, Push/Pull
Signal output	A+B+/A+/B
Pulses	1024, 2048, 4096
Connection	
Connector	type 9416 (M23), 12-pin, type 9416L (M23), 12-pin
Cable	Ø7 mm, 6 x 2 x 0.14 mm <sup>2</sup> , 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 <i>g</i> , 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 <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N

110 N

Radial

Acces	sories	
	9203	Angled flange
CI	9416	Female cordset
9	9310-3	Synchro clamping element
	9300	Mounting bracket for servo flange
<b>(</b> )	KW-10/10	Helical coupling
<b>S</b>	KW-6/10	Helical coupling
<b>(</b> )	KW-6/6	Helical coupling
<b>S</b>	KW-6/8	Helical coupling
	9401 10*10	Spring steel coupling
1. Contraction (1. Contraction)	9401 10*12	Spring steel coupling
	9401 6*10	Spring steel coupling
1	9401 6*6	Spring steel coupling
	9402 6*6	Spring steel coupling
(?)·	9404 10*10	Spring disk coupling
(?)	9404 6*6	Spring disk coupling
( init	9409 10*10	Bellows coupling
(interior	9409 6*10	Bellows coupling
()	9409 6*6	Bellows coupling
( Juni	9409 6*8	Bellows coupling
0	9410 10*10	Precision coupling

Accessories			
C	9410 6*6	Precision coupling	
	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm	
Chine -	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core	

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
А	Blue	7	12	Incremental track A
V/R	Red	8	5	Input for selection of counting direction
Reserved	Black	9	9	Not wired, reserved
В	Violet	10	4	Incremental track B
А	Grey/Pink	11	6	Incremental track A
В	Red/Blue	12	7	Incremental track B
		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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.
- 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.

### Singleturn absolute encoder

• After the first transmission, the  $26^{th}$  pulse controls data repetition. If the  $26^{th}$  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

### Line length



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

Rotary encoder

Interface electronics

### Operation

### Signal output



### ひ cw - with view onto the shaft

### Input

The selection of the counting direction input (V/R) is activated with 0-level.



### Order code

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																				1	I	ncre	men	tal t	track	102	24 p	ulses	s, Pus	h/Pull	
																				2	I	ncre	men	tal t	track	204	48 p	ulses	s, Pus	h/Pull	
																				3	I	ncre	men	tal t	track	409	96 p	ulses	s, Pus	h/Pull	
																				4	I	ncre	men	tal t	track	102	24 p	ulses	s, RS4	122	
																				5	I	ncre	men	tal t	track	204	48 p	ulses	s, RS4	122	
																				6	I	ncre	men	tal t	track	409	96 p	ulses	s, RS4	122	
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Α	SSI (Synchronous Serial Interface)							*H	lou	sing	g ma	ateri	al I o	only	avai	lable	e wit	th ax	ial exi	t posi	tion.										





### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the ASS58-H is maximum 65536 steps per revolution. In contrast to the ASS58 series the encoder does not have a microcontroller. Thus, it is a pure hardware encoder.

The control module sends a clock bundle to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input. The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a

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. It is also possible to obtain a version with a 1 m cable connector.

### **Dimensions**



### Dimensions



### **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Electrical specifications		
Operating voltage	$U_B$	4.5 30 V DC (SSI, SSI + RS422) ; 10 30 V DC (SSI + Push/Pull)
No-load supply current	I <sub>0</sub>	max. 180 mA
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 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 ; SSI + incremental track
Monoflop time		20 ± 10 µs
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		0.1 2 MBit/s
Voltage drop		U <sub>B</sub> - 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
Connection		
Connector		type 9416 (M23), 12-pin, type 9416L (M23), 12-pin
Cable		Ø7 mm, 6 x 2 x 0.14 mm², 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

### **Technical Data**

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 <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
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

CI	9416	Female cordset
Charter of the second s	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core
ŶQ	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
° (1	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

### Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
Reserved	Black	9	9	Not wired, reserved
Reserved	Violet	10	4	Not wired, reserved
Reserved	Grey/Pink	11	6	Not wired, reserved
Reserved	Red/Blue	12	7	Not wired, reserved
		9 8 10 7 12 6	8 7 11 6 5 4	

### 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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

### ASS58-H

### Singleturn absolute encoder

- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, 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**

### Line length



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

### Input

The selection of the counting direction input (V/R) is activated with 0-level.



### **Type Code**

### Order code

A		S :	S 5	8		-							Н				-	0	0		T			
																Γ								
																			I	Num	ber of	bits si	ngletur	n
																			-	12	409	96 (star	idard)	
																			•	13	819	92		
															_					16	655	536		
															Opti	ions	<b>3</b>							
															N	Sta	anda	rd					/D !!	
															1	Inc	creme	ental 1	rack	1024	i pulse	es, Pusi	1/Pull	
															2	Inc	creme	ental 1	rack	2048	3 pulse	es, Pusi	1/Pull	
															3	Inc	creme	entali	rack	4096	o puise	es, Pusr	1/Puli	
															4	Inc	creme	entali	rack	1024	+ puise	S, R54	22	
															о с				rack	2040	s puise	S, RO4	22 00	
														0			do	entari	lack	4090	o puise	s, no4	22	
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														G	G	irav	у							
												F	kit nosi	tion	, Ŭ	aray								
													Axia	al										
												R	Rad	lial										
										Cor	nnect	ion	type											
										K1	(	Cabl	e Ø7 mi	m, 6	x 2 x	(0.1	4 mn	n², 1 r	n					
										AA	F	Plug	connec	tor t	ype 9	9416	6, 12-	pin						
										AB	F	Plug	connec	tor t	ype 9	9416	6L, 12	2-pin						
							Shaft	dime	ensio	n/fla	inge	vers	ion											
							F1A	Re	cesse	ed ho	ollow	shaf	it Ø10 m	nm >	( 30 n	nm								
							F2A	Re	ecesse	ed ho	ollow	shaf	it Ø12 m	nm x	( 30 n	nm								
							F3A	Re	ecesse	ed ho	ollow	shaf	t Ø15 m	nm y	( 30 n	nm								
					Ηοι	ising m	ateri	al																
					Ν	Alumi	nium,	powo	der co	ated	l													
					I	Inox*																		
					w	Alumi	nium,	powo	der co	ated	l with	shaf	it seal											
		P	rinciple	e of ope	erati	on																		
	-	S	Sin	igleturn																				
	S	naft v	rsion																					
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108	ແສ TO	rmat	nobro-			torfoot	`							*1			otor		alva	(oilo)			wit noch	tion
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### Singleturn absolute rotary encoder

### AHS58-0

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Zero-set function
- Hollow shaft



### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the AHS58 is maximum 65536 steps per revolution. The devices of the AHS58 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).

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**



### Dimensions



### **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute rotary encoder
Electrical specifications		
Operating voltage	$U_B$	4.5 30 V DC
No-load supply current	I <sub>0</sub>	max. 180 mA
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 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
Overall resolution		up to 16 Bit
Transfer rate		0.1 2 MBit/s
Voltage drop		U <sub>B</sub> - 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
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

Technical Data	
Cable	$07 \text{ mm} 6 \times 2 \times 0.14 \text{ mm}^2 1 \text{ m}$
Standard conformity	
Degree of protection	DIN EN 60529 JP65
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 q, 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: aluminum Flange: aluminum Shaft: stainless steel
Mass	approx. 300 g (combination 1)
Rotational speed	max. 3000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 3 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
Dimensions	
Length	36 mm
Diameter	59 mm

### Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
		9 8 10 7 12 6	8 7 11 6 5 4	

### 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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

### Singleturn absolute rotary encoder

- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, 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

### 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.





Input for selection of counting direction (cw/ccw)



**Type Code** 



### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- The wiring of the screen and 0 V should be arranged radially, if and when possible.

### AHS58-0

### Singleturn absolute rotary encoder

#### • 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 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:metalised connector,shieldclamped with the strainreliefclampDisadvantage:soldering shield on



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!



## Singleturn absolute rotary encoder

### AHS58-H

- Industrial standard housing Ø58 mm
- 16 Bit singleturn
- Hardware encoder
- Data transfer up to 2 MBaud
- Optically isolated RS 422 interface
- Hollow shaft



### **Function**

This singleturn absolute encoder with modern fast technology transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The resolution of the AHS58-H is maximum 65536 steps per revolution.

In contrast to the AHS58 series the encoder does not have a microcontroller. Thus, it is a pure hardware encoder. 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 counting direction with the function input. 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



### Dimensions



### **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute rotary encoder
Electrical specifications		
Operating voltage	$U_B$	4.5 30 V DC
No-load supply current	I <sub>0</sub>	max. 180 mA
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 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
Overall resolution		up to 16 Bit
Transfer rate		0.1 2 MBit/s
Voltage drop		U <sub>B</sub> - 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
Connection		
Connector		type 9416 (M23), 12-pin, type 9416L (M23), 12-pin
Cable		Ø7 mm, 6 x 2 x 0.14 mm², 1 m
Standard conformity		
Degree of protection		DIN EN 60529, IP65
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 20 g, 10 2000 Hz

### **Technical Data**

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: aluminum Flange: aluminum Shaft: stainless steel
Mass	approx. 300 g (combination 1)
Rotational speed	max. 3000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 3 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

CENT	9416	Female cordset
Num-	9416-*M-12P-AVM	Female cordset, M23, 12-pin, PVC cable, 8-core

### Connection

Signal	Cable Ø7 mm, 12-core	Connector 9416, 12-pin	Connector 9416L, 12-pin	Explanation
GND (encoder)	White	1	1	Power supply
U <sub>b</sub> (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
Reserved	Black	9	9	Not wired, reserved
Reserved	Violet	10	4	Not wired, reserved
Reserved	Grey/Pink	11	6	Not wired, reserved
Reserved	Red/Blue	12	7	Not wired, reserved
		9 8 10 7 12 6	8 7 11 6 5 4	

### 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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

### Singleturn absolute rotary encoder

- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, 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

### Line length



Baudrate in kHz
< 400
< 300
< 200
< 100

### Input

The selection of the counting direction input (V/R) is activated with 0-level.



### **Type Code**



SSI (Synchronous Serial Interface)

### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- The wiring of the screen and 0 V should be arranged radially, if and when possible. ٠

### Singleturn absolute rotary encoder

### • 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 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:metalised connector,shieldclamped with the strainreliefclampDisadvantage: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!

Release date: 2023-09-05 Date of issue: 2023-09-05 Filename: t155603\_eng.pdf



# Singleturn absolute rotary encoder

### AVS78E

- Up to 16 Bit singleturn
- ATEX approval
- **IECEx** approval
- Flameproof enclosure
- Removable connection cap
- Galvanically isolated RS 422 interface



### **Function**

This absolute rotary encoder returns a position value corresponding to the shaft position via the SSI interface. In order to obtain the position data, the controller sends a start sequence to the absolute rotary encoder. The encoder then responds synchronously to the pulses from the controller with the position data. The modular design enables you to order the absolute rotary encoder so that it fulfills your requirements. A listing of the part options can be found in the protein intervention.

in the ordering information.

You can select the counting direction via 2 functional inputs and set the zero position.

### Dimensions

#### **Encoder length L**

Version		Length L
Radial cable exit	Clamping flange	118 mm
	Servo flange	118 mm
Axial cable exit	Clamping flange	134 mm
	Servo flange	134 mm



Release date: 2024-03-11 Date of issue: 2024-03-11 Filename: t157828\_eng.pdf

### **Dimensions**



### **Technical Data**

General specifications
Technical Data		
Detection type		photoelectric sampling
Device type		Singleturn absolute rotary encoder
Functional safety related parameters		
MTTE.		210 a
		7 7 F±9 at 3000 rpm
Flectrical specifications		
	Ha	10 30 V DC
No-load supply current	La La	
Linearity	•0	+ 21 SB at 16 Bit + 11 SB at 13 Bit + 0.51 SB at 12 Bit
Output code		Grav code binary code
Code course (counting direction)		see innut 1
Interface		
Interface type		SSI
Monoflop time		20 + 10 us
Besolution		20 1 10 μ0
Single turn		up to 16 Bit
Transfer rate		0.1 2 MBit/e
Standard conformity		BS 422
		Selection of counting direction (cw/ccw)
Signal voltage		
High		10 30 V or open input
i igii		cw descending (clockwise rotation, code course descending)
Low		0 2 V cw ascending (clockwise rotation, code course ascending)
Input current		< 6 mA
Switch-on delay		< 10 ms
Input 2		
Input type		zero-set (PRESET)
Signal voltage		
High		10 30 V
Low		0 2 V
Input current		< 6 mA
Signal duration		min. 100 ms
Switch-on delay		< 10 ms
Connection		
Cable		Ø 10.2 mm, Radox 9 x 0.5 mm <sup>2</sup>
Terminal compartment		see ordering information
Standard conformity		
Degree of protection		DIN EN 60529, IP66
Climatic testing		DIN EN 60068-2-78, no moisture condensation
Emitted interference		EN 61000-6-4:2007/A1:2011
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 3 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
IECEx approval		
Equipment protection level Gb		IECEx ITS 15.0061X
ATEX approval		
Equipment protection level Gb		ITS 15 ATEX 18372X
Ambient conditions		
Operating temperature		-40 70 °C (-40 158 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		

Technical Data	
Material	
Waterial	
Combination 1	housing: anodized aluminum flange: anodized aluminum shaft: Stainless steel 1.4404 / AISI 316L
Combination 2 (Inox)	housing: Stainless steel 1.4404 / AISI 316L flange: Stainless steel 1.4404 / AISI 316L shaft: Stainless steel 1.4404 / AISI 316L
Mass	approx. 2600 g (combination 1) approx. 3900 g (combination 2)
Rotational speed	max. 3000 min <sup>-1</sup>
Moment of inertia	180 gcm <sup>2</sup>
Starting torque	≤ 4 Ncm
Shaft load	
Axial	60 N
Radial	80 N
General information	
Use in the hazardous area	see instruction manuals

# Connection

Signal	Cable	Terminal compartment	
Ground wire	green-yellow	Grounding terminal	
GND (rotary encoder)	1	1	
+U <sub>b</sub> (rotary encoder)	2	2	
Pulse (+)	3	5	
Pulse (-)	4	6	
Data (+)	5	8	÷
Data (-)	6	7	
Preset	7	4	
Counting direction	8	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



#### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
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#### 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.
- 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 26<sup>th</sup> pulse controls data repetition. If the 26<sup>th</sup> pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, 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

Line length



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

Rotary encoder

Interface electronics

#### 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

## **Ordering information**



# 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	a Ba
relief	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 rema

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!



# PVS78E

- Up to 16 Bit singleturn
- ATEX approval
- **IECEx** approval
- Flameproof enclosure
- Removable connection cap



## **Function**

This series of PROFIBUS rotary encoders is based on the modern fast technology of singleturn sampling and the mechanical gear box of the multiturn unit. The absolute encoder corresponds to the PROFIBUS profile for encoders, order no. 3.062. Operation is supported based on Class 1 and Class 2

For operation based on Class 1, position data and diagnostic data bytes 1 ... 16 are available. In addition, the direction of the code can be selected as either cw ascending (clockwise rotation, code course ascending) or cw descending (clockwise rotation, code course descending). If the rotary encoder is operated according to Class 2, additional functions to those from Class 1 are available. These include scaling of the resolution per revolution and the overall resolution, as well as the preset function. In addition, expanded diagnostic reporting is supported. Besides, the rotary encoder offers extended functionalities such as speed transfer, extended scaling functions, programmable limit switches and a commissioning mode.

The removable connecting hood contains a slide switch for setting the terminating resistor and the rotary switches for setting the address. Assign a fixed address and bus termination to the encoder with this switches.

The device is designed for shaft mounting and is available in servo flange or clamping flange design.

# Dimensions

#### Encoder length L

Version		Length L
Radial cable exit	Clamping flange	109 mm
	Servo flange	109 mm
Axial cable exit	Clamping flange	125 mm
	Servo flange	125 mm



# Dimensions



# **Technical Data**

**General specifications** 

Technical Data		
Detection type		nhotoelectric sampling
Device type		Singleturn absolute rotary encoder
Functional safety related parameters		
		210 a
		7 7 F+9 at 3000 rpm
Electrical specifications		
	L In	10 30 V DC
No-load supply current	La La	max 230 mA at 10 V DC
	•0	max. 100 mA at 24 V DC
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		PROFIBUS DP
Resolution		
Single turn		up to 16 Bit
Transfer rate		0.0096 12 MBit/s
Standard conformity		PNO profile 3.062, RS-485
Connection		
Cable		Ø9.6 mm, 7-core
Terminal compartment		see ordering information
Standard conformity		
Degree of protection		DIN EN 60529, IP66
Climatic testing		DIN EN 60068-2-78, no moisture condensation
Emitted interference		EN 61000-6-4:2007/A1:2011
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 3 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
IECEx approval		
Equipment protection level Gb		IECEx ITS 15.0061X
ATEX approval		
Equipment protection level Gb		ITS 15 ATEX 18372X
Ambient conditions		
Operating temperature		-40 70 °C (-40 158 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		
Combination 1		housing: anodized aluminum flange: anodized aluminum shaft: Stainless steel 1.4404 / AISI 316L
Combination 2 (Inox)		housing: Stainless steel 1.4404 / AISI 316L flange: Stainless steel 1.4404 / AISI 316L shaft: Stainless steel 1.4404 / AISI 316L
Mass		approx. 2600 g (combination 1) approx. 3900 g (combination 2)
Rotational speed		max. 3000 min <sup>-1</sup>
Moment of inertia		180 gcm <sup>2</sup>
Starting torque		≤4 Ncm
Shaft load		
Axial		60 N
Radial		80 N
General information		
Use in the hazardous area		see instruction manuals

Signal	Terminal	Cable Ø9.6 mm, 7-core	Description
GND encoder	-	1	- Supply voltage
U <sub>S</sub> encoder	+	2	+ Supply voltage
RxD/TxD-P	В	3	Data wire B (pair 1), bus in
RxD/TxD-N	A	4	Data wire A (pair 1), bus in
RxD/TxD-P	В	5	Data wire B (pair 2), bus out
RxD/TxD-N	A	6	Data wire A (pair 2), bus out
potential earth	T	GN/YE	

# Configuration



## Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 99, and may only be assigned once.



#### Adjusting the termination resistor

The terminating resistor  $R_T$  (220  $\Omega) can be connected to the circuit by means of the switch:$ 



last participant





# Function Principle



# Parameterization

Octet number (Byte)	Parameter	Bit number
18	PROFIBUS standard parameters	
9	Direction of rotation	0
	Class 2 functionality	1
	Commissioning Diagnostics	2
	Scaling function	3
	Reserved	4
	Reserved	5
	Activate manufacturer specific parameters (Octet 26)	6
	Reserved	7
10 13	Desired measuring steps (reference: Octet 26, Bit 0 and 1)	
14 17	Overall resolution	
18 25	Reserved	
26	Reference for desired measuring steps	0
		1
	Activate commissioning mode	2
	Reduced diagnosis	3
	Reserved	4
	Activate lower software limit switch	5
	Activate upper software limit switch	6
	Activation of the parameters from Octet 27	7
27 30	Lower limit switch	
31 34	Upper limit switch	
35 38	Physical measuring steps	
39	Reserved	0
	Rotary encoder type (singleturn or multiturn)	1
	Reserved	2
	Reserved	3
	Selection of the unit for speed transfer	4
		5
	Reserved	6
	Reserved	7

Type Code



# Installation

#### Anti-interference measures

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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:

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- The wiring of the encoder should be laid at a large distance to energy lines which could cause interferences.
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- 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 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.

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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:	metalised connector,	1ª <b>6</b> *
	clamped with the strain	
relief	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!



# CVS78E

- Up to 16 Bit singleturn
- ATEX approval
- **IECEx** approval
- Flameproof enclosure
- Removable connection cap



# **Function**

Absolute encoders deliver an absolute step value for each angle setting. All these values are represented by code samples on one or more code disks which are sampled by a photoelectric array.

The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The integrated CAN bus interface of the absolute encoder supports all DeviceNet functions. The following operating modes can be programmed, and can selectively be turned on or off: • Polled mode

- · Cyclic mode
- Sync mode

The device is designed for shaft mounting and is available in servo flange or clamping flange design. The bus electronics module is integrated into the removable housing cover. This makes it possible to mount or replace the new rotary encoders and the matching bus electronics separately during installation or service.

# Dimensions

#### Encoder length L

Version		Length L
Radial cable exit	Clamping flange	109 mm
	Servo flange	109 mm
Axial cable exit	Clamping flange	125 mm
	Servo flange	125 mm



# Dimensions



# **Technical Data**

General specifications

Technical Data		
Detection type		nhotoelectric sampling
Device type		Singleturn absolute rotary encoder
Functional safety related parameters		
MTTE.		25 a
		7 7 F±9 at 3000 rpm
Electrical specifications		
	11-	10 30 V DC
No-load supply current	UB L	max 350 mA
	10	$\pm 21$ SB at 16 Bit $\pm 11$ SB at 13 Bit $\pm 0.51$ SB at 12 Bit
		$\pm 2$ LOD at 10 bit, $\pm 1$ LOD at 10 bit, $\pm 0.5$ LOD at 12 bit
Code course (counting direction)		ow ascending (clockwise rotation, code course ascending)
course (counting direction)		cw descending (clockwise rotation, code course descending)
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		max. 1 MBit/s
Standard conformity		communication profile: DS 301 Device profiles: DS 406 and DS 417 , programmable according to class 2
Connection		
Cable		Ø 10.2 mm, Radox 9 x 0.5 mm <sup>2</sup>
Terminal compartment		see ordering information
Standard conformity		
Degree of protection		DIN EN 60529, IP66
Climatic testing		DIN EN 60068-2-78, no moisture condensation
Emitted interference		EN 61000-6-4:2007/A1:2011
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 3 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
IECEx approval		
Equipment protection level Gb		IECEx ITS 15.0061X
ATEX approval		
Equipment protection level Gb		ITS 15 ATEX 18372X
Ambient conditions		
Operating temperature		-40 70 °C (-40 158 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		
Combination 1		housing: anodized aluminum flange: anodized aluminum shaft: Stainless steel 1.4404 / AISI 316L
Combination 2 (Inox)		housing: Stainless steel 1.4404 / AISI 316L flange: Stainless steel 1.4404 / AISI 316L shaft: Stainless steel 1.4404 / AISI 316L
Mass		approx. 2600 g (combination 1) approx. 3900 g (combination 2)
Rotational speed		max. 3000 min <sup>-1</sup>
Moment of inertia		180 gcm <sup>2</sup>
Starting torque		≤ 4 Ncm
Shaft load		
Axial		60 N
Radial		80 N
General information		
Use in the hazardous area		see instruction manuals

# Connection

Terminal	Cable	Explanation
(-)	1	- Power supply
(+)	2	+ Power supply
L	3	CAN low
Н	4	CAN high
G	5	CAN ground
L	6	CAN low
Н	7	CAN high
G	8	CAN ground
$\perp$	green / yellow	Ground connection of encoder housing

# Configuration

# Indicating and operating elements



#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 96, and may only be assigned once. The addresses 97 ... 99 are reserved.

# Adjusting the termination resistor

The terminating resistor  $R_T$  (121  $\Omega)$  can be connected to the circuit by means of the switch:



last participant



member X

## **Baud rate adjustment**

Baud rate [kBit/s]	Switch position	Baud rate [kBit/s]	Switch position
20	0	500	5
50	1	800	6
100	2	1000	7
125	3	reserved	8
250	4	set baud rate by SDO message and LSS	9

# Parameterization

#### **Programmable CAN operating modes**

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.

Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple
	nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier.
	There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit
	until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
2 limit switches	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
8 cam switches	Up to 8 position values can be programmed as cams. By reaching these values bits in object 6300h Cam state register are set.

# **Type Code**

# Ordering information



# 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	
roliof	clamped with the strain	
Teller	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.



# DVS78E

- Up to 16 Bit singleturn
- ATEX approval
- **IECEx** approval
- Flameproof enclosure
- Removable connection cap

# **Device**Net<sup>™</sup>

# **Function**

Absolute encoders deliver an absolute step value for each angle setting. All these values are represented by code samples of one or more code disks. The code disks are screened by an infrared LED and the bit obtained sample is detected by means of an optical array. Its signals are electronically amplified and are forwarded on to the interface for processing.

The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The integrated CAN bus interface of the absolute encoder supports all DeviceNet functions. The following operating modes can be programmed, and can selectively be turned on or off:

- Polled mode
- · Cyclic mode
- · Change of state mode

The device is designed for shaft mounting and is available in servo flange or clamping flange design. The bus electronics module is integrated into the removable housing cover. This makes it possible to mount or replace the new rotary encoders and the matching bus electronics separately during installation or service.

# **Dimensions**

#### Encoder length L

Version		Length L
Radial cable exit	Clamping flange	118 mm
	Servo flange	118 mm
Axial cable exit	Clamping flange	134 mm
	Servo flange	134 mm



# Dimensions



# **Technical Data**

**General specifications** 

Technical Data		
Detection type		photoelectric complian
		Singleture absolute retary anoder
Eurotional safety related parameters		Singletum absolute rotary encoder
		25.0
WITTEd		20 d
		7.7 E+9 at 5000 fpm
		10 201/00
Operating voltage	UB	10 30 V DC
No-load supply current	1 <sub>0</sub>	max. 100 mA at 24 V DC
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		DeviceNet
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		max. 0.5 MBit/s
Connection		
Cable		Ø 10.2 mm, Radox 9 x 0.5 mm <sup>2</sup>
Terminal compartment		see ordering information
Standard conformity		
Degree of protection		DIN EN 60529, IP66
Climatic testing		DIN EN 60068-2-78 , no moisture condensation
Emitted interference		EN 61000-6-4:2007/A1:2011
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 3 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
IECEx approval		
Equipment protection level Gb		IECEx ITS 15.0061X
ATEX approval		
Equipment protection level Gb		ITS 15 ATEX 18372X
Ambient conditions		
Operating temperature		-40 70 °C (-40 158 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		
Combination 1		housing: anodized aluminum flange: anodized aluminum shaft: Stainless steel 1.4404 / AISI 316L
Combination 2 (Inox)		housing: Stainless steel 1.4404 / AISI 316L flange: Stainless steel 1.4404 / AISI 316L shaft: Stainless steel 1.4404 / AISI 316L
Mass		approx. 2600 g (combination 1) approx. 3900 g (combination 2)
Rotational speed		max. 3000 min <sup>-1</sup>
Moment of inertia		180 gcm <sup>2</sup>
Starting torque		≤ 4 Ncm
Shaft load		
Axial		60 N
Radial		80 N
General information		
Use in the hazardous area		see instruction manuals

# Connection

Terminal	Cable	Explanation
(-)	1	- Power supply
(+)	2	+ Power supply
L	3	CAN low
Н	4	CAN high
G	5	CAN ground
L	6	CAN low
Н	7	CAN high
G	8	CAN ground
$\perp$	green / yellow	Ground connection of encoder housing

# Configuration



## Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 63, and may only be assigned once.

#### Adjusting the termination resistor

The terminating resistor  $R_T$  (121  $\Omega)$  can be connected to the circuit by means of the switch:





participant X

last participant

### **Baud rate adjustment**

Baud rate [kBit/s]	Switch position
125	0
250	1
500	2
125	3
reserved	4 9

# **Parameterization**

### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a telegram. The absolute encoder reads in the current position, calculates all parameters that may have been set and then sends back the actual process value.
Cyclic mode	The absolute encoder sends the current process value depending on a programmable timer. This can cause the bus load to be reduced since the member on the network only sends a message after a specific amount of time without a prompt from the master.
Change of state mode	The absolute encoder monitors the current process value and transfers the current value by itself if there is any change in the value. This can cause the bus load to be reduced, since the member on the network only sends a message if there has been a change.

# Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will be rising or descending.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to a revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.

# **Type Code**

# **Ordering information**



# 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<sup>2</sup>.
- Cable cross-section at least 0.14 mm<sup>2</sup>.
- 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 guality 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 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	metalised connector,	)
relief	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!



# CVS78E Mining

- Up to 16 Bit singleturn
- ATEX-approval for mining
- **IECEx** approval
- Flameproof enclosure
- Removable connection cap



# **Function**

Absolute encoders deliver an absolute step value for each angle setting. All these values are represented by code samples on one or more code disks which are sampled by a photoelectric array.

The absolute encoder has a maximum basic resolution of 65536 steps per revolution (16 Bits). The integrated CAN bus interface of the absolute encoder supports all DeviceNet functions. The following operating modes can be programmed, and can selectively be turned on or off: • Polled mode

- · Cyclic mode
- Sync mode

The device is designed for shaft mounting and is available in servo flange or clamping flange design. The bus electronics module is integrated into the removable housing cover. This makes it possible to mount or replace the new rotary encoders and the matching bus electronics separately during installation or service.

# Dimensions

#### Encoder length L

Version		Length L
Radial cable exit	Clamping flange	109 mm
	Servo flange	109 mm
Axial cable exit	Clamping flange	125 mm
	Servo flange	125 mm



Clamping flange, cable exit radial

## **Dimensions**



# **Technical Data**

General specifications

Technical Data		
Detection type		photoelectric sampling
Device type		Singleturn absolute rotary encoder
Functional safety related parameters		
MTTF <sub>d</sub>		25 a
L <sub>10</sub>		7.7 E+9 at 3000 rpm
Electrical specifications		
Operating voltage	UB	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 350 mA
Linearity		$\pm$ 2 LSB at 16 Bit, $\pm$ 1 LSB at 13 Bit, $\pm$ 0,5 LSB at 12 Bit
Output code		binary code
Code course (counting direction)		cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		max. 1 MBit/s
Standard conformity		communication profile: DS 301 Device profiles: DS 406 and DS 417 , programmable according to class 2
Connection		
Terminal compartment		with 2 threads for cable glands: each M20 x 1.5 6H, 17 mm thread depth
Standard conformity		
Degree of protection		DIN EN 60529, IP66
Climatic testing		DIN EN 60068-2-78, no moisture condensation
Emitted interference		EN 61000-6-4:2007/A1:2011
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 3 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
IECEx approval		
Equipment protection level Mb		IECEx ITS 15.0060X
ATEX approval		
Equipment protection level Mb		ITS 15 ATEX 18371X
Ambient conditions		
Operating temperature		-40 70 °C (-40 158 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		
Combination 2 (Inox)		
Housing		Stainless steel 1.4404 / AISI 316L
Flange		Stainless steel 1.4404 / AISI 316L
Shaft		Stainless steel 1.4404 / AISI 316L
Mass		approx. 3900 g
Rotational speed		max. 3000 min <sup>-1</sup>
Moment of inertia		180 gcm <sup>2</sup>
Starting torque		≤ 4 Ncm
Shaft load		
Axial		60 N
Radial		80 N
General information		
Use in the hazardous area		see instruction manuals

#### **Type Code** Structure of the type code С ٧ S 8 Е (2) 0 0 0 В 4 (4) 7 (1) (1) (3) 0 0 (4) -Data format С С CANopen Shaft version ν V Solid shaft **Funktional principle** S S Singleturn 78 Size 78 Housing diameter 78 mm **Option 1** Е Е Explosion proof, standard IP66 (1) (1 Shaft diameter 01 Shaft Ø 10 mm x 20 mm 02 Shaft Ø 12 mm x 20 mm Flange (2) 1 Clamping flange 2 Servo flange 00 **Connection type** 00 Terminal compartment with two M20 x 1.5 6H threads each, 17 mm thread depth, for cable glands (3) Exit position А Axial R Radial Option 0 0 None В **Output Code** В Binary Housing material 4 4 Stainless steel 1.4404 / AISI 316L (V4A) 00 Multiturn: Number of bits and puls count 00 Singleturn Encoder (4) (4) Singleturn: Number of bits and puls count 12 12 bits, 4096 pulses 13 13 bits, 8192 pulses 16 bits, 65536 pulses 16

# Connection

Terminal	Cable	Explanation
(-)	1	- Power supply
(+)	2	+ Power supply
L	3	CAN low
Н	4	CAN high
G	5	CAN ground
L	6	CAN low
Н	7	CAN high
G	8	CAN ground
$\perp$	green / yellow	Ground connection of encoder housing

# Configuration

# Indicating and operating elements



#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 96, and may only be assigned once. The addresses 97 ... 99 are reserved.

# Adjusting the termination resistor

The terminating resistor  $R_T$  (121  $\Omega)$  can be connected to the circuit by means of the switch:



last participant



member X

#### 

#### **Baud rate adjustment**

Baud rate [kBit/s]	Switch position	Baud rate [kBit/s]	Switch position
20	0	500	5
50	1	800	6
100	2	1000	7
125	3	reserved	8
250	4	set baud rate by SDO message and LSS	9

# Parameterization

#### **Programmable CAN operating modes**

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.



# Singleturn absolute encoder

# EVS58-PZ

- Industrial standard housing Ø58 mm
- Ethernet interface with Powerlink
- 16 Bit singleturn
- Two Ethernet connectors with built in hub
- Servo or clamping flange

# 

# **Function**

Absolute rotary encoders deliver an absolute step value for each angle setting. On account of the high number of measuring steps, this type of absolute rotary encoder can be used to divide very long linear distances into small measuring steps. The Ethernet interface of this absolute encoder supports the Powerlink V2 protocol. An integrated hub allows wiring in a line structure (daisy

chain). In addition to various functions like resolution adjustment, rotation direction, node number setting or limit switch adjustment, the following operation modes can be selected:

- Polled mode
- · Multiplexed mode
- Poll Response chaining

The device is designed for shaft assembly and is available in servo flange or clamping flange design.

# **Dimensions**



# Dimensions



# **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Singleturn absolute encoder
Functional safety related parameters		
MTTF <sub>d</sub>		130 a
Mission Time (T <sub>M</sub> )		20 a
L <sub>10h</sub>		1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC , safe galvanic isolation per EN 50178
Power consumption	P <sub>0</sub>	max. 3 W
Linearity		± 0.5 LSB (12 Bit) , ± 2 LSB (16 Bit)
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		Ethernet Powerlink
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Physical		Ethernet
Transfer rate		100 MBit/s
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 5-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source
CCC approval		CCC approval / marking not required for products rated $\leq$ 36 V

# **Technical Data**

Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Mass	approx. 550 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	≤ 3 Ncm (version without shaft seal)
Shaft load	
Axial	40 N
Radial	80 N

# Accessories

	9203	Angled flange
	V1SD-G-ABG-PG9	Male connector M12 straight D-coded 4-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
$\geq$	V1SD-G-2M-PUR-ABG- V45-G	Connection cable, M12 to RJ-45, PUR cable 4-pin, CAT5e
$\sim$	V15-G-YE2M-PVC	Female cordset, M12, 5-pin, PVC cable
	9300	Mounting bracket for servo flange
	V15-G-YE5M-PVC	Female cordset, M12, 5-pin, PVC cable
	V15-G-PG9	Female connector M12 straight A-coded 5-pin, for cable diameter 6 - 8 mm, field-attachable
D	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

# Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded		
1	Supply voltage +U <sub>B</sub>	Tx +		
2	-	Rx +		
3	0 V	Tx -		
4	-	Rx -		
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$			

# Indication

#### LEDs for HUB Port

LED	Color	Status	Meaning
LS/DA 1	green	on	LINK active for HUB Port 1
		blinking	Activity on HUB Port 1
LS/DA 2	green	on	LINK active for HUB Port 2
		blinking	Activity on HUB Port 2

## LEDs for Powerlink

LED	Color	Status	Meaning
Error	red	on	<ul> <li>not allowed node number</li> </ul>
			<ul> <li>internal communication error</li> </ul>
			- buffer underrun/overflow
			- collision
			- CRC error
			- loss of SoC
		off	no error
Status	green	off	not active
		flickering	Basic Ethernet mode
		flashes 1x	Pre-Operational 1
		flashes 2x	Pre-Operational 2
		flashes 3x	ready to operate
		on	Operational
		blinking	Stopped



#### Node number adjustment

The setting of the controlled node number is achieved by 2 hexadicimal switches x16 and x1. Allowed node numbers range is 1 ... 239. The adjusted node number is calculated as follows: Node number = Decimal value<sub>[switch x16]</sub> x 16 + Decimal value<sub>[switch x1]</sub> x 1 **Example:** 

[switch x16] = A, [switch x1] = 5 A<sub>hex</sub> =  $10_{dec} \times 16 = 160 + 5 = 165$ 

# Type Code

## Order code





# Singleturn absolute encoder

# ESS58-PZ

- Industrial standard housing Ø58 mm
- Ethernet interface with Powerlink
- 16 Bit singleturn
- Two Ethernet connectors with built in hub
- Recessed hollow shaft



# Function

Absolute rotary encoders deliver an absolute step value for each angle setting. On account of the high number of measuring steps, this type of absolute rotary encoder can be used to divide very long linear distances into small measuring steps. The Ethernet interface of this absolute encoder supports the Powerlink V2 protocol. An integrated hub allows wiring in a line structure (daisy

chain). In addition to various functions like resolution adjustment, rotation direction, node number setting or limit switch adjustment, the following operation modes can be selected:

- Polled mode
- · Multiplexed mode
- Poll Response chaining

The absolute encoder is mounted directly onto the application shaft, without any coupling. Rotation of the absolute encoder is prevented by a torque rest.

# **Dimensions**



# **Technical Data**

General specifications				
Detection type	photoelectric sampling			
Device type	Singleturn absolute encoder			
Functional safety related parameters				
MTTF <sub>d</sub>	130 a			
Mission Time (T <sub>M</sub> )	20 a			
L <sub>10h</sub>	1.9 E+11 at 6000 rpm and 20/40 N axial/radial shaft load			
Technical Data				
-------------------------------------	----	---		
Diagnostic Coverage (DC)		0 %		
Electrical specifications		0 /8		
		10 20 V DC sofe colveriginalities per EN 50179		
	D	To So V DC, sale galvanic isolation per EN S0176		
Linearity	Γ0			
Linearity		$\pm 0.5 \text{ LSB}(12 \text{ Bil}), \pm 2 \text{ LSB}(10 \text{ Bil})$		
		binary code		
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)		
Interface				
Interface type		Ethernet Powerlink		
Resolution				
Single turn		up to 16 Bit		
Overall resolution		up to 16 Bit		
Physical		Ethernet		
Transfer rate		100 MBit/s		
Connection				
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 5-pin, A-coded		
Standard conformity				
Degree of protection		DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65		
Climatic testing		DIN EN 60068-2-3, no moisture condensation		
Emitted interference		EN 61000-6-4:2007		
Noise immunity		EN 61000-6-2:2005		
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms		
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz		
Approvals and certificates				
UL approval		cULus Listed, General Purpose, Class 2 Power Source		
CCC approval		CCC approval / marking not required for products rated ≤36 V		
Ambient conditions				
Operating temperature		-40 79 °C (-40 174.2 °F)		
Storage temperature		-40 85 °C (-40 185 °F)		
Relative humidity		98 %, no moisture condensation		
Mechanical specifications				
Material		housing: powder coated aluminum flange: aluminum shaft: stainless steel		
Mass		approx. 550 g		
Rotational speed		max. 12000 min <sup>-1</sup>		
Moment of inertia		30 gcm <sup>2</sup>		
Starting torque		≤ 3 Ncm (version without shaft seal)		
Tightening torque, fastening screws		max. 1.8 Nm		
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

V15-G-YE2M-PVC Female cordset, M12, 5-pin, PVC cable

Acces	sories	
	V15-G-YE5M-PVC	Female cordset, M12, 5-pin, PVC cable
	V1SD-G-ABG-PG9	Male connector M12 straight D-coded 4-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
$\sum$	V1SD-G-2M-PUR-ABG- V45-G	Connection cable, M12 to RJ-45, PUR cable 4-pin, CAT5e
	V15-G-PG9	Female connector M12 straight A-coded 5-pin, for cable diameter 6 - 8 mm, field-attachable
°Q	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
20	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
20	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

## Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded	
1	Supply voltage +U <sub>B</sub>	Tx +	
2	-	Rx +	
3	0 V	Tx -	
4	-	Rx -	

# Indication

#### LEDs for HUB Port

LED	Color	Status	Meaning
LS/DA 1	green	on	LINK active for HUB Port 1
		blinking	Activity on HUB Port 1
LS/DA 2	green	on LINK active for HUB Port 2	
		blinking	Activity on HUB Port 2

### **LEDs for Powerlink**

LED	Color	Status	Meaning
Error	red	on	- not allowed node number - internal communication error - buffer underrun/overflow - collision - CRC error - loss of SoC
		off	no error
Status	green	off	not active
		flickering	Basic Ethernet mode
		flashes 1x	Pre-Operational 1
		flashes 2x	Pre-Operational 2
		flashes 3x	ready to operate
		on	Operational
		blinking	Stopped



#### Node number adjustment

The setting of the controlled node number is achieved by 2 hexadicimal switches x16 and x1. Allowed node numbers range is 1 ... 239. The adjusted node number is calculated as follows: Node number = Decimal value[switch x16] x 16 + Decimal value[switch x1] x 1

**Example:** [switch x16] = A, [switch x1] = 5  $A_{hex} = 10_{dec} \times 16 = 160 + 5 = 165$ 

### Order code







### **Function**

The ENA58IL series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

### Dimensions



Clamping flange





Servo flange

ø58

# Dimensions

	L [mm]		
Design	Axial output	Radial output	
Singleturn	41.7	52.7	
Multiturn	52	2.7	

Connections Dimensions in mm

Cable Connector M12 Connector M23

# **Technical Data**

Release date: 2023-07-31 Date of issue: 2023-07-31 Filename: t166164\_eng.pdf

General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		700 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		55 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	4.5 30 V DC (SSI, SSI + RS422) ; 10 30 V DC (SSI + Push/Pull)
No-load supply current	I <sub>0</sub>	typ. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	< 450 ms
Output code		Gray code, binary code
Code course (counting direction)		adjustable
Interface		
Interface type		SSI; SSI + incremental track
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 16 Bit
Overall resolution		up to 32 Bit
Transfer rate		0.1 2 MBit/s
Cycle time		< 100 µs
Standard conformity		RS 422

# **Technical Data**

Input 1	
Input type	Selection of counting direction (cw/ccw)
Signal voltage	
High	4.75 V $U_B$ or unconnected (cw descending)
Low	0 2 V (cw ascending)
Input current	< 6 mA
Switch-on delay	< 250 ms
Input 2	
Input type	zero-set (PRESET 1) with falling edge
Signal voltage	
High	4.75 V U <sub>B</sub>
Low	0 2 V
Input current	< 6 mA
Signal duration	min. 1.1 s
Output	
Output type	RS422, Push/Pull
Signal output	A+B+/A+/B
Pulses	1024, 2048, 4096
Connection	
Connector	M12 connector, 8-pin or M23 connector, 12-pin
Cable	Ø7 mm, 6 x 2 x 0.14 mm <sup>2</sup> , 1 m (cable length, see order code)
Standard conformity	
Degree of protection	DIN EN 60529, IP65 or IP67 (not for M23 device plug)
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel , painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g , with cable
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N
Radial	110 N

Acces	sories	
66	V19-G-2M-PUR-ABG- V19-G	Cordset M12 socket straight to M12 plug straight A-coded, 8-pin, PUR cable grey, shielded
<i>d</i> /	V19-G-2M-PUR-ABG	Female cordset single-ended M12 straight A-coded, 8-pin, PUR cable grey, shielded
ø /	V19-G-5M-PUR-ABG	Female cordset single-ended M12 straight A-coded, 8-pin, PUR cable grey, shielded
a como	V19-W-ABG-PG9	Female connector M12 angled A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
0. mil	9401 6*10	Spring steel coupling
1. The second	9401 6*6	Spring steel coupling
	9402 6*6	Spring steel coupling
	9404 6*6	Spring disk coupling
· ini	9409 6*10	Bellows coupling
()	9409 6*6	Bellows coupling
· ini	9409 6*8	Bellows coupling
•	9410 6*6	Precision coupling
<b>i</b>	KW-6/10	Helical coupling
<b>i</b>	KW-6/6	Helical coupling
<b>i</b>	KW-6/8	Helical coupling
(FF)	9108, 6	Measuring wheel
(F)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm

# Absolute rotary encoder

Acces	sories	
	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm
	V19-G-10M-PVC-TP	Female cordset, M12, 8-pin, shielded, PVC cable
$\sum$	V19-G-2M-PVC-TP	Female cordset, M12, 8-pin, shielded, PVC cable
	V19-G-5M-PVC-TP	Female cordset, M12, 8-pin, shielded, PVC cable

### Connection

Signal	Cable, 12-core	Connector M12, 8-pin	Connector M23, 12-pin, cw	Connector M23, 12-pin, ccw	Explanation
GND (encoder)	White	1	1	1	Power supply
U <sub>b</sub> (encoder)	Brown	2	2	8	Power supply
Clock (+)	Green	3	3	3	Positive cycle line
Clock (-)	Yellow	4	4	11	Negative cycle line
Data (+)	Grey	5	5	2	Positive transmission data
Data (-)	Pink	6	6	10	Negative transmission data
A	Black		7	12	Incremental track A
V/R	Red	8	8	5	Input for selection of counting direction
PRESET 1	Blue	7	9	9	Zero-setting input
В	Grey/Pink		10	4	Incremental track B
Ā	Violet		11	6	Incremental track A
B	Red/Blue		12	7	Incremental track B
			$\begin{array}{c} & 9 \\ 12 \\ 7 \\ 6 \\ 5 \\ 11 \\ 4 \end{array}$	$\begin{array}{c} & 9 \\ 10 \\ 2 \\ 3 \\ 4 \\ 11 \\ 5 \end{array}$	

## Operation

### Signal output



#### ℃ cw - with view onto the shaft

### Interface

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



### Absolute rotary encoder

### 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  $(D_n)$ ) 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<sub>m</sub> has expired. ٠
- No subsequent data transfer can be started until the data line switches to high again or the time for the clock pause T<sub>n</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

Line length

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.



If the pulse line is exchanged, the data word is generated offset.

### **Block diagram**



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

Rotary encoder

Interface electronics

## Parameterization

### Push buttons on encoder with model characteristic SB2, SG2

In addition to the electrical preset function (PRESET 1) these models are equipped with 2 push buttons for manually setting the zero point of the rotary encoder.

### Manually zero set

1. Simultaneously press and hold the push buttons A and B for 2 s.

After releasing the push buttons the rotary encoder sets the current position as zero point.

## Type Code



# SI1 SSI Gray + 1024 pulses, Push/Pull SI2 SSI Gray + 2048 pulses, Push/Pull SI3 SSI Gray + 4096 pulses, Push/Pull SI4 SSI Gray + 1024 pulses, RS422 SI5

- SSI Gray + 2048 pulses, RS422 SI6 SSI Gray + 4096 pulses, RS422
- SI7 SSI Binär + 1024 pulses, Push/Pull





### **Function**

The ENA58IL series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

### Dimensions





\* See type code \*\* Singleturn design with axial output: L = 60.6

All other designs: L = 71 mm

Recessed hollow shaft

# Dimensions

### Connections

### Dimensions in mm

Cable



17.5 exit position axial

exit position radial

Connector M12



Connector M23

# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		700 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		5 E+8 revolutions at 24/198 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	4.5 30 V DC (SSI, SSI + RS422) ; 10 30 V DC (SSI + Push/Pull)
No-load supply current	I <sub>0</sub>	typ. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	< 450 ms
Output code		Gray code, binary code
Code course (counting direction)		adjustable
Interface		
Interface type		SSI ; SSI + incremental track
Resolution		
Single turn		up to 16 Bit
Multitum		up to 16 Bit
Overall resolution		up to 32 Bit
Transfer rate		0.1 2 MBit/s
Cycle time		< 100 µs
Standard conformity		RS 422
Input 1		
Input type		Selection of counting direction (cw/ccw)
Signal voltage		
High		$4.75 \text{ V} \dots \text{U}_{\text{B}}$ or unconnected (cw descending)
Low		0 2 V (cw ascending)
Input current		< 6 mA
Switch-on delay		< 250 ms

# **Technical Data**

Input 2	
Input type	zero-set (PRESET 1) with falling edge
Signal voltage	
High	4.75 V U <sub>B</sub>
Low	0 2 V
Input current	< 6 mA
Signal duration	min. 1.1 s
Output	
Output type	RS422, Push/Pull
Signal output	A+B+/A+/B
Pulses	1024, 2048, 4096
Connection	
Connector	M12 connector, 8-pin or M23 connector, 12-pin
Cable	Ø7 mm, 6 x 2 x 0.14 mm <sup>2</sup>
Standard conformity	
Degree of protection	DIN EN 60529, IP65 or IP67 (not for M23 device plug)
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g , with cable
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static
Badial offset	+0.5 mm static

### Accessories

T

V19-G-2M-PUR-ABG-V19-G Cordset M12 socket straight to M12 plug straight A-coded, 8-pin, PUR cable grey, shielded

V19-G-2M-PUR-ABG

G Female cordset single-ended M12 straight A-coded, 8-pin, PUR cable grey, shielded

# Accessories

ø /	V19-G-5M-PUR-ABG	Female cordset single-ended M12 straight A-coded, 8-pin, PUR cable grey, shielded
	V19-W-ABG-PG9	Female connector M12 angled A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
	V19-G-2M-PVC-TP	Female cordset, M12, 8-pin, shielded, PVC cable
	V19-G-5M-PVC-TP	Female cordset, M12, 8-pin, shielded, PVC cable
	V19-G-10M-PVC-TP	Female cordset, M12, 8-pin, shielded, PVC cable
ŶQ	ACC-PACK-ABSS_58 ø15	Accessory kit for Ø58 absolute rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolute rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolute rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessory kit for Ø58 absolute rotary encoder with recessed hollow shaft 10 mm

## Connection

Signal	Cable, 12-core	Connector M12, 8-pin	Connector M23, 12-pin, cw	Connector M23, 12-pin, ccw	Explanation
GND (encoder)	White	1	1	1	Power supply
U <sub>b</sub> (encoder)	Brown	2	2	8	Power supply
Clock (+)	Green	3	3	3	Positive cycle line
Clock (-)	Yellow	4	4	11	Negative cycle line
Data (+)	Grey	5	5	2	Positive transmission data
Data (-)	Pink	6	6	10	Negative transmission data
A	Black		7	12	Incremental track A
V/R	Red	8	8	5	Input for selection of counting direction
PRESET 1	Blue	7	9	9	Zero-setting input
В	Grey/Pink		10	4	Incremental track B
Ā	Violet		11	6	Incremental track A
B	Red/Blue		12	7	Incremental track B
			$\begin{array}{c} & 9 \\ 12 \\ 7 \\ 6 \\ 5 \\ 11 \\ 4 \end{array}$	$\begin{array}{c} & 9 \\ 10 \\ 2 \\ 3 \\ 4 \\ 11 \\ 5 \end{array}$	

## Operation

### Signal output



#### ℃ cw - with view onto the shaft

### Interface

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



### 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  $(D_n)$ ) 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<sub>m</sub> has expired. ٠
- No subsequent data transfer can be started until the data line switches to high again or the time for the clock pause T<sub>n</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

Line length

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.



If the pulse line is exchanged, the data word is generated offset.

### **Block diagram**



Line length in m	Baudrate in kH
< 50	< 400
< 100	< 300
< 200	< 200

< 100

< 400

Rotary encoder

Interface electronics

## Parameterization

### Push buttons on encoder with model characteristic SB2, SG2

In addition to the electrical preset function (PRESET 1) these models are equipped with 2 push buttons for manually setting the zero point of the rotary encoder.

### Manually zero set

1. Simultaneously press and hold the push buttons A and B for 2 s.

After releasing the push buttons the rotary encoder sets the current position as zero point.

## Type Code



Electrical interface SG1 SSI Gray

SSI binary

SG2 SSI Gray, with push buttonsSB2 SSI binary, with push buttons

SSI Gray + 1024 pulses, Push/Pull

SSI Gray + 2048 pulses, Push/Pull

SSI Gray + 4096 pulses, Push/Pull

SSI Gray + 1024 pulses, RS422

SSI Gray + 2048 pulses, RS422

SB1

SI1

SI2

SI3

SI4

SI5





# **Function**

The ENA36IL series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

Absolute encoders

ENA36IL-S\*\*\*-SSI

## **Dimensions**



L [mm] Degree of protection **Axial output Radial output** IP54 43 IP64/IP65 43 39

# Dimensions



Output, axial, IP64/IP65



25.2 44.5

Output, radial, IP64/IP65



Output, axial, IP64/IP65

# Dimensions



Output, radial, IP64/IP65



Output, axial, IP54



# **Technical Data**

General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Linearity error	$\leq \pm 0.1$ °
UL File Number	E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	700 a at 40 °C

Technical Data		
Mission Time (T.,)		20. a
		40 E-8 revolutions at 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		
Electrical specifications		0 /0
Operating voltage	11a	4 75 30 V DC
Power consumption	Po	<1W
Time delay before availability	t.	< 450 ms
	τ <sub>ν</sub>	Grav code, binary code
Code course (counting direction)		adiustable
Interface		agustable
Interface type		SSI
Besolution		
Single turn		up to 16 Bit
Multiturn		up to 16 Bit
Overall resolution		up to 32 Bit
Transfer rate		0.1 2 MBit/s
Cycle time		< 100 us
Standard conformity		BS 422
Input 1		
Input type		Selection of counting direction (cw/ccw)
Signal voltage		
High		4.75 V U <sub>R</sub> (cw descending)
Low		02 V or unconnected (cw ascending)
Input current		< 6 mA
Switch-on delay		< 250 ms
Input 2		
Input type		zero-set (PRESET 1) with falling edge
Signal voltage		
High		4.75 V U <sub>B</sub>
Low		02V
Input current		< 6 mA
Signal duration		min. 1.1 s
Connection		
Connector		M12 connector, 8-pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP54
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 %, no moisture condensation
Mechanical specifications		
Material		
Housing		nickel-plated steel

Housing

Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t168923\_eng.pdf

# Absolute encoders

# ENA36IL-S\*\*\*-SSI

Technical Data	
Flores	Aluminum
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 150 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	20 N
Radial	40 N

# Accessories

	V19-W-ABG-PG9	Female connector M12 angled A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
(FF)	9108, 6	Measuring wheel
()	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(FF)	9113, 6	Measuring wheel for shaft diameter 6 mm

## **Connection Assignment**

Signal	Wire end	Connector
GND (encoder)	White	1
U <sub>b</sub> (encoder)	Brown4	2
Clock (+)	Green	3
Clock (-)	Yellow	4
Data (+)	Grey	5
Data (-)	Pink	6
Preset	Black or Blue	7
Counting direction	Red	8
Shielding	Shielding	Housing
Pinout	-	2 (1) 7 3 4 5 6

### 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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

### Absolute encoders

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.



If the pulse line is exchanged, the data word is generated offset.

### **Block diagram**



### Line length

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

Rotary encoder

Interface electronics

# Type Code



ENA Absolute rotary encoder

## 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- The wiring of the screen and 0 V should be arranged radially, if and when possible.

### Absolute encoders

• 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 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:metalised connector,shieldclamped with the strainreliefclampDisadvantage: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!



- Up to 32 Bit multiturn
- Free of wear magnetic sampling
- High resolution and accuracy



### **Function**

The ENA36IL series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

## Dimensions



	L [mm]		
Degree of protection	Axial output	Radial output	
IP54	3	6	
IP64/IP65	36	32	

# Dimensions



Output, axial, IP64/IP65





Output, radial, IP64/IP65



Output, axial, IP64/IP65

# Dimensions



Output, radial, IP64/IP65



Output, axial, IP54



# **Technical Data**

General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Linearity error	$\leq \pm 0.1$ °
UL File Number	E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	700 a at 40 °C

Technical Data		
Mission Time $(T_M)$		20 a
		1035 E+8 revolutions at 19/44 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	U⊳	4.75 30 V DC
Power consumption	Po	<1W
Time delay before availability	t.	< 450 ms
Output code	-v	Grav code, binary code
Code course (counting direction)		adiustable
Interface		
Interface type		SSI
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 16 Bit
Overall resolution		up to 32 Bit
Transfer rate		0.1 2 MBit/s
Cycle time		< 100 µs
Standard conformity		RS 422
Input 1		
Input type		Selection of counting direction (cw/ccw)
Signal voltage		
High		4.75 V U <sub>B</sub> (cw descending)
Low		0 2 V or unconnected (cw ascending)
Input current		< 6 mA
Switch-on delay		< 250 ms
Input 2		
Input type		zero-set (PRESET 1) with falling edge
Signal voltage		
High		4.75 V U <sub>B</sub>
Low		02V
Input current		< 6 mA
Signal duration		min. 1.1 s
Connection		
Connector		M12 connector, 8-pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP54
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 % , no moisture condensation
Mechanical specifications		
Material		

nickel-plated steel

Housing

Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t168924\_eng.pdf

# **Technical Data**

Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 150 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	19 N
Radial	44 N
Axial offset	± 0.3 mm static
Radial offset	± 0.5 mm static

# Accessories

	V19-W-ABG-PG9	Female connector M12 angled A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
0.77	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable

# **Connection Assignment**

Signal	Wire end	Connector
GND (encoder)	White	1
U <sub>b</sub> (encoder)	Brown4	2
Clock (+)	Green	3
Clock (-)	Yellow	4
Data (+)	Grey	5
Data (-)	Pink	6
Preset	Black or Blue	7
Counting direction	Red	8
Shielding	Shielding	Housing
Pinout	-	2 (1) 7 3 4 5 6

### 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



### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time  $\mathrm{T}_{\mathrm{m}}$  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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

### Absolute encoders

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.



If the pulse line is exchanged, the data word is generated offset.

### **Block diagram**



Line length

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

Rotary encoder

Interface electronics

### **Type Code**



ENA Absolute rotary encoder

## 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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.
- ٠ 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: metalised connector, shield clamped with the strain relief 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!



# Absolute encoders ENA58IL-S\*\*\*-EtherCAT

- Solid shaft
- 30 Bit multiturn
- Free of wear magnetic sampling
- High resolution and accuracy
- Mechanical compatibility with all major encoders with fieldbus interface
- Status LEDs



#### **Function**

The ENA58IL series are high precision encoders with internal magnetic sampling.

### Dimensions



Clamping flange





Servo flange

# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		256 a at 40 °C
Mission Time (T <sub>M</sub> )		12 a
L <sub>10</sub>		55 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 4 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		EtherCAT CoE (CANopen over EtherCAT, according to CiA DS-301 and DS-406 device profile CiA)
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		10 MBit/s / 100 MBit/s
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, IP65, IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 %, no moisture condensation
Mechanical specifications		
Material		
Housing		Zinc plated steel, painted
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 300 g
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		50 gcm <sup>2</sup>
Starting torque		< 5 Ncm
Shaft load		
Axial		40 N
Badial		110 N

# ENA58IL-S\*\*\*-EtherCAT

00	00	00	00
		-1.	
			$\sim$

()	9108, 6	Measuring wheel
()	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm
	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

# Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -

# Indication

#### Port LEDs

LED	Color	Status	Description
Link/Act IN	green	on	LINK active for HUB port 1
		blinking	Activity on HUB port 1
Link/Act OUT	green	on	LINK active for HUB port 2
		blinking	Activity on HUB port 2

#### EtherCAT LEDs

LED	Color	Status	Description
Error	red	off	no error
		blinking	invalid configuration
		single flash	local error
		double flash	process data watchdog timeout/ EtherCAT watchdog timeout
		flickering	booting error
		on	application failure
Run	green	off	initialization
		blinking	Pre-Operational
		single flash	Safe-Operational
		flickering	initialization or bootstrap
		on	Operational





**ENA** Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	
relief	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!



# Absolute encoders ENA58IL-R\*\*\*-EtherCAT

- Recessed hollow shaft
- **30** Bit multiturn
- Free of wear magnetic sampling
- High resolution and accuracy
- Mechanical compatibility with all major encoders with fieldbus interface
- Status LEDs



#### **Function**

The ENA58IL series are high precision encoders with internal magnetic sampling.

#### **Dimensions**



Recessed hollow shaft

#### **Technical Data**

# General specifications

Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		256 a at 40 °C
Mission Time (T <sub>M</sub> )		12 a
L <sub>10</sub>		5 E+8 revolutions at 24/198 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 4 W

# ENA58IL-R\*\*\*-EtherCAT

Technical Data		
Time delay before availability	t,	< 250 ms
Output code	-0	binary code
Code course (counting direction)		adjustable
Interface		
Interface type		EtherCAT CoE (CANopen over EtherCAT, according to CiA DS-301 and DS-406 device profile CiA)
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		10 MBit/s / 100 MBit/s
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, IP65, IP66, IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 % , no moisture condensation
Mechanical specifications		
Material		
Housing		Zinc plated steel, painted
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 300 g
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		50 gcm <sup>2</sup>
Starting torque		< 5 Ncm
Shaft load		
Axial		24 N
Radial		198 N
Angle offset		± 0.9 °
Axial offset		± 0.3 mm static
Radial offset		± 0.5 mm static

# Accessories

(FF)	9108, 6	Measuring wheel
(e)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm

# ENA58IL-R\*\*\*-EtherCAT

Acces	sories	
(B)	9113, 6	Measuring wheel for shaft diameter 6 mm
°Q	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

# Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -

# Indication

#### Port LEDs

LED	Color	Status	Description
Link/Act IN	green	on	LINK active for HUB port 1
		blinking	Activity on HUB port 1
Link/Act OUT	green	on	LINK active for HUB port 2
		blinking	Activity on HUB port 2

#### EtherCAT LEDs

LED	Color	Status	Description
Error	red	off	no error
		blinking	invalid configuration
		single flash	local error
		double flash	process data watchdog timeout/ EtherCAT watchdog timeout
		flickering	booting error
		on	application failure
Run	green	off	initialization
		blinking	Pre-Operational
		single flash	Safe-Operational
		flickering	initialization or bootstrap
		on	Operational





ENA Absolute rotary encoder

# 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	
roliof	clamped with the strain	
reliel	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!



IP69K





### **Function**

The ENA42HD series are high precision encoders with internal magnetic sampling.

This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

### **Dimensions**





# Dimensions





# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		700 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		10 E+8 revolutions
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	4.75 30 V DC
Power consumption	P <sub>0</sub>	≤ 1 W
Time delay before availability	t <sub>v</sub>	< 450 ms
Output code		Gray code, binary code
Code course (counting direction)		adjustable
Interface		
Interface type		SSI
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 16 Bit

Technical Data	
Overall resolution	up to 32 Bit
Transfer rate	0.1 2 MBit/s
Cycle time	< 100 us
Standard conformity	RS 422
Input 1	
Input type	Selection of counting direction (cw/ccw)
Signal voltage	
High	4.75 V U <sub>B</sub> (cw descending)
Low	0 2 V or unconnected (cw ascending)
Input current	< 6 mA
Switch-on delay	< 250 ms
Input 2	
Input type	zero-set (PRESET 1) with falling edge
Signal voltage	
High	4.75 V U <sub>B</sub>
Low	0 2 V
Input current	< 6 mA
Signal duration	min. 1.1 s
Connection	
Connector	M12 connector, 8-pin
Cable	Ø7 mm, 6 x 2 x 0.14 mm <sup>2</sup> , 1 m (cable length, see order code)
Standard conformity	
Degree of protection	DIN EN 60529 , IP66 / IP68 / IP69K
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 300 <i>g</i> , 6 ms
Vibration resistance	DIN EN 60068-2-6, 30 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	stainless steel 1.4404 / AISI 316L
Flange	stainless steel 1.4404 / AISI 316L
Shaft	Stainless steel 1.4412 / AISI 440B
Mass	approx. 350 g
Rotational speed	max. 6000 min -1
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 5 NCM
Shaft load	
Axial	2/0 N
Hadial	2/0 N

### Accessories

V19-W-ABG-PG9

Female connector M12 angled A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable

# ENA42HD-S\*\*\*-SSI

# Accessories

	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
	9108, 6	Measuring wheel
()	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm

#### Connection

Signal	Cable, 12-core	Connector M12, 8-pin	Explanation
GND (encod- er)	White	1	Power supply
U <sub>b</sub> (encoder)	Brown	2	Power supply
Clock (+)	Green	3	Positive cycle line
Clock (-)	Yellow	4	Negative cycle line
Data (+)	Grey	5	Positive transmission data
Data (-)	Pink	6	Negative transmission data
V/R	Red	8	Input for selection of counting di- rection
PRESET 1	Blue	7	Zero-setting input

#### 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



#### 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<sub>n</sub>) 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<sub>m</sub> 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<sub>p</sub> has expired.
- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time T<sub>m</sub> 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.

٠ In multiple transmission, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.

As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions (12 bit) has a total resolution of n = 25 bit.

- If the clock change is not interrupted after the last falling pulse edge, ring slide operation automatically becomes active. This ٠ means that the information that was stored at the time of the first clock change is generated again.
- After the first position transmission, the n+1 pulse controls data repetition. If the n+1 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.

#### **Block diagram**



Line	length
------	--------

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

Rotary encoder

Interface electronics

#### **Type Code**



#### ENA Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	
relief	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!





#### **Function**

The ENA36HD series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via the SSI interface (Synchronous Serial Interface). The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

#### **Dimensions**





Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t182024\_eng.pdf

# Dimensions







# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		700 a at 40 °C
Mission Time (T <sub>M</sub> )		12 a
L <sub>10</sub>		10 E+8 revolutions
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	UB	4.75 30 V DC
Power consumption	P <sub>0</sub>	≤ 1 W
Time delay before availability	t <sub>v</sub>	< 450 ms
Output code		Gray code, binary code
Code course (counting direction)		adjustable
Interface		
Interface type		SSI
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 16 Bit

Technical Data	
Overall resolution	un to 32 Bit
Transfer rate	
	< 100 up
Standard conformity	< 100 μs
	N3 422
	Coloction of counting direction (our/cour)
	Selection of counting direction (cw/ccw)
Signal voltage	4.75 V LL (au descending)
High	4.75 V $O_B$ (cw descending)
Low	0 2 V or unconnected (cw ascending)
Input current	< 6 mA
Switch-on delay	< 250 ms
Input 2	
Input type	zero-set (PRESET 1) with falling edge
Signal voltage	
High	4.75 V U <sub>B</sub>
Low	0 2 V
Input current	< 6 mA
Signal duration	min. 1.1 s
Connection	
Connector	M12 connector, 8-pin
Cable	Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity	
Degree of protection	DIN EN 60529 , IP68 / IP69K
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 11 ms
Vibration resistance	DIN EN 60068-2-6, 30 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	powder coated steel
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 150 g
Rotational speed	max. 6000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	180 N
Badial	180 N

### Accessories

V19-W-ABG-PG9

Female connector M12 angled A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable

# Accessories

	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
(FF)	9108, 6	Measuring wheel
()	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(B)	9113, 6	Measuring wheel for shaft diameter 6 mm

### Connection

Signal	Wire end	Connector
GND (encoder)	White	1
U <sub>b</sub> (encoder)	Brown	2
Clock (+)	Green	3
Clock (-)	Yellow	4
Data (+)	Grey	5
Data (-)	Pink	6
Preset	Blue	7
Counting direction	Red	8
Shielding	Shielding	Housing
Pinout	-	

#### 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



#### 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<sub>n</sub>) and special bit (S)) is stored in the encoder is introduced.±
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- After the clock sequence is complete, the monoflop time T<sub>m</sub> is triggered with the last falling pulse edge.
- The monoflop time  $\mathrm{T}_\mathrm{m}$  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, n bits are transferred per data word in standard format. The value n equals the total resolution of the encoder.
  - As an example: a multiturn encoder with a resolution of 8192 steps/revolution (13 bit) and a max. number of 4096 revolutions

(12 bit) has a total resolution of n = 25 bit.

- 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 position transmission, the n+1 pulse controls data repetition. If the n+1 pulse follows after an amount of time greater than the monoflop time T<sub>m</sub>, a new current data word will be transmitted with the following pulses.



#### **Block diagram**



#### Line length

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

Rotary encoder

Interface electronics

# Type Code



**ENA** Absolute rotary encoder

# Installation

#### Anti-interference measures

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- 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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.

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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:	metalised connector,	
silief	clamped with the strain	
reliel	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!



# Absolute encoders ENA36IL-S\*\*\*-CANopen

- Very small housing
- Up to 31 bit overall resolution
- CANopen interface
- Free of wear magnetic sampling High resolution and accuracy

# **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated CAN bus interface. The integrated CAN-bus interface supports all CANopen functions. Thus the following modes can be programmed to either enabled or disabled:

- Polled mode
- Cyclic mode
- Sync mode

# Dimensions



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Degree of Protection	Axial Output	Radial Output
IP54	4	3
IP65	43	39

# Dimensions



Output, axial, IP65









Output, axial, IP65

# Dimensions





Output, axial, IP54



# **Technical Data**

General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Linearity error	$\leq \pm 0.1$ °
UL File Number	E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	480 a at 40 °C

# ENA36IL-S\*\*\*-CANopen

Technical Data		
Mission Time (T <sub>1</sub> )		20 a
		40 E-8 revolutions at 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		
Electrical specifications		
	Un	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>o</sub>	< 1.2 W
Time delay before availability	t.	< 250 ms
	٩V	binary code
Code course (counting direction)		adjustable
		adjustable
Interface type		CANonen
Resolution		
Single turn		up to 16 Bit
Multiturp		
Transfer rate		min 20 kBit/s may 1 MBit/s
Standard conformity		
		D3F 400
Connection		M10 connector E nin
Coble		$\frac{2}{3} \frac{1}{3} \frac{1}$
Cable		20 mm, 4 x 2 x 0. 14 mm
Climatic testing		DIN EN 600529, IF05 01 IF34
Emitted interference		
Noise immunity		EN 61000-6-4.2007
Shock registered		EIN 61000-0-2.2003
Vibration registance		DIN EN 60068.2.6.20 $\alpha$ 10 1000 Hz
		Din Lin 00000-2-0, 20 g, 10 1000 Hz
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 %, no moisture condensation
Mechanical specifications		
Material		
Housing		nickel-plated steel
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 150 g
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		< 3 Ncm
Shaft load		
Axial		20 N
Radial		40 N

# ENA36IL-S\*\*\*-CANopen

A			
Δ	00	60	00
	63	30	60

	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
()	9108, 6	Measuring wheel
(3)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(FF)	9113, 6	Measuring wheel for shaft diameter 6 mm

# Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

# Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre-
		Operational"
Single flash	Stopped	The Encoder is in CAN state "Stopped"
On	Operational	The encoder is in CAN state "Operational"
Off		No power supply
Err (red)	State	Description
Off	No error	The Encoder is in operating mode
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid
		CAN message for baud rate measurement
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the
		warning level (too many error frames)
Double flash	Error control event	A guard event (NTM slave or NTM master) or a heartbeat event has occured
On	Bus off	The CAN controller is in stae bus off. No communication possible anymore. Too many
		error frames in the network.

# Programming

### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.



#### ENA Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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**
#### ENA36IL-S\*\*\*-CANopen

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 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	metalised connector,	
relief	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!



## Absolute encoders ENA36IL-R\*\*\*-CANopen

- Very small housing
- Up to 31 bit overall resolution
- CANopen interface
- Free of wear magnetic sampling
- High resolution and accuracy

## 

#### **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated CAN bus interface. The integrated CAN-bus interface supports all CANopen functions. Thus the following modes can be programmed to either enabled or disabled:

- Polled mode
- Cyclic mode
- · Sync mode

#### Dimensions



Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t182404\_eng.pdf

	L [mm]		
Degree of Protection	Axial Output	Radial Output	
IP54	36		
IP65	36 32		



Output, axial, IP65









Output, axial, IP65

#### Dimensions



Output, radial, IP65



Output, axial, IP54



### **Technical Data**

General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Linearity error	$\leq \pm 0.1$ °
UL File Number	E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	480 a at 40 °C

## ENA36IL-R\*\*\*-CANopen

Technical Data		
Mission Time $(T_M)$		20 a
		1035 E+8 revolutions at 19/44 N axial/radial shaft load
Diagnostic Coverage (DC)		
Electrical specifications		
Operating voltage	Un	930 V DC (with galvanic isolation)
Power consumption	P <sub>o</sub>	< 1.2 W
Time delay before availability	t.	< 250 ms
Output code	••	binary code
Code course (counting direction)		adiustable
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 15 Bit
Overall resolution		up to 31 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		≥1 ms
Standard conformity		DSP 406
Connection		
Connector		M12 connector, 5 pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP54
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates		
UL approval		$\ensuremath{cULus}$ Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 % , no moisture condensation
Mechanical specifications		
Material		
Housing		nickel-plated steel
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 150 g
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		< 3 Ncm
Shaft load		
Axial		19 N
Radial		44 N
Axial offset		± 0.3 mm static
Radial offset		± 0.5 mm static

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

### Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre-
		Operational"
Single flash	Stopped	The Encoder is in CAN state "Stopped"
On	Operational	The encoder is in CAN state "Operational"
Off		No power supply
Err (red)	State	Description
Off	No error	The Encoder is in operating mode
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid
		CAN message for baud rate measurement
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the
		warning level (too many error frames)
Double flash	Error control event	A guard event (NTM slave or NTM master) or a heartbeat event has occured
On	Bus off	The CAN controller is in stae bus off. No communication possible anymore. Too many
		error frames in the network.

### Programming

#### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.



#### ENA Absolute rotary encoder

#### Installation

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- 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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**

#### ENA36IL-R\*\*\*-CANopen

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- 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.

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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	metalised connector,	
relief	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 rem

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!



## Absolute encoders ENA36HD-S\*\*\*-CANopen

- Very small housing
- Up to 31 bit overall resolution
- CANopen interface
- Free of wear magnetic sampling
- High resolution and accuracy
- High climatic resistance

# 

#### **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated CAN bus interface. The integrated CAN-bus interface supports all CANopen functions. Thus the following modes can be programmed to either enabled or disabled:

- Polled mode
- Cyclic mode
- · Sync mode

#### Dimensions









## **Technical Data**

General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Linearity error	$\leq \pm 0.1$ °
UL File Number	E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	480 a at 40 °C

## ENA36HD-S\*\*\*-CANopen

Technical Data		
Mission Time (T <sub>M</sub> )		20 a
		10 E+8 revolutions
Diagnostic Coverage (DC)		0%
Electrical specifications		
Operating voltage	U <sub>R</sub>	9 30 V DC (with galvanic isolation)
Power consumption	Po	≤1.2W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 15 Bit
Overall resolution		up to 31 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		≥ 1 ms
Standard conformity		DSP 406
Connection		
Connector		M12 connector, 5 pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529 , IP68 / IP69K
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 g, 11 ms
Vibration resistance		DIN EN 60068-2-6, 30 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 %, no moisture condensation
Mechanical specifications		
Material		
Housing		powder coated steel
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 150 g
Rotational speed		max. 6000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		< 5 Ncm
Shaft load		
Axial		180 N
Radial		180 N

#### Accessories

0.7

V19-G-ABG-PG9

Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

#### Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre-
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Single flash	Stopped	The Encoder is in CAN state "Stopped"
On	Operational	The encoder is in CAN state "Operational"
Off		No power supply
Err (red)	State	Description
Off	No error	The Encoder is in operating mode
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid
		CAN message for baud rate measurement
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the
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		error frames in the network.

### Programming

#### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.



ENA Absolute rotary encoder

#### Installation

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

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- 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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**

#### ENA36HD-S\*\*\*-CANopen

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 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.

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- 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	metalised connector,	1ª E
relief	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 rema

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!

## Absolute encoders ENA42HD-S\*\*\*-CANopen



- Solid shaft
- Up to 31 bit overall resolution
- CANopen interface
- Free of wear magnetic sampling
- High resolution and accuracy
- Highly shock / vibration and soiling resistant
- Sturdy construction
- Increased shaft load capacity
- Stainless steel housing
- IP69K



### Function

The ENA42HD series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via its interface. The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data

synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

#### Dimensions











### **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		10 E+8 revolutions
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	UB	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 15 Bit

## ENA42HD-S\*\*\*-CANopen

Technical Data	
Overall resolution	up to 31 Bit
Transfer rate	min. 20 kBit/s , max. 1 MBit/s
Cycle time	≥ 1 ms
Standard conformity	DSP 406
Connection	
Connector	M12 connector, 5 pin
Cable	$\emptyset$ 6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity	
Degree of protection	DIN EN 60529 , IP66 / IP68 / IP69K
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 300 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 30 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	stainless steel 1.4404 / AISI 316L
Flange	stainless steel 1.4404 / AISI 316L
Shaft	Stainless steel 1.4412 / AISI 440B
Mass	approx. 350 g
Rotational speed	max. 6000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	270 N
Radial	270 N

#### Accessories

(F)	9108, 6	Measuring wheel
(F)	9109, 6	Measuring wheel for shaft diameter 6 mm
F	9110, 6	Measuring wheel for shaft diameter 6 mm
1	9113, 6	Measuring wheel for shaft diameter 6 mm

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

#### Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description	
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre-	
		Operational"	
Single flash	Stopped	The Encoder is in CAN state "Stopped"	
On	Operational	The encoder is in CAN state "Operational"	
Off		No power supply	
Err (red)	State	Description	
Off	No error	The Encoder is in operating mode	
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid	
		CAN message for baud rate measurement	
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the	
		warning level (too many error frames)	
Double flash	Error control event	A guard event (NTM slave or NTM master) or a heartbeat event has occured	
On	Bus off	The CAN controller is in stae bus off. No communication possible anymore. Too many	
		error frames in the network.	

### Programming

#### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.



#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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:

#### ENA42HD-S\*\*\*-CANopen

- Avoid any impact on the housing and in particular on the encoder shaft as well as the axial and radial overload of the encoder 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	metalised connector,	
relief	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!





#### **Function**

Absolute singleturn rotary encoders deliver an absolute step value for each angle setting. This device has a maximum basic resolution of 65536 steps per revolution (16 bits). The absolute rotary encoder is designed for shaft assembly and is available in servo flange or clamping flange design.

#### Dimensions

#### Encoder length L

Version		Length L
Radial cable exit	Clamping flange	134 mm
	Servo flange	134 mm
Axial cable exit	Clamping flange	150 mm
	Servo flange	150 mm



Release date: 2024-08-09 Date of issue: 2024-08-09 Filename: t182526\_eng.pdf



#### **Technical Data**

General specifications

Technical Data		
Detection type		photoelectric sampling
Device type		Singleturn absolute rotary encoder
Functional safety related parameters		
MTTE <sub>d</sub>		120 a
		7 7 F+9 at 3000 rpm
Electrical specifications		
	Ha	10 30 V DC
No-load supply current	I <sub>0</sub>	max. 230 mA at 10 V DC may 100 mA at 24 V DC
Time delay before availability	t <sub>v</sub>	< 250 ms
Linearity		± 2 LSB at 16 Bit, ± 1 LSB at 13 Bit
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		PROFINET
Resolution		
Single turn		up to 16 Bit
Overall resolution		up to 16 Bit
Transfer rate		100 MBit/s
Cycle time		$\leq$ 1 ms (IRT) , $\leq$ 10 ms (RT)
Connection		
Terminal compartment		see ordering information
Standard conformity		
Degree of protection		DIN EN 60529, IP66
Climatic testing		DIN EN 60068-2-78, no moisture condensation
Emitted interference		EN 61000-6-4:2007/A1:2011
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 3 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 2000 Hz
Approvals and certificates		
IECEx approval		
Equipment protection level Gb		IECEx ITS 15.0061X
ATEX approval		
Equipment protection level Gb		ITS 15 ATEX 18372X
Ambient conditions		
Operating temperature		-40 70 °C (-40 158 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Mechanical specifications		
Material		
Combination 1		housing: anodized aluminum flange: anodized aluminum shaft: Stainless steel 1.4404 / AISI 316L
Combination 2 (Inox)		housing: Stainless steel 1.4404 / AISI 316L flange: Stainless steel 1.4404 / AISI 316L shaft: Stainless steel 1.4404 / AISI 316L
Mass		approx. 2600 g (combination 1) approx. 3900 g (combination 2)
Rotational speed		max. 3000 min <sup>-1</sup>
Moment of inertia		180 gcm <sup>2</sup>
Starting torque		≤ 4 Ncm
Shaft load		
Axial		60 N
Radial		80 N
General information		

Singleturn abs	solute rotary encoder	EVS78E-P
<b>Technical D</b>	ata	
Use in the hazard	ous area see instruction manua	S
Type Code		
Structure of the ty		
EVS	7 8 E - (1) (1) (2) (3) (3	) (4) $\mathbf{P}$ $\mathbf{B}$ (5) $ 0$ $0$ (6) (6)
E E	Data format Ethernet	
٧	Shaft version	
V	Solid shaft	
e	Funktional principla	
S	Singleturn	
-		
78	Size	
78	Housing diameter 78 mm	
E	Option 1	
E	Explosion Proof, Standard IP66	
(1)(1)	Shaft diameter	
01	Shaft Ø 10 mm x 20 mm	
02	Shaft Ø 12 mm x 25 mm	
(2)	Flange	
1	Clamping flange	
2	Servo flange	
$\langle 0 \rangle \langle 0 \rangle$	Connection type	
(3) (3)	Terminal compartment with two M20 x 1 5 6H threads as	ach 17 mm thread depth for cable glands
DR	Terminal compartment, 2 cable glands	
KR	Terminal compartment, 1 cable gland, 1 stopping plug	
(4)		
(4) A	Axial	
R	Radial	
P	Option	
P	Prolinet	
В	Output Code	
В	Binary	
(5)	Housing material	
N	Aluminum	
	INOX 1.4404 (AISI 316L)	
00	Multiturn: Number of bits and puls count	
00	Singleturn rotary encoder	
(6) (6)	Singleturn: Number of bits and puls count	
13	13 Bits, 8192 IMPUISE	

#### Connection

Signal	Terminal compartment	
Ground wire	Grounding terminal	
GND (rotary encoder)	1	
+U <sub>b</sub> (rotary encoder)	2	
Not connected	3	
Not connected	4	
Rx-	5	
Tx-	6	
Rx+	7	
Tx+	8	

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,
relief	clamped with the strain
	clamp
Disadvantage:	soldering shield on



#### Singleturn absolute rotary encoder

#### 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!





#### **Function**

The ENA58IL series with Profibus interface are high-precision rotary encoders with internal magnetic sampling. The most common mechanical interfaces are available in the ENA58IL series. For the electrical connection, models with connection cover and radial connector outlet or cable outlet or models with axial connector outlet are available. This versatility allows the use of the rotary encoder for all common applications.

#### Dimensions



Clamping flange









Servo flange





### **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		280 a at 40 °C
Mission Time (T <sub>M</sub> )		12 a
L <sub>10</sub>		55 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 2.5 W
Time delay before availability	t <sub>v</sub>	< 1000 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		PROFIBUS DP DPV0, DPV1, DPV2
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		≤ 12 MBit/s
Connection		
Connector		For model with axial connector outlet or connection cover with radial connector outlet: Profibus: 1 plug M12 x 1, 5-pin, B-coded; 1 socket M12 x 1, 5-pin, B-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Terminal compartment		For model with connection cover with radial cable outlet
Standard conformity		
Degree of protection		DIN EN 60529 , axial connector outlet: IP54 connection cover and shaft seal: IP66/IP67 connection cover, no shaft seal: IP65
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms

Technical Data	
Vibration resistance	DIN EN 60068-2-6, $10 \times 10^{-1000}$ Hz
Approvals and cortificatos	Div Elv 00000-2-0, 10 g, 10 1000 112
Approvais and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g for model without connection cover approx. 480 g for model with connection cover
Rotational speed	max. 12000 min <sup>-1</sup> for IP54, IP65 max. 3000 min <sup>-1</sup> for IP66/IP67
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	40 N
Radial	110 N
Accessories	
Designation	for model without connection cover : Terminator ICZ-TB-V15B, item number 127860 (optional)

### Accessories

A.	ICZ-TR-V15B	Terminal resistor for PROFIBUS
(FF)	9108, 6	Measuring wheel
(3)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm
J.	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

#### Connection

Pin	Male connector M12 x 1, 4-pin, A-coded	Male connector M12 x 1, 5-pin, B-coded	Female connector M12 x 1, 5-pin, B-coded	Terminal	Explanation
1	Supply voltage +U <sub>B</sub>	Not connected	+ 5 V for terminator (2P5)	Ţ	Ground connection for power supply
2	Not connected	Data wire A, Bus IN	Data wire A, Bus Out	B (left)	Data line B (pair 1), Bus In
3	0 V	Not connected	GND for terminator (2M)	A (left)	Data line A (pair 1), Bus In
4	Not connected	Data wire B, Bus IN	Data wire B, Bus Out	(-)	0 V
5	-	Not connected	Not connected	(+)	10 V 30 V
	2 ( 4	2 4		B (right)	Data line B (pair 2), Bus Out
				A (right)	Data line A (pair 2), Bus Out
				(-)	0 V
				(+)	10 V 30 V
					The supply lines only have to be connected once (regardless to which terminal). The outgoing bus is being uncoupled while the terminal resistor is on.

#### Operation

#### Model with axial connector outlet



#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 99, and may only be assigned once.

#### LED-indicators

LED red	LED green	Meaning
off	off	No voltage supply
on	on	Encoder ready, no configuration data received.
		possible reasons:
		- wrong address adjusted
		- wrong bus wiring
on	flashing	Parameterising or configuration error. Encoder receives data of incorrect length or inconsistant data.
		possible reason: adjusted encoder resolution exceeds
flashing	on	Encoder ready, no communication with master (i.e. wrong address setting)
on	off	Data timeout (> 40 s). (i.e. data lines interrupted)
off	on	Normal operation, Data Exchange Mode
off	flashing	Installation Mode in Data Exchange Mode.

#### ENA58IL-S\*\*\*-Profibus

#### Model with connection cover



#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 99, and may only be assigned once.

#### Adjusting the termination resistor

The terminating resistor  $R_T$  (220  $\Omega) can be connected to the circuit by means of the switch:$ 



participant X

RT

OFF ON

ON





OFF



LED red	LED green	Meaning
off	off	No voltage supply
on	on	Encoder ready, no configuration data received.
		possible reasons:
		- wrong address adjusted
		- wrong bus wiring
on	flashing	Parameterising or configuration error. Encoder receives data of incorrect length or inconsistant data.
		possible reason: adjusted encoder resolution exceeds
flashing	on	Encoder ready, no communication with master (i.e. wrong address setting)
on	off	Data timeout (> 40 s). (i.e. data lines interrupted)
off	on	Normal operation, Data Exchange Mode
off	flashing	Installation Mode in Data Exchange Mode.



#### 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.

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- 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	
relief	clamped with the strain	45
	clamp	01
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 re

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!



## Absolute encoders ENA58IL-R\*\*\*-Profibus

- Recessed hollow shaft
- 30 Bit multiturn
- Free of wear magnetic samplingHigh resolution and accuracy
- Mechanical compatibility with all major encoders with fieldbus interface
- Status LEDs



#### Function

The ENA58IL series with Profibus interface are high-precision rotary encoders with internal magnetic sampling. The most common mechanical interfaces are available in the ENA58IL series. For the electrical connection, models with connection cover and radial connector outlet or cable outlet or models with axial connector outlet are available. This versatility allows the use of the rotary encoder for all common applications.

#### Dimensions





Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t183769\_eng.pdf



\* see type code

### **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		280 a at 40 °C
Mission Time (T <sub>M</sub> )		12 a
L <sub>10</sub>		5 E+8 revolutions at 24/198 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	UB	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 2.5 W
Time delay before availability	t <sub>v</sub>	< 1000 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		PROFIBUS DP DPV0, DPV1, DPV2
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		≤ 12 MBit/s
Connection		
Connector		For model with axial connector outlet or connection cover with radial connector outlet: Profibus: 1 plug M12 x 1, 5-pin, B-coded; 1 socket M12 x 1, 5-pin, B-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Terminal compartment		For model with connection cover with radial cable outlet
Standard conformity		
Degree of protection		DIN EN 60529 , axial connector outlet: IP54 connection cover and shaft seal: IP66/IP67 connection cover, no shaft seal: IP65
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Technical Data		
----------------------------	--	
	DIN EN 60068-2-6, 10 <i>g</i> , 10 1000 HZ	
Approvals and certificates		
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.	
Ambient conditions		
Operating temperature	-40 85 °C (-40 185 °F)	
Storage temperature	-40 85 °C (-40 185 °F)	
Relative humidity	98 %, no moisture condensation	
Mechanical specifications		
Material		
Housing	Zinc plated steel, painted	
Flange	Aluminum	
Shaft	Stainless steel	
Mass	approx. 300 g for model without connection cover approx. 510 g for model with connection cover	
Rotational speed	max. 12000 min <sup>-1</sup> for IP54, IP65 max. 3000 min <sup>-1</sup> for IP66/IP67	
Moment of inertia	30 gcm <sup>2</sup>	
Starting torque	< 3 Ncm	
Shaft load		
Axial	24 N	
Radial	198 N	
Angle offset	± 0.9 °	
Axial offset	± 0.3 mm static	
Radial offset	± 0.5 mm static	
Accessories		
Designation	for model without connection cover : Terminator ICZ-TR-V15B, item number 127860 (optional)	

## Accessories

<b>M</b>	ICZ-TR-V15B	Terminal resistor for PROFIBUS
(FFF)	9108, 6	Measuring wheel
(%)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm
ŶQ	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
20	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

## Connection

Pin	Male connector M12 x 1,	Male connector M12 x 1,	Female connector M12 x 1,	Terminal	Explanation
1	4-pin, A-coded Supply voltage +U <sub>B</sub>	Not connected	+ 5 V for terminator (2P5)	1	Ground connection for power supply
2	Not connected	Data wire A, Bus IN	Data wire A, Bus Out	B (left)	Data line B (pair 1), Bus In
3	0 V	Not connected	GND for terminator (2M)	A (left)	Data line A (pair 1), Bus In
4	Not connected	Data wire B, Bus IN	Data wire B, Bus Out	(-)	0 V
5	-	Not connected	Not connected	(+)	10 V 30 V
	2 (1) 4 3	2 4		B (rigni)	Data line B (pair 2), Bus Out
				A (right)	Data line A (pair 2), Bus Out
				(-)	0 V
				(+)	10 V 30 V
					The supply lines only have to be connected once (regardless to which terminal). The outgoing bus is being uncoupled while the terminal resistor is on.

## Operation

#### Model with axial connector outlet



#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 99, and may only be assigned once.

#### LED-indicators

LED red	LED green	Meaning
off	off	No voltage supply
on	on	Encoder ready, no configuration data received. possible reasons: - wrong address adjusted - wrong bus wiring
on	flashing	Parameterising or configuration error. Encoder receives data of incorrect length or inconsistant data. possible reason: adjusted encoder resolution exceeds
flashing	on	Encoder ready, no communication with master (i.e. wrong address setting)
on	off	Data timeout (> 40 s). (i.e. data lines interrupted)
off	on	Normal operation, Data Exchange Mode
off	flashing	Installation Mode in Data Exchange Mode.

## ENA58IL-R\*\*\*-Profibus

#### Model with connection cover



#### Adjusting the participant address

The participant address can be adjusted with the rotary switches. The address can be defined between 1 and 99, and may only be assigned once.

#### Adjusting the termination resistor

The terminating resistor  $R_T$  (220  $\Omega) can be connected to the circuit by means of the switch:$ 



participant X

R<sub>T</sub>

OFF ON

ON



last participant R<sub>T</sub>

OFF



LED red	LED green	Meaning	
off	off	No voltage supply	
on	on	Encoder ready, no configuration data received.	
		possible reasons:	
		- wrong address adjusted	
		- wrong bus wiring	
on	flashing	Parameterising or configuration error. Encoder receives data of incorrect length or inconsistant data.	
		possible reason: adjusted encoder resolution exceeds	
flashing	on	Encoder ready, no communication with master (i.e. wrong address setting)	
on	off	Data timeout (> 40 s). (i.e. data lines interrupted)	
off	on	Normal operation, Data Exchange Mode	
off	flashing	Installation Mode in Data Exchange Mode.	



ENA Absolute rotary encode

## 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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:	metalised connector,	
silief	clamped with the strain	
rener	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!



## Absolute encoders ENA58IL-S\*\*\*-CANopen

- Solid shaft
- Up to 31 bit overall resolution
- CANopen interface
- Free of wear magnetic sampling
- High resolution and accuracy

# 

#### **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated CAN bus interface. The integrated CAN-bus interface supports all CANopen functions. Thus the following modes can be programmed to either enabled or disabled:

3 x M4 6 deep

3 x M3

6 deep

348

- Polled mode
- Cyclic mode
- · Sync mode

## Dimensions



Clamping flange

## Dimensions



Servo flange

#### Connections

Dimensions in mm



## **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		55 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	$U_B$	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1.2 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		CANopen
Resolution		

## ENA58IL-S\*\*\*-CANopen

Technical Data	
Single turn	up to 16 Bit
Multiturn	up to 15 Bit
Overall resolution	up to 31 Bit
Transfer rate	min. 20 kBit/s , max. 1 MBit/s
Cycle time	≥1 ms
Standard conformity	DSP 406
Connection	
Connector	M12 connector, 5 pin
Cable	Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity	
Degree of protection	DIN EN 60529, IP65 or IP67
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N
Radial	110 N

## Accessories

$\sum$	V15-G-BK2M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
$\sum_{i=1}^{n}$	V15-G-BK5M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
$\sum_{i=1}^{n}$	V15-G-BK10M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
(FF)	9108, 6	Measuring wheel
(3)	9109, 6	Measuring wheel for shaft diameter 6 mm

## Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

## Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre-
		Operational"
Single flash	Stopped	The Encoder is in CAN state "Stopped"
On	Operational	The encoder is in CAN state "Operational"
Off		No power supply
Err (red)	State	Description
Off	No error	The Encoder is in operating mode
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid
		CAN message for baud rate measurement
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the
		warning level (too many error frames)
Double flash	Error control event	A guard event (NTM slave or NTM master) or a heartbeat event has occured
On	Bus off	The CAN controller is in stae bus off. No communication possible anymore. Too many
		error frames in the network.

## Programming

## Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.



#### 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.

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- 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 guality 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 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.
- ٠ 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	metalised connector,	
relief	clamped with the strain	
Tener	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!



## Absolute encoders ENA58IL-R\*\*\*-CANopen

- Recessed hollow shaft
- Up to 31 bit overall resolution
- CANopen interface
- Free of wear magnetic sampling
- High resolution and accuracy

# 

#### **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated CAN bus interface. The integrated CAN-bus interface supports all CANopen functions. Thus the following modes can be programmed to either enabled or disabled:

- Polled mode
- · Cyclic mode
- · Sync mode

## Dimensions



Recessed hollow shaft

## **Dimensions**

#### Connections

Dimensions in mm



## **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		5 E+8 revolutions at 24/198 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Electrical specifications		
Operating voltage	UB	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1.2 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 15 Bit
Overall resolution		up to 31 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		$\geq$ 1 ms
Standard conformity		DSP 406
Connection		
Connector		M12 connector, 5 pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005

Technical Data	
Shock resistance	DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static
Radial offset	± 0.5 mm static

## Accessories

$\geq$	V15-G-BK2M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
$\geq$	V15-G-BK5M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
$\geq$	V15-G-BK10M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
Q	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

## Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

## Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre-
		Operational"
Single flash	Stopped	The Encoder is in CAN state "Stopped"
On	Operational	The encoder is in CAN state "Operational"
Off		No power supply
Err (red)	State	Description
Off	No error	The Encoder is in operating mode
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid
		CAN message for baud rate measurement
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the
		warning level (too many error frames)
Double flash	Error control event	A guard event (NTM slave or NTM master) or a heartbeat event has occured
On	Bus off	The CAN controller is in stae bus off. No communication possible anymore. Too many
		error frames in the network.

## Programming

## Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync mode	After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.



**ENA** Absolute rotary encoder

#### Installation

#### Anti-interference measures

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- 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.

- 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 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	metalised connector,	
relief	clamped with the strain	
Tellel	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!



# 

#### **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated J1939 interface. The rugged miniature encoders are based on magnetic sampling.

## Dimensions





## Dimensions





## **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		10 E+8 revolutions
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED green		Operating mode
LED red		wrong baud rate
Electrical specifications		
Operating voltage	$U_B$	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1.2 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		J1939

## **Technical Data**

Resolution	
Single turn	up to 16 Bit
Multiturn	up to 15 Bit
Overall resolution	up to 31 Bit
Transfer rate	min. 20 kBit/s , max. 1 MBit/s
Cycle time	≥ 1 ms
Standard conformity	ISO 11898
Connection	
Connector	M12 connector, 5 pin
Cable	$Ø6 \text{ mm}, 4 \text{ x } 2 \text{ x } 0.14 \text{ mm}^2$
Standard conformity	
Degree of protection	DIN EN 60529 , IP68 / IP69K
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 11 ms
Vibration resistance	DIN EN 60068-2-6, 30 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	powder coated steel
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 150 g
Rotational speed	max. 6000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	180 N
Radial	180 N

## Accessories

	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
()	9108, 6	Measuring wheel
(F)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

## Interface

#### Example of the transmit commands

Command	Identifier	Data	Comments
Read request Direction	18EA2000	01 EF 00 00 00 00 00 00	
Read request Node	18EA2000	08 EF 00 00 00 00 00 00	
Write Direction	00EF2000	01 01 00 00 00 FF FF FF (CCW increase position)	When you change direction it will give you a different positional value. You will then need to set your preset value.
Write PRESET	00EF2000	04 A8 61 00 00 FF FF FF (value 25.000)	The preset value should be received at positional value 18FFAA20.
Write Save	00EF2000	FA 73 61 76 65 FF FF FF	The settings saved in non-volatile memory

If you change the node number, you will need to cycle power (after you save your settings) for the node number to change. Once you cycle power, you will need to enter the new node number in your identifier. You can confirm everything is saved in non-volatile memory by cycling power.

Receive:

18FFAA20: Positional and speed data

18EA2000: Read response

## Type Code



ENA Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	
relief	clamped with the strain	45
	clamp	01
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 rem

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!





## Absolute encoders ENA36IL-R\*\*\*-J1939

- Very small housing
- Up to 31 bit overall resolution
- CAN bus with SAE J1939 protocol
  Free of wear magnetic sampling
- Free of wear magnetic samplir
  High resolution and accuracy
- \_\_\_\_\_

# 

#### **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated J1939 interface. The rugged miniature encoders are based on magnetic sampling.

## Dimensions



	L [n	nm]
Degree of Protection	Axial Output	Radial Output
IP54	3	6
IP65	36	32

## Dimensions



Output, axial, IP65









Output, axial, IP65

## Dimensions



Output, radial, IP65



Output, axial, IP54



## **Technical Data**

General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Linearity error	≤±0.1 °
UL File Number	E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	480 a at 40 °C

## **Technical Data**

Mission Time (Tw)		20 a
		1035 E+8 revolutions at 19/44 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED green		Operating mode
LED red		wrong baud rate
Electrical specifications		5
Operating voltage	U <sub>B</sub>	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1.2 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		J1939
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 15 Bit
Overall resolution		up to 31 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		≥ 1 ms
Standard conformity		ISO 11898
Connection		
Connector		M12 connector, 5 pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP54
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 % , no moisture condensation
Mechanical specifications		
Material		
Housing		nickel-plated steel
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 150 g
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		< 3 Ncm
Shaft load		
Axial		19 N
Radial		44 N
Axial offset		± 0.3 mm static
Radial offset		± 0.5 mm static

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2 0 4

## Interface

#### Example of the transmit commands

Command	Identifier	Data	Comments
Read request Direction	18EA2000	01 EF 00 00 00 00 00 00	
Read request Node	18EA2000	08 EF 00 00 00 00 00 00	
Write Direction	00EF2000	01 01 00 00 00 FF FF FF (CCW increase position)	When you change direction it will give you a different positional value. You will then need to set your preset value.
Write PRESET	00EF2000	04 A8 61 00 00 FF FF FF (value 25.000)	The preset value should be received at positional value 18FFAA20.
Write Save	00EF2000	FA 73 61 76 65 FF FF FF	The settings saved in non-volatile memory

If you change the node number, you will need to cycle power (after you save your settings) for the node number to change. Once you cycle power, you will need to enter the new node number in your identifier. You can confirm everything is saved in non-volatile memory by cycling power.

Receive:

18FFAA20: Positional and speed data

18EA2000: Read response

## Type Code



#### ENA Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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 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	metalised connector,	1 and 1
relief	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 rer

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!



## ENA36IL-S\*\*\*-J1939

- Very small housing
- Up to 31 bit overall resolution
- CAN bus with SAE J1939 protocolFree of wear magnetic sampling
- High resolution and accuracy

# 

## **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated J1939 interface. The rugged miniature encoders are based on magnetic sampling.

## Dimensions



	L [n	nm]
Degree of Protection	Axial Output	Radial Output
IP54	4	3
IP65	43	39

## Dimensions



Output, axial, IP65









Output, axial, IP65



Output, radial, IP65



Output, axial, IP54



## **Technical Data**

General specifications	
Detection type	magnetic sampling
Device type	Absolute encoders
Linearity error	≤±0.1 °
UL File Number	E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters	
MTTF <sub>d</sub>	480 a at 40 °C

## **Technical Data**

Mission Time (T.,)		20.a
		40 E-8 revolutions at 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		
Indicators/operating means		0 /0
		Operating mode
		wrong baud rate
Electrical specifications		wong badd rate
	11-	9 30 V DC (with galvanic isolation)
Power concumption	D	
Time delay before availability	F 0	250 mg
	ι <sub>V</sub>	< 200 mis
Code course (counting direction)		adjustable
		aujustable
		11020
Besolution		01939
Resolution		up to 10 Dit
		up to 31 Bit
		min. 20 KBivs , max. 1 MBivs
		≥ 1 ms
Standard conformity		150 11898
Connection		
Connector		M12 connector, 5 pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP54
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 <i>g</i> , 6 ms
Vibration resistance		DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 %, no moisture condensation
Mechanical specifications		
Material		
Housing		nickel-plated steel
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 150 g
Rotational speed		max. 12000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		< 3 Ncm
Shaft load		
Axial		20 N
Badial		40 N

## Accessories

	V19-G-ABG-PG9	Female connector M12 straight A-coded 8-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
()	9108, 6	Measuring wheel
()	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2 0 4

## Interface

#### Example of the transmit commands

Command	Identifier	Data	Comments
Read request Direction	18EA2000	01 EF 00 00 00 00 00 00	
Read request Node	18EA2000	08 EF 00 00 00 00 00 00	
Write Direction	00EF2000	01 01 00 00 00 FF FF FF (CCW increase position)	When you change direction it will give you a different positional value. You will then need to set your preset value.
Write PRESET	00EF2000	04 A8 61 00 00 FF FF FF (value 25.000)	The preset value should be received at positional value 18FFAA20.
Write Save	00EF2000	FA 73 61 76 65 FF FF FF	The settings saved in non-volatile memory

If you change the node number, you will need to cycle power (after you save your settings) for the node number to change. Once you cycle power, you will need to enter the new node number in your identifier. You can confirm everything is saved in non-volatile memory by cycling power.

Receive:

18FFAA20: Positional and speed data

18EA2000: Read response

## Type Code


#### **ENA** Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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**

#### Absolute encoders

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 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	metalised connector,	1 and 1
relief	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 rem

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!

# Absolute encoders ENA42HD-S\*\*\*-J1939



- Solid shaft
- Up to 31 bit overall resolution
- CAN bus with SAE J1939 protocol
- Free of wear magnetic sampling
- High resolution and accuracy
- Highly shock / vibration and soiling resistant
- Sturdy construction
- Increased shaft load capacity
- Stainless steel housing
- IP69K



## Function

The ENA42HD series are high precision encoders with internal magnetic sampling. This multiturn absolute encoder transmits a position value corresponding to the shaft setting via its interface. The control module sends a start sequence to the absolute encoder to obtain the position data. The rotary encoder then sends the position data

synchronous to the cycles of the control module. It is possible to select the counting direction with the function input.

## Dimensions





# Dimensions







# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		10 E+8 revolutions
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED green		Operating mode
LED red		wrong baud rate
Electrical specifications		
Operating voltage	$U_B$	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		J1939

# **Technical Data**

Resolution	
Single turn	up to 16 Bit
Multiturn	up to 15 Bit
Overall resolution	up to 31 Bit
Transfer rate	min. 20 kBit/s , max. 1 MBit/s
Cycle time	≥ 1 ms
Standard conformity	ISO 11898
Connection	
Connector	M12 connector, 5 pin
Cable	Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity	
Degree of protection	DIN EN 60529 , IP66 / IP68 / IP69K
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 300 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 30 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	stainless steel 1.4404 / AISI 316L
Flange	stainless steel 1.4404 / AISI 316L
Shaft	Stainless steel 1.4412 / AISI 440B
Mass	approx. 350 g
Rotational speed	max. 6000 min <sup>-1</sup>
Moment of inertia	30 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	270 N
Radial	270 N

# Accessories

	V15B-G-2M-PUR-ABG- V15B-G	PROFIBUS bus cable M12 socket straight to M12 plug straight B-coded, 5-pin, PUR cable 2-core violet, shielded
	V15B-G-5M-PUR-ABG- V15B-G	PROFIBUS bus cable M12 socket straight to M12 plug straight B-coded, 5-pin, PUR cable 2-core violet, shielded
$\geq$	V15B-G-10M-PUR-ABG- V15B-G	PROFIBUS bus cable M12 socket straight to M12 plug straight B-coded, 5-pin, PUR cable 2-core violet, shielded
2	V15B-G-2M-PUR-ABG	PROFIBUS bus cable female cordset single-ended M12 straight B-coded, 5-pin, PUR cable 2-core violet, shielded
$\geq$	V15B-G-5M-PUR-ABG	PROFIBUS bus cable female cordset single-ended M12 straight B-coded, 5-pin, PUR cable 2-core violet, shielded

# Absolute encoders

Acces	sories	
$\sum$	V15B-G-10M-PUR-ABG	PROFIBUS bus cable female cordset single-ended M12 straight B-coded, 5-pin, PUR cable 2-core violet, shielded
	V15B-W-ABG-PG9	Female connector M12 angled B-coded 5-pin, for cable diameter 6 - 8 mm, shielded, field-attachable
	V15B-G-ABG-PG9	Female connector M12 straight B-coded 5-pin, for cable diameter 5 - 8 mm, shielded, field-attachable
(FFF)	9108, 6	Measuring wheel
()	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(FFF	9113, 6	Measuring wheel for shaft diameter 6 mm

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

## Interface

#### Example of the transmit commands

Command	Identifier	Data	Comments
Read request Direction	18EA2000	01 EF 00 00 00 00 00 00	
Read request Node	18EA2000	08 EF 00 00 00 00 00 00	
Write Direction	00EF2000	01 01 00 00 00 FF FF FF (CCW increase position)	When you change direction it will give you a different positional value. You will then need to set your preset value.
Write PRESET	00EF2000	04 A8 61 00 00 FF FF FF (value 25.000)	The preset value should be received at positional value 18FFAA20.
Write Save	00EF2000	FA 73 61 76 65 FF FF FF	The settings saved in non-volatile memory

If you change the node number, you will need to cycle power (after you save your settings) for the node number to change. Once you cycle power, you will need to enter the new node number in your identifier. You can confirm everything is saved in non-volatile memory by cycling power.

Receive:

18FFAA20: Positional and speed data

18EA2000: Read response

# Type Code



#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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:

#### Absolute encoders

### ENA42HD-S\*\*\*-J1939

- Avoid any impact on the housing and in particular on the encoder shaft as well as the axial and radial overload of the encoder 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:	metalised connector,	
soliof	clamped with the strain	
reliet	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!



# Absolute encoders ENA58IL-R\*\*\*-J1939

- Recessed hollow shaft
- Up to 31 bit overall resolution
- CAN bus with SAE J1939 protocol
- Free of wear magnetic sampling
  High resolution and accuracy
- High resolution and accuracy

# 

#### Function

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated J1939 interface. The rugged miniature encoders are based on magnetic sampling.

# Dimensions



#### Recessed hollow shaft







Release date: 2022-12-12 Date of issue: 2022-12-12 Filename: t185557\_eng.pdf

# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		≤±0.1 °
UL File Number		E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		5 E+8 revolutions at 24/198 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED green		Operating mode
LED red		wrong baud rate
Electrical specifications		
Operating voltage	UB	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1.2 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		J1939
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 15 Bit
Overall resolution		up to 31 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		≥ 1 ms
Standard conformity		ISO 11898
Connection		
Connector		M12 connector, 5 pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 % , no moisture condensation
Mechanical specifications		
Material		
Housing		nickel-plated steel , painted
Flange		Aluminum
Shaft		Stainless steel
Mass		approx. 300 g

# Absolute encoders

# ENA58IL-R\*\*\*-J1939

# **Technical Data**

Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static
Radial offset	± 0.5 mm static

# Accessories

Ś	V15-G-BK2M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
Ś	V15-G-BK5M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
Ś	V15-G-BK10M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
ŶQ	ACC-PACK-ABSS_58 ø15	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 15 mm
°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessories set for Ø58 absolut rotary encoder with recessed hollow shaft 10 mm

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2 0 4

## Interface

#### Example of the transmit commands

Command	Identifier	Data	Comments
Read request Direction	18EA2000	01 EF 00 00 00 00 00 00	
Read request Node	18EA2000	08 EF 00 00 00 00 00 00	
Write Direction	00EF2000	01 01 00 00 00 FF FF FF (CCW increase position)	When you change direction it will give you a different positional value. You will then need to set your preset value.
Write PRESET	00EF2000	04 A8 61 00 00 FF FF FF (value 25.000)	The preset value should be received at positional value 18FFAA20.
Write Save	00EF2000	FA 73 61 76 65 FF FF FF	The settings saved in non-volatile memory

If you change the node number, you will need to cycle power (after you save your settings) for the node number to change. Once you cycle power, you will need to enter the new node number in your identifier. You can confirm everything is saved in non-volatile memory by cycling power.

Receive:

18FFAA20: Positional and speed data

18EA2000: Read response

# Type Code



**ENA** Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.

#### Absolute encoders

- 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 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	metalised connector,	
roliof	clamped with the strain	
rener	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!



# Absolute encoders ENA58IL-S\*\*\*-J1939

- Solid shaft
- Up to 31 bit overall resolution
- CAN bus with SAE J1939 protocol
- Free of wear magnetic samplingHigh resolution and accuracy

# 

#### **Function**

This absolute rotary encoder provides a position value corresponding to the shaft position on its integrated J1939 interface. The rugged miniature encoders are based on magnetic sampling.

### Dimensions



Clamping flange





Servo flange

### **Dimensions**

#### Connections

Dimensions in mm



# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute encoders
Linearity error		≤±0.1 °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		55 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED green		Operating mode
LED red		wrong baud rate
Electrical specifications		
Operating voltage	$U_B$	9 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 1.2 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		J1939
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 15 Bit
Overall resolution		up to 31 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		≥ 1 ms
Standard conformity		ISO 11898
Connection		
Connector		M12 connector, 5 pin
Cable		Ø6 mm, 4 x 2 x 0.14 mm <sup>2</sup>
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP67

Technical Data	
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 200 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 20 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	cable, flexing: -5 70 °C (23 158 °F), cable, fixed: -30 70 °C (-22 158 °F) connector models: -40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N
Radial	110 N

# Accessories

$\geq$	V15-G-BK2M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
$\geq$	V15-G-BK5M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
$\geq$	V15-G-BK10M-PUR- O2/CAN	DeviceNet/CANOpen bus cable female cordset single-ended M12 straight A-coded 5-pin, PUR cable 4-core twisted pairs black, shielded, UL approved, drag chain suitable, outdoor
(T)	9108, 6	Measuring wheel
(3)	9109, 6	Measuring wheel for shaft diameter 6 mm
F	9110, 6	Measuring wheel for shaft diameter 6 mm
(F)	9113, 6	Measuring wheel for shaft diameter 6 mm
D	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm

#### Connection

Signal	Wire end	5-pin, M12 x 1 connector
CAN GND	green	1
+Vs	red	2
GND	yellow	3
CAN-High	white	4
CAN-Low	brown	5
Shielding	Shielding	Housing
Pinout		2

## Interface

#### Example of the transmit commands

Command	Identifier	Data	Comments
Read request Direction	18EA2000	01 EF 00 00 00 00 00 00	
Read request Node	18EA2000	08 EF 00 00 00 00 00 00	
Write Direction	00EF2000	01 01 00 00 00 FF FF FF (CCW increase position)	When you change direction it will give you a different positional value. You will then need to set your preset value.
Write PRESET	00EF2000	04 A8 61 00 00 FF FF FF (value 25.000)	The preset value should be received at positional value 18FFAA20.
Write Save	00EF2000	FA 73 61 76 65 FF FF FF	The settings saved in non-volatile memory

If you change the node number, you will need to cycle power (after you save your settings) for the node number to change. Once you cycle power, you will need to enter the new node number in your identifier. You can confirm everything is saved in non-volatile memory by cycling power.

Receive:

18FFAA20: Positional and speed data

18EA2000: Read response

# Type Code



ENA Absolute rotary encoder

#### 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<sup>2</sup>.
- Cable cross-section at least 0,14 mm<sup>2</sup>.
- 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**

#### Absolute encoders

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 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	metalised connector,	1 and 1
relief	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 rem

Do not remachine the drive shaft!

Avoid impact!

Do not remachine the housing!



# Absolute rotary encoder ENA58TL-S\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Pure Line
- Solid shaft
- IO-Link Interface for process data, parameterization and diagnosis
- Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy
- Status LEDs

# 

#### **Function**

Absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

#### Dimensions



Clamping flange





Servo flange

#### Connector M12



# **Technical Data**

Release date: 2023-08-29 Date of issue: 2023-08-29 Filename: t193101\_eng.pdf

General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder as Pure Line
Measured variable		position Temperature
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		566 a at 40 °C
Mission Time $(T_M)$		20 a
L <sub>10</sub>		420 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED STATUS		LED green flashing with short break (1 Hz) - IO-Link mode
Electrical specifications		
Operating voltage	UB	18 30 V DC
No-load supply current	I <sub>0</sub>	max. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	<1s
Interface		
Interface type		IO-Link
IO-Link revision		1.1
Device profile		Identification and Diagnosis - I&D
Resolution		
Single turn		up to 16 Bit programmable
Multiturn		up to 15 Bit programmable
Overall resolution		up to 31 Bit programmable
Process data		Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 2 Bit - diagnosis signals 2 Bit - status data
Vendor ID		1 (0x0001)
Device ID		5243907 (0x500403), 5243908 (0x500404), 5243911 (0x500407), 5243912 (0x500408)
Transfer rate		COM3 (230.4 kbits/s)

Technical Data	
Min. cycle time	1.5 ms
SIO mode support	no
Compatible master port type	Class A Class B (use 3-pole adapter or 3-wire cable)
Connection	
Connector	M12 connector, 5 pin , A-coded
Standard conformity	
Degree of protection	DIN EN 60529, IP65, IP67
Communication interface	IEC 61131-9 / IO-Link V1.1.2
Climatic testing	DIN EN 60068-2-78, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 350 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	< 30 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	40 N
Radial	110 N

# Connection



# **Connection Assignment**



Acces	sories	
	ICE1-8IOL-G60L-V1D	Ethernet IO-Link module with 8 inputs/outputs
đđ	V1-G-0,6M-PUR-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable grey
66	V15-G-1M-PUR-V15-G	Cordset M12 socket straight to M12 plug straight A-coded, 5-pin, PUR cable grey
	9401 6*10	Spring steel coupling
	9401 6*6	Spring steel coupling
()	9402 6*6	Spring steel coupling
(?)·	9404 6*6	Spring disk coupling
	9409 6*10	Bellows coupling
()	9409 6*6	Bellows coupling
	9409 6*8	Bellows coupling
O	9410 6*6	Precision coupling
<b>S</b>	KW-6/10	Helical coupling
•	KW-6/6	Helical coupling
<b>S</b>	KW-6/8	Helical coupling
(FF)	9108, 6	Measuring wheel
(e)	9109, 6	Measuring wheel for shaft diameter 6 mm
(F)	9110, 6	Measuring wheel for shaft diameter 6 mm
(B)	9113, 6	Measuring wheel for shaft diameter 6 mm
	MBT-36ALS	Spring-loaded mounting bracket with a diameter of 36 mm
2	MBT-36ALS120	Spring arm for larger spring deflections for diameter 58 rotary encoder with clamping flange

Accessories			
-	ICE1-8IOL-G30L-V1D	Ethernet IO-Link module with 8 inputs/outputs	
	ICE2-8IOL-G65L-V1D	EtherNet/IP IO-Link master with 8 inputs/outputs	
the state	ICE3-8IOL-G65L-V1D	PROFINET IO IO-Link master with 8 inputs/outputs	
	ICE2-8IOL-K45S-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, screw terminal	
	ICE3-8IOL-K45P-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, push-in terminals	
	ICE3-8IOL-K45S-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, screw terminal	
	IO-Link-Master02-USB	IO-Link master, supply via USB port or separate power supply, LED indicators, M12 plug for sensor connection	
	ICE2-8IOL-K45P-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, push-in connectors	





# Absolute rotary encoder ENA58TL-R\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Pure Line
- Recessed hollow shaft
- IO-Link Interface for process data, parameterization and diagnosis
- Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy
- Status LEDs

# 

#### **Function**

Absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

#### Dimensions



Recessed hollow shaft

#### Connections Dimensions in mm



# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder as Pure Line
Measured variable		position Temperature
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		566 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		5 E+8 revolutions at 24/198 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED STATUS		LED green flashing with short break (1 Hz) - IO-Link mode
Electrical specifications		
Operating voltage	U <sub>B</sub>	18 30 V DC
No-load supply current	I <sub>0</sub>	max. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	<1s
Interface		
Interface type		IO-Link
IO-Link revision		1.1
Device profile		Identification and Diagnosis - I&D
Resolution		
Single turn		up to 16 Bit programmable
Multiturn		up to 15 Bit programmable
Overall resolution		up to 31 Bit programmable
Process data		Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 2 Bit - diagnosis signals 2 Bit - status data
Vendor ID		1 (0x0001)
Device ID		5243905 (0x500401), 5243906 (0x500402), 5243909 (0x500405), 5243910 (0x500406)
Transfer rate		COM3 (230.4 kbits/s)
Min. cycle time		1.5 ms
SIO mode support		no
Compatible master port type		Class A Class B (use 3-pole adapter or 3-wire cable)
Connection		
Connector		M12 connector, 5 pin , A-coded
Standard conformity		
Degree of protection		DIN EN 60529, IP65, IP67
Communication interface		IEC 61131-9 / IO-Link V1.1.2
Climatic testing		DIN EN 60068-2-78, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.

# **Technical Data**

Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 370 g
Rotational speed	max. 12000 min -1
Moment of inertia	< 30 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static; ± 0,1 mm dynamic
Radial offset	± 0.5 mm static; &lusmn 0,2 mm dynamic

# Connection



# **Connection Assignment**



Acces	sories	
	ICE1-8IOL-G60L-V1D	Ethernet IO-Link module with 8 inputs/outputs
66	V1-G-0,6M-PUR-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable grey
66	V15-G-1M-PUR-V15-G	Cordset M12 socket straight to M12 plug straight A-coded, 5-pin, PUR cable grey
ŶQ	ACC-PACK-ABSS_58 ø15	Accessory kit for $\varnothing$ 58 absolute rotary encoder with recessed hollow shaft 15 mm

# Accessories

°Q	ACC-PACK-ABSS_58 ø14	Accessories set for Ø58 absolute rotary encoder with recessed hollow shaft 14 mm
°Q	ACC-PACK-ABSS_58 ø12	Accessories set for Ø58 absolute rotary encoder with recessed hollow shaft 12 mm
°Q	ACC-PACK-ABSS_58 ø10	Accessory kit for Ø58 absolute rotary encoder with recessed hollow shaft 10 mm
and a second	ICE1-8IOL-G30L-V1D	Ethernet IO-Link module with 8 inputs/outputs
le .	ICE2-8IOL-G65L-V1D	EtherNet/IP IO-Link master with 8 inputs/outputs
n	ICE3-8IOL-G65L-V1D	PROFINET IO IO-Link master with 8 inputs/outputs
	ICE2-8IOL-K45S-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, screw terminal
	ICE3-8IOL-K45P-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, push-in terminals
	ICE3-8IOL-K45S-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, screw terminal
	IO-Link-Master02-USB	IO-Link master, supply via USB port or separate power supply, LED indicators, M12 plug for sensor connection
	ICE2-8IOL-K45P-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, push-in connectors

### **Type Code**





# Absolute rotary encoder ENA36TL-R\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Pure Line
- Recessed hollow shaft
- IO-Link Interface for process data, parameterization and diagnosis
- Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy
- Status LEDs

# 

#### **Function**

Absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

#### Dimensions



	L [mm]		
Degree of Protection	Axial Output	Radial Output	
IP65	43	39	

# Dimensions



Output, axial, IP65



# **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder as Pure Line
Measured variable		position Temperature
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		566 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		1035 E+8 revolutions at 19/44 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED STATUS		LED green flashing with short break (1 Hz) - IO-Link mode
Electrical specifications		
Operating voltage	$U_B$	18 30 V DC
No-load supply current	I <sub>0</sub>	max. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	<1s
Interface		
Interface type		IO-Link

Technical Data	
IO-Link revision	1.1
Device profile	Identification and Diagnosis - I&D
Resolution	
Single turn	up to 16 Bit programmable
Multiturn	up to 15 Bit programmable
Overall resolution	up to 31 Bit programmable
Process data	Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 2 Bit - diagnosis signals 2 Bit - status data
Vendor ID	1 (0x0001)
Device ID	5243649 (0x500301), 5243650 (0x500302)
Transfer rate	COM3 (230.4 kbits/s)
Min. cycle time	1.5 ms
SIO mode support	no
Compatible master port type	Class A Class B (use 3-pole adapter or 3-wire cable)
Connection	
Connector	M12 connector, 5 pin , A-coded
Standard conformity	
Degree of protection	DIN EN 60529, IP65, IP67
Communication interface	IEC 61131-9 / IO-Link V1.1.2
Climatic testing	DIN EN 60068-2-78, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 190 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	< 18 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	19 N
Radial	44 N
Axial offset	± 0.3 mm static; ± 0,1 mm dynamic
Radial offset	± 0.5 mm static; &lusmn 0,2 mm dynamic

# Connection



# **Connection Assignment**



Accessories		
	ICE1-8IOL-G60L-V1D	Ethernet IO-Link module with 8 inputs/outputs
d d	V1-G-0,6M-PUR-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable grey
d d	V15-G-1M-PUR-V15-G	Cordset M12 socket straight to M12 plug straight A-coded, 5-pin, PUR cable grey
	ICE1-8IOL-G30L-V1D	Ethernet IO-Link module with 8 inputs/outputs
11-	ICE2-8IOL-G65L-V1D	EtherNet/IP IO-Link master with 8 inputs/outputs
. In	ICE3-8IOL-G65L-V1D	PROFINET IO IO-Link master with 8 inputs/outputs
2	ICE2-8IOL-K45S-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, screw terminal
	ICE3-8IOL-K45P-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, push-in terminals
a and	ICE3-8IOL-K45S-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, screw terminal
	IO-Link-Master02-USB	IO-Link master, supply via USB port or separate power supply, LED indicators, M12 plug for sensor connection
	ICE2-8IOL-K45P-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, push-in connectors


**ENA** Absolute rotary encoder



## Absolute rotary encoder ENA36TL-S\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Pure Line
- Solid shaft
- IO-Link Interface for process data, parameterization and diagnosis
- Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy
- Status LEDs

# 

#### **Function**

Absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

#### Dimensions



	L [n	nm]
Degree of Protection	Axial Output	Radial Output
IP65	43	39

## Dimensions



Output, axial, IP65



## **Technical Data**

	magnetic sampling
	Absolute rotary encoder as Pure Line
	position Temperature
	$\leq \pm 0.1$ °
	E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
	566 a at 40 °C
	20 a
	30 E+8 revolutions at 20/40 N axial/radial shaft load
	0 %
	LED green flashing with short break (1 Hz) - IO-Link mode
$U_B$	18 30 V DC
I <sub>0</sub>	max. 50 mA
P <sub>0</sub>	approx. 1.5 W
t <sub>v</sub>	<1s
	IO-Link
	U <sub>В</sub> Іо Ро t <sub>v</sub>

Technical Data	
IO-Link revision	1.1
Device profile	Identification and Diagnosis - I&D
Resolution	
Single turn	up to 16 Bit programmable
Multiturn	up to 15 Bit programmable
Overall resolution	up to 31 Bit programmable
Process data	Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 2 Bit - diagnosis signals 2 Bit - status data
Vendor ID	1 (0x0001)
Device ID	5243651 (0x500303), 5243652 (0x500304)
Transfer rate	COM3 (230.4 kbits/s)
Min. cycle time	1.5 ms
SIO mode support	no
Compatible master port type	Class A Class B (use 3-pole adapter or 3-wire cable)
Connection	
Connector	M12 connector, 5 pin , A-coded
Standard conformity	
Degree of protection	DIN EN 60529, IP65
Communication interface	IEC 61131-9 / IO-Link V1.1.2
Climatic testing	DIN EN 60068-2-78, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 195 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	< 10 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	40 N
Radial	110 N



## **Connection Assignment**



Acces	sories	
	ICE1-8IOL-G60L-V1D	Ethernet IO-Link module with 8 inputs/outputs
d d	V1-G-0,6M-PUR-V1-G	Cordset M12 socket straight to M12 plug straight A-coded, 4-pin, PUR cable grey
d d	V15-G-1M-PUR-V15-G	Cordset M12 socket straight to M12 plug straight A-coded, 5-pin, PUR cable grey
	ICE1-8IOL-G30L-V1D	Ethernet IO-Link module with 8 inputs/outputs
11-	ICE2-8IOL-G65L-V1D	EtherNet/IP IO-Link master with 8 inputs/outputs
. In	ICE3-8IOL-G65L-V1D	PROFINET IO IO-Link master with 8 inputs/outputs
2	ICE2-8IOL-K45S-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, screw terminal
	ICE3-8IOL-K45P-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, push-in terminals
a and	ICE3-8IOL-K45S-RJ45	PROFINET IO IO-Link master with 8 inputs/outputs, DIN rail, screw terminal
	IO-Link-Master02-USB	IO-Link master, supply via USB port or separate power supply, LED indicators, M12 plug for sensor connection
	ICE2-8IOL-K45P-RJ45	EtherNet/IP IO-Link master with 8 inputs/outputs, DIN rail, push-in connectors





## Absolute rotary encoder ENA58PL-R\*\*\*-CANopen redundant

- Recessed hollow shaft
- Up to 30 bit overall resolution
- Redundant CANopen Interface
- Independent photoelectric and magnetic redundant sampling
- Redundant connection option with 2 connectors
- High resolution and accuracy

# 

#### **Function**

The absolute rotary encoder is equipped with an independent optical and magnetic sampling.

Optionally, versions with a combined connector or separate connector outlets for each sampling technology are available. Due to the redundancy, the absolute rotary encoder is ideally suited for safety-relevant applications. The integrated CAN bus interface supports all CANopen functions.

Thus the following modes can be programmed to either enabled or disabled:

- Polled mode
- · Cyclic mode
- Sync mode

#### **Dimensions**





## Dimensions

Recessed hollow shaft



## **Technical Data**

General specifications		
Detection type		photoelectric and magnetic sampling
Device type		Absolute rotary encoder
Linearity error		≤±0.1 °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
Performance level (PL)		Suitable for PL d; both channels of the encoder must be connected to a safety PLC and evaluated there.
Category		Suitable for cat. 3; both channels of the encoder must be connected to a safety PLC and evaluated there.
MTTF		100 a at 40 °C (based on EN ISO 13849-1)
Mission Time (T <sub>M</sub> )		10 a
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 3.7 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		≥ 1 ms
Standard conformity		DSP 406
Connection		

Technical Data	
Connector	1 plug M12 x 1, 5-pin, A-coded (with connection type BD) 1 plug M12 x 1, 5-pin, A-coded and 1 socket M12 x 1, 5-pin, A-coded (with connection type BN)
Standard conformity	
Degree of protection	DIN EN 60529, IP65 or IP67
Climatic testing	DIN EN 60068-2, no moisture condensation
Emitted interference	EN 61000-6-4
Noise immunity	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 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	nickel-plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static
Radial offset	± 0.5 mm static
Dimensions	
Diameter	58 mm

## Type Code

#### Aufbau des Typenschlüssels

E	Ν	Α	5	8	Р	L	-	R	(1)	(1)	D	Α	(2)	-	(3)	(3)	(4)	(4)	С	R	D	-	(5)	(6)	(6)
				•	•	•	•		•		•					•						•	•		,

ENA	Device type					
ENA	Absolute rotary encoder					
58	Size					
58	Housing diameter 58 mm					
PL	Version					
PL	Performance Line					
_						
R	Shaft tye					
R	Recessed hollow shaft					
(1)(1)	Shaft diameter					
12	12  mm (d = 12F7)					
15	15 mm (d = 15F7)					
DA	Flange					
DA	Dual spring plate					

Type Code	
(2)	Degree of protection
5	IP65
7	IP67
(3) (3)	Multiturn resolution
12	Multiturn rotary encoder, 12 Bit
14	Multiturn rotary encoder, 14 Bit
(4) (4)	Singleturn resolution
13	13 Bit
16	16 Bit
CRD	Interface, electric
CRD	CANopen redundant, U <sub>B</sub> 5 V 30 V
	Openandian allowerset
(5)	
A	
R	Radial
(6) (6)	
I RD	M12 device plug, 5-pin
BN	M12 device plug, 5-pin and M12 socket, 5-pin

Signal	Device plug M12 x 1, 5-pin, A-coded	Device socket M12 x1, 5-pin, A-coded				
	always present	only with connection type BN				
CAN GND	1	1				
+Vs	2	2				
GND	3	3				
CAN-High	4	4				
CAN-Low	5	5				
Shielding	Housing	Housing				
Pinout	2 0 4					

The following scheme illustrates the relationships for the electrical connection:



#### Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre- Operational"
Single flash	Stopped	The Encoder is in CAN state "Stopped"
On	Operational	The encoder is in CAN state "Operational"
Off		No power supply
Err (red)	State	Description
Off	No error	The Encoder is in operating mode
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid CAN message for baud rate measurement
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)
Double flash	Error control event	A guard event (NTM slave or NTM master) or a heartbeat event has occured
On	Bus off	The CAN controller is in stae bus off. No communication possible anymore. Too many error frames in the network.

## Programming

#### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.

#### Absolute rotary encoder

#### ENA58PL-R\*\*\*-CANopen redundant

Sync mode

After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.

# Absolute rotary encoder ENA58PL-S\*\*\*-CANopen redundant

- Solid shaft
- Up to 30 bit overall resolution
- Redundant CANopen Interface
- Independent photoelectric and magnetic redundant sampling
- Redundant connection option with 2 connectors
- High resolution and accuracy

# 

#### **Function**

The absolute rotary encoder is equipped with an independent optical and magnetic sampling.

Optionally, versions with a combined connector or separate connector outlets for each sampling technology are available. Due to the redundancy, the absolute rotary encoder is ideally suited for safety-relevant applications. The integrated CAN bus interface supports all CANopen functions. Thus the following modes can be programmed to either enabled or disabled:

- · Polled mode
- · Cyclic mode
- · Sync mode

#### **Dimensions**

#### Clamping flange





#### Servo flange





#### **Dimensions**

Clamping flange



Servo flange



## **Technical Data**

General specifications	
Detection type	photoelectric and magnetic sampling
Device type	Absolute rotary encoder
Linearity error	$\leq \pm 0.1$ °
UL File Number	E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Functional safety related parameters	
Performance level (PL)	Suitable for PL d; both channels of the encoder must be connected to a safety PLC and evaluated there.

## **Technical Data**

Category		Suitable for cat. 3; both channels of the encoder must be connected to a safety PLC and evaluated there.
MTTF		100 a at 40 °C (based on EN ISO 13849-1)
Mission Time (T <sub>M</sub> )		10 a
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC (with galvanic isolation)
Power consumption	P <sub>0</sub>	≤ 3.7 W
Time delay before availability	t <sub>v</sub>	< 250 ms
Output code		binary code
Code course (counting direction)		adjustable
Interface		
Interface type		CANopen
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		min. 20 kBit/s , max. 1 MBit/s
Cycle time		≥ 1 ms
Standard conformity		DSP 406
Connection		
Connector		1 plug M12 x 1, 5-pin, A-coded (with connection type BD) 1 plug M12 x 1, 5-pin, A-coded and 1 socket M12 x 1, 5-pin, A-coded (with connection type BN)
Standard conformity		
Degree of protection		DIN EN 60529, IP65 or IP67
Climatic testing		DIN EN 60068-2, no moisture condensation
Emitted interference		EN 61000-6-4
Noise immunity		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 1000 Hz
Approvals and certificates		
UL approval		$\ensuremath{cULus}$ Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 %, no moisture condensation
Mechanical specifications		
Material		
Housing		Aluminum
Flange		Aluminum
Shaft		Stainless steel 1.4305 / AISI 303
Mass		approx. 320 g
Rotational speed		max. 3000 min <sup>-1</sup>
Moment of inertia		30 gcm <sup>2</sup>
Starting torque		< 5 Ncm
Shaft load		
Axial		40 N
Radial		110 N
Dimensions		
Length		55.7 mm
Diameter		58 mm

## Type Code

#### Structure of the type code

ENA5	8 P L – S (1) (1) (2) (2) (3) – (4) (4) (5) (5) C R D – (6) (7) (7)									
	Device type									
LINA	Absolute Totaly encoder									
58	Size									
58	Housing diameter 58 mm									
PI	Version									
PL	Performance Line									
S	Shaft tye									
5	Solid shaft									
(1) (1)	Shaft diameter									
06	6 mm									
10	10 mm									
(2) (2)	Flance									
CA	Clamping flange									
SA	Servo flange (only with degree of protection B)									
(3)	Degree of protection									
7	IF65									
1										
(4) (4)	Multiturn resolution									
12	Multiturn rotary encoder, 12 Bit									
14	Multiturn rotary encoder, 14 Bit									
(5) (5)	Singleturn resolution									
13	13 Bit									
16	16 Bit									
CRD	Interface electric									
CRD	CANopen redundant, U <sub>B</sub> 5 V 30 V									
(6)	Connection alignment									
A	Axial									
К	μασιαι									
(7) (7)	Connection type									
BD	M12 device plug, 5-pin									
BN	M12 device plug, 5-pin and M12 socket, 5-pin									

Signal	Device plug M12 x 1, 5-pin, A-coded	Device socket M12 x1, 5-pin, A-coded
	always present	only with connection type BN
CAN GND	1	1
+Vs	2	2
GND	3	3
CAN-High	4	4
CAN-Low	5	5
Shielding	Housing	Housing
Pinout	2	

The following scheme illustrates the relationships for the electrical connection:



#### Indication

#### LED-indicator with dual color LED

CAN Run (green)	State	Description
Blinking	Pre-Operational	Boot up message is sent, device configuration is possible, device is in CAN state "Pre- Operational"
Single flash	Stopped	The Encoder is in CAN state "Stopped"
On	Operational	The encoder is in CAN state "Operational"
Off		No power supply
Err (red)	State	Description
Off	No error	The Encoder is in operating mode
Flickering	AutoBitrate	Auto baud mode is active and the encoder tries to find within the time out period a valid CAN message for baud rate measurement
Single flash	Warning limit reached	At least one of the error counters of the CAN controller has reached or exceeded the warning level (too many error frames)
Double flash	Error control event	A guard event (NTM slave or NTM master) or a heartbeat event has occured
On	Bus off	The CAN controller is in stae bus off. No communication possible anymore. Too many error frames in the network.

## Programming

#### Programmable CAN operating modes

Mode	Explanation
Polled mode	The connected host requests the current actual position value via a remote transmission request telegram. The absolute encoder reads in the current position, calculates all parameters that have been set and sends back the process actual value through the same CAN identifier.
Cyclic mode	The absolute encoder sends the current actual process value cyclically, without being prompted by the host. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.

#### Absolute rotary encoder

## ENA58PL-S\*\*\*-CANopen redundant

Sync mode

After the sync telegram has been received by the host, the absolute encoder sends the current actual process value. If multiple nodes should respond to the sync telegram, the individual nodes report one after the other according to their CAN identifier. There is no programming of an offset time. The sync counter can be programmed so that the rotary encoder does not transmit until after a defined number of sync telegrams.

#### Programmable rotary encoder parameters

Parameter	Explanation
Operating parameter	The direction of rotation (complement) can be specified by parameter as the operating parameter. This parameter determines the direction of rotation in which the output code will ascend or descend.
Resolution per revolution	The "Resolution" parameter is used to program the rotary encoder so that a desired number of steps can be implemented in reference to one revolution.
Preset value	The preset value is the desired position value that must be achieved for a specific physical setting of the axis. The preset value parameter is used to set the actual position value to the desired actual process value.
Min. and max. limit switch	A total of two positions can be programmed. The absolute encoder sets one bit to high state in the 32 Bit actual process value if a value falls outside the range between these two positions.
Cam	8 freely programmable cams can be set within the overall resolution. This produces the functionality of a mechanical cam shifting mechanism.



Absolute rotary encoder with magnetic sampling and PROFINET interface



#### **Function**

The absolute rotary encoders with PROFINET IO interface and magnetic sampling can be used in all PROFINET applications. Thanks to the Encoder Profile 4.2 and the IRT mode, they are ideally suited for I4.0 applications.

#### **Dimensions**



#### Recessed hollow shaft





Recessed hollow shaft

## **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 4 W
Time delay before availability	t <sub>v</sub>	< 15 s
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		PROFINET IO
Device profile		Encoder Profile V4.2
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		100 MBit/s
Cycle time		≥ 250 µs
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, IP65, IP66, IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
		98 %, no moisture condensation
Meterial		
		Zine ploted steel pointed
		Zinc plated steel, painted
Flange		Aluminum
Maga		
Potational speed		approx. 300 g
Moreant of inertia		max. 3000 min <sup>-1</sup> for IP66/IP67
Noment of Inertia		
Starting torque		< 5 INCITI
		24 N
Axidi Dediel		24 IN 109 N
		+ 0 0 °
Angle Unset		± 0.3 mm static
ANIAI VIIJEL		± 0.0 mm stallo

## **Technical Data**

Radial offset

± 0.5 mm static

## Type Code

#### Structure of the type code

Е	Ν	Α	5	8	Ι	L	-	R	(1)	(1)	D	Α	(2)	-	(3)	(3)	(4)	(4)	В	1	7	-	(5)	(5)	(5)
FNA				De	vice t	vne																			
ENA				Abo	Abolute rotary encoder																				
				-																					
58				Siz	e																				
58				Ho	using	diame	eter 5	68 mm	1																
Ш				Ve	rsion																				
IL				Ind	ustria	l Line																			
				_																					
R				Sha	aft ty	ре																			
R				Re	cesse	ed holl	ow sł	aft																	
(1) (1	)			Sh	aft di	amete	۹r																		
06	/			6 m	nm (d	= 6F7	·)																		
10				10	mm (e	d = 10	, F7)																		
12				12	mm (	d = 12	F7)																		
14				14	mm (	d = 14	F7)																		
15				15	mm (e	d = 15	F7)																		
DA				Elo	200																				
					nge al enri	ina nl	ato																		
DA				Du	aropr	ing pic	110																		
(2)				De	gree	of pro	otecti	on																	
5				IP6	5																				
7				IP6	7																				
(3) (3	)			Mu	ltitur	n res	olutic	n																	
00	,			Sin	aletu	rn rota	rv en	coder																	
12				Mu	ltiturn	rotan	/ enc	oder,	12 bit																
14				Mu	ltiturn	rotar	/ enc	oder,	14 bit																
(4) (4	)			Sin	gletu	ırn re	solut	ion																	
13																									
16				16	BIt																				
B17			_	Inte	erfa <u>c</u>	e, el <u>e</u>	ctric													_					
B17				PR	OFIN	ET																			
	) (=)																			_					
(5) (5	) (5)			Co	nnec	tion t	ype				- 1 1		0 1												
				AXI	al cor	necti	on all	gnme	nt, 2 S	ocket	s / plu	Ig M1	2 X 1	. / ml··	~ 140	) v 1									
I RH2				тна	uiai co	onnec	uon a	ugnm	ent, B	us cov	ver wi	u12 S	ockets	s / più	y wit≥	X I									

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$	4 (0°) 2 3 2

## Indication

#### Diagnostic LEDs

LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below
+ (1 )		

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another device	bus disconnected
		Criteria: no data exchange	Master not available / switched off
on	flashes 1)	Parameterization fault, no data	Slave not configured yet or wrong configuration
		exchange	• Wrong station address assigned (but not outside the permitted range)
		Criteria: data exchange correct.	
			• Actual configuration of the slave differs from the
		However, the slave did not switch to the data exchange mode.	nominal configuration
on	off	Data exchange.	
		Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds



Absolute rotary encoder with magnetic sampling and PROFINET interface



#### **Function**

The absolute rotary encoders with PROFINET IO interface and magnetic sampling can be used in all PROFINET applications. Thanks to the Encoder Profile 4.2 and the IRT mode, they are ideally suited for I4.0 applications.

3 x M3

₹6

#### Dimensions



Clamping flange







## **Technical Data**

General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder
Linearity error		≤±0.1 °
UL File Number		E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Electrical specifications		
Operating voltage	$U_B$	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 4 W
Time delay before availability	t <sub>v</sub>	< 15 s
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		PROFINET IO
Device profile		Encoder Profile V4.2
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		100 MBit/s
Cycle time		≥ 250 µs

3 x M4 ∓6 **Technical Data** 

Connection	
Connector	Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity	
Degree of protection	DIN EN 60529, IP65, IP66, IP67
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 300 g
Rotational speed	max. 12000 min <sup>-1</sup> for IP65 max. 3000 min <sup>-1</sup> for IP66/IP67
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N
Radial	110 N

## Type Code

Structure of the type code

E N A 5	8 I L – S (1) (1) (2) (2) (3) – (4) (4) (5) (5) B 1 7 – (6) (6) (6)							
ENA	Device type							
ENA	Abolute rotary encoder							
58	Size							
58	Housing diameter 58 mm							
11	Version							
IL	Industrial Line							
s	Shaft type							
S	Solid shaft							
(1) (1)	Shaft diameter							
06	6 mm							
10	10 mm							
(2) (2)	Flange							
СА	Clamping flange							
SA	Servo flange							
(3)	Degree of protection							
5	IP65							
7	IP67							

Type Code	
(4) (4)	Multiturn resolution
00	Singleturn rotary encoder
12	Multiturn rotary encoder, 12 bit
14	Multiturn rotary encoder, 14 bit
(5) (5)	Singleturn resolution
13	13 Bit
16	16 Bit
B17	Interface, electric
B17	PROFINET
(6) (6) (6)	Connection type
ABP	Axial connection alignment, 2 Sockets / plug M12 x 1
RH2	Radial connection alignment, Bus cover with 2 sockets / plug M12 x 1

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$	4 (00) 2 3 2

## Indication

#### Diagnostic LEDs

LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below
+ (1 )		

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another device	bus disconnected
		Criteria: no data exchange	Master not available / switched off
on	flashes 1)	Parameterization fault, no data	Slave not configured yet or wrong configuration
		exchange	• Wrong station address assigned (but not outside the permitted range)
		Criteria: data exchange correct.	
			• Actual configuration of the slave differs from the
		However, the slave did not switch to the data exchange mode.	nominal configuration
on	off	Data exchange.	
		Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds



Absolute rotary encoder with photoelectric sampling and PROFINET interface



#### Function

The absolute encoders with PROFINET IO interface and precious photoelectric sampling can be used in all PROFINET applications. Thanks to the Encoder Profile 4.2 and the IRT mode, they are ideally suited for I4.0 applications.

#### **Dimensions**





#### **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Absolute rotary encoder
Linearity error		≤ ± 0.02 ° (14 16 bit)
UL File Number		E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product.
Electrical specifications		
Operating voltage	UB	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 4 W
Time delay before availability	t <sub>v</sub>	< 15 s
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		

Technical Data	
Interface type	PROFINET IO
Device profile	Encoder Profile V4.2
Besolution	
Sinale turn	up to 16 Bit
Multiturn	up to 14 Bit
Overall resolution	up to 30 Bit
Transfer rate	100 MBit/s
Cycle time	≥ 250 µs
Connection	
Connector	Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity	
Degree of protection	DIN EN 60529, shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65 Stainless steel version (INOX): completely IP67
Climatic testing	DIN EN 60068-2-3, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Combination 1	housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 2 (Inox)	housing: stainless steel 1.4305 / AISI 303 flange: stainless steel 1.4305 / AISI 303 shaft: stainless steel 1.4305 / AISI 303
Mass	approx. 360 g (combination 1) approx. 910 g (combination 2)
Rotational speed	max. 12000 min <sup>-1</sup> for IP65 max. 3000 min <sup>-1</sup> for IP66/IP67
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static
Radial offset	± 0.5 mm static

## **Type Code**

## Structure of the type code

Е	Ν	Α	5	8	Р	L	-	R	(1)	(1)	(2)	(2)	(3)	-	(4)	(4)	(5)	(5)	В	1	7	-	R	Н	2
ENA				De	vice t	type																			
ENA				Ab	olute	rotary	enco	der																	

Туре Сос	de
58	Size
58	Housing diameter 58 mm
PL	Version
PL	Performance Line
B	Shaft type
R	Recessed hollow shaft
(1) (1)	Shaft diameter
06	6 mm (d = 6F7)
10	10 mm (d = 10F7)
12	12 mm (d = 12F7)
14	14 mm (d = 14F7)
15	15 mm (d = 15F7)
(2) (2)	Flange
DA	Dual spring plate, housing and flange in aluminum, shaft in stainless
D2	Dual spring plate, housing, flange and shaft in stainless steel 1.4305 / AISI303 (V2A)
(3)	Degree of protection
5	IP65
/	IP67
(4) (4)	Multiturn resolution
00	Singleturn rotary encoder
12	Multiturn rotary encoder, 12 bit
14	Multiturn rotary encoder, 14 bit
(5) (5)	Singleture resolution
13	13 Bit
16	16 Bit
B17	Interface, electric
B17	PROFINET
BH2	Connection type
BH2	Badial connection alignment. Bus cover with 2 sockets / plug M12 x 1
1 1 1 1 4	Fiddia officiation anglitton, bus over with 2 sources / plug with X i

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$	4 (0°) 2 3 2

## Indication

#### Diagnostic LEDs

LED	Color	Description for LED = ON
Active1	Yellow	Incoming and outgoing data traffic for port 1
Link1*	Green	Connection to other Ethernet devices on port 1
Active2	Yellow	Incoming and outgoing data traffic for port 2
Link2*	Green	Connection to other Ethernet devices on port 2
Stat1	Green	Status 1, details see table below
Stat2	Red	Status 2, details see table below

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another device	bus disconnected
		Criteria: no data exchange	Master not available / switched off
on	flashes 1)	Parameterization fault, no data	Slave not configured yet or wrong configuration
		exchange	• Wrong station address assigned (but not outside the permitted range)
		Criteria: data exchange correct.	
			• Actual configuration of the slave differs from the
		However, the slave did not switch to the data exchange mode.	nominal configuration
on	off	Data exchange.	
		Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds



Absolute rotary encoder with photoelectric sampling and PROFINET interface



#### **Function**

The absolute encoders with PROFINET IO interface and precious photoelectric sampling can be used in all PROFINET applications. Thanks to the Encoder Profile 4.2 and the IRT mode, they are ideally suited for I4.0 applications.

#### **Dimensions**





## **Technical Data**

General specifications		
Detection type		photoelectric sampling
Device type		Absolute rotary encoder
Linearity error		≤ ± 0.02 ° (14 16 bit)
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Electrical specifications		
Operating voltage	U <sub>B</sub>	10 30 V DC
Power consumption	P <sub>0</sub>	approx. 4 W
Time delay before availability	t <sub>v</sub>	< 15 s
Output code		binary code
Code course (counting direction)		programmable, cw ascending (clockwise rotation, code course ascending) cw descending (clockwise rotation, code course descending)
Interface		
Interface type		PROFINET IO
Device profile		Encoder Profile V4.2
Resolution		
Single turn		up to 16 Bit
Multiturn		up to 14 Bit
Overall resolution		up to 30 Bit
Transfer rate		100 MBit/s
Cycle time		≥ 250 µs
Connection		
Connector		Ethernet: 2 sockets M12 x 1, 4-pin, D-coded Supply: 1 plug M12 x 1, 4-pin, A-coded
Standard conformity		
Degree of protection		DIN EN 60529, Aluminum version: shaft side: IP64 (without shaft seal)/IP66 (with shaft seal) housing side: IP65 Stainless steel version (INOX): completely IP67
Climatic testing		DIN EN 60068-2-3, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates		
UL approval		cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions		
Operating temperature		-40 85 °C (-40 185 °F)
Storage temperature		-40 85 °C (-40 185 °F)
Relative humidity		98 %, no moisture condensation
Mechanical specifications		
Material		
Combination 1		housing: powder coated aluminum flange: aluminum shaft: stainless steel
Combination 2 (Inox)		housing: stainless steel 1.4305 / AISI 303 flange: stainless steel 1.4305 / AISI 303 shaft: stainless steel 1.4305 / AISI 303
Combination 3 (A)		housing: stainless steel 1.4404 / AISI 316L flange: stainless steel 1.4404 / AISI 316L shaft: stainless steel 1.4112 / AISI 440B
Mass		approx. 370 g (combination 1) approx. 860 g (combination 2/3)
Rotational speed		max. 12000 min <sup>-1</sup> for IP65 max. 3000 min <sup>-1</sup> for IP66/IP67

## Absolute rotary encoder

Technical Data	
Moment of inertia	50 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	40 N
Radial	110 N

## Type Code

#### Structure of the type code

E N A 5	8 P L – S (1) (1) (2) (2) (3) – (4) (4) (5) (5) B 1 7 – R H 2			
ENA	Device type			
ENA	Abolute rotary encoder			
58	Sizo			
58	Housing diameter 58 mm			
PL	Version			
PL	Performance Line			
S	Shaft type			
S	Solid shaft			
(1) (1)	Shaft diameter			
06	6 mm			
10	10 mm			
(2) (2)	Flange			
CA	Clamping flange, housing and flange in aluminum, shaft in stainless steel			
C2	Clamping flange, housing, flange and shaft in stainless steel 1.4305 / AISI303 (V2A)			
C4	Clamping flange V4A, housing and flange in stainless steel 1.4404 / AISI316L (V4A), shaft in stainless steel 1.4112 / AISI440B			
SA	Servo flange, housing and flange in aluminum, shaft in stainless steel			
S2	Servo flange, housing, flange and shaft in stainless steel 1.4305 / AISI303 (V2A)			
S4	Servo flange V4A, housing and flange in stainless steel 1.4404 / AISI316L (V4A), shaft in stainless steel 1.4112 / AISI440B			
(3)	Degree of protection			
5	IP65			
7	IP67			

(4) (4)	Multiturn resolution
00	Singleturn rotary encoder
12	Multiturn rotary encoder, 12 bit
14	Multiturn rotary encoder, 14 bit
(5) (5)	Singleturn resolution
13	13 Bit

Connection type Radial connection alignment, Bus cover with 2 sockets / plug M12 x 1

16

**B17** B17

RH2 RH2 16 Bit

Interface, electric PROFINET

Pin	Male connector M12 x 1, 4-pin, A-coded	Female connector M12 x 1, 4-pin, D-coded
1	Supply voltage +U <sub>B</sub>	Tx +
2	-	Rx +
3	0 V	Tx -
4	-	Rx -
	$2 \underbrace{\begin{pmatrix} 1 \\ \bullet \\ \bullet \\ 3 \end{pmatrix}}_{3} 4$	

## Indication

#### Diagnostic LEDs

LED	Color	Description for LED = ON	
Active1	Yellow	Incoming and outgoing data traffic for port 1	
Link1*	Green	Connection to other Ethernet devices on port 1	
Active2	Yellow	Incoming and outgoing data traffic for port 2	
Link2*	Green	Connection to other Ethernet devices on port 2	
Stat1	Green	Status 1, details see table below	
Stat2	Red	Status 2, details see table below	
* * *			

\* flashes with 2 Hz if engineering identification call is activated and link connection is available



Stat1 (green)	Stat2 (red) bus failure	Meaning	Cause
off	off	No power	
on	on	No connection to another device	bus disconnected
		Criteria: no data exchange	Master not available / switched off
on	flashes 1)	Parameterization fault, no data	Slave not configured yet or wrong configuration
		exchange	• Wrong station address assigned (but not outside the permitted range)
		Criteria: data exchange correct.	
			• Actual configuration of the slave differs from the
		However, the slave did not switch to the data exchange mode.	nominal configuration
on	off	Data exchange.	
		Slave and operation ok.	

1) flashing frequency 0.5 Hz for at least 3 seconds



## Absolute rotary encoder ENA36HT-S\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Pure Line
- Solid shaft
- High climatic resistance
- High mechanical stability
- IO-Link Interface for process data, parameterization and diagnosis
- Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable

ø 24

- Free of wear magnetic sampling
- High resolution and accuracy
- Status LEDs



## Function

Heavy duty absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

## Dimensions




#### **General specifications** Detection type magnetic sampling Device type Heavy duty absolute rotary encoder as Pure Line position Temperature Measured variable Linearity error ≤±0.1 ° **UL File Number** E223176 "For use in NFPA 79 Applications only", if UL marking is marked on the product. Functional safety related parameters 480 a at 40 °C $\mathsf{MTTF}_{\mathsf{d}}$ 20 a Mission Time (T<sub>M</sub>) 10 E+8 revolutions at 20/40 N axial/radial shaft load L<sub>10</sub> Diagnostic Coverage (DC) 0% Indicators/operating means LED green flashing with short break (1 Hz) - IO-Link mode LED STATUS **Electrical specifications** 18 ... 30 V DC Operating voltage UB No-load supply current max. 50 mA $I_0$ Power consumption $P_0$ approx. 1.5 W Time delay before availability < 1 s tv Interface Interface type IO-Link **IO-Link revision** 1.1 Identification and Diagnosis - I&D Device profile Resolution up to 16 Bit programmable Single turn Multiturn up to 15 Bit programmable Overall resolution up to 31 Bit programmable Process data Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 2 Bit diagnosis signals 2 Bit status data Vendor ID 1 (0x0001) Device ID 500901 (0x5245185), 500902 (0x5245186) Transfer rate COM3 (230.4 kbits/s) Min. cycle time 1.5 ms SIO mode support no Compatible master port type Class A Class B (use 3-pole adapter or 3-wire cable) Connection Connector M12 connector, 5 pin, A-coded Standard conformity Degree of protection DIN EN 60529, IP68, IP69 Communication interface IEC 61131-9 / IO-Link V1.1.2 Climatic testing DIN EN 60068-2-3, no moisture condensation Emitted interference EN 61000-6-4:2007 Noise immunity EN 61000-6-2:2005 Shock resistance DIN EN 60068-2-27, 200 g, 11 ms Vibration resistance DIN EN 60068-2-6, 30 g, 10 ... 1000 Hz Approvals and certificates UL approval cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.

Ambient conditions

On evention to man eventure	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	powder coated steel
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 150 g
Rotational speed	max. 6000 min <sup>-1</sup>
Moment of inertia	< 30 gcm <sup>2</sup>
Starting torque	< 5 Ncm
Shaft load	
Axial	180 N
Radial	180 N

## Connection



### **Connection Assignment**



## Type Code

E N A 3 6	6       H       T       -       S       1       0       S       A       9       -       (1)       (1)       1       6       -       I       O       -       (2)       (2)       (2)       0       1							
ENA	Device type							
ENA	Abolute rotary encoder							
36	36 Size							
36	36 Housing diameter 36 mm							
HT	Version							
HT	Heavy Duty as Targel Line / Pure Line							
S	Shaft type							
S	Solid shaft							
10	Shaft diameter							
10	10 mm							
SA	Flange							
SA	Servo flange							

Type Code	
9	Degree of protection
9	IP68/IP69
(2) (2)	Multiture resolution
(2) (2)	
00	Singleturn rotary encoder
15	Multiturn rotary encoder, parameterizable up to 15 bit
16	Singleturn resolution
16	16 Bit
10	Interface, electric
10	IO-Link
(3) (3) (3)	Connection type
ABP	Axial connection alignment, M12 x 1, 5-pin, A coded
RH2	Radial connection alignment, M12 x 1, 5-pin, A coded
01	Parameterization status
01	P+F factory setting



# Absolute rotary encoder ENA36IL-R\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Performance Line
- Recessed hollow shaft
- Position and shaft velocity
- IO-Link Interface for process data, parameterization and
- diagnosis Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy

# 

### **Function**

Absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

### Dimensions



	L [r	nm]
Degree of Protection	Axial Output	Radial Output
IP65	43	39

### Dimensions



Output, axial, IP65



General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder as Performance Line
Measured variable		position shaft velocity Temperature
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		566 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		1035 E+8 revolutions at 19/44 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED STATUS		LED green flashing with short break (1 Hz) - IO-Link mode
Electrical specifications		
Operating voltage	UB	18 30 V DC
No-load supply current	I <sub>0</sub>	max. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	<1s
Interface		

Technical Data	
Interface type	IO-Link
IO-Link revision	1.1
Device profile	Identification and Diagnosis - I&D
Resolution	
Single turn	up to 16 Bit programmable
Multiturn	up to 15 Bit programmable
Overall resolution	up to 31 Bit programmable
Process data	Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 4 Bit - diagnosis signals 2 Bit - status data Output 1 Byte - Trigger 1 Bit
Vendor ID	1 (0x0001)
Device ID	5244161 (0x500501), 5244162 (0x500502)
Transfer rate	COM3 (230.4 kbits/s)
Min. cycle time	1.5 ms
SIO mode support	no
Compatible master port type	Class A Class B (use 3-pole adapter or 3-wire cable)
Connection	
Connector	M12 connector, 5 pin , A-coded
Standard conformity	
Degree of protection	DIN EN 60529, IP65, IP67
Communication interface	IEC 61131-9 / IO-Link V1.1.2
Climatic testing	DIN EN 60068-2-78, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 <i>g</i> , 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 190 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	< 18 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shatt load	
Axial	19 N
Radial	44 N
Axial offset	$\pm$ 0.3 mm static; $\pm$ 0,1 mm dynamic
Radial offset	± 0.5 mm static; &lusmn 0,2 mm dynamic



# **Connection Assignment**



## Type Code

EN	ΙΑ	3	6	I	L	- R	0	6	D	Α	5	-	(1)	(1)	1	6	-	Ι	0	-	(2)	(2)	(2)	0	1
ENA				Devic	e type																				
ENA			1	Abolu	te rotar	y encod	ər																		
36				Size	a a al' a a	n at a r OC																			
30			1	Tousi	ng diar	neter 36	mm																		
IL.				/ersi	on																				
IL				ndust	rial Lin	e / Perfo	rmano	e Line	е																
P				Shoft	type																				
R			-	Reces	sed ho	llow sha	ft																		
			!'	10000	0000110																				
06			\$	Shaft	diame	ter																			
06			6 mm																						
DA				-lang	e																				
DA			[	Dual s	pring	olate																			
5				Degre	e of p	rotectio	n																		
5				P65																					
(1) (1)				Multit	urn re	solution	1																		
00			5	Single	turn ro	tary enco	oder																		
15			1	Multitu	urn rota	try encod	der, pa	arame	teriza	able ι	up to 1	5 bit													
16			5	Single	əturn r	esolutio	n																		
16			-	16 Bit	otarri	oooratire																			
10				nterf	ace, el	ectric																			
10				O-Lin	K																				
(2) (2)	(2)		(	Conn	ection	type																			
ABP			/	Axial o	connec	tion alig	nment	, M12	x 1,	5-pin	, A coo	ded													
RBD			F	Radia	l conne	ection ali	gnmei	nt, M1	2 x 1	, 5-pi	in, A co	oded													
01				Daran	neteriz	ation st	atue																		
01			F	P+F f	actory	setting	atus																		
<u> </u>			( '																						



# Absolute rotary encoder ENA58IL-R\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Performance Line
- Recessed hollow shaft
- Position and shaft velocity
- IO-Link Interface for process data, parameterization and
- diagnosisSuitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy

# 

### **Function**

Absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

### Dimensions



Recessed hollow shaft

# Connections

### Dimensions in mm



General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder as Performance Line
Measured variable		position shaft velocity Temperature
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		566 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		5 E+8 revolutions at 24/198 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED STATUS		LED green flashing with short break (1 Hz) - IO-Link mode
Electrical specifications		
Operating voltage	$U_B$	18 30 V DC
No-load supply current	I <sub>0</sub>	max. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	<1s
Interface		
Interface type		IO-Link
IO-Link revision		1.1
Device profile		Identification and Diagnosis - I&D
Resolution		
Single turn		up to 16 Bit programmable
Multiturn		up to 15 Bit programmable
Overall resolution		up to 31 Bit programmable
Process data		Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 4 Bit - diagnosis signals 2 Bit - status data Output 1 Byte - Trigger 1 Bit
Vendor ID		1 (0x0001)
Device ID		5244417 (0x500601), 5244418 (0x500602), 5244421 (0x500605), 5244422 (0x500606)
Transfer rate		COM3 (230.4 kbits/s)
Min. cycle time		1.5 ms
SIO mode support		no
Compatible master port type		Class A Class B (use 3-pole adapter or 3-wire cable)
Connection		
Connector		M12 connector, 5 pin , A-coded
Standard conformity		
Degree of protection		DIN EN 60529, IP65, IP67
Communication interface		IEC 61131-9 / IO-Link V1.1.2
Climatic testing		DIN EN 60068-2-78, no moisture condensation
Emitted interference		EN 61000-6-4:2007
Noise immunity		EN 61000-6-2:2005
Shock resistance		DIN EN 60068-2-27, 100 <i>g</i> , 6 ms
Vibration resistance		DIN EN 60068-2-6, 10 <i>g</i> , 10 1000 Hz
Approvals and certificates		

Technical Data	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 %, no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 370 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	< 30 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	24 N
Radial	198 N
Angle offset	± 0.9 °
Axial offset	± 0.3 mm static; ± 0,1 mm dynamic
Radial offset	± 0.5 mm static; &lusmn 0,2 mm dynamic

# Connection



# **Connection Assignment**



### Type Code

E	Ν	Α	5	8	I	L	-	R	(1)	(1)	D	Α	(2)	-	(3)	(3)	1	6	-	I	0	-	(4)	(4)	(4)	0	1
	_																										
EN	NA Device type																										
EN	A			I A	Abolu	te rota	ary er	ncode	er																		
58				5	Size																						
58				H	lousi	ng dia	amete	er 58	mm																		
IL.	Version																										
IL	Industrial Line / Performance Line																										

Type Code	
B	Shaft type
R	Recessed hollow shaft
(1) (1)	Shaft diameter
06	6 mm
10	10 mm
12	12 mm
14	14 mm
15	15 mm
-	
DA	Flange
DA	Dual spring plate
(2)	Degree of protection
5	IP65
7	IP66. IP67
(3) (3)	Multiturn resolution
00	Singleturn rotary encoder
15	Multiturn rotary encoder, parameterizable up to 15 bit
16	Singleturn resolution
16	16 Bit
10	Interface electric
	IQ-Link
(4) (4) (4)	Connection type
ABP	Axial connection alignment, M12 x 1, 5-pin, A coded
RBD	Radial connection alignment, M12 x 1, 5-pin, A coded
01	Parameterization status
01	P+F factory setting



# Absolute rotary encoder ENA58IL-S\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Performance Line
- Solid shaft
- Position and shaft velocity
- IO-Link Interface for process data, parameterization and diagnosis
- Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy

# 

### **Function**

Absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

### **Dimensions**



Clamping flange

- de

ø58 ø50f7



ø42

120

Servo flange

### Dimensions

Connections Dimensions in mm

### Connector M12



General specifications		
Detection type		magnetic sampling
Device type		Absolute rotary encoder as Performance Line
Measured variable		position shaft velocity Temperature
Linearity error		≤±0.1 °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		566 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		420 E+8 revolutions at 40/110 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED STATUS		LED green flashing with short break (1 Hz) - IO-Link mode
Electrical specifications		
Operating voltage	$U_B$	18 30 V DC
No-load supply current	I <sub>0</sub>	max. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	<1s
Interface		
Interface type		IO-Link
IO-Link revision		1.1
Device profile		Identification and Diagnosis - I&D
Resolution		
Single turn		up to 16 Bit programmable
Multiturn		up to 15 Bit programmable
Overall resolution		up to 31 Bit programmable
Process data		Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 4 Bit - diagnosis signals 2 Bit - status data Output 1 Byte - Trigger 1 Bit
Vendor ID		1 (0x0001)

Technical Data	
Device ID	5244419 (0x500603), 5244420 (0x500604), 5244423 (0x500607), 5244424 (0x500608)
Transfer rate	COM3 (230.4 kbits/s)
Min. cycle time	1.5 ms
SIO mode support	no
Compatible master port type	Class A Class B (use 3-pole adapter or 3-wire cable)
Connection	
Connector	M12 connector, 5 pin , A-coded
Standard conformity	
Degree of protection	DIN EN 60529, IP65, IP67
Communication interface	IEC 61131-9 / IO-Link V1.1.2
Climatic testing	DIN EN 60068-2-78, no moisture condensation
Emitted interference	EN 61000-6-4:2007
Noise immunity	EN 61000-6-2:2005
Shock resistance	DIN EN 60068-2-27, 100 g, 6 ms
Vibration resistance	DIN EN 60068-2-6, 10 g, 10 1000 Hz
Approvals and certificates	
UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Ambient conditions	
Operating temperature	-40 85 °C (-40 185 °F)
Storage temperature	-40 85 °C (-40 185 °F)
Relative humidity	98 % , no moisture condensation
Mechanical specifications	
Material	
Housing	Zinc plated steel, painted
Flange	Aluminum
Shaft	Stainless steel
Mass	approx. 350 g
Rotational speed	max. 12000 min <sup>-1</sup>
Moment of inertia	< 30 gcm <sup>2</sup>
Starting torque	< 3 Ncm
Shaft load	
Axial	40 N
Radial	110 N

# Connection



## **Connection Assignment**



### **Type Code**

EN	Α	5	8	I	L	-   S	(1)	(1) (2	2) (2)	(3)	- (4)	(4)	1	6 -	I	0	-	(5)	(5)	(5)	0 1
ENA			D	Device type																	
ENA			A	Abolute rotary encoder																	
58			S	ize	a al'an	atar 50															
58				iousir	ig diarr	ieter 58	mm														
IL			V	ersio	n																
IL			Ir	ndustr	ial Line	e / Perfo	rmanc	e Line													
				1 <b>(</b> 1- )																	
5			5		type																
3			13	olia s	nan																
(1) (1)			S	haft	diamet	ter															
06			6	mm																	
10			1	0 mm																	
(2)(2)				long																	
(2)(2)				lamp	, ing flar	ae															
SA			s	ervo	flange	.90															
					0																
(3)			D	egre	e of pr	otectio	n														
5				P65	D07																
/			11	-66, I	P67																
(4) (4)			N	lultitu	urn res	olutior	1														
00			S	Singleturn rotary encoder																	
15			N	Multiturn rotary encoder, parameterizable up to 15 bit																	
16				ingle	turn re	eoluti	20														
16																					
			'	0 Dit																	
10			h	Interface, electric																	
10			10	IO-Link																	
(5)(5)	(5)		0	onne	ction	vpe -															
ABP			A	xial c	onnect	ion alia	nment.	M12 x	1. 5-pin	. A code	ed										
RBD			F	ladial	conne	ction ali	gnmer	nt, M12	x 1, 5-p	in, A co	ded										
							-														
01			P	aram	eteriza	ation si	atus														
01			P	'+F fa	ctory s	etting															



# Absolute rotary encoder ENA42HT-S\*\*\*-IO-Link

- Absolute rotary encoder of the innovative Pure Line
- Solid shaft
- High climatic resistance
- High mechanical stability
- IO-Link Interface for process data, parameterization and diagnosis
- Suitable for condition monitoring
- Measuring range, direction of rotation and switching signals programmable
- Free of wear magnetic sampling
- High resolution and accuracy
- Status LEDs



### Function

Heavy duty absolute encoders with IO Link are high precision encoders with internal magnetic sampling. The integrated IO Link interface offers an optimal adaption to different applications through parameterization as well as process data transfer and condition monitoring.

### Dimensions



#### Servo flange

ø10h7





### Dimensions





General specifications		
Detection type		magnetic sampling
Device type		Heavy duty absolute rotary encoder as Pure Line
Measured variable		position Temperature
Linearity error		$\leq \pm 0.1$ °
UL File Number		E223176 "For use in NFPA 79 Applications only" , if UL marking is marked on the product.
Functional safety related parameters		
MTTF <sub>d</sub>		480 a at 40 °C
Mission Time (T <sub>M</sub> )		20 a
L <sub>10</sub>		10 E+8 revolutions at 20/40 N axial/radial shaft load
Diagnostic Coverage (DC)		0 %
Indicators/operating means		
LED STATUS		LED green flashing with short break (1 Hz) - IO-Link mode
Electrical specifications		
Operating voltage	$U_B$	18 30 V DC
No-load supply current	I <sub>0</sub>	max. 50 mA
Power consumption	P <sub>0</sub>	approx. 1.5 W
Time delay before availability	t <sub>v</sub>	<1s
Interface		
Interface type		IO-Link
IO-Link revision		1.1

Device profileIdentification and Diagnosis - I&DResolutionup to 16 Bit programmableMutturnUp to 15 Bit programmableOverall resolutionUp to 15 Bit programmableProcess dataInput 12 Byte - resolution 16 Bit - Bit Bit - resolution 16 Bit - resolution 16 Bit - resolution 16 Bit - resolution 16 Bit - resol		
Resolutionup to 16 Bit programmableMultitumup to 16 Bit programmableOverall resolutionUp to 13 Bit programmableProcess dataInput 12 Byta - measurement value 4 Byte - solution 16 Bit - solution 16 Bit - exolution 16 Bit - solution 16 Bit <b< td=""><td>Device profile</td><td>Identification and Diagnosis - I&amp;D</td></b<>	Device profile	Identification and Diagnosis - I&D
Single turiup to 16 Bit programmableWultituriup to 31 Bit programmableVerail resolutionup to 31 Bit programmableProcess dataInput 12 Byte - measurement value 4 Byte - measurement value 4 Byte - status dataVendr ID1 (kox001)Device ID5246978 (kx 501001), 5246978 (kx 501002)Device ID5246977 (ko 501001), 5246978 (kx 501002)Transfer rateCOM3 (230.4 kbits/s)Min. cycle time5246977 (ko 501001), 5246978 (kx 501002)Storber DD6246977 (ko 501001), 5246978 (kx 501002)Transfer rateCOM3 (230.4 kbits/s)Min. cycle time5.5 msStorber DD0Compatible measter port typeClass A Class B (use 3-pole adapter or 3-wire cable)ConnectorM12 connector, 5 pin , A-codedStandard conformiyDIN EN 60529, IP66 / IP68 / I	Resolution	
Multum         up 16 15 Bit programmable           Overall resolution         up 06 31 Bit programmable           Process data         Input 12 Byte resolution 16 Bit - axiliary measurement value 4 Byte - existion segmest 2 Bit - axiliary measurement value 4 Byte - axiliary measurement v	Single turn	up to 16 Bit programmable
Overall resolution         up to 31 Bit programmable           Process data         Input 12 Bit programmable 4 Byte -resolution 16 Bit -surkiting signals 2 Bit -surkiting 2 Bit (x 501001), 5246978 (0x 501002)           Vendor ID         1 (0x0001)           Device ID         5246977 ((x 501001), 5246978 (0x 501002)           Transfer rate         COMS (230.4 kbits/s)           Min. cycle time         5246977 ((x 501001), 5246978 (0x 501002)           Sol mode support         no           Compatible master port type         Class A (class B (us 3-pole adapter or 3-wire cable)           Sol mode support         No           Connector         M12 connector, 5 pin, A-coded           Standar Conformity         ENE (6058-2-9, no Bef / IP68 / IP	Multiturn	up to 15 Bit programmable
Process data       Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - acuilary measurement value 4 Byte - acuilary measurement value 4 A Byte 5 (- aduilary 16 (- aduilary 16 (- aduilary 16 (- aduilary 16 (- adui	Overall resolution	up to 31 Bit programmable
Vendor ID1 (0x0001)Device ID5246977 (0x 501001), 5246978 (0x 501002)Transfor rateCOM3 (20.4 kbits/s)Min. cycle time1.5 msSIO mode supportnoCompatible master port typeClass A Class B (use 3-pole adapter or 3-wire cable)ConnectorM12 connector, 5 pin, A-codedConnector rateIM 2 connector, 5 pin, A-codedStandard conformityDIN EN 60529, IP66 / IP68 / IP68 / IP68 K Communication interfaceCommunication interfaceEN 61030-6-2:005Contact singDIN EN 6068-2:3, no moisture condensationEmitted interferenceEN 6100-6-2:2005Noise immunityEN 6100-6-2:200 g, 11 msVibration resistanceDIN EN 6068-2:7, 20 g, 11 msVibration resistanceSi an est "C (-40 185 "F)Storage temperature-40 85 "C (-40 185 "F)Storage temperature-40 85 "C (-40 185 "F)Relati temperatureSi tainless steel 1.4404 / AISI 316LFiangeSi tainless steel 1.4404 / AISI 316LFiangeSi tainless steel 1.4404 / AISI 316LShaftSiainless steel 1.4404 / AISI 316LMaterial	Process data	Input 12 Byte - measurement value 4 Byte - resolution 16 Bit - auxiliary mesurement value 4 Byte - switching signals 2 Bit - diagnosis signals 2 Bit - status data
Device ID5246977 (0x 501001), 5246978 (0x 501002)Transfer rateCOM3 (230.4 kbits/s)Min. cycle line1.5 msSIO mode supportnCompatible master port typeClass A Class S (use 3-pole adapter or 3-wire cable)ConnectorM12 connector, 5 pin, A-codedStandard conformityDIN EN 60529, IP66 / IP68 / IP69 KDegree of protectionDIN EN 60529, IP66 / IP68 / IP69 KCommunication interfaceIEC 61131-9 / IO-Link V1.12Communication interfaceEN 61000-64-2007Noise immunityEN 61000-64-2005Noise immunityEN 61000-64-2005Shock resistanceDIN EN 60688-27, 200 g, 11 msVibration resistanceDIN EN 60688-27, 200 g, 11 msVibration resistanceDIN EN 60068-22, 200 g, 10 msVibration resistanceDIN EN 60068-22, 200 g, 10 msVibration resistanceDIN EN 60068-27, 200 g, 11 msVibration resistanceBis ", on moisture condensationPaprovalclus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.Material-40 85 "C (-40 185 "F)Storage temperature98 %, no moisture condensationPoles temperatureStainless steel 1.4404 / AISI 316LNatiStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.440	Vendor ID	1 (0x0001)
Transfer rateCOM3 (230.4 kbits/s)Min. cycle time1.5 msSIO mode supportnoCompatible master port typeClass B (use 3 pole adapter or 3-wire cable)ConnectorM12 connector, 5 pin, A-codedStandard conformityED IN EN 60529, IP66 / IP69	Device ID	5246977 (0x 501001), 5246978 (0x 501002)
Min. cycle timeI. 5 msSIO mode supportnoCompatible master port typeClass A Class B (use 3-pole adapter or 3-wire cable)ConnectorM12 connector, 5 pin, A-codedConnectorM12 connector, 5 pin, A-codedStandard conformityEG 611319 / IO-Link V1.1.2Degree of protectionED IN EN 60529, IP66 / IP68 / IP68 / IP69	Transfer rate	COM3 (230.4 kbits/s)
SIO mode support         no           Compatible master port type         Class A Class B (use 3-pole adapter or 3-wire cable)           Connector         M12 connector, 5 pin , A-coded           Standard confomity         M12 connector, 5 pin , A-coded           Degree of protection         DIN EN 60529, IP66 /IP68 /I	Min. cycle time	1.5 ms
Compatible master port type         Class A class B (use 3-pole adapter or 3-wire cable)           Connector         M12 connector, 5 pin, A-coded           Standard conformity         Image: Connector, 5 pin, A-coded           Communication interface         DIN EN 60529, IP66 / IP68 / IP69 / IC60           Communication interface         Image: Connector, 6 pin, A-coded           Shock resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         Oll EN 60068-2-27, 200 g, 11 ms           Shock resistance         Ull eproval           Operating temperature         -40 85 °C (-40 185 °F)           Stange temperature         -40 85 °C (-40 185 °F)	SIO mode support	no
Connection         Image: Connector, 5 pin, A-coded           Standard conformity         Example Connector, 5 pin, A-coded           Standard conformity         EXAMple Connector, 5 pin, A-coded           Degree of protection         Image: Connector, 5 pin, A-coded           Communication interface         IEC 61131-9 / IO-Link V1.1.2           Communication interface         IEC 61131-9 / IO-Link V1.1.2           Climatic testing         EN 61000-64-2207           Noise immunity         EN 61000-64-2200 g, 11 ms           Noise immunity         EN 61000-62-200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         CulLus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.           Approx.350 g         Stainless steel 1.4404 / AISI 316L           R	Compatible master port type	Class A Class B (use 3-pole adapter or 3-wire cable)
Connector         M12 connector, 5 pin, A-coded           Standard conformity           Degree of protection         DIN EN 60529, IP66 / IP68 / IP69K           Communication interface         IEC 61131-9 / IO-Link V1.1.2           Climatic testing         DIN EN 60068-2-3, no moisture condensation           Emitted interference         EN 61000-6-4:2007           Noise immunity         EN 61000-6-2:200 g, 11 ms           Shock resistance         DIN EN 60068-2-27, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-20, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-20, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-20, 200 g, 11 ms           Vibration resistance         DIN EN 60068-2-6, 30 g, 10 1000 Hz           Approvals         CulLus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.           Approval         culLus sproval (40 185 °F)           Operating temperature         -40 85 °C (-40 185 °F)           Stardge temperature         -40 85 °C (-40 185 °F)           Relative humidity         Bas on o moisture condensation           Material         Emitted stainless steel 1.4404 / AISI 316L           Flange         Stainless steel 1.4404 / AISI 316L           Shaft         Stainless steel 1.4412 / AISI 440B	Connection	
Standard conformity       IDE No 5029, IP66 / IP68 / IP69 K         Degree of protection       IEC 61131-9 / IO-Link V1.1.2         Communication interface       IEC 61131-9 / IO-Link V1.1.2         Colimatic testing       IDIN EN 60068-2-3, no moisture condensation         Emitted interference       EN 61000-64-2:005         Shock resistance       DIN EN 60068-2-3, 0g, 11 ms         Vibration resistance       DIN EN 60068-2-3, 0g, 10 1000 Hz         Approvals and certificates       CULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.         Approval       cull Lus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.         Approval       cull Lus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.         Approval       cull Lus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.         Approval       que van Lus de	Connector	M12 connector, 5 pin , A-coded
Degree of protectionIN EN 60529, IP66 / IP69 / IP60 /	Standard conformity	
Communication interfaceIEC 61131-9 / IO-Link V1.1.2Climatic testingDIN EN 60068-2-3, no moisture condensationEmitted interferenceEN 61000-64:2007Noise immunityEN 61000-64:2005Shock resistanceDIN EN 60068-2-27, 200 g, 11 msVibration resistanceDIN EN 60068-2-6, 30 g, 10 1000 HzApprovals and certificatesDIN EN 60068-2-6, 30 g, 10 1000 HzUL approvalctlus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.Ambient conditions-40 85 °C (-40 185 °F)Storage temperature-40 85 °C (-40 185 °F)Relative humidity98 % , no moisture condensationMaterial-HousingStainless steel 1.4404 / AISI 316LFlageStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia< 30 gcm²	Degree of protection	DIN EN 60529 , IP66 / IP68 / IP69K
Climatic testingDIN EN 60068-2-3, no moisture condensationEmitted interferenceEN 61000-6-4:2007Noise immunityEN 61000-6-2:2005Shock resistanceDIN EN 60068-2-27, 200 g, 11 msVibration resistanceDIN EN 60068-2-27, 200 g, 10 1000 HzApprovals and certificatesUL approval of certificatesUL approvalCULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.AmberUL approvalOperating temperature-40 85 °C (-40 185 °F)Storage temperature-40 85 °C (-40 185 °F)Relative humidity98 %, no moisture condensationWethanical specifications	Communication interface	IEC 61131-9 / IO-Link V1.1.2
Emitted interferenceEN 61000-6-4:2007Noise immunityEN 61000-6-2:2005Shock resistanceDIN EN 60068-2-27, 200 g, 11 msVibration resistanceDIN EN 60068-2-6, 30 g, 10 1000 HzApprovals and certificatesUL approval certificatesUL approvalcULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.Ambient conditionsUL aps °C (40 185 °F)Storage temperature-40 85 °C (-40 185 °F)Relative humidity88 %, no moisture condensationWethanical specificationsUL approv.MaterialStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4412 / AISI 440BMassapprox. 350 gRotational speedmax. 6000 min °1Moment of inertia< 30 gcm²	Climatic testing	DIN EN 60068-2-3, no moisture condensation
Noise immunityEN 61000-6-2:2005Shock resistanceDIN EN 60068-2-27, 200 g, 11 msVibration resistanceDIN EN 60068-2-6, 30 g, 10 1000 HzApprovals and certificatesUL approvals and certificatesUL approvalcultus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.Ambient conditions-40 85 °C (-40 185 °F)Operating temperature-40 85 °C (-40 185 °F)Relative humidity98 % , no moisture condensationMaterial98 % , no moisture condensationMaterialStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia<30 gcm²	Emitted interference	EN 61000-6-4:2007
Shock resistanceDIN EN 60068-2-27, 200 g, 11 msVibration resistanceDIN EN 60068-2-6, 30 g, 10 1000 HzApprovals and certificatesctULs Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.Ambient conditionsctULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.Operating temperature-40 85 °C (-40 185 °F)Storage temperature-40 85 °C (-40 185 °F)Relative humidity98 % , no moisture condensationMaterial98 % , no moisture condensationHousingStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LMassapprox.350 gRotational speedmax. 6000 min °1Moment of inertia< 30 gcm²	Noise immunity	EN 61000-6-2:2005
Vibration resistanceDIN EN 60068-2-6, 30 g, 10 1000 HzApprovals and certificatesUL approvalcUL us Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the conduct.Ambient conditions-40 85 °C (-40 185 °F)Operating temperature-40 85 °C (-40 185 °F)Storage temperature-40 85 °C (-40 185 °F)Relative humidity98 % , no moisture condensationWechanical specificationsMaterial1HousingStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LMassapprox. 350 gRotational speedmax. 6000 min °1Moment of inertia< 30 gcm²	Shock resistance	DIN EN 60068-2-27, 200 g, 11 ms
Approvals and certificates           UL approval         cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.           Ambient conditions         -40 85 °C (-40 185 °F)           Operating temperature         -40 85 °C (-40 185 °F)           Storage temperature         -40 85 °C (-40 185 °F)           Relative humidity         08 v, no moisture condensation           Wechanical specifications         -           Material         1           Housing         Stainless steel 1.4404 / AISI 316L           Flange         Stainless steel 1.4404 / AISI 316L           Shaft         Stainless steel 1.4402 / AISI 316L           Mass         approx. 350 g           Rotational speed         -30 gcm²           Moment of inertia         < 30 gcm²	Vibration resistance	DIN EN 60068-2-6, 30 g, 10 1000 Hz
UL approval       cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.         Ambient conditions       -40 85 °C (-40 185 °F)         Operating temperature       -40 85 °C (-40 185 °F)         Storage temperature       -40 85 °C (-40 185 °F)         Relative humidity       98 %, no moisture condensation         Wechanical specifications	Approvals and certificates	
Ambient conditionsOperating temperature-40 85 °C (-40 185 °F)Storage temperature-40 85 °C (-40 185 °F)Relative humidity98 %, no moisture condensationRelative humidity98 %, no moisture condensationMeterial6HousingStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia< 30 gcm²	UL approval	cULus Listed, General Purpose, Class 2 Power Source , if UL marking is marked on the product.
Operating temperature-40 85 °C (-40 185 °F)Storage temperature-40 85 °C (-40 185 °F)Relative humidity98 % , no moisture condensationMaterial98 % , no moisture condensationMaterialHousingStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia< 30 gcm²	Ambient conditions	
Storage temperature-40 85 °C (-40 185 °F)Relative humidity98 %, no moisture condensationMeterial98 %, no moisture condensationMaterialImage: Stainless steel 1.4404 / AISI 316LHousingStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4404 / AISI 316LMassapprox. 350 gRotational speedmax. 6000 min °1Moment of inertia<	Operating temperature	-40 85 °C (-40 185 °F)
Relative humidity       98 %, no moisture condensation         Material       98 %, no moisture condensation         Material       Vertications         Material       Stainless steel 1.4404 / AISI 316L         Housing       Stainless steel 1.4404 / AISI 316L         Flange       Stainless steel 1.4402 / AISI 316L         Shaft       Stainless steel 1.4412 / AISI 440B         Mass       approx.350 g         Rotational speed       max. 6000 min <sup>-1</sup> Moment of inertia       < 30 gcm <sup>2</sup> Shaft load       Z70 N         Axial       Z70 N	Storage temperature	-40 85 °C (-40 185 °F)
MaterialImageMaterialImageHousingStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4402 / AISI 316LMassStainless steel 1.4412 / AISI 440BMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertiaimageShaft load< 30 gcm²	Relative humidity	98 %, no moisture condensation
MaterialImageHousingStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4412 / AISI 440BMassApprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia<	Mechanical specifications	
HousingStainless steel 1.4404 / AISI 316LFlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4412 / AISI 440BMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia<	Material	
FlangeStainless steel 1.4404 / AISI 316LShaftStainless steel 1.4412 / AISI 440BMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia<	Housing	Stainless steel 1.4404 / AISI 316L
ShaftStainless steel 1.4412 / AISI 440BMassapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia< 30 gcm²	Flange	Stainless steel 1.4404 / AISI 316L
Massapprox. 350 gRotational speedmax. 6000 min <sup>-1</sup> Moment of inertia< 30 gcm <sup>2</sup> Starting torque< 5 Ncm	Shaft	Stainless steel 1.4412 / AISI 440B
Rotational speed     max. 6000 min <sup>-1</sup> Moment of inertia     < 30 gcm <sup>2</sup> Starting torque     < 5 Ncm	Mass	approx. 350 g
Moment of inertia< 30 gcm²Starting torque< 5 Ncm	Rotational speed	max. 6000 min <sup>-1</sup>
Starting torque     < 5 Ncm	Moment of inertia	< 30 gcm <sup>2</sup>
Shaft load     Z70 N       Axial     Z70 N       Radial     Z70 N	Starting torque	< 5 Ncm
Axial270 NRadial270 N	Shaft load	
Radial 270 N	Axial	270 N
	Radial	270 N

## Connection



## **Connection Assignment**



### Type Code

E N A 4	2 H T - S 1 0 (1) (1) 9 - (2) (2) 1 6 - I O - (3) (3) (3) 0 1						
ENA	Device type						
ENA	Abolute rotary encoder						
42	Size						
42	Housing diameter 42 mm						
HT	Version						
HT	Heavy Duty as Targel Line / Pure Line						
•	Chaft hund						
<b>S</b>	Shart type						
3	Solid Shalt						
10	Shaft diameter						
10	10 mm						
(4) (4)	Floren						
	Flange Clemping flange						
S4							
04							
9	Degree of protection						
9	IP66/IP66/IP69K						
(2)(2)	Multiture resolution						
(2)(2)	Singleturn resolution						
15	Multiturn rotary encoder, parameterizable up to 15 bit						
-							
16	Singleturn resolution						
16	16 Bit						
10	Interface, electric						
10	IO-Link						
(3) (3) (3)	Connection type						
ARA	Axial connection alignment, M12 x 1, 5-pin, A coded						
INDU	Hadiai connection alignment, MT2 X 1, 5-pin, A coded						
01	Parameterization status						
01	P+F factory setting						

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