Absolute rotary encoder

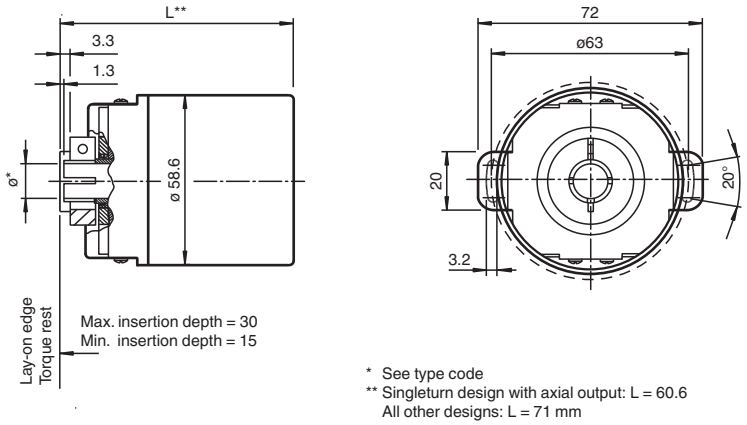
ENA58IL-R***-SSI

- Recessed hollow shaft
- SSI interface
- Up to 32 Bit multiturn
- Free of wear magnetic sampling
- High resolution and accuracy
- Additionally push buttons for preset function (only model characteristic SB2, SG2)
- Up to 4096 pulses on incremental track

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

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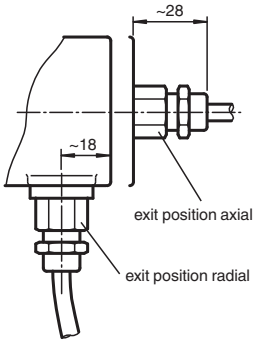
Dimensions

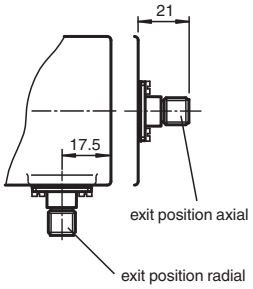
Connections

Dimensions in mm

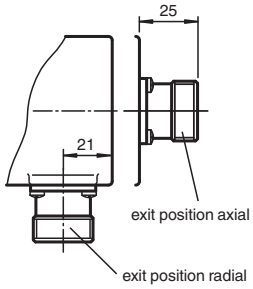
Cable



Connector M12



Connector M23



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.
Functional safety related parameters		
$MTTF_d$		700 a at 40 °C
Mission Time (T_M)		20 a
L_{10}		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_0	typ. 50 mA
Power consumption	P_0	approx. 1.5 W
Time delay before availability	t_v	< 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
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

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Technical Data

Input 2		
Input type		zero-set (PRESET 1) with falling edge
Signal voltage		
High		4.75 V ... U_B
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 mm²
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 $^{-1}$
Moment of inertia		50 gcm²
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

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

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Accessories

	**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
	**ACC-PACK-ABS-_S_58 ø15**	Accessory kit for Ø58 absolute rotary encoder with recessed hollow shaft 15 mm
	**ACC-PACK-ABS-_S_58 ø14**	Accessories set for Ø58 absolute rotary encoder with recessed hollow shaft 14 mm
	**ACC-PACK-ABS-_S_58 ø12**	Accessories set for Ø58 absolute rotary encoder with recessed hollow shaft 12 mm
	**ACC-PACK-ABS-_S_58 ø10**	Accessory kit for Ø58 absolute rotary encoder with recessed hollow shaft 10 mm

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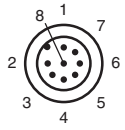
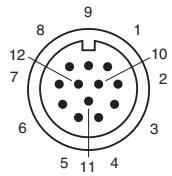
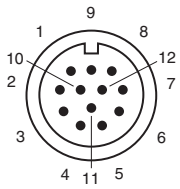
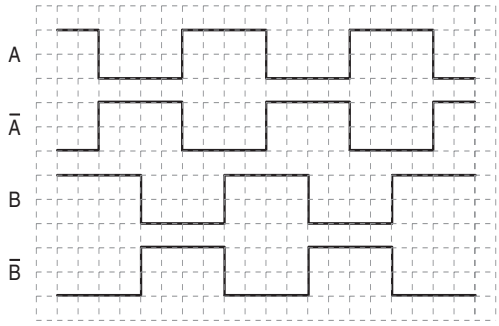
Connection

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_b (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
B	Grey/Pink		10	4	Incremental track B
$\overline{A}$	Violet		11	6	Incremental track $\overline{A}$
$\overline{B}$	Red/Blue		12	7	Incremental track $\overline{B}$
					

Operation

Signal output



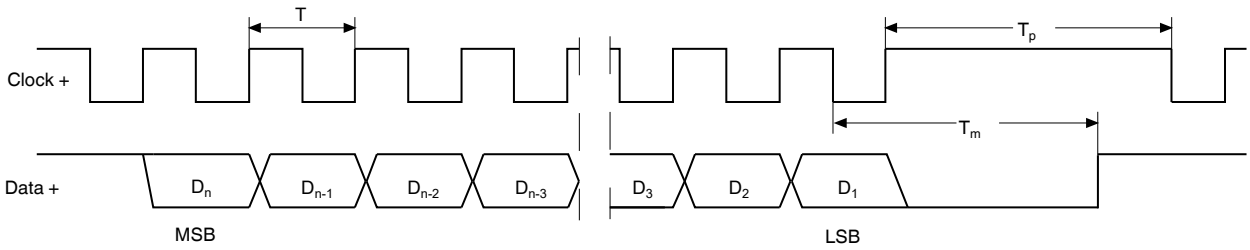
↻ cw - with view onto the shaft

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



D_1, ..., D_n:	Position data	T = 1/f:	Duration of period of clock signal ≤ 2 MHz
MSB:	Most significant bit	T_m:	Monoflop time 20 µs ± 1 µs
LSB:	Least significant bit	T_p:	Clock pause ≥ monoflop time ($T_p \geq T_m$)

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SSI output format Standard

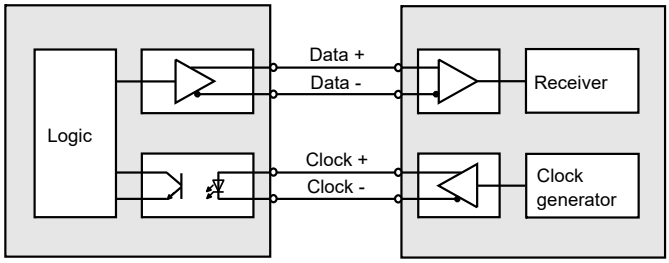
- At idle status signal lines "Data +" and "Clock +" are at high level (5 V).
- The first time the clock signal switches from high to low, the data transfer in which the current information (position data (D_n)) is stored in the encoder is introduced.±
- The highest order bit (MSB) is applied to the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

SSI output format ring slide operation (multiple transmission)

- In ring slide operation, multiple transmission of the same data word over the SSI interface makes it possible to offer the possibility of detecting transmission errors.
- In multiple transmission, 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_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

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

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Connection type
C1 Cable, 1 m
C2 Cable, 2 m
C5 Cable, 5 m
CA Cable, 10 m
AA M23 device plug, cw
AB M23 device plug, ccw
BE M12 device plug, 8-pin (not available with SSI + incremental track)

Connection alignment
A axial
R radial

Electical interface
SG1 ... SIC see next page

Singleturn resolution
12 12 bit
13 13 bit
16 16 bit

Multiturn resolution
00 Singleturn rotary encoder
12 Multiturn rotary encoder, 12 bit
14 Multiturn rotary encoder, 14 bit
16 Multiturn rotary encoder, 16 bit

Degree of protection
5 IP65
7 IP67 (not for M23 device plug)

Flange
DA Dual spring plate

Shaft diameter
06 6 mm (d = 6F7)
10 10 mm (d = 10 F7)
12 12 mm (d = 12 F7)
14 14 mm (d = 14 F7)
15 15 mm (d = 15 F7)

Shaft type
R Recessed hollow shaft

Version
IL Industrial Line

Size
58 Housing diameter: 58 mm

Device type
ENA Absolute rotary encoder

Electrical interface
SG1 SSI Gray
SB1 SSI binary
SG2 SSI Gray, with push buttons
SB2 SSI binary, with push buttons
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

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SI6	SSI Gray + 4096 pulses, RS422
SI7	SSI Binär + 1024 pulses, Push/Pull
SI8	SSI Binär + 2048 pulses, Push/Pull
SI9	SSI Binär + 4096 pulses, Push/Pull
SIA	SSI Binär + 1024 pulses, RS422
SIB	SSI Binär + 2048 pulses, RS422
SIC	SSI Binär + 4096 pulses, RS422

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