



OVERVIEW ROTARY ENCODERS

Edition 2006



Encoders

In automation, rotary encoders are used as sensors for angle, position, speed and acceleration. By the use of spindles, gear racks, measuring wheels or cable pulls, linear movements can also be picked up. They convert the actual value of a mechanical parameter into electrical signals which can be processed by counters, tachometers, programmable logic controllers and industrial PCs.

INCREMENTAL ENCODERS

Incremental encoders supply a certain number of pulses for each shaft revolution. The measurement of the cycle duration or the counting of the pulses per unit of time supplies the speed of a movement. If the pulses after a reference point are added, the calculated value represents a parameter for the scanned angle or the distance covered. Two-channel encoders – with a phase shift of 90 deg. – enable the follow-up electronic equipment to recognise the direction of rotation of the shaft and thus permit bidirectional positioning tasks. In addition, three-channel incremental encoders provide a so-called zero signal for each revolution.



INCREMENTAL
ENCODERS
SPECIAL DESIGNS



Series 10

Series 20

Series 30

Number of pulses		≤ 5,000	≤ 2,500	≤ 5,000
Design	[mm]	ø58	55 x 55	ø90
Flange type		clamping flange, servo flange, square flange	square flange	clamping flange
Spigot	[mm]	ø36, ø50	—	ø40
Solid shaft	[mm]	ø6 x 10, ø10 x 20	ø6 x 20	ø12 x 25
Hollow shaft	[mm]	—	—	—
Recessed hollow shaft	[mm]	—	—	—
Max. rotational speed	[min ⁻¹]	10,000	3,000	6,000
Max. shaft load, axial	[N]	60	10	60
Max. shaft load, radial	[N]	80	10	80
Operating voltage	[V DC]	5 or 10 ... 30	5 or 10 ... 30	5 or 10 ... 30
Output type		push-pull, RS 422	push-pull, RS 422	push-pull, RS 422
Max. output frequency	[kHz]	100	160	100
Signal outputs		$\bar{A}$, A, $\bar{B}$, B, 0, $\bar{O}$	A, B, 0	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{O}$
Protection class		IP65	IP40	IP65

INCREMENTAL
ENCODERS
SPECIAL DESIGNS



Series 60

Series 81

Number of pulses		≤ 1,250	≤ 500
Design	[mm]	74 x 74	40 x 50
Flange type		Square flange	rectangular flange
Spigot	[mm]	—	—
Solid shaft	[mm]	ø12 x 25	—
Hollow shaft	[mm]	ø7	ø6
Recessed hollow shaft	[mm]	—	—
Max. rotational speed	[min ⁻¹]	6,000	3,000
Max. shaft load, axial	[N]	40	—
Max. shaft load, radial	[N]	60	—
Operating voltage	[V DC]	10 ... 30	10 ... 30
Output type		push-pull	push-pull
Max. output frequency	[kHz]	50	20
Signal outputs		A, B, 0	A, B, 0
Protection class		IP50	IP52

INCREMENTAL ENCODERS R-LINE

			
	RHI58	RSI58	RVI58
Number of pulses	up to 400,000	≤ 5,000	≤ 10,000
Design [mm]	ø58	ø58	ø58
Flange type	–	–	clamping flange, servo flange
Spigot [mm]	–	–	ø36, ø50
Solid shaft [mm]	–	–	ø6 x 10, ø10 x 20
Hollow shaft [mm]	ø10, ø12, ø15	–	–
Recessed hollow shaft [mm]	–	ø10 x 20, ø12 x 20	–
Max. rotational speed [min ⁻¹]	6,000	12,000	12,000
Max. shaft load, axial [N]	–	–	40
Max. shaft load, radial [N]	–	–	60
Operating voltage [V DC]	5 or 10 ... 30	5 or 10 ... 30	5 or 10 ... 30
Output type	push-pull, RS 422	push-pull, RS 422	push-pull, RS 422
Max. output frequency [kHz]	200	200	200
Signal outputs	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$
Protection class	IP54	IP54	IP65

INCREMENTAL ENCODERS R-LINE

			
	RVI50	RVI78	RHI90
Number of pulses	≤ 2,500	≤ 5,000	≤ 2,500
Design [mm]	ø50	ø78	ø90
Flange type	clamping flange	servo flange	–
Spigot [mm]	ø30	ø42	–
Solid shaft [mm]	ø8 x 15	ø10 x 23	–
Hollow shaft [mm]	–	–	ø16, ø20, ø24, ø25, ø30, ø38, ø45
Recessed hollow shaft [mm]	–	–	–
Max. rotational speed [min ⁻¹]	10,000	6,000	3,500
Max. shaft load, axial [N]	30	50	–
Max. shaft load, radial [N]	50	100	–
Operating voltage [V DC]	5 or 4.75 ... 30	10 ... 30	5 or 10 ... 30
Output type	push-pull, RS 422	push-pull	push-pull
Max. output frequency [kHz]	160	100	120
Signal outputs	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$	A, B, 0	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$
Protection Class	IP65	IP50, IP65	IP65

INCREMENTAL ENCODERS T-LINE



		TVI40	TSI40
Number of pulses		≤ 1,024	≤ 1,024
Design	[mm]	ø40	ø40
Flange type		clamping flange	–
Spigot	[mm]	ø20	–
Solid shaft	[mm]	ø6 x 15, ø8 x 15	–
Hollow shaft	[mm]	–	–
Recessed hollow shaft	[mm]	–	ø4 x 15, ø6 x 15
Max. rotational speed	[min ⁻¹]	6.000	6.000
Max. shaft load, axial	[N]	20	–
Max. shaft load, radial	[N]	30	–
Operating voltage	[V DC]	4.75 ... 30	4.75 ... 30
Output type		push-pull, RS 422-function	push-pull, RS 422-function
Max. output frequency	[kHz]	100	100
Signal outputs		A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$
Protection class		IP54	IP54

INCREMENTAL ENCODERS T-LINE



		TVI50	TVI58	THI58
Number of pulses		≤ 1,024	≤ 1,500	≤ 1,500
Design	[mm]	ø50	ø58	ø58
Flange type		clamping flange	clamping flange servo flange	–
Spigot	[mm]	ø30	ø36, ø50	–
Solid shaft	[mm]	ø8 x 15	ø6 x 10, ø10 x 20	–
Hollow shaft	[mm]	–	–	ø10, ø12, ø15
Recessed hollow shaft	[mm]	–	–	–
Max. rotational speed	[min ⁻¹]	6,000	6,000	6,000
Max. shaft load, axial	[N]	20	20	–
Max. shaft load, radial	[N]	40	40	–
Operating voltage	[V DC]	4.75 ... 30	4.75 ... 30	4.75 ... 30
Output type		push-pull, RS 422-function	push-pull, RS 422-function	push-pull, RS 422-function
Max. Output frequency	[kHz]	100	100	100
Signal outputs		A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$
Protection class		IP54	IP54	IP54

Absolute encoders provide a distinctly coded numerical value for each shaft position. In positioning tasks in particular, the absolute encoders relieve the follow-up electronics of computation tasks so that complicated and expensive input components can be dispensed with. Moreover, reference runs when the machine is switched on or after a power failure are no longer required as the current position value is available immediately. Parallel absolute encoders transmit the position value to the analysing electronics parallel through several cables. In case of serial absolute encoders the output data can be transmitted by means of standardised interfaces and standardised protocols. Whilst in the past frequently point-to-point connections were set up for serial data transmission, field bus systems are being used increasingly today.

FUNCTION

Singleturn

In case of singleturn encoder, a revolution of the encoder (360°) is divided up into a maximum of 65,536 measuring steps (16 Bit). After each complete revolution, the coding process starts at the initial value. The encoder electronics does not recognise how many revolutions have been carried out.

Multiturn

In this configuration, a gear has been integrated – in addition to the disc coded in the singleturn configuration. This gear has been geared down and coded in such a way that up to 16,384 revolutions (14 bit) can be picked up.

Thus, the overall resolution amounts to 16 bit (singleturn resolution) plus 14 bit (speed), totalling 30 bit. On account of the high number of measuring this type of encoder can be used to divide very long linear distances into small measuring steps.

INTERFACES

The Pepperl+Fuchs encoder portfolio includes the most varied range of current interfaces for absolute encoders to be found on the market:

Parallel interface

The emphasis for this interface is on rapid data transfer. Position data is read directly out of the gray-code code disc.

SSI-Interface

The Synchronous Serial Interface (SSI) 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.

AS-Interface

In modern machines and systems, binary sensors are networked extensively with AS-Interface. In order to meet the real-time demands, a multislave solution using the AS-Interface encoder was created.

CAN

Pepperl+Fuchs offers two rotary encoders in accordance with CAN standard:

- CAN open encoder to DSP406 (Class 1 and Class 2)

DeviceNet

The product range is completed by DeviceNet encoders. The integrated interface supports all DeviceNet functions.

PROFIBUS

The absolute encoders in this series satisfy the PROFIBUS profile for encoders, order no. 3.062. Operation is supported based on Class 1 and Class 2.

Ethernet

The Ethernet encoders support the TCP/IP and Powerlink protocols. Parameterisation takes place with the Java Applets provided by the internal Web server.



ABSOLUTE
ENCODERS

					
		ASS58 ASS58-H	ASM58 ASM58-H	AVS58 AVS58-H	AVM58 AVM58-H
Resolution Singleturn		65,536	65,536	65,536	65,536
Resolution Multiturn		1	4,096	1	4,096
Design	[mm]	ø58		ø58	
Flange type		–		clamping flange, servo flange	
Spigot	[mm]	–		ø36, ø50	
Solid shaft	[mm]	–		ø6 x 10, ø10 x 20	
Hollow shaft	[mm]	–		–	
Recessed hollow shaft	[mm]	ø10 x 30, ø12 x 30, ø15 x 30		–	
Max. rotational speed	[min ⁻¹]	6,000		6,000	
Max. shaft load, axial	[N]	–		40	
Max. shaft load, radial	[N]	–		110	
Operating voltage	[V DC]	10 ... 30		10 ... 30	
Interfaces		SSI		SSI	
Output type		RS 422		RS 422	
Selection of counting direction		yes		yes	
LATCH		–		–	
TRISTATE		–		–	
PRESET 1		yes (only ASS58, ASM58)		yes (only AVS58, AVM58)	
PRESET 2		–		–	
Protection Class		IP65		IP65	



ABSOLUTE
ENCODERS

					
		BSS58	BSM58	BVS58	BVM58
Resolution Singleturn		8,192	8,192	8,192	8,192
Resolution Multiturn		1	4,096	1	4,096
Design	[mm]	ø58		ø58	
Flange type		–		clamping flange, servo flange	
Spigot	[mm]	–		ø36, ø50	
Solid shaft	[mm]	–		ø6 x 10, ø10 x 20	
Hollow shaft	[mm]	–		–	
Recessed hollow shaft	[mm]	ø10 x 20, ø12 x 20		–	
Max. rotational speed	[min ⁻¹]	10.000	6.000	12.000	6.000
Max. shaft load, axial	[N]	–		40	
Max. shaft load, radial	[N]	–		60	
Operating voltage	[V DC]	29.5 ... 36.6		29.5 ... 31.6	
Interfaces		AS-Interface		AS-Interface	
Output type		–		–	
Selection of counting direction		yes		yes	
LATCH		yes		yes	
TRISTATE		–		–	
PRESET 1		yes		yes	
PRESET 2		–		–	
Protection Class		IP65		IP65	

CANopen ABSOLUTE ENCODERS

				
	CSS58	CSM58	CVS58	CVM58
Resolution Singleturn	65,536	65,536	65,536	65,536
Resolution Multiturn	1	16,384	1	16,384
Design [mm]	ø58		ø58	
Flange type	–		clamping flange, servo flange	
Spigot [mm]	–		ø36, ø50	
Solid shaft [mm]	–		ø6 x 10, ø10 x 20	
Hollow shaft [mm]	–		–	
Recessed hollow shaft [mm]	ø10 x 30, ø12 x 30, ø15 x 30		–	
Max. rotational speed [min ⁻¹]	12,000		12,000	
Max. shaft load, axial [N]	–		40	
Max. shaft load, radial [N]	–		110	
Operating voltage [V DC]	10 ... 30		10 ... 30	
Interfaces	CANopen		CANopen	
Output type	DSP 406, Class 1 and 2		DSP 406, Class 1 and 2	
Selection of counting direction	yes		yes	
LATCH	–		–	
TRISTATE	–		–	
PRESET 1	yes		yes	
PRESET 2	–		–	
Protection class	IP65		IP65	

DeviceNet™ ABSOLUTE ENCODERS

				
	DSS58	DSM58	DVS58	DVM58
Resolution Singleturn	65,536	65,536	65,536	65,536
Resolution Multiturn	1	16,384	1	16,384
Design [mm]	ø58		ø58	
Flange type	–		clamping flange, servo flange	
Spigot [mm]	–		ø36, ø50	
Solid shaft [mm]	–		ø6 x 10, ø10 x 20	
Hollow shaft [mm]	–		–	
Recessed hollow shaft [mm]	ø10 x 30, ø12 x 30, ø15 x 30		–	
Max. rotational speed [min ⁻¹]	12,000		12,000	
Max. shaft load, axial [N]	–		40	
Max. shaft load, radial [N]	–		110	
Operating voltage [V DC]	10 ... 30		10 ... 30	
Interfaces	DeviceNet		DeviceNet	
Output type	–		–	
Selection of counting direction	yes		yes	
LATCH	–		–	
TRISTATE	–		–	
PRESET 1	yes		yes	
PRESET 2	–		–	
Protection Class	IP65		IP65	



ABSOLUTE ENCODERS

						
		PSS58	PSM58	PVS58	PVM58	PVE14 PVM14
Resolution Singleturn		65,536	65,536	65,536	65,536	8,192 8,192
Resolution Multiturn		1	16,384	1	16,384	1 4,096
Design	[mm]	ø58		ø58		ø116
Flange type		–		clamping flange, servo flange		clamping flange
Spigot	[mm]	–		ø36, ø50		ø40, ø80
Solid shaft	[mm]	–		ø6 x 10, ø10 x 20		–
Hollow shaft	[mm]	–		–		–
Recessed hollow shaft	[mm]	ø10 x 30, ø12 x 30, ø15 x 30		–		–
Max. rotational speed	[min ⁻¹]	6,000		6,000		6,000
Max. shaft load, axial	[N]	–		40		40
Max. shaft load, radial	[N]	–		110		60
Operating voltage	[V DC]	10 ... 30		10 ... 30		18 ... 30
Interfaces		PROFIBUS		PROFIBUS		PROFIBUS
Output type		RS 485		RS 485		RS 485
Selection of counting direction		yes		yes		yes
LATCH		–		–		–
TRISTATE		–		–		–
PRESET 1		yes		yes		yes
PRESET 2		–		–		–
Protection Class		IP65		IP65		IP 65



ETHERNET ABSOLUTE ENCODERS

					
		ESS58	ESM58	EVS58	EVM58
Resolution Singleturn		65,536	65,536	65,536	65,536
Resolution Multiturn		1	16,384	1	16,384
Design	[mm]	ø58		ø58	
Flange type		–		clamping flange, servo flange	
Spigot	[mm]	–		ø36, ø50	
Solid shaft	[mm]	–		ø6 x 10, ø10 x 20	
Hollow shaft	[mm]	–		–	
Recessed hollow shaft	[mm]	ø10 x 30, ø12 x 30, ø15 x 30		–	
Max. rotational speed	[min ⁻¹]	6,000		6,000	
Max. shaft load, axial	[N]	–		40	
Max. shaft load, radial	[N]	–		110	
Operating voltage	[V DC]	10 ... 30		10 ... 30	
Interfaces		Ethernet: TCP/IP or Powerlink		Ethernet: TCP/IP or Powerlink	
Scale of resolution		yes		yes	
PRESET		yes		yes	
Protection Class		IP65		IP65	

ABSOLUTE ENCODERS



FSS58



FVS58

Resolution Singleturn		65,536
Design	[mm]	ø58
Flange type		– clamping flange, servo flange
Spigot	[mm]	– ø36, ø50
Solid shaft	[mm]	– ø6 x 10, ø10 x 20
Hollow shaft	[mm]	–
Recessed hollow shaft	[mm]	ø10 x 30, ø12 x 30, ø15 x 30 –
Max. rotational speed	[min ⁻¹]	12,000 12,000
Max. shaft load, axial	[N]	– 40
Max. shaft load, radial	[N]	– 60
Operating voltage	[V DC]	10 ... 30
Interfaces		parallel
Output type		push-pull
Selection of counting direction		yes
LATCH		yes
TRISTATE		–
PRESET 1		yes
PRESET 2		–
Protection Class		IP65

ABSOLUTE ENCODERS



FSM58

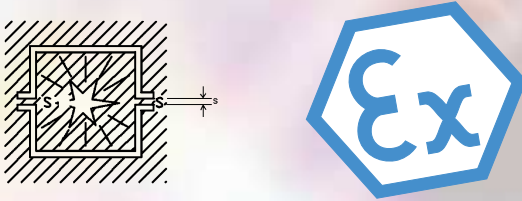


FVM58

Resolution Singleturn		65,536
Resolution Multiturn		16,384
Design	[mm]	ø58
Flange type		clamping flange, servo flange
Spigot	[mm]	ø36, ø50
Solid shaft	[mm]	– ø6 x 10, ø10 x 20
Recessed hollow shaft	[mm]	ø10 x 30, ø12 x 30, ø15 x 30 –
Max. rotational speed	[min ⁻¹]	12,000
Max. shaft load, axial	[N]	–
Max. shaft load, radial	[N]	–
Operating voltage	[V DC]	10 ... 30
Interfaces		parallel
Output type		push-pull
Selection of counting direction		yes
LATCH		yes
TRISTATE		–
PRESET 1		yes
PRESET 2		–
Protection class		IP65

Pepperl+Fuchs offers rotary encoders with two different ignition protection types. It is distinguished between the ignition protection type “flame proof enclosure” (EEx d) and the ignition protection type “Intrinsic Safety” (EEx i).

Ignition protection type EEx d (DIN EN 50016/VDE/0170/0171 section 5)



Devices of ignition protection type EEx d are designed in a way that their housings are not damaged in case of an explosion of an explosive mixture inside the housing. Thus, a propagation of the explosion to the surrounding explosive atmosphere is prevented. The following devices are available:

■ Incremental encoders:

- Series 14 with parallel push-pull interface

■ Absolute encoders:

- Series AVE14 and AVM14 with SSI interface
- Series BVE14 and BVM14 with AS-Interface
- Series CVE14 and CVM14 with CAN interface
- Series SCS14 with parallel push-pull interface

Ignition protection class EEx i (DIN EN 50020)

In case of the ignition protection type EEx i the values of the voltage and the current are kept at such a low level that the occurrence of an ignition spark is prevented, thus preventing the ignition of an explosive atmosphere. The following devices are designed in accordance with this ignition protection type:

■ Incremental encoders:

- Series RVI84 and TRD-G with NAMUR¹⁾ interface in accordance with DIN EN 60947-5-6.

NAMUR sensors, two-wire

NAMUR sensors in accordance with DIN EN 60947-5-6 are two-wire sensors.

¹⁾ NAMUR: Normenarbeitsgemeinschaft für Mess- und Regeltechnik der chemischen Industrie

EX-ENCODERS INCREMENTAL ENCODERS

		
	Series 14	RVi84
Ex-designation	Ⓔ EEx d IIC T6	Ⓔ EEx ia IIC T6
EC-type examination certificate	ZELM 02 ATEX, 0078	PTB 99 ATEX, 2219 X
Number of pulses	≤ 5,000	≤ 25
Design [mm]	ø116	ø78
Flange type	clamping flange	servo flange
Spigot [mm]	ø40	ø56
Solid shaft [mm]	ø12 x 25	ø10 x 23
Hollow shaft [mm]	–	–
Recessed hollow shaft [mm]	–	–
Max. rotational speed [min ⁻¹]	6,000	3,000
Max. shaft load, axial [N]	60	50
Max. shaft load, radial [N]	80	100
Operating voltage [V DC]	5 or 10 ... 30	8
Output type	push-pull, RS 422	NAMUR
Max. output frequency [kHz]	100	5
Signal outputs	A, $\bar{A}$, B, $\bar{B}$, 0, $\bar{0}$	A, B
Protection Class	IP66	IP65

EX-ENCODERS ABSOLUTE ENCODERS

EX-ENCODERS ABSOLUTE ENCODERS						
	AVE14	AVM14	BVE14	BVM14	CVE14	CVM14
	Ex-designation		⊕ EEx d II C T6		⊕ EEx d II C T6	
	EC-type examination certificate		ZELM 02 ATEX 0078		ZELM 02 ATEX 0078	
	Resolution Singleturn		4,096	4,096	8,192	8,192
	Resolution Multiturn		1	4,096	1	4,096
	Design [mm]		ø116		ø116	
	Flange type		clamping flange		clamping flange	
	Spigot [mm]		ø40		ø40	
	Solid shaft [mm]		ø12 x 25		ø12 x 25	
Hollow shaft [mm]		–		–		
Recessed hollow shaft [mm]		–		–		
Max. rotational speed [min ⁻¹]		6,000		6,000		
Max. shaft load, axial [N]		40		40		
Max. shaft load, radial [N]		60		60		
Operating voltage [V DC]		18 ... 30		29.5 ... 31.6		
Interfaces		SSI		AS-Interface		
Output type		RS 422		–		
Selection of counting direction		yes		yes		
LATCH		–		yes		
TRISTATE		–		–		
PRESET 1		–		yes		
PRESET 2		–		–		
Protection class		IP66		IP66		

MOUNTING AIDS

- Eccentric clamping elements
- Mounting brackets
- Mounting bell



COUPLING

- Spring steel coupling
- Spring disc coupling
- Bellows coupling
- Precision coupling
- Helical coupling



MEASURING WHEELS

- Circumference 200 mm
- Circumference 500 mm
- Plastic
- Pimped rubber
- Knurled aluminium
- Knurled plastic



CABLE SOCKETS

- Amphenol
- Coninvers
- SUB-D
- Souriau
- Binder



CABLE PULLS

- Measuring range 1,000 mm
- Measuring range 2,000 mm
- Measuring range 3,000 mm
- Measuring range 5,000 mm
- Measuring range 15,000 mm



EVALUATION

- Counters





FACTORY AUTOMATION



SIGNALS FOR THE WORLD OF AUTOMATION

For half a century Pepperl+Fuchs has been continually providing new impetus to the world of automation. We develop, manufacture and market electronic sensors and interface modules through our worldwide network. Our global presence and highly flexible production and service organisations enable us to offer you complete individual solutions – right where you need us! We know what we are talking about – because today Pepperl+Fuchs is the company with the largest selection of industrial sensor technology in the world – serving an exceptionally broad spectrum of applications.

Our signals move the World.



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SIGNALS FOR THE WORLD OF AUTOMATION