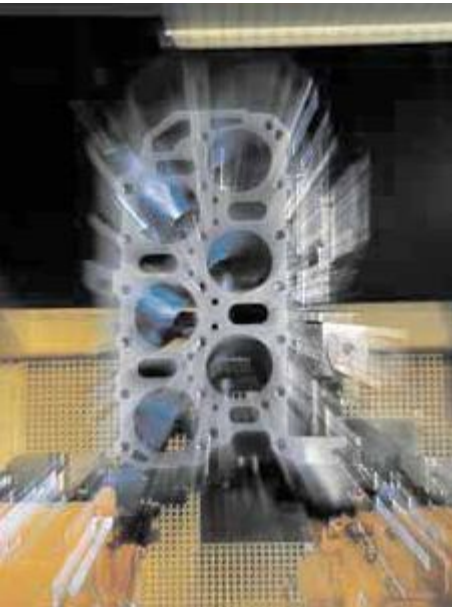


Measuring systems SIMODRIVE sensor

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For products approved for Canada and U.S.A., see Appendix.

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Introduction

Overview



SIMODRIVE sensors are built-on optoelectronic rotary encoders for the recording of paths, angles of rotation, or speeds of machines. They can be used in conjunction with numerical controllers, programmable logic controllers, drives and position displays, e.g. for:

- SINAMICS drive systems
- SIMOTION Motion Control systems
- SINUMERIK CNCs
- SIMATIC programmable logic controllers
- SIMODRIVE and SIMOVERT MASTERDRIVES drive systems

Application

A distinction is made between incremental and absolute measuring procedures:

- In the case of incremental encoders, the machine must travel to a reference point after each power-off state, as the position is not usually stored in the controller, and movements of the machine while the power is off are not recorded.
- Absolute encoders, on the other hand, also record these movements while the power is off and return the actual position with power On. Travel to a reference point is not necessary.

Design

All encoders are available in Synchro flange and supported flange joint versions. Encoders with a Synchro flange can be attached to the machine with 3 clamp straps or mounted with axial screws. The encoder is driven by means of a plug-in coupling or a spring disk coupling. Alternatively, pulleys can also be used.

The encoder supply voltage is 5 V DC or alternatively 10 V to 30 V DC. The 10 V to 30 V DC version supports longer cable lengths. Most control systems apply the supply voltage directly on the measuring circuit connector.

For rotary encoders with cables, the cable length including the connector is 1 m (3.28 ft).

The following bending radii for the cables at the encoder must be complied with:

- One-time bending: ≥ 20 mm (0.79 in)
- Continuous bending: ≥ 75 mm (2.95 in)

Incremental encoders

Function



Incremental encoders deliver a defined number of electrical pulses per rotation, which represent the measurement of the traveled distance or angle.

Incremental encoders operate on the principle of optoelectronic scanning of dividing disks with the transmitted light principle. The light source is a light emitting diode (LED). The light-dark modulation generated as the encoder shaft rotates is picked up by photoelectronic elements. With an appropriate arrangement of the line pattern on the dividing disk connected to the shaft and the fixed aperture, the photoelectronic elements provide two trace signals A and B at 90° to one another, as well as a reference signal R. The encoder electronics amplify these signals and convert them into different output levels.

The following output levels are available:

- RS 422 difference signals (TTL)
In the case of RS 422 encoders (TTL), the resolution can be improved by a factor of four by means of edge evaluation.
- sin/cos $1 V_{pp}$ analog signals
Even better resolution can be achieved for encoders with sinusoidal signals by interpolating them in the higher-level controller.
- HTL (High Voltage Transistor Logic)
Encoders with HTL interfaces are designed for applications with digital inputs with 24 V levels.

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Incremental encoders

Technical specifications

Product name	TTL (RS 422) incremental encoder	sin/cos 1 V _{pp} incremental encoder	HTL incremental encoder	TTL (RS 422) double-track incremental encoder
Operating voltage V_p on encoder	5 V DC ± 10 % or 10 ... 30 V DC	5 V DC ± 10 %	10 ... 30 V DC	5 V DC ± 5 %
Limit frequency, typical	–	≥ 180 kHz (- 3 dB) ≥ 450 kHz (- 6 dB)	–	–
Scanning frequency, max.	300 kHz	–	300 kHz	Track 1: 160 kHz Track 2: 1 MHz
No-load current consumption, max.	150 mA	150 mA	150 mA	150 mA per track
Signal level	TTL (RS 422)	sinusoidal 1 V _{pp}	V _H ≥ 21 V at I _H = 20 mA at 24 V V _L ≤ 2.8 V at I _L = 20 mA at 24 V	TTL (RS 422)
Outputs protected against short-circuit to 0 V	Yes	Yes	Yes	Yes
Switching time (10 ... 90 %) (1 m (3.28 ft) cable and recommended input circuit)	Rise/fall time t _r /t _f ≤ 50 ns	–	Rise/fall time t _r /t _f ≤ 200 ns	Rise/fall time t _r /t _f ≤ 100 ns
Phase angle, signal A to B Edge spacing, min. at	90°	90° ± 10°el.	90°	90°
• 1 MHz	–	–	–	Track 2: ≥ 0.125 μs
• 300 kHz	≥ 0.45 μs	–	≥ 0.45 μs	–
• 160 kHz	–	–	–	Track 1: ≥ 0.8 μs
Cable length to downstream electronics¹⁾, max.	100 m (328 ft)	150 m (492 ft)	300 m (984 ft)	Up to 500 kHz: 100 m (328 ft) Up to 1 MHz: 50 m (164 ft)
LED failure monitoring	High-resistance driver	–	High-resistance driver	–
Resolution, max.	5 000 S/R	2 500 S/R	2 500 S/R	Track 1: 1 024 S/R Track 2: 9 000 S/R
Accuracy (in angular seconds)	± 18° mech. x 3 600/ number of signals/revolution z	± 18° mech. x 3 600/ number of signals/revolution z	± 18° mech. x 3 600/ number of signals/revolution z	Track 1: ± 63 Track 2: ± 12
Speed, max.				
• Electrical	(18 × 10 ⁶ rpm)/ number of signals/revolution	(27 × 10 ⁶ rpm)/ number of signals/revolution (at - 6 dB)	(18 × 10 ⁶ rpm)/ number of signals/revolution	Track 1: 9 000 rpm Track 2: 6 500 rpm
• Mechanical	12 000 rpm	12 000 rpm	12 000 rpm	12 000 rpm
Friction torque (at 20 °C) (68 °F)	≤ 0.01 Nm (0.08 lb _f -in)	≤ 0.01 Nm (0.08 lb _f -in)	≤ 0.01 Nm (0.08 lb _f -in)	≤ 0.01 Nm (0.08 lb _f -in)
Starting torque (at 20 °C) (68 °F)	≤ 0.01 Nm (0.08 lb _f -in)	≤ 0.01 Nm (0.08 lb _f -in)	≤ 0.01 Nm (0.08 lb _f -in)	≤ 0.01 Nm (0.08 lb _f -in)
Shaft loading capacity				
• n > 6 000 rpm				
- Axial	10 N (2.25 lb _f)	10 N (2.25 lb _f)	10 N (2.25 lb _f)	–
- Radial at shaft extension	20 N (4.50 lb _f)	20 N (4.50 lb _f)	20 N (4.50 lb _f)	–
• n ≤ 6 000 rpm				
- Axial	40 N (8.99 lb _f)	40 N (8.99 lb _f)	40 N (8.99 lb _f)	10 N (2.25 lb _f)
- Radial at shaft extension	60 N (13.5 lb _f)	60 N (13.5 lb _f)	60 N (13.5 lb _f)	20 N (4.50 lb _f)
Angular acceleration, max.	10 ⁵ rad/s ²	10 ⁵ rad/s ²	10 ⁵ rad/s ²	10 ⁵ rad/s ²
Moment of inertia of rotor	1.45 × 10 ⁻⁶ kgm ² (12.8 × 10 ⁻⁶ lb _f -in-s ²)	1.45 × 10 ⁻⁶ kgm ² (12.8 × 10 ⁻⁶ lb _f -in-s ²)	1.45 × 10 ⁻⁶ kgm ² (12.8 × 10 ⁻⁶ lb _f -in-s ²)	20 × 10 ⁻⁶ kgm ² (177 × 10 ⁻⁶ lb _f -in-s ²)
Vibration (55 ... 2 000 Hz) to EN 60068-2-6	≤ 300 m/s ² (984 ft/s ²)	≤ 300 m/s ² (984 ft/s ²)	≤ 300 m/s ² (984 ft/s ²)	≤ 100 m/s ² (328 ft/s ²)
Shock to EN 60068-2-27				
• 2 ms	≤ 2 000 m/s ² (6 562 ft/s ²)	≤ 2 000 m/s ² (6 562 ft/s ²)	≤ 2 000 m/s ² (6 562 ft/s ²)	–
• 6 ms	≤ 1 000 m/s ² (3 281 ft/s ²)	≤ 1 000 m/s ² (3 281 ft/s ²)	≤ 1 000 m/s ² (3 281 ft/s ²)	≤ 1 000 m/s ² (3 281 ft/s ²)

S/R = signals/revolution

¹⁾ With recommended cable and input circuitry of the downstream electronics, observe max. permissible cable length of module to be evaluated

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Incremental encoders

Technical specifications (continued)

Product name	TTL (RS 422) incremental encoder	sin/cos 1 V _{pp} incremental encoder	HTL incremental encoder	TTL (RS 422) double-track incremental encoder
Ambient temperature				
<u>Operation</u>				
• Flange outlet or fixed cable				
- At V _p = 5 V ± 10 %	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +100 °C (-40 ... +212 °F)	-10 ... +70 °C (+14 ... +158 °F)
- At V _p = 10 ... 30 V	-40 ... +70 °C (-40 ... +158 °F)	–	–	–
• Flexible cable				
- At V _p = 5 V ± 10 %	-10 ... +100 °C (+14 ... +212 °F)	-10 ... +100 °C (+14 ... +212 °F)	-10 ... +100 °C (+14 ... +212 °F)	-10 ... +70 °C (+14 ... +158 °F)
- At V _p = 10 ... 30 V	-10 ... +70 °C (+14 ... +158 °F)	–	–	–
Degree of protection to EN 60529 (IEC 60529)				
• Without shaft input	IP67	IP67	IP67	IP67
• With shaft input	IP64	IP64	IP64	IP64
EMC				
	Tested in accordance with the guidelines for electromagnetic compatibility 89/336/EEC and the regulations of the EMC guidelines (applicable basic standards)			
Weight, approx.	0.25 kg (0.55 lb)	0.25 kg (0.55 lb)	0.25 kg (0.55 lb)	0.7 kg (1.54 lb)
CE mark	Yes	Yes	Yes	Yes

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Incremental encoders

Selection and ordering data

Designation	Order No.
TTL (RS 422) incremental encoder	
<u>Synchro flange and 5 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-2G ■■■
• Radial flange outlet	6FX2001-2E ■■■
• Cable 1 m (3.28 ft) with connector ¹⁾	6FX2001-2C ■■■
<u>Synchro flange and 10 ... 30 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-2H ■■■
• Radial flange outlet	6FX2001-2F ■■■
• Cable 1 m (3.28 ft) with connector ¹⁾	6FX2001-2D ■■■
<u>Supported flange joint and 5 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-2R ■■■
• Radial flange outlet	6FX2001-2P ■■■
• Cable 1 m (3.28 ft) with connector ¹⁾	6FX2001-2M ■■■
<u>Supported flange joint and 10 ... 30 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-2S ■■■
• Radial flange outlet	6FX2001-2Q ■■■
• Cable 1 m (3.28 ft) with connector ¹⁾	6FX2001-2N ■■■
<u>Resolution</u>	
500 S/R	A 5 0
1 000 S/R	B 0 0
1 024 S/R	B 0 2
1 250 S/R	B 2 5
1 500 S/R	B 5 0
2 000 S/R	C 0 0
2 048 S/R	C 0 4
2 500 S/R	C 5 0
3 600 S/R	D 6 0
5 000 S/R	F 0 0

S/R = signals/revolution

Designation	Order No.
sin/cos 1 V_{pp} incremental encoder	
<u>Synchro flange and 5 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-3G ■■■
• Radial flange outlet	6FX2001-3E ■■■
• Cable 1 m (3.28 ft) with connector ¹⁾	6FX2001-3C ■■■
<u>Resolution</u>	
1 000 S/R	B 0 0
1 024 S/R	B 0 2
2 500 S/R	C 5 0
HTL incremental encoder	
<u>Synchro flange and 10 ... 30 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-4H ■■ 0
• Radial flange outlet	6FX2001-4F ■■ 0
• Cable 1 m (3.28 ft) with connector ¹⁾	6FX2001-4D ■■ 0
<u>Supported flange joint and 10 ... 30 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-4S ■■ 0
• Radial flange outlet	6FX2001-4Q ■■ 0
• Cable 1 m (3.28 ft) with connector ¹⁾	6FX2001-4N ■■ 0
<u>Resolution</u>	
100 S/R	A 1
500 S/R	A 5
1 000 S/R	B 0
2 500 S/R	C 5
TTL (RS 422) double-track incremental encoder	
<u>Synchro flange and 5 V DC supply voltage</u>	
Connection:	
• Cable 1 m (3.28 ft) with axial connector 2 types of resolution: 9 000/1 024 S/R	6FX2001-2UK00

¹⁾ Universal integrated cable outlet for axial and radial outlet direction.

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Absolute encoders

Function

Absolute encoders (absolute shaft encoders) are designed on the same scanning principle as incremental encoders, but have a greater number of tracks. For example, if there are 13 tracks, then $2^{13} = 8\,192$ steps are coded in the case of single-turn encoders. The code used is a one-step code (gray code), which prevents any scanning errors from occurring.

After switching on the machine, the position value is transmitted immediately to the controller. There is no need to travel to a reference point.

SSI and EnDat absolute encoders are of advantage in time-critical applications.

In plants with a large number of encoders, PROFIBUS DP is more of an advantage due to the reduced wiring overhead. PROFIBUS DP encoders are programmable and support isochronous mode with internode communication.

Single-turn encoders divide one rotation (360° mechanical) into a specific number of steps, e.g. 8 192. A unique code word is assigned to each position. After 360° the position values are repeated.

Multi-turn encoders also record the number of revolutions, in addition to the absolute position within one revolution. To do this, further code discs which are coupled via gear steps with the encoder shaft are scanned. When evaluating 12 additional tracks, this means that $2^{12} = 4\,096$ revolutions can be coded.



Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Absolute encoders

Technical specifications

Product name	SSI absolute encoder	EnDat absolute encoder	PROFIBUS DP absolute encoder (EN 50170)
Operating voltage V_p on encoder	10 ... 30 V DC	5 V DC \pm 5%	10 ... 30 V DC
Power consumption, approx.			
• Single-turn	160 mA	160 mA	300 ... 100 mA (2.5 W)
• Multi-turn	200 mA	200 mA	300 ... 100 mA (2.5 W)
Interface	SSI	EnDat	PROFIBUS
Clock input	Differential cable receiver according to EIA standard RS 485	Differential cable receiver according to EIA standard RS 485	Differential cable receiver according to EIA standard RS 485
Data output	Differential cable driver according to EIA standard RS 485	Differential cable driver according to EIA standard RS 485	Differential cable driver according to EIA standard RS 485
Short-circuit strength	Yes	Yes	Yes
Data transfer rate	100 kHz ... 1 MHz	100 kHz ... 2 MHz	12 Mbit/s
LED for diagnostics	–	–	Yes (green/red)
Speed, max.			
• Electrical	–	–	–
- At \pm 1 bit accuracy	5 000 rpm	5 000 rpm	5 800 rpm
- At \pm 100 bit accuracy	10 000 rpm	10 000 rpm	–
• Mechanical			
- Single-turn	12 000 rpm	12 000 rpm	12 000 rpm
- Multi-turn	10 000 rpm	10 000 rpm	6 000 rpm
Cable length to downstream electronics¹⁾, max.	Up to 1-MHz-cycle: 50 m (164 ft) Up to 300-kHz-cycle: 100 m (328 ft) Up to 100-kHz-cycle: 400 m (1 312 ft)	Up to 1-MHz-cycle: 50 m (164 ft) Up to 300-kHz-cycle: 150 m (492 ft)	Up to 12 Mbit/s: 100 m (328 ft) Up to 1.5 Mbit/s: 200 m (656 ft) Up to 93.75 kbit/s: 1 200 m (3 937 ft)
Number of nodes	–	–	99
Connection	Flange outlet, axial/radial	Flange outlet, axial/radial	Terminal block with address selector switch and bus terminating resistor in removable cover with 3 radial cable glands
Cable diameter	–	–	6.5 ... 9 mm (0.26 ... 0.35 in) Removal of cover possible without interrupting bus
Resolution			
• Single-turn	13 bit (8 192 steps)	13 bit (8 192 steps)	13 bit (8 192 steps)
• Multi-turn	25 bit (8 192 \times 4 096 steps)	25 bit (8 192 \times 4 096 steps)	27 bit (8 192 \times 16 384 steps)
Message frame length			
• Single-turn	13 bit, without parity	According to EnDat specification	–
• Multi-turn	25 bit, without parity	According to EnDat specification	–
Incremental track	–	512 S/R, 1 V_{pp}	–
Code type			
• Sampling	Gray	Gray	Gray
• Transfer	Gray, fir tree format	Binary	Binary

¹⁾ Observe the maximum permissible cable length of the connected module.

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Absolute encoders

Technical specifications (continued)

Product name	SSI absolute encoder	EnDat absolute encoder	PROFIBUS DP absolute encoder (EN 50170)
Parameterization capability			
• Resolution per revolution	–	–	Arbitrary 1 ... 8 192
• Total resolution	–	–	Arbitrary 1 ... 16 384
• Preset	Set to zero	–	Arbitrary
• Counting direction	Yes	–	Yes
• Speed signal	–	–	Yes
• Limit switches	–	–	Yes, 2
• Isochronous mode and internode communication acc. to DP V2	–	–	Yes
Online parameterization	–	–	Yes
Network load, approx.	–	–	20 µs per encoder at 12 Mbit/s
Cycle time	–	–	667 µs
Accuracy	±60 angular seconds	±60 angular seconds (incr. track)	±½ LSB
EMC	Tested in accordance with EN 50081 and EN 50082	Tested in accordance with EN 50081 and EN 50082	Tested in accordance with EN 50081 and EN 50082
Friction torque (at 20 °C) (68 °F)	≤0.01 Nm (0.08 lb _f -in)	≤0.01 Nm (0.08 lb _f -in)	≤0.01 Nm (0.08 lb _f -in)
Starting torque (at 20 °C) (68 °F)	≤0.01 Nm (0.08 lb _f -in)	≤0.01 Nm (0.08 lb _f -in)	≤0.01 Nm (0.08 lb _f -in)
Shaft loading capacity			
• $n > 6\,000$ rpm			
- Axial	10 N (2.25 lb _f)	10 N (2.25 lb _f)	10 N (2.25 lb _f)
- Radial at shaft extension	20 N (4.50 lb _f)	20 N (4.50 lb _f)	20 N (4.50 lb _f)
• $n \leq 6\,000$ rpm			
- Axial	40 N (8.99 lb _f)	40 N (8.99 lb _f)	40 N (8.99 lb _f)
- Radial at shaft extension	60 N (13.5 lb _f)	60 N (13.5 lb _f)	110 N (24.7 lb _f)
Angular acceleration, max.	10^5 rad/s ²	10^5 rad/s ²	10^5 rad/s ²
Moment of inertia of rotor			
• Solid shaft	1.45×10^{-6} kgm ² (12.8×10^{-6} lb _f -in-s ²)	1.45×10^{-6} kgm ² (12.8×10^{-6} lb _f -in-s ²)	1.90×10^{-6} kgm ² (16.8×10^{-6} lb _f -in-s ²)
• Hollow shaft	–	–	2.80×10^{-6} kgm ² (24.8×10^{-6} lb _f -in-s ²)
Vibration (55 ... 2 000 Hz) to EN 60068-2-6	≤300 m/s ² (984 ft/s ²)	≤300 m/s ² (984 ft/s ²)	≤100 m/s ² (328 ft/s ²)
Shock to EN 60068-2-27			
• 2 ms	≤2 000 m/s ² (6 562 ft/s ²)	≤2 000 m/s ² (6 562 ft/s ²)	≤2 000 m/s ² (6 562 ft/s ²)
• 6 ms	≤1 000 m/s ² (3 281 ft/s ²)	≤1 000 m/s ² (3 281 ft/s ²)	≤1 000 m/s ² (3 281 ft/s ²)
Ambient temperature			
• Operation	-40 ... +85 °C (-40 ... +185 °F)	-40 ... +100 °C (-40 ... +212 °F)	-40 ... +85 °C (-40 ... +185 °F)
Degree of protection to EN 60529 (IEC 60529)			
• Without shaft input	IP67	IP67	IP67
• With shaft input	IP64	IP64	IP64
Weight, approx.			
• Single-turn	0.35 kg (0.77 lb)	0.35 kg (0.77 lb)	0.5 kg (1.10 lb)
• Multi-turn	0.35 kg (0.77 lb)	0.35 kg (0.77 lb)	0.7 kg (1.54 lb)
CE mark	Yes	Yes	Yes
PROFIBUS certificate	–	–	Yes
Supported profiles	–	–	Class 1, Class 2

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Absolute encoders

Selection and ordering data

Designation	Order No.
SSI absolute encoder	
<u>Synchro flange and 10 ... 30 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-5HS ■■
• Radial flange outlet	6FX2001-5FS ■■
<u>Supported flange joint and 10 ... 30 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-5SS ■■
• Radial flange outlet	6FX2001-5QS ■■
<u>Resolution</u>	
• Single-turn 8 192 steps/revolution (13 bit)	1 2
• Multi-turn 8 192 steps/revolution, 4 096 revolutions (25 bit)	2 4
EnDat absolute encoder	
<u>Synchro flange and 5 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-5HE ■■
• Radial flange outlet	6FX2001-5FE ■■
<u>Supported flange joint and 5 V DC supply voltage</u>	
Connection:	
• Axial flange outlet	6FX2001-5SE ■■
• Radial flange outlet	6FX2001-5QE ■■
<u>Resolution</u>	
• Single-turn 8 192 steps/revolution (13 bit)	1 3
• Multi-turn 8 192 steps/revolution, 4 096 revolutions (25 bit)	2 5

Designation	Order No.
PROFIBUS DP absolute encoder (EN 50170)	
<u>10 ... 30 V DC supply voltage</u>	
<u>Radial connection</u>	
• Synchro flange Solid shaft	6FX2001-5FP ■■
• Supported flange joint Solid shaft	6FX2001-5QP ■■
• Torque bracket Hollow shaft 8 mm/10 mm/12 mm/15 mm (0.31 in/0.39 in/0.47 in/0.59 in)	6FX2001-5WP ■■
<u>Resolution</u>	
• Single-turn 8 192 steps/revolution (13 bit)	1 2
• Multi-turn 8 192 steps/revolution, 16 384 revolutions (27 bit)	2 4
User Manual	6SN1197-0AB10-0YP4
For start-up and parameterization of PROFIBUS encoders Language: English/German	

More information

Designation	Order No.
Decentralizing with PROFIBUS DP	ISBN3-89578-074-X

Measuring systems SIMODRIVE sensor

Built-on optoelectronic rotary encoders

Mounting accessories

Overview



Clamp straps/couplings

Clamp straps and couplings are available as mounting accessories for the rotary encoders. The clamp straps are used to fix the encoders with a Synchro flange.

Mating connector

A mating connector is available for the encoder with flange outlet or with cable and encoder connector for cable diameters 5.5 mm (0.22 in) to 12 mm (0.47 in). Connectors with 12 contacts are suitable for all incremental encoders, as well as SSI absolute encoders. Connectors with 17 contacts are suitable for EnDat encoders.

Replacement connector

A replacement connector is available for encoders with cable.

Selection and ordering data

Designation	Order No.
Clamp strap For double-track encoders and encoders with Synchro flange (3 units are required)	6FX2001-7KP01
Spring disk coupling Shaft diameter: <ul style="list-style-type: none"> 6 mm/6 mm (0.24 in/0.24 in) 6 mm/5 mm (0.24 in/0.20 in) 	6FX2001-7KF10 6FX2001-7KF06
Plug-in coupling Shaft diameter: <ul style="list-style-type: none"> 6 mm/6 mm (0.24 in/0.24 in) 10 mm/10 mm (0.39 in/0.39 in) 	6FX2001-7KS06 6FX2001-7KS10
Mating connector for flange outlet or encoder connector with cap nut (1 unit) Crimp version, socket contacts for cable diameters 5.5 ... 12 mm (0.22 ... 0.47 in) <ul style="list-style-type: none"> 12-pin, insulator with 12 socket contacts (1 unit) for TTL, sin/cos 1 V_{pp}, HTL incremental encoders or for SSI absolute encoders 17-pin, insulator with 17 socket contacts (1 unit) for EnDat absolute encoders 	6FX2003-0SU12 6FX2003-0SU17
Replacement connectors with external thread for encoders (1 unit) <ul style="list-style-type: none"> 12-pin, insulator with 12 contact pins (1 unit) for RS 422, sin/cos 1 V_{pp}, HTL incremental encoders for SSI absolute encoders 	6FX2003-0SA12

Technical specifications

Product name	Spring disk coupling	Plug-in coupling
Transmission torque, max.	0.8 Nm (2.88 oz _f)	0.7 Nm (2.52 oz _f)
Shaft diameter	6 mm (0.24 in) both ends or d ₁ = 6 mm (0.24 in), d ₂ = 5 mm (0.20 in)	6 mm (0.24 in) both ends or 10 mm (0.39 in) both ends
Center offset of shafts, max.	0.4 mm (0.02 in)	0.5 mm (0.02 in)
Axial offset	±0.4 mm (0.02 in)	±0.5 mm (0.02 in)
Angular displacement of shafts, max.	3°	1°
Torsional rigidity	150 Nm/rad (539.51 oz _f /rad)	31 Nm/rad (111.5 oz _f /rad)
Lateral spring stiffness	6 N/mm (1.35 lb _f)	10 N/mm (2.25 lb _f)
Moment of inertia	19 gcm ² (168 x 10 ⁻⁷ lb _f -in-s ²)	20 gcm ² (177 x 10 ⁻⁷ lb _f -in-s ²)
Speed, max.	12 000 rpm	12 000 rpm
Ambient temperature		
• Operation	-40 ... +150 °C (-40 ... +302 °F)	-40 ... +80 °C (-40 ... +176 °F)
Weight, approx.	16 g (0.56 oz)	20 g (0.71 oz)