Function

SSI/EnDat and PROFIBUS DP absolute encoders, top, and DRIVE-CLiQ and PROFINET IO absolute encoders, bottom

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} = 8192 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.

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

In plants with a large number of encoders, PROFIBUS DP or PROFINET IO are more of an advantage due to the reduced wiring overhead. PROFIBUS DP encoders are programmable and support isochronous mode with slave-to-slave communication. PROFINET IO encoders are programmable as well, they have two additional ports and support RT and IRT operation.

Single-turn encoders

Single-turn encoders divide one rotation (360 degrees mechanical) into a specific number of steps, e.g. 8192. A unique code word is assigned to each position. After 360° the position values are repeated.

Multi-turn encoders

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} = 4096 revolutions can be coded.

Technical specifications

		Absolute encoder with DRIVE-CLiQ 6FX2001-5.D..-0AA1	**SSI absolute encoder** 6FX2001-5.S..	**EnDat absolute encoder** 6FX2001-5.E..
Operating voltage DC U_p on encoder	V	24 - 15 % + 20 %	10 ... 30	5 ± 5 %
Power consumption, approx.				
• Single-turn	mA	245	160	160
• Multi-turn	mA	325	200	200
Interface		DRIVE-CLiQ	SSI	EnDat
Clock input		–	Differential cable receiver according to EIA standard RS485	Differential cable receiver according to EIA standard RS485
Data output		DRIVE-CLiQ	Differential cable driver according to EIA standard RS485	Differential cable driver according to EIA standard RS485
Short-circuit strength		Yes	Yes	Yes
Data transfer rate	Mbit	100	–	–
	kHz	–	100 ... 1000	100 ... 2000
Speed, max.				
• Electrical	rpm	14000	–	–
- At ± 1 bit accuracy	rpm	–	5000	5000
- At ± 100 bit accuracy	rpm	–	10000	10000
• Mechanical				
- Single-turn	rpm	12000	12000	12000
- Multi-turn	rpm	10000	10000	10000
Cable length to downstream electronics, max. [1]	m (ft)	100 (328)	–	–
• Up to 1-MHz-cycle	m (ft)	–	50 (164)	50 (164)
• Up to 300-kHz-cycle	m (ft)	–	100 (328)	150 (492)
• Up to 100-kHz-cycle	m (ft)	–	400 (1312)	–
Connection		DRIVE-CLiQ connector, radial	Flange outlet, axial/radial	Flange outlet, axial/radial

[1] Observe the maximum permissible cable length of the connected module.

Technical specifications (continued)

		PROFIBUS DP absolute encoder 6FX2001-5.P..	PROFINET IO absolute encoder 6FX2001-5.N..
Operating voltage DC U_p on encoder	V	10 ... 30	10 ... 30
Power consumption, approx.			
• Single-turn	mA	300 ... 100 (2.5 W)	400 ... 130 (< 4 W)
• Multi-turn	mA	300 ... 100 (2.5 W)	400 ... 130 (< 4 W)
Interface		PROFIBUS DP-V2	PROFINET IO with RT/IRT
Clock input		Differential cable receiver according to EIA standard RS485	2 IRT ports
Data output		Differential cable driver according to EIA standard RS485	2 IRT ports
Short-circuit strength		Yes	Yes
Data transfer rate	Mbit/s	12	100
LED for diagnostics		Green/red	Green/red/yellow
Speed, max.			
• Electrical			
- At ± 1 bit accuracy	rpm	5800	5800
• Mechanical			
- Single-turn	rpm	12000	12000
- Multi-turn	rpm	6000	6000
Cable length to down-stream electronics, max.[1]	m (ft)	–	85 (279)
• Up to 12 Mbit/s	m (ft)	100 (328)	–
• Up to 1.5 Mbit/s	m (ft)	200 (565)	–
• Up to 93.75 kbit/s	m (ft)	1200 (3937)	–
Number of nodes		99	–
Connection		Terminal block with address selector switch and bus terminating resistor in removable cover with radial cable glands (3 units)	2 × 4-pin M12 connector for PROFINET ports 1 × 4-pin M12 connector for operating voltage
• Cable diameter	mm (in)	6.5 ... 9 (0.26 ... 0.35) Removal of cover possible without interrupting bus	–
Resolution			
• Single-turn	bit	13 (8192 steps)	13 (8192 steps)
• Multi-turn	bit	27 (8192 steps × 16384 revolutions)	27 (8192 steps × 16384 revolutions)
Frame		According to PNO encoder profile V4.1 Class 1, Class 2, Class 3 Standard telegram 81	According to PNO encoder profile V4.1 Class 1, Class 2, Class 3, Class 4 Standard telegrams 81/82/83/84 Siemens telegram 860
Code type			
• Sampling		Gray	Gray
• Transfer		Binary, PROFIBUS	Binary, PROFINET
Network load, approx.			
• At 12 Mbit/s per encoder	µs	20	–
Cycle time	ms	0.667	1 ... 100

[1] Observe the maximum permissible cable length of the connected module.

Technical specifications (continued)

		PROFIBUS DP absolute encoder 6FX2001-5.P..	PROFINET IO absolute encoder 6FX2001-5.N..
Parameterization capability			
• Resolution per revolution		1 ... 8192	1 ... 8192
• Total resolution		1 ... 16384	1 ... 16384
• Preset		Yes	Yes
• Counting direction		Yes	Yes
• Speed signal		Yes	Yes
• Limit switches		Yes, 2 units	No
• Isochronous mode		Yes	Yes
• Slave-to-slave communication		Yes	No
Online parameterization		Yes	Yes
PNO certificate		Yes	Yes
Supported profiles		PNO encoder profile V4.1	PNO encoder profile V4.1
Accuracy with 8192 steps	arcsec	± 79 (± ½ LSB)	± 79 (± ½ LSB)
Friction torque (at 20 °C (68 °F))	Nm (lb_f-in)	≤ 0.01 (0.09)	≤ 0.01 (0.09)
Starting torque (at 20 °C (68 °F))	Nm (lb_f-in)	≤ 0.01 (0.09)	≤ 0.01 (0.09)
Shaft loading capacity			
• n > 6000 rpm			
- Axial	N (lb_f)	10 (2.25)	10 (2.25)
- Radial at shaft extension	N (lb_f)	20 (4.50)	20 (4.50)
• n ≤ 6000 rpm			
- Axial	N (lb_f)	40 (8.99)	40 (8.99)
- Radial at shaft extension	N (lb_f)	110 (24.7)	110 (24.7)
Angular acceleration, max.	rad/s^2	10^5	10^5
Moment of inertia of rotor			
• Solid shaft	kgm^2 (lb_f-in-s^2)	1.90×10^{-6} (16.8×10^{-6})	1.90×10^{-6} (16.8×10^{-6})
• Hollow shaft	kgm^2 (lb_f-in-s^2)	2.80×10^{-6} (24.8×10^{-6})	2.80×10^{-6} (24.8×10^{-6})
Vibration (55 ... 2000 Hz) to EN 60068-2-6	m/s^2 (ft/s^2)	≤ 100 (328)	≤ 100 (328)
Shock to EN 60068-2-27			
• 2 ms	m/s^2 (ft/s^2)	≤ 2000 (6562)	≤ 2000 (6562)
• 6 ms	m/s^2 (ft/s^2)	≤ 1000 (3281)	≤ 1000 (3281)
Degree of protection to EN 60529 (IEC 60529)			
• Without shaft input		IP67	IP67
• With shaft input		IP64	IP64
Ambient temperature			
• Operation	°C (°F)	-40 ... +85 (-40 ... +185)	-40 ... +85 (-40 ... +185)
Weight, approx.			
• Single-turn	kg (lb)	0.4 (0.88)	0.4 (0.88)
• Multi-turn	kg (lb)	0.5 (1.10)	0.5 (1.10)
EMC		Tested in accordance with EN 50081 and EN 50082	Tested in accordance with EN 50081 and EN 50082
Approvals, according to		CE, cULus	CE, cULus

Selection and ordering data

Description	Order No.
Absolute encoder with DRIVE-CLiQ	
24 V DC supply voltage	
Radial connection	
• Synchro flange Solid shaft 6 mm (0.24 in)	**6FX2001-5FD ■■-0AA1**
• Clamp flange Solid shaft 10 mm (0.39 in)	**6FX2001-5QD ■■-0AA1**
• Torque bracket Hollow shaft 10 mm (0.39 in)	**6FX2001-5VD ■■-0AA1**
• Torque bracket Hollow shaft 12 mm (0.47 in)	**6FX2001-5WD ■■-0AA1**
Resolution	
• Single-turn 22 bit	**13**
• Multi-turn 34 bit	**25**
SSI absolute encoder	
10 ... 30 V DC supply voltage	
Synchro flange and connection via	
• Axial flange outlet	**6FX2001-5HS ■■**
• Radial flange outlet	**6FX2001-5FS ■■**
Clamp flange and connection via	
• Axial flange outlet	**6FX2001-5SS ■■**
• Radial flange outlet	**6FX2001-5QS ■■**
Resolution	
• Single-turn 8192 steps/revolution (13 bit)	**12**
• Multi-turn 8192 steps/revolution, 4096 revolutions (25 bit)	**24**
EnDat absolute encoder	
5 V DC supply voltage	
Synchro flange and connection via	
• Axial flange outlet	**6FX2001-5HE ■■**
• Radial flange outlet	**6FX2001-5FE ■■**
Clamp flange and connection via	
• Axial flange outlet	**6FX2001-5SE ■■**
• Radial flange outlet	**6FX2001-5QE ■■**
Resolution	
• Single-turn 8192 steps/revolution (13 bit)	**13**
• Multi-turn 8192 steps/revolution, 4096 revolutions (25 bit)	**25**

Description	Order No.
PROFIBUS DP absolute encoder	
10 ... 30 V DC supply voltage	
Radial connection	
• Synchro flange Solid shaft	**6FX2001-5FP ■■**
• Clamp flange 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 ■■**
Resolution	
• Single-turn 8192 steps/revolution (13 bit)	**12**
• Multi-turn 8192 steps/revolution, 16384 revolutions (27 bit)	**24**
PROFINET IO absolute encoder	
10 ... 30 V DC supply voltage	
Radial connection	
• Synchro flange Solid shaft	**6FX2001-5FN ■■**
• Clamp flange Solid shaft	**6FX2001-5QN ■■**
• Torque bracket Hollow shaft 8 mm/10 mm/12 mm/15 mm (0.31 in/0.39 in/0.47 in/0.59 in)	**6FX2001-5WN ■■**
Resolution	
• Single-turn 8192 steps/revolution (13 bit)	**13**
• Multi-turn 8192 steps/revolution, 16384 revolutions (27 bit)	**25**

More information

Description	Order No.
Decentralization with PROFIBUS DP/DPV1	**ISBN-13: 978-3-89578-218-3**