WayCon
Positionsmesstechnik

DRAW WIRE

Draw Wire Position Transducers - Industrial Series

Series SX

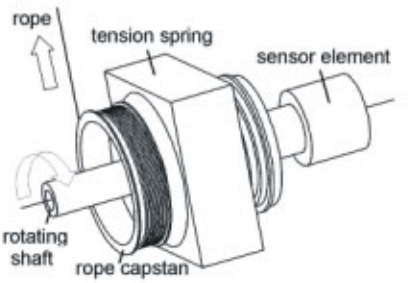
- Ranges 50...40000 mm
- Output types:
  - Analogue: potentiometer, 0...10 V, 4...20mA
  - Digital: RS422/TTL/push-pull
  - Digital-Absolute: SSi-Gray, Parallel-Gray
  - Bus system: Profibus DP, CANopen, DeviceNet, Interbus K3
- Linearity
  - Analogue output ±0,1% of FS
  - Digital/Digital-Absolute/Bus ±0,05% of FS
- Protection class up to IP67
- High dynamics
- Off-shore sensors
- High EMC-grade
- Customised versions available

Introduction

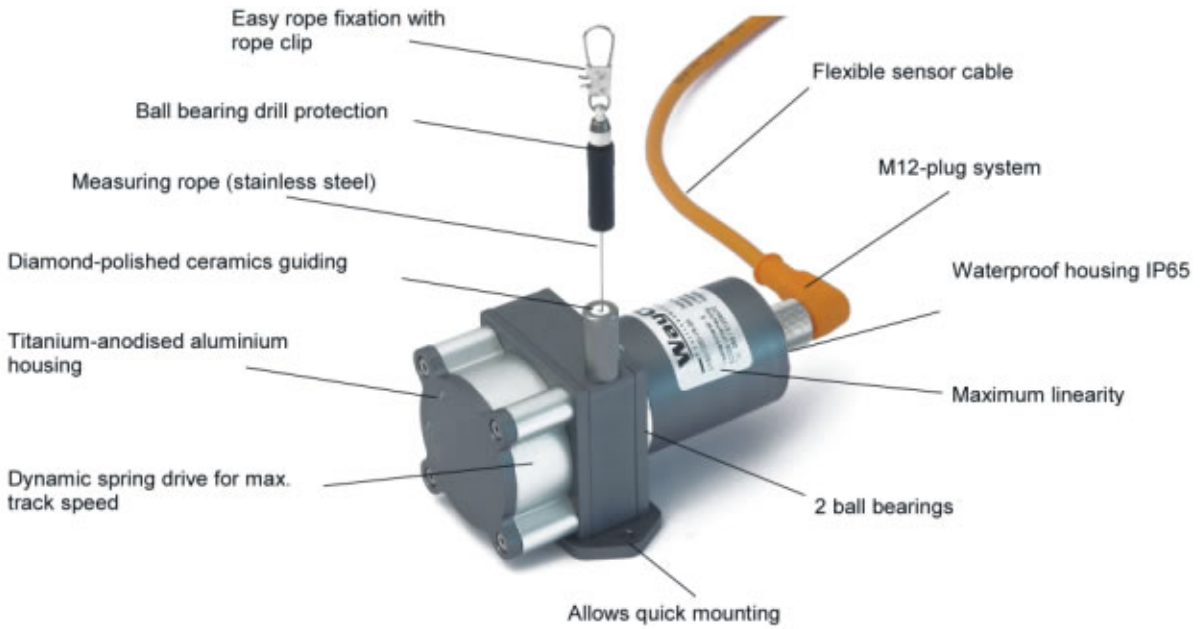
WayCon Positionsmesstechnik GmbH is a manufacturer of high quality draw wire position transducers for industrial use.
Due to its small overall size, its short assembly time and its possible customisation, the SX sensor technology is a cost-effective and flexible solution for a wide range of industrial applications.

A constant spring force coils the measuring rope accurately single-layered on an ultralight rope capstan, so that its linear motion is converted into rotation. The sensor element (encoder) provides the output signal required. The dynamics of the draw wire transducer allows a high motion speed and max. acceleration of the measuring target.
Its high quality makes applications in harsh industrial environments possible. Sensors specifically designed for use off-shore receive a Hart-Coat surface, which makes them resistant to e.g. sea water.

Special instruments with mounting service of encoder on site available, as well as customised versions of housing.



Outline



Applications

- Lifting tables and platforms
- Suspension motorbike/passenger car
- Positioning of fork-lifts
- Level control system
- Portal frames and gantry cranes
- Medical Technology
- Lifting and rescue technology
- x-y-Axis positioning
- Pneumatic cylinder
- Hydraulic cylinder and press slit
- Injection moulding machine
- Crash-tests
- Air frame load testing
- Auto body/carriage deformation
- Robot applications
- Property management
- Linear guides
- Pipe displacement

Options

HG

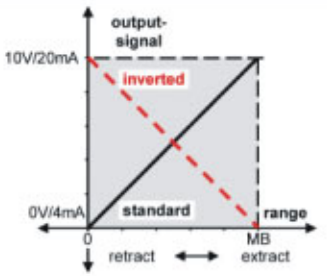
A reinforced spring drive provides a greater traction outwards of the measuring rope and allows a higher max. rope acceleration. Please note the different dimensions of the housing and the higher traction of the rope. This option is available for all sensors of type series SX50.

CO

By the use of a special technology all components of the housing and of the inner mechanics of the sensor become HART-COAT ® coated. This coating is a hartanodic oxidation that protects the sensor from corrosion by aggressive media (e.g. sea water) with a hard ceramics-like layer. The sensor can thus be used off-shore.

IN

The analogue signal of the sensor is increasing with the extraction of the rope (standard).
Option IN inverts the signal, i.e. the signal of the sensor declines with the extraction of the rope.



L05

Improved linearity on 0,05% of measuring range. Resolution, repeatability and sensibility remain unchanged.

IP67

Use Option IP67, if sensor is fully immersed in water (temporarily). Note that with this option there may occur a light hysteresis in the output signal due to the special sealing. The max. acceleration is reduced to 60% of the specified value.

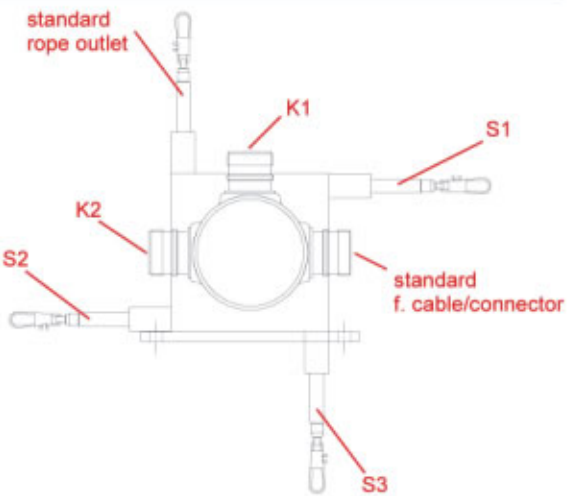
S1/S2/S3

Optional rope outlet (see diagram)
S1 rope outlet on up
S2 rope outlet on down
S3 rope outlet at bottom (suitable for container adjustment)

(S2/S3 with altered plate)

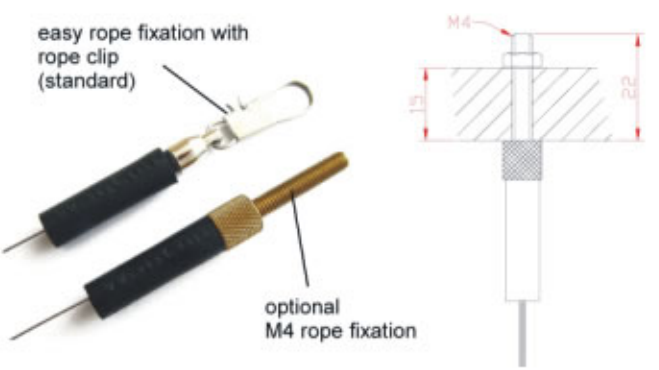
K1/K2

Optional cable/connector orientation
for sensors with digital output/encoder
(see diagram)



M4 rope fixation

Optional rope fixation with screw thread M4. Ideal for attachment to through holes or M4-thread holes.



SX50

max. 1250 mm
Analogue/Digital

Technical data

	Analogue output	Digital output (Incremental)
Ranges	50/125/150/250/375/500/625/1250 mm	625/1250 mm
Output	Potentiometer/0..10 V/4..20 mA (see page 12)	A/B-pulse, 90° phase-delayed (see page 13)
Linearity	0,1 % (0,05%), FS 50/125: 0,5% (0,1%) range 150/250/375/500/625: 0,15%	0,05%
Sensor element	Hybrid potentiometer	Incremental encoder
Connection	M12-connector or PG-cable output	M23-connector or PG-cable output
Protection class	IP65	
Humidity	max. 90% relative, not condensating	
Weight	approx. 330 g	
Housing	aluminium, titanium grey anodised	

Mechanics - characteristics

SX50	Rope Tension		Velocity	Acceleration*	Rope Tension HG-Option		Acceleration*
Range [mm]	Fmin [N]	Fmax [N]	Vmax [m/s]	a max [m/s²]	Fmin [N]	Fmax [N]	a max [m/s²]
50	5,2	5,4	8	85	9,7	10,1	160
125	3,8	4,0	10	100	6,4	6,7	255
150	5,2	5,8	8	85	9,7	10,9	160
250	5,2	6,3	8	85	9,7	11,7	160
375	3,8	4,3	10	100	6,4	7,2	255
500	5,2	7,3	8	85	9,7	13,7	160
625	3,8	4,6	10	100	6,4	7,7	255
1250	3,8	5,4	10	100	6,4	9,1	255

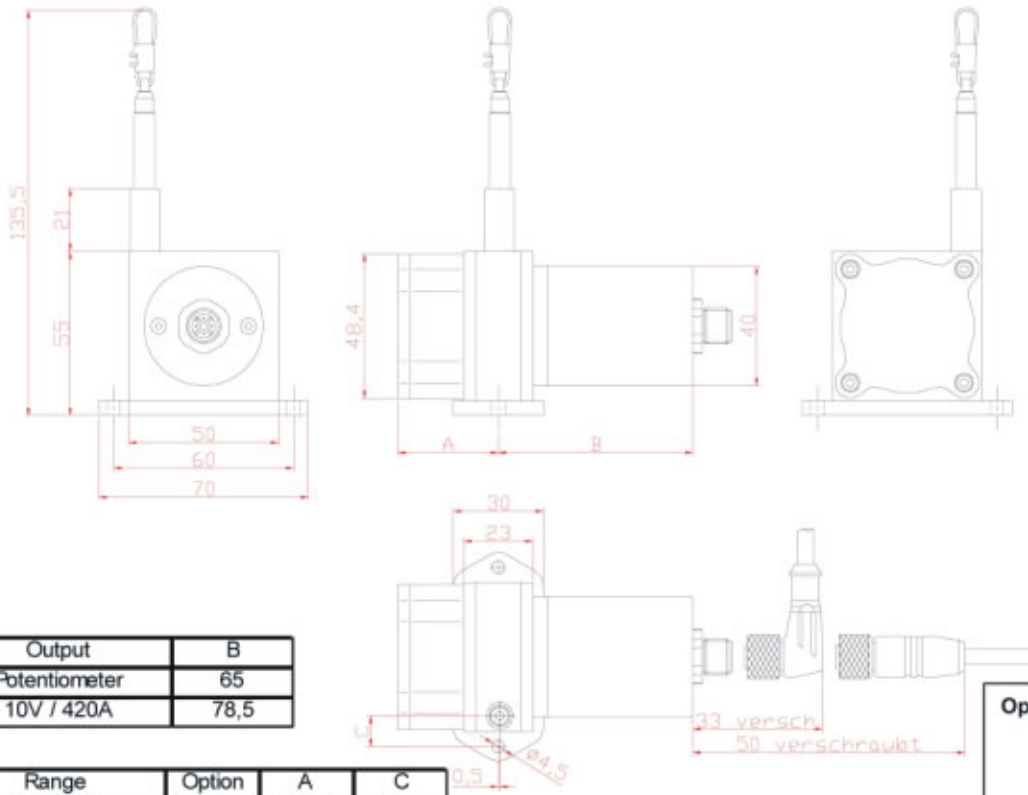
*with option IP67 reduced to 60%

Resolution digital output

Available resolution SX50						Z-puls-distance
[pulses/mm]						[mm]
1	4	8	12	16	28,8	125

Technical drawings SX50

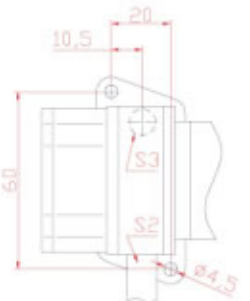
Analogue output



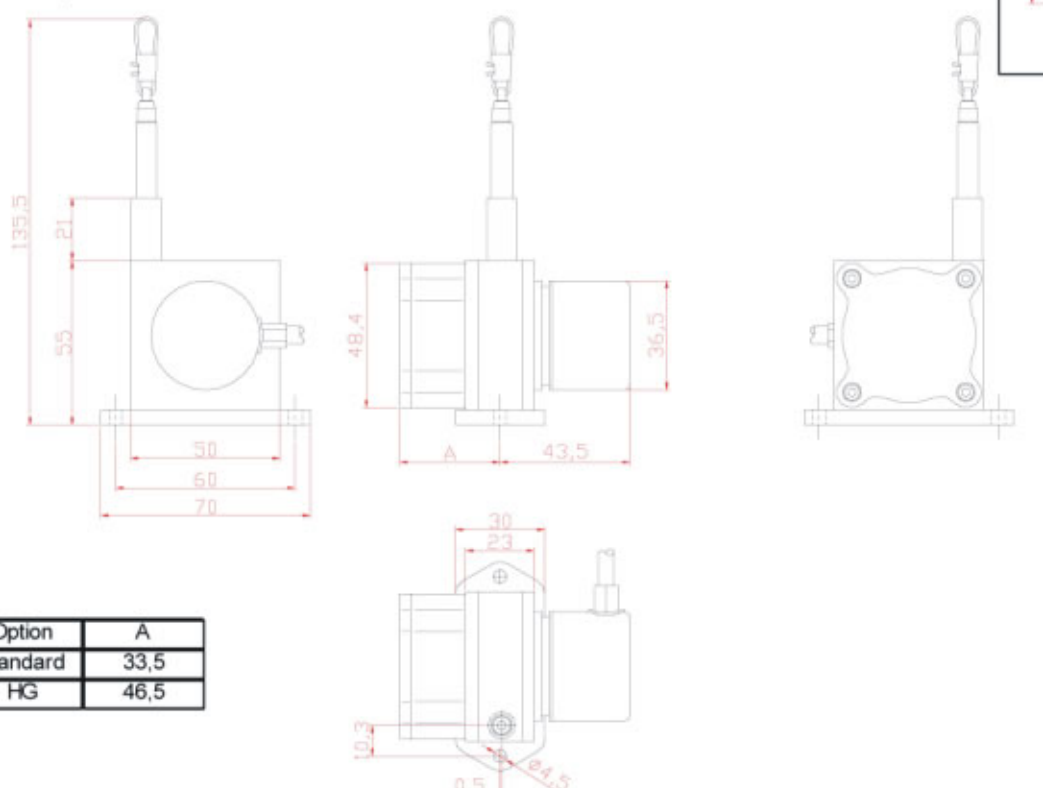
Output	B
Potentiometer	65
10V / 420A	78,5

Range	Option	A	C
50/150/250/500 mm	Standard	26,5	21,6
125/375/625/1250 mm	Standard	33,5	10,3
50/150/250/500 mm	HG	33,5	21,6
125/375/625/1250 mm	HG	46,5	10,3

Option S2/S3



Digital output



Option	A
Standard	33,5
HG	46,5

SX80

SX80

max. 3000 mm
Analog/Digital
Digital-Absolut

Technical data

	Analogue output	Digital output/Digital-Absolute/Bus systems
Ranges	1000/2000/2500/3000 mm	1000/2000/2500/3000 mm
Output	Potentiometer/0..10 V/4..20 mA (see page 12)	Digital -> page 13/Digital-Absolute -> page 14
Linearity	0,1 % (0,05%), range 1500/2000: 0,15%	0,05%
Sensor element	Hybrid potentiometer	Incremental encoder/opt. Code disc
Connection	M12-connector or PG-cable output	M23-connector or PG-cable output
Protection class	IP65	
Humidity	max. 90% relative, not condensating	
Weight	approx. 750 g	
Housing	Aluminium, titanium grey anodised	

Mechanics - characteristics

SX80	Rope Tension		Velocity	Acceleration*
Range [mm]	Fmin [N]	Fmax [N]	Vmax [m/s]	a max [m/s²]
1000	5,4	6,6	10	140
2000	5,4	7,8	10	140
2500	5,4	8,5	10	140
3000	5,4	9,1	10	140

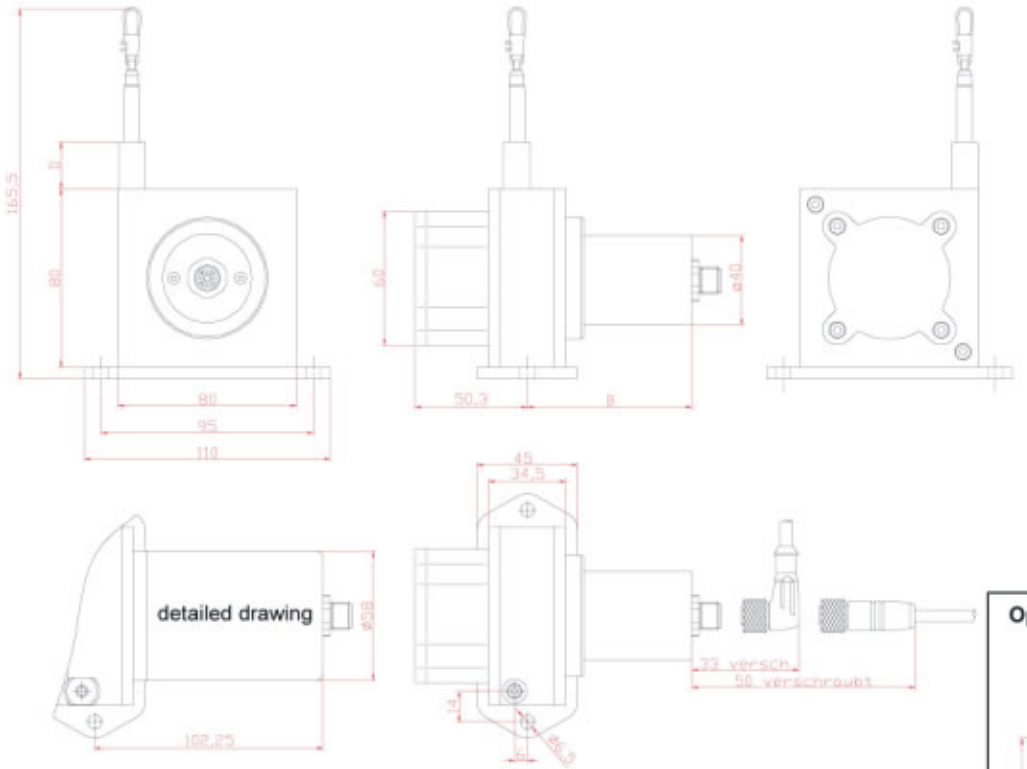
*with option IP67 reduced to 60%

Resolution Digital output

Available resolution SX80					Z-puls-distance
[pulses/mm]					[mm]
0,5	2,5	5	10	25	200

Technical drawings SX80

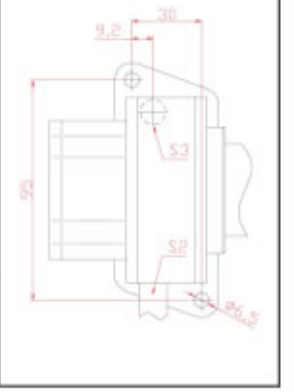
Analogue output



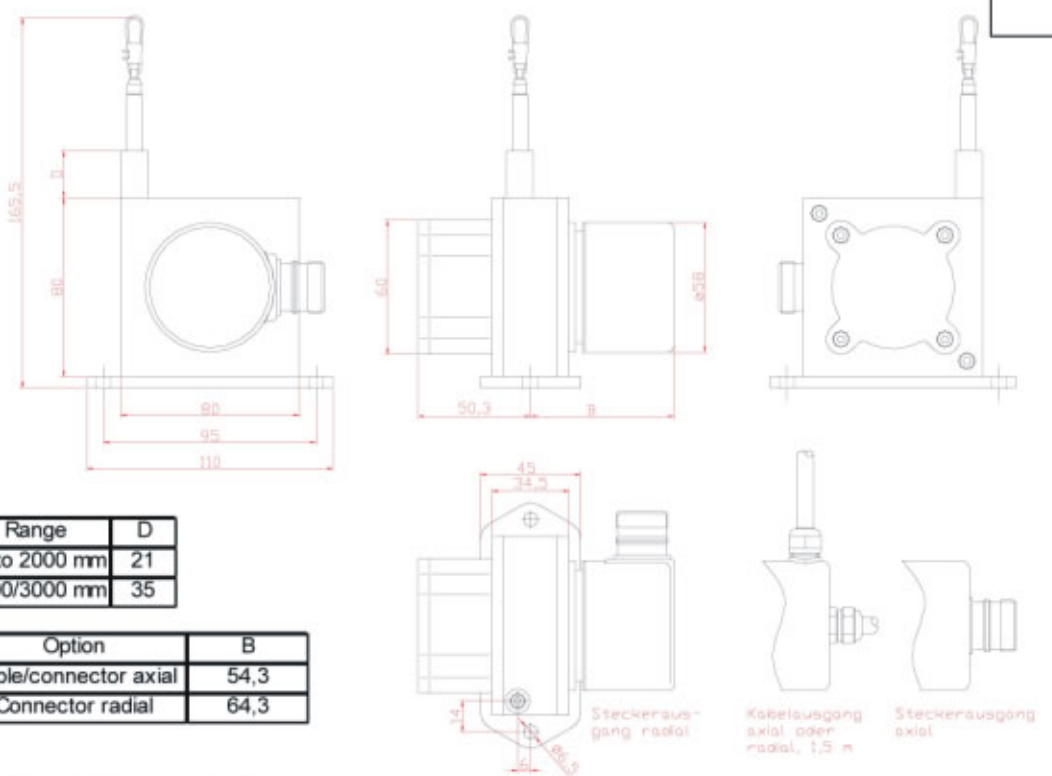
Range	Output	B
up to 2000 mm	Poti	74
up to 2000 mm	10V / 420A	87,5
2500/3000 mm see detailed drawing		

Range	D
up to 2000 mm	21
2500/3000 mm	35

Option S2/S3



Digital output



Range	D
up to 2000 mm	21
2500/3000 mm	35

Option	B
Cable/connector axial	54,3
Connector radial	64,3

SX120

max. 6000 mm
Analogue/Digital
Digital-Absolute

Technical data

	Analogue output	Digital output/Digital-Absolute/Bus systems
Ranges	3125/4000/5000/6000 mm	3125/4000/5000/6000 mm
Output	Potentiometer/0..10 V/4..20 mA (see page 12)	Digital -> page 13/Digital-Absolute -> page 14
Linearity	0,1 % (0,05%)	0,05%
Sensor element	Hybrid potentiometer	Incremental encoder/opt. Code disc
Connection	M12-connector or PG-cable output	M23-connector or PG-cable output
Protection class	IP65	
Humidity	max. 90% relative, not condensating	
Weight	approx. 1625 g	
Housing	Aluminium, titanium grey anodised	

Mechanics - characteristics

SX120	Rope Tension		Velocity	Acceleration*
Range [mm]	Fmin [N]	Fmax [N]	Vmax [m/s]	a max [m/s²]
3125	7,8	16,2	10	140
4000	7,8	18,5	10	140
5000	7,8	20,0	10	140
6000	7,8	21,0	10	140

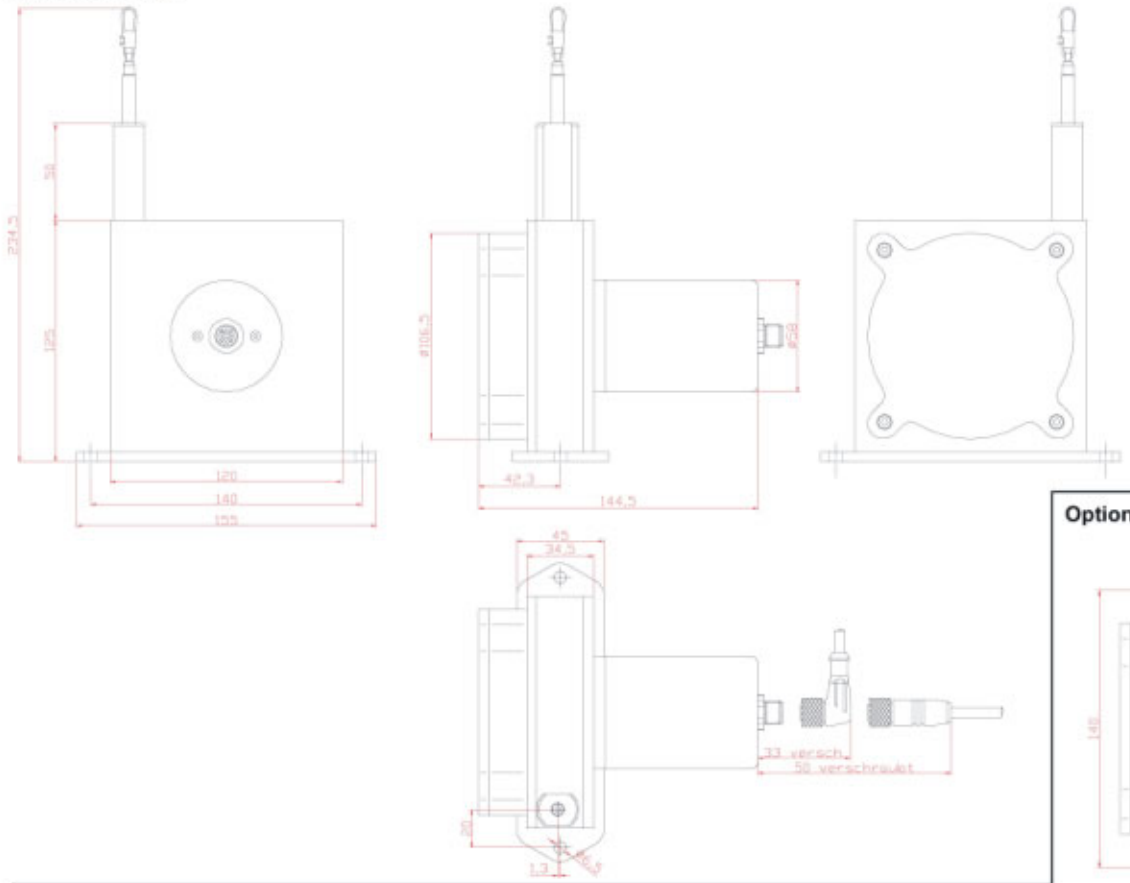
*with option IP67 reduced to 60%

Resolution digital output

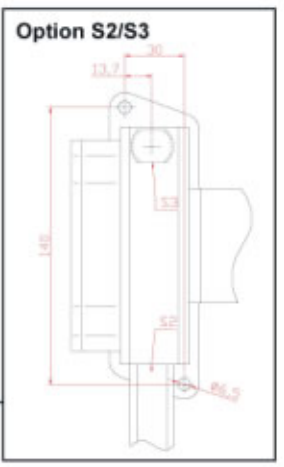
Available resolution SX120 [pulses/mm]					Z-puls-distance [mm]
0,3	1,6	3,1	6,3	15,7	317,68

Technical drawings SX120

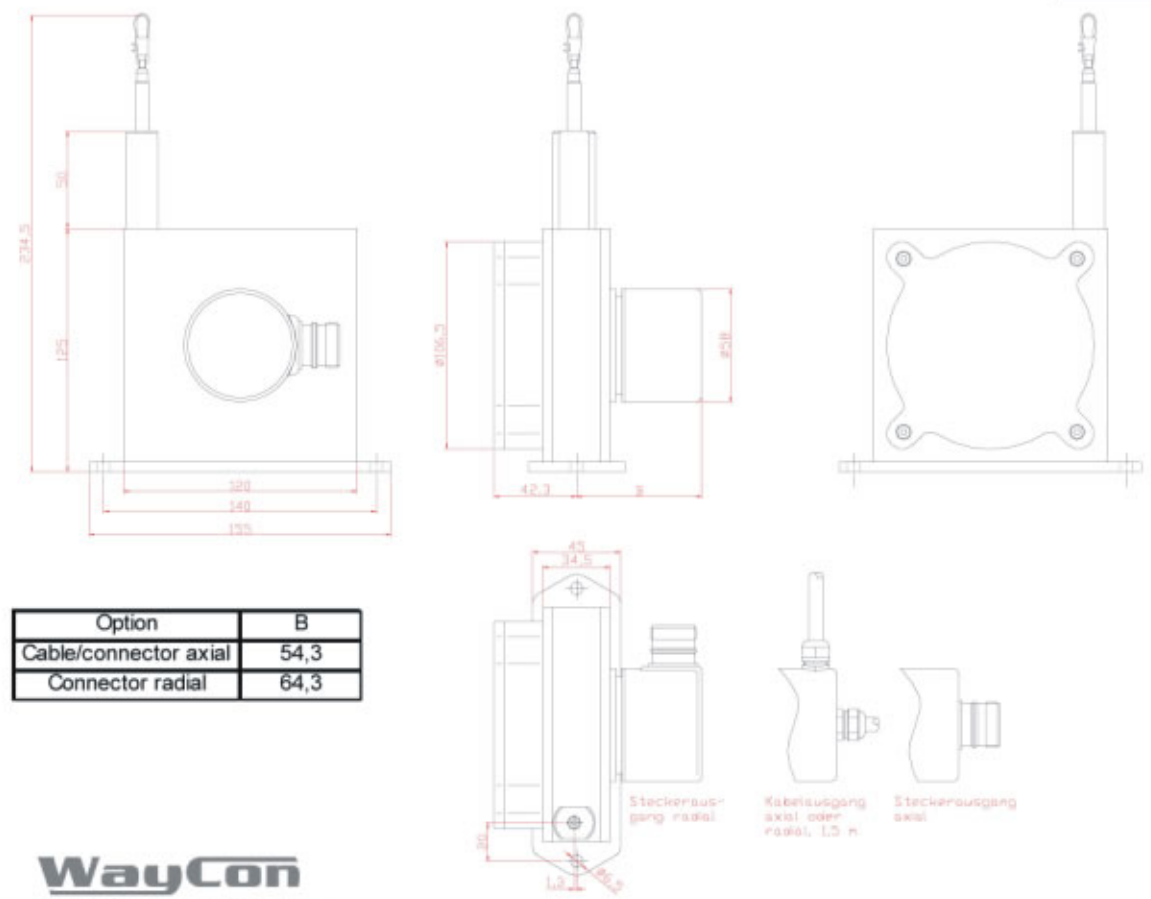
Analogue output



Option S2/S3



Digital output



Option	B
Cable/connector axial	54,3
Connector radial	64,3

SX135

Technical data	Analogue output	Digital output/Digital-Absolute/Bus systems
Ranges	8/10/15/20/25/30/35/40 m	8/10/15/20/25/30/35/40 m
Output	Potentiometer/0..10 V/4..20 mA (see page 12)	Digital -> page 13/Digital-Absolute -> page 14
Linearity	0,1 % (0,05%)	0,05%
Sensor element	Hybrid potentiometer	Incremental encoder/opt. Code disc
Connection	M12-connector or PG-cable output	M23-connector or PG-cable output
Protection class	IP65	
Humidity	max. 90% relative, not condensating	
Weight	approx. 4200 g	
Housing	Aluminium, titanium grey anodised	

Mechanics - characteristics

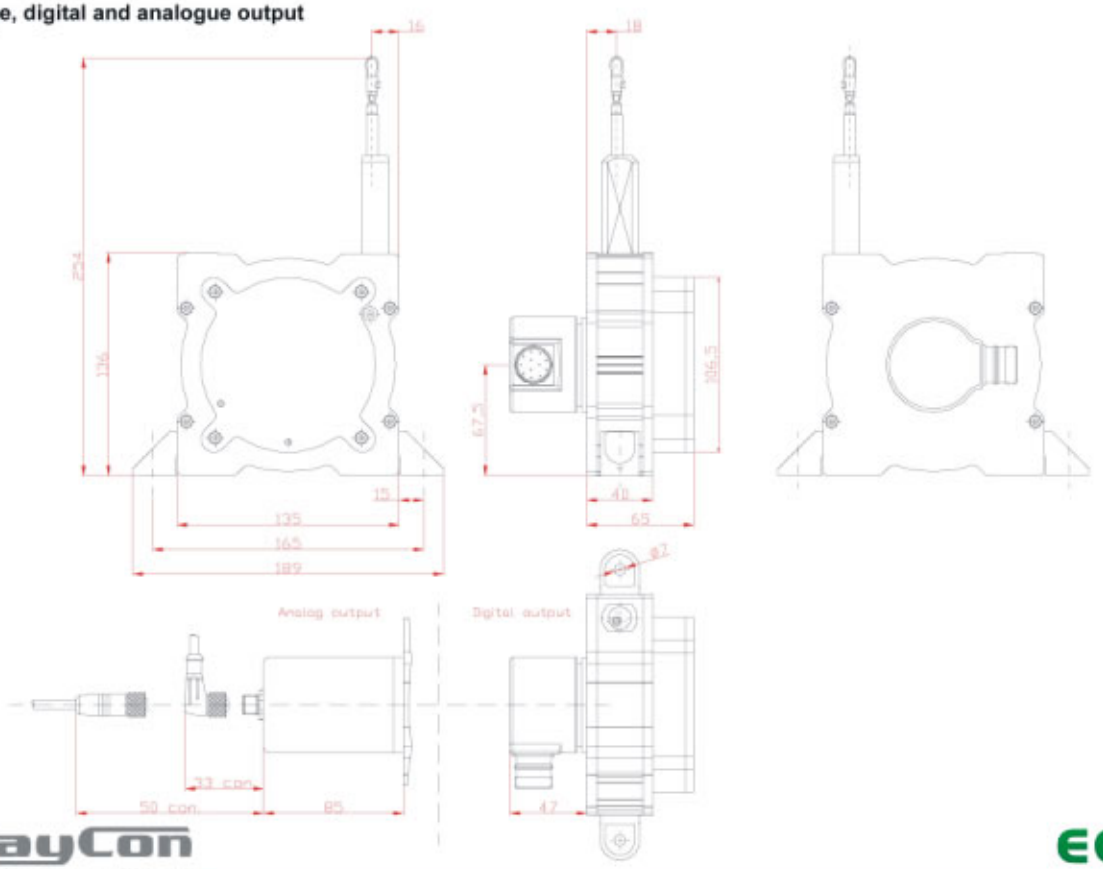
SX135	Rope Tension		Velocity	Acceleration*
Range [m]	Fmin [N]	Fmax [N]	Vmax [m/s]	a max [m/s²]
8	7,2	16,0	10	140
10/15	8,7	16,9	6	80
20	7,0	12,4	5	60
25/30	7,3	15,7	5	60
35/40	7,0	14,1	5	60

*with option IP67 reduced to 60%

Resolution digital output

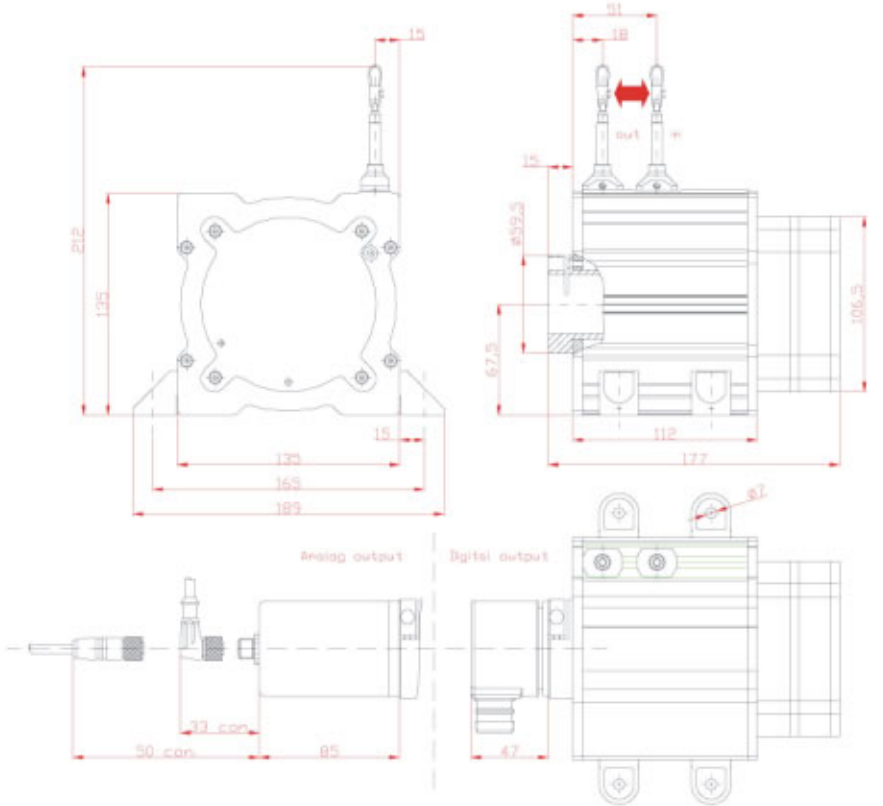
Available resolution SX135						Z-puls-distance
Range	[pulses/mm]					[mm]
8 m	0,28	1,4	2,8	5,6	14	357,14
10 m above	0,3	1,5	3	6	15	333,33

8 m Range, digital and analogue output



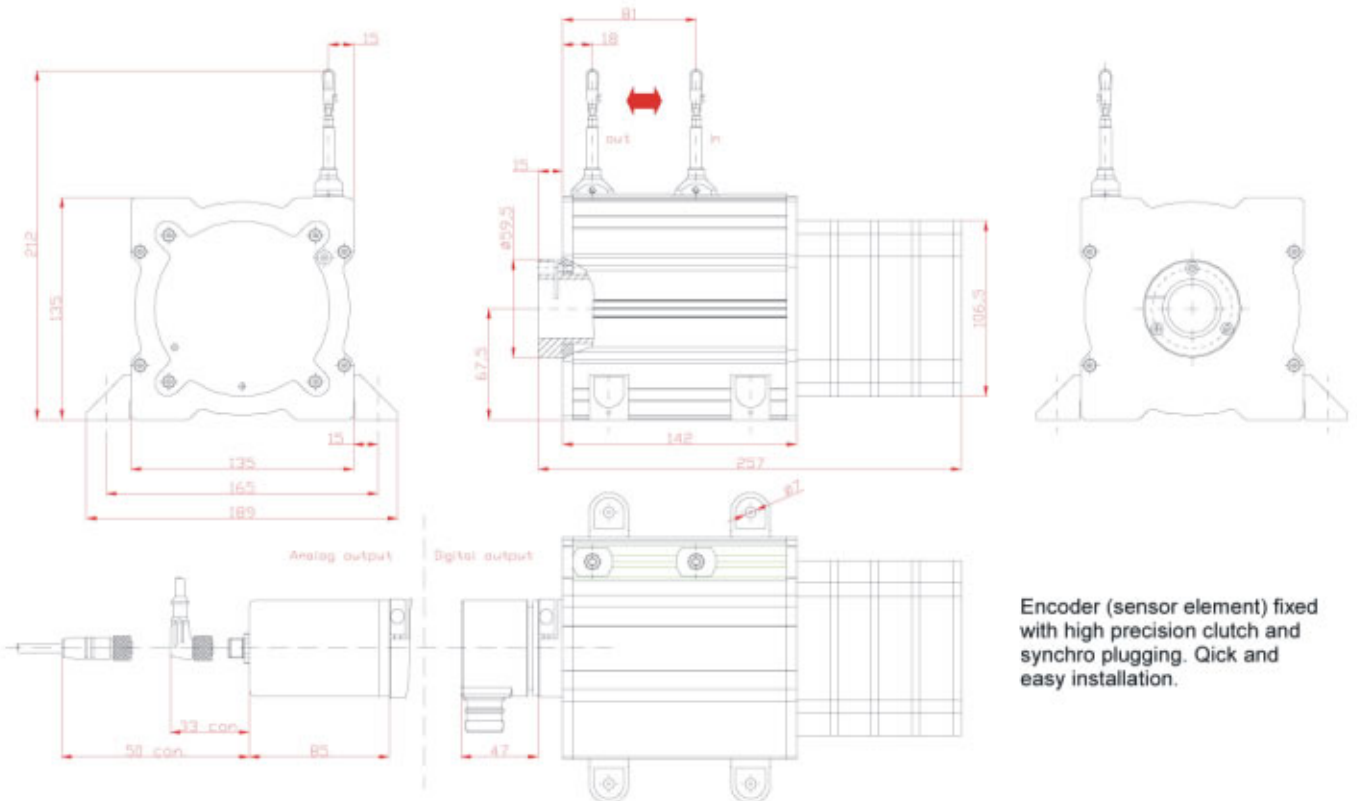
Technical drawings SX135

10...20 m range, digital and analogue output



Encoder (sensor element) fixed with high precision clutch and synchro plugging. Qick and easy installation.

25...40 m range, digital and analogue output

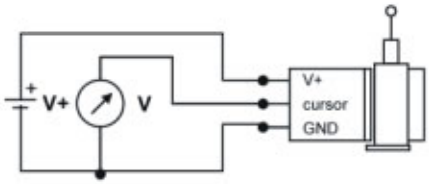


Encoder (sensor element) fixed with high precision clutch and synchro plugging. Qick and easy installation.

Analogue output

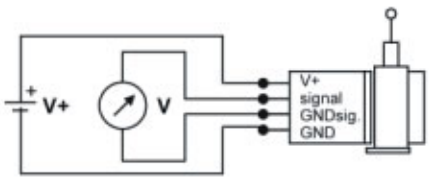
Potentiometer (voltage divider)

Output	1 kOhm
Supply	max. 30 V
Recommended slider current	<1 µA
Noise	depending on supply
Working temperature	-20...+85°C
Temperature coefficient	±0,0025 %/K



0...10V voltage output

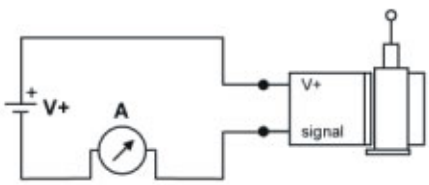
Output	0...10 V, galvanically isolated, 4-conductors
Supply	12...30 VDC
Current consumption max.	22,5 mA (unloaded)
Output current	max. 10 mA, min. load 1 kOhm
Dynamics	< 3 ms of 0..100% and 100..0%
Noise	3 mVss typisch, max. 37 mVss
Electrical protection	Inverse-polarity protection Short-circuit proof
Working temperature	-20...+60°C
Temperature coefficient	0,0037%/K



Note: GNDsig. and GND may be connected in 3-wire system

4...20 mA current output

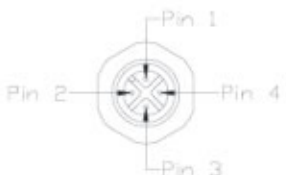
Output	4...20 mA, 2-Leiter
Supply	12...30 VDC
Current output	max. 50 mA in case of error
Dynamics	< 1 ms of 0..100% and 100..0%
Noise	0,03 mAss = 6 mVss at 200 Ohm
Electric protection	Inverse-polarity protection
Working temperature	-20...+60°C
Temperature coefficient	0,0079 %/K



Output

pin	wire color	10V	420mA	1 kOhm
1	brown	V+	V+	V+
2	white	signal	n.c.	cursor
3	blue	GND	signal	GND
4	black	GNDsig.	n.c.	n.c.

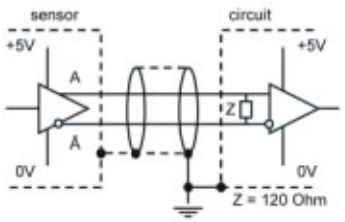
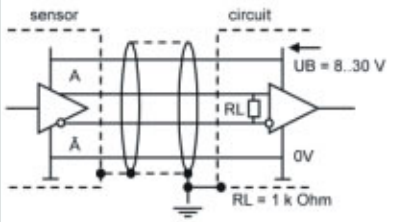
4-pin M12 connector output (socket)
Profile/view on solder side of mating connector



Cable:
axial 2,0 metre standard
other lengths optional
Type: -, flexible
Diameter: approx. 4,5 mm
Core: 0,25 mm²
Temperature range: fixed in installation: -30...+80°C, flexible: -20...+80°C

Digital output

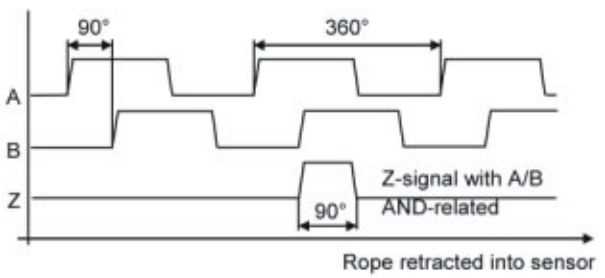
Linearity	±0,05% of FS (±0,01% of FS on request)
Supply	5 VDC (line driver L) , 8...30 VDC (push-pull G)
Working temp. range	-25...+85°C
Output	Line driver RS422 (TTL-compatible), push-pull antivalent (other outputs on request)
Connection	12-pin connector (radial, anticlockwise), cable output (radial, 1500 mm)
Protection class encoder	IP65 (IP67 on request)
Max- line length	Line driver RS422 up to 1000 m, push-pull up to 250 m

Data Electronics	**Line driver L** **RS 422 (TTL-compatible)**	**Push-pull G**
Power supply:	5 VDC ±5%	8 up to 30 VDC
Current consumption without load:	typ. 70 mA, max. 100 mA	typ. 80 mA, max. 150 mA
Max. load/canal SX50:	±10 mA	±30 mA
Max. load/canal SX80/120:	±20 mA	±30 mA
Max. pulse frequency SX50:	125 kHz	100 kHz
Max. pulse frequency SX80/120:	300 kHz	300 kHz
Min. signal level high:	2,5 V	U_B - 3 V
Max. signal level low:	0,5 V	2,5 V
Recommended circuit:		

Output signal

Pulses A and B are 90° phase-delayed (detection of direction). The Z-signal recurs with pulse distance Z and may be used as point of reference.

Display of signal without inverted signals, timeline for return of rope.



Values for impulse and resolution in the according manuals

Connection

signal	0V	+UB	0Vsens*	+UBsens*	A	A-	B	B-	Z	Z-	Screen
12pin connector	10	12	11	2	5	6	8	1	3	4	Housing
Wire colour	white	brown	black	violet	green	yellow	grey	pink	blue	red	Housing

* For line driver L only (RS422 TTL-compatible). For long line lengths it may occur that the operating voltage at the sensor does not suffice due to the output resistance. With the sensor lines 0Vsens and +UBsens the operating voltage can be checked and, if necessary, be readjusted at the input connection.

12pin connector output (socket)
Profile/view on solder side of mating connector (only SX80/SX120/SX135)

Cable:
radial/axial 1,5 m standard
other lengths optional
Type: UL2464/1061, LIYY, flexible
Diameter: approx. 6,5 mm
Core: 0,25 mm²
Temperature range: fixed in installation -30...+80°C,
flexible -20...+80°C

Digital-Absolute/Bus systems SX80/SX120

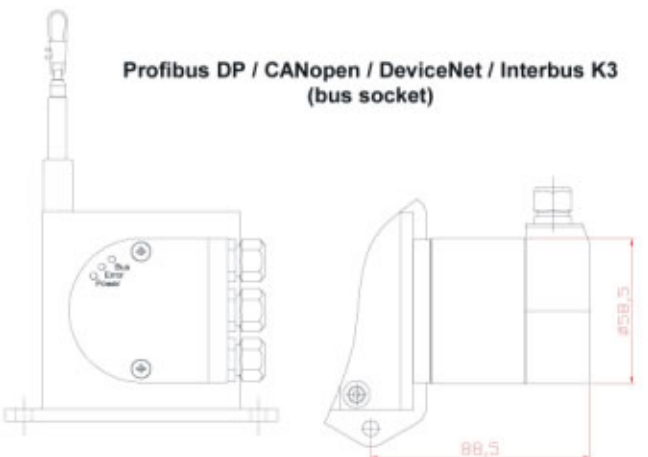
Output	Profibus DP	CANopen	DeviceNet	Interbus K3	SSI-Gray	Parallel-Gray
Current Consumption	250	250	250	250	100	300
Connector/cable	cable Bus socket 3 x PG	cable Bus socket 3 x PG	cable Bus socket 3 x PG	cable Bus socket 3 x PG	connector-12P	cable-10 cm 37-pol. SUB-D

Protection class	IP64
Max. temp.	+85°C
Supply	10-30 V
Resolution	12 Bit Multiturn

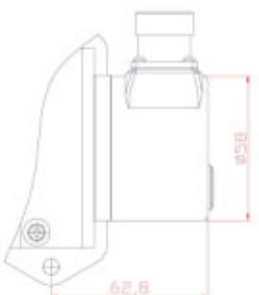
Digital-Absolute output options only available for type series SX80 and SX120

Technical drawings (Completion of SX80/SX120)

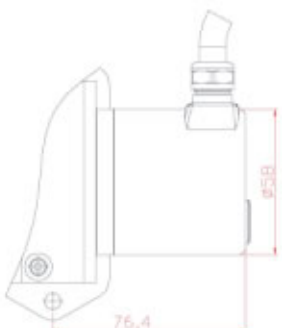
Profibus DP / CANopen / DeviceNet / Interbus K3 (bus socket)



SSI-Gray



Parallel-Gray



Connection

Standard	(other connection types, printouts available on request)
SSI:	12-pin socket encoder(pins anticlockwise), mating connector CON012-S
Parallel:	10 cm cable radial with 37-pol. SUB-D, mating connector CON037-S
Profibus-DP:	Bus socket: 3 x PG (middle PG N.C.)
CANopen:	Bus socket: 3 x PG (middle PG N.C)
DeviceNet:	Bus socket: 3 x PG (middle PG N.C.)
Interbus-K3	Bus socket: 3 x PG (middle PG N.C.)

For wiring diagram see manual for encoder

Accessories

Cable with M12 mating connector straight and angular - K4P (for analogue output Poti/10V/420A)

Cable with straight connector:		Cable with angular connector:	
K4P2M-S-M12	2 m	K4P2M-SW-M12	2 m
K4P5M-S-M12	5 m	K4P5M-SW-M12	5 m
K4P10M-S-M12	10 m	K4P10M-SW-M12	10 m

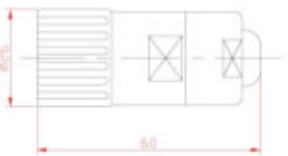
M12 mating connector straight and angular for analogue output - CON4P (zur Eigenkonfektion)

Straight connector: D4-G-M12-S
Angular connector: D4-G-W12-S

Protection class: IP67
Temperature: -25...+90°C
Connection: Screw clamps

Cable aperture: ø3...6,5 mm
Cable cross-sectional area: max. 0,75 mm²
Good chemical and oil resistance

M23 mating connector for Digital output and SSI - CON012-S



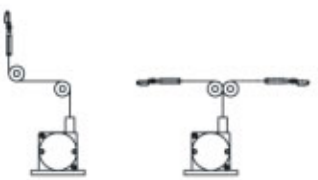
M23, straight
12 pin connector clockwise
(fits in anticlockwise encoder sockets)
Metal housing

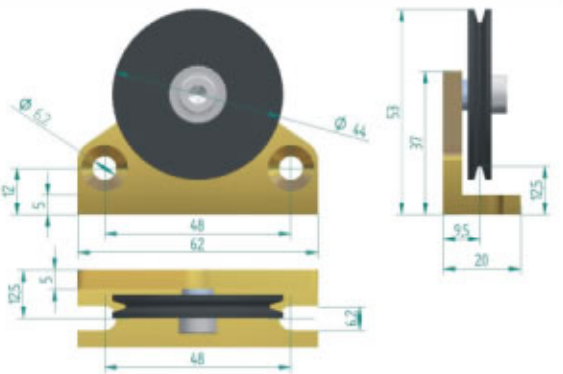
Deflection pulley - UR2

Using the deflection pulley the rope can be looped around to e.g. measure in places that are difficult to access or to protect the sensor from inclined traction on the rope. Several pulleys may be used.

Material: aluminium anodised
Mounting: with 2 M6 cylinder or countersunk head bolts, vertical or horizontal mounting possible.

Bearing with low temperature grease and RS-sealing.
Temperature range -40°C...+80°C.





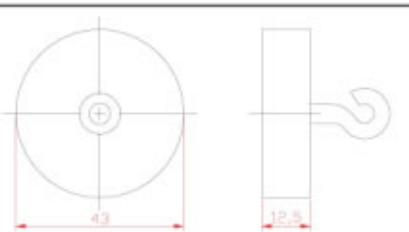
Rope extension - SV

For bridging a greater distance from the measuring target to the sensor a rope extension can be applied. The rope clip (drill protection) must not be guided over the deflection pulley.

Please specify the length needed in your order

Magnet clamp - MGG1

Use the magnetic clamp to quickly attach the rope to metal objects without any assembly time. A rubber coating provides sparing contact (e.g. on varnished surfaces) and prevents from slipping due to vibration. Magnet with Neodym core for an increased adhesive force of 260N. Possibility of attaching a drill protection (rope clip).



Digital distance and speed measurement - PAX

Use PAX to visualise the covered distance or the speed (Tacho sensor) of the position transducer. It enables a transmission of the measurement data on the computer via interface. The comparator allows a Good-Bad-evaluation (limiting values function).

Inputs: Incremental/Analogue, 2 independent counter, 1 Tacho sensor
2 or 4 limiting values (plug in card)
Analogue output (0)4...20 mA, 0...10 V (plug in card)
Serial interfaces: RS 485, RS232, DeviceNet (plug in card)
Protection class (front panel) IP 65
6-digit display and power supply 11...36 VDC or 85...250 VAC

For further information please ask for the data sheet for the PAX display series.

Installation

- Mount the sensor at the designated place at the fixing holes **before** extracting the rope and **before** attaching the rope to the measuring target.
- Open the rope clip (not with set screw M4) after the sensor is fully mounted and extract the measuring rope. Hook the rope clip on the measuring object and close the bracket of the clip. For your safety put a screw driver trough the clip to extract the rope.
- Check the track of the measuring target on **collision** with the sensor housing and on **exceeding** the specified measurement range. When installing the sensor make sure that the rubber stopper does not touch the rope outlet.
- Connect the electronics according to the sensor type. When laying the cables be careful not to under-run the min. allowed bending radius of the cable (5x cable diameter).
- The rope must be extracted from the sensor **vertically**. The max. variation from the vertical is 3°. Avoid carefully extracting the rope at an inclination, since the durability of the instrument would shorten considerably.
- The measuring range / the **zero point** begins after approx. 2 mm extracted rope. The mechanical reserve at the end of the measuring range is approx. 20 mm.
- When mounting outdoors protect the sensor and the rope from ice-formation for negative temperatures.
- Lay the rope preferably in corners or guarded in guidings to prevent pollution or accidental touch.
- When operating the sensor, take care **not** to **let** the rope **snap back** by mistake or extract the rope **over** the specified **measurement range**, as this might destroy the sensor.
- **Maintenance**: These instruments are maintenance-free. If however, the rope is soiled due to adverse environmental conditions, it should be cleaned with a cloth drenched in resin-free machine oil.

Warning notices

- Don't let the rope snap back. If the rope is retracted freely, this may lead to injuries (whiplash effect) and the instrument may be damaged. Caution when unhooking and retracting the rope into the sensor.
- Never exceed the specified measurement range when extracting the rope!
- Don't try to open the instrument. The stored energy of the mainspring may lead to injuries when being mishandled.
- Don't touch the rope when operating the sensor.
- Avoid guiding the rope over edges or corners. Use a deflection pulley instead.
- Don't operate the sensor if the rope is buckled or damaged. A ripping of the rope may lead to injuries or damaging the sensor.

Order code analogue output

SX □ – □ – □ – □ – □

Types	
SX50	50
SX80	80
SX120	120
SX135	135

Optional ranges	
SX50: 50/125/150/250/375/500/625/1250	z.B.1250
SX80: 1000/2000/2500/3000 mm	z.B.2000
SX120: 3125/4000/5000/6000 mm	z.B.6000
SX135: 8/10/15/20/25/30/35/40 m**	z.B.40

Analogue output	
Potentiometer 1 k Ohm	1R
Voltage output 0...10V	10V
Current output 4...20mA	420A

	Options
HG	Increased acceleration SX50
CO	HART-COAT coating
IN	Inverted output
L05	Improved linearity 0,05%
IP67	Waterproof IP67
S1	Rope outlet up*
S2	Rope outlet down*
S3	Rope outlet bottom*
M4	M4 Rope fixation

	Connection
SA	M12 connection axial
KA	Cable output axial

*not for SX135
**SX135 Range in m

Order code digital output/Digital-Absolute/Bus systems

SX □ – □ – □ – □ – □ – □

Types	
SX50	50
SX80	80
SX120	120
SX135	135

Optional ranges	
SX50: 500/1250	e.g. 1250
SX80: 1000/2000/2500/3000 mm	e.g. 2000
SX120: 3125/4000/5000/6000 mm	e.g. 6000
SX135: 8/10/15/20/25/30/35/40 m**	e.g 40

Digital output pulses/mm	
SX50: 1/4/8/12/16/28,8	e.g. 8
SX80: 0,5/2,5/5/10/25	e.g. 5
SX120: 0,3/1,6/3,1/6,3/15,7	e.g. 6,3
SX135 (8 m): 0,28/1,4/2,8/5,6/14	e.g. 14
SX135 (10 m above): 0,3/1,5/3/6/15	e.g. 15

Digital-Absolute/Bus systems	
SSI-Gray	SSI
Parallel-Gray	PAR
Profibus DP	PRO
CANopen	CAN
DeviceNet	DVN
Interbus K3	INT

	Options
HG	Increased acceleration SX50
CO	HART-COAT coating
S1	Rope outlet up*
S2	Rope outlet down*
S3	Rope outlet bottom*
K1	Cable/connector orientation up
K2	Cable/connector orientation left
M4	M4 Rope fixation

	Connection
SR	Connector output radial (not SX50)
KA	Cable output axial
KR	Cable output radial

	Output type (Digital output only)
L	Line driver RS422
G	Push-pull antivalent

*not for SX135
**SX135 Range in m

WayCon Positionsmesstechnik GmbH
e-mail: info@waycon.de
internet: www.waycon.de

Options

Additional charge for version -1R (see above):

Analogue output

1R	Potentiometer 1 k Ohm
10V	Voltage output 0...10V
420A	Current output 4...20mA

Digital output

L/G	for SX50
L/G	for SX80/120/135

Digital-Absolute/Bus systems

SSI-Gray	für SX80/120/135
Parallel-Gray	für SX80/120/135
Profibus DP	für SX80/120/135
CANopen	für SX80/120/135
DeviceNet	für SX80/120/135
Interbus K3	für SX80/120/135

Extended connector cable for axial/radial cable output, KA/KR

KAB-1M-S-4L	additional metre of PVC cable

Options

HG	Increased acceleration SX50
CO	SX50 HART-COAT coating SX80 HART-COAT coating SX120 HART-COAT coating
IN	Inverted output
L05	Improved linearity 0,05%
IP67	Waterproof IP67
S1	Rope outlet up
S2/S3	Rope outlet down/bottom
K1/K2	cable/connector orientation
M4	M4 Rope fixation

Accessories

Cable with M12 mating connector for analogue output

K4P2M-S-M12	2 m, straight connector
K4P5M-S-M12	5 m, straight connector
K4P10M-S-M12	10 m, straight connector
K4P2M-SW-M12	2 m, angular connector
K4P5M-SW-M12	5 m, angular connector
K4P10M-SW-M12	10 m, angular connector

M12 Mating connector for analogue output

D4-G-M12-S	M12 mating connector straight
D4-G-W12-S	M12 mating connector angular

M23 Mating connector for digital output

CON012-S	M23 mating connector straight

SUB-D Mating connector for Parallel-Gray

CON037-S	SUB-D mating connector

UR2	Deflection pulley
SV	Rope extension (specify length)
MGG1	Magnetic clamp
PAX	Digital distance and speed display (see data sheet for PAX displays)

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