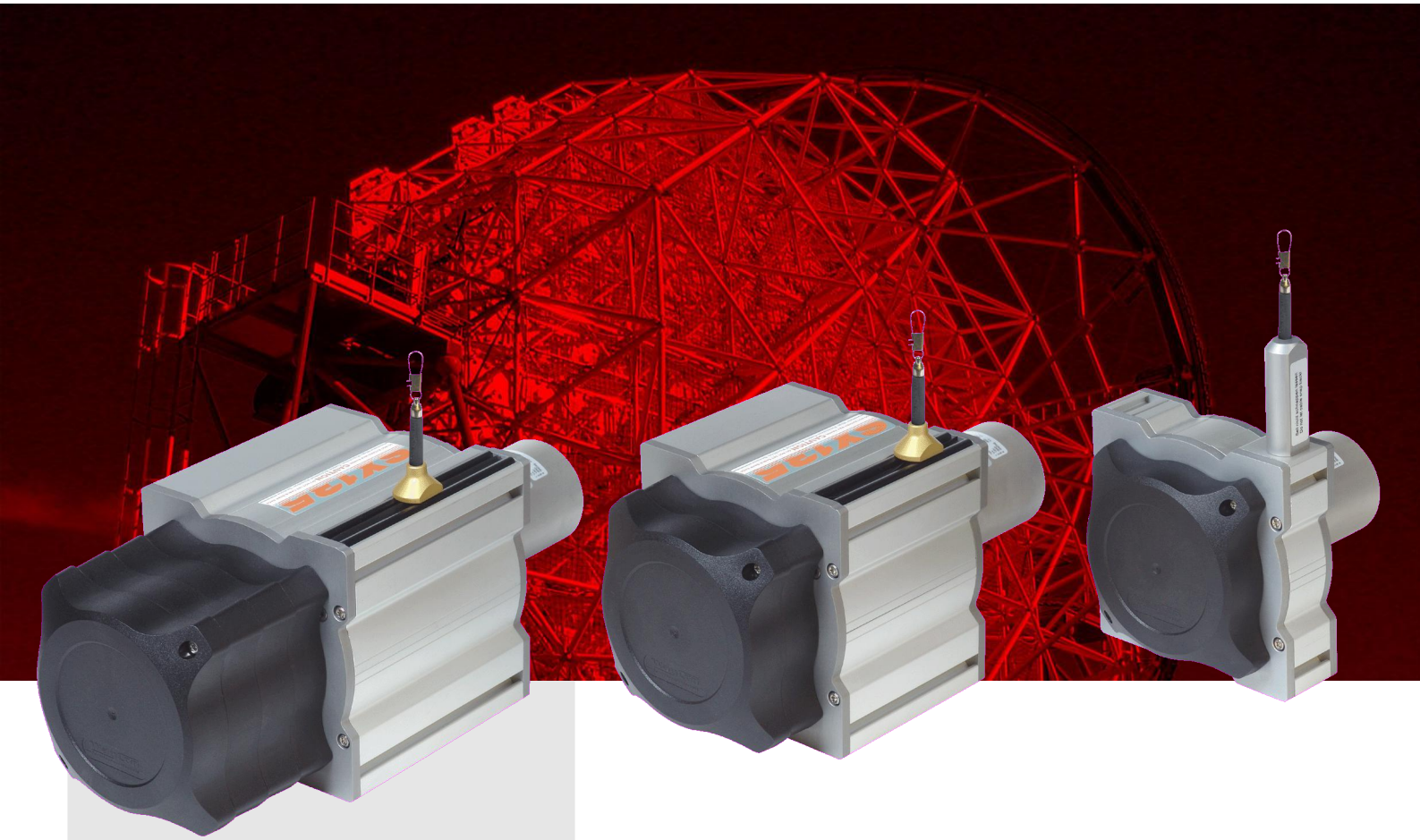
DRAWWIRE SENSOR



Content:

SX135 Long Range

Key-Features:

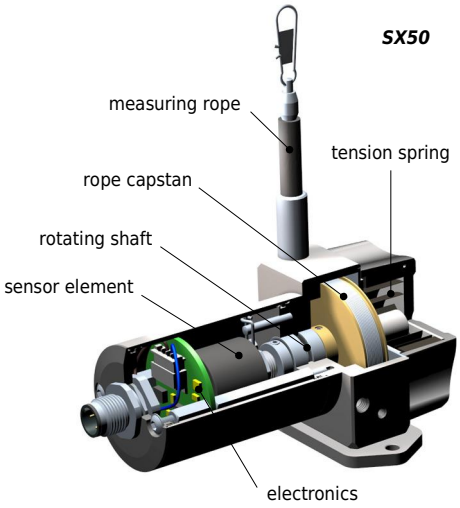
- Ranges 8000...42.500 mm
- Analog – Digital Incremental – Digital Absolute
- Linearity up to ±0.02 % of FS
- Protection class up to IP67
- High dynamics
- High EMC-grade
- Customised versions available

INTRODUCTION

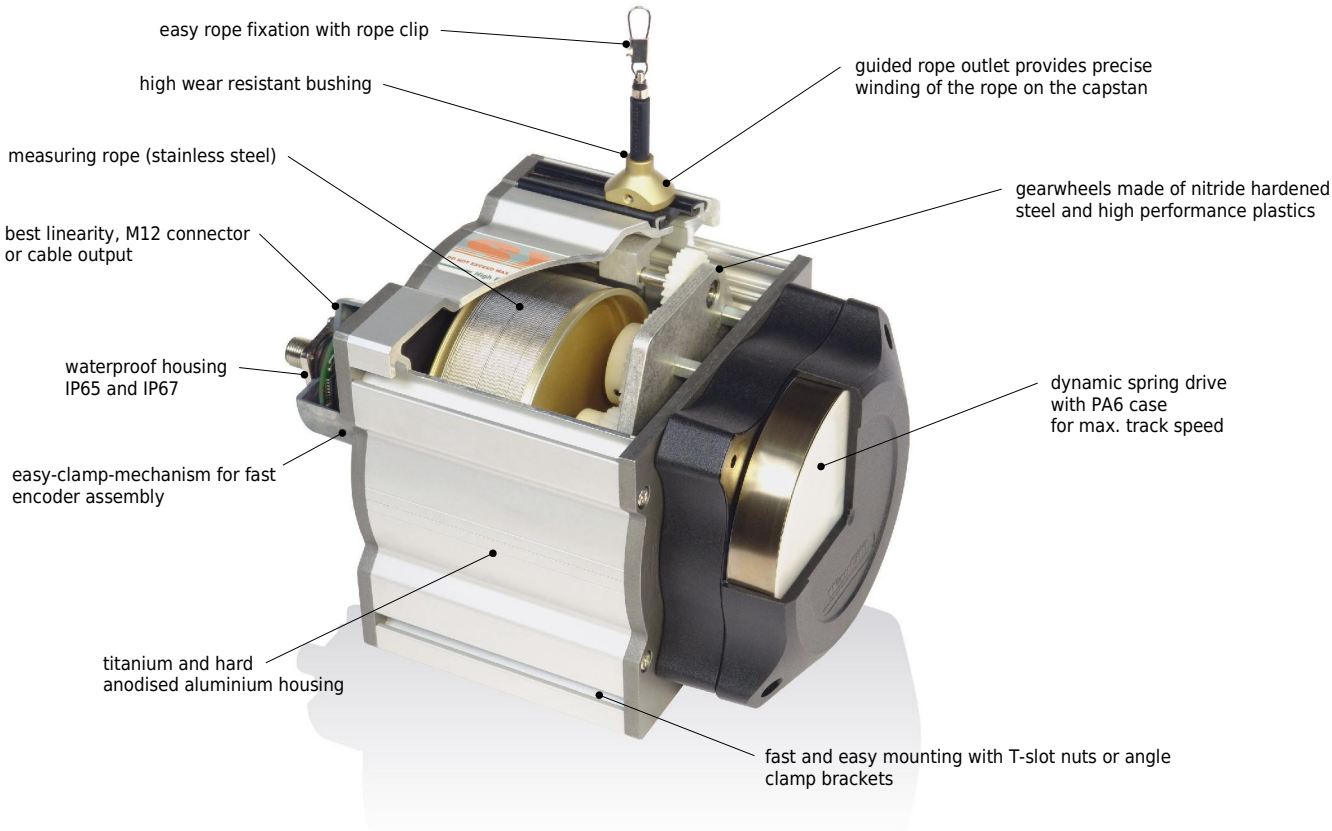
WayCon Positionsmesstechnik GmbH is a manufacturer of high quality draw wire position transducers for industrial use. Due to its small overall size, its short assembly time and its possible customisation, the SX sensor technology is a cost-effective and flexible solution for a wide range of industrial applications. The dynamics of the draw wire transducer allows a high motion speed and acceleration of the measuring target. Its rugged design and high quality makes applications in harsh industrial environments possible. Special instruments are available with mounting service of encoder on site, as well as customised versions of housing.

Sensor principle:

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.



OUTLINE



APPLICATIONS

- lifting tables and platforms
- positioning of fork-lifts
- level control system
- portal frames and gantry cranes
- lifting and rescue technology
- hydraulic cylinder
- property management
- linear guides
- x-y-axis positioning
- pipe displacement

OPTIONS

SSB8 / SSB10 / IP67 / CO / ICP / TEMP-40

SSB8 (up to range 8 m) / SSB10 (range 10-42.5 m): All ball bearings are made of stainless steel. This option is suitable for applications in humid or moderate corrosive environmental conditions.

IP67: Use option IP67, if sensor is fully immersed in water (temporarily). Like option SSB8, only stainless steel ball bearings are mounted. 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.

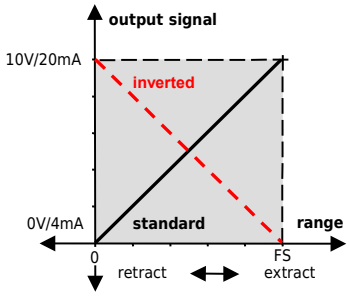
CO: By the use of a special technology all components of the housing and the inner mechanics become HARTCOAT® coated. This coating is a hartanodic oxidation that protects the sensor from corrosion by aggressive media (e. g. sea water) with a hard ceramics-like layer. This option includes SSB8.

ICP: This version combines the options CO (HARTCOAT®-coating) and IP67 (protection class IP67). In addition, a increased corrosive protection is achieved by the use of special components.

TEMP-40: The use of special components enhances the operating temperature to -40...+85 °C.

IN

The analog signal of the sensor is increasing by extracting the rope (standard). Option IN inverts the signal, i. e. the signal of the sensor declines by extracting the rope.



L05 / L02

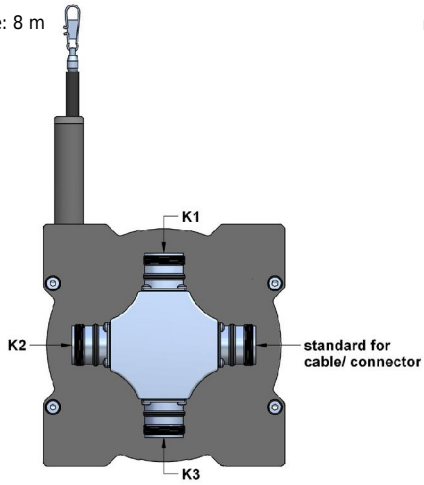
Improved linearity on 0.05% of measuring range. Resolution, repeatability and sensibility remain unchanged.

Improved linearity on 0.02% of measuring range. Resolution, repeatability and sensibility remain unchanged. This option is only available for incremental sensors.

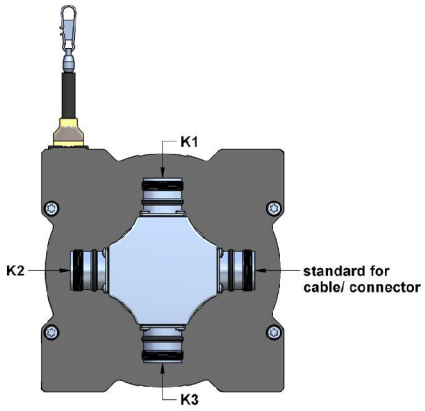
K1 / K2 / K3

Optional cable/ connector orientation for sensors with digital output/ encoder.

range: 8 m

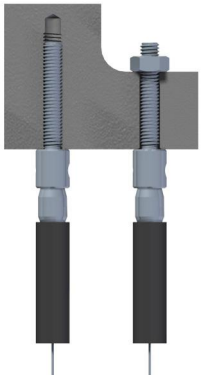


range: 10...42.5 m



M4 rope fixation

Optional, pivoted rope fixation with screw thread M4, length 22 mm. Ideal for attachment to through holes or thread holes M4.



SERIES SX135

output	**analog output**	**digital output incremental**
	potentiometer/ 0...10 V/ 4...20 mA (page 10)	A/B-pulse, 90° phase-delayed (page 11)
sensor element	hybrid potentiometer	incremental encoder/ optical code disc
connection	M12-connector or cable output 2 m	connector or cable output 2 m
protection class	IP65, optional IP67	IP65, optional IP67
humidity	max. 90 % relative, no condensation	max. 90 % relative, no condensation
temperature	-20...+85 °C	-20...+85 °C
weight	approx. 4200 g	approx. 4200 g
housing	aluminium, titanium-grey anodised, spring case PA6	aluminium, titanium-grey anodised, spring case PA6

Technical data – analog output										
ranges [m] *	8	10	12	15	20	25	30	35	40	42.5
linearity [%]	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
linearity optional [%]	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Technical data – digital output incremental										
ranges [mm] *	8	10	12	15	20	25	30	35	40	42,5
linearity [%]	0.05, independent of measurement range									
linearity optional [%]	0.02, independent of measurement range									
available resolution, range 8 m [pulses/ mm]	0.28	1.4	2.8	5.6	14					
available resolution, range 10 – 42.5 m [pulses/ mm]	0.3	1.5	3	6	15					
Z-pulse-distance, range 8 m [mm]	357.14									
Z-pulse-distance, range 10 – 42.5 m [mm]	333.33									

* other measurement ranges on request

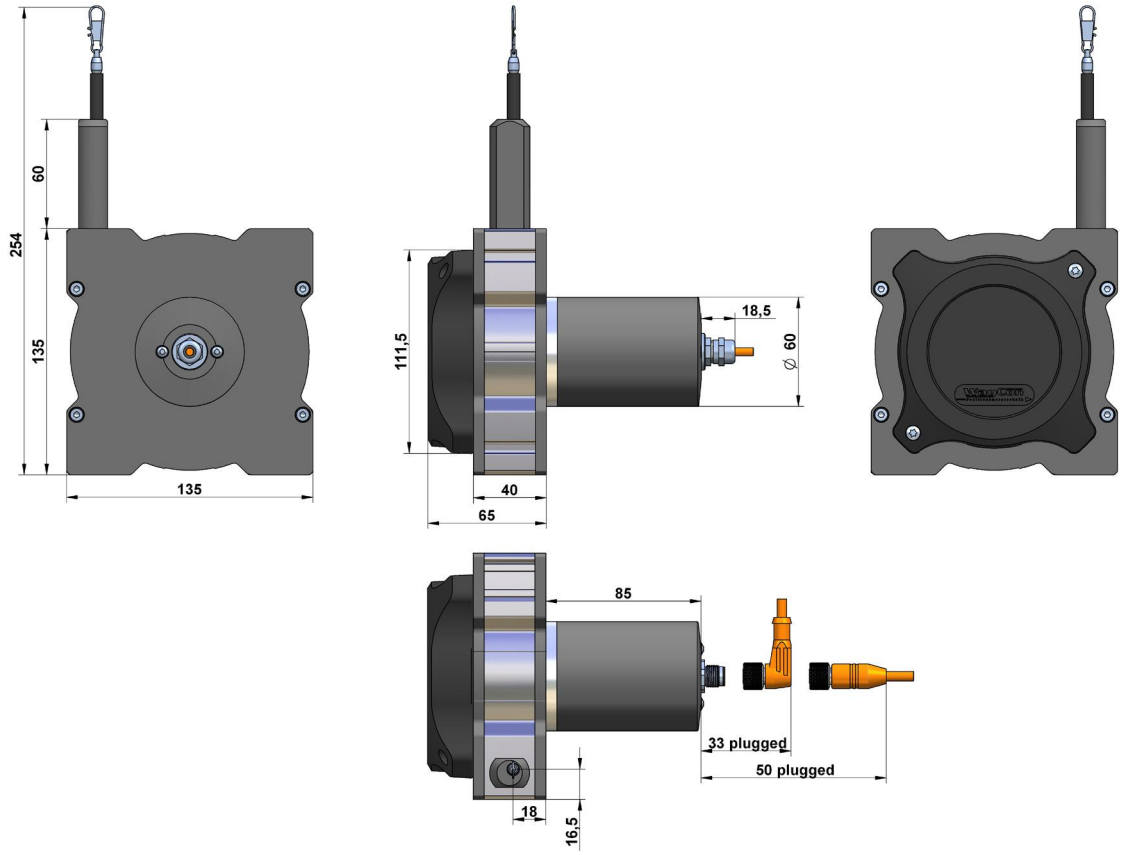
Mechanical data

	rope tension		velocity	acceleration*
range [m]	F_{min} [N]	F_{max} [N]	V_{max} [m/s]	a_{max} [m/s²]
8	7.2	10.4	10.0	140
10 / 12	4.8	7.2	6.0	80
15	6.8	11.2	6.0	80
20	6.4	9.2	5.0	60
25	7.8	11.4	5.0	60
30	6.4	9.6	5.0	60
35	7.4	11.6	5.0	60
40 / 42.5	5.4	9.0	5.0	60

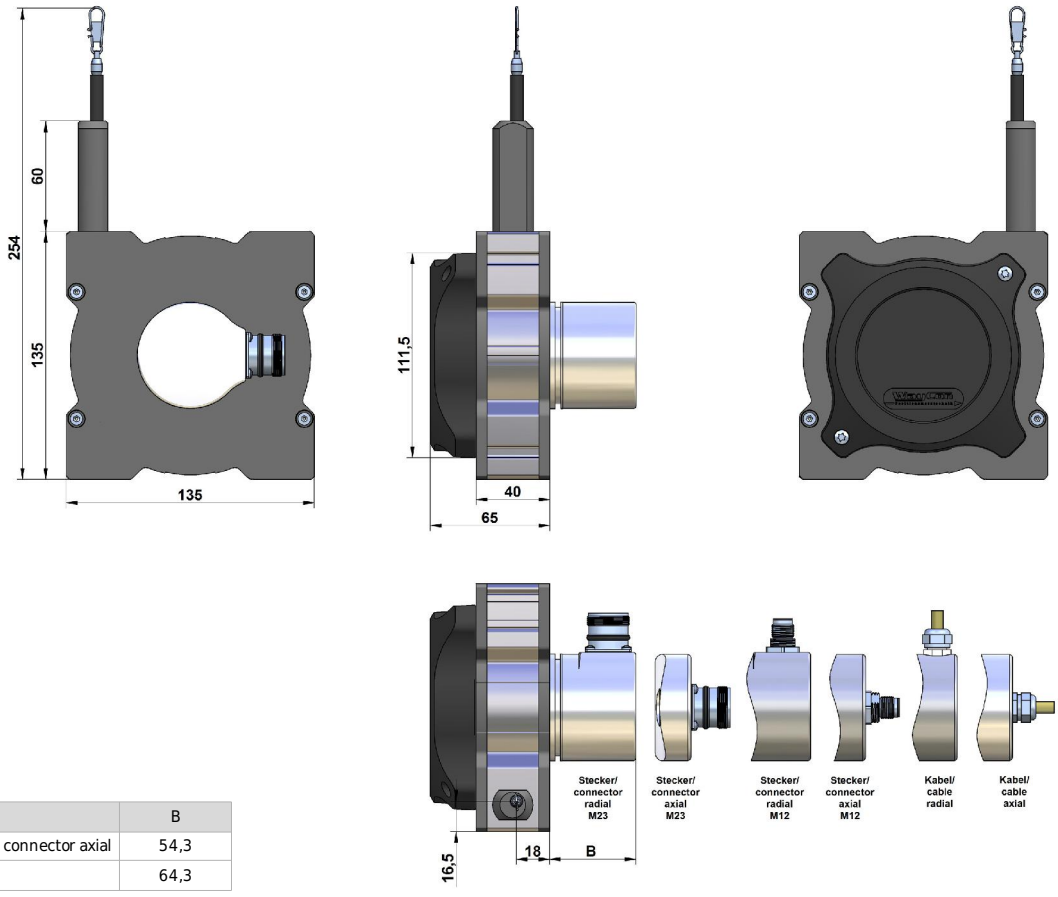
* reduced to 60 % with option IP67

TECHNICAL DRAWING

8 m range, analog output



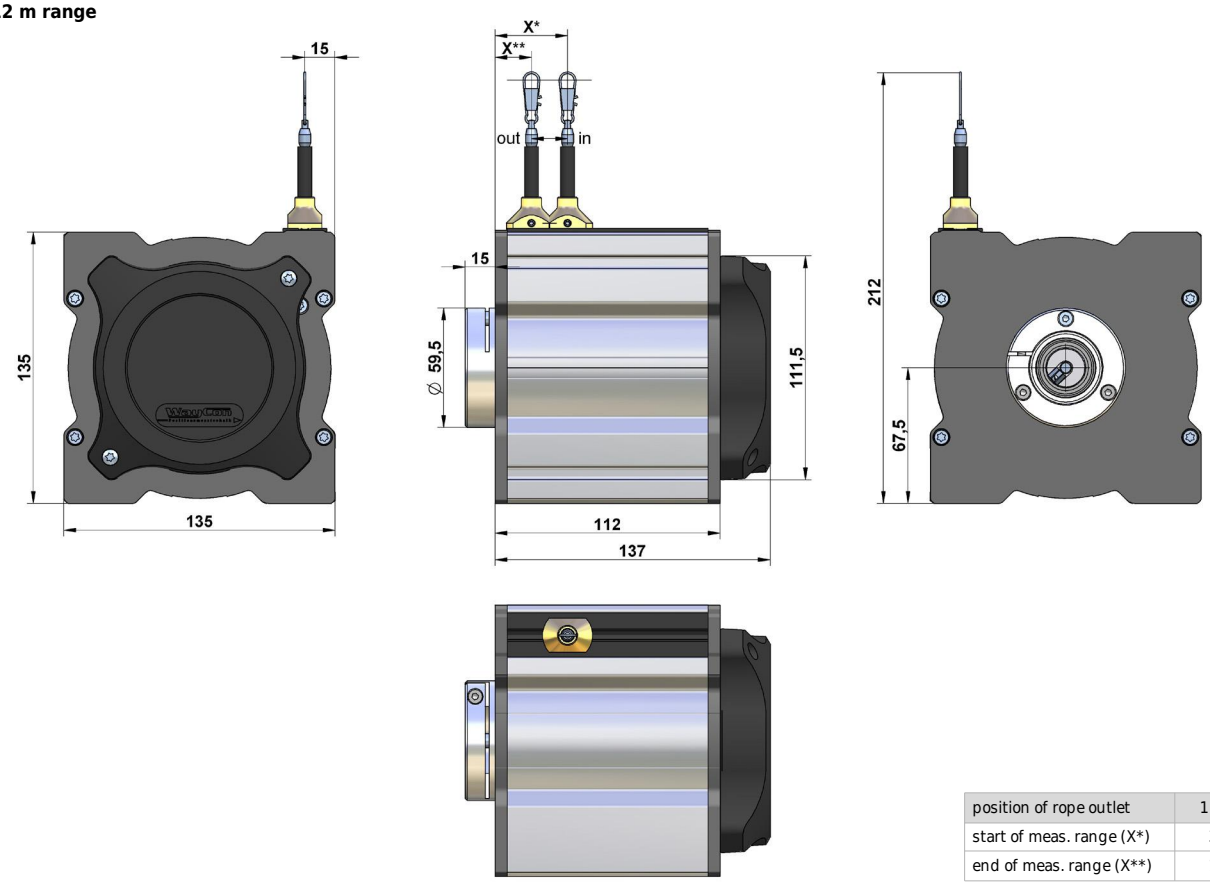
8 m range, digital output incremental



output	B
cable axial/ radial, connector axial	54,3
connector radial	64,3

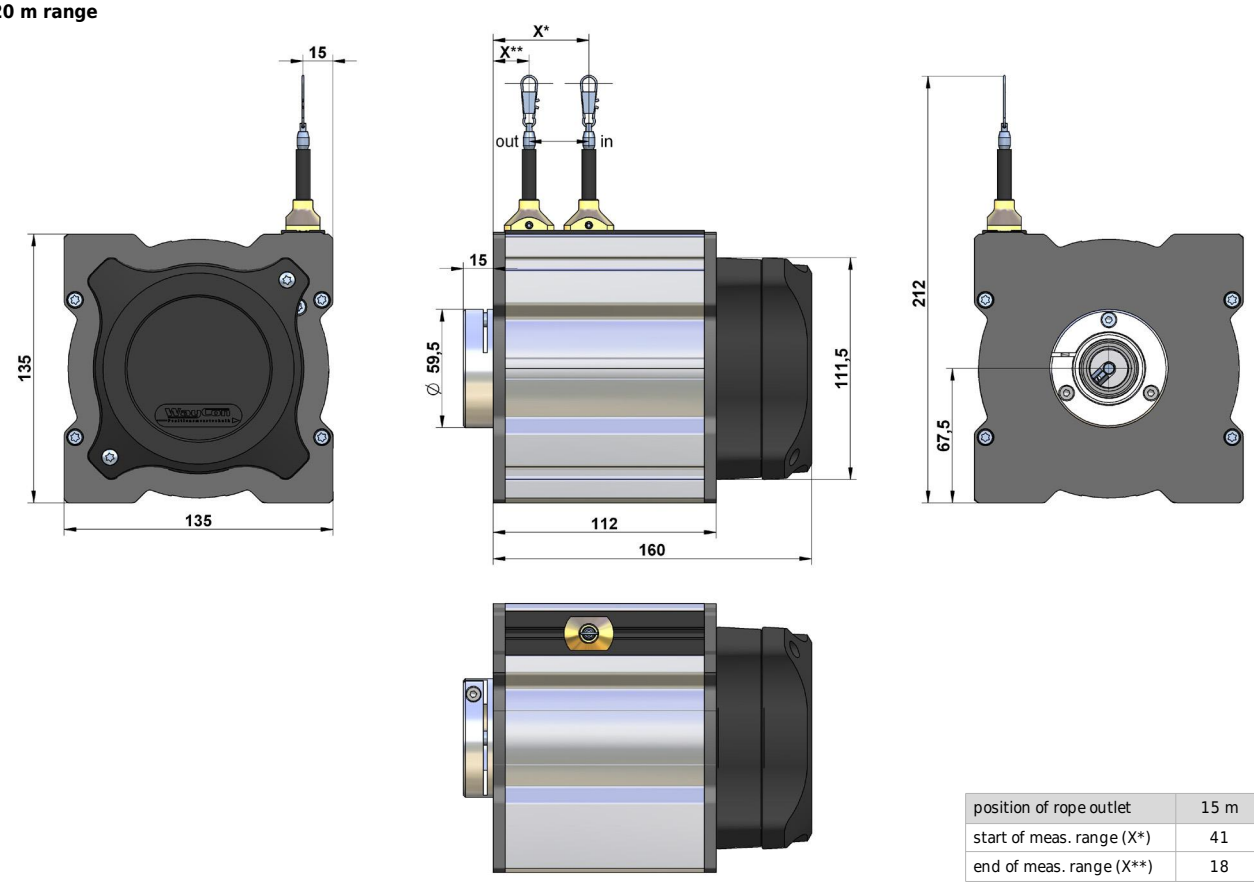
TECHNICAL DRAWING

10 - 12 m range



position of rope outlet	10 m	12 m
start of meas. range (X*)	33	36
end of meas. range (X**)	18	18

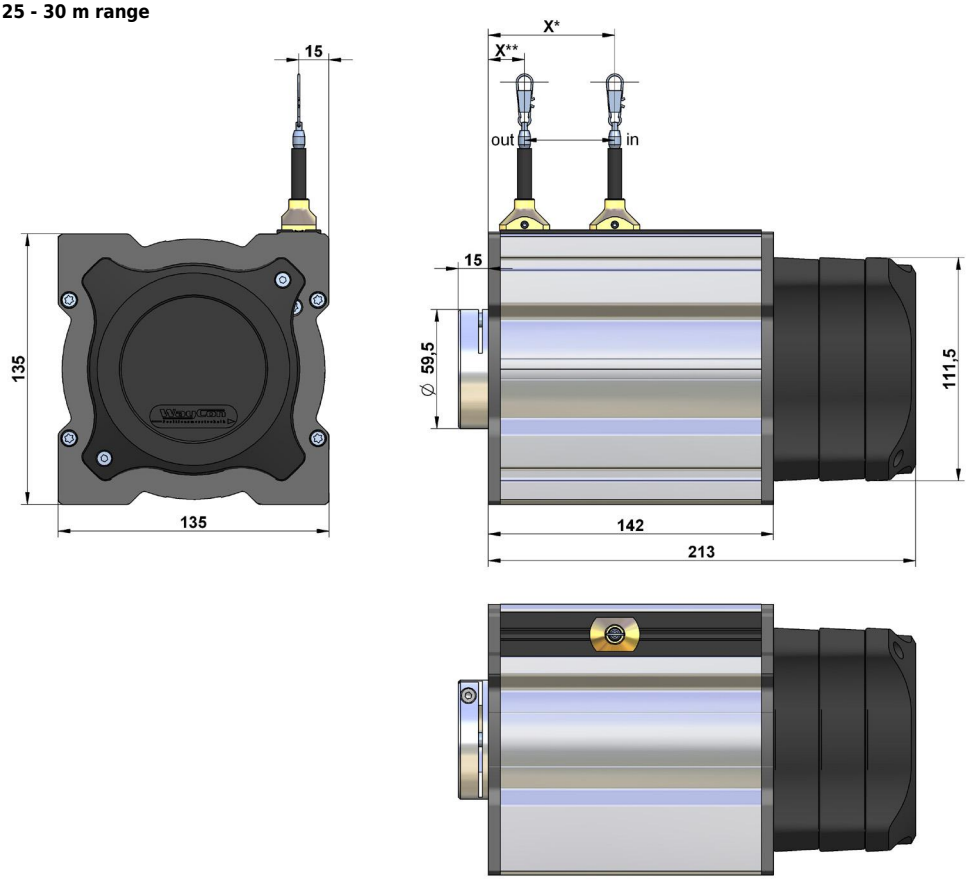
15 - 20 m range



position of rope outlet	15 m	20 m
start of meas. range (X*)	41	48
end of meas. range (X**)	18	18

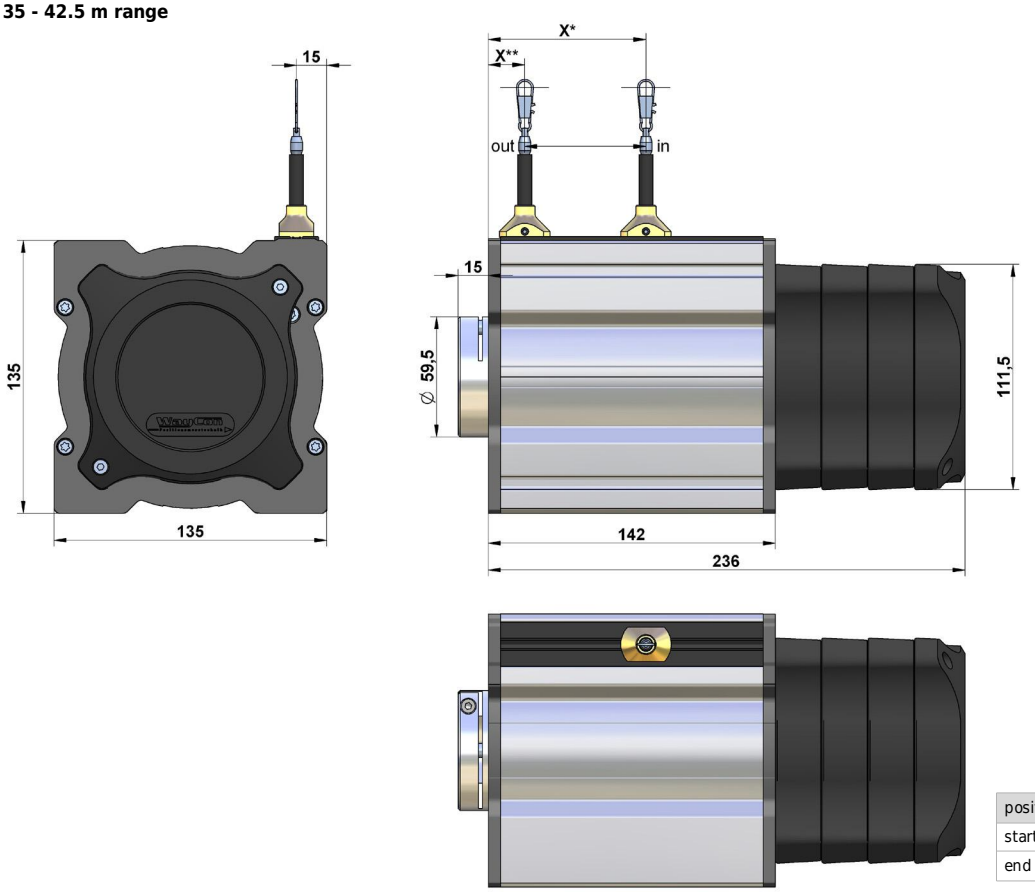
TECHNICAL DRAWING

25 - 30 m range



position of rope outlet	25 m	30 m
start of meas. range (X*)	56	63
end of meas. range (X**)	18	18

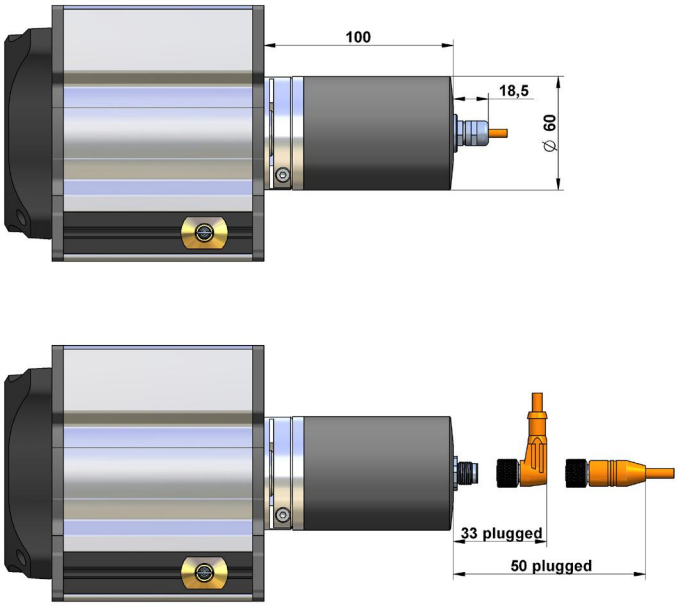
35 - 42.5 m range



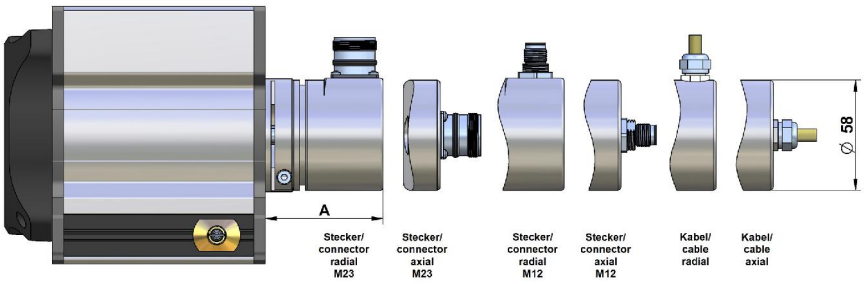
position of rope outlet	35 m	40 m	42,5 m
start of meas. range (X*)	71	78	82
end of meas. range (X**)	18	18	18

TECHNICAL DRAWING

dimensions for analog output



dimensions for digital output incremental

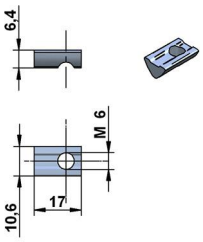


output	A
cable axial/ radial, connector axial	54,3
connector radial	64,3

MOUNTING OPTIONS

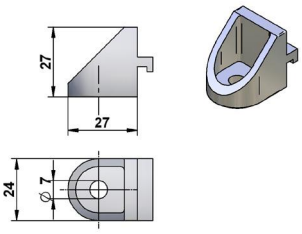
1. by using the grooves in the sensor housing

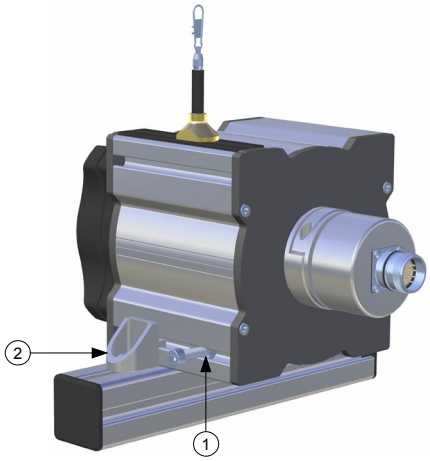
The included T-slot nuts can be easily inserted into grooves of the sensor housing. The nuts have a me thread M6.
Each sensor up to 20 m measurement range comes v 2 nuts, from 20 to 42.5 m for nuts are included.



2. by angle clamp brackets

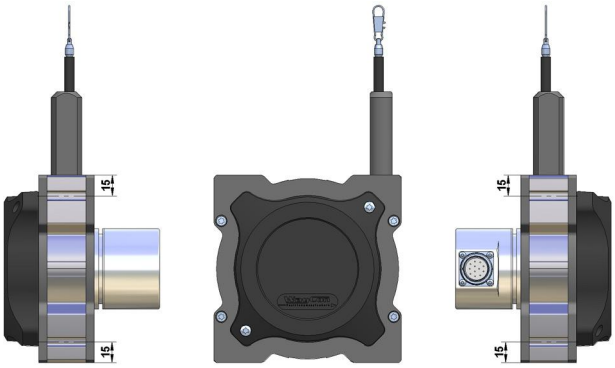
The angle clamp brackets feature a bore for M6 scre to fix it on a plate/ slab or a profile.
Each sensor up to 20 m measurement range comes w 2 brackets, from 20 to 42.5 m for brackets are include



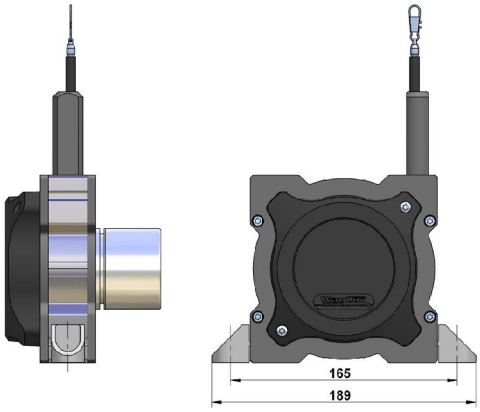


Important: The grooves of the sensor housing, the nuts and brackets are compatible to the aluminium building kit system from *item Industrietechnik GmbH (www.item.info).*

Position of the grooves:



Mounting by using brackets:

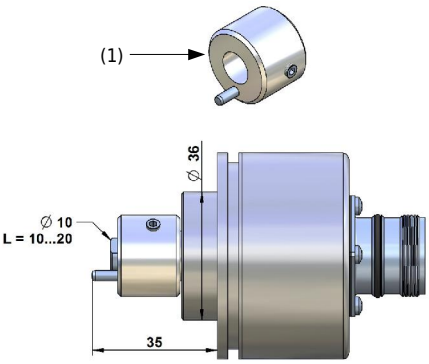


ENCODER ASSEMBLY BY EASY-CLAMP-MECHANISM

IMPORTANT: All incremental and absolute encoders must have a clamping flange (diameter 36 mm), a shaft diameter of 10 mm and a shaft length of 10-20 mm.

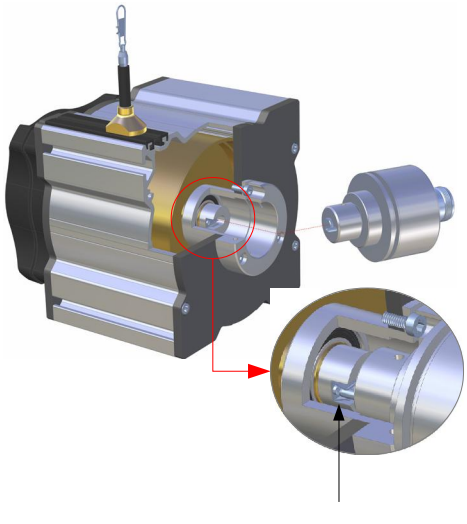
1.

Please mount the included coupling (1) on the shaft of the encoder and fix the set screw. Therefore you will need a hexagon screwdriver, size 2. Be careful that the dimension between contact surface of the encoder and the end of the cylinder bolt is 35 mm.



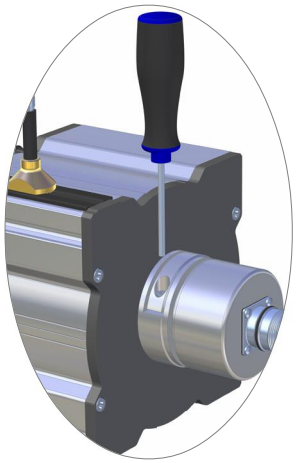
2.

Please mount the encoder into the easy-clamp-flange. The cylinder bolt must slip into the spring (2).



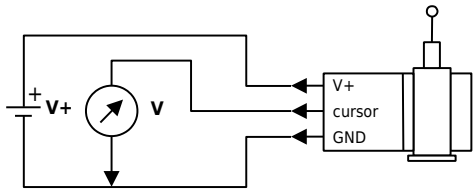
3.

By tightening the radial screw the encoder will be clamped and secured from twisting. Please use a hexagon screwdriver, size 3.

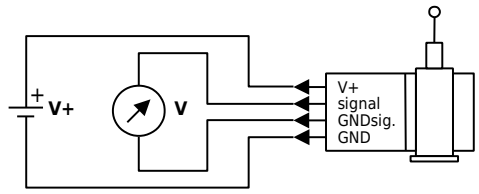


ANALOG OUTPUT

Potentiometer (voltage divider)	
output	1 kOhm
supply voltage	max. 30 V
recommended cursor current	< 1 µA
noise	depending on supply
working temperature	-20…+85 °C
temperature coefficient	± 0.0025 %/K

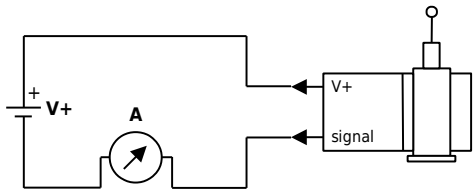


0…10 V voltage output	
output	0…10 V, galvanically isolated, 4 conductors
supply voltage	12…30 VDC
max. current consumption	22.5 mA (unloaded)
output current	max. 10 mA, min. load 10 kOhm
dynamics	< 3 ms from 0…100 % and 100…0 %
noise	3 mV_{pp} typically, max. 37 mV_{pp}
inverse-polarity protection	yes, infinite
short-circuit proof	yes, permanent
working temperature	-20…+85 °C
temperature coefficient	0.0037 %/K
electromagnetic compatibility (EMC)	according to EN 61326-1:2006



note: GNDsignal and GND may be connected in 3-wire system.

4…20 mA current output	
output	4…20 mA, 2 conductors
voltage supply	12…30 VDC
output current	max. 50 mA in case of error
dynamics	< 1 ms from 0…100 % and 100…0 %
noise	0.03 mA_{pp} = 6 mV_{pp} at 200 Ohm
inverse-polarity protection	yes, infinite
working temperature	-20…+85 °C
temperature coefficient	0.0079 %/K
electromagnetic compatibility (EMC)	according to EN 61326-1:2006



CONNECTION

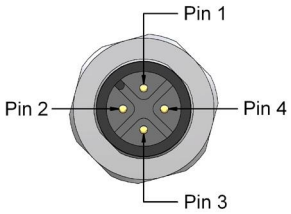
cable output:

axial 2.0 meter standard, other cable lengths optional
type: TPE, flexible
diameter: ø 4.5 mm
stranded wire: 0.25 mm²
temperature range: fixed installation -30…+85 °C, flexible installation -20…+85 °C

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

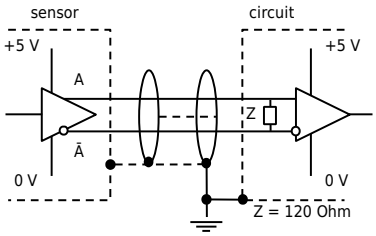
4-pin M12 connector output (socket):

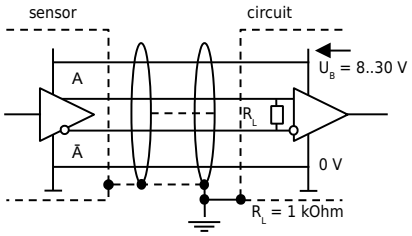
profile/ view on solder side of mating connector



DIGITAL OUTPUT INCREMENTAL

Electrical data	**Linedriver L** **RS422 (TTL-compatible)**	**Push Pull G**
supply voltage	5 VDC, ±5 %	8...30 VDC
current consumption (no load)	typical 70 mA, max. 100 mA	typical 80 mA, max. 150 mA
max. load/ channel	±20 mA	± 30 mA
max. pulse frequency	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		



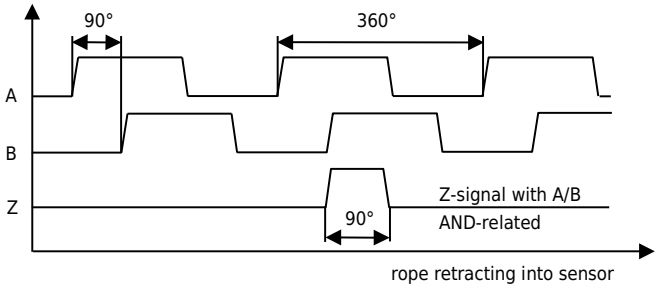


connection	connector 12-pin (counterclockwise), cable output 2 m	connector 12-pin (counterclockwise), cable output 2 m
protection class	IP65, optional IP67	IP65, optional IP67
max. cable length	up to 1000 m	up to 250 m

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.

Diagram shows the signal without inverted signals; time-line for return of rope.

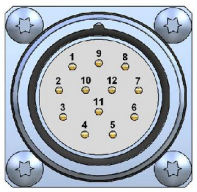


CONNECTION

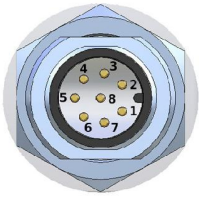
Assignment											
signal	0 V	U_B+	0 V_{sens}*	U_{Bsens}+ *	A	A -	B	B -	Z	Z -	screen
12-pin connector	10	12	11	2	5	6	8	1	3	4	housing
8-pin connector	1	2	-	-	3	4	5	6	7	8	housing
wire colours	white	brown	black	violet	green	yellow	grey	pink	blue	red	housing

* For Linedriver L only. For long cable lengths it may occur that the operating voltage at the sensor does not suffice due to the output resistance. With the sensor lines $0V_{sens}$ and $+UB_{sens}$ the operating voltage can be checked and, if necessary, be readjusted at the input connection.

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



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



cable output
radial/ axial 2 metre standard
other cable length optional

type:	UL2464/ 1061, LiYY, flexible
outer diameter:	ø 6,5 mm
stranded wire:	10 x 0,25 mm²
temperature range:	fixed installation -30...+80 °C, flexible installation -20...+80 °C

DIGITAL OUTPUT ABSOLUTE

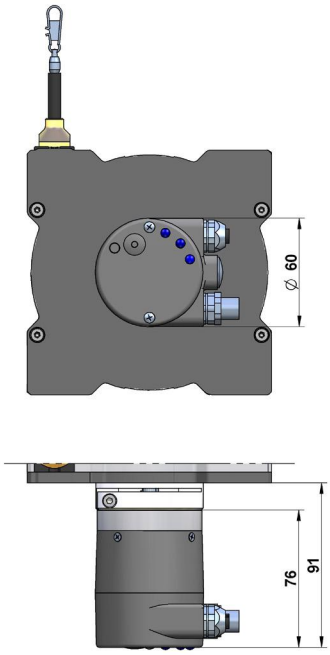
output	Profibus-DP	CANopen	DeviceNet	EtherCAT	SSI	Profinet
scalable resolution	yes	yes	yes	yes	no	yes
standard resolution at range 8 m [pulses/ mm]	22.94	22.94	22.94	22.94	22.94	22.94
max. resolution at range 8 m [pulses/ mm]	183.50	183.50	22.94	183.50	-	183.5
standard resolution at range 10 – 42.5 m [pulses/ mm]	24.58	24.58	22.94	24.58	24.58	24,58
max. resolution at range 10 – 42.5 m [pulses/ mm]	196.61	196.61	22.94	196.61	-	196.61
supply voltage	10...30 VDC	10...30 VDC	10...30 VDC	10...30 VDC	10...30 VDC	10...30 VDC
current consumption (no load, at 24 VDC)	90 mA	65 mA	max. 290	90 mA	25 mA	200 mA
protection class	IP65	IP65	IP65	IP65	IP65	IP65
protection class optional	IP67	IP67	-	IP67	IP67	IP67
working temperature	-20...+80 °C	-20...+80 °C	-20...+80 °C	-20...+80 °C	-20...+80 °C	-20...+80 °C

Other encoder types (supply voltage, resolution, cable/ connector output) are available on request.

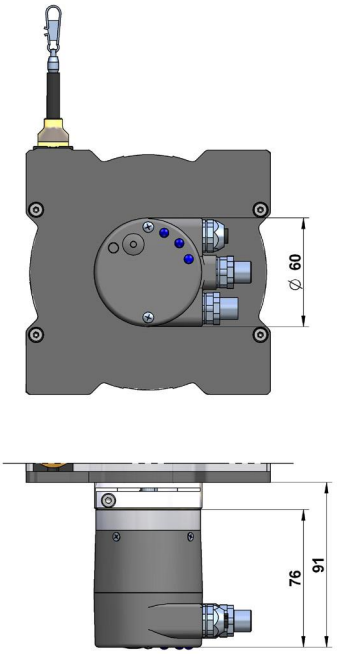
TECHNICAL DRAWING

Note: The dimensions of the sensor housings are given on pages 5 to 8.

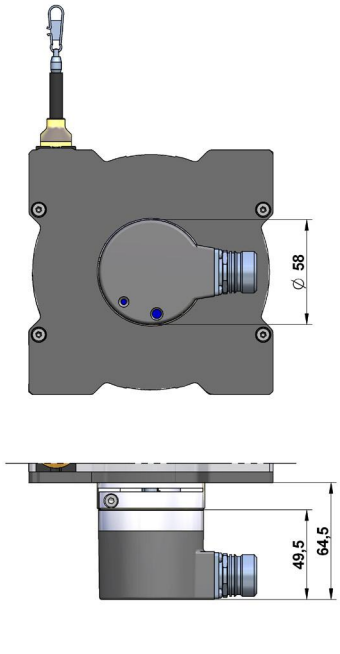
CANopen



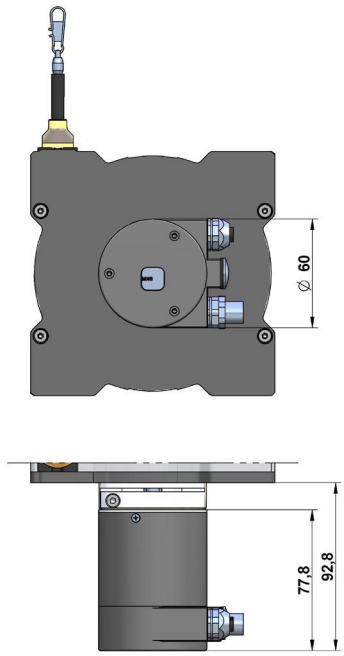
Profibus-DP, EtherCAT
Profinet



SSI



DeviceNET



CONNECTION

encoder type	
Profibus-DP	bus terminal cover, 3 x M12-connector (2 x male, 1 x female)
CANopen	removable bus terminal cover, 2 x M12-connector (1 x male, 1 x female)
DeviceNET	bus terminal cover, 2 x M12-connector (1 x male, 1 x female)
EtherCAT, Profinet	bus terminal cover, 3 x M12-connector (1 x male, 2 x female)
SSI	12-pin M23-connector (pins counter clockwise), mating connector CON012-S

For further information and electrical connection please see Sendix Absolute Encoder data sheet

ACCESSORIES

Cable with mating connector M12, shielded
K4P: 4-pole for analog output: Poti/ 10V/ 420A
K8P: 8-pole for digital output incremental

cable with straight connector:		cable with angular connector:	
K4P2M-S-M12 / K8P2M-S-M12	2 m	K4P2M-SW-M12 / K8P2M-SW-M12	2 m
K4P5M-S-M12 / K8P5M-S-M12	5 m	K4P5M-SW-M12 / K8P5M-SW-M12	5 m
K4P10M-S-M12 / K8P10M-S-M12	10 m	K4P10M-SW-M12 / K8P10M-SW-M12	10 m

Mating connector M12, shielded, for self assembly
D4: 4-pole for analog output: Poti/ 10V/ 420A
D8: 8-pole for digital output incremental

straight connector: D4-G-M12-S / D8-G-M12-S
angular connector: D4-W-M12-S / D8-W-M12-S

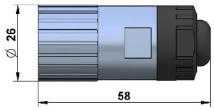
protection class:	IP67	cable passage:	ø 4...8 mm
temperature range:	-25...+90 °C	wire cross-section:	0.14...0.34 mm²
mode of connection:	spring cage	good chemical and oil resistance	

Cable with mating connector M23, for digital output incremental and SSI, shielded

Incremental:		SSI:	
K8P2M-S-M23	2 m	K12P02M-S-M23-SSI	2 m
K8P5M-S-M23	5 m	K12P05M-S-M23-SSI	5 m
K8P10M-S-M23	10 m	K12P10M-S-M23-SSI	10 m
		K12P15M-S-M23-SSI	15 m

Mating connector CON012-S for digital output incremental and SSI, shielded

M23, straight, female connector, 12-pin, metal housing



Cable with mating connector M12 for digital output CANopen and Profibus, shielded

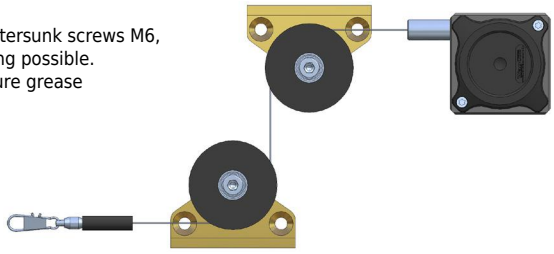
CANopen:		Profibus:	
K5P2M-B-M12-CAN	2 m, female connector	K5P2M-B-M12-PROF	2 m, female connector
K5P2M-S-M12-CAN	2 m, male connector	K5P2M-S-M12-PROF	2 m, male connector
K5P2M-SB-M12-CAN	2 m, female - male	K5P2M-SB-M12-PROF	2 m, female - male
		M12-PROF-AW	terminating resistor

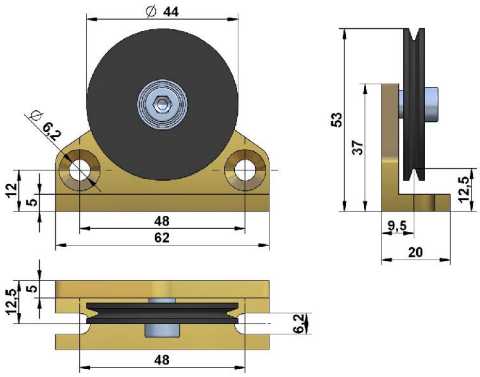
Deflection pulley - UR2

By 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: anodised aluminium, POM
mounting: by 2 hexagon socket or countersunk screws M6, vertical or horizontal mounting possible.
Ball bearings with special low temperature grease and RS-sealing.

Temperature range: -40...+80 °C.



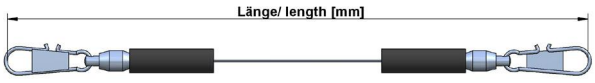


Rope extension - SV

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

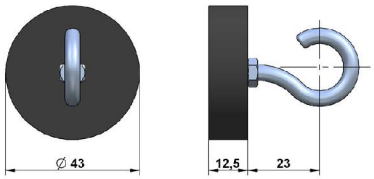
Please specify the length needed in your order. The minimum length is 150 mm.

SV1-XXXX: rope extension (150...4995 mm)
SV2-XXXX: rope extension (5000...19.995 mm)
SV3-XXXX: rope extension (20.000...40.000 mm)



Magnetic clamp - MGG1

Use the magnetic clamp to quickly attach the rope to metallic objects without any assembly time. A rubber coating provides gentle contact (e. g. on varnished surfaces) and prevents from slipping due to vibration.
The magnet consists of a neodym core for an increased adhesive force of 260 N. The hook makes it easy to attach the rope clip (drill protection).



Other cable length are available on request.

ACCESSORIES

Digital distance and speed measurement - PAX

Use PAX display to visualise the covered distance or the speed (tachometer sensor) of the position transducer. It enables a transmission of the measurement data to the computer via interface. The comparator allows a good-bad-evaluation (limit values function).

inputs:	incremental/ analog, 2 independent counter, 1 tachometer sensor
analogue output:	0...20 mA, 4...20 mA, 0...10 V (plug in card)
serial interfaces:	RS485, RS232, DeviceNet, USB, Profibus (plug in cards)
Protection class (front panel):	IP65
display:	6 digits
power supply:	11...36 VDC or 85...250 VAC

For further information please see the data sheets of the PAX display series.

INSTALLATION

- Mount the sensor at the designated place by using 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 minimal allowed bending radius of the cable (5 x cable diameter).
- The rope must be extracted from the sensor **vertically**. The maximum variation from the vertical is 3°. Avoid carefully extracting the rope at an inclination, since the durability of the instrument would shorten considerably. If it is not possible to keep the limit of 3°, a deflection pulley has to be used.
- The measuring range/ the **zero point** begins after approximately 2 mm extracted rope. The mechanical reserve at the end of the measuring range is about 20 mm.
- When mounting outdoors protect the sensor and the rope from ice-formation at temperatures below 0 °C.
- 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 spring drive 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.

SX135 — □ — □ — □

Measurement ranges 10 / 12 / 15 / 20 / 25 / 30 / 35 / 40 / 42.5 m	e.g. 10
Easy-Clamp-Mechanismus	F58K

	Version
-	standard
O	sensor with options

	Options
M4	M4 rope fixation
SSB10	stainless steel ball bearings
TEMP-40	temperature range -40...+85 °C
CO(135)-8	HARTCOAT coating for range 8 m
CO(135)	HARTCOAT coating for range 10 - 42.5 m

ORDER CODE ANALOG OUTPUT

SX135 — □ — □ — □ — □

Measurement ranges 8 / 10 / 12 / 15 / 20 / 25 / 30 / 35 / 40 / 42.5 m	e.g. 10
Analog output	
potentiometer 1 kOhm	1R
voltage output 0...10 V	10V
current output 4...20 mA	420A
Connection	
M12 connector output axial	SA
cable output axial	KA

	Version
-	standard
O	sensor with options

	Options
M4	M4 rope fixation
IN	inverted output signal
L05	improved linearity 0.05 %
SSB8	stainless steel ball bearings for range 8 m
SSB10	stainless steel ball bearings for range 10-42,5 m
TEMP-40	temperature range -40...+85 °C
IP67	protection class IP67
CO(135)-8	HARTCOAT coating for range 8 m
CO(135)	HARTCOAT coating for range 10 - 42.5 m
ICP135-8	increased corrosion protection for range 8 m
ICP135	increased corrosion protection for range 10-42.5 m

ORDER CODE DIGITAL OUTPUT INCREMENTAL

SX135 — □ — □ — □ — □ — □

Measurement ranges 8 / 10 / 12 / 15 / 20 / 25 / 30 / 35 / 40 / 42.5 m	e.g. 10
Pulse/ mm	
up to 8 m: 0.28 / 1.4 / 2.8 / 5.6 / 14	e.g. 14
10 m and above: 0.3 / 1.5 / 3 / 6 / 15	e.g. 15
Output type	
Linedriver RS422	L
Push-Pull antivalent	G
Connection	
connector output axial	SR
connector output radial	SA
cable output axial	KA
cable output radial	KR

	Version
-	standard
O	sensor with options

	Options
M4	M4 rope fixation
M12	connector output M12 (instead of M23)
K1	cable/ connector orientation up
K2	cable/ connector orientation left
K3	cable/ connector orientation down
L02	improved linearity 0.02 %
IP67	protection class IP67
CO(135)-8	HARTCOAT coating for range 8 m
CO(135)	HARTCOAT coating for range 10 - 42.5 m

ORDER CODE DIGITAL OUTPUT ABSOLUTE

SX135 – □ – □ – □

Measurement ranges	
8 / 10 / 12 / 15 / 20 / 25 / 30 / 35 / 40 / 42.5 m	e.g. 10

interfaces / bus systems	
SSI	SSI
Profibus-DP	PRO
CANopen	CAN
DeviceNet	DVN
EtherCAT	CAT
Profinet	NET

	Version
-	standard
O	sensor with options

	Options
M4	M4 rope fixation
K1	cable/ connector orientation up
K2	cable/ connector orientation left
K3	cable/ connector orientation down
IP67	protection class IP67
CO(135)-8	HARTCOAT coating for range 8 m
CO(135)	HARTCOAT coating for range 10 - 42.5 m

OVERVIEW

Base model draw wire mechanics (for encoder assembly)	Base model with potentiometer output
	SX135-8-1R
SX135-10-F58K	**SX135-10-1R**
SX135-12-F58K	**SX135-12-1R**
SX135-15-F58K	**SX135-15-1R**
SX135-20-F58K	**SX135-20-1R**
SX135-25-F58K	**SX135-25-1R**
SX135-30-F58K	**SX135-30-1R**
SX135-35-F58K	**SX135-35-1R**
SX135-40-F58K	**SX135-40-1R**
SX135-42,5-F58K	**SX135-42,5-1R**

With additional charge on -1R Version:

Analog output		Digital output absolute
10V	Voltage output 0...10 V	SSI
420A	Current output 4...20 mA	CANopen
		Profibus-DP
Digital output incremental		DeviceNet
L/ G	Linedriver RS422/ Push-Pull	EtherCAT
		Profinet

Subject to change without prior notice.