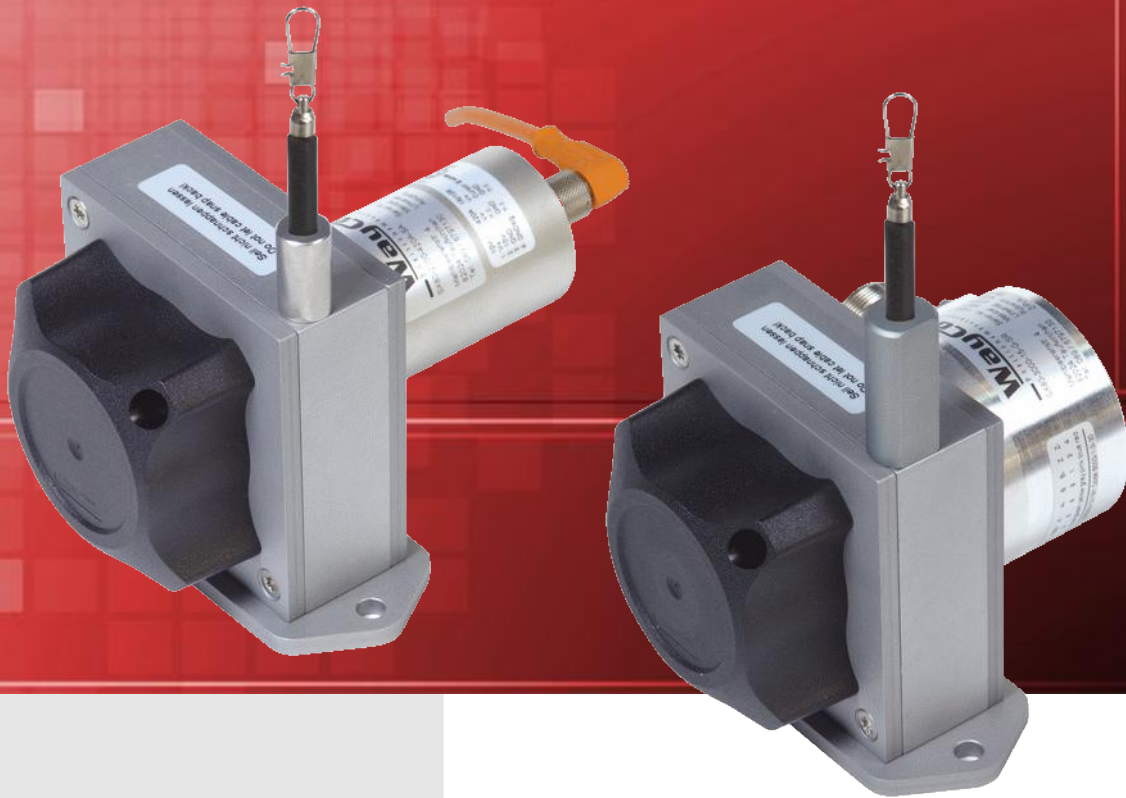


DRAW WIRE SENSOR



Series SX80

Key-Features:

- *Measurement ranges from 1000 to 3000 mm*
- *Analog Output: Potentiometer, 0...10 V, 4...20 mA*
- *Teachable outputs: 0...5 V, 0...10 V, with an additional Open-Collector switching output*
- *Digital Output Incremental: RS422 (TTL), push-pull*
- *Digital Output Absolute: CANopen, SSI, Profibus, EtherCAT, Profinet*
- *Linearity up to $\pm 0.02\%$ of full scale*
- *Protection class up to IP67*
- *Temperature range -20...+85 °C (optional -40 °C or +120 °C)*
- *High dynamics*
- *High interference immunity factor*
- *Customised versions available*

Content:

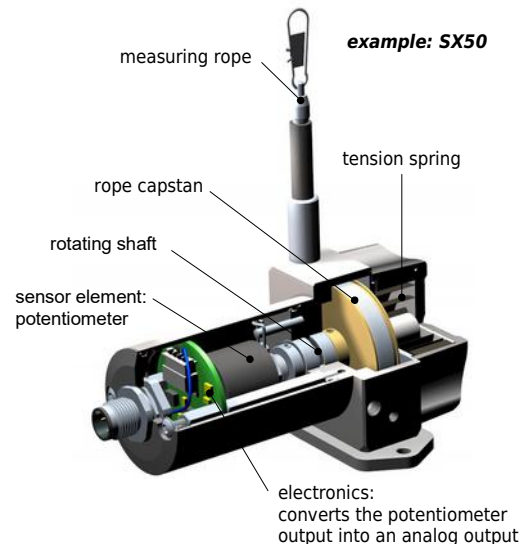
| | |
|-----------------------------------|--------------|
| Introduction |2 |
| Analog Output |3 |
| Digital Output Incremental |6 |
| Digital Output Absolute |8 |
| CANopen, SSI |9 |
| Profibus, EtherCAT | ..10 |
| Profinet | ..11 |
| Options | ..12 |
| Accessories | ..13 |
| Installation | ..15 |
| Order Code | ..16 |

INTRODUCTION

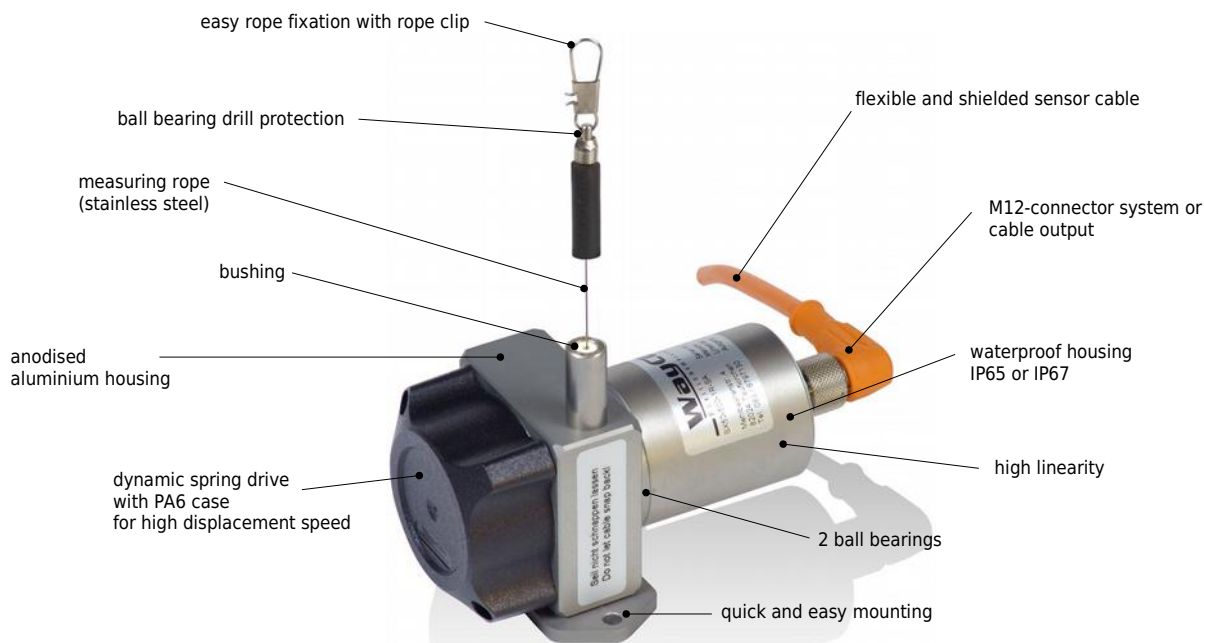
WayCon Positionsmesstechnik GmbH is a manufacturer of high quality draw wire position sensors for industrial use. Due to its small overall size, its short assembly time and its possible customisation, the SX sensor technology is a cost-effective and flexible solution for a wide range of industrial applications.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

The key component of a draw wire sensor is a highly flexible steel wire rope, that is wound single-layered on an ultra light capstan. This capstan is connected to the sensor housing by a pre-stressed spring. The end of the steel wire rope, that is equipped with a rope clip gets connected to the target object. As soon as the distance between sensor and target object changes, the steel wire rope gets pulled out of the sensor and is rolled off the capstan (or vice versa). The shaft of the capstan is connected to a potentiometer (for analog output signals), or to an encoder (for digital output signals). If there is a rotation of the capstan due to a change in the distance to the target object, the sensor element will turn proportionally. This way the potentiometer, or the encoder converts a linear movement into a proportional electrical signal. If a standard analog output signal, like 0...10 V or 4...20 mA is needed, the sensor is equipped with an additional electronics.



SPECIAL FEATURES



WARNING NOTICES

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



TECHNICAL DATA ANALOG OUTPUT

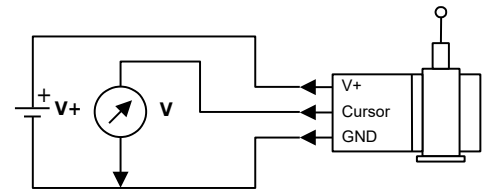
| | | | | | | |
|-------------------------------|------|--|------|------|------|------|
| Measurement range * | [mm] | 1000 | 1500 | 2000 | 2500 | 3000 |
| Linearity | [%] | 0.15 | 0.15 | 0.10 | 0.10 | 0.10 |
| Improved linearity (optional) | [%] | 0.10 | 0.10 | 0.05 | - | - |
| Resolution | | see types of output table below | | | | |
| Sensor element | | Hybrid Potentiometer | | | | |
| Connection | | connector output M12 axial or cable output axial (TPE cable, standard length 2 m) | | | | |
| Protection class | | IP65, optional IP67 | | | | |
| Humidity | | maximum 90 % relative, no condensation | | | | |
| Temperature | [°C] | standard: -20...+85 / optional: -40...+85 / optional: -20...+120 °C (only with Potentiometer (1R) and cable output (KA)) | | | | |
| Mechanical data | | extraction force, maximum velocity and maximum acceleration see table page 13 | | | | |
| Weight | [g] | 300 to 500, depending on the measurement range | | | | |
| Housing | | aluminium, anodised, spring case PA6 | | | | |
| Accessories | | cables, connectors, digital displays, deflection pulley, rope extensions, magnetic clamp (see pages 11 and 12) | | | | |

* other ranges on request

TYPES OF ANALOG OUTPUT

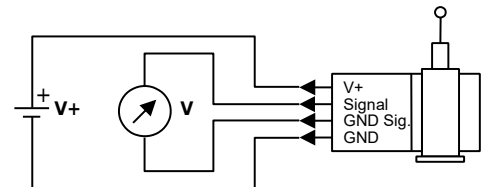
Potentiometer (voltage divider)

| | |
|----------------------------|--|
| Output | 1 kΩ |
| Supply | max. 30 V |
| Recommended cursor current | < 1 μA |
| Resolution | theoretically unlimited, limited by the noise |
| Noise | dependent on the quality of the power supply |
| Working temperature | -20...+85 °C, optional: -40...+85 °C / -20...+120 °C |
| Temperature coefficient | ± 0.0025 %/K |



Voltage 0...10 V

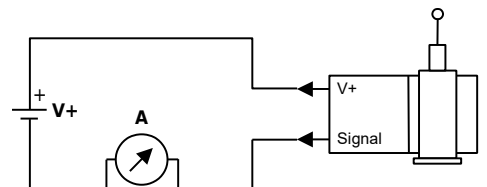
| | |
|-------------------------------------|--|
| Output | 0...10 V, galvanically isolated, 4 conductors |
| Supply | 12...30 VDC |
| Current consumption | max. 22.5 mA (unloaded) |
| Output current | max. 10 mA, min. load 10 kΩ |
| Dynamics | < 3 ms from 0...100 % and 100...0 % |
| Resolution | limited by the noise |
| Noise | 3 mV _{pp} typical, max. 37 mV _{pp} |
| Inverse-polarity protection | yes, infinite |
| Short-circuit proof | yes, permanent |
| Working temperature | -20...+85 °C, optional: -40...+85 °C |
| Temperature coefficient | 0.0037 %/K |
| Electromagnetic compatibility (EMC) | according to EN 61326-1:2006 |



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

Current 4...20 mA

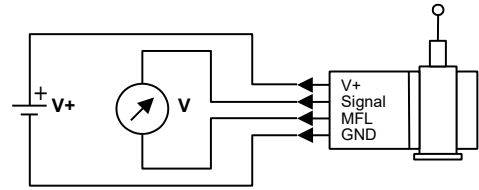
| | |
|-------------------------------------|---|
| Output | 4...20 mA, 2 conductors |
| Supply | 12...30 VDC |
| Output current | max. 50 mA in case of error |
| Dynamics | < 1 ms from 0...100 % and 100...0 % |
| Resolution | limited by the noise |
| Noise | 0.03 mA _{pp} = 6 mV _{pp} at 200 Ω |
| Inverse-polarity protection | yes, infinite |
| Working temperature | -20...+85 °C, optional: -40...+85 °C |
| Temperature coefficient | 0.0079 %/K |
| Electromagnetic compatibility (EMC) | according to EN 61326-1:2006 |



TYPES OF ANALOG OUTPUT

Voltage 0...5 V, 0...10 V, teachable up to approx. 50% of full scale

| | |
|-------------------------------------|--|
| Output | 0...5 V, 0...10 V, 3 wire system |
| Supply | 8...35 VDC |
| Power consumption | max. 150 mW |
| Output current | max. 10 mA, min. load 1 kOhm |
| Dynamics | 1 ms |
| Resolution | 1 mV |
| Noise | 3 mV _{ss} typical, max. 37 mV _{ss} |
| Inverse-polarity protection | yes, infinite |
| Short-circuit proof | yes, permanent |
| Working temperature | -40...+85 °C |
| Temperature coefficient | 0.0016 %/K |
| Electromagnetic compatibility (EMC) | according to EN 61326-1:2006 |



MFL: Multi-functional line

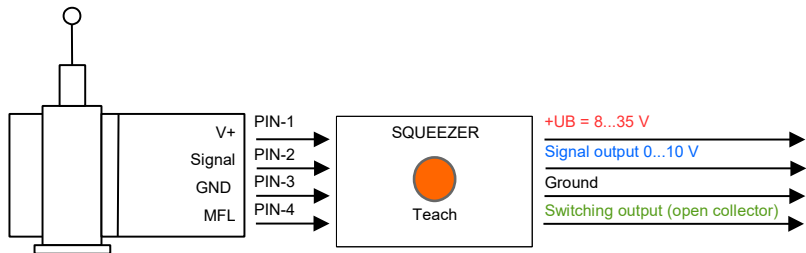
TEACHABLE OUTPUT 5VT, 10VT, SQUEEZER

Draw wire sensors with the analogue output versions 5VT and 10 VT are equipped with a teachable, internal electronics, called VT-Electronics. The signals provided by the sensor's potentiometer are digitized by the VT-Electronics. This digital information is first processed by the electronics, then transformed back and given out as an analogue output signal 0 to 10 V or 0 to 5 V.

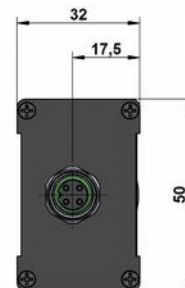
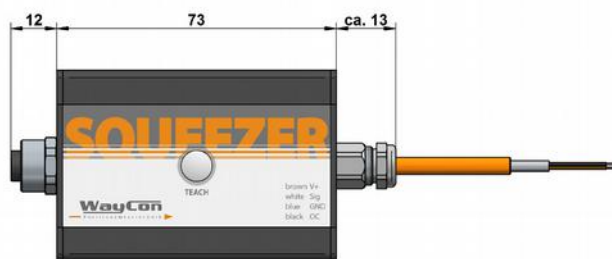
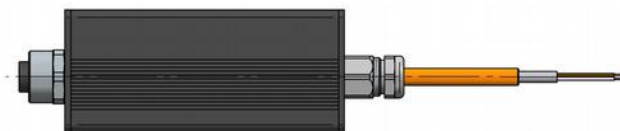
The digitization offers two possibilities of adjustment, by which the sensor can be configured individually using the squeezer:

- 1) Teaching of the measurement range. After a successful teaching process the squeezer can be pulled off the sensor and be replaced by a standard cable or connector.
- 2) Setting an individual switching point. The squeezer allows the setting of an individual switching point open collector. The switching signal is emitted through the Multi-functional line MFL.

You will find a detailed description of the functions in a separate manual.



TECHNICAL DRAWING SQUEEZER



Available cable lengths:
 Squeezer2M: cable length 2 m
 Squeezer5M: cable length 5 m
 Squeezer10M: cable length 10 m

TECHNICAL DRAWING ANALOG OUTPUT

| Range | Output | B |
|---------------|--------------------|----|
| 1000/ 2000 mm | Potentiometer | 73 |
| 1000/ 2000 mm | 10V / 420A | 87 |
| 1500 mm | see detail drawing | |
| 2500/ 3000 mm | see detail drawing | |

Detail drawing for measurement ranges 1500, 2500, 3000 mm

connector output axial

connector output radial

ELECTRICAL CONNECTION ANALOG OUTPUT

Cable output

| | | | | |
|-----------------|---|--|--|--|
| Cable type | TPE, flexible | | | |
| Cable direction | axial | | | |
| Length | standard: 2 m, (others on request) | | | |
| Diameter | 4.5 mm | | | |
| Wire | 0.25 mm ² | | | |
| Temperature | fixed installation -30...+85 °C, flexible installation -20...+85 °C | | | |

| Cable colour | 0...10 V | 4...20 mA | 1 kOhm | 0...5 V, 0...10 V (teachable) |
|--------------|------------|-----------|--------|-------------------------------|
| brown | V + | V + | V + | V + |
| white | Signal | n. c. | Cursor | Signal |
| blue | GND | Signal | GND | GND |
| black | GND Signal | n. c. | n. c. | MFL* |

* Multi-functional line

Connector output

- M12, 4 poles
- female connector

| Pin | 0...10 V | 4...20 mA | 1 kOhm | 0...5 V, 0...10 V (teachable) |
|-----|------------|-----------|--------|-------------------------------|
| 1 | V + | V + | V + | V + |
| 2 | Signal | n. c. | Cursor | Signal |
| 3 | GND | Signal | GND | GND |
| 4 | GND Signal | n. c. | n. c. | MFL |

* Multi-functional line

Squeezer for sensors with analogue output 5VT, 10VT
 Connection cable sensor – squeezer:
 K4P1,5M-SB-M12 (accessory)

| Connector (to sensor) | | Cable ends (e.g. to PLC) | |
|-----------------------|--------|--------------------------|----------------|
| Pin 1 | V + | brown | V + (8...35 V) |
| Pin 2 | Signal | white | Signal |
| Pin 3 | GND | blue | GND |
| Pin 4 | MFL* | black | NPN** |

* multifunctional line ** The Open Collector is a NPN switching output

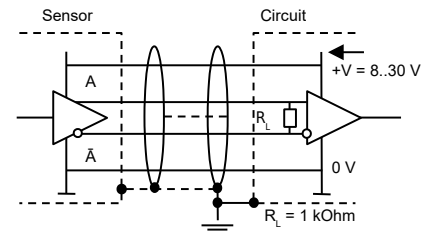
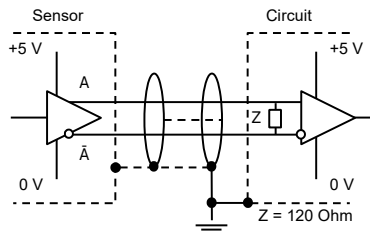
TECHNICAL DATA DIGITAL OUTPUT INCREMENTAL

| | | |
|-------------------------------|-------------|---|
| Measurement range * | [mm] | 1000 / 1500 / 2000 / 2500 / 3000 |
| Linearity | [%] | 0.05, independent of the measurement range |
| Improved linearity (optional) | [%] | 0.02, independent of the measurement range, only in combination with resolution 10 pulses/mm, or higher |
| Selectable resolution | [Pulses/mm] | 0.5 / 5 / 10 / 25 (this resolution can be raised by the factor 4 using quadruple edge detection) |
| Z-Pulse distance | [mm] | 200 |
| Sensor element | | Incremental-Encoder (with optical code disk) |
| Output signal | | A/B-Pulses (90° phase-delayed), Z-Pulse (plus inverted pulses A_{not} , B_{not} , Z_{not}) |
| Connection | | M12 or M23 connector output or cable output with open ends (standard length 2 m) |
| Protection class | | IP65, optional IP67 |
| Humidity | | maximum 90 % relative, no condensation |
| Temperature range | [°C] | -20...+85 |
| Mechanical data | | extraction force, maximum velocity and maximum acceleration see table page 13 |
| Life expectancy | | approx. 2 million full strokes (dependent on the displacement speed) |
| Weight | [g] | approx. 750 |
| Housing | | aluminium, anodised, spring case PA6 |
| Accessories | | digital displays, deflection pulley, rope extensions, magnetic clamp (see pages 12 and 13) |

* other ranges on request

| Electrical Data | | Linedriver L | Push-Pull G |
|-------------------------------|-------|------------------------|----------------------|
| | | RS422 (TTL-compatible) | |
| Power supply +V | [VDC] | 5, ±5 % | 8...30 |
| Current consumption (no load) | [mA] | typical 40, max. 90 | typical 40, max. 100 |
| Load/ Channel | [mA] | max. ±20 | max. ±40 |
| Pulse frequency | [kHz] | max. 300 | max. 200 |
| Signal level high | [V] | min. 2.5 | min. +V – 3 |
| Signal level low | [V] | max. 0.5 | max. 0.5 |

Recommended circuit

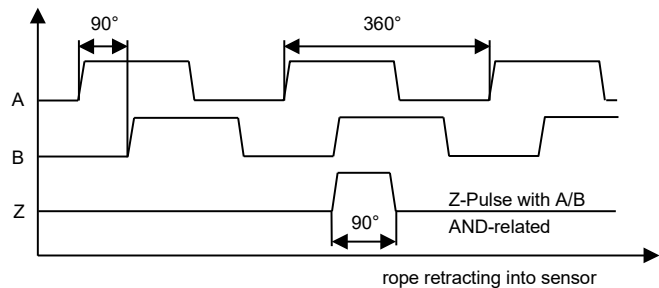


OUTPUT SIGNAL DIGITAL OUTPUT INCREMENTAL

Output signal

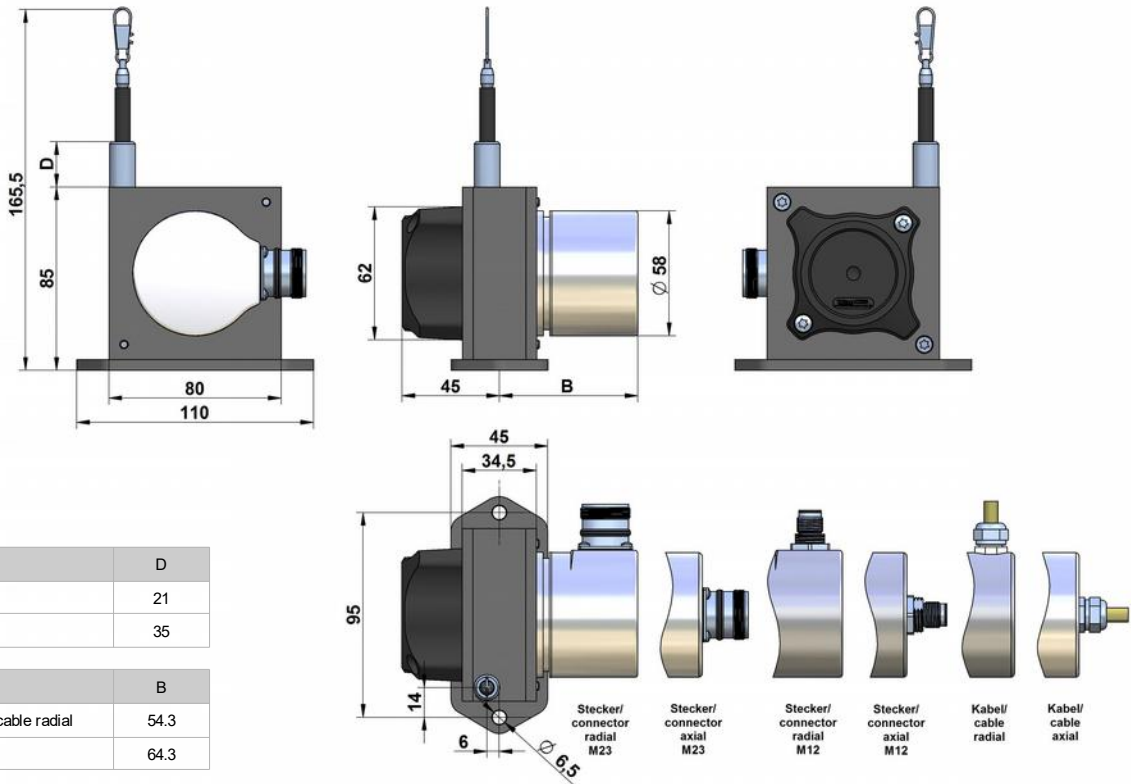
Pulses A and B are 90° phase-delayed (detection of direction). The Z-Pulse is emitted once per turn. The Z-Pulse distance is 125 mm (= circumference of the rope drum) and can be used as a reference mark.

The diagram shows the signal without inverted signals; time line for return of rope.



TECHNICAL DRAWING DIGITAL OUTPUT INCREMENTAL

Digital Output Incremental



| | |
|--------------------------------------|------|
| Range | D |
| 1000/ 1500/ 2000 mm | 21 |
| 2500/ 3000 mm | 35 |
| Output | B |
| cable/ connector axial, cable radial | 54.3 |
| connector radial | 64.3 |

CONNECTION DIGITAL OUTPUT INCREMENTAL

| Signal | 0 V | +V | 0 V _{sens} * | +V _{sens} * | A | A _{Not} | B | B _{Not} | Z | Z _{Not} | screen |
|------------------------|-------|-------|-----------------------|----------------------|-------|------------------|------|------------------|------|------------------|---------|
| Connector M23, 12-pole | 10 | 12 | 11 | 2 | 5 | 6 | 8 | 1 | 3 | 4 | housing |
| Connector M12, 8-pole | 1 | 2 | - | - | 3 | 4 | 5 | 6 | 7 | 8 | housing |
| Cable output | white | brown | black | violet | green | yellow | grey | pink | blue | red | housing |

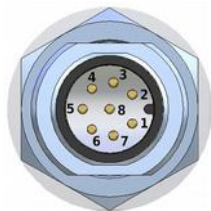
* For Linedriver L only. For long cable lengths it may occur that the operating voltage at the sensor does not suffice due to the output resistance. With the sensor lines 0 V_{sens} and +V_{sens} the operating voltage can be checked and, if necessary, be readjusted at the input connection.

| | | | |
|--|---|-----------------------|------------------------------|
| +V: | Encoder power supply +VDC | A, A _{Not} : | Incremental output channel A |
| 0 V: | Encoder power supply ground GND (0 V) | B, B _{Not} : | Incremental output channel B |
| 0 V _{sens} / +V _{sens} : | Using the sensor outputs of the encoder, the voltage present can be measured and if necessary increased accordingly | Z, Z _{Not} : | Reference signal |

Connector output



Connector output, M23, 12 poles



Connector output, M12, 8 poles

Cable output

| | |
|-----------------|---|
| Cable type | PVC, flexible |
| Cable direction | radial or axial |
| Length | 2.0 m |
| Diameter | ø 4.5 mm |
| Wires | 8 (push-pull) and 10 (linedriver) x 0.14 mm ² |
| Temperature | fixed installation -30...+85 °C flexible installation -20...+85 °C |
| Assignment | see table above |

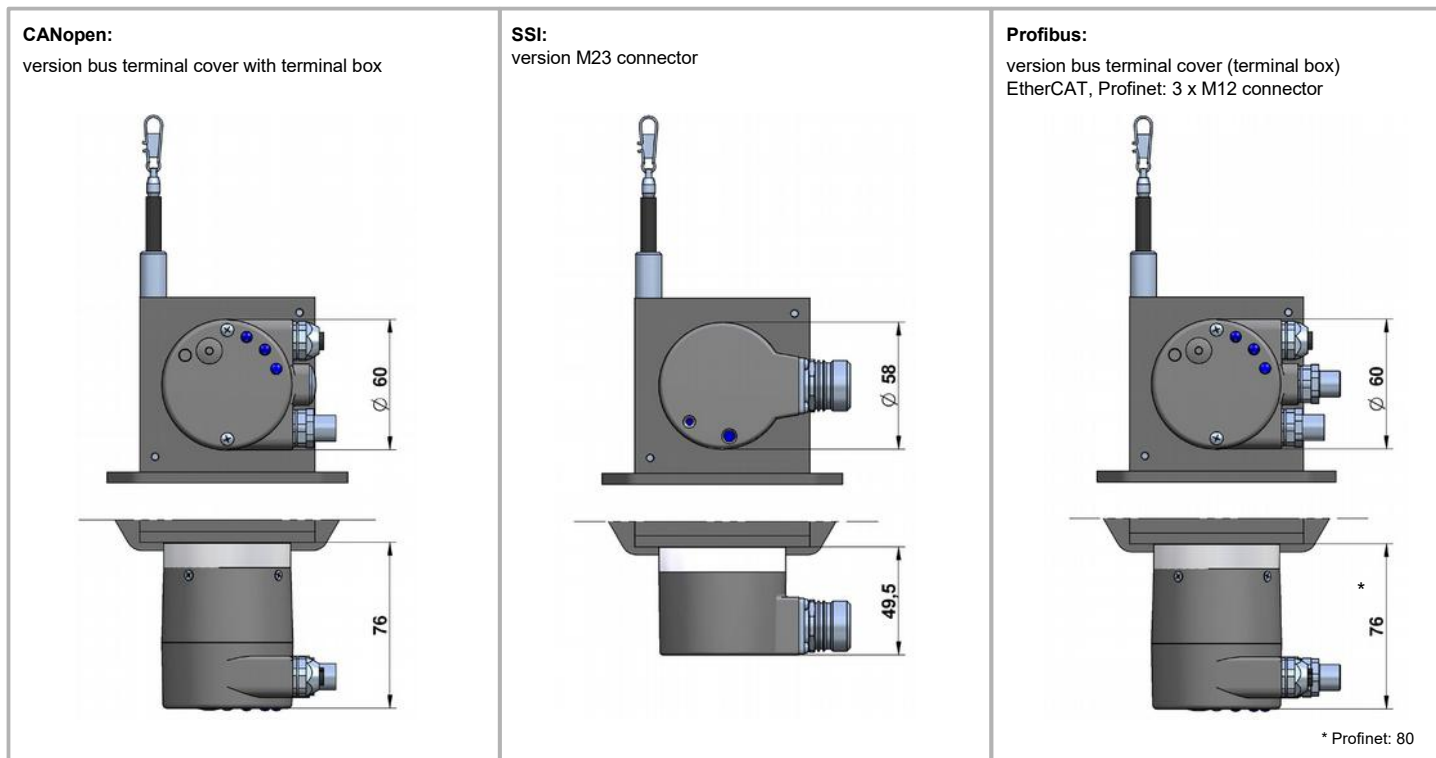
TECHNICAL DATA DIGITAL OUTPUT ABSOLUTE

| | | CANopen | SSI | Profibus-DP | EtherCAT | Profinet |
|-------------------------------------|-------------|---|---------|-------------|----------|----------|
| Measurement range | [mm] | 1000 / 1500 / 2000 / 2500 / 3000 | | | | |
| Linearity | [%] | 0.05, independent of the measurement range | | | | |
| Resolution scalable (with Software) | | yes | no | yes | yes | yes |
| Standard resolution | [Pulses/mm] | 40,96 | 20,48 | 40,96 | 40,96 | 40,96 |
| | [Bit] | 13 | 12 | 13 | 13 | 13 |
| Maximum resolution | [Pulses/mm] | 327.68 | - | 327.68 | 327.68 | 327.68 |
| | [Bit] | 16 | - | 16 | 16 | 16 |
| Sensor element | | Multiturn-Absolute-Encoder (with optical code disk) | | | | |
| Electrical connection | | see order code page 16 | | | | |
| Power supply | [VDC] | 10...30 (reverse polarity protection of the power supply) | | | | |
| Current consumption (no load, 24 V) | [mA] | max. 100 | max. 50 | max. 120 | max. 120 | max. 200 |
| Protection class | | IP65, optional IP67 | | | | |
| Humidity | | max. 90 % relative, no condensation | | | | |
| Temperature | [°C] | -20...+80 | | | | |
| Mechanical data | | extraction force, maximum velocity and maximum acceleration see table page 14 | | | | |
| Life expectancy | | approx. 2 million full strokes (dependent on the displacement speed) | | | | |
| Weight | [g] | approx. 1100 | | | | |
| Housing | | aluminium, anodised, spring case PA6 | | | | |
| Special cables needed | | yes | yes | yes | yes | yes |
| Accessories | | cable, connector, digital display, deflection pulley, rope extensions, magnetic clamp (see pages 12 and 13) | | | | |

Other encoder types are available on request

TECHNICAL DRAWING DIGITAL OUTPUT ABSOLUTE

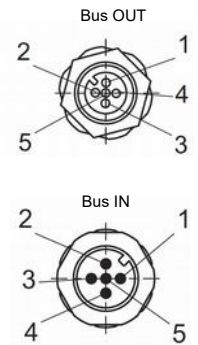
Note: for dimensions of the sensor housing please see page 4.



DESCRIPTION CANopen

Parameters of the CANopen Interface

| | |
|------------------------|--|
| Code | Binary |
| Interface | CAN High-Speed acc. to ISO 11898, Basic- and Full-CAN, CAN Specification 2.0 B |
| Protocol | CANopen profile DS406 V3.2 with manufacturer-specific add-ons |
| Baud rate | 10 ... 1000 kbit/s (can be set via DIP switches/ Software configurable) |
| Node address | 1...127 (can be set via rotary switches/ Software configurable) |
| Termination switchable | can be set via DIP switches/ Software configurable |
| SET Button (Option) | Zero or defined value option |
| LED | LED is ON with the following fault conditions: Sensor error (internal code or LED error) too low voltage, over-temperature |



Electrical connection CANopen with 2 x M12 connectors, radial

| | Bus OUT | | | | | Bus IN | | | | |
|--------|---------|-----|-------|-------|---------|--------|-----|-------|-------|---------|
| Signal | 0 V | + V | CAN_L | CAN_H | CAN_GND | 0 V | + V | CAN_L | CAN_H | CAN_GND |
| PIN | 3 | 2 | 5 | 4 | 1 | 3 | 2 | 5 | 4 | 1 |

Electrical connection CANopen with cable gland radial (removable bus terminal cover)

| | Bus out | | | | | Bus in | | | | |
|--------------|---------|-------|-------|-----|----|--------|----|-------|-------|---------|
| Signal | CAN_GND | CAN_L | CAN_H | 0 V | +V | 0 V | +V | CAN_L | CAN_H | CAN_GND |
| Abbreviation | CG | CL | CH | 0 V | +V | 0 V | +V | CL | CH | CG |

DESCRIPTION SSI

Parameters of the SSI interface

| | |
|--------------------------|--|
| Output driver | RS485 Transceiver-type |
| Permissible load/channel | max. ±20 mA |
| Signal level | HIGH: typ 3.8 V LOW: with I _{Load} = 20 mA typ 1.3 V |
| Resolution | 12 bit |
| Code | Gray |
| SSI clock rate | ST-resolution: 50 kHz...2 MHz |
| Monoflop time | ≤ 15 µs |
| Data refresh rate | ≤ 1 µs |
| Status and Parity bit | on request |

SET Input (optional)

| | |
|----------------------------------|---|
| Input | active HIGH |
| Input type | comparator |
| Signal level | HIGH: min 60% of +V, max. +V LOW: max. 25% of +V |
| (+V = power supply) | |
| Input current | <0.5 mA |
| Min. pulse duration (SET) | 10 ms |
| Input delay | 1 ms |
| New position data readable after | 1 ms |
| Internal processing time | 200 ms |

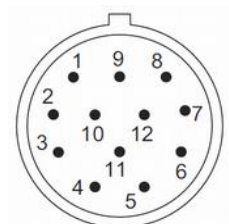
Electrical connection SSI with cable output

| | Cable (Isolate unused wires individually before initial start-up) | | | | | | | | | | | | |
|--------|---|-------|-------|--------|------|------|------|-----|--------|------|------|------|--------|
| Signal | 0V | +V | C+ | C- | D+ | D- | SET | DIR | Status | n.c. | n.c. | n.c. | H |
| Colour | white | brown | green | yellow | gray | pink | blue | red | black | - | - | - | shield |

Electrical connection SSI with connector output M23, 12 pole

| | M23 connector | | | | | | | | | | | | |
|--------|---------------|----|----|----|----|----|-----|-----|--------|------|------|------|--------|
| Signal | 0V | +V | C+ | C- | D+ | D- | SET | DIR | Status | n.c. | n.c. | n.c. | H |
| PIN | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | shield |

- + V: Encoder power supply +VDC
- 0 V: Encoder power supply GND (0 V)
- C+, C-: Clock signal
- D+, D-: Data signal
- SET: SET Input
- DIR: Direction input: If this input is active, output values are counted backwards (decrease) when the shaft is turning clockwise.
- H: Plug connector housing (Shield)



DESCRIPTION PROFIBUS DP

Parameters of the Profibus DP interface

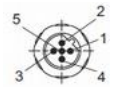
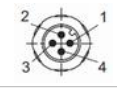

| | |
|------------------------|--|
| Code | Binary |
| Interface | Profibus DP 2.0 Standard (DIN 19245 Part 3), RS485 Driver galvanically isolated |
| Protocol | Profibus Encoder Profile V1.1 Class1 and Class2 with manufacturer-specific add-ons |
| Baud rate | maximum 12 Mbit/s |
| Device address | 1...127 (set by rotary switches) |
| Termination switchable | set by DIP switches |
| SET Button (Option) | Zero or defined value option |
| LED | LED is ON with the following fault conditions: Sensor error, Profibus error |

Electrical connection Profibus with cable gland radial (removable bus terminal cover)

| | Bus IN | | | | Bus OUT | | | |
|----------|--------|---|-----|----|---------|----|---|---|
| Signal | B | A | 0 V | +V | 0 V | +V | B | A |
| Terminal | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

The shield of the connection cable must be connected over a large area via the cable gland.

Electrical connection Profibus with connector output 3 x M12

| | | | | | | | |
|--------------|--------|----------|------|----------|------|--------|---|
| Bus IN | Signal | - | PB_A | - | PB_B | shield |  |
| | PIN | 1 | 2 | 3 | 4 | 5 | |
| Power supply | Signal | +V | - | 0 V | - | |  |
| | PIN | 1 | 2 | 3 | 4 | | |
| Bus OUT | Signal | BUS_VDC* | PB_A | BUS_GND* | PB_B | shield |  |
| | PIN | 1 | 2 | 3 | 4 | 5 | |

* For supplying an external Profibus termination resistor

Connection cables for connector output 3 x M12



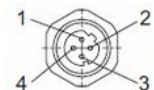
| | cable end 1 | cable end 2 | cable order code |
|--------------|-------------|-------------|-------------------|
| Bus IN | open ends | | K5P2M-B-M12-PROF |
| | Bus OUT | | K5P2M-SB-M12-PROF |
| Bus OUT | open ends | | K5P2M-S-M12-PROF |
| | Bus IN | | K5P2M-SB-M12-PROF |
| Power supply | | | K4P2M-S-M12 |
| Terminator | | | M12-PROF-AW |

DESCRIPTION EtherCAT

Parameters of the EtherCAT Interface

| | |
|----------------------|---|
| Code | Binary |
| Protocol | EtherNet / EtherCAT |
| Modes | Freerun, Distributed Clock |
| Diagnostic LED red | LED is ON with the following fault conditions: Sensor error (internal code or LED error), low voltage, over-temperature |
| Run LED green | LED is ON with the following conditions: Preop-, Safeop and Op-State (EtherCAT Status machine) |
| 2 x Link LEDs yellow | LED is ON with the following conditions (Port IN and Port OUT): Link detected |

Electrical connection EtherCAT with connector output 3 x M12

| | | | | | | |
|--------------|--------------|-----------------|----------------|-----------------|----------------|---|
| Bus Port in | Signal | Transmit data + | Receive data + | Transmit data - | Receive data - |  |
| | Abbreviation | TxD+ | RxD+ | TxD- | RxD- | |
| | PIN | 1 | 2 | 3 | 4 | |
| Power supply | Signal | Voltage + | - | Voltage - | - |  |
| | Abbreviation | +V | - | 0 V | - | |
| | PIN | 1 | 2 | 3 | 4 | |
| Bus Port out | Signal | Transmit data + | Receive data + | Transmit data - | Receive data - |  |
| | Abbreviation | TxD+ | RxD+ | TxD- | RxD- | |
| | PIN | 1 | 2 | 3 | 4 | |

DESCRIPTION PROFINET



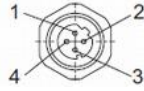
Parameters of the Profinet interface

| | |
|-----------------|---|
| Code | Binary |
| Protocol | PROFINET 10 |
| LED Link1/Link2 | two coloured: green = active link yellow = data transfer |

Ezturn Software for Profinet (supplied with the encoder)

- Monitoring of cyclic data (e.g. position, speed)
- Monitoring of acyclic data (e.g. IMO, electronic name plate, encoder parameters, warnings and error messages, preset)
- Setting of preset values
- Firmware updates via the bus

Electrical connection Profinet with connector output 3 x M12

| Bus Port 1 | Signal | Transmit data + | Receive data + | Transmit data - | Receive data - | |
|--------------|--------------|-----------------|----------------|-----------------|----------------|---|
| | Abbreviation | TxD+ | RxD+ | TxD- | RxD- |  |
| | PIN | 1 | 2 | 3 | 4 | |
| Power supply | Signal | Voltage + | - | Voltage - | - |  |
| | Abbreviation | +V | - | 0 V | - | |
| | PIN | 1 | 2 | 3 | 4 | |
| Bus Port 2 | Signal | Transmit data + | Receive data + | Transmit data - | Receive data - |  |
| | Abbreviation | TxD+ | RxD+ | TxD- | RxD- | |
| | PIN | 1 | 2 | 3 | 4 | |

General information about PROFINET IO

The PROFINET encoder implements the Encoder Profile 4.1. (according to the specification Encoder Version 4.1 Dec 2008“).

It permits scaling and preset values, as well as many other additional parameters to be programmed via the PROFINET-Bus.

When switching on, all parameters are loaded from an EEPROM, where they were saved previously to protect them against power-failure, or taken over by the controller in the start-up phase.

Position, speed and many other states of the encoder can be transmitted.

PROFINET IO

The complete encoder profile according to Profile Encoder Version 4.1 as well as the Identification & Maintenance functionality Version 1.16 has been implemented. IM blocks 0, 1, 2, 3 and 4 are supported.

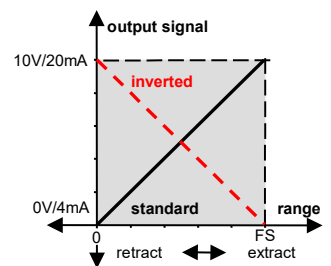
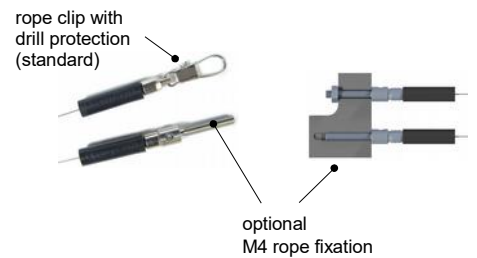
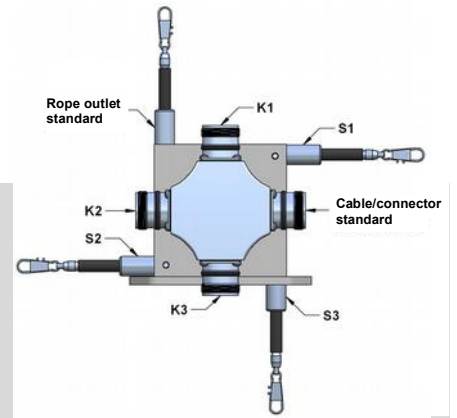
The Media Redundancy Protokoll is implemented here.

Basically, the advantage of MRP is that the functionality of the components, which are wired in a ring structure, is maintained in case of a failure or of a breakage of the wires in any location.

OPTIONS

The following table gives an overview of frequently used options, with which the standard sensors can be equipped. Please pay attention that not all options can be combined. You will find the not-combinable options on page 15 and 16 in the section of the product codes.

| Option | Order code | Description |
|--|------------|---|
| Synthetic wire rope (instead of stainless steel wire rope) | COR | Synthetic wire rope, made out of abrasion resistant and enhanced Coramid. (not available for ranges 2500/3000 mm) |
| Protection class IP67 (instead of IP65) | IP67 | Use option IP67, if the sensor will operate in a humid environment. Note that with this option there may occur a light hysteresis in the output signal due to the special sealing. The max. acceleration and displacement speed are reduced to 80 % of the specified value. |
| Corrosion protection | CP | Includes a V4A wire rope, stainless steel bearings and option M4. The sensors rope drum gets HARTCOAT® coated. This coating is a hard-anodic oxidation that protects the sensor from corrosion by aggressive media (e. g. sea water) with a hard ceramics-like layer. |
| Increased corrosion protection only in combination with analog output | ICP | Components of the housing and the rope drum get HARTCOAT® coated. Includes the options CP, IP67 and M4. |
| Increased temperature range Low only in combination with analog output | T40 | Special components and a low temperature grease make a working temperature down to -40 °C (up to +85°C) possible. |
| Increased temperature range High only in combination with potentiometer 1R | T120 | Sensors with potentiometer output (1R) and cable output can be operated from -20 to +120 °C when this option is used. (NOT in combination with voltage-, current or digital output signals) |
| Changed rope outlet | S1, S2, S3 | S1: rope outlet sideways at the top S2*: rope outlet sideways at the bottom S3*: rope outlet on the bottom * with modified mounting plate, see page 13 |
| Changed cable or connector orientation only for digital incremental output and digital absolute output | K1, K2, K3 | Standard: sideways, opposite to the rope outlet K1: at the top K2: sideways, same side as the rope outlet K3: at the bottom |
| Rope fixation by M4 thread | M4 | Optional, pivoted rope fixation with screw thread M4, length 22 mm. Ideal for attachment to through holes or thread holes M4. |
| Ring eye | RI | The end of the wire rope is equipped with a ring eye instead of a rope clip. Inside diameter 20 mm |
| Inverted output signal only in combination with analog output | 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. |



ACCESSORIES

Deflection pulley - UR2

The rope must be extracted from the sensor **vertically**. The maximum variation from the vertical is 3°. A deflection pulley allows a change in the direction of the wire rope. Several pulleys may be used. The rope clip must not be guided over the deflection pulley.

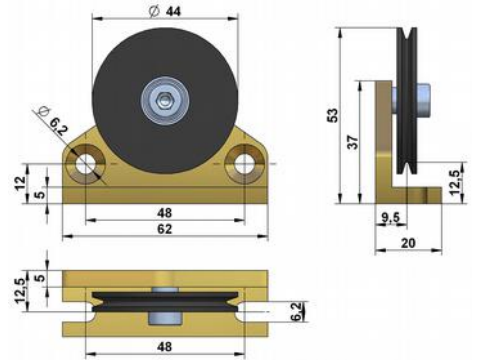
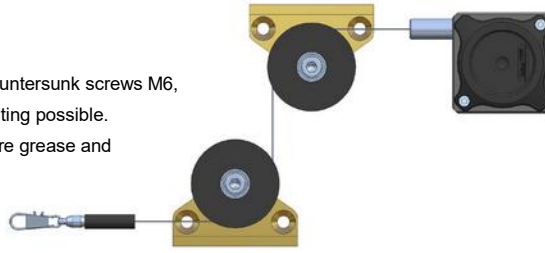
Material foot: anodised aluminium

Material rope wheel: POM-C

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: -40...+80 °C.



Rope extension - SV

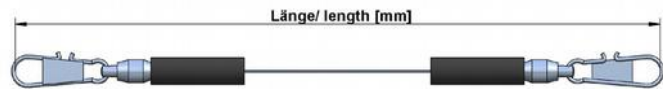
For bridging a greater distance between the measuring target and the sensor a rope extension can be applied. The rope clip must not be guided over the deflection pulley.

Please specify the length needed in your order (XXXX). The minimum length is 150 mm:

SV1-XXXX: rope extension (150...4995 mm)

SV2-XXXX: rope extension (5000...19995 mm)

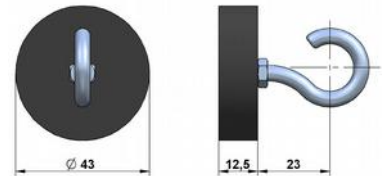
SV3-XXXX: rope extension (20000...40000 mm)



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.



ACCESSORIES ANALOG OUTPUT

Cable with connector M12, 4 poles, shielded

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



| PIN No. | cable colour | PIN No. | cable colour |
|---------|--------------|---------|--------------|
| Pin 1 | brown | Pin 3 | blue |
| Pin 2 | white | Pin 4 | black |

Mating Connector M12, 4 poles, shielded

| | |
|-------------------------------------|---------------------------------|
| D4-G-M12-S | straight, M12 for self assembly |
| D4-W-M12-S | angular, M12 for self assembly |
| protection class: IP67 | |
| temperature: -25...+90 °C | |
| cable passage: ø 4...8 mm | |
| wire cross-section: 0.14...0.34 mm² | |
| mode of connection: spring cage | |

Digital display - PAXD (for Potentiometer)

Use the PAXD display to visualise the measured distance of the position transducer with a potentiometer as sensor element. A transmission of the measurement data to a computer or PLC can be done with interface plug-in cards.

| | |
|------------------------------------|---|
| Inputs: | Potentiometer signal |
| Analog output (plug-in cards): | 0...20 mA, 4...20 mA, 0...10 V |
| Serial interfaces (plug-in cards): | RS485, RS232, DeviceNet, USB, Profibus, Relay output, Transistor output |
| Protection class: | IP65 (Front panel) |
| Display: | 5 digits |

PAXD000B: 1 channel, power supply: 85 to 250 VAC

PAXD001B: 1 channel, power supply: 11 to 36 VDC/24 VAC

For further information please see the data sheet of the PAXD display series



ACCESSORIES ANALOG OUTPUT

Digital displays PAXP (1 channel) and PAXDP (2 channels) for sensors with analog output signals 0...10V or 4...20 mA

Use the PAXD or PAXDP display to visualise the measured distance of transducers with an analog output signal. A transmission of the measurement data to a computer or PLC can be done with interface plug-in cards.

| | |
|------------------------------------|---|
| Inputs: | 0...10 V or 4...20 mA, 2 independent counters (for PAXDP) |
| Analog output (plug-in cards): | 0...20 mA, 4...20 mA, 0...10 V |
| Serial interfaces (plug-in cards): | RS485, RS232, DeviceNet, USB, Profibus, Relay output, Transistor output |
| Protection class: | IP65 (front panel) |
| Display: | 5 digits |
| PAXP000B: | 1 channel, power supply: 85 to 250 VAC |
| PAXP001B: | 1 channel, power supply: 11 to 36 VDC/24 VAC |
| PAXDP000B: | 2 channels, power supply: 85 to 250 VAC |
| PAXDP001B: | 2 channels, power supply: 11 to 36 VDC/24 VACC |



For further information please see the PAXD and PAXDP data sheet.

ACCESSORIES DIGITAL OUTPUT INCREMENTAL

Cable with connector M12, 8 poles, shielded

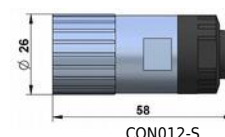
| | |
|--------------|--------------------------|
| K8P2M-S-M12 | 2 m, connector straight |
| K8P5M-S-M12 | 5 m, connector straight |
| K8P10M-S-M12 | 10 m, connector straight |
| K8P2M-SW-M12 | 2 m, connector angular |
| K8P5M-SW-M12 | 5 m, connector angular |

Mating connector M12, 8 poles, shielded

| | |
|------------|---------------------------------------|
| D8-G-M12-S | mating connector straight |
| D8-W-M12-S | mating connector angular |
| | protection class: IP67 |
| | temperature: -25...+90 °C |
| | cable passage: \varnothing 4...8 mm |

Mating connector M23, 12 poles

| | |
|----------|--|
| CON012-S | straight, metal housing |
| | wire diameter: AWG 16...26 mm ² |
| | cable diameter: \varnothing 5.5...10 mm |



Digital distance and speed display - WAY-D for incremental output signals

Use the WAY-D display to visualise the measured distance or the speed (tachometer) of the position transducer. A transfer of data to a PC or PLC can be done with the RS232 interface of the WAY-DR.

| | |
|-------------------|--------------------|
| Protection class: | IP65 (front panel) |
| Display: | 6 digits |
| Supply: | 115 / 250 VAC |

Output Linedriver L (TTL, RS422):

| | |
|-------------|---|
| WAY-DS-5VH: | display only, input level TTL |
| WAY-DG-5VH: | display with two presets and switching outputs, input level TTL |
| WAY-DR-5VH: | display with serial interface RS232 / RS485, input level TTL |

Output Push-Pull G:

| | |
|---------|---|
| WAY-DS: | display only, input level HTL |
| WAY-DG: | display with two presets and switching outputs, input level HTL |
| WAY-DR: | display with serial interface RS232 / RS485, input level HTL |



For further information please see the WAY-D data sheet.

ACCESSORIES DIGITAL OUTPUT ABSOLUTE SSI

Digital distance and speed display - WAY-SSI for SSI output signals

Use the WAY-SSI display to visualise the measured distance or the speed (tachometer) of the position transducer. A transfer of data to a PC or PLC can be done with the RS232 interface of the WAY-SSI-R.

| | |
|-------------------|--------------------|
| Protection class: | IP65 (front panel) |
| Display: | 6 digits |
| Supply: | 115 / 250 VAC |

| | |
|------------|--|
| WAY-SSI-S: | display only |
| WAY-SSI-A: | display with analog output |
| WAY-SSI-G: | display with two presets and switching outputs |
| WAY-SSI-R: | display with serial interface RS232 / RS485 |



For further information please see the WAY-SSI data sheet.

MECHANICAL DATA

| Measurement Range [mm] | Extraction Force | | Speed* V_{max} [m/s] | Acceleration* a_{max} [m/s ²] |
|---------------------------|------------------|---------------|---------------------------|--|
| | F_{min} [N] | F_{max} [N] | | |
| 1000 | 4.2 | 5.4 | 10 | 140 |
| 1500 | 4.2 | 5.4 | 10 | 140 |
| 2000 | 5.0 | 6.4 | 10 | 140 |
| 2500 | 5.0 | 6.4 | 10 | 140 |
| 3000 | 5.0 | 6.4 | 10 | 140 |

* reduced to 80 % when option IP67 is used

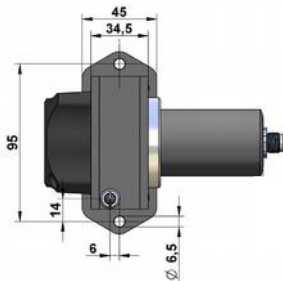
INSTALLATION

- 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 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 safety reasons 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 begins after approximately 2 mm extracted rope (=zero point). The mechanical reserve at the end of the measuring range is about 20 mm.
- When mounting outdoors protect the sensor and the rope from icing at temperatures below 0 °C.
- Guide the rope preferably in corners or guarded in channels 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 can be cleaned with a cloth drenched in resin-free machine oil.



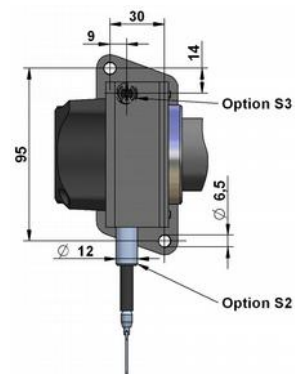
Mounting: standard rope outlet, rope outlet sideways top (S1)

The sensor is usually installed by using the regular mounting plate (see technical drawing on page 4).
By disassembling the mounting plate, there are 2 x M4 threads in the sensor housing for alternative installation.

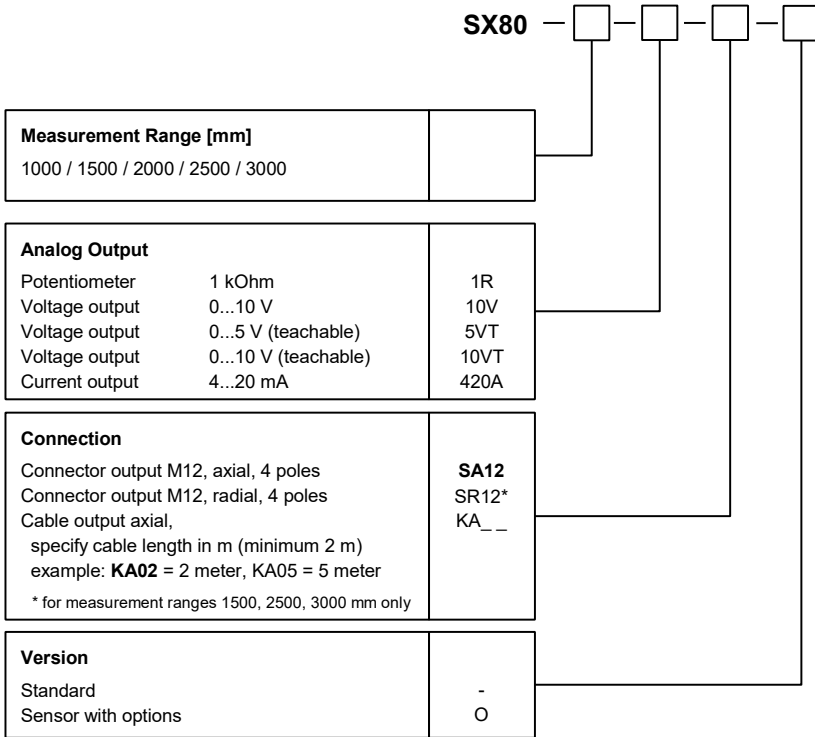


Mounting: rope outlet sideways bottom (S2), rope outlet bottom (S3)

Sensors with option rope outlet S2 and S3 have a modified base plate.



ORDER CODE ANALOG OUTPUT

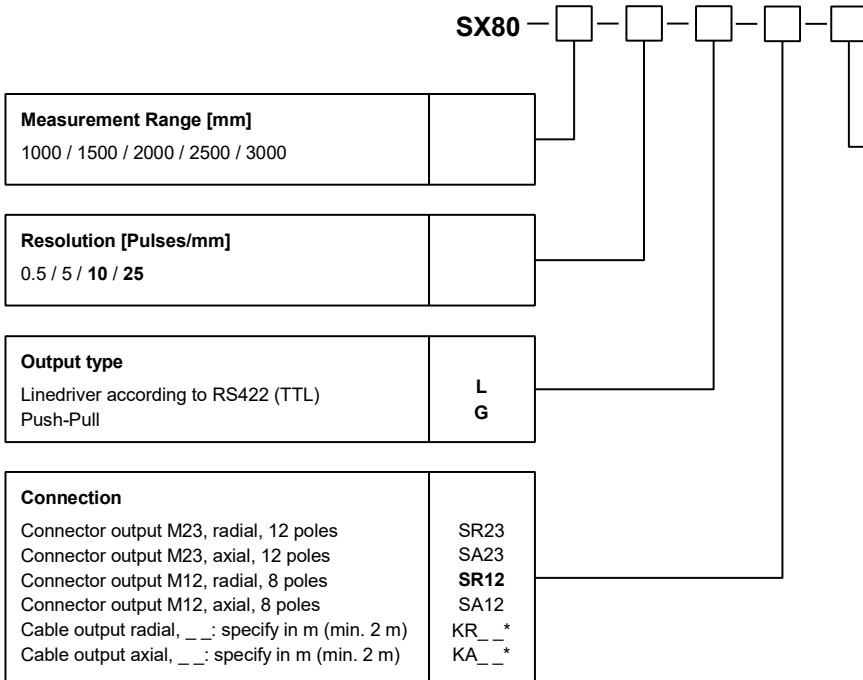


| Option | Description |
|--------|--|
| M4 | rope fixation M4 thread |
| COR | synthetic wire rope, made out of Coramid |
| RI | ring eye (instead of rope clip) |
| S1 | rope outlet sideways top |
| S2 | rope outlet sideways bottom |
| S3 | rope outlet bottom |
| IN | inverted output signal |
| L05 | improved linearity 0.05 % |
| L10 | improved linearity 0.10 % |
| T40 | increased temperature range low -40...+85°C |
| T120 | increased temperature range high -20...+120 °C |
| IP67 | protection class IP67 |
| CP | corrosion protection SX80 |
| ICP | increased corrosion protection SX80 |

| Option | not combinable with |
|--------|---|
| M4 | CP, ICP |
| COR | ranges 2500/3000 mm |
| RI | CP, ICP |
| T40 | L05, L10 |
| T120 | IP67, COR, CP, ICP, 10V, 420A, SA12, SR12 |
| IP67 | TEMP120, ICP |
| CP | M4, RI |
| ICP | IP67, M4, RI |

Bold text: standard with shorter lead time

ORDER CODE DIGITAL OUTPUT INCREMENTAL



| Version |
|---------|
| - |
| O |

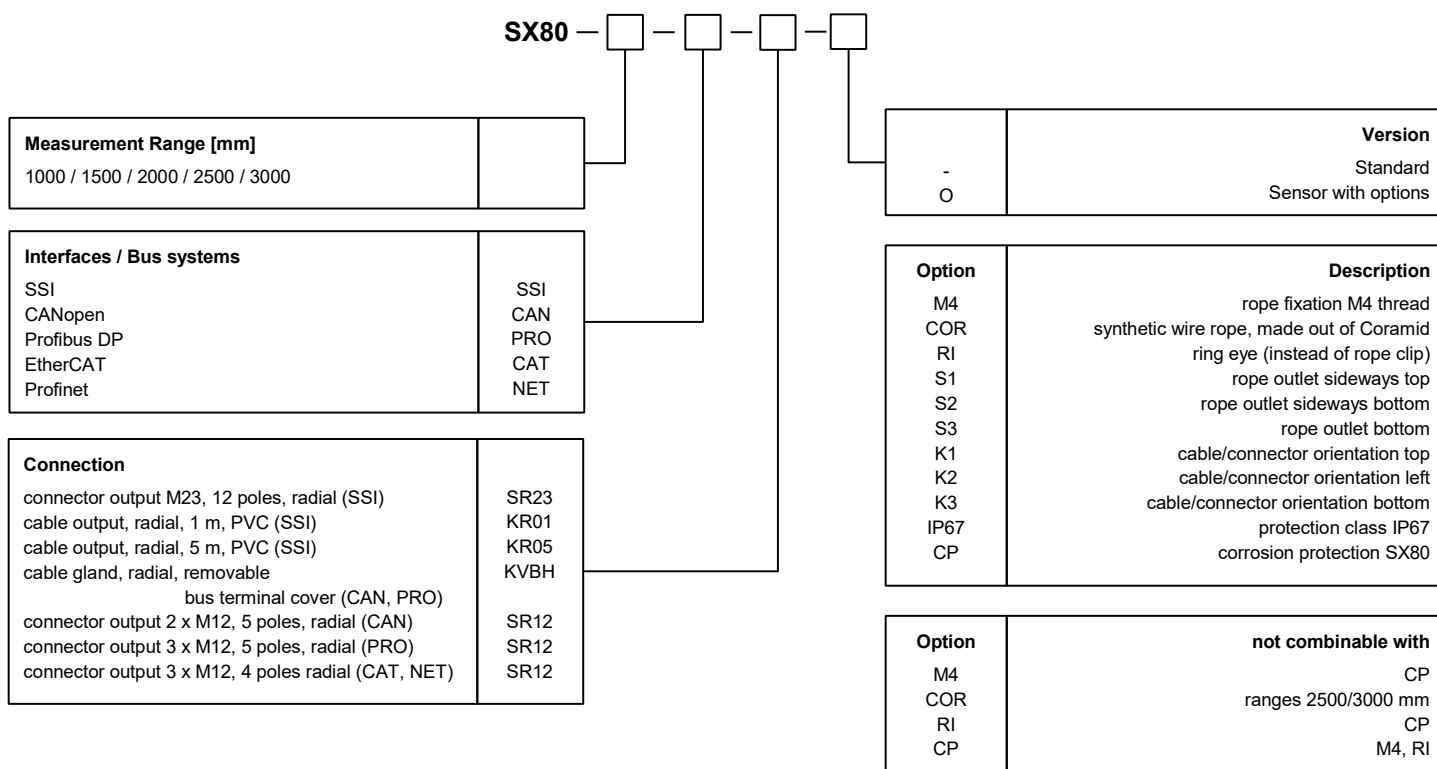
| Option | Description |
|--------|--|
| M4 | rope fixation M4 thread |
| COR | synthetic wire rope, made out of Coramid |
| RI | ring eye (instead of rope clip) |
| S1 | rope outlet sideways top |
| S2 | rope outlet sideways bottom |
| S3 | rope outlet bottom |
| K1 | cable/connector orientation top |
| K2 | cable/connector orientation left |
| K3 | cable/connector orientation bottom |
| L02 | improved linearity 0.02 % |
| IP67 | protection class IP67 |
| CP | corrosion protection SX80 |

| Option | not combinable with |
|--------|---------------------|
| M4 | CP |
| COR | ranges 2500/3000 mm |
| RI | CP |
| L02 | resolutions 0.5 / 5 |
| CP | M4, RI |

Bold text: standard with shorter lead time

* for linedriver: 10 wires (with additional sensor lines)
for push-pull: 8 wires (without sensor lines)

ORDER CODE DIGITAL OUTPUT ABSOLUTE



GENERAL ACCESSORIES

| | | | |
|-------------|-------------------|----------|-----------------------------------|
| SQUEEZER2M | 2 m cable | SV1-XXXX | rope extension (150...4995 mm) |
| SQUEEZER5M | 5 m cable | SV2-XXXX | rope extension (5000...19995 mm) |
| SQUEEZER10M | 10 m cable | SV3-XXXX | rope extension (20000...40000 mm) |
| UR2 | deflection pulley | | |
| MGG1 | magnetic clamp | | |

ACCESSORIES ANALOG OUTPUT

| | | | |
|---|---------------------------------|--|--|
| Cable with mating connector M12, 4 poles, shielded | | Digital display 1 channel, 0...10V/4...20 mA | |
| K4P2M-S-M12 | 2 m, straight connector | PAXP000B | 1 channel, supply: 85 to 250 VAC |
| K4P5M-S-M12 | 5 m, straight connector | PAXP001B | 1 channel, supply: 11...36 VDC/24 VAC |
| K4P10M-S-M12 | 10 m, straight connector | | |
| K4P2M-SW-M12 | 2 m, angular connector | Digital display 2 channels, 0...10V/4...20 mA | |
| K4P5M-SW-M12 | 5 m, angular connector | PAXDP00B | 2 channels, supply: 85 to 250 VAC |
| K4P10M-SW-M12 | 10 m, angular connector | PAXDP01B | 2 channels, supply: 11...36 VDC/24 VAC |
| | | Digital display 1 channel, Potentiometer | |
| Mating Connector M12, 4 poles, shielded | | PAXD000B | 1 channel, supply: 85 to 250 VAC |
| D4-G-M12-S | straight, M12 for self assembly | PAXD001B | 1 channel, supply: 11...36 VDC/24 VAC |
| D4-W-M12-S | angular, M12 for self assembly | | |
| Connection cable Sensor - Squeezer | | | |
| K4P1,5M-SB-M12 | 1.5 m, 4-pole, shielded | | |

ACCESSORIES DIGITAL OUTPUT INCREMENTAL

Cable with mating connector M12, 8 poles, shielded

| | |
|---------------|--------------------------|
| K8P2M-S-M12 | 2 m, straight connector |
| K8P5M-S-M12 | 5 m, straight connector |
| K8P10M-S-M12 | 10 m, straight connector |
| K8P2M-SW-M12 | 2 m, angular connector |
| K8P5M-SW-M12 | 5 m, angular connector |
| K8P10M-SW-M12 | 10 m, angular connector |

Cable with mating connector M23, 12 poles, shielded

| | |
|--------------|--------------------------|
| K8P2M-S-M23 | 2 m, straight connector |
| K8P5M-S-M23 | 5 m, straight connector |
| K8P10M-S-M23 | 10 m, straight connector |

Mating Connector M23, 12 poles, shielded

| | |
|----------|--|
| CON012-S | straight, M23 for self assembly, metal housing |
|----------|--|

Mating Connector M12, 8 poles, shielded

| | |
|------------|---------------------------------|
| D8-G-M12-S | straight, M12 for self assembly |
| D8-W-M12-S | angular, M12 for self assembly |

Digital display 1 channel, Linedriver L (input level TTL, RS422)

| | |
|------------|--|
| WAY-DS-5VH | display only |
| WAY-DG-5VH | display with two presets and switching outputs |
| WAY-DR-5VH | display with serial interface RS232 / RS485 |

Digital display 1 channel, Push-Pull G

| | |
|--------|--|
| WAY-DS | display only |
| WAY-DG | display with two presets and switching outputs |
| WAY-DR | display with serial interface RS232 / RS485 |

ACCESSORIES DIGITAL OUTPUT ABSOLUTE

SSI output:

| | |
|-------------------|---|
| K12P02M-S-M23-SSI | 2 m cable, shielded, M23 connector straight |
| K12P05M-S-M23-SSI | 5 m cable, shielded, M23 connector straight |
| K12P10M-S-M23-SSI | 10 m cable, shielded, M23 connector straight |
| K12P15M-S-M23-SSI | 15 m cable, shielded, M23 connector straight |
| CON012-S | Mating connector M23 shielded, straight, 12 poles |

Digital display 1 channel, for sensors with SSI signal

| | |
|-----------|--|
| WAY-SSI-S | display only |
| WAY-SSI-A | display with analog output |
| WAY-SSI-G | display with two presets and switching outputs |
| WAY-SSI-R | display with serial interface RS232 / RS485 |

Profibus DP:

| | |
|-------------------|---|
| K5P2M-B-M12-PROF | 2 m cable, plug female M12, 5 poles, open ends |
| K5P2M-SB-M12-PROF | 2 m cable, connector male M12, 5 poles, plug female M12 |
| K5P2M-S-M12-PROF | 2 m cable, connector male, M12, 5 poles, open ends |
| M12-PROF-AW | terminator |

CANopen output:

| | |
|------------------|---|
| K5P2M-B-M12-CAN | 2 m cable, plug female M12, 5 poles, open ends |
| K5P2M-SB-M12-CAN | 2 m cable, connector male M12, 5 poles, plug female M12 |
| K5P2M-S-M12-CAN | 2 m cable, connector male, M12, 5 poles, open ends |

EtherCAT / Profinet:

| | |
|------------------|--|
| K4P2M-S-M12-CAT | 2 m cable, connector male M12, 4 poles, open ends |
| K4P5M-S-M12-CAT | 5 m cable, connector male M12, 4 poles, open ends |
| K4P10M-S-M12-CAT | 10 m cable, connector male M12, 4 poles, open ends |
| K4P2M-B-M12-CAT | 2 m cable, plug female M12, 4 poles, open ends |
| K4P5M-B-M12-CAT | 5 m cable, plug female M12, 4 poles, open ends |
| K4P10M-B-M12-CAT | 10 m cable, plug female M12, 4 poles, open ends |

Subject to change without prior notice.

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