

# ***DRAW WIRE SENSOR***



## ***MH120 series for use in mobile hydraulics***

### ***Key-Features:***

- *Cost-effective sensor for construction machinery*
- *Measurement ranges from 3.0 to 10.0 m*
- *extreme robust construction*
- *Standard outputs: Potentiometer, 0...5 V, 0...10 V, 4...20 mA, optional redundant*
- *teachable outputs: 0...5 VT, 0...10 VT, with an additional Open-Collector switching output*
- *Digital output: CANopen (in preparation)*
- *Linearity up to  $\pm 0.1$  % of full scale*
- *Protection class up to IP69K (suitable for close-range high pressure, high temperature spray downs)*
- *Temperature range -20...+85 °C (optional -40 °C)*
- *exchangeable rope cleaner (in preparation)*

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## INTRODUCTION

The draw wire sensors of the mobile hydraulic series MH120 were specially developed for the demanding area of construction machines and construction equipment. The sensor can be individually configured depending on the application, in which it is used. Small adhesive and abrasive particles with small grain size can easily be removed when using the open MH120 versions. Seawater resistant protective grating provide a maximum protection against larger foreign objects like tree branches. In case of applications with high safety requirements, thicker stainless steel wire ropes are available, as well as redundant, analogue outputs. This mobile hydraulics series offers the possibility to perform accurate and cost-effective distance measurement on construction machinery.

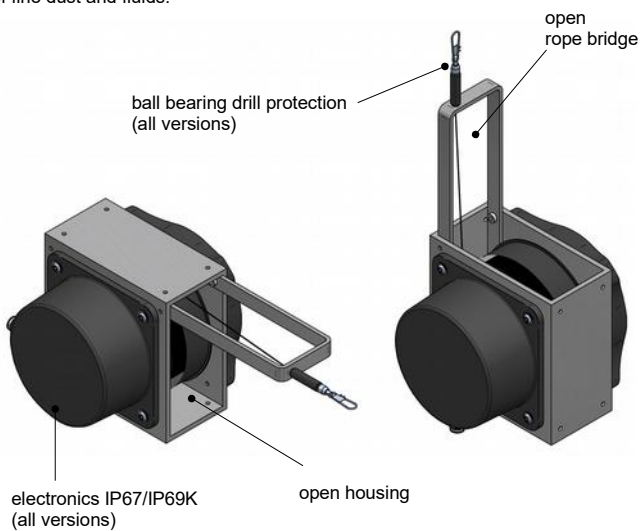
## HOUSING VARIANTS

The MH120 series comprises four different types of housings.  
Common to all versions:

- Aluminium housing with bore holes for the mounting
- easy rope fixation by rope clip, secured against twisting
- stainless steel wire rope
- Sensor element inside an enclosed housing
- M12 connector system or cable output
- dynamic spring drive with PA6 case

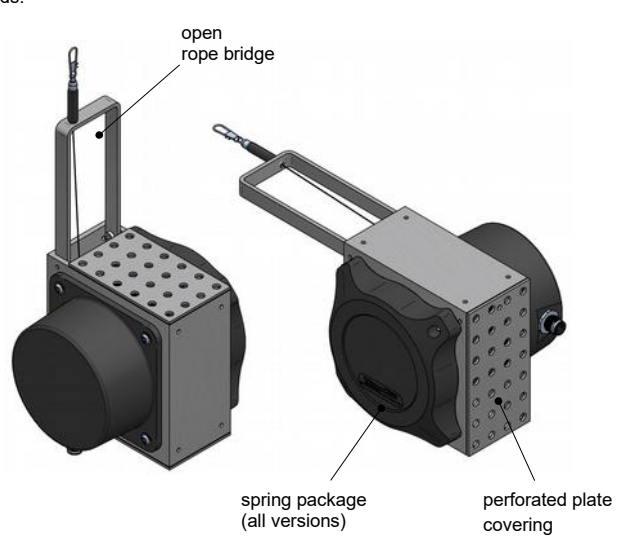
### Standard: open housing + open rope bridge

Specially suited for applications under the conditions of fine dust and fluids.



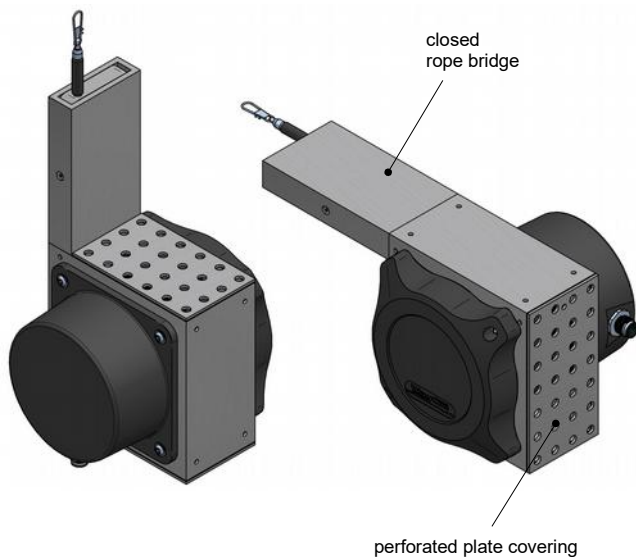
### Version COV1: housing with perforated plate covering + open rope bridge

Specially suited for applications under the conditions of dirt, particle size > 2 mm and fluids.



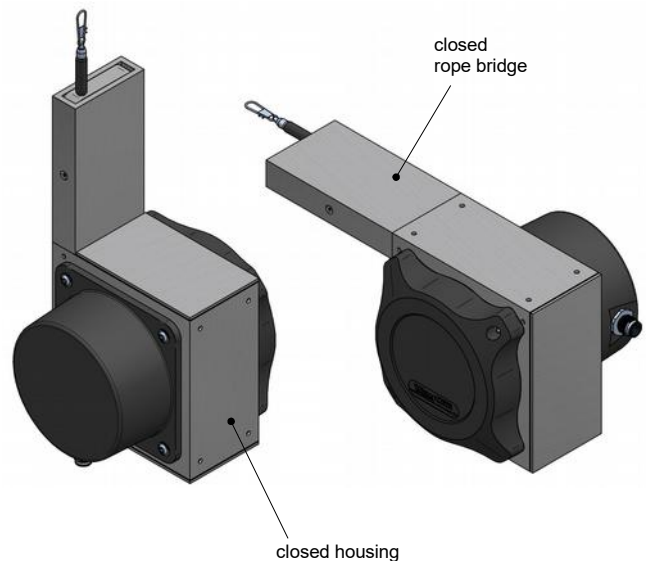
### Version COV2: housing with perforated plate covering + closed rope bridge

Specially suited for applications under the conditions of dirt, particle size > 2 mm and fluids, protection against impact and shock, rope cleaner (in preparation)



### Version COV3: closed housing + closed rope bridge

Specially suited for applications under the conditions of adhesive dust, cement, concrete, clay, protection against impact and shock, rope cleaner (in preparation)



## TECHNICAL DATA

Measurement range	[m]	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Linearity	[%]	±0.5							
improved linearity (optional)	[%]	±0.25 or ±0.1							
Rope diameter	[mm]	0.5 / 1.0 / 1.5	0.5 / 1.0 / 1.5	0.5 / 1.0 / 1.5	0.5 / 1.0 / 1.5	0.5 / 1.0	0.5 / 1.0	0.5	0.5
Resolution		see output types page 4							
Sensor element		Hybrid Potentiometer							
Output signals *		Potentiometer, 0...5 V, 0...10 V, 0...5 V (teachable), 0...10 V (teachable), 4...20 mA, CANopen (in preparation)							
redundant output signals		optional for: Potentiometer, 0...5 V, 0...10 V, 4...20 mA							
Connection		connector output M12 radial or cable output radial (TPE cable, standard length 2 m)							
Protection class		IP67, optional IP69K (only in combination with cable output)							
Humidity		max. 90 % relative, no condensation							
Temperature	[°C]	-20...+85 / optional: -40...+85							
Rope extraction speed	[m/s]	max 3.0							
Weight	[g]	1300 – 1600, depending on the measurement range							
Housing		Aluminium, spring case PA6							

\* other output signals on request

## ELECTRICAL CONNECTION

### Cable output

Cable type	TPE, flexible			
Direction	radial			
Length	2 m standard (others on request)			
Diameter	ø 4.5 mm			
Wire	0.25 mm <sup>2</sup>			
Temperature	fixed installation -30...+85 °C, flexible installation -20...+85 °C			

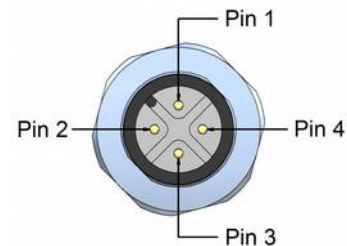
  

Cable colour	5V, 10V	5VT, 10VT	420A	1R
brown	V +	V +	V +	V +
white	Signal	Signal	n. c.	Cursor
blue	GND	GND	Signal	GND
black	GND Signal	MFL *	n. c.	n. c.

\* Multi-functional line

### Connector output

- radial  
- M12, 4 poles



Pin	5V, 10V	5VT, 10VT	420A	1R
1	V +	V +	V +	V +
2	Signal	Signal	n. c.	Cursor
3	GND	GND	Signal	GND
4	GND Signal	MFL *	n. c.	n. c.

\* Multi-functional line

### Cable output redundant output signal

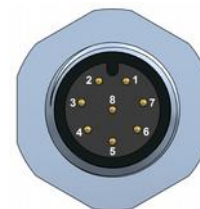
Cable type	TPE, flexible		
Direction	radial		
Length	2 m standard (others on request)		
Diameter	ø 4.5 mm		
Wire	0.25 mm <sup>2</sup>		
Temperature	fixed installation -30...+85 °C, flexible inst. -20...+85 °C		

Cable colour	0...5 V, 0...10 V	4...20 mA	1 kOhm
white	V1 +	V1 +	V1 +
brown	Signal1	n. c.	Cursor1
green	GND1	Signal1	GND1
yellow	GND1 Signal	n. c.	n. c.
grey	V2 +	V2 +	V2 +
pink	Signal2	n. c.	Cursor2
blue	GND2	Signal2	GND2
red	GND2 Signal	n. c.	n. c.

### Connector output redundant output signal

- radial  
- M12, 8 poles

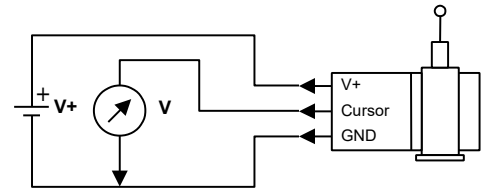


Pin	0...5 V, 0...10 V	4...20 mA	1 kOhm
1	V1 +	V1 +	V1 +
2	Signal1	n. c.	Cursor1
3	GND1	Signal1	GND1
4	GND1 Signal	n. c.	n. c.
5	V2 +	V2 +	V2 +
6	Signal2	n. c.	Cursor2
7	GND2	Signal2	GND2
8	GND2 Signal	n. c.	n. c.

## ELECTRICAL DATA

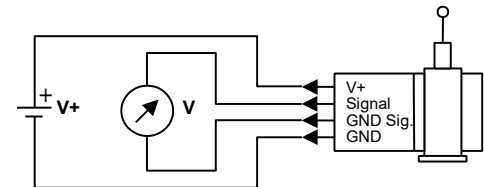
### Output: Potentiometer (voltage divider)

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
Temperature coefficient	± 0.0025 %/K



### Output: Voltage 0...5 V, 0...10 V

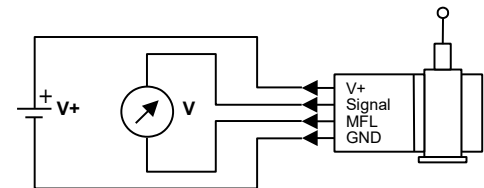
Output	0...5 V, 0...10 V, galvanically isolated, 4 conductors
Supply	12...30 VDC
Current consumption	max. 22.5 mA (unloaded)
Output current	max. 10 mA, min. load 10 kOhm
Dynamics	< 3 ms from 0...100 % and 100...0 %
Resolution	limited by the noise
Noise	3 mV <sub>pp</sub> typical, max. 37 mV <sub>pp</sub>
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: GND Sig. and GND may be connected in a 3-wire system.

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

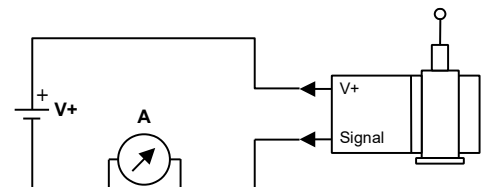
Output	0...5 V, 0...10 V, 3 wire system
Supply	8...35 VDC
Power consumption	max. 150 mW
Output current	max. 10 mA, min. load 1 kOhm
Dynamics	1 ms
Resolution	1 mV
Noise	3 mV <sub>ss</sub> typical, max. 37 mV <sub>ss</sub>
Inverse-polarity protection	yes, infinite
Short-circuit proof	yes, permanent
Working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



MFL: Multi-functional line

### Output: 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 <sub>pp</sub> = 6 mV <sub>pp</sub> 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



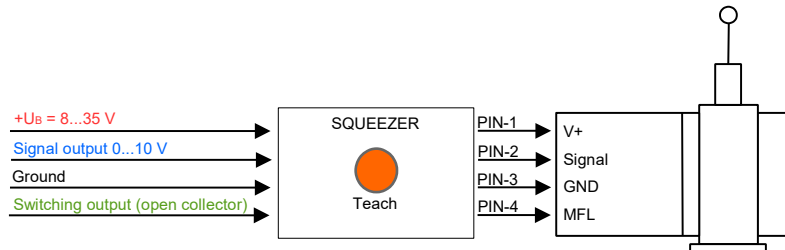
## TEACHABLE OUTPUT 5VT, 10VT, SQUEEZER

The signals provided by the 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.

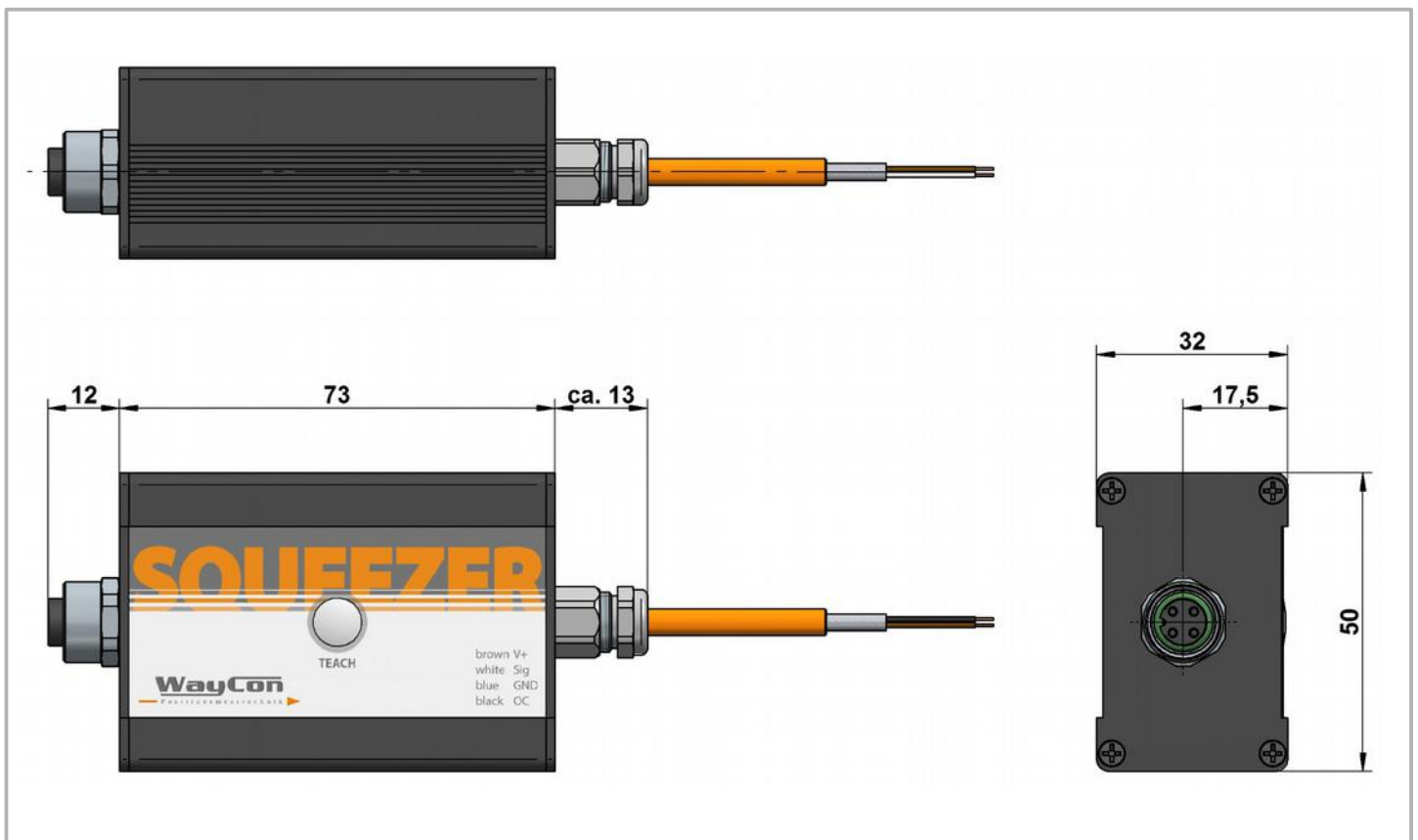
The digitization offers two possibilities of adjustment, by which the sensor can be configured individually using the squeezer:

- 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.

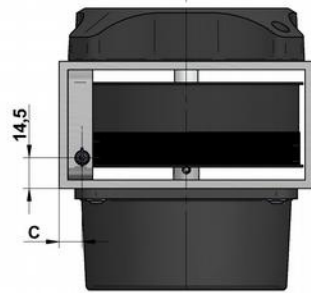
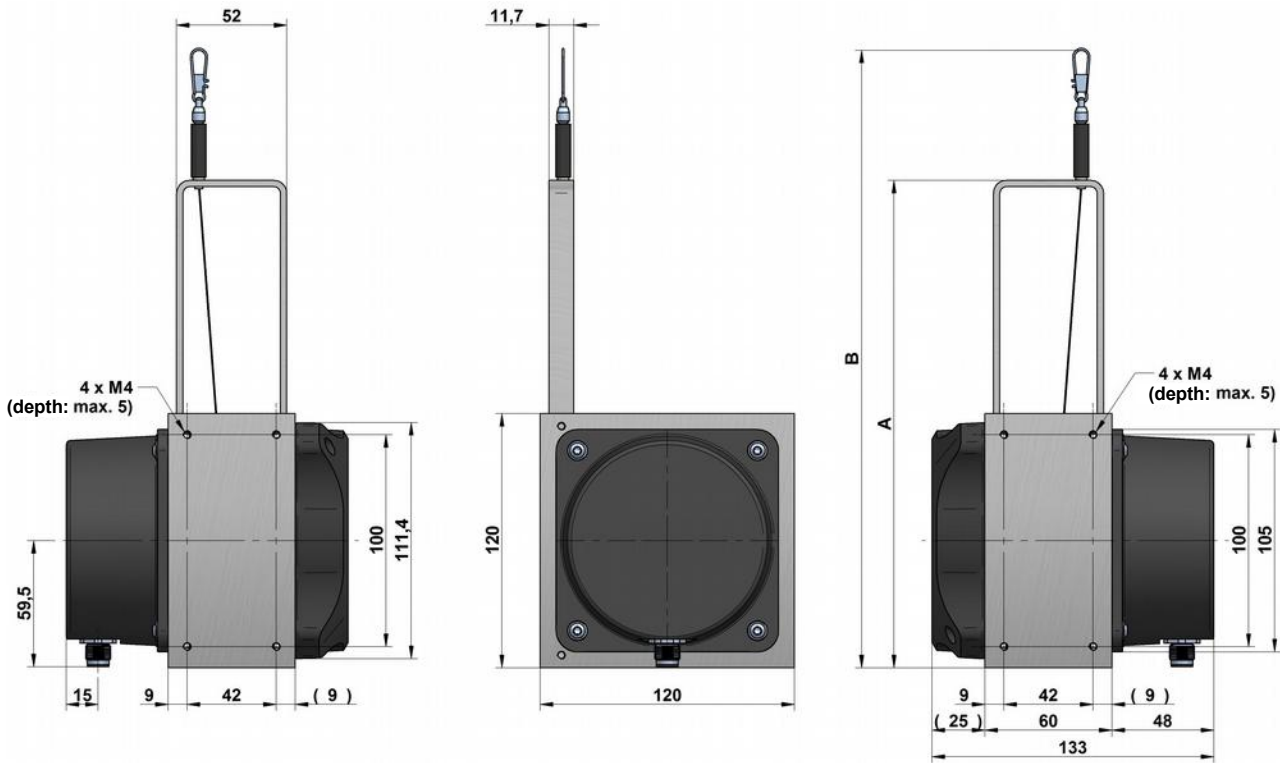


## TECHNICAL DRAWING SQUEEZER



# TECHNICAL DRAWING

Standard: open housing + open rope bridge

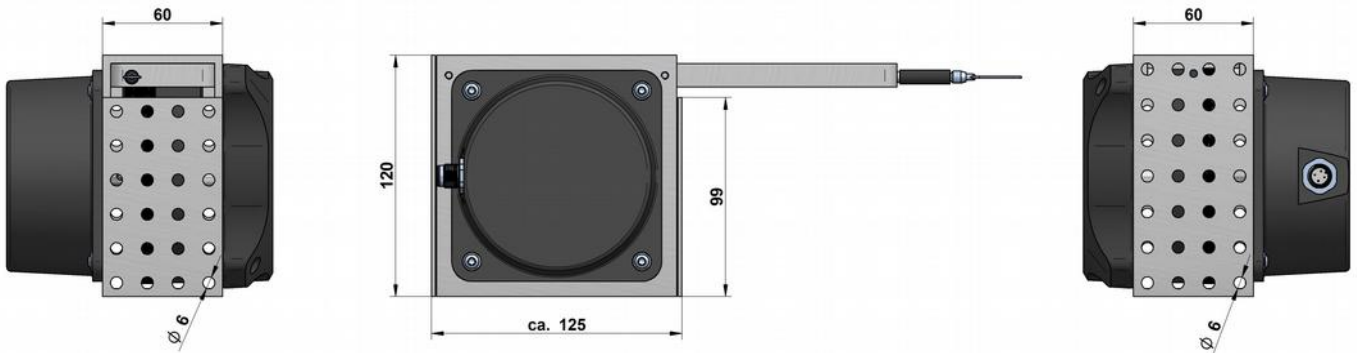


Dependency of dimensions A, B, C from the measurement range and the rope diameter

	Ø 0.5:			Ø 1.0:			Ø 1.5:		
	A	B	C	A	B	C	A	B	C
3 m	230.0	~ 291.5	10.8	230.0	~ 291.5	10.8	230.0	~ 291.5	10.8
4 m	230.0	~ 291.5	10.8	230.0	~ 291.5	10.8	230.0	~ 291.5	10.8
5 m	230.0	~ 291.5	10.8	230.0	~ 291.5	10.8	320.0	~ 381.5	12.3
6 m	230.0	~ 291.5	10.8	320.0	~ 381.5	12.3	320.0	~ 381.5	12.3
7 m	230.0	~ 291.5	10.8	320.0	~ 381.5	12.3	-	-	-
8 m	230.0	~ 291.5	10.8	320.0	~ 381.5	12.3	-	-	-
9 m	230.0	~ 291.5	10.8	-	-	-	-	-	-
10 m	230.0	~ 291.5	10.8	-	-	-	-	-	-

Note: The dimensions in the technical drawings (sensor height) relate to a single layered winding of the rope. The dimensions of a multi-layered winding are in preparation.

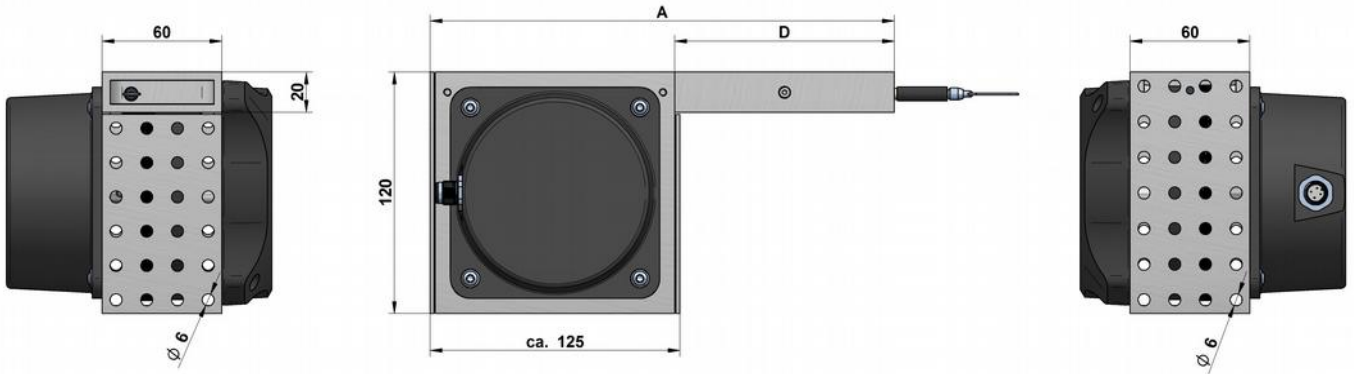
Version COV1: housing with perforated plate covering + open rope bridge



Note: The dimensions in the technical drawings (sensor height) relate to a single layered winding of the rope. The dimensions of a multi-layered winding are in preparation.

# TECHNICAL DRAWING

## Version COV2: housing with perforated plate covering + closed rope bridge

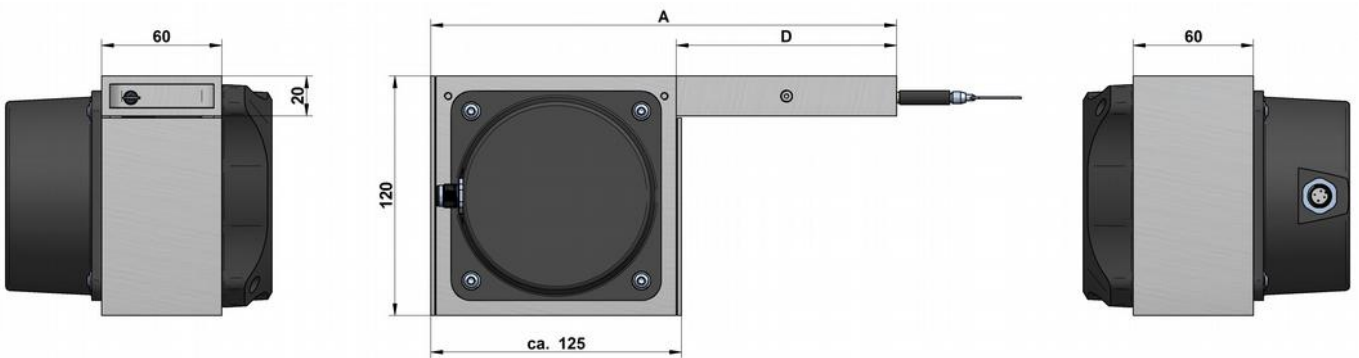


Note: The dimensions in the technical drawings (sensor height) relate to a single layered winding of the rope. The dimensions of a multi-layered winding are in preparation.

Dependency of dimensions A, D from the measurement range and the rope diameter for versions COV2 and COV3.

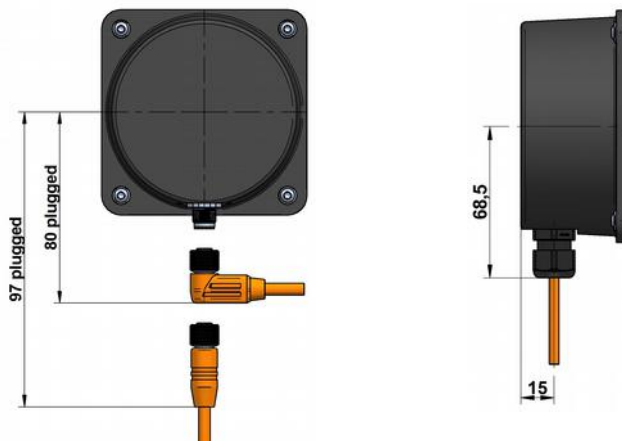
	Ø 0.5:		Ø 1.0:		Ø 1.5:	
	A	D	A	D	A	D
3 m	233	110	233	110	233	110
4 m	233	110	233	110	233	110
5 m	233	110	233	110	323	200
6 m	233	110	323	200	323	200
7 m	233	110	323	200	-	-
8 m	233	110	323	200	-	-
9 m	233	110	-	-	-	-
10 m	233	110	-	-	-	-

## Version COV3: closed housing + closed rope bridge



Note: The dimensions in the technical drawings (sensor height) relate to a single layered winding of the rope. The dimensions of a multi-layered winding are in preparation.

## Connector output / cable output all versions



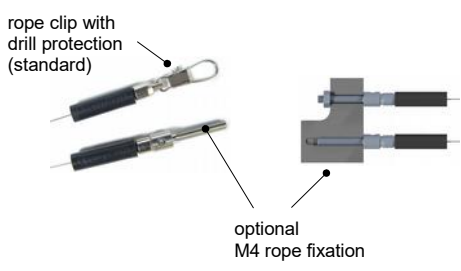

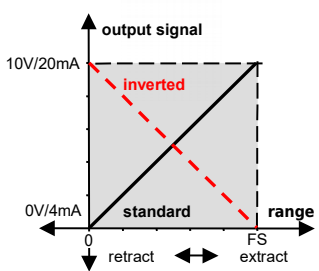
Note: when using close-range high pressure or high temperature spray downs for cleaning purposes the cable must be protected.

## WIRE ROPES

Code	Diameter	Material	Note
D05 (standard)	0.5 mm	stainless steel	
D10	1.0 mm	stainless steel	not possible for ranges 9 and 10 m
D15	1.5 mm	stainless steel	not possible for ranges 7 m to 10 m and in combination with option M4

## OPTIONS

The following table gives an overview of frequently used options, with which the standard sensors can be equipped.

Option	Order code	Description
<b>Protection class IP69K</b>	IP69K	All relevant components are completely encapsulated. Suitable for close-range high pressure or high temperature spray downs. Only in combination with cable output.
<b>Increased temperature range Low</b>	T40	The use of special components allow a working temperature down to -40 °C (up to +85°C).
<b>Redundant output signal</b>	RED1, RED2, RED3	By using a double potentiometer the sensor delivers two independent output signals. RED1 : 2 x 1 kOhm, RED2 : 2 x 5 V oder 2 x 10 V, RED3 : 2 x 420 A
<b>Sensor housing</b>	COV1, COV2, COV3	Standard: open housing + open rope bridge COV1: housing with perforated plate covering + open rope bridge COV2: housing with perforated plate covering + closed rope bridge COV3: closed housing + closed rope bridge
<b>Rope fixation by M4 thread</b>	M4	Optional, pivoted rope fixation with screw thread M4, length 22 mm. Ideal for attachment to through holes or thread holes M4. <div style="text-align: right;">  <p>rope clip with drill protection (standard)</p> <p>optional M4 rope fixation</p> </div>
<b>Ring eye</b>	RI	The end of the wire rope is equipped with a ring eye instead of a rope clip. Inside diameter 20 mm. <div style="text-align: right;">  </div>
<b>Inverted output signal</b>	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. <div style="text-align: right;">  <p>The graph plots 'output signal' on the y-axis (0V/4mA to 10V/20mA) against 'range' on the x-axis (0 retract to FS extract). A solid black line labeled 'standard' shows an increasing signal as the rope is extracted. A dashed red line labeled 'inverted' shows a decreasing signal as the rope is extracted.</p> </div>
<b>Rope Cleaner</b>	RC	in preparation



## GENERAL ACCESSORIES

### Deflection pulley - UR2

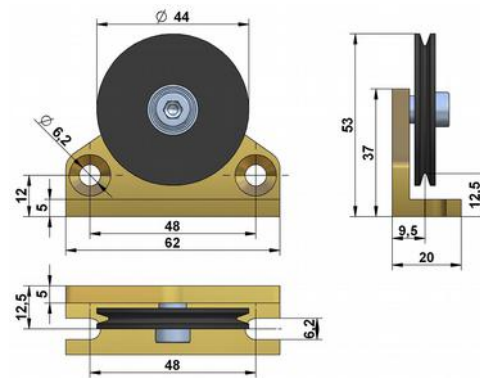
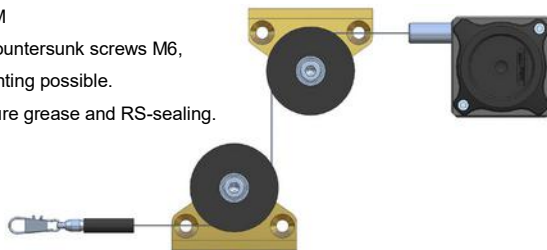
The rope must be extracted from the sensor **vertically**. The maximum variation from the vertical is 3°. A deflection pulley allows a change in the direction of the wire rope. Several pulleys may be used. The rope clip must not be guided over the deflection pulley.

material: 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: -40...+80 °C.



### Rope extension - SV

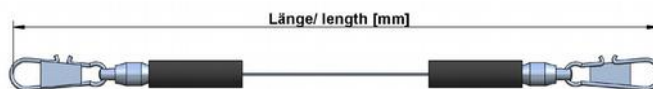
For bridging a greater distance between the measuring target and the sensor a rope extension can be applied. The rope clip must not be guided over the deflection pulley.

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)

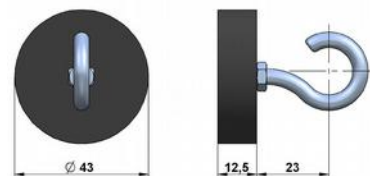
SV3-XXXX: rope extension (20000...40000 mm)



### 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

### Single output signal

#### Cable with connector M12, 4 poles, shielded

K4P2M-S-M12 2 m, connector straight

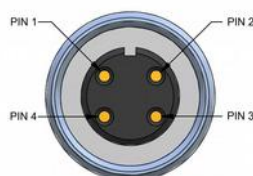
K4P5M-S-M12 5 m, connector straight

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	cable colour	PIN	cable colour
1	brown	3	blue
2	white	4	black

#### Mating connector M12, 4 poles, shielded, IP67

D4-G-M12-S straight, M12 for self assembly

D4-W-M12-S angular, M12 for self assembly

cable passage:  $\varnothing 4...8$  mm

wire cross-section: 0.14...0.34 mm<sup>2</sup>



### Redundant output signal

#### Cable with connector M12, 8 poles, shielded

K8P2M-S-M12 2 m, connector straight

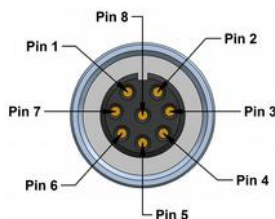
K8P5M-S-M12 5 m, connector straight

K8P10M-S-M12 10 m, connector straight

K8P2M-SW-M12 2 m, connector angular

K8P5M-SW-M12 5 m, connector angular

K8P10M-SW-M12 10 m, connector angular



PIN	cable colour	PIN	cable colour
1	white	5	grey
2	brown	6	pink
3	green	7	blue
4	yellow	8	red

#### Mating connector M12, 8 poles, shielded, IP67

D8-G-M12-S straight, M12 for self assembly

D8-W-M12-S angular, M12 for self assembly

cable passage:  $\varnothing 4...8$  mm

wire cross-section: 0.14...0.34 mm<sup>2</sup>



## 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.
- 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.



## WARNING NOTICES

- Do not 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.
- Only for standard version with open housing: the free turning of the rope drum **must** be ensured. In case the rope drum gets blocked there is a serious danger of injury and the sensor may get destroyed.



**ORDER CODE**

MH120 — □ — □ — □ — □ — □

<b>Measurement range MR [m]</b> 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10	
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<b>Wire rope</b> Diameter 0.5 mm (standard) Diameter 1.0 mm (not for MR 9 and 10 m) Diameter 1.5 mm (not for MR 7 to 10 m)	D05 D10 D15
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<b>Analog Output</b>		
Potentiometer	1 kOhm	1R
Voltage output	0...5 V	5V
Voltage output	0...10 V	10V
Voltage output	0...5 V (teachable)	5VT
Voltage output	0...10 V (teachable)	10VT
Current output	4...20 mA	420A

<b>Connection</b>	
Connector output M12 radial, 4 pole *, IP67 Cable output radial, only in combination with Option IP69K specify cable length in m (minimum 2 m) example: <b>KA02</b> = 2 meter, <b>KA05</b> = 5 meter	SR12 KR_ _

- O	<b>Version</b> Standard Sensor with options
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Option	Description
M4	rope fixation M4 thread (not with D15)
RI	ring eye (instead of rope clip)
IN	inverted output signal
L10	improved linearity 0.10 %
L25	improved linearity 0.25 %
T40	temperature range -40...+85°C
IP69K	protection class IP69K, only with cable output
RED1	redundant output signal 1R
RED2	redundant output signal 5V, 10V
RED3	redundant output signal 420A
COV1	perforated plate covering + open rope bridge
COV2	perforated plate covering + closed rope bridge
COV3	closed housing + closed rope bridge
RC	rope cleaner (in preparation)

Note: In case one of the options T40, L10, or L25 is chosen for a redundant sensor (option RED1,2,3), the price for this option gets doubled.

\* 8 pole in combination with options RED1/2/3

## GENERAL ACCESSORIES

SQUEEZER1000	squeezer, 1 m cable, open ends
UR2	deflection pulley
MGG1	magnetic clamp

SV1-XXXX	rope extension (150...4995 mm)
SV2-XXXX	rope extension (5000...19995 mm)
SV3-XXXX	rope extension (20000...40000 mm)

## ACCESSORY CABLE

### Cable with mating connector M12, 4 poles, shielded

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

### 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

### Mating Connector M12, 4 poles, shielded

D4-G-M12-S	straight, M12 for self assembly
D4-W-M12-S	angular, M12 for self assembly

### Mating Connector M12, 8 poles, shielded

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

## ACCESSORY DISPLAY

### Digital display 1 channel, 0...10V/4...20 mA

PAXP000B	1 channel, supply: 85 to 250 VAC
PAXP001B	1 channel, supply: 11...36 VDC/24 VAC

### Digital display 1 channel, Potentiometer

PAXD000B	1 channel, supply: 85 to 250 VAC
PAXD001B	1 channel, supply: 11...36 VDC/24 VAC

### Digital display 2 channels, 0...10V/4...20 mA

PAXDP00B	2 channels, supply: 85 to 250 VAC
PAXDP01B	2 channels, supply: 11...36 VDC/24 VAC

Subject to change without prior notice.

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