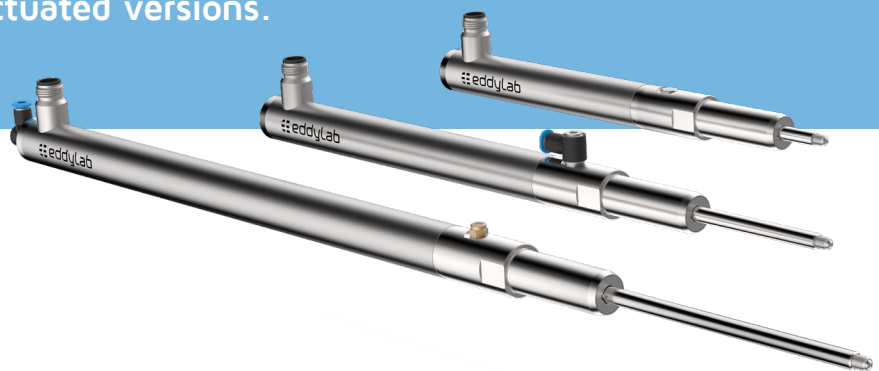


SLT SERIES | LVDT

Inductive Transducer: Ultra robust LVDT series with spring loaded and air actuated versions.

- Measurement range 10...300 mm
- Linearity up to ± 0.10 %
- Housing $\varnothing 20$ mm
- Protection class up to IP67
- Working temperature up to 200 °C
- External or cable electronics with cable break detection



INTRODUCTION

■ LVDTs (Linear Variable Differential Transformers) are inductive sensors excellent for use in harsh industrial environments, e.g. high temperature and pressure ranges, as well as high accelerations and measuring cycles.

Based on the SL series, the SLT probes are also characterized by an ultra robust construction and a fully stainless steel housing which makes them suitable for harsh environments.

The combination of a hardchrome plated shaft with 6 mm in diameter and precision bearings guarantees highest resistance to lateral forces on the push rod. There are three different functional variants available to meet the demands of most measuring tasks:

- Spring loaded mechanism: The push rod is fully extended by an internal spring.
- Pneumatic version 1: The push rod extends by applying pressurized air. An internal spring retracts the push rod after releasing the pressure.
- Pneumatic version 2: The push rod retracts by applying pressurized air. An internal spring extends the push rod after releasing the pressure.

Each sensor requires a carrier frequency measuring amplifier to operate, which evaluates and transforms the sensors signal to a standardised analog output signal of 0...10 V or 4...20 mA. Eddylab measuring amplifiers are available both protected in a switch cabinet or integrated into the sensor connection cable. The electronics (explanation see page 5) have a built-in cable breakage monitoring and are entirely galvanically isolated. The signal output is optimized for interference compatibility with very low residual noise. The guarantee for ultimate resolution and measuring accuracy.

TECHNICAL DATA - SENSORS

SENSOR								
Measurement range FS [mm]	0...10	0...25	0...50	0...80	0...100	0...150	0...200	0...300
Linearity [% of FS]	0,30 % (0,20 % optional), 0,10 % for selected models							
Types	spring loaded mechanism							
	pneumatic version PR1: pressurized air extends push rod							
	pneumatic version PR2: pressurized air retracts push rod							
Protection class	IP65, optional IP67							
Vibration stability DIN IEC68T2-6	10 G							
Shock stability DIN IEC68T2-27	200 G/ 2 ms							
Supply voltage / frequency	3 V _{eff} / 3 kHz							
Supply frequency	2...10 kHz							
Temperature range	-40...+120 °C (150 °C and 200 °C on option)							
Mounting	ø 16 and 20 mm clamp diameter							
Housing	stainless steel 1.4571, 1.4305							
Connection	4 core cable or M12-connector with coupling nut							
cable TPE (standard)	ø 4,5 mm, 0,14 mm², non-halogen, suitable for drag chains							
cable PTFE (option H)	ø 4,8 mm, 0,24 mm², max. temperature 205 °C, UL-style 2895							
Max. cable length	100 m between sensor and electronics							
weight (approx., without cable) [g]	280	300	340	460	560	610	660	760
Spring loaded type								
Spring force (middle of range) [N] *	2,5	2,5	3	3	3,5	3,5	3,5	3,5
Life cycle	> 10 million cycles							
Pneumatic actuated versions								
Air supply *	1,5...2,5 bar, free of oil, water and dust							

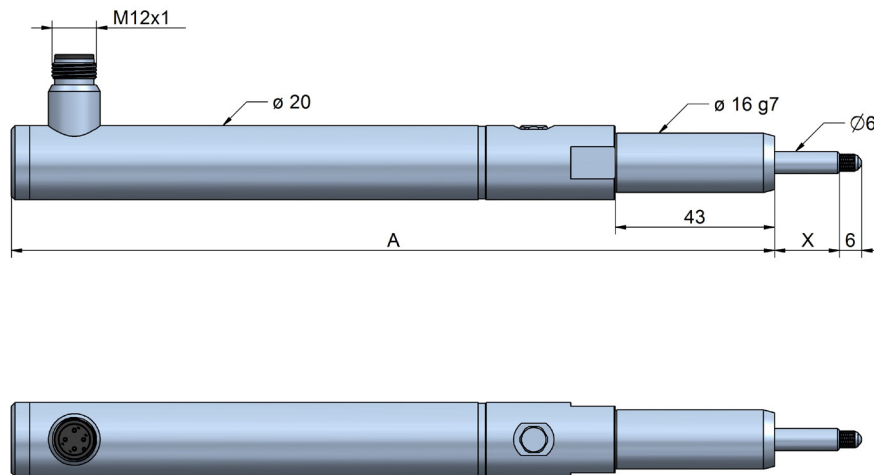
* preliminary data

TECHNICAL DRAWINGS

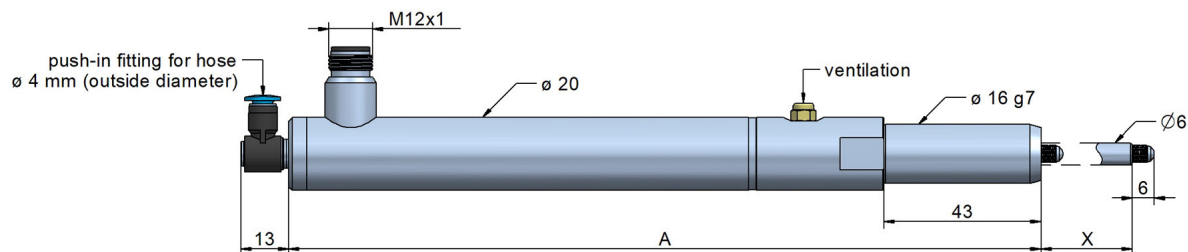
RANGE (FS) [MM]	HOUSING LENGTH A [MM]
0...10	176
0...25	206
0...50	256
0...80	316

RANGE (FS) [MM]	HOUSING LENGTH A [MM]
0...100	356
0...150	456
0...200	556
0...300	776

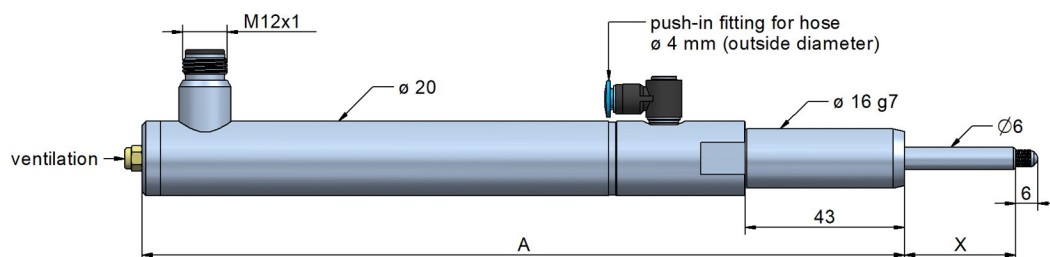
■ TYPE: SPRING LOADED



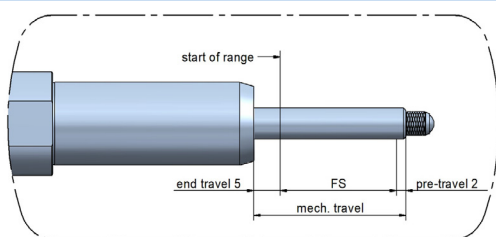
■ TYPE: PNEUMATIC ACTUATED PR1 (PRESSURIZED AIR EXTENDS PUSH ROD)



■ TYPE: PNEUMATIC ACTUATED PR2 (PRESSURIZED AIR RETRACTS PUSH ROD)



■ EXPLANATION: MECHANICAL TRAVEL



POSITION OF PUSH ROD	X [MM]
mechanical stop, retracted position	0
start of range	5
end of range	FS + 5
fully extended position	FS + 7

SENSOR TYPES

CONNECTOR / CABLE OUTPUT RADIAL

Sensors with cable output have a cable fitting and a spring for bend protection of the cable. The standard cable length is 2 m.

For sensors with connector output the cable has to be ordered separately. You can choose from a cable with a straight connector or with an angular connector. The connector is protected from accidental removal by a threaded fitting (M12). When bolted, the connector pair has the protection class IP67.

AC-OUTPUT

assignment for TPE-cable:

- white (5): primary 2
- black (6): secondary 2
- brown (9): primary 1
- blue (8): secondary 1

assignment for PTFE-cable:

- white (5): primary 2
- green (6): secondary 2
- yellow (9): primary 1
- brown (8): secondary 1

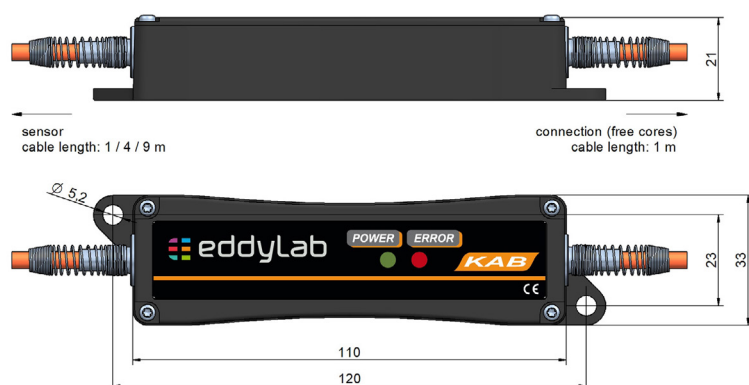
assignment M12-connector:

TECHNICAL DATA - ELECTRONICS

ELECTRONICS	IMCA EXTERNAL ELECTRONICS*		KAB CABLE ELECTRONICS
Output signal	0...20 mA, 4...20 mA (load < 300 Ohm)		0...5 V, ± 5 V (load > 5 kOhm)
			0...10 V, ± 10 V (load > 10 kOhm)
Temperature coefficient			-0,0055, ±0,002 %/K
Resolution**			0,04 % FS
Corner frequency			300 Hz/-3 dB (6-pole Bessel)
Isolation stability			> 1000 VDC
Power supply			9...36 VDC
Current consumption	75 mA at 24 VDC		65 mA at 24 VDC
	150 mA at 12 VDC		140 mA at 12 VDC
Sensor supply	3 V _{eff} , 3 kHz (adjustable, 1-18 kHz)		3 V _{eff} , 3 kHz (adjustable, 1-18 kHz)
Working temperature			-40...+85 °C
Storage temperature			-40...+85 °C
Housing	polyamide PA6.6, meets UL94-VO		ABS
Mounting	on DIN EN-rail		bore diameter ø 5,5

* switch cabinet installation
 ** 98,5 % confidence interval (confidence limit)

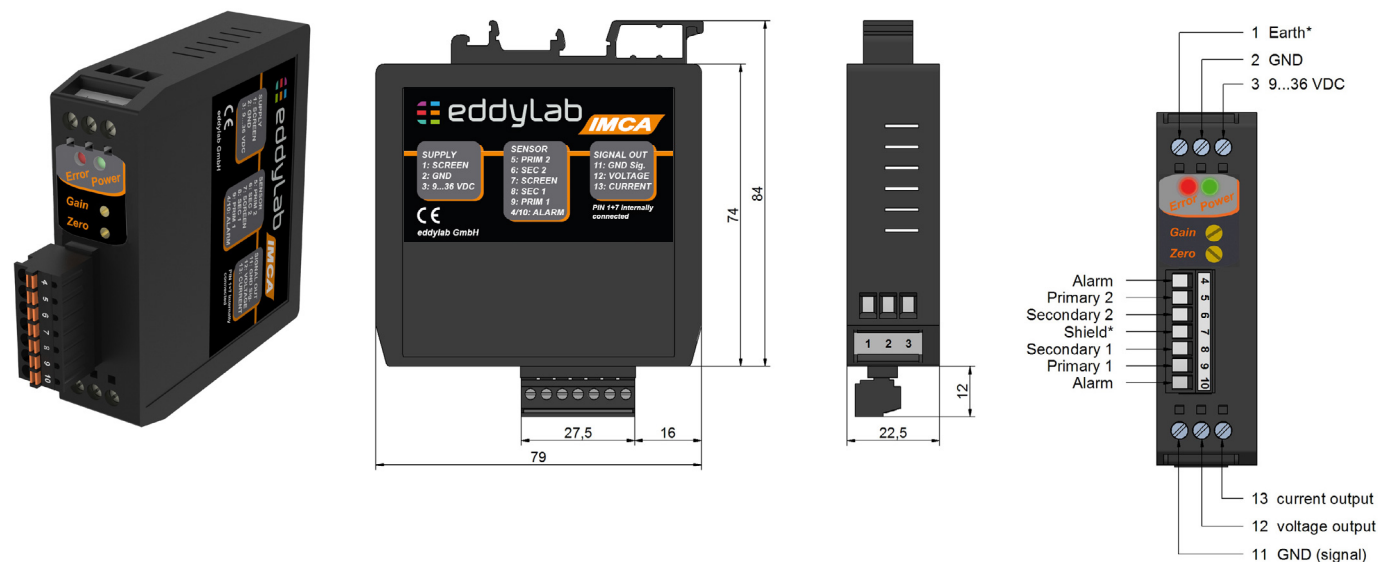
CABLE ELECTRONICS KAB



FUNCTION	CABLE TPE	CABLE PTFE-UL
V+	brown	yellow
GND	blue	brown
signal	white	white
signal GND	black	green

If not specified otherwise the cable electronics is placed at 1 m from the end of the cable.

EXTERNAL ELECTRONICS IMCA

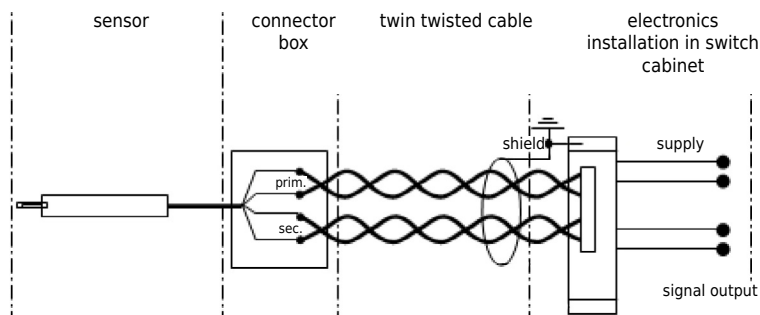


■ Connection

The external electronics IMCA is designed to be installed in switch cabinets (Din-rail mounting). The connection to the sensor is conducted as connector with push-in spring connection.

* Terminals 1 and 7 are internally connected.

At harsh EMC environments, it is possible to install the electronics at a max. distance of 100 m in a switch cabinet. A twin twisted pair cable (4-cores, minimum cross section 0,5 mm²), single or double shielded, is to be used for the further wiring to connect the external electronics to the system. It is recommended to ground the shield in the switch cabinet near the electronics (do not ground at the machine/ sensor). The sensor housing is grounded at the machine frame. To prevent interference, the cable length should not exceed 100 m.

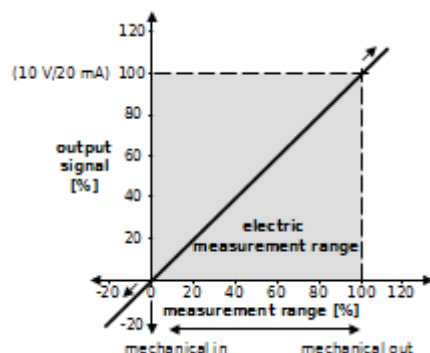


ADJUSTMENT OF ZERO POINT AND GAIN

Each sensor, manufactured by eddyLab, is basically adjusted and calibrated. You will receive a traceable calibrated measurement equipment, adjusted and tested in the company's own high-end calibration laboratory, and a calibration certificate. Please note: If the zero point or gain is changed the calibration certificate will lose validity. The potentiometers shall be protected by a label against unauthorised access. In some cases, it is necessary to adjust the zero point and gain, e.g. with hydraulic cylinders or reduced measurement ranges. In this case, the output signal can be adapted to the mechanical stroke of the measurement object precisely. Please note that the zero point and gain may shift for long cable length between sensor and electronics. Thus install the sensor with the according cable length to the electronics and then adjust zero point and gain.

- Push rod entirely in – adjust offset.
Move the sensor to the zero point of the measuring range and set the offset potentiometer on 4 mA/0 V for the output signal
- Push rod entirely out – adjust gain.
Move the sensor to the end of the measuring range (push rod moved out) and set the gain potentiometer on 20 mA /10 V/5 V for the output signal.

Running direction of signal: If the push rod is moving into the sensor (e.g. sprung load pushed in), the signal is reducing. If the push rod is moving out, the output signal is increasing. The running direction of the signal can also be inverted.



The output signal is referring to the electric measuring range. If the sensor is operated outside the measuring range or the measuring range is exceeded, the signal is also outside the defined range (i.e. $> 10 \text{ V}/20 \text{ mA}$ or $< 0 \text{ V}/4 \text{ mA}$, in the graph: $> 100\%$ or $< 0\%$). Please keep this in mind for control systems with cable break detection lower than 4 mA or for a maximum input voltage $> 10 \text{ V}$ of measuring instruments. If necessary install the sensor **before** connecting to the PLC.

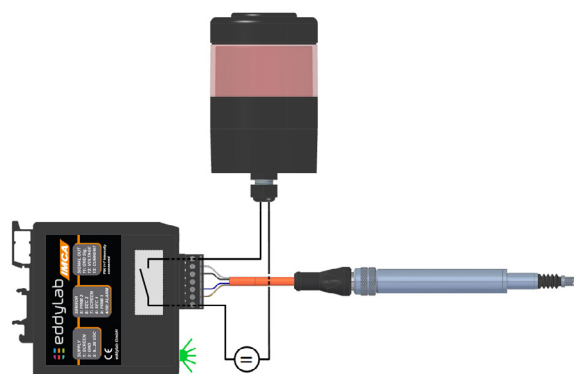
Running direction of signal: If the push rod is moving into the sensor, the signal is reducing. If the push rod is moving out, the output signal is increasing. The running direction of the signal can also be inverted.

CABLE BREAK DETECTION

The electronics by eddyLab feature a built-in cable break detection. This is achieved by an impedance measurement of the LVDT's secondary coil. If the sensor cable is cut, the impedance on the secondary connections of the electronics change regardless of the push rod position, triggering the cable break detection. This feature is based on a broken secondary connection. A partial cable break of the primary connections (cables between primary coil and electronics) will not activate this function. The electronics vary in their functional range. The external electronics IMCA offers the widest range. The cable electronics KAB only visualises a cable break by a red LED.

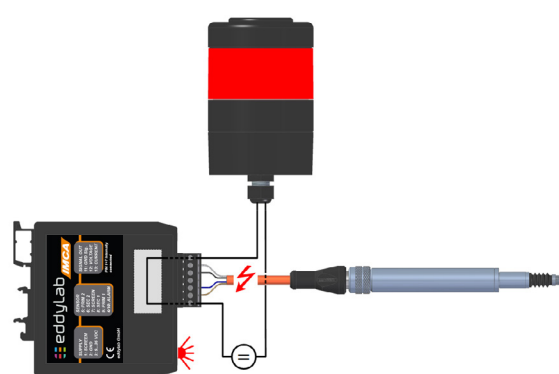
IMCA: For the use of the cable break functions an alarm system (signal lamp, acoustic alarm device) or an alarm input of the PLC must be connected to the 7-pole terminal. The circuit board features a analog switch which is a normally open.

■ NORMAL OPERATION IMCA:



- The green „POWER-LED“ on the front side is on.
- The signal output is active.
- The alarm output is disabled.

■ CABLE BREAK IMCA:



- In case of a cable break the analog switch closes and the alarm system is activated or an electrical signal is conducted. Please note the maximum electrical values: 30 mA or 14 V .
- A front side „ERROR-LED“ flashes in case of an error.
- The signal output is deactivated. There is no current or voltage signal.

■ NORMAL OPERATION KAB:



- The green „POWER-LED“ on the front side is on.

■ CABLE BREAK KAB:

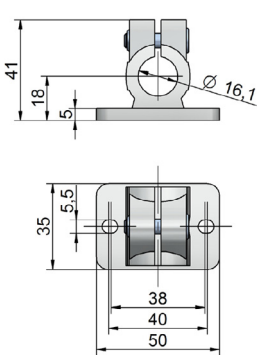


- A front side „ERROR-LED“ flashes in case of an error.

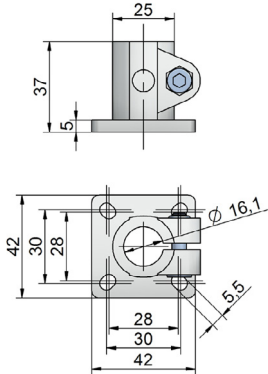
ACCESSORIES

MOUNTING PARTS

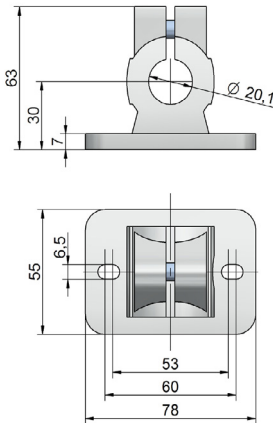
Flanschklemmstück 16-AL
clamping diameter: 16 mm
material: aluminium



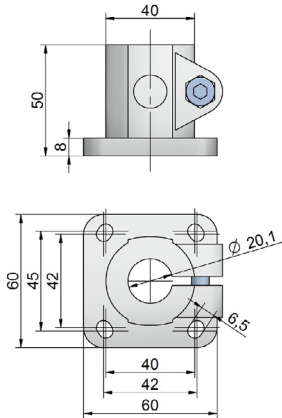
Fußklemmstück 16-AL
clamping diameter: 16 mm
material: aluminium



Flanschklemmstück 20-AL
clamping diameter: 20 mm
material: aluminium



Fußklemmstück 20-AL
clamping diameter: 20 mm
material: aluminium



CONNECTION CABLE (SHIELDED) FOR CONNECTOR OUTPUT

CABLE M12 WITH ANGULAR CONNECTOR		CABLE M12 WITH STRAIGHT CONNECTOR	
K4P2M-SW-M12	2 m	K4P2M-S-M12	2 m
K4P5M-SW-M12	5 m	K4P5M-S-M12	5 m
K4P10M-SW-M12	10 m	K4P10M-S-M12	10 m
K4P15M-SW-M12	15 m	K4P15M-S-M12	15 m
K4P20M-SW-M12	20 m	K4P20M-S-M12	20 m



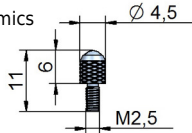
MATING CONNECTOR M12 (SHIELDED)

	STRAIGHT CONNECTOR D4-G-M12-S	ANGULAR CONNECTOR D4-W-M12-S
Protection class	IP67	
Temperature range	-25...+90 °C	
Mode of connection	spring closure construction	
Cable diameter	ø 4...8 mm	
Conductor	0,14...0,34 mm²	

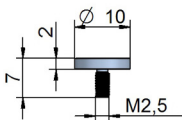


FEELER

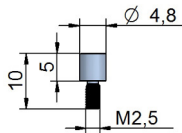
- Tastkopf-01, steel (standard)
- Tastkopf-01-HM, cemented carbide
- Tastkopf-01-R, ruby
- Tastkopf-01-K, ceramics



- Tastkopf-02, steel
- Tastkopf-02-HM, cemented carbide



- Tastkopf-03, steel
- Tastkopf-03-HM, cemented carbide



MATERIAL OF TASTKOPF-01 FEELER BALLS:

steel: for standard applications
ruby: much harder and wear resistant than steel, non-conductive, for all applications except for measuring on aluminium and cast iron
ceramics: comparable to ruby, best choice for measuring on aluminium and cast iron

ORDER CODE SENSOR

SLT X - X - X - X X X X X
 a b c d e f g h

a measurement ranges [mm]

10 / 25 / 50 / 80 / 100 / 150 /
200 / 300

b type

T = spring loaded
PR1 = pneumatic PR1
PR2 = pneumatic PR2

c cable / connector

KR = cable radial
SR = M12 connector radial

d cable / connector output

S1: sensor with connector output

1 = radial connector output M12 (no cable)

S2: sensor with cable output, open cable end (for IMCA)

A = TPE cable 2 m
B = TPE cable 5 m
C = TPE cable 10 m
D = PTFE-UL cable 2 m (option H)
E = PTFE-UL cable 5 m (option H)
F = PTFE-UL cable 10 m (option H)

S3: sensor with cable output for KAB

G = TPE cable 2 m
H = TPE cable 5 m
J = TPE cable 10 m
K = PTFE-UL cable 2 m (option H)
L = PTFE-UL cable 5 m (option H)
M = PTFE-UL cable 10 m (option H)

e linearity

1 = 0,30 % (standard)
2 = 0,20 % (option L20)
3 = 0,10 % (option L10)

f temperature range

1 = -40...+120 °C (standard)
2 = -40...+150 °C (option H)
3 = -40...+200 °C (option H200)

g push rod sealing

1 = - (standard)

h protection class

1 = IP65
2 = IP67 (option IP67)

ORDER CODE ELECTRONICS

IMCA - 24V - X
 a

KAB - 24V - X - X
 a b

type

IMCA = external electronics
KAB = cable electronics

a output signal

020A = 0...20 mA
420A = 4...20 mA
10V = 0...10 V
5V = 0...5 V
±5V = -5...5 V
±10V = -10...10 V

b KAB: type of cable / length

E1: for sensor with cable output

- = KAB integrated in sensor cable

E2: for sensor with connector output

A = cable 2 m, M12 straight female conn.
B = cable 2 m, M12 angular female conn.
C = cable 5 m, M12 straight female conn.
D = cable 5 m, M12 angular female conn.
E = cable 10 m, M12 straight female conn.
F = cable 10 m, M12 angular female conn.

b KAB: type of cable / length

E3: for sensor with cable output

M12 = KAB integrated in sensor cable, M12 connector

E4: for sensor with connector output

M12A = cable 2 m, M12 straight female conn., M12 conn.
M12B = cable 2 m, M12 angular female conn., M12 conn.
M12C = cable 5 m, M12 straight female conn., M12 conn.
M12D = cable 5 m, M12 angular female conn., M12 conn.
M12E = cable 10 m, M12 straight female conn., M12 conn.
M12F = cable 10 m, M12 angular female conn., M12 conn.

possible combinations:

- S3+E1: sensor with cable output, KAB integrated in sensor cable
- S3+E3: sensor with cable output, KAB integrated in sensor cable, M12 connector
- S1+E2: sensor with connector output, cable electronics with cable K4PxM
- S1+E4: sensor with connector output, cable electronics with cable K4PxM, M12 connector

- IMCA: sensor with connector output (S1), cable K4PxM, external electronics IMCA
- IMCA: sensor with cable output (S2), external electronics IMCA

