

# LVDT

## Inductive Position Transducer - Hydraulic Series



### SM-HYD Hydraulic Series

#### Key-Features:

- Screw flange M18x1,5 / M30x1,5 or plug-in flange Ø18
- Pressure up to 400 bar
- Measurement range 2...180 mm
- Linearity up to  $\pm 0.10\%$
- Protection class IP67
- Sensor working temperature up to 150°C
- High EMC-grade
- Customized versions available

#### Content:

## DESCRIPTION

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. The SM series offers ultimate reliability and precision in a small size, and is designed for industrial- and lab use. The SM series is also available as a pressurized hydraulic model to 400 bar for installation directly in hydraulic cylinders (See data sheet SM-HYD and SM-F18). As of 2013 IMCA and KAB 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.

The sensors are used in hydraulic cylinders with a maximum pressure resistance of up to 400 bar. They are especially suited to be employed in harsh industrial environments where a high electromagnetic tolerance is required. The sensor works nearly unaffected by electric or magnetic fields.

This sensor enables a connection between the hydraulic cylinder and the machine control.



## TECHNICAL DATA

Sensor		
Ranges [mm]	2...180 mm (see chart on page 3)	
Linearity [% of FS]	±0.20 % - 0.80 % (see chart on page 3), 0.10 % for selected models	
Temperature range	-40...+120 °C, optional up to 150 °C (H-option)	
Vibration stability DIN IEC68T2-6	10 G	
Shock stability DIN IEC68T2-27	200 G / 2 ms	
Connection	4 core cable or M12-connector with coupling nut	
cable TPE (standard)	ø 4.5 mm, 0.14 mm <sup>2</sup> , non-halogen, suitable for drag chains	
PTFE (option H)	ø 4.8 mm, 0.24 mm <sup>2</sup> , max. temperature 200 °C, UL-Style 2895	
Max. cable length	100 m between sensor and electronics	
Electronics		
	<b>IMCA external electronics (built-in)</b>	<b>KAB cable electronics</b>
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)	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	-0,0055, ±0,002 %/K
Resolution*	0,04 % FS	0,04 % FS
Corner frequency	300 Hz/-3 dB (6-pole Bessel)	300 Hz/-3 dB (6-pole Bessel)
Isolation stability	> 1000 VDC	> 1000 VDC
Power supply	9...36 VDC	9...36 VDC
Current consumption	75 mA at 24 VDC 150 mA at 12 VDC	65 mA at 24 VDC 140 mA at 12 VDC
Sensor supply	3 V <sub>eff</sub> , 3 kHz (adjustable, 1-18 kHz)	3 V <sub>eff</sub> , 3 kHz (adjustable, 1-18 kHz)
Working temperature	-40...+85 °C	-40...+85 °C
Storage temperature	-40...+85 °C	-40...+85 °C
Housing	polyamide PA6.6, meets UL94-VO	ABS
Mounting	on DIN EN-rail	bore diameter ø 5,5

\* 98.5% confidence interval (confidence limit)

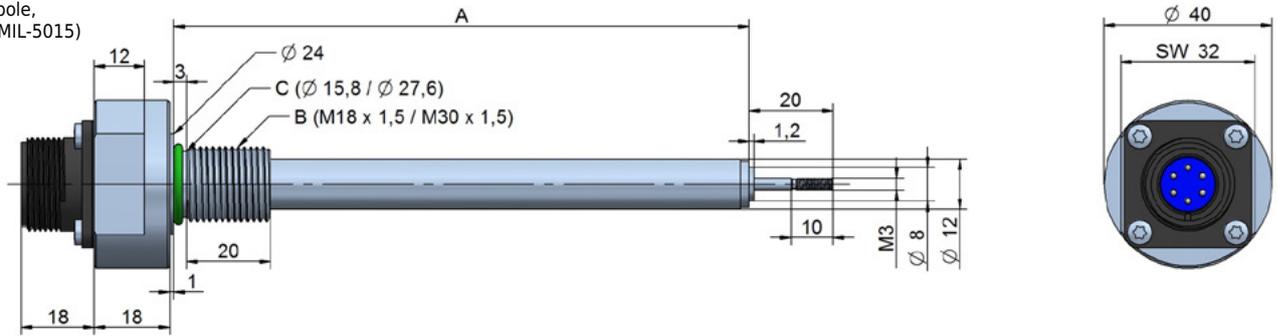
## TECHNICAL DATA AND DIMENSIONS

Range (FS) [mm]	Type	Body length A [mm]	Linearity [%] (standard)	Linearity [%] (optional)
0...2	SM2-HYD	48	0.30	0.20
0...5	SM5-HYD	54	0.30	0.20
0...10	SM10-HYD	64	0.30	0.20
0...25	SM25-HYD-M	94	0.30	0.20
0...25	SM25-HYD	137	0.30	0.20
0...50	SM50-HYD-M	144	0.30	0.20
0...50	SM50-HYD	207	0.30	0.20
0...100	SM100-HYD-M	220	0.80	-
0...100	SM100-HYD	244	0.30	0.20
0...120	SM120-HYD	227	0.80	-
0...140	SM140-HYD	260	0.80	-
0...160	SM160-HYD	336	0.80	-
0...180	SM180-HYD	300	0.80	-

other ranges on request

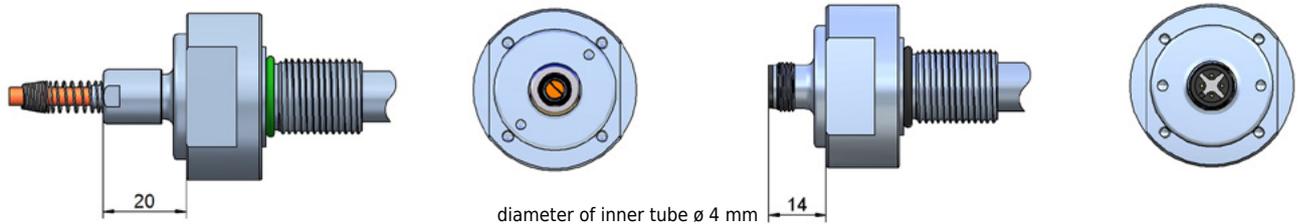
### Different output types with flange type thread M18 x 1,5 / M30 x 1,5

Connector, 6-pole,  
(according to MIL-5015)

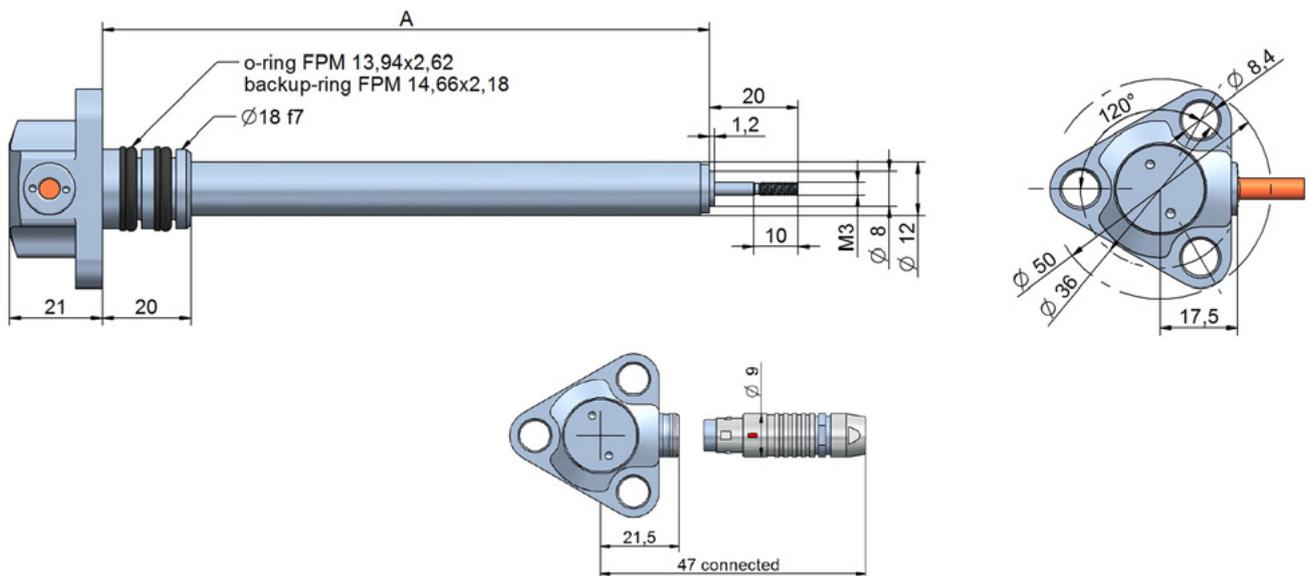


Cable output

Connector, 4-pole, M12

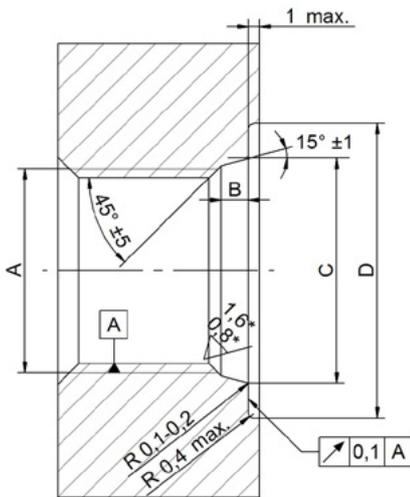


### Plug-in flange with radial cable or radial connector output



## INSTALLATION DRAWING

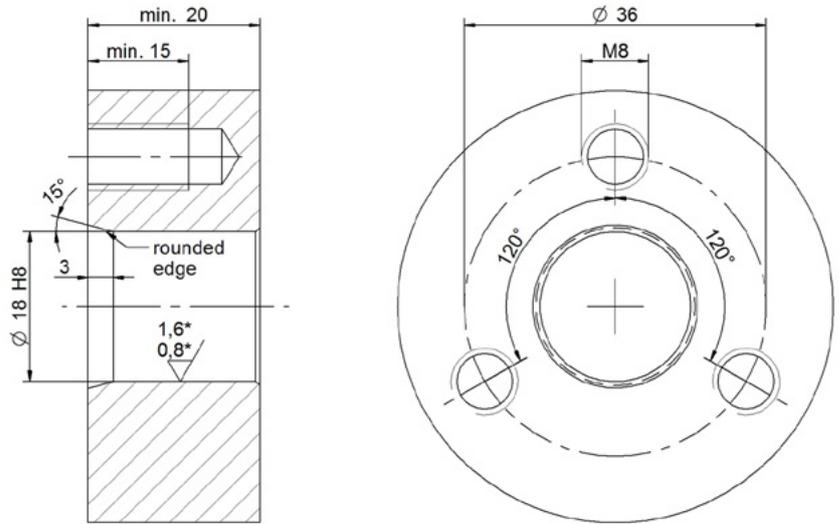
flange with thread M30



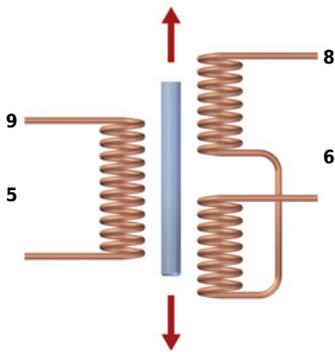
\* note: Rz = 1,6 for non pulsating pressure  
Rz = 0,8 for pulsating pressure

	M18x1,5	M30x1,5
A	M18x1,5	M30x1,5
B	2,4	3,1
C	19,8	32,4
D	26	42

for plug-in flange S18



## AC-OUTPUT



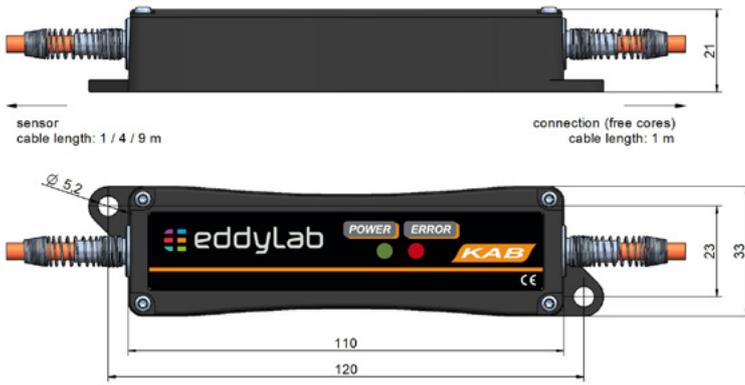
### assignment for TPE-cable:

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

## CABLE ELECTRONICS KAB



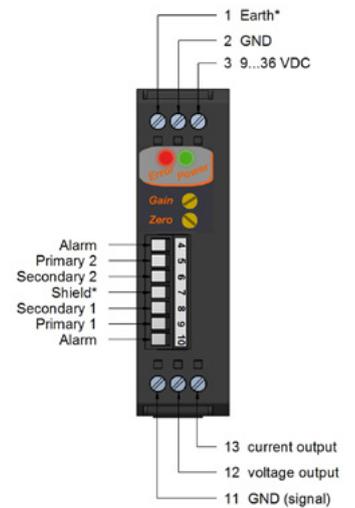
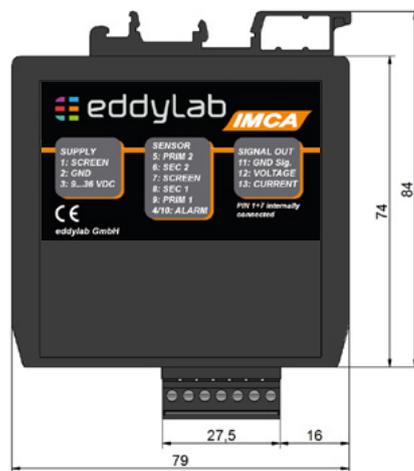
function	cable TPE	cable PTFE-UL
V+	brown	yellow
GND	blue	brown
signal	white	white
signal GND	black	green

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

## EXTERNAL ELECTRONICS IMCA



external electronics IMCA (for DIN-rail mounting)



### 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.

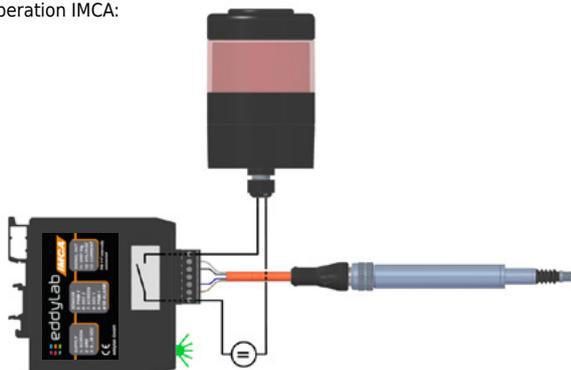
\* Terminals 1 and 7 are internally connected.

## 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.

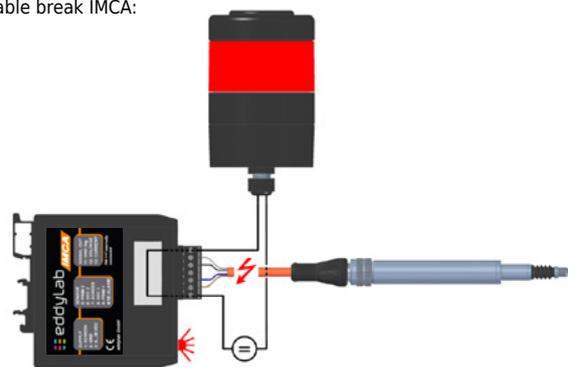
IMCA: For the use of the cable break functions an alarm system (signal lamp, acoustic alarm device) or an alarm input of the PLC must be connected to the 7-pole terminal. The circuit board features a analog switch which is a normally open.

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.

## CABLE BREAK DETECTION

Normal operation KAB:



- The green „POWER-LED“ is on.

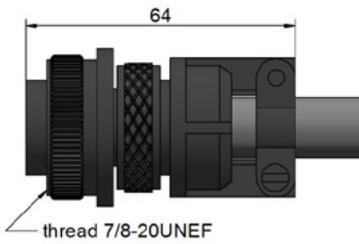
Cable break KAB:



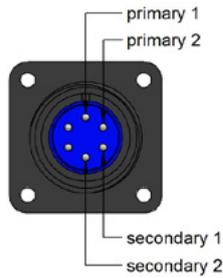
- The red „ERROR-LED“ is on.

## ELECTRICAL CONNECTION & CABLE

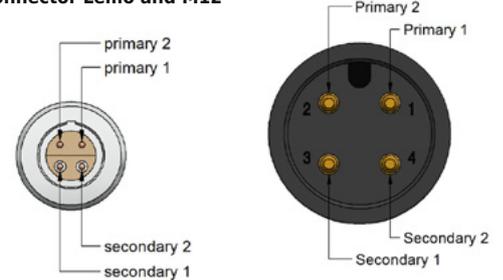
**mating connector: AT3106F, according to MIL-5015** (please order separately)



**PIN assignment**



**PIN assignment connector Lemo and M12**



**Connection cable (shielded) for connector output**

**Cable M12 with straight connector**

K4P2M-S-M12	2 m
K4P5M-S-M12	5 m
K4P10M-S-M12	10 m

**Cable M12 with angular connector**

K4P2M-SW-M12	2 m
K4P5M-SW-M12	5 m
K4P10M-SW-M12	10 m



**Mating connector for self assembly (shielded)**

	<b>Straight connector D4-G-M12-S M18 / M30 flange</b>	<b>Angular connector D4-W-M12-S M18 / M30 flange</b>	<b>Straight connector Lemo-FGG.0T S18 flange</b>
Protection class	IP67		IP68
Temperature range	-25...+90 °C		-40...150 °C
Mode of connection	spring closure construction		soldering contact
Cable diameter	ø 4...8 mm		ø 4,5...5,0 mm
Conductor	0,14...0,34 mm <sup>2</sup>		0,14...0,25 mm <sup>2</sup>



## ADJUSTMENT OF ZERO POINT AND GAIN

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.

1. 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.
2. 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.

Signal inversion:

If an inverted output signal is required (20...4 mA /10...0 V/5...0 V), swap clamps 6 and 8 (secondary coil) on the external electronics.

## ORDER CODE SENSOR

SM **X** -HYD- **X** - **X** - **X** **X** **X** **X**  
**a** **b** **c** **d** **e** **f** **g**

**a** measurement ranges [mm]

2 / 5 / 10 / 25 / 50 / 100  
 120 / 140 / 160 / 180

**b** type of flange

18 = thread M18 x 1,5  
 30 = thread M30 x 1,5  
 S18 = plug-in flange ø18

**c** output

S = connector output (MIL-5015 / LEMO)  
 M12 = connector output (M12)  
 K = cable output

**d** cable / connector output

**S1: sensor with connector output**  
 1 = connector output

**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 / 0,80 % (standard, see table page 3)  
 2 = 0,20 % (option L20, see table page 4)  
 3 = 0,10 % (option L10, see table page 4)

**f** temperature range

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

**g** housing

1 = standard body length  
 2 = short body length

## 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 / cable length

**E1: for sensor with cable output**

- = KAB integrated in sensor cable

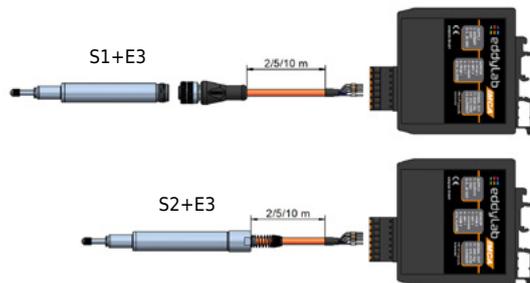
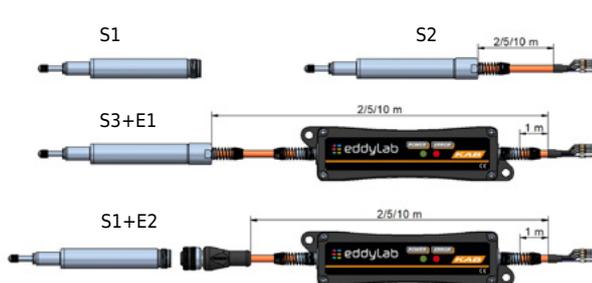
**E2: for sensor with connector output**

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

possible combinations:

- S1: sensor with connector output
- S2: sensor with cable output
- S3+E1: sensor with cable output, KAB integrated in sensor cable

- S1+E2: sensor with connector output, cable electronics with cable K4PxM
- S1+E3: sensor with cable output, cable K4PxM, external electronics IMCA
- S2+E3: sensor with cable output, external electronics IMCA





Subject to change without prior notice.

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