



Instruction Manual indu**SENSOR**, EDS

EDS-100-S/F
EDS-160-S/F
EDS-200-S/F
EDS-220-Z
EDS-250-S/F
EDS-260-Z

EDS-300-S/F/Z
EDS-370-Z
EDS-400-S/F/Z
EDS-630-S/F

Long-Stroke sensors, Series EDS

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Certified acc. to DIN EN ISO 9001: 2008

Contents

1.	Safety	5
1.1	Symbols Used	5
1.2	Warnings	5
1.3	Notes on CE Identification	6
1.4	Proper Use	6
1.5	Proper Invironment	7
2.	Funcional Principle, Technical Data	8
2.1	Measuring Principle	8
2.2	Structure.....	9
2.3	Technical Data.....	10
3.	Delivery	12
3.1	Unpacking.....	12
3.2	Storage.....	12
4.	Installation and Assembly.....	13
4.1	Precautionary Measures	13
4.2	Measuring Tube Guide and Fastening	13
4.3	Sensor Mounting.....	15
4.3.1	Model EDS-...-S	15
4.3.2	Model EDS-...-F.....	22
4.3.3	Model EDS-...-Z.....	24
4.4	Power Supply and Display/Output Device	27
4.4.1	Model EDS-...-S	27
4.4.2	Model EDS-...-F.....	29
4.4.3	Model EDS-...-Z.....	30
4.4.4	Load Resistor, Maximum Operating Temperature	32

5.	Operation	33
6.	Operation and Maintenance	33
7.	Warranty.....	34
8.	Decommissioning, Disposal	34
9.	Appendix.....	35

1. Safety

The handling of the system assumes knowledge of the instruction manual.

1.1 Symbols Used

The following symbols are used in this instruction manual:



Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.



Indicates a situation which, if not avoided, may lead to property damage.



Indicates a user action.



Indicates a user tip.

1.2 Warnings



Connect the power supply according to the safety regulations for electrical operating equipment.

> Danger of injury

> Damage to or destruction of the sensor



The supply voltage must not exceed specified limits.

> Damage to or destruction of the sensor

Avoid banging and knocking the sensor.

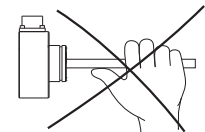
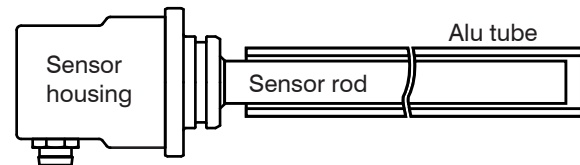
> Damage to or destruction of the sensor

Avoid bending the sensor rod or the alu tube.

> Damage to or destruction of the sensor

Do not transport the sensor on the sensor rod.

> Damage to or destruction of the sensor



1.3 Notes on CE Identification

The following applies to EDS eddy current long stroke displacement sensors:

EMC regulation 2004/108/EC

Products which carry the CE mark satisfy the requirements of the EMC regulation 2004/108/EC

'Electromagnetic Compatibility' and the European standards (EN) listed therein. The EC declaration of conformity is kept available according to EC regulation, article 10 by the authorities responsible at

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The eddy current long stroke displacement sensors are designed for use in industry and satisfy there requirements of the standards:

- DIN EN 61326-1: 2006-10
- DIN 61326-2-3: 2007-05

The sensors satisfy the requirements if they comply with the regulations described in the instruction manual for installation and operation.

1.4 Proper Use

- The sensors are used for
 - displacement measurement in presses, punches, rolling mills, et cetera
 - position determination of piston in hydraulic and pneumatic cylinders
- The sensors may only be operated within the limits specified in the technical data (Chap. 2).
- Use it in such a way that with malfunctions or total failure of the sensor, persons are not endangered and machines are not damaged.
- Take additional precautions for safety and damage prevention for safety-related applications.

1.5 Proper Invironment

- Protection class for sensor
 - Sensor rod IP 68
 - Electronics: IP 67 ¹
- Operating temperature: -40 °C bis +85 °C (-40 to +185 °F), $R_L = 500 \text{ Ohm}$
- Storage temperature: -40 °C bis +100 °C (-40 to +212 °F)
- Humidity: 5 - 95 % (no condensation)
- Ambient pressure: $450 \cdot 10^5 \text{ Pa}$ ($1 \text{ Pa} = 1 \text{ N/m}^2$) max. ²
- EMC: According to: DIN EN 61326-1: 2006-10
DIN 61326-2-3: 2007-05

- 1) Models with male plug connection only with gasketed female plug
- 2) Confined on sensor rod with alu tube to o-ring

2. Functional Principle, Technical Data

2.1 Measuring Principle

The eddy current long stroke displacement sensors transform a linear motion (for example piston position in hydraulic cylinders) into a linear, electrical signal. An aluminium tube, moving concentrically around a sensor rod, is used as target. Energy is transferred from the coil by inducing of eddy currents in the aluminium tube and it is detuned as a result. The integrated, miniaturized electronics convert the tube position into a linear, electrical output signal. The eddy current measuring principle works without contact between moving parts and is therefore free of wear.

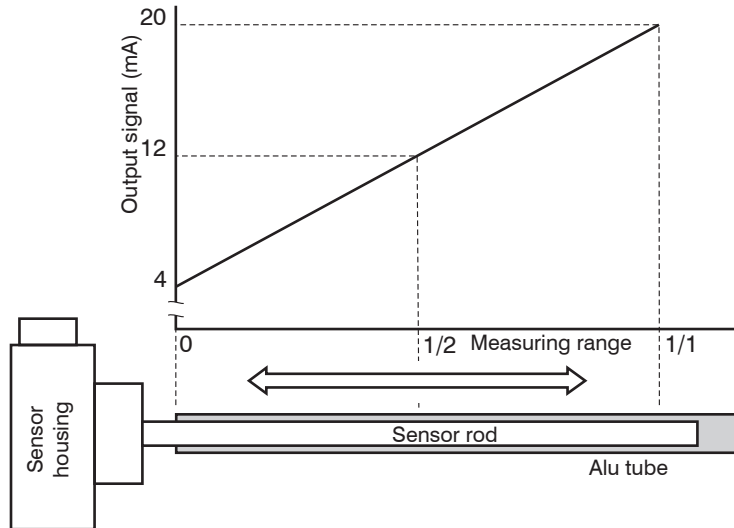


Fig. 1: Measuring Principle of an eddy current long stroke displacement sensor, alu tube at the start of the measuring range

2.2 Structure

A coil is mounted inside the sealed rod, protected against environmental influences. The micro-electronics is integrated in the sensor housing. A pressure-proof, stainless steel housing is available as an option. The sensors are used for measuring lengths from 100 to 630 mm.

Electrical connection:

- Connector 4-pins, type Amphenol C164P compact (Model EDS-...-S...)
- Connector 7-pins, type Binder 712 (Model EDS-...- S ...7...)
- Connector 5-pins, CA02COM-E14S with bayonet connection (Model EDS-...-F...)
- Wire, axial (model EDS-...-Z...)

2.3 Technical Data

Model			EDS -100	EDS -160	EDS -200	EDS -220	EDS -250	EDS -260	EDS -300	EDS -370	EDS -400	EDS -630
Connections			S, F	S, F	S, F	Z	S, F	Z	S, F, Z	Z	S, F, Z	S, F
Measuring range	mm		100	160	200	220	250	260	300	370	400	630
Linearity	±0.3 % FSO	mm	0.3	0.48	0.6	0.66	0.75	0.78	0.9	1.1	1.2	1.89
Resolution	0.05 % FSO	mm	0.05	0.08	0.1	0.11	0.125	0.13	0,15	0.18	0.2	0.315
Repeatability			0.05 % FSO									
Temperature range			-40 °C ... +85 °C									
Temperature stability			±200 ppm / °C									
Frequency response	-3 dB		150 Hz, optional up to 300 Hz									
Output signal			4 - 20 mA									
Output load			≤ 500 Ohm									
Power supply			18 - 30 VDC									
Current consumption			max. 40 mA									
Connector	Model S		7-pin connector (sensor cable as an option), options radial or axial output									
	Model F		5-pin radial bayonet-connector with mating plug									
	Model Z		Wire axial									
Pressure resistance			450*10 ⁵ Pa max. (Sensor rod, flange) ¹									
Protection class			Sensor rod: IP 68, electronics: IP 67 ²									
Elektromagnetic compatibility (EMC) ³			DIN EN 61326-1: 2006-10 DIN 61326-2-3: 2007-05									
Shock ⁴	IEC 68-2-29 IEC 68-2-27		40 g, 3000 shocks per axis 100 g radial, 300 g axial									
Vibration	EC 68-2-6		5 Hz ... 44 Hz ±2.5 mm 44 Hz ... 500 Hz ±23 g									

Model		EDS -100	EDS -160	EDS -200	EDS -220	EDS -250	EDS -260	EDS -300	EDS -370	EDS -400	EDS -630	
Connections		S, F	S, F	S, F	Z	S, Z	Z	S, F, Z	Z	S, F, Z	S, F	
Sensor material		V4A-Steel 1.4571										
Tube material		AlMgSi, enodized										
Sensor weight	EDS-...-S	g	134	156	172	---	195	---	212	---	323	448
	EDS-...-F		1,300	1,350	1,370	---	1,400	---	1,420	---	1,450	1,500
	EDS-...-Z		---	---	---	223	---	270	310	480	480	---
	Alu tube		23	37	44	46	53	58	62	92	92	138

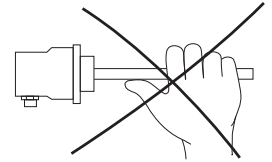
FSO = Full Scale Output

- 1) For all models confined on sensor rod with alu tube to the O-ring.
- 2) With gasketed female plug.
- 3) Model Z only when integrated.
- 4) Half sinusoid 6 ms.

3. Delivery

3.1 Unpacking

- ➡ Do not take and hold the sensor at the sensor rod.
- ➡ Check for completeness and shipping damage immediately after unpacking.



The delivery of an eddy current long stroke displacement sensor includes:

- | | |
|--|---|
| 1 Eddy current long stroke displacement sensor | 1 O-ring (mounted on sensor) ¹ |
| 1 Measuring tube | 1 Test report |
| 1 Instruction manual | |

- ➡ In case of damage or missing parts, please contact the manufacturer or supplier.

3.2 Storage

- Storage temperature: -40 °C bis +100 °C (-40 to +212 °F)
- Humidity: 5 - 95 % (no condensation)
- Atmospheric pressure

1) For sensor models S and F only

4. Installation and Assembly

4.1 Precautionary Measures

The measuring tube must not contact the sensor rod during operation.
> Damage to or destruction of the sensor through abrasion is possible.

Do not deform or shorten the measuring tube.
> Loss of specified technical data.

Do not crush the O-ring or damage through sharp-edged items.
> Loss of functionality

4.2 Measuring Tube Guide and Fastening

➡ Mount the measuring tube in the piston borehold.

The dimensions for the measuring tube are shown in Fig. 8, 10, 14 and 16. When the piston is moved in the measuring tube must not touch the sensor shaft. Observe the measuring tube position at the zero point (= 4 mA output), see Fig. 2, 3 and 4. A slightly eccentric mounting of the measuring tube has no negative influence on the sensor signal.

➡ Mount the measuring tube in the piston by means of pressing or glueing.

Spot clamping is not permissible.

i

The specified technical data are valid only if the measuring tube is used supplied by MICRO-EPSILON!

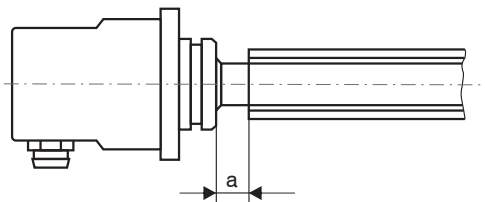


Fig. 2: Zero point of the measuring tube, EDS-...-S

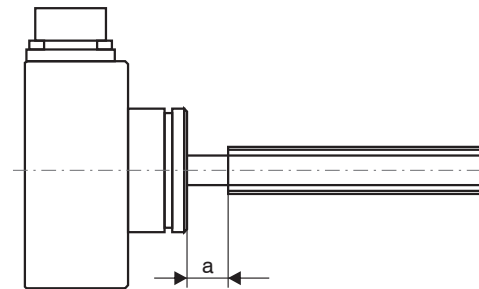


Fig. 3: Zero point of the measuring tube, EDS-...-F

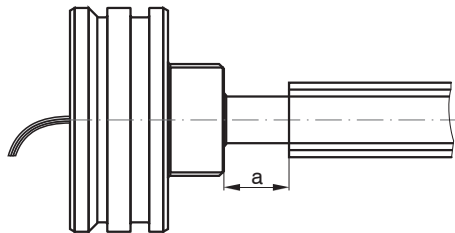


Fig. 4: Zero point of the measuring tube, EDS-...-Z

Legend: mm (inches)

Measuring range	Dimension a
100	20 (0.79)
160	20 (0.79)
200	20 (0.79)
220	20 (0.79)
250	20 (0.79)
260	20 (0.79)
300	20 (0.79)
370	25 (0.98)
400	25 (0.98)
630	25 (0.98)

4.3 Sensor Mounting

4.3.1 Model EDS-...-S

➔ Mount the sensor in the cylinder with a mounting ring (Appendix, see Fig. 12) and six cylinder headbolts (M5x10).

Sealing is effected at the sensor shaft by means of an O-ring supplied.

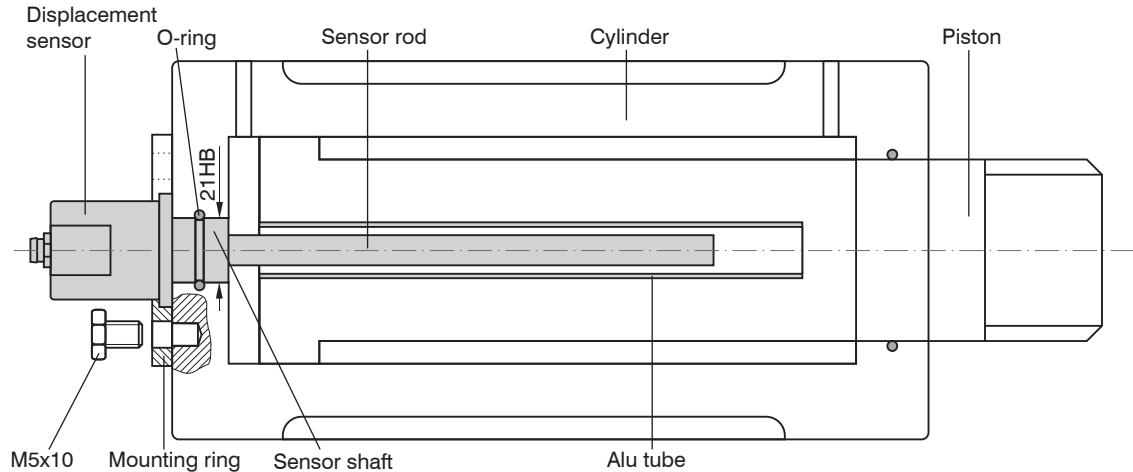


Fig. 5: Sensor mounting in a hydraulic cylinder, model EDS-...-S

Sealing

O-Ring: 18.5x1.5

Material: Viton

Diameter of the borehole: 21H8 dia.

Borehole surface:

$R_a = 0.8$

$R_{max} = 3.2$

Dimension	Fit tolerance μm
21H8	+33 0

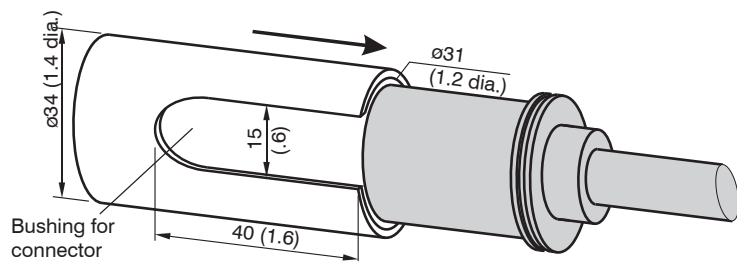


Fig. 6: Mounting of an induSENSOR, model EDS-...-S

Use a connection piece for mounting (see Fig. 6). The bushing must be congruent with the connector for models with radial connector.

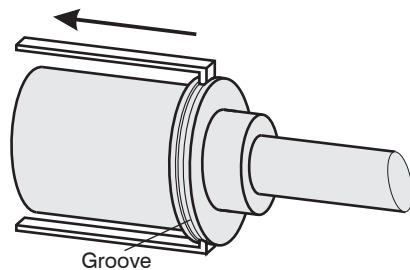


Fig. 7: Dismounting of an induSENSOR, model EDS-...-S

Use an extractor for dismounting (see Fig. 7).
Dimensions of the flange groove:
1.5 x 1.5 mm
(.06 x .06 ", depth x width).

Legend: mm (inches)

Dimensional drawing, model EDS-...-S

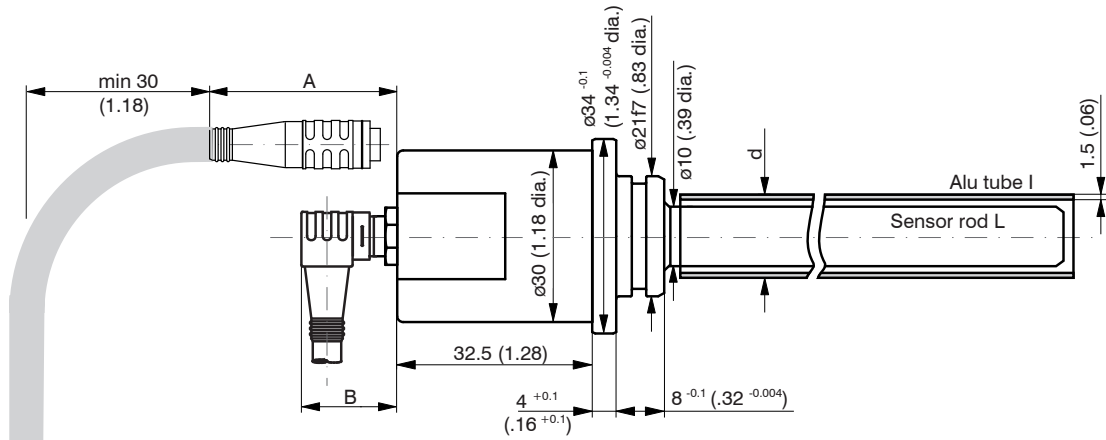


Fig. 8: induSENSOR with axial connector, model EDS-...-SA - I, measuring range: 100 (3.94) / 160 (6.29) / 200 (7.87) / 250 (9.84) / 300 (11.81), dimensions in mm (inches), not to scale

Dimension	Fit tolerance μm
21f7	-20 -41

	A	B
EDS-xxx-S-Sx4-l	31 (1.2)	16 (.63)
EDS-xxx-S-Sx7-l	54 (2.1)	48 (1.9)

Measuring range	Sensor rod		Alu tube	
	L	l	d	
100 (3.93)	140 (5.51)	140 (5.51)	16 (.63)	
160 (6.29)	200 (7.87)	200 (7.87)	16 (.63)	
200 (7.87)	240 (9.45)	240 (9.45)	16 (.63)	
250 (9.84)	290 (11.42)	290 (11.42)	16 (.63)	
300 (11.81)	340 (13.39)	340 (13.39)	16 (.63)	

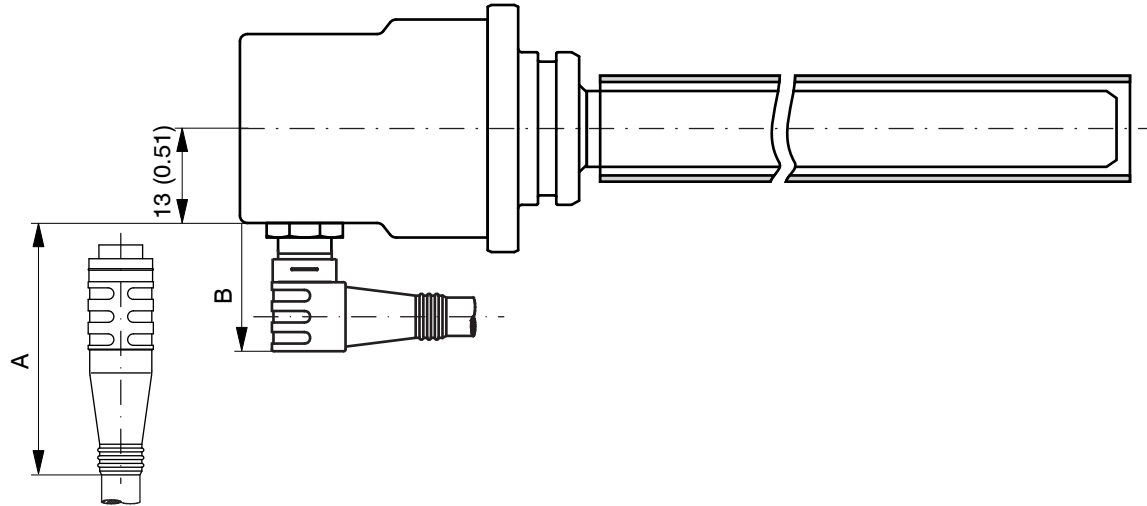


Fig. 9: induSENSOR with radial connector, model EDS-...-SR - I, measuring range: 100 (3.93) / 160 (6.29) / 200 (7.87) / 250 (9.84) / 300 (11.81), dimensions in mm (inches), not to scale

	A	B
EDS-xxx-S-Sx4-I	31 (1.2)	16 (.63)
EDS-xxx-S-Sx7-I	54 (2.1)	48 (1.9)

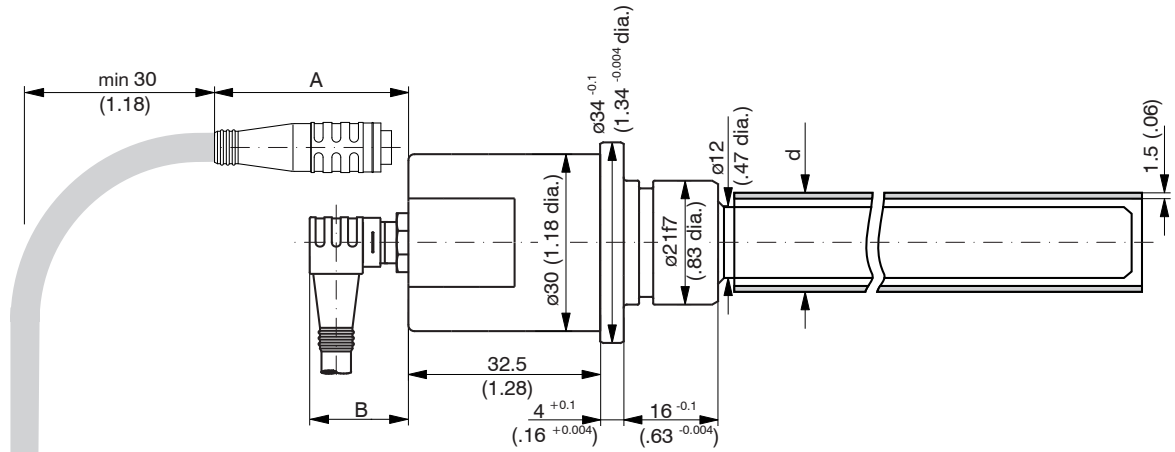


Fig. 10: induSENSOR with axial connector, model EDS-...-SA - I, measuring range: 400 (15.74) / 630 (24.80), dimensions in mm (inches), not to scale

Dimension	Tolerance μm		A	B
21f7	-20 -41	EDS-xxx-S-Sx4-I	31 (2.19)	16 (.63)
		EDS-xxx-S-Sx7-I	54 (2.1)	48 (1.9)

Measuring range	Sensor rod L	Alu tube	
		l	d
400 (15.74)	450 (17.72)	450 ¹ / 460 (17.72/18.11)	18 ¹ / 26 (.71/1.02)
630 (24.80)	680 (26.77)	680 ¹ / 690 (26.77/27.17)	18 ¹ / 26 (.71/1.02)

1) Option

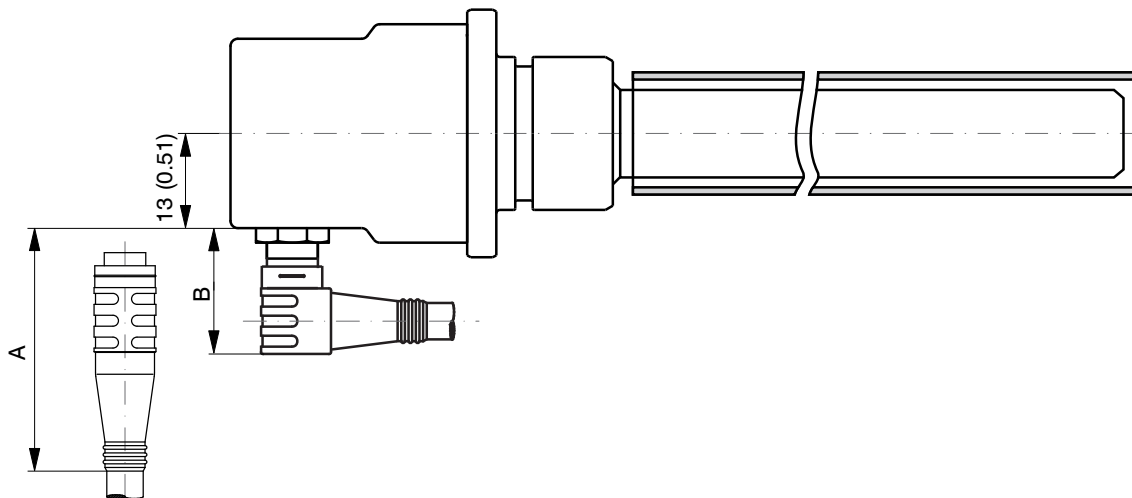


Fig. 11: induSENSOR with radial connector, model EDS-...-SR - I, measuring range: 400 (15.74) / 630 (24.80), dimensions in mm (inches), not to scale

	A	B
EDS-xxx-S-Sx4-I	31 (1.2)	16 (.63)
EDS-xxx-S-Sx7-I	54 (2.1)	48 (1.9)

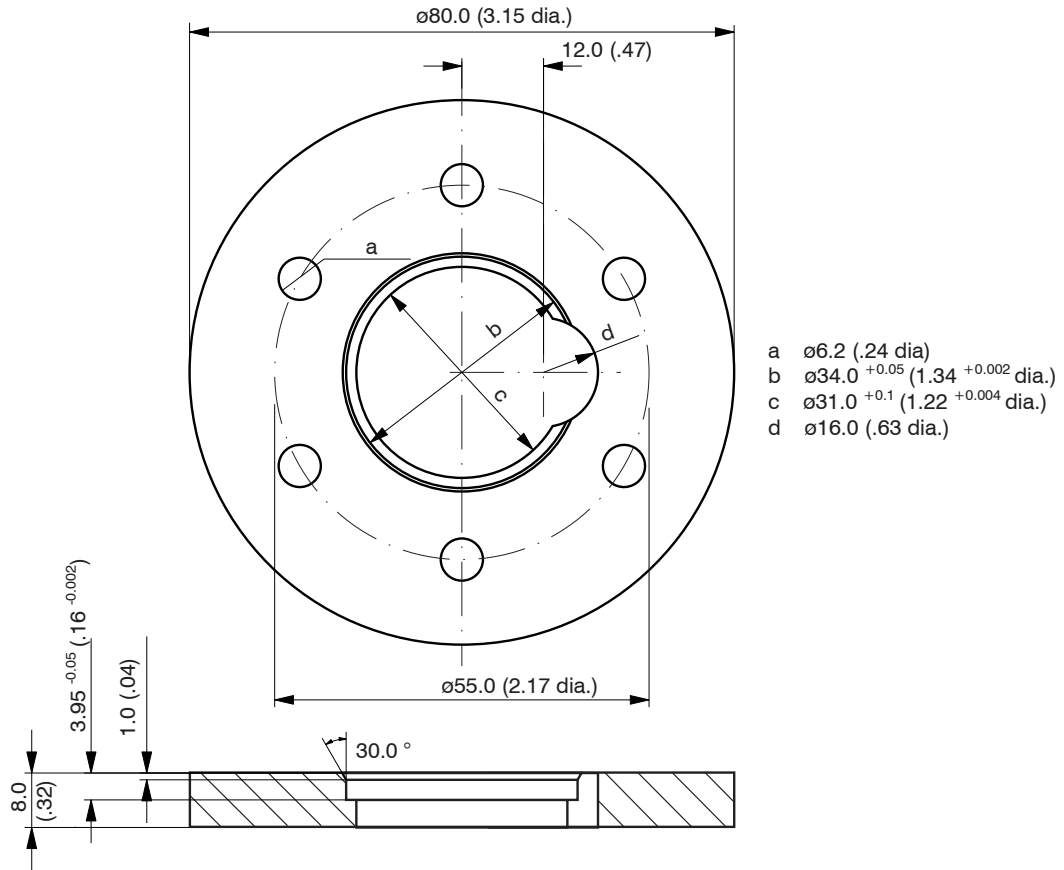


Fig. 12: Mounting ring, model EDS-...-S, dimensions in mm (inches)

4.3.2 Model EDS-...F

The sensor is mounted in the cylinder by means of cylinder head bolts (6 x M8). The sealing is effected at the sensor shaft by means of an O-ring supplied.

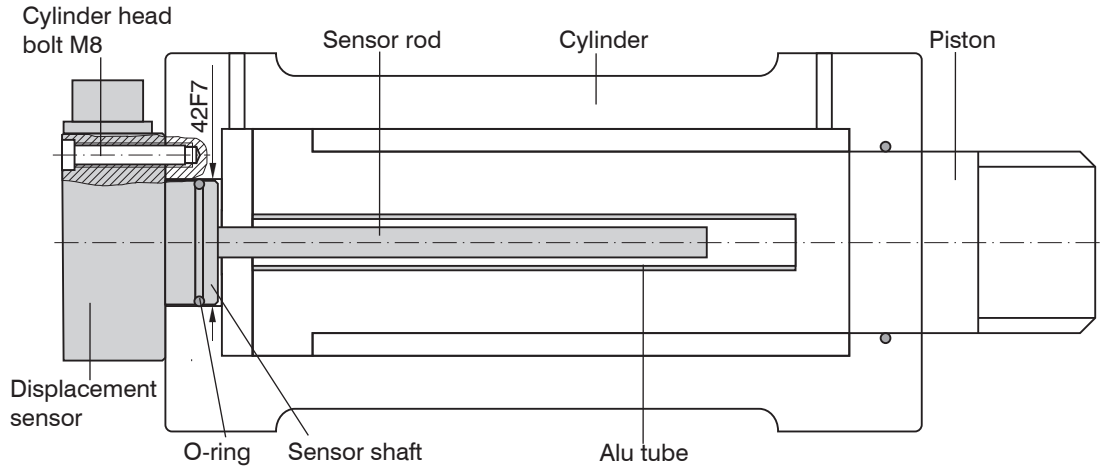


Fig. 13: Sensor mounting in a hydraulic cylinder, model EDS-...-F

Sealing
O-Ring: 38x2.0
Material: PUR

Diameter of the borehole: 42F7 dia.
Borehole surface:
 $R_a = 0.8$
 $R_{max} = 3.2$

Dimensions	Fit tolerance μm
42F7	+50 +25

Dimensional drawing, model EDS-...-F

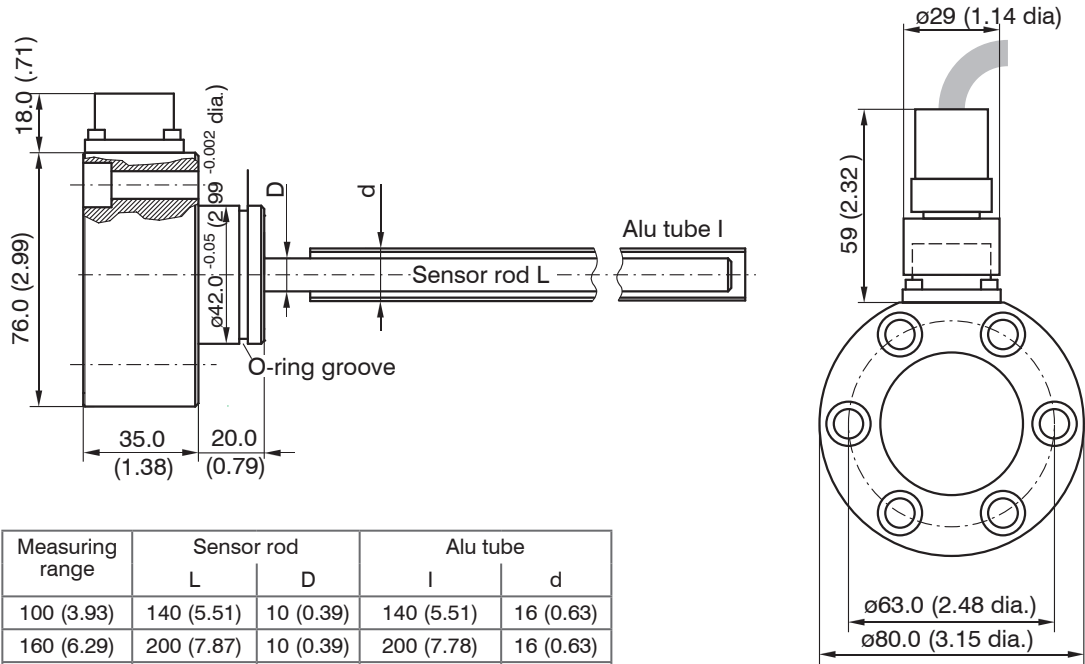


Fig. 14: induSENSOR with radial connector, model EDS-...-F, dimensions in mm (inches), not to scale

1) Option

4.3.3 Model EDS-...-Z

The sensor is fixed in the cylinder with a grub screw and clamped from the back panel. Sealing is effected at the sensor shaft by means of an O-ring.

➡ Feed the connecting wires in cable duct outwards and connect them with the mounting plug.

Sealing (not included in the delivery)
 O-Ring:
 44.12x2.62
 material: Viton

Diameter of the bore-hole:
 48H8 dia.,
 borehole surface:
 $R_a = 0.8$
 $R_{max} = 3.2$

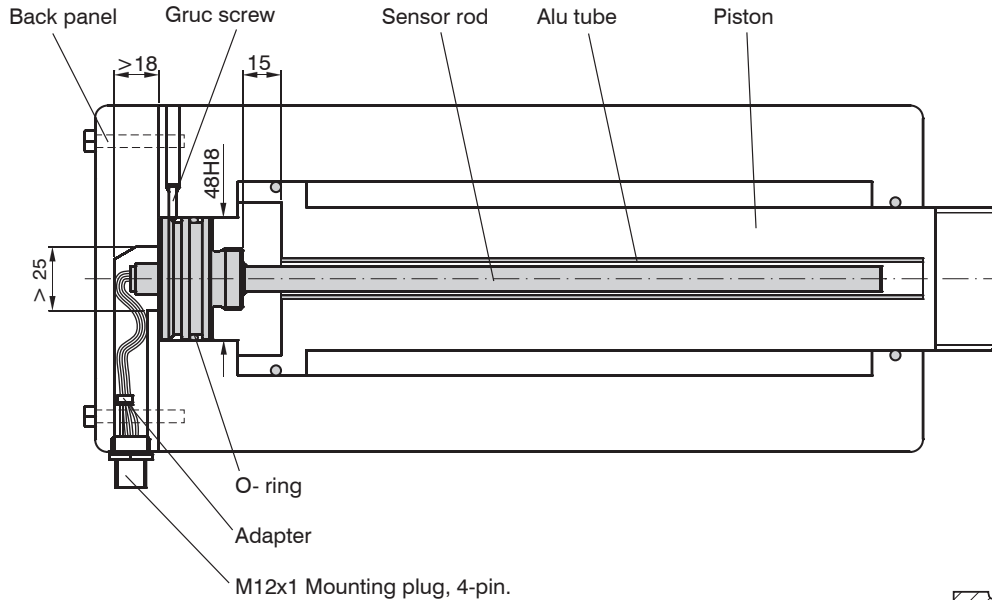
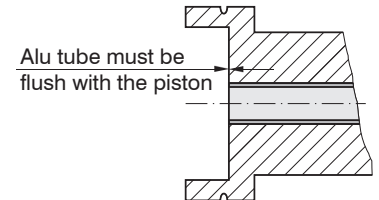


Fig. 15: Sensor mounting in a hydraulic cylinder, model EDS-...-Z

Dimension	Fit tolerance μm
48H8	$\begin{matrix} +39 \\ 0 \end{matrix}$



Dimensional drawing, model EDS-...-Z

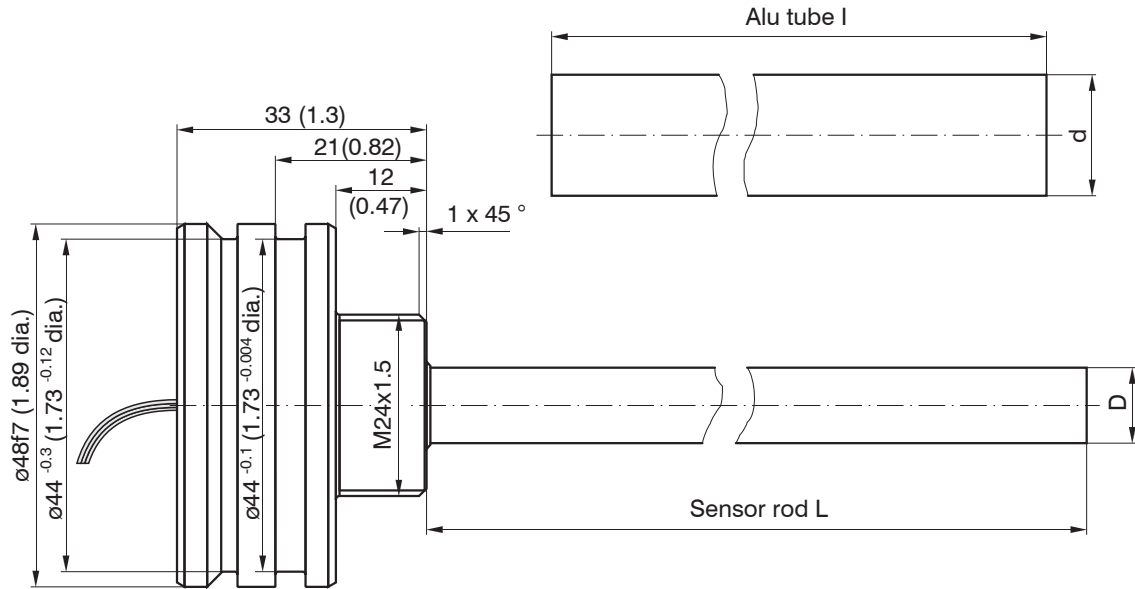


Fig. 16: induSENSOR with axial wires, model EDS-...-Z, dimensions in mm (inches), not to scale

Dimension	Fit tolerance μm
48f7	-25 -50

Measuring range	Sensor rod		Alu tube	
	L	D	I	d
220 (8.66)	250 (9.84)	10 (.39)	252 (9.92)	16 (.63)
260 (10.23)	290 (11.42)	10 (.39)	292 (11.50)	16 (.63)
300 (11.81)	342 (13.46)	10 (.39)	340 (13.39)	16 (.63)
370 (14.57)	464 (18.27)	12 (.47)	450 (17.72)	18 (.71)
400 (15.74)	450 (17.72)	12 (.47)	450 (17.72)	18 (.71)

➡ Use an extractor pipe for dismounting (see Fig. 17).

Female thread in the extractor pipe: M24 x 1.5

Proceeding:

1. Unplug the adapter.
2. Release the grub screw
3. Screw on the extractor pipe on the sensor shaft and pull out the sensor from the cylinder.

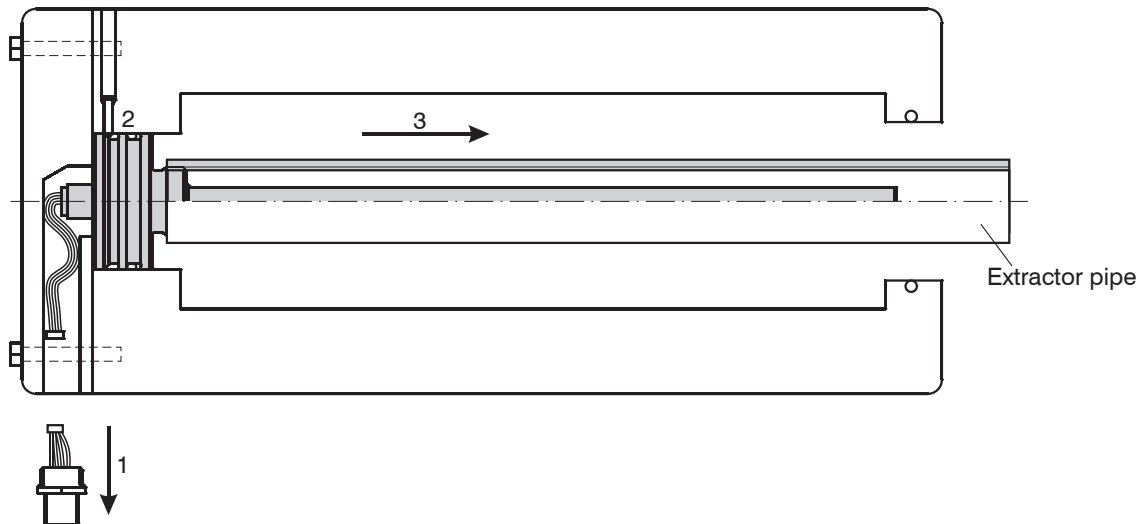


Fig. 17: Dismounting of the induSENSOR, model EDS-...-Z

4.4 Power Supply and Display/Output Device

4.4.1 Model EDS-...-S

The power supply and the signal output are effected through the 4-contact or 7-contact connector on the sensor's electronic housing. The pin assignment is shown in Fig. 18 and 19.

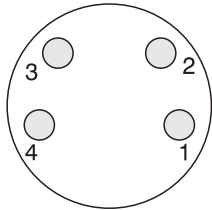
Amphenol connector

Type C164P compact

Model:

EDS-...- SA - I
connector axial

EDS-...- SR - I
connector radial



View on solder pin side, female cable connector

Pin	Assignment	Color C704-5
1	Power supply + (18 ... 30 VDC)	blue
2	0 V Ground	black
3	I_{OUT} 4 ... 20 mA	white
4	Signal ground	brown

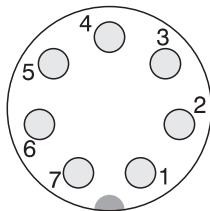
Connection instructions:
Pull back black retainer on the cable socket, plug in the socket, push back retainer.

Fig. 18: Connection pin assignment, 4-pole

Binder connector

Type 702

The sensor cable C703-5 and C704-5, length 5 m, are available as an accessory.



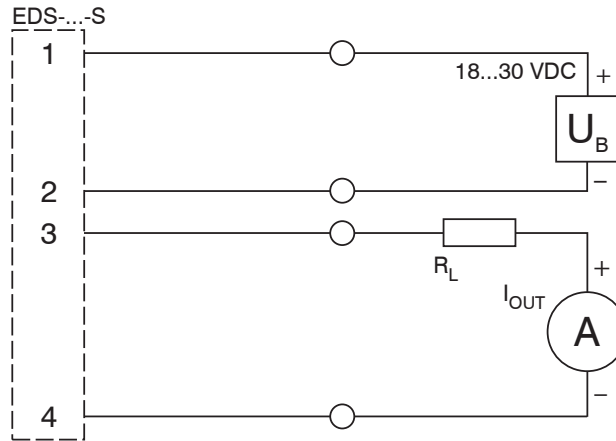
View on solder pin side, female cable connector

Pin	Assignment	Color C704-5
1	Power supply + (18 ... 30 VDC)	white
2	0 V Ground	brown
3	I_{OUT} 4 ... 20 mA ¹	green
4	Signal ground	yellow
5	SCL (Sensor calibration)	grey
6	SCL (Sensor calibration)	pink
7	n.c.	blue

Pin 2 is connected with pin 4 on the electronics board. The screen of the sensor cable is connected with the connector housing. Connect the screen of the sensor cable with the protective earth conductor on power side.

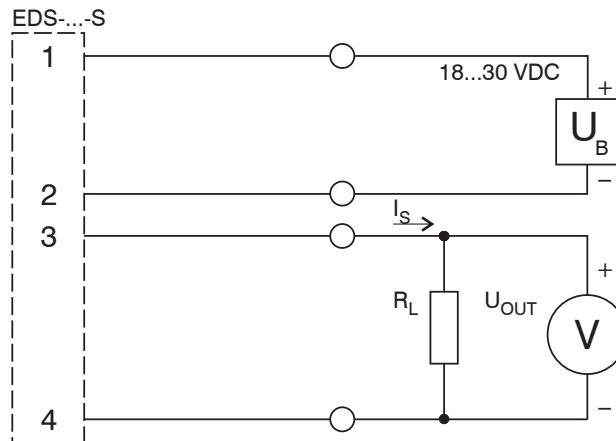
Fig. 19: Connection pin assignment, 7-pole

1) Output voltage of 1 up to 5 V with the C703-5/U supply and output cable.



R_L can be inserted as an option for adaptation of the power loss to high ambient temperatures (see Chap. 4.4.4).

Fig. 20: Signal monitoring with amperemeter



If the signal is monitored with a voltmeter the load resistor R_L is sized to give the desired output voltage U_{OUT}

Formula: $U_{OUT} = R_L * I_{Signal}$

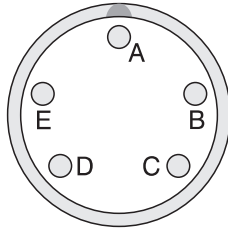
Fig. 21: Signal monitoring with load resistor and voltmeter

4.4.2 Model EDS-...-F

Power supply and signal output are effected through the 5-contact connector on the sensor's electronic housing. The pin assignment is shown in Fig. 22.

Connector
Type CA02COM-G14S

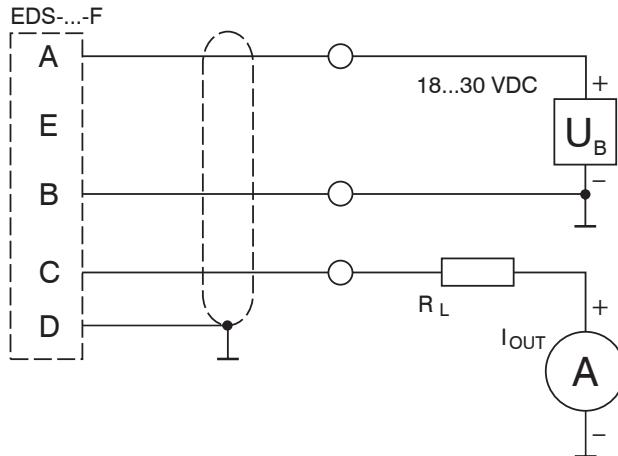
The C705-5 sensor cable is available as an accessory.



Pin	Assignment
A	Power supply + (18 ... 30 VDC)
B	Ground
C	4 ... 20 mA
D	Housing
E	---

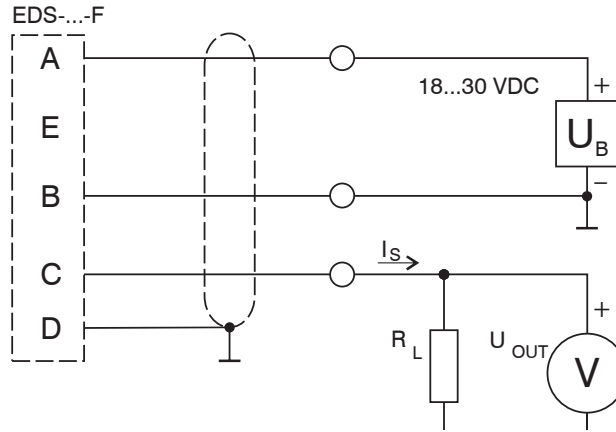
A 5-pin cable socket for the user-side assembly of your own connecting cable is part of the delivery scope.

Fig. 22: Table connection pin assignment, bayonet connection, view of solder pin side female cable connector



R_L can be inserted as an option for adaptation of the power loss to high ambient temperatures (see Chap. 4.4.4).

Fig. 23: Signal monitoring with amperemeter



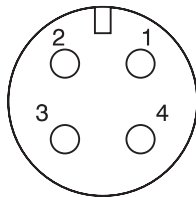
If the signal is monitored with a voltmeter the load resistor R_L is dimensioned in accordance with the desired output voltage U_{OUT}

Formula: $U_{OUT} = R_L * I_{Signal}$

Fig. 24: Signal monitoring with load resistor and voltmeter

4.4.3 Model EDS-...-Z

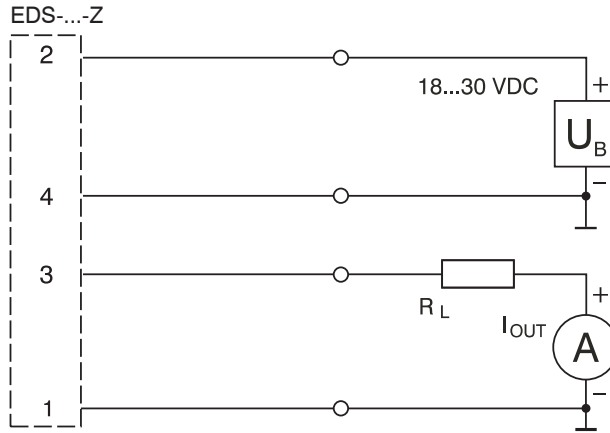
Power supply and signal output are effected through the 4-contact connector on the hydraulic cylinder. The pin assignment is shown in Fig. 25.



Pin	Assignment	Color
1	Signal ground	brown
2	Power supply + (18 ... 30 VDC)	white
3	Signal (4 ... 20 mA)	blue
4	Supply ground	black

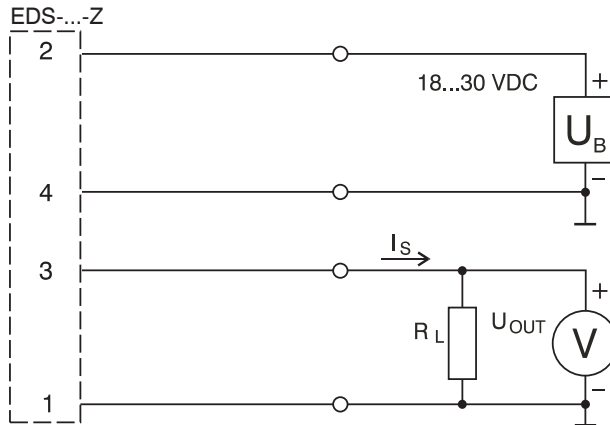
A 4-pin cable socket for the user-side assembly of your own connecting cable is part of the delivery scope.

Fig. 25: Connection pin assignment, view of solder pin side female cable connector



R_L can be inserted as an option for adaptation of the power loss to high ambient temperatures (see Chap. 4.4.4).

Fig. 26: Signal monitoring with amperemeter



If the signal is monitored with a voltmeter the load resistor R_L is dimensioned in accordance with the desired output voltage U_{OUT}

Formula:

$$U_{OUT} = R_L * I_{Signal}$$

Fig. 27: Signal monitoring with load resistor and voltmeter

4.4.4 Load Resistor, Maximum Operating Temperature

The sensors are connected according to the pin assignment shown in, Fig. 18 and 19 (series EDS-...-S), Fig. 22 (series EDS-...-F), Fig. 25 (series EDS-...-Z) and Fig. 20, 21, 23, 24, 26 and 27. Notice the different criterias:

- $R_{L\max} = (U_B - 10 \text{ V}) / 20 \text{ mA}$
- $R_{L\min} = 82.5 * 1/V * U_B - 1625 \text{ Ohm}$
- $T_{\max} = 150 \text{ °C} - 3.3 \text{ °C/V} * U_B + 0.04 \text{ °C/W} * R_L$

The maximum load resistor R_L is limited by the operating voltage U_B .

$$R_{L\max} = \frac{(U_B - 10 \text{ V})}{20 \text{ mA}}$$

A small load resistor loads the sensor electronics more thermal. With a maximum operating temperature of 85 °C (+185 °F) the minimum load resistor R_L permitted is calculated as:

$$R_{L\min} = \frac{82.5 * U_B}{V} - 1625 \text{ Ohm} \quad (\text{If the result is negative: } R_L = 0 \Omega)$$

With a preset load resistor the maximum operating temperature permitted is calculated as:

$$T_{\max} = 150 \text{ °C} - \frac{3.3 * U_B}{V} + \frac{0.04 * R_L}{\text{Ohm}} ; \quad \text{and } T_{\max} \leq 85 \text{ °C}$$

R_L	=	Load resistor
U_B	=	Operating voltage
T_{\max}	=	Maximum operating temperature

5. Operation

The sensors have no adjustment and setting elements.

After assembly and connection of display/output device the sensor should warm-up 10 minutes to be ready for operation.

Output signal: 4 mA (start of measuring range) up to 20 mA (end of measuring range)

- The sensor is ready for measuring without adjustment.
- 1 Warm-up time: 10 min.
Output signal: 4 ... 20 mA

6. Operation and Maintenance

 Observe the notes on measuring tube guiding in Chap. 4.2 during operation.

Imperfect measuring tube guiding can lead to increased wear and premature defects.

The warranty and all liability claims are null and void if the device is worked on by unauthorised persons.

Repairs are to be made exclusively by MICRO-EPSILON.

7. Warranty

All components of the device have been checked and tested for perfect function in the factory.

In the unlikely event that errors should occur despite our thorough quality control, this should be reported immediately to MICRO-EPSILON MESSTECHNIK.

The warranty period lasts 12 months following the day of shipment.

Defective parts, except wear parts, will be repaired or replaced free of charge within this period if you return the device free of cost to MICRO-EPSILONMESSTECHNIK.

This warranty does not apply to damage resulting from abuse of the equipment and devices, from forceful handling or installation of the devices or from repair or modifications performed by third parties.

No other claims, except as warranted, are accepted. The terms of the purchasing contract apply in full.

MICRO-EPSILON will specifically not be responsible for eventual consequential damages.

MICRO-EPSILON always strives to supply the customers with the finest and most advanced equipment. Development and refinement is therefore performed continuously and the right to design changes without prior notice is accordingly reserved.

For translations in other languages, the data and statements in the German language operation manual are to be taken as authoritative.

8. Decommissioning, Disposal

➡ Disconnect the power supply and output cable at the sensor respectively the cylinder.

The sensor is produced according to the directive 2002/95/EC („RoHS“)

➡ Do the disposal according to the legal regulations (see directive 2002/96/EC).

9. Appendix

Accessories

DD800/90-265	Digital readout, programmable, 90 - 265 VAC
DD800/10-32	Digital readout, programmable, 10 - 32 VDC
DD800/90-265/RS	Digital readout, programmable, two output relays and serial interface, 90 - 265 VAC
C704/90-5	Supply and output cable, 90 °-connector, 4-pole, 5 m long, (Model EDS-...- S ...)
C704-5	Supply and output cable, straight connector, 4-pole, 5 m long, (Model EDS-...- S ...)
PS2010	Power supply for mounting on DIN rail, output 24 VDC, input 230 VAC, switchable for 110 VAC
C703-5	Supply and output cable, 7-pole, 5 m long, (Model EDS-...- S ...7...)
C703/90-5	Supply and output cable, 90 °-plug, 7-pole, 5 m long, (Model EDS-...- S ...7...)
C703-5/U	Supply and output cable, 7-pole, 5 m long, voltage output 1...5 VDC, (Model EDS-...- S ...7...)
C705-5	Supply and output cable, 5-pole, 5 m long, (Model EDS-...- F)
EDS mounting ring,	(Model EDS-...- S ...)



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