DATASHEET

SM-F14 SERIES | LVDT

Inductive transducer: Pressure-tight designed for integration into hydraulic and pneumatic cylinders or servo valves.

- Measurement ranges 2...10 mm
- Linearity up to ±0,10 % of full scale
- Stainless steel housing
- Operating pressure 150 bar
- Protection class IP67 or IP68
- Sensor working temperature up to 200 °C

eddylab

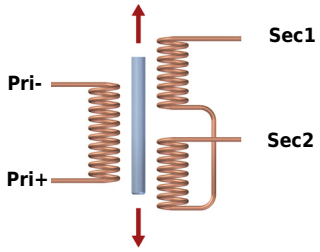
LVDTs (Linear Variable Differential Transformers) are inductive sensors excellent for use in harsh industrial environments, e.g. high temperature and pressure ranges, as well as high accelerations and measuring cycles.
The **F14 series** offers ultimate reliability and precision in a small size, and is designed for industrial and lab use. The position transducer is a pressurized hydraulic model up to 150 bar for installation directly in hydraulic and pneumatic cylinders. The sensors can also be used under water because of their high protection class and stainless steel housing.

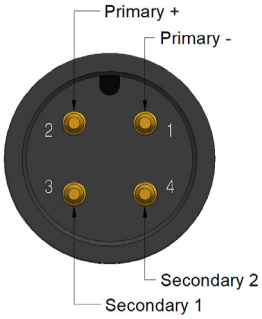
Note: A measuring amplifier is required to operate LVDT sensors. eddylab offers the digital signal conditioners **DEEneo** for DIN rail mounting and **DEEneo-ISC**, a version integrated into the sensor connection cable. See p.5 or separate data sheets at www.eddylab.com. The electronics take over the sensor supply and convert the sensor signal into a standardized, analogue output signal with the help of a microcontroller output signal. They also feature simple adjustment (teach function) and linearization of the sensor characteristic curve to achieve the highest possible precision.

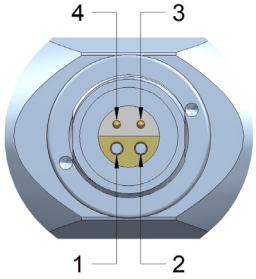
TECHNICAL DATA - SENSORS

SENSOR			
Measurement range FS [mm]	0...2	0...5	0...10
Linearity [% of FS]	0.30 % (0.20 % optional, 0.10 % for selected models)		
Types	spring loaded (MR 2 and 5 mm), free core, push rod guided/ unguided		
Protection class cable/ connector side	IP67, optional IP68 (connector output radial LEMO IP50)		
Protection class flange side	IP68/ 150bar		
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 range	2...10 kHz		
Temperature range	-40...+120 °C (H-option 150 °C, H200-option up to 200 °C)		
Operating pressure	150 bar (on flange side)		
Mounting	M14 x 1 thread or ø 12 mm clamping diameter		
Housing	stainless steel		
Connection	4 core cable output or connector		
cable TPE (standard)	ø 4.5 mm, 0.14 mm², non-halogen, suitable for drag chains		
PTFE (option H)	ø 4.8 mm, 0.24 mm², max. temperature 200 °C, UL-Style 2895		
max. cable length	100 m between sensor and electronics		
Spring loaded version (up to range 5 mm)			
Spring force (middle of range) [N]	1,20	1,20	
Max. cycles of tip at 1 mm amplitude [Hz]	55	50	
Spring stiffness [N/ mm[N/ mm]	0,29	0,20	
Life cycle	> 10 Mio. cycles		
Free core/ push rod/ push rod guided			
Max. acceleration of core/ push rod	100 G		
Service life	infinite		

CABLE/PIN ASSIGNMENT (AC OUTPUT)







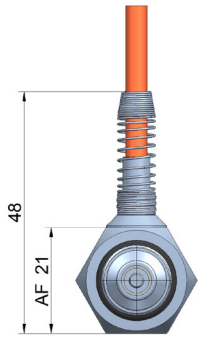
	WIRE COLOUR CABLES		
FUNCTION	TPE	PTFE-UL	PIN
Primary +	white	white	2
Primary -	brown	yellow	1
Secondary 1	blue	brown	3
Secondary 2	black	green	4

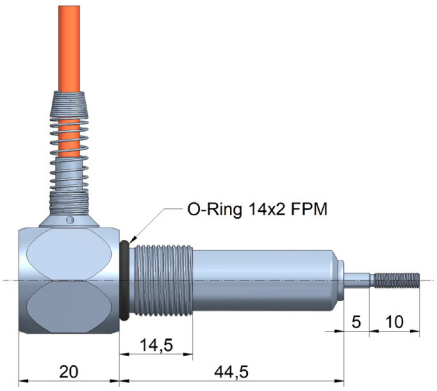
TECHNICAL DIMENSIONS

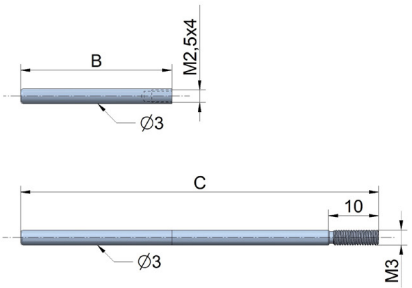
RANGE (FS) [MM]	MAX. LENGTH A SPRING LOADED MECHANICS [MM]	CORE LENGTH B [MM]	PUSH ROD LENGTH C [MM]
0...2	16	22	48
0...5	19	25	54
0...10		30	64

TYPE: FREE CORE (B), PUSH ROD (C)

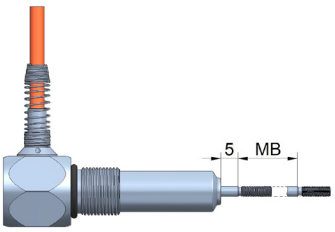
Free core (B): scope of supply: core (non-magnetic extensions have to be manufactured by customer).
push rod (un)guided (C): scope of supply: core + extension (=push rod)



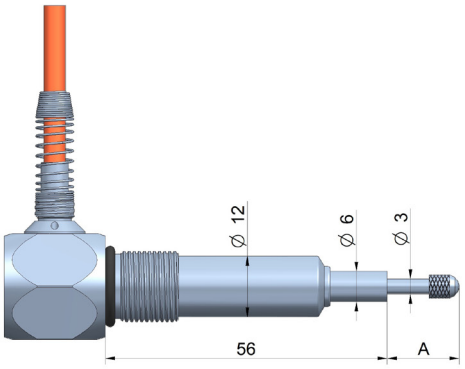


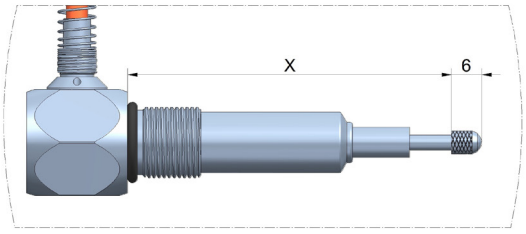


MEASURING RANGE



TYPE: SPRING LOADED (UP TO RANGE 0...5 MM)





POSITION X (MM)	SM2-T	SM5-T
start of measuring range	61	61
end of measuring range	63	66
fully extended	65	68

SENSOR TYPES

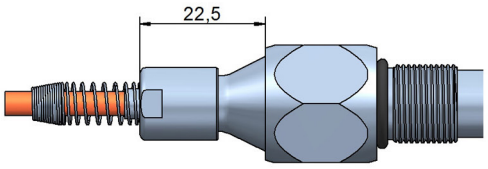
CABLE / CONNECTOR OUTPUT AXIAL / RADIAL

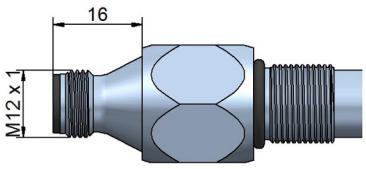
Following types for cable and connector outputs are available:

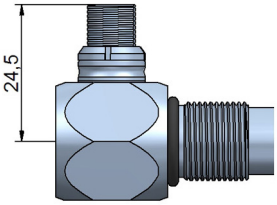
- cable output axial: cable fitting and a spring for bend protection
- cable output radial: cable fitting and a spring for bend protection (page 3)
- connector output axial: M12, 4-pole
- connector output radial: LEMO plug, 4-pole

Instruments with option H for temperatures up to 150 °C/ 200 °C feature a PTFE cable.

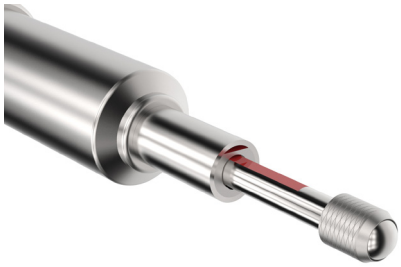
For sensors with connector output the cable has to be ordered separately. You can choose from a cable with a straight connector or with an angular connector. The connector pair has a protection class of IP67.







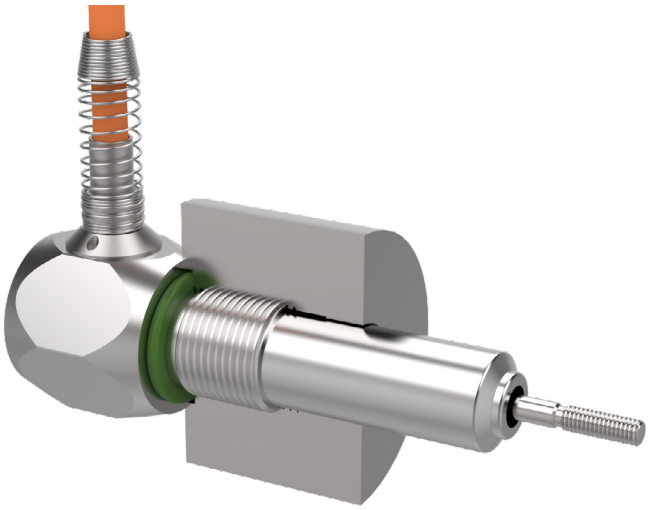
OPTION VH



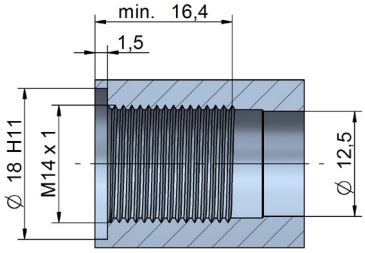
The option VH should to be chosen, if the sensor is used in liquids (oil, water, ...) or if fast pressure variations may occur. By milling plane surfaces on parts of the mechanics (see picture red marked) the pressure balance or venting of the inside area will be improved.

- For „spring loaded version“: Two plane surfaces combined with a higher spring force of approximately 2,5 N improve significantly the mechanical performance.
- For version „guided push rod“: The push rod features a plane surface.

SENSOR INSTALLATION



RECOMMENDED INSTALLATION GEOMETRY

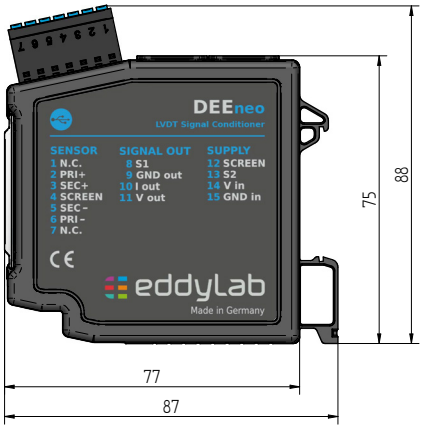


DEENEO | DEENEO-ISC

The **DEEneo** signal conditioner was developed for operating inductive LVDT sensors (full bridge). The electronics supply the sensor and convert the sensor signal into a standardized, analogue output signal with the help of a microcontroller. A push button (SET button) is used for the basic configuration and to set the measuring range limits - this enables quick and easy adaptation to the customer's application. Where possible, eddylab calibrates the sensor and electronics together. The sensor characteristic curve can be linearized to meet the highest demands on the accuracy of the measuring chain. Further features can be configured via the **eddySetup** configuration software. Further information can be found in the DEEneo and DEEneo-ISC data sheets.

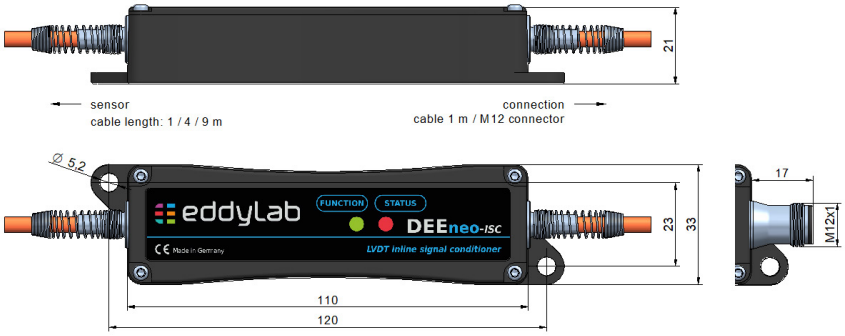
DEEneo*

Digital signal converter for DIN rail mounting



DEEneo-ISC*

Inline Signal Conditioner (cable electronics)



TECHNICAL DATA

ELECTRONICS	DEEneo*	DEEneo-ISC*
Output signal	0...20 mA, 4...20 mA (load < 300 Ohm)	
	0...5 V, ± 5 V; 0...10 V, ± 10 V	
Mounting	on 35 mm DIN rail in accordance with DIN EN 60715	integrated in sensor cable
Power supply	9...36 VDC	
Power consumption	70 mA at 24 VDC, 130 mA at 12 VDC	
Sensor supply	standard: 3V / 3.3 kHz, can be modified by software	
Settings (factory setting)	frequency, amplitude, output signal	
Resolution	16 bit	
Signal processing	digital via microcontroller	
Signal adjustment	via SET-button or software	
Linearisation of sensor	yes, optionally possible	
Switching output	open drain up to 60 V, max. 115 mA	-
Alarm output	open drain up to 60 V, max. 115 mA	-
Cable break detection	yes	

*Separate data sheets for DEEneo and DEEneo-ISC at www.eddylab.com

ACCESSORIES

CONNECTION CABLE (SHIELDED) FOR CONNECTOR OUTPUT

CABLE M12 ANGULAR CONNECTOR	
K4P2M-SW-M12	2 m
K4P5M-SW-M12	5 m
K4P10M-SW-M12	10 m
K4P15M-SW-M12	15 m
K4P20M-SW-M12	20 m
K4P50M-SW-M12	50 m

CABLE M12 WITH STRAIGHT CONNECTOR	
K4P2M-S-M12	2 m
K4P5M-S-M12	5 m
K4P10M-S-M12	10 m
K4P15M-S-M12	15 m
K4P20M-S-M12	20 m
K4P50M-S-M12	50 m

MATING CONNECTOR M12 FOR SELF ASSEMBLY (SHIELDED)

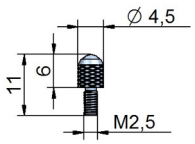
	STRAIGHT CONNECTOR D4-G-M12-S	ANGULAR CONNECTOR D4-W-M12-S	STRAIGHT CONNECTOR LEMO-FGG.0S
Protection class	IP67		IP50
Temperature range	-25...+90 °C		-40...150 °C
Mode of connection	spring closure construction		soldering contacts
Cable diameter	ø 4...8 mm		Ø 3,7...4,5 mm
Conductor	0,14...0,34 mm²		0,14...0,25 mm²

FEELER FOR SPRING LOADED VERSION

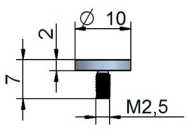
MATERIAL OF TASTKOPF-01 FEELER BALLS

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

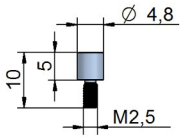
- Tastkopf-01, steel (standard)
- Tastkopf-01-HM, cemented carbide
- Tastkopf-01-R, ruby
- Tastkopf-01-K, ceramics



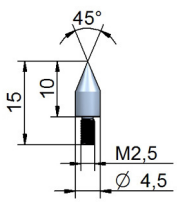
- Tastkopf-02, steel
- Tastkopf-02-HM, cemented carbide



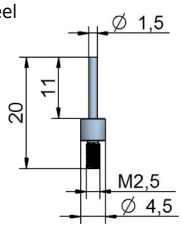
- Tastkopf-03, steel
- Tastkopf-03-HM, cemented carbide



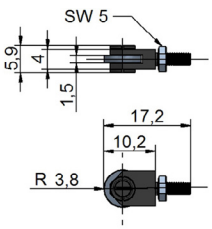
- Tastkopf-04, steel



- Tastkopf-05, steel



- Tastkopf-782.238, roller



ORDER CODE SENSOR / ELECTRONICS

SM X (a) – X (b) – X (c) – **F14** – X (d) X (e) X (f) X (g) . X (h) X (i)

a measurement ranges [mm]
2 / 5 / 10

b type
- A = free core
- S = unguided push rod
- SG = guided push rod
- T = spring loaded

c cable/ connector
- KA = axial cable output
- KR = radial cable output
- SA = axial connector output M12
- SR = radial connector output LEMO

d cable / connector output

S1: sensor with connector output
- 1 = connector output

S2: sensor with cable output, open cable end for DEEneo
- 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 DEEneo-ISC
- 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
- 2 = ventilation hole (option VH)

h protection class
- 1 = IP67
- 2 = IP68 (option IP68)

i spring force
- 1 = for type „A/S/SG“
- 2 = standard
- 3 = HD2.5 (approx. 250g)
- 4 = HD (approx. 500g)

ORDER CODE ELECTRONICS

DEEneo – X (a)

DEEneo-ISC – X (a) – X (b)

type
- DEEneo = external electronics
- DEEneo-ISC = inline signal conditioner

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 type of cable / length

E1: for sensor with cable output
- - = 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.

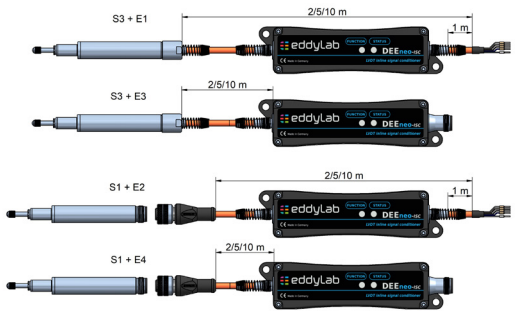
b type of cable / length

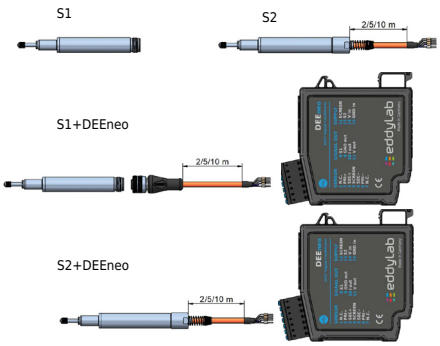
E3: for sensor with cable output
- M12 = integrated in sensor cable, M12 connector

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, DEEneo-ISC integrated in sensor cable
- S3+E3: sensor with cable output, DEEneo-ISC integrated in sensor cable, M12 connector
- S1+E2: sensor with connector output, DEEneo-ISC with cable K4PxM
- S1+E4: sensor with connector output, DEEneo-ISC with cable K4PxM, M12 connector
- S1+DEEneo: sensor with connector output, cable K4PxM, electronics DEEneo
- S2+DEEneo: sensor with cable output, electronics DEEneo





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