



## Product specification



### 2 mm Measuring Range

### Non-Contacting Displacement Sensor System Series ds821 / Series ds822

#### Features

- Non-contacting displacement measurement based on the eddy-current principle
- System length: 5 m or 10 m
- Series ds822 with ATEX approval
- Temperature range displacement sensor: -55 °C ... +180 °C
- Frequency: DC ... 10 kHz
- Compact design of the driver housing (oscillator / demodulator)
- Enhanced tip design
- One driver for both system lengths: system length detected automatically by the driver
- Reduction of spare parts storage
- Easy assembly due to
  - self-latching push-pull plug connections
  - one mounting adapter for hat-rail or drill-hole mounting
- Excellent precision and temperature stability
- When ordering a complete displacement sensor system, the delivery comes with an acceptance test certificate, including measurement report (factory calibration).

#### Use



Relative shaft vibration



Eccentricity



Axial shaft position



Speed



Radial shaft position



Reciprocating Piston drop

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## Product description

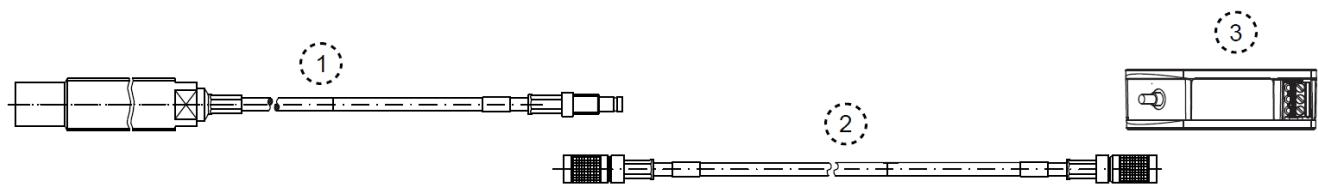
The displacement sensor systems of the ds820 family are based on the non-contacting eddy-current measurement process. The distance is measured between the tip of the displacement sensor and an electrically conductive surface and sent via a proportional voltage signal to a subsequent monitoring system. In the application range of machine monitoring, this makes it possible to record the status of rotating shafts.

The ECDS system (**Eddy Current Displacement Sensor**) consists of the components of displacement sensor with an integrated cable, an optional separate extension cable and the driver (oscillator/demodulator).

The displacement sensor is available as a forward as well as a reverse-side mountable version.

The ECDS system (**Eddy Current Displacement Sensor**) is available as series ds821 Standard and ds822 ATEX. Each series is available in system lengths of 5 m and 10 m.

The name of a component is a combination of the series name (ds821 or ds822 ATEX) and the component designation (**mc** = complete system, **ds** = displacement sensor, **ec** = connection cable or **od** = driver).



Displacement sensor system

2 mm Series ds821 Standard:

2 mm Series ds822 ATEX:

Complete system (mc)		ds821.mc10x	ds822.mc10x
①	Displacement sensor (ds)	ds821.ds10xx	ds822.ds10xx
②	Connection cable (ec)	ds821.ec10x	ds822.ec10x
③	Driver (oscillator/demodulator) (od)	ds821.od110	ds822.od110

## Colour coding

The non-contacting displacement sensor systems series ds821 and ds822 are available with various measuring ranges. Each measuring range is identified by a coloured mark at the end of the integrated cable of the displacement sensor, at the ends of the extension cable and on the driver unit. This makes it easy to identify associated components during installation. The colour codes according to measuring range are as follows:

Colour code	Blue	Red
Measuring range	2 mm	4 mm

## Scope of delivery

Depending on the order, the delivery includes the following components:

Supplied components	Displacement sensor	Connection cable	Driver	Complete sensor system
<b>Displacement sensor</b>	X			X
Protection cap	X			X
2 nuts <sup>1</sup>	X			X
1 O-ring <sup>2</sup>	X			X
<b>Connection cable<sup>3</sup></b>		X		X
<b>Driver</b>			X	X
Assembly adapter			X	X
<b>Acceptance test certificate</b> acc. to DIN EN 10204	X	X	X	X
<b>Measurement protocol</b> (works calibration)				X
<b>User Manual</b>	X	X	X	X

1. **not** available for ds1003 (reverse mount sensor)
2. **only** available for ds1003 (reverse mount sensor), operating temperature range for o-ring -40 °C to +180 °C, for lower temperatures down to -55 °C o-ring (silicone) on request
3. **not** available if the length of the displacement sensor with integrated cable corresponds to the nominal system length of 5 m or 10 m

## Technical data

These performance characteristics are valid under the following conditions unless specified otherwise:  
 +18 °C to +27 °C ambient temperature, -24 VDC supply voltage, 100 kΩ load at signal output, 42CrMo4 B&K Vibro reference material, -10 V Gap Voltage (approx. 1.4 mm measuring distance between sensor and measuring surface), all components are at their operating temperature.

### Non-Contacting Displacement Sensor System Series ds821 and Series ds822 ATEX

Measurand	Displacement
Measuring principle	Eddy-current measuring principle
Nominal system lengths	5 m and 10 m
Linear measuring range	2 mm (approx. 0.4 ... 2.4 mm distance from the object to be measured corresponding to an output signal of approx. -2 VDC ... -18 VDC )
Colour code	blue

#### Dynamic characteristics<sup>1</sup>:

Sensitivity (ISF)  
 in regard to B&K Vibro Reference material  
 42CrMo4 (material no. 1.7225) acc. to DIN 17 200,  
 acc. to AISI/SAE 4140.

Accuracy of the sensitivity (ISF error/%) within temperature range of: 0 °C ... +45 °C (total system) at a nominal system length of 5 m at a nominal system length of 10 m  -35 °C ... +120 °C (displacement sensor) and -35 °C ... +85 °C (driver od130) at a nominal system length of 5 m at a nominal system length of 10 m	±5.0 % ±7.5 %  ±10 % ±15 %
---	--

Deviation from the reference line.  
 (DSL/µm = Deviation from best fit straight line) the temperature range of:

0 °C ... +45 °C (total system)  
 at a nominal system length of 5 m  
 at a nominal system length of 10 m

± 25 µm  
 ± 50 µm

-35 °C ... +120 °C (displacement sensor) and  
 -35 °C ... +85 °C (driver od130)  
 at a nominal system length of 5 m  
 at a nominal system length of 10 m

±75 µm  
 ±150 µm

Operating frequency range	DC ... 10 kHz (-3 dB damping of the output signal)
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#### Electrical characteristics:

Within the temperature range of -35 °C and -55 °C the stated accuracies of dynamical characteristics further decrease.



Supply voltage (U <sub>B</sub> )	-24 VDC (-18 VDC ... -28 VDC)
Output range	0 V ... (U <sub>B</sub> +2 V)
Current consumption	max. 12 mA
Output impedance	50 Ω

#### Mechanical characteristics:

Connector type	Coaxial connector (SAA), push-pull self-latching
Cable:	

Cable type

## 2 mm Measuring Range

### Non-Contacting Displacement Sensor System Series ds821 / Series ds822

Cable jacket and colour	FEP, blue
Impedance	95 Ω
Diameter	Ø 3.5 mm (± 0.15 mm)
Altitude	< 2000 m

1. ISF (Incremental Scale Factor), DSL (Deviation from best fit straight line) and temperature ranges according to API 670

#### Displacement sensor type ds82x.ds100S

<b>Sensor tip:</b>	
Material	Ceramic
Tip diameter	Ø 7.2 mm (± 0.1 mm)
<b>Sensor housing</b>	
Material	Stainless steel (material no. 1.4301 acc. to DIN 17200)
<b>Length</b>	
Including integral cable (measured from the sensor's tip to the end of the integral cable)	0.5 m (-0 m / +0.3 m) 1.0 m (-0 m / +0.3 m) 5.0 m (-0 m / +1.0 m) 10.0 m (-0 m / +1.8 m)
<b>Integrated cable</b>	
Minimum bending radius	35 mm without cable protection 35 mm with steel protective conduit 75 mm with PTFE protective conduit <sup>2</sup> 100 mm with corrugated tube protection
Connector	Socket (female) or Plug (male) with nominal system length
<b>Ambient conditions:</b>	
Degree of protection for the tip acc. to EN 60529	IP 68 / 2 h at 10 bar
<b>Pressure tightness (expected as based on the design):</b>	
Sensor tip	25 bar
Sensor and corrugated tube protection	25 bar (valid only for ds1002)
<b>Temperature range</b>	
Operating temperature range <sup>3</sup>	-55 °C ... +180 °C
Storage temperature range <sup>4</sup>	-20 °C ... +70 °C

#### Connection cable type ds82x.ec10x (dependent on system design)

<b>Length</b>	4.0 m (-0 m / +0.8 m) 4.5 m (-0 m / +0.8 m) 9.0 m (-0 m / +1.6 m) 9.5 m (-0 m / +1.6 m)
<b>Minimum bending radius</b>	35 mm without cable protection 35 mm with steel protective conduit 75 mm with PTFE protective conduit <sup>2</sup>
<b>Connection</b>	Plug (male) at each end
<b>Ambient conditions</b>	
Operating temperature range <sup>3</sup>	-55 °C ... +180 °C
Storage temperature range <sup>4</sup>	-20 °C ... +70 °C

2. The PTFE protective conduit may only be used outside the potentially explosive area or, to prevent static charging, must be fitted with a steel protective conduit or steel tube.

3. When used in hazardous areas, the ambient temperatures of the series ds822 ATEX must be observed, see page 18.

4. When stored in original package

## Driver ds82x.od110

Electric characteristics	
Supply voltage ( $U_B$ )	-24 VDC (-18 VDC ... -28 VDC)
Current consumption	max. 12 mA ( $R_L \geq 100 \text{ k}\Omega$ )
Power supply	max. 1A and short-circuit proof
Source resistance dynamic	50 $\Omega$

Mechanical characteristics	
Housing material	Aluminium alloy (ADC 12)
Dimensions (WxHxD)	26,5 mm x 83 mm x 60 mm
Weight of the driver	approx. 200 g
Connection	Socket (female)

Ambient conditions	
Degree of protection according to EN 60529	IP 20

## Temperature

Operating temperature range<sup>5</sup>

-55 °C ... +85 °C

Storage temperature range<sup>6</sup>

-20 °C ... +70 °C

## Humidity

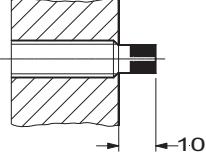
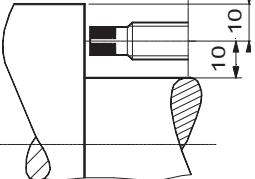
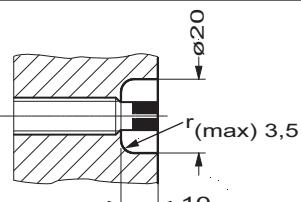
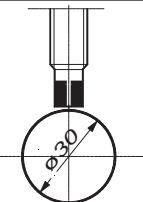
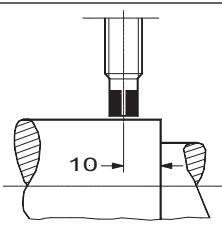
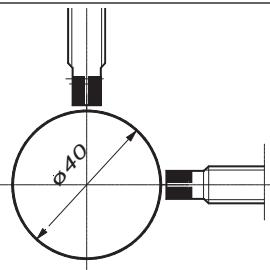
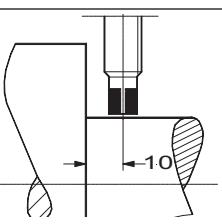
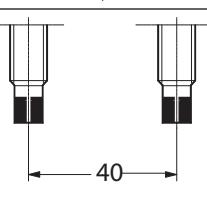
100 % non-condensing  
with protection of the plug connections and cable clamp

5. When used in hazardous areas, the ambient temperatures of the series ds822 ATEX must be observed, see page 18.

6. When stored in original package

## Clearances and minimum distances

The clearances and minimum distances specified below must be observed when mounting sensors.

	Sensor tip protruding		Distance to the shaft shoulder, sensor parallel to electrically conductive material
	Sensor tip flush		Required minimum diameter of the shaft for one sensor
	Distance to a shaft end		Required minimum diameter of the shaft with two sensors
	Distance to the shaft shoulder, sensor parallel to electrically conductive material		Parallel arranged sensors

Notes on the diagrams:  
All specifications in [mm]

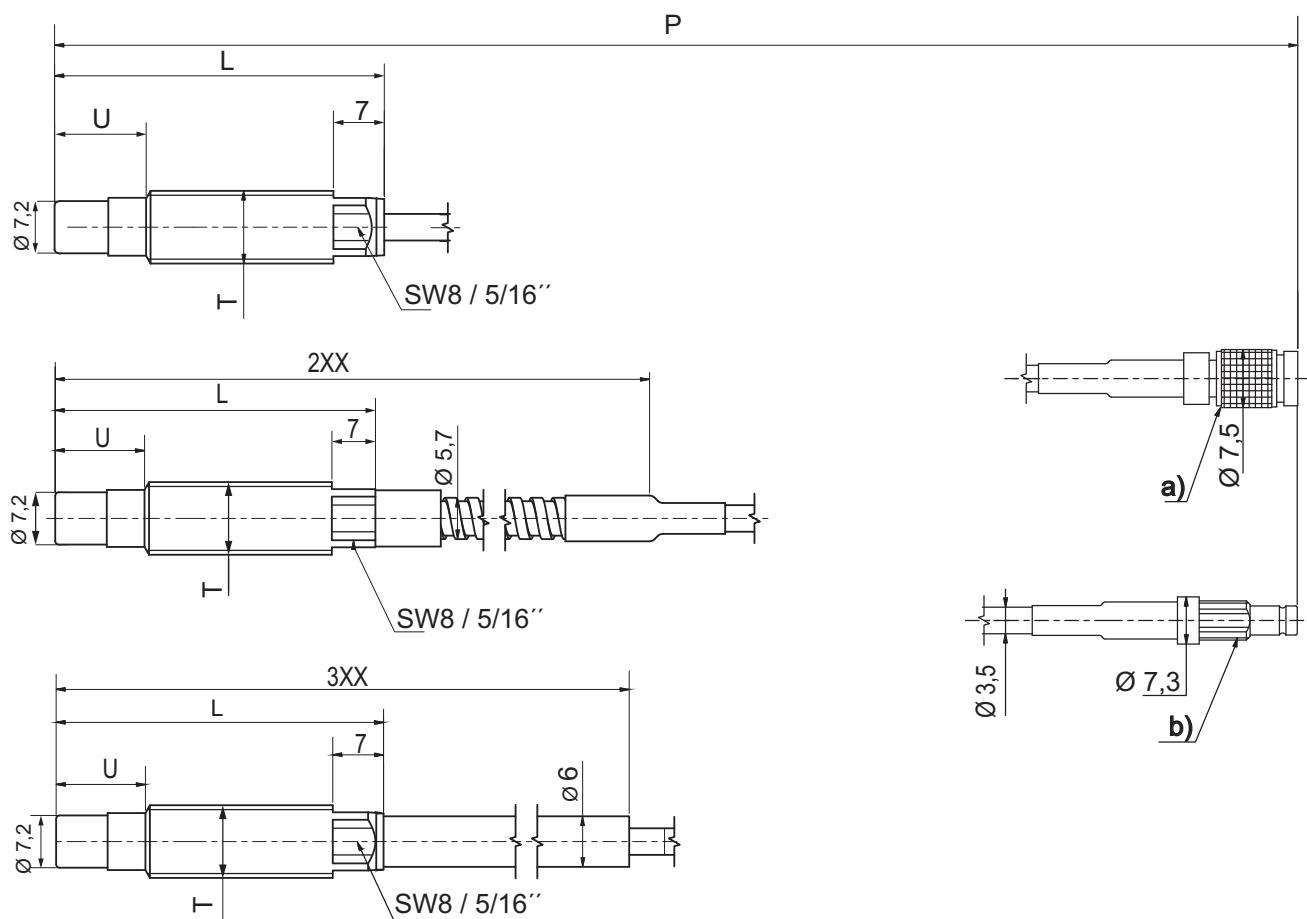
## Versions and order codes

## Diagrams of sensor types (ds)

## Design of the displacement sensor type 1 with full-length thread (ds82x.ds1001/ ...)

top down:

- Displacement sensor **without cable protection** (ds82x.ds1001/TT/LLL/UUU/PPP/**000**/R)
- Displacement sensor **with steel protective conduit, length XX** (ds82x.ds1001/TT/LLL/UUU/PPP/**2XX**/R)
- Displacement sensor **with PTFE protective conduit, length XX** (ds82x.ds1001/TT/LLL/UUU/PPP/**3XX**/R)



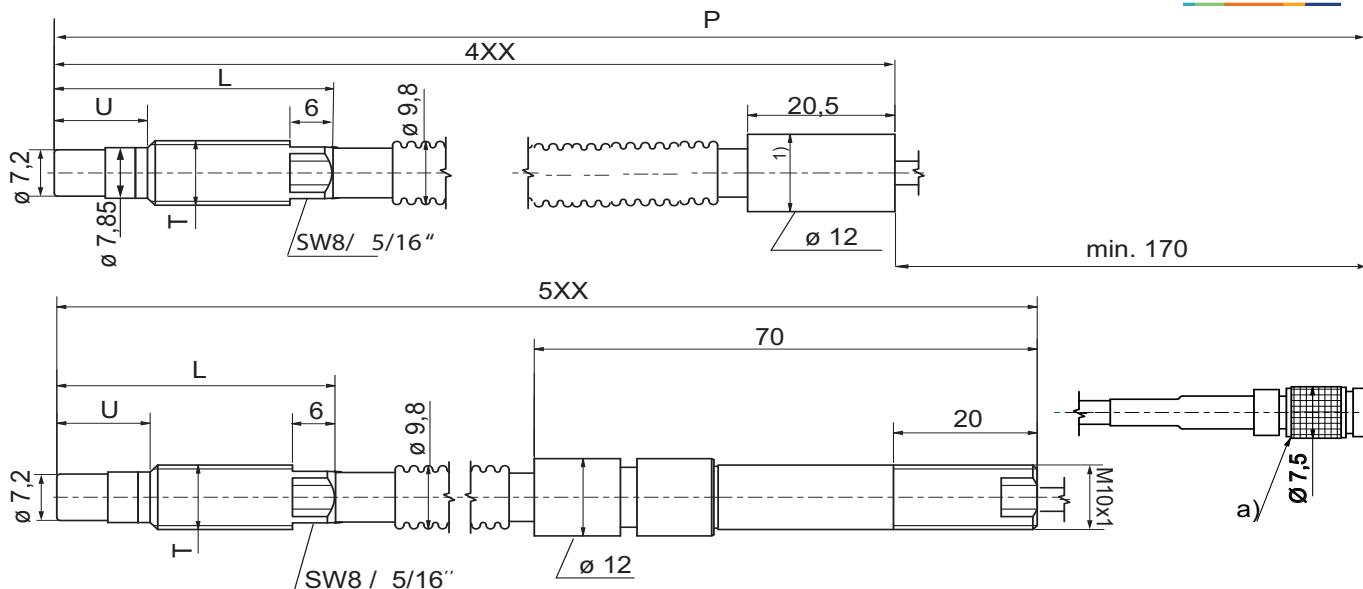
a) Plug (male) for straight connect to driver (nominal system length)  
 b) Socket (female) for the use of an extra connection cable

**Design of the displacement sensor type 2 with full-length thread and corrugated tube (ds82x.ds1002)**

top down:

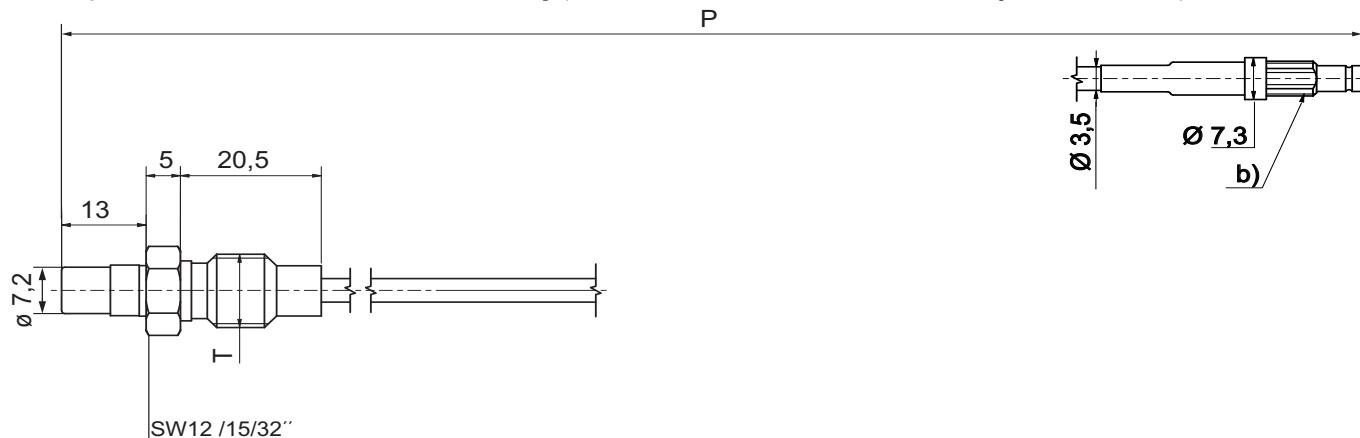
- *Displacement sensor with corrugated tube protection design A, length **XX** (ds82x.ds1002/TT/LLL/UUU/PPP/**4XX/R**)*
- *Displacement sensor with corrugated tube protection design B, length **XX** (ds82x.ds1002/TT/LLL/UUU/PPP/**5XX/R**)*

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**Displacement sensor type 3 for reverse mounted probe (ds82x.ds1003)**

- *Displacement sensor for reverse mounting (ds82x.ds1003/TT/LL/VV/PP/**000 (no protection)** / R)*

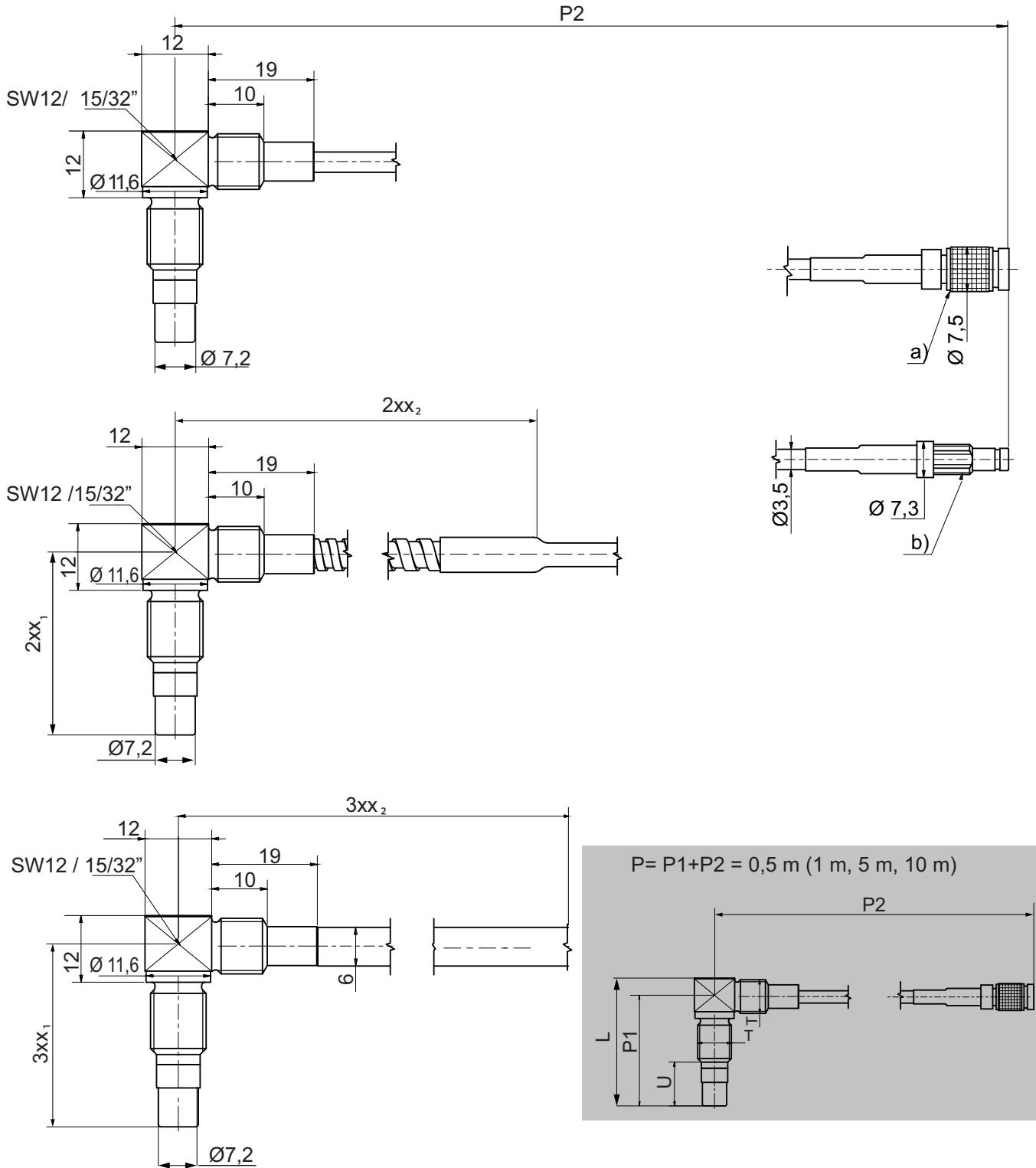


a) Plug (male) for straight connect to driver (nominal system length)  
b) Socket (female) for the use of an extra connection cable

1) Special design with 10 mm diameter on request

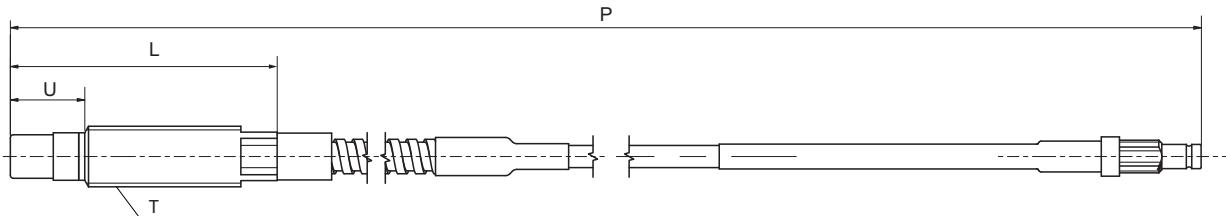
## Displacement sensor type 4 for right angled probe (ds82x.ds1004)

- Displacement sensor without cable protection (ds82x.ds1004/TT/LLL/UUU/PPP/**000/R**)
- Displacement sensor with steel protective conduit, length XX (ds82x.ds1004/TT/LLL/UUU/PPP/**2XX/R**)
- Displacement sensor with PTFE protective conduit, length XX (ds82x.ds1004/TT/LLL/UUU/PPP/**3XX/R**)



a) Plug (male) for straight connect to driver (nominal system length)  
b) Socket (female) for the use of an extra connection cable

## 2 mm Measuring Range

Non-Contacting Displacement Sensor System Series ds821 /  Series ds822Order code for displacement sensor (ds) **ds82x.ds100S / TT / LLL / UUU / PPP / CXX / R**

Displacement sensor	ds821	ds822
Standard	●	
ATEX		●

x	
1	
2	

Order code

ds82



Sensor type	ds1001	ds1002	ds1003	ds1004	/ S
Full-length thread	●				1
Full-length thread with corrugated tube		●			2
Reverse mounted probe			●		3
Right - angled head				●	4

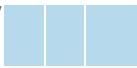
.ds100



Thread					/ TT
M10 x 1	●	●	●	●	10
3/8 – 24 UNF-2A	●	●	●	●	62



Length of the sensor body					/ LLL
38 mm, minimal				●	038
45 mm	●	●		●	045
75 mm	●	●		●	075
105 mm	●	●		●	105
135 mm	●	●		●	135
39 mm fixed			●		039
Other lengths min ...max [step size 5mm]	50...255	39	40 ... 150	xxx	



Unthreaded section					/ UUU
12 mm				●	012
15 mm	●	●			015
13 mm fixed			●		013
Other lengths min ...max [step size 5 mm] <sup>1</sup>	20 ... 230	13	15 ... 125	xxx	



Length sensor with integrated cable					/ PPP
0.5 m	●	●	●	●	005
1.0 m	●	●	●	●	010
5.0 m	●	●	●	●	050
10.0 m	●	●	●	●	100



Cable protection (C) and protection length (XX) for integrated cable <sup>2</sup>					/ CXX
No protection	●		●	●	000
Steel protective conduit	●			●	299 or 2xx
PTFE protective conduit	●			●	399 or 3xx
Corrugated tube protective conduit, design A		●			499 or 4xx
Corrugated tube protective conduit, design B		●			599 or 5xx



Special requirements - need to be put in writing					/ R
No	●	●	●	●	0
Yes		upon request			1



1.  $U_{max} = L - 25 \text{ mm}$ , measured from the sensor tip to the threadless end
2. The first position C defines the type of the cable protection, CXX = 000 stands for no protection. The second and third positions XX specify the length of the protection. XX = 99 is standard setting and specifies the maximum possible protection length for the selected length sensor with integrated cable. The protection ends about 0.2 m before the end of the plug. The protection length is measured from the sensors tip to the end of the protective conduit. The shortest length is 03 = 0.3 m. The step size is 01 = 0.1 m.

## 2 mm Measuring Range

## Non-Contacting Displacement Sensor System Series ds821 / Series ds822

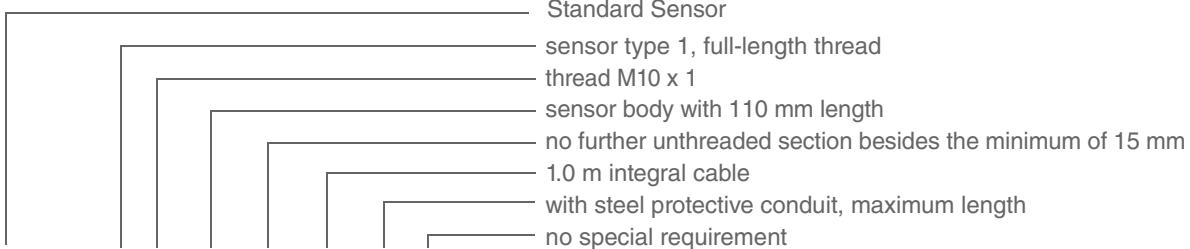
EN

For an order, write the number of the selected option in the corresponding boxes on the right. Read from top to bottom, an order code has the following form:

ds82x.ds100S / TT / LLL / UUU / PPP / CXX / R

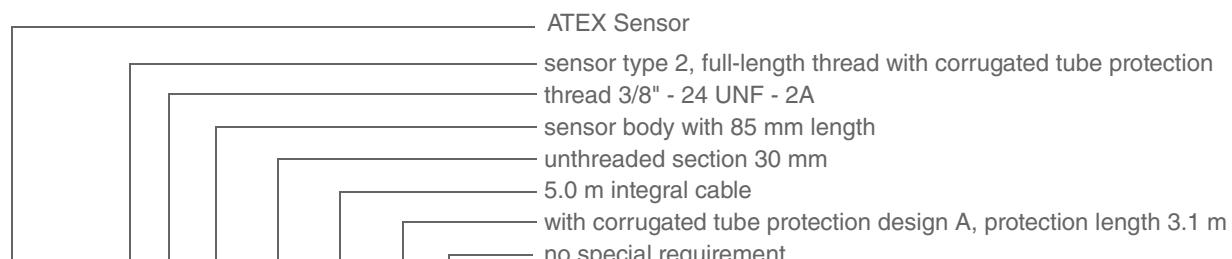
### Order examples ds82x.ds100S:

#### Series ds821 Standard



ds821.ds1001/10/110/015/010/299/0

#### Series ds822 ATEX



ds822.ds1002/62/085/030/050/431/0

Notes on the diagrams:  
All specifications in [mm]

Diagrams of connection cable (ec)

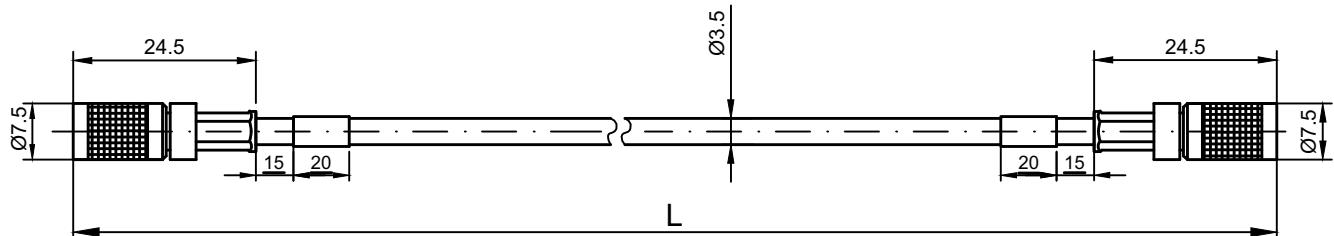


Figure 1 Dimensions of connection cable ds82x.ec100 (no protection)

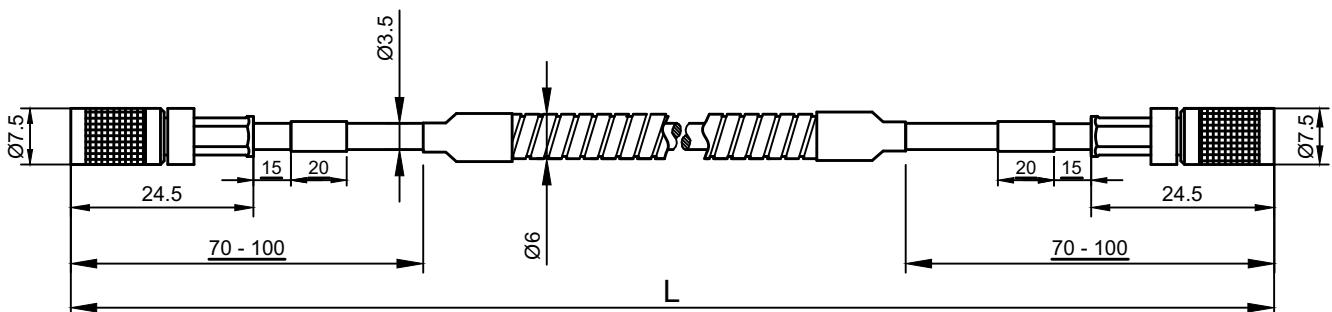


Figure 2 Dimensions of connection cable ds82x.ec102 (steel protection) mechanical reinforcement

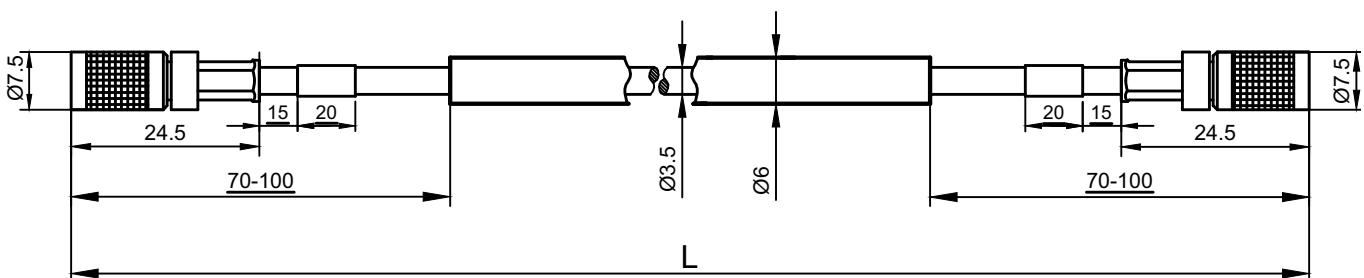


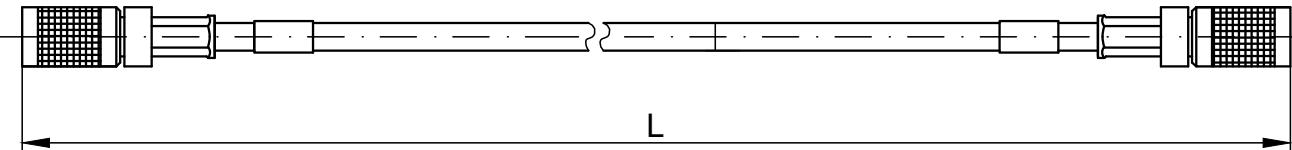
Figure 3 Dimensions of connection cable de82x.ec103 (PTFE tube)

## 2 mm Measuring Range

## Non-Contacting Displacement Sensor System Series ds821 / Series ds822

EN

Order code for connection cable (ec) **ds82x.ec10E / LL / R**



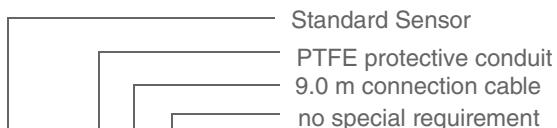
connection cable for displacement sensor series	ds821	ds822		Order code
Standard	●		X	ds82
ATEX		●	1	
			2	
Cable protection	ec100	ec102	ec103	E
No protection	●			0
Steel protective conduit		●		2
PTFE protective conduit			●	3
Length of the connection cable				/ LL
4.0 m	●	●	●	40
4.5 m	●	●	●	45
9.0 m	●	●	●	90
9.5 m	●	●	●	95
Special requirements - need to be put in writing				/ R
No	●	●	●	0
Yes		upon request		1

For an order, write the number of the selected option in the corresponding boxes on the right. Read from top to bottom, an order code has the following form:

**ds82x.ec10E / LL / R**

**Order examples ds82x.ec10E:**

Series ds821 Standard



**ds821.ec103/90/0**

## Diagram of driver (od)

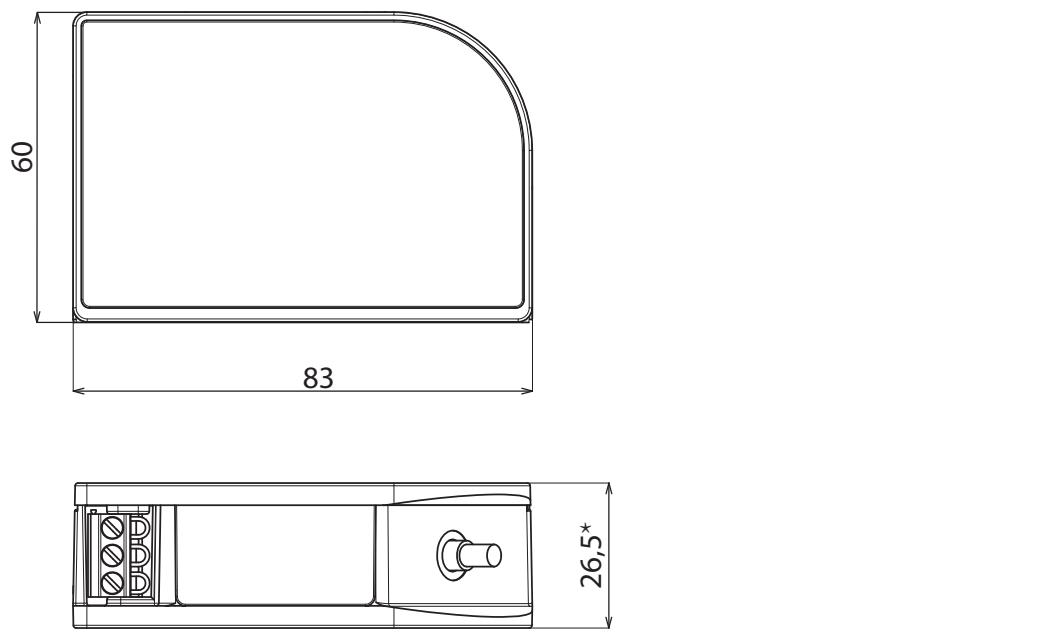


Figure 4 Dimensions of driver ds82x.od110

Order code for driver (od)**ds82x.od110 / R**

Displacement sensor series	ds821	ds822
Standard	●	
ATEX		●

X
1
2

Order code  
ds82  .od110

Special requirements - need to be put in writing		/ R
No	●	0
Yes	upon request	1

 / 

For an order, write the number of the selected option in the corresponding boxes on the right. Read from top to bottom, an order code has the following form:

**ds82x.od110 / R**

Order examples **ds82x.od110:**

## Serie ds821 Standard

Standard Sensor  
no special requirements

**ds821.od110/0**

## Mounting adapter for hat-rail or drill-hole mounting

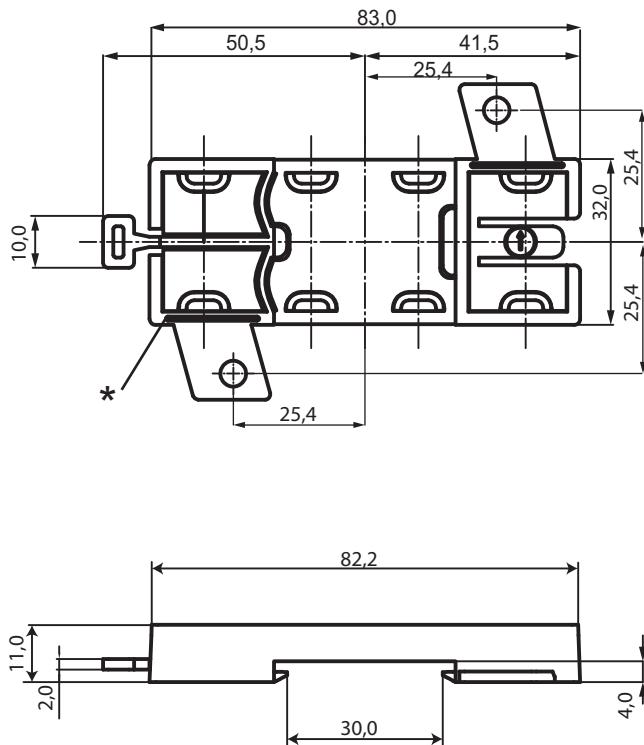


Figure 5 Dimensional diagram of mounting adapter

\* Predetermined breaking point for separating the mounting tabs for mounting on hat-rails

The driver (od) can be mounted from both sides on the mounting adapter

## 2 mm Measuring Range

Non-Contacting Displacement Sensor System Series ds821 /  Series ds822

## Order code for complete displacement sensor system (mc)

ds82x.mc101 / S / TT / LLL / UUU / NN / PP / CXX / E / R

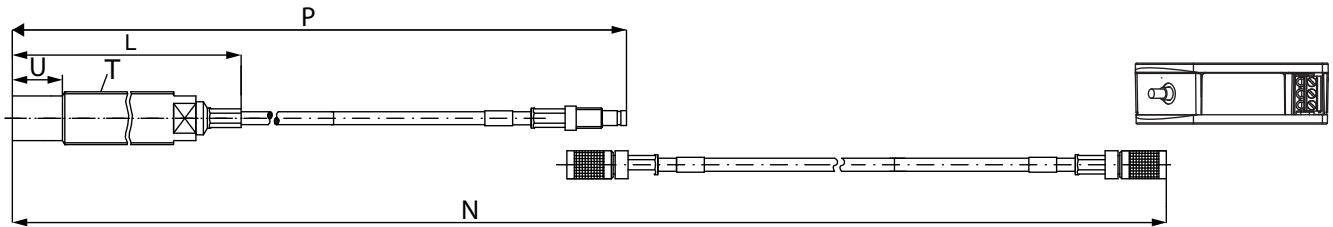
Displacement sensor series	ds821	ds822	Yekan		X	Order code
Standard	●				1	ds82  .mc101
ATEX		●			2	
<b>Sensor type</b>					/ S	
Full-length thread	●				1	
Full-length thread with corrugated tube		●			2	
Reverse mounted probe			●		3	
Right - angled head				●	4	
<b>Thread</b>					/ TT	
M10 x 1	●	●	●	●	10	
3/8 – 24 UNF-2A	●	●	●	●	62	
<b>Length of the sensor body</b>					/ LLL	
38 mm, minimal				●	038	
45 mm	●	●		●	045	
75 mm	●	●		●	075	
105 mm	●	●		●	105	
135 mm	●	●		●	135	
39 mm fixed			●		039	
Other lengths min ... max [step size 5 mm]	50 ... 255	39	40 ... 150	xxx		
<b>Unthreaded section</b>					/ UUU	
12 mm				●	012	
15 mm	●	●		●	015	
13 mm fixed			●		013	
Other lengths min...max [step size 5 mm] <sup>1</sup>	20 ... 230	13	15 ... 125	xxx		
<b>Nominal ECDS system length</b>					/ NN	
5 m	●	●	●	●	05	
10 m	●	●	●	●	10	
<b>Length of sensor with integrated cable</b>					/ PP	
Complete nominal system length, no additional connection cable	●	●	●	●	00	
0.5 m	●	●	●	●	05	
1.0 m	●	●	●	●	10	
<b>Cable protection (C) and protection length for integrated cable (XX)<sup>2</sup></b>					/ CXX	
No protection	●		●	●	000	
Steel protective conduit	●			●	299 or 2xx	
PTFE protective conduit	●			●	399 or 3xx	
Corrugated tube protective conduit, design A		●			499 or 4xx	
Corrugated tube protective conduit, design B		●			599 or 5xx	
<b>E cable protection of connection cable (if available)<sup>3</sup></b>					/ E	
No protection	●	●	●	●	0	
Steel protective conduit	●	●	●	●	2	
PTFE protective conduit	●	●	●	●	3	
<b>R special requirements - need to be put in writing</b>					/ R	
No	●	●	●		0	
Yes			upon request		1	

1.  $U_{max} = L-25$  mm, measured from the sensor tip to the threadless end
2. The first position C defines the type of the cable protection, CXX = 000 stands for no protection. The second and third positions XX specify the length of the protection. XX = 99 is standard setting and specifies the maximum possible protection length for the selected length sensor with integrated cable. The protection ends about 0.2 m before the end of the plug. The protection length is measured from the sensors tip to the end of the protective.
3. If there is no connection cable (PP = 00), then enter the value "0".

## 2 mm Measuring Range

### Non-Contacting Displacement Sensor System Series ds821 / Series ds822

EN

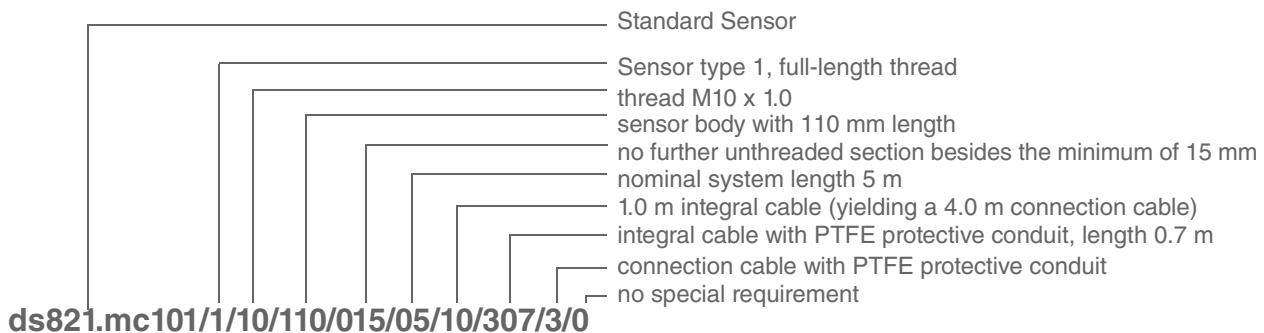


For an order, write the number of the selected option in the corresponding boxes on the right. Read from top to bottom, an order code has the following form:

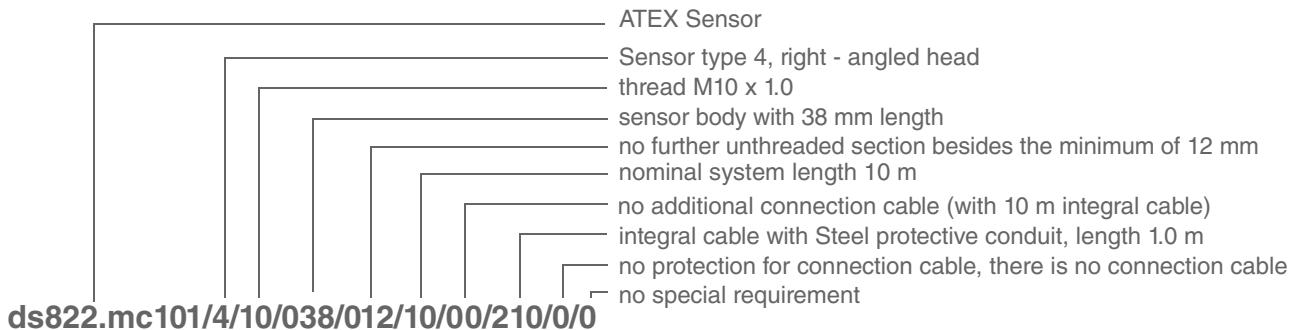
ds82x.mc101 / S / TT / LLL / UUU / NN / PP / CXX / E / R

#### Order examples ds82x.mc101:

##### Series ds821 Standard



##### Series ds822 ATEX



#### Remark:

The length of the possible connection cable is derived automatically from the length of the integral cable and the nominal system length. The delivery contents of a complete measuring system always include a driver of the corresponding series.

## Approvals

Displacement sensor systems of the series ds822 and series ds821 are:

CE compliant acc. to EMC Directive and



RCM for Australia and New Zealand



Displacement sensor system series ds822 ATEX is additionally approved for:

use in hazardous Ex-area according 2014/34/EU.



EC type examination certificate PTB 12 ATEX 2011 designation

 II 1/2 G Ex ia IIC T6...T1 Ga/Gb or  II 2G Ex ia IIC T6...T1 Gb

 II 2 D Ex ia IIIC T168 °C Db

in compliance with EN 60079-0:2012+A13, and EN 60079-11:2012, EN 60079-26:2015.

IECEx certificate: IECEx PTB 13.0010 mark

Ex ia IIC T6...T1Ga/Gb or Ex ia IIC T6...T1 Gb

Ex ia IIIC T168 °C Db

Voltage supply: type of protection Intrinsic Safety EX ia IIC only for connection to a certified intrinsically safe circuit

Maximum values:

$U_i = 28$  V

$L_i = \text{negligibly low}$

$I_i = 140$  mA

$C_i = 12$  nF

$P_i = 840$  mW

In Compliance with

TR-TS 012/2011 (TP-TC 012/2011)

EAC Ex Certificate:

RU-C-DE.AA87.B.00334

Ga/Gb Ex ia IIC T6...T1 X or

1Ex ia IIC T6...T1 Gb X  
Ex ia IIIC T 168°C Db



## Ambient temperature range

## Category 1/2 equipment

Temperature class	Permissible ambient temperature range category 1/2-G-equipment		Permissible surface temperature category 2-D-equipment	
	Sensor / Connection cable	Oscillator	Sensor / Connection cable	Oscillator
T6	-55 °C ... +53 °C	-55 °C ... +61 °C	+71 °C	+91 °C
T5	-55 °C ... +65 °C	-55 °C ... +76 °C	+83 °C	+106 °C
T4	-55 °C ... +93 °C	-55 °C ... +79 °C	+111 °C	+109 °C
T3	-55 °C ... +145 °C	-55 °C ... +79 °C	+163 °C	+109 °C
T2, T1	-55 °C ... +150 °C	-55 °C ... +79 °C	+168 °C	+109 °C

## Category 2 equipment

Temperature class	Permissible ambient temperature range category 2-G-equipment		Permissible surface temperature category 2-D-equipment	
	Sensor / Connection cable	Oscillator	Sensor / Connection cable	Oscillator
T6	-55 °C ... +67 °C	-55 °C ... +61 °C	+85 °C	+91 °C
T5	-55 °C ... +82 °C	-55 °C ... +76 °C	+100 °C	+106 °C
T4	-55 °C ... +117 °C	-55 °C ... +79 °C	+135 °C	+109 °C
T3, T2, T1	-55 °C ... +150 °C	-55 °C ... +79 °C	+168 °C	+109 °C

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