




Product specification



4 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)
- 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

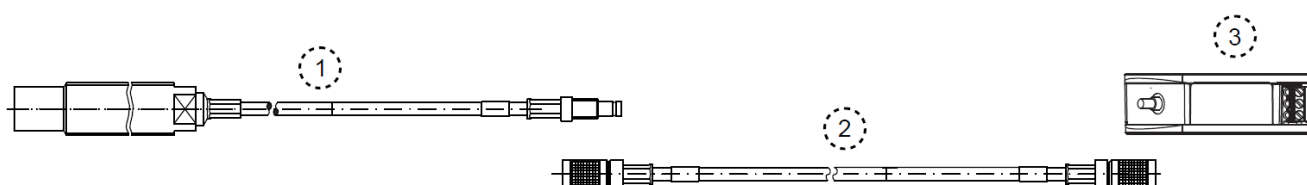
The displacement sensor systems of the ds820 family are based on the non-contacting eddy-current measurement process. The distance is measured between the tip of the displacement sensor and an electrically conductive surface and as a proportional voltage signal send to an electronic monitoring system.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

The eddy-current displacement sensor system consists of the component's displacement sensor with an integrated cable, an optional separate connection cable, and the driver electronics (oscillator/demodulator).

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

The eddy-current displacement sensor system 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	4 mm Series ds821 Standard:	4 mm Series ds822 ATEX:
	Complete system (mc)	ds821.mc301	ds822.mc301
①	Displacement sensor (ds)	ds821.ds300S	ds822.ds300S
②	Connection cable (ec)	ds821.ec30E	ds822.ec30E
③	Driver (oscillator/demodulator) (od)	ds821.od130	ds822.od130

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

4 mm Measuring range

Non-Contacting Displacement Sensor System Series ds821 / Series ds822

EN

Scope of delivery

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

Supplied components	Displacement sensor	Connection cable	Driver	Complete sensor system
Displacement sensor	X			X
Protection cap	X			X
2 nuts ¹	X			X
1 O-ring ²	X			X
Connection cable³		X		X
Driver			X	X
Assembly adapter			X	X
Acceptance test certificate acc. to DIN EN 10204	X	X	X	X
Measurement protocol (works calibration)				X
User Manual	X	X	X	X

1. **not** available for ds3003 (reverse mount sensor)

2. **only** available for ds3003 (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. 2.5 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	4 mm (approx. 0.5 ... 4.5 mm distance from the object to be measured corresponding to an output signal of approx. -2 VDC ... -18 VDC)
Colour code	red

Dynamic characteristics¹:

Sensitivity (ISF)
in regard to B&K Vibro Reference material 42Cr-Mo4 (material no. 1.7225) acc. to DIN 17 200, acc. to AISI/SAE 4140.

-4 mV/μm (-101.5 mV/mil)

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

±5.0%
±7.5%

-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

±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

±50 μm
±100 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

±100 μm
±300 μm

Operating frequency range

DC ... 10 kHz (-3 dB damping of the output signal)

Electrical characteristics:

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



Supply voltage (U_B)

-24 VDC (-18 VDC ... -28 VDC)

Output range

0 V ... ($U_B + 2$ V)

Current consumption

max. 12 mA

Output impedance

50 Ω

Mechanical characteristics:

Connector type

Coaxial connector (SAA), push-pull self-latching

Cable:

Cable type

Coaxial

4 mm Measuring range

Non-Contacting Displacement Sensor System Series ds821 / Series ds822

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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.ds300s

Sensor tip:	
Material	Ceramic
Tip diameter	Ø 11 mm (± 0.2 mm)
Sensor housing:	
Material	Stainless steel (material no. 14301 acc. to DIN 17200)
Length 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)
Integrated cable	
Minimum bending radius	35 mm without cable protection 35 mm with steel protective conduit 75 mm with PTFE protective conduit ² 100 mm with corrugated tube protection
Connector	Socket (female) or Plug (male) with nominal system length
Ambient conditions:	
Degree of protection for the tip acc. to EN 60529	IP 68 / 2 h at 10 bar ³
Pressure tightness (expected as based on the design):	
Sensor tip	25 bar
Sensor and corrugated tube protection	25 bar (valid only for ds3002)
Temperature range	
Operating temperature range ⁴	-55 °C ... +180 °C
Storage temperature range ⁵	-20 °C ... + 70 °C

Connection cable type ds82x.ec30x (dependent on system design)

Length	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)
Minimum bending radius	35 mm without cable protection 35 mm with steel protective conduit 75 mm with PTFE protective conduit ²
Connection	Plug at each end
Ambient conditions	
Operating temperature range ⁴	-55 °C ... +180 °C
Storage temperature range ⁵	-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 stored or operated at a temperature of less than -30 °C, the protection class is reduced to IP65

4. When used in hazardous areas, the ambient temperatures of the series ds822 ATEX must be observed, see page 17.

5. When stored in original package

Driver ds82x.od130

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 Ω

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

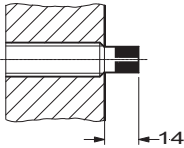
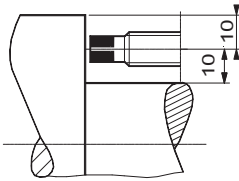
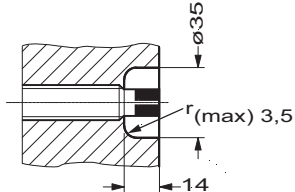
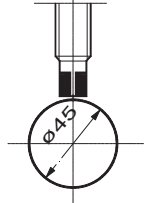
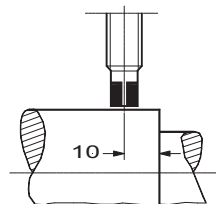
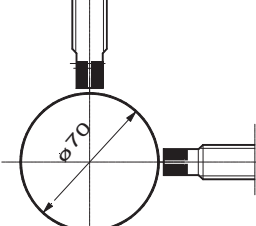
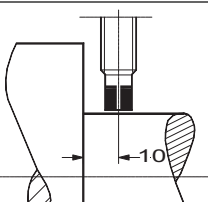
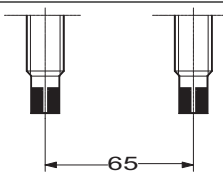
Operating temperature range ⁶	-55 °C ... +85 °C
Storage temperature range ⁷	-20 °C ... +70 °C
Humidity	100 % non-condensing with protection of the plug connections and cable terminals

6. When used in hazardous areas, the ambient temperatures of the series ds822 ATEX must be observed, see page 17.

7. 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]

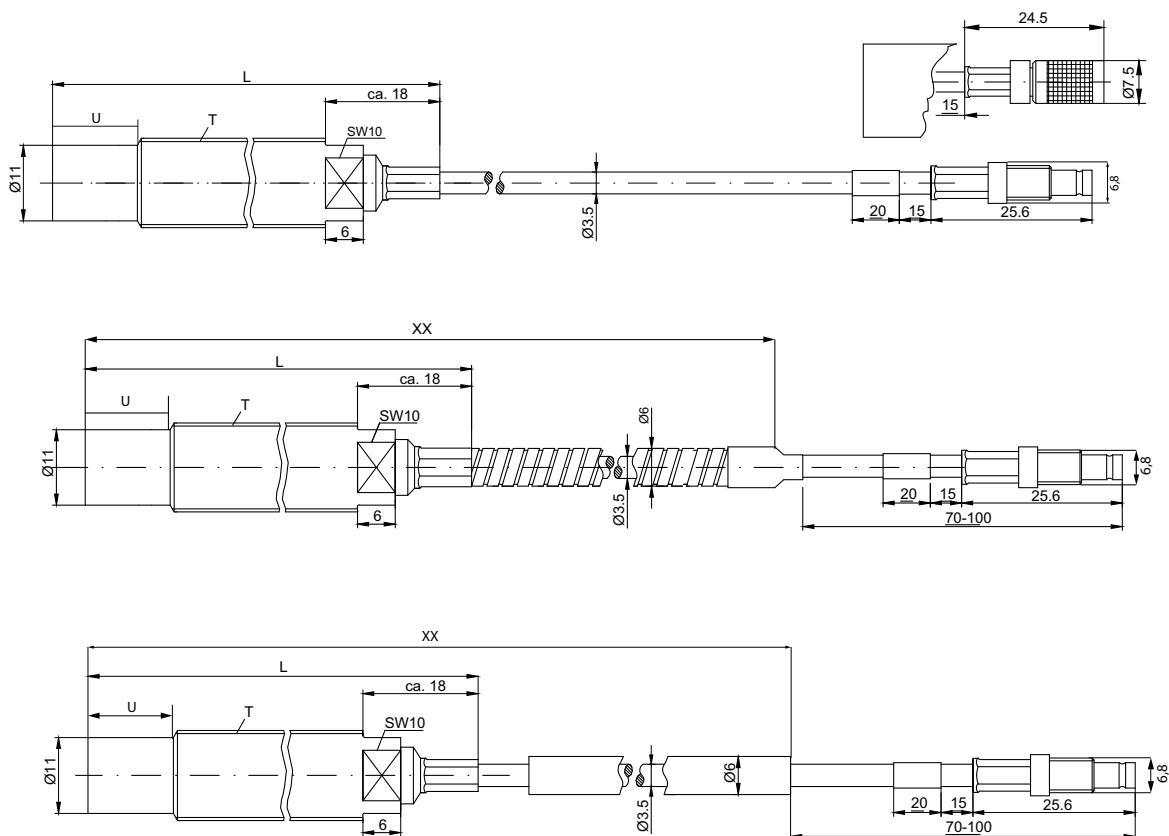
Versions and order codes

Diagrams of sensor types

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

top down:

- Displacement sensor **without cable protection** (ds82x.ds3001/TT/LLL/UUU/PPP/000/R)
- Displacement sensor **with steel protective conduit, length XX** (ds82x.ds3001/TT/LLL/UUU/PPP/2XX/R)
- Displacement sensor **with PTFE protective conduit, length XX** (ds82x.ds3001/TT/LLL/UUU/PPP/3XX/R)



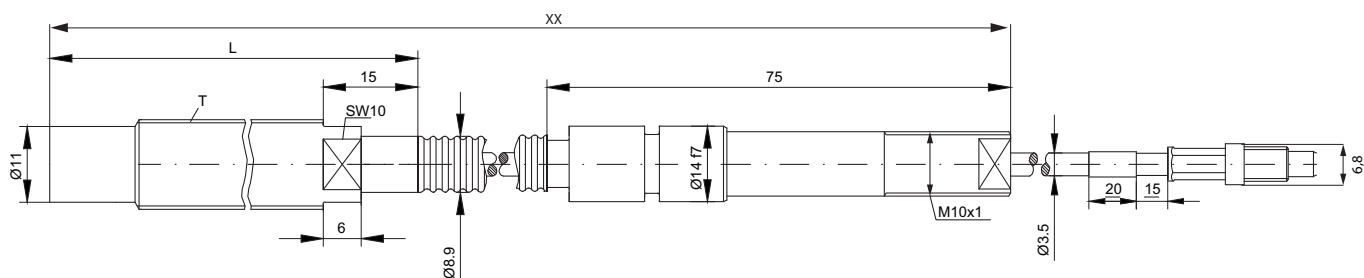
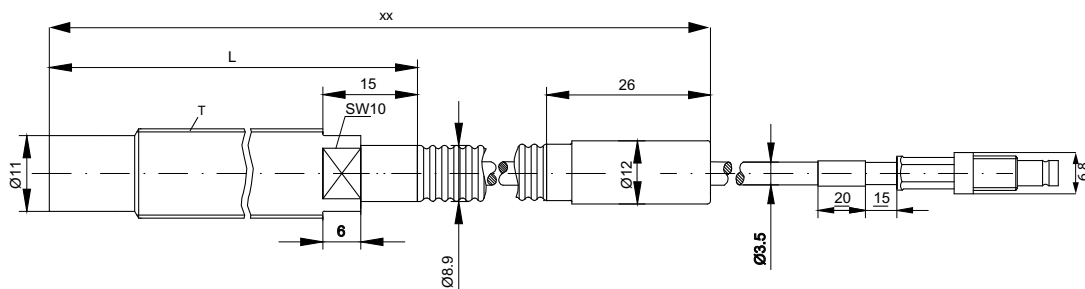
a) Plug (male) for straight connect to driver (nominal system length)

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.ds3002)

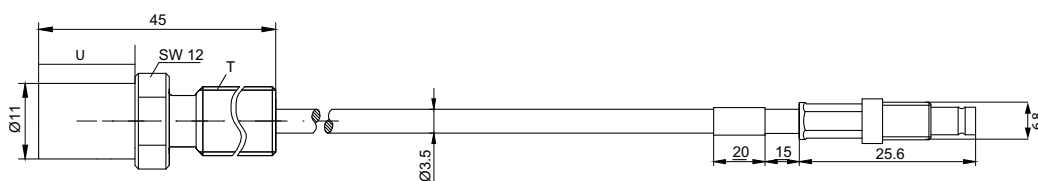
top down:

- Displacement sensor with corrugated tube protection design A, length **XX** (ds82x.ds3002/TT/LLL/UUU/PPP/4**XX**/R)
- Displacement sensor with corrugated tube protection design B, length **XX** (ds82x.ds3002/TT/LLL/UUU/PPP/5**XX**/R)



Displacement sensor type 3 for reverse mounted probe (ds82x.ds3003)

- Displacement sensor for reverse mounting ds82x.ds3003/TT/LL/VV/PP/000 (no protection) / R

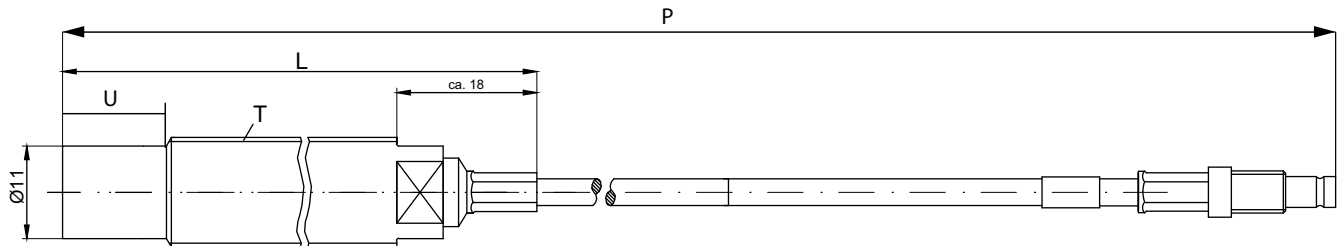


4 mm Measuring range

Non-Contacting Displacement Sensor System Series ds821 / Series ds822

EN

Order code for displacement sensor **ds82x.ds300S / TT / LLL / UUU / PPP / CXX / R**



Displacement sensor	ds821	ds822	x	Order code
Standard	•		1	ds82
ATEX		•	2	

Sensor type	ds3001	ds3002	ds3003	S	
Full-length thread	•			1	.ds300
Full-length thread with corrugated tube		•		2	
Reverse mounted probe			•	3	

Thread				/ TT	
M10 x 1			•	10	/
M14 x 1	•	•		18	
M14 x 1.5	•	•		19	
M16 x 1.5	•	•		22	
3/8 – 24 UNF-2A			•	62	
1/2 – 20 UNF-2A	•	•		70	
5/8 – 18 UNF-2A	•	•		78	

Length of the sensor body				/ LLL	
45 mm or 55 mm ¹	•	•	•	045 / 055	/
60 mm	•	•		060	
85 mm	•	•		085	
110 mm	•	•		110	
135 mm	•	•		135	
Other lengths min ...max [step size 5 mm]		45...285	45	xxx	

Unthreaded section ²				/ UUU	
15 mm	•	•	•	015	/
Other lengths	•	•		xxx	
Minimum ...maximum [step size 5 mm]		15 ...245	-		

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 (X) for the integrated cable ³				/ 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. On M16 x 1.5 or 5/8 - 18 UNF-2A threads, the minimum sensor body length is 55 mm

2. Umax = L - 40 mm, step size 5 mm = '005' order code measured from the sensor tip to the threadless end

3. 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 02 = 0.2 m.

4 mm Measuring range

EN

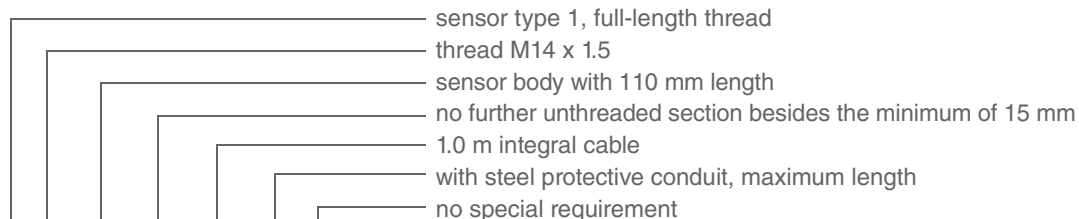
Non-Contacting Displacement Sensor System Series ds821 / Series ds822

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.ds300x / TT / LLL / UUU / PPP / CXX / R

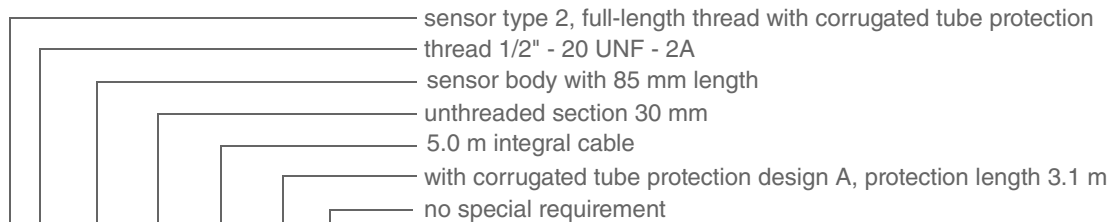
Order examples ds82x.ds300S:

Series ds821 Standard



ds821.ds3001/19/110/015/010/299/0

Series ds822 ATEX



ds822.ds3002/70/085/030/050/431/0

Diagrams of connection cable

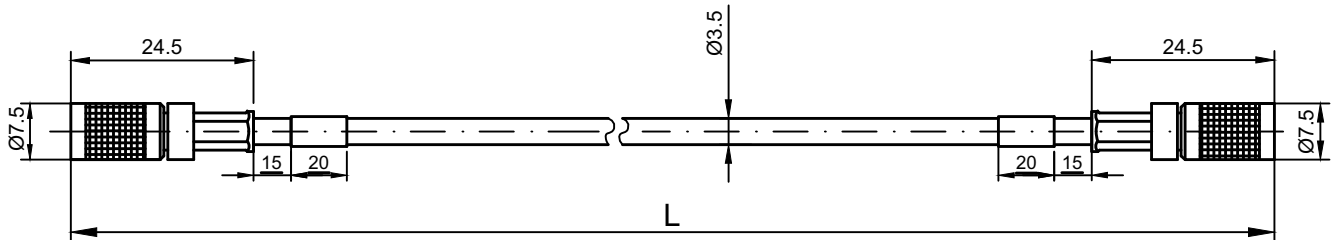


Figure 1 Dimensions of connection cable ds82x.ec300 (no protection)

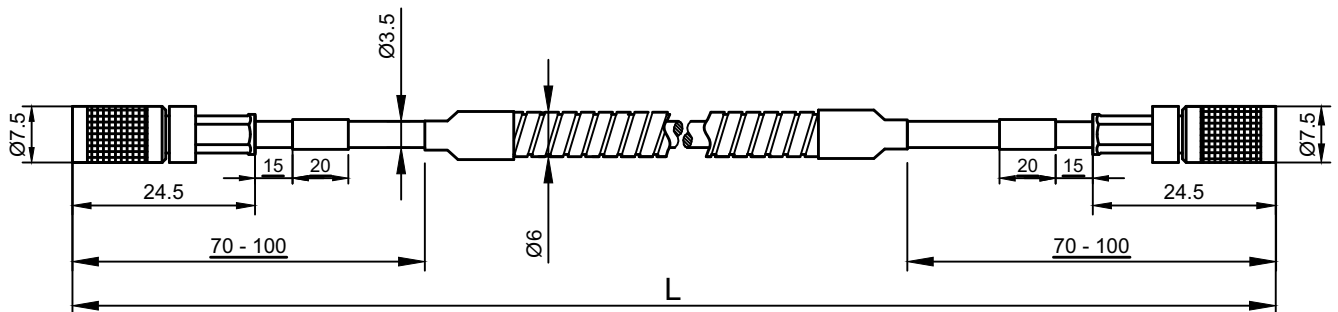


Figure 2 Dimensions of connection cable ds82x.ec302 (steel protection) mechanical reinforcement

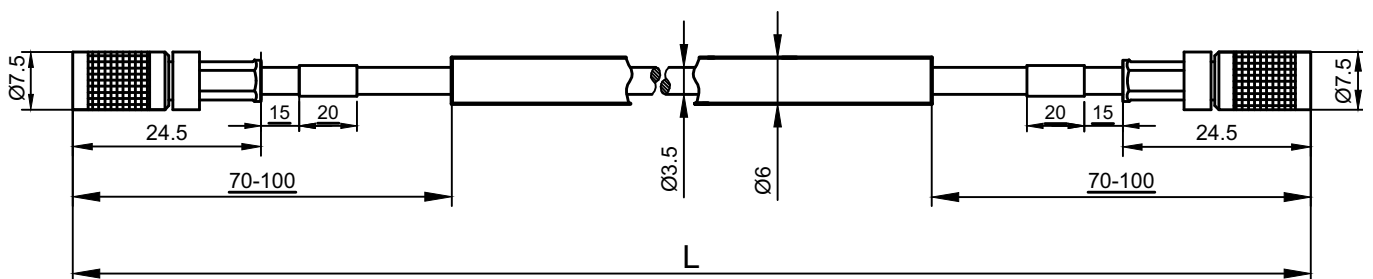


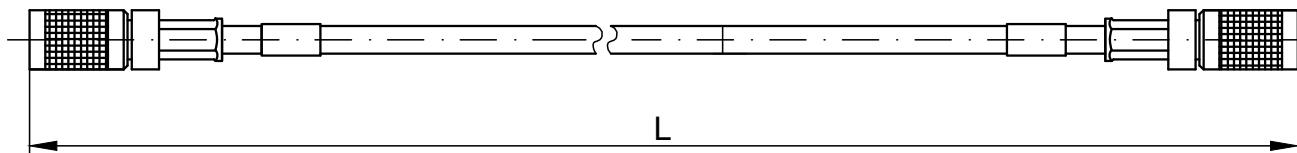
Figure 3 Dimensions of connection cable ds82x.ec303 (PTFE tube)

4 mm Measuring range

EN

Non-Contacting Displacement Sensor System Series ds821 / Series ds822

Order code for connection cable **ds82x.ec30E / LL / R**



connection cable for displacement sensor series	ds821	ds822
Standard	●	
ATEX		●

X
1
2

Order code

ds82 

Cable protection	ec300	ec302	ec303	E
No protection	●			0
Steel protective conduit		●		2
PTFE protective conduit			●	3

.ec30 

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.ec30E / LL / R

Order examples ds82x.ec30E:

Series ds821 Standard



ds821.ec303/90/0

Diagram of driver

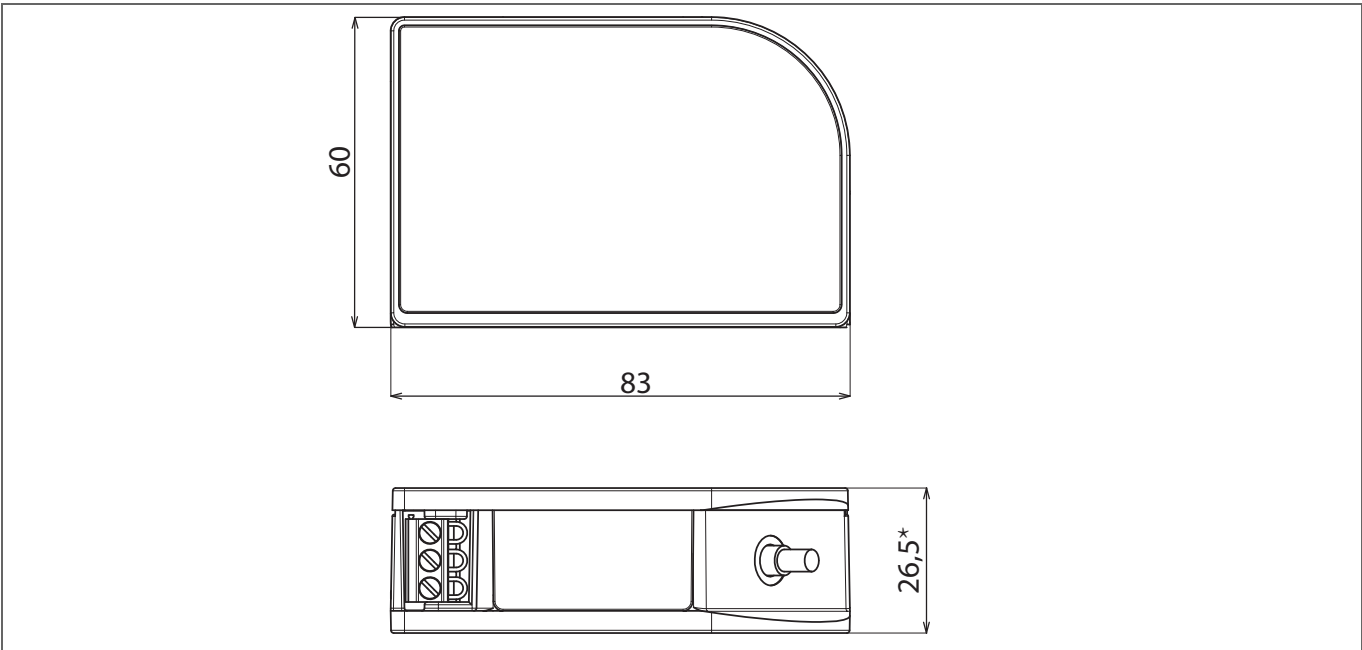


Figure 4 Dimensions of driver (oscillator/demodulator) ds82x.od130

Order code for driver (oscillator/demodulator) **ds82x.od130 / R**

Displacement sensor series	ds821	ds822
Standard	●	
ATEX		●

X
1
2

Order code

ds82 .od130

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.od130 / R

Order examples ds82x.od130:

Serie ds821 Standard

ds821.od130/0

 Standard Sensor
no special requirements

Mounting adapter for hat-rail or drill-hole mounting

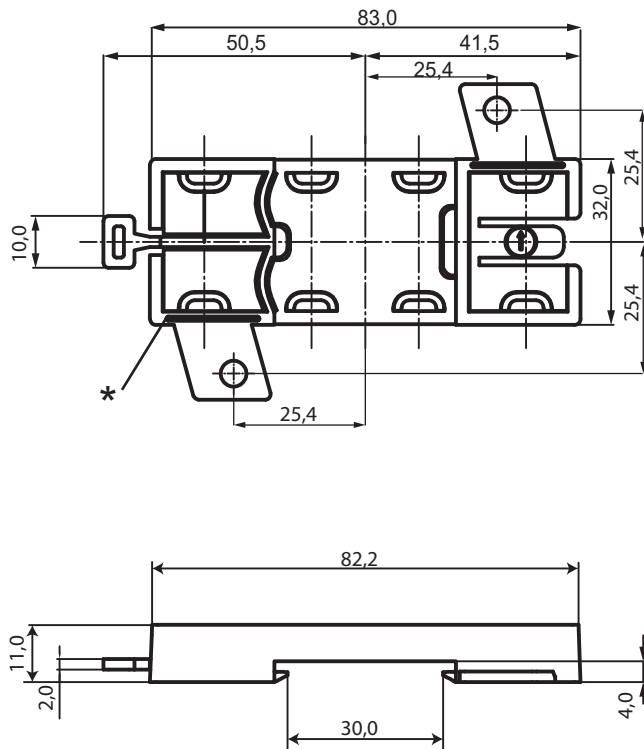



Figure 5 Dimensional diagram of mounting adapter

* 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

Order code for complete displacement sensor system

ds82x.mc301 / S / TT / LLL / UUU / NN / PP / CXX / E / R

Displacement sensors series	ds821	ds822	X	Order code
Standard	●		1	ds82  .mc301
ATEX		●	2	

Sensor type	ds3001	ds3002	ds3003	/ S
Full-length thread	●			1
Full-length thread with corrugated tube		●		2
Reverse mounted probe			●	3

Thread	/ TT
M10 x 1	10
M14 x 1	18
M14 x 1.5	19
M16 x 1.5	22
3/8 – 24 UNF-2A	62
1/2 – 20 UNF-2A	70
5/8 – 18 UNF-2A	78

Length of the sensor body	/ LLL
45 or 55 ¹ mm	045 / 055
60 mm	060
85 mm	085
110 mm	110
135 mm	135
Other lengths min ... max [step size 5 mm]	45..285 xxx

Unthreaded section ²	/ UUU
15 mm	015
Other lengths [in mm]	XXX
Other lengths min...max [step size 5 mm]	15..245 15

Nominal ECDS system length ³	/ NN
5 m	05
10 m	10

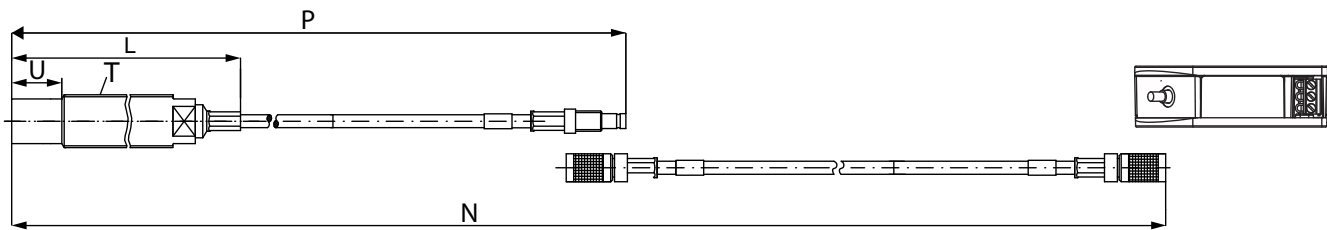
Length of sensor with integrated cable	/ PP
Complete nominal system length, no additional connection cable	00
0.5 m	05
1.0 m	10

Cable protection and protection length for the integrated cable ⁴	/ CXX
No protection	000
Steel protective conduit	2xx
PTFE protective conduit	3xx
Corrugated tube protective conduit, design	4xx
Corrugated tube protective conduit, design	5xx

E cable protection of connection cable (if available) ⁴	/ E
No protection (ec300)	0
Steel protective conduit (ec302)	2
PTFE protective conduit (ec303)	3

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

- On M16 x 1.5 and 5/8 - 18 UNF-2A threads, the min. sensor head length is 55 mm
- Umax = L - 40 mm, step size 5 mm = '005' order code measured from the sensor tip to the threadless end
- From the sensors tip to the end of the protective conduit. Shortest length: 03 = 3 dm, with step size of 2 dm XX = 00 stands for no protection, XX = 99 is maximum protection length for the selected sensor version (protection ends about 0.2 m before the end of the plug).
- If there is no connection cable (PP = 00), then enter the value "0".



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.mc301 / S / TT / LLL / UUU / NN / PP / CXX / E / R

Order examples ds82x.mc301:

Series ds821 Standard

	sensor type 1, full-length thread
	thread M14 x 1.0
	sensor body with 110 mm length
	no further unthreaded section besides the minimum of 15 mm
	nominal system length 5 m
	1.0 m integral cable (yielding a 4.0 m connection cable)
	integral cable with PTFE protective conduit, length 0.7 m
	connection cable with PTFE protective conduit
	no special requirement

ds821.mc301/1/18/110/015/05/10/307/3/0

Series ds822 ATEX

	sensor type 3 for reverse mounted probe
	thread M10 x 1.0
	sensor body with 45 mm length
	no further unthreaded section besides the minimum of 15 mm
	nominal system length 10 m
	no additional connection cable (with 10 m integral cable)
	integral cable with PTFE protective conduit, length 0.7 m
	no protection for connection cable, because this cable is not attached
	no special requirement

ds822.mc301/3/10/045/015/10/00/307/0/0

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:

$U_i = 28 \text{ V}$

$I_i = 140 \text{ mA}$

$P_i = 840 \text{ mW}$

$L_i = \text{negligibly low}$

$C_i = 12 \text{ nF}$

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

Brüel & Kjær Vibro GmbH
 Leydheckerstraße 10
 64293 Darmstadt
 Germany

Tel.: +49 6151 428 0
 Fax: +49 6151 428 1000
 info@bkvibro.com

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