



**Brüel & Kjær Vibro**

A member of the NSK Group



Product specifications and ordering information

## **Non-Contacting Displacement Sensor System Series ds821**

8 mm Measuring Range



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## 1 Features

- Non-contacting displacement measurement based on the eddy-current principle
- System length: 5 m
- Temperature range: -55 °C ... +180 °C
- Frequency: DC ... 10 kHz
- Compact design of the driver housing (oscillator / demodulator)
- Enhanced tip design
- 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).

### 1.1 Use



Relative shaft vibration



Eccentricity



Axial shaft position



Speed



Radial shaft position



Reciprocating Piston drop

### 1.2 Product description

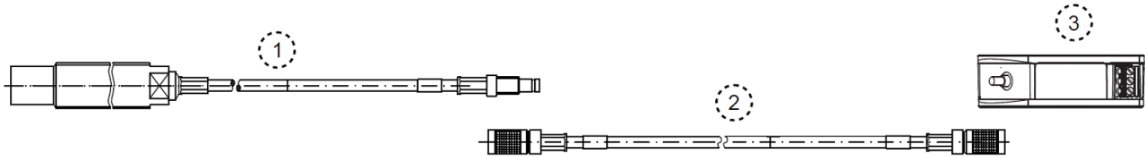
The displacement sensor systems of the ds82x family are based on the non-contacting eddy-current measurement process. The distance is measured between the tip of the displacement sensor and an electrically conductive surface and sent via a proportional voltage signal to a subsequent monitoring system. In the application range of machine monitoring, this makes it possible to record the status of rotating shafts.

The ECDS system (**E**ddy **C**urrent **D**isplacement **S**ensor) 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 (**E**ddy **C**urrent **D**isplacement **S**ensor) is available as series ds821 Standard and ds822 ATEX (applies only to 2 mm and 4 mm). Each series is available in system lengths of 5 m and 10 m (applies only to 2 mm and 4 mm).

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		8 mm Series ds821 Standard:
	<b>Complete system (mc)</b>	<b>ds821.mc50x</b>
①	Displacement sensor ( <b>ds</b> )	ds821.ds50xx
②	Connection cable ( <b>ec</b> )	ds821.ec50x
③	Driver (oscillator/demodulator) ( <b>od</b> )	ds821.od150

### 1.3 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	Black
Measuring range	2 mm	4 mm	8 mm

### 1.4 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	X			X
<b>Connection cable<sup>1</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

Table 1-1) Components included in the scope of delivery

<sup>1</sup> not available if the length of the displacement sensor with integrated cable corresponds to the nominal system length of 5 m.



## 2 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. 4.5 mm measuring distance between sensor and measuring surface), all components are at their operating temperature.

### 2.1 Non-Contacting Displacement Sensor System Series ds821

Measurand	Displacement
Measuring principle	Eddy-current measuring principle
<b>Nominal system lengths</b>	5 m
Linear measuring range	2 mm (approx. 0.6 ... 8.6 mm distance from the object to be measured corresponding to an output signal of approx. -2 VDC ... -18 VDC )
<b>Colour code</b>	black
<b>Dynamic characteristics<sup>1</sup></b>	
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.	2 mV/μm (50,8 mV/mil)
Accuracy of the sensitivity <sup>2</sup> (ISF error/%) within temperature range of: 0 °C ... +45 °C (total system) - at a nominal system length of 5 m	±10 %
-50 °C ... +180 °C (displacement sensor) and -40 °C ... +85 °C (driver od150) - at a nominal system length of 5 m	±20 %
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	±150 μm
-50 °C ... +180 °C (displacement sensor) and -40 °C ... +85 °C (driver od150) at a nominal system length of 5 m	±500 μm
Operating frequency range	DC ... 10 kHz (-3 dB damping of the output signal)

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

<sup>2</sup> Temperature range according to API 670

<b>Electrical characteristics:</b>	
Supply voltage ( $U_B$ ) The sensor system must be connected to a SELV supply be supplied with limited energy, which is fused with a current of $\leq 2.5$ A.	-24 VDC (-18 VDC ... -28 VDC)
Output range	0 V ... ( $U_B + 2$ V)
Current consumption	max. 12 mA
Output impedance	50 $\Omega$
<b>Mechanical characteristics:</b>	
Connector type	Coaxial connector (SAA), push-pull self-latching
<b>Cable:</b>	
Cable type	Coaxial
Cable jacket and colour	FEP, blue
Impedance	95 $\Omega$
Diameter	$\varnothing 3,5$ mm ( $\pm 0,15$ mm)

## 2.2 Displacement sensor type ds82x.ds500S

<b>Sensor tip:</b>	
Material	Ceramic
Tip diameter	$\varnothing 17,8$ mm ( $\pm 0.2$ mm)
<b>Sensor housing</b>	
Material	Stainless steel (material no. 1.4404 acc. to DIN 17200)
<b>Length</b>	
Including integral cable (measured from the sensor's tip to the end of the integral cable)	1,0 m (-0 m / +0,3 m) 5,0 m (-0 m / +1,0 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
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 <sup>3</sup>
<b>Pressure tightness (expected as based on the design):</b>	
Sensor tip	25 bar
<b>Temperature range:</b>	
Operating temperature range	-55 °C ... +180 °C
Storage temperature range <sup>4</sup>	-20 °C ... +70 °C

<sup>3</sup> When stored or operated at a temperature of less than -30 °C, the protection class is reduced to IP65

<sup>4</sup> When stored in original package



## 2.3 Connection cable type ds82x.ec50x (dependent on system design)

<b>Length</b>	4,0 m (-0 m / +0,8 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	-55 °C ... +180 °C
Storage temperature range <sup>5</sup>	-20 °C ... +70 °C

## 2.4 Driver ds82x.od150

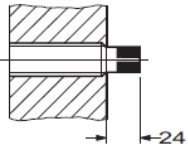
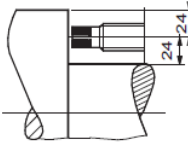
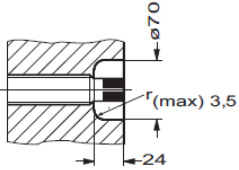
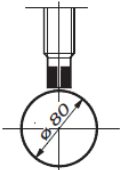
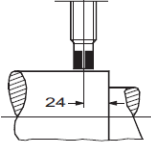
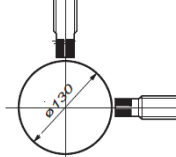
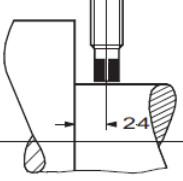
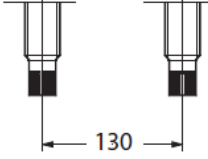
<b>Electric characteristics</b>	
Supply voltage ( $U_B$ )	-24 VDC (-18 VDC ... -28 VDC)
Current consumption	max. 12 mA ( $R_L \geq 100 \text{ k}\Omega$ )
Power supply	max. 1A and short-circuit proof
Source resistance dynamic	50 $\Omega$
<b>Mechanical characteristics</b>	
Housing material	Aluminium alloy (ADC 12)
Dimensions (WxHxD)	26,5 mm x 83 mm x 60 mm
Weight of the driver (Oszillator/Demodulator)	approx. 200 g
Connection	Socket (female)
<b>Ambient conditions</b>	
Degree of protection according to EN 60529	IP 20
<b>Temperature</b>	
Operating temperature range	-55 °C ... +85 °C
Storage temperature range <sup>6</sup>	-20 °C ... +70 °C
Humidity	98% non-condensing with protection of the plug connections and cable clamp

<sup>5</sup> When stored in original package<sup>6</sup> When stored in original package



## 2.5 Clearances and minimum distances

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

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



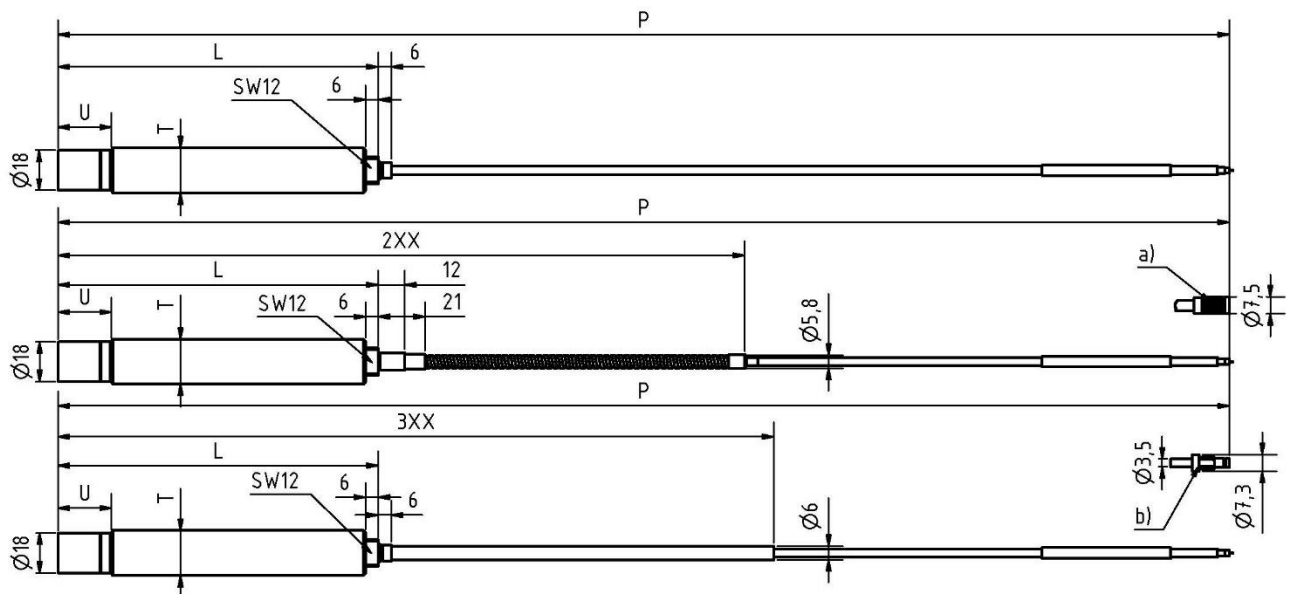
### 3 Versions and order codes

#### 3.1 Diagrams of sensor types (ds)

##### 3.1.1 Design of the displacement sensor type 1 with full-length thread (ds82x.ds5001/ ...)

top down:

- Displacement sensor **without cable protection** (ds82x.ds5001/TT/LLL/UUU/PPP/000/R)
- Displacement sensor **with steel protective conduit**, length XX (ds82x.ds5001/TT/LLL/UUU/PPP/2XX/R)
- Displacement sensor **with PTFE protective conduit**, length XX (ds82x.ds5001/TT/LLL/UUU/PPP/3XX/R)

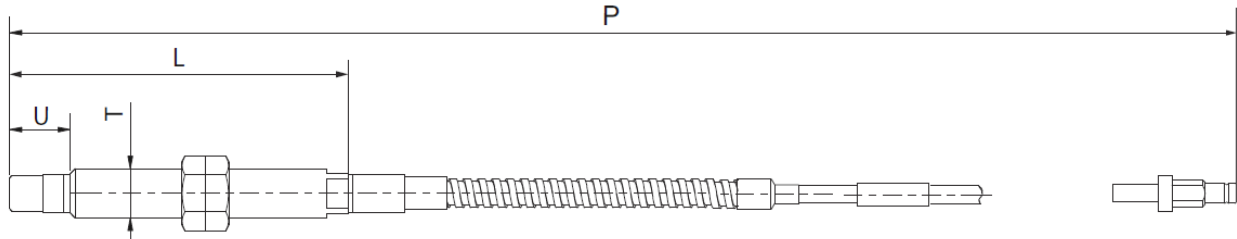


- a) Plug (male) for straight connect to driver (nominal system length)
- b) Socket (female) for the use of an extra connection cable





### 3.2 Order code for displacement sensor (ds) ds82x.ds500S / TT / LLL / UUU / PPP / CXX / R



Displacement sensor	<b>ds821</b>		<b>x</b>		Order code ds82
Standard	●		1	▶	
<b>Sensor type</b>	<b>ds5001</b>	<b>ds5004</b>	<b>/ S</b>		.ds500
Full-length thread	●		1	▶	
Right - angled head		●	4	▶	
<b>Thread</b>			<b>/ TT</b>		/
M20 x 1	●	●	28	▶	
<b>Length of the sensor body</b>			<b>/ LLL</b>		/
50 mm, minimal		●	050	▶	
70 mm		●	070	▶	
75 mm	●		075	▶	
105 mm	●		105	▶	
Other lengths min ...max [step size 5mm]	50 ... 255	50 ... 150	XXX	▶	
<b>Unthreaded section</b>			<b>/ UUU</b>		/
23 mm	●	●	023	▶	
Other lengths min ...max [step size 5 mm] <sup>1</sup>	... 230	15 ... 125	xxx	▶	
<b>Length sensor with integrated cable</b>			<b>/ PPP</b>		/
1,0 m	●	●	010	▶	
5,0 m	●	●	050	▶	
<b>Cable protection (C) and protection length (XX) for integrated cable <sup>2</sup></b>			<b>/ CXX</b>		/
No protection	●	●	000	▶	
Steel protective conduit	●	●	299 or 2xx	▶	
PTFE protective conduit	●	●	399 or 3xx	▶	
<b>Special requirements - need to be put in writing</b>			<b>/ R</b>		/
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:

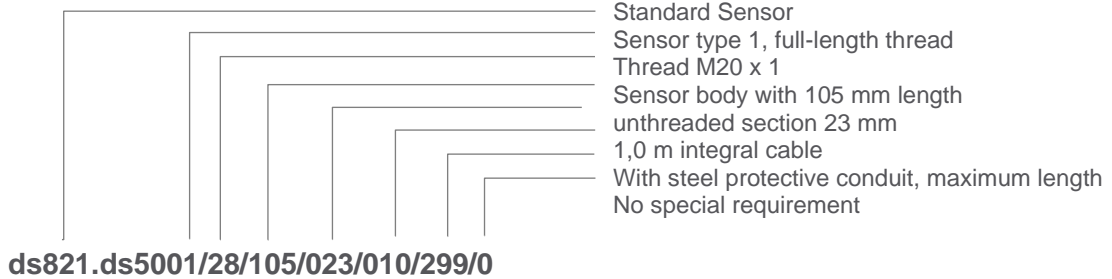
**ds82x.ds500S / TT / LLL / UUU / PPP / CXX / R**

<sup>1</sup> U<sub>max</sub> = L - 25 mm, measured from the sensor tip to the threadless end

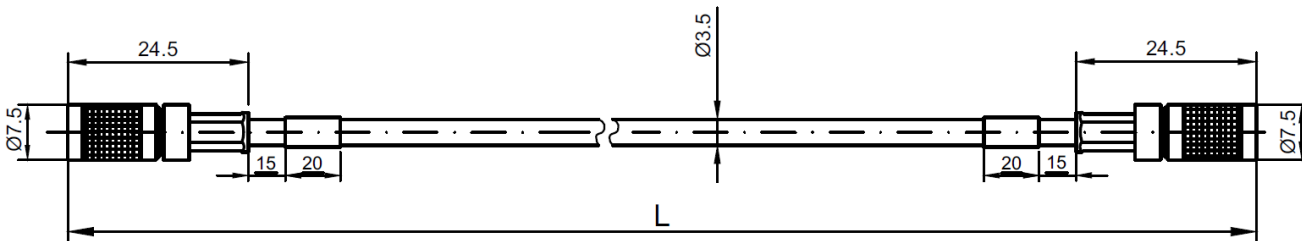
<sup>2</sup> The first position C defines the type of the cable protection, CXX = 000 stands for no protection. The second and third positions XX specify the length of the protection. XX = 99 is standard setting and specifies the maximum possible protection length for the selected length sensor with 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.

**Order examples ds82x.ds500S:**

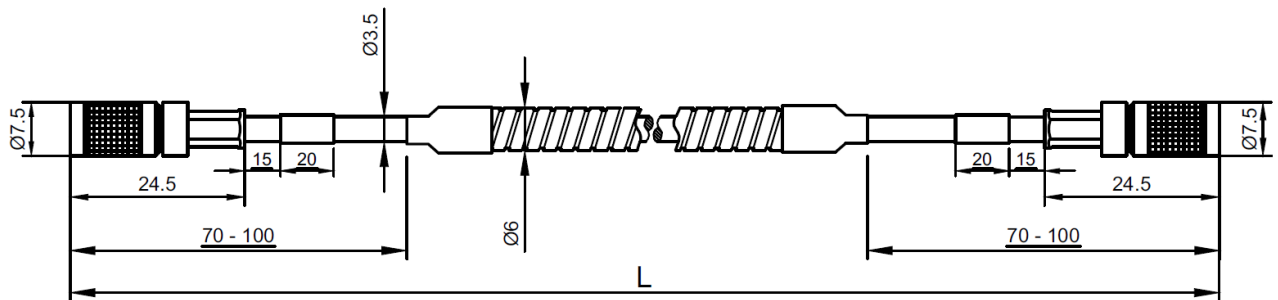
**Series ds821 Standard**



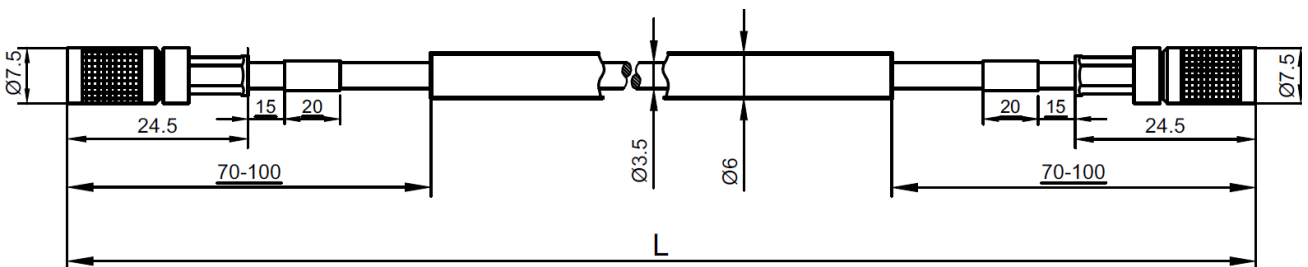
**3.3 Diagrams of connection cable (ec)**



**Figure 3-1)** Dimensions of connection cable ds82x.ec500 (no protection)



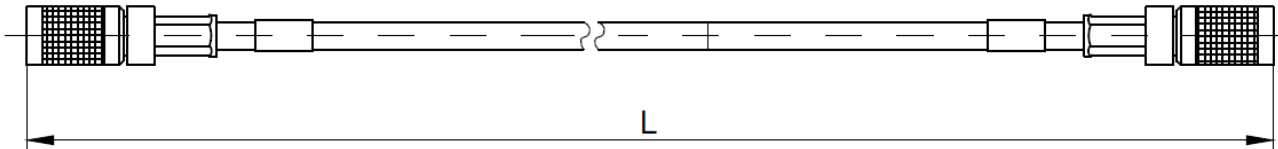
**Figure 3-2)** Dimensions of connection cable ds82x.ec502 (steel protection) mechanical reinforcement



**Figure 3-3)** Dimensions of connection cable ds82x.ec503 (PTFE tube)



### 3.4 Order code for connection cable (ec) ds82x.ec50E / LL / R



connection cable for displacement sensor series	ds821
Standard	•

X
1

Order code

ds82

Cable protection	ec500	ec502	ec503	/ E
No protection	•			0
Steel protective conduit		•		2
PTFE protective conduit			•	3

.ec50

Length of the connection cable	/ LL
4,0 m	40

/

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

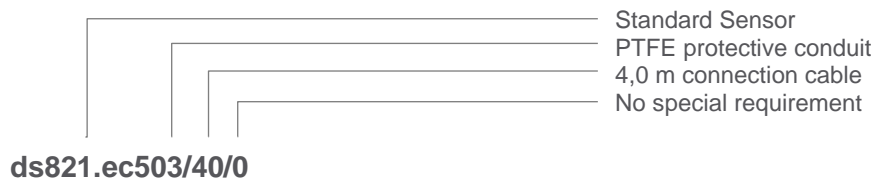
/

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.ec50E /LL / R

#### Order examples ds82x.ec500E:

##### Series ds821 Standard



### 3.5 Diagram of driver (od)

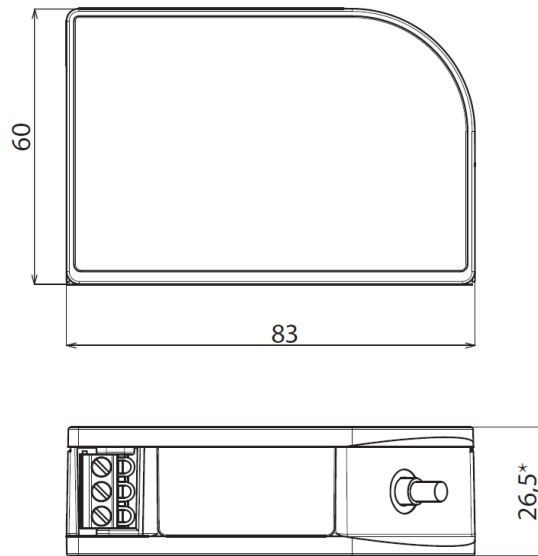


Figure 3-4 Dimensions of driver ds82x.od150

### 3.6 Order code for driver (od) ds82x.od150 / R

<b>Displacement sensor series</b>		<b>ds821</b>	<b>X</b>	➤	<b>Order code</b>	ds82	.od150
Standard	•		1				
<b>Special requirements - need to be put in writing</b>			<b>/ R</b>	➤	/		
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.od150 / R

#### Order examples ds82x.od150

##### Serie ds821 Standard





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

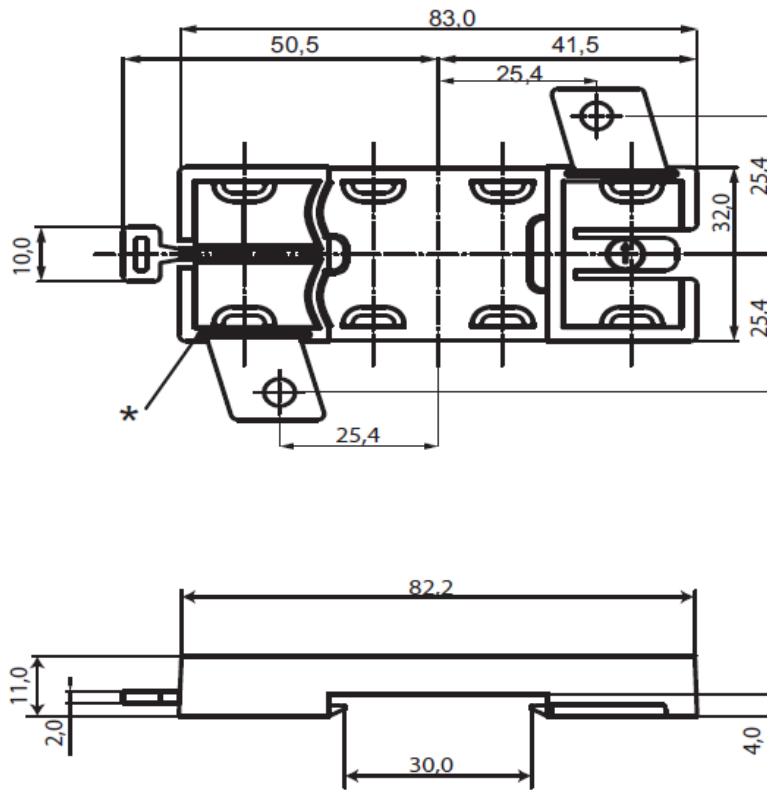


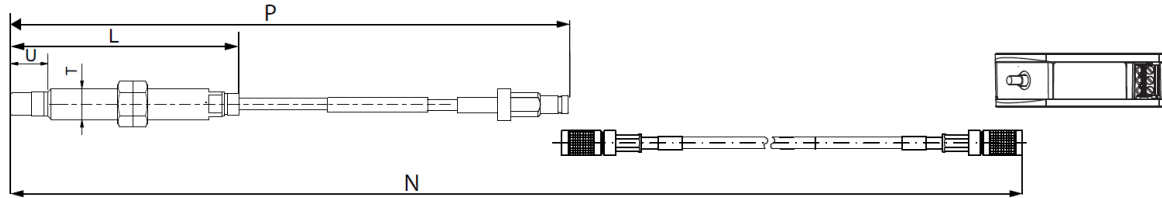
Figure 3-5) Dimensional diagram of mounting adapter

\* 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.



### 3.7 Order code for complete displacement sensor system (mc) ds82x.mc501 / S / TT / LLL / UUU / NN / PP / CXX / E / R



<b>Displacement sensor series</b>	ds821		<b>x</b>	1	➤	Order code	ds82		.mc501
Standard	●								
<b>Sensor type</b>	ds5001	ds5004	<b>/ S</b>		➤				
Full-length thread	●		1						
Right - angled head		●	4			/			
<b>Thread</b>			<b>/ TT</b>		➤				
M20 x 1	●	●	28			/			
<b>Length of the sensor body</b>			<b>/ LLL</b>		➤				
50 mm, minimal		●	050			/			
70 mm		●	070						
75 mm	●		075						
105 mm	●		105						
Other lengths min ... max [step size 5 mm]	50 ... 255	50 ... 150	XXX						
<b>Unthreaded section</b>			<b>/ UUU</b>		➤	/			
23 mm	●	●	023						
Other lengths min ... max [step size 5 mm] <sup>1</sup>	... 230	15 ... 125	xxx						
<b>Nominal ECDS system length</b>			<b>/ NN</b>		➤	/			
5 m	●	●	05						
<b>Length of sensor with integrated cable</b>			<b>/ PP</b>		➤	/			
Complete nominal system length, no additional connection cable	●	●	00						
1,0 m	●	●	10						
<b>Cable protection (C) and protection length for integrated cable (XX)<sup>2</sup></b>			<b>/ CXX</b>		➤	/			
No protection	●	●	000						
Steel protective conduit	●	●	299 oder 2xx						
PTFE protective conduit	●	●	399 oder 3xx						

<sup>1</sup> U<sub>max</sub> = L-25 mm, measured from the sensor tip to the threadless end

<sup>2</sup> 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.



E cable protection of connection cable (if available) <sup>3</sup>			/ E
No protection (ec500)	●	●	0
Steel protective conduit (ec502)	●	●	2
PTFE- protective conduit (ec503)	●	●	3
<b>special requirements - need to be put in writing</b>			<b>/ R</b>
No	●	●	0
Yes	upon request		1

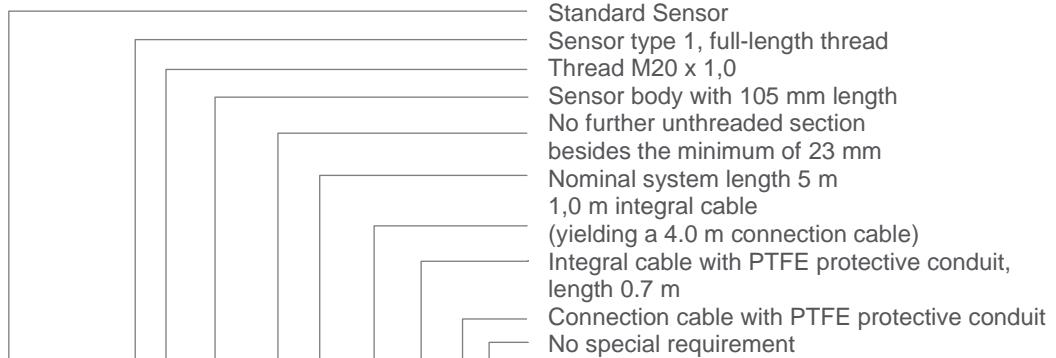


For an order, write the number of the selected option in the corresponding boxes on the right. Read from top to bottom, an order code has the following form:

**ds82x.mc501 / S / TT / LLL / UUU / NN / PP / CXX / E / R**

**Order examples ds82x.mc501:**

**Serie ds821 Standard**



**ds821.mc501/1/28/105/023/05/10/307/3/0**

**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.

<sup>3</sup> If there is no connection cable (PP = 00), then enter the value "0".

## 4 Approvals

### 4.1 Displacement sensor systems of the series ds821 are:

- CE compliant acc. to EMC Directive and
- RCM for Australia and New Zealand



# Contact

## **Brüel und Kjær Vibro GmbH**

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