

Mobile Position-/Strain Sensor

Datasheet



Properties

This robust and cost-competitive sensor enables position or displacement measurements across different applications. Being made of rubber, it tolerates installation misalignments while compensating for any measurement error due to misalignment hence making it ideal for retrofitting with a simple mounting process. The sensor is equipped with an in-built adaptable electronic that provides standard analog output as well as digital communication IOs. The digital IOs e.g. enable the adjustment of measurement range and alarm criteria – on-the-fly and without any need for mechanical adjustment.

- ◆ Especially suited for mobile applications by power-down option and low voltage supply
- ◆ Rubber sensor tolerating misalignment, shocks, and vibration.
- ◆ Simple installation, perfect for retrofitting
- ◆ No additional measuring amplifier required (Plug and play)
- ◆ Intelligent electronics enabling alarm generation with on-the-fly configuration
- ◆ Highly customizable in shape, size, and range for applications with unique requirements
- ◆ High-resolution analog signal
- ◆ Compact size

Applications

- ◆ Crack, strain, and displacement monitoring of structures (**Structural Health Monitoring**)
- ◆ Surface strain measurement of large industrial structures such as **windmills, pipes**, etc.
- ◆ Displacement measurement of moving parts in **off-road and heavy-duty vehicles**

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Technical Data

- Different information within one row describes orderable options, see chapter ordering code for details.
- All the following information represents our technical standard. Other configurations/specifications are available on request.

Mechanical and Environmental Data

Parameter	Symbol	Value			Unit	Comments
Measurement Range	l	25	50	100	mm	
Weight	m	~ 25			g	Sensor with electronic
Elongation Force	F _e	< 12			N	when stretched 100%
Electrical Connection		Bare Ends				
Operating Temperature	T _{op}	-55 ... 80			°C	Up to 150°C with separate electronic
Storage Temperature	T _{st}	0 ... 30			°C	
IP Classification		w/o	IP68			

Electrical Data

Parameter	Symbol	Value		Unit	Comments	
Supply Voltage	V _{sup}	2.3 ... 5.2		V	Max 5.0 V for best performance	
Power Consumption	P _{tot}	≤ 0.15		mW	Enable = Low	
		≤ 200			Enable = High	
Analog Outputs	V _{out}	0 ... 3.3	0 ... 5	V		
Electrical Resolution		12		bit	Resolution of DAC	
Communication		UART			Adapter (PRA) is required	
Digital IOs	Input	V _{IL}	< 1.3		V	Logical Low
		V _{IH}	> 3.4		V	Logical High
	Output	Open Drain				Output characteristics
		V _{OL}	< 0.8		V	
		I _{OL}	< 25		mA	
		V _{OH}	< 5.2		V	Pullup dependent
R _{pull}	∞	4.7		kΩ	Sensor internally to V _{sup}	

Performance Data

Parameter	Symbol	Value		Unit	Comments
Sampling Frequency*	f _s	≤ 1		kHz	Maximum refresh rate of analog output
Resolution		0.1		%FS	Smallest detectable output change
Repeatability		< 0.1		%FS	Maximum error when stretched to same value
Drift		5x10 ⁻⁴		%FS/day	Creep over 24h at room temperature
Accuracy		0.5		%FS	Including Hysteresis, Noise, Non-Linearity
Temperature Dependency		0.2	0.05	%FS/K	Value w/o and w/ temperature compensation
Humidity Dependency		0.02		%FS/%rH	

*Specifications performed at 125 Hz

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Materials

Part	Material
Housing	PLA
Cable	PVC
Bushings	Stainless Steel
Sensor element	PDMS
Others	Nickel-plated brass, CR/NBR

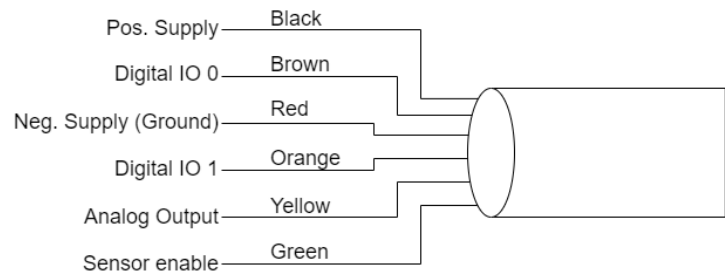
Please contact us for further information.

Other Materials are available on request.

Electrical Connection

Bare Ends Cable (6BED)

Function	Color
Supply Voltage	Black
DIO 0	Brown
Ground	Red
DIO 1	Orange
Analog Out	Yellow
Enable Sensor	Green



See also sensor packaging and calibration protocol for details.

Cable details:

Parameter	Value
Outer diameter	4.9 mm
Cores x cross. sec	6 x 0.23 mm ²
Shielding	unshielded

Mechanical Dimensions

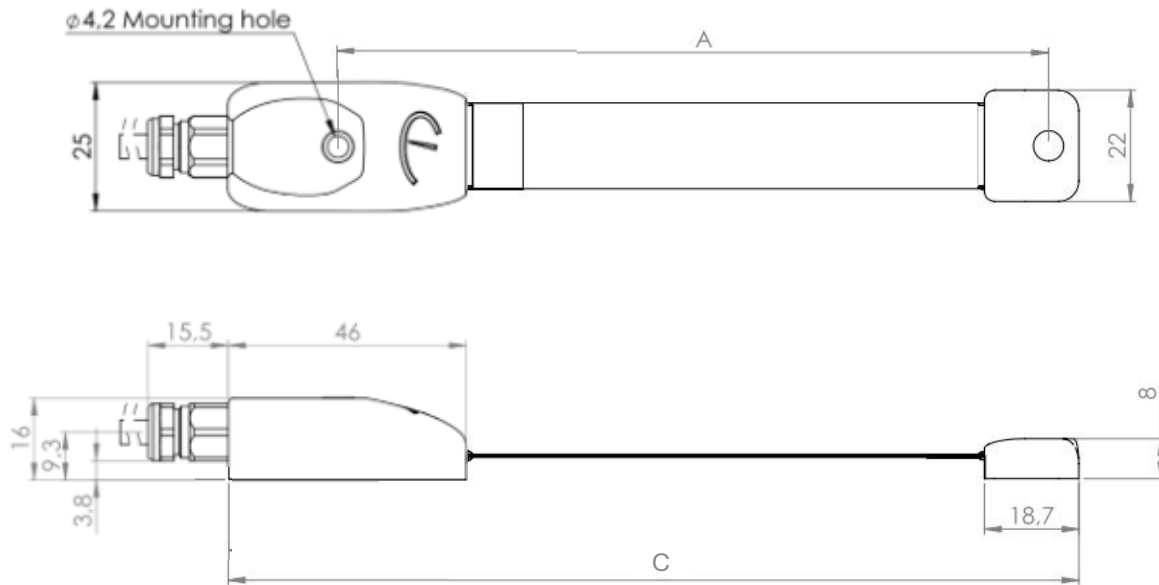


Figure 3: Drawing of Sensor with cable

Range [mm]	A* [mm]	C* [mm]
25	66,5	93,8
50	93	120,3
100	145	172,3

* include a recommended pre-stretch of the sensor

Other lengths or mounting conditions are available on request!

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Order Code

		DST	-	S1M4	-	050	-	6BEC	-	3X	-	2H	-	U1	-	00	-	XXXX	
Type																			
	DST	Delfa Stretch System																	
Housing Type																			
	S1M4	PA12, M4 with stainless steel bushings																	
Range																			
	025	max. 25 mm																	
	050	max. 50 mm																	
	100	max. 100 mm																	
Electrical Connection																			
	6BED	2 m cable with bare ends																	
Supply Voltage																			
	3X	2.3 to 5.2 VDC																	
Sampling Rate																			
	1X	10 Hz																	
	1C	100 Hz																	
	2H	250 Hz																	
	5H	500 Hz																	
	1K	1.000 Hz																	
Analog Output																			
	00	w/o																	
	U2	0 – 3.3 V																	
	U3	0 - 5 V																	
Digital Ports ^{*1)}																			
	00	w/o																	
	2I	Two digital Inputs to teach																	
	IO	one Input, one Output																	
	2O	Two digital Outputs																	
Additional Features																			
e.g. temperature compensation, IP-classification, etc. See the next page.																			

Core Product Range

Other options (sensor range, supply & output voltage, housing, communication, ...) available on request.

*1) Digital ports are preconfigured, programming adapter PRA-MOBI is recommended to adjust limits via software

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Optional Features

Multiple selection possible, add corresponding suffixes to end of order code without separators.

Leave it blank if no options are chosen.

Order code table	
T1	Temperature Compensated
PU	Digital Output: 4.7 kΩ Pull-up (Only available when Digital Output(s) is/are chosen.)
IP	IP68 protection: 1 m depth for 24 hours

Customer-specific sensor systems are assigned a factory order code.

Device usage

General information

After powering the device, a typical time of 15 minutes is recommended to assure stable measurement values.

Digital IO's and Communication

General information

- All digital outputs are open drain low-switching (NPN) type, external pull-up is required. (An internal 4.7 kΩ Pull-up is available as an optional feature)
- By default, the digital outputs are active (i.e. output pulled to ground) when the assigned limit is exceeded.
- By default, digital inputs react on a digital high (positive logic). Always tie unused inputs to Ground.
- For executing the “Set” functions of the input, drive the input high for minimum 200 ms and maximum 1 s.
- Other switching options (e.g. output change to digital low when exceeding a limit; pulse instead of edge; ...) are available on request.
- All limit values can be set by software with the programming adapter (PRA-MOBI) or with corresponding digital inputs.
- Outputs can be used to switch e.g. a relay, a valve, or an alarm system.

Enable Sensor Input

This input can be tied to ground to disable the sensor which leads to a very low power consumption (typ. 30 µA current). Tie the input to supply voltage or leave it floating to enable the sensor.

Functionality of the digital IOs according to the ordered configuration

	2I	IO	2O
DIO 0	Set min limit	Limit 1 (Output)	Limit 1
DIO 1	Set max limit (*)	Set Limit 1 (Input) (*)	Limit 2

(*): Hold this input high for more than 2 and less than 4 seconds to store the current configuration into the non-volatile memory of the sensor.

Option “2I”: Two digital Inputs to teach the analog output

This option enables defining the positions where the analog signal should be at 5% / 95% of its span using the digital inputs. When an input is activated, the current position is latched as the value for the according analog signal limit. This enables the user to focus the analog output on a specific range of interest. The limits can also be adjusted using the programming adapter PRA-MOBI.

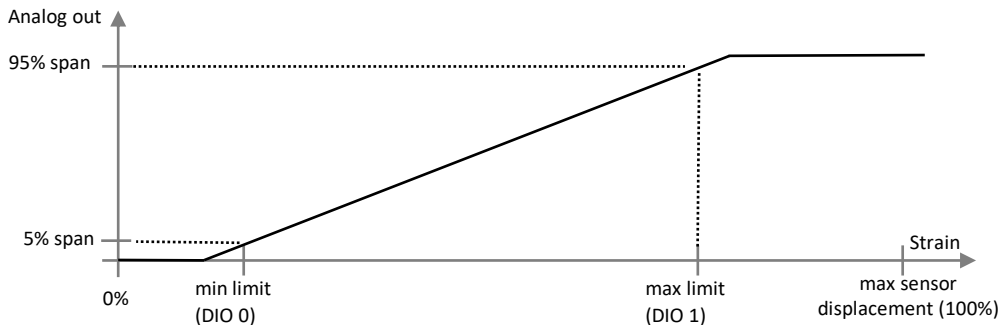


Figure 1: Analog output signal with taught limits.

Option “IO”: 1 digital input to teach a limit and 1 digital output signal

This option is used for generating an alarm or control signal when a maximum displacement value, configured in software, is exceeded. It can be used to mimic a limit switch generating a digital signal output. The limit can be adjusted using the digital Input or the programming adapter PRA-MOBI.



Figure 2: Digital output signal vs. displacement (with external pull-up resistor).

Option “2O”: 2 digital output signals

This option is used for generating two alarm or control signals when a minimum or maximum displacement value, configured in software, is exceeded. It can be used to mimic two limit switches generating a digital signal output. The limits can be adjusted using the programming adapter PRA-MOBI.

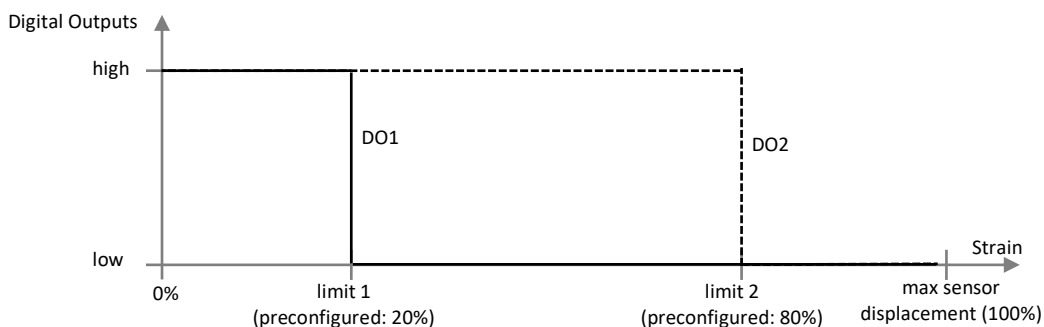


Figure 3: Digital output signals vs. sensor position (with external pull-up resistor).

Analog Output

The limits for the analog output signal (i.e. the sensor position for minimum / maximum output signal) can always be changed using the programming adapter PRA-MOBI.

Optional Features

Temperature Compensation

To improve the temperature stability, an optional temperature compensation can be ordered. If this is used, due to self-heating of the system, stability will be reached after a run-in time of approximately 15 minutes.

The performance of the compensation can be influenced by temperature differences between the electronic housing and the sensitive element e.g. due to radiant heat. For best performance, the temperature of all parts should be as close as possible.

Pullup for Digital Outputs

Additional Pullup-Resistors with a resistance of 4.7 kOhm between the output and the supply voltage are added.

Protection Class IP68

Extended protection of the sensor against water reaching IP68 classification. This is only available with cabled connections.

Accessories

- ◆ Programming Adapter **PRA-MOBI**
- ◆ Mounting Kit **MKI-DST-...**