Position-/Strain Sensor

Datasheet DST-S1M4-XXX-5M8V-XX-XX-XX-XX-XX

Properties

This robust and cost-competitive sensor enables position or displacement measurement 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.

- 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**)
- Displacement measurement of moving parts in **off-road and heavy-duty vehicles**
- Position measurement of **industrial actuators** for monitoring and automation
- Surface strain measurement of large industrial structures such as **windmills, pipes**, etc.
- Displacement and angle measurement of **Soft Robots** for position control

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Technical Data

Weight	approx. 25g	Weight of sensor with electronic
Range	25 mm 50 mm 100 mm	Maximum displacement (Full Scale), others on request
Elongation force	<12 N	Force when stretched 100%
Resolution	0.1%FS up to 12 bit	Sensor: Smallest detectable output change Electronic: Resolution of DAC
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	Maximum difference between output and ideal linear curve including noise
Temperature	0.08%FS/K 0.01% FS/K	Uncompensated sensor drift per Kelvin With integrated temperature compensation (option)
Humidity	0.02%FS/%rH	Uncompensated sensor drift per percent relative humidity
Digital IOs	In: max. 24 V Out: Open Drain, max. 24 V, 250 mA or 10 kΩ Pull-up	Function upon definition Resistive Loads only
Analog output	0...3.3 V 0...10 V 0...20 mA, max. 24 V 4..20 mA, max. 24 V	Proportional to sensor signal Scaling can be changed using the PRA-GPIO
Communication	UART	Programming Adapter is required, others on request
Sampling frequency	≤2 kHz*	Maximum refreshing rate of analog output
Operating temp.	-55°C to 80°C	Can be higher for sensor with separate electronic
Supply voltage	3.4 to 5.2 VDC 12 VDC +/- 20% 24 VDC +/- 20% 9 to 30 VDC +/- 20%	Others on request
Connector	M8 5 Pin B-coded	Different orientations or M12 on request

* specification performed at 125 Hz

Linearity and Hysteresis

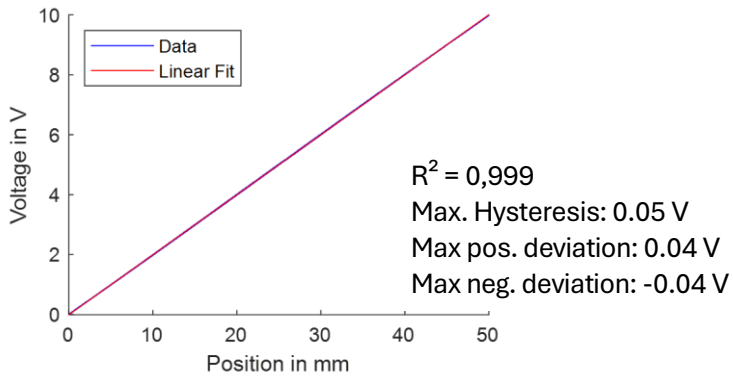


Figure 1: Typical sensor data (three cycles) and the linear fit

Mechanical Dimensions

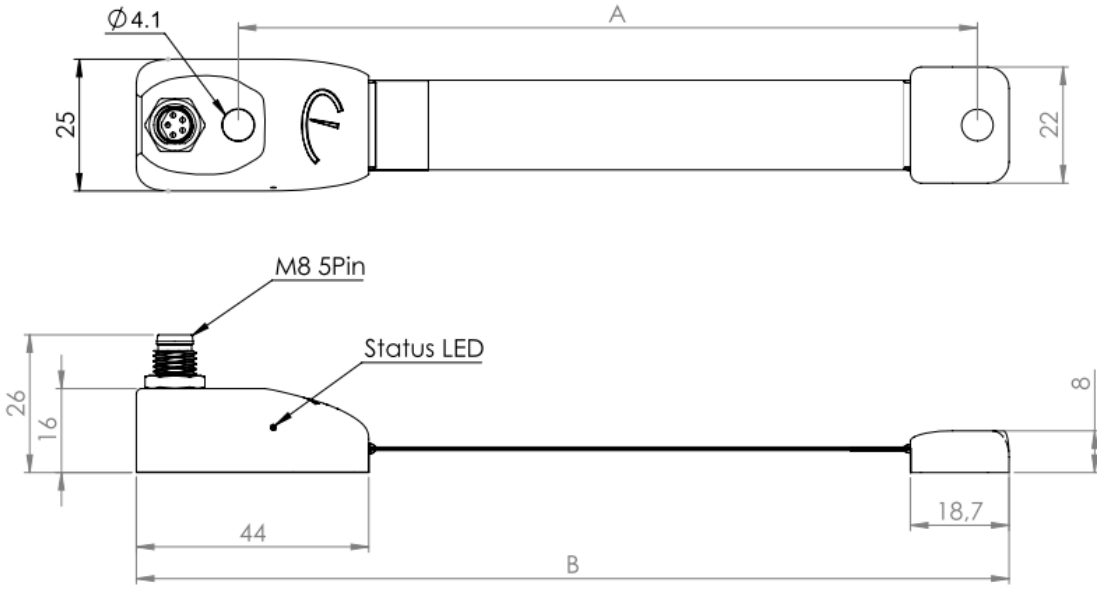


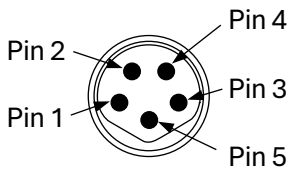
Figure 2: Drawing of Sensor

Range [mm]	A* [mm]	B* [mm]
25	66,5	91,8
50	93	118,3
100	145	170,3

* 'A' & 'B' include a recommended pre-stretch of the sensor

Other lengths or mounting conditions are available or on request!

Contacts Position and Pinout



Pin 1: Supply voltage
Pin 2: DIO 0
Pin 3: Ground
Pin 4: DIO 1
Pin 5: Analog Out

IEC 61076-2-104 B-coded M8

Position-/Strain Sensor

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Order Code

DST - S1M4 - 050 - 5M8V - 24 - 2H - I0 - 00 - XXXX

Type		
◠	DST	Delfa Stretch System
Housing		
◠	S1M4	Standard
Range		
	025	max. 25 mm
◠	050	max. 50 mm
	100	max. 100 mm
Electrical Connection		
◠	5M8V	IEC 61076-2-104 b-coded M8
Supply Voltage		
	3X	3.4 to 5.2 VDC *1)
	12	12 VDC
◠	24	24 VDC
	9X	9 - 30 VDC *2)
Sampling Rate		
	1X	10 Hz
	1C	100 Hz
◠	2H	250 Hz
	5H	500 Hz
	1K	1.000 Hz
Analog Output		
	00	w/o
◠	U1	0 - 10 V
	I0	0 - 20 mA
	I4	4 - 20 mA
	U2	0-3.3 V *3)
Digital Ports *4)		
◠	00	w/o
	2I	Two digital Inputs to teach
	2C	Two digital Inputs
	IO	one Input, one Output
	2O	Two digital Outputs
Optional Features (separate table)		

◠ Core Product Range

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

*1) This option limits the analog output selection to "U2" 0-3.3 V
*2) Maximum analog output voltage limited to supply voltage
*3) Only available with supply voltage selection "3X"
*4) Digital ports are preconfigured, programming adapter PA-GPIO is recommended to adjust limits via software

Optional Features

Multiple selection possible, add corresponding suffix to end of order code without separator.
Leave blank if no options are desired.

Order code table	
T1	Temperature Compensated
PU	Digital Output: 10 kΩ Pull-up (Only available when Digital Output(s) is/are chosen.)

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

Digital IO's and Communication

- All digital outputs are open drain low-switching (NPN) type, external pull-up is required. (An internal 10 kΩ Pull-up is available as an optional Feature)
- By default, the digital outputs are high when the assigned limit is exceeded.
- By default, digital inputs react on a digital high (positive logic). Always tie unused inputs to Ground.
- 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-GPIO) or with corresponding digital inputs.
- Outputs can be used to switch e.g. a relay, a valve, or an alarm system.

Functionality of the digital IOs according to the ordered configuration

	2I	2C	IO	2O
DIO 0	Set min limit	ON/OFF	Limit 1 (Output)	Limit 1
DIO 1	Set max limit	Start/Stop	Set Limit 1 (Input)	Limit 2

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

This option enables defining the measurement range of the sensor on-the-fly. The digital inputs are used to specify the minimum and maximum measurement range of the sensor if the desired range is other than the maximum measurement range of the sensor. This enables increasing the resolution of analog output in the operating measurement range.

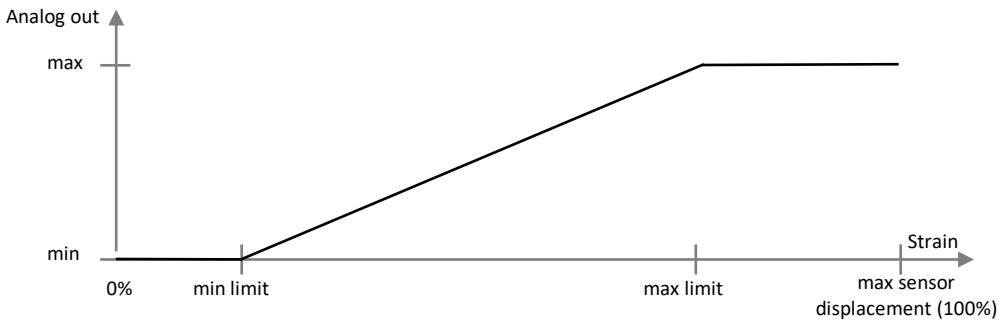

Figure 3: Analog output signal with taught limits.

Option “2C”: Two digital Inputs for Energy Saving

This option is particularly useful for conserving energy, such as when connecting to a battery. One digital input switches the sensor on and off, while the other input starts and stops the measurement.

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-GPIO.

Figure 4: Digital output signal vs. displacement.

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 switch generating a digital signal output. The limit can be adjusted using the programming adapter PRA-GPIO.

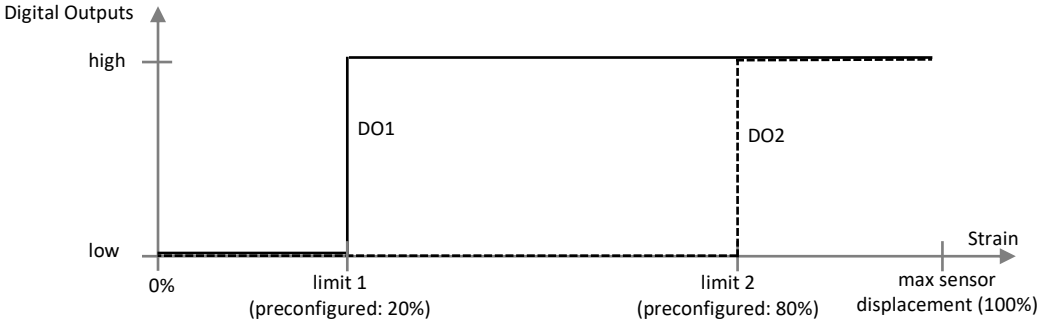

Figure 5: Digital output signals vs. sensor position.

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-GPIO.

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 10 kOhm between the output and the supply voltage are added.

Accessories

- Programming Adapter **PRA-GPIO**
- Sensor Cable **SCA-...**
- Mounting Kit **MKI-DST-...**
- Communication adapter for RS422/485, RS232 **PRA-COM...**