Srew-on strain sensors

manual

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ME-Meßsysteme GmbH
Neuendorfstr. 18a
16761 Hennigsdorf
Tel.: +49 3302 89824 60
Fax: +49 3302 89824 69
Mail: info@me-systeme.de
Web: www.me-systeme.de

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Description

The strain sensor is suitable for strain and force measurement on machine elements under rough conditions. Installation is done quite simply by screwing the sensor with screws on an even material surface. Mechanical loads on the component are transmitted to the strain transducer by means of a force introduction via the fastening screws and converted into an electrical output signal.

The connection cable is protected by a non-crushable spiral tube. The areas of application are, for example, force monitoring in agricultural and construction machinery, fill level measurement and strain data acquisition on machine elements. They are suitable for retrofitting a force measurement or an overload detection.
The temperature behavior and conversion factor depend on the geometrical and material pairing of sensor and component. The sensor is calibrated by subjecting the component to a known force. Strain transducer is available with an integrated evaluation electronics. This measuring amplifier has an alternative voltage or current output as well as a threshold output. Amplification and zeroing can be each set via digital input.

The product variants DA90i and DA120i have an integrated measuring amplifier GSV-6L, which is completely scalable and settable. The configuration is made via two “control lines Tara” and “Scale”. The detailed explanation of the configuration can be found in the user manual „ClickRClackR“.

Figure 1: Strain sensor DA70, DA70e

Figure 2: Strain sensor DA90, DA90e, DA90i

Figure 3: Strain sensor DA120, DA120e, DA120i

Technical Data DA70

material		
Construction design		Strain transducer (tension-compression)
Material		Tool steel
IP protection class		IP65
fastening 1)		2 screws M10; 12.9 tightening torque 50Nm
Therm. Expansion coefficient		≈ 12 10^{-6} m/m/K
mechanical data		
Nominal strain (F_N)	µm/m	±300
Operational strain	%F_N	±150
electrical data straingauge		
Nominal characteristic value	mV/V @ F_N	1,5 ±0,3
Zero signal	mV/V	< ± 0,1
max. suppy voltage	V	10
Input resistance	Ohm	400 ± 60
Output resistance	Ohm	400 ± 60
Insulation resistance	Ohm	> 5 · 10^9
Connection cable	DA70 DA70e	5m cable 2x2x0,25 PUR 5m cable 4x2x0,25 PUR
accuracy		
Linearity error 2)	% v.S.	≤ 1,0
reproducibility 0...300 µm/m 2)	% v.S.	< 0,2
Hysteresis error 2) ± 100 µm/m ± 200 µm/m ± 300 µm/m ± 400 µm/m	% F_N	 < 0,5 < 1,0 < 2,0 < 5,0
Temperature coefficient of the zero signal 3)	%F_N /10K	< 0,5
Temperature coefficient of the characteristic value	% v.S. /10K	< 1
Creep error (30 min)	% S_N	< 1
temperature		

Nominal temperature range	°C	-10…+60
Operation temperature range	°C	-20…+70
Storage temperature range	°C	-20…+70

1) Follow the manual instruction
2) Linearity, reproducibility and hysteresis error are significantly influenced by the material properties of the carrier component. The specified technical data apply to assembly on a heat treatable steel with Rp02 > 500 N/mm2
3) The drift of the zero point depends on the material pairing

Technical Data DA90

length x width x height	90 x 25 x 11	mm x mm x mm
Accuracy class	0,5	%
Nominal measuring range	±100	µm/m
Operational range	±400	µm/m
Output signal	≈ 1 mV/V / 225 µm/m	
Therm. expansion coefficient	$\approx 12 \cdot 10^{-6}$	1/K
Input resistance	350 ± 1	Ohm
Output resistance	350 ± 1	Ohm
Insulation resistance	$> 5 \cdot 10^{9}$	Ohm
Supply voltage	10	V
connection 4 wire	5	m

Technical Data DA120

Länge x Breite x Höhe	120 x 20 x 11	mm x mm x mm
Genauigkeitsklasse	0,5	%
Nennmessbereich	±100	µm/m
Gebrauchsbereich	±400	µm/m
Ausgangssignall	ca. 1 mV/V / 225 µm/m	
therm. Ausdehnungskoeffizient	ca. 12 10^{-6}	1/K
Eingangswiderstand	350 ± 1	Ohm
Ausgangswiderstand	350 ± 1	Ohm
Isolationswiderstand	> 5 x10^{9}	Ohm
Speisespannung	2,5…10	V
Anschluss 4 Leiter	5	m

Pin assignment

Standard type with strain gauge measuring bridge

+U_S	positive bridge supply	brown
-U_S	negative bridge supply	white
+U_D	positive bridge output	green
-U_D	negative bridge output	yellow
	shield (not connected to the housing)	transparent

Type with integrated electronics

Ub	Supply voltage (24V or 12V DC)	brown
GND	Connect ground, supply voltage and signal	white
Ua	Output signal 4...20mA or 0...10V	green
Tara	Control input for zero adjustment	yellow
Scale	Control input for amplification factor	gray
SW	Threshold output	pink
GND	Ground signal	blue
	shield (is not connected with the housing)	transparent

Type with shunt resistance

		5x0,14/PUR cable sheath „grey“	3x2x0,14/Teflon cable sheath „white“
+U_S	positive bridge supply	brown	red
-U_S	negative bridge supply	white	black
+U_D	positive bridge output	green	green
-U_D	negative bridge output	yellow	yellow
Shunt		grey	grey
	shield (is not connected with the housing)	transparent	transparent

Connect to Shunt with -UD : +0,28 mV/V; Connect to Shunt with +UD : -0,28 mV/V;
Shunt resistor: 300kOhm;

Order options

Type of the measuring amplifier	Output signal	Input sensitivity	Zero point
010/105/3,5	0 ... 10V	10V per 3,5 mV/V	0V
010-5/105/3,5	0 ... 10V	10V per 3,5 mV/V	5V
4-20/105/3,5	4 ... 20mA	20mA per 3,5mV/V	4mA
4-20-12/105/3,5	4 ... 20mA	20mA per 3,5mV/V	12mA

Configuration of DA70e, DA90e and DA120e

The integrated GSV-15L measuring amplifier supplies an analog output signal from 0.0 to 10.0V. The default input sensitivity is: 10V per 3.5 mV/V.
The input sensitivity (the measurement range) can be adjusted using the “scale function”.
In unloaded state, the display can be adjusted to 0.0V or another factory-set value.

Zero setting (tare function)

The output signal is automatically adjusted to 0.0V by applying a control pulse at the “tare” input. The control pulse must be at least 1s high and then 100 ms low.
Please note: a high signal must not be applied at the tare input when switching on the electronics.

Scale function

The GSV-15L measuring amplifier has a scale function. A high level at the “scale input” scales the current measuring signal to 10.0V.
The zero setting must be applied before activating the scale function.

Procedure: the sensor is subject to mechanical stress with 100% load. The output signal is automatically adjusted to 10.0V by applying a control pulse at the “scale” input. The control pulse must be at least 2s high and then 100 ms low.
Please note: a high signal must not be applied at the scale input when switching on.

Configuring the scale function (Set-up mode_1)

The end value can also be scaled with less than 100% of the maximum load.
The proportion of calibration load in the maximum load can be configured in 5% increments in *Set-up mode_1*
Procedure:

1) switch off supply voltage;
2) connect scale input (grey) to the supply voltage (high-potential);
3) switch on supply voltage;
4) disconnect scale input from the supply voltage (high-potential); (*Set-up mode_1* is now active).
5) the threshold is increased by 5% by reconnecting the high-potential to the scale input (for 2s).The threshold is lowered by 5% by connecting the high-potential to the tare input (for 2s).
   The output signal now indicates the tension that is displayed after activating the scale function. Example: If a voltage of 1.0V is applied at the output (in *Set-up mode_1*), calibration should be performed with 10% of the maximum load.
   If a voltage of 9.0V is applied at the output (in *Set-up mode_1*), calibration should be performed with 90% of the maximum load.

6) switch off supply voltage;
7) switch on supply voltage. The measuring amplifier is now in the normal operating mode again.

Threshold value (open collector)

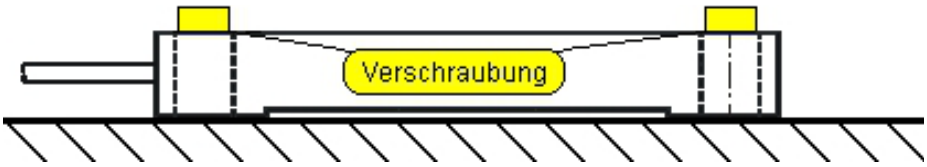
The threshold value switch reacts when the threshold value is exceeded. The default threshold value is 90% of the measurement range. The threshold value output is switched to ground when 90% is exceeded. If the strain falls below 88%, the output switches to high-impedance.

Configuring the threshold value function (Set-up mode_2)

The threshold of the threshold switch can be set in 5% increments.
Procedure:

1) switch off supply voltage;
2) connect tare input to the supply voltage (high-potential);
3) switch on supply voltage;
4) disconnect tare input from the supply voltage (high-potential). (The *Set-up mode_2* is now active).
5) The threshold is increased by 5% by re-applying the high-potential to the scale input. The threshold is lowered by 5% by applying the high-potential to the tare input. In *Set-up mode_2*, the output signal displays at what point the threshold value is activated.
   Example: If a voltage of 1.0V is displayed at the output, then the threshold value encoder is activated at 10% of the maximum load and reset again at 8%.
   If a voltage of 9V is displayed at the output, then the threshold value encoder is activated at 90% of the maximum load.
6) switch off supply voltage;
7) switch on supply voltage. The measuring amplifier is now in normal operating mode again.

Mounting instruction for screw-on strain sensors



The screws are set diagonally and tightened with the required torque.

	M6	M10
DIN 912, 12.9	16 Nm	70 Nm
DIN 912, 10.9	10 Nm	50 Nm

The strain sensor must be mounted on a flat surface without tension. Varnishes and paints must be removed in order to ensure a sufficient frictional connection between the strain transducer and the component. The area between the support points must be free and unloaded.

General information

- The first time it is loaded, there may be settling in the contact area between the component and the strain transducer.
- A roughened surface (e.g. by sanding with grain size 120, sandblasting) and the use of expansion screws are advantageous for a reliable frictional connection.
- The use of a joint connection, e.g. Loxeal-8521 or Loctite 638 is recommended from a strain of 100 µm/m.
- With expansions of 250 µm/m or more, errors such as hysteresis and zero point shift occur due to settling phenomena or insufficient frictional connection.
- The strain transducers DA70, DA90 and DA120 react to strain / compression in their longitudinal axis. This strain / compression can be caused by both bending and normal force loading on the component. The quality of the measurement result can be influenced by the selection of the suitable location for the assembly.
- Tensile load results in a positive output signal

Änderungen vorbehalten.
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