Strain sensors for static applications with integrated amplifier

Models

X-103-3

Flat dimensions with four mounting screws

93 x 25 x 13-14 mm, 4x M6,
0…50 µm/m
0…250 µm/m

X-113-3

Easy mounting with two screws

96 x 25 x 15 mm, 2x M8,
0…50 µm/m
0…250 µm/m

X-113-H07-3

Narrow dimensions with two mountings screws

96 x 18 x 36 mm, 2x M8,
0…250 µm/m

X-109-3

High-precision measurement of strains up to 775 µm/m

107 x 27 x 26 mm, 4x M6,
0…50 µm/m up to 0…775 µm/m

[A
4...20 mA
0...20 mA]

[V
± 10 V]

Ordering code

- For static applications
- For weight, level, force and construction monitoring
- Measuring very small strains in rigid structures
- With integrated amplifier with ± 10 V or 4-20 mA

Application

Surface strain sensors monitor the strain between its two mounting screws and amplifies this mechanically. In this way the strain is concentrated in the measuring area and can therefore be measured using a resistive strain gauge bridge. The integrated low-noise amplifier raises the signal to an easily handled standard industrial output level. The solid steel body and sealed construction guarantees trouble-free installation even under harsh environmental conditions.

The strain sensors for static applications are suitable for the following use cases:

- Determination of weight by measuring the deformation in the weight-bearing structure. This is a cost-effective way to retrofit existing construction, e.g. a silo, with a weight measurement.
- Monitoring of mechanical deformation at components
- Monitoring of loads at constructions and buildings in order to avoid critical overloading

Ordering code

Ordering code			
Output signal	**Measuring range**	**0-10 V**	**4-20 mA**
X-103			
M12	0…50 µm/m	X-103-30-M12-0-50Z	X-103-31-M12-0-50Z
	0…250 µm/m	X-103-30-M12-0-250Z	X-103-31-M12-0-250Z
Cable outlet	0…50 µm/m	X-103-30-1.0m-0-50Z	X-103-31-1.0m-0-50Z
	0…250 µm/m	X-103-30-1.0m-0-250Z	X-103-31-1.0m-0-250Z
X-113			
M12	0…50 µm/m	X-113-30-M12-0-50Z	X-113-31-M12-0-50Z
	0…250 µm/m	X-113-30-M12-0-250Z	X-113-31-M12-0-250Z
Cable outlet	0…50 µm/m	X-113-30-1.0m-0-50Z	X-113-31-1.0m-0-50Z
	0…250 µm/m	X-113-30-1.0m-0-250Z	X-113-31-1.0m-0-250Z
X-113-H07			
Cable outlet	0…250 µm/m	X-113-H07-30-1.0m-0-250Z	X-113-31-1.0m-0-250Z
X-109			
M16	0…50 µm/m	X-109-30-M16-0-50Z	
	0…250 µm/m	X-109-30-M16-0-250Z	
	0…500 µm/m	X-109-30-M16-0-500Z	
	0…775 µm/m	X-109-30-M16-0-775Z	

Order information:

Type/Description
Measuring range
Output signal
Cable length / connector
Signal positive on tension (pull) or pressure (push)

Options:

Customer specific calibration
Cable connector at the free end
Customer specific cable length
Reset-Logic

Strain sensor X-103

93 x 25 x 13-14 mm, 4x M6,
Up to 250 µm/m

Specifications

Performance	
Measuring range	0...50 µm/m 0...250 µm/m
Resolution	1/5000
Linearity	< 0,3 % from full-scale
Hysteresis	< 0,3 % from full-scale
Repeatability of reinstallation	Typ. 1 %, max 2 %
Zero drift over temperature range	0.02 % / °C
Deviation of full scale over temperature range	0.003 % / °C
Temperature coefficient	11.6 ppm / °C
Optional temperature coefficient for aluminium compensation	23.5 ppm / °C

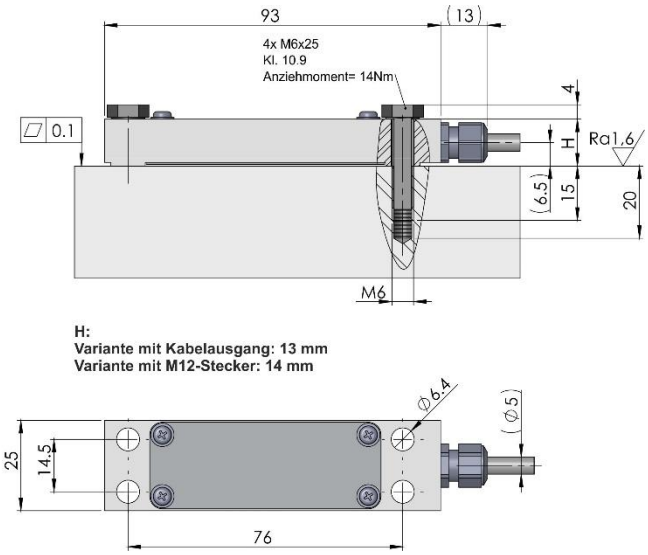
Electrical data	
Power supply	18...30 VDC, <40mA
Output signal at full scale	± 10 V / 4-20 mA
Output signal at overload	± 11.5 V / 1.5-23 mA

Materials	
Housing	Steel (TC 11.1 ppm / °C)
Cable	PUR
Weight	110 gr

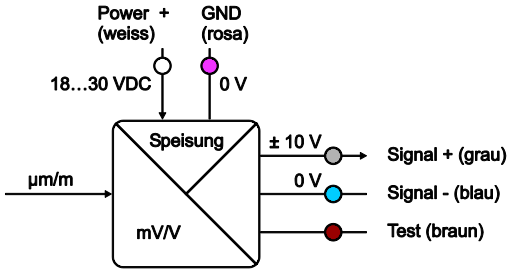
Mechanical data	
Electrical connection	Cable with open leads, 1.0 m M12 plug, 5 pole, male

Environmental data	
Ambient temperature	-10...65 °C
EMV standards	IEC 61000-4, Performance A
Shock and vibration	EN60068-2-6/27
Protection rate	IP 64

Mechanical dimensions



Block diagram



Wiring

Wire colour (DIN 47 100)	X-103-3
White / PIN 1	Power +
Pink / PIN 2	Power 0V (GND)
Grey / PIN 3	Signal +
Blue / PIN 4	Signal 0V
Green / PIN 5	NC
Brown	Test
Yellow	NC

Ordering information

This strain sensor is delivered without mounting screws. For detailed ordering information, please see page 2.

Strain sensor X-113

96 x 25 x 15 mm, 2x M8,
Up to 250 µm/m

Specifications

Performance	
Measuring range	0...50 µm/m 0...250 µm/m
Resolution	1/5000
Linearity	< 0,3 % from full-scale
Hysteresis	< 0,3 % from full-scale
Repeatability of reinstallation	Typ. 1 %, max 2 %
Zero drift over temperature range	0.02 % / °C
Deviation of full scale over temperature range	0.003 % / °C

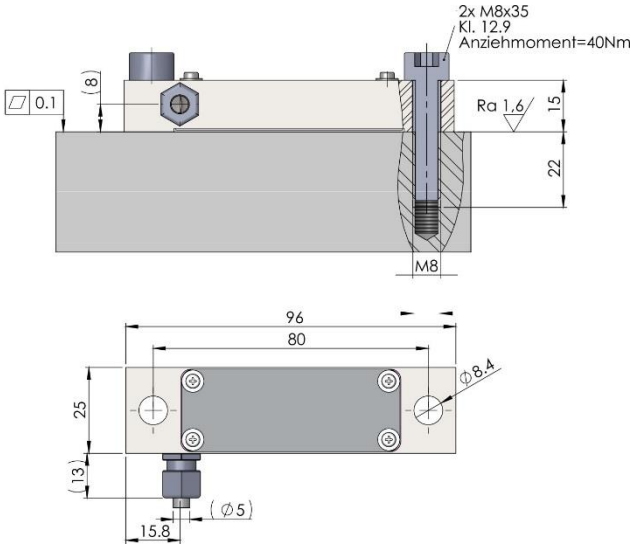
Electrical data	
Power supply	18...30 VDC, <40mA
Output signal at full scale	± 10 V / 4-20 mA
Output signal at overload	± 11.5 V / 1.5-23 mA

Materials	
Housing	Steel (TC 11.1 ppm / °C)
Cable	PUR
Weight	150 gr

Mechanical data	
Electrical connection	Cable with open leads, 1.0 m M12 plug, 5 pole, male

Environmental data	
Ambient temperature	-10...65 °C
EMV standards	IEC 801/2
Protection rate	IP64

Mechanical dimensions



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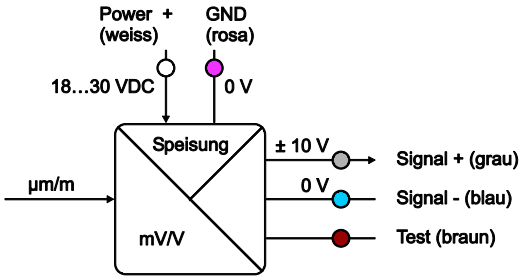


Wiring

Wire colour (DIN 47 100)	X-113-3
White / PIN 1	Power +
Pink / PIN 2	Power 0V (GND)
Grey / PIN 3	Signal +
Blue / PIN 4	Signal 0V
Green / PIN 5	NC
Brown	Test
Yellow	NC

Ordering information

This strain sensor is delivered without mounting screws. For detailed ordering information, please see page 2.

Narrow strain sensor X-113-H07

96 x 18 x 36 mm, 2x M8,

Up to 250 µm/m

Specifications

Performance	
Measuring range	0...250 µm/m
Resolution	1/5000
Linearity	< 0,5 % from full-scale
Hysteresis	< 0,5 % from full-scale
Repeatability of reinstallation	Typ. 1 %, max 2 %
Zero drift over temperature range	0.02 % / °C
Deviation of full scale over temperature range	0.003 % / °C

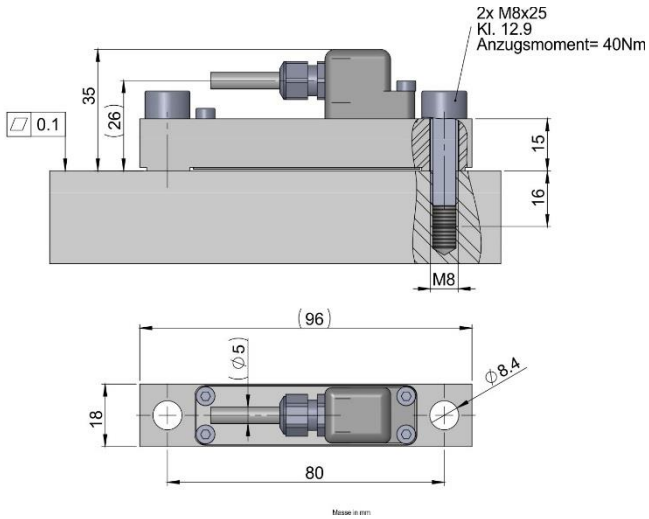
Electrical data	
Power supply	18...30 VDC, <40mA
Output signal at full scale	± 10 V
Output signal at overload	± 11 V

Materials	
Housing	Steel (TC 11.1 ppm / °C)
Cable	PUR
Weight	150 gr

Mechanical data	
Electrical connection	Connection cable
Cable length	1.0 m
Connector-type	Open leads

Environmental data	
Ambient temperature	-10...65 °C
EMV standards	IEC 61000-4-5
Protection rate	IP 64

Mechanical dimensions



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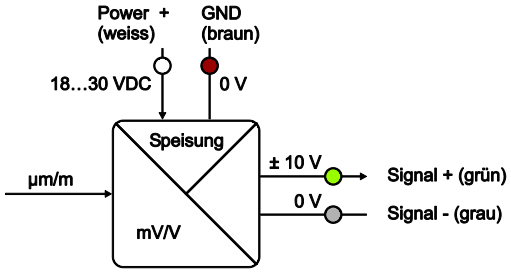


Wiring

Wire colour (DIN 47 100)	X-113-H07-3
White	Power +
Brown	Power 0V
Green	Signal +
Yellow	NC
Grey	Signal 0V

Ordering information

This strain sensor is delivered without mounting screws. For detailed ordering information, please see page 2.

High-precision strain sensor X-109

107 x 27 x 26 mm, 4x M6,
0…50 µm/m up to 0…775 µm/m

Specifications

Performance	
Measuring range	0…50 µm/m 0…250 µm/m 0…500 µm/m 0…775 µm/m
Resolution	< 0.1 µm/m
Detection level	< 0.05 µm/m
Linearity	< 0,5 % from full-scale
Hysteresis	< 0,2 % from full-scale
Repeatability of reinstallation	Typ. 1 %, max 2 %
Zero signal unmounted	-7…-5 V
Zero signal mounted	-9…3 V
Zero drift over temperature range	0.02 % / °C
Deviation of full scale over temperature range	0.003 % / °C

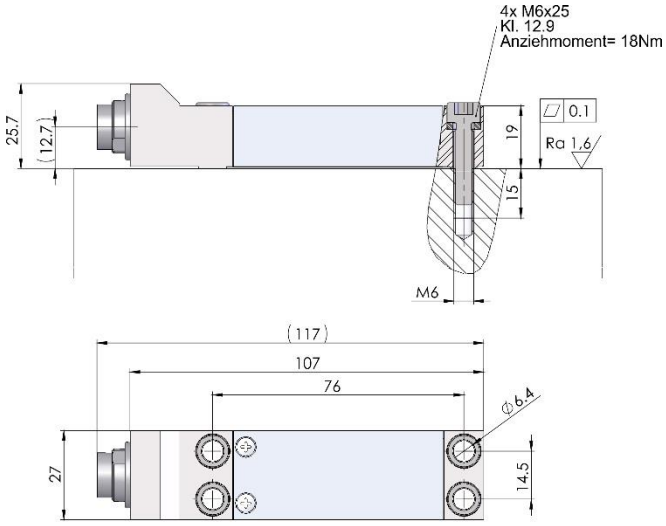
Electrical data	
Power supply	18…28 VDC, <40mA
Output signal at full scale	± 10 V
Output signal at overload	± 14 V
Noise	<5 mV @0..500Hz <10 mV @0..10kHz

Materials	
Housing	Stahl (10.7 ppm / °C)

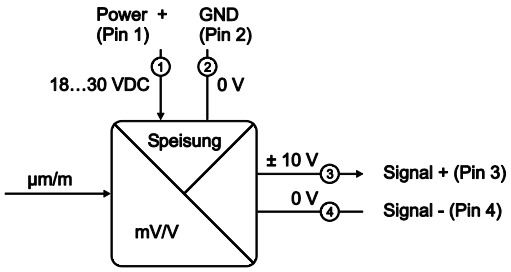
Mechanical data	
Overload	130 % of full scale
Electrical connection	Electrical plug
Connector-type	M16, 8 pole, male, DIN45326

Environmental data	
Ambient temperature	-10…65 °C
EMV standards	IEC 61000-4-5
Protection rate	IP 54

Mechanical dimensions



Block diagram



Wiring

Pin assignment	X-109-SK13
PIN 1	Power +
PIN 2	Power 0V
PIN 3	Signal +
PIN 4	Signal 0V
PIN 5	NC
PIN 6	NC

Ordering information

This strain sensor is delivered with four M6x25 / 12.9 mounting screws. For detailed ordering information, please see page 2.

Mounting instructions

The strain sensors should be mounted on machined surfaces N7 (N9 for X-103) with a flatness to within 0,1 mm (0,5 mm for X-103). The mounting thread should have a similar strength. Use the following parameter for tighten the socket screws:

	Screws	Tightening torque at strength class 12.9
X-103	4x M6	18 Nm
X-113	2x M8	40 Nm
X-113-H07	2x M8	40 Nm
X-109	4x M6	18 Nm

Definition of accuracy

The accuracy includes the following parameters:

1. Linearity and hysteresis

The linearity and hysteresis specifies the measuring error in reference to the ideal BFSL curve. The maximum measuring error is stated in reference to the full scale value. This means that an accuracy of 0.5 % FS at a strain sensor with a measuring range of 0…250 µm/m correspondents to a measuring error of only 1.25 µm/m.

2. Repeatability of reinstallation

The force closure between strain sensor and the structure it is applied to does vary slighlty from installation to installation. As a consequence, the zero point and span is minimally moving form installation to installation. But the zero-point and the span can be easily recalibrated by the input for the zero-offset adjustment and by a recalibration with known process parameters. This eliminates a measuring error due to the reinstallation. In case that a recalibration is not possible in the application, the maximum error of reinstallation is specified within the data sheets.