Strain sensors for static applications with integrated amplifier and digital zero adjustment

Models

X-103-7

Flat dimensions with four mounting screws

93 x 25 x 19.1 mm, 4x M6,
0…50 µm/m
0…250 µm/m

X-113-7

Easy mounting with two screws

96 x 25 x 20.3 mm, 2x M8,
0…50 µm/m
0…250 µm/m

X-109-7

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

88 x 27 x 19 mm, 4x M6, 0…50 µm/m up to 0…775 µm/m

[→0←] Installation-Zero Captive

[Ⓐ] 4...20 mA
0...20 mA

[Ⓥ] ± 10 V

Features

- For static applications
- With external input for zero-point adjustments, teach-in is stored permanently (installation zero)
- 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

The strain sensors from X-Sensors reliably measure even smallest strains on the surface of flat structures. The strain sensors are particularly suitable for static measurements, for example at the monitoring of structures or in the weight measurement of silos. Thanks to the digital input, the zero point adjustment can be easily teached-in by the PLC.

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 for avoiding critical overloading

The zero point adjustment at these strain sensors is carried out by a digital zero adjustment mechanism. The zero point adjustment is stored permanently, it is not lost after a power off. It provides a non-volatile, stable zero point (intallation tara). Therefore, it is qualified for all static applications. The numbers of tarings is limited to 100.000.

Ordering code

Description	Measuring range	Connection	Specification
X-103	0…50 µm/m	M12	Page 3
	0…250 µm/m	M12	
X-103	0…50 µm/m	Cable	Page 3
	0…250 µm/m	Cable	
X-113	0…50 µm/m	M12	Page 4
	0…250 µm/m	M12	
X-113	0…50 µm/m	Cable	Page 4
	0…250 µm/m	Cable	
X-109	0…50 µm/m	M12	Page 5
	0…250 µm/m	M12	
	0…500 µm/m	M12	
	0…775 µm/m	M12	

Strain sensor X-103-7

93 x 25 x 19.1 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

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

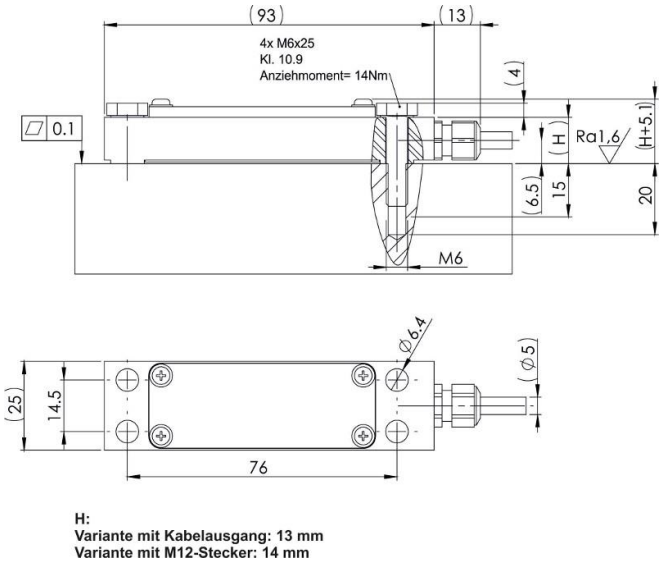
External zero reset	
Measurement mode	< 3 V or open
Zero reset / adjustment	> 10 V
Minimal pulse duration	1000 ms
Adjustment of zero point	200 % from full-scale
Max numbers of tarings	100.000

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

Mechanical data	
Life endurance alternating 90 % load	10^8 cycles
Electrical connection	Cable with open leads, 1.0 m M12 plug, 5 pole, male

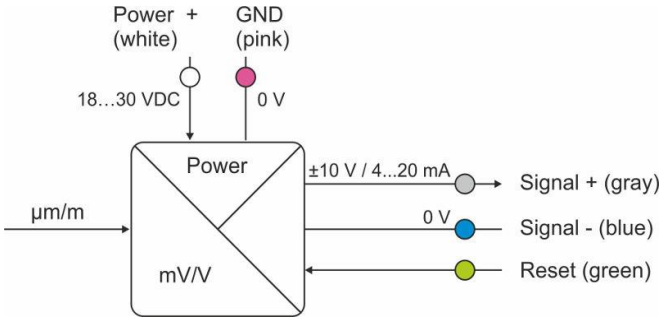
Environmental data	
Ambient temperature	-10...65 °C
EMV standards	IEC 61000-4, Performance A
Shock and vibration	EN60068-2-6/27
Protection rate	IP 64

Mechanical dimensions



H:
Variante mit Kabelausgang: 13 mm
Variante mit M12-Stecker: 14 mm

Block diagram



Wiring

Wire colour (DIN 47 100)	X-103-7
White / PIN 1	Power +
Pink / PIN 2	Power 0V (GND)
Grey / PIN 3	Signal + (10 V / 4...20 mA)
Blue / PIN 4	Signal 0V
Green / PIN 5	Zero Reset
Brown	NC
Yellow	NC

Ordering information

This strain sensor is delivered without mounting screws.

For detailed ordering information, please see page 2.

Strain sensor X-113-7

96 x 25 x 20.3 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

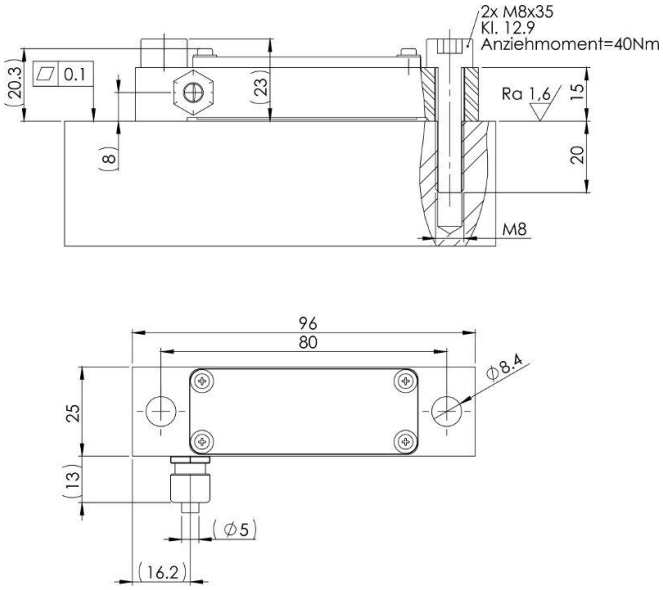
External zero reset	
Measurement mode	< 3 V or open
Zero reset / adjustment	> 10 V
Minimal pulse duration	1000 ms
Adjustment of zero point	200 % from full-scale
Max numbers of tarings	100.000

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

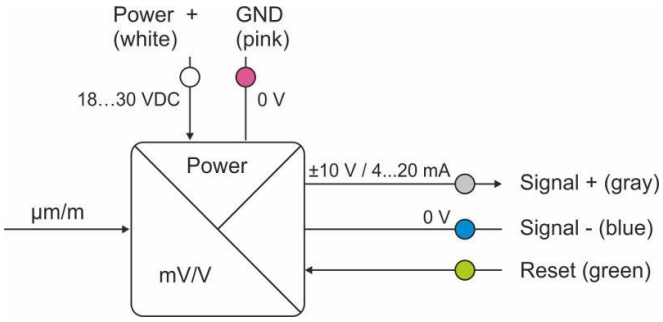
Mechanical data	
Life endurance alternating 90 % load	10^8 cycles
Electrical connection	Cable with open leads, 1.0 m M12 plug, 5 pole, male

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

Mechanical dimensions



Block diagram



Wiring

Wire colour (DIN 47 100)	X-113-7
White / PIN 1	Power +
Pink / PIN 2	Power 0V (GND)
Blue / PIN 3	Signal + (10 V / 4...20 mA)
Grey / PIN 4	Signal 0V
Green / PIN 5	Zero Reset
Brown	NC
Yellow	NC

Ordering information

This strain sensor is delivered without mounting screws.

For detailed ordering information, please see page 2.

Strain sensor X-109-7

88 x 27 x 19 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	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

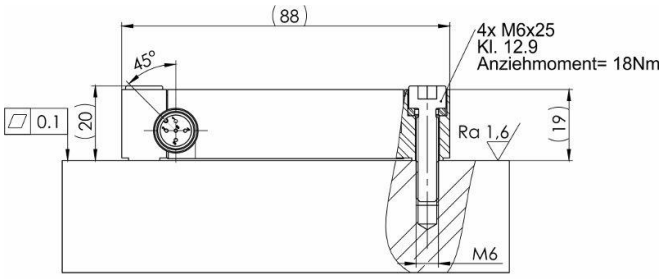
External zero reset	
Measurement mode	< 3 V or open
Zero reset / adjustment	> 10 V
Minimal pulse duration	1000 ms
Adjustment of zero point	200 % from full-scale
Max numbers of tarings	100.000

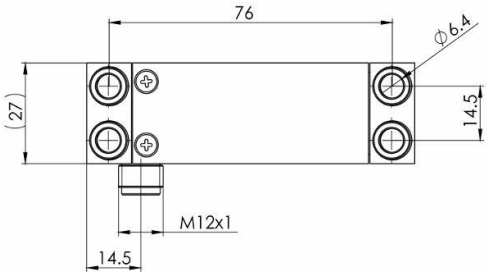
Materials	
Housing	Steel (10.7 ppm / °C)

Mechanical data	
Overload	130 % of full scale
Life endurance alternating 90 % load	10^8 cycles
Connector-type	M12 plug, 5 pole, male

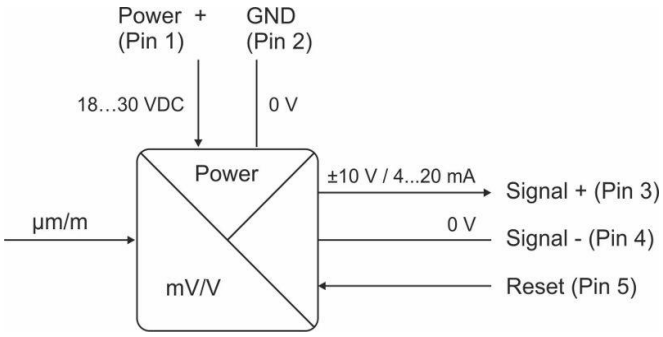
Environmental data	
Ambient temperature	-10…65 °C
EMV standards	IEC 61000-4-5
Protection rate	IP 54

Mechanical dimensions





Block diagram



Wiring

Pin assignment	X-109-7
PIN 1	Power +
PIN 2	Power 0V (GND)
PIN 3	Signal + (10 V / 4…20 mA)
PIN 4	Signal 0V
PIN 5	Zero Reset

Ordering information

This strain sensor is delivered with four M6x25 / 12.9 mounting screws.

For detailed ordering information, please see page 2.

Zero reset / adjustment

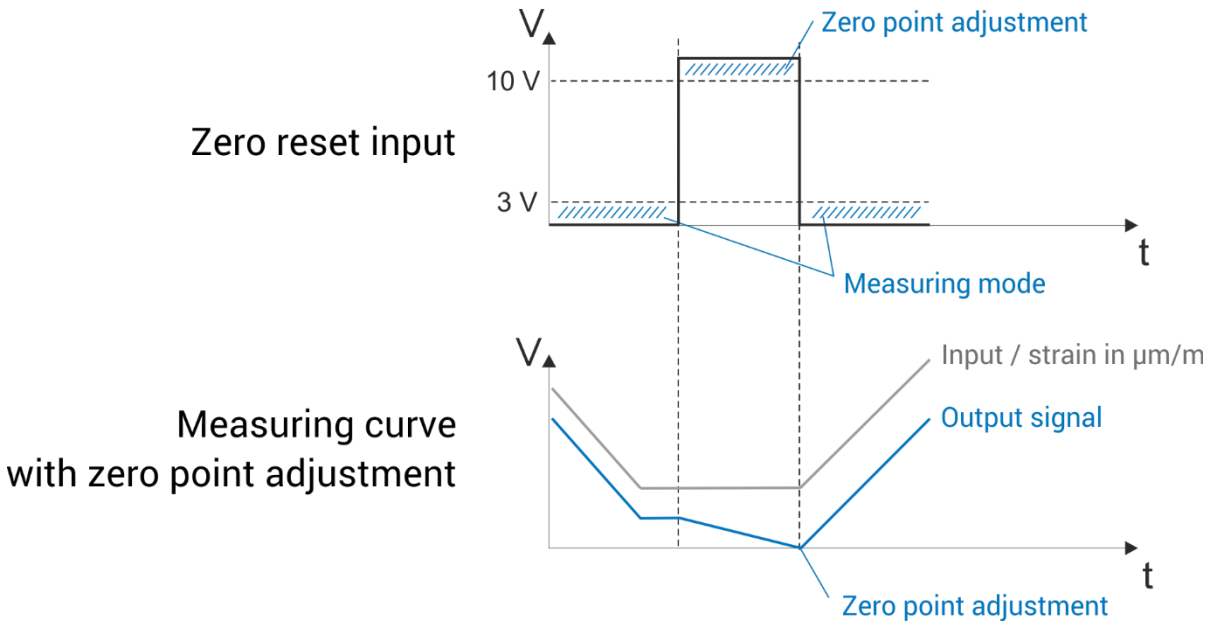
The zero point adjustment at these strain sensors is carried out by a digital zero adjustment mechanism. The zero point adjustment is stored permanently, it is not lost after a power off. It provides a non-volatile, stable zero point (installation zero). Therefore, it is qualified for all static applications. The numbers of tarings is limited to 100.000.

The reset input does trigger a zero point adjustment. It is available with an “Active Low” and “Active High” Logic.

The following paramters should be respected in regard to the external zero-point adjustment:

External zero-point adjustment	Active Low	Active High
Measuring mode	> 10 V or open	< 3 V or open
Zero point adjustment	< 3 V	> 10 V
Minimum pulse time	1000 ms	1000 ms

The following graph describes the characteristic during the zero point adjustment:



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-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.