

Strain sensors for dynamic applications with integrated amplifier

Models

X-103-2

Flat dimensions with
four mounting screws



93 x 25 x 13-14 mm, 4x M6,
0...50 µm/m
0...250 µm/m
0...360 µm/m

X-113-2

Easy mounting with two
screws



96 x 25 x 15 mm, 2x M8,
0...50 µm/m
0...250 µm/m
0...360 µm/m

X-113-H07-2

Narrow dimensions with
two mountings screws



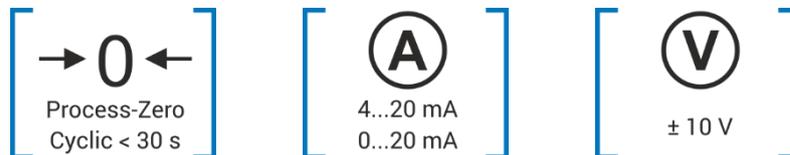
96 x 18 x 36 mm, 2x M8,
0...250 µm/m
0...440 µm/m

X-109-2

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



107 x 27 x 26 mm, 4x M6,
0...50 µm/m bis 0...775
µm/m



Features

- For dynamic applications with external input for automatic zero-point adjustments
- For indirect force and deformation measurements
- Measuring very small strains in rigid structures
- With integrated amplifier with ± 10 V or 4-20 mA

Application

Dynamic applications describe recurring, fast measurement cycles, as usually found in presses. In cyclic applications, it is important that the zero point is tared in regular intervals in order to minimize drifting of the measuring signal. Thanks to the digital input, the zero point adjustment can be easily teached-in by the PLC.

- Force measurement in machineries (e.g. presses, welding tongs, assembly machines)
- Force measurement in presses and injection-molding machines
- Monitoring of process parameters and maximum peak values

Output signal	Measuring range	Ordering code	
		0-10 V	4-20 mA
X-103			
M12	0...50 µm/m	X-103-20-M12-2-50Z	X-103-21-M12-2-50Z
	0...250 µm/m	X-103-20-M12-2-250Z	X-103-21-M12-2-250Z
	0...360 µm/m	X-103-20-M12-2-360Z	X-103-21-M12-2-360Z
Cable outlet	0...50 µm/m	X-103-20-1.0m-2-50Z	X-103-21-1.0m-2-50Z
	0...250 µm/m	X-103-20-1.0m-2-250Z	X-103-21-1.0m-2-250Z
	0...360 µm/m	X-103-20-1.0m-2-360Z	X-103-21-1.0m-2-360Z
X-113			
M12	0...50 µm/m	X-113-20-M12-2-50Z	X-113-21-M12-2-50Z
	0...250 µm/m	X-113-20-M12-2-250Z	X-113-21-M12-2-250Z
	0...360 µm/m	X-113-20-M12-2-360Z	X-113-21-M12-2-360Z
Cable outlet	0...50 µm/m	X-113-20-1.0m-2-50Z	X-113-21-1.0m-2-50Z
	0...250 µm/m	X-113-20-1.0m-2-250Z	X-113-21-1.0m-2-250Z
	0...360 µm/m	X-113-20-1.0m-2-360Z	X-113-21-1.0m-2-360Z
X-113-H07			
Cable outlet	0...250 µm/m	X-113-H07-20-1.0m-2-250Z	X-113-21-1.0m-2-250Z
	0...440 µm/m	X-113-H07-20-1.0m-2-440Z	X-113-21-1.0m-2-440Z
X-109			
M16	0...50 µm/m	X-109-20-M16-2-50Z	
	0...250 µm/m	X-109-20-M16-2-250Z	
	0...500 µm/m	X-109-20-M16-2-500Z	
	0...775 µm/m	X-109-20-M16-2-775Z	

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
 Switched Reset-Logic: Zero adjustment at < 3 V or > 12 V

Strain sensor X-103

93 x 25 x 13-14 mm, 4x M6,
Up to 360 µm/m



Specifications

Performance

Measuring range	0...50 µm/m 0...250 µm/m 0...360 µm/m
Resolution	1/5000
Linearity	< 0,3 % from full-scale
Hysteresis	< 0,3 % from full-scale
Repeatability of reinstallation	Typ. 1 %, max 2 %
Cut-off frequency	1,5 kHz (-3dB)

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 (Reset A + Reset B)

Measurement mode	12...24 V
Zero reset / adjustment	< 3 V
Minimal pulse duration	10 ms
Adjustment of zero point	200 % from full-scale

Materials

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

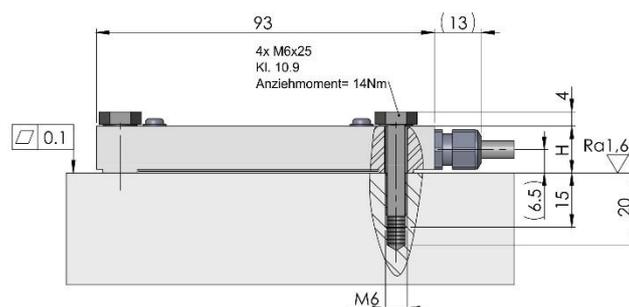
Mechanical data

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

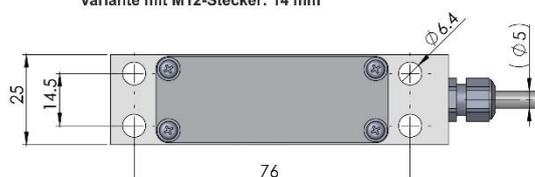
Environmental data

Ambient temperature	-10...65 °C
EMV standards	IEC 61000-4-5, Performance A
Shock and vibration	EN60068-2-6/27
Protection rate	IP 64

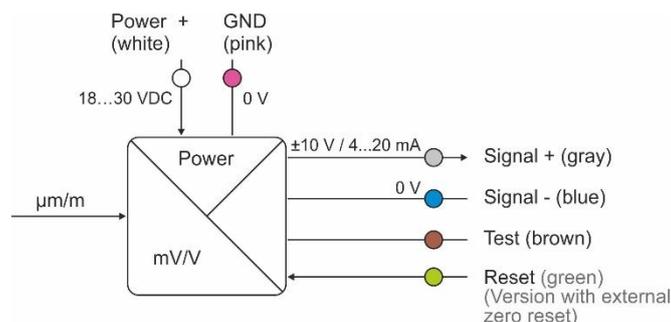
Mechanical dimensions



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



Block diagram



Wiring

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

Ordering code

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 360 µm/m



Specifications

Performance

Measuring range	0...50 µm/m 0...250 µm/m 0...360 µm/m
Resolution	1/5000
Linearity	< 0,3 % from full-scale
Hysteresis	< 0,3 % from full-scale
Repeatability of reinstallation	Typ. 1 %, max 2 %
Cut-off frequency	1,5 kHz (-3dB)

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 (Reset A + Reset B)

Measurement mode	12...24 V
Zero reset / adjustment	< 3 V
Minimal pulse duration	10 ms
Adjustment of zero point	200 % from full-scale

Materials

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

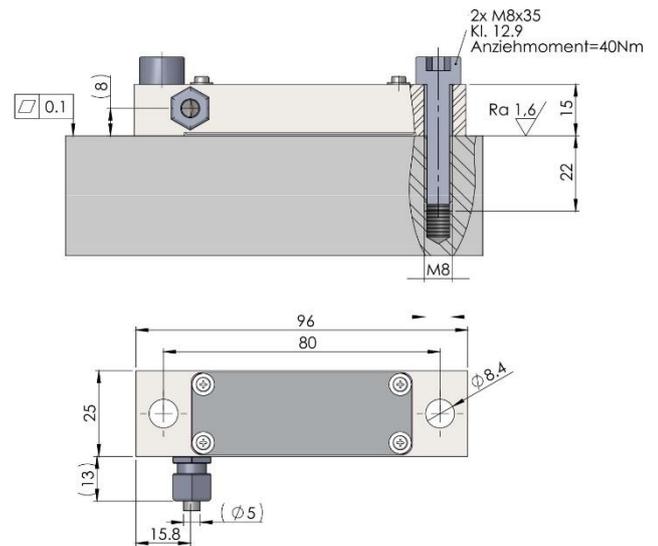
Mechanical data

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

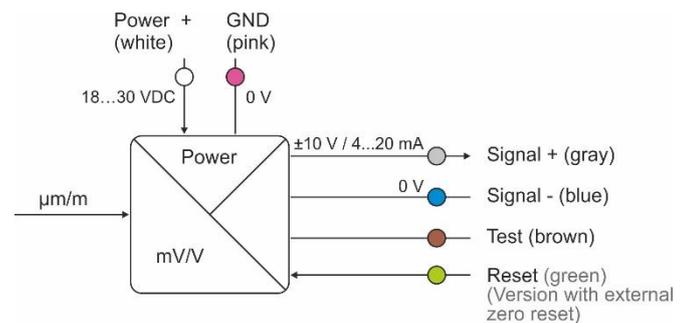
Environmental data

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

Mechanical dimensions



Block diagram



Wiring

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

Ordering code

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 440 µm/m



Specifications

Performance

Measuring range	0...250 µm/m 0...440 µm/m
Resolution	1/5000
Linearity	< 0,5 % from full-scale
Hysteresis	< 0,5 % from full-scale
Repeatability of reinstallation	Typ. 1 %, max 2 %
Cut-off frequency	1,5 kHz (-3dB)

Electrical data

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

External zero reset (Reset A + Reset B)

Measurement mode	12...24 V
Zero reset / adjustment	< 3 V
Minimal pulse duration	10 ms
Adjustment of zero point	200 % from full-scale

Materials

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

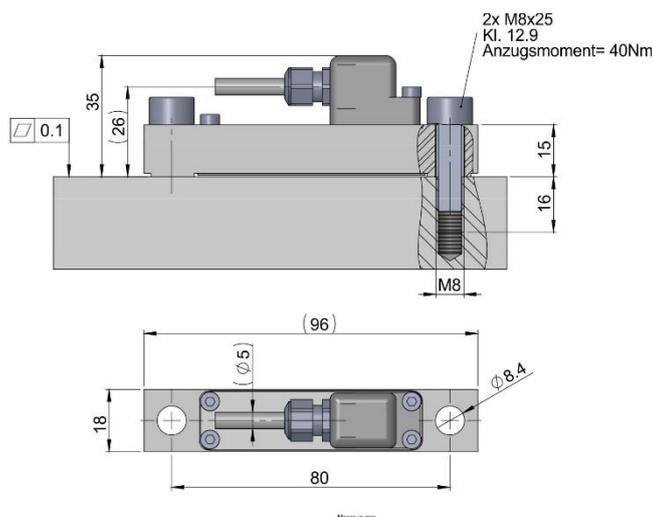
Mechanical data

Life endurance alternating 90 % load	10 ⁸ cycles
Electrical connection	Connection cable
Cable length	1.0 m
Connector-type	Open leads, connector plug on request

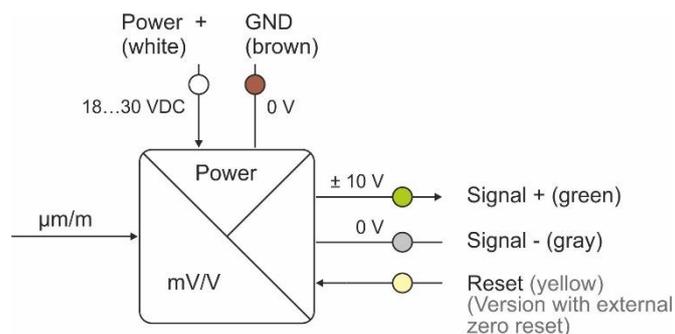
Environmental data

Ambient temperature	-10...65 °C
EMV standards	IEC 61000-4-5
Protection rate	IP 67

Mechanical dimensions



Block diagram



Wiring

Wire colour (DIN 47 100)	X-113-H07-1	X-113-H07-2
White	Power +	Power +
Brown	Power 0V	Power 0V
Green	Signal +	Signal +
Yellow	NC	Reset
Grey	Signal 0V	Signal 0V

Ordering code

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 %
Cut-off frequency	2 kHz (-3dB)

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

External zero reset (Reset A + Reset B)

Measurement mode	12...24 V
Zero reset / adjustment	< 3 V
Minimal pulse duration	10 ms
Adjustment of zero point	200 % from full-scale

Materials

Housing	Steel (10.7 ppm / °C)
----------------	-----------------------

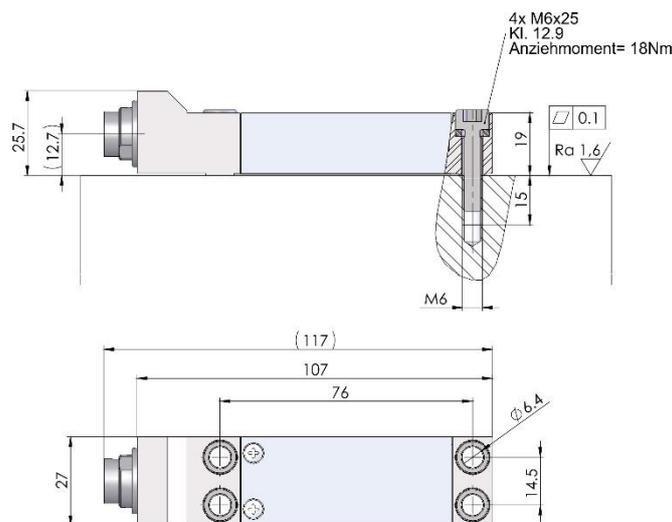
Mechanical data

Overload	130 % from full-scale
Life endurance alternating 100 % load	10 ⁸ cycles
Electrical connection	Electrical plug
Connector-type	M16, 8 pol. male, DIN45326

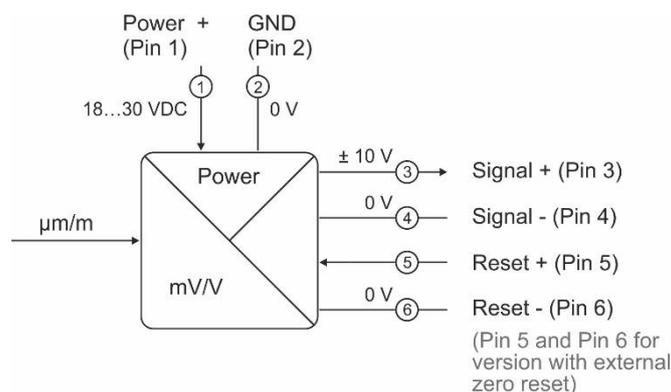
Environmental data

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

Mechanical dimensions



Block diagram



Wiring

Pin assignment	X-109-SK11	X-109-SK12
PIN 1	Power +	Power +
PIN 2	Power 0V	Power 0V
PIN 3	Signal +	Signal +
PIN 4	Signal 0V	Signal 0V
PIN 5	NC	Reset +
PIN 6	NC	Reset 0V

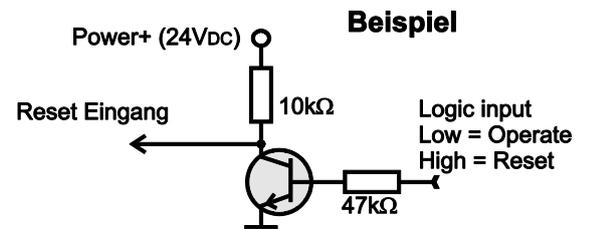
Ordering code

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

Zero reset / adjustment

Digital input for automatic zero-point adjustments:

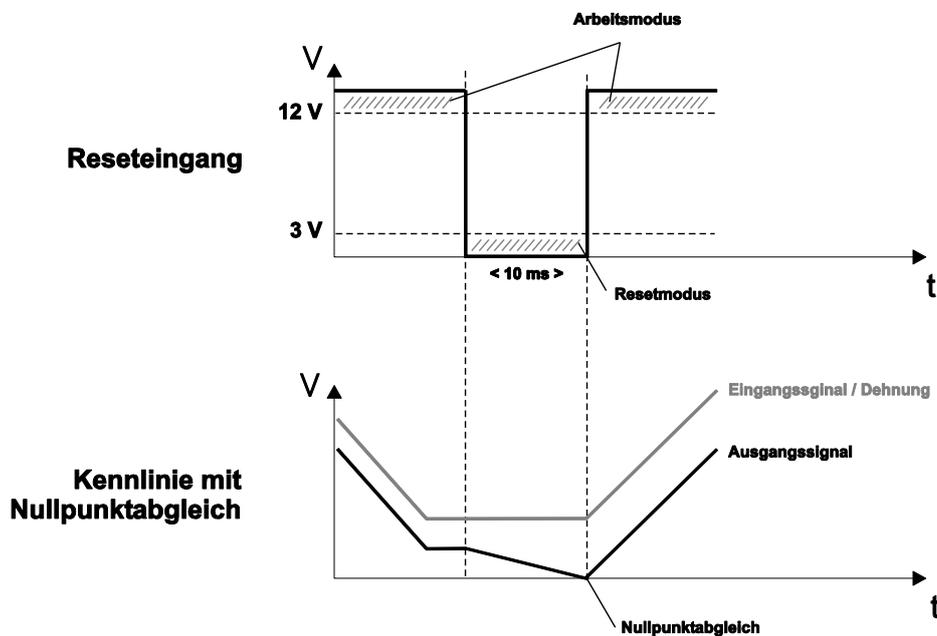
The reset input has an internal pull-up resistor. Hence an open reset input forces the sensor in measurement mode (Operate). To set the output to zero (Reset) the reset input must be tied to 0V.



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

External zero-point adjustment	
Measuring mode	> 12 V
Zero point adjustment	< 3 V
Minimum pulse time	10 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 10.9	Tightening torque at strength class 12.9
X-103	4x M6	14 Nm	18 Nm
X-113	2x M8	32 Nm	40 Nm
X-113-H07	2x M8	32 Nm	40 Nm
X-109	4x M6	14 Nm	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 $\mu\text{m}/\text{m}$ corresponds to a measuring error of only 1.25 $\mu\text{m}/\text{m}$.

2. Repeatability of reinstallation

The force closure between strain sensor and the structure it is applied to does vary slightly from installation to installation. As a consequence, the zero point and span is minimally moving from 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.