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

Models

X-103-8

Flat dimensions with four mounting screws

93 x 25 x 19.1 mm, 4x M6,
0…50 µm/m
0…250 µm/m
0…360 µm/m

→0← Process-Zero Cyclic

X-113-8

Easy mounting with two screws

96 x 25 x 20.3 mm, 2x M8,
0…50 µm/m
0…250 µm/m
0…360 µm/m

Ⓐ 4...20 mA
0...20 mA

X-109-8

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

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

Ⓥ ± 10 V

Features

• Analogue signal path with fast response time
• For dynamic applications with external input for automatic zero point adjustments, qualified for periodical and recurring zero point adjustment
• Zero point adjustment is not stored after power-off
• 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.

The strain sensors can be used for the following applications:

- Indirect force measurement by detecting smallest strains allows efficient control of relevant process parameters (e.g., presses, assembly machines, welding machines, jigs, feed force)
- Limit value monitoring to avoid overloads
- Monitoring and documentation of process forces for increased process reliability (eg joining forces, assembly machines, pressing force, detection of tool breakage and wear)

The zero point adjustment at these strain sensors is carried out by a digital zero adjustment mechanism. The zero point adjustment is not stored permanently, it is lost after a power off. It provides a non-volatile, stable zero point independent of cycle times. Therefore, it is qualified for all dynamic applications and can be used in all kind applications which require a periodical zero point reset, triggered by a digital input.

Ordering code

Description	Measuring range	Connection	Specification
X-103	0…50 µm/m	M12	Page 3
	0…250 µm/m	M12	
	0…360 µm/m	M12	
X-103	0…50 µm/m	Cable	Page 3
	0…250 µm/m	Cable	
	0…360 µm/m	Cable	
X-113	0…50 µm/m	M12	Page 4
	0…250 µm/m	M12	
	0…360 µm/m	M12	
X-113	0…50 µm/m	Cable	Page 4
	0…250 µm/m	Cable	
	0…360 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-103-8

93 x 25 x 19.1 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	700 Hz (-3dB)

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

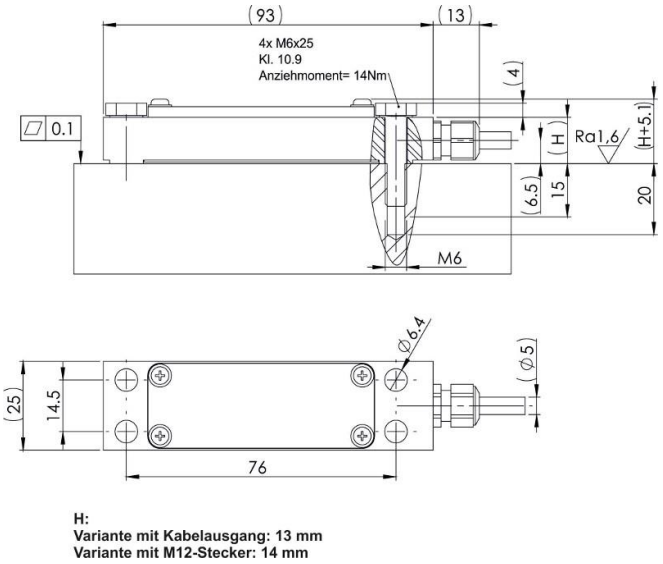
External zero reset	
Measurement mode	< 3 V or open
Zero reset / adjustment	> 10 V
Minimal pulse duration	210 ms
Adjustment of zero point	200 % from full-scale
Max numbers of tarings	Unlimited

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

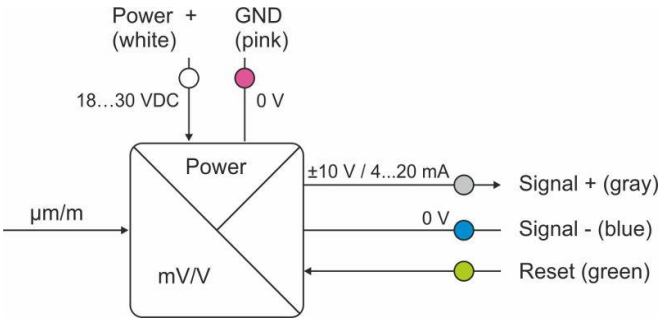
Environmental data	
Ambient temperature	-10…65 °C
EMV standards	IEC 61000-4-5, Performance A
Shock and vibration	EN60068-1-6/27
Protection rate	IP 64

Mechanical dimensions



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

Block diagram



Wiring

Wire colour (DIN 47 100)	X-103-8
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 code

This strain sensor is delivered without mounting screws.

For detailed ordering information, please see page 2.

Strain sensor X-113-8

96 x 25 x 20.3 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	700 Hz (-3dB)

Electrical data	
Power supply	18…30 VDC, < 40 mA
Output signal at full scale	± 10 V / 4-20 mA
Output signal at overload	± 11.5 V / 1.5-23.5 mA

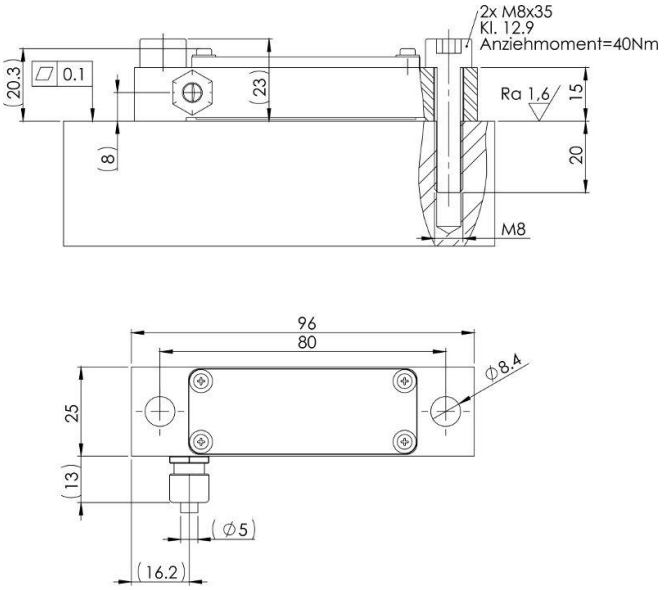
External zero reset	
Measurement mode	< 3 V or open
Zero reset / adjustment	> 10 V
Minimal pulse duration	210 ms
Adjustment of zero point	200 % from full-scale
Max numbers of tarings	Unlimited

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

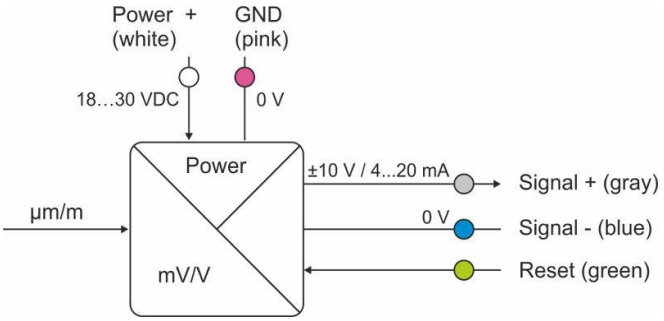
Mechanical data	
Life endurance alternating 90 % load	10^8 cycles
Electrical connection	Cable with open leads, 1.0 m M12 plug, 5 pole, male

Environmental data	
Ambient temperature	-10…65 °C
EMV standards	IEC 801/2
Protection rate	IP 64

Mechanical dimensions



Block diagram



Wiring

Wire colour (DIN 47 100)	X-113-8
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 code

This strain sensor is delivered without mounting screws.

For detailed ordering information, please see page 2.

Strain sensor X-109-8

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 %
Cut-off frequency	700 Hz (-3dB)

Electrical data	
Power supply	18…30 VDC, < 40 mA
Output signal at full scale	± 10 V / 4-20 mA
Output signal at overload	± 11.5 V / 1.5-23.5 mA

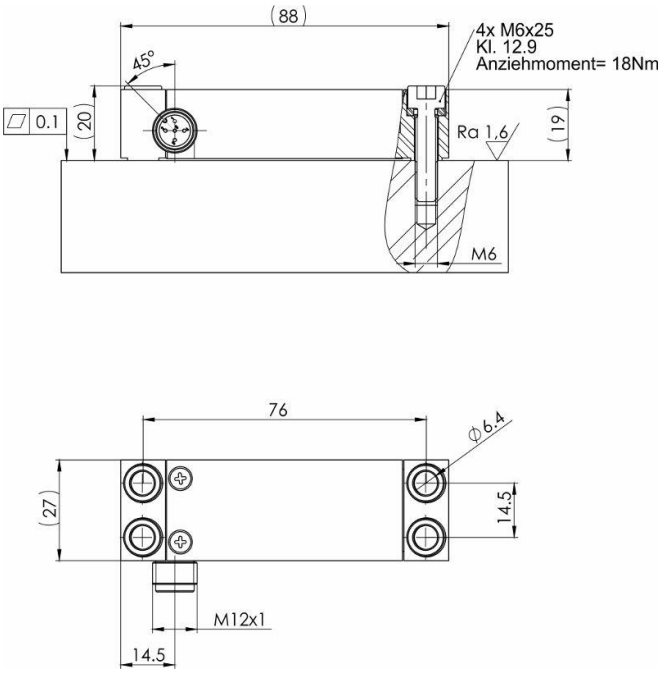
External zero reset	
Measurement mode	< 3 V or open
Zero reset / adjustment	> 10 V
Minimal pulse duration	210 ms
Adjustment of zero point	200 % from full-scale
Max numbers of tarings	Unlimited

Materials	
Housing	Steel (10.7 ppm / °C)

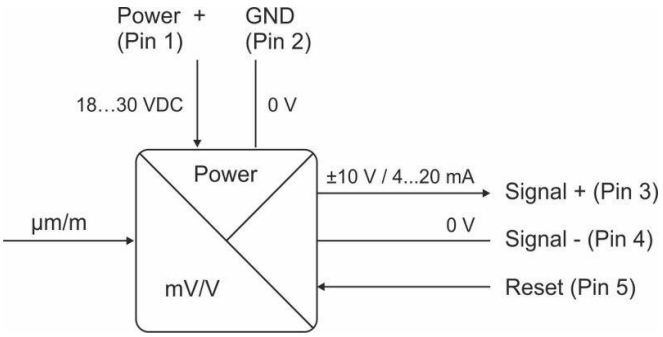
Mechanical data	
Overload	130 % from full-scale
Life endurance alternating 100 % load	10^8 cycles
Connector-type	M12 plug, 5 pol. male

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-109-8
PIN 1	Power +
PIN 2	Power 0V
PIN 3	Signal +
PIN 4	Signal 0V
PIN 5	Reset

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

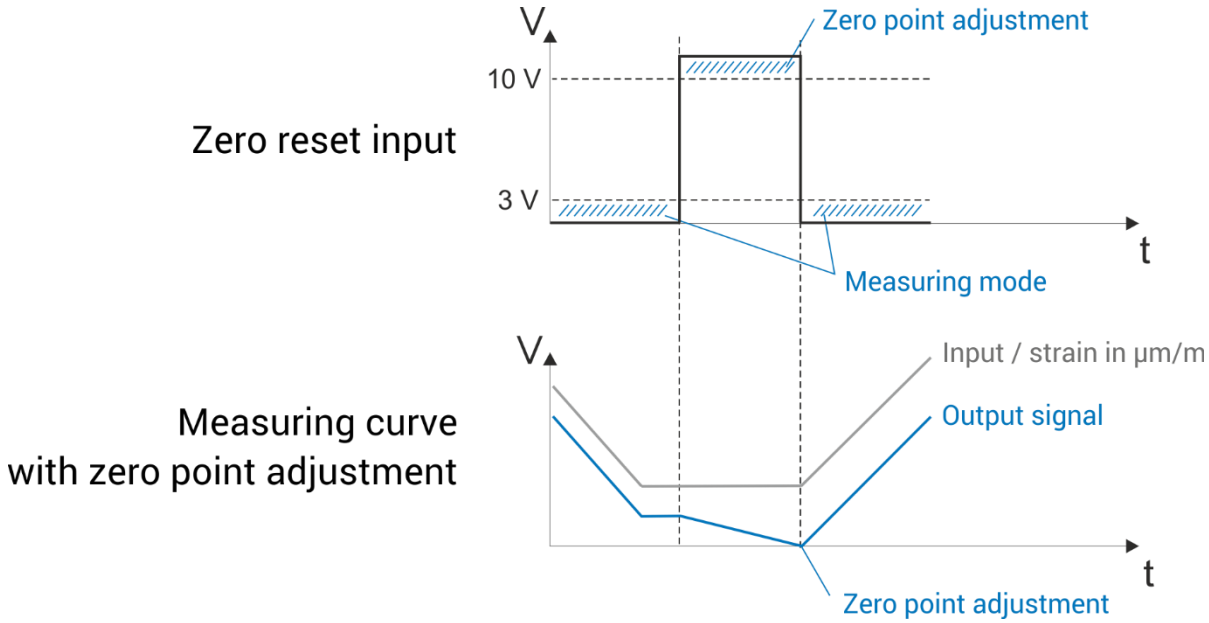
The zero point adjustment at these strain sensors is carried out by a digital zero adjustment mechanism. The zero point adjustment is not stored permanently, it is lost after a power off. It provides a non-volatile, stable zero point independent of cycle times. Therefore, it is qualified for all dynamic applications and can be used in all kind applications which require a periodical zero point reset, triggered by a digital input.

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

The following parameters 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	10 ms	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-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 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.