

Signal-amplifier for resistive force and strain sensors – Dynamic applications

Models

X-201-04

Strain gauge amplifier with 4...20 mA and 0...10 V output, with PLC input for zero reset



DIN-rail mounting
X-201-KA04



Aluminium field housing
X-201-IP04

Features

- PLC input for cyclical zero point adjustment
- High measuring speed of up to 5000 Hz
- Sensitivity from 0,5 mV/V up to 4 mV/V for the connection of strain gauge sensors
- Featuring both voltage and current output simultaneous
- The bridge excitation can be selected between 5 V or 10 V

Application

The X-201 is designed to amplify low-level signals from force and strain-sensors basing on the strain-gauge technique. It is considered for signal conditioning and interfacing to PLC's or any control-unit with analogue inputs.

The X-201 has a PLC input for process controlled zero reset. This way of zero nulling is very effective in applications with a cyclical signal, where the force is at a certain moment zero. If the X-201 is nulled in this very moment, all drifts and zero-offset are tared and therefore completely suppressed. This way of nulling can be used in dynamic applications like stamping machines, injection- and die casting machines.

The amplifier is available for DIN-rail mounting and in a robust aluminium field housing.

Ordering code

Ordering code	Measuring range	Output signal	Description	Specification
X-201-KA04 (Nr. 12.0201.0094.00)	0,5...4 mV/V	0...10 V 4...20 mA	DIN-rail mounting	Page 3
X-201-IP04 (Nr. 12.2010.0482.00)	0,5...4 mV/V	0...10 V 4...20 mA	Aluminium field housing	Page 4

Options:

- 6-wire measuring bridge: KA06
- Preconfigured factory settings (specific sensitivity)
- Calibrated measuring chain (amplifier and sensor)

Ordering code

Ordering code	Function	Description
X-912-0	Junction box	Connection of 2 strain gauge sensor to 1 amplifier
X-913-0	Junction box	Connection of 3 strain gauge sensor to 1 amplifier
X-914-0	Junction box	Connection of 4 strain gauge sensor to 1 amplifier
Cable socket M16 Male – 6-pole	Electrical connection	Sensor connection to amplifier with aluminium field housing (Amphenol C091A T 3400 001, Binder 09-0321-09-06, Lumberg KV60)
Cable socket M16 Female – 8-pole	Electrical connection	Connection of PLC to aluminium field housing (Amphenol C091A T 3505 001, Binder 09-0572-00-08, Lumberg SV81)
Connection cable 8-wires	Electrical connection	Connection of PLC to amplifier with DIN-rail mounting
Cable socket M12 Male – 4-pole	Electrical connection	Connection of sensor to junction box

Fitting sensors

Type	Ordering code	Output signal	Description
Strain sensor	X-103-D05	+ 2 mV/V	Strain sensors for strain up to 0...1000 µm/m
Strain sensor	X-103-D15	+ 1.5 mV/V	Strain sensors for strain up to 0...250 µm/m
Strain sensor	X-103-D30	+ 3 mV/V	Strain sensors for strain up to 0...250 µm/m with very high sensitivity
Force sensor	All force sensors without integrated amplifier (mV/V output) from X-Sensors		

X-201-KA04 for DIN-rail mounting

Amplifier with analogue path and external zero point adjustment, 0,5...4 mV/V



Specifications

Performance

Factory default sensitivity	1 mV/V
Range of sensitivity	0,5...1,5 / 1,5...4,0 mV/V
Linearity	< 0,05 % from full-scale
Zero drift over temperature range	< 0,01 % / °C
Cut-off frequency	0...5 kHz (-3dB)
Signal path	Analogue

Electrical data

Power supply	18...28 VDC, <70mA
Output signal at full scale	0...±10 V @ Rload 3 kΩ
Voltage output	0/4...20 mA @ Rload 0...800 Ω
Current output	
Ripple voltage	Max. 1 Vpp / 50 Hz
Noise	Max. 20 mVpp (0...5kHz)
DMS resistance of sensor input	5 V: 120 Ω...10 kΩ 10 V: 330 Ω...10 kΩ

Zero point adjustment

Initial configuration by DIP switches	-75%... +75%, in 5 ranges
Cyclical zero point adjustment by digital input for PLC	> 10 V, please see page 5 for detailed information

External zero reset (Reset A + Reset B)

Measurement mode	< 8 V
Zero reset / adjustment	> 10 V
Minimal pulse duration	10 ms
Max cycles time	> 3 Min

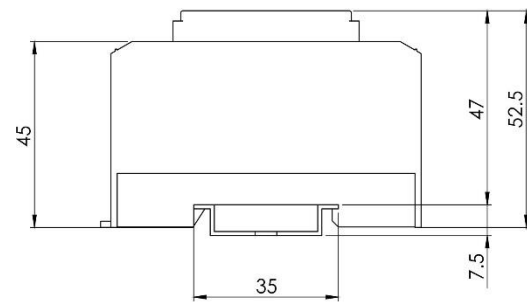
Mechanical data

Material	Polycarbonate fiber reinforced, UL 94 V0
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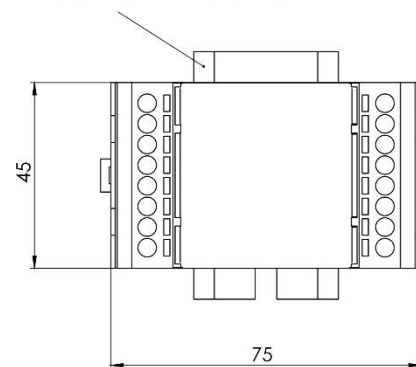
Environmental data

Ambient temperature	-20...+60 °C
EMV standards	EN 61000-4
Protection rate	IP 52

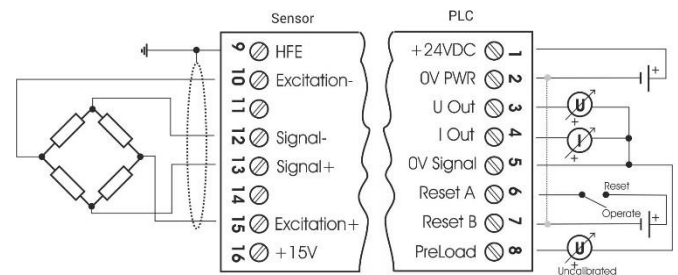
Mechanical dimensions



DIN-rail DIN EN 60715



Pin assignment



Ordering code

X-201-□□□□

KA04 DIN-rail mounting
IP04 Aluminium field housing

Options:

- Input for 6-wire DMS
- Preconfigured settings
- Calibrated measuring chain (amplifier and sensor)

X-201-IP04 aluminium field housing

Amplifier with analogue path and external zero point adjustment, 0,5...4 mV/V



Specifications

Performance

Ordering information	1 mV/V
Models	0,5...1,5 / 1,5...4,0 mV/V
Linearity	< 0,05 % from full-scale
Zero drift over temperature range	< 0,01 % / °C
Cut-off frequency	0...5 kHz (-3dB)
Signal path	Analogue

Electrical data

Power supply	18...28 VDC, <70mA
Output signal at full scale	0...±10 V @ Rload 3 kΩ
Voltage output	
Current output	0/4...20 mA @ Rload 0...800 Ω
Ripple voltage	Max. 1 Vpp / 50 Hz
Noise	Max. 20 mVpp (0...5kHz)
DMS resistance of sensor input	5 V: 120 Ω...10 kΩ 10 V: 330 Ω...10 kΩ

Zero point adjustment

Initial configuration by DIP switches	-75%... +75%, in 5 ranges
Cyclical zero point adjustment by digital input for PLC	> 10 V, please see page 5 for detailed information

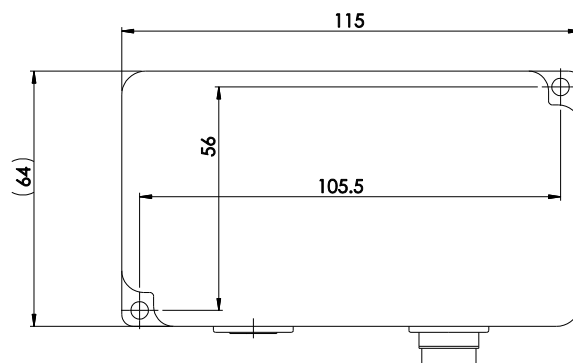
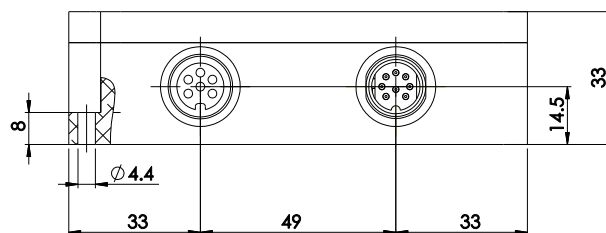
Mechanical data

Material	Optional temperature coefficient for aluminium compensation
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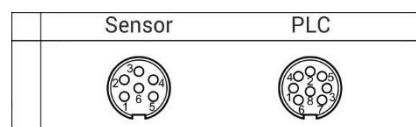
Environmental data

Ambient temperature	-20...+60 °C
EMV standards	EN 61000-4
Protection rate	IP 65

Mechanical dimensions



Pin assignment



- | | |
|-----------------|-----------------------|
| 1: Excitation + | 1: Supply +24VDC |
| 2: - | 2: Preload |
| 3: - | 3: Reset A (GND) |
| 4: Signal - | 4: Reset B (+ Supply) |
| 5: Signal + | 5: Signal Vout+ |
| 6: Excitation- | 6: Supply 0V |
| | 7: Signal 0V |
| | 8: Signal Iout+ |

Ordering code

X-201-□□□□

KA04

IP04

DIN-rail mounting

Aluminium field housing

Options:

- Input for 6-wire DMS
- Preconfigured settings
- Calibrated measuring chain (amplifier and sensor)

Zero point adjustment with digital input for PLC

The X-201 has a PLC input for automatic zero point adjustment (reset). The internal nulling circuit forces the output to zero, as long as a voltage is present at the digital inputs Reset A, Reset B (high-active). If a load is present before nulling, it will be suppressed. By switching the voltage at the Reset input to zero, the X-201 will change to "operate" mode. The output will show the signal relative to its internal zero (relative measurement).

The nulling circuit consists of a storage capacitor. This capacitor shows a small drift over time. This error can be reduced nearly to zero, by nulling the amplifier within a short period of time (for example every 30 seconds). This way of nulling is very effective in applications with a cyclical signal, where the force is at a certain moment really zero. If the X-201 is nulled in this very moment, all drifts and zero-offset are tared and therefore completely suppressed.

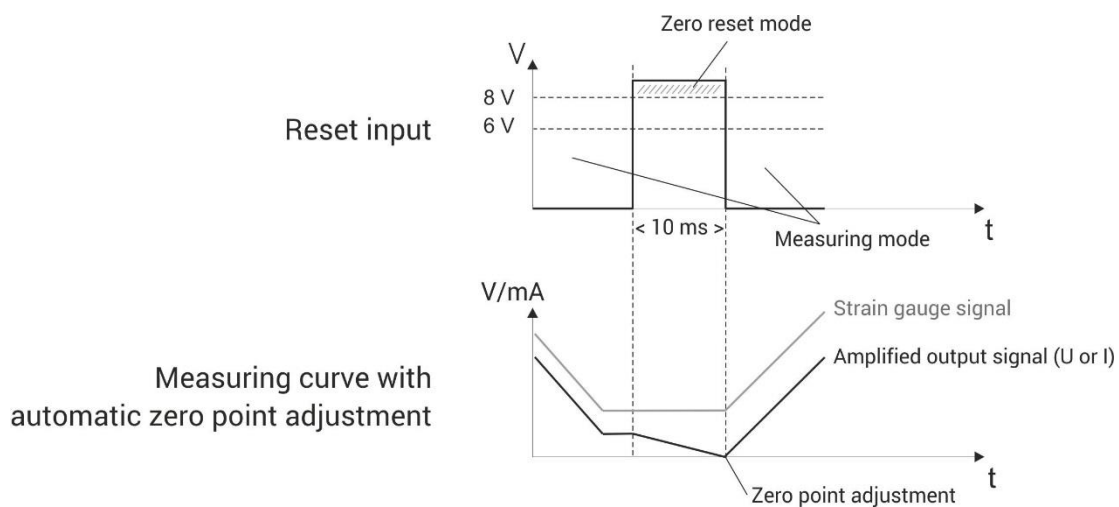
This way of nulling can be used in stamping machines, injection- and die casting machines.

Hint: The digital inputs (Reset A, B) are galvanically separated. Both inputs must be connected to its potential.

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

External zero-point adjustment	
Measuring mode	< 8 V
Zero point adjustment	> 10 V
Minimum pulse time	10 ms

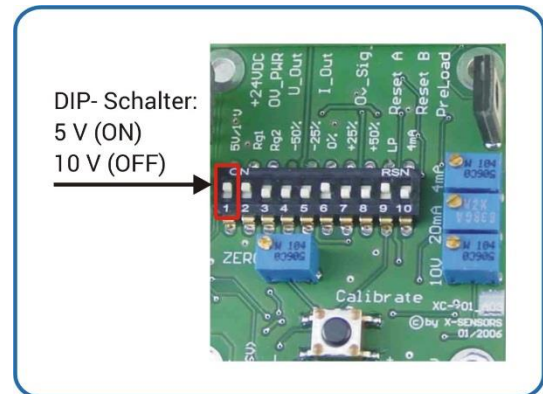
The following graph describes the characteristic during the zero point adjustment:



Excitation

The bridge excitation can be selected between 5 V or 10 V. As a general rule, low impedance sensors should be driven with 5V whereas high impedance sensors can be operated with 10V. If you're in doubt, select the lower excitation voltage.

Bridge excitation		
DIP-Switch	Voltage	Bridge resistance
SW 1 ON	5 V DC	120...10 k Ω
SW 1 OFF	10 V DC	350...10 k Ω

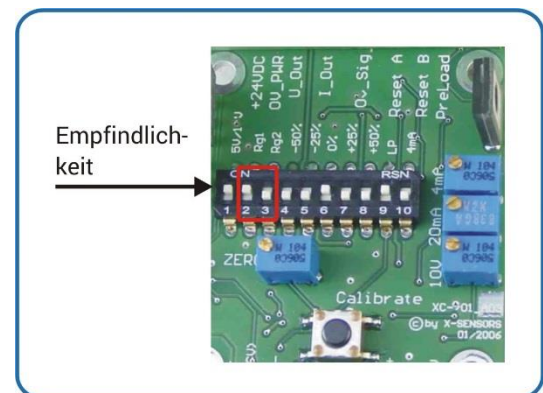


Factory default setting

The default input sensitivity of the X-201 is adjusted to 1mV/V in conjunction with a bridge excitation of 5 V. To adapt the X-201 to other signals you can easily select other ranges with the DIP-switch or adjust the calibration with the potentiometer in large ranges. Please note, that you will lose factory calibration by doing so. Therefore only qualified personal should recalibrate the X-201 with adequate tools.

The following ranges can be selected with the DIP-switches:

Input sensitivity selection with DIP-switches	
DIP-Switch	Sensitivity
SW 2 ON	1,00 ... 2,50 mV/V @ 5V 0,50 ... 1,25 mV/V @ 10V
SW 3 ON	1,75 ... 4,00mV/V @ 5V

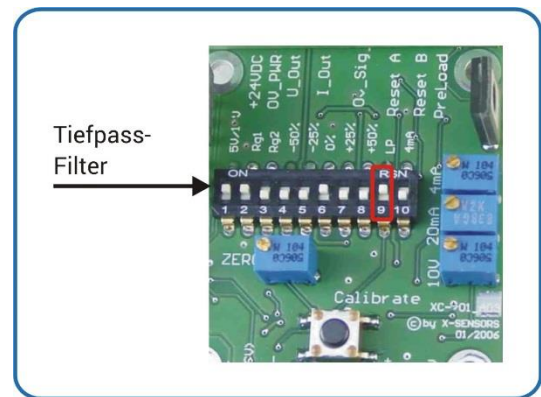


Frequency

The onboard low-pass filter is switched on and off by toggling the appropriate DIP-Switch. It is recommended to reduce the bandwidth, because this eliminates high frequency noise and gives more stability to the readings. If your application needs more speed, you can switch off the low-pass filter in order to achieve a bandwidth up to 5'000Hz.

Frequency selection with DIP-switches

DIP-Switch	Frequency
SW 9 ON	f_c : 500 Hz
SW 9 OFF	f_c : 5000 Hz

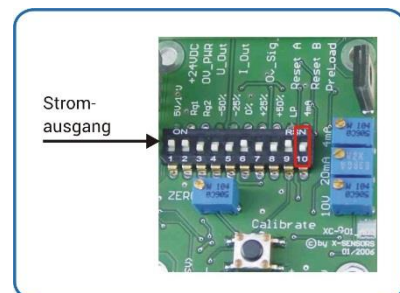


Parametrization output signal

The current output can be switched between 4...20 mA and 0...20 mA.

Configuration current output with DIP-switches

DIP-Switch	Current output
SW 10 ON	4...20 mA (life zero)
SW 10 OFF	0...20 mA



Output signal

The X-201 offers two calibrated outputs at once, a voltage output and a current output. The relation between these two outputs is strictly proportional, in other words, if the voltage output is forced to 100%, the current output will also go to 100%.

Definition: $U_{out} 0...10\text{ V} = I_{out} 0...20\text{ mA}$ (or 4...20 mA)

The explanations for adjusting "gain" by using the calibrate-button are therefore also valid for the current output. Nevertheless, it is highly recommended to calibrate the X-201 always by taking the voltage output as reference.