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

Models

X-201-03

Strain gauge amplifier with 4…20 mA and 0…10 V output

DIN-rail mounting
X-201-KA03

Aluminium field housing
X-201-IP03

Features

- Large adjustment of zero for preload
- Ranges of sensitivity from 0.5 mV/V up to 4.0 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.

Thanks to the integrated DIP-switches and potentiometer, the amplifier can be easily configured to the desired input range and zero offset. The X-201 is optimized for static-measurement, like stress analysis and weighing applications. Very often, the user wants an exact proportional signal without any offset or zero-errors. Therefore, the zero of the whole measuring chain has to be adjusted after installation. If the zero error is within a few percent, one can adjust this error very easily by using the zero potentiometer. However, if the zero-offset is larger, the DIP-switches do preselect the adjusting range roughly. By doing so, also large preloads or packaging weights can be suppressed.

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-KA03 (Nr. 12.0201.0093.00)	0.5...4.0 mV/V	0...10 V 4...20 mA	DIN-rail mounting	Page 3
X-201-IP03 (Nr. 12.2010.0481.00)	0.5...4.0 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)

Fitting sensors

Type	Ordering code	Output signal	Description
Strain sensor	X-103-S05	+ 2 mV/V	Strain sensors for strains up to 0...1000 µm/m
Strain sensor	X-103-S10	+ 1.0 mV/V	Strain sensors with M12 plug
Strain sensor	X-103-S15	+ 1.5 mV/V	Strain sensors for strains up to 0...250 µm/m
Strain sensor	X-103-S30	+ 3 mV/V	Strain sensors for strains 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-KA03 for DIN-rail mounting

Amplifier with analogue path and large adjustment of zero point 0.5…4.0 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

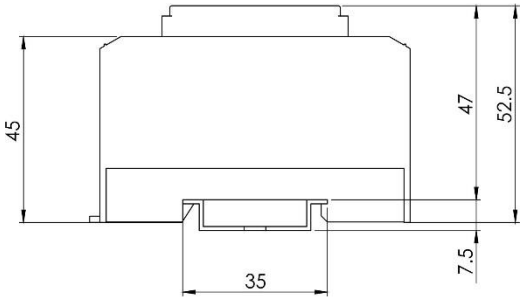
Electrical data	
Power supply	18…28 VDC, <70mA
Output signal at full scale	
Voltage output	0…±10 V @ Rload 3 kΩ
Current output	0/4…20 mA @ Rload 0…800 Ω
Ripple voltage	Max. 1 Vpp / 50 Hz
Noise	Max. 20 mVpp (0…5kHz)
DMS resistance of sensor input	5 V: 120 Ω…10 kΩ 10 V: 330 Ω…10 kΩ

Zero point adjustment	
Adjustment range	
Coarse configuration by DIP switches	-75%... +75%, in 5 ranges
Fine-Tuning	10-turn potentiometer
Max. adjustment	±10 mV

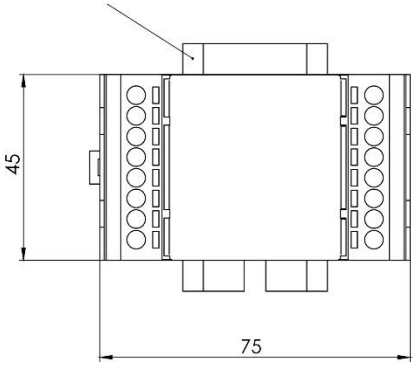
Mechanical data	
Material	Polycarbonate fiber reinforced, UL 94 V0

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

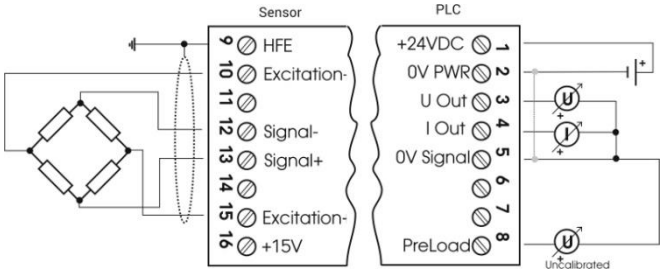
Mechanical dimensions



DIN-rail DIN EN 60715



Pin assignment



Ordering code

For detailed ordering information, please see page 2.

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

X-201-IP03 aluminium field housing

Amplifier with analogue path and large adjustment of zero point 0.5…4.0 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

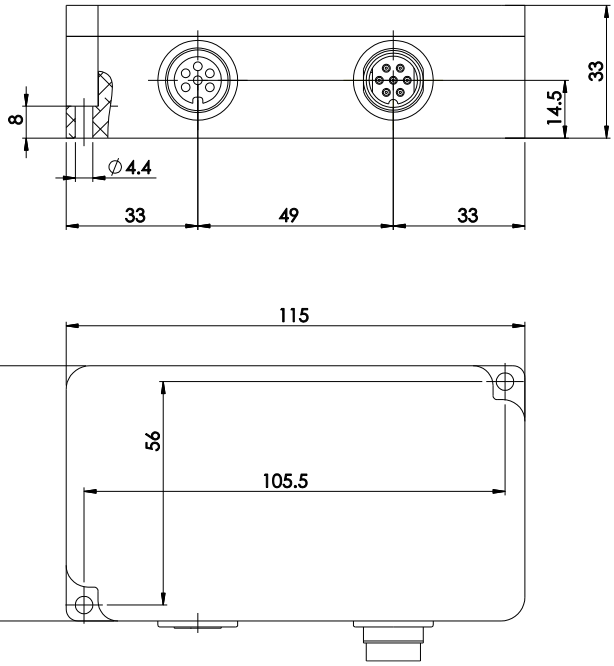
Electrical data	
Power supply	18…28 VDC, <70mA
Output signal at full scale	
Voltage output	0…±10 V @ Rload 3 kΩ
Current output	0/4…20 mA @ Rload 0…800 Ω
Ripple voltage	Max. 1 Vpp / 50 Hz
Noise	Max. 20 mVpp (0...5kHz)
DMS resistance of sensor input	5 V: 120 Ω…10 kΩ 10 V: 330 Ω…10 kΩ

Zero point adjustment	
Adjustment range	
Coarse configuration by DIP switches	-75%... +75%, in 5 ranges
Fine-Tuning	10-turn potentiometer
Max. adjustment	±10 mV

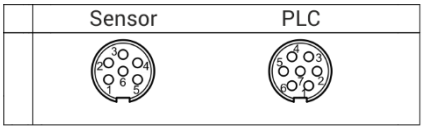
Mechanical data	
Material	Aluminium
Electrical connection sensor	M16 plug, 6 pole, female
Electrical connection PLC	M16 plug, 7 pole, male

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

Mechanical dimensions



Pin assignment



Sensor	PLC
1: Excitation +	1: Supply +24VDC
2: -	2: -
3: -	3: -
4: Signal +	4: Signal Iout+
5: Signal -	5: Signal Vout+
6: Excitation-	6: Supply 0V
	7: Signal 0V

Supply 0V, Signal 0V and E- are internally connected.

Ordering code

For detailed ordering information, please see page 2.

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

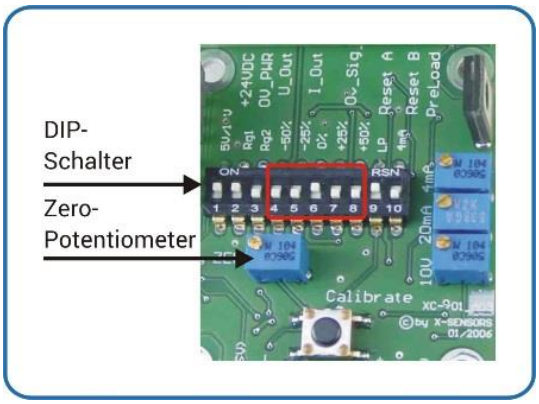
Zero point adjustment

The X-201 is optimized for static-measurement, like force measuring and weighing applications. Very often, the user wants an exact proportional signal without any offset or zero-errors. Therefore, the zero of the whole measuring chain has to be adjusted after installation.

If the zero error is within a few percent, one can adjust this error very easily by using the zero potentiometer. However, if the zero-offset is larger, the DIP-switches do preselect the adjusting range roughly. By doing so, also large errors, preloads or packaging weights can be suppressed.

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

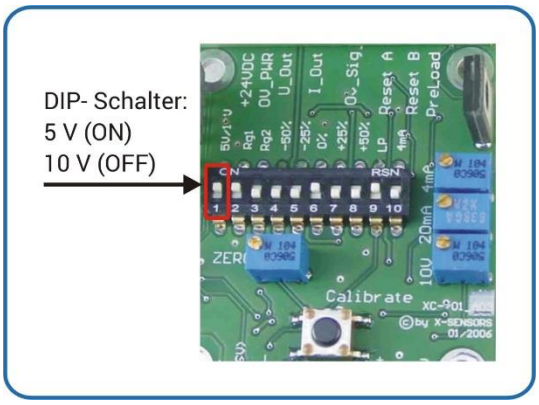
Range selection with DIP-switches		
DIP-Switch	**Bottom**	**Top**
SW 4 ON	-75 %	-35 %
SW 5 ON	-50 %	-10 %
SW 6 ON	-20 %	+20 %
SW 7 ON	+10 %	+50 %
SW 8 ON	+35 %	+75 %



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 kΩ
SW 1 OFF	10 V DC	350...10 kΩ

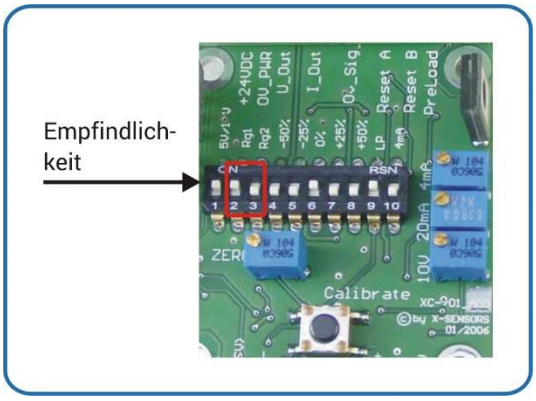


Factory default setting of sensor sensitivity

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.

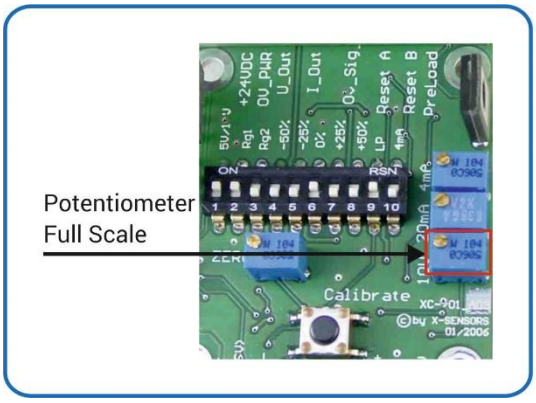
The following values can be selected with the DIP-switches:

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



The fine adjustment of the full scale can be made with a potentiometer. For this purpose, compare the full scale value simulated by means of a strain gauge simulator. By turning the potentiometer, you can set the full scale value to the desired value.

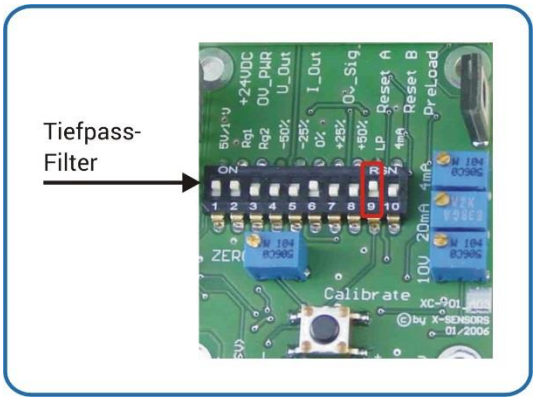
Please note that only the 10 V potentiometer is allowed to be turned. It will change the senitivity of both output signals. The adjustment of the full scale value will cause the factory calibration to be lost.



Frequency

The onboard low-pass filter is switched on and off by toggling the appropiate DIP-Switch. It is recommended to reduce the bandwith, 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 achive a bandwith up to 5'000Hz.

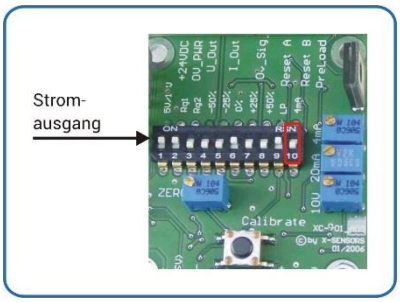
Frequency selection with DIP-switches	
DIP-Switch	**Frequency**
SW 9 ON	fc : 500 Hz
SW 9 OFF	fc : 5000 Hz



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



Adjustment measuring range

As a special feature the X-201 contains a calibration button for quick and easy calibration. By pressing the "calibrate" button, the X-201 creates an internal signal of 1mV/V to the input.

The calibration procedure is like that:

1. Calculate the sensorsignal in mV/V for a 10 V output span
2. Connect the sensor to the X-201
3. Adjust the output to 0.00 V
4. Press the calibrate button
5. Adjust the voltage-output according to the following formula: $Uout = \frac{10\ \text{V x 1 (mV/V)}}{Sensor\ output\ (mV/V)}$

Example: A 5kN force-sensor should measure a force of 3,5kN, whereas this sensor is specified with 2,00mV/V at 5kN. Therefore, the sensors output will be 1,40mV/V at 3,5kN. According to the formula above the output has to be adjusted to 7,143 volts, when the calibration button is pressed. After this, the X-201 will deliver 10,00 V (or 20 mA) at the outputs, when the sensor is loaded with 3,5kN.

The voltage output can handle bipolar signals and will therefore also deliver -10 V. In our example you can also measure negative forces, as long as the sensor itself is designed to do so.

Output signal

The X-201 offers two calibrated outputs at once, a voltage ouput 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: Uout 0…10 V = Iout 0…20 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.