Operating Manual EMGZ308

Analog Tension Measuring Amplifier

Version 2.03 04/08 st

This operation manual is also available in German.
Please contact your local representative.

Diese Bedienungsanleitung ist auch in Deutsch erhältlich.
Bitte kontaktieren Sie die Vertretung im zuständigen Land.

1 Safety Instructions

1.1 Description conditions

a) High danger of health injury or loss of life

Danger

This symbol refers to high risk for persons to get health injury or loss life. It has to be followed strictly.

b) Risk of damage of machines

Caution

This symbol refers to informations, that, if ignored, could cause heavy mecanical damage. This warning has to be followed absolutely.

c) Notice for proper function

Notice

This symbol refers to an important information about proper use. If not followed, malfunction can be the result.

1.2 List of safety instructions

- Proper function of the Tension Measuring Amplifier is only guaranteed with the recommended application of the components. In case of other arrangement, heavy malfunction can be the result. Therefore, the installation instructions on the following pages must be followed strictly.
- Local installation regulations are to preserve safety of electric equipment. They are not taken into consideration by this operating manual. However, they have to be followed strictly.
- Improper handling may damage the fragile electronic equipment! Don’t touch the electronic unit! Don’t use rough tools as screwdrivers or pliers! Touch earthed metal part to discharge static electricity before touching the electronic unit!
- Bad earth connection may cause electric shock to persons, malfunction of the total system or damage of the electronic unit! It is vital to ensure that proper earth connection is done.

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2 Definitions

Offset:
Correction value for compensation of the zero point difference. Thanks to the offset, it is ensured that a force of 0N will generate a signal of 0V exactly.

Gain:
Amplification factor for the measuring signal. Use of proper value will set the measuring range of the sensor exactly corresponding to the signal output range (0...10V).

Strain gauge:
Electronic component that will change its resistance while its length has changed. Strain gauges are used in the FMS force sensors for acquisition of the feedback value.

3 System components

The EMGZ308 consists of the following components (refer also to fig. 1):

Force sensors

- For mechanical/electrical conversion of the tension force
- Force measuring bearing (load cell)
- *Force measuring roller*
- *Force measuring journal*
- *Force measuring bearing block*

Measuring amplifier EMGZ308

- Hybrid module for supplying the force sensors and amplification of the mV signal
- One single electronic board may contain up to 2 hybrid modules
- Design with robust aluminium housing
- Gain and offset alternatively configurable for infinitely or fixed adjustment
- Freely configurable lowpass filter
- Freely configurable outputs (±10V; 0...20mA; 4...20mA)
- Integrated digital display
- Supports connection of an external feedback display

(Italic components as variant or option)

4 System description

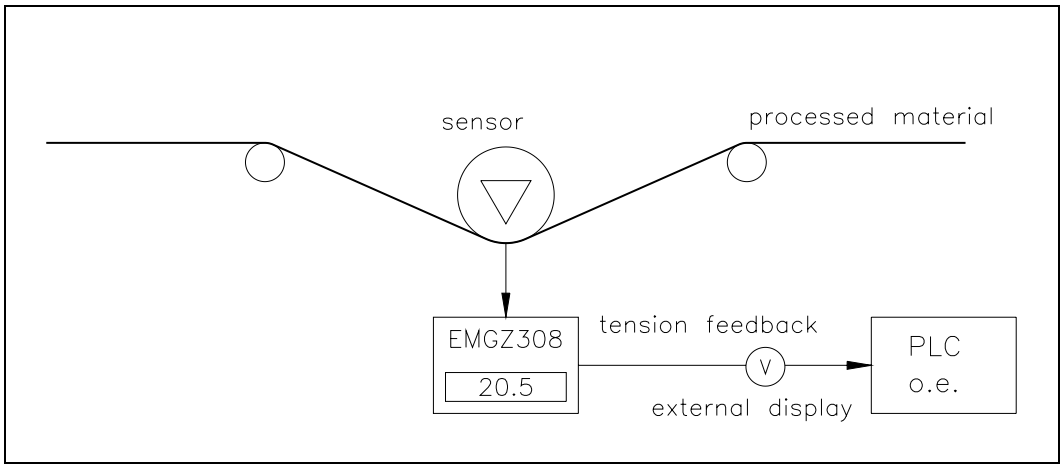

fig. 1: Basic structure of the EMGZ308 Tension Measuring Amplifier (picture shows single channel version) E308001e

4.1 Functional description

The force sensors measure the tension force in the processed material and transmit the measuring value as a mV signal to the hybrid module in the measuring amplifier EMGZ308. The measuring amplifier amplifies the mV signal depending on configuration. The resulting feedback value can be transmitted to an analog instrument, a PLC or equivalent devices. In addition, the force value is shown in the integrated digital display.

4.2 Force sensors

The force sensors are based on the flexion beam principle. The flexion is measured by strain gauges and transmitted to the measuring amplifier as mV signal. Due to the wheatstone wiring of the strain gauges, the measured value is according also to the power supply. So, the force sensors are supplied from the EMGZ308 by a very accurate power supply.

4.3 Measuring amplifier EMGZ308

The EMGZ308 is a single or double channel analog Tension Measuring Amplifier based on a hybrid circuit per channel. It is delivered in a robust aluminium housing. All connections are led through glands to screw terminals. There can be connected 1 or 2 force sensors of 350Ω to each channel. The hybrid modules provide the highly accurate 5V power supply and amplify the mV signals of the force sensors to a level of 10V and 20mA. Tension and current output are active the same time. The hybrid technology ensures both good thermal and electrical characteristics. Measuring circuit and power supply are galvanic insulated.
Setting of gain and offset is done by 2 trimmers. For filtering of the signals, non-polarized capacitors can be soldered.

Infinite adjustment of gain and offset
Setting by trimmers is used to get a standardized output signal (i.e. 10V) from any kind of sensor signal. This ensures accurate amplifying of the signal and maximum immunity to any interference of the signal cable.

Fixed setting of gain and offset
Fixed setting is used when maximum thermal stability and vibration-proof conditions are needed. The signal is pre-amplified with a fixed value and has to be evaluated digitally (for ex. by a PLC), so that offset and gain can be calculated.

4.4 Block diagram

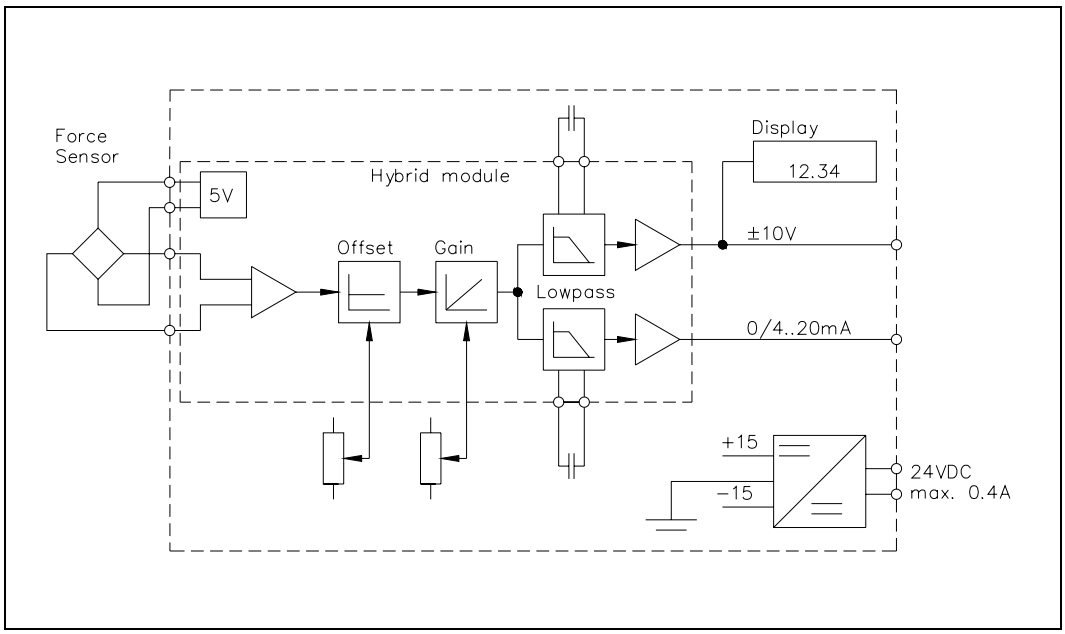

fig. 2: The block diagram shows the single channel version. E308002e

5 Dimensions

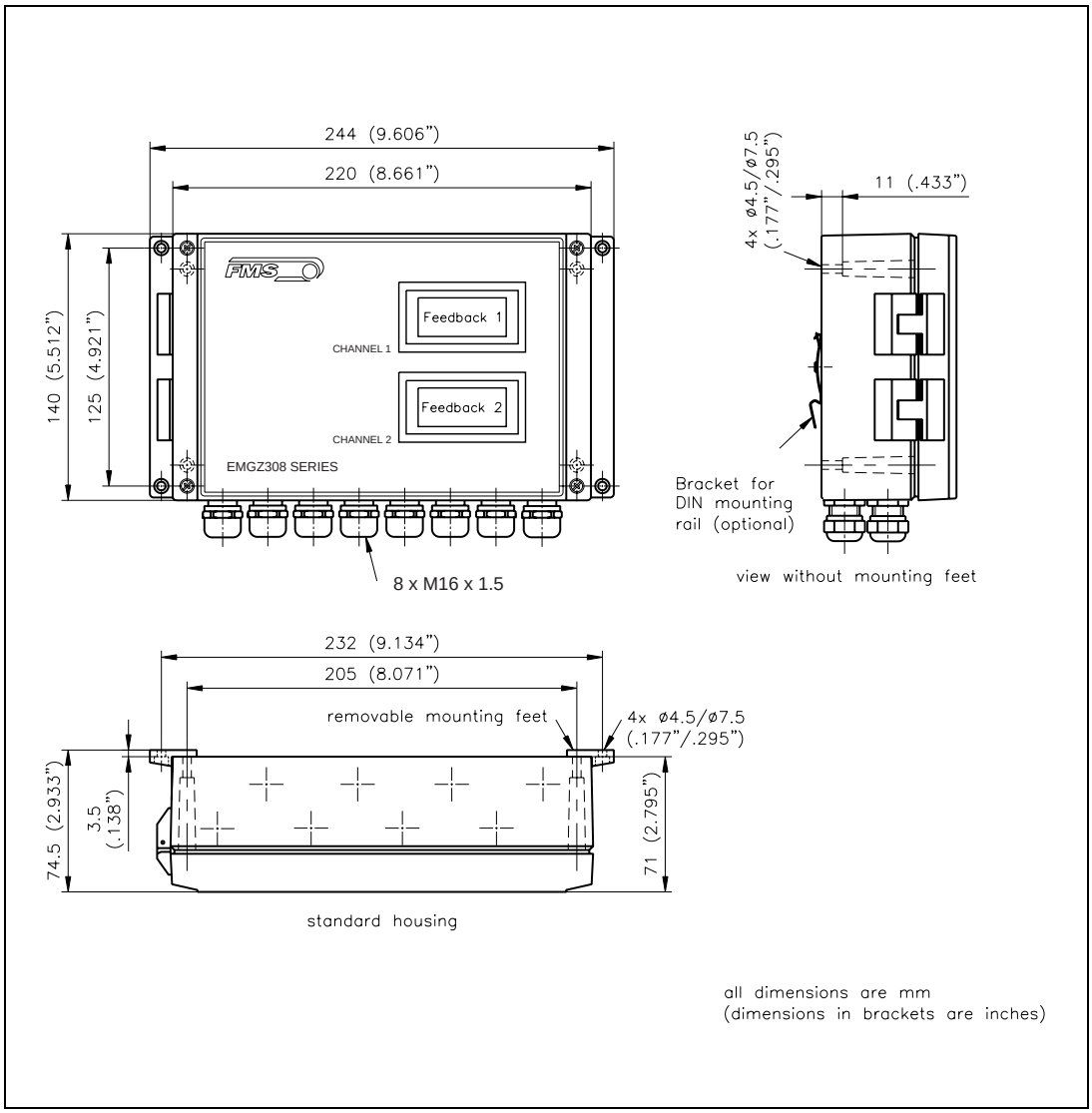

fig. 3 E308013e

6 Installation and wiring

Caution

Proper function of the Tension Measuring Amplifier is only guaranteed with the recommended application of the components. In case of other arrangement, heavy malfunction can be the result. Therefore, the installation instructions on the following pages must be followed strictly.

Caution

Local installation regulations are to preserve safety of electric equipment. They are not taken into consideration by this operating manual. However, they have to be followed strictly.

Caution

Improper handling may damage the fragile electronic equipment! Don't touch the electronic unit! Don't use rough tools as screwdrivers or pliers! Touch earthed metal part to discharge static electricity before touching the electronic unit!

6.1 Mounting and wiring of the electronic unit

The aluminium housing of the measuring amplifier may be mounted to any place in the machine, but usefully a position close to the force sensors is chosen. Wiring to the terminals is done according to wiring diagram (fig. 5).

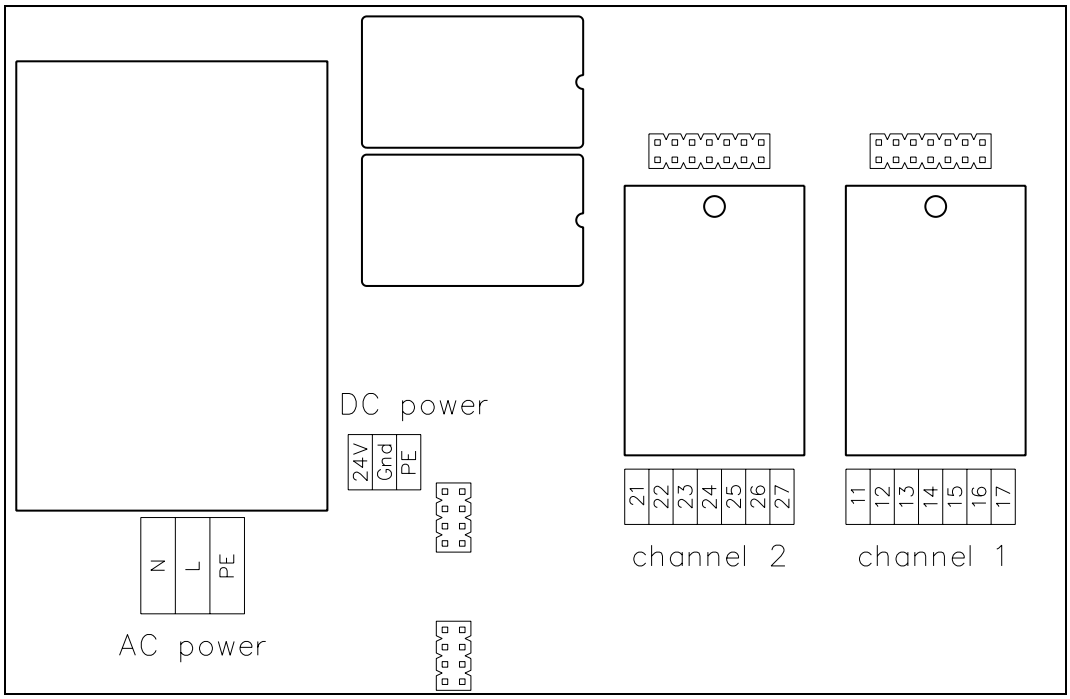

fig. 4: Screw terminal arrangement on the electronic pc board E308009e

6.2 Mounting the force sensors

Mounting of the force sensors is done referring to the FMS Installation manual which is delivered together with the force sensors.
Wiring to the terminals of the electronic unit is done according to wiring diagram (fig. 5).

Notice

Connecting the shield of the signal cable to the electronic unit *and* to the force sensor may cause ground circuits which may interfere the measuring signal massively. Malfunction can be the result. The shield should be connected only to the electronic unit. On the „force sensor“ side, the shield should stay open.

6.3 Wiring

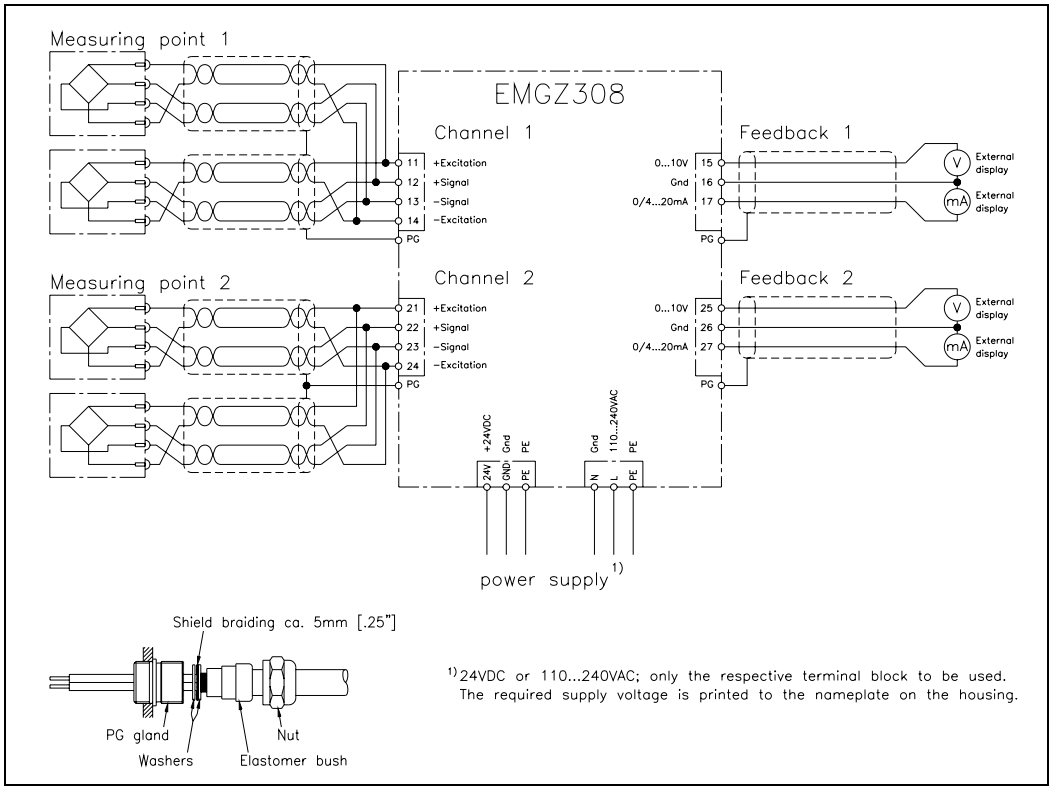

fig. 5: Wiring diagram E308007e

There can be connected 1 or 2 force sensors per channel. Using 2 force sensors, the connections will be wired parallel. The output signal of the measuring amplifier then will correspond to the average value of the 2 sensors.
The connection between force sensors and measuring amplifier has to be done using 2x2x0.75mm^2 [AWG 18] shielded twisted-pair cable. (With cable length below 15m, 2x2x0.25 mm^2 [AWG 23] is also suitable.) The cable must be installed separate from power lines.

Caution

Bad earth connection may cause electric shock to persons, malfunction of the total system or damage of the electronic unit! It is vital to ensure that proper earth connection is done.

7 Setting into operation

7.1 View of the setting elements

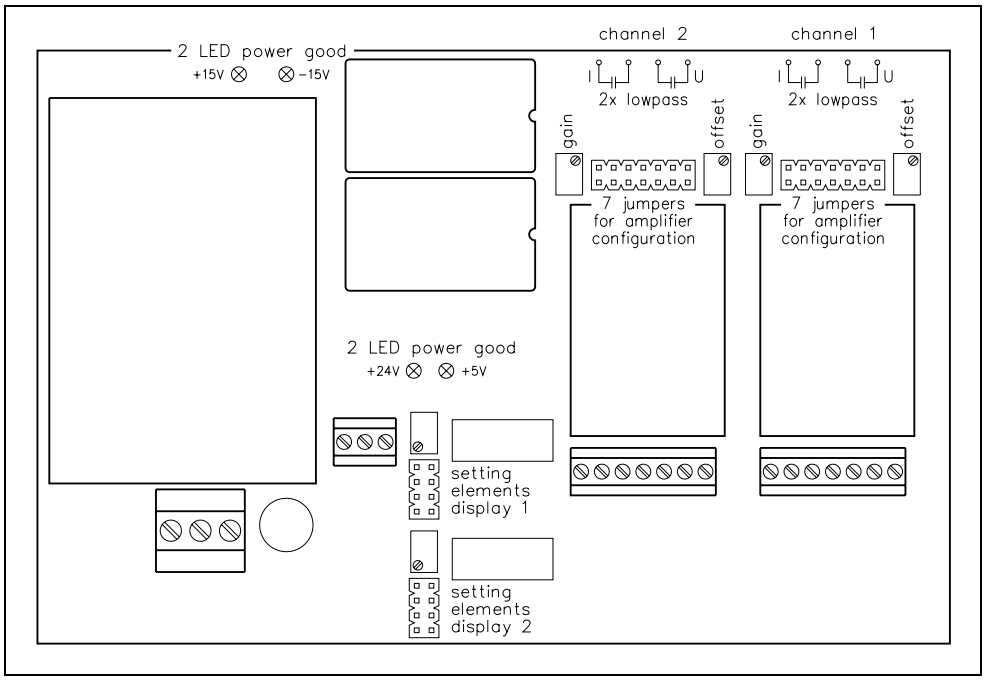

fig. 6: Setting elements E308008e

7.2 Configuring gain and offset

Gain and offset are configured by jumpers. The settings can be made individually for each channel.

Gain and offset with infinite setting

If gain and offset are adjusted with the trimmers, the jumpers have to be set according to fig. 7. Gain and offset then may be adjusted using the trimmers (refer to „7.5 Calibrating the measuring amplifier“).

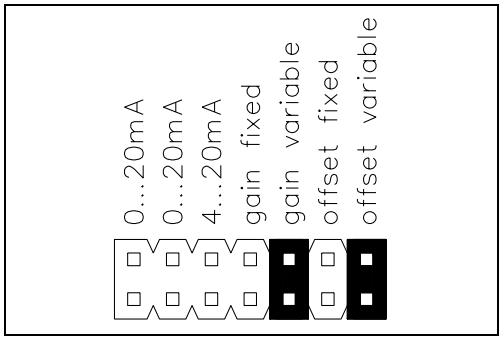

fig. 7: Jumper setting for infinite gain and offset adjustment E308010a

Gain and offset with fixed setting
If the signal is processed by a control unit (i.e. a PLC), configuration with fixed gain and offset is recommended (offset = 0; gain = 1111). Therefore, the jumpers have to be set according to fig. 8. With this configuration, the good thermal characteristics of the hybrid module are best utilized. The output signal will be 20mA when the nominal force of the sensor is applied.

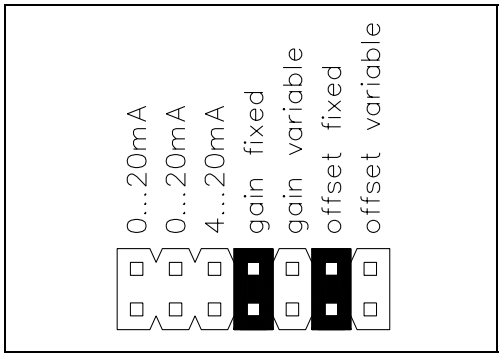

fig. 8: Jumper setting for fixed gain and offset E308010b

7.3 Configuring the output

Each channel provides a voltage output (±10V) and a current output (0...20mA or 4...20mA) which are active simultaneously. The signal of the current output is configured as follows:

Current output 0...20mA
The jumpers have to be set according to fig. 9. This is the standard FMS factory setting.

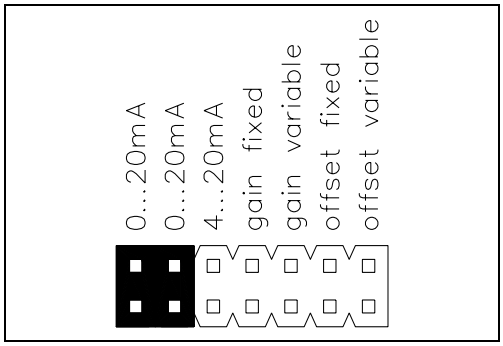

fig. 9: Jumper setting for current output 0...20mA E308010c

Current output 4...20mA
The jumpers have to be set according to fig. 10.

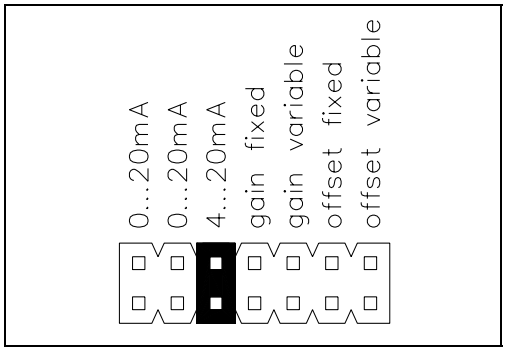

fig. 10: Jumper setting for current output 4...20mA E308010d

7.4 Configuring the lowpass filter

The measuring amplifier provides 2 lowpass filters per channel. They are used to eliminate faulty signal variations which may be caused by unbalanced rollers, vibrations of the machine, or equivalent.

Lowpass U	acts only to the tension output
Lowpass I	acts only to the current output

The lower the cut-off frequency, the more sluggish the signal will be. The configuration is made by soldering a non-polarized capacitor to the respective soldering points (refer to fig. 6). The capacitor will be determined referring to the following formula or table:

$$C = 10 / F$$

C: Capacity [µF]
F: Cut-off frequency [Hz]

Cut-off frequency [Hz]	**Capacitor [µF]**
1	10
2	5
5	2
10	1
20	0.5
50	0.2
100	0.1
200	0.05
500	0.02
1000	0.01

Notice

You must not use electrolytic capacitors because positive and negative signals are appearing! They would damage the electrolytic capacitor.

7.5 Calibrating the measuring amplifier

Proceed the calibration for each channel as follows:

- Connect gauge to the tension or current output.
- Connect the first force sensor.
- Check if a positive output signal is appearing when loading the sensor in measuring direction. If not, exchange the two signal wires of the referring force sensor in the terminal block (+*Signal* and –*Signal*).
- If used, connect the second force sensor.
- Check if a positive output signal is appearing when loading the sensor in measuring direction. If not, exchange the two signal wires of the referring force sensor in the terminal block (+*Signal* and –*Signal*).
- Insert material or a rope loosely to the machine.
- Adjust the offset trimmer until the output value is zero.
- Load material or rope with a defined weight (fig. 11).
- Adjust the gain trimmer until the output value shows the needed value (i.e. 10V corresponding to 500N).

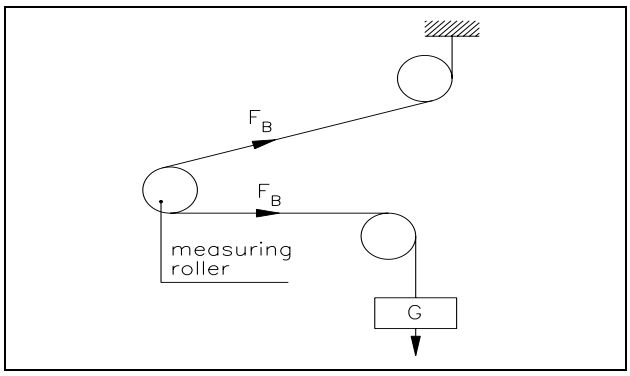

fig. 11: Calibrating the measuring amplifier

Notice

If the measuring amplifier is operated with fixed gain and offset, signal conditioning has to be done with additional equipment (for ex. PLC).

7.6 Scaling the integrated display

After configuring offset and gain, scale the value shown in the display of the respective channel as follows:

- Scale the display value with trimmer „scale display“ (fig. 12).
- Set the jumper „set decimal point“ (fig. 12) in the position which gives a correct decimal point in the display.
- Close the housing.

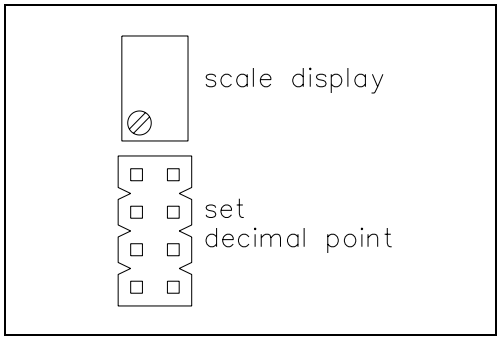

fig. 12: Display setting elements

E308011e

8 Trouble shooting

Error	Cause	Corrective action
Output shows signal > 0 although material has no tension	Offset setting is bad	Re-adjust offset (refer to „7.5 Calibrating the measuring amplifier“)
	Current output is configured for 4...20mA	Change jumper setting if required
Output signal is not stable although material tension doesn’t change	Cut-off frequency too high	Adjust cut-off frequency (refer to „7.4 Configuring the lowpass filter“)
	Ground terminal of the output isn’t 0V	Connect Gnd terminal of the output with earth (terminal PE)
Adjusting of the trimmers causes no result	Jumpers are set to „fixed gain“ / „fixed offset“	Set jumpers to „variable gain“ / „variable offset“
Display shows inaccurate value	Display scaling not correct	Proceed display scaling (refer to „7.6 Scaling the integrated display“)
Output shows no reaction, or 1 or 2 LED’s don’t light	Fuse blown	Replace fuse on power supply
	Power supply not correct	Check / correct power supply
	Measuring amplifier defect	Contact FMS customer service

9 Technical Data

Sensor excitation	5VDC ±20ppm/K max. 30mA [±11ppm/°F]
Gain factor range	fixed: 1111; variable: 500...5000
Offset range	fixed: 0mV; variable: ±9mV
Temperature drift offset	fixed: < 20ppm/K [11ppm/°F]; variable: ca. 50ppm/K [28ppm/°F]
Linearity error	< 0.1%
Tension output	±10V min. 1kΩ
Current output	0/4...20mA max. 500Ω
Lowpass cut-off frequency	adjustable, ca. 1...1000Hz
Power supply	24VDC or 100...240VAC max. 0.2A (see name plate)
Power consumption	max. 2.5W
Temperature range	–10...+60°C [14...140°F]
Protection class	IP54

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