



Operating Manual EMGZ300

Analog multi channel Tension Measuring Amplifier

Version 2.03 04/02 fg

This operation manual is also available in German, French and Italian.
Please contact your local representative.

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

Ce mode d'emploi est également disponible en Français, en Italien et en Allemand.
Veuillez contacter la représentation locale.

Queste manuale d'installazione è disponibile anche in lingua italiano, francese e tedesco.
Vogliate cortesemente contattare la locale rappresentanza.

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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 mechanical damage. This warning has to be followed absolutely.

c) Note for proper function



Note

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 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.
-  Improper mounting may damage the hybride module! The black mark on the hybride module must match to the edge shown on the printed circuit board. Avoid static electricity!
-  The thin ceramic plate of the hybride module is very sensitive. Breaking hazard! Avoid high forces while mounting! Do not unmount modules once fitted!

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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 EMGZ300 consists of the following components (refer also to fig. 1):

Force sensors

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

Electronic unit EMGZ300

- Hybrid module for supplying the force sensors and amplification of the mV signal
- One single electronic board may contain up to 4 hybrid modules
- Variable or fixed values for gain and offset
- Freely configurable lowpass filter
- Freely configurable outputs ($\pm 10V$; 0...20mA; 4...20mA)
- For mounting into insert card support block EMGZ555959 (by mounting into control cabinet)
- *With aluminium front panel for mounting into 19" rack*
- Supports connection of an external feedback display

(Italic components as variant or option)

4 System Description

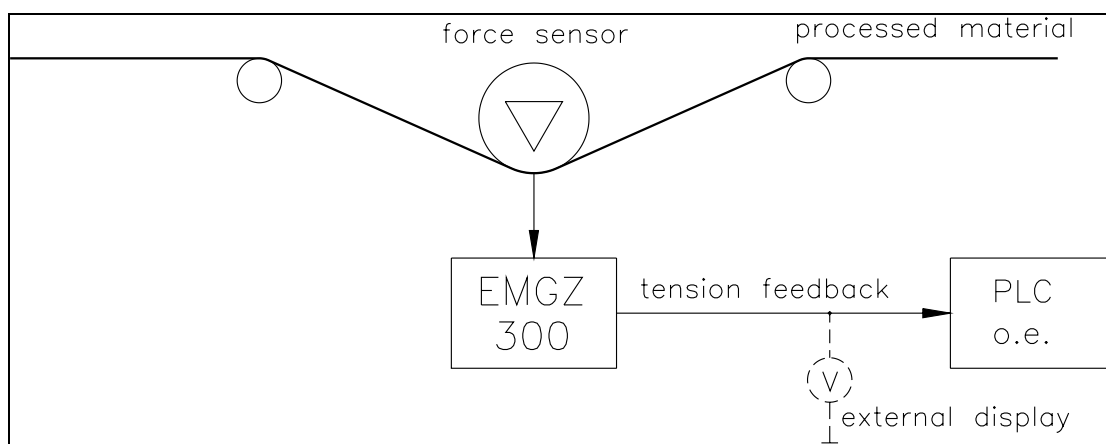


fig. 1: Basic structure of the EMGZ300 Tension Measuring Amplifier (picture shows single channel version)

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4.1 Functional description

The force sensors measure the tension force in the material and transmit the measuring value as a mV signal to the hybrid module in the electronic unit EMGZ300. The electronic unit amplifies the mV signal depending on configuration. The resulting feedback value can be transmitted to an analog instrument, a PLC or equivalent devices.

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 electronic unit 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 EMGZ300 by a very accurate power supply.

4.3 Electronic unit EMGZ300

The EMGZ300 is an analog Tension Measuring Amplifier with 1 to 4 channels. Each channel consists of a separate hybrid module which can be connected to 1 or 2 force sensors of 350Ω . The hybrid module provides the highly accurate 5V power supply and amplifies the mV signal 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.

All settings are done by 2 trimmers and 4 jumpers for each channel. Each channel can be set independent of the other channels. Offset and gain are set using the trimmers. For filtering of the signals, a non-polarized capacitor can be soldered.

The jumpers enables also to operate the amplifier with fixed gain and offset. This will provide better thermal stability. But the signal then has to be processed digitally (for ex. by a PLC), so that offset and gain can be calculated.

4.4 Block Diagram

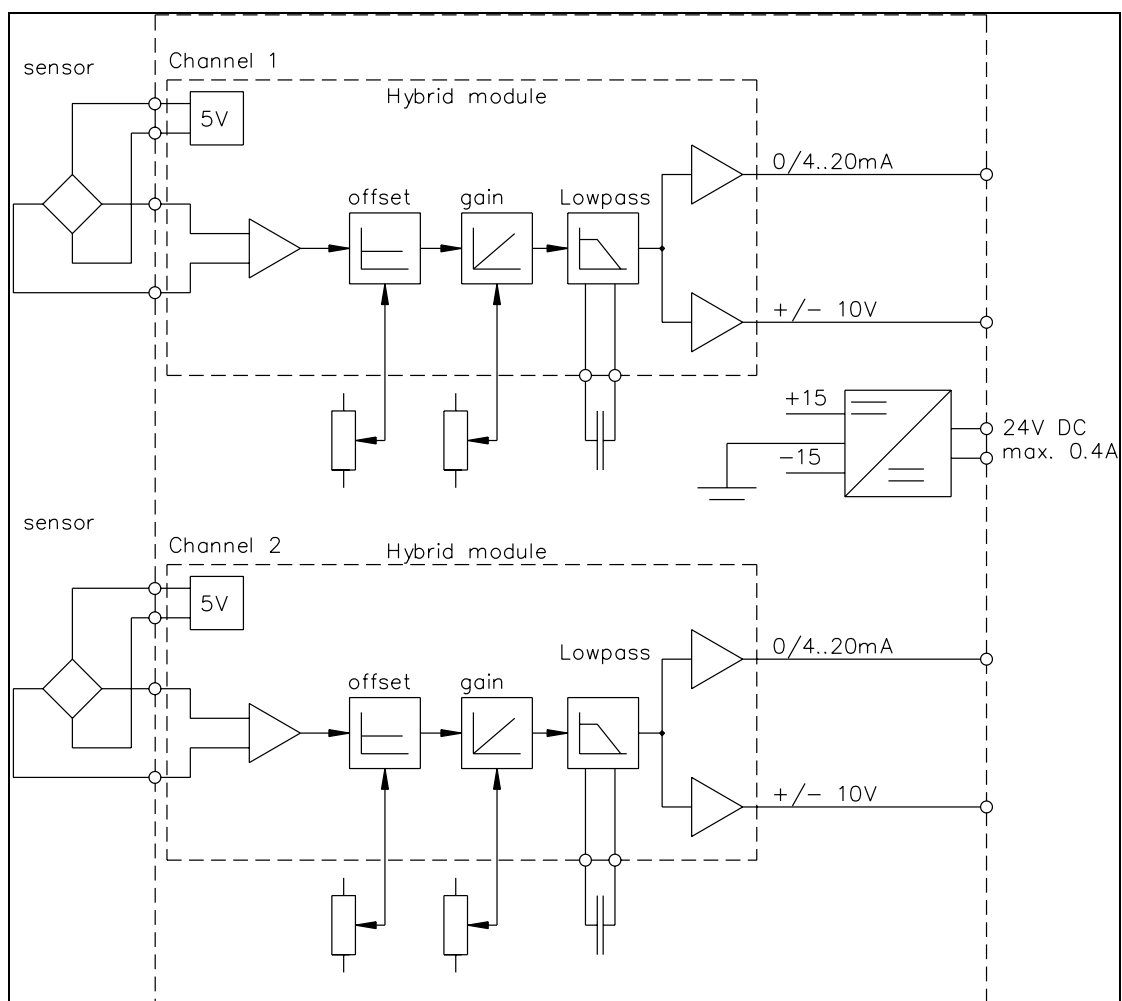


fig. 2

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5 Dimensions

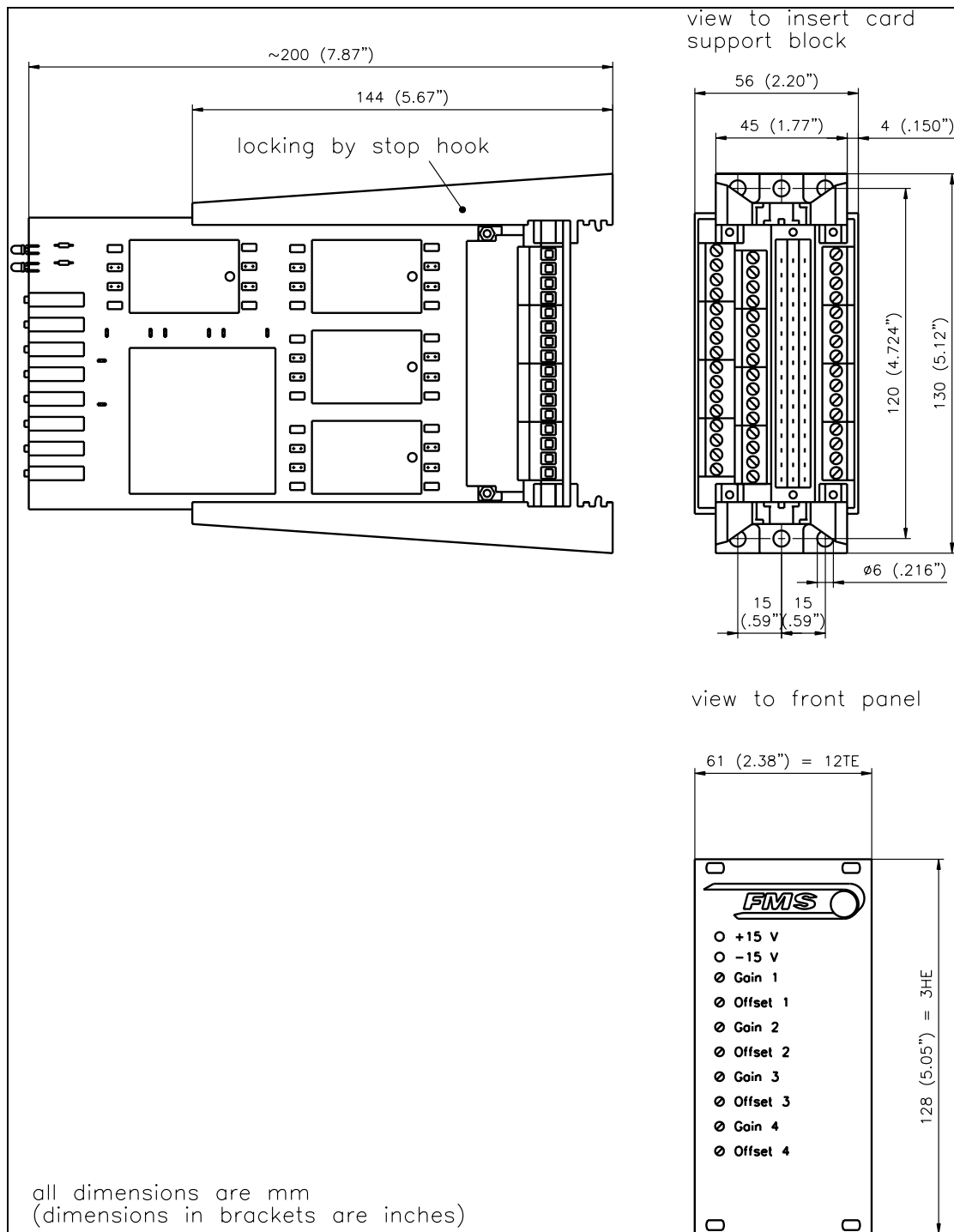


fig. 3: Dimensions. The insert card support block EMGZ555959 has to be ordered separately. The aluminium front panel is optional.

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If the electronic unit should be mounted into a 19" rack, the electronic unit has to be ordered with aluminium front panel (EMGZ300-x channel.581748). Instead of the support block, a multipoint plug can be used.

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.

6.1 Mounting and wiring of the electronic unit

The insert card support block can be mounted in a control cabinet. Wiring to the terminals is done according to wiring diagram (fig. 4). The electronic card then will be inserted into the insert block. It will be locked by a stop hook (fig. 3).



Caution

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

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. 4).



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

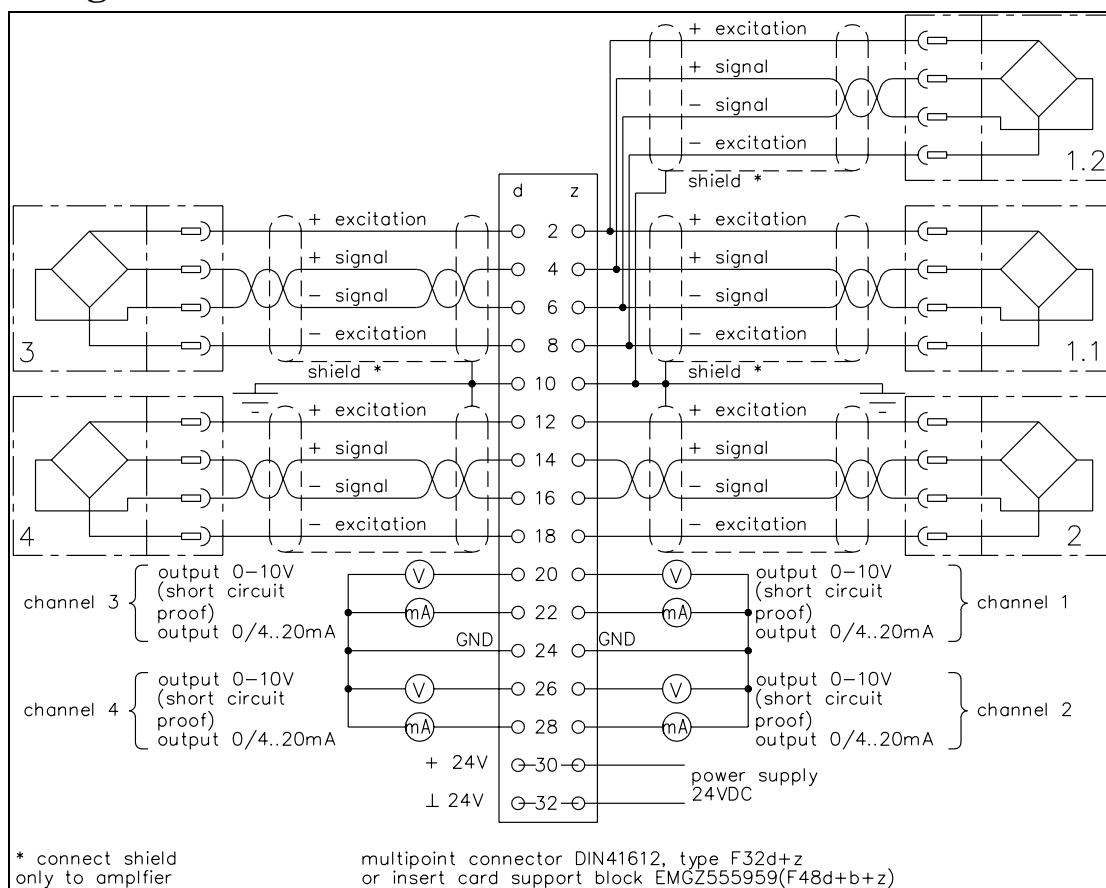


fig. 4: Wiring diagram

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There can be connected 1 or 2 force sensors to each channel. Using 2 force sensors in 1 channel, the connection cables 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 $2 \times 2 \times 0.75 \text{ mm}^2$ [AWG 18] shielded twisted-pair cable. (With cable length below 15m, $2 \times 2 \times 0.25 \text{ mm}^2$ [AWG 23] is also suitable.) The cable must be installed separate from power lines.

The terminals 10d and 10z have to be connected to earth.



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

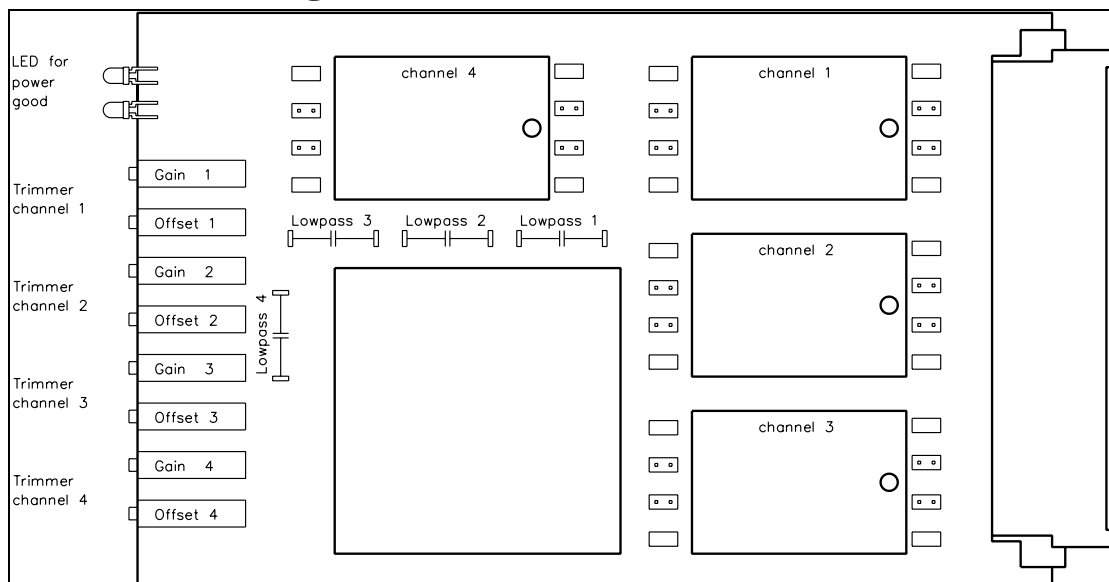


fig. 5: Setting elements for all channels

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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 variable

If gain and offset will be adjusted on the electronic unit, the jumpers will be set to „variable“ (fig. 6). Gain and offset then may be adjusted using the trimmers (refer to „7.5 Calibration of the measuring amplifier“).

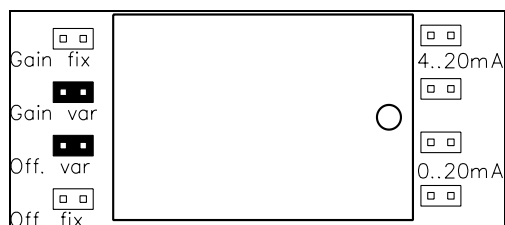


fig. 6: Jumper setting for variable gain and offset

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Gain and offset fixed

If the signal is processed by a control unit (for ex. a PLC), configuration with fixed gain and offset is recommended (offset = 0; gain = 1111). Therefore, the jumpers will be set to „fixed“ (fig. 7). This configuration takes the highest advantage of the good thermal characteristics of the hybrid module. The output signal will be 10V resp. 20mA when nominal force of the sensor is applied.

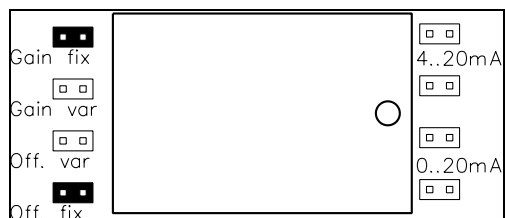


fig. 7: Jumper setting for fixed gain and offset

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7.3 Configuring the outputs

Each channel provides a tension output ($\pm 10\text{V}$) and a current output ($0\ldots 20\text{mA}$ resp. $4\ldots 20\text{mA}$) which are active simultaneously. The signal of the current output is configured as follows:

Current output $0\ldots 20\text{mA}$

The jumpers will be set to „ $0\ldots 20\text{mA}$ “ (fig. 8).

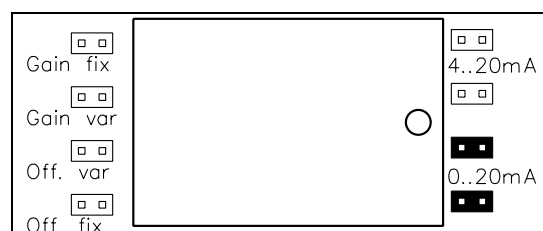


fig. 8: Jumper setting for current output $0\ldots 20\text{mA}$ E300006c

Current output $4\ldots 20\text{mA}$

The jumpers will be set to „ $4\ldots 20\text{mA}$ “ (fig. 9).

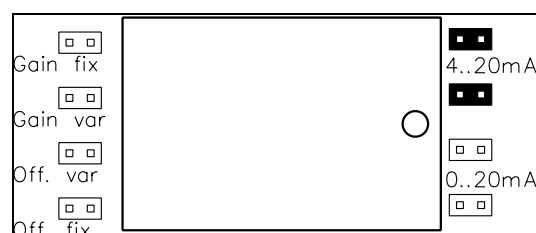


fig. 9: Jumper setting for current output $4\ldots 20\text{mA}$ E300006d

7.4 Configuring the lowpass filter

Each channel provides an independently configurable lowpass filter. It is used to eliminate faulty signal variations which may be caused by unbalanced rollers, vibrations of the machine, or equivalent.

The lowpass filter is effective to both the tension- and the current output. The lower the cut-off frequency, the more sluggish the output signal will be. The configuration is made by soldering of a non-polarized capacitor to the soldering points (refer to fig. 5). The capacitor will be determined referring to the following formula resp. list:

$$C = 10 / F$$

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



Note

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- resp. 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.
- 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.
- Insert material or a rope loosely to the machine.
- Adjust the offset trimmer of the referring channel until the output value is zero.
- Load material or rope with a defined weight (fig. 10).
- Adjust the gain trimmer of the referring channel until the output value shows the needed value (for ex. 10V corresponding to 500N).

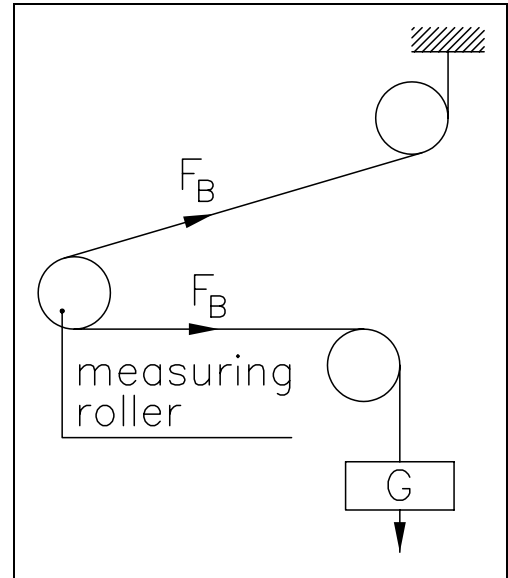


fig. 10: Calibrating the measuring amplifier

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Note

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

8 Upgrade with additional channels

The electronic units EMGZ300 may be equipped with 1 to 4 channels (1 hybrid module for each channel). If any channels should be added in the future, additional hybride modules EMGZ581620 can be ordered.

Mounting the hybride modules

The hybride modules will be fitted to the sockets like integrated circuits.



Caution

Improper mounting may damage the hybride module! The black mark on the hybride module must match to the edge shown on the printed circuit board. Avoid static electricity!



Caution

The thin ceramic plate of the hybride module is very sensitive. Breaking hazard! Avoid high forces while mounting! Do not unmount modules once fitted!

9 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 (terminals 24d + 24z) with earth (terminals 10d + 10z)
Adjusting of the trimmers causes no result	Jumpers are set to „fixed gain“ / „fixed offset“	Set jumpers to „variable gain“ / „variable offset“
1 or 2 LED's don't light	Fuse blown	Replace fuse on power supply
	Power supply not correct	Check / correct power supply
	Electronic unit defect	Contact FMS customer service

10 Technical Data

Sensor excitation	5VDC ± 20 ppm/K max. 30mA [± 11 ppm/°F]
Gain factor range	fixed: 1111; variable: 500...5000
Offset range	fixed: 0mV; variable: ± 9 mV
Temperature drift offset	fixed: < 20ppm/K [11ppm/°F]; variable: ca. 50ppm/K [28ppm/°F]
Linearity error	< 0.1%
Tension output	± 10 V min. 1k Ω
Current output	0/4...20mA max. 500 Ω
Lowpass cut-off frequency	adjustable, ca. 1...1000Hz
Power supply	24VDC (18...36VDC) max. 0.4A
Power consumption per channel	max. 2.5W
Connector	DIN 41612 type F 32 d+z
Temperature range	-10...+60°C [14...140°F]



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