



Operating Manual

EMGZ310

Digital Microprocessor Controlled Tension Amplifier

EMGZ310.ComACT

Digital Microprocessor Controlled Tension Amplifier
with intuitive operation via FMS ComACT™ app

Version 2.10	10/2016 NS
Firmware Version EMGZ310	V1.14
Firmware Version EMGZ310.ComACT	V2.10



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

Diese Bedienungsanleitung ist auch in Deutsch erhältlich.
Bitte kontaktieren Sie Ihren nächstgelegenen FMS Vertreter.

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1 Safety Instructions

All safety related regulations, local codes and instructions that appear in the manual or on equipment must be observed to ensure personal safety and to prevent damage to the equipment connected to it. If equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Do not stress the equipment over the specification limits neither during assembly nor operation. To do so can be potentially harmful to persons or equipment in the event of a fault to the equipment.

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 of life. It has to be followed strictly.

b) Risk of damage of machines



Caution

This symbol refers to information, 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.**

- ⚠ Bad earth connection may cause electric shock to persons, malfunction of the total system or damage of the control unit. It is vital to ensure a proper earth ground connection.**

- ⚠ Each change of the Device Mode requires a re-calibration of the system**

- ⚠ Changes or modifications made to this equipment not expressly approved by FMS AG may void the FCC authorization to operate this equipment.**

1.3 Regulatory Notices

NOTE:

This device complies with Part 15 of the FCC Rules and with Industry Canada licence-exempt RSS standard(s).

Operation is subject to the following two conditions:

- this device may not cause harmful interference, and
- this device must accept any interference received, including interference that may cause undesired operation.

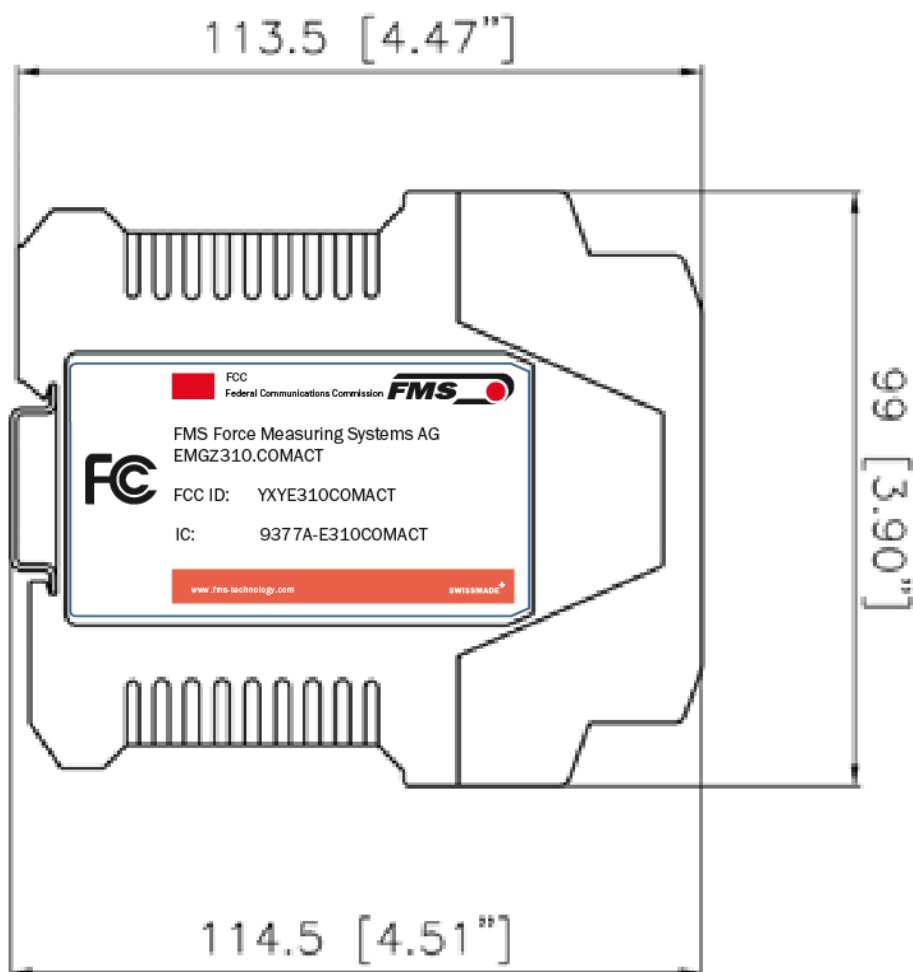


Fig. 1a: FCC labeling on device

FCC_Label_EMGZ310ComACT.ai

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

NOTE:

Changes or modifications made to this equipment not expressly approved by FMS Force Measuring Systems AG may void the FCC authorization to operate this equipment.

Radiofrequency radiation exposure Information:

This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of [50] cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

1.4 Notes Réglementaires

NOTE:

Cet équipement est conforme à la section 15 du règlement de la Commission fédérale américaine des communications (FCC) et au(x) Cahier(s) des charges sur les normes radioélectriques (CNR) d'Industrie Canada exemptes de licence.

Son utilisation est soumise aux deux conditions ci-dessous :

- cet équipement ne peut pas causer d'interférences nuisibles, et
- cet équipement doit accepter toutes les interférences, y compris celles qui pourraient provoquer un fonctionnement indésirable.

NOTE:

Cet équipement a été testé et déclaré conforme aux limites applicables aux appareils numériques de classe A, selon la section 15 du règlement FCC. Ces limites visent à garantir une protection raisonnable contre les interférences nuisibles lorsque l'équipement est utilisé dans un environnement commercial.

Cet équipement produit, utilise et peut émettre une énergie de fréquence radio et, s'il n'est pas installé ni utilisé conformément au manuel d'instruction, il peut générer des interférences affectant les communications radio. L'utilisation de cet équipement dans une zone résidentielle peut causer des interférences nuisibles, auquel cas l'utilisateur sera tenu d'y remédier à ses frais.

NOTE:

Des changements ou modifications apportés à cet équipement sans l'autorisation expresse de FMS Force Measuring Systems AG peuvent invalider l'agrément d'utilisation de cet équipement accordé par la FCC.

Informations sur l'exposition aux rayonnements radioélectriques

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de

[50] cm de distance entre la source de rayonnement et votre corps.

Ce transmetteur ne doit pas être placé au même endroit ou utilisé simultanément avec un autre transmetteur ou antenne. “

2 Quick Installation Guide

In a Plug & Play configuration the set-up of the EMGZ310 and force sensor is limited to only the offset compensation and the calibration.

2.1 Preparations for Set-up

1. Read the Operation Manual of your force measuring sensors
2. Check your requirements such as:
 - Desired output configuration $\pm 10V$ or $0/4\dots 20mA$
 - Devise Mode (Force Gauge or Volt Gauge)
 - Cut off frequency of low-pass filter
3. Draw the wiring diagram for your configuration (ref. to 2.6 "Wiring the Amplifier")

2.2 Installation Procedure

1. Mount your force measuring sensors to the machine
2. Wire the Force Measuring Sensor(s) (ref. to Fig. 1 and 2)
3. Connect the amplifier to the power supply.
4. The power supply voltage must be in the range 18 to 36V DC.
5. Perform offset compensation and calibration (ref. to chapters 3.4 to 3.7)
6. If required, do additional settings (ref. to 4 "Parameterization")

2.3 Mounting the Force Sensors

Mounting of the force sensors is done according to the FMS Installation manual which is delivered together with the force sensors.

2.4 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.

2.5 Block diagram

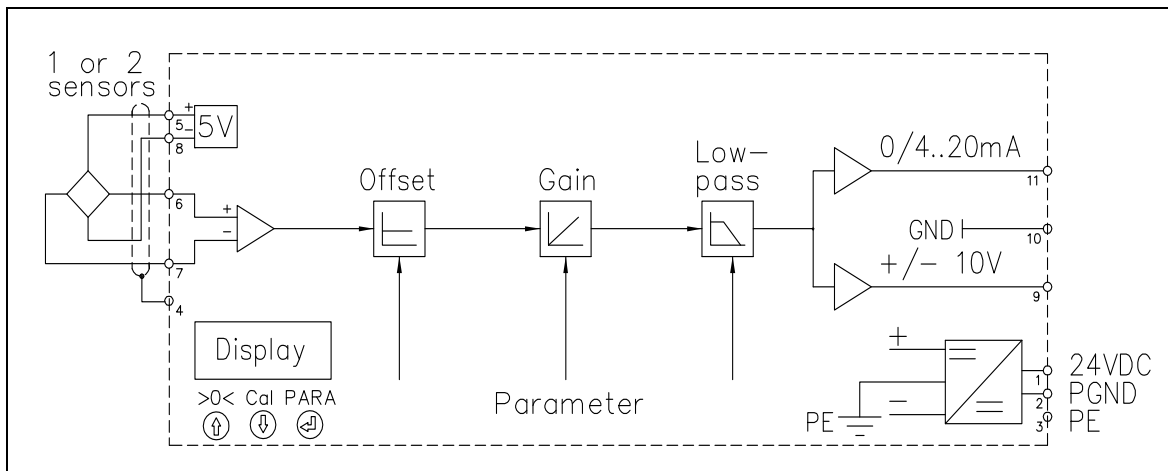


Fig. 1: Block diagram EMGZ 310

E310001e

2.6 Wiring the Amplifier

One or two force sensors can be connected to the measuring amplifier. When using two force sensors, the output signal of the measuring amplifier will then correspond to the average value of the two sensors. The connection between force sensors and measuring amplifier has to be done using a 2x2x0.25mm² [AWG 23] shielded twisted-pair cable.

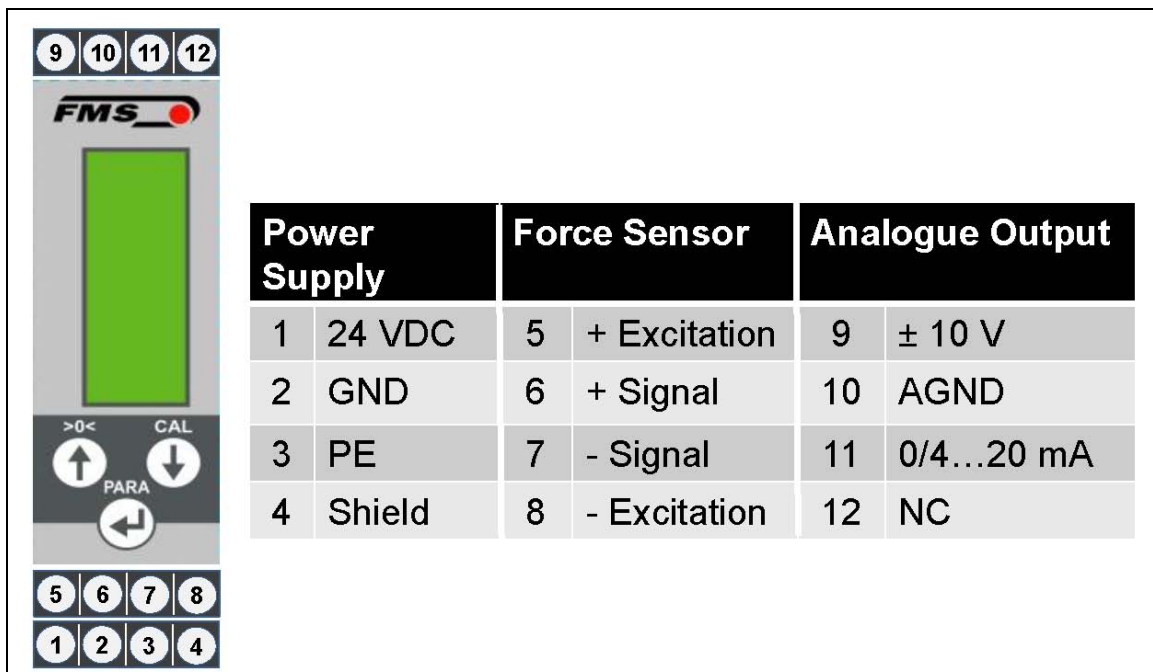


Fig. 2: Wiring of EMGZ 310

E310002e



Caution

Bad earth connection may cause electric shock to persons, malfunction of the total system or damage of the control unit. It is vital to ensure a proper earth ground connection.



Note

The shield should be connected only to the electronic unit. On the force sensor side the shield should stay open.



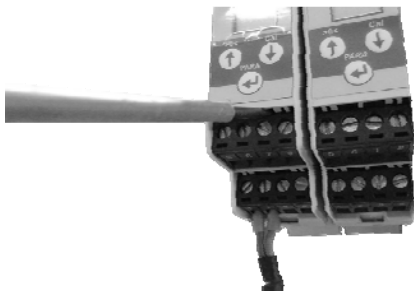
Note

Sensor cables must be installed separate from power lines.

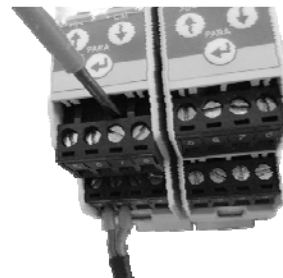
2.7 Modify the wiring

For an easy and quick exchange of an amplifier it is possible to exchange the single terminal blocks as assembly. You neither have to disconnect the wiring, nore do you have to open the housing of the device.

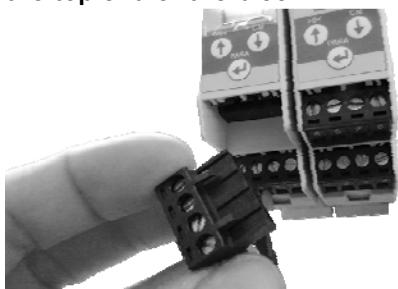
Make sure that the amplifier is disconnected from the power supply.



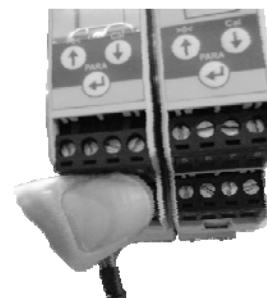
Insert a screw driver with a small blade in between the terminal block and the housing on the top end of the block



Using the screw driver as a lever will loosen the block from the housing. It will slide downwards



The block is now disconnected. You can slide it out the device.



Insert the block on the desired position. Push the block fully into the slot. You will hear a “click” sound as the block interlocks

3 Configuring the Amplifier

3.1 Power up the EMGZ 310

1. Connect the first force sensor (see Fig.2 Wiring Diagram EMGZ310)
2. Check whether applying a force in measuring direction (in the direction of the red point) on the first sensor results in a positive output signal. If not, exchange the two signal wires of this force sensor in the terminal block (terminals 6/7).
3. If applicable, connect the second force sensor.
4. Check whether applying a force in measuring direction on the second sensor results in a positive output signal. If not, exchange the two signal wires of this force sensor in the terminal block (terminals 6/7).

3.2 Operating the EMGZ310 over the Operating Panel

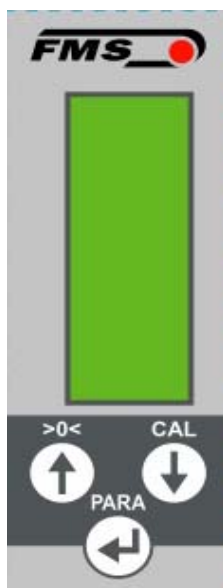
The EMGZ310 amplifier can go in 4 different states:

- **Operation State:** Amplifier operating
- **Offset Compensation:** Automatic procedure to offset the roller weight
- **Calibration State:** Procedure to calculate the amplifier gain
- **Parameterisation State:** Set or change parameters

When using the operating panel, the user can toggle between these modes by pressing a key or a combination of keys.

3.3 Operating Panel

The keys on the operation panel have the following functions:





Key	Key Function
	Change the selections, increase / decrease the values or choose
	Enter
>0< + PARA	Enter Offset Compensation Procedure. Press the two keys at the same time for longer than 3 sec.
Cal + PARA	Enter Calibration Procedure. Press the two keys at the same time for longer than 3 sec.
PARA	Enter the Parameter Setting Mode. Press the key for longer than 3 sec.

Fig. 3: Operating Panel EMGZ 310
E310003

3.4 Change the Device Mode

The EMGZ310 amplifier has two Device Modes:

- **Display of Force Gauge:** Tension data are displayed in a force unit
- **Display of Voltage Gauge:** Tension data are displayed in Volt (V)

1. Press the **PARA** key for longer than 3 seconds, to enter the parameter-selection mode. The display changes to Output
2. Scroll down the parameter list with the keys until you see on the LCD Mode
3. Press the key to enter the Parameter Chang Mode
4. Select **V** for **Voltage Gauge** or **kgkNN** for **Force Gauge**
5. Confirm the parameter change with the key
6. Leave the Parametrisation by holding the key for longer than 3 sec.

Caution
 Each change of the Device Mode requires a re-calibration of the system

3.5 Offset Compensation

With the Offset Compensation the roller weight is compensated. It is always performed before the calibration. The Force Measuring Sensor should not be loaded while the Offset Compensation is performed.

1. Start offset compensation by pressing the two keys **>0< + PARA** at the same time for longer than 3 seconds.
2. The offset compensation is done automatically.(see state diagram **Fig.4**)

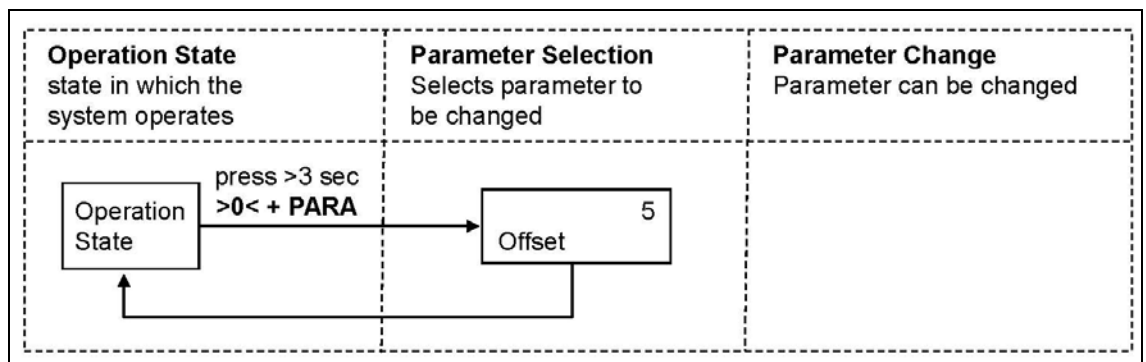


Fig. 4: State diagram offset compensation

EMGZ310008e

3.6 Calibration

By calibrating (setting the Gain), amplifier and force sensors are adjusted so that the display gives the actual tension value. There are two methods of calibrating the system. The first method uses a defined weight attached at a rope (see Fig. 5). The second method is based on a calculation process in conjunction with the FMS Calculator tool. The method with the calibration weight is preferred since it simulates the real material path in the machine and delivers the most accurate results.

If the material tension cannot be simulated in the machine by the weight method (e.g. because of space restrictions), the gain can be calculated with the FMS Calculator tool. This Calculator can be down loaded from the FMS web page.

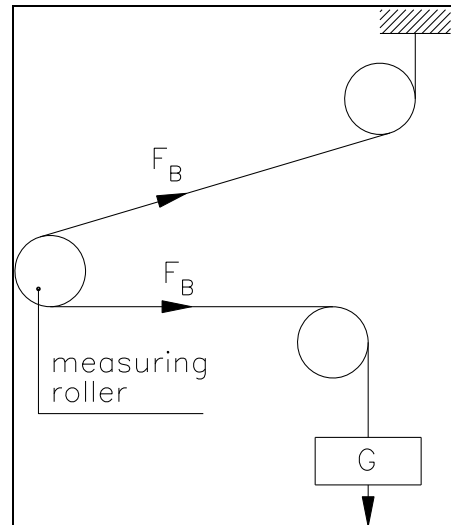


Fig. 5: Calibrating the measuring amplifier C431011e

3.7 Calibration Procedure in the Force Gauge Mode



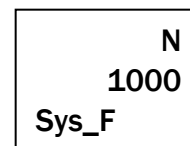
Note

If you do not press any key on the operating panel the display will automatically switch to the initial screen. You have to repeat any previously performed steps.

Execute the single steps uninterrupted and prepare any required material in advance.

1. Load a rope with a defined weight corresponding to your calibration force on the roller. The roller configuration must correspond to the real configuration in the machine (wrap angle, distance of the rollers etc.).

2. Enter calibration mode by pressing the two keys **Cal** and **PARA** at the same time for longer than 3 seconds. The display changes to



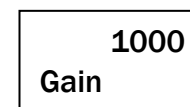
3. The System Force [**Sys_F**] determines the measuring capability of your measuring roller. E.g. if two 500 N sensors are installed, enter 1000N. If only one 500N sensor is used, enter 500N (see chapter 4.3 “Descriptions of Parameter”, [**Sys_F**]).

4. Use the keys to enter the system force. The LCD shows:

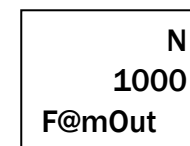
5. Press the key to confirm your input.

6. Enter the force corresponding to your calibration weight with the keys

7. Press the key to confirm your input. The display changes t



8. The parameter [**F@mOut**] determines the force corresponding to the maximum amplifier output (10V or 20mA) (see chapter 4.3)



9. Enter the value of [**F@mOut**] with the keys and confirm your input with the key. The calibration procedure has been completed successfully.

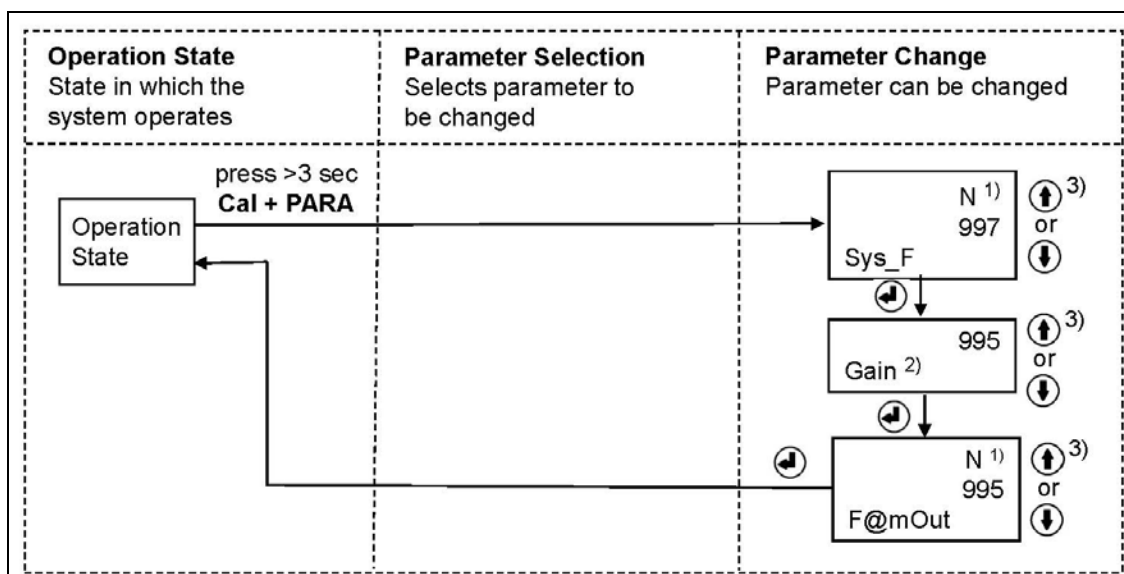


Fig. 6: State diagram calibration

EMGZ31009e

- 1) The display shows the unit of measure that was previously selected.
- 2) Enter the force corresponding to your calibration weight
- 3) Permanent key pressing expedites the changing speed.

3.8 Calibration Procedure in Volt Gauge Mode

1. Load a rope with a defined weight corresponding to your calibration force on the roller. The roller configuration must correspond to the real configuration in the machine (wrap angle, distance of the rollers etc.).
2. Enter calibration mode by pressing the key **Cal + PARA** for longer than 3 seconds. The display changes to


V	7.4
Gain	

3. Use   keys to change the output to the correct value, corresponding to the calibration force.












Note

The force corresponding to the calibration weight must be inputted in Volt (V) in the following calibration procedure (Volt Gauge).

4. Press the  key to confirm the input. The calibration procedure has been completed successfully.

4 Configuration via operating panel

After having done the offset and calibration procedures the system is configured and ready for operation. Description of parameterization:

1. Press the key **PARA** for longer than 3 seconds, to enter the parameter-select mode. The display changes to 
2. Use   keys to select the parameter to be changed.
3. Press the  key to enter the parameter changing mode.
Use   keys to change the parameter value.
4. Press the  key to confirm the input. The display changes back to the parameter-select mode.
5. If needed, press   keys to select another parameter.
6. To leave the parameterization, press the key **PARA** for longer then 3 seconds or wait for the timeout after 30 seconds, the parameters will be saved then.

The state diagrams (**Fig. 6 -7**) in the following page help to navigate through the parameter setting menu.

In the Parameterisation State the EMGZ 310 can be brought into the 2 modes: “Parameter Selection” and “Parameter Change”.

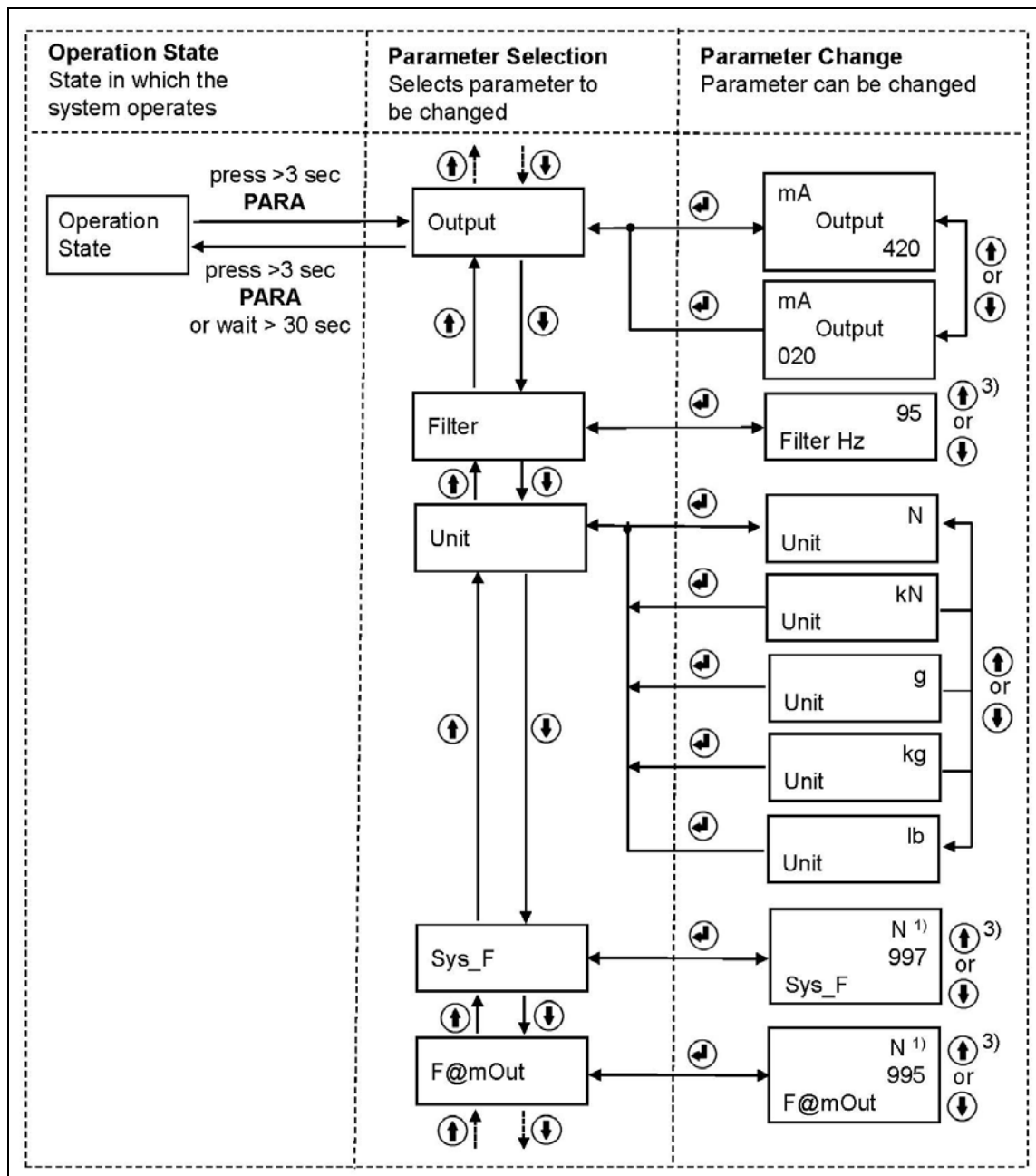


Fig. 6: State Diagram Parameter Setting (1st part)

E310010e

- 1) The display shows the unit of measure that was previously selected.
- 2) Enter the force corresponding to your calibration weight
- 3) Permanent key pressing expedites the changing speed.

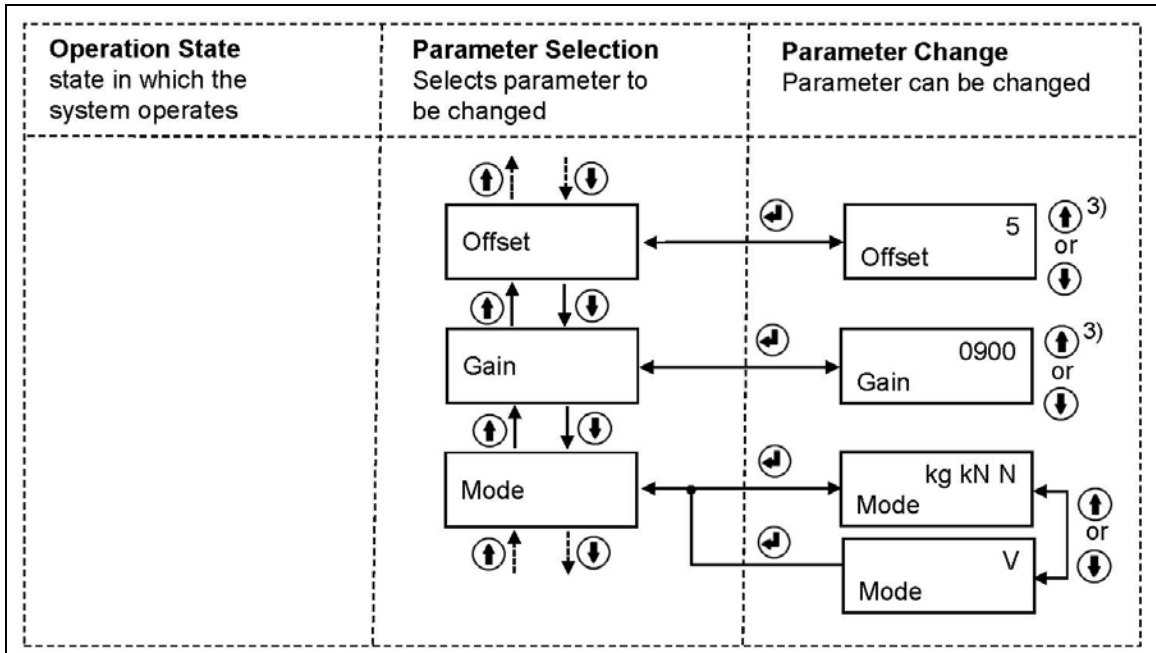


Fig. 7: State Diagram Parameter Setting (2nd part)

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4.1 Reset to Default Parameter Set

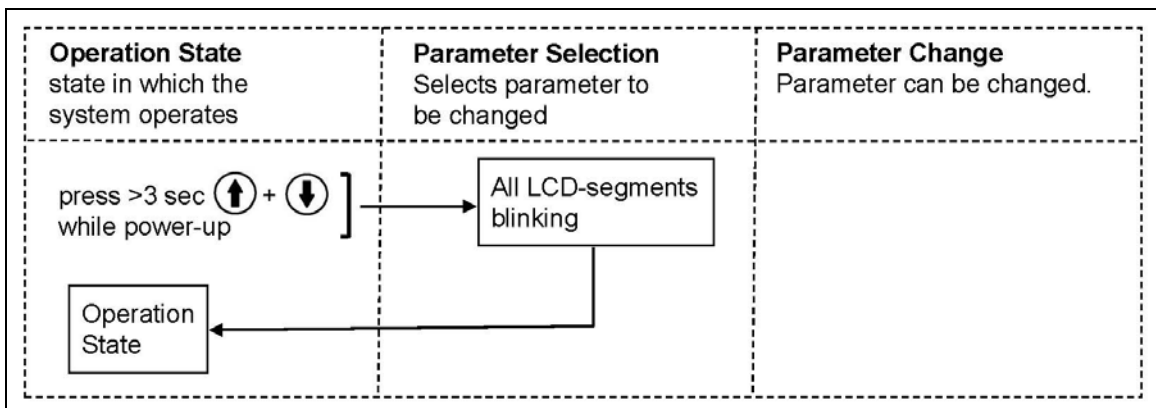


Fig. 8: Reset to Default Parameter Set

E310012e



4.2 Parameter List


Parameter	Unit	Min	Max	Default	Remarks
Output	[mA]	0...20 or 4...20		4...20	Current output
Filter	[Hz]	0.1	999.9	10.0	Noise filter
Unit	[-]	N; kN; g; kg; or lb		N	System unit
Sys_F	N; kN; g; kg; or lb	1	100'000	1000	System force of the roller
F@mOut	N; kN; g; kg; or lb	1	100'000		Force at max. output
Offset	[Digit]	-8000	8000	8000	Roller weight
Gain	[-]	0.1	20.0	20.0	Amplification
Mode	[-]	Volt or Force		Force	Requires new calibration

4.3 Description of Parameters


Current Output Selection			LCD: <i>.Output</i>	
<p>Use: This parameter selects the current output signal of the amplifier. The voltage output (+/-10V) is parallel in use</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	4..20mA 0..20mA	4..20mA

Low-pass Filter			LCD: <i>Filter</i>	
<p>Use: The amplifier provides a low-pass filter to prevent noise overlaying the output signal. The parameter <i>Filter</i> stores the cut off frequency of the filter. The lower the cut off frequency, the more sluggish the output and the display will be. The filter stabilizes the output signal in case of highly fluctuating force values. A correctly tuned filter will steady the value shown in the display.</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
Hz	0.1	999.9	-	10.0

Unit of Measure			LCD: <i>Unit</i>	
<p>Use: This parameter determines the unit used in the system. The label on the force sensor shows always the nominal force in N.</p> <p> By changing the units to lb (pounds) the whole unit system will change from metric to imperial units.</p> <p> If the Device Mode [VoltGauge] is set, this parameter is deactivated</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	N kN lb g kg	N

System Force			LCD: <i>Sys_F</i>	
<p>Use: The System Force [<i>Sys_F</i>] determines the measuring capability of your measuring roller. E.g. If two 500 N sensors are installed in your measuring roller, enter 1000N. If only one 500N sensor is used, enter 500N. If sensors with sheaves are used (e.g. RMGZ-Series), the nominal force 500N must be entered.</p> <p> If the Device Mode Volt Gauge is set, this parameter is deactivated</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
N, kN, g, kg, lb ¹⁾	1	100'000	-	1000


¹⁾ The display shows the unit of measure that was previously selected

Force at max. Amplifier Output			LCD: <i>F@mOut</i>	
<p>Use: This parameter defines what force value (N, kN, lb, g, kg) corresponds to the maximum output of the amplifier (10V or 20mA).</p> <p> If the Device Mode Volt Gauge is set, this parameter is deactivated</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
N, kN, g, kg, lb ¹⁾	1	100'000	-	1000

¹⁾ The display shows the unit of measure that was previously selected

Offset Value			LCD: <i>Offset</i>	
<p>Use: The offset value is used to compensate the roller weight (see chapter 3.4 “Offset Compensation”).</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
Digit	-8000	+8000	-	0

Gain of Amplifier			LCD: <i>Gain</i>	
<p>Use: This parameter stores the value determined with the Procedure <i>Calibration</i> (see chapter 3.6). With a gain value ≥ 10.000, the display format changes to 10.00.</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
-	0.001	20.000	-	1.000

Device Mode			LCD: <i>Mode</i>	
<p>Use: The Device Mode determines the functionality of the amplifier. If Volt Gauge is set, force values will be displayed only in Volt (V) or mA. Force units won't be available.</p>				
<p> Each change of the Device Mode requires a re-calibration of the system (see chapter 3.6).</p>				
Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	kgkNN V	kgkNN

5 Configuration via FMS ComACT™ app

If you have purchased an EMGZ310.ComACT measuring amplifier you are able to display actual readings and configure the amplifier via the FMS ComACT™ app.

You can identify the type of amp on the type label. The EMGZ310.ComACT has also the last 4 digits of its serial number printed on the front housing.



Only a single mobile device at a time can connect to an amplifier.

As soon as the connection between amp and mobile device is setup, the display of the amp will start flashing.

The FMS ComACT™ app is meant as an operation aid to display actual readings and to help configure the amplifier. The settings are only stored in the amplifier and not in the mobile device.

5.1 Screenshots

<p>Download FMS ComACT™ app → Google Play Store (Android); iTunes (IOS)</p>	<p>Overview with all amplifiers within the transmitting range.</p>	<p>Display of actual readings with the selected settings (unit, gain, output, etc.)</p>	<p>“Settings” requires a password. The password is preset to “3231” and it cannot be modified.</p>

<p>„Calibration“ leads you to the offset and gain menu.</p>	<p>You can perform an offset without any further input. Make sure that the web does not material in the</p>	<p>Successful input and operations are confirmed</p>	<p>Before you perform the calibration, you have to enter the applied weight.</p>

6 Dimensions

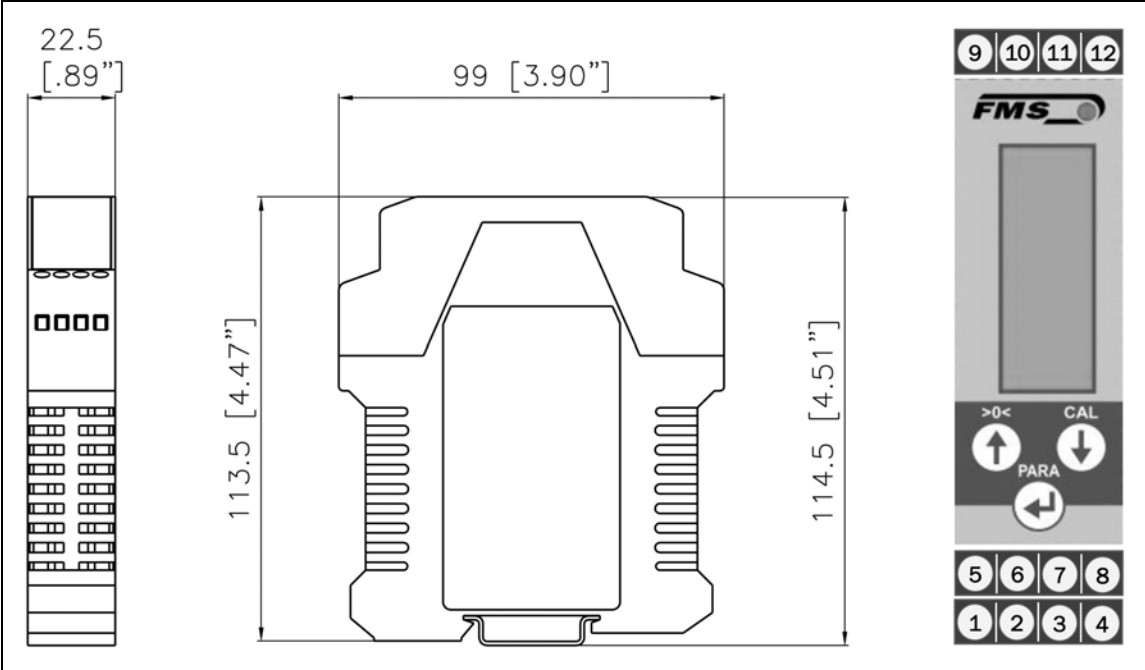


Fig. 8: Drawing EMGZ 310 rail mount housing

E310004

7 Technical Specification

Amplifier type	Digital, microprocessor controlled
# of channel	1 channel for 2 sensors @ 350 Ω
Sensor excitation	5VDC max. 30mA (high voltage stability)
Linearity error	< 0.1%
Processor cycle time	1ms
Operation / parameter setting	3 keys, 4-digit LCD display (alpha-num)
Resolution A/D converter	± 8192 digit (14 bit)
Volt output	$\pm 10V$ min. 1.0 k Ω (12 bit)
Current output	0/4...20mA max. 500 Ω (12 bit)
Power supply	24VDC (18...36VDC); max. 0.2A
Power consumption	< 3.0W
Temperature range	0...+50 °C [32...122 °F]
Protection class	IP20
Special functions	Buttons for calibration and offset compensation

8 Your Settings

Parameter	Your Settings	Remarks
Output		Current output
Filter		Noise filter
Unit		System unit
Sys_F		System force of the roller
F@mOut		Force at max. output
Offset		Roller weight
Gain		Amplification
Mode		Requires new calibration

9 Notes



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