Operating Manual EMGZ321._.EIP

Left / Right Tension Measuring Amplifier with integrated EtherNet/IP Interface

Version	2.21 07/2017 NS
Firmware Version	V2.20

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

Table of Contents

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) Danger of health injury or loss of life

STOP **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 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

⚠ *In order to improve the natural convection and keep the temperature of the amplifiers that are mounted in a cabinet, to a minimum, a distance of at least 15mm (0.6") between the devices must be kept*

⚠ *Proper function of the FMS tension controllers is only guaranteed with the recommended application of the components. In case of other arrangement, heavy malfunction can be the result. 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.*

⚠ *The processor board is mounted directly behind the operation panel. Improper handling of the electronic boards may cause damage to the fragile equipment. Don't use rough tools such as screwdrivers or pliers! Operators handling the electronic boards must wear a well earthed bracelet in order to discharge static electricity.*

2 System Description

2.1 Product Range

The tension measuring amplifier series EMGZ21 is available in two versions:
- EMGZ321._ with standard analogue outputs
- EMGZ321._.EIP with analogue outputs and integrated EtherNet/IP interface

Both versions are available in three different housing / mounting options:
- EMGZ321.R rail mount housing
- EMGZ321.S panel mount housing
- EMGZ321.W wall mount housing

2.2 Block Diagram
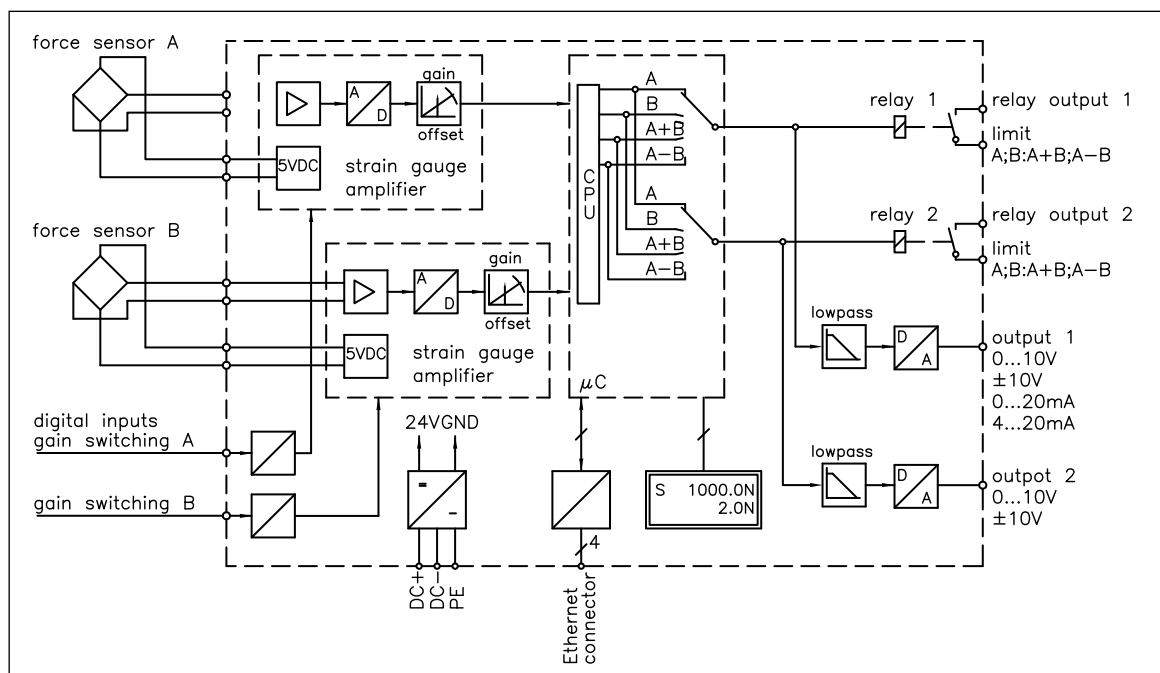
Fig. 1: Block diagram EMGZ321   E321002e

2.3 Functional Description EMGZ321

The EMGZ321 is a double channel strain gauge amplifier for a single measuring point. The material tension can be measured on both sides of the measuring roller independently.

The 2 force sensors of the measuring point measure the tension force in the material and transmit the measuring value as a mV signal to the electronic unit EMGZ321. The electronic unit amplifies the mV signal of each force sensor independently. This signal will be fed to the A/D converter. The microprocessor does then all application specific calculations such as offset, gain, low-pass filter, limit switches, etc.

A sum value (A+B) and a difference value (|A-B|) are calculated from the force values of the sensors A and B. The resulting feedback values are shown in the display in [N] or the chosen unit. In addition, the feedback values are provided at the analogue outputs and can be evaluated by analogue instruments, a PLC or equivalent devices.
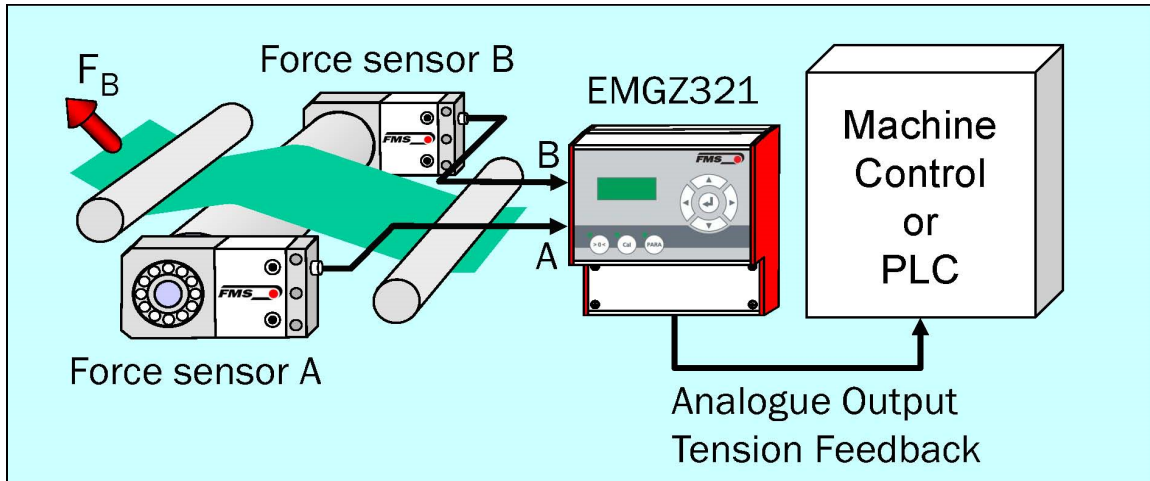
Fig. 2: Application example of EMGZ321   E321020e

2.4 System Description EMGZ321._.EIP

The amplifier EMGZ321._.EIP offers in addition to his standard features the possibility to be used as an EtherNet/IP device in a corresponding network. EtherNet/IP bases on the Ethernet TCP/IP and the UDP technology as well as on the CIP (Common Industrial Protocol). The amplifier can be embedded in a standard Ethernet infrastructure. Its fast data rate with cycle times down to 2ms makes the device ideal for applications in automated assembly and production lines. It allows the measurement of web tension and its transmission over Ethernet to a controller in real time. Configuration of the amplifier takes place either over the EtherNet/IP, a web browser or over the operating panel.
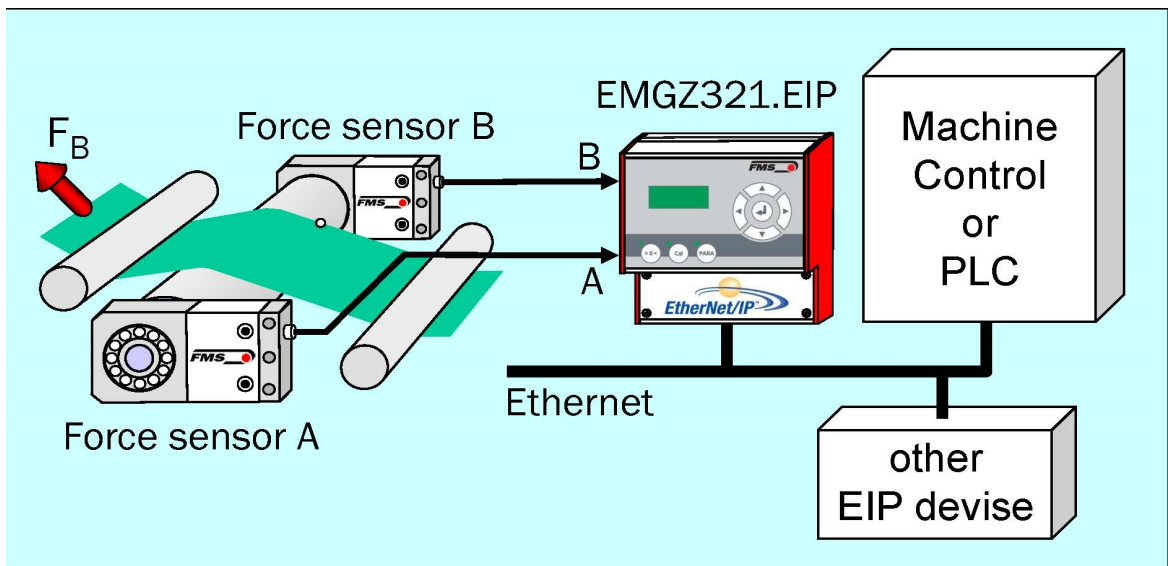
Fig. 3: System Configuration EMGZ321._.EIP integrated in EtherNet network E321021e

3 Quick Installation Guide

In a Plug & Play configuration the set-up of the EMGZ321._.EIP and the corresponding force sensors is straight forward and limited to only the offset compensation and the calibration procedure.

3.1 Preparations for Set-up

1. Read the Operation Manual of your force measuring sensors and amplifier
2. Check your requirements such as:
   – Desired output configuration 0...10V, ±10V or 0/4... 20mA
   – Display unit of nominal force
3. Draw the wiring diagram for your configuration (ref. to **3.6** "Wiring the Tension Monitoring System")
4. If required, determine special parameters (ref. to **8** "Parameter Setting over the Operation Panel")

3.2 Installation Procedure

1. Mount your force maesuring roller to the machine frame.
2. Wire the force measuring sensors (ref. to **3.6** "Wiring the Tension Monitoring System")
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 paragraphs **7.3** to **7.4**)
6. If required, do additional settings (ref. to "**8** "Parameter Setting over the Operation Panel")
7. Integrate the amplifier in your Ethernet network respectively your PLC.

3.3 Installation and Wiring

> ⚠️ *Caution*
>
> *In order to improve the natural convection and keep the temperature of the amplifiers that are mounted in a cabinet, to a minimum, a distance of at least 15mm (0.6") between the devices must be kept.*

> ⚠️ *Caution*
>
> *Proper function of the FMS tension amplifier is only guaranteed with the recommended application of the components. Other arrangements, can cause heavy malfunctions. Installation instructions on the following pages must strictly be followed.*

> *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.*

3.4 Mounting the Force Measuring Roller

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

3.5 Mounting the EMGZ321._.EIP

The EMGZ321 series is available in 3 different housing options. The respective mechanical dimensions of the different housings can be seen in **chapter 10**.

3.6 Wiring the Tension Monitoring System

Use the original FMS cables to connect the system components together.
The connection between the force sensors and the electronic unit is done with a 2x2x0.25 mm² [AWG 23] cable. The wiring diagrams show how the wiring to the terminals of the electronic unit is done.

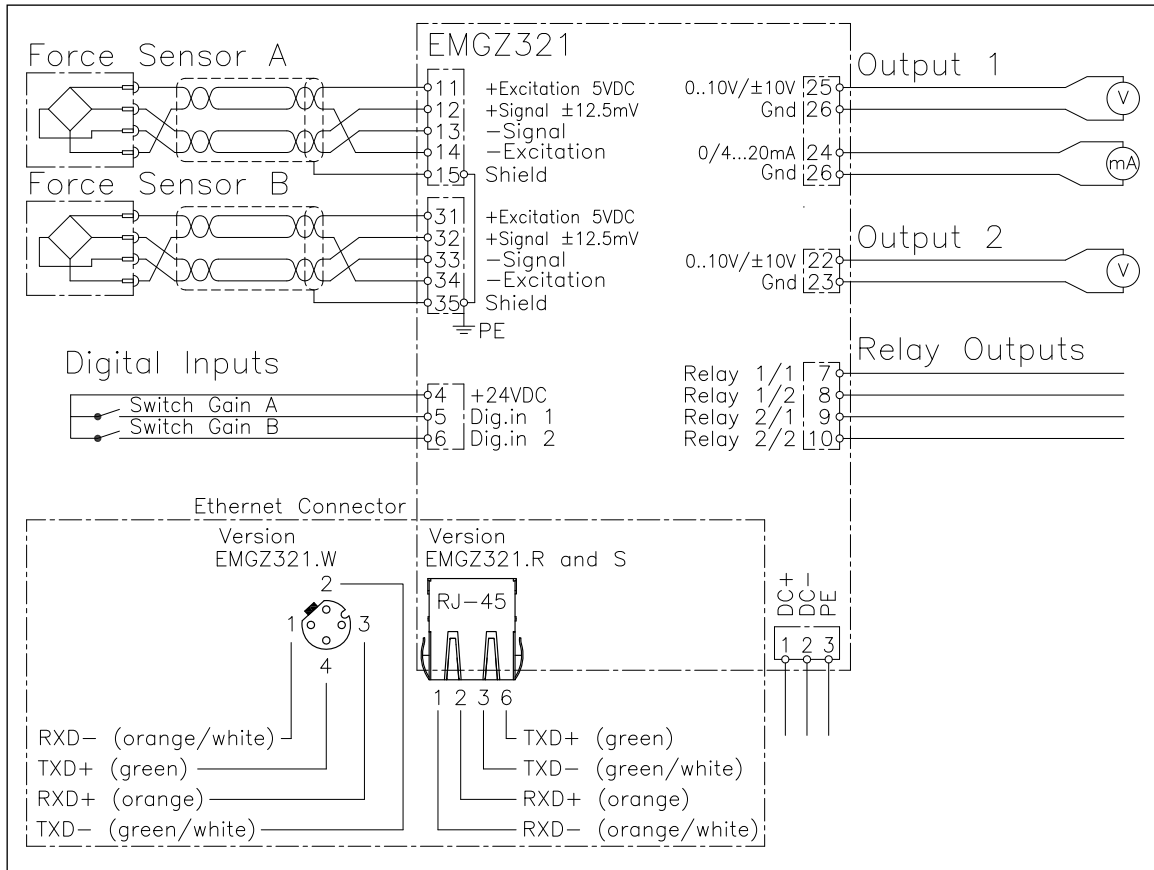**Fig. 4:** Wiring diagram EMGZ321   E321001e

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⚠ **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 that there is a proper and secure earth ground connection.

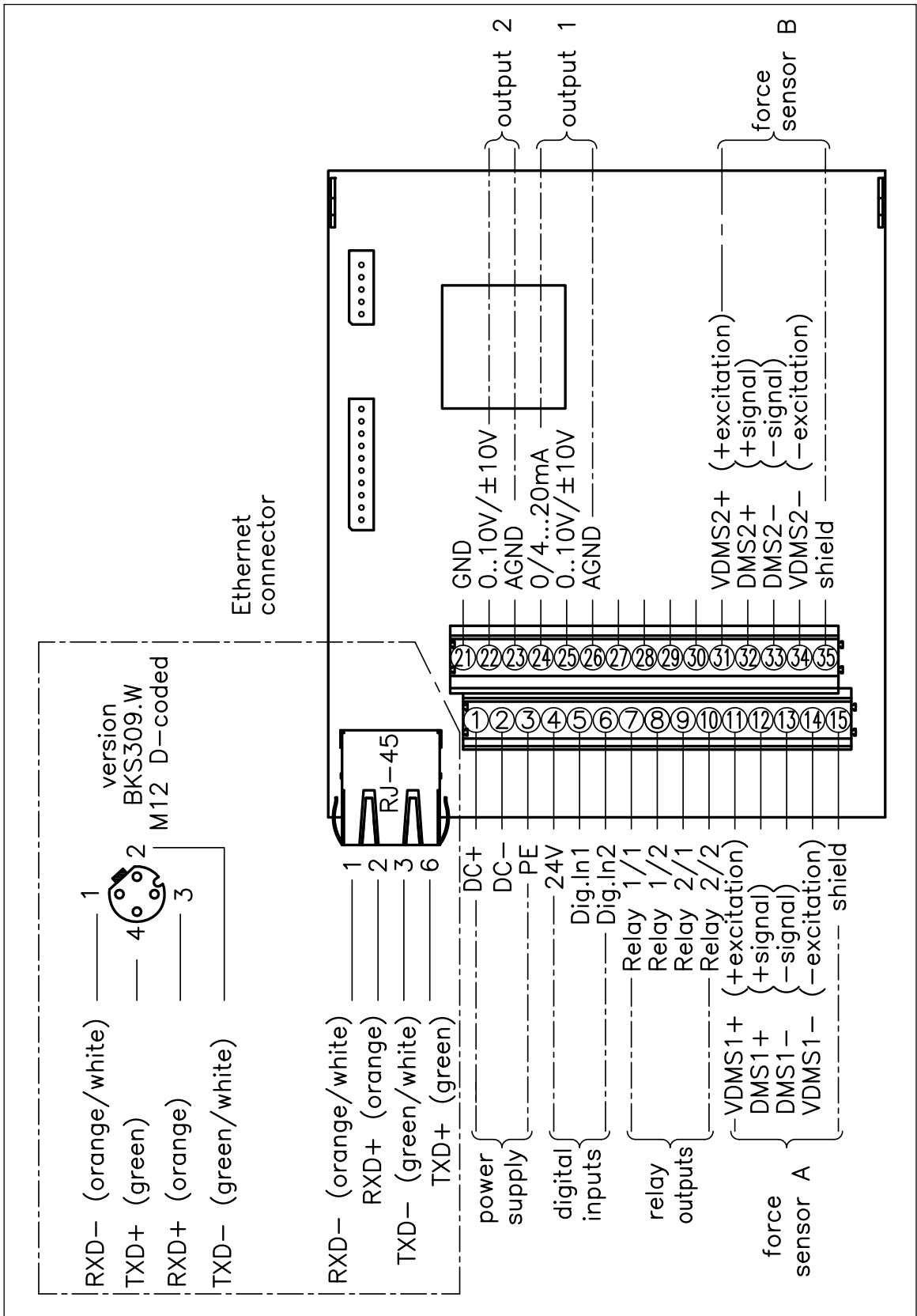## 3.7 Screw Terminal Arrangement

Fig. 5: Screw terminal arrangement on processor board

E321003e

3.8 Connection of the Cable Shield

Cable shields must be connected as indicated in the wiring diagram (see **Fig. 4** and **5**). The shield should be connected only to the amplifier side. On the force sensor side, the shield should stay open. Other arrangements may cause ground/earth loops which may interfere with the measuring signal. Malfunction can be the results. If a housing type with PG glands is used, one must pay heed to a proper connection of the shield. Skinning of the cable and shield handling are indicated in **Fig. 6.**
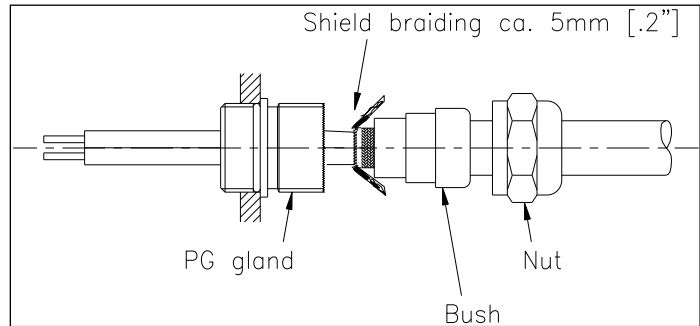

Fig. 6: Shield connection   E470009e

👉 *Note*

Force sensors deliver a signal of a few mV and are therefore susceptible to external influences. To increase immunity to interfering use one twisted pair cable for +signal and –signal. This signal cables must be separated from power lines.

👉 *Note*

Connecting the shield of the signal cable to the electronic unit and to the force sensor may cause ground loops which may interfere with the measuring signal. 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.

3.9 Digital Inputs

The EMGZ321._.EIP amplifier provides 2 digital inputs for the special functions of switching between two different gain factors.
The digital inputs are level triggered. A threshold change activates the gain switch:
- In sensor A from gain factor 1 to gain factor 2
- In sensor b from gain factor 1 to gain factor 2

Signal Name	Terminal #	Sensor	Threshold low	Threshold high
Dig. In 1	5	A	Gain factor 1	Gain factor 2
Dig. In 2	6	B	Gain factor 1	Gain factor 2

3.10 Relays Outputs

The EMGZ321._.EIP amplifier provides 2 programmable relay outputs. The outputs are software controlled. Electrically they are potential-free. Each relay output can individually be configured to check violations of force limits. The outputs are configured in chapter 8.6 "Relay Parameter Group".

Following functions can be assigned to each output:
- Indicate if force limit of sensor A has be violated
- Indicate if force limit of sensor B has be violated
- Indicate if the sum of the forces of sensor A+B has be violated
- Indicate if the absolute value of difference ₁A-B₁ has be violated

For more details about the functions refer to paragraph **8.7** "Description Relay Parameter Group".

Hardware access via screw terminals (see **Fig. 4** and **5**)

Signal Name	Terminal #
Relay 1/1	7
Relay 1/2	8
Relay 2/1	9
Relay 2/2	10

4 Configuring the System

The amplifier EMGZ321._.EIP can be configured over the operation panel (**chapter 8**), over a PC (web interface, **chapter 9**) or over EtherNet/IP. The basic configuration is performed over the operation panel.

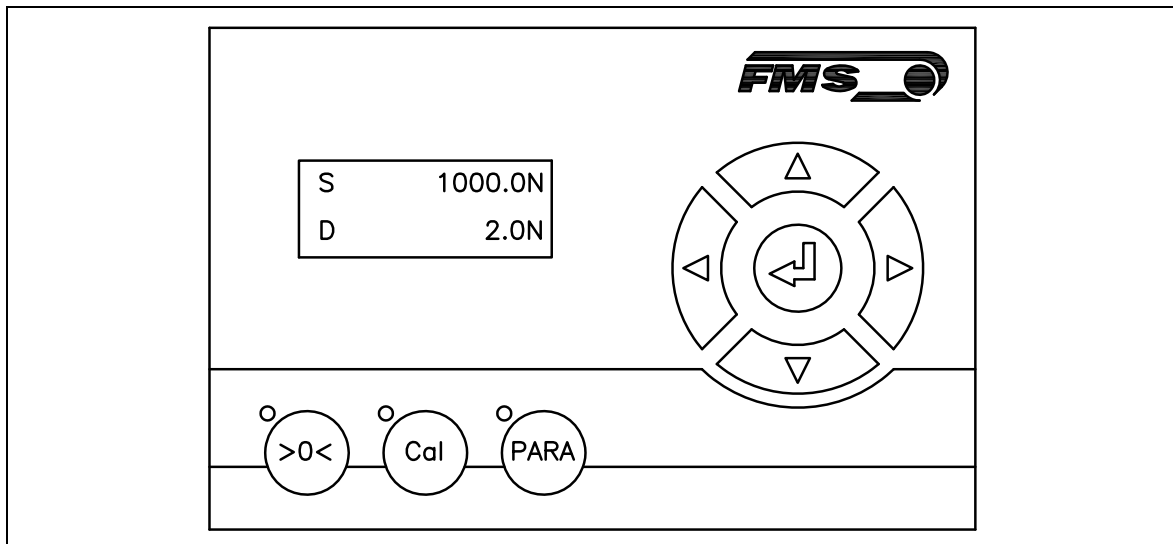## 4.1 Description of the Operating Panel

Fig. 7: View of the Operating Panel EMGZ321.W.EIP   E321005

The keys on the operating panel have the following functions:
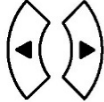
Key	Key function during operation
>0<	Enter Offset Compensation Procedure
Cal	Enter Calibration Procedure
PARA	To enter the Parameter Setting Mode, press the key for longer than 3 sec. The LED will light and the first parameter group will appear on the LCD display indicating that you entered the mode. The State Diagrams (**Fig. 20** to **25**) in paragraph **8** "Parameter Setting over the Front Panel" will help you to navigate in the parameter setting mode.
↵	Enter
◄ ►	Changes the parameter selection.
▲	Increases the parameter values. Pressing the button increases continuously the parameter value.
▼	Decreases the parameter values. Pressing the button reduces continuously the parameter value.

Fig. 8: Functions of the operation panel keys

4.2 Preparations for System Configuration
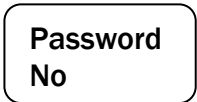
In order to facilitate the configuration of the tension monitoring system it is advisable to adapt some basic system parameters to the specific requirement of the application.

1. Adopt password
2. Set the language on the display
3. Set measuring unit

Above features are changed in the **8.8** "System Parameter Group". Please refer to **Fig. 17** to **19** to visualise the following parameter changing procedures:
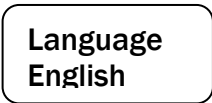
A) Adopt Password

The password cannot be changed. It is always **3231**. However, it can be adopted or disabled. If adopted, the system will request the password for every parameter change. If you wish to adopt the password, follow the following instructions:

1. Hold the (PARA) key for longer then 3 sec. until you enter the Parametrisation State.

2. The display shows | Amp. ******* | . Scroll the menu by pressing the key until you are in the parameter group **"System"**.

3. Press . The display shows | Password No |

4. Press again . The display starts flashing indicating that you can now change the parameter with the or keys.

5. To confirm your change by pressing the Enter key .

6. Press the key twice, if you want to return to the Operation State. If you desire to change the language, continue with the steps below.
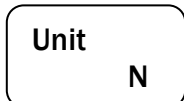
B) Change Language

The default setting for the language is English.

1. Press to select the Parameter *Language* | Language English |

2. Press again . The display starts flashing indicating that you can now change the parameter with the or keys.

3. Set your language

4. To confirm your change by pressing the Enter key .

5. To change the measuring units continue with next paragraph C)

6. Press the key twice, if you want to return to the Operation State. If you desire to change the measuring unit, continue with the steps below.

C) Change the Measuring Units

The default tension measuring unit is N (Newton). The user can, however, select another unit before the system is calibrated..

1. Press ⬦ to select the Parameter *Unit*.

   ```
   ┌──────────────┐
   │ Unit         │
   │         N    │
   └──────────────┘
   ```

2. Press again ⏎ . The display starts flashing indicating that you can now change the unit parameter with the ⬆ or ⬇ keys.

3. To confirm your change by pressing the Enter key ⏎ .

4. Press the ⬆ key twice to return to the Operation State.

5 Network Connection over EtherNet/IP

The amplifier EMGZ321._.EIP is able to communicate with other devices over an Ethernet network. CIP (Common Industrial Protocol) is used as the protocol for the data link. The amplifier acts as a so called "Producer" and the machine control (or PLC) as the "Consumer".

5.1 EtherNet/IP Specification:

Physical layer: Ethernet IEEE 802.3.
Transport protocol: TCP/IP und UDP
Standard: CIP IEC 61158
Conformity: CPF 2 (Communication Profile Family 2) IEC 61784-1

5.2 Amplifier Functionality over EtherNet/IP

Basically all functions for configuration and calibration can be performed over EtherNet/IP. Furthermore, the measured tension values are cyclically propagated over the network and made available to the Consumer (PLC).

5.3 Integration of EMGZ321._.EIP in an Ethernet Network

In order to integrate the amplifier in an Ethernet network and enable data transfer over it following conditions must be fulfilled:

- ✔ An EMGZ321 amplifier with the option EtherNet/IP (EIP) must be used.
- ✔ The IP-Address must be assigned in the fix address block and must be unambiguously. It may only exist once in the network.
- ✔ The network mask must correspond with the used device configuration.

If these prerequisites are given, the controller will recognise the amplifier as an EtherNet/IP device in the network and be able to communicate with it. The interface information for EMGZ321._.EIP is defined in an EDS-file. The EDS file is only used as documentation and cannot be imported into RSLogix 5000.

EDS-files for EMGZ321._. EIP can be downloaded from the FMS webpage.

☞ *Note*

The device does not support the import of the EDS files. The import with development software e.g. RSLogix5000 will generate error messages.

Utilize "Messages" to change parameter values of the device. Details are explained in the sample file which is available for download on the FMS website.

5.4 Configuration of the Amplifier over EtherNet/IP

EMGZ321._.EIP may, but need not be configured via EtherNet/IP. The Amplifier can be configured by means of a controller. It is integrated in the same network, The communication between machine control and amplifier is carried out with dedicated software (e.g. RSLogix5000 from Rockwell). Please refer to the manual of the respective controller.

There are three possibilities to configure the EMGZ321._.EIP. If the method over EtherNet/IP is used, the other two options (operation panel or web interface) are still possible but not meaningful. The EtherNet/IP method has then always priority and overwrites any other configurations set by the other two methods.
If the configuration over EtherNet/IP is selected then messages from the PLC to the EMGZ321 must be used.
How the messages are used, is described in shows the example program.
The example project EMGZ321_EIP_Example_Project_Vx.xx is available for download on the FMS website.

☞ *Note*

The configuration of the amplifier via EtherNet/IP must be used as commissioning procedure. Continuously writing parameters on a cyclic base is not allowed and will lead to communication problems and reduced the lifetime of the device.

5.5 Calibration over EtherNet/IP

Usually the calibration procedure for amplifier and load cells is carried out at the commissioning of the machine. The two commands *Offset* and *Calibration* are available for the calibration of the amplifier over EtherNet/IP. From case to case it is to consider whether a calibration via web interface or operation panel is more favourable. With difficult accessibility of the amplifier it might make sense to do the calibration over EtherNet/IP.

6 Integration in an Allen-Bradley PLC

Following chapters deal with the integration and operation of the EMGZ321._.EIP amplifier with an Allen-Bradley PLC. The project software RSLogix5000 from Allen-Bradley is required to program the PLC. Furthermore, it is assumed that a development system with PC and corresponding development software RSLogix 5000 from Rockwell Automation is available and the programmer is familiar with these tools..

6.1 Hardware Environment

The EMGZ321._.EIP must be connected to an Ethernet switch which in turn is in the same network as the PLC. Only in this way a communication between amplifier and PLC can take place. Several EMGZ321._.EIP amplifiers or other Erthernet devices can be connected to the same network.

6.2 IP Configuration

In an industrial environment the IP addresses are normally assigned fix to the EIP devices. This holds also for the EMGZ321._.EIP amplifier that needs a fix IP address in the network. The IP address configuration must take place before the amplifier is integrated in a network. This is done over the operation panel or over the web interface.
The procedures are described in the state diagrams **chapter 8.8 (Fig. 25)** and **chapter 9 (Fig.34)**

6.3 Integration in a Project

Before starting the development system RSLogix5000 the PLC and amplifier need to be connected to the network and powered-up. Now a new project or an existing project can be opened in RSLogix5000. Search in the tree structure *Controller Organizer* for the listing **Ethernet** and make a right mouse click (see **Fig. 10**).
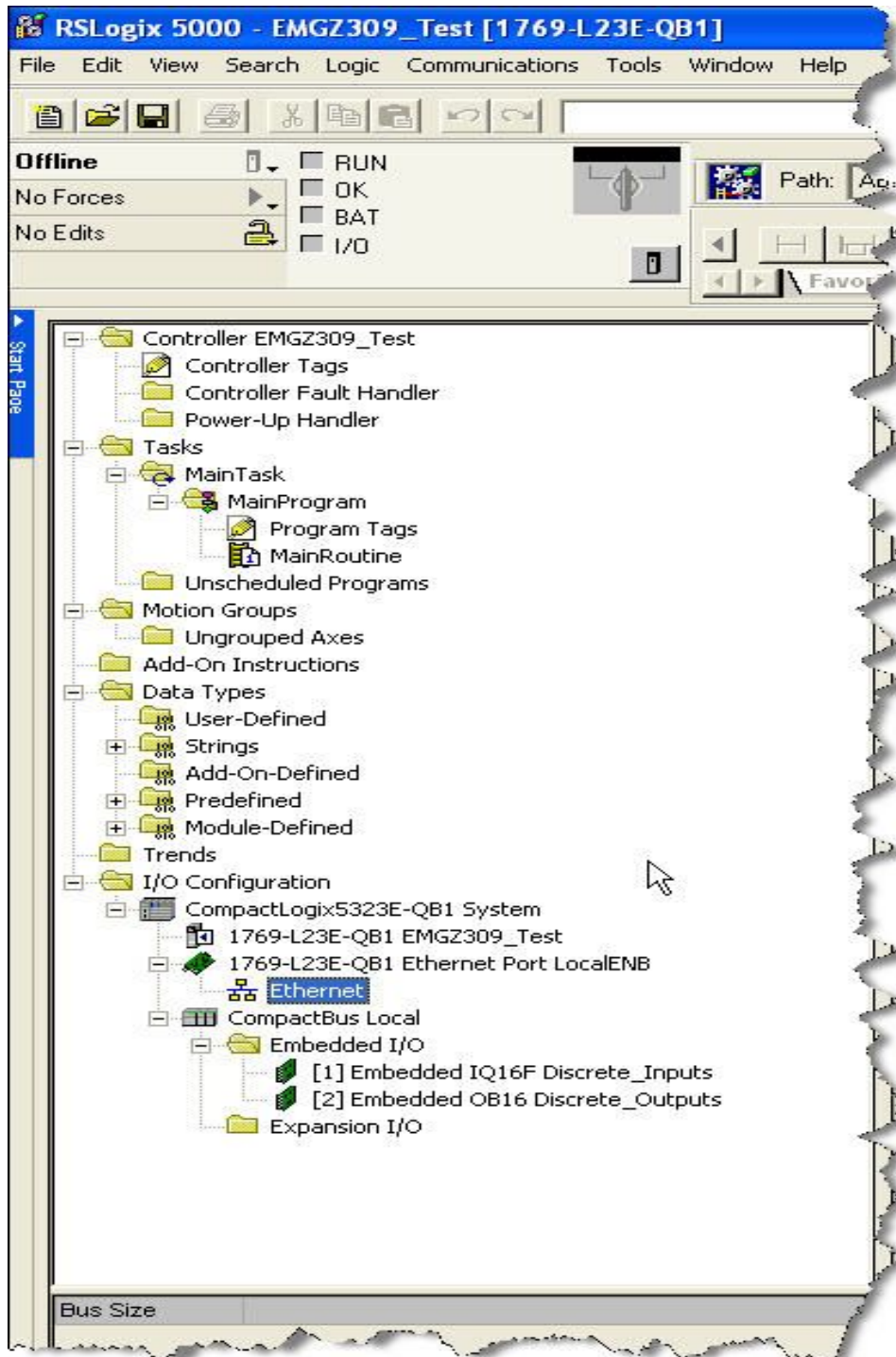
Fig. 10: Controller Organisation   E309021

In this example CompactLogixL23E-QB1B is used. If a different hardware is used, one may find the listing *Ethernet* in another place. However, the principal approach is always the same. After a right mouse click on *Ethernet* a dialog window will open up. Left mouse click on *New Module...*and a new window will open up (see **Fig.11**).

Open plus-sign [**+**] in front of *Communications* to see all the other listings.
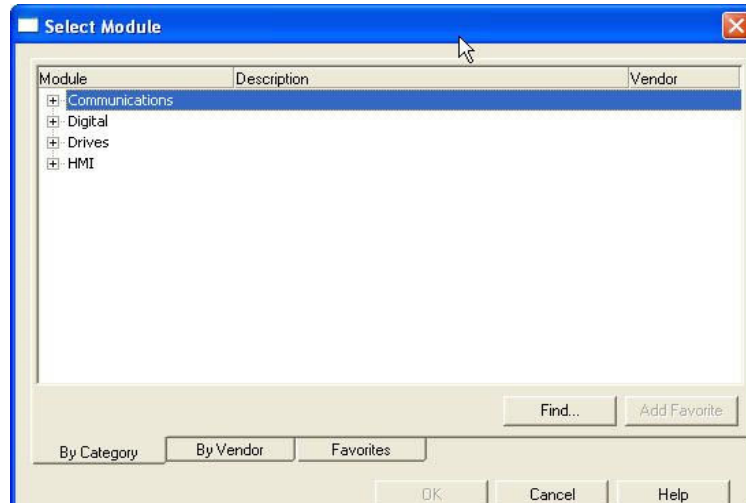
Select *ETHERNET-MODULE Generic Ethernet Module* and confirm with **OK**.
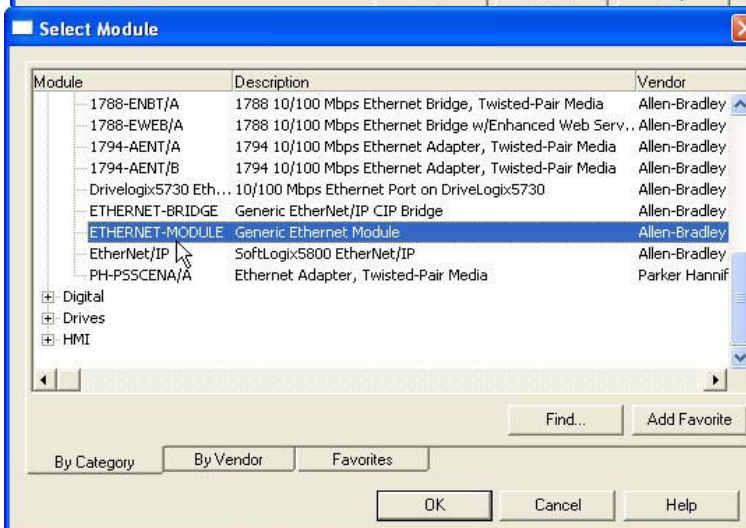
Fig. 12: Module Selection open   E309023

Following window opens up in which the *Name EMGZ321_91*, the *Comm Format Input Data - DINT* and the *IP Address* (eg. *192.168.0.91*) need to be entered. On the Connection Parameters side the values *Input=100* with *Size 11*, *Output= 101* (leave empty) and *Configuration= 102* with *Size 116* must be entered. Confirm with **OK**
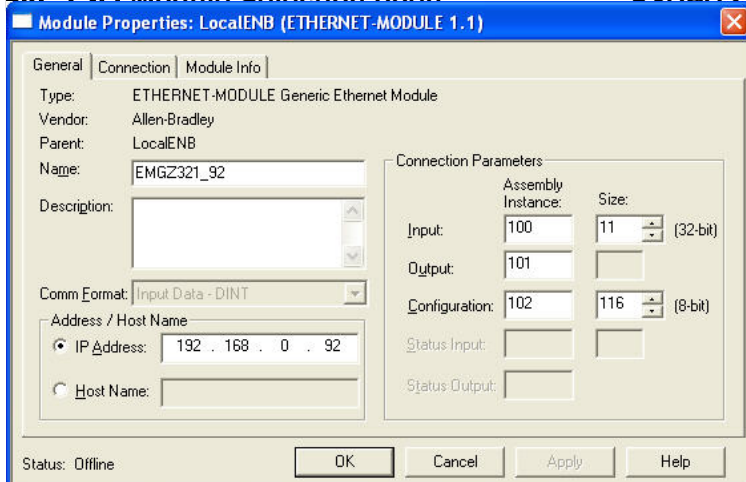
Fig. 13: New Module   E321022

The dialog window (**Fig. 14**) will open up. Here, one can enter the cycle time. This determines how often the data will be propagated in the network. The minimal cycle time is 2 ms. Default setting is 10 ms. Basically the cycle time must be set so that the maximum speed requirements of the system are fulfilled. A fast cycle time leads to more data traffic in the network. That can create communication bottlenecks. Especially when using several EMGZ321 amplifiers and other EIP devices in the same network a well-balanced data speed is important.
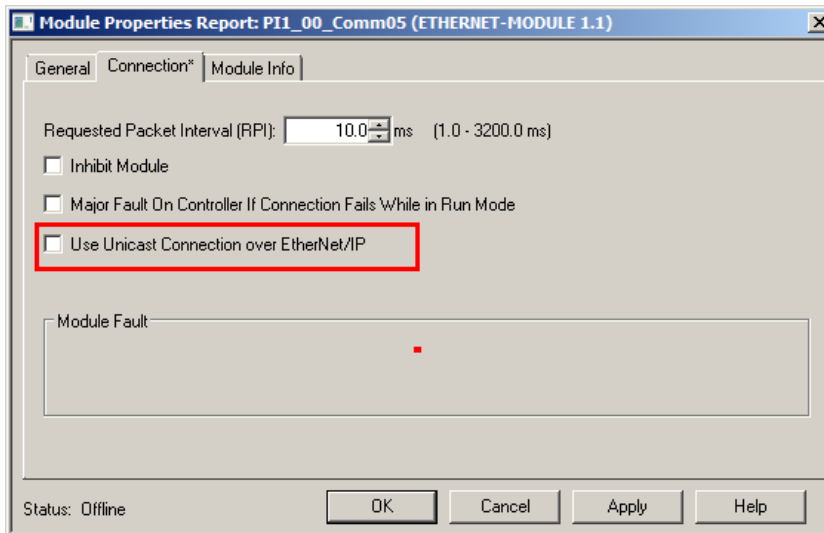
Fig. 14: **Module Properties**

👉 *Note*

Untick the box „Use Unicast Connection over EtherNet/IP". The use of this feature is not allowed as it will cause communication problems.

6.4 Access to the Tension Values

After the integration of the amplifier in the network the tension data are available in the global input tags of the controller and that in the defined cycle time. In our example the amplifier was named **EMGZ321_92**. The tension values can therefore be found under the controller tags **EMGZ321_92:I** >> **EMGZ321:I Data**
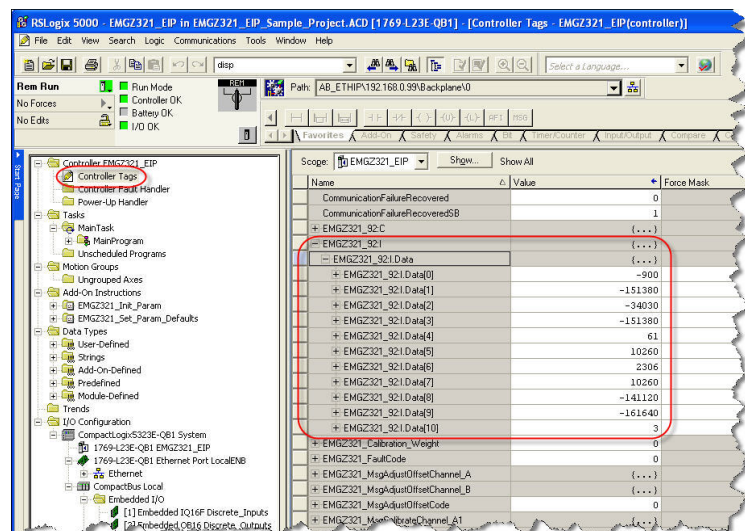
Fig. 15: RSLogix   E321023

Index 0 to 10. Where the values are assigned to the indices as follows:

Index	Value
0	Tension value in digits channel A
1	Tension value in Newton with 3 decimals channel A
2	Tension value in Pounds [lbs] with 3 decimals channel A
3	Tension value in the configured unit with 3 decimals channel A
4	Tension value in digits channel B
5	Tension value in Newton with 3 decimals channel B
6	Tension value in Pounds [lbs] with 3 decimals channel B
7	Tension value in the configured unit with 3 decimals channel B
8	Actual value channel A+B in units
9	Absolute value channel IA-BI in units
10	Bit 0 is the state of Relay 1; Bit 1 is the state of Relay 2

The access to the data in its values is marked red in **Fig. 15**.

7 Operation

7.1 Operating the EMGZ321 over the Front Panel

The dual channel amplifier EMGZ321 can go in 5 different states:

- **Operation State:**   Amplifier processes tension data
- **Display Selection:**   Selection of force values that are displayed
- **Offset Compensation:**   Automatic procedure to offset the roller weight
- **Calibration State:**   Procedure to calculate the amplifier gain
- **Parametrisation State:**   Set or change parameters

The user can toggle between the different states by pressing a key on the front panel. **Fig. 16** provides an overview about the different Operation States and how to move from one state to the other.
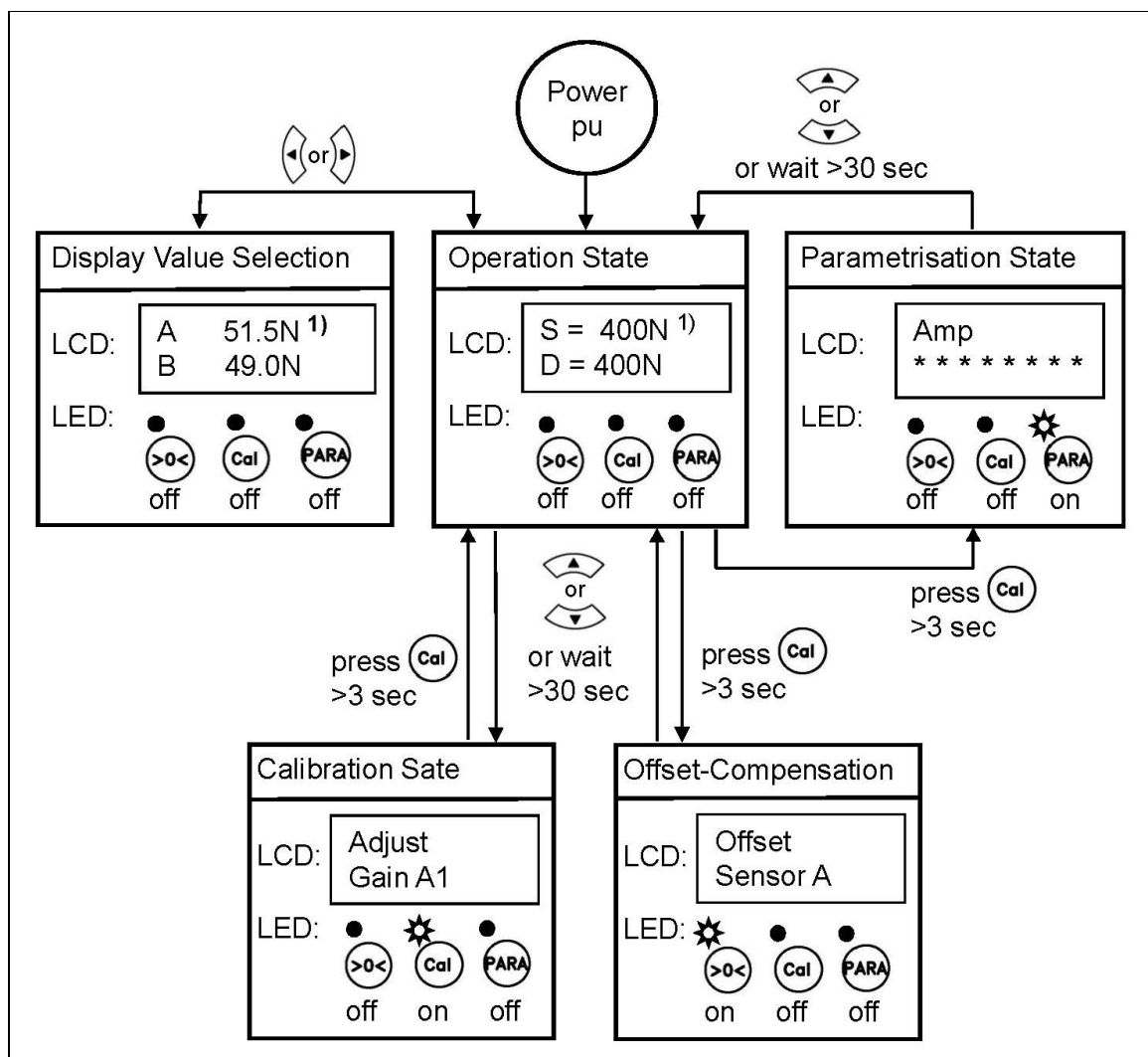
Fig. 16: Top-level view of operation control   E321006e

7.2 Display Value Selection State

There are several options to display force values the individual channels. The user can choose between 4 display forms:
S = Sum of sensor A+B   or   **A** = Force on sensor A
D = Difference of sensor ‖A-B‖   or   **B** = Force on sensor B

7.3 Offset Compensation Procedure

With the Offset Compensation one can compensate the roller weight. This procedure is always performed before the calibration. The force measuring roller should not be loaded while the Offset Compensation is being done. Continue with following steps:

1. Press the ⟨>0<⟩ key for longer then 3 sec. until you enter the Calibration State.

2. The display shows ┌─────────┐
   │ **Offset** │
   │ **Sensor** │
   │   -   │
   └─────────┘

3. Press ⟨⏎⟩ to start the offset compensation for channel A. After pressing the key this procedure will be executed automatically.

4. The display will indicate ┌─────────┐ ┌─────────┐ ┌─────────┐
   │ **Offset** │ │ **Offset** │ │ **Offset** │
   │ **Running** │ │ **Complet** │ │ **Sensor A** │
   └─────────┘ └─────────┘ └─────────┘

5. Select with ⟨▸⟩ key sensor B and repeat step 2 and 3 to do the offset compensation in sensor A.

6. Press the ⟨⌣⟩ key to return to the Operation State.
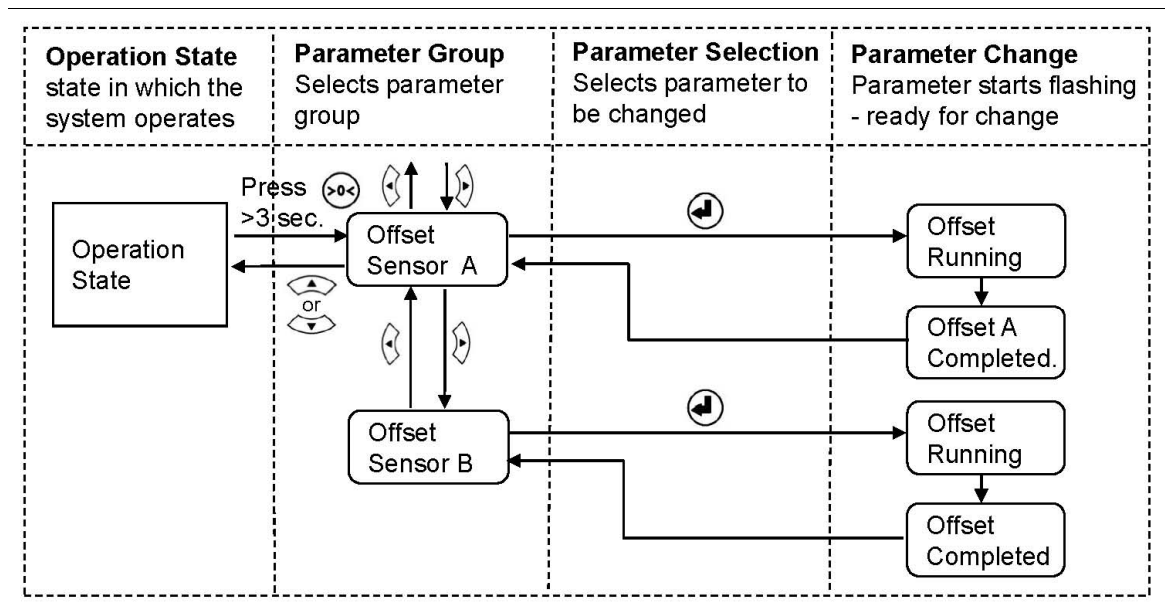
Fig. 17: State diagram offset compensation   E321007e

7.4 Calibration Methods

The Calibrating procedure (setting the Gain), adjusts the controller and load cells so that the display gives you the actual tension value. The method uses a defined weight. FMS recommends using the method with the weight (see **Fig. 18**) since it delivers the most accurate results.

To set the Gain, load a rope with a defined weight on the roller. The roller configuration must correspond to the real material path in the machine (wrap angle, distances between the rollers etc.).
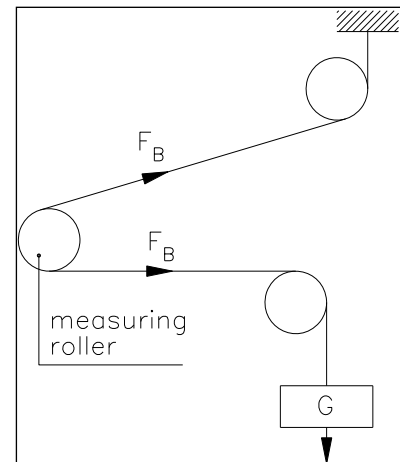
Fig. 18: Calibrating the measuring amplifier C431011e

7.5 Calibration Procedure:

Refer to Fig. 19 "State diagram calibration procedure" to get an overview of the calibration process.

1. Press the $\boxed{Cal}$ key for longer than 3 sec. until you enter the Calibration State.

2. The display will show

    | Adjust |
    | Gain A1 |

3. Press ⏎ to enter the nominal force of the force sensor. The force is indicated on the label of the installed force sensor.

4. The display will indicate

    | NomForceA |
    | 1000.0 |

5. Change the force value with the ⏶ or ⏷ keys. Enter the force that has been installed in the measuring roller. E.g. if two 250N sensors are used, enter 250N for sensor A and 250N for sensor B further below.

6. Press ⏎ to start the first gain factor calculation for sensor A.

7. The display will show

    | Calibra. |
    | 980.7 N |

8. Enter the force that corresponds to your calibration weight with the ⏶ or ⏷ keys.

9. Press ⏎ to store Gain A1.

10. The display will show

    | Calibra. | | Adjust |
    | Complet | | Gain A1 |

11. Select with ▷ key sensor B and repeat step 3 and 9 to do perform the gain calculation in channel B.

12. If you like to store a second gain factor set (e.g. for a different force measuring roller or for another wrap angle), select with ⬦ key "Gain A2" and repeat the procedure above.

13. Press the ⬦ key to return to the Operation State.

Operation State state in which the system operates	Parameter Group Selects parameter group	Parameter Selection Selects parameter to be changed	Parameter Change Parameter starts flashing - ready for change
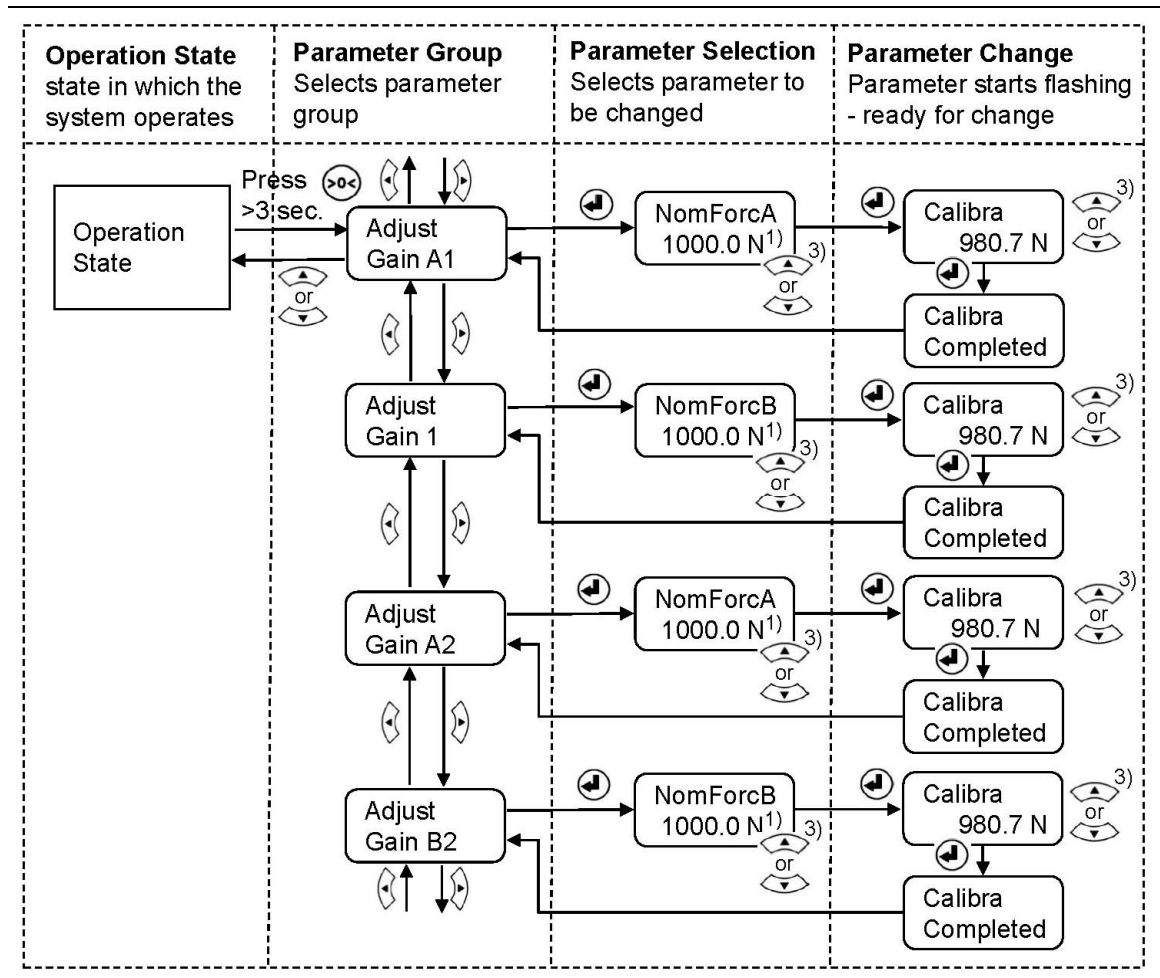
Fig. 19: State diagram calibration procedure   E321008e

1) The display shows the unit of measure that was previously selected
3) Permanent key pressing expedites the changing speed of the value.

8 Parameter Setting over the Front Panel

8.1 Basic Instructions for Parameter Setting

The force amplifier EMGZ321 can be configured via its parameters. Moreover, several adjustment procedures can be activated to capture or calculate application relevant values. Parameters and all other settings are stored in the parameter list. This list is organised in 4 parameter groups. In detail these are:

- **Amplifier Parameter Group**
- **Outputs Parameter Group**
- **Relay Outputs Parameter Group**
- **System Parameter Group**

The workflow in the Parametrisation State has three basic operator modi:

- **Parameter Group Selection**
- **Parameter Selection within the group**
- **Parameter Change or Setting**

Parameter setting can be performed via the front panel or via a web browser.

The Parametrisation State can only be accessed from the **"Operation State"**. The EMGZ321 displays only the parameters that are relevant for a used application (see **Fig. 16**).

8.2 Amplifier Parameter Group

With the two procedures **7.3** "Offset Compensation" and **7.5** "Calibration Procedure" the application specific parameter are determinate and the system calibrated. These parameters are stored in the Amplifier Parameter Group. They can be accessed and changed as described in the following state diagram.
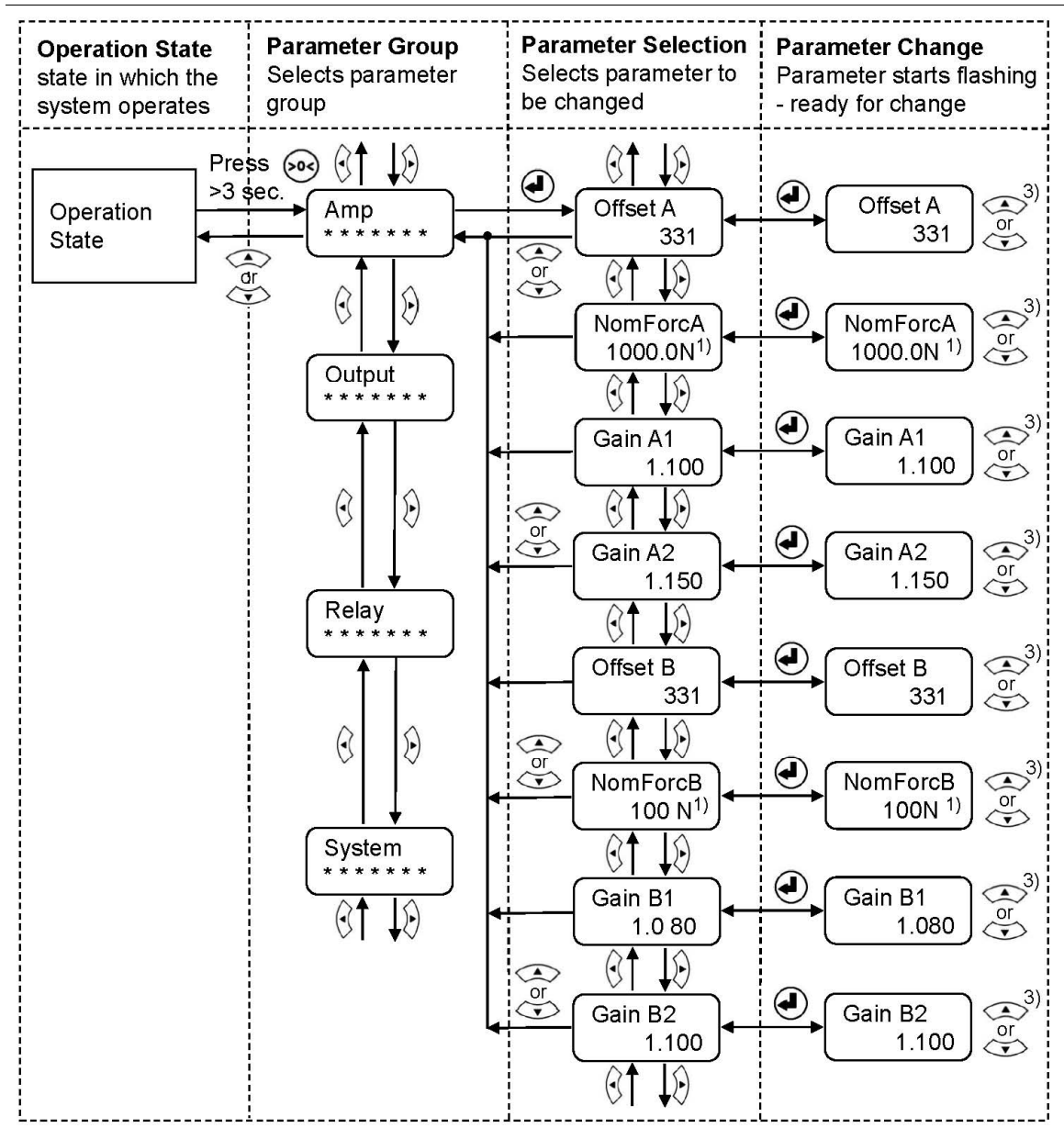
Fig. 20: Amplifier Parameter Group   E321009e

Notes for parameter settings:

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

[3] Permanent key pressing expedites the changing speed of the value.

8.3 Description of Amplifier Parameters

Offset A Offset B	LCD: *Offset A* LCD: *Offset B*

Use:	With the Offset Compensation procedure you can automatically compensate the roller weight. It is always performed before the calibration procedure. The value for offsetting the roller weight is stored in the parameter *Offset* in the parameter group Amplifier.

Unit	Parameter Range		Selection	Default
	Min	Max		
Digit	-8000	+8000	-	0

Nominal Force Sensor A Nominal Force Sensor B	LCD: *NomForcA* LCD: *NomForcB*

Use:	This parameter stores the nominal force of your force measuring roller. The nominal force is printed on the label of each force sensor. Enter the forces that have been installed in the measuring roller individually for sensor A and sensor B.

Unit	Parameter Range		Selection	Default
	Min	Max		
N, kN, g, kg, lb [1]	1.0	100'0000.0	-	1000.0

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

8.4　Outputs Parameter Group

In the Outputs Parameter Group all settings regarding the amplifier outputs, output modes and filter can be entered.

Fig. 21: Outputs Parameter Group (1ˢᵗ part)　　　　　　　　　　　　　E321010e

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

[3] Permanent key pressing expedites the changing speed of the value.
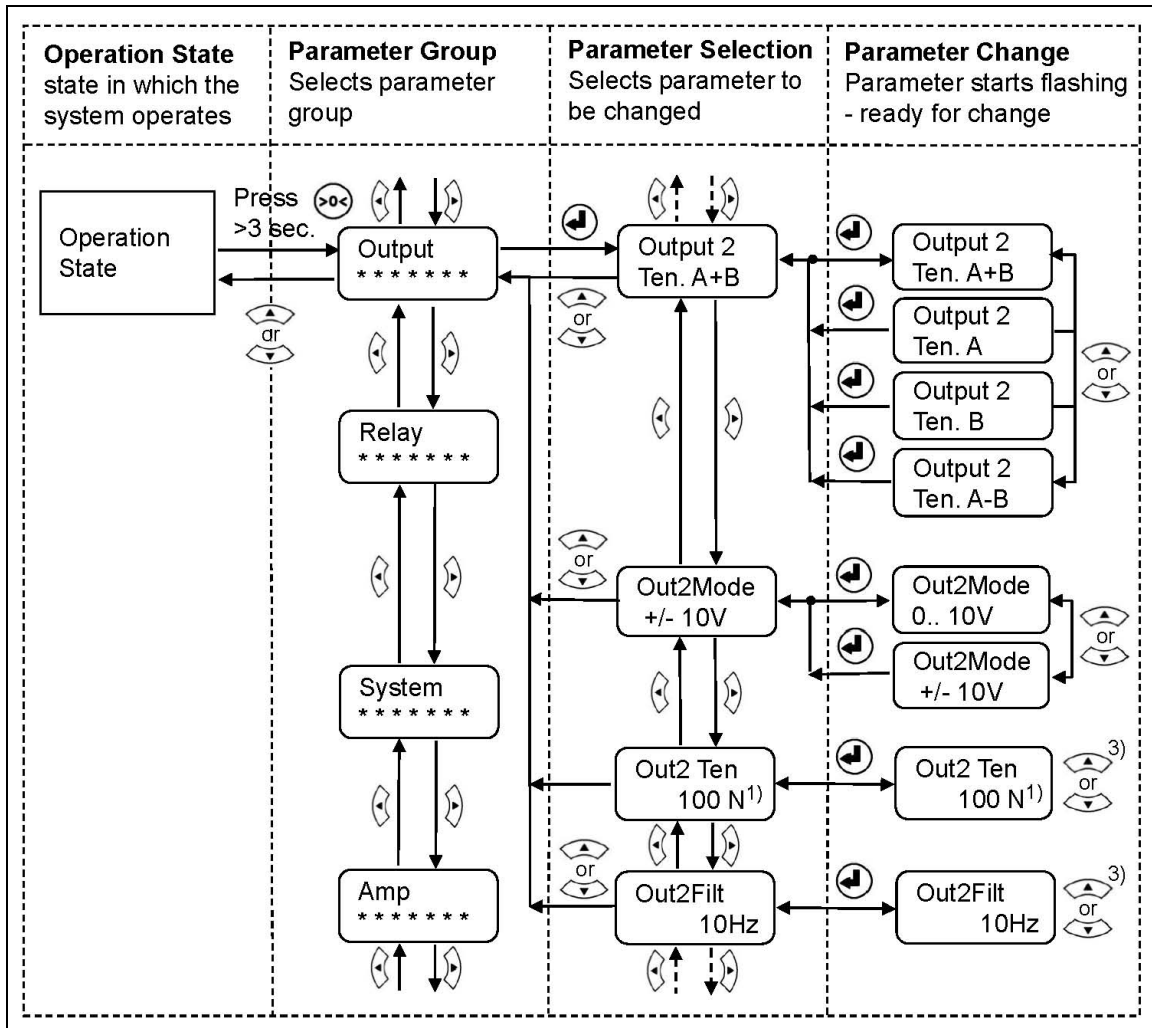
Fig. 22: Outputs Parameter Group (2nd part)   E321011e

1) Das LCD zeigt die Masseinheit die zuvor ausgewählt wurde.
3) Anhaltendes Tastendrücken beschleunigt die Anzeigegeschwindigkeit

8.5 Description of Output Parameters

Output value 1 Output value 2	LCD: *Output 1* LCD: *Output 2*
Use: This parameter determines the signal that will be outputted to the analogue outputs and displayed on the LCD. The user can select the sum or the difference of force sensor A and B or each sensor individually. With the later choice e.g. the force on the left and right side of the roller can individually be monitored.	

Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	Ten. ∣A-B∣ Ten. A+B Ten. A Ten. B	Output 1= Ten. ∣A-B∣ Output 2= Ten. A+B

Output Mode Selection	LCD: *Out1Mode*
Use: This parameter selects the output mode. The analogue output 1 can be set to work as a voltage or as a current output.	

Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	0..10V 0..20mA 4..20mA +/- 10V	+/-10V

Output Mode Selection	LCD: *Out2Mode*
Use: This parameter selects the output mode.	

Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	0..10V +/- 10V	0..10V

Output Tension			LCD: *Out1 Ten* LCD: *Out2 Ten*	
Use:	This parameter determines the tension value at the maximum output.			
Unit	**Parameter Range**		Selection	Default
	Min	Max		
N [1]	0.1	100'000.0	-	1000.0

Filter			LCD: *Out1Filt* LCD: *Out2Filt*	
Use:	The amplifier provides an upstream low-pass filter to prevent noise and interferences being overlaid to the output signal. This parameter determines the cut off frequency of the filter. The lower the cut off frequency, the more sluggish the output signal will be.			
Unit	**Parameter Range**		Selection	Default
	Min	Max		
Hz	0.1	200.0	-	10

8.6 Relay Parameter Group

Each relay output can individually be configured to check violations of force limits (see **3.10** "Relay Outputs"). The following state diagrams described how the relay output parameters con be configured.
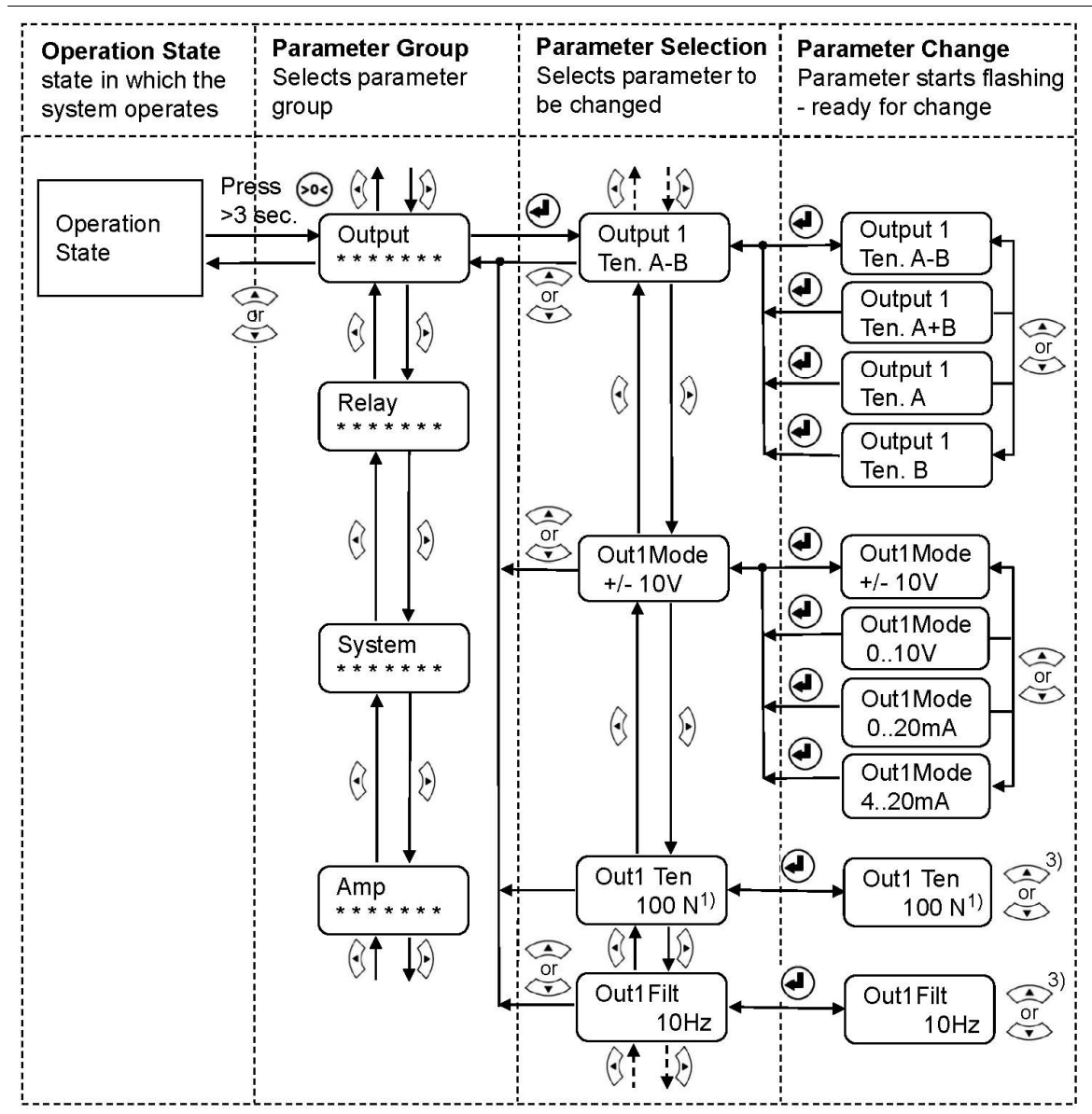

Fig. 23: State Diagram Relay Parameter Group (1st part)   E321012e

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

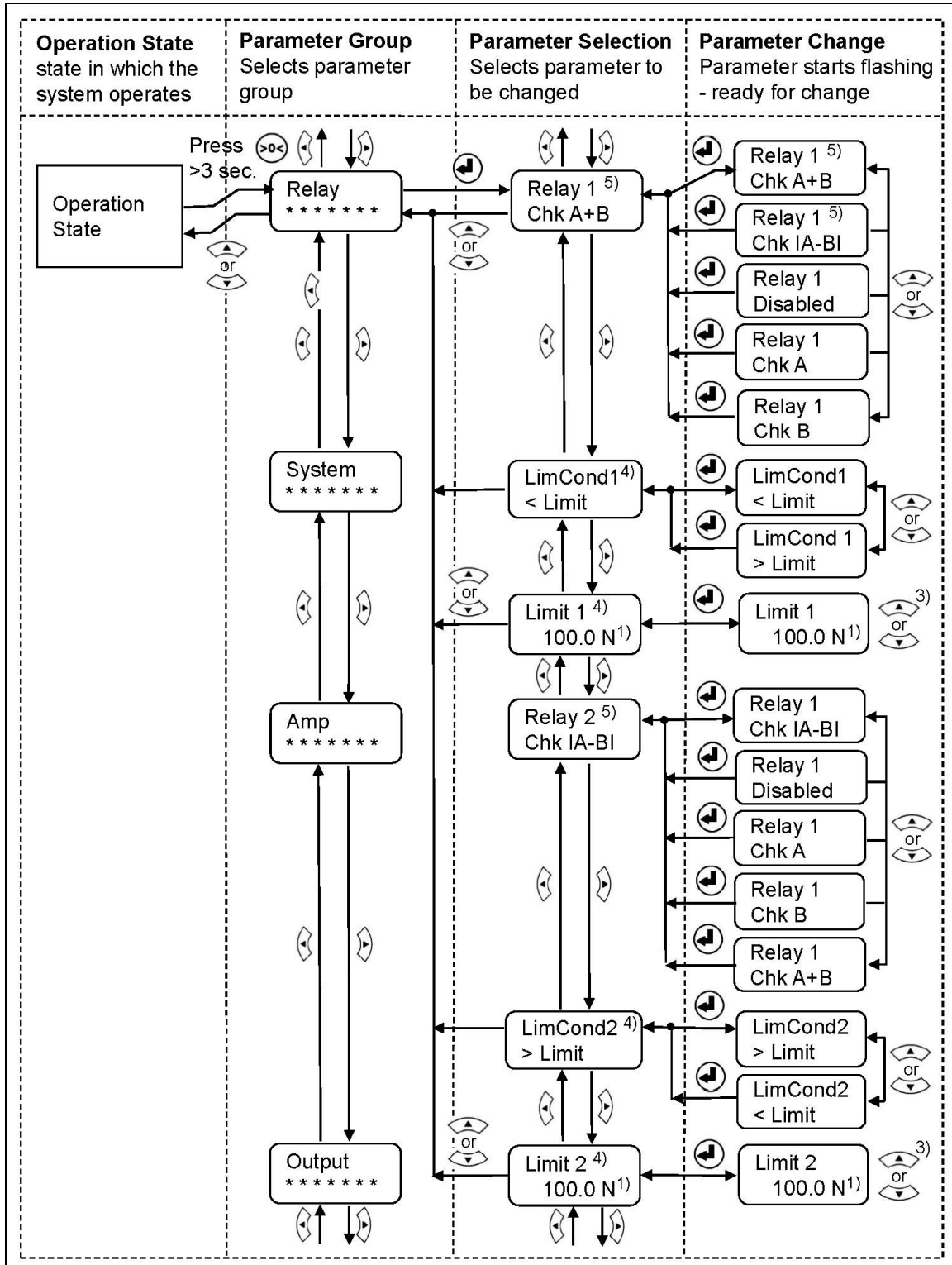³⁾ Permanent key pressing expedites the changing speed of the value.

⁴⁾ This parameter is only displayed, if the function check **"Limit 1"** or **"Limit 2"** have been assigned to Relay 1 respectively Relay 2.

⁵⁾ A relay function can only be assigned once to a relay output. If a function is being used the function will not appear on the parameter selection.

8.7 Description of Relay Parameters

Relay Output 1 Relay Output 1			LCD: *Relay 1* LCD: *Relay 2*	
Use:	Each relay output can individually be configured to check violations of force limits (see also **3.10** "Relay Outputs"). If a violation is detected an event can be initiated (e.g. activate a flash light or alarm horn). A relay function can only be assigned once to a relay output. If a function is being used the function will not appear on the parameter selection.			

Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	Chk A Chk B Chk A+B Chk ɪA-Bɪ Disabled	Relay Output 1= Chk A+B Relay Output 2= Chk ɪA-Bɪ

Chk A

Check and indicate if force limit of sensor A has been violated.

Chk B

Check and indicate if force limit of sensor B has been violated.

Chk A+B

Check and indicate if the sum of the forces of sensors (A+B) has been violated.

Chk ɪA-Bɪ

Check and indicate if the difference of the forces of sensors (ɪA-Bɪ) has been violated.

Disabled

Disable the relay output.

Limit Condition Relay Output 1	LCD: *LimCond1[4]*		
Limit Condition Relay Output 2	LCD: *LimCond [4]*		
Use:	The *LimCond1* determines whether the relay output must be activated when over-shooting (> *Limit*) or under-shooting (< *Limit)* the value stored in the Parameter *Limit 1*. Analogously this holds for *LimCond2*.		

Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	< Limit > Limit	LimCond 1= < Limit LimCond 2= > Limit

Limit 1	LCD: *Limit 1[4]*		
Limit 2	LCD: *Limit 2[4]*		
Use:	The relay output will be activated, if the threshold value stored in this parameter *Limit 1* is exceeded or falls below the value (dependent from the setting in parameter *LimCond*). Analogously this holds for *Limit 2*		

Unit	Parameter Range		Selection	Default
	Min	Max		
N [1]	0.1	200'000.0	-	100.0

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

[4] This parameter is only displayed, if the function check **"Limit 1"** or **"Limit 2"** have been assigned to Relay 1 respectively Relay 2.

[5] A relay function can only be assigned once to a relay output. If a function is being used the function will not appear on the parameter selection.

8.8 System Parameter Group

The System Parameter Group contains basic parameters that determine the general characteristics of the amplifier but that don't influence its performance.

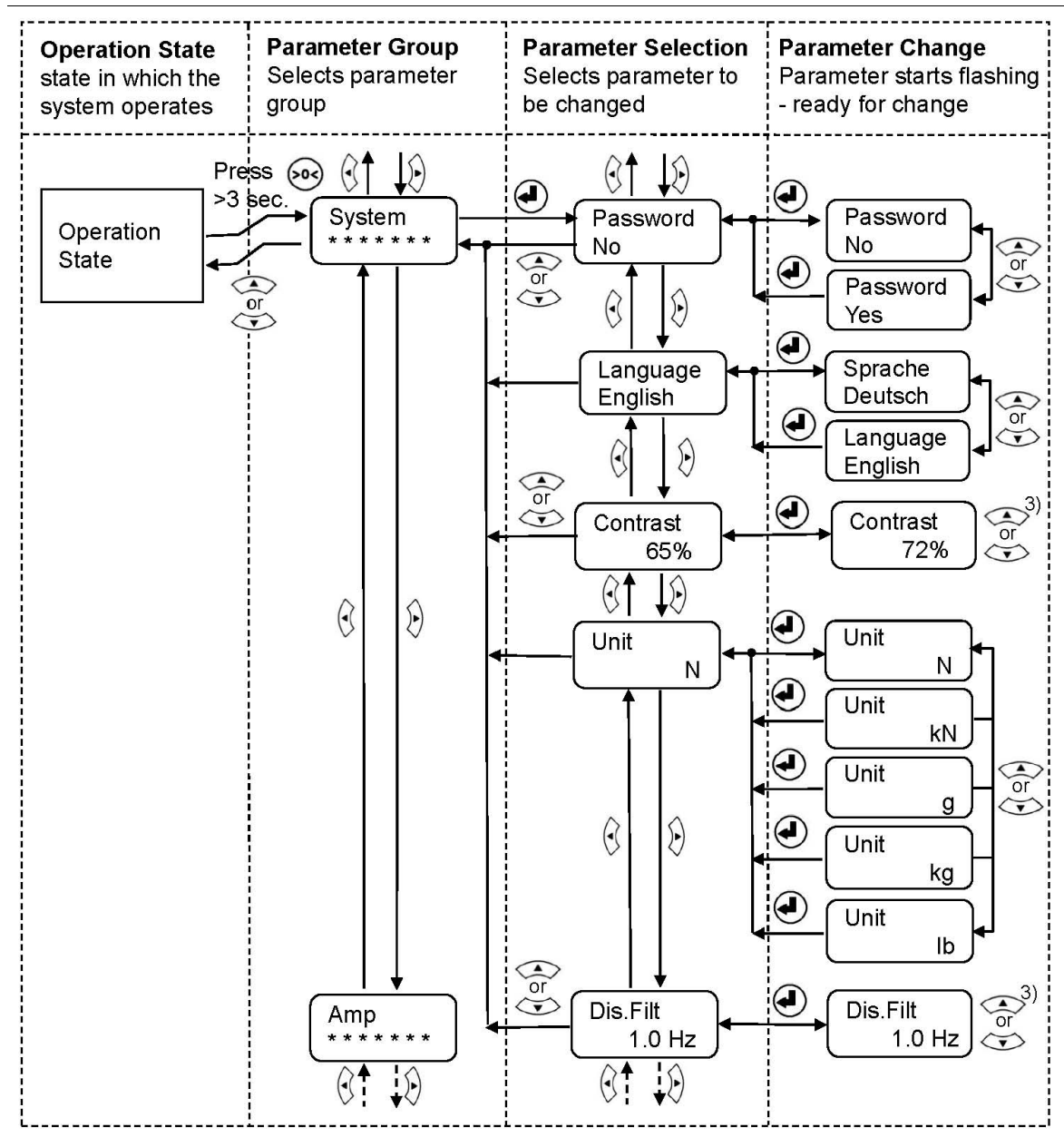**Fig. 24:** State Diagram System Parameter Group (1st part)   E321013e

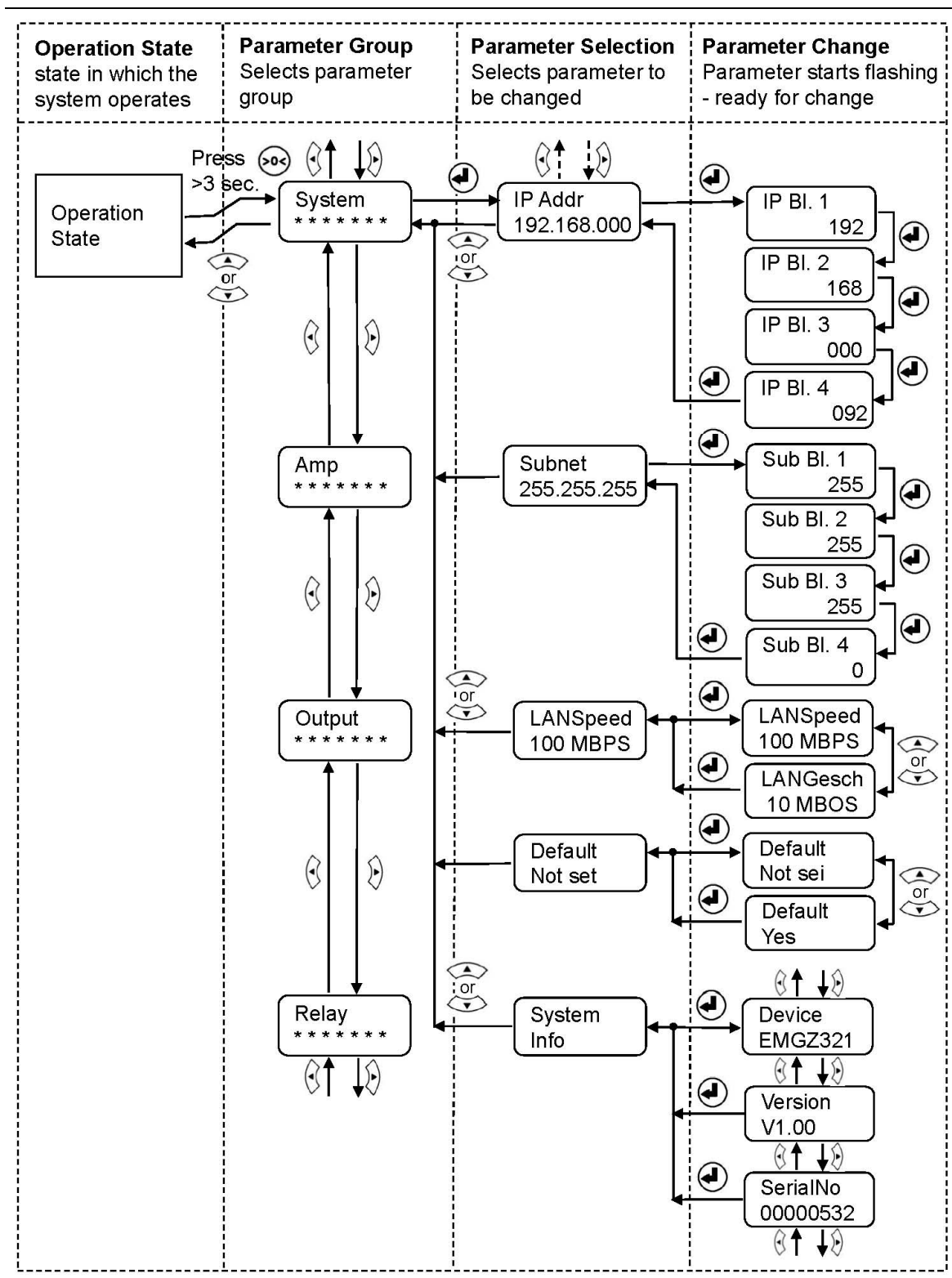3) Permanent key pressing expedites the changing speed of the value.

Fig. 25: State Diagram System Parameter Group (2nd part)   E321014e

3) Permanent key pressing expedites the changing speed of the value.

8.9 Description System Parameters

Password			LCD: *Password*	
Use:	The controller can be protected from unauthorised access by means of password. If *Password yes* is chosen, the system will request the password to change parameters and other setting. The password itself can't be changed. It is always **3231**.			
Unit	**Parameter Range**		**Selection**	**Default**
	Min	**Max**		
-	-	-	No Yes	No

Language			LCD: *Language*	
Use:	This parameter determines the displayed language. The user can choose between two languages. If *English* is chosen, the display shows all texts in English. The web browser is always in English. If *German* is chosen, the display shows all texts in German.			
Unit	**Parameter Range**		**Selection**	**Default**
	Min	**Max**		
-	-	-	English German	English

LCD-Contrast			LCD: *Contrast.*	
Use:	The parameter **[Contrast]** changes the contrast of the LCD to achieve optimal readability.			
Unit	**Parameter Range**		**Selection**	**Default**
	Min	**Max**		
%	1	100	-	65

Unit of Measure			LCD: *Unit*	

Use:	This parameter determines the unit system used.

☞ **Note:** By changing the units to *lb* the whole unit system will change from metric to imperial units.

Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	N kN g kg lb	N

Display Filter			LCD: *Dis.Filt*	

Use:	The amplifier provides a lowpass filter to prevent noise disturbing the LSD or to steady high fluctuation of the force values on the display. The parameter *Dis.Filt* stores the cut off frequency of the filter. The lower the cut off frequency, the more sluggish the display will be. A correctly tuned filter will steady the value shown in the display.

Unit	Parameter Range		Selection	Default
	Min	Max		
Hz	0.1	10.0	-	1.0

Ethernet IP Address			LCD: *IP Addr.*	

Use:	The parameter assigns an IP address to the amplifier. This enables the user to communicate via a web browser with the amplifier that is imbedded in a network. The IP address must be entered in 4 separate blocks (IP Bl. 1; IP Bl. 2; IP Bl. 3; and IP Bl. 4)

Unit	Parameter Range		Selection	Default
	Min	Max		
-	000.000 000.000	255.255. 255.255	-	192.168. 000.090

Subnet Mask Address | LCD: *Subnet*

Use:	The parameter assigns the Subnet Mask of the amplifier in the Ethernet network. This enables the user to communicate via a web browser with the amplifier. The Subnet Mask must be entered in 4 separate blocks (Sub. Bl 1; Sub. Bl 2; Sub. Bl 3; and Sub. Bl 4).

Unit	Parameter Range		Selection	Default
	Min	Max		
-	000.000 000.000	255.255. 255.255	-	255.255. 255.000

LAN Speed | LCD: *LANSpeed*

Use:	*LANSpeed* determines the data speed of the tension controller to communicate with the receiver (Switch, Hub or PC).

Unit	Parameter Range		Selection	Default
	Min	Max		
MBPS	-	-	100 10	100

Default Settings | LCD: *Default*

Use:	This menu point is a command. It resets the parameters to the factory settings. If *Not Set* is chosen, all parameters stay as set by the user. If *Yes* is chosen, the default parameters are loaded.

Unit	Parameter Range		Selection	Default
	Min	Max		
-	-	-	Not set Yes	Not set

System Information | LCD: *System Info*

Use:	The *System Info* parameter contains all relevant device information to identify the product. It is used for service purpose. Please make sure that you have this information ready when you call the FMS service department.

Unit	Parameter Range		Selection	Remarks
	Min	Max		
-	-	-	Device Version SerialNo	Type number of device. Software version used in this device. FMS unique serial number.

8.10 Reset to Default Parameters

Factory settings of your EMGZ321 tension controller can be re-established either over the parameter setting menu (see **8.8** "System Parameter Group") or by holding the two keys ⊘>0< and ⊡Cal at the same time while the controller is powered on.

8.11 Complete Parameter List

Amplifier Parameter Group							
	Parameter	**LCD**	**Unit**	**Min**	**Max**	**Selection**	**Default**
Sensor A	Offset A	Offset A	Digit	-8000	+8000	-	0
	Nominal force A	NomForcA	N [1]	1.0	100'000.0	-	1000.0
	Gain of amp. A	Gain A1	-	0.100	20.000	-	1.000
	Gain of amp. A	Gain A2	-	0.100	20.000	-	1.000
Sensor B	Offset B	Offset B	Digit	-8000	+8000	-	0
	Nominal force B	NomForcB	N [1]	1.0	100'000.0	-	1000.0
	Gain of amp. B	Gain B1	-	0.100	20.000	-	1.000
	Gain of amp. B	Gain B2	-	0.100	20.000	-	1.000

FMS

Output Parameter Group

	Parameter	LCD	Unit	Min	Max	Selection	Default
Output 1	Output value 1	Output 1	-	-	-	Ten. ꟾA-Bꟾ Ten. A+B Ten. A Ten. B	Ten. A-B
	Output 1 Display Mode	Out1Mode	-	-	-	0..10V 0..20mA 4..20mA +/- 10V	+/- 10V
	Max. Tension at Output 1	Out1 Ten	N [1]	0.1	100'000.0	-	1000.0
	Lowpass filter for Output 1	Out1Filt	Hz	0.100	20.000	-	1.000
Output 2	Output value 2	Output 2	-	-	-	Ten. ꟾA-Bꟾ Ten. A+B Ten. A Ten. B	Ten. A+B
	Output 2 Display Mode	Out2Mode	-	-	-	0..10V +/- 10V	0..10V
	Max. Tension at Output 2	Out2 Ten	N [1]	0.100	20.000	-	1.000
	Lowpass filter for Output 2	Out2Filt	Hz	0.100	20.000	-	1.000

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

Relay Parameter Group

	Parameter	LCD	Unit	Min	Max	Selection[5]	Default
Relay 1	Assignment of Relay 1 function	Relay 1	-	-	-	Chk A Chk B Chk A+B Chk ∣A-B∣ Disable	Chk A+B
	Limit condition check Relay 1	LimCond1[4]	-	-	-	< Limit > Limit	< Limit
	Limit value R1	Limit 1	N [1]	0.1	200'000.0	-	100.0
Relay 2	Assignment of Relay 2 function	Relay 2	-	-	-	Chk A Chk B Chk A+B Chk ∣A-B∣ Disable	Chk ∣A+B∣
	Limit condition check Relay 2	LimCond2[4]	-	-	-	< Limit > Limit	> Limit
	Limit value R2	Limit 2	N [1]	0.1	200'000.0	-	100.0

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

[4] This parameter is only displayed, if the function check **"Limit 1"** or **"Limit 2"** have been assigned to Relay 1 respectively Relay 2.

[5] A relay function can only be assigned once to a relay output. If a function is being used the function will not appear on the parameter selection.

System Parameter Group

Parameter	LCD	Unit	Min	Max	Selection	Default
Password protection	Password	-	-	-	Yes No	No
Language on LCD	Language	-	-	-	English German	English
Unit of Measure	Unit	-	-	-	N kN g kg lb	N
Contrast	Contrast	%	1	100	-	65
Display Filter	Dis.Filt	Hz	0.1	10.0	-	1.0
Ethernet IP Address	IP Addr.	-	000.000.000.000	255.255.255.255	-	192.168.000.090
Subnet Mask Address	Subnet	-	000.000.000.000	255.255.255.255	-	255.255.255.000
LAN Speed	LANSpeed	MBPS			10 100	100
Default Settings	Default	-	-	-	Not set Yes	Not set
System Information	System Info	-	-	-	-	-

System Information

Parameter	LCD	Example	Remarks
Device Code	Device EMGZ321	EMGZ321	Customer specific versions will be coded with an additional character at the basic type number.
Software Version	Version V1.00	V1.00	Software version used in this device
Serial Number	SerialNo 00000532	00000532	Every FMS product has his unique serial number.

9 Parameter Setting via a PC

The EMGZ321.EIP force measuring amplifier can be embedded in an Ethernet network and the parameter setting can be done over this network by means of a web browser (Internet Explorer 7). The devices have a static IP-address that can be set over the user interface. The IP-address is not automatically assigned over DHCP.
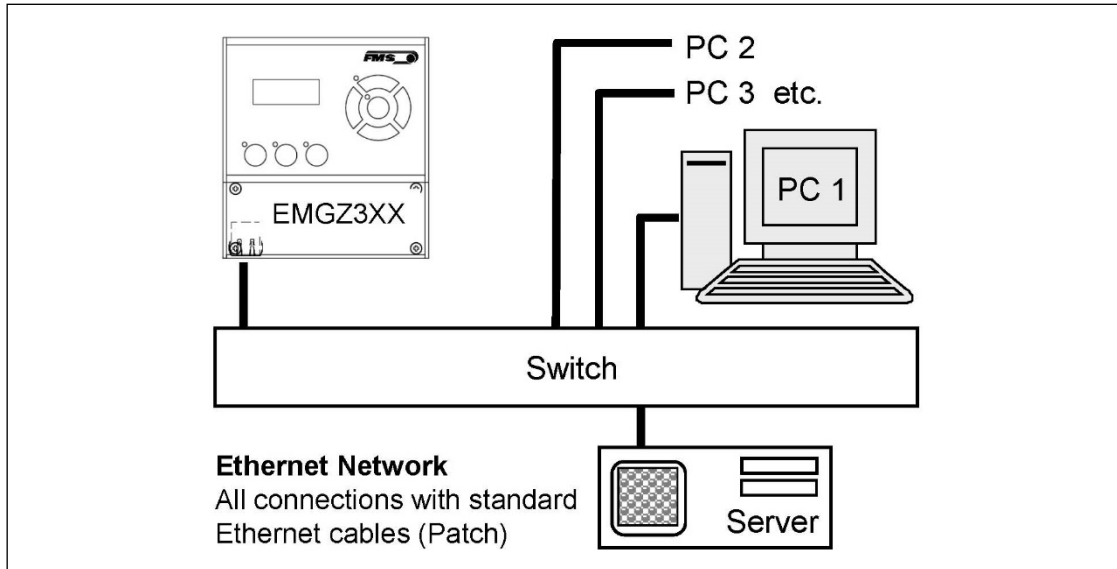
Fig. 26: EMG321.EIP configuration in a LAN (Local Area Network).   E309001e

The parameter setting can be carried out with a desktop- or laptop computer via a peer-to-peer connection (see **chapter 9.2**)
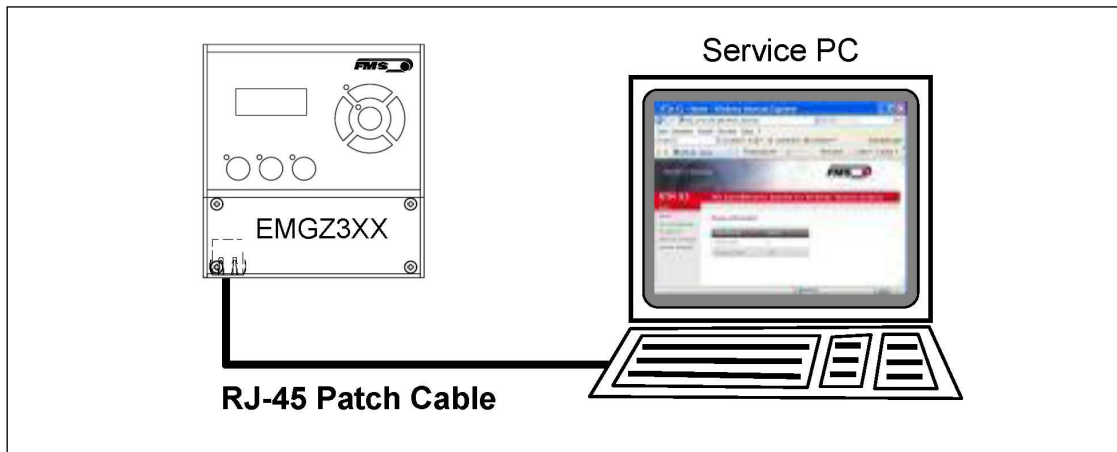

Fig. 27: Connection EMG321-PC via RJ-45 cable.   E309002e

9.1 Parameterisation in an Ethernet Network via Web Browser

For the integration of an EMGZ321 amplifier in your Ethernet network please contact your IT system administrator. When embedding the EMGZ321 in an Ethernet network it must be certain that the EMGZ321 uses an IP address in a static block (not assigned by the server). Once the amplifier was integrated in the network you can address the device e.g. with *http://192.168.000.090* . After establishing the link, the screen **Fig. 29** will open up.
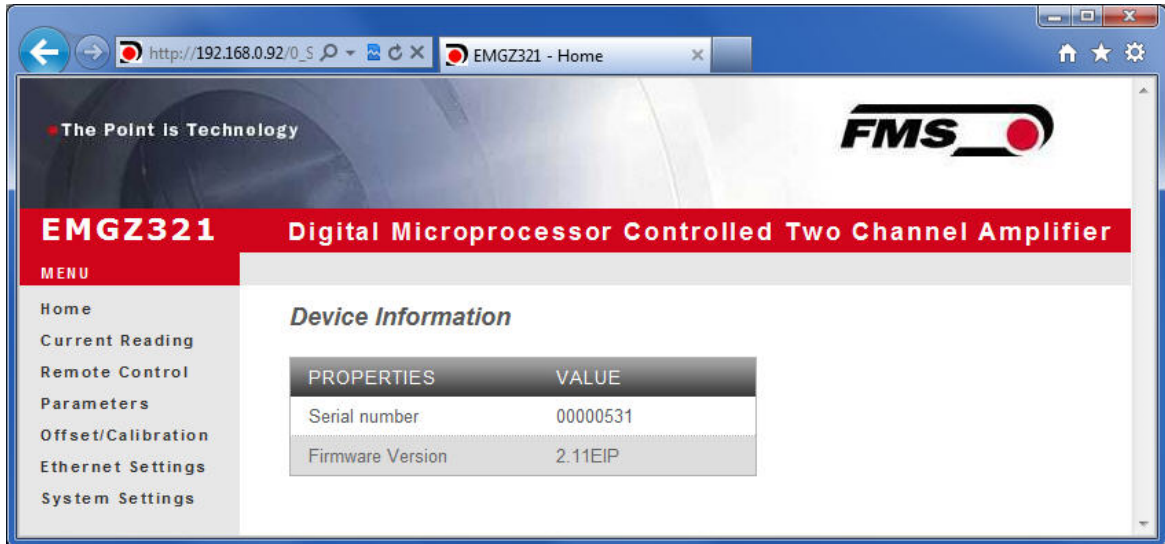
Fig. 29: Serial number and device information   Home (EIP)

☞ *Note*
With the menu on the left side of the screen you can navigate through the web page.
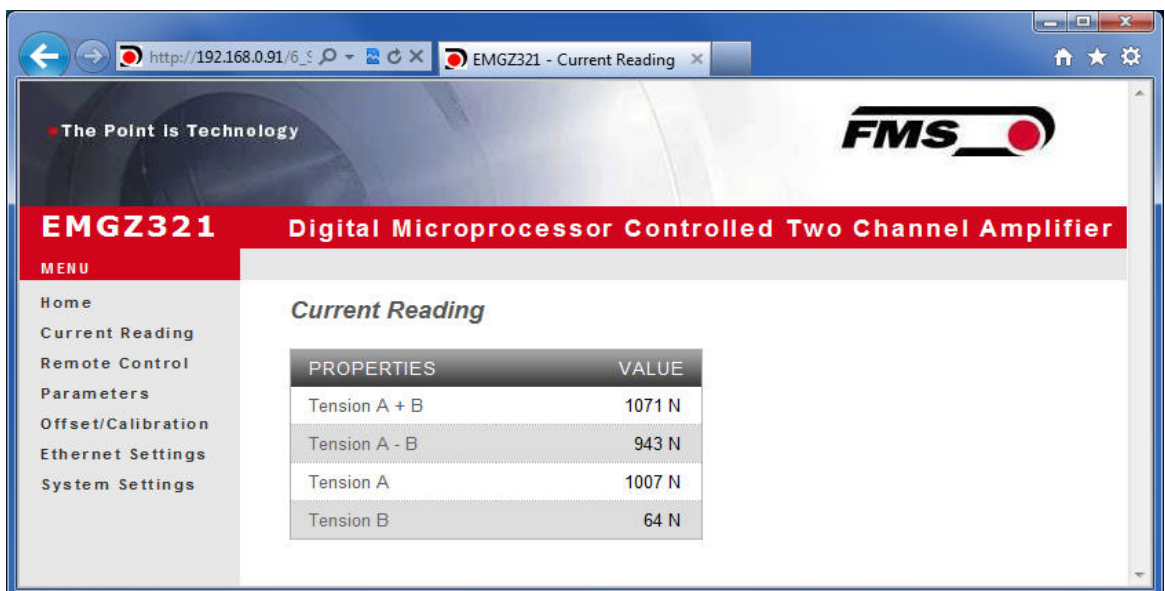
Fig. 30: Current reading of tension on the output   Current reading

Fig. 31: Remote Control Screen to operate the EMGZ321 via Ethernet   Remote Cont

☞ *Note*
A mouse click on the desired button in the control panel activates the function.

> ☞ **Note**
>
> *In the next screen, the parameters can be changed by overwriting the parameter with the desired value. By clicking the field "Save Changes" the changes can be save.*

Fig. 32: Parameter setting Screen   Parameters
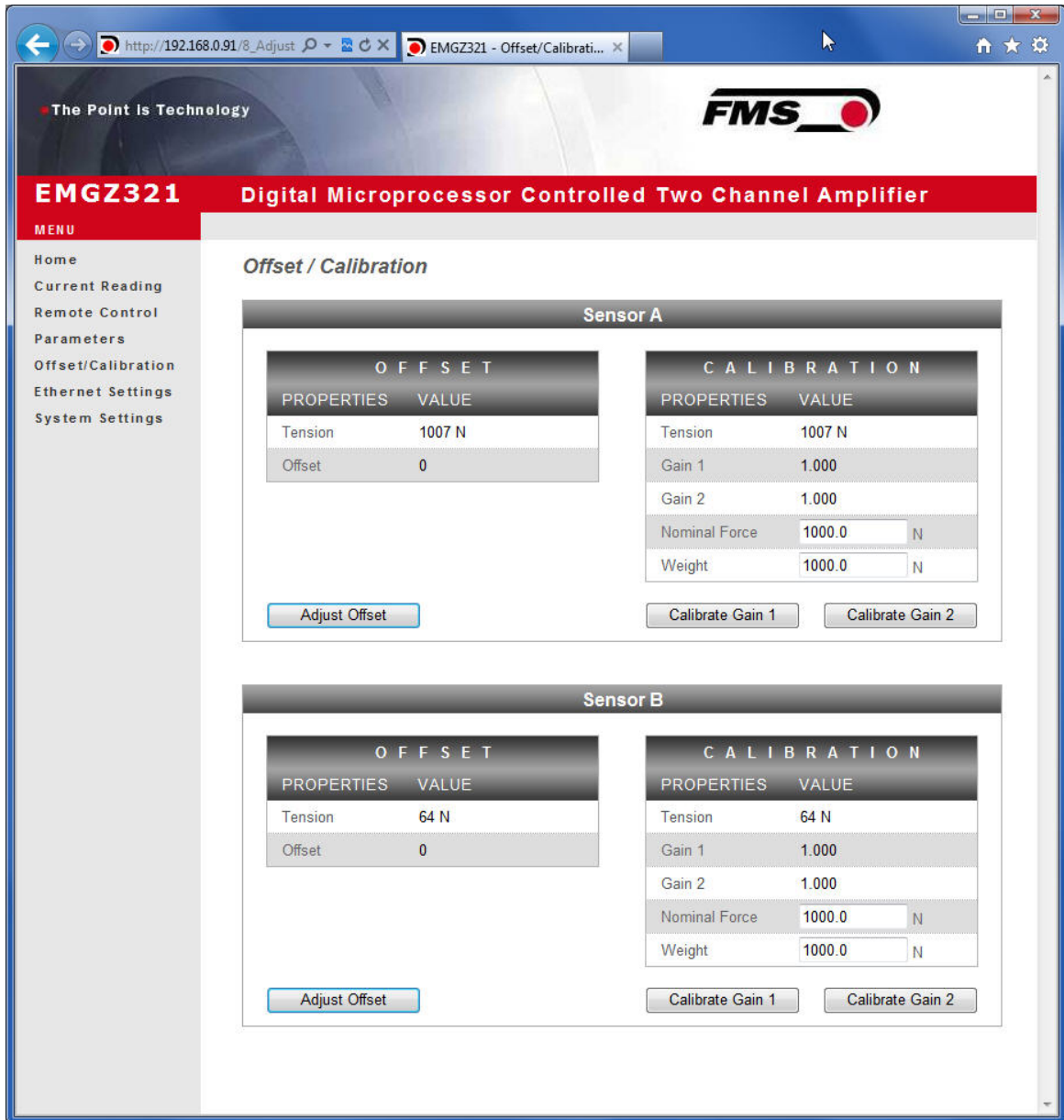
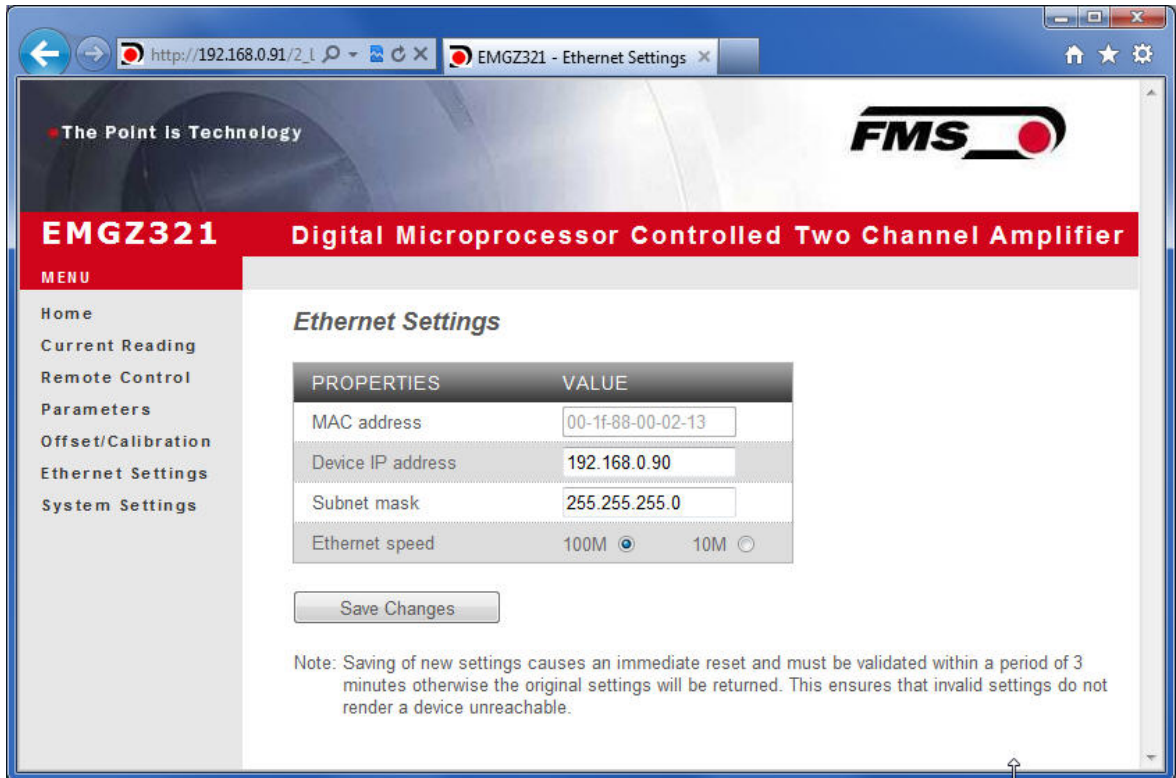**Fig. 33:** Offset Compensation and Calibration via web browser   E309006e
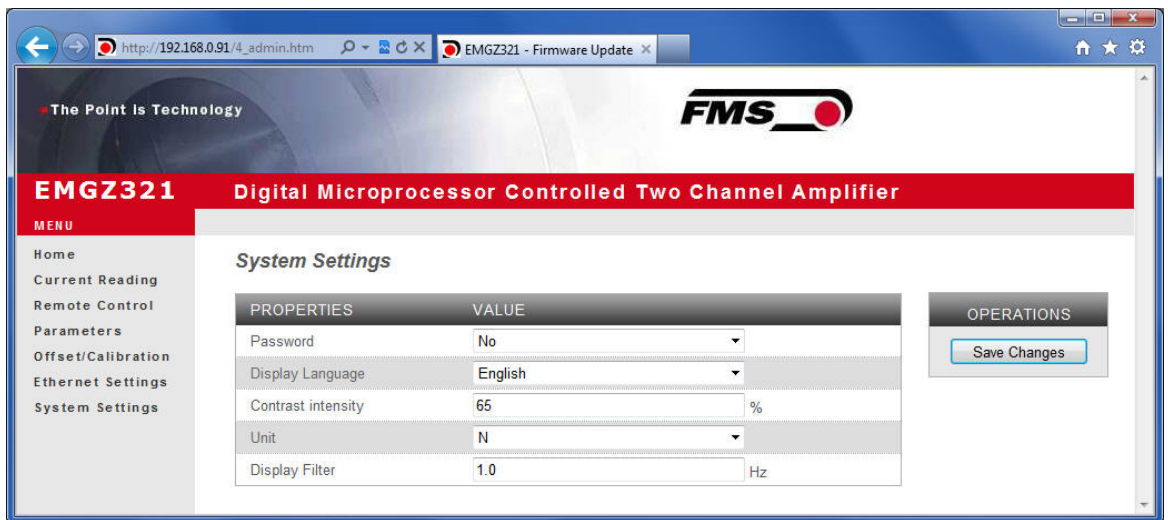
Fig. 34: Ethernet settings

Fig. 35: System settings

## 9.2 Connecting the EMGZ321 Amplifier with a PC (Peer-to-Peer)

The parameter setting can also be carried out with a desktop or laptop computer directly connected to the EMGZ321. In this case, the PC is connected via a Peer-to-Peer connection to the amplifier.This chapter describes the procedure for setting up a computer to communicate with EMGZ321.

Setup for OS Window 7:

1. Connect PC and EMGZ321 with a "RJ-45 patch cable"
2. Power-up PC and EMGZ321
3. In order to recognize the EMGZ321 amplifier your PC must be configured with a static IP-address. Click on the Windows button (lower left-hand corner).
4. Click on Control Panel
5. Double click on Network ... Center.
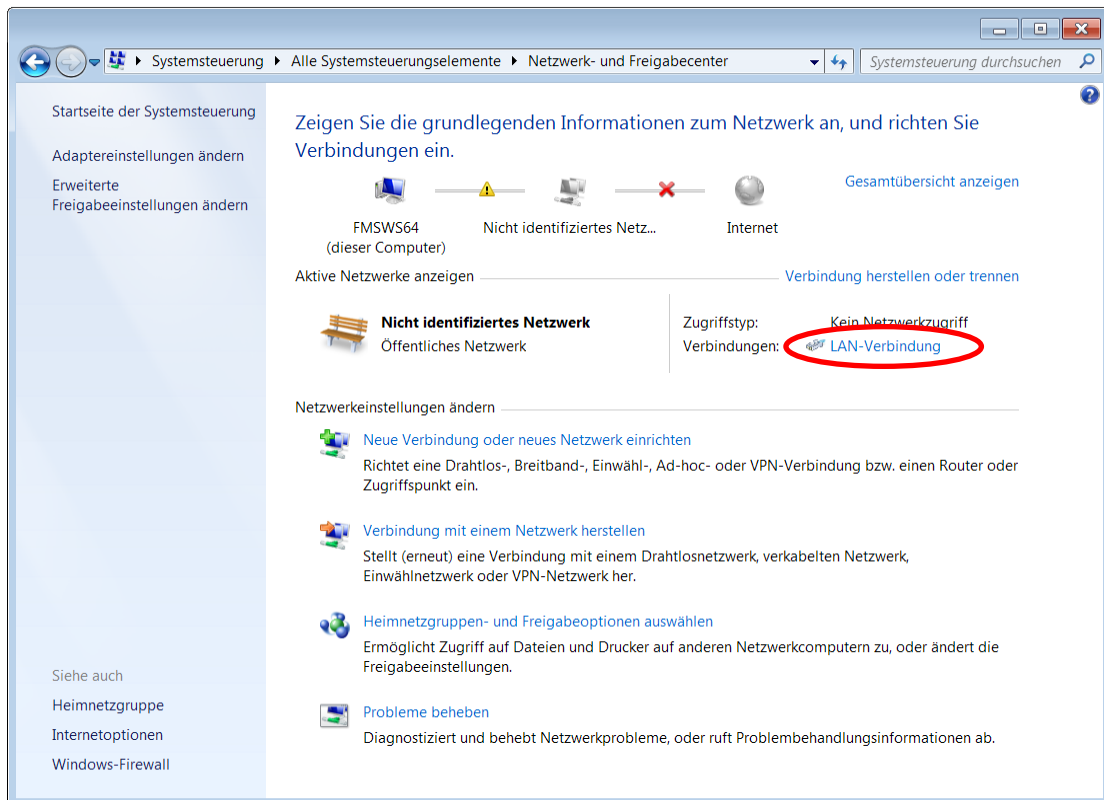
6. Double click on "Local Area Network". The dialog box "Status of LAN connection" will open up.
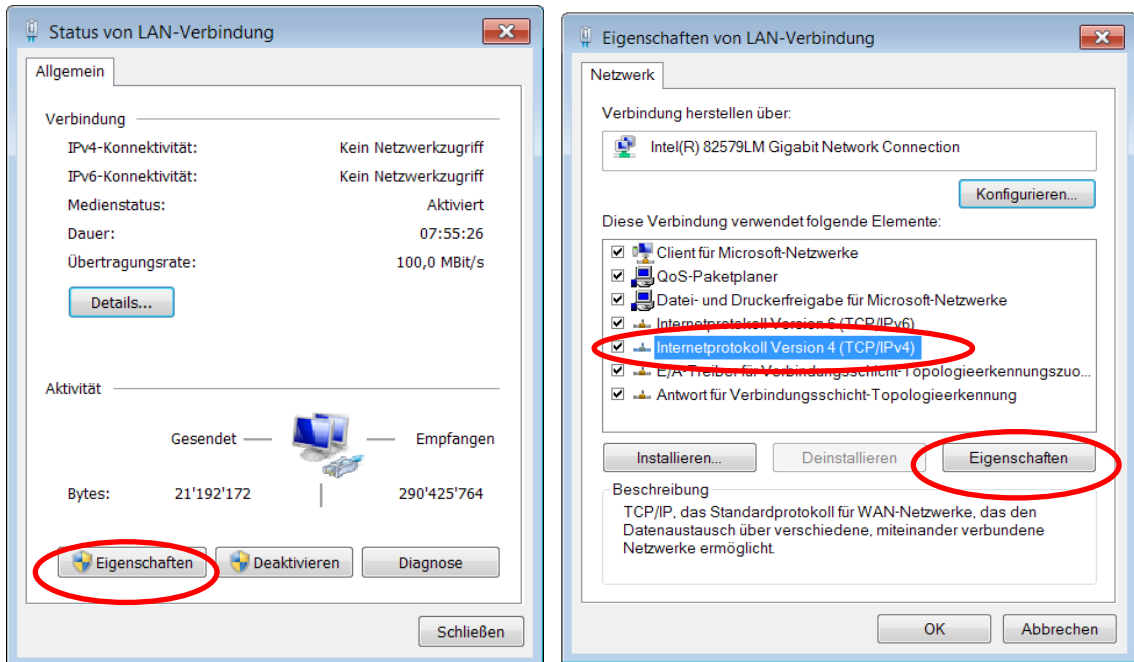
7. Click on Properties
8. On the next dialog box select the network adapter that is used for the connection. In our case "Internet protocol version 4 (TCP/IP)"
9. Click on Properties. The following dialog box "Internet protocol Version 4 (TCP/IPv4) Properties" will appear.
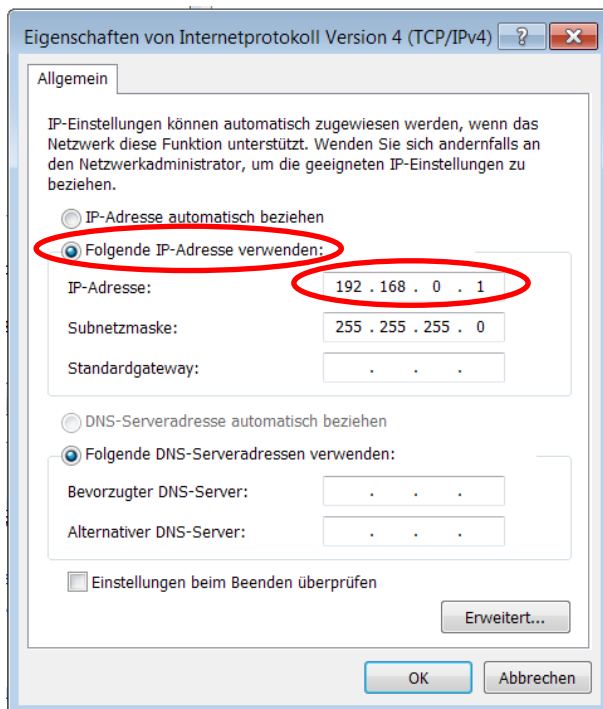
10. Select the radio button "Use the following IP address:"
11. Enter the IP address for the computer that could be 192.168.0.1
12. In the Subnet mask, enter **255 255 255 000**, as shown above.
13. Click the "**OK**" button.
14. Close all windows

The computer is now ready to communicate with the EMGZ321 amplifier:

1. Open Microsoft Internet Explorer or Mizilla Firefox.
2. The default IP address for the EMGZ321 is **192.168.000.090** as long as it was not changed over the operating penal. Enter the IP address e.g. with *http://192.168.000.090* in the address bar and hit the Enter key. The screen "Device information" **Fig.29** will open up.
3. Then proceed as described in chapter 9.1 "Parameterization in a Network Using a Web Browser".
4.   If a different IP address and subnet mask is configured at the EMGZ321 make sure that the computer is setup appropriate.
5. Once you return to your office, don't forget to reconfigure your PC to "Automatic assignment of the IP-address" (see last dialog box).

10 Dimensions

The EMGZ321 series is available in three different housing options. The mechanical dimensions can be seen in the following pages.
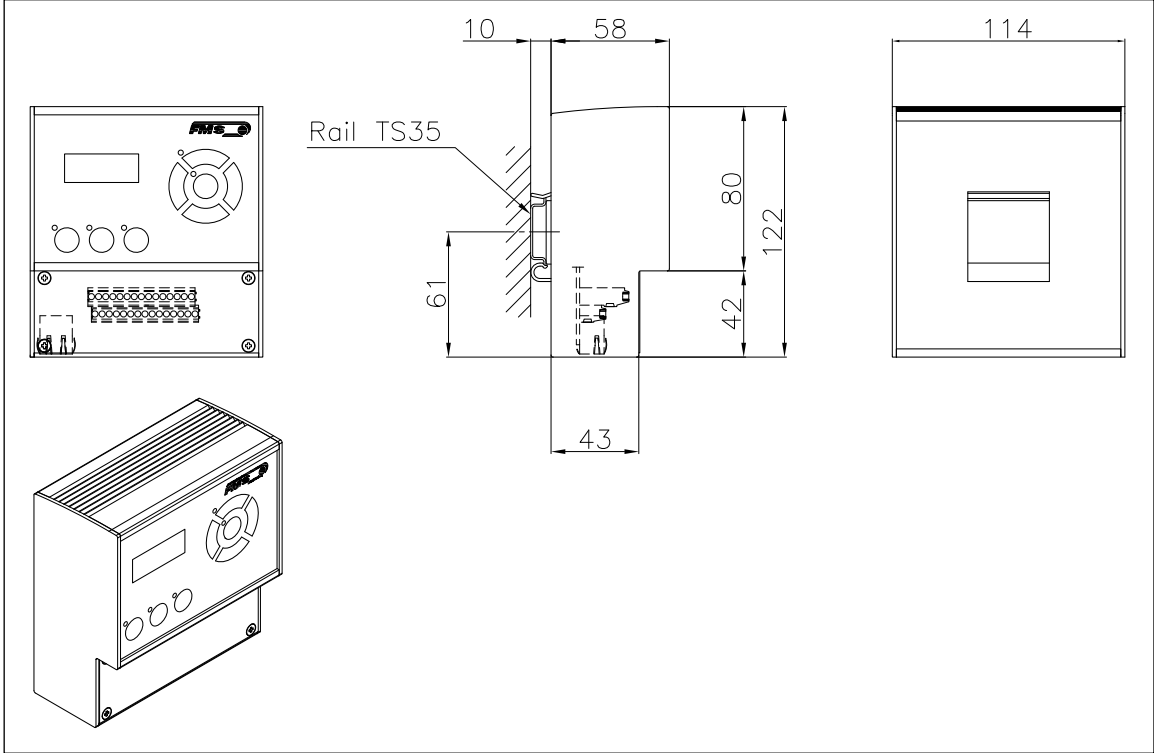

Fig. 36: Outline Drawing for EMGZ321.R.EIP rail mount housing   C309001e
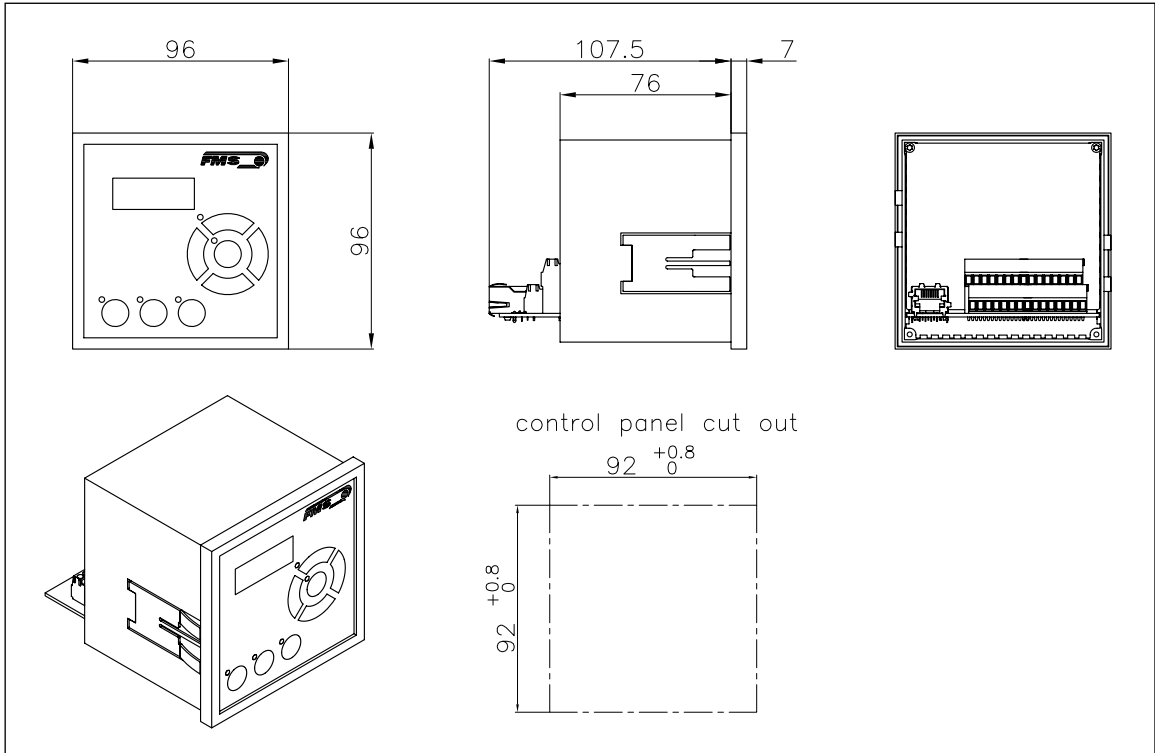Ethernet connection: RJ-45 connector

Fig. 37: Outline Drawing for EMGZ321.S.EIP panel mount housing (RJ-45)C309002e
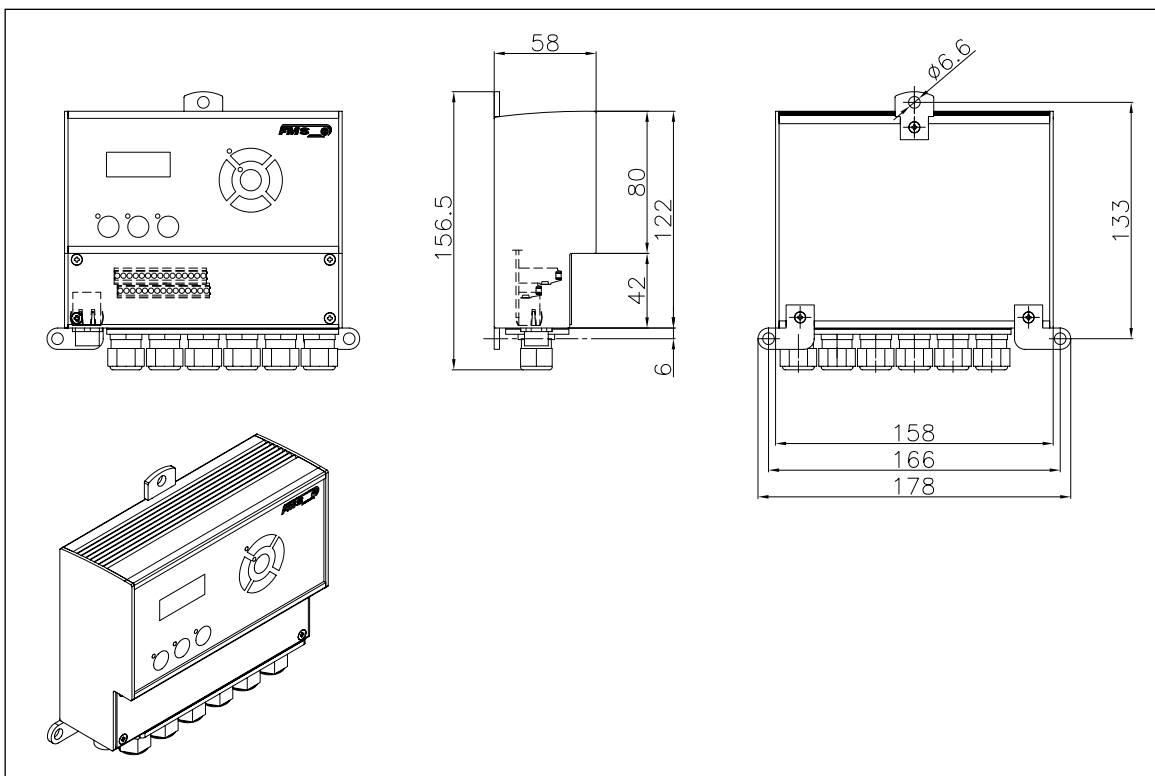

Fig. 38: Outline Drawing for EMGZ321.W.EIP wall mount housing
Ethernet connection: M12 4-pole D-coded   C309003

11 Trouble Shooting

Error	Cause	Corrective action
Output value off – it is far from the expected value	Offset badly adjusted	Proceed again for offset compensation procedure (chapter 7.3).
	Wrong nominal force entered. Forgotten to enter the force of sensor A or B.	Proceed to **7.5** "Calibration Procedure" and enter the correct value. E.g. if you have a roller with two 250N sensors, enter 250 for sensor A and 250N for sensor B.
	Wrong Gain value determine	Repeat calibration procedure as described in **chapter** 7.3 - **7.5**.
	If gain switching is used, possibly wrong gain chosen	Change the dig. input used for gain switching (see **chapter 3.9**)
Sensor A or B shows >>0.1 even though material is loose	Current output is set to 4...20mA	Set the correct output mode in the Output Parameter Group, if a signal 0...20mA is required
Output value of sensor A or B is jittery	Cut off frequency of the filters set too high	Adjust cut off frequency (ref. to **8.4** "Outputs Parameter Group")
Output value of sensor A or B is not stable	Grounding problem. (PE) badly connected	Check ground wire and able shield for proper contact.
	Electrical interference on the cable to the force sensor	Check connection of the shield. Use one twisted pair for +signal and –signal.
Relay outputs behave different as expected	Limit values wrongly parametrised.	Check the parameter *LimCond* and *Limit 1* and *2* for plausibility. Set parameter to appropriate values.
Display is dark and the amplifier does not respond to key commands.	No supply voltage	Check your wiring (ref. to **chapter 3.6 -.3.8**).
Amplifier does not respond to key commands.	Electronic boards or key foil defective.	Contact service department of FMS

12 Technical Specification

12.1 Technical Data

Parameter	Specification
Number of Channel	2 Channel for 2 force sensors @350 Ω
Sensor Supply	5 VDC, max. 60mA, high stability
Input signal range	0 to 9mV (max. 12.5mV)
Resolution A/D converter	±8192 Digit (14 Bit)
Measuring error	<0.05% FS
Processor cycle time	1 ms
EtherNET/IP minium cycle time	2 ms
Operation	3 buttons, 5 buttons wind rose, LCD-display 2x8 characters (size 8mm)
Interfaces	EtherNet/IP-Bus; Standard: CIP über IEE 802.3
Power supply	24VDC (18 to 36VDC) / 10W (max. 0.5A) For EMGZ321ACV: 85 to 264 VAC, 50/60 Hz; max. 120W
Temperature range	-10 to 60°C (14 to 140°F)
Protection class	EMGZ321.R and S: IP50 EMGZ321.W, ACV: IP65
Weight	EMGZ321.R: 0.57kg [1.26 lbs]; EMGZ321.S: 0.40kg [0.88 lbs]; EMGZ321.W: 0.72kg [1.59 lbs];

12.2 Input / Output Configuration

In / Outputs	Configuration
Analogue input 1	1 sensor with strain gauges @ 350 Ω (0 to 9 mV, max. 12.5 mV)
Analogue input 2	1 sensor with strain gauges @ 350 Ω (0 to 9 mV, max. 12.5 mV)
Analogue output 1	0 to 10 VDC; ±10VDC; 0/4 to 20mA)
Analogue output 2	0 to 10VDC ±10VDC;
Digital Inputs	2 inputs @ 24 VDC galvanically isolated
Relay outputs	2 outputs (DC: 220V/2A/60W; AC:250V/2A/62.5VA)