



Operation Manual RTM X2

**2-Channel Radio Transmission Tension Monitoring and
Control System for Bunchers and Twisters**

Version 1.2 08/2011 ff
Firmware Version: V 0.9

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1 Safety Instructions

1.1 Description conditions

a) 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 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 RTM System is only guaranteed with the recommended application of the components. In case of other arrangements, malfunctions can be the result. 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 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.*
-  *It is of paramount importance to compensate the centrifugal forces caused by the rotating base plate of the stranding machine. The measuring results will be wrong, if this rule is broken.*

2 System Description

2.1 RTM X2 System

FMS' „Radio Transmitted Tension Monitoring “ X2 system, following called RTM X2, is a fully consistent system from its electronics components to the dedicated load cells.

- The RTM X2 is a cost effective 1 or 2 channel tension monitoring system.
- RTM X2 measures tensions in individual wires or cables in rotating applications e.g. in stranding machines.
- The tension data is captured, converted in electrical signals and conditioned.
- Tension Data is **transmitted wirelessly in real-time** to a receiver/processing unit.
- RTM X2 is designed to easily retrofit onto existing machines.
- RTM is the ideal upgrade of existing machinery to cutting edge technology for tension measurement.
- Existing stranding machines can be retrofitted with the RTM system with a minimum of effort and investment.

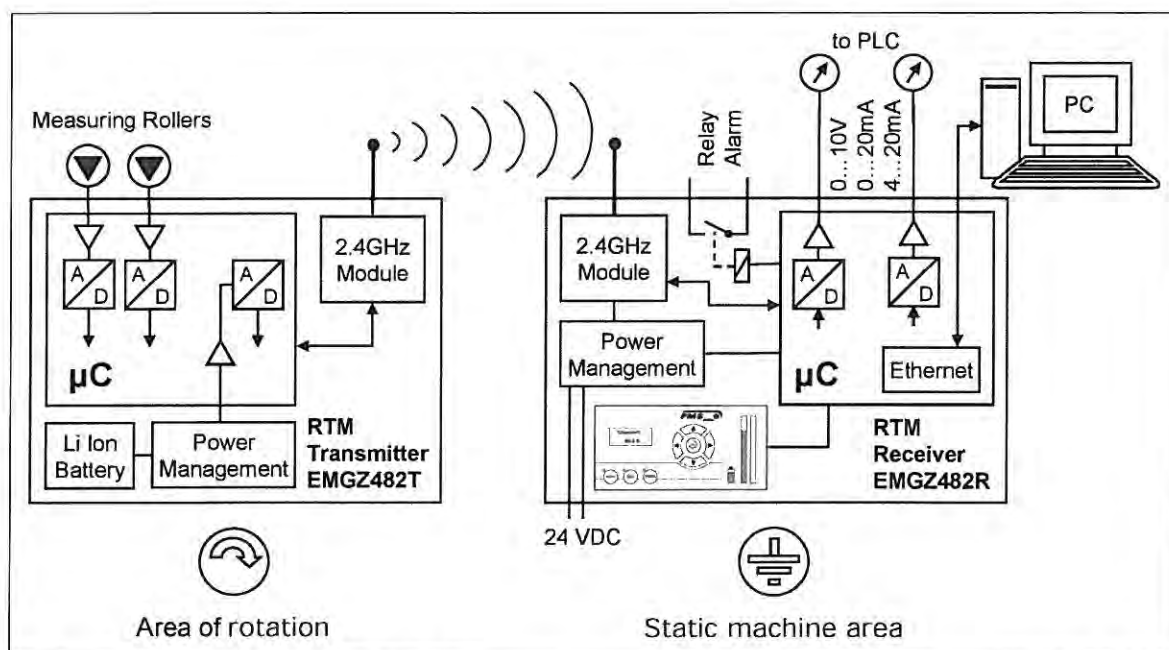


Fig. 1: Block diagram of RTM X2 -System

RTMX2_0001e

2.2 System Components

RMGZ Force Measuring Rollers

- Measures the wire tension
- Converts the tension values in an electrical signal

EMGZ482T RTM X2 Transmitter

Amplification and conditioning of the electrical signals

- Wireless transmission of tension data
- Power supply via battery or slip rings

EMGZ482R RTM X2 Receiver

- Wireless reception of tension data
- Parameter setting
- Force monitoring and force display
- Indication of battery charge status
- Alarm outputs
- Interfaces to PLC
- Interface to PC via Ethernet browser (near future)

Software

- Data processing and data management
- Tension limit control
- Protocol handling RS485 and 2.4 GHz link

Tachometer

- *Wheel with impulse transmitter module (optional)*
Capturing wire or robe speed

Power package

For RTM X2 where the supply voltage is provided by the internal battery:

- 3.7V / 6700mAh Li Ion battery including charge control
(battery autonomy ~84h)
- Battery charger Li-Ion

(Italic text indicates a variant or option)

2.3 Certifications and Compliancy

This equipment has been tested and found to comply with following rules:

ETSI Radio Certification	
Magnitude of Test (Coverage)	Article 3.2 of Directive 1999/5/EC (R&TTE Directive)
Certification	ETSI EN 300 440-2 V1.5.1 (2009-03) ETSI EN 300 440-1 V1.3.1 (2009-03)
ETSI EMC Certification	
Magnitude of Test (Coverage)	ECM-Test according to 98/37/EC and 2004/108/EC harmonized
Emission and Immunity Test	ETSI EN 489-3 EN 61326-1
FCC Certification	
Magnitude of Test	Class A digital device, pursuant to Part 15 of the FCC Rules
Certification	FCC Registration #: 0020311882



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.



Caution

Changes or modifications made to this equipment not expressly approved by (manufacturer name) may void the FCC authorization to operate this equipment.



Caution

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:

- (1) this device may not cause harmful interference, and*
- (2) this device must accept any interference received, including interference that may cause undesired operation*



Caution

Radiofrequency radiation exposure Information

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body:

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

3 Installation and Wiring

3.1 Area of Machine Rotation

Following RTM X2 components are installed either on the rotating part of the machine or in the area of machine rotation:

- RMGZ Force Measuring Rollers
- EMGZ482T RTM X2 Transmitter
- Li-Ion Battery (in the battery compartment of EMGZ482T)

3.2 Force Measuring Sensors on the Static Machine Area

The red point should always be aligned in the direction of the resulting Force (see **Fig. 2**). For further mounting information please consult the respective installation manual of the sensor. The installation manual is always delivered together with the sensor.

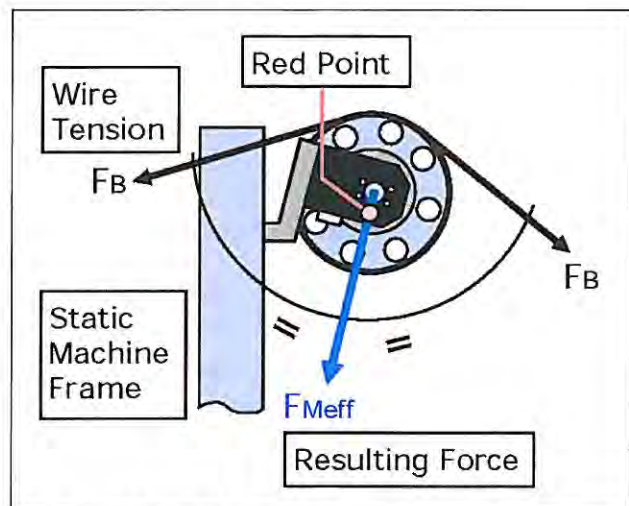


Fig. 2: RMGZ Red Point alignment on static machine parts RTMX2 0028e

3.3 Force Measuring Sensors on a Rotating Machine Part



Note

In rotating applications the force measuring sensors are mounted such that centrifugal forces are compensated. If using FMS RMGZ sensors, this can be achieved by turning the Red Point parallel to the rotation axis and in direction of the positive force component (refer to Fig. 3).



Note

The adjustment of the red point can be tested after offset compensation and calibration. If the reading of an unloaded load cell stays at zero (e.g. 0 N) regardless of the load cell position (e.g. at 12 o'clock or at 6 o'clock position), the red point is correctly aligned.

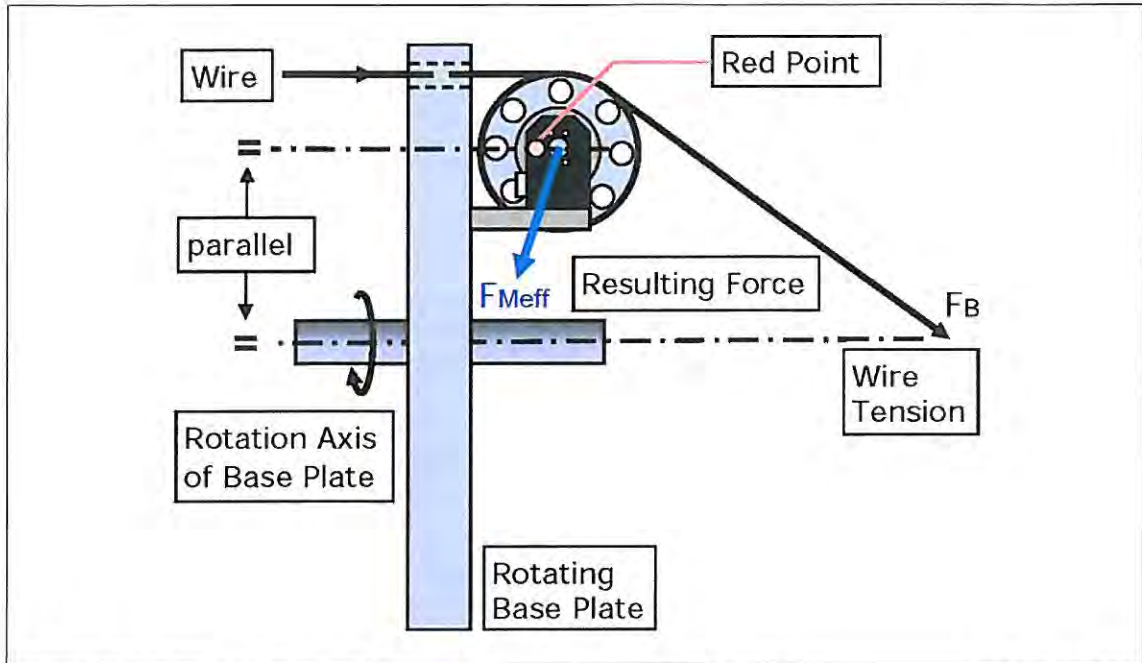


Fig. 3: RMGZ Red Point alignment on rotating machine parts

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Caution

It is of paramount importance to compensate the centrifugal forces caused by the rotating base plate of the stranding machine. The measuring results will be wrong, if this rule is broken.

3.4 Mounting and Wiring the Electronic Components

An RTM X2 system is usually delivered complete with all its components and cables. The cables are prepared with connectors on both sides for easy assembly



Caution

Proper function of the FMS RTM X2 System can only be guaranteed with the recommended application of the components. Other arrangements can cause malfunctions. Therefore, the installation instructions on the following pages must 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.

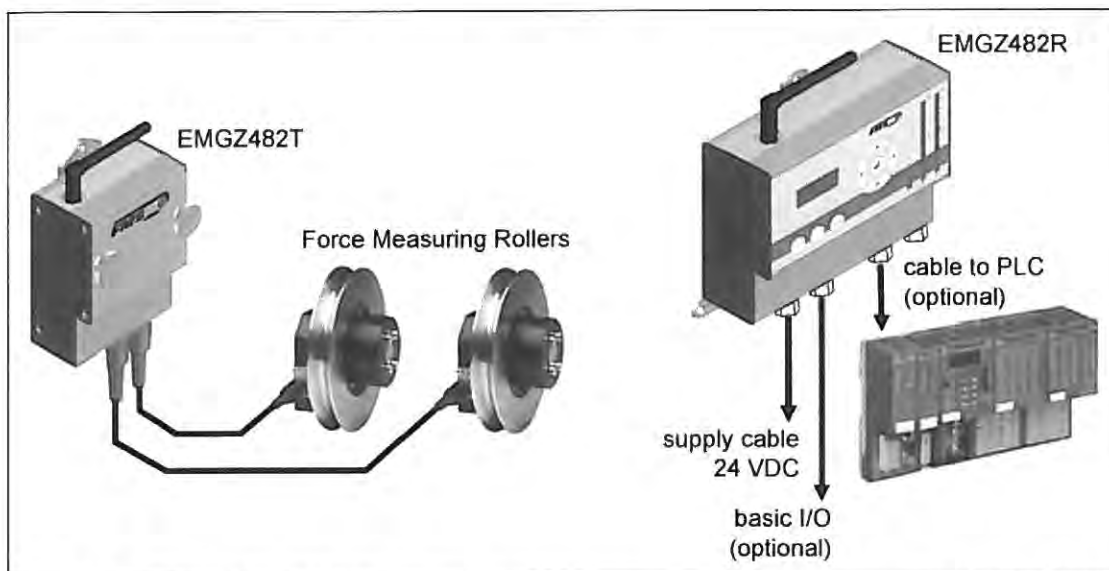


Fig. 4: Cabling of RTM X2 System Components

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3.5 Mounting and Wiring the Transmitter EMGZ482T

One or two force sensors can be connected to the RTM X2 Transmitter EMGZ482T. It is favourably to mount the EMGZ482T Transmitter close to the RMGZ load cells to keep the signal cables short.

If no standard FMS cables are used, the connection between force sensors and EMGZ482T must be wired with $2 \times 2 \times 0.25 \text{mm}^2$ [AWG 23] shielded twisted-pair cable. The wiring diagram below (Fig. 5) shows how the signals are wired to the connectors.

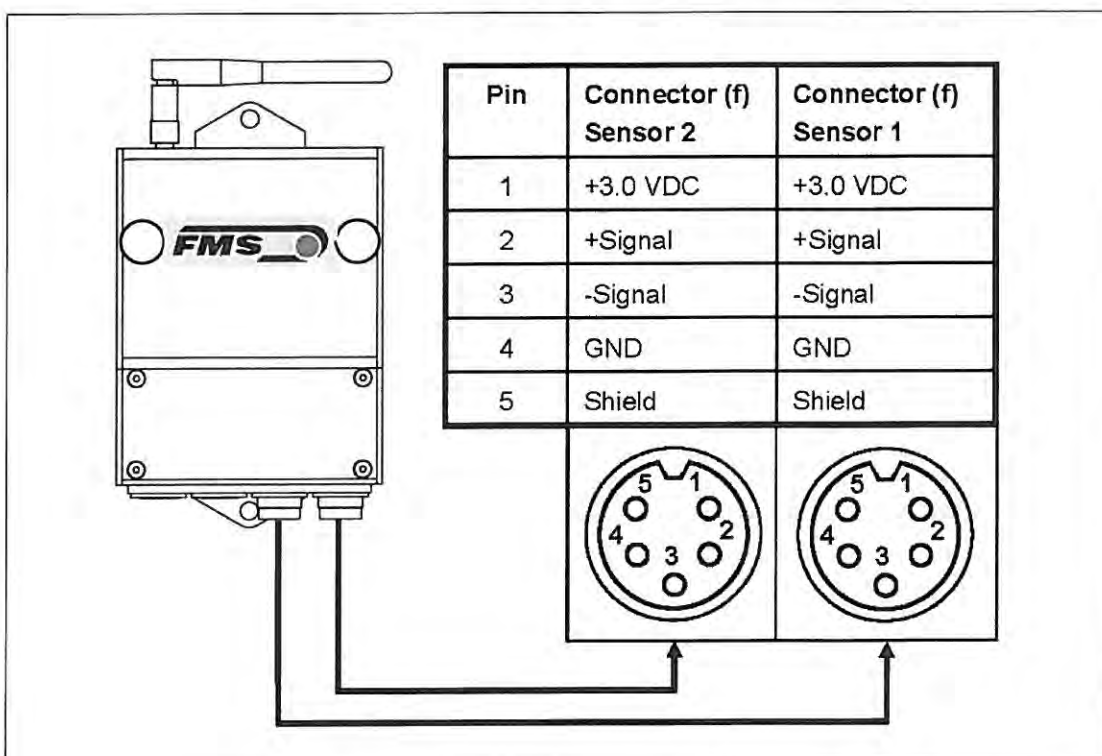


Fig. 5: In / Output configuration EMGZ482T

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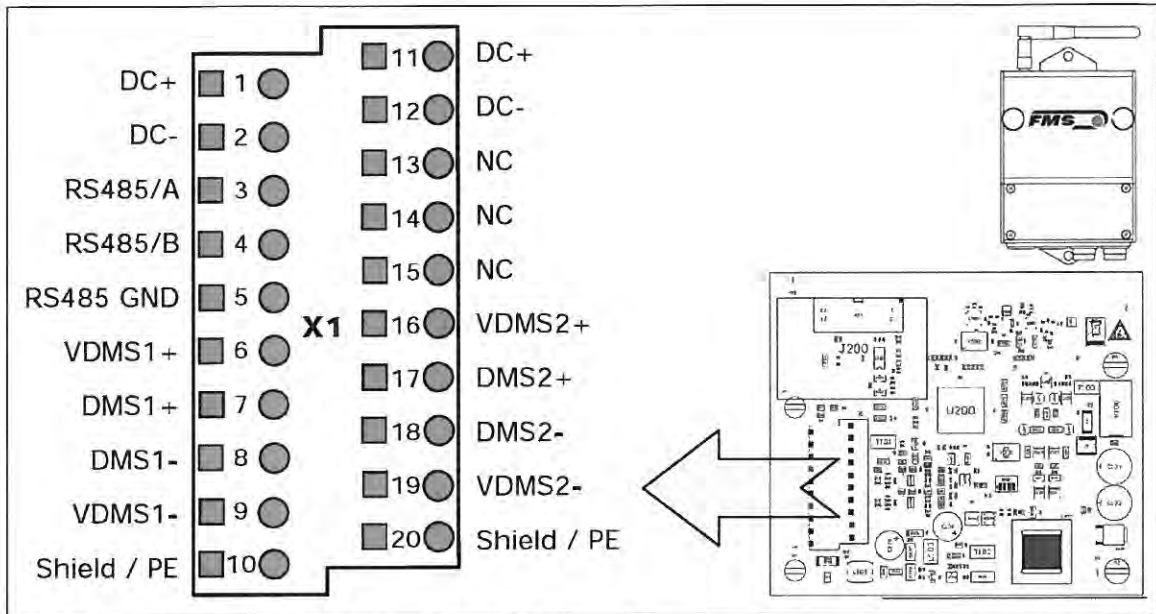


Fig. 6: Pin Assignment EMGZ482T on Electronic Board

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

Caution
Bad earth ground 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.

Caution
The cable must be installed separate from power lines.

3.6 Components on the Static Part of the Machine

Following RTM X2 components are installed on the static part of the system:

- EMGZ482R RTM X2 Receiver
- Battery charger Li-Ion
- Cables to PLC / Machine Control

3.7 Wiring the Receiver EMGZ482R

Apart from the functions described in 2.2 “System Components” the EMGZ482R acts as a man-machine-interface to the RTM X2 system and it can also be used as an interface to a PLC or to a close-loop tension controller.

Wiring to a supply unit or to control unit are described in the following diagrams.

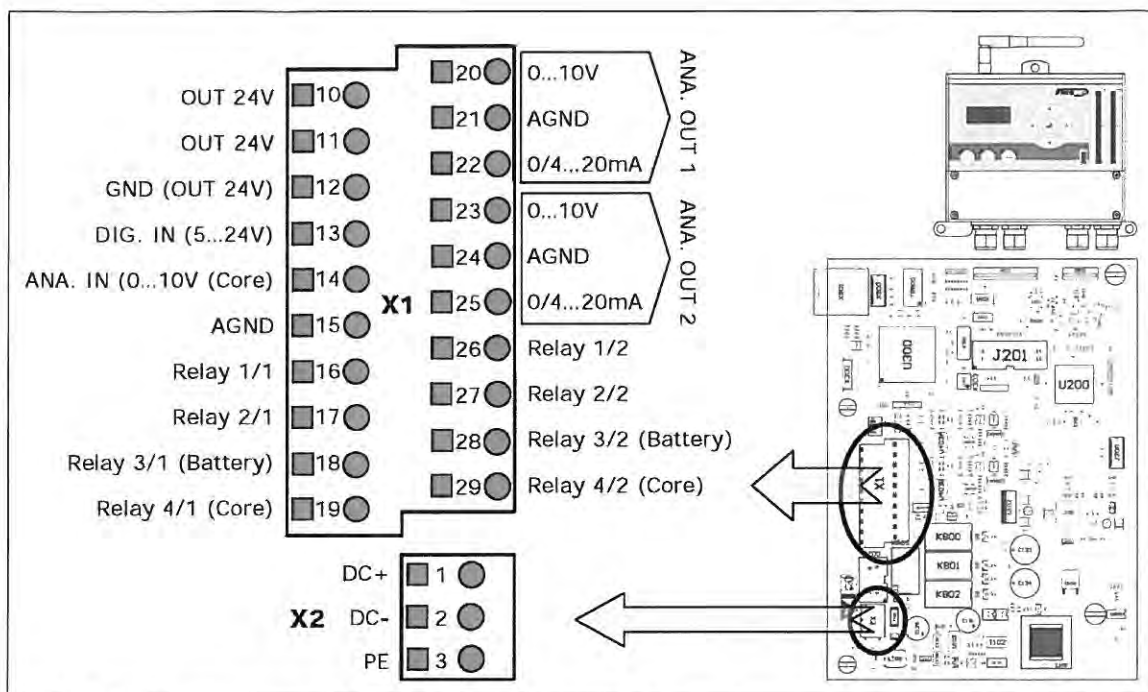


Fig. 7: Pin Assignment EMGZ482R on Electronic Board

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3.8 Charging the Battery

1. Connect the empty Li Ion battery pack to the charger.
2. The charge status LED will light red, if the battery is empty.
3. In the battery pack a charging control circuitry is built-in to control the charging process and protect the battery from being over-charged.
4. The charging process will be stopped as soon as the battery pack receives its maximum charging level. The charging process takes 3-4 hours.
5. Once the battery is loaded the charge status LED on the charger will turn green.

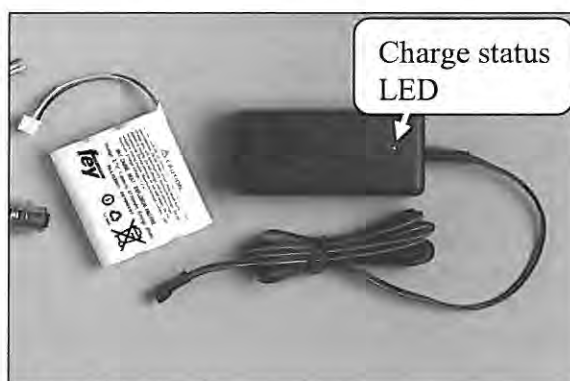



Fig. 9: RTM X2 battery and charger

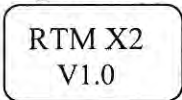
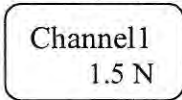
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 **Note**
The battery packet must be mounted in the compartment of the EMGZ482T before starting the system set-up.

4 Configuration of the RTM X2 System

FMS delivers the RTM X2 System with preset hardware components, installed software, a configured 2.4 GHz radio-link and all cables applied and prepared.

4.1 RTM X2 Quick Start

1. After having mounted and wired the RTM X2 system components on your machine open the EMGZ482T by unfastening the two screws on the front plate.
2. In the battery compartment of the EMGZ482T connect the battery to the Transmitter and close the compartment.
3. Connect the EMGZ482R Receiver to the 24 VDC power supply and power up.
4. The RTM X2 system will establish the wireless radio link automatically. This initial process can take 5-10 sec.
5. After having achieved a stable radio link the LCD display on the EMGZ482R will show:  and than change to 
6. The LCD will display a very low tension since no load is applied on the measuring rollers.
7. The system is now ready and can be configured to over the operation panel on the EMGZ482T.

4.2 Description of the Operating Panel EMGZ482R

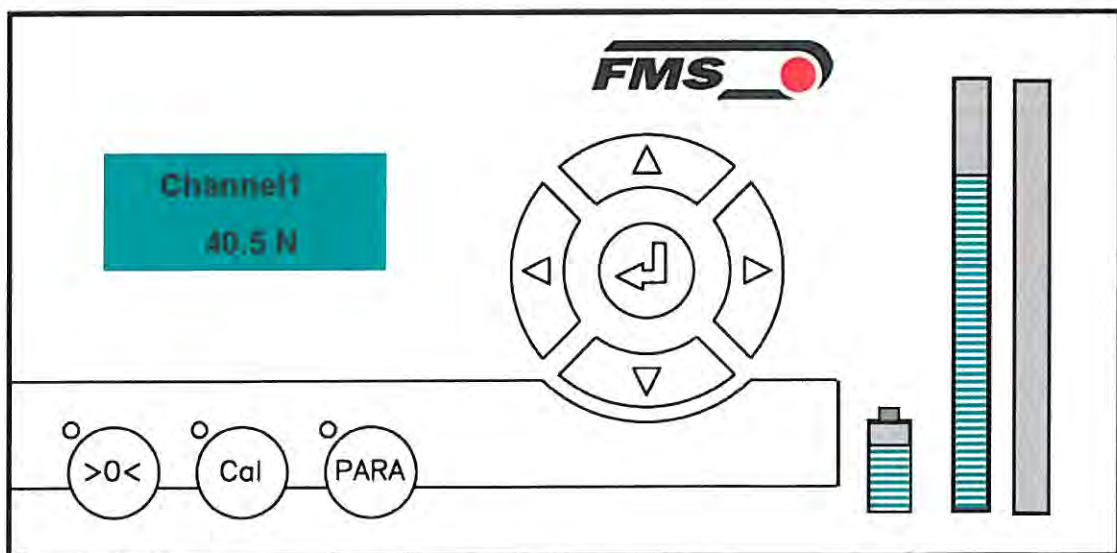


Fig. 10: View of the Operating Panel EMGZ482R

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The keys on the operating panel have the following functions:

Key	Key function during operation
	Enter Offset Compensation Procedure
	Enter Calibration Procedure
	To enter the Parameter Setting Mode, press the key for longer then 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. 15 to 18) in paragraph 5 ‘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.

4.3 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. Set the language on the display
2. Set measuring unit




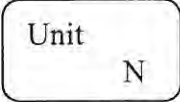





A) Change Language

The default setting for the language is English.

1. Hold the key for longer then 3 sec. until you enter the Parametrisation State.
2. The display shows . Scroll the menu by pressing the key until you are in the parameter group “System”.
1. Press to select the Parameter *Language*. The LCD shows .
2. Press . The display starts flashing indicating that you can now change the parameter with the or keys.
3. Confirm your change by pressing the Enter key .
4. Press the key to return to Parameter Selection.
5. Hold the key for longer then 3 sec to return to the Operation State.


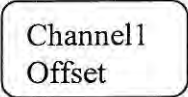

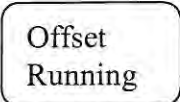
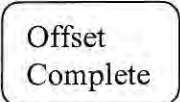


B) Change the Measuring Units

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

1. Hold the  key for longer then 3 sec. until you enter the Parametrisation State.
2. Scroll the menu by pressing the  key until you are in the parameter group “System”.
3. Scroll down with  to select the Parameter *Unit*. 
4. Press . The display starts flashing indicating that you can now change the unit parameter with the  or  key.
5. To confirm your change by pressing the Enter key . Press the  key twice to return to the Operation State.

4.4 Offset Compensation Procedure

With the Offset Compensation one can compensate the roller weight of the sensor. This procedure is always performed before the calibration. The here determined value is stored in the parameter *Offset* (in the Channel Parameter Group). The roller weight compensation of all three channels (CH1, CH2 and Core) can be compensated. The force measuring roller should not be loaded while the Offset Compensation is being done. Continue with following steps:

1. Enlighthent any wires that may apply a force to the roller.
2. Press the  key for longer then 3 sec. until you enter the Offset Compensation procedure.
3. The display shows: 
4. Press  to start the offset compensation for channel 1. After pressing the key this procedure will be executed automatically.
5. The display will indicate   
6. Press the  key to return to the Operation State.
7. To do offset compensation for channel 2 select channel 2 in the Parameter Group Selection and repeat step 1 to 6.

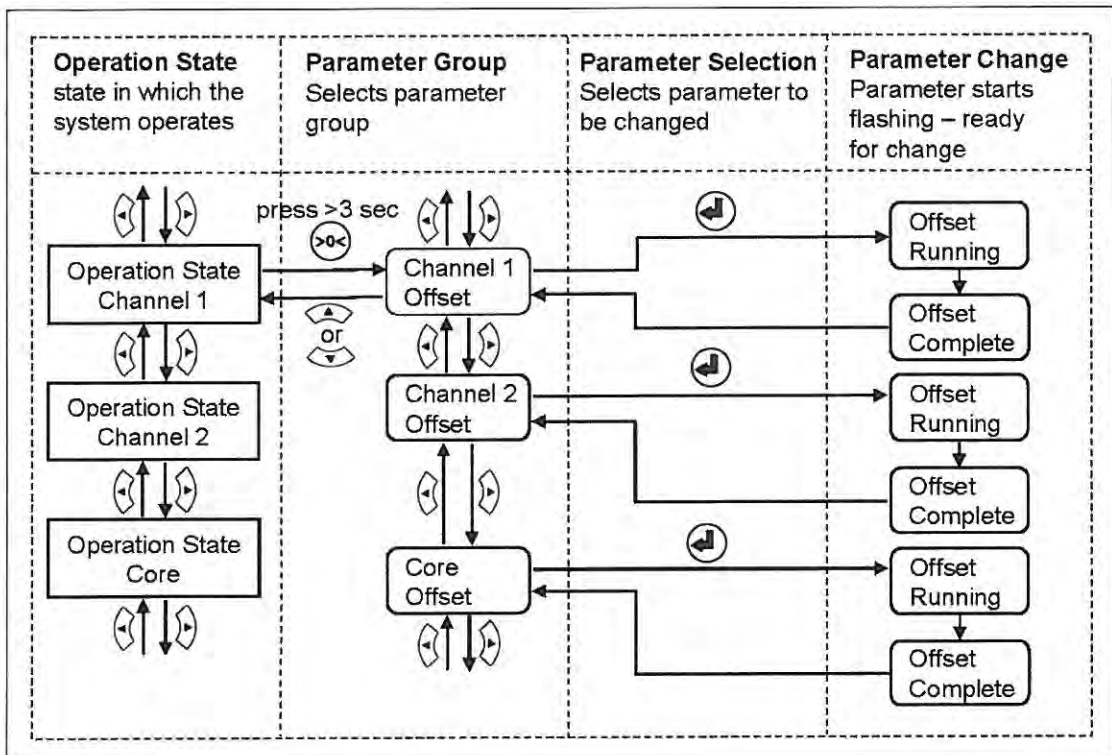


Fig. 11: State diagram offset compensation

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4.5 Calibration Methods

The Calibrating procedure (setting the Gain), adjusts the controller and load cells so that the display gives you the actual tension value. There are two methods of calibrating the system. The first method uses a defined weight. The second method is based on a calculation method in conjunction with the FMS Calculator. This Calculator can be downloaded from the FMS web page. FMS recommends using the method with the weight (see Fig. 12) since it delivers the most accurate results.

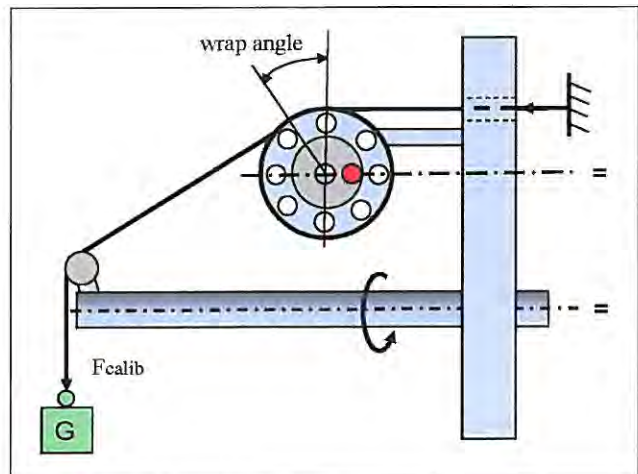



Fig. 12: Calibrating the measuring amplifier

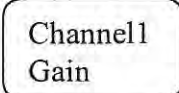
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4.6 Calibration Procedure

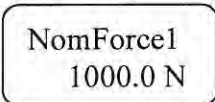
The Calibration Procedure calculates the value for the amplifier gain. The procedure requests inputs such as the system force and the force corresponding to the calibration weight. The here determined values are stored in the parameter *Gain* and *NomForce*. All three channels can be calibrated.



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


2. Press the  key for longer then 3 sec. until you enter the Calibration State.

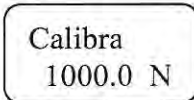
3. The display will show 



4. Press  to enter the nominal force of the force sensor.

5. The display will indicate 

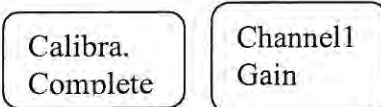
6. Change the force value according to the used force sensor with the  or  key. The nominal force of the sensor is indicated on its label.


7. Press  to start the first gain factor calculation for channel 1.

8. The display will show 

9. Enter the force that corresponds to your calibration weight with the  or  key.

10. Press  to store Gain.

11. The display will show 

12. Press the  key to return to the Operation State.

13. If you are working with a two channel RTM X2 system repeat the calibration procedure (step 1 to 12) for Channel 2 or the virtual channel "Core".

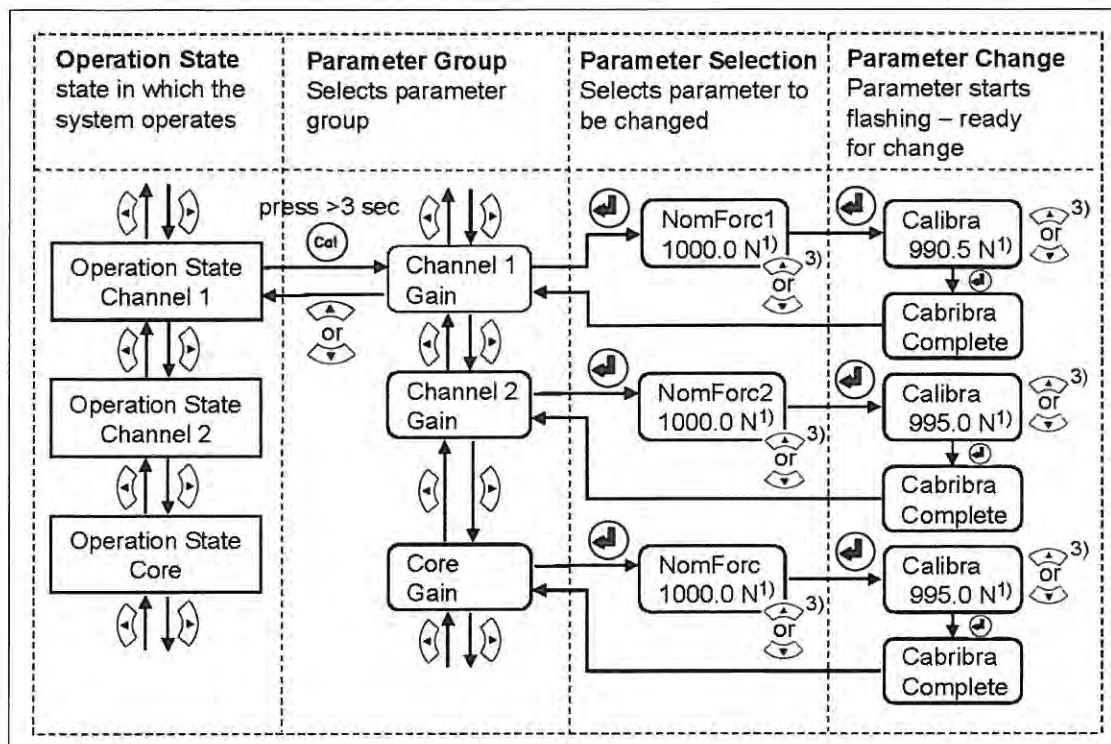


Fig. 13: State diagram calibration procedure

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

4.7 Operating the EMGZ482R over the Front Panel

The EMGZ482R has 3 Operation States:

- **Operation of Channel 1**
- **Operation of Channel 2**
- **Operation of Core**

Furthermore the EMGZ482R has a **Parameter Setting State** and two adjusting procedures.

- **Offset Compensation**
- **Calibration Procedure.**

The user can toggle between the different states by pressing a key on the front panel. **Fig. 14** provides an overview about the different Operation States and how to move from one state to the other.

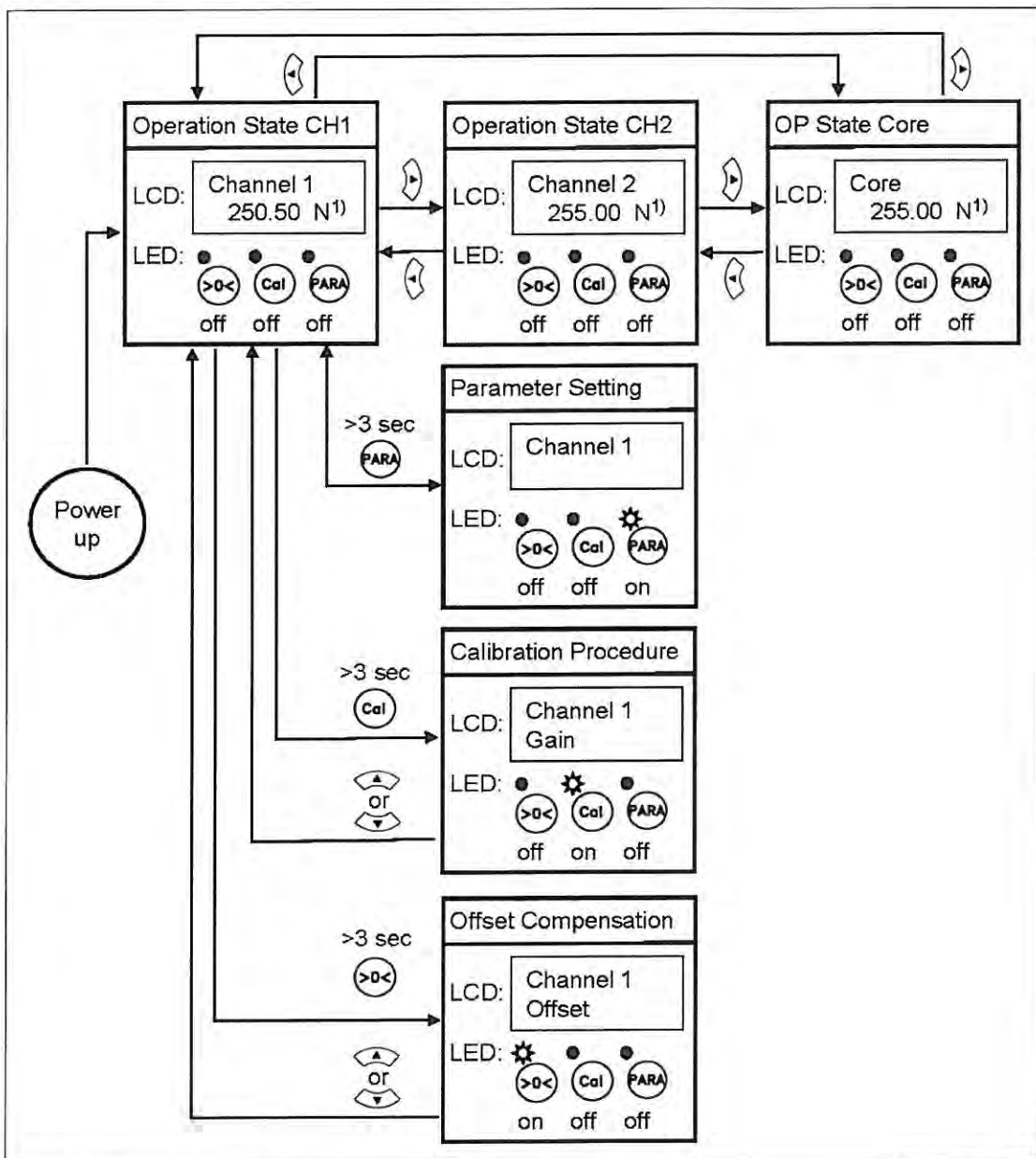


Fig. 14: Top-level view of operation control

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5 Parameter Setting over the Front Panel

5.1 Basic Instructions for Parameter Setting

The RTM X2 System can be configured and parameters changed via the EMGZ482R. 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 two parameter groups:

- **Channel 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 Adjustment**

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 EMGZ482R displays only the parameters that are relevant for a used application.

5.2 Channel Parameter Group

With the two Adjustment Procedures 4.4 “Offset Compensation” and 4.6 “Calibration Procedure” the application specific parameters are determinate and the system calibrated. These parameters are stored in the Channel Parameter Group. They can be accessed and changed as described in the following state diagram.

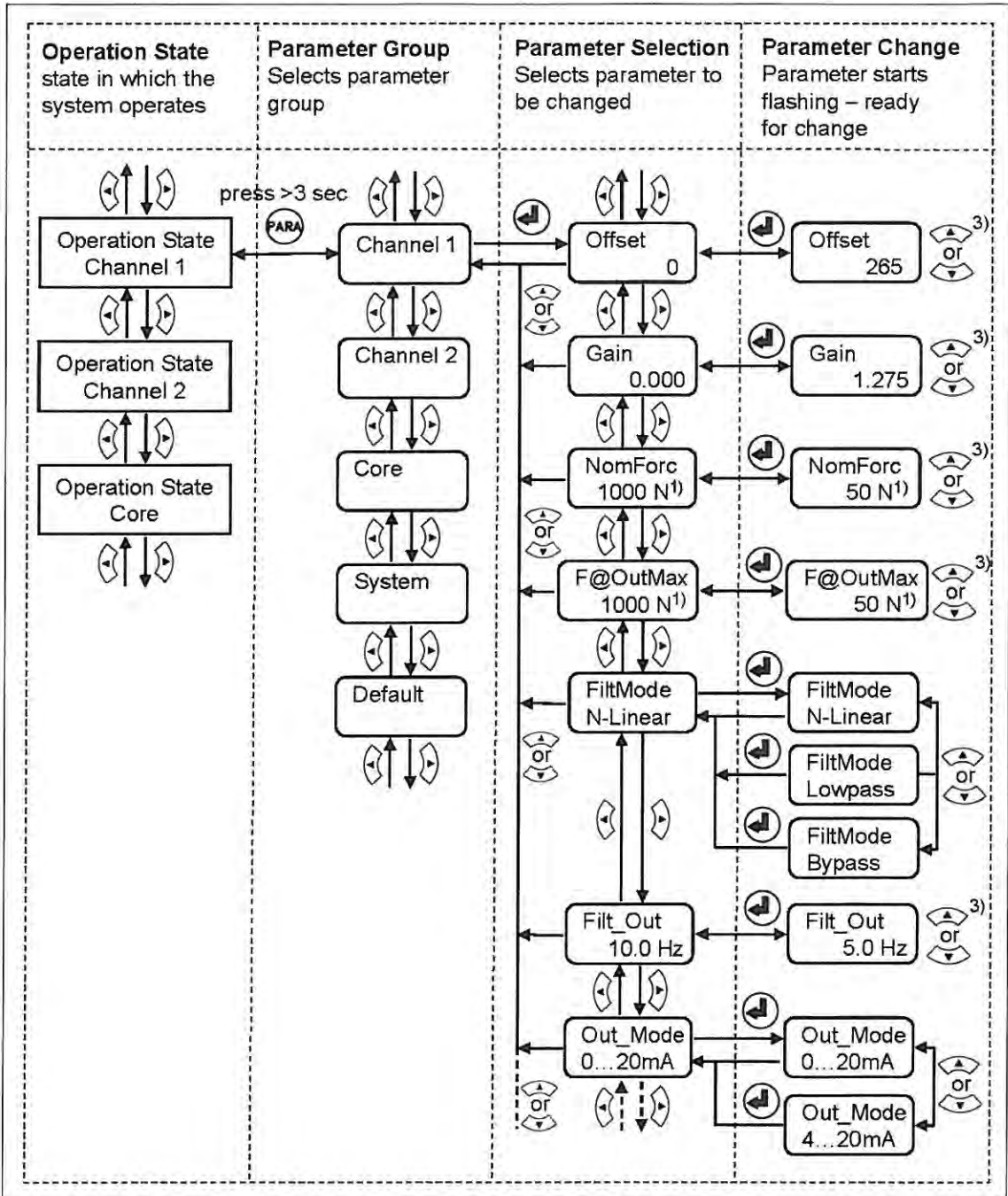


Fig. 15: State Diagram Parameter Group Channel 1 (1st Part)

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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.

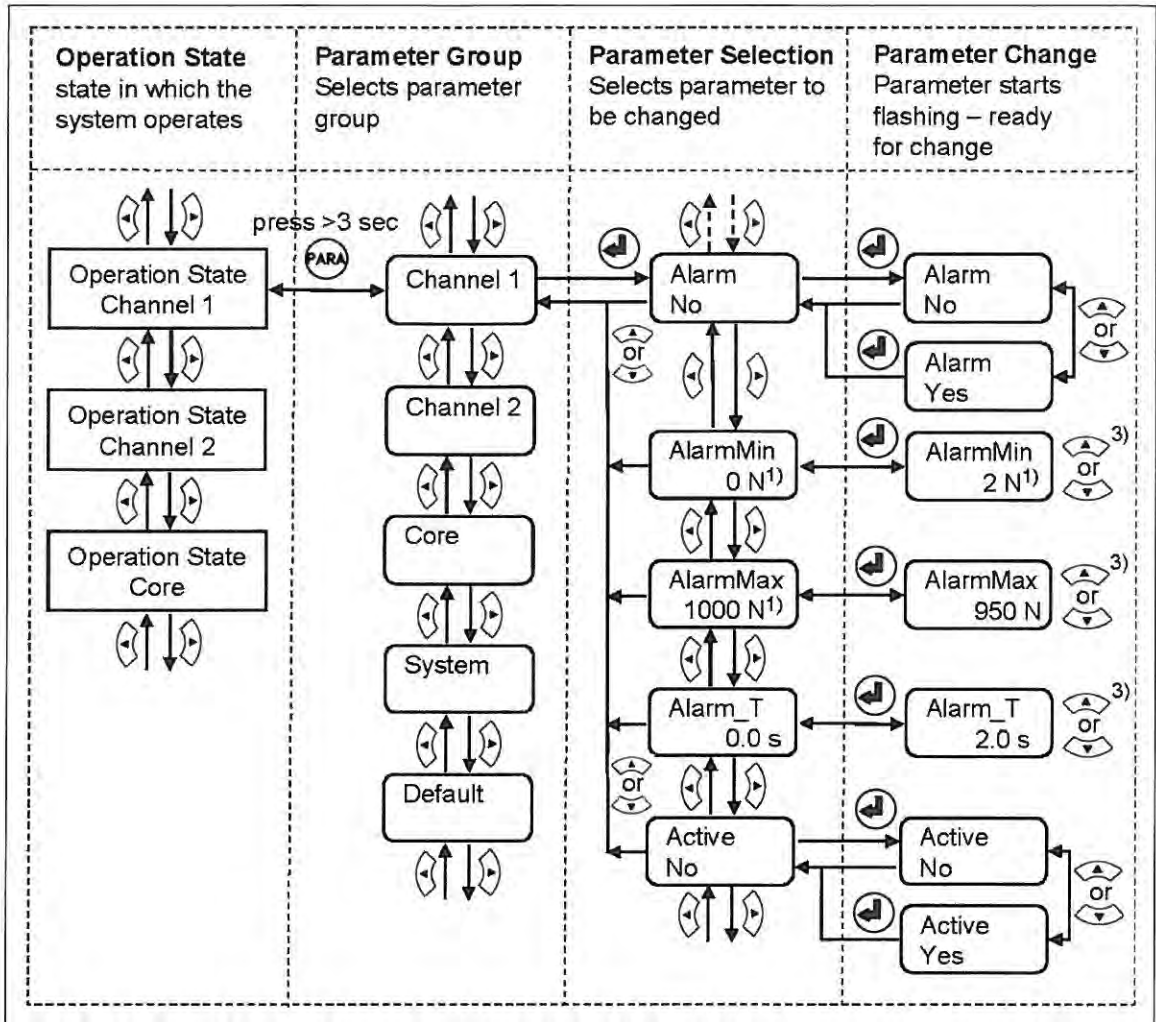


Fig. 16: State Diagram Parameter Group Channel 1 (2nd Part)

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Parameter Setting for Channel 2 and Core

The following State Diagram shows the programming of the Core Channel. “Core” is an analogue channel and it has different attributes as the two other channels CH1 and CH2.

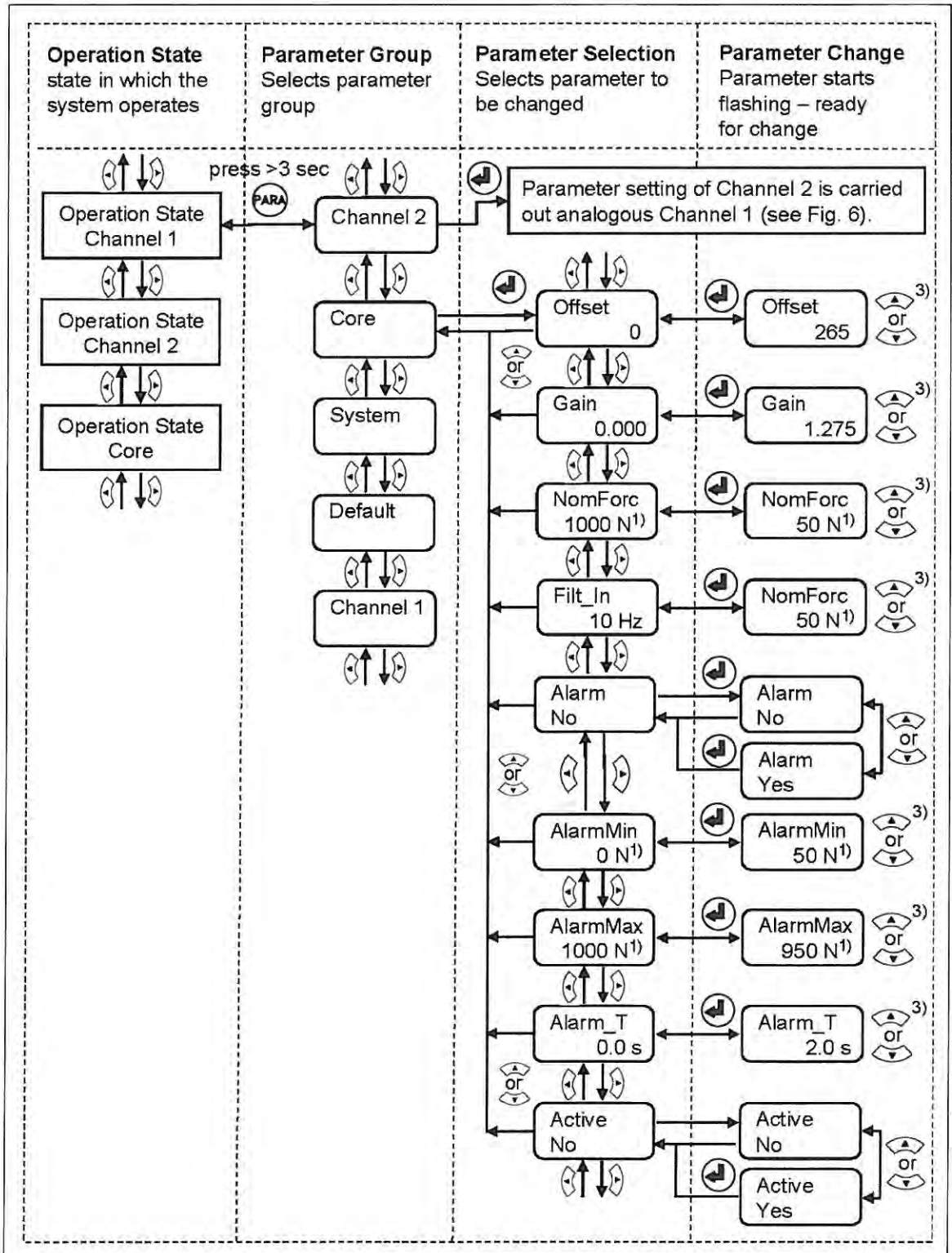


Fig. 17: State Diagram Parameter Group Channel 2 and Core

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5.3 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.

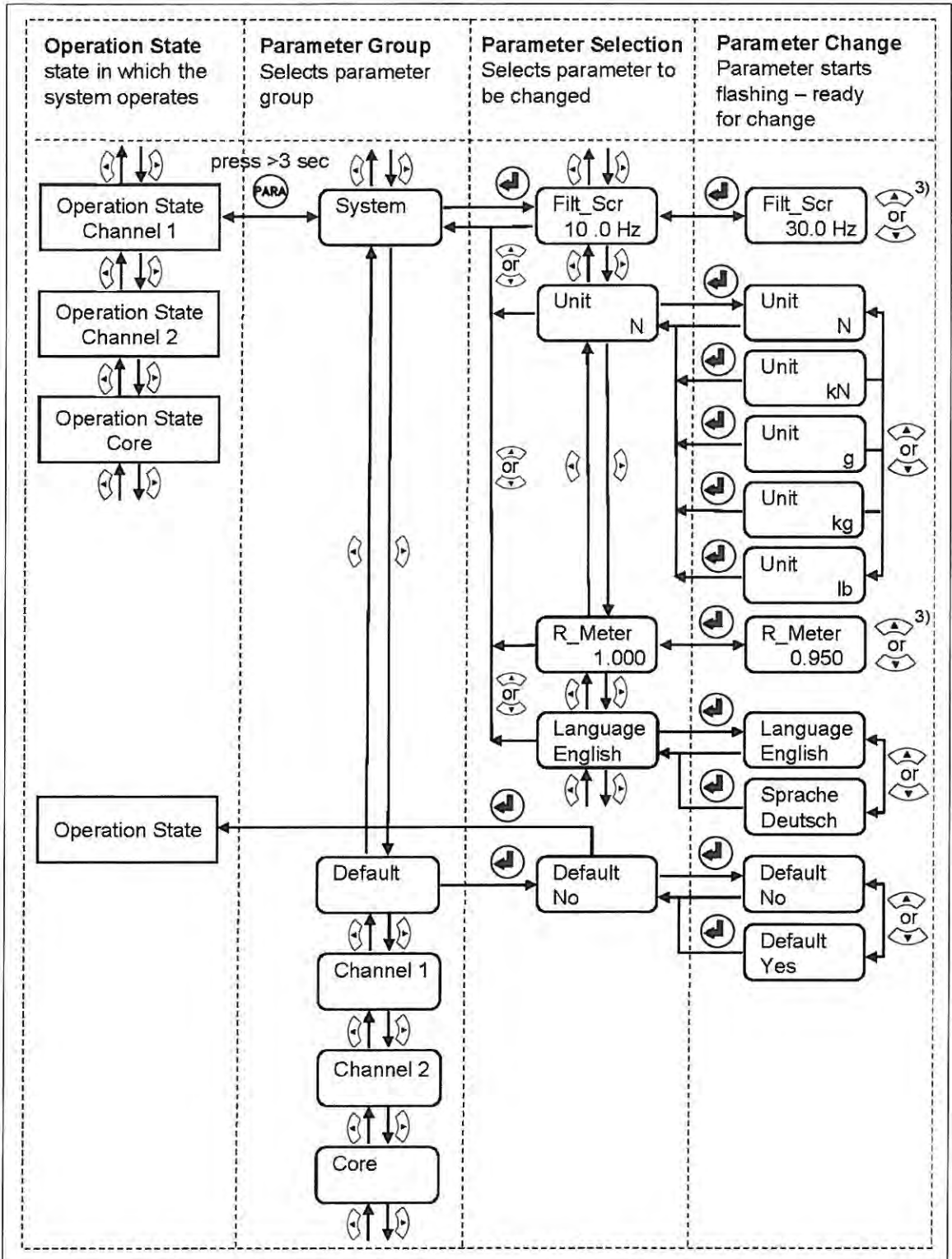




Fig. 18: State Diagram System Parameter Group

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5.4 Reset to Default Parameters

Factory settings of your RTM X2 system can be re-established either over the parameter setting menu by changing the parameter *Default* to *yes* (see **Fig. 16**) or by holding the two keys  and  at the same time while the controller is powered on.

6 Mechanical Dimensions

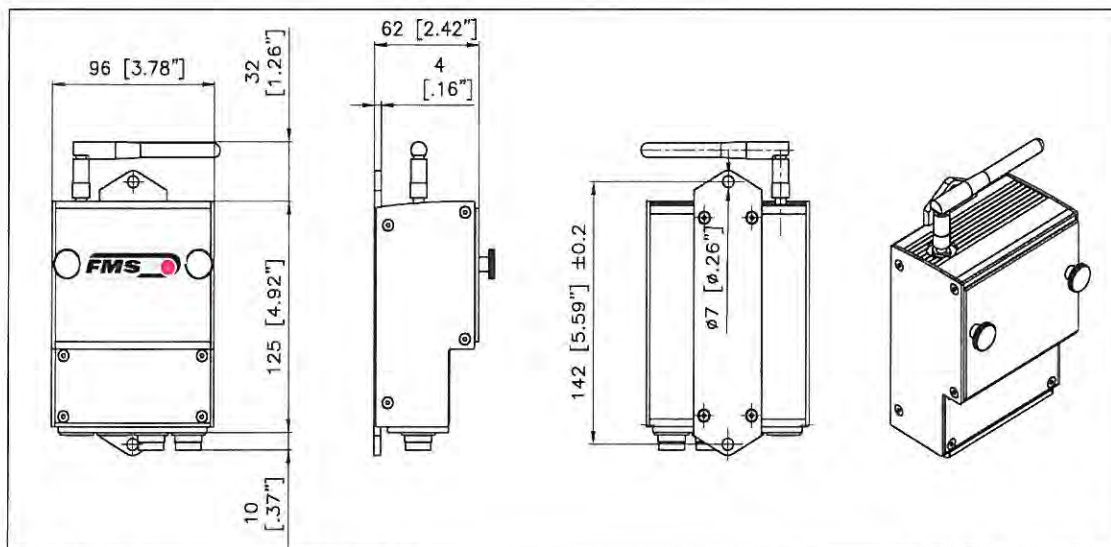


Fig. 19: Dimensions EMGZ482T

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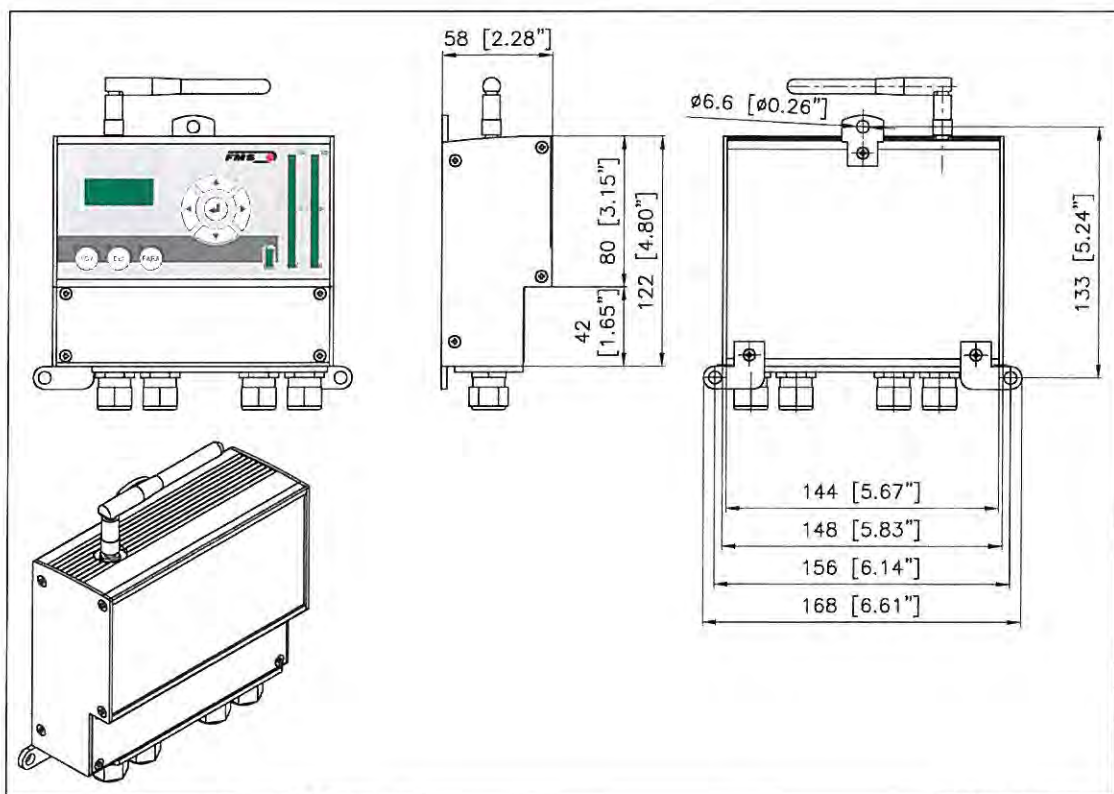


Fig. 20: Dimensions EMGZ482R

RTX2 0018US

7 Trouble Shooting

Error	Cause	Corrective action
The EMGZ482R gives error message: Radio link lost	EMGZ482T Transmitter does not respond.	Check battery in EMGZ482T whether it is connected or empty.
Very low force indication on LED row.	Wrong nominal force entered.	Re-calibrate the system 4.6 "Calibration Procedure". Or proceed to 4.6 "Calibration Procedure" and enter the correct value. Enter the nominal force that is indicated on the sensor in the Parameter <i>NomForc</i> .
	Forgotten to set the LED display range	Proceed to 5.2 "Channel Parameter Group" and enter the correct value in parameter <i>F@OutMax</i> .
	Feedback value doesn't correspond to the effective material tension	Gain badly calculated
Error message: Channel1 >min. limit Channel2 >min. limit Core >min. limit	The erroneous channel is active and has no measuring roller connected	Deactivate the channel (Parameter: <i>Active ->no</i>). Or connect a measuring roller in the respective connector of EMGZ482.
	Tension indication is very sluggish.	Output signal Filter set too low.

8 Technical Data

EMGZ482T	
Number of Channel	2 channels for 2 sensors
Measuring Error	<0.05% FS
Sensor Supply	3.0 VDC, max. 60mA?, high stability
Power Supply	3.7V battery Li Ion (6.7mAh) or 24VDC via slip rings (18...36VDC /10W max. 05A)
Resolution A/D Converter	±8192 Digit (14 Bit)
Options	EMGZ482T.24V for 24V supply via slip rings
Wireless Interface	2.44 GHz
Analogue Input 1	1 sensor with strain gauges @ 350 Ω (0...9 mV, max. 12.5 mV) or (0...6.7mV, max 9.2mV)
Analogue Input 2	1 sensor with strain gauges @ 350 Ω (0...9 mV, max. 12.5 mV) or (0...6.7mV, max 9.2mV)
Temperature Range	-10...60°C [14...140°F]
Protection Class	IP40
Weight	0.52 kg [1.15 lbs]

EMGZ482R	
Number of Channel	2 channels
Displays	LCD 2x 8 characters (8mm) 2 LED rows for tension indication Battery load indicator
Cycle Time of Measurement	2ms
Resolution D/A Converter	±8192 Digit (14 Bit)
PLC Interface	Ethernet via web browser (Ethernet explorer 7 or higher)
Control interface	Ethernet (not yet implemented)
Wireless Interface	2.44 GHz
Analogue Output 1	0...10 VDC; min. 1.2kΩ or 0/4...20mA, max. 500Ω
Analogue Output 2	0...10 VDC; min. 1.2kΩ or 0/4...20mA, max. 500Ω
Relay Outputs	2 outputs (DC: 220V/2A/60W; AC:250V/2A/62.5VA)
Power Supply	24VDC (18...36VDC) / 10W (max. 0.5A)
Temperature Range	-10...60°C [14...140°F]
Protection Class	IP40
Weight	0.65 kg [1.43 lbs]



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