RTM X42.Modbus Installation Manual and Operating Instructions
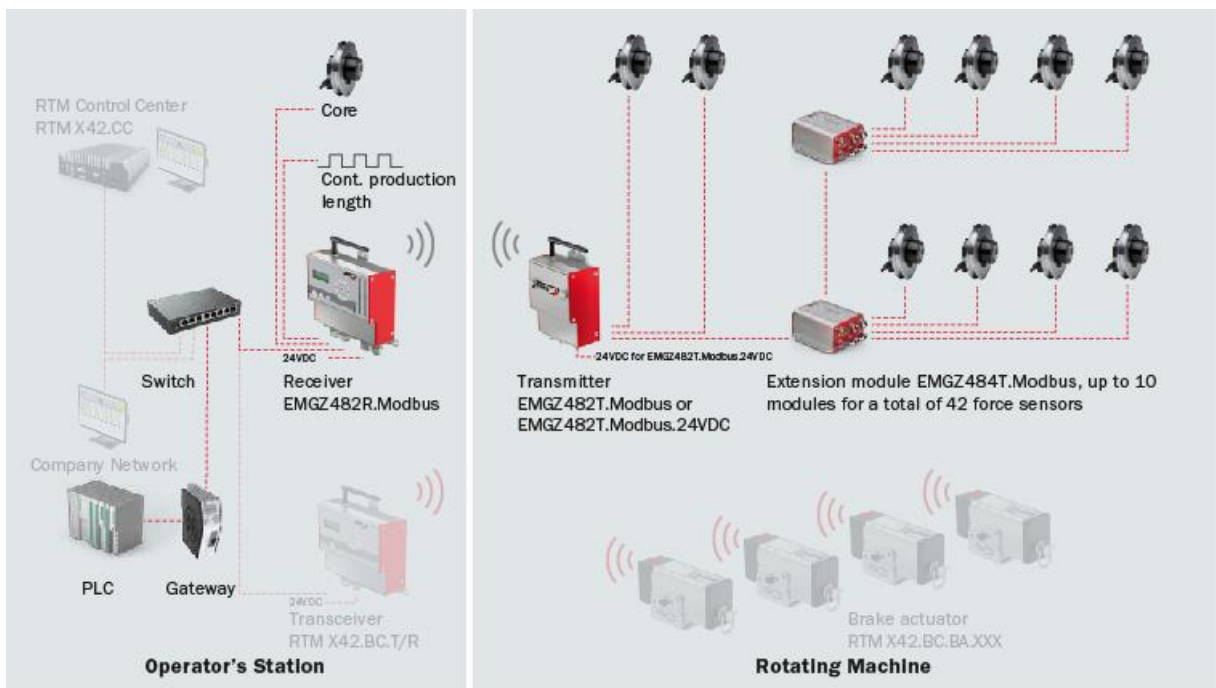
Telemetry System for Wire Tension Measurements in Cage and Tubular Type Stranders

Document version	3.30
Published/author	01/2024 NS

Diese Bedienungsanleitung ist auch in Deutsch erhältlich.

Bitte kontaktieren Sie Ihren nächstgelegenen FMS Vertreter.

1 Content

2 Safety Information

All safety information, operating and installation regulations listed here ensure proper function of the device. Safe operation of the system requires compliance at all times. Noncompliance with the safety information or using the device outside of the specified performance data can endanger the safety and health of persons.

Work with respect to operation, maintenance, retrofit, repair, or setting the device described here must only be performed by expert personnel.

2.1 Presentation of Safety Information

2.1.1 Danger that Could Result in Minor or Moderate Injuries

Danger, warning, caution

Type of danger and its source

Possible consequences of nonobservance

Measure for danger prevention

2.1.2 Note Regarding Proper Function

Note

Note regarding proper operation

Simplification of operation

Ensuring function

2.2 General Safety Information

Flying parts

If the battery is not secured correctly, it can be ejected in the case of rotating machines.

Secure the battery using the knurled screws

Changes or modification to this device that have not been expressly approved by FMS AG, will result in the FCC approval for operation of this device being voided.

This device complies with the FCC Rules Part 15 as well as the RSS standards issued in Canada not requiring approval. Operation is

subject to the following two conditions:

- The device may not cause any harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation of the device

Information about radio frequency radiation

This device complies with the FCC limit values for an uncontrolled environment. This device should be installed and operated such that a minimum distance of 20 cm is maintained between radiation source and your body. This transmitter must not be operated near or in connection with another antenna or transmitter

The function of this system is only ensured with the components in the specified layout to one another. Otherwise, severe malfunctions may occur. Thus, the installation information on the following pages must be followed.

The local installation regulations ensure the safety of electrical systems. They are not considered in these operating instructions. However, they must be met.

Poor grounding can result in electric shocks for persons, malfunctions of the overall system or damage to the control electronics! Proper grounding must always be ensured.

It is of utmost importance to compensate for the centrifugal forces generated through the rotation of the strander. Non-compensated force-measuring rollers lead to faulty measurements.

Electrical connections must be implemented by an expert.

All system components are sensitive components that can be damaged in the case of improper installation! Installation must be performed by trained service personnel!

3 Product Information

3.1 Functional Description

The telemetry system RTM X42 uses force sensors for measuring the wire tension of strands and wires. It radio-transmits the measured values from the rotating to the static part of the machine. The telemetry system RTM X42 with its components is an integrated system. The individual components are optimally aligned to one another. Thanks to its modular and space-saving design, it can be ideally used in confined conditions of tubular type stranding machines, and cage type stranders with up to 42 spools. The machine efficiency is increased as well as the production yield during wire and cable production.

3.2 System Extensions to the RTM X42 Measuring System

RTM X42.CC Control Center – Master controller with pre-installed RTM Monitoring & Control Software

- Clear presentation of measured values
- Storage, printing of measured data, quality documentation for your customers
- Integrated solution with user-friendly interface
- Storage of recipes, fast setup/conversion to other products
- Wide database for analysis, sound statements regarding system performance as basis for process improvements

RTM X42.BC Brake control – Brake actuators on every spool carrier

- Integrated solution, fully automated control of the pull-off force
- For belt and rope type friction brakes, continuous production with highest quality
- Simple design, maintenance-free, robust, easy to retrofit, highest reliability
- Proven battery technology, ease of operation, long lifetime, highest efficiency

3.3 Main Components
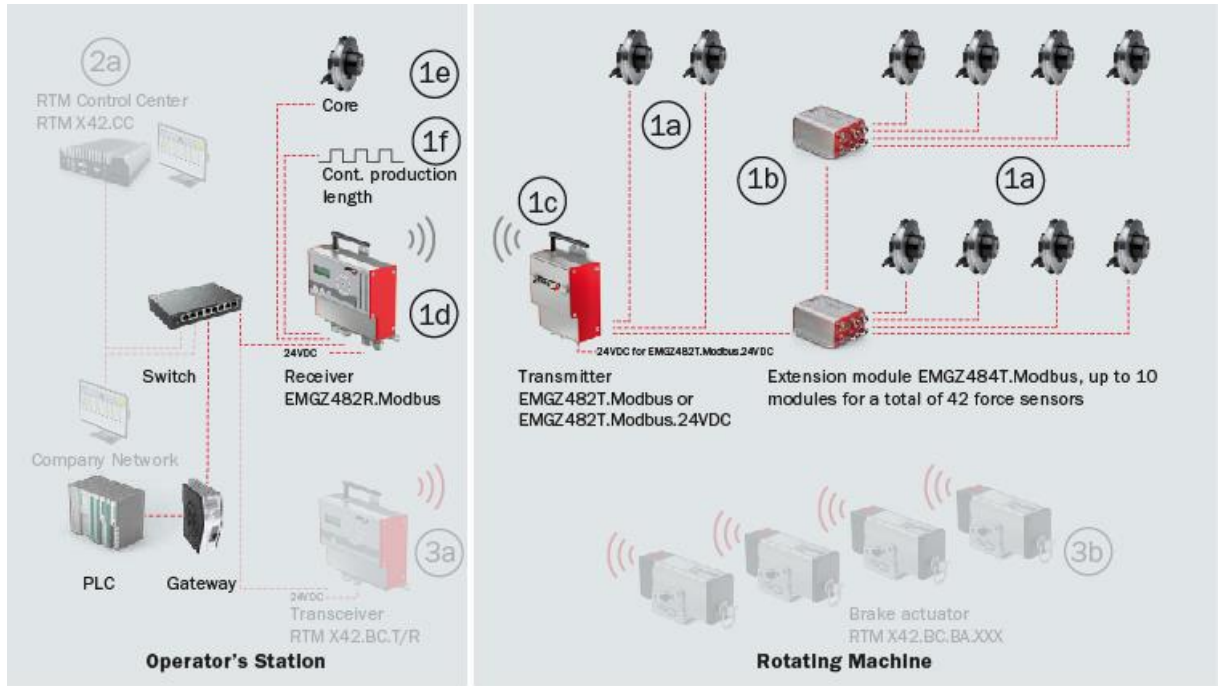
Figure 1: RTM X42 main components

Main component designations	
Item	Description
1a to 1f	Telemetry system RTM X42
1a	Force sensor(s), according to your specifications
1b	Channel extension module(s)
1c	Transmitter module
1d	Receiver module
1e	Force sensor (for core)
1f	Dig. input for production length
not shown	Battery for transmitter module and charger for battery
not shown	Connection cable from force sensors to transmitter module resp. extension modules
not shown	Patch cable for gateway or PLC connection
not shown	Measuring amplifier for core

Table 1: Main Components

3.4 Scope of Supply

Scope of supply:

Force sensors, model and size according to specification; transmitter module(s) with battery/ies and charger, channel extension module(s); receiver module(s); pre-fabricated connection cables, force sensor to channel extension module and/or to receiver module; pre-fabricated connection cables of the channel extension modules to transmitter module; RTM X42 system installation manual and operating instructions

Options:

Transmitter module with 24VDC power supply instead of battery

The following is not included in the scope of supply:

Pulleys, installation material; 24VDC power supply for receiver module, cable for power supply

Accessories:

Gateway; switch; patch cable for the connection of receiver module and gateway resp. PLC

4 Installation and Electrical Connections

4.1 Installation of Force Sensor for Core

Core measurement in static part of machine

The following information describes the installation of the core sensor when installed outside the rotating part of the machine

The red point should be aligned in the direction of the resulting force. Further installation information can be found in the installation manual of the force sensor.
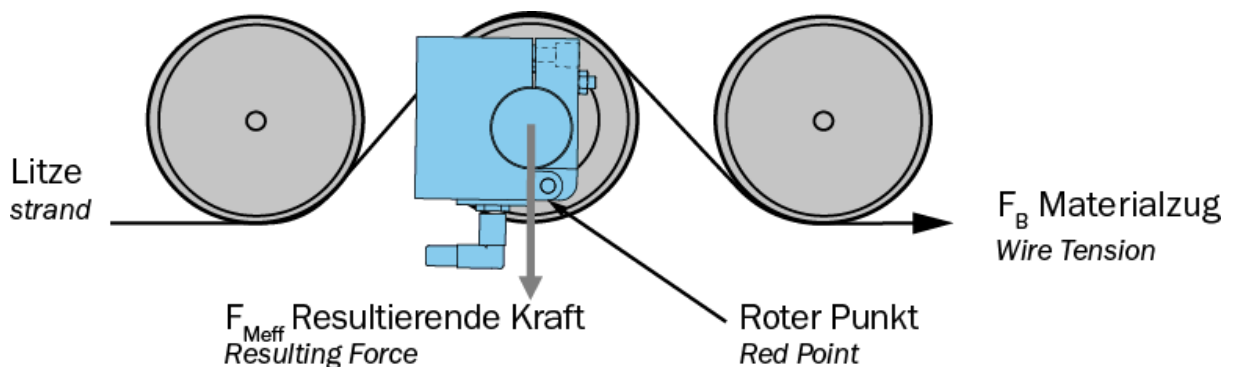

Litze
strand

F_B Materialzug
Wire Tension

F_{Meff} Resultierende Kraft
Resulting Force

Roter Punkt
Red Point

Figure 2: Force sensor alignment in static area

4.2 Installation of the Force Sensor in the Rotating Part of the Machine

In rotating applications, the force sensors are installed such that the centrifugal forces are compensated.

Note

It is of utmost importance to compensate for the centrifugal forces generated through the rotation of the strander. Non-compensated force-measuring rollers lead to faulty measurements,

In the case of FMS force sensors of the RMGZ series, this is achieved by aligning the force sensor such that the measuring direction is exactly parallel to the axis of rotation of the strander. The red point of the force sensor points in the direction of the positive force component.

Correct alignment of the red point can be tested after offset compensation and calibration. If the display of an unloaded force sensor is always 0 N in all positions (e.g., in 12 o'clock or 6 o'clock position), the force measuring roller is aligned correctly.
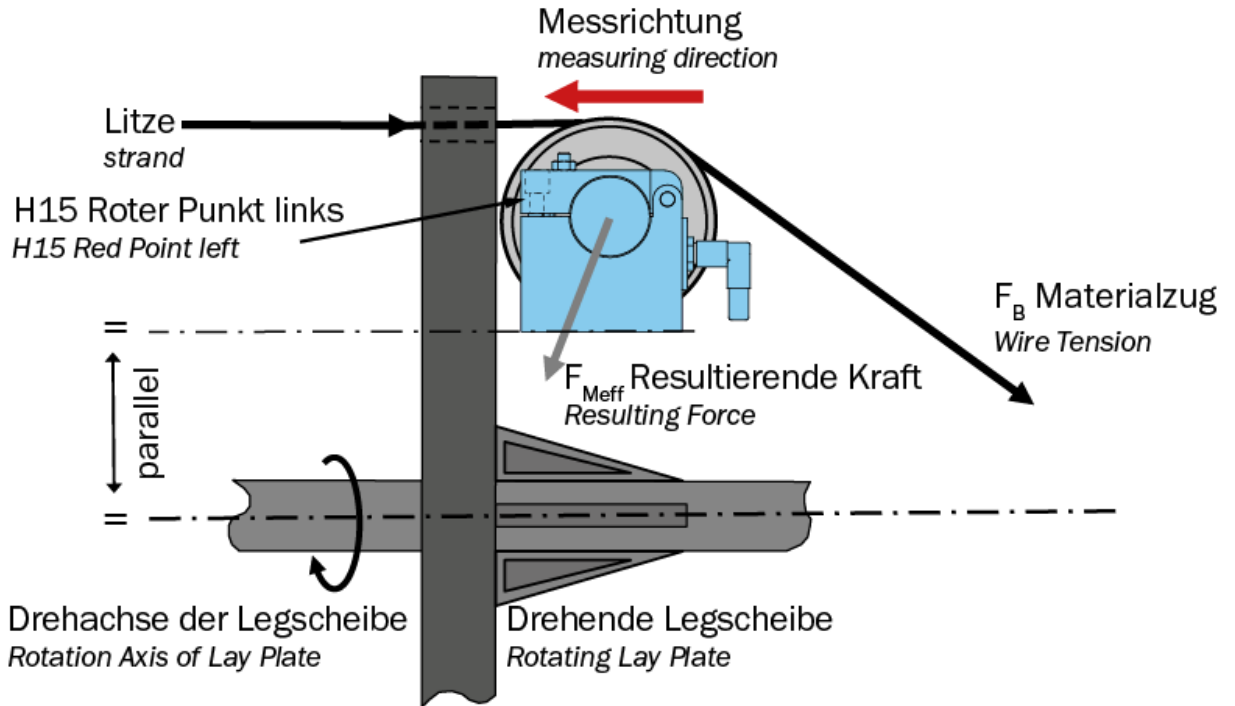
Messrichtung
measuring direction

Litze
strand

H15 Roter Punkt links
H15 Red Point left

F_B **Materialzug**
Wire Tension

F_{Meff} **Resultierende Kraft**
Resulting Force

parallel

Drehachse der Legscheibe
Rotation Axis of Lay Plate

Drehende Legscheibe
Rotating Lay Plate

Figure 3: Force sensor alignment, here RMGZ200

Parallel alignment

The exact, parallel alignment of the measuring direction to the axis of rotation of the machine is decisive for achieving precise measured data.

Otherwise, measured value fluctuations occur during machine operation due to the high sensitivity of the FMS force sensors. These interfere with the assessment of the product quality later.

Due to irregularities in the installation surfaces, the alignment may have to be readjusted very precisely. Some FMS force sensors feature an integrated mechanism facilitating this fine adjustment. For force sensors without such features, we recommend the use of shims or thin metal strips.

4.3 Installation of the Electronics Components in the Rotating Part of the Machine

The transmitter module and the channel extension modules should be mounted as closely as possible to the axis of rotation of the strander. This reduces the influencing centrifugal forces.

During installation of the transmitter module, make sure that the centrifugal forces do not act in the direction of the fastening screws of the battery.

Make also sure that the transmission path to the receiver module is free from obstacles.

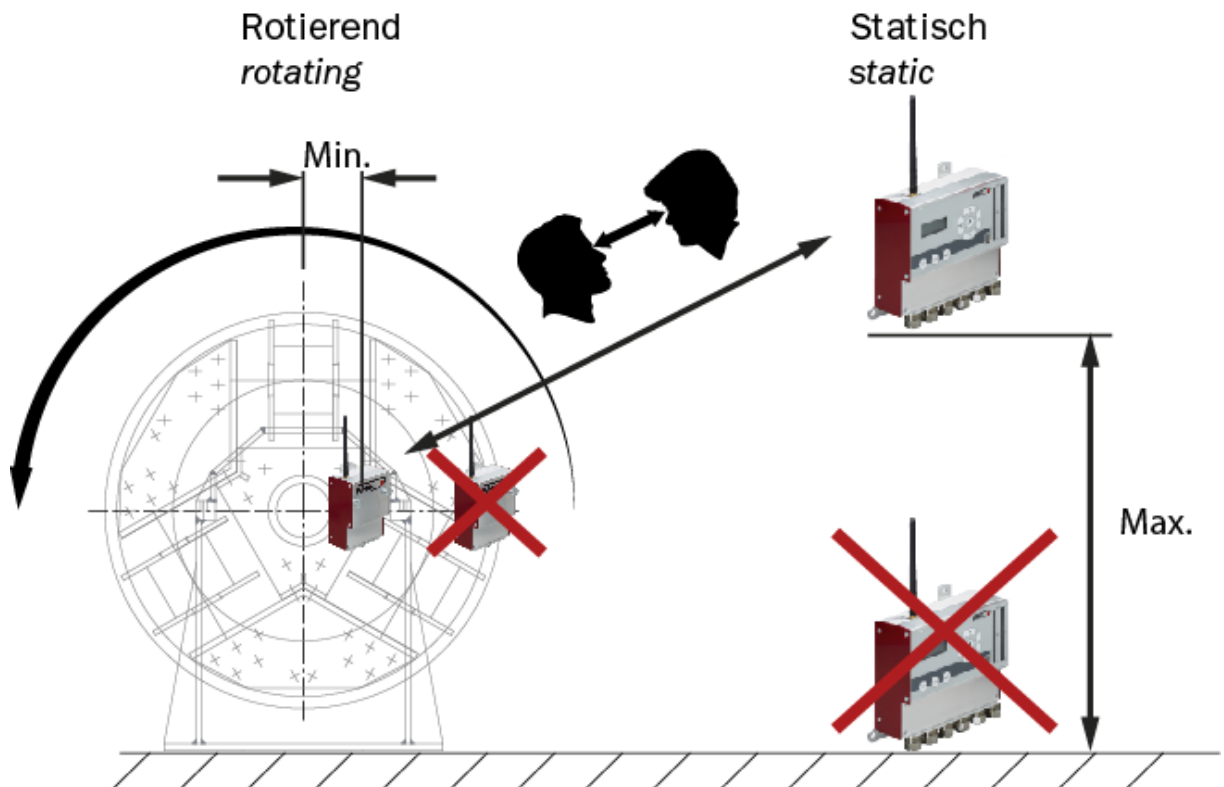Mount the receiver as high as possible.

Abbildung 4: Installation

4.4 Electrical Connection

4.4.1 EMGZ482T.Modbus Receiver Module (with battery)

The connection cables are pre-fabricated with respective connectors.

⚠️ **Re-tighten connector periodically**

Due to vibration on the machine, the connector can become loose. Re-tighten them regularly to avoid communication errors and malfunctions.

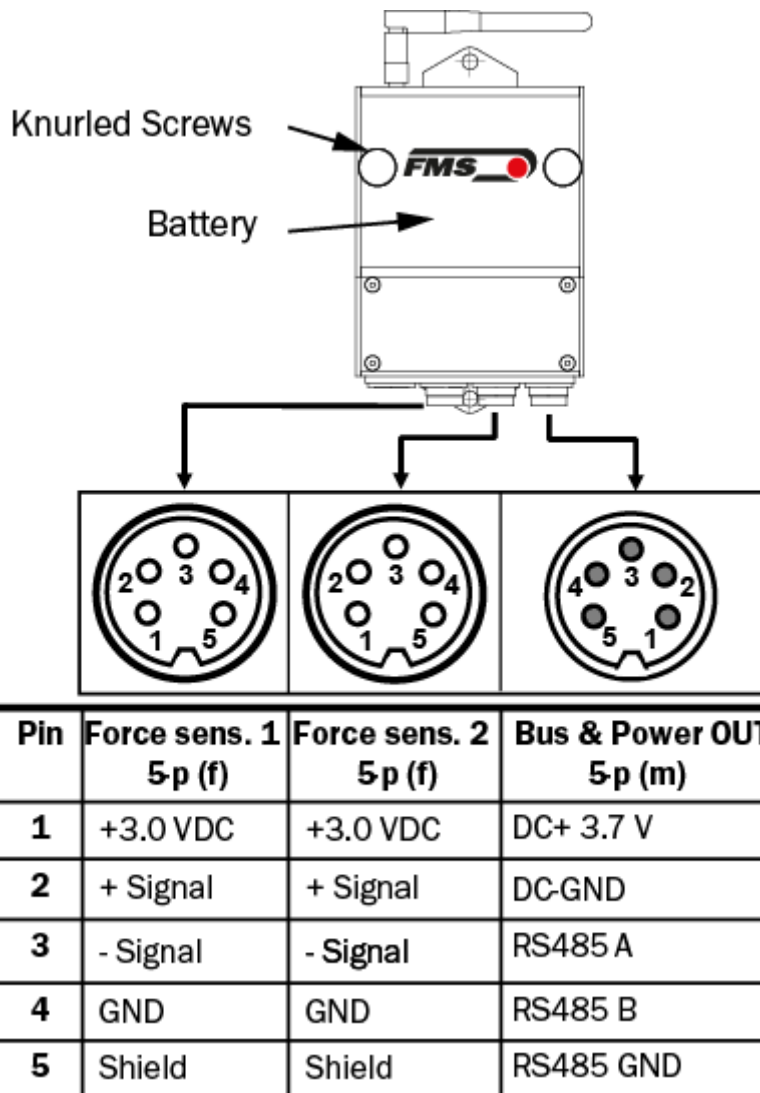| Pin	Force sens. 1 5-p (f)	Force sens. 2 5-p (f)	Bus & Power OUT 5-p (m)
1	+3.0 VDC	+3.0 VDC	DC+ 3.7 V
2	+ Signal	+ Signal	DC-GND
3	- Signal	- Signal	RS485 A
4	GND	GND	RS485 B
5	Shield	Shield	RS485 GND

Figure 5: EMGZ482T.Modbus electrical connection

4.4.1 EMGZ482T.Modbus.24VDC Receiver Module (version without battery, with 24VDC power supply via slip rings on the strander)

The connections between the force measuring rollers and transmitter are realized using a 2x2x0.25 mm2 [AWG 23] cable with 2 shielded, twisted pairs of strands.

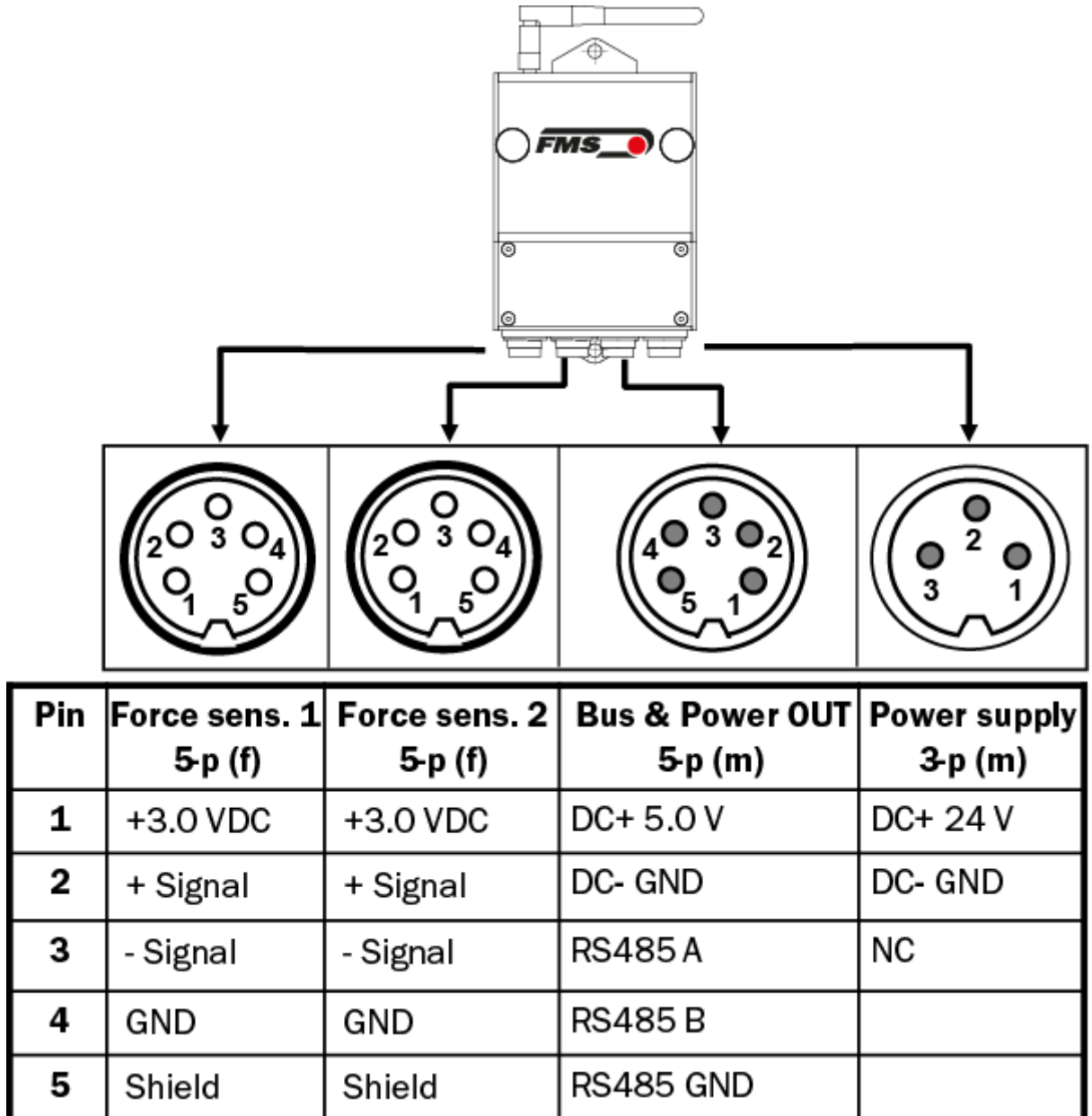The cables have connectors on both sides to facilitate installation.

Pin	Force sens. 1 5-p (f)	Force sens. 2 5-p (f)	Bus & Power OUT 5-p (m)	Power supply 3-p (m)
1	+3.0 VDC	+3.0 VDC	DC+ 5.0 V	DC+ 24 V
2	+ Signal	+ Signal	DC- GND	DC- GND
3	- Signal	- Signal	RS485 A	NC
4	GND	GND	RS485 B	
5	Shield	Shield	RS485 GND	

Figure 6: EMGZ482T.Modbus.24VDC electrical connection

⚠️ **Electrical noise and fluctuating voltage**

Protect the power lines from electrical noise and ensure that all components are supplied with adequate, stable 24 (18 to 24) VDC to avoid communication errors and malfunctions.
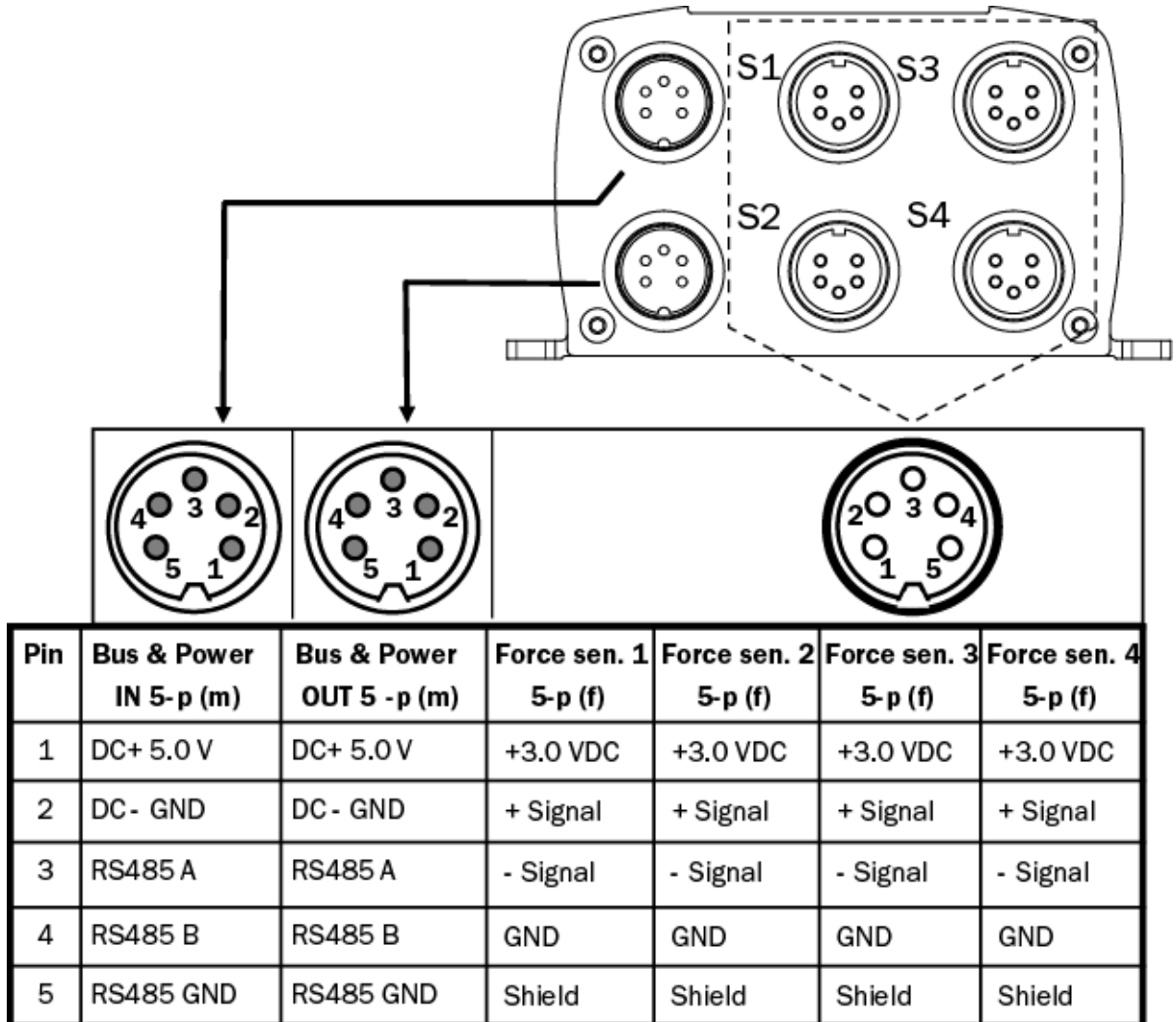
4.5 EMGZ484T.Modbus Channel Extension Module

Pin	Bus & Power IN 5-p (m)	Bus & Power OUT 5 -p (m)	Force sen. 1 5-p (f)	Force sen. 2 5-p (f)	Force sen. 3 5-p (f)	Force sen. 4 5-p (f)
1	DC+ 5.0 V	DC+ 5.0 V	+3.0 VDC	+3.0 VDC	+3.0 VDC	+3.0 VDC
2	DC - GND	DC - GND	+ Signal	+ Signal	+ Signal	+ Signal
3	RS485 A	RS485 A	- Signal	- Signal	- Signal	- Signal
4	RS485 B	RS485 B	GND	GND	GND	GND
5	RS485 GND	RS485 GND	Shield	Shield	Shield	Shield

Figure 7: EMGZ484T.Modbus electrical connection

Bus Termination Plug

All Bus & Power Socket have to be connected. Otherwise errors in communcaiton may occure.

Always insert the included bus termination plug to last channel extension module in the row (out).

Indication LEDs	
LED	**Description**
POWER	Lights up green: Voltage supply is present
	Not lit: power supply interruption for > 60 ms
	Flashing green: regular power supply interruptions
BUS	Lights up green: communication OK.
	Not lit: communication interrupted for > 3 sec.
	Flashing green: regular interruption of supply voltage (5 VDC from EMGZ482T) - all EMGZ484T flash synchronously

Table 2: LEDs on EMGZ484T

4.5.1 EMGZ482R.Modbus Receiver Module
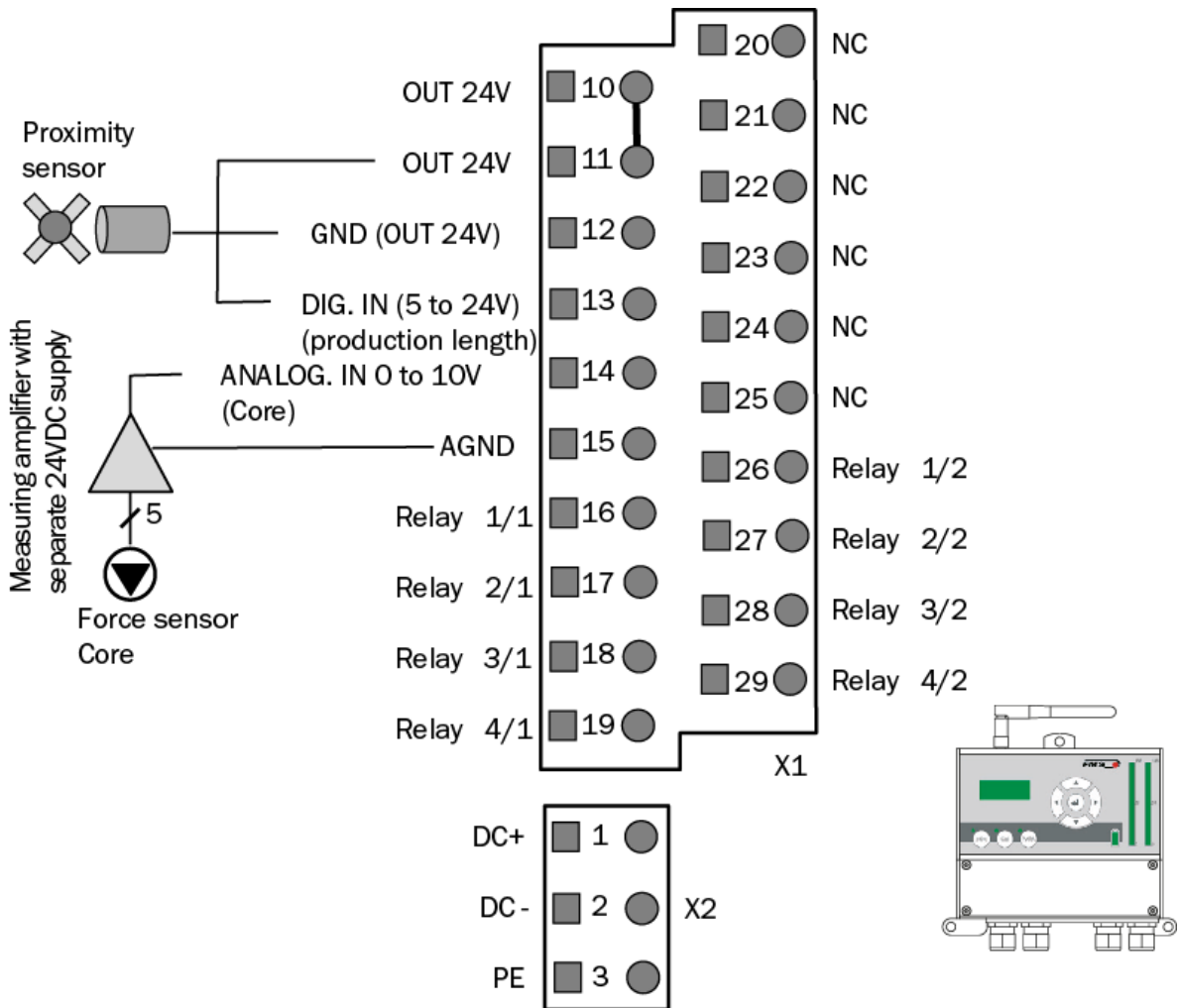
Figure 8: EMGZ482R.Modbus electrical connection

EMGZ482R.Modbus pin assignment		
Pin(s)	**Description**	
1	24 VDC+	
2	24 VDC-	
3	PE	
10, 11	24 VDC output	
12	GND for 24 VDC	
13	Digital input for production length	
14	Analog input for force sensor core	
16, 26	Relay 1/1 – 1/2	Configurable relay outputs 1 to 4:
17, 27	Relay 2/1 – 2/2	Tension value limits channel 1, 2; tension value limits collective alarm, limit pre alarm collective alarm, radio connection, battery state of charge, core tension value
18, 28	Relay 3/1 – 3/2	
19, 29	Relay 4/1 – 4/2	

Table 3: EMGZ482R.Modbus pin assignment

The RTM X42 system has pre-configured relay outputs. The respective alarm output is activated if the assigned function condition occurs.

Electrical noise and fluctuating voltage

Protect the power lines from electrical noise and ensure that all components are supplied with adequate, stable 24 (18 to 24) VDC to avoid communication errors and malfunctions.

5 Operation and Display

The EMGZ482R.Modbus receiver module features buttons and a display for the configuration.

The >0< and Cal buttons have no function.

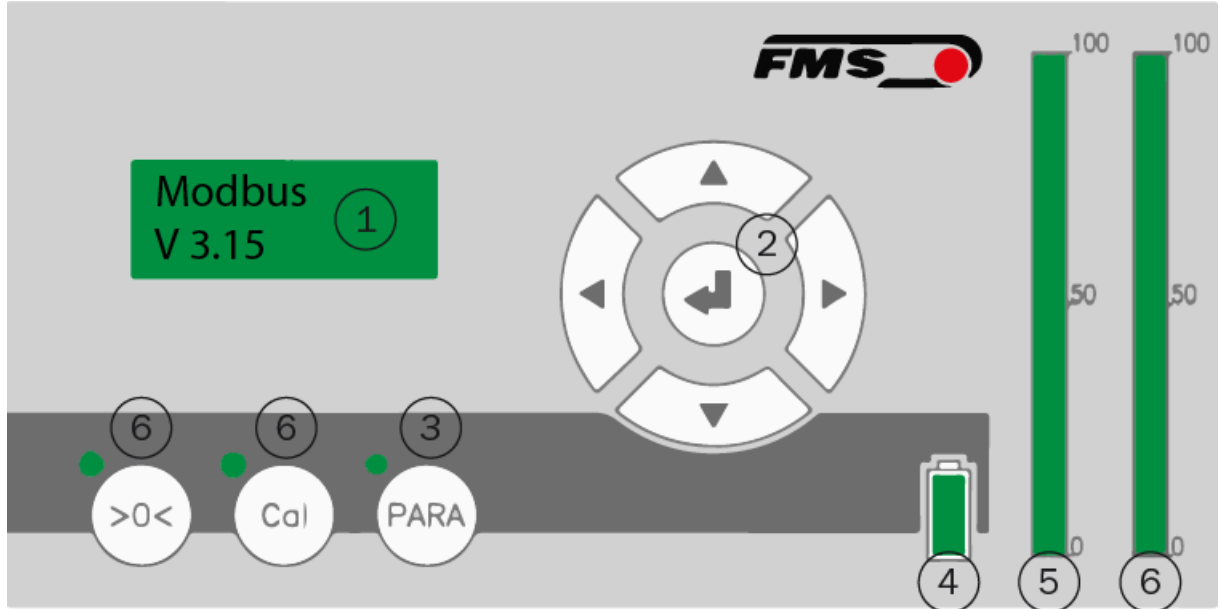System parameters can be adjusted via the operating panel

Figure 9: Receiver module operation and display

Operation and Display	
Item	**Description**
1	LED
2	Main operating panel with navigation buttons and confirmation button
3	"PARA" button for access to the configuration
4	Battery indicator in the EMGZ482T.Modbus transmitter module 5 bars – 100% charged 4 bars – 80% charged 3 bars – 60% charged 2 bars – 40% charged 1 bar – 20% charged, battery replacement recommended
5	Visual indicator of the quality of the radio connection Full indicator – 100 % No indicator – 0 %
6	Without function

Table 4: Receiver module operation and display

5.1 Offset Compensation of the Force Sensors

Offset compensation is used to compensate for the weight of the pulley on the force sensor. The measuring system is practically "zeroed."

Observe the following:

- The force sensor may only be loaded with the pulley (do not place a wire)
- Turn the lay-plate until the force sensor, for which the offset compensation is performed, is vertically over the axis of rotation (12 o'clock position)
- The force indicate due to the weight of the lay plate must be compensated in the PLC so that the outputted value is "0."
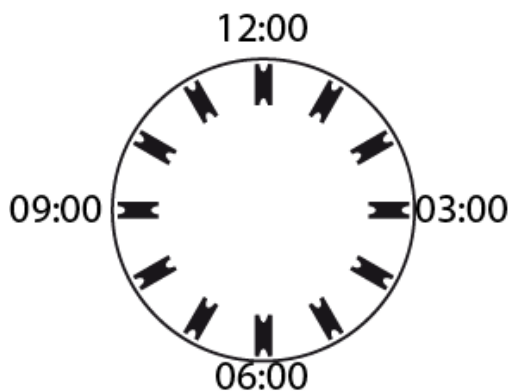
Figure 10: Lay-plate alignment

For the offset compensation of the force sensor for the core observe the operating manual of the measuring amplifier connected to this force sensor.

5.2 Force Sensor Calibration

Calibration is used for matching the measuring amplifier with the force sensor. The so-called gain factor is determined. After calibration, the displayed force corresponds to the force effectively affecting the material. Two calibration methods are possible; one computational method and calibration with a defined weight force. The defined weight-based calibration method is simple and delivers more accurate results as it replicates the material profile and considers the actual circumstances in the machine.
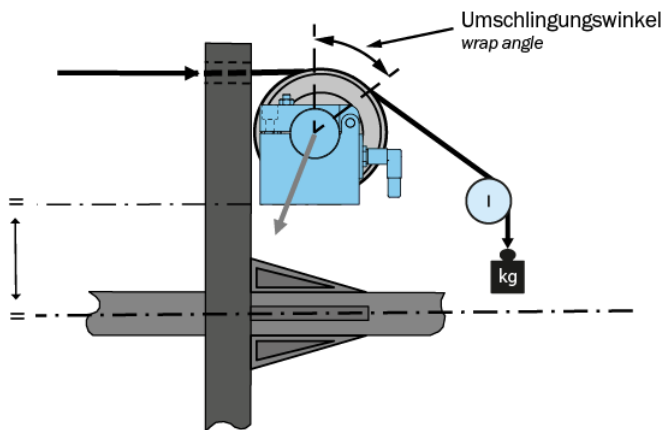
Figure 11: Application of a defined weight force to the force sensor

To adjust the gain, load the measuring roller with a cable with a defined weight attached to its end. The cable must correspond to the real material course in the machine (wrap angle, distances between the rollers, etc.). The displayed/determined digit value must now be assigned in the PLC to the weight force corresponding to the calibration weight.

For the calibration of the force sensor for the core observe the operating manual of the measuring amplifier connected to this force sensor.

5.3 Charger

Figure 12: Charger with battery

- Connect battery to charger
- The state of charge LED lights up red if the battery is discharged
- The safety circuit protects the batteries from overcharging.
- Charging is finished as soon as the battery pack reached its maximum charge capacity. The charging process takes 3-4 hours.
- The state of charge LED lights up green if the battery is charged
- The battery must be connected in the battery compartment of the EMGZ482T prior to start-up.
- If a battery is not needed for the moment, it may remain in the charger

⚠️ Flying parts

If the battery is not secured correctly, it can be ejected in the case of rotating machines.

Secure the battery using the knurled screws. Tighten the knurled screws sufficiently.

6 Configuration

6.1 Quick Start

- Insert the battery into the EMGZ482T.Modbus transmitter module and secure with both knurled screws. The screws must be tightened sufficiently otherwise, the centrifugal forces caused by cage rotation could eject the battery.
  - o Connect the 24VDC power supply of the machine if a version without battery is used
- Connect the EMGZ482R.Modbus receiver module and the gateway using a patch cable.
- Connect the gateway to the power supply (24 VDC)
- Connect the EMGZ482R.Modbus receiver module to the power supply (24 VDC)
- Switch on the power supply for both devices
- The radio connection of the RTM X42 system is established automatically. This can take approx. 5 to 10 seconds.
- After system start and establishment of the radio connection, the display in the receiver module, e.g., shows "Modbus V3.15". This describes the currently loaded firmware.
- The RTM X42 system is now ready and can be configured.

6.2 System Parameters

The system parameter group contains the general parameters that control the operation of the RTM X42 system, but do not influence the actual measurement.
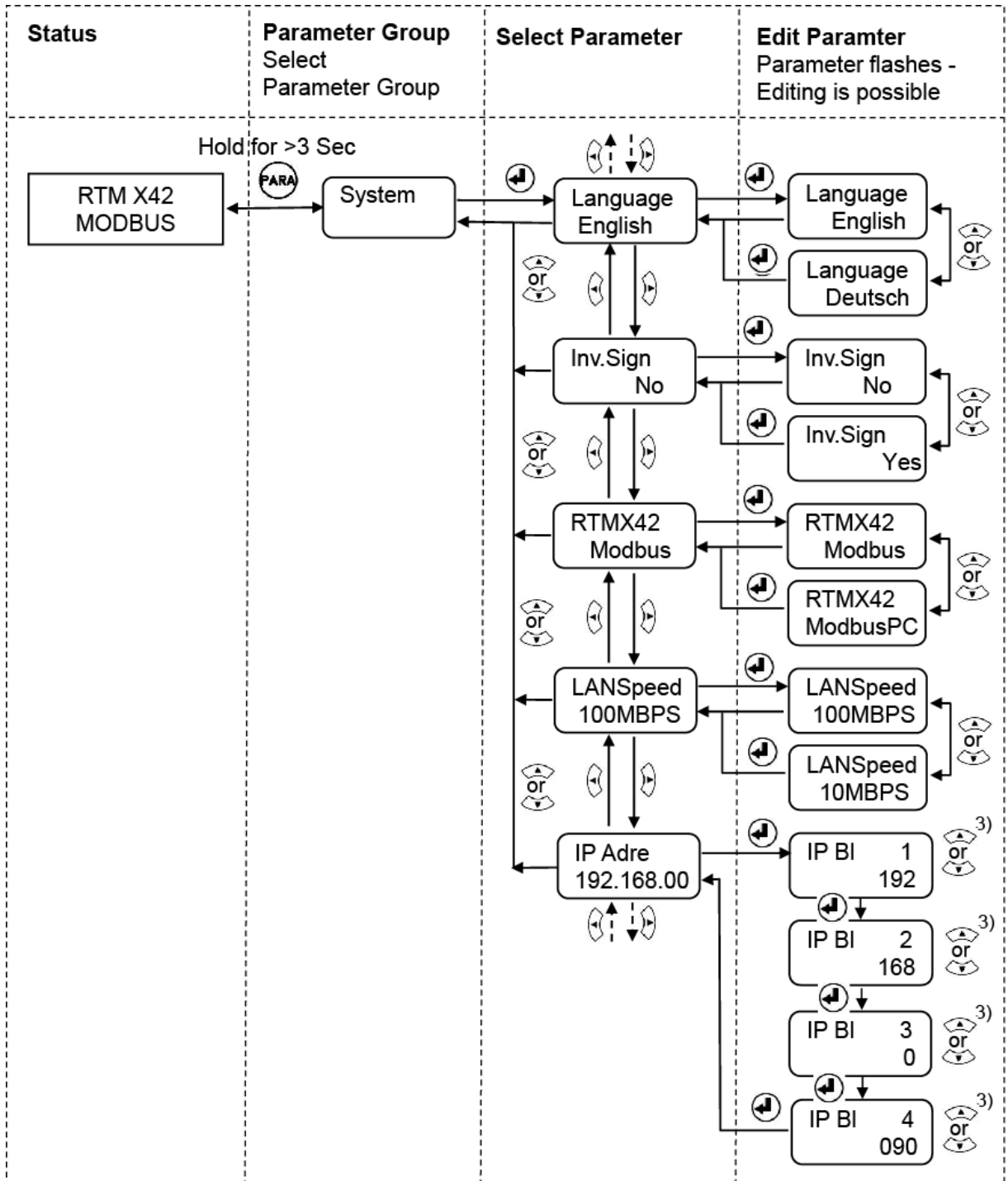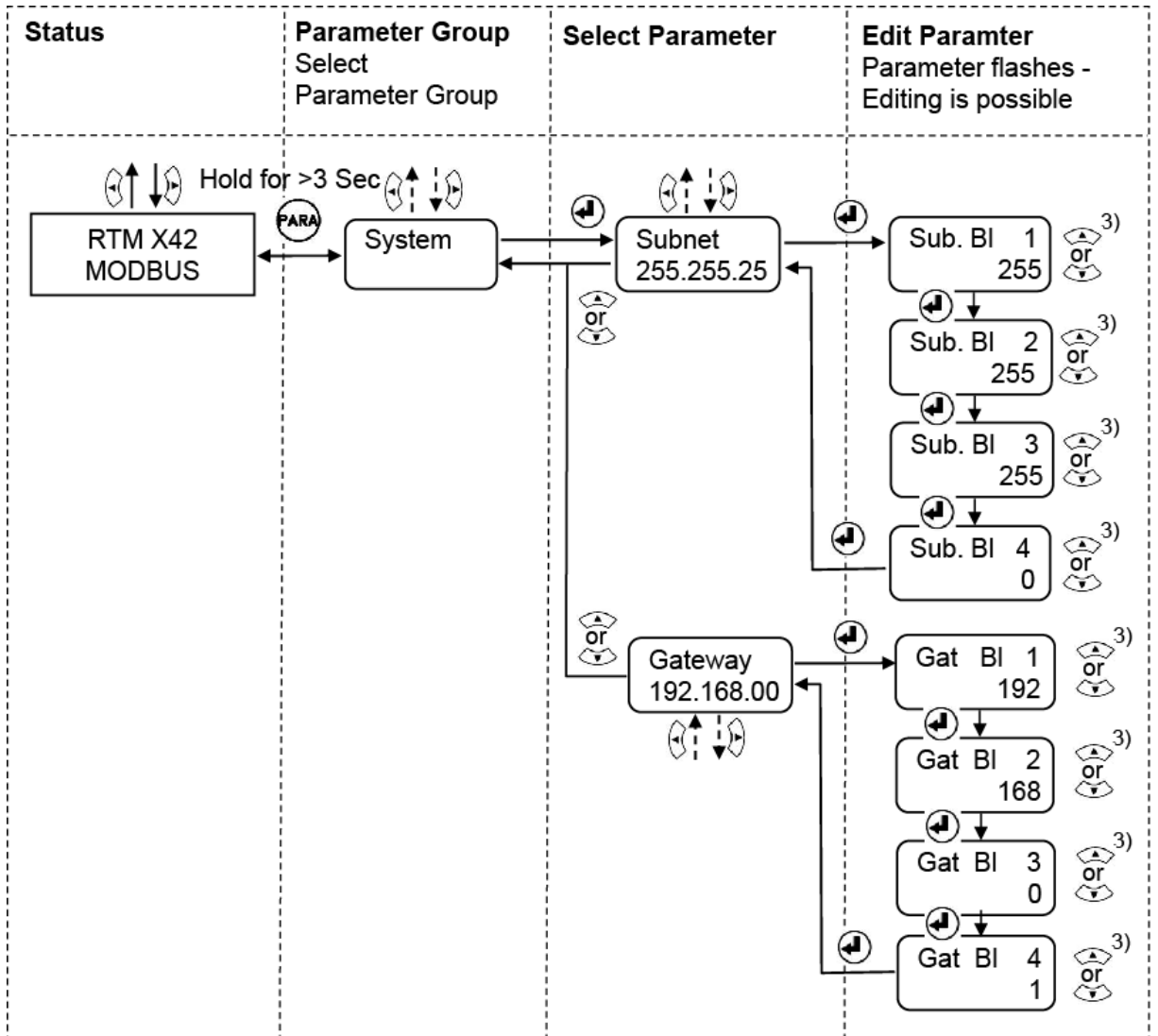

Figure 13: System parameter 1

Figure 14: System parameter 2

6.3 System Parameter Overview

System Parameters	
Parameter	**Description**
Language	Language on the display of the operating panel Unit [-] Values German, English, Russian Default English
Inv.Sign	Inverts the signal of all force sensors Unit [-] Values Yes, No Default No
RTMX42	Modbus - Relay functions specified - R1: Radio connection OK - R2: Radio connection lost - R3: Battery OK - R4: Battery state of charge low ModbusPC - Selection when using RTM X42.CC Control Center - The operating panel is blocked, buttons are disabled Unit [-] Values Modbus, ModbusPC Default Modbus
FiltMode	Off: - Deactivated N-Linear: - Non-linear filter of second order Low pass - Filter of first order Unit [-] Values Off; N-Linear; Low pass Default Off

System Parameters	
Parameter	**Description**
Filt_Out	Frequency for N-Linear and Low pass filter Unit Hz Min 0.1 Max 100 Default 10
LANSpeed	Data rate of LAN connection Unit BPS Min 10 Max 100 Default 100
IP Addr.	IP address (static) of the EMGZ482R.Modbus receiver module. Address is entered in 4 blocks. Unit [-] Min 0 Max 255 Default 192.168.000.090
Subnet	Address of subnet mask. Is entered in 4 blocks Unit [-] Min 0 Max 255 Default 255.255.255.0
Gateway	Gateway IP address (static). Is entered in 4 blocks Unit [-] Min 0 Max 255 Default 192.168.000.100

Table 5: System Parameter Overview

7 PLC communications

7.1 EMGZ482R.Modbus/TCP

The EMGZ482R.Modbus/TCP receiver is the central unit that gets the actual values from the EMGZ482T transmitter. These values can be accessed via the Modbus/TCP interface.

The RTM X42 Control Center (if this extension module is part of the system) has implemented the Modbus/TCP protocol and can access the data directly.

A PLC can access the actual values over the same interface. But as PLCs usually have not implemented the Modbus/TCP protocol, a Gateway is needed to translate the protocol to the one that the PLC uses. That could be PROFINET, Profibus, EtherNet/IP, or Modbus RTU, just to mention a few.

The following picture shows a typical data flow of the actual values.
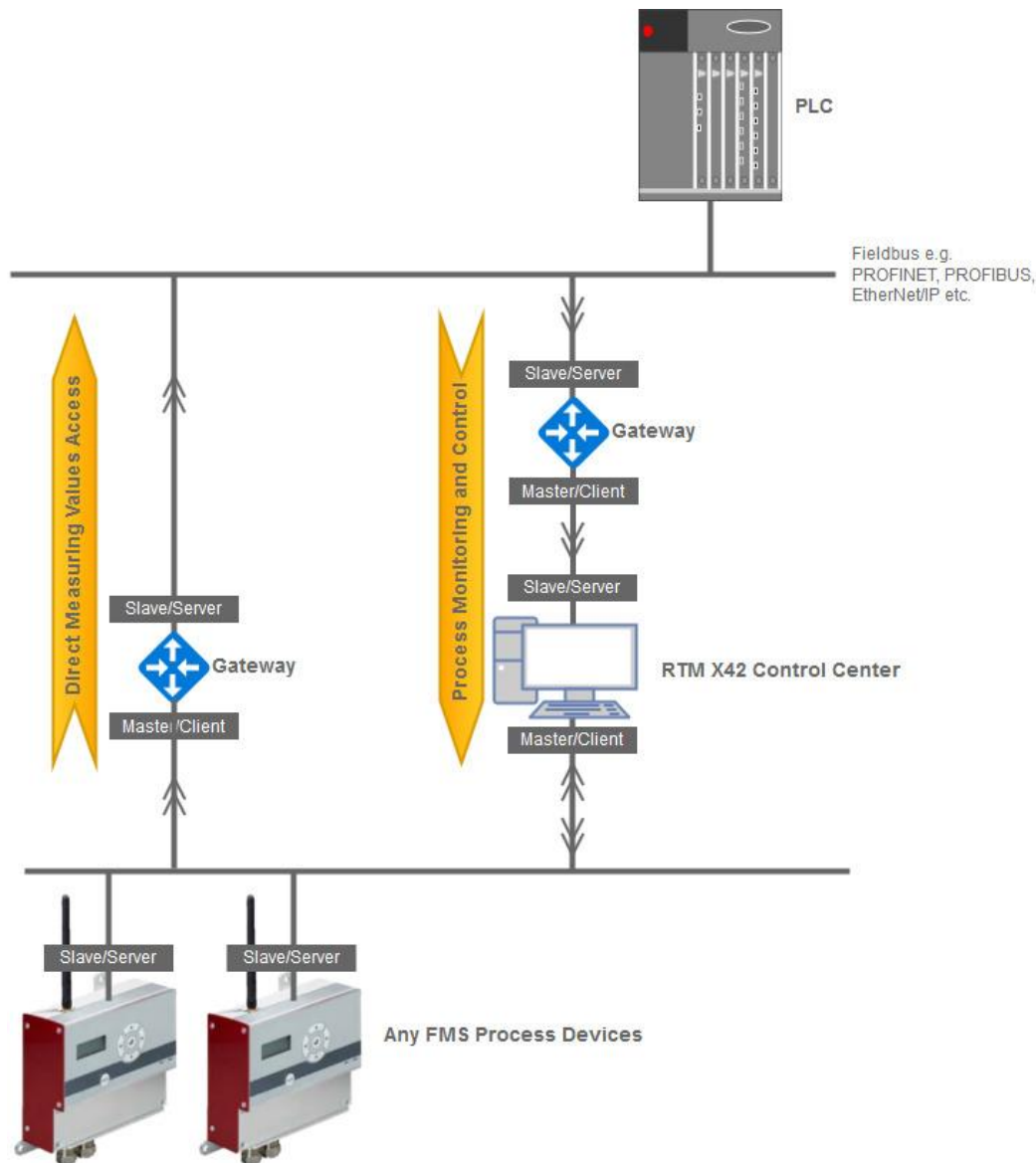
Figure 15: typical data flow

As the above picture shows, the data path for the actual values split up into two paths. One to the RTM X42.CC Control Center and one to the PLC. Each of those devices reads the actual values independently from each other. Therefore, both of them must do their own calculation of the force. The PLC cannot retrieve the determined offset and gain values from the RTM X42.CC Control Center.

7.2 Reading data with a PLC that uses the Modbus RTU interface

7.2.1 System Test Layout

The following is an example of how the actual data can be read from a PLC by using a Modbus RTU Gateway. The test environment uses a USB to RS485 Converter and PC as a replacement for a PLC. With this configuration a simulation of the mainly available PLCs is provided to ensure proper functionality of the communication via the Gateway.
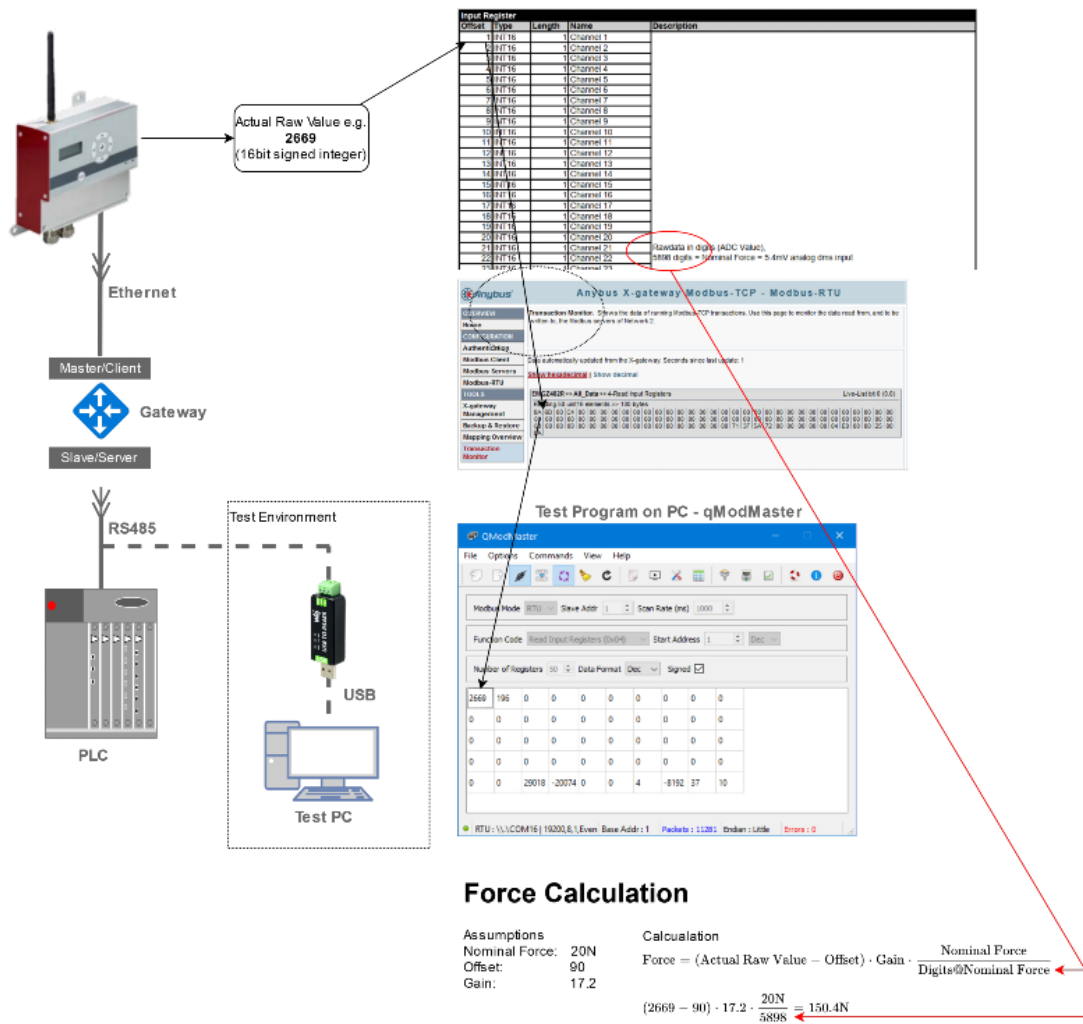
Figure 16: data flow in test environment

7.2.2 Force calculation

Assumptions:

Nominal force F_{Nom}: 20 N

Offset: 90

Gain: 17.2

$$\text{Force} = (\text{Actual Raw Value} - \text{Offset}) * \text{Gain} * \frac{\text{Nominal Force}}{\text{Digits @ Nominal Force}}$$

$$\mathbf{150.4\,N} = (2669 - 90) * 17.2 * \frac{20\,N}{5898}$$

7.3 System Setup

- Check or configure the IP-address of the EMGZ482R. The default IP-address is 192.168.0.90. Usually you don't have to change this address unless other devices have the same IP on the network.
- Check or configure the Anybus X-gateway Art# AB9005B. Usually, you don't have to do anything here because FMS has configured it already before delivery. The Gateway communicates with the EMGZ482R via IP192.168.0.90. If you want to change the configuration, enter the IP192.168.0.80 in a web browser. That opens the web interface of the Gateway.
- Connect all devices as shown in the picture above – Except for the test environment which in only used for testing.
- Set up the communication characteristics for the RS485 port on the PLC as follows.
  Baud Rate: 19200
  Parity: Even
  Stop bits: 1

Figure 17: web interface of Gateway

- Reading the data via Modbus protocol by using the function Read Input Register (0x04). The data array has an element size of 50 and the datatype for the actual values is a signed 16-bit value. The description of the other elements is documented in the next chapter ANYBUS Gateway AB9001 Register. See p. 38 ff.

8 Gateway

A gateway from Anybus is available as accessory item from FMS. In the following, the configuration of a Modbus TCP – Profibus DP gateway is explained as example.
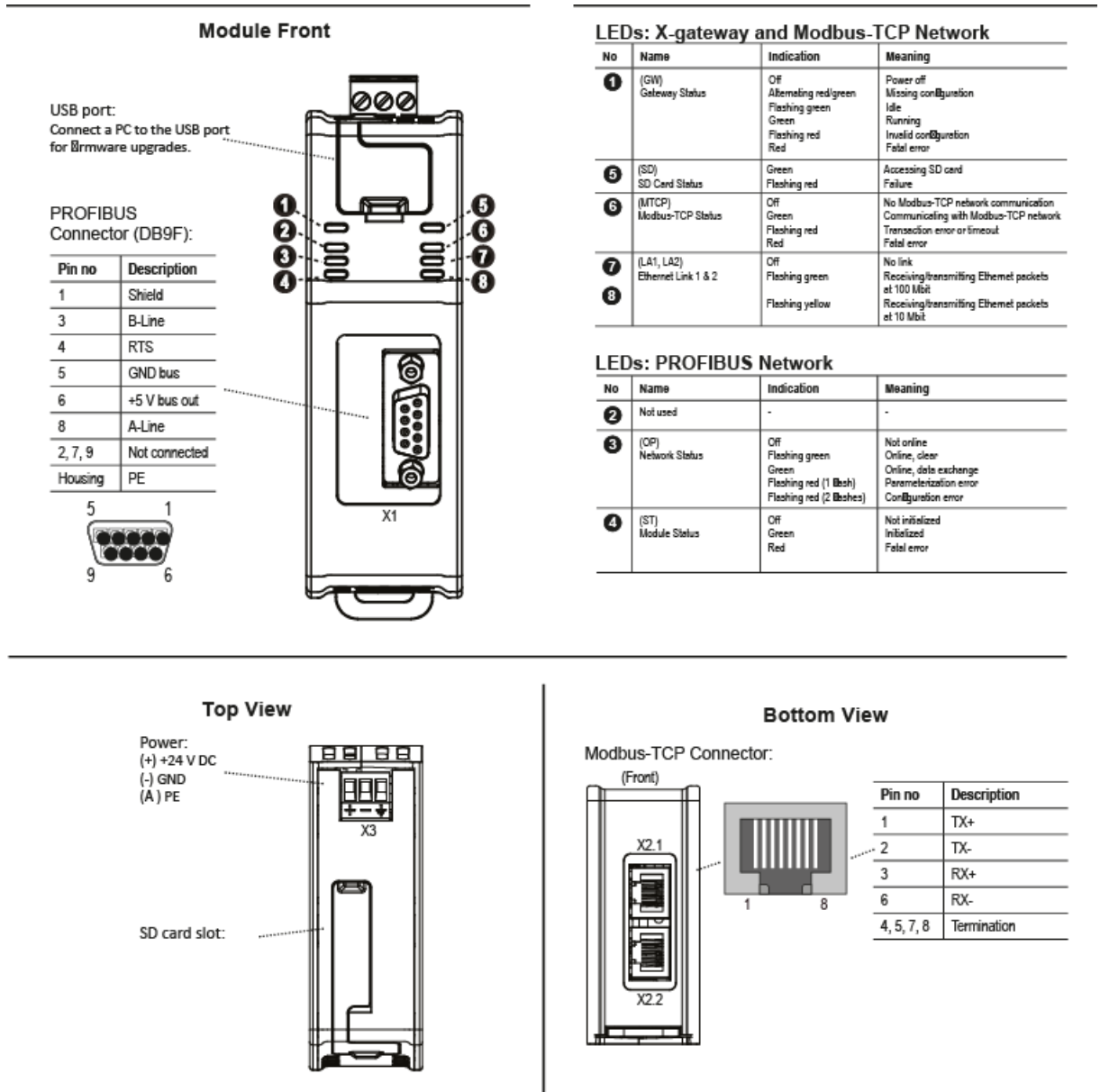
8.1 Electrical Connection

Figure 18: Gateway electrical connection

8.2 Summary of Gateway Installation and Start-up

- Mount gateway on DIN rail
- Connect gateway to Profibus network
- Connect MODBUS TCP network to Profibus network
- Switch on the excitation voltage (24VDC)
- Download the ANYBUS IPconfig tool on the PC.

https://www.anybus.com/products/gateway-index/ethernet-fieldbus-to-control-system

Here you must select the correct gateway and click on READ MORE. On the following page, click on SUPPORT PAGES, which leads to a list of possible downloads.

- Connect PC using a MODBUS batch cable module via the RJ-45 connector
- Use ANYBUS IPconfig tool to identify the IP address of the module in the network (use MODBUS-TCP address, visible at the bottom in the module)
- Input IP address in the web browser and connect with the web interface of the gateway.
- Configure module using the "web configuration" pages.
- Integrate Gateway GSD file in the Profibus configuration tool (download GSD file from upper link)
- Configure and start the Profibus network.

8.3 RTM X42 Gateway Technical Data

Gateway Technical Data	
Property	**Description**
Power supply	24VDC (-15% to 20%)
Current consumption	Max 300mA @ 24V; typical 150mA @ 24V
Ambient temperature	Max. 70°C [158°F] @ 225mA and 24V
Grounding (PE):	Internal connection to PE via DIN rail, if no DIN rail possible, then via power plug

Table 6: Gateway Technical Data

8.4 Data Exchange between RTM and PLC

The configuration between the RTM X42 system and the gateway is configured by FMS. The system can be restored using a configuration file as needed. This file is available via the FMS Service department.

The following configuration instructions of the gateway module are only required if the application operates in a different IP address range than pre-configured by FMS.
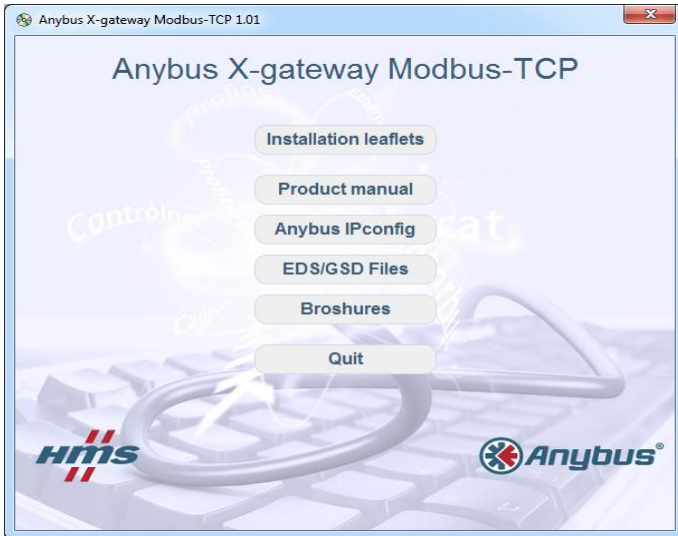
Table 7: Install Anybus IPconfig from CD (provided with the gateway).
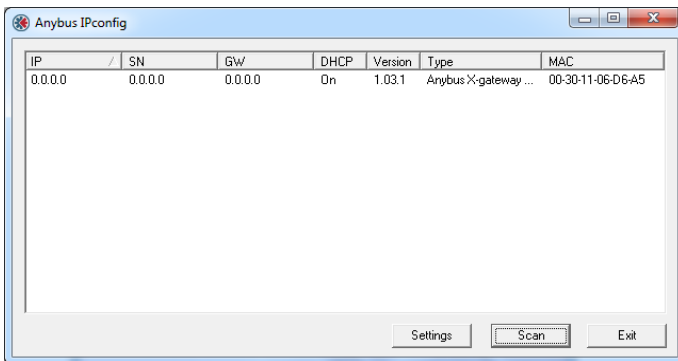

Table 8: Start Anybus IPconfig program. It is possible to search for the listed gateway again using the Scan button. Double-clicking on the listed line opens the configuration window.
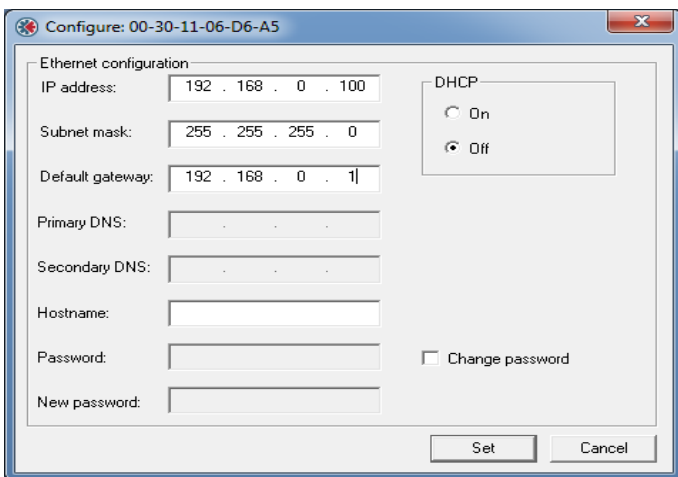

Table 9: Set the IP accordingly and switch off DHCP.

List of IP addresses:

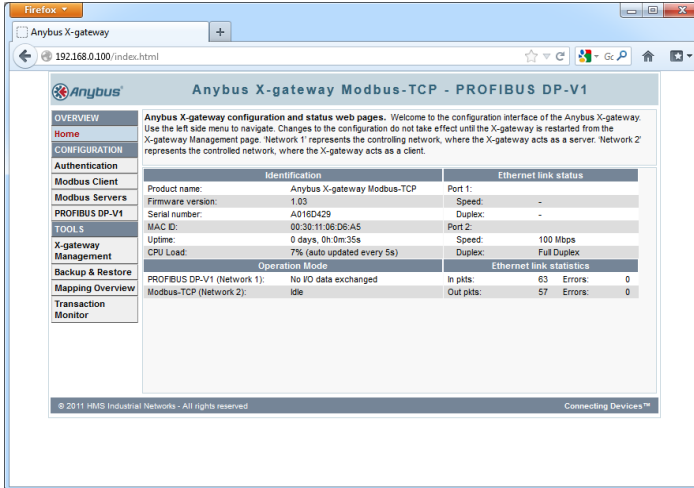|		
Gateway:	192.168.0.100	(static)
RTM X42:	192.168.0.090	(static)

Figure 19: The website of the RTM X42 gateway can be accessed using a web browser and the following IP address: 192.168.0.100.
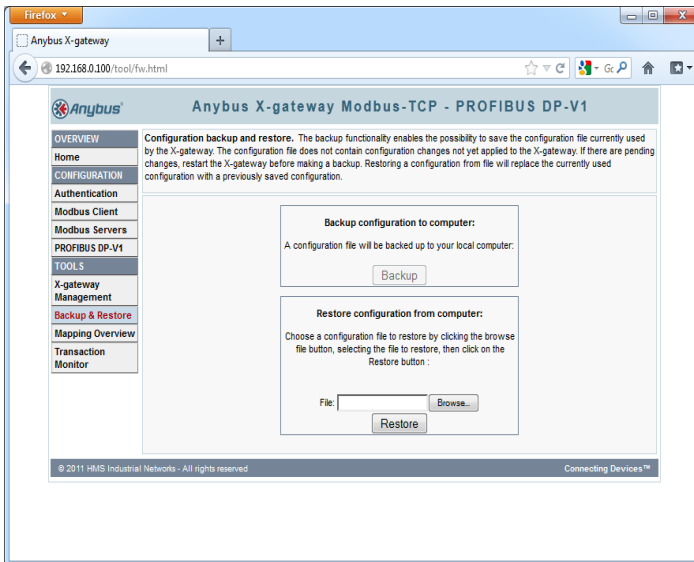

Figure 20: If a configuration file is available, it can be loaded under "Backup & Restore."
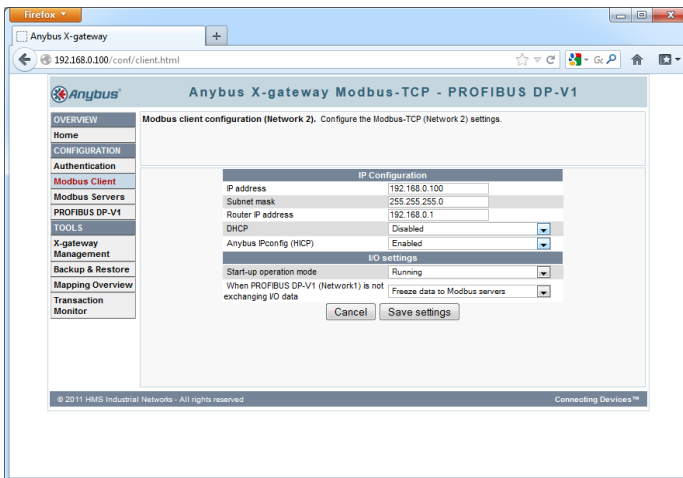

Figure 21: Set the IP address, subnet mask, router IP address, and DHCP accordingly under "Modbus Client." These are the settings of the RTM X42 gateway
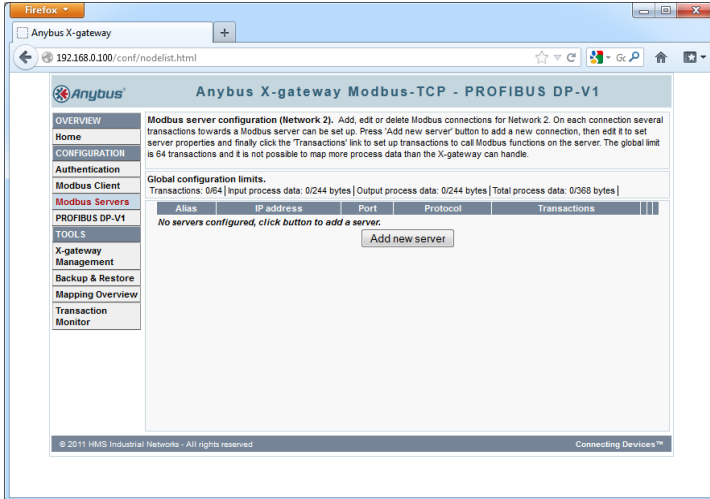
Figure 22: The settings for the Modbus communication from the RTM X42 gateway to the RTM X42 are defined under "Modbus Servers." To do so, click on the "Add new server" field.

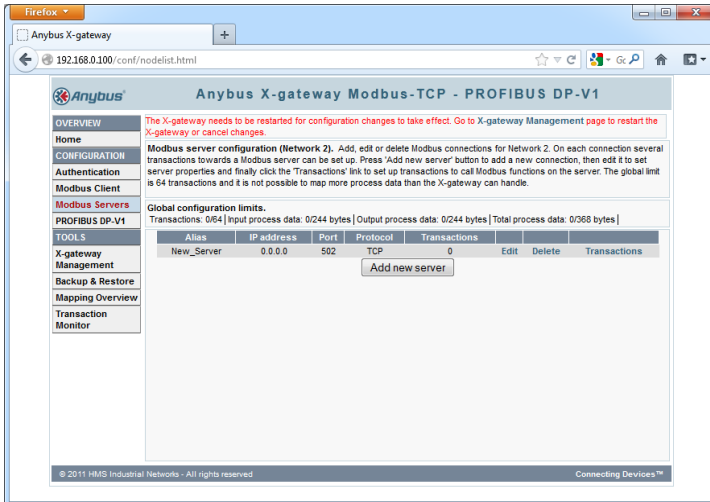*Figure 23: A new server connection is inserted. Changes become only effective after a restart. Click on "Edit"*
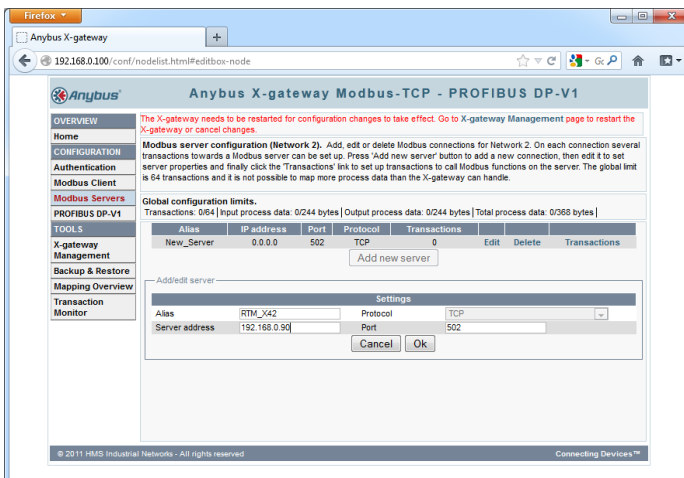

Figure 24: Enter the alias name (RTM_X42) and server address (192.168.0.90) and clock on OK.
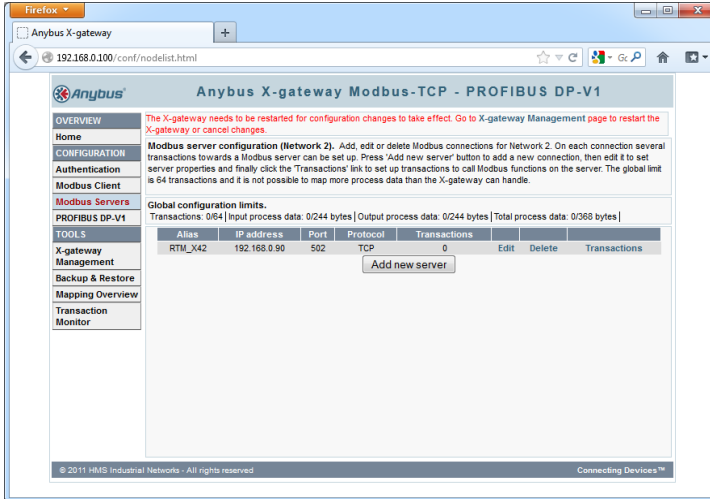
Figure 25: Next, click on "Transactions"
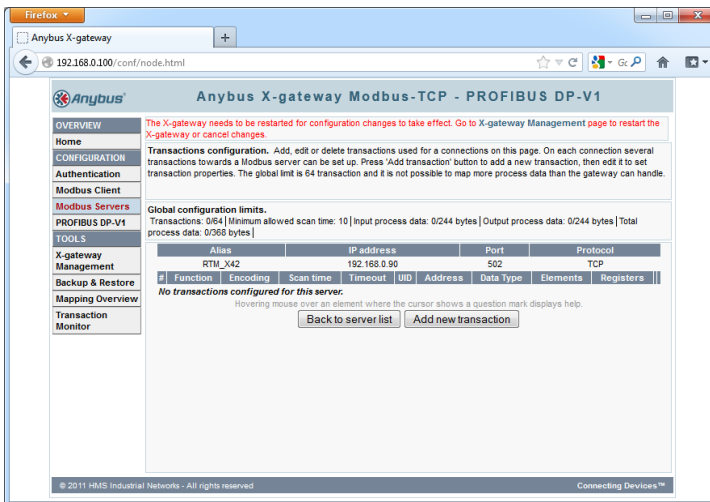
Figure 26: Insert a new communication transaction using the "Add new transaction" button.
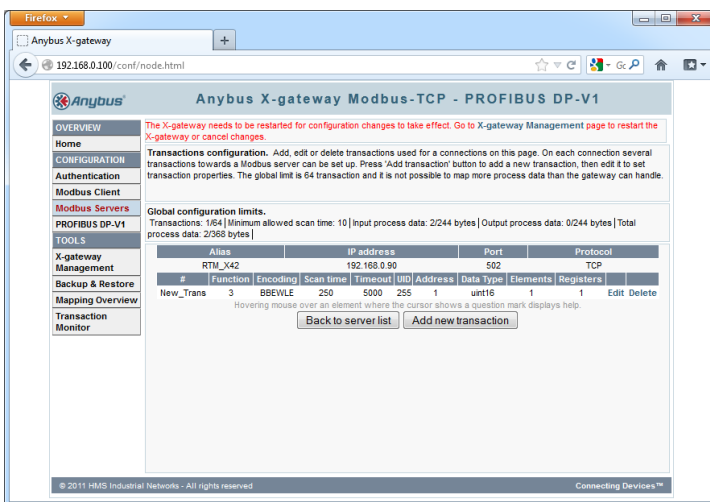
Figure 27: Edit this new transaction using "Edit".
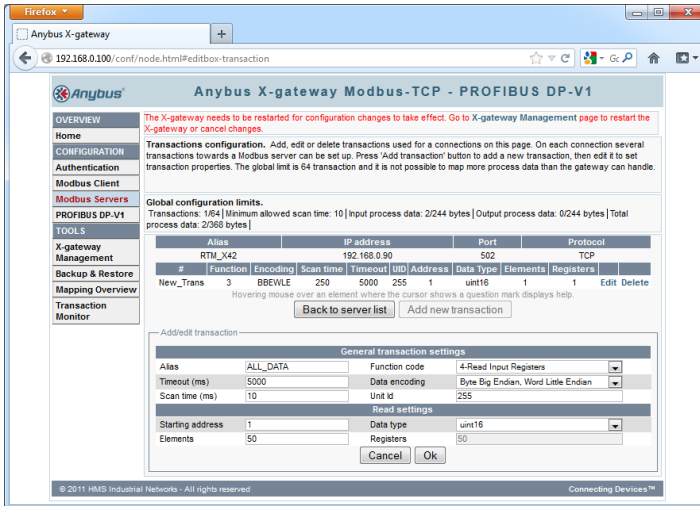
Figure 28: Enter the data respectively and confirm with OK
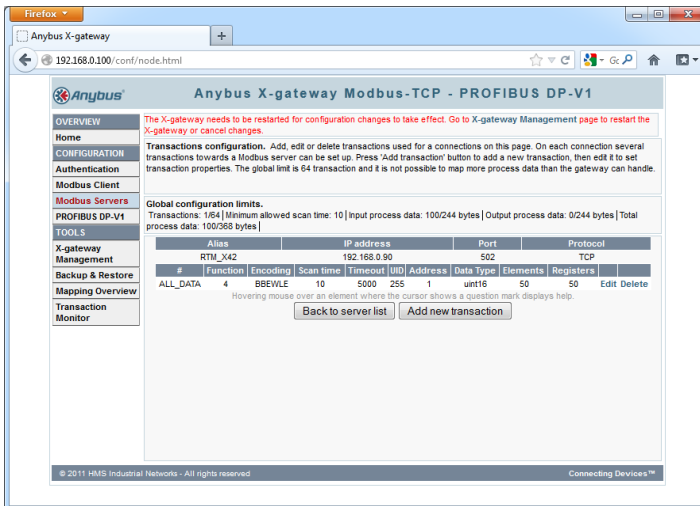
Figure 29: Here, all wire tension data (50 registers) are retrieved with a cycle time of 10ms from the RTM X42 device and transferred to the RTM X42 gateway. The MODBUS register contains the data mapping information.
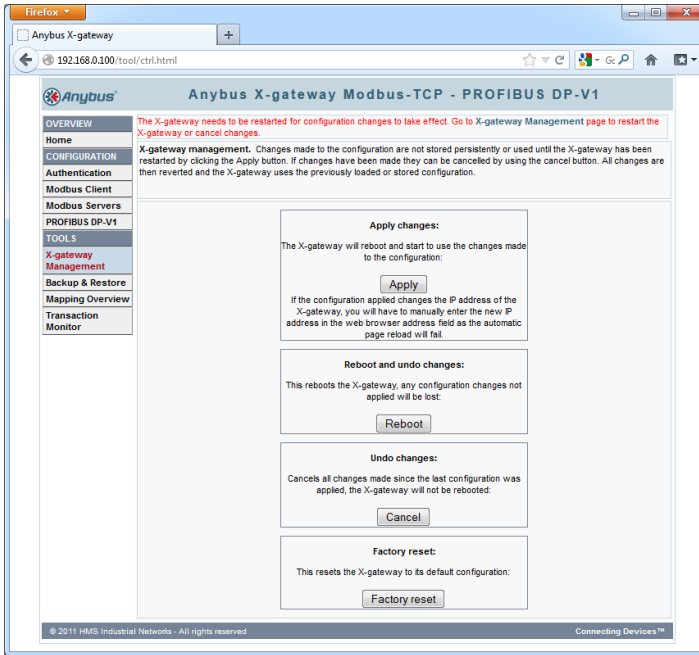
Figure 30: The changes must still be saved with "Apply" under "X-gateway Management."
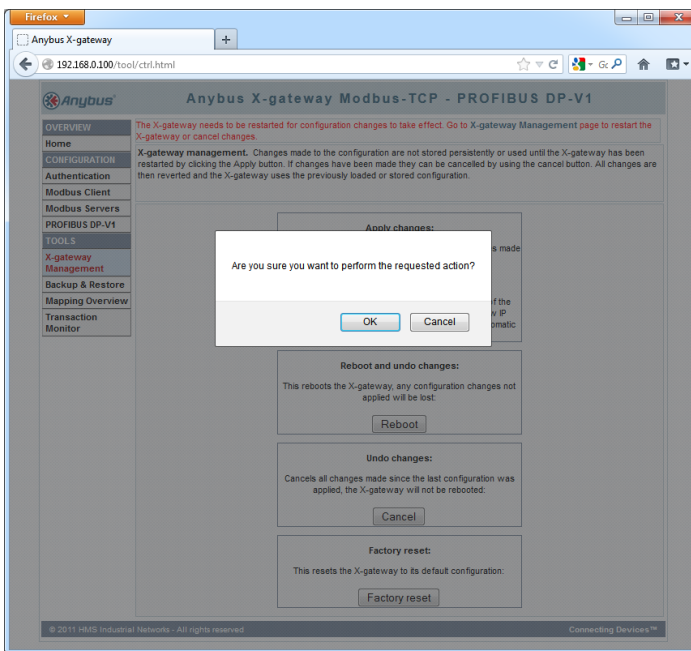
Figure 31: The RTM X42 gateway is restarted after confirming with the OK button

Figure 32: The configuration can be saved in a file under "Backup & Restore"

Figure 33: The current data is visible under "Transaction Monitor"

8.5 ANYBUS Gateway AB9001 Register

The RTM X42 system provides a bit stream with the raw cable tension data of 42 channels every 10 ms. The tension values of the "Core" measuring channel are transmitted on register 47.

Notes on gateway configuration

- Read and write the MSB first: Example 0x12345678
- MODBUS offset 0: 0x1234
- MODBUS offset 1: 0x5678

ANYBUS Gateway AB9001 input register				
Offset	Type	Length	Name	Description
1	INT16	1	Channel 1	Raw date in digits (ADC value)
2	INT16	1	Channel 2	5898 digits= nominal force
3	INT16	1	Channel 3	= 5.4mV analog DMS input
4	INT16	1	Channel 4	
5	INT16	1	Channel 5	
6	INT16	1	Channel 6	
7	INT16	1	Channel 7	
8	INT16	1	Channel 8	
9	INT16	1	Channel 9	
10	INT16	1	Channel 10	
11	INT16	1	Channel 11	
12	INT16	1	Channel 12	
13	INT16	1	Channel 13	
14	INT16	1	Channel 14	
15	INT16	1	Channel 15	
16	INT16	1	Channel 16	
17	INT16	1	Channel 17	
18	INT16	1	Channel 18	
19	INT16	1	Channel 19	
20	INT16	1	Channel 20	
21	INT16	1	Channel 21	
22	INT16	1	Channel 22	
23	INT16	1	Channel 23	
24	INT16	1	Channel 24	
25	INT16	1	Channel 25	
26	INT16	1	Channel 26	
27	INT16	1	Channel 27	
28	INT16	1	Channel 28	
29	INT16	1	Channel 29	
30	INT16	1	Channel 30	
31	INT16	1	Channel 31	

ANYBUS Gateway AB9001 input register				
Offset	**Type**	**Length**	**Name**	**Description**
32	INT16	1	Channel 32	Raw date in digits (ADC value)
33	INT16	1	Channel 33	5898 digits= nominal force
34	INT16	1	Channel 34	= 5.4mV analog DMS input
35	INT16	1	Channel 35	
36	INT16	1	Channel 36	
37	INT16	1	Channel 37	
38	INT16	1	Channel 38	
39	INT16	1	Channel 39	
40	INT16	1	Channel 40	
41	INT16	1	Channel 41	
42	INT16	1	Channel 42	
43	UINT32	2	Counter (time)	Time counter 10 ms after restart
45	UINT32	2	Counter (pulse) (production length)	Pulse counter after restart
47	UINT16	1	Analog input (core)	Raw date in digits (ADC value) 0 to 8192 digits= 0 to 10V
48	INT16	1	Battery pack	Raw date in digits (ADC value) 2530 digits = 100% 2380 digits = 80% 2200 digits = 60% 1860 digits = 40% 1420 digits = 20% < -2000 digits= 24V excitation
49	UINT16	1	STATUS	BIT0= relay 1, status 1 = set BIT1= relay 2, status 1 = set BIT2= relay 3, status 1 = set BIT3= relay 4, status 1 = set
50	UINT16	1	Installed channels	Number of valid channels

Table 10: Gateway input register

9 Maintenance

The force sensors are maintenance-free. If repairs are necessary, we recommend contacting FMS Customer Service and sending the affected components for revision to FMS.
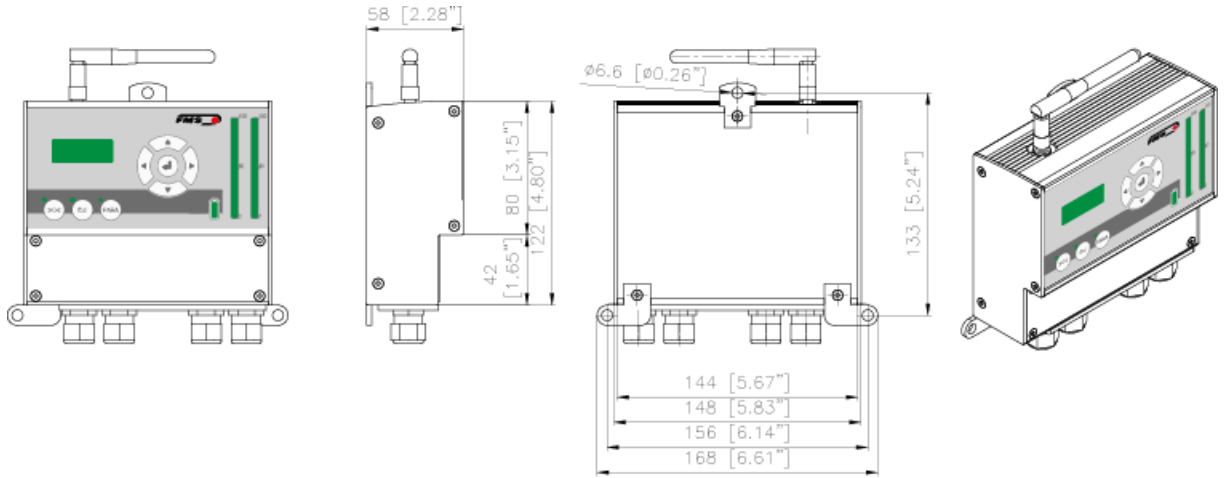
10 Dimensions

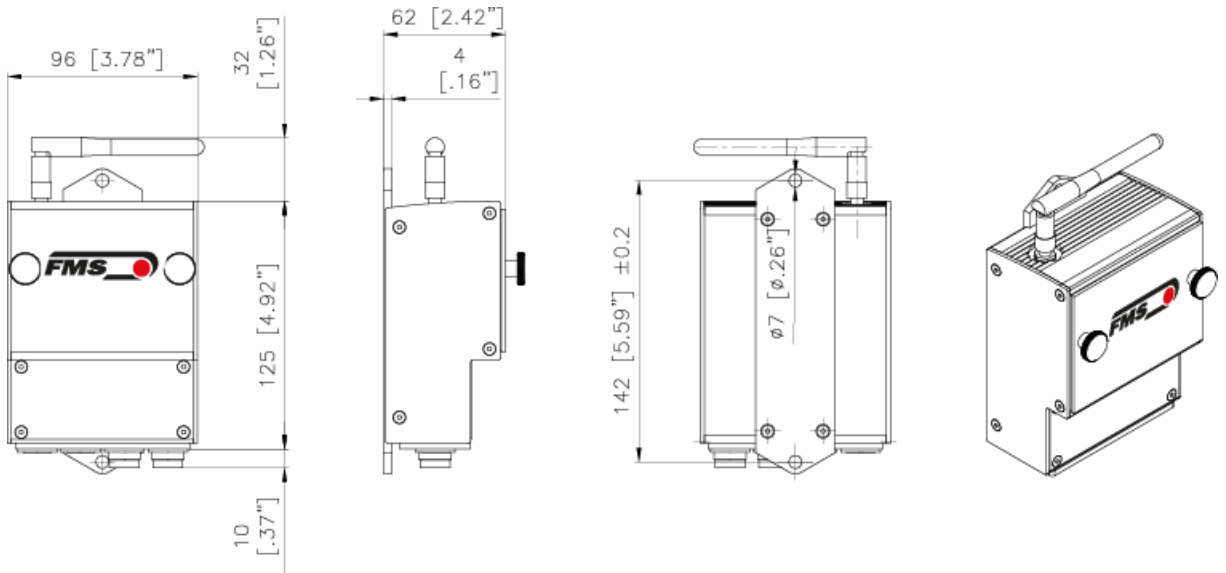*Figure 34: Dimensions of the EMGZ482R.Modbus receiver module*

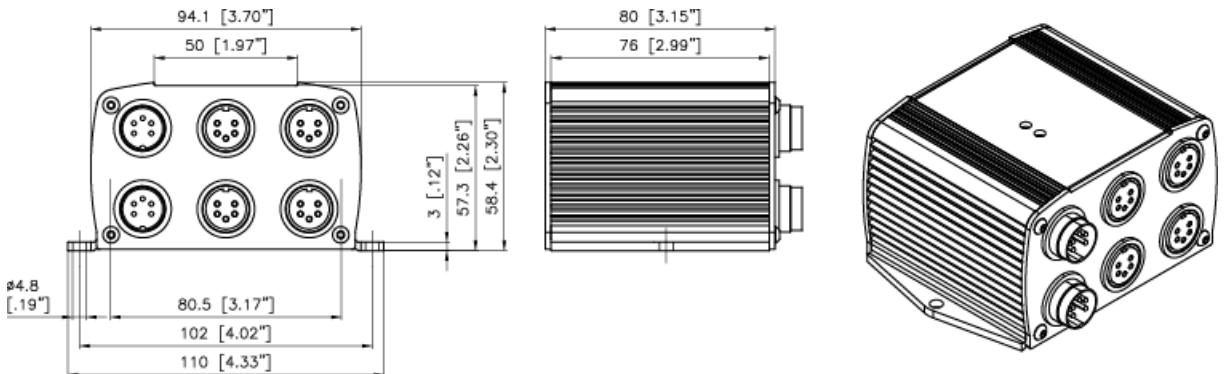*Figure 35: Dimensions of the EMGZ482T.Modbus transmitter module*

Figure 36: Dimensions of the EMGZ484T.Modbus channel extension module

11 Error Causes and Troubleshooting

Troubleshooting		
Message	**Cause**	**Remedy**
"Radio link lost"	Radio connection to the EMGZ482T is interrupted. (Metal) objects interfere with the transmission path	Check battery in the **EMGZ482T** (battery empty or not inserted?). Remove antennas from the interference range. Install the receiver and transmitter in a way that they "see" each other.
"Channel X >min. limit" "Core >min. limit"	The faulty channel is active, however not connected to a force sensor.	Connect force sensor to the respective connector of the **EMGZ482T or EMGZ484T**.
"Modbus Error"	MODBUS connection faulty.	Contact FMS Service Center.
Very small force amplitudes to PLC.	Calibrated incorrectly	Repeat calibration
Changed parameters cannot be saved in the web browser	Change procedures was not completed correctly	The change must be confirmed with "Save parameters" and "OK" after parameter inputs
Frequent losses of communication between modules on the machine	Loose connectors	Re-tighten connectors periodically

12 Technical Data

12.1 EMGZ482T.Modbus Transmitter Module

EMGZ482T.MODBUS	
Number of measuring points	2 channels for 2 force sensors
Measuring inaccuracy	<0.05% F_{System}
Sensor excitation	3.0 VDC, max. 20mA, highly stable
Power supply	3.7V battery Li Ion (20Ah) or 24VDC via slip rings (18 to 36VDC /10W max. 0.5A)
Variants	EMGZ482T.MODBUS.24V for 24V supply via slip rings
Radio interface	2.44 GHz
A/D converter resolution	±8192 digit (14 bit)
Analog inputs 1 and 2	1 strain gauge force sensor @ 350 Ω (0 to 5.4 mV, max. 7.4 mV)
Temperature range	0 to 50°C [32 to 122°F]
Protection class	IP52
Weight	0.52 kg [1.15 lbs] (without battery)

Table 11: Transmitter module technical data

12.2 EMGZ482R.Modbus Receiver Module

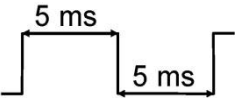| EMGZ482R.MODBUS	
Display	LCD 2x 8 characters (5mm) 2 LED bar indicators, graphical force presentation Battery state of charge or power supply
Propagation delay	≤10ms
Control interface	Ethernet via web browser (Internet Explorer 7 or higher)
Radio interface	2.44 GHz
Relay outputs (alarms)	4 relay contacts DC: 24V/0.5A/12W; AC: 24V/0.5A/62.12VA
Power supply	24VDC (18 to 36VDC) / 10W (max. 0.5A)
Digital input	5 to 24 VDC

EMGZ482R.MODBUS	
(tachometer impulses for production length)	Cycle time: ≥ 10ms, Max. frequency: ≤ 100 Hz Conditions: 5ms on / 5ms off
Analog input	0 to 10 VDC; min. 1.2kΩ (for core)
Temperature range	0 to 50°C [32 to 122°F]
Protection class	IP52
Weight	0.65 kg [1.43 lbs]

Table 12: Receiver module technical data

12.3 EMGZ484T.Modbus Channel Extension Module

EMGZ484T.MODBUS	
Number of measuring points	4 channels for 4 force sensors
Measuring inaccuracy	<0.05% FS
Sensor excitation	3.0 VDC, max. 20mA, highly stable
Power supply	24 VDC supply via bus & power cable from EMGZ482T.MODBUS
A/D converter resolution	±8192 digit (14 bit)
Analog inputs 1 to 4	1 strain gauge force sensor each @ 350 Ω (0 to 5.4 mV, max. 7.4 mV)
Temperature range	0 to 50°C [32 to 122°F]
Protection class	IP52
Weight	0.45 kg [1.0 lbs]

Table 13: Channel extension module technical data

12.4 Certifications

Certified tests (copy of certificates provided upon request)	
RTM X42.BC	5.3 Radio Certification ETSI
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)
RTM X42	FCC Certification USA, Canada

Magnitude of Test (Coverage)	Class A digital device, pursuant to Part 15 of the FCC Rules
Certification	FCC Registration #: 0020311882
RTM X42	CAB Radio Certification for Japan
Magnitude of Test (Coverage)	Low power data communi. FXD; Art. 38 - 24, Paragraph 1 of radio law
Certification	Article 2, Clause 1 Item 19, Certification ID #: 202WWSM10126721

Table 14: Radio Certification

12.5 Lloyd's Register Type Approval

Certificate available upon request.