

Operating Manual



FTC470XMB

Protocol converter for the connection of the
Bender measuring interface to the
Modbus RTU
Software version: D143 V2.1x



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1. How to use this documentation effectively

1.1 About the operating manual

This operating manual will concern qualified experts in electrical engineering and communication technology!

In order to make it easier to find certain text passages or references in this manual and for reasons of comprehensibility, important information is emphasized by symbols. The meaning of these symbols is explained below:



Information calling attention to hazards are marked with this warning symbol.



Information intended to assist the user to make optimum use of the product are marked with the Info symbol.

1.2 Overview of the individual chapters

- How to use this documentation effectively:
This chapter provides information about the use of this documentation.
- Safety instructions:
This chapter draws attention to hazards involved with the installation and operation.
- Basic application:
This chapter deals with the normal use of this product.
- The protocol converter FTC470XMB (gateway):
This chapter describes the scope of delivery, the operating and display elements available at the device, the function of the protocol converter as well as the intended use.
- Installation:
This chapter describes the device settings which are to be set prior to installation and the installation itself.
- Function:
This chapter includes a summary of all Modbus RTU commands that can be transmitted to the FTC470XMB converter.
- Programming examples mode 1 and mode 2:
These chapters contain various programming examples which are intended to help you to configure the FTC470XMB.

- **Service and support:**
This chapter offers service and support in case of a fault. In addition you will find information about the technical sales department.
- **Appendix:**
This chapter provides an overview of technical data, a dimension diagram as well as the ordering details.

1.3 Brief instruction

If you are familiar with automation engineering, particularly with the Modbus RTU, it may be helpful to start right away with "Chapter 4. The FTC470XMB protocol converter" and "Chapter 5. Installation". In chapter 4 you will find information about the BMS-Modbus communication model including the ID numbers and start addresses required for read and write access. Chapter 5 provides information about the basic configuration, installation as well as the connection of the FTC470XMB. Furthermore a wiring diagram is provided.

2. Safety instructions

2.1 Work activities on electrical installations

- All work activities necessary for installation, commissioning or work activities during operation of electrical devices or systems are to be carried out by adequately skilled personnel.
- Observe the relevant regulations applying to work on electrical installations, in particular DIN EN 50110 or its subsequent regulation.



Unprofessional work activities on electrical installations may result in personal injury!

- If the equipment is used outside the Federal Republic of Germany, the respective national standards and regulations are to be observed. The European standard EN 50110 is recommended to be used as a directive.

2.2 Intended use

The FTC470XMB protocol converter connects the serial Bender BMS bus to the serial Modbus RTU. The converter is capable of transmitting information from the BMS bus to the Modbus RTU and vice versa.

Interface on the Modbus RTU side:



FTC470XMB is always operated as a Slave on the Modbus RTU

Hence, the Modbus RTU Master must be informed about the protocol converter and its Modbus RTU address.

Interface on the BMS side:

The FTC470XMB can be operated either as Master or as Slave.



FTC470XMB must take over the Master function if
- parameters are requested or modified
- or special control commands are given

2.3 Address setting and termination

A prerequisite for proper functioning of the FTC470XMB protocol converter is its correct address setting and termination.



Addresses assigned twice may lead to serious malfunctions in BMS or Modbus RTU systems.

Ensure correct address setting and termination of the FTC470XMB. For details refer to the chapter basic configuration on page 31.

2.4 Setting of the DIP switches for Modbus RTU



After each modification of the DIP switch settings, the FTC470XMB must be disconnected from the supply. Connecting it to the power supply again provides the actual indication of the Modbus RTU status.

3. Standard application

3.1 Bus interface

In common building services management systems (GLT) as well as in other areas of automation engineering a variety of field buses are used. Bender systems like EDS46x/47x/49x, RCMS46x/47x/49x and MEDICS communicate with each other via the Bender Measuring Interface BMS.

Our protocol converter FTC470XMB (gateway) is intended to connect this BMS interface to the Modbus RTU. For that purpose, the FTC470XMB is connected to the Modbus RTU network in the function of a Modbus RTU Slave.

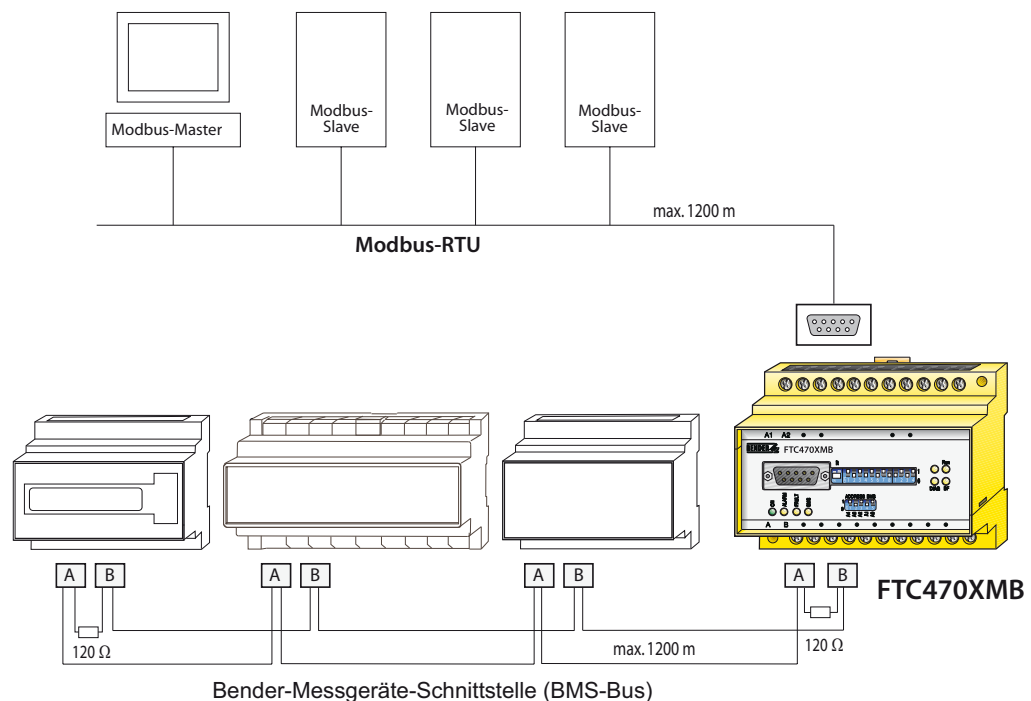


Fig. 3.1: block diagram of an interface between the BMS bus and Modbus RTU

3.2 Modbus RTU

The fieldbus Modbus RTU (Remote Terminal Unit) has been specified by Modicon, a subsidiary of Schneider Automation and is freely available to the public with no licensing fees or use restrictions. Modbus uses the serial hardware interface RS485 and communicates via a two-wire, twisted copper wire. The standard transmission rate is 19200 baud. Reference values are as follows:

- Master-Slave communication
- up to 32 stations per network, up to 247 stations with the use of a repeater
- baud rate between 1200 and 57600 bit/s
- Diagnosis mechanism

3.3 Application of the FTC470XMB

The connection of Bender systems to the BMS bus and to the Modbus RTU by means of the FTC470XMB can become necessary for several reasons:

- A Modbus RTU device is expected to respond to an event in the BMS world.
- A BMS interface device is expected to respond to an event in the Modbus RTU world.
- The BMS interface data and the Modbus RTU data are intended to be indicated and evaluated centrally on a personal computer using Modbus RTU software.
- The BMS interface data are to be indicated in the software of a building services management system incorporating a Modbus RTU interface.
- The configuration of devices of the BMS side is to be carried out via a personal computer with Modbus RTU interface.
- The control of certain BMS interface activities is to be carried out via the Modbus RTU.

3.4 Restrictions

Some Bender devices like TM operator panels or PRC1470 use in addition to the internal interface an external interface capable of connecting such devices to extended networks. This external interface **cannot** be addressed by the FTC470XMB. In BMS systems including TM operator panels or PRC1470 these components can only communicate with the FTC470XMB via the internal interface. Also refer to page 21.

4. The FTC470XMB protocol converter

This chapter describes:

- the scope of delivery
- the display and operating elements on the device
- the function of the protocol converter (gateways)
- the intended use

4.1 Scope of delivery

Included are:

- the FTC470XMB protocol converter
- the technical manual

4.2 Display and operating elements

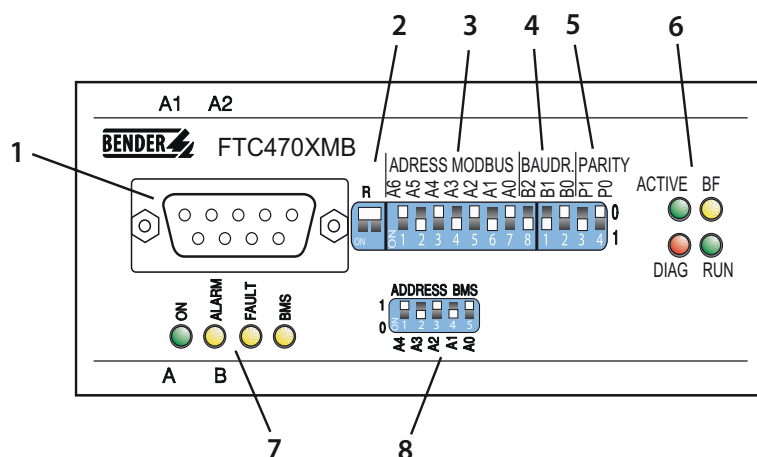


Fig. 4.1: FTC470XMB front plate

Legend to front plate

- 1 RS485 socket for Modbus RTU cable: 9 pole Sub-D
- 2 DIP switch for Modbus RTU termination: „ON“ = terminating resistor activated
- 3 DIP switch for binary Modbus RTU address setting: 1....127 (detailed information below)
- 4 DIP switch for binary Modbus RTU address setting: 1200....57600 bit/s (detailed info. below)
- 5 DIP switch for binary Modbus RTU address setting: none/even/odd (detailed info. below)
- 6 Modbus RTU status indication (detailed info. below)
- 7 BMS bus status indication (detailed info. below)
- 8 DIP switch for binary BMS bus address setting: 1-30 (1 = Master mode) (detailed info. below)

4.2.1 DIP switch for Modbus RTU address setting

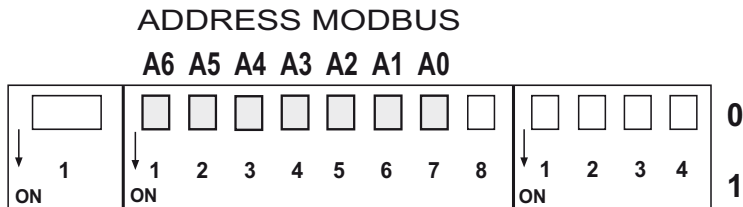


The FTC470XMB must be disconnected from the supply after changing the DIP switch settings. Reconnection to the power supply provides the actual indication of the Modbus RTU status.

The appropriate addresses are set using BCD numbers between 1 and 127. Selecting Modbus address 0, with all DIP switches in position OFF, would be an invalid address which is not allowed!



DIP switch of the Modbus group in **down** position means binary 1
 DIP switch of the BMS group in **up** position means binary 0

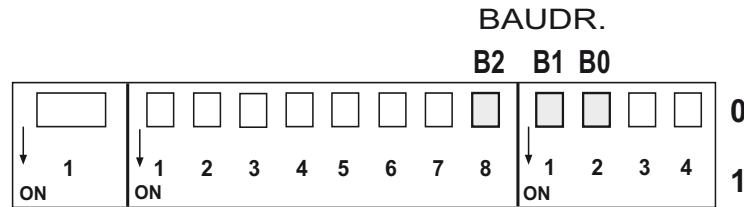


Dec. addr.	Address DIP switch						
	1	2	3	4	5	6	7
1	0	0	0	0	0	0	1
2	0	0	0	0	0	1	0
3	0	0	0	0	0	1	1
4	0	0	0	0	1	0	0
5	0	0	0	0	1	0	1
6	0	0	0	0	1	1	0
7	0	0	0	0	1	1	1
8	0	0	0	1	0	0	0
..
...
127	1	1	1	1	1	1	1

4.2.2 DIP switch for setting the baud rate

Valid baud rates can be set between 1200 bit/s and 57600 bit/s. The standard value for Modbus RTU is 19200 bit/s.

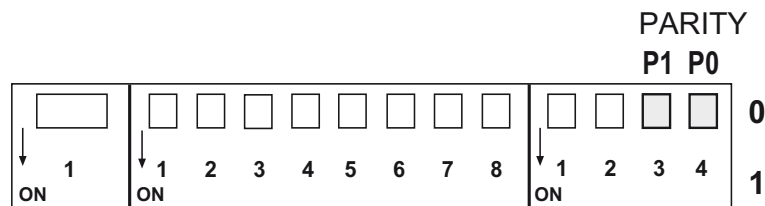
Setting 0, all DIP switches in position OFF, is invalid and not allowed!



Bit/s	Baud rate DIP switches		
	8	1	2
1200	0	0	1
2400	0	1	0
4800	0	1	1
9600	1	0	0
19200	1	0	1
38400	1	1	0
57600	1	1	1

4.2.3 DIP switches for Modbus RTU parity

Valid parity settings are none/even/odd. The standard value for Modbus RTU is "none parity". If Parity is none two stop bits are used, if parity is even or odd only one stop bit is used. Setting 0 -all DIP switches in OFF position- is invalid and must not be used!

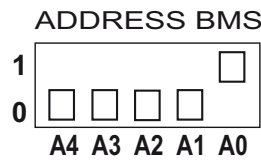


Parity	Parity DIP switches	
	3	4
none	0	1
even	1	0
odd	1	1

4.2.4 Modbus RTU status indicators

LED	Meaning
ACTIVE	Bus in operation Green LED lights up sporadically: The Modbus module answers to requests (data exchange)
BF	Bus error Red LED lights up: FTC470XMB is not connected to the Modbus RTU or the CRC error rate is above 10%. Data exchange is not possible
RUN	Bus function Green LED lights up: FTC470XMB is connected to the Modbus RTU and is ready for data exchange.
DIAG	Status of DIP switch settings (only Modbus RTU) Status LED red: all Modbus switches are in "OFF" position or an invalid value has been set. Status LED green: The settings of the Modbus DIP switches have been modified by mail box commands. Status LED does not light: DIP switch settings are correct and are used

4.2.5 DIP switches for BMS bus address setting



Dec. addr.	A4	A3	A2	A1	A0	Dec. addr.	A4	A3	A2	A1	A0
1	0	0	0	0	1	16	1	0	0	0	0
2	0	0	0	1	0	17	1	0	0	0	1
3	0	0	0	1	1	18	1	0	0	1	0
4	0	0	1	0	0	19	1	0	0	1	1
5	0	0	1	0	1	20	1	0	1	0	0
6	0	0	1	1	0	21	1	0	1	0	1
7	0	0	1	1	1	22	1	0	1	1	0
8	0	1	0	0	0	23	1	0	1	1	1
9	0	1	0	0	1	24	1	1	0	0	0
10	0	1	0	1	0	25	1	1	0	0	1
11	0	1	0	1	1	26	1	1	0	1	0
12	0	1	1	0	0	27	1	1	0	1	1
13	0	1	1	0	1	28	1	1	1	0	0
14	0	1	1	1	0	29	1	1	1	0	1
15	0	1	1	1	1	30	1	1	1	1	0

Table 4.1: BMS bus address setting

4.2.6 Status indicators for BMS bus and supply voltage

LED	Meaning
ON	Green Power ON LED lights in case of correct power supply.
ALARM	Yellow alarm LED lights when an alarm message is being transmitted to the BMS side of the Modbus RTU.
FAULT	Yellow fault lights in case of disturbances on the BMS bus, when an invalid BMS address has been set and/or in case of FTC470XMB malfunctions.
BMS	Yellow BMS LED shows activities on the BMS bus.

4.3 BMS side of the FTC470XMB

On the BMS side, the FTC470XMB can be used either as Master or as Slave.



It is recommended to use the Master mode for fast data access.

- BMS address 1 = Master mode
- BMS address 2 to 30 = redundant Master mode
- BMS address 2 to 30 = Slave mode
- Data transmission rate = 9600 baud

The following data is available on the BMS bus.

Alarm and operating messages

Bender devices connected to the BMS bus cyclically send their alarm and operating messages. Each device can store up to 12 alarm and operating messages in the channels 1-12.

Diagnostics and parameterization

This data is only sent to the bus if requested by BMS commands.

Redundant Master function

FTC470XMB can be used as a redundant Master. In the event failure of the regular Master (bus address 1) the FTC470XMB takes over the Master function after approximately 60 seconds in order to control the BMS bus. If the regular Master becomes active again, the "redundant" FTC470XMB returns the Master function.



The FTC470XMB provides the redundant Master function when the BMS address 2 to 30 was assigned to.

In case of failure of the regular Master tried first the BMS device with BMS address 2 to take over the Master function. If the taking over does not succeed, address 3 etc. follows. That means, a FTC470XMB with the BMS address 2 takes over the redundant Master function faster than equipment with the address 30.

4.4 Modbus RTU side of the FTC470XMB — Mode 1

In this manual, the Modbus RTU is generally viewed from the perspective of the Modbus RTU Master.

4.4.1 Definition of Mode 1

If FTC470XMB is operating in Mode 1, the Modbus Master can query values and functions from the BMS net, but a parameterization of network BMS devices is not possible. For the respective requests, the Modbus Master must set the configuration registers of the FTC470XMB. For this purpose, the registers are reserved with the following options:

- BMS addresses: 1...150
- BMS instruction codes: 4, 30, 32, 35, 37, 39, 48 and 105



FTC470XMB can be operated in Mode 1 or in Mode 2 or even alternately. This is possible since different memory ranges are used for both modes.

4.4.2 Communication between Modbus RTU and BMS

The assignment of input data and output data is organized over the configuration registers of the FTC470XMB. Therefore, the Modbus Master must set the configuration register consisting of 10 segments in an appropriate way. 10 address ranges of the read register are permanently linked with the 10 segments of the configuration register. Details of these linkages are described further below.

Description of data exchange

Communication between the components is carried out as follows:

1. The Modbus Master makes a request possible by setting the FTC470XMB configuration register. It writes the BMS address of a BMS device to be queried and the associated BMS instruction. 10 segments allow 10 devices with 12 channels each to be configured for requests in one configuration cycle.
2. Next, the Modbus Master reads the requested data from the Modbus read register of the FTC470XMB. This can take place uniquely or in a cyclic manner, depending upon the programming.

Address ranges for configuration- and input data

- The configuration data (BMS instruction code and BMS device address) of the Modbus Master are always written into the configuration register of the FTC470XMB Modbus Slave. Altogether, 10 register segments with the following pre-defined segment addresses are available:

| 0x0406 | 0x041F | 0x0438 | 0x0451 | 0x046A | 0x0483 | 0x049C | 0x04B5 | 0x04CE | 0x04E7 |

- The input data (read access) of the Modbus Master are also read out from pre-defined read registers of the FTC470XMB. The segment addresses of the read registers are coupled to those of the configuration registers using an offset of 400h. The address range for read accesses is pre-defined as:

Start address read register	Address range read register
0x0006	0x0006... 0x001E
0x001F	0x001F ... 0x0037
0x0038	0x0038 ... 0x0050
0x0051	0x0051 ... 0x0069
0x006A	0x006A ... 0x0082
0x0083	0x0083 ... 0x009B
0x009C	0x009C ... 0x00B4
0x00B5	0x00B5 ... 0x00CD
0x00CE	0x00CE ... 0x00E6
0x00E7	0x00E7 ... 0x00FF

4.4.3 Setting of the Modbus configuration register

The following data format must be used to set the configuration registers. Register address 406h is used for illustration purposes.

Start address Configuration register	Data length (Words)	BMS instruction code High-Byte	BMS address Low-Byte
406h	1	105	3

All usable BMS instruction codes are listed below:

BMS instruction code	Meaning of BMS instruction codes
4	Query operating messages
30	Query response value
32	Query current transformer type
35	Query CT transformation ratio (factor)
37	Query status of CT monitoring
39	Query channel function
48	Query response delay
105	Query measured value with status information

The BMS instruction codes 30, 32, 35, 37, 39 and 48 listed in the table are used for the inquiry of parameters in Mode 1 and require that FTC470XMB is operating in Master mode. Master mode is achieved by assigning BMS address 1 or automatically achieved in mode 1 by temporarily taking over the Master function.



Please note that some BMS Masters cannot return their Master function!

If the FTC470XMB needs to operate as Master in an existing BMS environment, only the following devices can temporarily return their Master function:

- EDS460/461, EDS490/491 software version 2.00 or higher
- FTC470XDP software version 1.31 or higher
- FTC470XET software version 1.00 or higher
- FTC470XMB software version 1.31 or higher
- IRDH275, 375, 575 software version 1.40 or higher
- MK2430 software version 1.00 or higher
- PRC1470 software version 1.81 or higher
- RCMS460/461, RCMS490/491 software version 2.00 or higher
- TM1000 software version 1.81 or higher

Factory setting of the configuration register



All 10 usable register segments of the FTC470XMB are pre-defined with BMS instruction code 105 and consecutively pre-assigned with BMS addresses 3...12.

That is, all channels (12) of the devices are queried in this setting by the 10 addressed BMS devices with BMS addresses 3...12. The units subsequently provide measured values and status information. The following table shows the factory-set allocation of the configuration register.

Start address Configuration register	BMS instruction code High-Byte	BMS address Low-Byte
406h	105	3
41Fh	105	4
438h	105	5
451h	105	6
46Ah	105	7
483h	105	8
49Ch	105	9
4B5h	105	10
4CEh	105	11
4E7h	105	12

Changing of the configuration

The factory setting of the configuration registers can be changed at any time. For this purpose, the Modbus Master must set the configuration registers again with the desired inquiry data. Use the data format described at the beginning of this chapter to set the register.

If the data must be read out of more than 10 BMS devices via FTC470XMB, it is made possible by the programming of the Modbus Master. For this purpose, the Master rewrites the 10 segments of the configuration register defined via their address with the desired BMS instruction codes and BMS addresses. The Modbus Master can then read out the provided data from the read register of the FTC470XMB.

The rewrite and read-out process can be repeated as often as necessary.

As BMS Master, the FTC470XMB requires no more than 2 s to refresh its Modbus read register; as Slave it generally requires 4 s. The refresh of all 10 register segments requires 20 s or 40 s.

Note: The configuration registers can also be configured via web browser by using an additional FTC470XET.

4.4.4 Reading out of the BMS data from the Modbus read register

The BMS data requested by the Modbus Master are read out of a total of 10 segments of the read register:

Address ranges of the read register segments

0x0006... 0x001E	0x0083 ... 0x009B
0x001F ... 0x0037	0x009C ... 0x00B4
0x0038 ... 0x0050	0x00B5 ... 0x00CD
0x0051 ... 0x0069	0x00CE ... 0x00E6
0x006A ... 0x0082	0x00E7 ... 0x00FF

Each register segment contains 25 words. The following information is available to the Modbus Master when reading out a register segment. Word 1 contains the repetition of the BMS instruction code and the BMS address defined in the configuration register. The subsequent words each contain in pairs the BMS information queried per device channel:

Word	High-Byte	Low-Byte
1	BMS command	BMS address
2	Data value Channel 1	Data value Channel 1
3	Data type Channel 1	Data type Channel 1
4	Data value Channel 2	Data value Channel 2
5	Data type Channel 2	Data type Channel 2
6	Data value Channel 3	Data value Channel 3
7	Data type Channel 3	Data type Channel 3
8	Data value Channel 4	Data value Channel 4
9	Data type Channel 4	Data type Channel 4
10	Data value Channel 5	Data value Channel 5
11	Data type Channel 5	Data type Channel 5
12	Data value Channel 6	Data value Channel 6
13	Data type Channel 6	Data type Channel 6
14	Data value Channel 7	Data value Channel 7
15	Data type Channel 7	Data type Channel 7
16	Data value Channel 8	Data value Channel 8
17	Data type Channel 8	Data type Channel 8
18	Data value Channel 9	Data value Channel 9
19	Data type Channel 9	Data type Channel 9
20	Data value Channel 10	Data value Channel 10
21	Data type Channel 10	Data type Channel 10
22	Data value Channel 11	Data value Channel 11
23	Data type Channel 11	Data type Channel 11
24	Data value Channel 12	Data value Channel 12
25	Data type Channel 12	Data type Channel 12

The first 5 of 25 words of the Modbus read register are represented here as an example. The words 2/3 and 4/5 subdivided in pairs correspond each to one BMS channel. The example features the first two of a total of 12 channels.

Word 1		Channel 1				Channel 2			
		Word 2		Word 3		Word 4		Word 5	
H byte	L byte	H byte	L byte	H byte	L byte	H byte	L byte	H byte	L byte
BMS comm and	BMS device address	BMS data value		BMS status information **	BMS Data type	BMS data value		BMS status information **	BMS Data type

- Word 1, High-Byte:
BMS instruction code, see table on page 35. The instruction code corresponds to the associated request (Output data of the Modbus Master are located in configuration register).
 Word 1, Low-Byte:
BMS address of the addressed device. The address corresponds to the associated request (output data of Modbus Master are located in configuration register).
- Word 2, High-Byte and Low-Byte:
BMS data value, see table on page 35. The data value represents the read out result corresponding to the query. This may be a numeric measured value or coded information. Both data categories become accessible only through the data type.
- Word 3, High-Byte:
 ** with instruction code 105: status information
 ** with other instruction codes: 0
BMS status information, it can take the value 0, 1 or 2
 0 = no alarm on this channel
 1 = device signals an alarm on this channel
 2 = no device available with this address (monitoring of device failures possible).
 Word 3, Low-Byte:
BMS data type, see table on page 35. The data type corresponds to the associated request (output data) and provides the interpretation of the BMS data value. For example, the read out BMS data value can be a current measured in mA or A, but also a coded value for a status.
 If no device is available with the queried address or if a device failed, the data type is 0.
- Word 4, High-Byte and Low-Byte:
BMS data value, like word 2, High-Byte and Low-Byte.
- Word 5, High-Byte:
BMS status information, like word 3, High-Byte.
 Word 5, Low-Byte:
BMS data type, like word 3, Low-Byte.

The content of the Modbus read register in the FTC470XMB is periodically refreshed. With measured values (BMS instruction codes 4 and 105), the refresh occurs every second; while parameters are refreshed every 5 minutes.

4.5 Modbus RTU side of the FTC470XMB — Mode 2

4.5.1 Definition of the Mode 2

In the mode 2 **all BMS commands** are usable, in particular also the instructions to the **Parameterization of BMS devices**. As only a limited storage area is available, FTC470XMB in this mode has only one register segment each for writing and one for reading of data. Input and output data consist of 5 words each for the respective register segment.

- BMS address: 1...150
- BMS commands: all

The FTC470XMB is a Modbus RTU Slave. That means that at least one Master must exist on the Modbus RTU side.

4.5.2 Cyclical data exchange

In this manual, the Modbus RTU is generally regarded from the Modbus RTU Master's point of view.

The communication process on the Modbus RTU is organized in cycles, which means that the Modbus RTU Master interrogates all Modbus RTU Slaves, one after the other. The Master sends requests to the Slaves, these represent the Master's **output data**. In reply the FTC470XMB send answers, these are the Master's **input data**.

Due to the large amount of data on the BMS side, a cyclical data exchange is not possible at the same time. For that reason, the Modbus RTU Master must define the data he wants to receive from the BMS device.

The allocation of input and output data is organized via a consecutive ID number. A request with the ID number 1 must be followed by an answer from the Slave with the ID number 1. Only then the next request with ID number 2 may be sent. Since one ID number needs 1 byte, the numbers from 0 to 255 can be allocated. Then it starts again with number 0.

4.5.3 Correct time control of the FTC470XDP by Modbus RTU commands is required.

Since commands are intended for different devices, different time behaviour must be considered. Answers to previously sent requests may accumulate while a Modbus RTU Master's request is being answered by the associated Slave (FTC470XMB). Therefore it is of utmost importance to compare the ID number of the request to the respective ID number of the answer.

Command	typ. response time	max. response time	BMS operating mode
Command 1, 2, 3, 4, 102, 104, 105 execute	20 ms	100 ms	Slave, Master
Switching commands execute	160 ms	600 ms	Master, temporary Master
Parameterizing	160 ms	600 ms	Master, temporary Master
Taking over the Master function	6 s	60 s	Slave
Returning the Master function	100 ms	200 ms	temporary Master



The Modbus RTU programmer is responsible for the correct increment of the ID numbers in compliance with the system requirements. Wrong control of the time behaviour may result in misinterpretations (Modbus RTU input data)! Attend the response time of the commands!

4.5.4 FTC470XMB communicate with the Modbus RTU Master as "BMS Slave"

If a BMS address between 2 and 30 has been assigned to the FTC470XMB, it acts as a BMS Slave. In this case, the Modbus RTU Master can use the following functions:

Function in the BMS network	Modbus RTU instruction code*
Request for the number of alarm messages of a device	1
Request for the alarm message of a channel	2
Request for the number of operating messages of a device	3
Request for the operating message of a channel	4
Request for the actual measuring value of a channel	105
Transmission of an alarm message from the Modbus RTU to a channel of the FTC470XMB	102
Transmission of an operating message from the Modbus RTU to a channel of the FTC470XMB	104
Starting, stopping or setting the position mode at EDS470/473 systems	115
Taking over respectively returning the Master function	112

* For detailed information about the Modbus RTU instruction code refer to the tables „bus requests“ beginning on page 34.

Taking over the Master function temporarily

Setting or requesting parameters of BMS cannot be carried out unless the FTC470XMB has taken over the Master function on the BMS bus. After the setting respectively the requesting of parameters, the Master function must be returned to the initial BMS Master. For the associated commands refer to on page 43 and page 84.

If no parameters are transmitted to the BMS bus by the Modbus RTU for 200 seconds, the FTC470XMB "assumes" that the Master function has not been returned. In this case, the FTC470XMB automatically returns the Master function to the initial BMS Master in order to avoid that the BMS bus is operated without a Master and hence would not be able to function reliably.

The response time for taking over or returning the Master function depends on the extension of the BMS system. A typical response time for taking over is approximately 6 seconds, but may be up to 60 seconds in extended systems. The returning typical demands 100 ms, in maximum up to 200 ms.

The time needed to execute the instruction codes 1, 2, 3, 4, 105, 102 and 104 is about 20 ms.

4.5.5 FTC470XMB communicates as the "BMS Master" with the Modbus RTU Master

Once the BMS address 1 is assigned to the FTC470XMB, the device acts as the BMS Master. In this way it can act as Master in all BMS systems. In addition to the interrogation of alarm and operating messages, it is also possible to set switching commands and parameters. The response time for the instruction codes 1, 2, 3, 4, 105, 102 and 104 is about 20 ms as it is in the Slave mode. Switching commands and requesting of parameters are usually executed within approximately 160 ms. Depending on the size of the BMS systems, however, also up to 600 ms are possible.

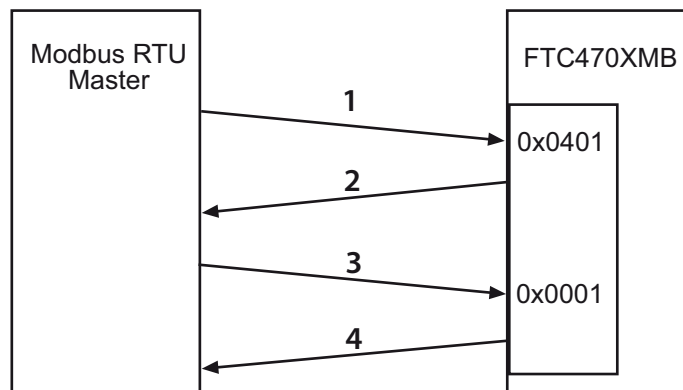
4.5.6 Communication between Modbus RTU and BMS

Description of data exchange

The communication process is regarded from the Modbus Master's point of view. Data exchange between the Modbus Master and FTC470 XMB by using the Modbus functions write (16) and read (3) in pairs. FTC470XMB only communicates via the Modbus functions read and write.

Communication between the components is as follows:

1. The Modbus Master starts a **request to the FTC470XMB with function 16**
2. FTC470XMB acknowledges the request
3. The Modbus Master starts the **read access to the requested data with function 3**
4. FTC470XMB transmits the requested data in defined format



All addresses: 1-based

Address ranges for output and input data

- The output data (request, write access) of the Modbus Master are always written into the same memory section of the FTC470XMB (Modbus Slave). This is done with the Modbus function 16 (writing of several Words). The address is entered in decimal or hexadecimal format depending on the Modbus Master. The address range for requests is preset:

	Start address	Address range
hexadecimal 1-based	0x0401	0x0401... 0x0405
decimal 1-based	1025	1025 ... 1029
hexadecimal 0-indexed	0x0400	0x0400 ... 0x0404
decimal 0-indexed	1024	1024 ... 1028

- The input data (read access) of the Modbus Master is always read out from the same memory range via the Modbus function 3 (reading of several Words). The address can be entered in decimal or hexadecimal format depending on the Modbus Master. The address range for read access is preset:

	Start address	Address range
hexadecimal 1-based	0x0001	0x0001... 0x0005
decimal 1-based	1	1 ... 5
hexadecimal 0-indexed	0x0000	0x0000 ... 0x0004
decimal 0-indexed	0	0 ... 4

Format of the output and input data

The whole communication is to be regarded from the Modbus Master's point of view. This Master sends the **output data**, a Words sequence (2 bytes each), to the FTC470XMB (Modbus RTU Slave).

As an answer, the input data is returned as a Words sequence (2 bytes each) to the Modbus Master. The assignment of output and input data (between requests and answers), is carried out via an ID number. The Modbus programmer is responsible for the correct assignment of the next ID number immediately after receiving an answer to the last request.

Format of the output data:

Writing to the FTC470XMB (= output data of the Modbus RTU Master)

Modbus function 16:

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
Always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	Always „0“	BMS command	Always „0“	BMS data type	BMS data value	

- Word 1, High-Byte:
No function, always zero (0) must be entered here.
Word 1, Low-Byte:
Consecutive Modbus ID No. of transmission. Must be set by the programmer of the Modbus RTU Master. The ID number for the next request must be incremented as soon as an answer to the previous request is received.
- Word 2, High-Byte:
BMS address of the addressed device. Note: TM operator panels and PRC1470 must be addressed via their **internal interface**. Data of the external interface of these devices cannot be processed by the FTC470XMB.
Word 2, Low-Byte:
BMS channel No. of the addressed device. If no channel number is required, enter "0".
- Word 3, High-Byte:
No function, always zero (0) must be entered here
- Word 3, Low-Byte:
BMS command code, refer to the tables beginning on page 33.
- Word 4, High-Byte:
No function, always zero (0) must be entered here
Word 4, Low-Byte:
BMS data type, refer to the tables beginning on page 33. If no data type is required, enter "0".
- Word 5, High-Byte:
BMS High-Byte data value, refer to the tables beginning on page 33. If no High-Byte data value is required, enter "0".
Word 5, Low-Byte:
BMS Lowbyte data value, refer to the tables beginning on page 33. If no Low-Byte data value is required, enter "0".

Format of the input data:
Reading from FTC470XMB (= input data of the Modbus RTU Master)

Modbus function 3

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
Always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	Always „0“	BMS command	always „0“	BMS type	BMS value	

- Word 1, High-Byte:
 No function, the device always reads zero (0) here
 Word 1, Low-Byte:
Consecutive Modbus ID No. of transmission. The ID number corresponds to the associated request (output data).
- Word 2, High-Byte:
BMS address of the addressed device. Address corresponds to the associated request (output data).
 Word 2, Low-Byte:
BMS channel number of the addressed device. Channel number corresponds to the associated request (output data).
- Word 3, High-Byte:
 No function, the device always reads zero (0) here
 Word 3, Low-Byte:
BMS instruction code, see tables beginning on page 33. The instruction code corresponds to the associated request (output data).
- Word 4, High-Byte:
 No function, the device always reads zero (0) here.
 Word 4, Low-Byte:
BMS data type, see tables beginning on page 33. The data type represents the requested result read out by the device.
- Word 5, High-Byte:
BMS High-Byte data value, see tables beginning on page 33. The data type represents the requested result read out by the device.
- Word 5, Low-Byte:
BMS Low-Byte data value, see tables beginning on page 33. The data type represents the requested result read out by the device.

A selection of possible Modbus requests and answers is listed on page 33.

5. Installation

5.1 Basic configuration

Before installing the FTC470XMB, an address must be assigned to it. The BMS bus and the Modbus RTU must also be provided with an address.



Double assignment of addresses may lead to serious malfunctions in the BMS or Modbus RTU networks concerned.

1. At first, consult the person in charge of the electrical installation for the address assignment of the protocol converter in the respective bus structures. Therefore, it is necessary to find out whether the FTC470XMB can be operated as BMS Master (basic setting).
2. Set the appropriate BMS address (1 to 30; 1 = Master) by means of the DIP switch using binary digits. Address 5 corresponds to the following switch positions, for example:
A4=0 A3=0 A2=1 A1=0 A0=1
Factory setting = 1
3. Set the appropriate Modbus RTU address (1 to 127) by means of the DIP switch (to 7). For details refer to the chapter 4.2.1 "DIP switch for Modbus RTU address assignment". Information about addresses up to 30 can be found in the BMS binary table on page 17.
Factory setting = 3
4. Set the baud rate to (1200 to 57600 Bit/s). For details refer to chapter 4.2.2 "DIP for setting the baud rate".
Factory setting = 9600 Bit/s
5. Set the parity bit (Parity) for data transmission (none/even/odd)
Factory setting = none
6. Set the termination switch R to the required position in order to activate or deactivate the internal terminating resistor:
 - If the FTC470XMB is located at the end of the Modbus RTU, set the switch R to "ON" position (down position). The terminating resistor is activated.
 - If the FTC470XMB is not located at the end of the Modbus RTU, set the switch R to up position. the terminating resistor is deactivated.

5.2 Mounting and connection of the device

1. Mounting on support rail
Snap the clamping springs at the rear of the FTC470XMB into place in a way that a tight and secure fit is ensured.
2. Connection to supply voltage U_S :
Connect the terminals A1 and A2 to a supply voltage of $U_S = 85$ to 275 V (AC/DC). Other supply voltages are under consideration, please refer to the nameplate of the device. A 6 A fuse is recommended for the voltage supply. In case of connection to an IT system, all poles are to be protected. In case of DC voltage supply, any connection polarity can be used.

3. Connection to BMS:
Connect the terminals A and B to the BMS bus by means of the control cable (A to A, B to B). A suitable cable type is J-Y(St)Y 2x0.6
4. If the FTC470XMB is located at the end of the bus, the end of the bus must be terminated with a resistor of 120 Ω. For that purpose loosen the terminals A and B in order to connect the terminating resistor in parallel.
5. Connection to Modbus RTU:
Connect the 9 pole Sub-D socket to the respective plug of the Modbus RTU cable.
If the FTC470XMB is located at the end of the Modbus RTU network, set the terminating resistor to "ON" position.

When all the points above are considered, the protocol converter is ready to receive and convert commands and data from the BMS network and from the Modbus RTU network.



The FTC470XMB must be disconnected from the supply after changing the DIP switch settings. Reconnection to the power supply provides the actual indication of the Modbus RTU status.

5.2.1 Wiring diagram

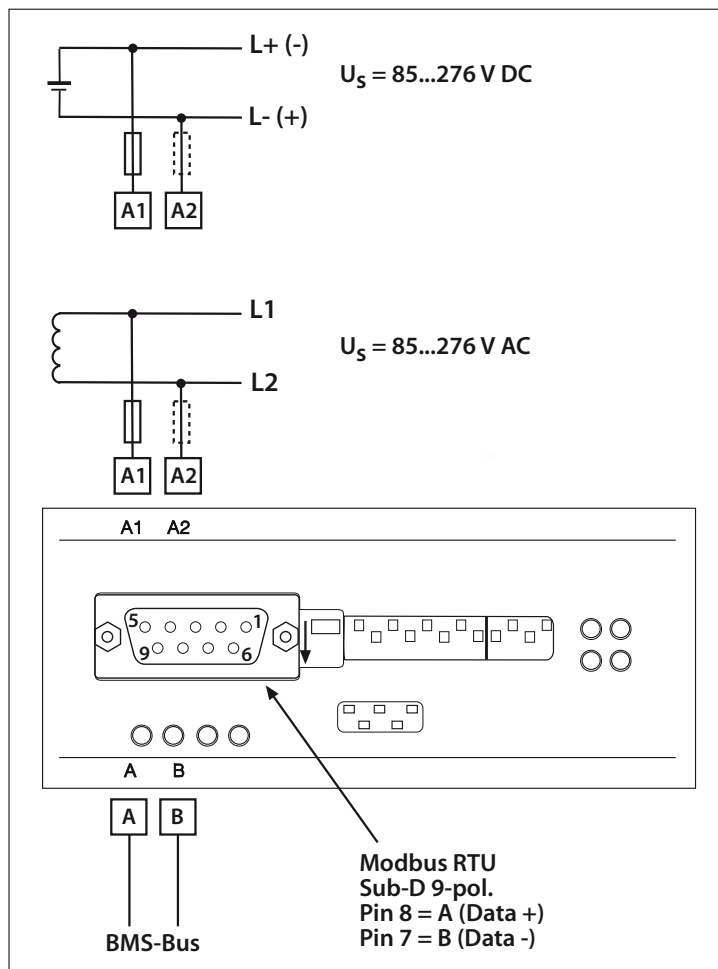


Fig. 5.1: Wiring diagram FTC470XMB

6. Function



Please note that the tables used in this chapter primarily describe mode 2 (page 25). The datagram format (Word 1...5) is valid for this mode only. For mode 1 application (page 19), only instruction codes 4, 30, 32, 35, 37, 39, 48 and 105 are available. In this mode, only the data type and value are required for readout.

The following tables describe the bus communication from the Modbus RTU Master's point of view. Possible answers from the protocol converter FTC470XMB to the Master's request are listed in the table below. The following data types are described:

- Alarm messages
- Operating messages
- Measuring values
- Requesting and setting the parameters
- Taking over the Master function
- Control commands

The tables contain the following information in columns:

- Function
- Addressable BMS devices
- BMS address and channel (Word 2)
- BMS instruction code (Word 3, only Low-Byte)
- BMS data type (Word 4, only Low-Byte)
- BMS data value (Word 5)



The columns of the table are hierarchical sorted according to command, data type, data value

Word 1 is not listed in the table. The ID number included in Word 1 is generated by the Modbus Master according to the programmer's input.

Detailed information about the data format can be found in "Communication between Modbus RTU and BMS" on Page 27.

6.1 Requesting alarm messages

Alarm messages occur when the preset value of a device falls below or exceeds the response value. Depending on the device, these can be measuring values or status messages. Alarm messages are provided by BMS devices and are requested by the BMS Master. Due to the fact that alarm values are relevant to safety, they take high priority on the bus.

6.1.1 Number of all alarm messages of a BMS device

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the actual number of alarm messages of a BMS device	all	address	0	0	1	0	0	0

Table 6.1: Master request: number of alarm messages

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No alarm messages	all	address	0	0	1	0	1	0
Number of alarm messages	all	address	0	0	1	0	1	quantity
Number of alarm messages Not all the channels have been measured yet	EDS...	address	0	0	1	0	2	quantity
Number of alarm messages occurred by pressing the test button or by activating the "TEST" menu integrated in the device (for example).	107TD47 IRDH... PRC487	address	0	0	1	0	3	quantity
Number of alarm messages occurred during a test initiated via the interface	107TD47 IRDH... MK2418...	address	0	0	1	0	4	quantity
Request for a self test for an insulation monitoring device	MK2418...	address	0	0	1	0	5	address
Switching off the buzzer for alarm messages of a device	MK2418...	address	0	0	1	0	6	address
No device with such an address available	all	address	0	0	1	0	0	0

Table 6.2: FTC answer to: number of alarm messages

6.1.2 Requesting alarm messages via the channel number

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Request for alarm messages via the channel number	all	address	Channel No.	0	2	0	0	0

Table 6.3: Master request: request for alarm messages via channel number

Reading from FTC470XMB (= input data from the Modbus RTU Master)

No alarm messages	all	Address	Channel No.	0	2	0	1	0
Insulation fault in the IT system	MK2418-11 SMI470-9	„	1 1	0	2	0	11	1
Transformer overload	MK2418-11 SMI470-9	„	2 2	0	2	0	11	2
Transformer overtemperature	107TD47 IZ427 MK2418-11 SMI470-9	„	3 3 3 3	0	2	0	11	3
Failure Line 1	PRC487 MK2418-11 SMI470-9	„	1 4 4	0	2	0	11	4
Failure Line 2	PRC487 MK2418-11 SMI470-9	„	2 5 5	0	2	0	11	5
Insulation fault operating theatre lamp	107TD47 MK2418-11 SMI470-9	„	8 6 6	0	2	0	11	6
Failure distribution board (Line 3, downstream the switchover module)	PRC487 MK2418-11 SMI470-9	„	3 8 8	0	2	0	11	8
Failure AV line	PRC487	„	1,2	0	2	0	11	25
Failure AV line	PRC487	„	1,2	0	2	0	11	26
Failure AV line	PRC487	„	1,2	0	2	0	11	27
Failure N conductor	PRC487	„	4	0	2	0	11	29
Short circuit distribution board	PRC487	„	10	0	2	0	11	30
Phase sequence left	ATICS	„	30	0	2	0	11	39
Failure BSV line (Battery-backed power supply system)	ATICS	„	1,2	0	2	0	11	40
Connection fault system	107TD47 IRDH...	„	4 3	0	2	0	12	101
Connection fault PE	107TD47 IRDH... IZ427	„	5 4 5	0	2	0	12	102
Short circuit CT input	107TD47 EDS46x/49x IZ427 RCMS460 RCMS490	„	6 1...12 6 1...12 1...12	0	2	0	12	103

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Connection fault CT	107TD47 IZ427 EDS46x/49x RCMS460 RCMS490	„	7 7 1...12 1...12 1...12	0	2	0	12	104
Fault K1 (open circuit, contactor cannot be switched on))	PRC487	„	5	0	2	0	12	107
Fault K2 (open circuit, contactor cannot be switched on)	PRC487	„	6	0	2	0	12	108
Control fault	MK2418-11 SMI470-9	„	7 7	0	2	0	12	112
Failure switching element K1 or Q1	PRC487	„	5	0	2	0	12	113
Failure switching element K2 or Q2	PRC487	„	6	0	2	0	12	114
Fault insulation monitoring device	107TD47 IRDH375B IRDH575 IZ427	„	9 5 5 8	0	2	0	12	115
Switchover device in manual mode	PRC487	„	9	0	2	0	12	116
Open circuit opening coil K1	PRC487	„	5	0	2	0	12	117
Open circuit closing coil K1	PRC487	„	5	0	2	0	12	118
Open circuit opening coil K2	PRC487	„	6	0	2	0	12	119
Open circuit closing coil K2	PRC487	„	6	0	2	0	12	120
Switching element 1 cannot be switched on	PRC487	„	5	0	2	0	12	121
Switching element 1 cannot be switched off	PRC487	„	5	0	2	0	12	122
Switching element 2 cannot be switched on	PRC487	„	6	0	2	0	12	123
Switching element 2 cannot be switched off	PRC487	„	6	0	2	0	12	124
Failure contactor relay K3	PRC487	„	7	0	2	0	12	125
Fault Q1 (open circuit, load switch cannot be switched on)	PRC487	„	5	0	2	0	12	126
Fault Q2 (open circuit, load switch cannot be switched on)	PRC487	„	6	0	2	0	12	127
Fault PGH47..	PGH47..	„	5	0	2	0	12	136
Short circuit tripping circuit breaker Line 1	PRC487	„	10	0	2	0	12	137
Short circuit tripping circuit breaker Line 2	PRC487	„	10	0	2	0	12	138
Fault CV460	PRC487	„	8	0	2	0	12	139
Fault RK464	PRC487	„	8	0	2	0	12	140
Test of the automatic transfer switching device every 6 months	ATiCS	„	6	0	2	0	12	144
End of the service life	ATiCS	„	6	0	2	0	12	145
Channel is switched off	EDS...	„	1... 12	0	2	0	21	0
Interferences (FAULT)	EDS..	„	1... 12	0	2	0	31	0
Start-up of insulation fault location, runs until the input is reset	PGH...	„	1	0	2	0	32	1

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Start-up of insulation fault location for 1 pass (approx. 5 min.)	PGH...	„	2	0	2	0	33	1
Start/stop insulation fault location via button	PGH...	„	4	0	2	0	34	1
Function of the device switched off (suppression)	IRDH575 PGH...	„	6 3	0	2	0	35	1
Start-up of insulation fault location: continuous measurement by a 5 minute pause	IRDH575	„	7	0	2	0	36	1
Start-up of insulation fault location: 1 cycle	IRDH575	„	8	0	2	0	36	1
Start-up of insulation fault location: Position mode	IRDH575	„	9	0	2	0	36	Position
Overcurrent in mA		„	1... 12	0	2	0	41	value
Overcurrent in A		„	1... 12	0	2	0	42	value
Overcurrent > as value in A		„	1... 12	0	2	0	43	value
Undercurrent in mA	RCMS460/ 490	„	1... 12	0	2	0	44	value
Undercurrent in A	RCMS460/ 490	„	1... 12	0	2	0	45	value
Undercurrent < as value in mA	RCMS460/ 490	„	1... 12	0	2	0	46	value
Undercurrent > as value in A	RCMS460/ 490	„	1... 12	0	2	0	47	value
Total hazard current in µA	LIM2010	„	1	0	2	0	48	value
Total hazard current > as value in µA	LIM2010	„	1	0	2	0	49	value
Residual current fault > as value in mA	RCMS...	„	1... 12	0	2	0	50	value
Insulation fault with fault current value in mA	EDS470/ 460/490	„	1... 12	0	2	0	51	value
Insulation fault with fault current value in µA	EDS473/ 461/491	„	1... 12	0	2	0	52	value
Residual current > 10 A (FAULT)	EDS470/ 460/490	„	1... 12	0	2	0	53	value
Residual current > 1 A (FAULT)	EDS473/ 461/491	„	1... 12	0	2	0	53	value
Residual current > as value in mA	EDS46x/49x RCMS460 RCMS490	„	1... 12	0	2	0	54	value
Residual current/overcurrent/undercurrent fault in mA	RCMS... EDS46x/49x	„	1... 12	0	2	0	55	value
Residual current/overcurrent/undercurrent fault in A	RCMS... EDS46x/49x	„	1... 12	0	2	0	56	value
Residual current/overcurrent/undercurrent fault > as [value] in A	RCMS...	„	1... 12	0	2	0	57	value
Prewarning residual current fault in mA	RCMS...	„	1... 12	0	2	0	58	value
Prewarning residual current fault in A	RCMS...	„	1... 12	0	2	0	59	value
Residual current fault < as value in A	RCMS...	„	1... 12	0	2	0	60	value
Insulation fault in kΩ	107TD47 IRDH...	„	1 1, 2	0	2	0	61	value

Insulation fault in Ω	107TD47 IRDH...	"	1 1, 2	0	2	0	62	value
Insulation fault in $M\Omega$	107TD47 IRDH...	"	1 1, 2	0	2	0	63	value
Transformer load in %	107TD47 IZ427	"	2 2	0	2	0	65	value
Transformer load < as value in %	IZ427	"	2	0	2	0	66	value
Transformer load > as value in %	IZ427	"	2	0	2	0	67	value
Alarm digital input [value]	Mk2418C..., TM..., SMI471..	"	1... 8 1... 8 1... 8	0	2	0	70	value
Overvoltage in V	ATiCS	"	1, 2	0	2	0	72	value
Undervoltage in V	ATiCS IZ427	"	1, 2 4	0	2	0	75	value
Undervoltage < as value in V	IZ427	"	4	0	2	0	76	value
Voltage in 1/10 V	ATiCS	"	1, 2	0	2	0	87	value
Impedance in $k\Omega$	IZ427	"	1	0	2	0	91	value
Impedance < as value in $k\Omega$	IZ427	"	1	0	2	0	92	value
Impedance > as value in $k\Omega$	IZ427	"	1	0	2	0	93	value
Prewarning Impedance in $k\Omega$	IZ427	"	1	0	2	0	94	value
This and the following channel numbers are not available for this device.	all	"	"	0	2	0	254	0

Table 6.4: FTC reply to: requests for alarm messages via channel number

6.2 Requesting operating messages

Operating messages are measuring values and/or information which is constantly provided by BMS devices and that can be requested from the BMS Master via the bus. Some BMS devices (EDS47x) do not provide operating messages, they only provide alarm messages.

6.2.1 Number of all operating messages of a BMS device

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Requesting the actual number of operating messages of a BMS device	all	address	0	0	3	0	0	0

Table 6.5: Master request: number of operating messages

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No operating messages	all	Address	0	0	3	0	1	0
Number of operating messages	all	„	0	0	3	0	1	quantity
Number of operating messages. The messages occurred by activating the "TEST" menu	107TD47 IRDH... PRC487	„	0	0	3	0	3	quantity
Number of operating messages, occurred during a test initiated via the interface	107TD47 IRDH...	„	0	0	3	0	4	quantity
No device with such an address available	all	„	0	0	3	0	0	0

Table 6.6: FTC reply to: number of operating messages

6.2.2 Requesting operating messages via the channel number

Writing to FTC470XMB (= output of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Requesting operating messages of a BMS device via the channel number	all	address	channel No.	0	4	0	0	0

Table 6.7: Master request: request for operating messages via channel number

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No operating messages (e.g. because of alarms)	All	Address	channel No.	0	4	0	1	0
Relay not connected	SMO..	„	1... 12	0	4	0	3	0
Relay connected	SMO..	„	1... 12	0	4	0	3	1
Line 1 ready for operation **	PRC487	„	1, 2	0	4	0	13	201
Line 2 ready for operation **	PRC487	„	1, 2	0	4	0	13	202
Switching element 1 is switched on	PRC487	„	3	0	4	0	13	203
Switching element 2 is switched on	PRC487	„	4	0	4	0	13	204
Insulation of the main Op light ok	107TD47	„	8	0	4	0	13	205
Switchover module in automatic mode	PRC487	„	5	0	4	0	13	206
Switchover module in manual mode	PRC487	„	6	0	4	0	13	207
Line AV ready for operation **	PRC487	„	1, 2	0	4	0	13	210
Line SV ready for operation **	PRC487	„	1, 2	0	4	0	13	211
Line ZSV ready for operation **	PRC487	„	1, 2	0	4	0	13	212
Channel is switched off	RCMS46x/ 49x EDS46x/49x	„	1... 12	0	4	0	13	213
Switching back interlocking function active	ATiCS	„	4	0	4	0	13	214
Phase sequence right	ATiCS	„	30	0	4	0	13	215
Switching element position 0	ATiCS	„	3	0	4	0	13	216
BSV line ready for operation	ATiCS	„	1, 2	0	4	0	13	217
Channel is switched off	RCMS470 EDS470	„	1... 12	0	4	0	21	0
No CT connected. Input open	RCMS470	„	1... 12	0	4	0	22	0
Input is short-circuited	RCMS470	„	1... 12	0	4	0	23	0
Overcurrent in mA		„	1... 12	0	4	0	41	value
Undercurrent in mA	RCMS460/ 490	„	1... 12	0	4	0	44	value
Undercurrent in A	RCMS460/ 490	„	1... 12	0	4	0	45	value
Undercurrent < as value in mA	RCMS460/ 490	„	1... 12	0	4	0	46	value

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Undercurrent > as value in A	RCMS460/490	„	1... 12	0	4	0	47	value
	LIM2010	„	1	0	4	0	48	value
	LIM2010	„	1	0	4	0	49	value
Residual current > as value in mA	EDS46x/49x RCMS460 RCMS490	„	1... 12	0	4	0	54	value
Residual current/overcurrent/undercurrent fault in mA	RCMS.. EDS46x/49x	„	1... 12	0	4	0	55	value
Residual current/overcurrent/undercurrent fault in A	RCMS.. EDS46x/49x	„	1... 12	0	4	0	56	value
Residual current/overcurrent/undercurrent fault > as [value] in A	RCMS..	„	1... 12	0	4	0	57	value
Insulation value in kΩ	107TD47 IRDH...	„	1 1, 2	0	4	0	61	value
Insulation value in Ω	107TD47 IRDH...	„	1 1, 2	0	4	0	62	value
Insulation value in MΩ	107TD47 IRDH...	„	1 1, 2	0	4	0	63	value
System leakage capacitance	IRDH...	„	3	0	4	0	64	value
Transformer load in %	107TD47 IZ427 SMI470-9	„	2 2 1	0	4	0	65	value
Tranformer load < as value in %	IZ427	„	2	0	4	0	66	value
Tranformer load > as value in %	IZ427	„	2	0	4	0	67	value
Digital input set	SMI1471	„	1... 4	0	4	0	70	value
Overvoltage in V	LIM2010	„	3	0	4	0	72	value
Undervoltage in V	IZ427 LIM2010	„	4 3	0	4	0	75	value
Voltage in V	LIM2010	„	3	0	4	0	86	value
Voltage in 1/10 V	LIM2010	„	3	0	4	0	87	value
Delay on release	ATiCS	„	4	0	4	0	95	value
This device does not provide these channel numbers and subsequent channel numbers	all	„	channel No.	0	4	0	254	0

Table 6.8: FTC reply to: request for operating messages via channel number

**Dependent on the settings in the menu POWER

6.3 Requesting measuring values

Measuring values are the sum of all existing alarm and operating messages. The protocol converters of the FTC470... series offers the possibility to request each actual measuring value (alarm as well as operating messages) via the channel number using the command 105.

This function can be used for the purpose of logging.

6.3.1 Requesting measuring values via the channel number

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the actual measuring value for a channel. As an answer the alarm message is provided or the operating message, if no alarm message exists.	all	address	Channel No.	0	105	0	0	0

Table 6.9: Master request: measuring values via channel number

Reading from FTC470XMB (= input data of the Modbus RTU Master)

All alarm and operating messages listed in table 6.4 on page 38 "Requests for alarm messages via channel number" and in table 6.8 on page 41 "Requests for operating messages via channel number".	all	Address	Channel No.	0	105	0	Data type	Data value
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Table 6.10: FTC reply to: request for actual measuring values via channel number

6.4 Taking over or returning the Master function

Certain commands in a BMS network can only be carried out when the FTC470XMB takes over the Master function. This is required for the parameterization of BMS devices, for example. When BMS address 1 is continuously assigned to the FTC470XMB, taking over of the Master function is not necessary.



The FTC470XMB **must** take over the Master function in case of parameter requests and new parameter settings!
Take into account that the Master function must be returned by the FTC470XMB after taking over the Master function and the subsequent parameterization.

6.4.1 Taking over the Master function

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	channel No.	„0“	BMS command	„0“	Data type	Data value
Command to FTC470XMB to take over the Master function in the BMS network temporarily. After carrying out this command, the FTC470XMB is ready to output further commands to the BMS network.	FTC470..., FTC470XMB	address	0	0	112	0	2	0

Table 6.11: Master request: taking over of the Master function by FTC470XMB

Reading from FTC470XMB (= input data of the Modbus RTU Master)

FTC470XMB has taken over the Master function. The taking over is acknowledged by the old Master by answering already as a Slave.		Address	0	0	112	0	2	0
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Table 6.12: FTC reply to: taking over of the Master function by FTC470XMB

Taking over of the Master function is **not** required for requesting alarm and operating messages, measuring values and in case of control functions for EDS systems.

6.4.2 Returning the Master function

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Command to FTC470XMB to return the Master function in the BMS network. After carrying out this command, the FTC470XMB again has the status of a Slave in the BMS network .	FTC470XDP, FTC470XMB	Address	0	0	112	0	101	0

Table 6.13: Master request: Master return by FTC470XMB

Reading from FTC470XMB (= input data of the Modbus RTU Master)

FTC470XMB has taken over the Slave function		Adresse	0	0	112	0	101	0
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Table 6.14: FTC reply to: Master return by FTC470XMB

6.5 Parameterization



When the FTC470XMB works in the BMS Slave mode, a temporary Master takeover is required before carrying out the parameterization below!
Take into consideration that the Master function must be returned by the FTC470XMB after Master function transfer and the parameterization.

6.5.1 Requesting the response values via channel number

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the response value of a device via channel number	all	address	channel No.	0	30	0	0	0

Table 6.15: Master request: requesting the device response values

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Response value, insulat. fault location in mA	EDS470	address	1... 12	0	30	0	51	value
Response value, insulat. fault location in μ A	EDS473, 474	„	1... 12	0	30	0	52	„
Response value of the residual current (mA), range: 1...1000 mA	RCMS....	„	1... 12	0	30	0	55	„
Response value of the residual current (A), range: 10...2250 A	RCMS....	„	1... 12	0	30	0	56	„
Response value insulation monitoring in k Ω	IRDH..	„	1, 2	0	30	0	61	„
Set prewarning in %	RCMS....	„	13	0	30	0	66	„
Digital input is set to 0 V (low)	MK2418..-11	„	1... 8	0	30	0	70	0
Digital input is set to 24 V (high)	MK2418..-11	„	1... 8	0	30	0	70	1
Relay mode of operation: 0 = N/O operation "N.O." test 1 = N/C operation "N.C. test 2 = Flash 3 = N.O. 4 = N.C.	IRDH..	„	3, 4	0	30	0	81	„
Mode current output: 0 = 0...20 mA; 1 = 4...20 mA	IRDH..	„	5	0	30	0	82	„
Mode coupling unit: 0 = none 1 = AGH204-S4 2 = AGH520S 3 = AGH204 4 = AGH150W-4 AK160	IRDH..	„	6	0	30	0	83	„
Max. leakage capacitance ISOMETER: 0 = 1 μ F 1 = 10 μ F 2 = 150 μ F 3 = 500 μ F	IRDH..	„	7	0	30	0	84	„
Repeating self test: 0 = 24 h 1 = 1 h 2 = off	IRDH..	„	8	0	30	0	85	„
Display language: 0 = de 1 = en	IRDH.., MK2418..	„	9	0	30	0	86	„
Service password: 000...999	IRDH..	„	10	0	30	0	87	„
Function password: 0 = off 1 = on	IRDH..	„	11	0	30	0	88	„

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Fault memory: 0 = off 1 = on	IRDH..	„	12	0	30	0	89	„
Start time self test: 00:00...23:59	IRDH..	„	13	0	30	0	90	„
EDS mode: 0 = off 1 = on 2 = auto 3 = 1 cycle 4 = position	IRDH..	„	14	0	30	0	91	„
EDS operation, system: 0 = DC 1 = AC 2 = 3AC	IRDH..	„	15	0	30	0	92	„
EDS pulse: 0 = 1mA 1 = 2,5 mA 2 = 10 mA 3 = 25 mA 4 = 50 mA	IRDH..	„	16	0	30	0	93	„
EDS position mode: indication of the BMS address	IRDH..	„	17	0	30	0	94	„
EDS position mode: indication of the channel number	IRDH..	„	18	0	30	0	95	„
Value = alarm address * 100 + channel No. (of the alarm giving device; reference to the subsequent pages)	SMO482-12	„	1... 12	0	30	0	96	„
Test address: 0 = all connected devices will be tested, Value = BMS address of the addressed device	MK2418..	„	13	0	30	0	97	„
Buzzer, collective alarm reset: 1 = on 2 = off	MK2418..	„	14	0	30	0	98	„
Personnel: 0 = medical 1 = technical	MK2418..	„	15	0	30	0	99	„
LSD470 mode Display language EDS mode	107TD47	„	16 17 18	0	30	0	181	„
Response value insulation monitoring in kΩ	107TD47	„	5	0	30	0	182	„
Response value load current in A	107TD47	„	6	0	30	0	183	„
Time delay of the alarm relay in s	107TD47	„	7	0	30	0	184	„
No further channels	all	„	chan- nel No.	0	30	0	254	254
Invalid value	RCMS..., MK2418..-11	„	1... 12	0	30	0	255	255

Table 6.16: FTC reply to: requesting the device response values

6.5.2 Setting the response values via channel number

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Response value, residual current in mA, range: 1...20000 mA	RCMS...	„	1... 12	0	28	0	55	„
Response value, residual current in A, range: 10...2250 A	RCMS...	„	1... 12	0	28	0	56	„
Response value insulation monitoring in kΩ	IRDH..	„	1, 2	0	28	0	61	„
Prewarning in %	RCMS...	„	13	0	28	0	66	„
Set the digital input to 0 V (low)	MK2418..-11	„	1... 8	0	28	0	70	„
Set the digital input to 24 V (high)	MK2418..-11	„	1... 8	0	28	0	70	1
Relay mode of operation: 0 = N/O operation "N.O." test 1 = N/C operation "N.C." test 2 = Flash 3 = N.O. 4 = N.C.	IRDH..	„	3, 4	0	28	0	81	„
Mode current output: 0 = 0...20 mA 1 = 4...20 mA	IRDH..	„	5	0	28	0	82	„
Mode coupling units: 0 = none 1 = AGH204 AK80 2 = AGH520S 3 = AGH204 AK160 4 = AGH150W AK160	IRDH..	„	6	0	28	0	83	„
Max. leakage capacitance ISOMETER: 0 = 1 μF 1 = 10 μF 2 = 150 μF 3 = 500 μF	IRDH..	„	7	0	28	0	84	„
Repeating self test: 0 = 24 h 1 = 1 h 2 = off	IRDH..	„	8	0	28	0	85	„
Display language: 0 = de 1 = en	IRDH.., MK2418..	„	9	0	28	0	86	„
Service password: 000...999	IRDH..	„	10	0	28	0	87	„
Function password: 0 = off 1 = on	IRDH..	„	11	0	28	0	88	„
Fault memory: 0 = off 1 = on	IRDH..	„	12	0	28	0	89	„
Start time self test: 00:00...23:59	IRDH..	„	13	0	28	0	90	„
EDS mode: 0 = off 1 = on 2 = auto 3 = 1 cycle 4 = pos(position)	IRDH..	„	14	0	28	0	91	„
EDS operation, system: 0 = DC 1 = AC 2 = 3AC	IRDH..	„	15	0	28	0	92	„
EDS pulse: 0 = 1mA 1 = 2.5 mA 2 = 10 mA 3 = 25 mA 4 = 50 mA	IRDH..	„	16	0	28	0	93	„
EDS position mode: BMS address setting	IRDH..	„	17	0	28	0	94	„
EDS position mode: channel no. setting	IRDH..	„	18	0	28	0	95	„
Data value = alarm address x 100 + channel no. (of the alarm giving device) **	SMO482-12	„	1... 12	0	28	0	96	„

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Test address: 0 = all connected devices will be tested Value = BMS address of the addressed device	MK2418..	„	13	0	28	0	97	„
Buzzer, collective alarm reset: 1 = on 2 = off	MK2418..	„	14	0	28	0	98	„
Personnel: 0 = medical 1 = technical	MK2418..	„	15	0	28	0	99	„
LSD470 mode	107TD47	„	16	0	28	0	181	„
Display language		„	17					
EDS mode		„	18					
Response value insulation monitoring in kΩ	107TD47	„	5	0	28	0	182	„
Response value load current in A	107TD47	„	6	0	28	0	183	„
Time delay of the alarm relay in s	107TD47	„	7	0	28	0	184	„

Table 6.17: Master request: setting the response values

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	RCMS..	Address	Channel No.	0	28	0	*	value
Invalid value	RCMS..	„	„	0	28	0	255	255

Table 6.18: FTC reply to: setting the response values

* The read-out data type corresponds to the previously defined data type.

** Example SMO482-12 (Table 6.17)

An A-Isometer with BMS address 3 provides an alarm message on channel 2. An SMO482-12 with address 37 located in the BMS network must signal this alarm message at its output relay 1. Output relay 1 = channel number 1 of SMO482-12. Which data value must be entered?

SMO address = 37

SMO channel no. = 1

ISOMETER® address = 3

ISOMETER® channel no. = 2

Data value = 3 x 100 + 2 = 302

value to be entered = 302

Data value = alarm address x 100 + channel no. (of the alarm giving device)	SMO482-12	37	1	0	28	0	96	302
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6.5.3 Requesting the delay on response

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the delay on response of a device	RCMS...,	Address	1... 12	0	48	0	0	0

Table 6.19: Master request: requesting the delay on response

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Delay on response in ms	RCMS...,	Address	1... 12	0	48	0	75	Value
No more channels	RCMS...,	„	1... 12	0	48	0	254	254
Invalid value	RCMS...,	„	1... 12	0	48	0	255	255

Table 6.20: FTC reply to: requesting the delay on response

6.5.4 Setting the delay on response

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Setting the delay on response of a device	RCMS...,	Address	1... 12	0	47	0	75	Value

Table 6.21: Master request: setting the delay on response

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	RCMS...,	Address	1... 12	0	47	0	75	Value
Invalid value	RCMS...,	„	1... 12	0	47	0	255	255

Table 6.22: FTC reply to: setting the delay on response

6.5.5 Requesting the CT type

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the sensor type of a device (CT type)	EDS..	address	1... 12	0	32	0	0	0

Table 6.23: Master request: request for the sensor type

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Standard CT (W0..W5 /-S-P, WR)	EDS..	Address	1... 12	0	32	0	1	0
Split core transformer WS	EDS..	„	1... 12	0	32	0	1	1
No CT connected. The channel is being deactivated.	EDS..	„	1... 12	0	32	0	1	4
No more channels	EDS..	„	1... 12	0	32	0	254	254
Invalid value	EDS..	„	1... 12	0	32	0	255	255

Table 6.24: FTC reply to: request for the sensor type

6.5.6 Setting the CT type

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Setting the CT type to standard CT (W0..W5/-S/-P, WR)	EDS..	address	1... 12	0	31	0	1	0
Setting the CT type to split core CT (WS)	EDS..	„	1... 12	0	31	0	1	1
Setting the CT type to "no CT"	EDS..	„	1... 12	0	31	0	1	4

Table 6.25: Master request: Setting the CT type

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	EDS..	Address	1... 12	0	31	0	1	value
Invalid value	EDS..	„	1... 12	0	31	0	255	255

Table 6.26: FTC reply to: Setting the CT type

6.5.7 Requesting the status of CT monitoring

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the status of CT monitoring of a device channel	EDS., RCMS	address	1... 12	0	37	0	0	0

Table 6.27: Master request: status of CT monitoring

Reading from FTC470XMB (= input data of the Modbus RTU Master)

CT monitoring activated	EDS., RCMS	Address	1... 12	0	37	0	1	1
CT monitoring deactivated	EDS., RCMS	„	1... 12	0	37	0	1	0
No more channels	EDS., RCMS	„	1... 12	0	37	0	254	254
Invalid value	EDS., RCMS	„	1... 12	0	37	0	255	255

Table 6.28: FTC reply to: status of CT monitoring

6.5.8 Setting the status of CT monitoring

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
CT monitoring ON	EDS., RCMS	address	1... 12	0	36	0	1	1
CT monitoring OFF	EDS., RCMS	„	1... 12	0	36	0	1	0

Table 6.29: Master request: switching the CT monitoring ON or OFF

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	EDS., RCMS	Address	1... 12	0	36	0	1	Value
Invalid value	EDS., RCMS	„	1... 12	0	36	0	255	255

Table 6.30: FTC reply to: switching the CT monitoring ON or OFF

6.5.9 Requesting the correction factor for the CT transformation ratio

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Requesting the correction factor for the CT transformation ratio via channel number	RCMS..	address	1... 12	0	35	0	0	0

Table 6.31: Master request: correction factor for CT transformation ratio

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Multiplication with correction factor, (data value = correction factor)	RCMS..	address	1... 12	0	35	0	1	value
Division by correction factor, (data value = correction factor)	RCMS..	"	1... 12	0	35	0	2	value
No more channels	RCMS..	"	1... 12	0	35	0	254	254
Invalid value	RCMS..	"	1... 12	0	35	0	255	255

Table 6.32: FTC reply to: correction factor for CT transformation ratio

6.5.10 Setting the correction factor for CT transformation ratio

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Transformation ratio is multiplied with correction factor 1... 255. (data value = correction factor) For example: Required if an additional CT is used in series with the standard CT	RCMS..	"	1... 12	0	33	0	1	value
Transformation ratio is divided by correction factor 1... 10. (data value = correction factor) Required if several windings are routed through a standard CT	RCMS..	"	1... 12		33	0	2	value

Table 6.33: Master request: setting the correction factor for CT

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	RCMS..	address	1... 12	0	33	0	1	value
Acknowledgement	RCMS..	"	1... 12		33		2	value
Invalid value	RCMS..	"	1... 12	0	33	0	255	255

Table 6.34: FTC reply to: setting the correction factor for CT

6.5.11 Requesting the fault memory

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the status of the fault memory	EDS., RCMS., PRC470, PRC487, MK2418., SMI..	address	0	0	24	0	0	0

Table 6.35: Master request: status of the fault memory

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Fault memory ON	EDS., RCMS., PRC470, PRC487, MK2418., SMI..	Address	0	0	24	0	1	1
Fault memory OFF	„	Address	0	0	24	0	1	0
Invalid value	„	Address	0	0	24	0	255	255

Table 6.36: FTC reply to: status of the fault memory

6.5.12 Setting the fault memory

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Fault memory ON	EDS., RCMS., PRC470	Address	0	0	23	0	1	1
Fault memory OFF	„	„	0	0	23	0	1	0

Table 6.37: Master request: switching the fault memory on or off

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	EDS., RCMS., PRC470	Address	0	0	23	0	1	Value
Invalid value	„	address	0	0	23	0	255	255

Table 6.38: FTC reply to: switching the fault memory on or off

6.5.13 Requesting the operating mode of the alarm relay

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the operating mode of the collective alarm relay	EDS..., RCMS..., PRC470	address	0	0	27	0	0	0

Table 6.39: Master request: operating mode of the collective alarm relay

Reading from FTC470XMB (= input data of the Modbus RTU Master)

N/O operation	EDS..., RCMS..., PRC470	Address	0	0	27	0	1	0
N/C operation	"	"	0	0	27	0	1	1
Invalid value	"	"	0	0	27	0	255	255

Table 6.40: FTC reply to: operating mode of the collective alarm relay

6.5.14 Setting the operating mode of the alarm relay

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Setting the alarm relays to N/O operation	107TD47 EDS..., RCMS..., PRC470	address	0	0	25	0	1	0
Setting the alarm relays to N/C operation	"	"	0	0	25	0	1	1

Table 6.41: Master request: setting the operating mode of the alarm relay

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	EDS..., RCMS..., PRC470	Address	0	0	25	0	1	Value
Invalid value	"	address	0	0	25	0	255	255

Table 6.42: FTC reply to: setting the operating mode of the alarm relay

6.5.15 Requesting the channel function

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the current function of a channel	all	address	Channel No.	0	39	0	1	0

Table 6.43: Master request: request for a channel's function

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Overcurrent monitoring, residual current monitoring	RCMS...	Address	1... 12	0	39	0	1	1
Undercurrent monitoring, open circuit	RCMS...	„	1... 12	0	39	0	1	2
Input switched off	RCMS...	„	1... 12	0	39	0	1	3
Alarm address ON	MK2418	„	1... 30	0	39	0	1	4
Alarm address OFF	MK2418	„	1... 30	0	39	0	1	5
No more channels	all	„	Channel No.	0	39	0	254	254
Invalid value	all	„	„	0	39	0	255	255

Table 6.44: FTC reply to: request for a channel's function

6.5.16 Setting the channel function

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Setting the channel to overcurrent/residual current monitoring	RCMS...	address	1... 12	0	38	0	1	1
Setting the channel to undercurrent / open circuit monitoring	RCMS...	„	1... 12	0	38	0	1	2
Switching the channel function off	RCMS...	„	1... 12	0	38	0	1	3
Setting the alarm address to ON	MK2418	„	1... 30	0	38	0	1	4
Setting the alarm address to OFF	MK2418	„	1... 30	0	38	0	1	5

Table 6.45: Master request: setting the channel's function

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	RCMS..., MK2418	Address	1... 12 1... 12	0	25	0	1	Value
Invalid value	„	address	channel No.	0	25	0	255	255

Table 6.46: FTC reply to: setting the channel's function

6.5.17 Requesting the number of measurements per channel

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the number of measurements per channel	EDS..	address	1... 12	0	46	0	0	0

Table 6.47: Master request: number of measurements per channel

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Number of measurements per channel	EDS..	Address	1... 12	0	46	0	1	Quantity
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Table 6.48: FTC reply to: number of measurements per channel

6.5.18 Setting the number of measurements per channel

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Setting the number of measurements per channel	EDS..	address	1... 12	0	45	0	1	quantity

Table 6.49: Master request: setting the number of measurements per channel

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	EDS..	address	1... 12	0	45	0	1	Value
Invalid value	„	address	1... 12	0	45	0	255	255

Table 6.50: FTC reply to: setting the number of measurements per channel

6.5.19 Requesting the maximum number of measurements

In EDS systems, the maximum number of measurements can be set in the menu item „Peak“. Setting a higher peak value allows increased measuring reliability in systems where interferences occur, for example caused by converters.

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the maximum number of measurements	EDS., PRC1470	address	1... 12 1... 12	0	41	0	0	0

Table 6.51: Master request: the maximum number of measurements

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Preset max. number of measurements	EDS., PRC1470	Address	1... 12 1... 12	0	41	0	1	Quantity
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Table 6.52: FTC reply to: the maximum number of measurements

6.5.20 Setting the maximum number of measurements

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Setting of the max. number of measurement	EDS., PRC1470	address	1... 12	0	40	0	1	Quantity

Table 6.53: Master request: setting of the maximum number of measurements

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	EDS., PRC1470	Address	1... 12 1... 12	0	40	0	1	Quantity
Invalid value	„	address	1... 12 1... 12	0	40	0	255	255

Table 6.54: FTC reply to: setting of the maximum number of measurements

6.6 Requesting device-specific information



When the FTC470XMB works in the BMS Slave mode, a temporary Master takeover is required before carrying out the parameterization below!
Take into consideration that the Master function must be returned by the FTC470XMB after Master function transfer and the parameterization.

6.6.1 Requesting fault messages after a self test

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for fault messages after a self test	all	address	channel No.	0	9	0	1	0

Table 6.55: Master request: fault messages after a self test

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No fault detected	EDS., RCMS....	Address	1... 12	0	9	0	1	0
Input not connected, no CT connected	EDS., RCMS....	„	1... 12	0	9	0	22	0
No CT connected	EDS., RCMS....	„	1... 12	0	9	0	22	0
Input switched off	EDS., RCMS....	„	1... 12	0	9	0	21	0
Input short-circuited	EDS., RCMS....	„	1... 12	0	9	0	23	0
No more channels	EDS., RCMS....	„	1... 12	0	9	0	254	254
Invalid value	EDS., RCMS....	„	1... 12	0	9	0	255	255

Table 6.56: FTC reply to: fault messages after a self test

6.6.2 Requesting the software version

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the software version	all	address	0	0	22	0	0	0

Table 6.57: Master request: for the software version

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Number of the device software version x 100. Example: answer 112 = V 1.12.	All	Address	0	0	22	0	1	Version x 100
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Table 6.58: FTC reply to: the software version

6.6.3 Requesting the device type and device version

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Request for the device type. The answer includes the device family [enclosure/variant]	all	address	0	0	20	0	0	0

Table 6.59: Master request: the device type and variant

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Device type:

A-ISOMETER for medical locations acc. to DIN VDE 0107	107TD47	Address	0	0	20	0	121	
Insulation fault evaluator	EDS470-12	"	0	0	20	0	1	
Insulation fault evaluator	EDS473-12	"	0	0	20	0	5	
Converter BMS <=> PROFIBUS DP	FTC470XDP	"	0	0	20	0	201	
Converter BMS <=> Ethernet, TCP/IP	FTC470XET	"	0	0	20	0	205	
Converter BMS <=> Modbus RTU	FTC470XMB	"	0	0	20	0	203	
Insulation monitoring device	IRDH275B	"	0	0	20	0	41	
Insulation monitoring device	IRDH375B	"	0	0	20	0	43	
Insulation monitoring device	IRDH575	"	0	0	20	0	45	
Alarm indicator and test combination	MK2418	"	0	0	20	0	81	

Alarm indicator and test combination	MK2418C	"	0	0	20	0	81	
Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Converter BMS=> digital outputs	MODS480	"	0	0	20	0	72	
Insulation fault test device	PGH471	"	0	0	20	0	51	
Insulation fault test device	PGH473	"	0	0	20	0	55	
Insulation fault test device	PGH474	"	0	0	20	0	57	
Control and indicating device	PRC1470	"	0	0	20	0	61	
Control and indicating device	PRC487	"	0	0	20	0	91	
Residual current evaluator	RCMS470-12	"	0	0	20	0	31	
Converter digital inputs => BMS	SMI470	"	0	0	20	0	111	
Converter digital inputs => BMS	SMI471	"	0	0	20	0	112	
Converter digital inputs => BMS	SMI472	"	0	0	20	0	113	
Converter BMS => digital outputs	SMO480	"	0	0	20	0	71	
Converter BMS => digital outputs	SMO481	"	0	0	20	0	73	
Invalid value	all	"	0	0	20	0	255	
No device with such an address available	all	"	0	0	20	0	0	

Device variant:

No variant		Address	0	0	20	0		0
Device variant -9 Number of inputs	...-9	"	0	0	20	0		9
Device variant -11 Number of inputs	...-11	"	0	0	20	0		11
Device variant -12 Number of inputs	...-12	"	0	0	20	0		12
Device variant C-11 Programmable device variant	...C-11	"	0	0	20	0		211
Device variant C-12 Programmable device variant	...C-12	"	0	0	20	0		212
Device variant E Device variant for an extended address range	...E	"	0	0	20	0		1
Device variant E-11 Device variant for an extended address range	...E-11	"	0	0	20	0		111
Device variant E-12 Device variant for an extended address range	...E-12	"	0	0	20	0		112
Invalid value	all	"	0	0	20	0		255

Table 6.60: FTC reply to: device type and variant

6.7 Control commands for use in BMS Master mode



When the FTC470XMB works in the BMS Slave mode, a temporary Master take-over is required before carrying out the control commands below!
Take into consideration that the Master function must be returned by the FTC470XMB after Master function transfer and after the control commands have been carried out.

6.7.1 Deleting all alarm messages

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Deleting all alarm messages	all	0	0	0	13	0	0	0

Table 6.61: Master request: deleting all alarm messages

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement that all alarm messages are deleted	RCMS...	0	0	0	13	0	0	0
No answer	EDS...	0	0	0	13	0	255	255

Table 6.62: FTC reply to: deleting all alarm messages

6.7.2 Starting a self test of insulation monitoring devices

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Starting the self test of an insulation monitoring device	107TD47, IRDH375B/575, MK2418-11, SMI470-9	address	0	0	8	0	0	0

Table 6.63: Master request: starting the self test of an insulation monitoring device

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Self test is being acknowledged	107TD47, IRDH375B/575, MK2418-11, SMI470-9	Address	0	0	8	0	0	0
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Table 6.64: FTC reply to: starting a self test of an insulation monitoring device

6.7.3 Starting the self test of an EDS system

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Starting the self test of an EDS system	EDS..., RCMS..	address	0	0	7	0	0	0

Table 6.65: Master request: starting the self test of an EDS system

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No answer	EDS..., RCMS..	Address	0	0	7	0	255	255
Self test is being confirmed	EDS... effective from version 2.0	„	0	0	7	0	0	0

Table 6.66: FTC reply to: starting the self test of an EDS system

6.7.4 Buzzer mute

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Buzzer mute	MK2418..., SMI470...	address	0	0	14	0	0	address

Table 6.67: Master request: buzzer mute

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No answer	Mk2418..., SMI470...	Address	0	0	14	0	255	255
Acknowledgement of the buzzer mute version 2.0 or higher	"	"	0	0	14	0	0	0

Table 6.68: FTC reply to: buzzer mute

6.7.5 Switching the relay of a specific channel

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Switching on the relay of a specific channel	SMO481	address	1... 12	0	42	0	1	0
Switching off the relay of a specific channel	"	"	1... 12	0	42	0	2	0
Switching off all relays	"	"	1... 12	0	42	0	3	0

Table 6.69: Master request: switching relays of a specific channel

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No answer	SMO481	Address	1... 12	0	42	0	255	255
Acknowledgement	"	"	1... 12	0	42	0	0	0

Table 6.70: FTC reply to: switching relays of a certain channel

6.8 Control commands to be used in the BMS Slave mode

6.8.1 Starting and stopping EDS systems

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Command to BMS Master to start insulation fault location of an EDS system		address	0	0	115	0	3	0
Command to BMS Master to stop insulation fault location of an EDS system		„	0	0	115	0	4	0
Command to BMS Master to start insulation fault location of an EDS system in POSITION mode		„	1... 12	0	115	0	5	BMS address + channel *

Table 6.71: Master request: BMS Master is intended to control the EDS system

* The value "address" consists of :

„Address“ = (BMS address x 100) + channel number

Reading from FTC470XMB (= input data of the Modbus RTU Master)

No answer		Address	0	0	115	0	255	255
Acknowledgement		„	0	0	115	0	data type	value

Table 6.72: FTC reply to: BMS Master is intended to control the EDS system

6.9 Output of Modbus messages via the BMS bus

The functions 102 and 104 allow messages to be transmitted from the Modbus to the BMS bus where they can be processed as alarm respectively operating messages. That allows, for example, the indication of Modbus messages on BMS panels or alarm and operator panels.
The FTC470XMB provides a maximum of 12 channels for Modbus messages.

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Output of a message as an alarm message from the Modbus to the BMS bus	FTC470XMB	address	1... 12	0	102	0	*	*

Table 6.73: Master request: Output of Modbus messages to BMS bus

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	FTC470XMB	Address	Channel No.	0	102	0	*	*
Invalid value		„	1... 12	0	102	0	255	255

Table 6.74: FTC reply to: Output of Modbus messages to BMS bus

* All the information about data types and values listed in the tables beginning on page 35 applies: "Requesting alarm messages via the channel number"

Writing to FTC470XMB (= output data of the Modbus RTU Master)

Function	Devices	Word 2		Word 3		Word 4		Word 5
		BMS address	Channel No.	„0“	BMS command	„0“	Data type	Data value
Output of a message as an operating message from the Modbus to the BMS bus	FTC470XMB	address	1... 12	0	104	0	*	*

Table 6.75: Master request: output of Modbus messages to the BMS bus

Reading from FTC470XMB (= input data of the Modbus RTU Master)

Acknowledgement	FTC470XMB	Address	1... 12	0	104	0	*	*
Invalid value		„	1... 12	0	104	0	255	255

Table 6.76: FTC reply to: output of Modbus messages to the BMS bus

* All the information about data types and values listed in the tables beginning on page 40 applies: "Requesting operating messages via the channel number"

7. Programming examples mode 1

In the following examples, the different devices are each addressed with BMS address 5. In mode 1, the 8 instruction codes listed can be used:

- Requesting operating messages (instruction code 4)
- Requesting response values (instruction code 30)
- Requesting CT type (instruction code 32)
- Requesting the correction factor for the CT transformation ratio (instruction code 35)
- Requesting status of CT monitoring (instruction code 37)
- Requesting channel function (instruction code 39)
- Requesting response delay (instruction code 48)
- Requesting measured values with status information (instruction code 105)

A schematic overview is listed first. The process always follows the sequence “setting configuration register, reading out read register.” The first 8 register segments of the FTC470XMB are described below in succession:

Start addresses Configuration register	BMS instruction code	BMS address
0406h	4	5
041Fh	30	5
0438h	32	5
0451h	35	5
046Ah	37	5
0483h	39	5
049Ch	48	5
04B5h	105	5

Depending upon the Modbus Master used, the entries must be made in decimal or hexadecimal notation.

After the configuration registers have been written once, the corresponding read registers can be read out:

Start addresses Read register	Readable information
0006h	Operating messages of all 12 channels, BMS address 5
001Fh	Response values of all 12 channels, BMS address 5
0038h	CT type of all 12 channels, BMS address 5
0051h	Correction factor for transformation ratio of all 12 channels, BMS address 5
006Ah	Status of CT monitoring of all 12 channels, BMS address 5
0083h	Channel function of all 12 channels, BMS address 5
009Ch	Time delay of all 12 channels, BMS address 5
00B5h	Measured values and status information of all 12 channels, BMS address 5

The instruction codes that can be used in mode 1 are described in detail in 8 tables on the following pages.

7.1 Requesting the operating messages of an RCMS470-12

A Modbus RTU Master is to query the operating messages of all 12 channels (BMS instruction code 4) from an RCMS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	0406h	004h	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.4 or table 6.8
1	0006h	004h	005h	Repetition of configuration data: instruction code 4, address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	0007h	00h	00h	Channel 1: data value 0 (00h) + data type 22 (16h), => no CT connected
3	0008h	00h	16h	
4	0009h	00h	00h	Channel 2: data value and data type like channel 1
5	000Ah	00h	16h	
6	000Bh	00h	2Ah	Channel 3: data value 42 (2Ah) = measured value, data value 55 (37h) = residual current in mA, => 42 mA residual current
7	000Ch	00h	37h	
8	000Dh	00h	00h	Channel 4: data value and data type like channel 1
9	000Eh	00h	16h	
10	000Fh	00h	00h	Channel 5: data value and data type like channel 1
11	0010h	00h	16h	
12	0011h	00h	00h	Channel 6: data value and data type like channel 1
13	0012h	00h	16h	
14	0013h	00h	00h	Channel 7: data value and data type like channel 1
15	0014h	00h	16h	
16	0015h	00h	00h	Channel 8: data value and data type like channel 1
17	0016h	00h	16h	
18	0017h	00h	00h	Channel 9: data value and data type like channel 1
19	0018h	00h	16h	
20	0019h	00h	00h	Channel 10: data value and data type like channel 1
21	001Ah	00h	16h	
22	001Bh	00h	00h	Channel 11: data value 0 + data type 1 (01h), no operating message, e.g. due to existing alarm message
23	001Ch	00h	01h	
24	001Dh	00h	00h	Channel 12: data value and data type like channel 1
25	001Eh	00h	16h	

7.2 Requesting the response values of an RCMS470-12

A Modbus RTU Master is to query the defined response values of all 12 channels (BMS instruction code 30) from an RCMS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	041Fh	01Eh	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.16
1	001Fh	01Eh	005h	Repetition of configuration data: instruction code 30 (1Eh), address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	0020h	00h	64h	Channel 1: data value 100 (64h) = measured value, data value 55 (37h) = residual curr. in mA, response value => 100 mA
3	0021h	00h	37h	
4	0022h	00h	64h	Channel 2: data value and data type like channel 1
5	0023h	00h	37h	
6	0024h	00h	55h	Chan. 3: data value 85 (55h) = measured value, data value 55 (37h) = residual current in mA, response value => 85 mA
7	0025h	00h	37h	
8	0026h	00h	64h	Channel 4: data value and data type like channel 1
9	0027h	00h	37h	
10	0028h	00h	64h	Channel 5: data value and data type like channel 1
11	0029h	00h	37h	
12	002Ah	00h	64h	Channel 6: data value and data type like channel 1
13	002Bh	00h	37h	
14	002Ch	00h	64h	Channel 7: data value and data type like channel 1
15	002Dh	00h	37h	
16	002Eh	00h	64h	Channel 8: data value and data type like channel 1
17	002Fh	00h	37h	
18	0030h	00h	64h	Channel 9: data value and data type like channel 1
19	0031h	00h	37h	
20	0032h	00h	64h	Channel 10: data value and data type like channel 1
21	0033h	00h	37h	
22	0034h	03h	E8h	Channel 11: data value 1000 (3E8h) = measured value, data value 55 (37h) = residual current in mA, response value => 1000 mA
23	0035h	00h	37h	
24	0036h	00h	64h	Channel 12: data value and data type like channel 1
25	0037h	00h	37h	

7.3 Requesting the type of CT of an EDS470-12

A Modbus RTU Master is to query the defined CT type of all 12 channels (BMS instruction code 32) from an EDS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	0438h	020h	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.24
1	0038h	020h	005h	Repetition of configuration data: instruction code 32 (20h), address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	0039h	00h	00h	Chan. 1: data value 0 (00h) + data type 1 (01h) => standard CT
3	003Ah	00h	01h	
4	003Bh	00h	01h	Chan. 2: data value 1 (01h) + data type 1 (01h) => split core CT
5	003Ch	00h	01h	
6	003Dh	00h	00h	Channel 3: data value and data type like channel 1
7	003Eh	00h	01h	
8	003Fh	00h	00h	Channel 4: data value and data type like channel 1
9	0040h	00h	01h	
10	0041h	00h	00h	Channel 5: data value and data type like channel 1
11	0042h	00h	01h	
12	0043h	00h	00h	Channel 6: data value and data type like channel 1
13	0044h	00h	01h	
14	0045h	00h	04h	Chan. 7: data value 4 (04h) + data type 1 (01h) => no CT connected, channel deactivated
15	0046h	00h	01h	
16	0047h	00h	00h	Channel 8: data value and data type like channel 1
17	0048h	00h	01h	
18	0049h	00h	00h	Channel 9: data value and data type like channel 1
19	004Ah	00h	01h	
20	004Bh	00h	04h	Chan. 10: data value 4 (04h) + data type 1 (01h) => no CT connected, channel deactivated
21	004Ch	00h	01h	
22	004Dh	00h	00h	Channel 11: data value and data type like channel 1
23	004Eh	00h	01h	
24	004Fh	00h	00h	Channel 12: data value and data type like channel 1
25	0050h	00h	01h	

7.4 Requesting the correction factor for CT of an RCMS470-12

A Modbus RTU Master is to query the defined correction factor of all 12 channels (BMS instruct. code 35) for the transformation ratio of a CT from an RCMS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	0451h	023h	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.32
1	0051h	023h	005h	Repetition of configuration data: instruction code 35 (23h), address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	0052h	00h	01h	Channel 1: data value 1 (01h) = correction factor data type 1 (01h) = multiplication => multiplication with correction factor
3	0053h	00h	01h	
4	0054h	00h	01h	Channel 2: data value and data type like channel 1
5	0055h	00h	01h	
6	0056h	00h	01h	Channel 3: data value and data type like channel 1
7	0057h	00h	01h	
8	0058h	00h	01h	Channel 4: data value and data type like channel 1
9	0059h	00h	01h	
10	005Ah	00h	01h	Channel 5: data value and data type like channel 1
11	005Bh	00h	01h	
12	005Ch	00h	01h	Channel 6: data value and data type like channel 1
13	005Dh	00h	01h	
14	005Eh	00h	01h	Channel 7: data value and data type like channel 1
15	005Fh	00h	01h	
16	0060h	00h	01h	Channel 8: data value and data type like channel 1
17	0061h	00h	01h	
18	0062h	00h	01h	Channel 9: data value and data type like channel 1
19	0063h	00h	01h	
20	0064h	00h	01h	Channel 10: data value and data type like channel 1
21	0065h	00h	01h	
22	0066h	00h	01h	Channel 11: data value and data type like channel 1
23	0067h	00h	01h	
24	0068h	00h	01h	Channel 12: Data value and data type like channel 1
25	0069h	00h	01h	

7.5 Requesting the status of CT monitoring of an RCMS470-12

A Modbus RTU Master is to query the status of the CT monitoring of all 12 channels (BMS instruction code 37) from an RCMS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	046Ah	025h	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.28
1	006Ah	025h	005h	Repetition of configuration data: instruction code 37 (25h), address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	006Bh	00h	01h	Chan. 1: Data value 1 (01h) + data type 1 (01h) => CT monitoring activated
3	006Ch	00h	01h	
4	006Dh	00h	01h	
5	006Eh	00h	01h	Channel 2: data value and data type like channel 1
6	006Fh	00h	01h	Channel 3: data value and data type like channel 1
7	0070h	00h	01h	
8	0071h	00h	01h	Channel 4: data value and data type like channel 1
9	0072h	00h	01h	
10	0073h	00h	01h	Channel 5: data value and data type like channel 1
11	0074h	00h	01h	
12	0075h	00h	01h	Channel 6: data value and data type like channel 1
13	0076h	00h	01h	
14	0077h	00h	01h	Channel 7: data value and data type like channel 1
15	0078h	00h	01h	
16	0079h	00h	01h	Channel 8: data value and data type like channel 1
17	007Ah	00h	01h	
18	007Bh	00h	01h	Channel 9: data value and data type like channel 1
19	007Ch	00h	01h	
20	007Dh	00h	01h	Channel 10: data value and data type like channel 1
21	007Eh	00h	01h	
22	007Fh	00h	01h	Channel 11: data value and data type like channel 1
23	0080h	00h	01h	
24	0081h	00h	01h	Channel 12: Data value and data type like channel 1
25	0082h	00h	01h	

7.6 Requesting the channel functions of an RCMS470-12

A Modbus RTU Master is to query the channel functions of all 12 channels (BMS instruction code 39) from an RCMS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	0483h	027h	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.44
1	0083h	027h	005h	Repetition of configuration data: instruction code 39 (27h), address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	0084h	00h	01h	Chan. 1: data value 1 (01h) + data type 1 (01h) => overcurrent or residual current monitoring activated
3	0085h	00h	01h	
4	0086h	00h	01h	Channel 2: data value and data type like channel 1
5	0087h	00h	01h	
6	0088h	00h	01h	Channel 3: data value and data type like channel 1
7	0089h	00h	01h	
8	008Ah	00h	01h	Channel 4: data value and data type like channel 1
9	008Bh	00h	01h	
10	008Ch	00h	01h	Channel 5: data value and data type like channel 1
11	008Dh	00h	01h	
12	008Eh	00h	01h	Channel 6: data value and data type like channel 1
13	008Fh	00h	01h	
14	0090h	00h	01h	Channel 7: data value and data type like channel 1
15	0091h	00h	01h	
16	0092h	00h	01h	Channel 8: data value and data type like channel 1
17	0093h	00h	01h	
18	0094h	00h	01h	Channel 9: data value and data type like channel 1
19	0095h	00h	01h	
20	0096h	00h	01h	Channel 10: data value and data type like channel 1
21	0097h	00h	01h	
22	0098h	00h	01h	Channel 11: data value and data type like channel 1
23	0099h	00h	01h	
24	009Ah	00h	01h	Channel 12: Data value and data type like channel 1
25	009Bh	00h	01h	

7.7 Requesting the response delay of an RCMS470-12

A Modbus RTU Master is to query the response delay of all 12 channels (BMS instruction code 48) from an RCMS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	049Ch	030h	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.20
1	009Ch	030h	005h	Repetition of configuration data: instruction code 48 (30h), address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	009Dh	07h	D0h	Channel 1: data value 2000 (07D0h) = measured value, data type 75 (4Bh) = delay in ms => response delay: 2000 ms
3	009Eh	00h	4Bh	
4	009Fh	00h	00h	Channel 2: data value 0 (00h) = measured value, data type 75 (4Bh) = delay in ms => response delay: 0 ms
5	00A0h	00h	4Bh	
6	00A1h	00h	00h	Channel 3: data value and data type like channel 2
7	00A2h	00h	4Bh	
8	00A3h	00h	00h	Channel 4: data value and data type like channel 2
9	00A4h	00h	4Bh	
10	00A5h	00h	00h	Channel 5: data value and data type like channel 2
11	00A6h	00h	4Bh	
12	00A7h	00h	00h	Channel 6: data value and data type like channel 2
13	00A8h	00h	4Bh	
14	00A9h	00h	00h	Channel 7: data value and data type like channel 2
15	00AAh	00h	4Bh	
16	00ABh	00h	00h	Channel 8: data value and data type like channel 2
17	00ACh	00h	4Bh	
18	00ADh	00h	00h	Channel 9: data value and data type like channel 2
19	00AEh	00h	4Bh	
20	00AFh	00h	00h	Channel 10: data value and data type like channel 2
21	00B0h	00h	4Bh	
22	00B1h	00h	00h	Channel 11: data value and data type like channel 2
23	00B2h	00h	4Bh	
24	00B3h	00h	00h	Channel 12: Data value and data type like channel 2
25	00B4h	00h	4Bh	

7.8 Requesting the measuring values of an RCMS470-12

A Modbus RTU Master is to query the measured values including status information of all 12 channels (BMS instruction code 105) from an RCMS470-12 with BMS address 5.

The **Configuration register** must be written as follows:

Word	Start address Config. register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning
1	04B5h	069h	005h	Setting the configuration register

In this example, the **Read register** provides the following information:

Word	Start address read register	BMS instruction code High-Byte	BMS address Low-Byte	Meaning see table 6.4 or table 6.8
1	00B5h	069h	005h	Repetition of configuration data: instruction code 105 (69h), address 5
	Address read register	Data value per channel Data type per channel High-Byte Low-Byte		
2	00B6h	00h	00h	Channel 1: data value 0 (00h) + data type 0 (00h, High-Byte) = no alarm + data type 22 (16h, Low-Byte) => no CT connected, input open
3	00B7h	00h	16h	
4	00B8h	00h	00h	Channel 2: data value and data type like channel 1
5	00B9h	00h	16h	
6	00BAh	00h	2Ah	Channel 3: data value 42 (2Ah) = measured val., + data type 0 (00h, High-Byte) = no alarm + data type 55 (37h, L-Byte) = residual curr. mA => 42 mA residual current
7	00BBh	00h	37h	
8	00BCh	00h	00h	Channel 4: data value and data type like channel 1
9	00BDh	00h	16h	
10	00BEh	00h	00h	Channel 5: data value and data type like channel 1
11	00BFh	00h	16h	
12	00C0h	00h	00h	Channel 6: data value and data type like channel 1
13	00C1h	00h	16h	
14	00C2h	00h	00h	Channel 7: data value and data type like channel 1
15	00C3h	00h	16h	
16	00C4h	00h	00h	Channel 8: data value and data type like channel 1
17	00C5h	00h	16h	
18	00C6h	00h	00h	Channel 9: data value and data type like channel 1
19	00C7h	00h	16h	
20	00C8h	00h	00h	Channel 10: data value and data type like channel 1
21	00C9h	00h	16h	
22	00CAh	08h	BAh	Channel 11: data value 2234 (08BAh) = measured value, + data type 1 (01h, High-Byte) = no alarm + data type 55 (37h, L-Byte) = resid. current mA => 2234 mA residual current
23	00CBh	01h	37h	
24	00CCh	00h	00h	Channel 10: data value and data type like channel 1
25	00CDh	00h	16h	

8. Programming examples mode 2

All the examples below include 5 Data Words. When programming, take into consideration that the Modbus address of the FTC470XMB as well as the respective Modbus function 16 (write) and 3 (read) is to be put in front of the Data Words. The formats of the output and input data are described on page 29.

8.1 Alarm messages

8.1.1 Number of alarm messages

The Modbus RTU-Master addresses BMS address 3, the EDS470-12 insulation fault evaluator, requesting the current number of its alarm messages.

The Modbus RTU-Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	1	3	0	0	1	0	0	0	

The addressed EDS470-12 returns 4 alarm messages (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	1	3	0	0	1	0	1	4	

The Modbus RTU-Master addresses BMS address 5, the insulation monitoring device 107TD47, requesting the current number of alarm messages:

The Modbus RTU-Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	2	5	0	0	1	0	0	0	

The addressed 107TD47 provides 3 stored alarm messages which had been released by pressing the internal test button of the device (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	2	5	0	0	1	0	3	3	

8.1.2 Alarm messages or information via channel number

The Modbus RTU Master interrogates BMS address 5, the 107TD47 insulation monitoring device, for information about the overtemperature (alarm message). This message is available at channel 3 of the 107TD47.

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	3	5	3	0	2	0	0	0	

The addressed 107TD47 signals overtemperature of the monitored isolating transformer (function 3, input data) :

Word 1		Word 2		Word 3		Word 4		Word 5	
0	3	5	3	0	2	0	11	3	

The Modbus RTU Master interrogates BMS address 10, a PRC487 control device, for information about the state of Line 1 (alarm message). This information is available at channel 1 of PRC487.

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	4	10	1	0	2	0	0	0	

The addressed PRC487 signals failure of Line 1 (function 3, input data).

Word 1		Word 2		Word 3		Word 4		Word 5	
0	4	10	1	0	2	0	11	4	

The Modbus RTU Master interrogates BMS address 20, an EDS470-12 insulation fault evaluator, for information about the alarm value of channel 5:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	5	20	5	0	2	0	0	0	

The EDS470-12 signals an alarm value of 11 mA to channel 5 (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	5	20	5	0	2	0	51	11	

The Modbus RTU Master addresses BMS address 17, the residual current evaluator RCMS470-12, for the alarm value of channel 12.

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	6	17	12	0	2	0	0	0	

The RCMS470-12 signals a „fault current of 3 A“ (depending on the setting of residual current/overcurrent/undercurrent) as alarm value (function 3, input data).

Word 1		Word 2		Word 3		Word 4		Word 5	
0	6	17	12	0	2	0	56	3	

8.2 Operating messages

The Modbus RTU Master addresses BMS address 25, the control device PRC487, for information about the state of Line 1 (operating message). This information is available at channel 1.

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	7	25	1	0	4	0	0	0	

The PRC487 replies that Line 1 is carrying current and is ready for operation (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	7	25	1	0	4	0	13	*201	

* The answer in byte 8 could also be 210, 211 or 212.

The Modbus RTU Master addresses BMS address 29, the IRDH.... insulation monitoring device, for information about the actual insulation resistance (operating message). This information is available at channel 1 of the IRDH.....

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	8	29	1	0	4	0	0	0	

The IRDH.... replies that the value of the actual insulation resistance is 185 kOhm (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	8	29	1	0	4	0	61	185	

The Modbus RTU Master addresses BMS address 29, 107TD47, for information about the actual load of the transformer (operating message). This value is available at channel 2 of the device:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	9	29	2	0	4	0	0	0	

The 107TD47 replies that the transformer utility is 66% (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	9	29	2	0	4	0	65	66	

8.3 Measuring values, with regard to the channels

The following examples only differ in their replies.

The Modbus RTU Master addresses BMS address 7, the RCMS470-12 residual current monitor, for information about the actual measuring value. This value is available at channel 10.

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	10	7	10	0	105	0	0	0	

The RCMS470-12 replies that a fault current of 100 mA is the measuring value to channel 10 (function 3, input data).

Word 1		Word 2		Word 3		Word 4		Word 5	
0	10	7	10	0	105	0	55	100	

The Modbus RTU Master addresses BMS address 7, the RCMS470-12 residual current monitor, for information about the actual measuring value. This value is available at channel 10.

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	11	7	10	0	105	0	0	0	

The RCMS470-12 signals a fault current of 9 A as the actual measuring value (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	11	7	10	0	105	0	56	9	

The Modbus RTU Master addresses BMS address 20, the insulation monitoring device 107TD47, for the actual measuring value. This information is available at channel 1 of the 107TD47:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	12	20	1	0	105	0	0	0	

The 107TD47 signals an insulation resistance of 100 kOhm as measuring value. (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	12	20	1	0	105	0	61	100	

8.4 Temporary Master takeover and return

Certain commands in a BMS network can only be carried out when the FTC470XMB takes over the Master function. This is required for the parameterization of BMS devices, for example.

When BMS address 1 is continuously assigned to the FTC470XMB, taking over of the Master function is not necessary.



*The FTC470XMB **must** take over the Master function in case of parameter requests and new parameter settings!*

Take into account that the Master function must be returned by the FTC470XMB after taking over the Master function and the subsequent parameterization.

8.4.1 Taking over the Master function

BMS address 3 is to be assigned to the protocol converter FTC470XDP.

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	30	3	0	0	112	0	2	0	

FTC470XMB acknowledges the temporary change to Master mode.

(function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	30	3	0	0	112	0	2	0	

8.4.2 Returning the Master function

The Modbus RTU Master sends an appropriate command to FTC470XMB

(function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	40	3	0	0	112	0	101	0	

FTC470XMB acknowledges the change to Slave mode (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	40	3	0	0	112	0	101	0	

8.5 Control commands for use in the Master mode

For the control commands in the tables below the FTC470XMB is required to take over the Master function or must already be in this mode.

The Modbus RTU Master deletes all existing alarm messages of all the devices connected to the bus:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	13	0	0	0	13	0	0	0	

All existing alarms are being deleted, neither a reply nor an acknowledgement is sent by the respective device (function 3, input data).t)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	13	0	0	0	13	0	255	255	

The Modbus RTU Master deletes all alarm messages of an EDS470-12 insulation fault evaluator with address 5:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	14	5	0	0	13	0	0	0	

The existing alarms of the EDS470-12 are being deleted, but not acknowledged by the device (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	14	5	0	0	13	0	255	255	

The Modbus RTU Master deletes all alarm messages of an RCMS470-12 residual current evaluator with address 10:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	15	10	0	0	13	0	0	0	

The existing alarms of the RCMS470-12 are being deleted and acknowledged (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	15	10	0	0	13	0	0	0	

The Modbus RTU Master introduces an internal self test of a 107TD47 insulation monitoring device with address 3:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	16	3	0	0	8	0	0	0	

The 107TD47 carries out a self test and acknowledges it (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	16	3	0	0	8	0	0	0	

The Modbus RTU Master mutes the buzzer of an MK2418 alarm indicator and test combination with address 22:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	17	22	0	0	14	0	0	0	

MK2418 acknowledges the buzzer mute (software 2.0 or higher (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	17	22	0	0	14	0	0	0	

8.5.1 Interrogating the FTC470XMB device type

For fault finding or commissioning, the following example can be helpful.

The device type of the protocol converter FTC470XMB with address 1 (= Master) is to be interrogated.

The Modbus RTU Master interrogates FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	1	1	0	0	20	0	0	0	

The Modbus RTU Master receives data type 203 as identification for FTC470XMB (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	1	1	0	0	20	0	203	0	

8.6 Control commands for use in the BMS Slave mode

For carrying out the control commands below, the FTC470XMB is **not** required to take over the Master function.

The Modbus RTU Master instructs a random Master in a BMS network to start insulation fault location in an EDS system. FTC470XMB is in Slave mode during the whole process:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	18	1	0	0	115	0	3	0	

Insulation fault location is being started and acknowledged (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	18	1	0	0	115	0	3	0	

The Modbus RTU Master instructs a random Master in a BMS network to start insulation fault location in an EDS system in POSITION mode. The value to be requested is available at channel 3 with BMS address 7. FTC470XMB is in the Slave mode during the whole process:

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	19	1	0	0	115	0	5	0	

Insulation fault location in POSITION mode is being started and acknowledged (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	19	1	0	0	115	0	5	*2	*191

In this example the „value“ results from linking High-Byte and Low-Byte (byte 7+8).

* The value of the whole „address“ is formed as follows:

"Address" = (BMS address x 100) + channel number.

As shown in the example above, the result of linking address = 7 and channel = 3 is 703.

703 = 2BF hex

Byte 7 = 002 decimal

Byte 8 = 191 decimal

8.6.1 Requesting the measuring value of all channels of an RCMS470-12

The actual measuring values of all 12 channels of an RCMS470-12 with address 12 are to be interrogated.

For that purpose the Modbus RTU Master at first interrogates channel 1 (output data):

The Modbus RTU Master sends an appropriate command to FTC470XMB (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	20	12	1	0	105	0	0	0	

In return the RCMS470-12 sends a measuring value of 22 mA to channel 1 (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	20	12	1	0	105	0	55	22	

Channel 2 is being requested (function 16, output data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	21	12	2	0	105	0	0	0	

In return the RCMS470-12 sends a measuring value of 224 mA to channel 2 (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	21	12	2	0	105	0	55	224	

Channel 3 is being requested (function 16, output data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	22	12	3	0	105	0	0	0	

In return the RCMS470-12 sends a measuring value of 8 A to channel 3 (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	22	12	3	0	105	0	56	8	

Channel 4 is being requested (function 16, output data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	23	12	4	0	105	0	0	0	

The RCMS470-12 replies that channel 4 has been switched off (function 3, input data)

Word 1		Word 2		Word 3		Word 4		Word 5	
0	23	12	4	0	105	0	21	0	

The channels 5 to 12 are to be requested consecutively, as shown in the example.

8.6.2 Requesting a device type after taking over the Master function by FTC470XMB

The following example shows the Master takeover, the subsequent interrogation and Master return. In this example it is assumed that BMS address 2 is assigned to FTC470XMB 2. By assigning BMS address 1 to the FTC470XMB, it would anyway have the Master function.

Requesting the device type (EDS470)

The insulation fault evaluator EDS470-12 with address 5 is to be interrogated. For that purpose, at first the protocol converter FTC470XMB with address 2 must take over the Master function

The Modbus RTU Master instructs the FTC470XMB to take over the Master function (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	1	2	0	0	112	0	2	0	

The Master function is acknowledged (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	1	2	0	0	112	0	2	0	

The Modbus RTU Master interrogates the device type of EDS470-12 (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	2	5	0	0	20	0	0	0	

The Modbus RTU Master reads the device type of EDS470-12 (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	2	5	0	0	20	0	31	0	

The Modbus RTU Master instructs the FTC470XMB to return the Master function to the initial Master (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	3	2	0	0	112	0	101	0	

The return of the Master function is acknowledged (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	3	2	0	0	112	0	101	0	

8.6.3 Parameter setting after the FTC470XMB has taken over the Master function

The examples below show the taking over of the Master function, the subsequent activity and the Master return. All the examples are based on the assumption that the BMS address of the FTC470XMB is 2. By assigning BMS address 1 to the FTC470XMB, it would anyway have the Master function.

Changing the operating mode of an alarm relay (107TD47)

The operating mode of the alarm relay of the insulation monitoring device 107TD47 with address 4 is to be changed from N/O operation to N/C operation. For that purpose, the protocol converter FTC470XMB with BMS address 2 at first has to take over the Master function.

The Modbus RTU Master instructs FTC470XMB to take over the Master function (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	4	2	0	0	112	0	2	0	

The transfer of the Master function will be acknowledged (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	4	2	0	0	112	0	2	0	

The Modbus RTU Master sets the operating mode of the alarm relay of the 107TD47 to N/C operation (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	5	4	0	0	25	0	0	0	

The changed operation mode is acknowledged (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	5	4	0	0	25	0	31	0	

The Modbus RTU Master instructs FTC470XMB to return the Master function to the initial Master (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	6	2	0	0	112	0	101	0	

The return of the Master function is acknowledged (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	6	2	0	0	112	0	101	0	

Switching two channels of an RCMS470 off

The channels 11 and 12 of a residual current evaluator RCMS470-12 with address 10 are to be switched off because they are not used. In this way the measuring time of the devices can be reduced. At first, the Modbus RTU Master instructs the FTC470XMB to take over the Master function

The Modbus RTU Master instructs FTC470XMB to take over the Master function (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte	H-Byte	L-Byte
always „0“	Consecutive Modbus ID No.	BMS address of the addressed device	BMS channel No.	always „0“	BMS command	always „0“	BMS data type	BMS data value	
0	7	2	0	0	112	0	2	0	

The transfer of the Master function is acknowledged (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	7	2	0	0	112	0	2	0	

The Modbus RTU Master disables channel 11 of the RCMS470-12 (function 16, output data.):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	8	10	11	0	38	0	1	3	

Acknowledgement that channel 11 has been disabled: (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	8	10	11	0	38	0	1	3	

The Modbus RTU Master disables channel 12 of the RCMS470-12 (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	9	10	12	0	38	0	1	3	

Acknowledgement that channel 12 has been disabled: (function 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	9	10	12	0	38	0	1	3	

The Modbus RTU Master instructs FTC470XMB to return the Master function to the initial Master (function 16, output data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	10	2	0	0	112	0	101	0	

The return of the Master function is acknowledged (function: 3, input data):

Word 1		Word 2		Word 3		Word 4		Word 5	
0	10	2	0	0	112	0	101	0	

9. Service and support

9.1 Damage in transit

Damage in transit must be confirmed directly by the carrier. In case of doubt, please inform Bender immediately:

Dipl.-Ing. W. Bender GmbH&Co.KG
Londorfer Straße 65
35305 Grünberg
+49(0)6401/807-0

9.2 Malfunctions

If the FTC470XMB leads to malfunctions in the connected system, please refer to the accompanying technical manual.

9.2.1 What shall be checked?

Check whether ...

- the device is supplied by the correct supply voltage U_s
- the BMS bus cable is correctly connected and terminated (120 Ω)
- the Modbus RTU cable is correctly connected and terminated (DIP switch)
- the BMS address is correctly set
- the Modbus RTU address is correctly set
- the Modbus RTU command "requesting device type" to FTC470XMB provides the correct result. Otherwise the FTC470XMB is already operating incorrectly. The Data Words to be input are shown in "chapter 7.5.1 Requesting the device type of the FTC470XMB"
- the Modbus RTU commands for FTC470XMB show the correct syntax.

9.2.2 Where do you get help?

If, after thorough reading of the technical manual and intensive fault location in your installation, you cannot clear the fault signalled by the protocol converter FTC470XMB, please contact our technical sales office:

0049 6401 807-0

or contact us via the Internet:

info@bender-de.com

9.3 Warranty claims

Bender warrants the FTC470XMB to be free from defects in material and workmanship under normal use and service for a period of 24 months from the date of delivery.

This warranty does not extend to any kind of maintenance work and shall only be valid for the first purchaser and shall not extend to products or individual parts thereof which have not been correctly used, or which have undergone modifications. Any warranty shall lapse if the device is used other than for the intended purpose.

The warranty obligation is limited to the repair or the exchange of a product which has been

sent to Bender within the warranty period. The qualifying conditions are that Bender shall recognize this product as being faulty, and that the fault cannot be attributed to improper handling or modification of the device, nor to abnormal operating conditions.

Any warranty obligation shall lapse if repairs are undertaken by persons who are not authorized. by BENDER.

BENDER shall not assume any liability for direct or indirect concomitant or subsequent damage regardless of whether these are attributable to legal, illegal or other actions.

9.4 Warranty and liability

Warranty and liability claims in cases of damage to persons and property shall be excluded if they are attributable to one or more of the following causes:

- Use of the FTC470XMB other than for the intended purpose
- Incorrect assembly or installation, commissioning, operation and maintenance of the device
- Operation of the device with faulty safety equipment, or safety and protective devices which are not correctly positioned or are not capable of functioning
- Failure to comply with the information in the operating instructions regarding transport, storage, assembly or installation, commissioning, operation and maintenance
- Unauthorized structural modifications to the device
- Failure to comply with the technical data
- Improperly executed repairs, and the use of spare parts or accessories which are not recommended by the manufacturer
- Cases of disaster and force majeure

10. Technical data

10.1 Technical data in tabular form

The values marked with * are absolute values

Insulation coordination acc. to IEC 60664-1

Rated voltage.....	AC 250 V
Rated impulse voltage/pollution degree	4 kV / 3

Voltage ranges

Supply voltage U_s (see nameplate)	AC/DC 85...276 V
.....	DC independent of polarity
Frequency range U_s	50...400 Hz
Max. power consumption	12 VA

Displays

Modbus RTU	4 diagnosis LEDs: ACTIVE (Processing), BF (bus error), RUN (bus ready), DIAG (HW setting status)
BMS bus	4 diagnosis LEDs: ON, Alarm, FAULT, BMS

Serial interfaces

Modbus RTU	RS485 Sub D 9 pole, electrically isolated/ Modbus RTU Slave protocol
BMS bus	RS485 (terminals A/B) / BMS protocol
Max. cable length	1200 m
Recommended cable (screened, screen on one side connected to PE)	J-Y(St)Y 2x0.6
Terminating resistor Modbus.....	DIP switch
Terminating resistor BMS.....	terminal connections, 120 Ω (,5 W)
Address assignment Modbus RTU	DIP switches, 1...127
Address assignment BMS.....	DIP switches, 1...30
Baud rate Modbus RTU.....	1.2...57.6 kBit/s
.....	factory setting: 19.2 kBit/s
Baud rate BMS	9.6 kBit/s

General data

EMC immunity	according to IEC 61326
EMC emission	according to IEC 61326
Shock resistance IEC60068-2-27 (device in operation)	15 g / 11 ms
Bumping IEC60068-2-29 (during transport)	40 g / 6 ms
Vibration resistance IEC 60068-2-6 (device in operation).....	1 g / 10...150 Hz
Vibration resistance IEC 60068-2-6 (during transport)	2 g / 10...150 Hz
Ambient temperature (during operation)	-10 °C...+55 °C
Ambient temperature (storage)	-40 °C...+70 °C
Climatic class according to IEC 60721-3-3	3K5
Operating mode	continuous operation
Mounting	any position
Connection.....	screw terminals
Connection rigid, flexible.....	0.2...4 mm ² / 0.2...2.5 mm ²
Connection, flexible with connector sleeve, without/with plastic sleeve	0.25...2.5 mm ²
Conductor sizes (AWG)	24...12
Protection class, internal components (DIN EN 60529)	IP30
Protection class, terminals (DIN EN 60529).....	IP20
Type of enclosure.....	X470, free from halogen
DIN rail mounting according to	IEC 60715

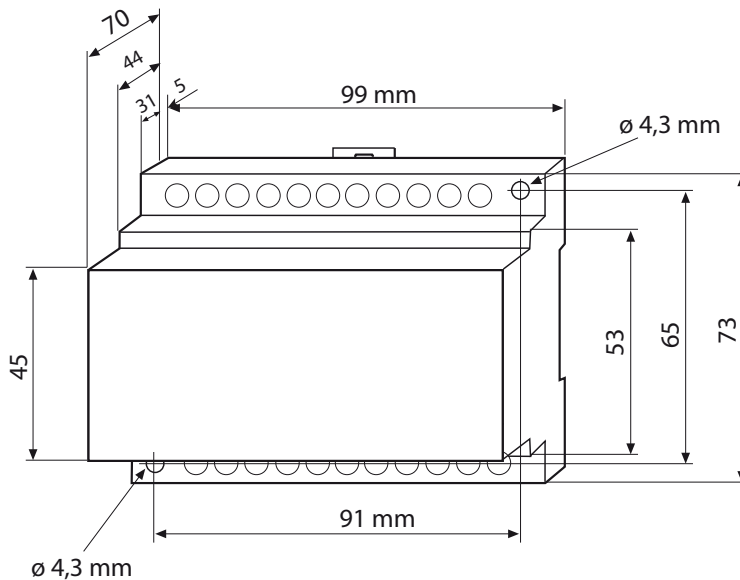
Flammability class..... UL94V-1
 Weight approx. 350 g

Option „W“

Shock resistance according to IEC 60068-2-27 (device in operation) 30 g / 11 ms
 Bumping according to IEC 60068-2-29 (transport) 40 g / 6 ms
 Vibration resistance according to IEC 60068-2-6 1.6 mm / 10...25 Hz
 4 g / 25...150 Hz
 Ambient temperature, during operation..... -25 °C...+70 °C
 Ambient temperature (storage) -40 °C...+85 °C
 Screw mounting..... 2 x M4

10.2 Dimension diagram

FTC470XMB is incorporated in a Bender enclosure of the X470 series, as described below.



Possible is:

- DIN rail mounting according to IEC 60715
- Screw Mounting

10.3 Ordering details

Type	Supply voltage U_S	Art. No.
FTC470XMB	AC 85...276 V / DC 85...276 V	B 9506 1002

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