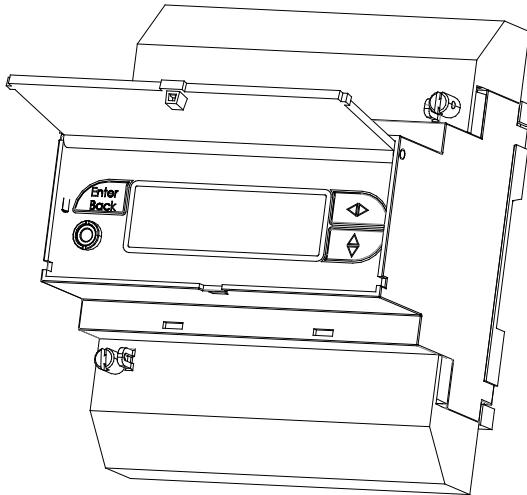




OPERATING MANUAL

M-BUS PROTOCOL for ML 311



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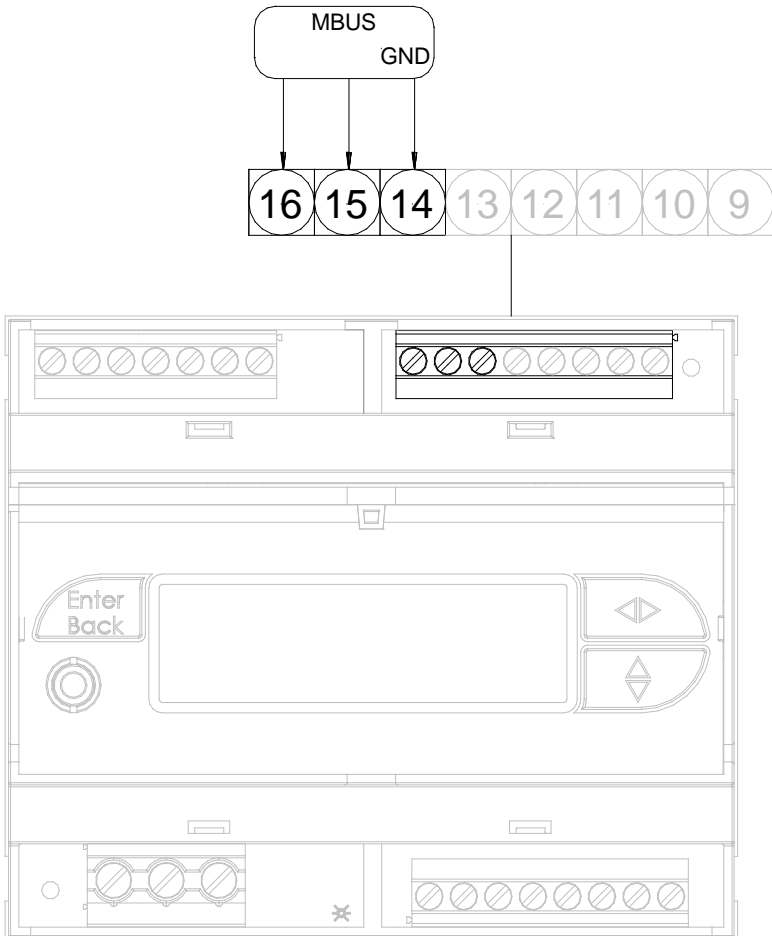
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INTRODUCTION

The **M-Bus** (Meter Bus) was developed to fill the need for a system for the networking and remote reading of utility meters, for example to measure the consumption of gas or water in the home. This bus fulfills the special requirements of remotely powered or battery driven systems, including consumer utility meters. When interrogated, the meters deliver the data they have collected to a common master, which can, for example, be a hand-held computer, connected at periodic intervals to read all utility meters of a building. An alternative method of collecting data centrally is to transmit meter readings via a modem. Other possible applications in home electronic systems for the M-Bus are alarm systems, flexible illumination installations and heating controlling.

HARDWARE CONNECTION



SETTING ML 311 TO COMMUNICATE WITH M-BUS PROTOCOL

- 1) Select Menu 6-COMMUNICAT. -> Select Function Protocol -> Select MBUS protocol type
- 2) Select Menu 6-COMMUNICAT. -> Select Function Address -> Insert the M-BUS Primary address of the ML 311
- 3) Select Menu 6-COMMUNICAT. -> Select Function Speed -> Select the M-BUS communication speed
- 4) Select Menu 6-COMMUNICAT. -> Select Function Parity -> Set the EVEN parity for the M-BUS communication protocol

ABBREVIATION DESCRIPTION

Abbreviation	Description
REQ_UD2	Request for an RSP_UD telegram
RSP_UD	Data telegram from ML 311 to Master
SND_UD	Data telegram from Master to ML 311 (Send User Data to Slave)
SND_NKE	Initialization telegram in accordance with EN 13757
ACK	Confirmation telegram in accordance with EN 13757
PADR	Place-holder for the Primary address (1 byte)
LEN	Place-holder for the length byte (1 byte), calculated in accordance with EN 13757
IDENT	Place-holder for the secondary address (4 bytes)
MAN	Place-holder for the manufacturer code (2 bytes)
DEV	Place-holder for the device version (1 byte)
MED	Place-holder for the medium (1 byte)
ACC	Place-holder for the access counter (1 byte)
STAT	Place-holder for the status (1 byte)
CS	Place-holder for the checksum (1 byte), calculated in accordance with EN 13757

THE ACK TELEGRAM

The ACK telegram is send by the ML 311 to the Master for confirm the acquisition of the parameterization commands.

The ACK telegram format:

Name	Number of byte	Value	Description
ACK	1	0xE5	

ADDRESSING TYPE VIA M-BUS PROTOCOL

Primary addressing

Every ML 311 in an M-BUS network can be addressed via primary addressing.

The Primary address range allowed is 0 ... 250.

Each telegram contains the Primary address in the A field.

The Primary address can be set with the function Address in the Menu 6-COMMUNICAT. or via M-BUS with the following telegram:

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	0x06	
L field	1	0x06	
Start field	1	0x68	
C field	1	0x53/0x73	SND_UD (Send User Data to Slave)
A field	1	PADR	Old Primary address
CI field	1	0x51	Parameterization telegram
DIF	1	0x01	
VIF	1	0x7A	
Value	1		New Primary address 0...250
Checksum	1	CS	
Stop field	1	0x16	

The ML 311 respond with an ACK telegram.

Secondary addressing

If an M-Bus network contains more than 250 meters, it is possible to use the Secondary addressing.

Secondary addressing uses the A field (Primary address) with the value of 253 (0xFD) and the Slave is identified with the 8-byte header of the telegram.

The 8-byte header of the telegram has the following composition:

- Secondary address number
- Manufacturer code
- Device version
- Medium

Secondary addressing communication must be initialized with a Slave select telegram and at the end of the communication it is necessary to de-select the Slave.

Slave select telegram:

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	0x0B	

L field	1	0x0B	
Start field	1	0x68	
C field	1	0x53/0x73	SND_UD (Send User Data to Slave)
A field	1	0xFE	Secondary addressing
CI field	1	0x52	Slave select telegram
Secondary address	4	IDENT	Secondary address number
Manufacturer code	2	MAN	0x266F = ISO (Isoil)
Device version	1	DEV	0x00 MBUS version of ML 311
Medium	1	MED	0x04 = return – 0x0C = flow
Checksum	1	CS	
Stop field	1	0x16	

If all 8 bytes of the ML 311 of the M-BUS network match with the select telegram, it is selected and responds with an ACK telegram.

If at least one of the 8 bytes does not match, the Slave is deselected and does not respond.

The Slave can be de-select with the following telegram:

Slave de-select telegram:

Name	Number of byte	Value	Description
Start field		0x10	
C field		0x40	SND_NKE
A field		PADR	Primary address
Checksum		CS	
Stop field		0x16	

The ML 311 respond with an ACK telegram.

Only the 4 bytes of the Secondary address number can be set via M-BUS. The other bytes are fixed for the ML 311.

The Secondary address number is saved in EEPROM.

It is possible to set the 4 bytes of the Secondary address number with the following telegram:

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	0x09	
L field	1	0x09	
Start field	1	0x68	
C field	1	0x53/0x73	SND_UD (Send User Data to Slave)
A field	1	PADR	Primary address
CI field	1	0x51	Parameterization telegram

DIF	1	0x07/0x0C	Set Secondary address
VIF	1	0x79	
Value	8		New Secondary address
Checksum	1	CS	
Stop field	1	0x16	

The ML 311 respond with an ACK telegram.

Point to point addressing

If the M-Bus network consists of a M-BUS Master and a single ML 311, point to point addressing can be used.

In a point to point communication the A field (Primary address) in the Master telegram is set to 254 (0xFE).

The Primary address of the ML 311 is irrelevant in a point to point communication.

Broadcast addressing

Broadcast addressing is used when is necessary to send a common message to all the devices of a M-BUS network at the same time, for example the date and time.

The A field (Primary address) in the telegram of the Master is set to 255 (0xFF).

The ML 311 does not respond to broadcast telegrams, but executes the commands.

The Primary address of the ML 311 is irrelevant in a Broadcast addressing communication.

M-BUS PARAMETERIZATION TELEGRAMS

Parameterize Date and Time

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	0x09	
L field	1	0x09	
Start field	1	0x68	
C field	1	0x53/0x73	SND_UD (Send User Data to Slave)
A field	1	PADR	Primary address
CI field	1	0x51	Parameterization telegram
DIF	1	0x04	
VIF	1	0x6D	
Value	4		New Date and Time
Checksum	1	CS	
Stop	1	0x16	

The ML 311 respond with an ACK telegram.

The Date and time do not support the summer/winter bit.

Parameterize Process data response telegram

The list of process data in the RSP_UD response telegram can be selected using the following telegram.

The appropriate DIF and VIF must be used depending on the response telegram required.

The factory setting for the ML 311 is the Standard telegram.

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	LEN	
L field	1	LEN	
Start field	1	0x68	
C field	1	0x53/0x73	SND_UD (Send User Data to Slave)
A field	1	PADR	Primary address
CI field	1	0x51	Parameterization telegram
DIF	1	0x08/0x28	0x08 = readout Process data 0x28 = readout Cooling Energy counter
VIF	1		VIF(EN 1434-3)
Checksum	1	CS	
Stop field	1	0x16	

The ML 311 respond with an ACK telegram.

The Global readout telegram

The following telegram set the response telegram for return the Full process data list from the ML 311.

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	0x04	
L field	1	0x04	
Start field	1	0x68	
C field	1	0x53/0x73	SND_UD (Send User Data to Slave)
A field	1	PADR	Primary address
CI field	1	0x51	Parameterization telegram
DIF	1	0x7F	Global readout telegram
Checksum	1	CS	
Stop field	1	0x16	

The ML 311 respond with an ACK telegram.

The Application reset telegram

The application reset telegram set the response telegram to the Standard response telegram.

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	0x03	
L field	1	0x03	
Start field	1	0x68	
C field	1	0x53/0x73	SND_UD (Send User Data to Slave)
A field	1	PADR	Primary address
CI field	1	0x50	Application reset
Checksum	1	CS	
Stop field	1	0x16	

The ML 311 respond with an ACK telegram.

M-BUS READOUT TELEGRAMS - READING PROCESS DATA FROM ML 311

The reading of the process data from the ML 311 is always initiated by the Master by means of an REQ_UD2 telegram. The ML 311 responds with the RSP_UD telegram.

The RSP_UD telegram is configurable with the SND_UD telegram (see previous sections).

When the ML 311 is turned on it respond with the Standard telegram that contains the main process data.

The REQ_UD2 telegram

With the REQ_UD2 telegram the Master send the request of the process data to the ML 311.

The ML 311 return the list of the process data depending on the list selected.

The possible lists of process data can be the Standard list, the Full process data list or a combination of process data set with the SND_UD telegram (see previous sections).

Name	Number of byte	Value	Description
Start field	1	0x10	
C field	1	0x5B/0x7B	REQ_UD2 (Request for Class 2 Data)
A field	1	PADR	Primary address
Checksum	1	CS	
Stop	1	0x16	

NOTE: The ML 311 does not distinguish between 0x5B and 0x7B in the C field.

The RSP_UD Standard telegram

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	LEN	
L field	1	LEN	
Start field	1	0x68	
C field	1	0x08	RSP_UD (response from Slave to Master)
A field	1	PADR	Primary address
CI field	1	0x72	Readout telegram
Secondary address	4	IDENT	Secondary address
Manufacturer	2	0x6F26	0x266F = ISO (Isoil)
Device version	1	DEV	M-BUS protocol version implemented
Medium	1	MED	0x04 = return – 0x0C = flow
Readout Counter	1	ACC	Incremented on each readout
Status	1	STAT	Status (see EN 13757)
Signature	1	0x0000	Not used
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)

VIF	1 (2)	VIF/VIFE (EN 1434-3)	0x03 = [Wh] 0x06 = [kWh] 0xFB01 = [MWh] 0x08 = [J] 0x0B = [kJ] 0x0E = [MJ] 0xFB09 = [GJ]
Value	4		Heating Energy counter
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	0x16	[m ³]
Value	4		Volume counter vector fluid
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	0x17	[m ³]
Value	4		Volume counter hot water
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	0x18	[m ³]
Value	4		Volume counter cold water
DIF	1	0x04	Instantaneous value - Long (32 bits)
VIF	1	VIF/VIFE (EN 1434-3)	0x20 = seconds 0x21 = minutes 0x22 = hours
Value	4		work time of the board
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x2B = [W] 0x2E = [kW]
Value	4		Power
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	0x3E	[m ³ /h]
Value	4		Flow rate
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x5B = [°C]
Value	4		Supply temperature
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x5F = [°C]

Value	4		Return temperature
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x63 = [K]
Value	4		Delta T
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1 (2)	VIF/VIFE (EN 1434-3)	0x03 = [Wh] 0x06 = [kWh] 0xFB01 = [MWh] 0x08 = [J] 0x0B = [kJ] 0x0E = [MJ] 0xFB09 = [GJ]
Value	4		Cooling energy
Checksum	1	CS	
Stop	1	0x16	

NOTE: The STAT byte can have the following values:

STAT = 0x00 -> no error

STAT = 0x02 -> Any application error and in this case it is possible to read the status byte of the alarms (see the last section).

The RSP_UD Full process data list telegram

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	LEN	
L field	1	LEN	
Start field	1	0x68	
C field	1	0x08	RSP_UD (response from Slave to Master)
A field	1	PADR	Primary address
CI field	1	0x72	Readout telegram
Secondary address	4	IDENT	Secondary address
Manufacturer	2	0x6F26	0x266F = ISO (Isoil)
Device version	1	DEV	M-BUS protocol version implemented
Medium	1	MED	0x04 = return - 0x0C = flow
Readout Counter	1	ACC	Incremented on each readout
Status	1	STAT	Status (see EN 13757)
Signature	1	0x0000	Not used
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)

VIF	1 (2)	VIF/VIFE (EN 1434-3)	0x03 = [Wh] 0x06 = [kWh] 0xFB01 = [MWh] 0x08 = [J] 0x0B = [kJ] 0x0E = [MJ] 0xFB09 = [GJ]
Value	4		Heating Energy counter
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	0x16	[m3]
Value	4		Volume counter
DIF	1	0x04	Instantaneous value - Long (32 bits)
VIF	1	VIF/VIFE (EN 1434-3)	0x20 = seconds 0x21 = minutes 0x22 = hours
Value	4		work time of the board
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x2B = [W] 0x2E = [kW]
Value	4		Power
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	0x3E	[m3/h]
Value	4		Flow rate
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x5B = [°C]
Value	4		Supply temperature
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x5F = [°C]
Value	4		Return temperature
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1	VIF/VIFE (EN 1434-3)	0x63 = [K]
Value	4		Delta T
DIF	1	0x04	Instantaneous value - 32 bits

			Integer
VIF	1	0x6D	F - format
Value	4		Current Date and Time of the ML 311
DIF	1	0x02	16 bits Integer
VIF	1	0x78	VIF/VIFE (EN 1434-3)
Value	2		Board Serial number
DIF	1	0x01	8 bits data
VIF	1	0x7A	VIF/VIFE (EN 1434-3)
Value	1		Primary address
DIF	1	0x05	Instantaneous value - floating point (IEEE 32 bits format)
VIF	1 (2)	VIF/VIFE (EN 1434-3)	0x03 = [Wh] 0x06 = [kWh] 0xFB01 = [MWh] 0x08 = [J] 0x0B = [kJ] 0x0E = [MJ] 0xFB09 = [GJ]
Value	4		Cooling energy
Checksum	1	CS	
Stop	1	0x16	

NOTE: The STAT byte can have the following values:

STAT = 0x00 -> no error

STAT = 0x02 -> Any application error and in this case it is possible to read the status byte of the alarms (see the last section).

M-BUS ALARM STATUS TELEGRAM

The Master inform the ML 311 of the request for reading of the status of the alarms with the following telegram:

Name	Number of byte	Value	Description
Start field	1	0x10	
C field	1	0x5A/0x7A	REQ_UD1 (Request for Class1 Data)
A field	1	PADR	Primary address
Checksum	1	CS	
Stop field	1	0x16	

The ML 311 send the following response telegram:

Name	Number of byte	Value	Description
Start field	1	0x68	
L field	1	0x04	
L field	1	0x04	
Start field	1	0x68	
C field	1	0x08	RSP_UD (response from Slave to Master)
A field	1	PADR	Primary address
CI field	1	0x71	Alarm status telegram
DIF	1		Alarm state
Checksum	1	CS	
Stop field	1	0x16	

NOTE: Alarm state byte description:

Bit0 = 1 -> max flow rate alarm

Bit1 = 1 -> min flow rate alarm

Bit2 = 1 -> measures overflow

Bit3 = 1 -> pulse overflow

Bit4 = 1 -> Ain Outrange (Input 4-20 mA > 5% of range 4-20 mA)

Bit5 = 1 -> Energy Outrange (Energy sign and remote input not match)

Bit6 = 1 -> RTD temperature sensor error

Bit7 = 1 -> power supply error

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