Chapter 4 Communications via M-Bus

M-Bus communications overview

M-Bus is a master / slave communications protocol where the master initiates transactions and the slave(s) respond with the requested information or action. Data is transferred using hexadecimal telegrams.

Communications via M-Bus protocol is available on the iEM2135.

The information in this section is intended for users with an advanced understanding of M-Bus protocol, their communications network and their power system.

Configuring basic communications settings

Before communicating with the meter via M-Bus protocol, use the display to configure the following settings:

Setting	Possible values
Baud rate	300 600 1200 2400 4800 9600
Primary address	1–250

NOTE: The meter is shipped as an unconfigured M-Bus slave with the address 0. You must change the address to a number in the 1–250 range, using the display or communications. If you need to set the address back to 0, you must use the display.

Key terms

Term	Definition
C-Field	The control or function field of the telegram. It provides information about the telegram, such as the direction of data flow (master to slave or slave to master), the status of the data flow and the function of the message.
CI-Field	The control information field of the telegram. It defines the type and sequence of data to be transmitted.
Fixed data header	Contains device and manufacturer identification information.
DIF	Data information field. The DIF contains information about the function of the data (for example, instantaneous) and the data format (for example, 16-bit integer).
DIFE	Data information field extension. A DIFE contain additional information about the data, such as tariff and subunit.
Master	A device that issues commands and receives responses from slave devices. There can be only one master per serial network.
Slave	A device that provides information or performs actions in response to requests from the master.
VIF / VIFE	Value information field and value information field extension. The VIF and VIFE contain information about the value (for example, whether it is an energy or power value). The meter uses both primary VIFE (as detailed in the M-Bus protocol documentation) and manufacturer-specific VIFE.

Related topics

- See the M-Bus organization website at www.m-bus.com for more information on the M-bus protocol.
- See “Communications setup” on page 25 for information on setting the baud rate using a telegram.

M-Bus protocol support

The meter supports the M-Bus protocol as follows:

- Mode 1 communications (least significant bit first).
- Telegram formats:
  - Single character
  - Short frame
  - Long frame
- Function codes (C-field bits 3-0):
  - SND_NKE: Initiates of communications between the master and slave.
  - SND_UD: The master sends user data to the slave.
  - REQ_UD2: The master requests Class 2 user data from the slave.
  - RSP_UD: The slave sends requested data to the master.
- Secondary addressing in accordance with the M-Bus standard.
- Broadcast telegrams.

Related topics

- See the M-Bus organization website at www.m-bus.com for more information on the M-Bus protocol, including secondary addressing procedures.
- See “Fixed data header” on page 21 for the meter-specific information required for secondary addressing (for example, identification number, manufacturer and medium).

M-Bus protocol implementation

M-Bus tool for viewing data and configuring the meter

The M-Bus tool provides a graphical user interface where you can view meter data and configure meter settings. To obtain the tool, go to www.schneider-electric.com and search for your meter model to find the downloads available for the meter, or contact your local Schneider Electric representative.

Communications indicator

A symbol appears on the display when the meter is communicating. You can use this indicator to assist in communications troubleshooting.

Related topics

- See “M-Bus tool for data display and meter configuration” on page 25 for information on obtaining and using the M-Bus tool.
- See “Communications troubleshooting” on page 29 for more information on troubleshooting communications issues.

Variable data structure telegram information

Fixed data header

Secondary address information						
Byte 1-4 Identification No.	**Byte 5-6 Manufacturer**	**Byte 7 Version**	**Byte 8 Medium**	**Byte 9 Access No.**	**Byte 10 Status**	**Byte 11-12 Signature**
Serial number of the meter in an 8-digit, BCD coded format The serial number can also be found on the meter front panel.	4CA3 hex = Schneider Electric	Firmware version of the communications board For example, 10 = version 1.0	02 hex (electricity)	Counter of successful access attempts	Indicates M-Bus application errors	Not used

Data record header information

Data formats used by the meter (DIF bits 3-0)

NOTE: x in the hex value is determined by bits 7-4 of the DIF.

Format	bin	hex
No data	0000	x0
8-bit integer	0001	x1
16-bit integer	0010	x2
24-bit integer	0011	x3
32-bit integer	0100	x4
32-bit real	0101	x5
48-bit integer	0110	x6
64-bit integer	0111	x7
Variable length	1101	xD

Data function types used by the meter (DIF bits 5-4)

Function type	bin
Instantaneous	00

Primary VIF used by the meter

NOTE: E denotes the extension bit; x in the hex value is determined by bits 7-4 of the VIF.

Primary VIF	bin	hex	Description
Energy	E000 0011	x3	Wh with a resolution of 10^0
Power	E000 1110	xE	kW with a resolution of 10^3
Bus address	E111 1010	xD	Data type C (unsigned integer), as detailed in the M-Bus protocol documentation
Primary VIFE	1111 1101	FD	Indicates that the first VIFE is a primary VIF extension
Manufacturer-specific VIFE	1111 1111	FF	Indicates that the next VIFE is manufacturer-specific

Primary VIFE codes used by the meter

The primary VIFE codes in the table below are used by the meter when the VIF equals FD hex (1111 1101 bin).

NOTE: E denotes the extension bit; x in the hex value is determined by bits 7-4 of the VIFE.

Primary VIFE codes	bin	hex	Additional information
Manufacturer	E000 1010	xA	—
Model	E000 1100	xC	—
Voltage	E100 1001	x9	Volts with a resolution of 10^0
Current	E101 1100	xC	Amps with a resolution of 10^0
Digital Input	E001 1011	xB	Tariff input information
Error flag	E001 0111	x7	—

Manufacturer-specific VIFE codes

The manufacturer-specific VIFE codes in the table below are used by the meter when the VIF equals FF hex (1111 1111 bin).

NOTE: E denotes the extension bit; the hex value assumes E = 0.

Description	bin	hex
Export energy value	E000 1001	09
Partial energy value	E000 1101	0D
Current	E000 0000	00
Voltage L-N	E000 0100	04
Power Factor	E000 1010	0A
Frequency	E000 1011	0B
Active tariff	E001 0000	10
Tariff control mode	E001 0001	11
Number of phases	E010 0001	21
Number of wires	E010 0010	22
Power system configuration	E010 0011	23
Digital input (tariff) association	E011 0000	30

Telegram information for data records

The following sections outline the telegram information used in data records. The tables contain the following information (if applicable):

- Data format in hex (for example, 16-bit integer)
- Primary VIF in hex
- Primary VIFE codes in bin and hex
- Manufacturer-specific VIFE codes in bin and hex

Meter information

NOTE: E denotes the extension bit; the hex value assumes E = 0.

Data format	Primary VIF Extension		Description
	bin	hex	
0D	E000 1010	0A	Manufacturer “Schneider Electric” in 18-byte ASCII format
0D	E000 1100	0C	Model in ASCII format

Data format	Primary VIF Extension		Description
	bin	hex	
03	E0001 0111	17	Meter error codes: 0 = Code 101: error in executable firmware code 1 = Code 102: calibration data is missing or has errors

Energy and energy by tariff measurements

The energy and energy by tariff measurements listed below are preserved through power failures.

NOTE: E denotes the extension bit; the hex value assumes E = 0.

Data format	DIFE	Primary VIF	Primary VIFE		Manufacturer-specific VIFE		Description
			bin	hex	bin	hex	
07	—	03	—	—	—	—	Total active energy import
07	—	83	—	—	E000 1001	09	Total active energy export
87	40	03	—	—	—	—	Total reactive energy import
87	40	83	—	—	E000 1001	09	Total reactive energy export
07	—	83	—	—	E000 1101	0D	Partial active energy import
87	40	83	—	—	E000 1101	0D	Partial reactive energy import
03	—	—	—	—	E001 0000	10	Active tariff 1 = rate A (tariff 1) active 2 = rate B (tariff 2) active
87	10	03	—	—	—	—	Rate A (tariff 1) active energy import
87	20	03	—	—	—	—	Rate B (tariff 2) active energy import

Instantaneous measurements

NOTE: E denotes the extension bit; the hex value assumes E = 0.

Data format	DIFE	Primary VIF	Primary VIFE		Manufacturer-specific VIFE		Description
			bin	hex	bin	hex	
05	—	2E	—	—	—	—	Active power
85	40	2E	—	—	—	—	Reactive power
85	80 40	2E	—	—	—	—	Apparent power
05	—	—	E100 1001	C9	E000 0100	04	Voltage L-N
05	—	—	E101 1100	DC	E000 0000	00	Current
05	—	—	—	—	E000 1010	0A	Power factor
05	—	—	—	—	E000 1011	0B	Frequency

Meter status information

Use the following information to read system and status information from the meter. See “Telegram information for meter configuration” on page 24 for more information on writing to the meter.

Power system configuration information

NOTE: E denotes the extension bit; the hex value assumes E = 0.

Data format	Manufacturer-specific VIFE		Description
	bin	hex	
03	E010 0011	23	Power system configuration (always 0 = 1PH2W L-N)
03	E010 0010	22	Number of wires (always 2)
03	E010 0001	21	Number of phases (always 1)
03	E010 0100	24	Nominal frequency (always 50)

Digital input (tariff) status information

NOTE: E denotes the extension bit; the hex value assumes E = 0.

Data format	Primary VIFE		Manufacturer-specific VIFE		Description
	bin	hex	bin	hex	
03	E001 1011	1B	—	—	Digital input control mode (always 2 = Multi Tariff control)
02	—	—	E011 0010	32	Digital input status: 0 = relay open 1 = relay closed
03	—	—	E011 0000	30	Digital input association with partial energy data reset (always 0 = Digital input is not associated with the partial energy reset)

Telegram information for meter configuration

You can use the information provided in this section to write to the meter using a SND_UD function.

You can also configure the meter using the M-Bus tool available from www.schneider-electric.com.

Supported VIFE codes for meter configuration

NOTE: E denotes the extension bit; the hex value assumes E = 0.

VIFE code		Action	Description
bin	hex		
E000 0000	00	Write and replace	Replaces the old value with the new value.
E000 0111	07	Clear	Resets an accumulated value to 0 (zero).

Example configuration telegram

This example shows the telegram for a command to reset partial energy on a slave with the primary address of 4

hex	Description
68	Start character
07	L-field
07	L-field repetition
68	Start character
53	C-field (control field) SND_UD = Send user data to slave

hex	Description
04	A-field (address field) Slave address of the meter you want to reset
51	CI-field (control information field) Data send to slave
00	Indicates no data is sent (because this is a reset)
FF	VIF indicating the next field is manufacturer specific
8D	Manufacturer-specific VIFE: Reset partial energy
07	Action = Reset
xx	Automatically generated Checksum
16	Stop character

Related topics

- See “M-Bus tool for data display and meter configuration” on page 25 for information on the M-Bus tool.

Communications setup

Setting the primary address

SND_UD code	Data format	Primary VIF	Range/options	Description
00	01	7A	0-250	Primary address

Setting the baud rate

To change the baud rate via communications, send a telegram to the meter with the appropriate value in the CI-field:

Baud rate	Hex value for CI-field
300	B8
600	B9
1200	BA
2400	BB
4800	BC
9600	BD

Resets

NOTE: E denotes the extension bit; the hex value assumes E = 1.

SND_UD code	Data format	Primary VIFE		Manufacturer-specific VIFE		Description
		bin	hex	bin	hex	
07	00	—	—	E000 1101	8D	Resets partial energy accumulation to 0 (imported / exported active and reactive energy).

M-Bus tool for data display and meter configuration

The M-Bus tool provides a graphical user interface where you can view meter data and configure meter settings. To obtain the tool, go to www.schneider-electric.com and search for your meter model to find the downloads available for the meter, or contact your local Schneider Electric representative.

If you access a different meter without closing and re-opening the M-Bus tool, the fields displayed in the tool may not match the device you are accessing. The M-Bus tool may indicate a setting was changed without the setting on the meter actually changing.

NOTICE
INACCURATE DEVICE SETTINGS Do not rely on the configuration information displayed in the M-Bus tool to determine if the associated device is correctly configured. **Failure to follow these instructions can result in inaccurate device settings and data results.**

Installing the M-Bus tool

1. Navigate to the location where you saved the installation files.
2. Double-click setup.exe. A welcome screen appears. Click **Next**.
3. Confirm the installation location for the tool. Click **Browse** if you want to select a different location. Click **Next**. A confirmation screen appears.
4. Click **Next** to begin the installation. A screen appears when the installation is complete.
5. Click **Close**.

Accessing the meter using the tool

Before you access the meter using the M-Bus tool, make sure that you:

- connect the meter to a level converter (for a direct serial connection) or a level converter and gateway (for connection via a serial or Ethernet network).
- set the address of the device to a value other than 0 (zero) using the HMI.
- install the M-Bus tool on your computer.

1. Select **Start > Programs > Schneider Electric > Mbus iEM2135 config tool** (or navigate to the location where you installed the program) and click **Mbus iEM2135 config tool** to open the tool. The login screen appears.
2. Select the port on your computer that you are using to connect to the meter and select the baud rate that matches the meter's configuration.
3. Click **Test Com** to open the communications port.
4. Type the device address in the **Address** field.
5. Select the communications mode that you want the tool to start in:
   - **Monitor(Automatic)**: The tool automatically sends read requests to and receives data from the meter. You can set the interval at which these read requests are sent.
   - **Monitor(Manual)**: You must manually send a read request to get data from the meter.
   - **Config**: The tool opens in configuration mode.

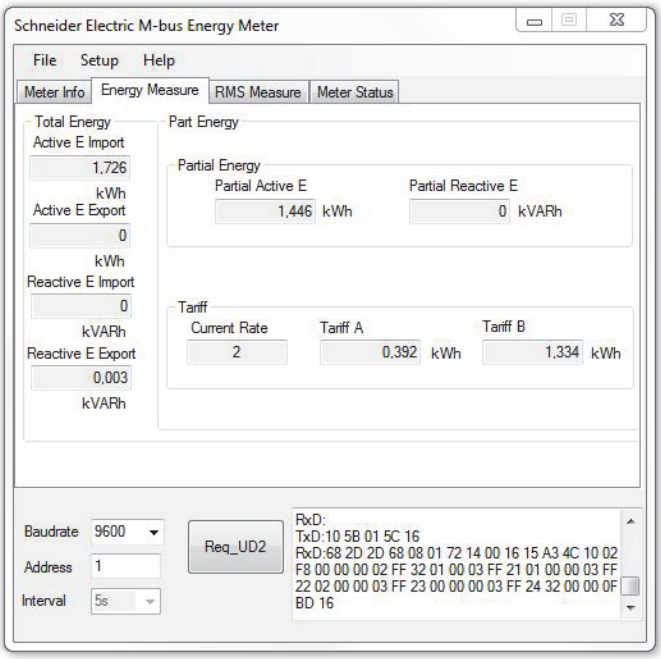
   You can change the mode from within the tool, if needed.
6. Click **OK** to start the M-Bus tool and access the meter.

Viewing meter data using the M-Bus tool

You can use two modes to view data from the device: automatic or manual.

- Automatic mode: Select the update interval from the **Interval** dropdown list.
- Manual mode: Press **Req_UD2** to request data from the meter.

To switch modes, select **Setup > Monitor** then select the mode you want to use.



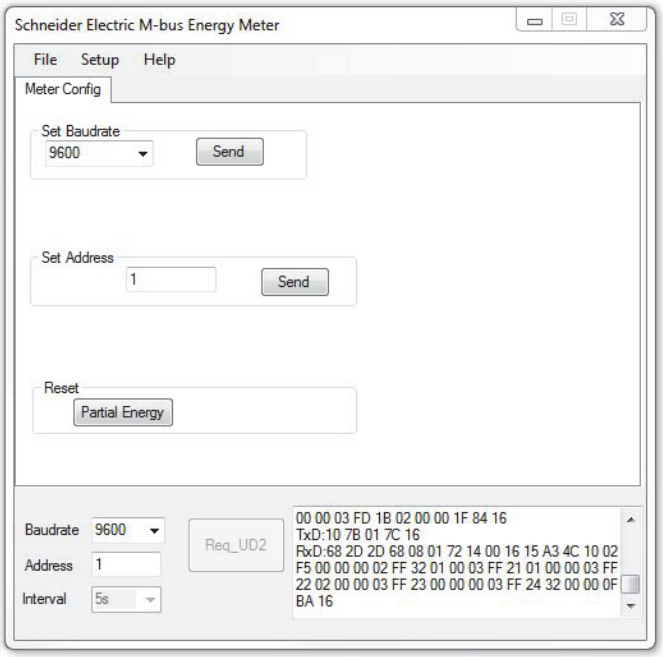
The tool has the following tabs for viewing meter information:

Tab name	Description
Meter Info	This tab provides basic information about the meter (for example, model and serial number) and any active error codes. Click **Clear** to remove the error codes from the display. This does not resolve the errors.
Energy Measure	This tab provides total and partial energy and energy by tariff information.
RMS Measure	This tab provides power, current, and voltage values as well as frequency and power factor information.
Meter Status	This tab provides information on the status of the tariff inputs and existing power system settings.

Configuring the meter using the M-Bus tool

You can use the M-Bus tool to configure basic meter settings.

1. Select **Setup > Config** to switch to configuration mode.



2. Set the values that you want to change then click **Send** for that value or section.
   Some values may be unavailable based on existing settings.
   The configuration screen has the following sections:

Section	Description
Set Baudrate	Set the baud rate.
Set Address	Set the meter address.
Reset	Reset partial energy and input metering accumulations.