elvaco

CMi4110 User Manual

User manual

1.6 Edition
Publication date 2023-11-15

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1. About this manual

This manual covers information needed to mount, install, configure, and use the product. It is intended for installers and system integrators.

To download the latest version of this User manual, visit the Elvaco website, https://www.elvaco.com. There you will also find information about Elvaco's other products and services.

1.1. Symbols

The following symbols are used throughout the manual to emphasize important information and useful tips:

WARNING
Indicates a potentially dangerous situation that could result in severe injuries or serious equipment damage.

CAUTION
Indicates a potentially dangerous situation that could result in minor injuries or equipment damage.

NOTE
Indicates information that is important to take into consideration for safety reasons or to assure correct operation of the product.

TIP
Indicates information intended to help you get the most out of your product. It can for example be used to highlight a possible customization option related to the current section.

1.2. Terms and abbreviations

Abbreviation	Description
DIB	Data Information Block
DIF	Data Information Field
VIF	Value Information Field
MCM	Meter Connectivity Module

Number representation

- Decimal numbers are represented as normal number, i.e. 10 (ten)
- Hexadecimal numbers are represented with prefix 0x, i.e. 0x0A (ten)
- Binary numbers are represented with the prefix 0b, i.e. 0b00001010 (ten)

2. Safety

The following safety precautions must be observed during all phases of the operation, usage, service, or repair of the product. Users of the product are advised to convey the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. Failure to comply with these precautions violates safety standards of design, manufacture and intended use of the product. Elvaco AB assumes no liability for customer's failure to comply with these precautions.

CAUTION
Electrostatic-sensitive product. Observe the necessary ESD protective measures when installing the product.

NOTE
The product receives and transmits radio frequency energy while switched on. Remember that interference can occur if the product is used close to TV sets, radios, computers or inadequately shielded equipment. Follow any special regulations and always switch off the product wherever forbidden, or when you suspect that it may cause interference or danger.

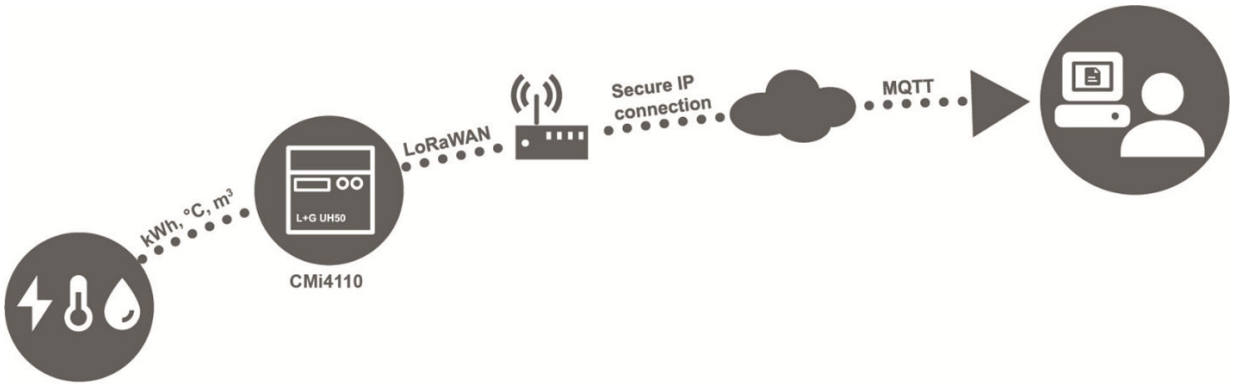
NOTE
Waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Contact your Local Authority for recycling advise.

3. Product

3.1. Application description

CMi4110 is a cost-effective LoRaWAN meter connectivity module, which is mounted in a Landis+Gyr UH50 meter or a UC50 calculator. It uses a very energy-efficient scheme to deliver meter data to a receiving (application) server over a LoRaWAN network. Meter data is securely transmitted, using LoRaWAN end-to-end security scheme.

CMi4110 can both be retrofitted into deployed meters or mounted before deployment.



3.2. Features

CMi4110 has the capability to offer a combination of battery operation with very long lifetime and a versatile application through its many configuration options.

Key features of the module include:

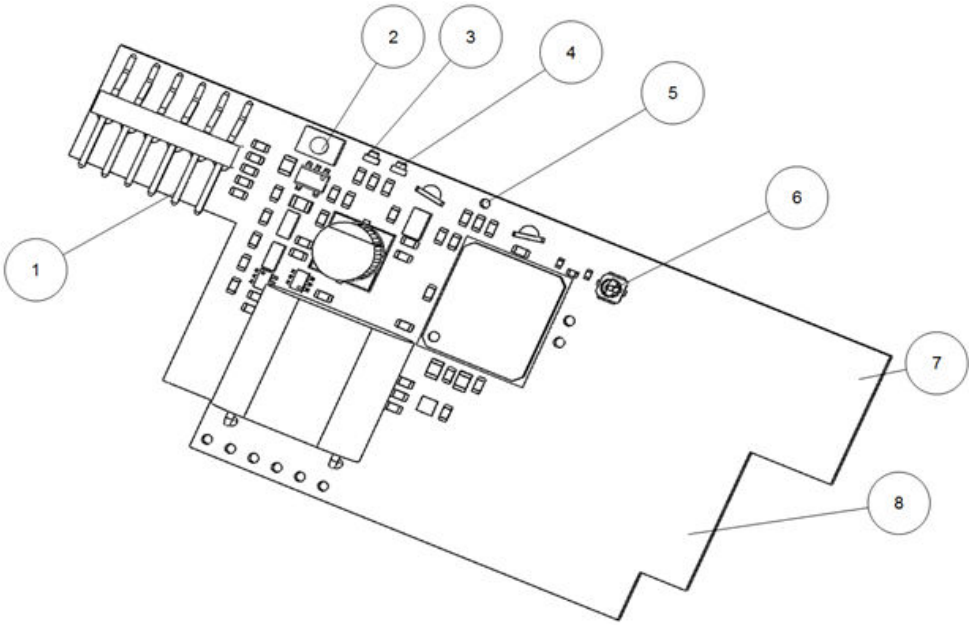
- **LoRaWAN certified**
  The CMi4110 is certified according to LoRaWAN alliance.
  See https://lora-alliance.org/lora_products/cmi4110ext/ for more information.
- **Long battery lifetime**
  The module's EcoMode feature enables the module to achieve a battery-lifetime of at least 11+1 years.
- **No meter installation needed**
  As soon as the meter connectivity module has been mounted and started up, it will join the LoRaWAN network and start delivering meter data, i.e. no manual steps need to be taken in order to install the product in the meter.
- **Quick commissioning**
  The product uses Elvaco's One-Touch Commissioning (OTC) solution to securely and quickly configure products deployed. Using Elvaco's OTC App, simply enter your desired settings and place your phone on the right side of the L+G UH50 meter / UC50 calculator. New settings will be applied instantaneously via NFC.
- **A unique and flexible message scheme**
  - Meter data aligned with meter's internal clock and redundant daily energy values enables coordinated high-precision readouts without network congestion and assures reliable delivery of daily energy consumption.
  - Several message formats to choose between, including JSON, gives the right fit for the unique demands of each application.

3.3. Compatibility

CMi4110 is compatible with all L+G UH50 meters using software version 5.15 or higher as well as with all L+G UC50 calculators using software version 8.06 or higher.

CMi4110 is supplied with power from the UH50/UC50 D cell battery. The module is also compatible with Elvaco's 230V CMip2110 PSUs and with the following PSUs from Landis+Gyr: WZU-AC230, WZU-AC110, WZU-ACDC24-00.

3.4. Parts overview



Buttons, indicators, and connectors

1. Meter interface
2. Push button
3. Green LED
4. Red LED
5. Tamper switch (optional)
6. External antenna connector (optional)
7. LoRa antenna
8. NFC antenna

4. Installation

4.1. Mounting the meter connectivity module

1. Mount CMi4110 in module slot 2 of either;
   a. a L+G UH50 heat meter, or
   b. a L+G UC50 heat calculator.

4.2. Connecting an external antenna

1. Order your desired antenna (wall-mount or magnet-mount) from the Elvaco (or L+G) accessory assortment.
2. Use the SMA connector (6) to connect the external antenna (if using CMi4110Ext).

> ⚠ **CAUTION**
> If using an external antenna, make sure to mount it at least 0.5 meters away from the meter in order not to cause interference.

4.3. Activating the module

Upon delivery, CMi4110 is set to passive mode, which means no messages will be transmitted from the module. There are two ways to activate the module:

Via the module

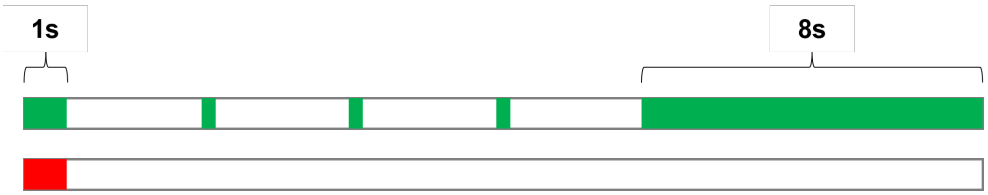
1. Press down the push button (2) for at least 5 seconds until the green LED lights up.
2. Release the button.
3. Wait for one to eleven seconds.
   The CMi4110 indicates start-up by flashing red and green LEDs for one second.

Via Elvaco OTC app

1. Open Elvaco OTC app.
2. Go to **APPLY**.
3. Set the Power mode to “Active”.
4. Select **APPLY** at the bottom of the screen and then *Apply settings*
5. Place the phone on the right side of the meter.
   The mobile phone vibrates three times to indicate that settings have successfully been applied.

4.4. Joining the LoRaWAN network

After activation, CMi4110 will attempt to join the LoRaWAN network. The phase is indicated by short flashes every 5th second on the green LED. When CMi4110 succeeds in joining the LoRaWAN network, the green LED will lighten up for 8 seconds.



Network join LED indication

When the module has joined the LoRaWAN network, meter data will initially be transmitted from the module every minute (regardless of transmit interval settings) in order to set the right data rate. After 10 minutes of calibration, the module will start to deliver meter data using its configured settings.

NOTE
When activation-by-personalization (ABP) is used, the module does not perform a join operation before sending messages. Therefore, the 8-second indication of connection will **not** appear in ABP mode.

Attempts to join the network for firmware version <1.07

If the module fails to join the LoRaWAN network after the first 6 attempts, it will backoff for more time for each new retry until the delay between each retry is more than hours. This is initiated to conserve battery.

A new join attempt cycle can be manually started anytime by pressing down the push button (2) for at least 5 seconds, until the green LED lights up, and then release the button. It will do retries on both DR0 and DR5.

Attempts to join the network for firmware version >=1.07

The module tries to join the LoRaWAN network with six requests, seven seconds apart, then sleeps for twelve hours and then sends another six requests. This sequence goes on forever.

A new join attempt cycle can be manually started anytime by pressing down the push button (2) for at least 5 seconds, until the green LED lights up, and then release the button. It will do retries on both DR0 and DR5.

5. Operation

5.1. Server configuration

Before the module is able to transmit messages via the LoRaWAN network, device information needs to be added to the network server. More specifically, the following parameters needs to be registered (in OTAA mode) in order to enable the network server to receive messages from the module:

- Device EUI (16-digit number printed on the device label)
- Application key
- Join EUI

NOTE
If activation mode is set to “ABP”. the application key does not need to be added to the network server. Instead, the following information will be needed: Network session key, Application session key and Device address.

5.2. Configuration

5.2.1. Configuration via Elvaco OTC app

CMi4110 is configured via the Elvaco OTC app. Elvaco OTC App can be downloaded from Google Play for Android or App Store for iOS. It uses NFC to transfer settings to the module.

1. Open the Elvaco OTC app on your smartphone
2. Place your smartphone close to the device and press *SCAN*

   TIP
   If the CMi4110 is installed in the meter, the NFC field is easiest accessible if placing your smartphone at the lower part on the right hand side of the meter.
3. After a successful scan, the current settings will be displayed on the *INSPECT* tab.
4. To change settings, go to the *APPLY* tab. Use the toggle button to activate an option, and make your changes.
5. When done with changes press *APPLY* at the bottom of the screen, then *Apply settings*, Repeat step 2 to change the settings in the device.
   A successful change is acknowledged by a vibration.

NOTE
The Elvaco OTC app is compatible with iPhone or Android phones with Android 5.0 or later.

5.2.2. Configuration via downlink

The product supports configuration via downlink, i.e. sending commands to an end-device via the LoRaWAN network. Communication via downlink is sent on LoRa port 2 and can only be made in a short window after an uplink transmission from module to server. Therefore, time-critical communication should not be performed over downlink.

Downlink commands are structured according to the following format: *“0x00” "TLV" "Number of bytes in configuration" "Configuration"*.

NOTE
This feature should only be used sparingly due to bandwidth consideration.

5.3. Transmit interval

The transmit interval is used to set how frequently the module should transmit data on the LoRaWAN network. The parameter can be set to a value between 5 and 1440 minutes (i.e. between 5-minute and daily values).

5.3.1. Transmit interval in EcoMode

When EcoMode is active, a battery-lifetime of at least 11+1 years is guaranteed for the module. The module is able to achieve this by using a table of allowed transmit intervals settings for each data rate. When radio conditions are poor (and data rate is low), the module will be able to send data less frequently in order to conserve battery-life. When signal conditions are good, the module will be able to send data more frequently. When EcoMode is enabled, the module will continuously check if the set transmit interval is “allowed” by the EcoMode table. If a lower transmit interval is needed for the specific data rate in order to achieve 11 years of battery life, the module will adjust the parameter accordingly.

Transmit interval for different data rates

Table 1. Data rate and transmit interval FW < 1.07

Data rate	Transmit interval
DR0	60 minutes
DR1 - DR2	30 minutes
DR3 - DR5	15 minutes

Table 2. Data rate and transmit interval FW >= 1.07

Data rate	Transmit interval
DR0	120 minutes
DR1 - DR2	60 minutes
DR3 - DR5	30* minutes

*Since Extended+ is scheduled the minimum practical limit is always 60 minutes.

5.3.2. Setting the transmit interval manually

If the transmit interval needs to be set to a fixed value, EcoMode can be disabled. Use the Elvaco OTC App to configure the transmit interval.

NOTE
If EcoMode has been disabled, guarantees about battery-life no longer apply, even if EcoMode is activated later on.

5.3.3. Setting an upper limit for number of daily telegrams

In some cases, it might be necessary to limit the number of daily telegrams that the module should be allowed to send. By using the MaxDTx parameter, such a limit can be easily set. For example, by setting MaxDTx to “24”, no more than 24 telegrams will be transmitted each day (regardless of the data rate).

Table 3. Examples of MaxDTx setting

MaxDTx value	Maximum transmit interval
1	Once per day
24	Once per hour
48	Once per 30 minutes
96	Once per 15 minutes

NOTE
To achieve a battery life time of 16+1 (storage) years, the MaxDTx parameter needs to be set to 9 or lower.

5.4. Time handling

The module relies on the meter's clock for keeping time. Time in the meter is assumed to be in standard local time (no DST). When synchronizing time in the meter using the OTC App, local standard time is always used, even if DST is in effect. The timestamped meter data sent from the module can be adjusted to be sent in UTC by specifying the "UTC offset" configuration parameter. The UTC offset will be subtracted from the timestamp prior to transmission. If the meter is in Sweden, which uses CET (Central European Time), it should have UTC offset set to +60 (+1h). In this case at time 12.00 a telegram is sent with timestamp 11.00 as this is the corresponding UTC time. A meter in New York (USA) should have a UTC offset of -300 (-5h) etc. A UTC offset of 0 means the meter time is used as-is.

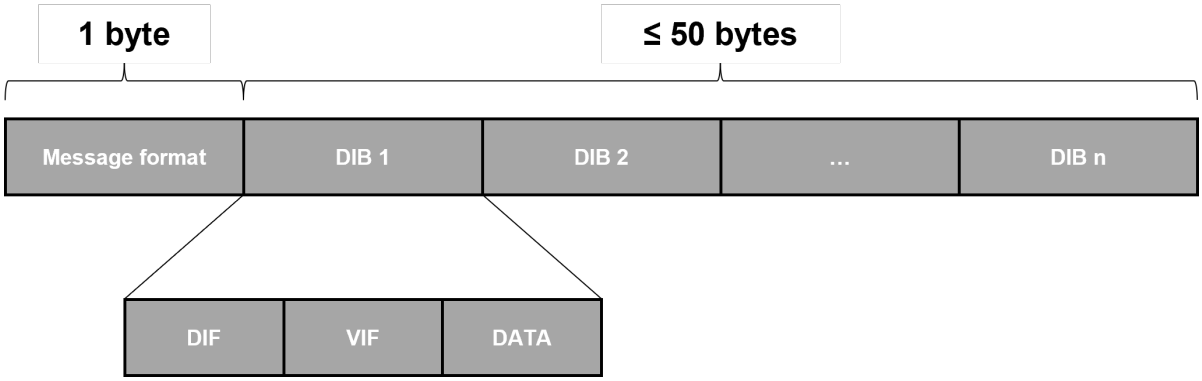
If the meter is set to used DST this is ignored by the module and the standard time is used. Thus, the time on the meter's display may not match the time in the telegram or in the OTC App.

5.5. Adaptive data rate (ADR)

ADR is part of the LoRaWAN standard where the network server determines the optimal rate of communication for the module based on current signal conditions. In the best radio conditions, the module will use its highest data rate (DR5) in order to be as energy-efficient as possible. When signal conditions are poor, the network server will incrementally lower the data rate until it is able to receive the message. When the data rate is low, the energy consumption per telegram will increase.

5.6. Message encoding

All message formats encoded to M-bus standard will have the following structure. Each telegram begins with one byte specifying the message format. Then follows a sequence of data information blocks (DIBs). The data and structure of the DIBs depends on the message type set. Each DIB contains a data information field (DIF), a value information field (VIF) and a data field (DATA), where the actual payload is stored.



M-Bus message structure

For message type JSON, the data is presented as plain text.

5.7. Security and access control

The product has a configuration lock feature, which prevents unauthorized access to the module. When configuration lock has been enabled, a Product Access Key will be needed to access the device.

For more information about security and access control for the product, refer to the One-touch commissioning (OTC) documentation, available on the Elvaco website.

5.8. Meter communication error messages

When CMi4110 is unable to communicate with UH50/UC50, an error message will be transmitted on the LoRaWAN network. Refer to the following table for description of that error message for each message type.

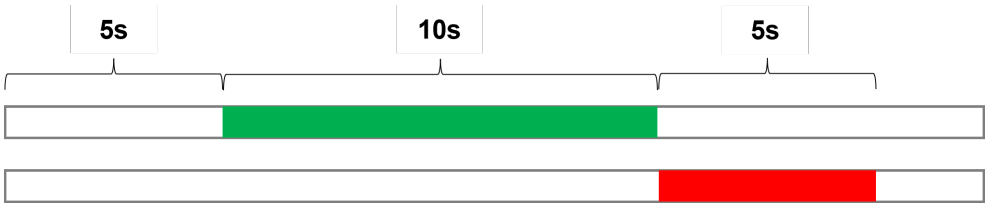
Table 4. Meter communication error message

Message type	Error message
Standard	0E00
Compact	0E00
JSON	{ }
Scheduled-daily redundant	0E00
Scheduled – extended +	0E00
Compact tariff	0E00

5.9. Rebooting and switching off the module

5.9.1. Rebooting the module

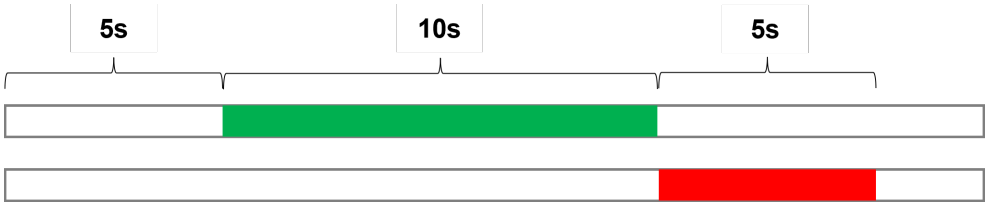
1. Press and hold the push button for 5-15 seconds.
2. Release the button when the green LED is lit.



LED indications; rebooting the module

5.9.2. Switching off the module

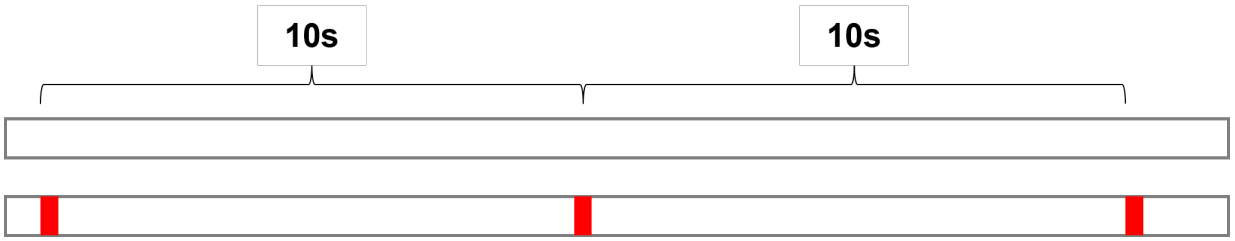
1. Press and hold the push button for 15-20 seconds.
2. Release the button when the red LED is lit.



LED indications; switching off the module

5.9.3. Soft start of the module

In rare cases, if the battery is weak, the module will perform a soft start to be able to start-up despite the condition of the battery. The soft start takes 10 minutes to complete. The red LED will blink shortly every 10th second until the start-up has completed.



Soft start LED indication

6. Configuration options

6.1. Device configuration

Before activating the module, you should make sure to apply the correct configuration profile by using the Elvaco mobile application. Settings are transferred to the device using NFC.

After you have set all configuration parameters, place the phone with the back facing the right side of the meter, parallel to the module, and select **Apply settings**. Hold the phone still until it vibrates three times. This confirms that new settings have successfully been transferred to the device via NFC.

Join EUI

The Join EUI sets the identification number of the application server where data from the module shall be delivered. The JoinEUI is by default set to 0000000000000000 in all CMi4110 modules.

Activation type

There are two different activation types for LoRaWAN - Over-the-air activation (OTAA) and Activation by personalization (ABP). Elvaco strongly recommends using OTAA, where all network keys are generated each time the module joins the LoRaWAN network. In contrast, for ABP, all keys are set manually and stay constant over time.

Application key

The application key of each CMi4110 device is generated by Elvaco and used in OTAA mode to generate network keys when the module joins the LoRaWAN network. Keys are managed in a secure way using Elvaco's OTC (One Touch Commissioning) solution which includes the mobile application for configuration.

Message format

CMi4110 supports four different message types: Standard, Compact, JSON and Scheduled-daily redundant. Refer to the CMi4110 user's manual for more information about the structure and payload of each message format.

Transmit interval

The transmit interval parameter is used to set how often the module transmits messages.

EcoMode

EcoMode can be enabled to achieve a battery-life of 11 years. The EcoMode table is then used to determine how often the module is allowed to transmit data for each data rate. If the transmit interval exceeds the limit in the EcoMode table, it will be lowered accordingly.

Configuration lock

CMi4110 has a configuration lock feature which can be used to prevent unauthorized users to access the module. When configuration lock has been enabled, a user needs the device-specific Product Access Key in order to access the device. Keys are managed in a secure way using Elvaco's OTC solution which includes the mobile application for configuration.

6.2. Elvaco OTC app configuration options

A complete description of all available settings in the Elvaco OTC app.

Table 5. Configuration options Elvaco OTC

Field name (Abbr.)	Description	Default value	Device access Locked device & correct Product Access Key or Open device	Device access No Product Access Key	Downlink
Meter ID	Meter identification number of the meter. Not configurable.	N/A	Readable	Readable	N/A
Power mode	Used to activate/deactivate the module.	Passive	Readable / Writeable	Readable	N/A
Message format	The message format determines the structure and payload of the telegram sent from the module.	0 (Compact)	Readable / Writeable	Readable	N/A
EcoMode	When activated, 11+1 years of battery-life is guaranteed by adapting the transmit interval of the module to current signal conditions.	On	Readable / Writeable	Readable	Writeable
Maximum daily transmissions	Maximum number of transmissions allowed per day.	Inactive	Readable / Writeable	Readable	Writeable
Date & Time	Date and time set for the meter	Current date/ time	Readable / Writeable	Readable	Writeable
Set Time Relative	Adjusts the time of the meter relative to the current time.	N/A	Writeable	N/A	Writeable
Configuration Lock	Locks the module to prevent unauthorized access.	Open	Readable / Writeable	Readable	Writeable
LoRaWAN settings					
Device EUI	Unique module identification number. Not configurable.	Device-unique 64-bit number	Readable	Readable	N/A
Activation type	Sets the way the device joins the LoRaWAN network.	OTAA	Readable / Writeable	Readable	N/A
Network join	Used to display whether the module has joined the LoRaWAN network.	N/A	Readable	Readable	N/A
Join EUI	Application ID that determines where data ends up.	0x 00 00 00 00 00 00 00 00	Readable / Writeable	Readable	N/A
Application key	Encryption key for payload data (only applicable in OTAA mode).	Device-unique 128-bit number	Writeable	N/A	N/A
Application session key	Encryption key for payload data (only applicable in ABP mode).	Device-unique 128-bit number	Writeable	N/A	N/A
Device address	Unique address used by the device to identify itself on the LoRaWAN network (only applicable in ABP mode).	Device-unique 32-bit number	Writeable	N/A	N/A

Field name (Abbr.)	Description	Default value	Device access Locked device & correct Product Access Key or Open device	Device access No Product Access Key	Downlink
Network session key	Encryption key for payload data (only applicable in ABP mode).	Device-unique 128-bit number	Writeable	N/A	N/A
Current data rate	The current data rate used for the module	N/A	Readable	Readable	N/A

6.3. Downlink configuration options

A complete description of all available downlink commands.

Table 6. Downlink commands

Field name	TLV (Type Length Value)	Number of bytes	Configuration
Configuration lock	0x05	0x01	0x00 = Locked 0x01 = Open
Transmit interval (only applies when Eco- Mode is inactive)	0x06	0x02	0xNumber of minutes (lsByte --> msByte)
Message format	0x07	0x01	Message ID Example: 0x41 = Message format Compact tariff NB! For multi-telegram formats, only the first telegram can be selected (select 0x3F for Scheduled Extended+, and not 0x40).
Date & Time	0x11	0x02	0xHHMM
Set Date	0x12	0x03	0xYYMMDD
Set Time Relative	0x13	0x02	0xNumber of minutes Negative numbers supported.
EcoMode	0x0F	0x01	0x00 = Disable EcoMode 0x01 = Enable EcoMode
MaxDTx (Maximum daily transmissions)	0x21	0x01	0xNumber of transmissions

TIP

Example: To set the MaxDTx parameter to 24, the following command would be sent by downlink: 0x00 21 01 18

6.4. Message formats

CMi4110 has several different message formats, listed in the table below. All data messages from the module will be transmitted on LoRa port 2.

Table 7. CMi4110 Message formats

Message format name	Message ID	Scheduled	Introduced in FW
Standard	0x00	No	1.0.3
Compact	0x01	No	1.0.3
JSON	0x02	No	1.0.3

Message format name	Message ID	Scheduled	Introduced in FW
Scheduled Daily Redundant	0x03	Yes	1.0.3
Scheduled Extended	0x04	Yes	1.0.3
Scheduled Extended+	0x3F + 0x40	Yes	1.0.4
Compact Tariff	0x41	Yes	1.0.6
Maximum Flow	0x46	No	1.0.8
Scheduled Daily Redundant Tariff	0x47 + 0x48	Yes	1.0.8
Scheduled Monthly	0x49	Yes	1.0.8
Scheduled Daily	0x4A	Yes	1.0.8

Scheduled message formats

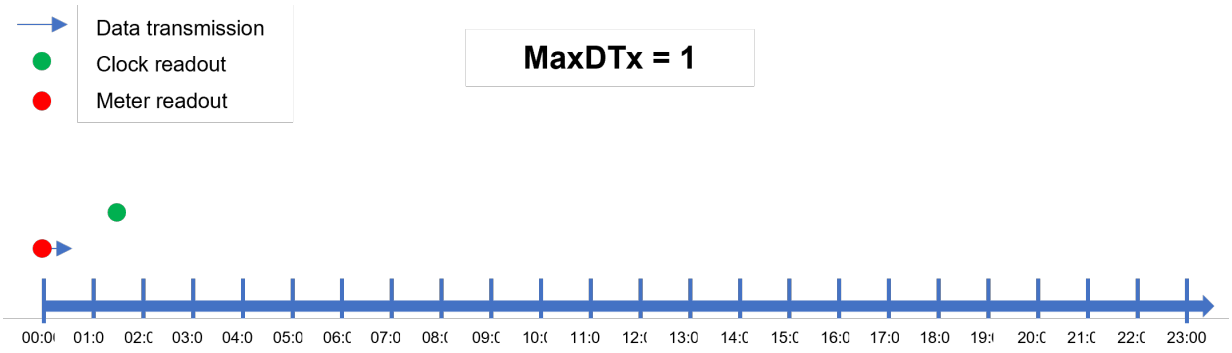
When using a scheduled message format, two types of messages will be transmitted from the module: a clock message and a data message. Refer to the following table for description of the difference between the two.

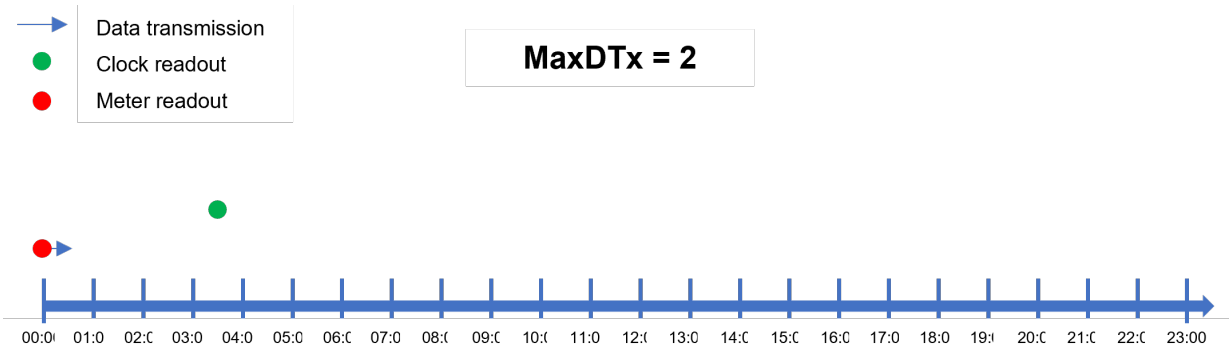
Table 8. Clock message and data message

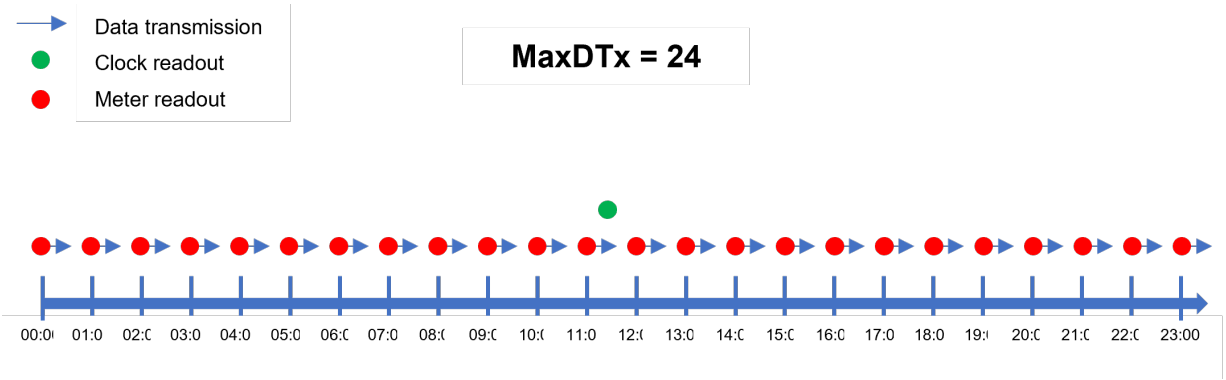
Message	Time interval	Description
Clock message	Once per day	The clock message presents the current time of UH50/UC50. It can be used to verify that the clock is correct and has not drifted more than accepted. Byte 0 = 0xFA Byte 1 = DIF, 0x04 = valid, 0x34 =invalid Byte 2 = VIF, 0x6D Byte 3-6 = 32-bit date/time encoded as M-Bus format F
Data message	Determined by MaxDTx parameter	The data message contains the fields listed in chosen message format.

The clock message will be transmitted once every day and the data message at least (regulated by MaxDTx parameter) once every day (on LoRa port 3). Although the meter readout will occur on top-of-the-hour, the data message will not necessarily be transmitted at that exact time. The LoRa transmission will occur after a random delay of 1-30 minutes. The meter readout for the clock message occurs at a random hour (00:00-23:00) at a random minute in the 35-45 interval. The clock message will be transmitted immediately after readout.

NOTE
When using a scheduled message format , the MaxDTx cannot not be set higher than 24.







The transmit interval of the data message is adapted to current data rate and MaxDTx settings. For scheduled message formats, the MaxDTx parameter can only assume the values listed in the following table.

Table 9. MaxDTx values for scheduled messages

Parameter	Values
MaxDTx	1, 2, 3, 4, 6, 8, 12, 24

6.4.1. Unscheduled message formats

6.4.1.1. Standard

Message format Standard is identified by Message ID 0x00 and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 10. Standard

DIB	Field	Size	Data type	Description
1	Energy	6-7 bytes (including DIF/VIF)	BCD8 M-Bus Type A	Energy consumption (MWh, kWh, MJ, GJ) Mapped to OBIS 6.8 0C06xxxxxxxx = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals If first byte is set to “3C” instead of “0C”, this indicates value during error state
2	Volume	6 bytes (including DIF/VIF)	BCD8 M-Bus Type A	Volume (m^3) Mapped to OBIS 6.26 0C14xxxxxxxx = m^3, 2 decimals 0C15xxxxxxxx = m^3, 1 decimal 0C16xxxxxxxx = m^3, 0 decimals If first byte is set to “3C” instead of “0C”, this indicates value during error state
3	Power	5 bytes (including DIF/VIF)	BCD6 M-Bus Type A	Power (kW) Mapped to OBIS 6.4 0B2Bxxxxxx = kW, 3 decimals 0B2Cxxxxxx = kW, 2 decimals 0B2Dxxxxxx = kW, 1 decimal 0B2Exxxxxx = kW, 0 decimals If first byte is set to “3B” instead of “0B”, this indicates value during error state
4	Flow	5 bytes (including DIF/VIF)	BCD6 M-Bus Type A	Flow (m^3/h) Mapped to OBIS 6.27 0B3Bxxxxxx = m^3/h, 3 decimals 0B3Cxxxxxx = m^3/h, 2 decimals 0B3Dxxxxxx = m^3/h, 1 decimal 0B3Exxxxxx = m^3/h, 0 decimals If first byte is set to “3B” instead of “0B”, this indicates value during error state

DIB	Field	Size	Data type	Description
5	Fw temp	4 bytes (including DIF/VIF)	BCD4	Forward temperature (°C) Mapped to OBIS 6.29 0A5Axxxx = °C, 1 decimal 0A5Bxxxx = °C, 0 decimals If first byte is set to “3A” instead of “0A”, this indicates value during error state
6	Rt temp	4 bytes (including DIF/VIF)	BCD4	Return temperature (°C) Mapped to OBIS 6.28 0A5Exxxx = °C, 1 decimal 0A5Fxxxx = °C, 0 decimals If first byte is set to “3A” instead of “0A”, this indicates value during error state
7	Meter ID	6 bytes (including DIF/VIF)	According to M-Bus EN13757-3 identification field	Meter ID 0C78xxxxxxxx If first byte is set to “3C” instead of “0C”, this indicates value during error state
8	Error flags	5 bytes (including DIF/VIF)	Uint16 M-Bus Type C	Error and warning flags 02FD17xxxx If first byte is set to “32” instead of “02”, this indicates value during error state

6.4.1.2. Compact

Message format Compact is identified by Message ID 0x01 and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 11. Compact

DIB	Field	Size	Data type	Description
1	Energy	6 bytes (including DIF/VIF)	BCD8 M-Bus Type A	Energy consumption (MWh, kWh, MJ, GJ) Mapped to OBIS 6.8 0C06xxxxxxxx = MWh, 3 decimals =kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C06xxxxxxxx = kWh 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals If first byte is set to “3C” instead of “0C”, this indicates value during error state

DIB	Field	Size	Data type	Description
2	Meter ID	6 bytes (including DIF/VIF)	According to M-Bus EN13757-3 identifi-cation field	Meter ID 0C78xxxxxxxx If first byte is set to “3C” instead of “0C”, this indicates value during error state
3	Error flags	5 bytes (including DIF/VIF)	Uint16 M-Bus Type C	Error and warning flags 02FD17xxxx =Error and warning flags If first byte is set to “32” instead of “02”, this indicates value during error state

6.4.1.3. JSON

Message format JSON is identified by Message ID 0x02 and encodes the telegram sent in a reader-friendly format, meaning the message can be read directly in plain text without decoding it. Data and information included in the message telegram are listed below.

Table 12. JSON

Field	Description
Energy	Energy consumption
Unit	Unit of energy consumption
Meter ID	Identification number of the meter in which the module is mounted.

Below shows an example of a telegram sent using the JSON message format.

{"E":12345.678","U":"MWh","ID":87654321}

6.4.1.4. Maximum Flow

Message format Maximum Flow is identified by Message ID 0x46and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 13. Maximum flow

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	`0x46`	Always set to `0x46`
Heat energy	6-7	BCD8	`0C06xxxxxxxx` = MWh, 3 decimals = kWh `0C07xxxxxxxx` = MWh, 2 decimals `0CFB00xxxxxxxx` = MWh, 1 decimal `0CFB01xxxxxxxx` = MWh, 0 decimals `0C0Exxxxxxxx` = GJ, 3 decimals `0C0Fxxxxxxxx` = GJ, 2 decimals `0CFB08xxxxxxxx` = GJ, 1 decimal `0CFB09xxxxxxxx` = GJ, 0 decimals	Heat energy prior to transmission
Energy at due date	7-8	BCD8	`8C0106xxxxxxxx` = MWh, 3 decimals = kWh	Energy at end of previous month
Max flow	6	BCD6	`9B013Bxxxxxx` = m3 /h, 3 decimals	Maximum flow last month Max value encoded with function field set to max (0b01) and then storage number 2 using using DIFE = 0x01

Value	Bytes	Type	Example	Comment
Timestamp of max flow	6	INT 32	046Dxxxxxxxx	Timestamp when maximum flow was registered. M-Bus Type F date
Return temp	4	BCD4	0A5Exxxx = °C, 1 decimal 0A5Fxxxx = °C, 0 decimals	Return temperature read prior to transmission
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

6.4.2. Scheduled message formats

6.4.2.1. Scheduled Extended

Message format Scheduled Extended is identified by Message ID 0x04 and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 14. Scheduled Extended

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x04	Always set to 0x04
Energy	6-7	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	Heat energy prior to transmission
Volume	6	BCD8	0C14xxxxxxxx = m^3, 2 decimals 0C15xxxxxxxx = m^3, 1 decimal 0C16xxxxxxxx = m^3, 0 decimals	
Power	5	BCD6	0B2Bxxxxxx = kW, 3 decimals 0B2Cxxxxxx = kW, 2 decimals 0B2Dxxxxxx = kW, 1 decimal 0B2Exxxxxx = kW, 0 decimals	
Flow	5	BCD6	B3Bxxxxxx = m^3/h, 3 decimals 0B3Cxxxxxx = m^3/h, 2 decimals 0B3Dxxxxxx = m^3/h, 1 decimal 0B3Exxxxxx = m^3/h, 0 decimals	
Fwd temp	4	BCD4	0A5Axxxx = °C, 1 decimal 0A5Bxxxx = °C, 0 decimals	
Rtn temp	4	BCD4	0A5Exxxx = °C, 1 decimal 0A5Fxxxx = °C, 0 decimals	
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration

Value	Bytes	Type	Example	Comment
Date & time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

6.4.2.2. Scheduled Extended+

Message format Scheduled Extended+ is divided in two telegrams due two size restrictions. The telegrams are identified by Message IDs 0x3F and 0x40, and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 15. Scheduled Extended+ Telegram 1 [0x3F]

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x3F	Always set to 0x3F
Energy	6-7	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	Heat energy prior to transmission
Tariff 1	7-8	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	
Tariff 2	7-8	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	
Tariff 3	8	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	

Value	Bytes	Type	Example	Comment
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Date & time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)

Table 16. Scheduled Extended+ Telegram 2 [0x40]

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x40	Always set to 0x40
Volume	6	BCD8	0C14xxxxxxxx = m^3, 2 decimals 0C15xxxxxxxx = m^3, 1 decimal 0C16xxxxxxxx = m^3, 0 decimals	
Power	5	BCD6	0B2Bxxxxxx = kW, 3 decimals 0B2Cxxxxxx = kW, 2 decimals 0B2Dxxxxxx = kW, 1 decimal 0B2Exxxxxx = kW, 0 decimals	
Flow	5	BCD6	B3Bxxxxxx = m^3/h, 3 decimals 0B3Cxxxxxx = m^3/h, 2 decimals 0B3Dxxxxxx = m^3/h, 1 decimal 0B3Exxxxxx = m^3/h, 0 decimals	
Fwd temp	4	BCD4	0A5Axxxx = °C, 1 decimal 0A5Bxxxx = °C, 0 decimals	
Rtn temp	4	BCD4	0A5Exxxx = °C, 1 decimal 0A5Fxxxx = °C, 0 decimals	
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Date & time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

6.4.2.3. Compact Tariff

Message format Compact Tariff is identified by Message ID 0x41 and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 17. Compact Tariff

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x41	Always set to 0x41

Value	Bytes	Type	Example	Comment
Energy	6-7	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	Heat energy prior to transmission
Tariff 1	7-8	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	
Tariff 2	7-8	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	
Tariff 3	8	BCD8	0C06xxxxxxxx = MWh, 3 decimals = kWh 0C07xxxxxxxx = MWh, 2 decimals 0CFB00xxxxxxxx = MWh, 1 decimal 0CFB01xxxxxxxx = MWh, 0 decimals 0C0Exxxxxxxx = GJ, 3 decimals 0C0Fxxxxxxxx = GJ, 2 decimals 0CFB08xxxxxxxx = GJ, 1 decimal 0CFB09xxxxxxxx = GJ, 0 decimals	
Meter ID	6	BCD8	0C78xxxxxxxx (serial number)or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

6.4.2.4. Scheduled Daily

Message format Scheduled Daily is identified by Message ID 0x4A and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 18. Scheduled Daily

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x4A	Always set to 0x4A

Value	Bytes	Type	Example	Comment
Energy at 24:00	6-7	BCD8	4C06xxxxxxxx = MWh, 3 decimals = kWh 4C07xxxxxxxx = MWh, 2 decimals 4CFB00xxxxxxxx = MWh, 1 decimal 4CFB01xxxxxxxx = MWh, 0 decimals 4C0Exxxxxxxx = GJ, 3 decimals 4C0Fxxxxxxxx = GJ, 2 decimals 4CFB08xxxxxxxx = GJ, 1 decimal 4CFB09xxxxxxxx = GJ, 0 decimals	Energy at midnight Storage nr 1 used
Fwd temp	4	BCD4	0A5Axxxx = °C, 1 decimal 0A5Bxxxx = °C, 0 decimals	Value read just prior to transmission.
Rtn temp	4	BCD4	0A5Exxxx = °C, 1 decimal 0A5Fxxxx = °C, 0 decimals	Value read just prior to transmission.
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Date & Time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

6.4.2.5. Scheduled Daily Redundant

Message format Scheduled Daily Redundant is identified by Message ID 0x03 and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 19. Scheduled Daily Redundant

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x03	Always set to 0x03
Energy	6	BCD8	4C06xxxxxxxx = MWh, 3 decimals = kWh 4C07xxxxxxxx = MWh, 2 decimals 4CFB00xxxxxxxx = MWh, 1 decimal 4CFB01xxxxxxxx = MWh, 0 decimals 4C0Exxxxxxxx = GJ, 3 decimals 4C0Fxxxxxxxx = GJ, 2 decimals 4CFB08xxxxxxxx = GJ, 1 decimal 4CFB09xxxxxxxx = GJ, 0 decimals	
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Date & Time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)

Value	Bytes	Type	Example	Comment
Accumulated energy at 24:00	6	BCD8	4C06xxxxxxxx = MWh, 3 decimals = kWh 4C07xxxxxxxx = MWh, 2 decimals 4CFB00xxxxxxxx = MWh, 1 decimal 4CFB01xxxxxxxx = MWh, 0 decimals 4C0Exxxxxxxx = GJ, 3 decimals 4C0Fxxxxxxxx = GJ, 2 decimals 4CFB08xxxxxxxx = GJ, 1 decimal 4CFB09xxxxxxxx = GJ, 0 decimals	
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

6.4.2.6. Scheduled Daily Redundant Tariff

Message format Scheduled Daily Redundant Tariff is divided in two telegrams due two size restrictions. The telegrams are identified by Message IDs 0x47 and 0x48, and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 20. Scheduled Daily Redundant Tariff Telegram 1 [0x47]

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x47	Always set to 0x47
Energy at 24:00	6-7	BCD8	4C06xxxxxxxx = MWh, 3 decimals = kWh 4C07xxxxxxxx = MWh, 2 decimals 4CFB00xxxxxxxx = MWh, 1 decimal 4CFB01xxxxxxxx = MWh, 0 decimals 4C0Exxxxxxxx = GJ, 3 decimals 4C0Fxxxxxxxx = GJ, 2 decimals 4CFB08xxxxxxxx = GJ, 1 decimal 4CFB09xxxxxxxx = GJ, 0 decimals	Energy at midnight Storage nr 1 used
Tariff 1 Energyat 24:00	7-8	BCD8	CC1007xxxxxxxx (Storage No 1, Tariff 1)	Fetched energy by module at 24:00. Coded with Storage 1 and tariff 1 in DIFE.
Tariff 2 Energy at 24:00	7-8	BCD8	CC2007xxxxxxxx (Storage No 1, Tariff 2)	Fetched energy by module at 24:00. Coded with Storage 1 and tariff 2 in DIFE.
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Date & Time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

Table 21. Scheduled Daily Redundant Tariff Telegram 2 [0x48]

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x48	Always set to 0x48
Tariff 1 Energy	7-8	BCD8	8C10xxxxxxxx Tariff 1 set in DIFE	Instantaneous readout
Tariff 2 Energy	7-8	BCD8	8C20xxxxxxxx Tariff 2 set in DIFE	Instantaneous readout

Value	Bytes	Type	Example	Comment
Flow	5	BCD6	B3Bxxxxxx = m^3/h, 3 decimals 0B3Cxxxxxx = m^3/h, 2 decimals 0B3Dxxxxxx = m^3/h, 1 decimal 0B3Exxxxxx = m^3/h, 0 decimals	
Fwd temp	4	BCD4	0A5Axxxx = °C, 1 decimal 0A5Bxxxx = °C, 0 decimals	
Rtn temp	4	BCD4	0A5Exxxx = °C, 1 decimal 0A5Fxxxx = °C, 0 decimals	
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Date & Time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)

6.4.2.7. Scheduled Monthly

Message format Scheduled Monthly is identified by Message ID 0x49 and is encoded as M-Bus. Data and information included in the telegram are listed below.

Table 22. Scheduled Monthly

Value	Bytes	Type	Example	Comment
Message ID	1	N/A	0x49	Always set to 0x49
Energy at due date	7-8	BCD8	8C0106xxxxxxxx = MWh, 3 decimals = kWh	Energy at end of previous month
Meter ID	6	BCD8	0C78xxxxxxxx (serial number) or 0C79xxxxxxxx (customer number)	Serial number or customer number depending on configuration
Date & Time	6	INT32	046Dxxxxxxxx	Date and Time (Type F)
Error flags	5	INT16	02FD17xxxx	Error flags prior to transmission

7. Technical specifications

Table 23. Mechanics

Type	Value
Protection class	IP54
Dimensions (w x h x d)	80 x 38 x 23 mm
Weight	35 g
Mounting	In Landis+Gyr UH50/UC50 module slot 2
External antenna connector	SMA female

Table 24. Electrical connections

Type	Value
Supply voltage	Internal meter battery or PSU (PSU options: Elvaco CMip2110 230V, Landis+Gyr WZU-AC230-xx or WZU-ACDC24-00)

Table 25. Electrical characteristics

Type	Value
Nominal voltage	3.0 - 5.0 VDC
Power consumption (max)	40 mA
Power consumption (sleep mode)	2.2 µA

Table 26. Environmental specifications

Type	Value
Operating temperature	5 - 55 ºC
Operating humidity	0 - 93 % RH, no condensation
Operating altitude	2000 m
Pollution degree	Degree 1
Usage environment	Indoors
Storage temperature	-20 - 60 ºC

Table 27. Radio characteristics

Type	Value
Frequency	868 MHz
Output power	14 dBm
Receiver sensitivity	-135 dBm

Table 28. LoRaWAN characteristics

Type	Value
Device class	Class A, bi-directional
LoRa version	1.0
Activation	OTAA or ABP
Data rate	DR0 - DR5 (250 – 5470 bit/s)

Table 29. User interface

Type	Value
Green LED	Status

Type	Value
Red LED	Error
Push button	Start-up / reboot / switch off module
Configuration	NFC via Elvaco OTC app or downlink data

Table 30. Approvals

Type	Value
EMC	EN 301 489-1, EN 301 489-3

7.1. European standards

- M-Bus standard EN 13757-3:2013 Communication systems for and remote reading of meters – Part 3: Dedicated application layer

7.2. Simplified Declaration of Conformity

Hereby, Elvaco declares that CMi4110 is in compliance with the following directives:

EU:

- 2014/53/EU (RED)
- 2014/30/EU (EMC)
- 2011/65/EU + 2015/863 (RoHS)

UK:

- 2017 No. 1206
- 2016 No. 1091
- 2012 No. 3032

The complete Declaration of Conformity can be found at http://www.elvaco.com > Search on product.

8. Document history

Table 31. Versions

Version	Date	Changes
v1.0	2018-07	Initial version
v1.1	2018-10	Information about Scheduled – extended added
v1.2	2019-03	Corrected DIF/VIF for energy DIB
v1.3	2019-04	Added information about EcoMode
v1.4	2020-03	Added information about value during error state in message formats
v1.5	2021-03	Added information related to FW 1.0.7. New message formats, new eco mode table
v1.6	2023-11	Added information related to FW 1.0.8, added message formats.

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