# CMa12w C1 Users Manual English

1050068-CMa12w Wireless M-Bus

CMa12w is a wireless M-Bus communicating temperature sensor for indoor use. CMa12w complies with OMS standard and uses wireless M-Bus mode C1. CMa12w is the perfect choice when wiring is not an option.

# Contents

# 1 Document notes

All information in this manual, including product data, diagrams, charts, etc. represents information on products at the time of publication, and is subject to change without prior notice due to product improvements or other reasons. It is therefore recommended that customers contact Elvaco AB for the latest product information before purchasing a CMa12w product.

The documentation and product are provided on an “as is” basis only and may contain deficiencies or inadequacies. Elvaco AB takes no responsibility for damages, liabilities or other losses by using this product.

## 1.1 Copyright and trademark



## 1.2 Contacts

Elvaco AB Headquarter

Teknikgatan 18
434 37 Kungsbacka
SWEDEN

Phone: +46 300 30250
Fax: +46 300 18440

E-Mail: info@elvaco.com

Elvaco AB Technical Support

Phone: +46 300 434300
E-Mail: support@elvaco.com

Online: http://www.elvaco.com

# 2 Using this manual

## 2.1 Purpose and audience

This manual covers information needed to mount, configure and use the CMa12w, trådlös Wireless M-Bus indoor temperature sensor. It is intended for field engineers and developers.

## 2.2 Models

CMa12w

## 2.3 Additional and updated information

Latest documentation version is available on Elvaco web site at http://www.elvaco.com.

# 3 Introduction

## 3.1 Product configuration

See Table 1 Product configuration, to find out the capabilities of your product.

| Product name | Comments |
|---|---|
| CMa12w | Indoor Wireless M-Bus temperature sensor |
| | |

*Table 1 Product configuration*

## 3.2 Capabilities

CMa12w is a 1-way wireless M-Bus communicating temperature sensor for indoor use. CMa12w is the ideal product for comfort level billing. The high accuracy sensor and user friendly handling make the CMa12w the perfect choice for tenant owners.

## 3.3 Applications

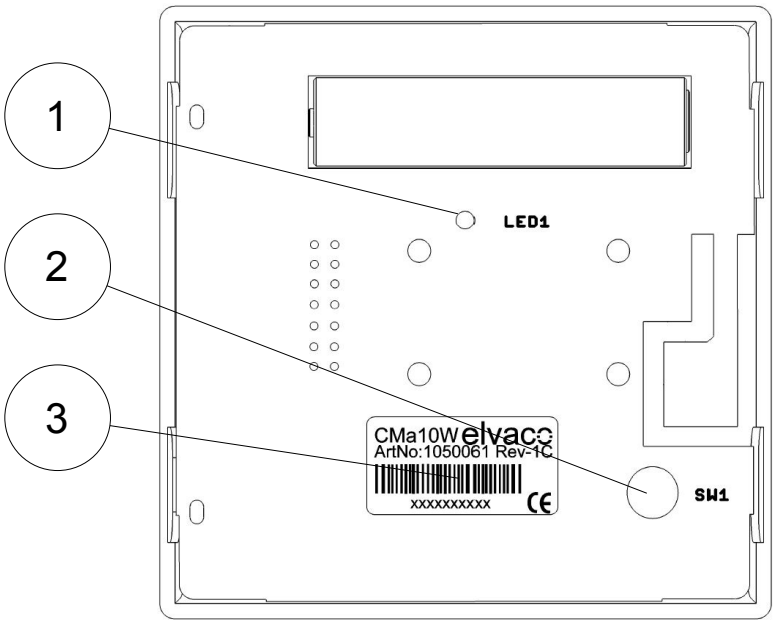
The CMa12w should be used in the following scenarios:

- Indoor measurement of temperature
- Used instead of a CMa10/CMa11 when wiring is not an option
- Used instead of a CMa10w/CMa11w when humidity does not need to be measured

# 4 Getting Started

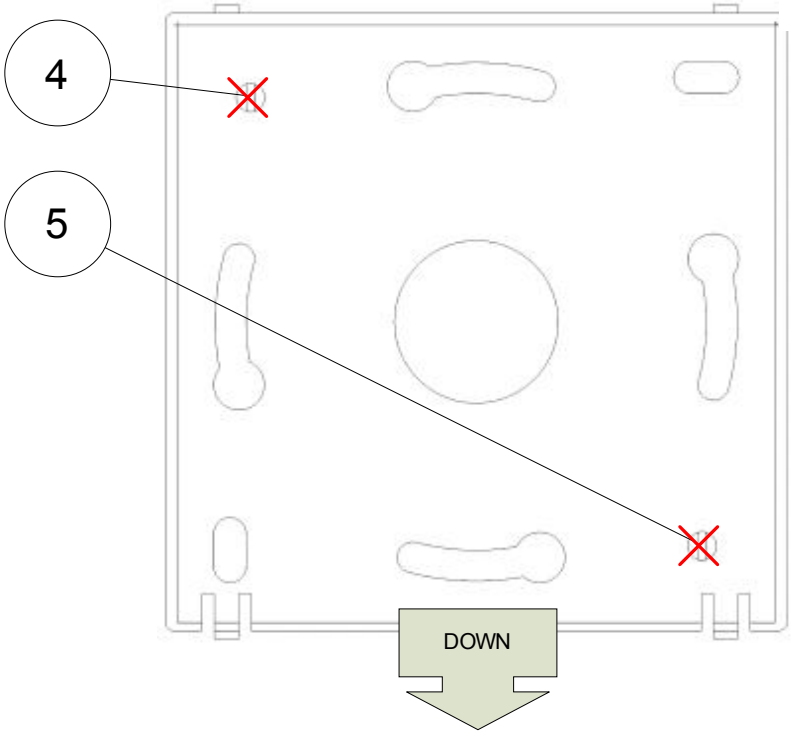
This chapter covers the steps required for getting the CMa12w installed and operational.

## 4.1 Overview




1. LED1
2. Push button (SW1)
3. Label with product information, serial number (identification), hardware revision and article number

*Figure 3*




4. Do not use for mounting
5. Do not use for mounting

*Figure 3*

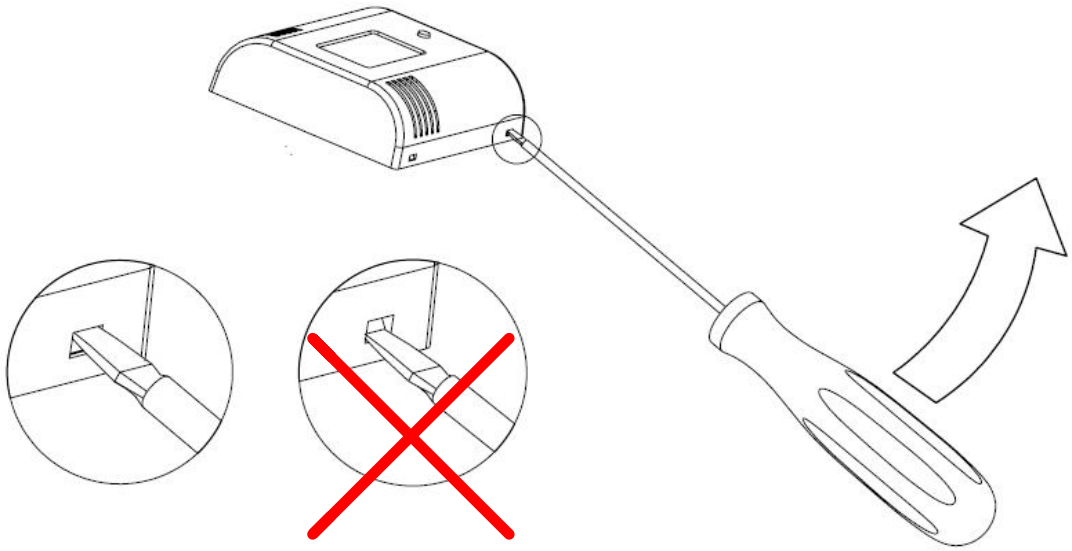


*Figure 3 Demounting*

## 4.2 Mounting

When mounting the CMa12w, avoid rooms with a lot of supplementary heat, such as kitchens or south facing rooms. Position the sensor away from direct sunlight. Avoid placing on an external wall or near an external door. Make sure that the sensor is not positioned closer than 1 m from the nearest radiator and at least 1.5 m above the floor.

CMa12w can be mounted directly on the wall, or over a mounting box Ø70 mm. If the product is placed over a conduit pipe, it is recommended to fill the pipe to prevent air flow which could affect accuracy of the values.

Remove the rear cover to be able to press the installation button SW1 (4).

⚠ **IMPORTANT**

Please take the following in consideration:

- Do not use mounting holes (6) as in Figure 3 .
- Turn the rear cover as shown in Figure 3 .
- Do not mount the product inside a steel cabinet, which will dramatically lower the possibilities to connect to a collector.

## 4.3 Wireless M-Bus

The product is delivered with the radio turned off. The radio must be manually switched on during the installation procedure.

**The product will not be activated until the installation procedure is started.**

### 4.3.1 Installation procedure

The product can be installed and enabled in two modes:

- **Unencrypted mode**: Data is sent unencrypted and the encryption key is not needed to decrypt the data.
- **Encrypted mode**: Data is sent in encrypted mode and the encryption key is needed to decrypt the data.

Please advise your project manager which operation mode is used in your project.

#### 4.3.1.1 Installation procedure – Select Unencrypted mode

By performing the following steps, the product will start to send spontaneous **unencrypted** data:

1. Press and hold button SW1 (4) for 5-10 seconds until LED1 (3) flashes quickly. See Table 2 for more information about LED indications.
2. Release SW1 (4)

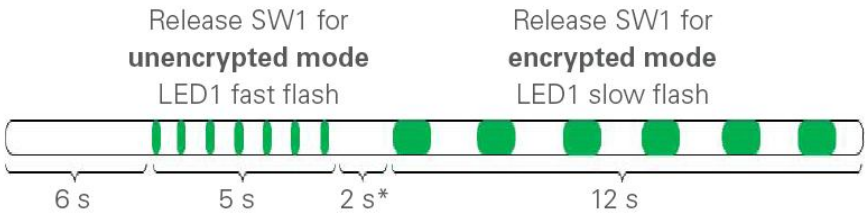
The product will now start to send spontaneous unencrypted SND_NR telegrams every 30 seconds.

#### 4.3.1.2 Installation procedure – Select Encrypted mode

By performing the following steps, the product will start to send spontaneous **encrypted** data:

1. Press and hold button SW1 (4) for 12-25 seconds, LED1 (3) changes from flashing quickly to flashing slowly. See Table 2 for more information about LED indications.
2. Release SW1 (4)

3. The product will now start to send spontaneous encrypted SND_NR telegrams every 30 seconds.




*** If the button is released in this mode, the CMa12w will return to inactive mode. This also applies if the button is pressed down for longer than 25 seconds.**

**⚠ IMPORTANT**

**Please take the following in consideration:**

**After the product is activated, the encryption mode cannot be changed.**

**The product must be sent to Elvaco to be unlocked.**

# 5 Application description

This chapter covers general application description and configuration of the product.

## 5.1 Operation

The product will automatically, after the installation procedure, send C1 messages every 3rd minute containing sensor data, such as instantaneous temperature. The product will also send product status information, containing battery status and other relevant information.

### 5.1.1 Operation modes

The product has the following operation modes:

1. Inactive (on delivery)
2. Installation procedure (during installation)
3. Normal operation - unencrypted mode
4. Normal operation - encrypted mode

#### 5.1.1.1 Inactive mode

The product is delivered inactive, which means that the product does not perform any tasks before an installation procedure is started. This saves the battery lifetime and ensures that there is no radio activity until the product is manually activated.

#### 5.1.1.2 Installation procedure

The installation procedure is used to activate the product, see 4.3.1.

#### 5.1.1.3 Normal operation – Unencrypted mode

In normal operation unencrypted mode, the product will by default send spontaneous **unencrypted** messages every 3rd minute. This mode is normally used when the collector or AMR/AMM system does not handle AES encryption or if the AES key is unknown to the host system.

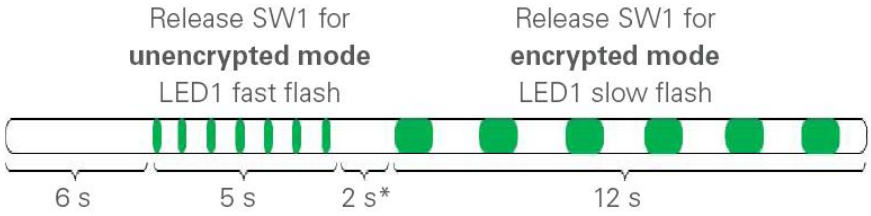
#### 5.1.1.4 Normal operation – Encrypted mode

In normal operation encrypted mode, the product will by default send spontaneous **encrypted** messages every 3rd minute. This mode is used to secure data sent from the product to the collector or AMR/AMM system. To be able to decrypt the data, the private 128 bit AES key must be known by the collector or by the host system. The private 128 bit AES key is on demand provided to the customer by Elvaco AB.

⚠ **IMPORTANT**

**The customer cannot change encryption mode/operation mode. The product must be sent to Elvaco to be unlocked.**

## 5.2 LED indications




*** If the button is released in this mode, the CMa12w will return to inactive mode. This also applies if the button is pressed down for longer than 25 seconds.**

| LED1 | State/Description | Visual |
|---|---|---|
| Permanently off | Off | |
| Fast flash<br><br>100 ms on/100 ms off | Triggered when button is pressed for 5-10 seconds to select unencrypted operation mode. Releasing the button in this state will select unencrypted operation mode. | |
| Slow flash<br><br>800 ms on/800 ms off | Triggered when button is pressed for 12-25 seconds to select encrypted operation mode. Releasing the button in this state will select encrypted operation mode. | |

*Table 2 LED 1 indications*

# 6 Administration of the product

This chapter covers the configuration and Wireless M-Bus implementation of the product. The product follows the new M-Bus standard EN13757-2, EN13757-3, EN13757-4.

## 6.1 M-Bus product identification

The product can be identified by the following information:

- Manufacturer string = ELV
- Medium = 0x1B (Room sensor)
- Generation = 30-39 (CMa12w),
- The generation field between product releases will **only** change (increase by 1) if the M-Bus protocol information changes between versions. Use the software version field in the M-Bus telegram to identify current software version.

### Wireless M-Bus mode

The product is using Wireless M-Bus mode C1-b, which means that the product sends spontaneous data in one direction, from product to collector.

## 6.2 M-Bus addressing

The address used is a globally unique address, which is set during production.

## 6.3 Operation mode

The product can operate in encrypted or unencrypted mode. In encrypted mode, a 128 bit AES key is used for all telegrams.

## 6.4 Spontaneous transmission

The product will automatically start sending spontaneous telegrams with measurement data after the installation procedure is completed. The product sends by default an SND_NR telegram every 3rd minute.

## 6.5 Telegram format

All data in the tables are described unencrypted.

### 6.5.1 Send spontaneous data (SND_NR)

During normal operation, the wireless M-Bus command SND_NR is sent by default every 3rd minute. Telegram type is type B, wireless M-Bus mode C1.

#### 6.5.1.1 Slave to master – Telegram 1 (SND_NR)

| Byte index | Data | Description |
|---|---|---|
| | 0x55 | preamble |
| | 0x55 | preamble |
| | 0x55 | preamble |
| | 0x55 | preamble |
| | 0x54 | sync word byte 0 |

| | | |
|---|---|---|
| | 0x3D | sync word byte 1 |
| | 0x54 | sync word byte 2 |
| | 0x3D | sync word byte 3 |
| 0 | 0xnn | L-field |
| 1 | 0x44 | C-field: SND_NR =0x44 |
| 2..3 | 0x9615 | Manufacturer<br>“ELV” |
| 4..7 | 0xnnnnnnnn | Identification number |
| 8 | 0x1E | Version field |
| 9 | 0x1B | Product type (medium) = room sensor |
| 10 | 0x7A | 0x7A = "short application header" |
| 11 | 0xnn | access number, increases after every TX<br>0...255 |
| 12 | 0xnn | Status. Bit 2 (0x04) is "low battery flag", bit 3 (0x08) is "sensor fault flag".<br>Default is STATUS = 0x00 |
| 13..14 | 0xnnnn | CONFIG:<br>Bit 7..4 = 0 or 2, = number of encrypted 16 byte block, 0 if encryption = OFF<br>Bit 11..8 = encryption mod, = 5 with encryption, 0 without encryption |
| 15 | 0x2F | Decryption verification byte 1 |
| 16 | 0x2F | Decryption verification byte 2 |
| 17 | DIF | 16-bit integer = 0x02 or 0x32 at sensor error |
| 18 | VIF | 0x65 = "external temperature" in "centi celsius" |
| 19..20 | 0xnnnn | Instantaneous temperature x 100<br>At sensor error, the temperature will be set to 0x0000 |
| 21 | DIF | 16-bit integer" = 0x42 or 0x72 at sensor error |
| 22 | VIF | 0x65 = "external temperature" in "centi celsius" |
| 23..24 | 0xnnnn | 1h average temp x 100<br>Or at error, the temperature will be set to 0x0000 |
| 25 | DIF | 0x02 (16 bit integer) |
| 26 | VIF | 0xFD |
| 27 | VIFE | 0x1B |
| 28..29 | 0xnnnn | Battery status<br>Bit9 Bit8<br>---<br>1 1 = 3 bars on LCD (CMa10W 100%)<br>1 0 = 2 bars on LCD<br>0 1 = 1 bars on LCD<br>0 0 = 0 bars on LCD<br>Bit 0: 1 = Sensor fault |

| | | |
|---|---|---|
| 30 | 0x0d | Firmware version DIF |
| 31 | 0xfd | Firmware version VIF |
| 32 | 0x0f | Firmware version VIFE = “ Other software version” |
| 33 | 0x05 | Length of firmware string (varying) |
| 34..38 | 0xnnnnnnnnnn | Firmware version string in format: Major.Minor.PatchLevel |
| 39 | 0x0F | End of telegram, no more data. |

# 7 Troubleshooting

## 7.1 Collector does not receive any telegram sent from the product

This can be due to the following reasons:

- Make sure that the product has been turned on during the installation by pressing the button SW1 quickly. LED1 flashes at unencrypted mode and is quickly illuminated at encrypted mode. If this does not occur, see, section 4.3.1 for operation/activation.
- The master is not powered up or not correctly configured.
- The distance to the master is not within range.
- The master antenna is not properly mounted for best performance.
- The product is mounted inside a metallic cabinet or is disturbed by other radio equipment.

## 7.2 Values are inaccurate

The temperature sensor is very accurate, but incorrect positioning of the product may result in unintended temperature variation. Please take the following in consideration when mounting the product:

- Do not mount the product close to heat sources (front and rear)
- Do not mount the product in direct sunlight
- Do not mount the product in the area of a spotlight beam

If the problem persists, please contact Elvaco AB.

# 8 Technical specifications

## 8.1 Characteristics

| Type | Value | Unit | Comments |
|---|---|---|---|
| Mechanics | | | |
| Material | ABS UL94-V0 | - | White |
| Protection class | IP20 | - | |
| Dimensions | 80 x 80 x 28 | mm | |
| Weight | 75 | g | |
| Antenna wireless M-Bus | Internal | - | |
| Mounting | Wall mounted | | |
| Electrical | | | |
| Power supply | Battery | - | Lifetime 15 years at 15-25 °C |
| Environmental | | | |
| Operating temperature range | -10 to +50 | °C | |
| Storage temperature range | -40 to +85 | °C | |
| Operating humidity | 0 to 95 | %RH | No condensation |
| Accuracy sensor | | | |
| Temperature range | -20 to +55 | °C | |
| Temperature +5 to +55 °C | +/- 0.2 | °C | Typical tolerance |
| Temperature -20 to 55 °C | +/- 0.4 | °C | Typical tolerance |
| User interface | | | |
| Green LED | Yes | - | Configuration/Activation |
| Push button | Yes | - | Configuration/Activation |
| Wireless M-Bus | | | |
| M-Bus standard | EN 13757-4 | - | Mode C1-b |
| M-Bus commands | SND_NR | - | |
| Momentary values | Temperature | - | Instantaneous and average over hour |
| Historic values | Average values for last hour | - | |
| Transmit power | 10 | mW | |
| Sensitivity | -102 | dBm | Reception not activated |
| Frequency | 868 | MHz | Band |

*Tabel 3 Technical specifications*

# 9 Type approvals

CMa12w is designed to comply with the directives and standards listed below.

| Approval | Description |
|---|---|
| EMC | EN 61000-6-2, EN 61000-6-3 |

*Table 4 Approvals*

# 10 Safety and environment

## 10.1 Safety precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of CMa12w. 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.

All instructions must be carefully read before CMa12w is installed and used. They contain important information about how the product is used properly.

The installation of CMa12w should not be started before the technical specifications are fully understood. The work must be performed in the order listed in this manual, and only by qualified personnel. The work must also be done in accordance with national electrical specifications and applicable local regulations.

In order to avoid the product being damaged by static electricity, an ESD wristband should be worn when handling the product.

The labelling of the product may not be changed, removed or made unrecognizable.

# 11 Document history

| Version | Date | Description | Author |
|---|---|---|---|
| 1.0 | 2015-01-09 | First release | Carl-Henrik Carlsson |

## 11.1 Document software and hardware appliance

| Type | Version | Date | Comments |
|---|---|---|---|
| Hardware | R1A | 2014-10-23 | |
| Software | 3.0.3 | 2014-10-23 | |

# 12 References

## 12.1 References

[1] EN-13757-1, EN-13757-2, EN-13757-3, EN-13757-4 (PR 2011)
*Communication System for meters and remote reading of meters, Part1, Part2, Part3, Part 4*

[2] Open Metering System Specification – Volume 2 – Primary Communication, Issue 3.0.1/2011-01-29

## 12.2 Terms and abbreviations

| Abbreviation | Description |
|---|---|
| Product, Device, M-Bus slave | In this document, CMa12w |
| DIF | Data Information Field (M-Bus data clock information) |
| VIF | Value Information Field (M-Bus value block information) |

### 12.2.1 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 prefix 0b, i.e. 0b00001010 (ten)

# 13 Appendix A – Example

## 13.1 Denomination of values in reports

| Denomination | Description |
|---|---|
| serial-number | M-Bus master id |
| device-identification | M-Bus slave id |
| Created | Time stamp |
| value-data-count | Index at multiple telegram.<br>Usually 0. |
| manufacturer | Manufacturer |
| version | Hardware version |
| device-type | M-Bus slave device type |
| access-number | Number of times the meter has been read |
| status | Status |
| signature | Reserved for future use |
| fabrication-no,,inst-value,0,0,0 | Id for the wireless M-Bus master CMeX50 |
| act-duration,minute(s),inst-value,0,0,0 | The values age in minutes |
| rf-level,dbm,inst-value,0,0,0 | Signal strength in dBm |
| ext-temp,°c,inst-value,0,0,0 | Temperature, momentary value |
| ext-temp,°c,inst-value,0,0,1 | Temperature, 1-hour rolling average |
| digital-input,,inst-value,0,0,0 | Product status |
| other-sw-version,,inst-value,0,0,0 | Software version |
| manufacturer-specific,,inst-value,0,0,0 | |

## 13.2 Denomination of values for use in filters

| Denomination | Description |
|---|---|
| mbus.dib.fabrication-no.0.0.0.0 | Id for the wireless M-Bus master CMeX50 |
| mbus.dib.act-duration,minute(s).0.0.0.0 | The values age in minutes |
| mbus.dib.rf-level.0.0.0.0 | Signal strength in dBm |
| mbus.dib.ext-temp.0.0.0.0 | Temperature, momentary value |
| mbus.dib.ext-temp.0.1.0.0 | Temperature, 1-hour rolling average |
| mbus.dib.digital-input.0.0.0.0 | Product status |