



## CMa20 Users Manual English

1050025-CMa20 M-Bus Temperatursensor

The CMa20 is an M-Bus communicating temperature and humidity sensor for outdoor use. CMa20 is the ideal product for temperature and humidity report of outdoor climate.

# Contents

|                                             |           |
|---------------------------------------------|-----------|
| <b>CONTENTS .....</b>                       | <b>2</b>  |
| <b>1 DOCUMENT NOTES .....</b>               | <b>4</b>  |
| 1.1 COPYRIGHT AND TRADEMARK.....            | 4         |
| 1.2 CONTACTS.....                           | 4         |
| <b>2 USING THIS MANUAL .....</b>            | <b>5</b>  |
| 2.1 PURPOSE AND AUDIENCE .....              | 5         |
| 2.2 MODELS .....                            | 5         |
| 2.3 ADDITIONAL AND UPDATED INFORMATION..... | 5         |
| <b>3 INTRODUCTION.....</b>                  | <b>6</b>  |
| 3.1 PRODUCT CONFIGURATION .....             | 6         |
| 3.2 CAPABILITIES .....                      | 6         |
| 3.3 APPLICATIONS.....                       | 6         |
| <b>4 GETTING STARTED .....</b>              | <b>7</b>  |
| 4.1 OVERVIEW .....                          | 7         |
| 4.2 MOUNTING .....                          | 7         |
| 4.2.1 M-Bus 2-wire bus.....                 | 7         |
| <b>5 APPLICATION DESCRIPTION .....</b>      | <b>9</b>  |
| 5.1.1 Purpose .....                         | 9         |
| 5.2 OPERATION.....                          | 9         |
| 5.3 RESET TO FACTORY DEFAULT .....          | 9         |
| <b>ADMINISTRATION OF THE PRODUCT .....</b>  | <b>10</b> |
| 5.4 M-BUS PRODUCT IDENTIFICATION .....      | 10        |
| 5.5 M-BUS ADDRESSING MODE .....             | 10        |
| 5.6 M-BUS BAUD RATE .....                   | 10        |
| 5.7 FCB-BIT TOGGING (MULTI-TELEGRAM) .....  | 10        |
| 5.8 M-BUS BREAK.....                        | 10        |
| 5.9 M-BUS COMMANDS .....                    | 10        |
| 5.9.1 Initialize product (SND_NKE).....     | 10        |
| 5.9.1.1 Master to slave.....                | 10        |
| 5.9.1.2 Slave to master.....                | 11        |
| 5.9.2 Request user data (REQ_UD2).....      | 11        |
| 5.9.2.1 Master to slave.....                | 11        |
| 5.9.2.2 Slave to master – Telegram 1.....   | 11        |
| 5.9.2.3 Slave to master – Telegram 2.....   | 15        |
| 5.9.3 Set baud rate.....                    | 16        |
| 5.9.3.1 Master to slave.....                | 16        |
| 5.9.3.2 Slave to master.....                | 17        |
| 5.9.4 Application reset.....                | 17        |
| 5.9.4.1 Master to slave.....                | 17        |
| 5.9.4.2 Slave to master.....                | 18        |
| 5.9.5 Set primary address.....              | 18        |
| 5.9.5.1 Master to slave.....                | 18        |
| 5.9.5.2 Slave to master.....                | 18        |

|           |                                                         |           |
|-----------|---------------------------------------------------------|-----------|
| 5.9.6     | Set secondary address.....                              | 18        |
| 5.9.6.1   | Master to slave.....                                    | 18        |
| 5.9.6.2   | Slave to master.....                                    | 19        |
| 5.9.7     | Select slave.....                                       | 19        |
| 5.9.7.1   | Master to slave.....                                    | 19        |
| 5.9.7.2   | Slave to master.....                                    | 20        |
| 5.9.8     | Select Humidity VIF code.....                           | 20        |
| 5.9.8.1   | Master to slave.....                                    | 20        |
| 5.9.8.2   | Slave to master.....                                    | 20        |
| <b>6</b>  | <b>TROUBLESHOOTING .....</b>                            | <b>22</b> |
| 6.1       | PRODUCT DOES NOT RESPOND TO M-BUS MASTER COMMANDS ..... | 22        |
| <b>7</b>  | <b>TECHNICAL SPECIFICATIONS .....</b>                   | <b>23</b> |
| 7.1       | CHARACTERISTICS.....                                    | 23        |
| 7.2       | FACTORY DEFAULTS .....                                  | 24        |
| <b>8</b>  | <b>TYPE APPROVALS .....</b>                             | <b>25</b> |
| <b>9</b>  | <b>SAFETY AND ENVIRONMENT .....</b>                     | <b>26</b> |
| 9.1       | SAFETY PRECAUTIONS.....                                 | 26        |
| <b>10</b> | <b>DOCUMENT HISTORY .....</b>                           | <b>27</b> |
| 10.1      | DOCUMENT SOFTWARE AND HARDWARE APPLIANCE.....           | 27        |
| <b>11</b> | <b>REFERENCES .....</b>                                 | <b>28</b> |
| 11.1      | REFERENCES .....                                        | 28        |
| 11.2      | TERMS AND ABBREVIATIONS .....                           | 28        |
| 11.2.1    | Number representation.....                              | 28        |
| <b>12</b> | <b>APPENDIX A – EXAMPLE .....</b>                       | <b>29</b> |
| 12.1      | DENOMINATION OF VALUES IN REPORTS .....                 | 29        |
| 12.2      | DENOMINATION OF VALUES FOR USE IN FILTERS .....         | 30        |

# 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 CMA20 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

© 2016, Elvaco AB. All rights reserved. No part of the contents of this manual may be transmitted or reproduced in any form by any means without the written permission of Elvaco AB. Printed in Sweden.

CMA20 is a trademark of Elvaco AB, Sweden.

## 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](mailto:info@elvaco.com)

Elvaco AB Technical Support

Phone: +46 300 434300

E-Mail: [support@elvaco.se](mailto:support@elvaco.se)

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 CMA20 M-Bus outdoor temperature and humidity sensor. It is intended for field engineers and developers.

### 2.2 Models

CMA20

### 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

Use the table below to find out the capabilities of your product.

| Product name | Comments                                      |
|--------------|-----------------------------------------------|
| CMA20        | Outdoor M-Bus temperature and humidity sensor |

Table 1 Product configuration

### 3.2 Capabilities

The CMA20 is an M-Bus communicating temperature and humidity sensor for outdoor use. CMA20 is the ideal product for temperature and humidity report of outdoor climate. The high accuracy sensor and user friendly handling makes the CMA20 the perfect choice for outdoor climate logging.

### 3.3 Applications

The CMA20 should be used in the following scenarios:

- Outside measure of temperature and/or humidity
- Attic monitoring of temperature and/or humidity
- Cellar monitoring of temperature and/or humidity
- Other bad environment conditions

*If measurement of temperature and humidity is needed for indoor use, please see Elvaco AB product CMA10 Indoor M-Bus temperature and humidity sensor.*

## 4 Getting Started

This chapter covers the steps required for getting the CMA20 installed and operational. No pre-configuration is needed before using the CMA20.

The secondary address (serial number) label is placed in the bottom of the product.

### 4.1 Overview

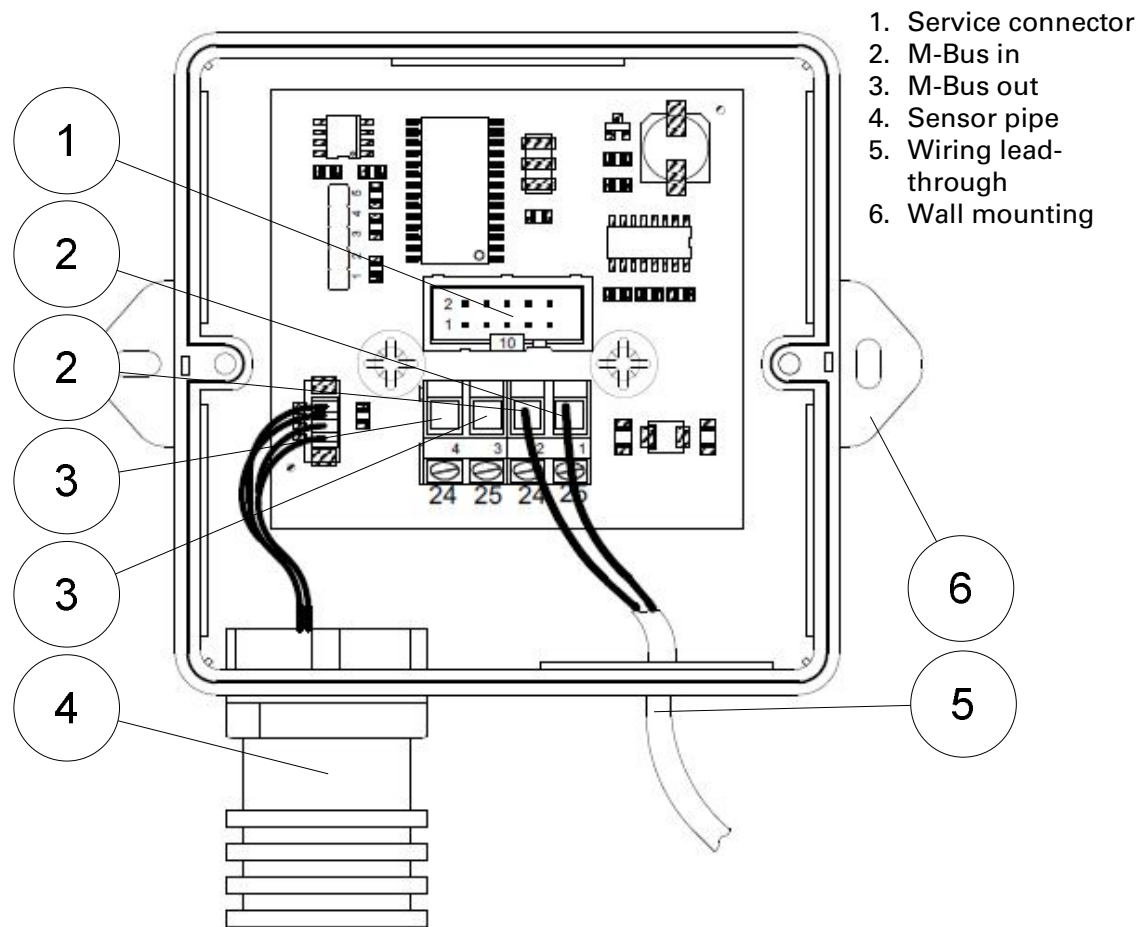


Figure 1 CMA20 Overview

### 4.2 Mounting

Mount the product in a weatherproof location to avoid that direct sunlight or rain affects the sensors. The product should be mounted straight vertically and horizontally with the sensor pipe (4) downwards. Use the holes (6) when mounting on wall.

#### 4.2.1 M-Bus 2-wire bus

M-Bus is a multi-drop 2-wire bus, with no polarity. Use a cable of area 0.25-1.5 mm<sup>2</sup>, e.g. a standard telephone cable (EKKX 2x2x0.25).

Connect the incoming wiring to the screw connector (2) and use the screw connector (3) for further M-Bus 2-wire bus connection.

 **IMPORTANT**

Please take the following in consideration:

- All connected M-Bus slave devices must have unique M-Bus secondary or primary addresses depending on addressing mode.
- Measure voltage over M-Bus slave connection to verify M-Bus master connection. Voltage should be between 21-42 VDC.

## 5 Application description

This chapter covers general application description of the product.

### 5.1.1 Purpose

The product has two main purposes:

- Measure outdoor temperature at high precision via M-Bus
- Measure outdoor humidity at high precision via M-Bus

### 5.2 Operation

The product has different operation states depending on the current operation mode. The configuration parameters are maintained during reboot and power cycling. All parameters and information can be remotely configured and read using M-Bus standard commands.

The product is equipped with watchdog monitoring, which secures long term stable operation in field.

### 5.3 Reset to factory default

Reset to factory default by issuing the M-Bus command Application reset, see chapter 5.9.4.

# Administration of the product

This chapter covers the configuration and M-Bus implementation of the product. The M-Bus slave implementation is according to the new M-Bus standard EN 13757.

## 5.4 M-Bus product identification

The product can be identified by the following information:

- Manufacturer string = ELV
- Medium = Room sensor
- Generation = 70-79

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.

## 5.5 M-Bus addressing mode

The product implements both primary and secondary addressing mode. The primary and secondary addresses can be changed using M-Bus standard command. Primary address from factory is **0** and secondary address from factory is the fabrication number (serial number).

## 5.6 M-Bus baud rate

The product can handle 300 or 2400 baud. No auto-baud detection is available. The baud rate can be changed using M-Bus standard commands. Baud rate from factory is **2400** baud.

## 5.7 FCB-bit toggling (multi-telegram)

Multi-telegram mode, or FCB-bit toggling, is implemented. First telegram contains momentary values, min/max and average values of measured temperature and humidity. Second telegram contains last 24 hours of temperature values.

## 5.8 M-Bus break

M-Bus master break signals are handled according to the M-Bus standard and any ongoing communication from M-Bus slave to master will be aborted on break detection from the M-Bus master.

## 5.9 M-Bus commands

### 5.9.1 Initialize product (SND\_NKE)

#### 5.9.1.1 Master to slave

| Byte index | Data | Description                |
|------------|------|----------------------------|
| 0          | 0x10 | Start character            |
| 1          | 0x40 | C-Field = SND_NKE          |
| 2          | 0xnn | A-Field = Address of slave |
| 3          | 0xnn | Checksum                   |

|   |      |                |
|---|------|----------------|
| 4 | 0x16 | Stop character |
|---|------|----------------|

#### 5.9.1.2 Slave to master

| Byte index | Data | Description |
|------------|------|-------------|
| 0          | 0xe5 | Acknowledge |

### 5.9.2 Request user data (REQ\_UD2)

Request user data from product and wait for slave response.

#### 5.9.2.1 Master to slave

| Byte index | Data                      | Description                |
|------------|---------------------------|----------------------------|
| 0          | 0x10                      | Start character            |
| 1          | 0x4b   0x5b   0x6b   0x7b | C-Field = REQ_UD2          |
| 2          | 0xnn                      | A-Field = Address of slave |
| 3          | 0xnn                      | Checksum                   |
| 4          | 0x16                      | Stop character             |

The RSP\_UD telegram depends on the FCV and FCB bits in the C field of the calling REQ\_UD2 telegram. There are two telegrams available:

- 1) If FCV is 0 in REQ\_UD2 or if first, third, fifth etc. REQ\_UD2 since last SND\_NKE (primary addressing mode) or if first, third, fifth etc. REQ\_UD2 since last successful secondary addressing selection first telegram is returned.
- 2) If FCV is 1 in REQ\_UD2 and if second, fourth, sixth etc. REQ\_UD2 since last SND\_NKE (primary addressing mode) or if second, fourth, sixth etc. REQ\_UD2 since last successful secondary addressing selection second telegram is returned.

#### 5.9.2.2 Slave to master – Telegram 1

| Byte index | Data       | Description                                       |
|------------|------------|---------------------------------------------------|
| 0          | 0x68       | Start character 1                                 |
| 1          | 0xnn       | L-Field 1                                         |
| 2          | 0xnn       | L-Field 2                                         |
| 3          | 0x68       | Start character 2                                 |
| 4          | 0x08       | RSP_UD                                            |
| 5          | 0xnn       | A-Field = Primary address                         |
| 6          | 0x72       | Variable data respond, mode 1 = LSByte first      |
| 7..10      | 0xnnnnnnnn | Secondary address                                 |
| 11..12     | 0x9615     | Manufacturer id "ELV"                             |
| 13         | 0xnn       | Generation field In the range from 70 to 79 (dec) |
| 14         | 0x1B       | Device type/medium = room sensor                  |

|        |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15     | 0xnn      | Access number                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 16     | 0xnn      | Status byte<br>0x00 = Ok (no error)<br>0x0a = Sensor failure (permanent application error)                                                                                                                                                                                                                                                                                                                                                                                     |
| 17..18 | 0x0000    | Signature, 16 bit binary                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 19     | 0x01      | Product status DIF                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 20     | 0xfd      | Product status VIF                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 21     | 0x1b      | Product status VIFE = digital input                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 22     | 0xnn      | 8-bit integer value with following bit-mask:<br><br>Bit 7: Not used (= 0 or 1)<br>Bit 6: Not used (= 0 or 1)<br>Bit 5, 4, 3: Not used (= 0)<br>Bit 2: 24 h average value indicator<br>- Toggles when the 24 h average temperature is updated (every hour)<br>Bit 1: 1 h average value indicator<br>- Toggles when the 1 h average is updated (every 6 minute)<br>Bit 0: Sensor failure<br>- 1 = Sensor failure (same as 0x0a in header status byte)<br>- 0 = No sensor failure |
| 23     | 0x02      | Instantaneous relative humidity DIF                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 24     | 0xfb      | Instantaneous relative humidity VIF.                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 25     | 0x9b      | Relative humidity, in % (integer) VIFE                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 26     | 0x74      | Scaling VIFE, x 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 27..28 | 0xn timer | Instantaneous relative humidity<br><br>In case of error the relative humidity will be set to 0.<br><br>An optional humidity VIF can be selected in the setup menu. In this case the 3 byte default VIF is replaced by<br>- 0xFC0348522574                                                                                                                                                                                                                                      |
| 29     | 0x22      | Minimum relative humidity DIF                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 30     | 0xfb      | Minimum relative humidity VIF                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 31     | 0x9b      | Minimum Relative humidity, in % (integer) VIFE                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 32     | 0x74      | Scaling VIFE, x 0.01                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 33..34 | 0xn timer | Minimum Instantaneous relative humidity<br><br>In case of error the minimum relative humidity will be set to 0.                                                                                                                                                                                                                                                                                                                                                                |

|        |           |                                                                                                                                                                                                                                                                                                                                                                   |
|--------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |           | <p>This is the lowest instantaneous relative humidity since last min/max reset command.</p> <p>An optional humidity VIF can be selected in the setup menu. In this case the 3 byte default VIF is replaced by</p> <p>- 0xFC0348522574</p>                                                                                                                         |
| 35     | 0x12      | Maximum relative humidity DIF                                                                                                                                                                                                                                                                                                                                     |
| 36     | 0xfb      | Maximum relative humidity VIF                                                                                                                                                                                                                                                                                                                                     |
| 37     | 0x9b      | Maximum Relative humidity, in % (integer) VIFE                                                                                                                                                                                                                                                                                                                    |
| 38     | 0x74      | Scaling VIFE, x 0.01                                                                                                                                                                                                                                                                                                                                              |
| 39..40 | 0xn timer | <p>Maximum Instantaneous relative humidity</p> <p>In case of error the maximum relative humidity will be set to 0.</p> <p>This is the highest instantaneous relative humidity since last min/max reset command.</p> <p>An optional humidity VIF can be selected in the setup menu. In this case the 3 byte default VIF is replaced by</p> <p>- 0xFC0348522574</p> |
| 41     | 0x02      | Instantaneous temperature DIF                                                                                                                                                                                                                                                                                                                                     |
| 42     | 0x65      | Instantaneous temperature VIF, external temperature                                                                                                                                                                                                                                                                                                               |
| 43..44 | 0xn timer | <p>Instantaneous temperature x 100</p> <p>In case of error the temperature will be set to 0.</p>                                                                                                                                                                                                                                                                  |
| 45     | 0x22      | Minimum temperature DIF                                                                                                                                                                                                                                                                                                                                           |
| 46     | 0x65      | Minimum temperature VIF, external temperature                                                                                                                                                                                                                                                                                                                     |
| 47..48 | 0xn timer | <p>Minimum temperature x 100</p> <p>In case of error the temperature will be set to 0.</p> <p>This is the lowest instantaneous temperature since last min/max reset command.</p>                                                                                                                                                                                  |
| 49     | 0x12      | Maximum temperature DIF                                                                                                                                                                                                                                                                                                                                           |
| 50     | 0x65      | Maximum temperature VIF, external                                                                                                                                                                                                                                                                                                                                 |

|        |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        |             | temperature                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| 51..52 | 0xn timer   | <p>Maximum temperature x 100</p> <p>In case of error the temperature will be set to 0.</p> <p>This is the highest instantaneous temperature since last min/max reset command.</p>                                                                                                                                                                                                                                                                              |
| 53     | 0x01        | Average duration DIF                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 54     | 0x72        | Average duration VIF                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 55     | 0xnn        | <p>Number of hour averages collected since power-on (0..24)</p> <p>This counter starts from zero at power-on and is incremented once per hour when a new hour average temperature value is stored in the 24-hour table. The counter does not count beyond 24 (i.e. this value is equal to number of valid hour values stored in the 24-hour table)</p> <p>The 24-hour temperature rolling average will not be available until this counter has reached 24.</p> |
| 56     | 0x42   0x72 | <p>1-hour temperature rolling average DIF, storage number 1</p> <p>0x42 = The value is available<br/>0x72 = The value is not yet calculated</p>                                                                                                                                                                                                                                                                                                                |
| 57     | 0x65        | 1-hour temperature rolling average VIF, external temperature                                                                                                                                                                                                                                                                                                                                                                                                   |
| 58..59 | 0xn timer   | <p>1-hour temperature rolling average x 100</p> <p>This value is unavailable (0) until 1 hour has passed since power-on. During this first hour the value will be flagged as "value during error state", DIF bits 5 and 4 = 1.</p> <p>This value is updated every 6 minute.</p> <p>The temperature data will be 0 in case of sensor error. See slave status byte in data header.</p>                                                                           |
| 60     | 0x82   0xb2 | <p>24-hour temperature rolling average DIF, storage number 2</p> <p>0x82 = The value is available<br/>0xb2 = The value is not yet calculated</p>                                                                                                                                                                                                                                                                                                               |
| 61     | 0x01        | 24-hour temperature rolling average DIFE                                                                                                                                                                                                                                                                                                                                                                                                                       |

|        |           |                                                                                                                                                                                                                                                                                                                                                                                |
|--------|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 62     | 0x65      | 24-hour temperature rolling average VIF, external temperature                                                                                                                                                                                                                                                                                                                  |
| 63..64 | 0xn timer | <p>24-hour temperature rolling average x 100</p> <p>This value is unavailable (0) until 24 hour has passed since power-on. During this period the value will be flagged as “value during error state”, DIF bits 5 and 4 = 1.</p> <p>This value is updated every hour.</p> <p>The temperature data will be 0 in case of sensor error. See slave status byte in data header.</p> |
| 65     | 0x0c      | Fabrication number DIF                                                                                                                                                                                                                                                                                                                                                         |
| 66     | 0x78      | Fabrication number VIF                                                                                                                                                                                                                                                                                                                                                         |
| 67..68 | 0xn timer | Fabrication number, 8-digit packed BCD                                                                                                                                                                                                                                                                                                                                         |
| 69     | 0x0d      | Firmware version DIF                                                                                                                                                                                                                                                                                                                                                           |
| 70     | 0xfd      | Firmware version VIF                                                                                                                                                                                                                                                                                                                                                           |
| 71     | 0x0f      | Firmware version VIFE = “ Other software version”                                                                                                                                                                                                                                                                                                                              |
| 72     | 0x05      | Length of firmware string (varying)                                                                                                                                                                                                                                                                                                                                            |
| 73..77 | 0xn timer | Firmware version string in format: Major.Minor.PatchLevel                                                                                                                                                                                                                                                                                                                      |
| 78     | 0x1f      | End of telegram, more data follows                                                                                                                                                                                                                                                                                                                                             |
| 79     | 0xnn      | Checksum                                                                                                                                                                                                                                                                                                                                                                       |
| 80     | 0x16      | Stop character                                                                                                                                                                                                                                                                                                                                                                 |

### 5.9.2.3 Slave to master – Telegram 2

| Byte index | Data      | Description                                       |
|------------|-----------|---------------------------------------------------|
| 0          | 0x68      | Start character 1                                 |
| 1          | 0xnn      | L-Field 1                                         |
| 2          | 0xnn      | L-Field 2                                         |
| 3          | 0x68      | Start character 2                                 |
| 4          | 0x08      | RSP_UD                                            |
| 5          | 0xnn      | A-Field = Primary address                         |
| 6          | 0x72      | Variable data respond, mode 1 = LSByte first      |
| 7..10      | 0xn timer | Secondary address                                 |
| 11..12     | 0x9615    | Manufacturer id “ELV”                             |
| 13         | 0xnn      | Generation field In the range from 70 to 79 (dec) |
| 14         | 0x1B      | Device type/medium = room sensor                  |

|                |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 15             | 0xnn                      | Access number                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 16             | 0xnn                      | Status byte<br>0x00 = Ok (no error)<br>0x0a = Sensor failure (permanent application error)                                                                                                                                                                                                                                                                                                                                                              |
| 17..18         | 0x0000                    | Signature, 16 bit binary                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 19 + 5 x N     | 0xc2   0xf2   0x82   0xb2 | 24-hour log temperature table DIF<br>Table index = N = 0..23<br>Storage numbers N + 3 = 3..26<br>Value age = N (+1/-0) hours<br><br>The newest value is transmitted first.<br>During the first 24 hours after power-on, values are sent as 0 and flagged as "value during error state" (DIF bits 5 and 4 = 1), while not yet updated.<br>All temperature data will be 0 in case of sensor error. See product status byte or status byte in data header. |
| 19 + 5 x N     | 0xnn                      | 24-hour log temperature table DIFE<br>nn = (N+3/2)                                                                                                                                                                                                                                                                                                                                                                                                      |
| 20 + 5 x N     | 0x65                      | 24-hour log temperature table VIFE                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 21..22 + 5 x N | 0xn timer                 | Average temperature of hour "now - N" x 100                                                                                                                                                                                                                                                                                                                                                                                                             |
| 23 + 5 x N     | 0x0f                      | End of telegram, no more data follows                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 23 + 5 x N + 1 | 0xnn                      | Checksum                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 23 + 5 x N + 2 | 0x16                      | Stop character                                                                                                                                                                                                                                                                                                                                                                                                                                          |

### 5.9.3 Set baud rate

Set baud rate of slave.

#### 5.9.3.1 Master to slave

| Byte index | Data                      | Description               |
|------------|---------------------------|---------------------------|
| 0          | 0x68                      | Start character 1         |
| 1          | 0x03                      | L-Field 1                 |
| 2          | 0x03                      | L-Field 2                 |
| 3          | 0x68                      | Start character 2         |
| 4          | 0x43   0x53   0x63   0x73 | C-Field = SND_UD          |
| 5          | 0xnn                      | A-Field = Primary address |

|   |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 | 0xnn | CI-Field = Baud rate selection code:<br>0xb8 = 300 baud<br>0xb9 = 600 baud<br>0xbA = 1200 baud<br>0xbb = 2400 baud<br>0xbc = 4800 baud (note 1)<br>0xbd = 9600 baud (note 1)<br>0xbe = no change (note 2)<br>0xbf = no change (note 2)<br><br>Baud rates > 2400 baud do work but have not been tested to comply with the timing specifications in the M-Bus standard.<br><br>Baud rate codes 0xbe and 0xbf are ACKed with 0xe5 although they do not change the baud rate (this is in accordance with the M-Bus specification). |
| 7 | 0xnn | Checksum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 8 | 0x16 | Stop character                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

#### 5.9.3.2 Slave to master

| Byte index | Data | Description |
|------------|------|-------------|
| 0          | 0xe5 | Acknowledge |

#### 5.9.4 Application reset

Restore all information to factory default, see section 7.2 for factory default values.

##### 5.9.4.1 Master to slave

| Byte index | Data                      | Description                  |
|------------|---------------------------|------------------------------|
| 0          | 0x68                      | Start character 1            |
| 1          | 0x04                      | L-Field 1                    |
| 2          | 0x04                      | L-Field 2                    |
| 3          | 0x68                      | Start character 2            |
| 4          | 0x43   0x53   0x63   0x73 | C-Field = SND_UD             |
| 5          | 0xnn                      | A-Field = Primary address    |
| 6          | 0x50                      | CI-Field = Application reset |
| 7          | 0xb0                      | Application reset sub-code   |
| 8          | 0xnn                      | Checksum                     |
| 9          | 0x16                      | Stop character               |

#### 5.9.4.2 Slave to master

| Byte index | Data | Description |
|------------|------|-------------|
| 0          | 0xe5 | Acknowledge |

### 5.9.5 Set primary address

Change M-Bus primary address.

#### 5.9.5.1 Master to slave

| Byte index | Data                      | Description                     |
|------------|---------------------------|---------------------------------|
| 0          | 0x68                      | Start character 1               |
| 1          | 0x06                      | L-Field 1                       |
| 2          | 0x06                      | L-Field 2                       |
| 3          | 0x68                      | Start character 2               |
| 4          | 0x43   0x53   0x63   0x73 | C-Field = SND_UD                |
| 5          | 0xnn                      | A-Field = Primary address       |
| 6          | 0x51                      | CI-Field                        |
| 7          | 0x01                      | Primary address DIF             |
| 8          | 0x7A                      | Primary address VIF             |
| 9          | 0xnn                      | New primary address (0x00-0xfa) |
| 10         | 0xnn                      | Checksum                        |
| 11         | 0x16                      | Stop character                  |

#### 5.9.5.2 Slave to master

| Byte index | Data | Description |
|------------|------|-------------|
| 0          | 0xe5 | Acknowledge |

### 5.9.6 Set secondary address

Change M-Bus secondary address.

#### 5.9.6.1 Master to slave

| Byte index | Data                      | Description               |
|------------|---------------------------|---------------------------|
| 0          | 0x68                      | Start character 1         |
| 1          | 0x09                      | L-Field 1                 |
| 2          | 0x09                      | L-Field 2                 |
| 3          | 0x68                      | Start character 2         |
| 4          | 0x43   0x53   0x63   0x73 | C-Field = SND_UD          |
| 5          | 0xnn                      | A-Field = Primary address |
| 6          | 0x51                      | CI-Field                  |
| 7          | 0x0c                      | Secondary address DIF     |

|       |           |                                         |
|-------|-----------|-----------------------------------------|
| 8     | 0x79      | Secondary address VIF                   |
| 9..12 | 0xn timer | New secondary address, 8-bit packed BCD |
| 13    | 0xnn      | Checksum                                |
| 14    | 0x16      | Stop character                          |

#### 5.9.6.2 Slave to master

| Byte index | Data | Description |
|------------|------|-------------|
| 0          | 0xe5 | Acknowledge |

#### 5.9.7 Select slave

Select slave for further secondary addressing. After successful selection, the slave can be addressed using primary address 253.

##### 5.9.7.1 Master to slave

| Byte index | Data                      | Description                                                                                                                                                                    |
|------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0          | 0x68                      | Start character 1                                                                                                                                                              |
| 1          | 0xnn                      | L-Field 1<br>Variable depending on selection mask.<br><br>The selection mask can have any size in the range 0..8 bytes except 5 (Manufacturer id requires a full 16-bit mask). |
| 2          | 0xnn                      | L-Field 2<br>Variable depending on selection mask                                                                                                                              |
| 3          | 0x68                      | Start character 2                                                                                                                                                              |
| 4          | 0x43   0x53   0x63   0x73 | C-Field = SND_UD                                                                                                                                                               |
| 5          | 0xnn                      | A-Field = Primary address                                                                                                                                                      |
| 6          | 0x52                      | CI-Field = Slave selection<br><br>The slave will be deselected if there is any mismatch.                                                                                       |
| 7..10      | 0xn timer                 | <i>Optional</i><br>M-Bus secondary address mask, packed BCD<br><br>The M-Bus ID mask can use the nibble 0xf as a wildcard in any of the eight BCD digit positions.             |
| 11..12     | 0xn timer                 | <i>Optional</i><br>M-Bus manufacturer id mask, 16-bit binary<br><br>The M-Bus manufacturer id mask can use 0xff as wildcard for one or both bytes.                             |

|    |      |                                                                                                                                          |
|----|------|------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | 0xnn | <i>Optional</i><br>M-Bus generation mask, 8-bit binary<br><br>The M-Bus generation mask can use 0xff as wildcard.                        |
| 14 | 0xnn | <i>Optional</i><br>M-Bus medium mask, 8-bit binary<br><br>The M-Bus meter medium mask will match if 0x00 ("unknown") or 0xff (wildcard). |
| 15 | 0xnn | Checksum                                                                                                                                 |
| 16 | 0x16 | Stop character                                                                                                                           |

### 5.9.7.2 Slave to master

| Byte index | Data | Description |
|------------|------|-------------|
| 0          | 0xe5 | Acknowledge |

## 5.9.8 Select Humidity VIF code

This command will change the relative humidity VIF presentation.

This command was implemented in software version 4.1.0.

### 5.9.8.1 Master to slave

| Byte index | Data                      | Description                                                                           |
|------------|---------------------------|---------------------------------------------------------------------------------------|
| 0          | 0x68                      | Start character 1                                                                     |
| 1          | 0x06                      | L-Field 1                                                                             |
| 2          | 0x06                      | L-Field 2                                                                             |
| 3          | 0x68                      | Start character 2                                                                     |
| 4          | 0x43   0x53   0x63   0x73 | C-Field = SND_UD                                                                      |
| 5          | 0xnn                      | A-Field = Primary address                                                             |
| 6          | 0x51                      | CI-Field                                                                              |
| 7          | 0x0F                      | Manufacture specific follows DIF                                                      |
| 8          | 0x06                      | Elvaco command Select humidity VIF code                                               |
| 9          | 0xnn                      | Humidity VIF selector<br>nn =<br>Dimensionless (0xFDBA)=0x00<br>Plain text (%RH)=0x01 |
| 10         | 0xnn                      | Checksum                                                                              |
| 11         | 0x16                      | Stop character                                                                        |

### 5.9.8.2 Slave to master

| Byte index | Data | Description |
|------------|------|-------------|
|------------|------|-------------|

|   |      |             |
|---|------|-------------|
| 0 | 0xe5 | Acknowledge |
|---|------|-------------|

## 6 Troubleshooting

### 6.1 Product does not respond to M-Bus master commands

Please verify your M-Bus master and slave configuration:

- Voltage over M-Bus connection should be between 21 VDC and 42 VDC.
- All M-Bus slaves connected to the M-Bus master must have unique primary or secondary addresses depending on addressing mode used.
- Verify M-Bus slave baud rate used by M-Bus master. M-Bus master baud rate must be identical to M-Bus slave baud rate.

## 7 Technical specifications

### 7.1 Characteristics

| Type                        | Value                          | Unit  | Comments                                                     |
|-----------------------------|--------------------------------|-------|--------------------------------------------------------------|
| Mechanics                   |                                |       |                                                              |
| Casing material             | Polystyrol                     | -     | Light Grey                                                   |
| Protection class            | IP65                           | -     |                                                              |
| Dimensions                  | 110x100x52                     | mm    |                                                              |
| Weight                      | 140                            | g     |                                                              |
| Connection M-Bus            | Screw terminal                 | -     | <1.5 mm <sup>2</sup>                                         |
| Mounting                    | Wall mounted                   |       |                                                              |
| Electrical                  |                                |       |                                                              |
| Power supply                | 21-42                          | VDC   | Through M-Bus connection, independent of the wiring polarity |
| Power consumption           | 1.5                            | mA    | M-Bus 1T                                                     |
| Environmental               |                                |       |                                                              |
| Operating temperature range | -40 to +55                     | °C    |                                                              |
| Storage temperature range   | -40 to +85                     | °C    |                                                              |
| Operating humidity          | 0 to 100                       | %RH   | No condensation                                              |
| Temperature sensor          |                                |       |                                                              |
| Temperature range           | -40 to +55                     | °C    |                                                              |
| Temperature 10 to +30 °C    | +/- 0.2                        | °C    |                                                              |
| Temperature 0 to +10 °C     | +/- 0.4                        | °C    |                                                              |
| Temperature -10 to +0 °C    | +/- 0.5                        | °C    |                                                              |
| Temperature -40 to +55 °C   | +/- 1.5                        | °C    |                                                              |
| Humidity sensor             |                                |       |                                                              |
| Range                       | 0 to 100                       | %RH   |                                                              |
| Repeatability RH            | +/- 0.1                        | %RH   |                                                              |
| Humidity 10 to 90 %RH       | +/- 2                          | %     |                                                              |
| Humidity 0 to 100 %RH       | +/- 4                          | %     |                                                              |
| M-Bus                       |                                |       |                                                              |
| M-Bus standard              | EN 13757                       | -     |                                                              |
| M-Bus baud rate             | 300, 2400                      | Bit/s |                                                              |
| IR interface                | No                             | -     |                                                              |
| M-Bus commands              | SND_UD,<br>SND_NKE,<br>REQ_UD2 | -     |                                                              |
| Addressing modes            | Secondary,                     | -     |                                                              |

|                  |                                                    |   |  |
|------------------|----------------------------------------------------|---|--|
|                  | Primary                                            |   |  |
| Momentary values | Temperature<br>, humidity,<br>status               | - |  |
| Historic values  | Average<br>values for<br>last hour<br>and last day | - |  |

*Table 2 Technical specifications*

## 7.2 Factory defaults

| Name                    | Value            | Unit  | Comments                                     |
|-------------------------|------------------|-------|----------------------------------------------|
| M-Bus Baud rate         | 2400             | Bit/s | M-Bus slave baud rate                        |
| M-Bus primary address   | 0                | -     | Slave not installed                          |
| M-Bus secondary address | Serial<br>number | -     | Revert secondary address to<br>serial number |

*Table 3 Factory defaults*

## 8 Type approvals

CMA20 is designed to comply with the directives and standards listed below.

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

*Table 4 Type approvals*

## 9 Safety and environment

### 9.1 Safety precautions

The following safety precautions must be observed during all phases of the operation, usage, service or repair of any CMA20 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.

All instructions must be carefully read before CMA20 is installed and used. They contain important information about how the product is used properly.

The installation of CMA20 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.

To prevent hazardous power levels, the M-Bus 2-wire cable should be disconnected from the M-Bus master or other installations.

The product is intended for permanent connection to the M-Bus master through the M-Bus 2-wire cable. The M-Bus master's 2-wire cable must be properly dimensioned, and if necessary, it must be possible to disconnect the product from the 2-wire cable.

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

## 10 Document History

| Version | Date       | Description                                         | Author                  |
|---------|------------|-----------------------------------------------------|-------------------------|
| 1.0     | 2009-12-09 | First release                                       | David Vonasek           |
| 2.0     | 2010-10-26 | Removed configuration tool information.             | David Vonasek           |
| 3.0     | 2010-11-22 | Updated text and technical specifications.          | Ericha Bloom            |
| 4.0     | 2013-03-11 | Added description for Elvaco specific command 0x06. | Ericha Bloom            |
| 4.1     | 2013-06-12 | Added Appendix A                                    | Peter King/Ericha Bloom |
| 7       | 2016-03-03 | Changed section 4.2                                 | Nicklas Alnström        |

### 10.1 Document software and hardware appliance

| Type     | Version | Date       | Comments |
|----------|---------|------------|----------|
| Hardware | R1A     | 2009-08-16 |          |
| Software | 4.1.0   | 2011-09-01 |          |

# 11 References

## 11.1 References

- [1] Sitronix ST7036
- [2] EN-13757-1, EN-13757-2, EN-13757-3  
*Communication System for meters and remote reading of meters, Part1, Part2 and Part3*

## 11.2 Terms and Abbreviations

| Abbreviation | Description                                             |
|--------------|---------------------------------------------------------|
| Product      | In this document, CMA20                                 |
| DIF          | Data Information Field (M-Bus data clock information)   |
| VIF          | Value Information Field (M-Bus value block information) |
| M-Bus slave  | General in this document CMA20                          |

### 11.2.1 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)

## 12 Appendix A – Example

### 12.1 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                                 |
| digital-input,,inst-value,0,0,0         |                                                         |
| %rh ,,inst-value,0,0,0                  | Humidity, momentary value                               |
| %rh ,,min-value,0,0,0                   | Humidity, lowest value since reset                      |
| %rh ,,max-value,0,0,0                   | Humidity, highest value since reset                     |
| ext-temp,°c,inst-value,0,0,0            | Temperature, momentary value                            |
| ext-temp,°c,min-value,0,0,0             | Temperature, lowest value since reset                   |
| ext-temp,°c,max-value,0,0,0             | Temperature, highest value since reset                  |
| avg-duration,hour(s),inst-value,0,0,0   | Number of hours that average values have been collected |
| ext-temp,°c,inst-value,0,0,1            | Temperature, 1-hour rolling average                     |
| ext-temp,°c,inst-value,0,0,2            | Temperature, 24-hour rolling average                    |
| fabrication-no,,inst-value,0,0,0        | Fabrication number                                      |
| other-sw-version,,inst-value,0,0,0      | Software version                                        |
| manufacturer-specific,,inst-value,0,0,0 |                                                         |

## 12.2 Denomination of values for use in filters

| Denomination                    | Description                                             |
|---------------------------------|---------------------------------------------------------|
| mbus.dib.%rh.0.0.0.0            | Humidity, momentary value                               |
| mbus.dib.%rh.0.0.0.2            | Humidity, lowest value since reset                      |
| mbus.dib.%rh.0.0.0.1            | Humidity, highest value since reset                     |
| mbus.dib.ext-temp.0.0.0.0       | Temperature, momentary value                            |
| mbus.dib.ext-temp.0.0.0.2       | Temperature, lowest value since reset                   |
| mbus.dib.ext-temp.0.0.0.1       | Temperature, highest value since reset                  |
| Mbus.dib.avg-duration.0.0.0.0   | Number of hours that average values have been collected |
| mbus.dib.ext-temp.0.1.0.0       | Temperature, 1-hour rolling average                     |
| mbus.dib.ext-temp.0.2.0.0       | Temperature, 24-hour rolling average                    |
| Mbus.dib.fabrication-no.0.0.0.0 | Fabrication number                                      |