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CMeX20W User's Manual English

1050069 CMeX20W External MCM for ABB B21/B23/B24, Wireless M-Bus

CMeX20 is a wireless M-Bus adapter for ABB electricity meters, that converts M-Bus over IR to wireless M-Bus. CMeX20W uses wireless M-Bus mode T1.

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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 CMeX20W.

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.

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CMeX20W is a trademark of Elvaco AB, Sweden.

1.2 Contacts

Elvaco AB Headquarter

Kabelgatan 2T
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.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 CMeX20W. It is intended for field engineers and developers.

2.2 Models

CMeX20W

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 to find out the capabilities of your product.

Product name	Comments
CMeX20W	External MCM for ABB B21/B23/B24, Wireless M-Bus

Table 1 Product

3.2 Capabilities

CMeX20W is an External MCM for ABB electricity meters. CMeX20W is the perfect product for collection of energy consumption when wiring from meter to data central is not an option.

3.3 Applications

CMeX20W should be used in the following scenarios:

- Reading of ABB electricity meters
- Used instead of a CMeX20 when wiring is not an option

4 Getting started

This chapter covers mounting and function control of CMeX20W.

4.1 Overview
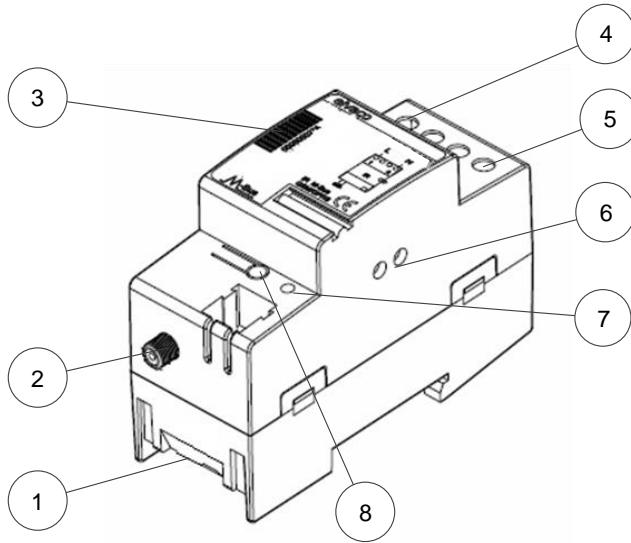
1. DIN lock
2. Antenna connection
3. Serial number
4. Power supply L
5. Power supply N
6. IR interface
7. LED
8. Push button (SW1)

Figure 1 CMeX20W.
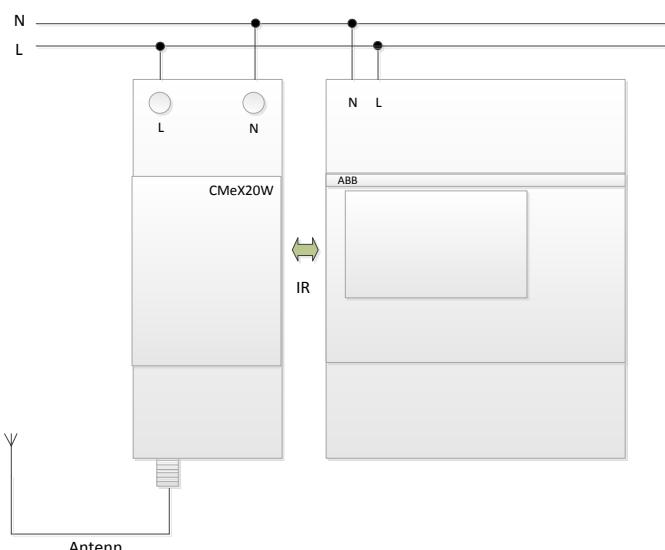
Figure 2 CMeX20W must be mounted as close to the ABB electricity meter as possible (on left side).

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4.2 Mounting

The CMeX20W is mounted on a DIN-rail, on the left side of, and as close as possible to, the meter. There should be a maximum of 3 mm between the devices.

⚠ **IMPORTANT**

Please take the following in consideration:

- Avoid mounting the product in a metal cabinet. It will reduce the ability of the product to connect to a master.

- If the product is still installed in a metal cabinet, an external antenna, for wireless M-Bus, should be used.

4.3 IR communication

CMeX20W starts searching for ABB electricity meter as soon as the supply voltage is connected.

For CMeX20W to be able to find ABB electricity meters, it must be configured correctly (see ABB's manual for complete information). The optic interface must be activated and the communication speed should not be over 9600 baud.

The CMeX20W can then automatically sense which baud rate the ABB meter is using and adapt after that.

When CMeX20W cannot establish any contact with the ABB meter, the LED will light up red. As soon as it establishes contact with the ABB meter it will light up green or yellow (depending on the encryption).

CMeX20W can handle an IR communication of maximum 9600 baud. The ABB meter can be set to a higher speed, but then the CMeX20W will not find the meter.

4.4 Wireless M-Bus

The radio will start when CMeX20W has a functioning IR communication with the ABB meter. The radio will send Wireless M-Bus messages with meter values in Wireless M-Bus mode T1.

4.4.1 Installation process

The product can be installed and activated in two modes:

- **Unencrypted mode**: The meter data is sent unencrypted and no encryption key is needed to decrypt data.

- **Encrypted mode**: The meter data is sent encrypted and an encryption key is needed to decrypt data. The information is encrypted using a 128 bit AES-key. When entering the key, you connect it to ABB's secondary address, so it's important to know which CMeX20W belongs to which ABB meter.

Please consult your project manager which mode to use in your project.

4.4.1.1 Installation process – Choose between encrypted and unencrypted mode

By pressing and holding the button SW1 (4) for 5 s you switch between encrypted and unencrypted mode.

When the LED turns green, it is sending in unencrypted mode.

When the LED turns yellow, it is sending in encrypted mode.

When the LED turns off (in about 500 ms), data is sent via Wireless M-Bus. This occurs every 16 seconds.

5 Application description

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

5.1 Operation

The product will automatically send messages with information from the ABB electricity meter every 16th seconds after the installation has been performed.

5.1.1 Operation modes

The product has the following operation modes:

1. Inactive, no ABB electricity meter is found
2. Normal operation - unencrypted mode
3. Normal operation - encrypted mode

5.1.1.1 Inactive mode

When the product does not have any contact with the ABB electricity meter, the LED will turn red and no data is sent. As long as the CMeX20W is powered, it will keep searching for an ABB electricity meter to connect to.

5.1.1.2 Normal operation – unencrypted mode

In normal operation unencrypted mode, the product will send **unencrypted** messages every 16th seconds. This mode is normally used when the master or AMR/AMM system does not handle AES encryption or if the AES key is unknown to the system.

In unencrypted mode, the information is sent in a wireless telegram with "short application header" (CI = 0x7A). The unencrypted telegram contains only one address, "link layer address", which is composed of data that is taken from the header in the ABB electricity meter's telegram ("Manufacturer code, ID, Version and Device type). In unencrypted mode, the CMeX20W is not sending its own address in the telegram.

5.1.1.3 Normal operation – encrypted mode

In normal operation encrypted mode, the product will send **encrypted** messages every 16th seconds. This mode is used to secure data that is sent from the product to the master or AMR/AMM system. To decrypt data, the master or system must know the unique 128 bit AES key to the meter. The unique 128 bit AES key is given at the delivery or at the demand of the customer.

In encrypted mode, the information is sent in a wireless telegram with "long application header" (CI = 0x72). The encrypted telegram contains two addresses, the CMeX20W's own address that is needed for choosing the right key for decryption and the ABB meter's address "Application layer address", which is included in "long application header" and contains data taken from the header in the ABB meter's telegram ("Manufacturer code, ID, Version and Device type). The telegram's "link layer address" contains the CMeX20W's own address ("Manufacturer code, ID, Version and Device type). Device type for CMeX20W is 0x37 = "Radio converter, meter side"

5.2 LED-indications

LED	Description	Visual
Off	Power supply is not connected	
Red steady on	CMeX20W has no contact with electricity meter, no messages are sent.	
Green Short dip	Normal operation unencrypted mode. Wireless telegram is sent.	
Yellow Short dip	Normal operation encrypted mode Wireless telegram is sent.	
Yellow flashing Short dip	The ABB electricity meter's telegram is too large to fit in the encrypted wireless telegram. The telegram is sent wirelessly but up to nine byte may have been truncated at the end of the meter's telegram. Wireless telegram is sent.	

Table 2 LED 1 indications

6 Administration of the product

This chapter covers the configuration of the product. Theproduct follows the M-Bus standards EN13757-2, EN13757-3 and EN13757-4

6.1 M-Bus identification

At operation in encrypted mode, the product can be identified by the following information in the "Link Layer Address":

- Manufacturer string = ELV

- Medium/DEVICE TYPE = 0x37 = "Radio converter, meter side"

- Generation/Version = 30 (CMeX20W),

6.2 Wireless M-Bus modes

The product uses Wireless M-Bus mode T1.

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 Transmissions

The product will automatically start sending telegrams with measurement data when the IR communication with the ABB electricity meter is established. The product sends by default an SND_NR telegram every 16 seconds.

6.4.1 Send data (SND_NR)

During normal operation, a wireless M-Bus telegram of the type SND_NR ("Send, No Reply") is sent by default every 16th seconds.

6.4.1.1 Slave to master – Telegram 1 (SND_NR)

Unencrypted telegram:
All bytes from index 0 (L-field) are 4-to-6-bit coded according to the standard for Wireless M-Bus mode T1. CRC byte and 4/8-bit postamble are also sent according to the standard but are not shown in the table below.

Byte index 2..9 is "Link layer address" that contains the address of the meter.
Byte index 11..14 is "short application header".

Byte index	Data	Description
	0x55	preamble
	0x55	preamble
	0x55	preamble
	0x55	preamble
	0x55	preamble
	0x54	sync word byte 0
	0x3D	sync word byte 1
0	0xnn	L-field
1	0x44	C-field, 0x44 = SND-NR
2..3	0xnnnn	Manufacturer field from the meter's telegram, e.g. "ABB"
4..7	0xnnnnnnnn	ID-field from the meter's telegram
8	0xnn	Version field from meter's telegram
9	0xnn	DeviceType field from meter's telegram
10	0x7A	CI-field, 0x7A = "Short header follows"
11	0xnn	ACC = increment number from CMeX20W
12	0xnn	STATUS = status byte from meter's telegram
13..14	0x2000	CONFIG word = synchronous, unencrypted
15....		Meter's payload (all data after meter's header)

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Encrypted telegram:
All bytes from index 0 (L-field) is 4-to-6-bit coded according to the standard for Wireless M-Bus mode T1. CRC-byte and 4/8-bit postamble are also sent according to the standard but are not shown in the table below.

Byte index 2..9 is "Link layer address" that contains the address of CMeX20W.
Byte index 11..22 is "long application header" where index 11..18 is "application layer address" here contains the meter's address.

Byte index	Data	Description
	0x55	preamble
	0x55	preamble
	0x55	preamble
	0x55	preamble
	0x55	preamble
	0x54	sync word byte 0
	0x3D	sync word byte 1
0	0xnn	L-field
1	0x44	C-field, 0x44 = SND-NR
2..3	0x1596	Manufacturer field, 0x1596 = "ELV"
4..7	0xnnnnnnnn	ID-field, CMeX20W serial number
8	0xnn	Version field, CMeX20W version number
9	0x37	DeviceType-field, "Radio converter, meter side"
10	0x72	CI-field, 0x72 = "Long header follows"
11..14	0xnnnnnnnn	ID-field from meter's telegram
15..16	0xnnnn	Manufacturer field from meter's telegram
17	0xnn	Version field from meter's telegram
18	0xnn	DeviceType-field from meter's telegram
19	0xnn	ACC = increment number from CMeX20W
20	0xnn	STATUS = status byte from meter's telegram
21..22	0x25n0	CONFIG word = "encryption mode 5", n = number of encrypted blocks
23..24	0x2F2F	"Decryption verification bytes"
25….		Meter's payload (all data after the meter's header)

7 Troubleshooting

7.1 The master does not receive any telegram from the product

Troubleshooting:

- Check that CMeX20W has been powered up and has contact with the ABB electricity meter. The LED should light green or yellow. If not, see section 4.4.1 for deployment/activation.

- The master is not powered up or correctly configured.

- The master is out of range of the radio signal.

- The master's antenna is not optimally placed.

- The product is mounted in a metal cabinet or disturbed by other radio equipment.

8 Technical specifications

8.1 Characteristics

Type	Value	Unit	Comments
Mechanics			
Casing material	ABS UL94-V0	-	White
Protection class	IP20	-	
Dimensions (w x h x d)	35 x 95 x 65	mm	2 DIN modules
Weight	100	g	
Mounting	Mounted on DIN rail	-	DIN 50022, 35 mm
Antenna	Built-in	-	Optionally external via SMA-f
Electrical connections			
Supply voltage	Screw terminal	-	Cable 0.25-1.5 mm²
Electrical characteristics			
Nominal voltage	220-240	VAC	+/- 10 %
Frequency	50	Hz	
Power consumption (max)	<2.5	W	
Power consumption (nom)	<1	W	
Installation category	CAT 3	-	
Environmental specifications			
Operating temperature	– 20 to +55	°C	
Operating humidity max	80 % RH at temperatures up to 31 °C, decreasing linearly to 50 % RH at 40 °C	-	
Operating altitude	0-2000	m	
Pollution degree	Degree 2		
Usage environment	Indoors	-	Can be extended with IP67 enclosure for outdoor use
Storage temperature range	– 40 to +85	°C	

User interface			
Green LED	Power	-	
Red LED	Error	-	
Orange LED	Encrypted mode	-	
Push button	Configuration /activation	-	
M-Bus			
Interfaces	IR, M-Bus slave	-	
M-Bus slave interface			
M-Bus standard	EN13757-4	-	Communication by T1
Frequency	868.95	MHz	
Addressing modes	Electricity meter's secondary address	-	
M-Bus information	All fields in the first telegram of the electricity meter	-	
Transmit power	25	mW	
Transmit interval	16	s	
Encryption	Unencrypted (default) or encrypted	-	
Integration			
Meter implementation	ABB meters with IR interface	-	
Maximum number connected meters	1	-	

Table 3 Technical specifications

9 Type approvals

CMeX20W is designed to comply with the directives and standards listed below.

Approval	Description
EMC	EN 61000-6-2, EN 61000-6-3
Safety	EN 60950-1, CAT 3

Table 4 Approvals

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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 CMeX20W. 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 CMeX20W is installed and used. They contain important information about how the product is used properly.

The installation of CMeX20W 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.

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

11 Document history

Version	Date	Description	Author
1.0	2014-11-28	First release	Nicklas Alnström
	2015-06-12	Translation to English	Ericha Bloom
1.1	2017-06-27	Added information about Wireless M-Bus modes	Anton Larsson

11.1 Document software and hardware appliance

Type	Version	Date	Comments
Hardware	R1D	2014-11-28	
Software	22	2014-12-05	

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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, CMeX20W
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 telegrams. 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

14 Appendix B – Antennas and accessories

Denomination	Article number
WM-Bus magnetic base antenna 868MHz	9950470
WM-Bus wall mounted antenna 868MHz	9950627

Table 5 Antennas and accessories

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