# EM24 W1

## Wireless M-BUS COMMUNICATION PROTOCOL

**Version 0 Revision 3**

**August 25th, 2020**

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# 1 OVERVIEW

## 1.1 Introduction

The wM-Bus interface implemented in EM24_W1 models supports the wireless M-Bus protocol according to EN13757-3 and EN13757-4.
In this document only the information necessary to read Data Measurement from EM24_W1 has been reported.

## 1.2 Wireless M-Bus main features

Wireless M-Bus in EM24_W1 is according to the OMS specifications and classified as “Basic Meter”:

| Feature | Basic Meter | EM24 implementation |
|---|---|---|
| Transmits data in push mode | M | Yes |
| Transmits data in pull mode | O | No |
| Internal clock | O | No |
| Pairs value and timestamp | O | No |
| Attends to a time service | N/A | No |
| Detects current meter data in regular intervals | M | Yes |
| Parameters for periodic meter reading (e.g. load profile) are adjustable | O | No |
| Internal (billing relevant) tariffing | N/A | No |
| Internal (billing relevant) load profiling | N/A | No |
| Internal breaker or valve | N/A | No |
| M: Mandatory - O: Optional - N/A: Not Applicable | | |

In particular:

- Frame format: A
- Encryption: no encryption, mode 5 (ENC-Mode 5, security profile A) or mode 7 (ENC-Mode 7 security profile B)
- ELL (Extended Link Layer)
- Available special version with suffix “50” without ELL (when used with no encryption or with mode 5 encryption)

The transmission mode (@868 MHz) can be T1 or C1 and the transmission interval from 10 s to 60 min.

# 2 TABLES

## 2.1 Data format representation in Carlo Gavazzi’s EM24 wM-Bus

The instantaneous variables, totalizers and errors are represented by integers:

| Format | IEC data type | Description | Bits | Range |
|---|---|---|---|---|
| INT8 | INT | Integer | 8 | -128… 127 |
| INT16 | INT | Integer | 16 | -32768 ... 32767 |
| INT32 | DINT | Double integer | 32 | $-2^{31}$ ... $2^{31}$ |

## 2.2 Frames

The frames are packages of messages sent by EM24 containing the variables measured. The variables and their encryption included in the frame depend on the type of frame selected:

### 2.2.1 Frame 1 (Active energy totalizer)

| Variable | Data Format | Engineering unit | DIF [hex] | VIF [hex] | VIFE#1 [hex] | VIFE#2 [hex] | VIFE#3 [hex] |
|---|---|---|---|---|---|---|---|
| Total imported active energy | 32 bit integer | Wh*100 | 04 | 05 | | | |
| Error flag | 8 bit integer | | 01 | FD | 17 | | |

### 2.2.2 Frame 2 (Main energy totalizers and imported active power)

| Variable | Data Format | Engineering unit | DIF [hex] | VIF [hex] | VIFE#1 [hex] | VIFE#2 [hex] | VIFE#3 [hex] |
|---|---|---|---|---|---|---|---|
| Total imported active energy | 32 bit integer | Wh*100 | 04 | 05 | | | |
| Total imported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | 75 | |
| Total exported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | F5 | 3C |
| Imported active power | 32 bit integer | Watt*0.1 | 04 | 2A | | | |
| Error flag | 8 bit integer | | 01 | FD | 17 | | |

### 2.2.3 Frame 3 (Main energy totalizes and all variables) for version AV23X and AV53X

| Variable | Data Format | Engineering unit | DIF [hex] | VIF [hex] | VIFE#1 [hex] | VIFE#2 [hex] | VIFE#3 [hex] |
|---|---|---|---|---|---|---|---|
| Total imported active energy | 32 bit integer | Wh*100 | 04 | 05 | | | |
| Total imported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | 75 | |
| Total exported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | F5 | 3C |
| Imported active power | 32 bit integer | Watt*0.1 | 04 | 2A | | | |
| Imported reactive power | 32 bit integer | Var | 04 | FB | 14 | | |
| Exported reactive power | 32 bit integer | Var | 04 | FB | 94 | 3C | |
| Current L1 | 32 bit integer | Ampere*0.001 | 04 | FD | D9 | FC | 01 |
| Current L2 | 32 bit integer | Ampere*0.001 | 04 | FD | D9 | FC | 02 |
| Current L3 | 32 bit integer | Ampere*0.001 | 04 | FD | D9 | FC | 03 |
| Voltage L1-N | 32 bit integer | Volt*0.1 | 04 | FD | C8 | FC | 01 |
| Voltage L2-N | 32 bit integer | Volt*0.1 | 04 | FD | C8 | FC | 02 |
| Voltage L3-N | 32 bit integer | Volt*0.1 | 04 | FD | C8 | FC | 03 |
| Frequency | 16 bit integer | Hz*0.1 | 02 | FB | 2E | | |
| Error flag | 8 bit integer | | 01 | FD | 17 | | |

### 2.2.4 Frame 3 (Main energy totalizes and all variables) for version AV21X

| Variable | Data Format | Engineering unit | DIF [hex] | VIF [hex] | VIFE#1 [hex] | VIFE#2 [hex] | VIFE#3 [hex] |
|---|---|---|---|---|---|---|---|
| Total imported active energy | 32 bit integer | Wh*100 | 04 | 05 | | | |
| Total imported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | 75 | |
| Total exported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | F5 | 3C |
| Imported active power | 32 bit integer | Watt*0.1 | 04 | 2A | | | |
| Imported reactive power | 32 bit integer | Var | 04 | FB | 14 | | |
| Exported reactive power | 32 bit integer | Var | 04 | FB | 94 | 3C | |
| Current | 32 bit integer | Ampere*0.001 | 04 | FD | D9 | FC | 01 |
| Voltage L-N | 32 bit integer | Volt*0.1 | 04 | FD | C8 | FC | 01 |
| Frequency | 16 bit integer | Hz*0.1 | 02 | FB | 2E | | |
| Error flag | 8 bit integer | | 01 | FD | 17 | | |

### 2.2.5 Frame 4 (All energy totalizers and powers)

| Variable | Data Format | Engineering unit | DIF [hex] | VIF [hex] | VIFE#1 [hex] | VIFE#2 [hex] | VIFE#3 [hex] |
|---|---|---|---|---|---|---|---|
| Total imported active energy | 32 bit integer | Wh*100 | 04 | 05 | | | |
| Total exported active energy | 32 bit integer | kWh*0.1 | 04 | 85 | 3C | | |
| Total imported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | 75 | |
| Total exported reactive energy | 32 bit integer | kVarh*0.1 | 04 | FB | 82 | F5 | 3C |
| Imported active power | 32 bit integer | Watt*0.1 | 04 | 2A | | | |
| Exported active power | 32 bit integer | Watt*0.1 | 04 | AA | 3C | | |
| Imported reactive power | 32 bit integer | Var | 04 | FB | 14 | | |
| Exported reactive power | 32 bit integer | Var | 04 | FB | 94 | 3C | |
| Error flag | 8 bit integer | | 01 | FD | 17 | | |

**Note**
The values transmitted - energy, current, voltage, frequency - are instant values, while power values are the average values within the transmission interval.

### 2.2.6 Available frames vs. EM24 models

| Frame type | "X" models | "PFA" models (including AV21X) | "PFB" models |
|---|---|---|---|
| 1 | X | X | X |
| 2 | X | X | X |
| 3 | X | X | X |
| 4 | X | | X |

## 2.3 Error flag

"Error flag" is a diagnostic variable used to communicate an overflow condition which makes the measured data invalid:

| Bit | | | | | | | | Meaning | |
|---|---|---|---|---|---|---|---|---|---|
| 8 [MSb] | 7 | 6 | 5 | 4 | 3 | 2 | 1 [LSb] | 1P system | 3P system |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | No error | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | V1N overflow | |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | N.A. | V2N overflow |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | N.A. | V3N overflow |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | I1 overflow | |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | N.A. | I2 overflow |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | N.A. | I3 overflow |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | Frequency out of range | |

**Note**
- N.A. (not available): the bit cannot be set because the relevant measurement is not defined, bit = 0.
- Frequency out of range is set when occurs an overflow or an underflow of the frequency measured by measuring module.
- In system 3P, monitored voltages that in case causes overflow conditions are the L-N ones (which refer to the instrument internal virtual neutral).

# 3 REVISIONS

- Version 0 Revision 1.
  First release of the EM24 W1 communication protocol.

- Version 0 Revision 2.
  Introduction of one note stating the availability of the special version 50 without ELL.

- Version 0 Revision 3.
  Introduction of AV21X version reference.