
P1 Companion Standard

Dutch Smart Meter Requirements

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1 INTRODUCTION

1.1 Scope

This document provides a companion standard for an Automatic Meter Reading (AMR) system for electricity, thermal (heat & cold), gas, water and hot water meters. The scope of this standard is the end-consumer (P1) interface for:

- Residential electricity meters
- Residential thermal (heat & cold) meters
- Residential gas meters
- Residential water meters

This companion standard focuses on the P1 interface for gas, thermal (heat / cold), and water meters. There is no separate interface for electricity meters since these meters are technically part of the metering system.

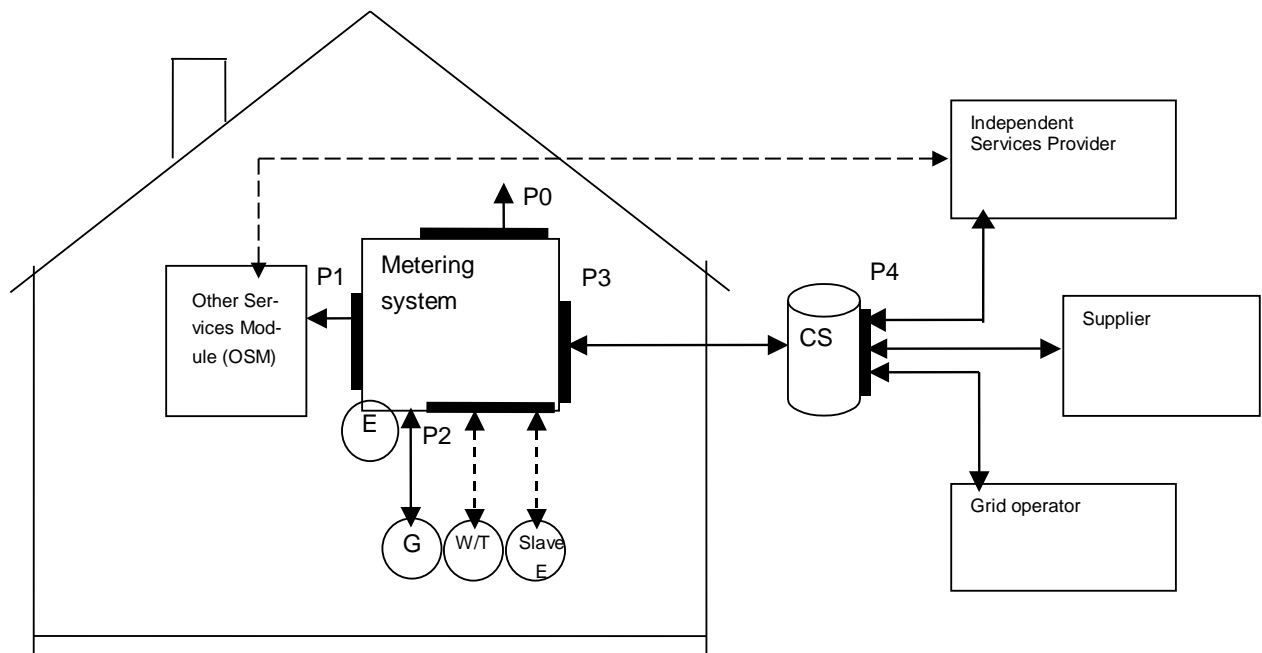


Figure 1-1: Meter interfaces overview.

The goal of this companion standard is to reach an open, standardized protocol implementation and functional hardware requirements related to the communication between several types of Service Modules and a Metering System. Any specification in this standard is intended to encourage suppliers to develop their hardware and software in a common direction. Standardised protocols and hardware specifications are referred to as much as possible.

This companion standard is the result of a combined effort of the major Dutch grid operators.

2 SYSTEM ARCHITECTURE

The interface is based on the following:

- Simple installation by customer;
- Simple and clearly defined interface;
- Low cost for the installation itself;
- Low cost for the customer installing, operating and maintaining the interface;
- Safe for the customer;
- The metering system or the data in it cannot be compromised.

The interface is based on NEN-EN-IEC 62056-21 (Electrical metering-Data exchange for meter reading, tariff and load control – Part 21: direct local data exchange, 2002-05).

This companion standard holds physical characteristics and protocol definitions for the interface.

3 ABBREVIATION LIST

| | |
|-----|---|
| ESD | ElectroStatic Discharge |
| IEC | International Electrotechnical Commission |
| GND | Ground |
| OSM | Other Service Module |
| OVP | Over Voltage Protection |

4 NORMATIVE REFERENCES

The following standards are referred to in this company standard. For undated references the latest edition applies.

| Ref.No. | Document | Description |
|---------|---------------|--|
| 1. | IEC 62056-21 | Electricity metering – Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange |
| 2. | IEC 62056-61 | Electricity metering - Data exchange for meter reading, tariff and load control – Part 61: OBIS Object Identification System |
| 3. | IEC 60747-5-5 | Electrical Safety Standard |
| 4. | IEC 61000-4-2 | Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques—Electrostatic discharge |
| 5. | IEC 61010 | Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use |
| | AmvB | Algemene maatregel van Bestuur “Besluit op afstand uitleesbare meet- inrichtingen” |

Table 4-1: Normative References

5 PHYSICAL INTERFACE CHARACTERISTICS

This specification is based on the use of one OSM-device. It is however possible to use more devices by using an active or passive hub or repeater (not in scope of this document).

5.1 Physical connector

The P1 port connector type is RJ12. The Metering System holds a female connector; the OSM (Other Service Module) connects via standard RJ12 male plug.

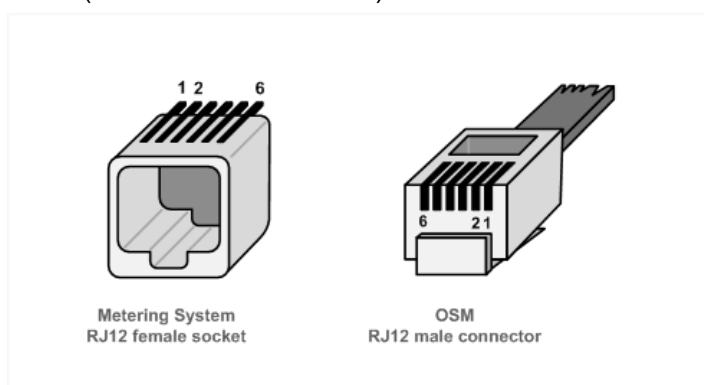


Figure 5-1: Physical connectors.

The P1 connector in the Metering System must be accessible at all times and should not be sealed or protected by a sealed cover. The P1 pin assignment is detailed in the table below:

| Pin # | Signal name | Description | Remark |
|-------|--------------|------------------|------------------------|
| 1 | +5V | +5V power supply | Power supply line |
| 2 | Data Request | Data Request | Input |
| 3 | Data GND | Data ground | |
| 4 | n.c. | Not connected | |
| 5 | Data | Data line | Output. Open collector |
| 6 | Power GND | Power ground | Power supply line |

Table 5-1: Physical connector pin assignment

5.2 User safety

5.2.1 Installation Category

The P1 interface (being integral part of the entire Metering System) has to fulfil the requirements for Installation Category IV, meaning impulse withstand voltages = 6000 V. See IEC standard - Ref [5].

5.2.2 Galvanic Isolation

The P1 port lines must be galvanically isolated from the mains, including +5V power supply line.

To secure a user of P1 port from electric shock, and at the same time to protect the Metering System against any kind of reversed connection, and to avoid the possibility of influencing the Metering System through the P1 port, **all the lines** of P1 port must be galvanically isolated from the mains (Including +5V power supply line).

To achieve galvanic isolation and to lower the possibility of influencing the Metering System through the P1 port, the signal lines (Data and Data Request) must be equipped with optocouplers.

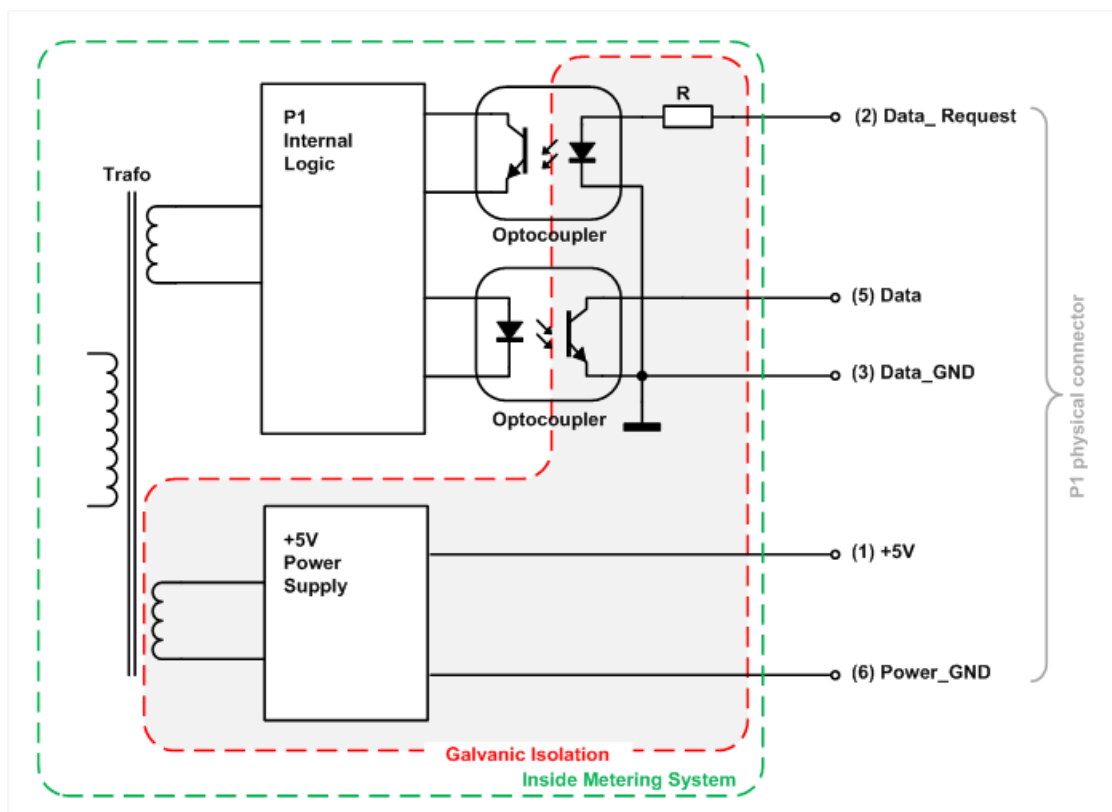


Figure 5-2: Galvanic isolation from the mains.

The P1 port design (including optocouplers) must adhere to the relevant IEC standards for measurement equipment.

Especially:

IEC 60747-5-5 - Electrical safety standard. Ref [3].

IEC 61010 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use. Ref [5].

5.3 Power supply

The “+5V” power supply line is meant to provide a power source to OSM devices, to enable their ability to process and transfer received metering data further wired or wireless (i.e. via Bluetooth or Wi-Fi technologies).

The power consumption of the P1 circuitry shall **NOT** be included in the register values of the Electricity meter.

5.3.1 Voltage characteristics

The P1 interface must provide stable +5V DC power supply via “+5V” (pin 1) and “Power GND” (pin 6) lines.

“+5V” voltage and its tolerances are defined as follows:

- Nominal voltage $U_L = 5,0 \text{ V}$
- Maximum voltage allowed $U_{L_MAX} \leq 5,3 \text{ V}$ at $I_L = 0 \text{ mA}$
- Minimum voltage allowed $U_{L_MIN} \geq 4,9 \text{ V}$ at $I_L = I_{L_CONT} = 250 \text{ mA}$

The “Allowed Voltage” window is presented on the picture below:

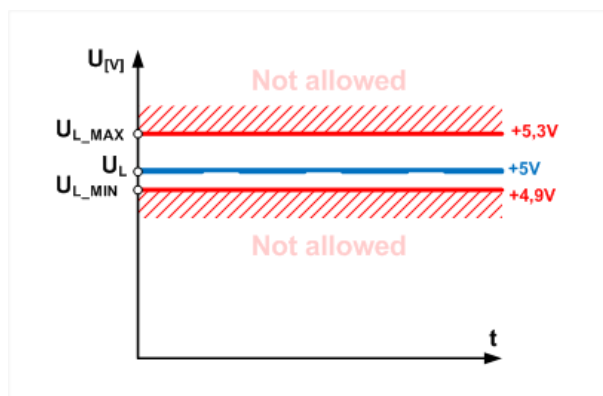


Figure 5-3: Allowed voltage window.

The “Ripple Voltage” U_{RIPPLE_MAX} at $I_{L_CONT} = 250 \text{ mA}$ must not exceed 2% of a nominal voltage (U_L). $U_{RIPPLE_MAX} \leq 100\text{mV}$ (pp - peak to peak), for frequencies lower or equal to 100 Hz. Defined at pure resistive load.

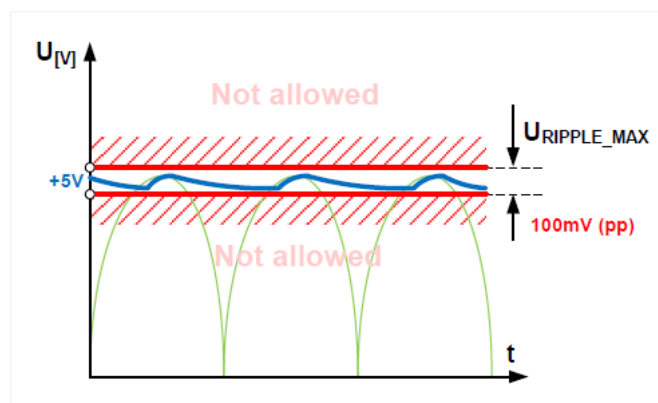


Figure 5-4: Ripple voltage window.

The “Noise Level” $U_{\text{NOISE_MAX}}$ must not exceed $\leq 50\text{mV}$ peak to peak, for frequencies higher than 50 kHz. Defined at pure resistive load.

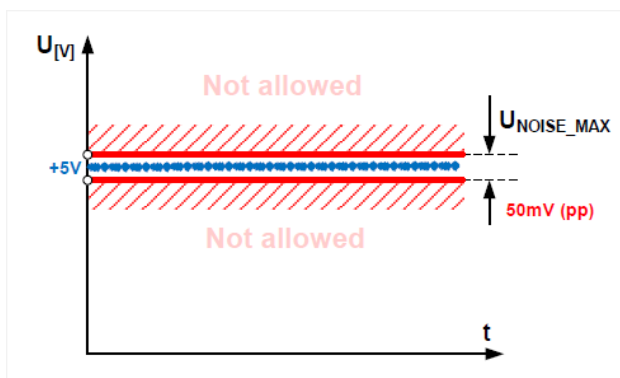


Figure 5-5: Noise level window.

5.3.2 Current characteristics

The power supply must be able to continuously supply current $I_{\text{L_CONT}} \leq 250\text{ mA}$.

The power supply line must be equipped with an overload / overcurrent mechanism, protecting P1 interface from excessive current by immediately shutting off the flow of current when it exceeds a level of $I_{\text{L_MAX}} \geq 300\text{ mA}$.

The tolerance of triggering the overload / overcurrent mechanism should stay between $I_{\text{L_CONT}} + 10\text{mA} \geq 260\text{ mA}$ and $I_{\text{L_MAX}} \leq 300\text{ mA}$.

The overload / overcurrent mechanism must be implemented as a “fold back” technology (see section 5.5.2).

5.3.2.1 Inrush Current

Once the OSM device is connected to the P1 port (depends on OSM internal design), its power supply unit may require to use an excessive current for a very short period of time (usually for less than 1 ms). Such current is often called: an “Inrush current”.

The power supply must be able to cope with an Inrush current, caused by the OSM.

The E-meter must be able to withstand a typical “Inrush current” from a circuit as presented in the picture below.

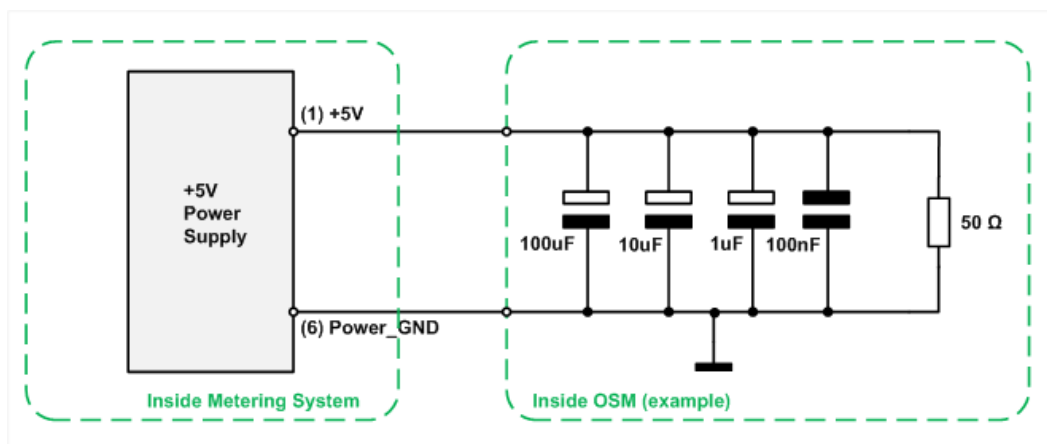


Figure 5-6: Inrush current circuit example.

5.4 Variable load on power supply

The OSM devices may incorporate radio technologies such as Bluetooth and Wi-Fi.

Such devices usually have a specific characteristic of power consumption.

To ensure the correct operation of these type of devices, the P1 “+5V” power supply must be able to cope with variable load.

If the load at OSM side remains within acceptable range (up to 250 mA), the power supply must provide accurate and continuous voltage regardless of the nature of load changes.

An example of a “Load Test Pattern” is presented on the picture below.

The exemplary “load change periods” could be: 2 ms, 20 ms, 200 ms, and 2 s.

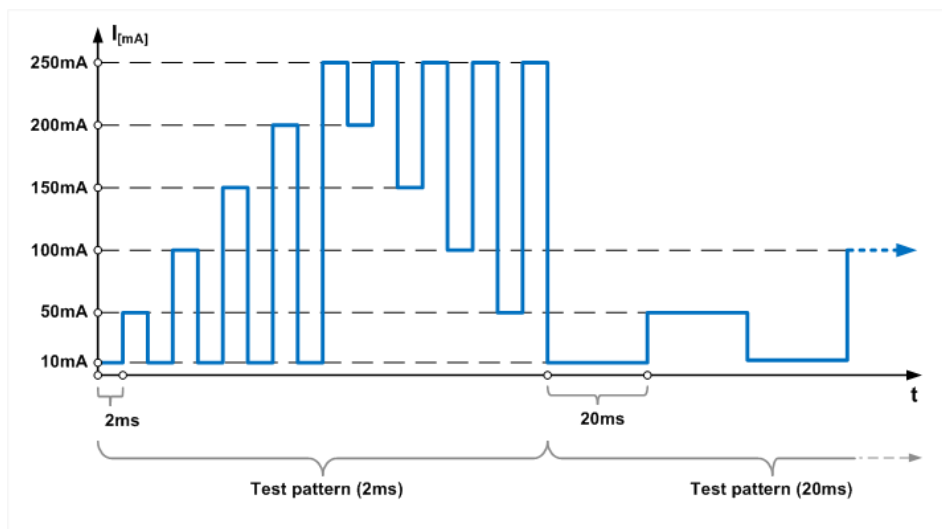


Figure 5-7: Variable load – test pattern example

5.5 Metering system protection

This section describes the protection of the metering system seen from the P1 port side.

5.5.1 Avoidance of influencing the Metering System through P1 port

It must not be possible to influence the Metering system in any way through the P1 port (except from requesting and receiving data, and getting +5V power supply as specified in section 5.3).

Especially it shall not be possible to interrupt or block in any way the other modules/ports/parts of the Metering System (i.e. by maliciously manipulate the “Data Request” line). See also section 5.2.2 – Galvanic isolation.

5.5.2 Short circuits

The “+5V” power supply line of the P1 port shall be able to withstand long lasting short circuits.

The maximum “short circuit current” has to be limited to 50 mA. $I_{SC} \leq 50 \text{ mA}$.

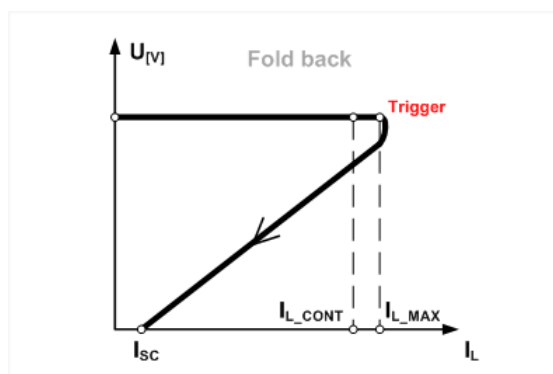


Figure 5-8: Over current / short circuit graph example.

Once the short circuit / over current situation does no longer occur, the power supply has to return automatically to normal operation.

5.5.3 External OVP (Overvoltage Protection)

To protect the “+5V” power line from an external overvoltage, caused by or a failure at OSM side or by an incorrect (i.e. by mistake) connection of a higher voltage source to “+5V” line, an OVP (Overvoltage Protection) mechanism must be implemented.

The OVP mechanism for “+5V” line should be triggered at:
5,9 V (± 100 mV). $U_{\text{OVP}} = 5,9$ V.

5.5.4 ESD – Electrostatical Discharge

All the lines of the P1 port have to be ESD protected.

ESD protection has to comply with IEC 61000 - Electromagnetic compatibility (EMC) Part 4-2: Testing and measurement techniques - Electrostatic discharge – Ref [4]. Applicable model
- HBM Human Body Model.

5.6 P1 OSM protection

To protect the OSM device (connected via P1 port) from an overvoltage caused by a failure at Metering System side, an OVP (Overvoltage Protection) mechanism should be implemented.

Note:

The above requirement is only applicable for the “+5V” line, as the other lines (Data Request and Data) cannot be physically influenced by the Metering System due to the use of opto-couplers.

5.7 P1 Data interface specification

To ensure a safe, stable solution the data connection will consist of three lines

- “Data Request” line,
- “Data” line and
- “Data ground” line

Note: the protocol is based on EN-IEC 62056-21 Mode D, exceptions are documented below where applicable. See Ref [1].

5.7.1 “Data Request” line specification

The P1 port is activated (start sending data) by setting “Data Request” line high (to +5V).

While receiving data, the requesting OSM must keep the “Data Request” line activated (set to +5V).

To stop receiving data OSM needs to drop “Data Request” line (set it to “high impedance” mode). Data transfer will stop immediately in such case. For backward compatibility reason, no OSM is allowed to set “Data Request” line low (set it to GND or 0V).

Data Request line HIGH level:

The voltage range for HIGH level for Data Request line must be between 4,0 V. ($U_{DR_1_MIN} \geq 4,0 \text{ V}$) and 5,5 V. ($U_{DR_1_MAX} \leq 5,5 \text{ V}$).

Data Request line current consumption:

Depending on the voltage on the “Data Request” line, power consumption may vary between 4,0 mA ($I_{DR_1_MIN} \geq 4,0 \text{ mA}$) and 10 mA ($I_{DR_1_MAX} \leq 10 \text{ mA}$).

The Data Request line needs to be OVP protected. This OVP mechanism for Data Request line should be triggered at 5,9 V ($\pm 100 \text{ mV}$). $U_{OVP} = 5,9 \text{ V}$.

5.7.2 “Data” line specification

Due to the use of optocouplers, the “Data” line must be designed as an OC (Open Collector) output, the “Data” line must be logically inverted.

“Data” line LOW level:

The voltage range for LOW level for Data line must be between 0 V ($U_{D_0_MIN} \geq 0 \text{ V}$) and 1,0 V ($U_{D_0_MAX} \leq 1,0 \text{ V}$).

“Data” line (while in LOW state) must be able to handle current up to and not exceeding 30 mA. ($I_{D_0_MAX} \leq 30 \text{ mA}$).

From an OSM perspective, the maximum current flowing towards the “Data” line must not exceed 5 mA.

5.7.3 Addressing of the Metering System

Since a Metering System has only one P1 port, there is no need to address it.

5.8 P1 signal levels

| Symbol | Description | Requirement for the Meter | | | Requirement for OSM | | | Units |
|-------------------------|--|---------------------------|---------|------|---------------------|---------|-----|-------|
| | | Min | Typical | Max | Min | Typical | Max | |
| U _{DR_1} | "Data request" line - HIGH level | - | - | 5,5 | 4,0 | 5,0 | 5,5 | V |
| I _{DR_1} | "Data request" line current | - | 5 | 10 | 4 | 5 | 10 | mA |
| U _{D_0} | "Data" line – LOW level | 0 | 0,2 | 1 | 0 | 0,2 | 1 | V |
| U _{D_1} | "Data" line – HIGH level | - | 5,0 | - | - | 5,0 | - | V |
| I _{D_0_MAX} | "Data" line max current | - | - | 30 | - | - | 5 | mA |
| U _L | " +5V " power supply – voltage | 4,9 | 5 | 5,3 | 4,9 | 5 | 5,3 | V |
| U _{RIPPLE_MAX} | " +5V " line maximum ripple voltage | - | - | 100 | - | - | 100 | mV |
| U _{NOISE_MAX} | " +5V " line- maximum noise | - | - | 50 | - | - | 100 | mV |
| U _{OVP} | OVP level (" +5V " and "Data request" lines) | 5,8 | 5,9 | 6 | - | - | - | V |
| I _{L_CONT} | " +5V " maximum continuous current | 250 | - | 260 | - | - | 250 | mA |
| I _{L_MAX} | " +5V " line overload protection trigger | 260 | - | 3000 | - | - | - | mA |
| I _{SC} | " +5V " line Short Circuit current | - | - | 50 | - | - | - | mA |

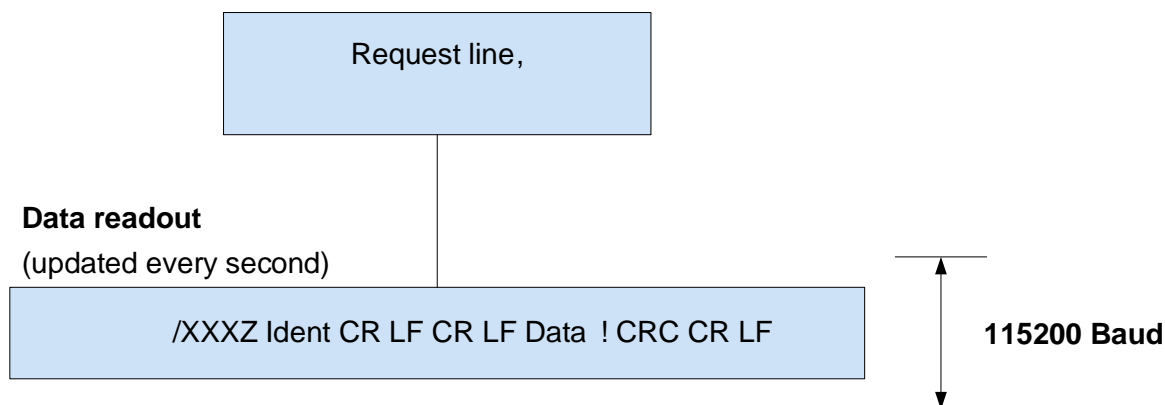
Logical levels are specified as follows:

SPACE "0" usually > 4V

MARK "1" as < 1 V

6 PROTOCOL DESCRIPTION

The protocol is based on NEN-EN-IEC 62056-21 Mode D. Data transfer is requested with request line and automatically initiated every second until request line is released.



6.1 Transfer speed and character formatting

The interface must use a fixed transfer speed of 115200 baud.

The Metering System must send its data to the OSM device every single second and the transmission of the entire P1 telegram must be completed within 1s.

The format of transmitted data must be defined as “8N1”. Namely:

- 1 start bit,
- 8 data bits,
- no parity bit and
- 1 stop bit.

Note:

This is not conforming to EN-IEC 62056-21 Mode D – Ref [1].

6.2 Data readout

The Metering System transmits the data message, as described below, immediately following the activation through the Request signal.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|----------------|----|----|----|----|------|---|-----|----|----|
| / | X | X | X | 5 | Identification | CR | LF | CR | LF | Data | ! | CRC | CR | LF |
|---|---|---|---|---|----------------|----|----|----|----|------|---|-----|----|----|

One of the COSEM object attribute values in the data blocks could be used for firmware updates or parameter update of a P1 device. Because of this it is not allowed to split the large data block (which can contain up to 1024 characters).

CRC is a CRC16 value calculated over the preceding characters in the data message (from “/” to “!” using the polynomial: $x^{16}+x^{15}+x^2+1$). CRC16 uses no XOR in, no XOR out and is computed with least significant bit first. The value is represented as 4 hexadecimal characters (MSB first).

6.3 End of transmission

The data transmission is complete after the data message has been transmitted by the Metering System. An acknowledgement signal is not provided for.

6.4 Representation of COSEM objects

IEC 62056-61 [2] specifies the logical names of COSEM objects using OBIS, the Object Identification System. Value group F is not used. The following Value Formats are used for P1 Data Readout value representations:

| Value Format | Format/Example | Meaning |
|--------------|---|---|
| Fn(x,y) | F7(3,3) – YYYY.YYY | Floating decimal number with a fixed number of decimals behind the decimal point (in this case 3) |
| Fn(x,y) | F7(0,3) – YYYY.YYY or YYYYYY.YY or YYYYYY.Y or YYYYYYYY | Floating decimal number with a variable number of decimals behind the decimal point (with a maximum of 3) |
| In | I4 - YYYY | Integer number |
| Sn | S6 - CCCCCC | Alphanumeric string |
| TST | YYMMDDhhmmssX | ASCII presentation of Time stamp with Year, Month, Day, Hour, Minute, Second, and an indication whether DST is active (X=S) or DST is not active (X=W). |

Note: n is the number of characters in the string.

Table 5-1: Value Formats

COSEM object attribute values are using the following Value Formats:

| COSEM Data Type | Tag | Value Format |
|----------------------|-----|--------------|
| null-data | 0 | Empty |
| boolean | 3 | I1 |
| bit-string | 4 | Sn |
| double-long | 5 | Fn(x,y) |
| double-long-unsigned | 6 | Fn(x,y) |
| floating-point | 7 | Fn(x,y) |
| octet-string | 9 | Sn |
| visible-string | 10 | Sn |

| | | |
|-----------------|----|------------|
| bcd | 13 | S2 |
| integer | 15 | In |
| long | 16 | Fn(x,y) |
| unsigned | 17 | Fn(x,y) |
| long-unsigned | 18 | Fn(x,y) |
| long64 | 20 | Fn(x,y) |
| long64-unsigned | 21 | Fn(x,y) |
| enum | 22 | In |
| float-32 | 23 | Fn(x,y), l |
| float-64 | 24 | Fn(x,y), l |

Table 5-2: Cosem Object Attributes

6.5 Representation of COSEM Data Type octet-string (tag 9)

COSEM Data Type octet-string is represented with Sn format where octets are formatted with hexadecimal characters. Octet-string length is implicit.

(XXXX..XX)

1) 2) 3)

- 1) XX Hexadecimal characters for first octet
- 2) XX Hexadecimal characters for second octet
- 3) XX Hexadecimal characters for m-th octet (m is octet-string length).

Note: An octet string or bit string with a length of m, will result in a Alphanumeric string Sn with a length of n, where n is 2 times m

6.6 Representation of COSEM Data Type bit-string (tag 4)

COSEM Data Type bit-string is represented with Sn format where bit-string is formatted with hexadecimal characters. First two hexadecimal characters represent number of unused bits in bit-string. The remaining hexadecimal characters represent bit-string bit values. Bit-string length is implicit.

(XXXX..XX)

1) 2) 3)

- 1) XX Hexadecimal characters for first octet (number of unused bits)
- 2) XX Hexadecimal characters for second octet (first 8 bits)

3) XX Hexadecimal characters for m-th octet (last 8 -number of unused bits).

Note: An octet string or bit string with a length of m, will result in a Alphanumeric string S_n with a length of n, where n is 2 times m

6.7 Representation of COSEM Data Type boolean

COSEM Data Type boolean is represented with I1 format where value false is represented as 0 and value true as 1.

6.8 Representation of COSEM Data Type enum

COSEM Data Type enum is represented with In format where enum values are represented as integer values.

6.9 Representation of COSEM objects

COSEM objects identified with OBIS Reduced ID use the following Dataset formatting for representation:

| | |
|----|--------|
| ID | (Mv*U) |
|----|--------|

1) 2)3) 4)5)

1) OBIS Reduced ID-code

2) Separator “(“, ASCII 28_h

3) COSEM object attribute value

4) Unit of measurement values (Unit of capture objects attribute) – only if applicable

5) Separator “)”, ASCII 29_h

6.10 Representation of M-Bus values

COSEM Profile Generic objects identified with OBIS Reduced ID use the following Dataset formatting for representation.

| | | |
|----|-------|----------|
| ID | (TST) | (Mv1*U1) |
|----|-------|----------|

1) 2) 3) 4)

- 1) OBIS Reduced ID-code
- 2) Time Stamp (TST) of capture time of measurement value
- 3) Measurement value 1 (most recent entry of buffer attribute without unit)
- 4) Unit of measurement values (Unit of capture objects attribute)

6.11 Representation of Profile Generic – Power failure logs

COSEM Profile Generic objects identified with OBIS Reduced ID use the following Dataset formatting for representation.

| ID | (z) | (ID1) | (TST) | (Bv1*U1) | (TST) | (Bvz*Uz) |
|----|-----|-------|-------|----------|-------|----------|
|----|-----|-------|-------|----------|-------|----------|

1) 2) 3) 4) 5) 6) 7) 8) 9)

- 1) OBIS Reduced ID-code
- 2) Number of values z (max 10).
- 3) Identifications of buffer values (OBIS Reduced ID codes of capture objects attribute)
- 4) Time Stamp (TST) of power failure end time
- 5) Buffer value 1 (most recent entry of buffer attribute without unit)
- 6) Unit of buffer values (Unit of capture objects attribute)
- 7) Time Stamp (TST) of power failure end time
- 8) Buffer value 2 (oldest entry of buffer attribute without unit)
- 9) Unit of buffer values (Unit of capture objects attribute)

6.12 Representation of P1 telegram

The following table holds data objects represented with P1 Interface together with OBIS reference including object Attribute and Value Format for Reduced ID codes.

Every line (except the last one) is ended with a CR/LF (Carriage Return / Line Feed).

Note:

The OBIS reference Channel number (n) will be defined by the installing order of the M-Bus devices. So for example a Gas meter can be installed on channel 1, 2, 3 or 4. For that reason the Device-Type is sent first to identify the medium on P1. A slave E-meter can also be an M-Bus device.

Only when a M-Bus device is installed, its data will be exported on the P1 interface. Values for L2 and L3 will only be available in a P1 telegram of a poly phase meter.

| Value | OBIS reference | Attribute | Class ID | Value Format | Value Unit |
|---|-----------------|------------|---------------|-----------------------|---------------|
| Header information | - | - | - | Manufacturer specific | |
| Version information for P1 output | 1-3:0.2.8.255 | 2 | 1 Data | S2, tag 9 | |
| Date-time stamp of the P1 message | 0-0:1.0.0.255 | 2 | 8 | TST | YYMMDDhhmmssX |
| Equipment identifier | 0-0:96.1.1.255 | 2 Value | 1 Data | Sn (n=0..96), tag 9 | |
| Meter Reading electricity delivered to client (Tariff 1) in 0,001 kWh | 1-0:1.8.1.255 | 2 Value | 3 Register | F9(3,3), tag 6 | kWh |
| Meter Reading electricity delivered to client (Tariff 2) in 0,001 kWh | 1-0:1.8.2.255 | 2 Value | 3 Register | F9(3,3), tag 6 | kWh |
| Meter Reading electricity delivered by client (Tariff 1) in 0,001 kWh | 1-0:2.8.1.255 | 2 Value | 3 Register | F9(3,3), tag 6 | kWh |
| Meter Reading electricity delivered by client (Tariff 2) in 0,001 kWh | 1-0:2.8.2.255 | 2 Value | 3 Register | F9(3,3), tag 6 | kWh |
| Tariff indicator electricity. The tariff indicator can also be used to switch tariff dependent loads e.g boilers. This is the responsibility of the P1 user | 0-0:96.14.0.255 | 2 Value | 1 Data | S4, tag 9 | |
| Actual electricity power delivered (+P) in 1 Watt resolution | 1-0:1.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |
| Actual electricity power received (-P) in 1 Watt resolution | 1-0:2.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |
| Number of power failures in any phase | 0-0:96.7.21.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |

| Value | OBIS reference | Attribute | Class ID | Value Format | Value Unit |
|---|-----------------|-------------|----------------------|---|--|
| Number of long power failures in any phase | 0-0:96.7.9.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |
| Power Failure Event Log (long power failures) | 1-0:99.97.0.255 | 2 Buffer | 7 Profile Generic | TST, F10(0,0) - tag 6 Format applicable for the value within the log (OBIS code 0-0:96.7.19.255) | Timestamp (end of failure) – duration in seconds |
| Number of voltage sags in phase L1 | 1-0:32.32.0.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |
| Number of voltage sags in phase L2 | 1-0:52.32.0.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |
| Number of voltage sags in phase L3 | 1-0:72.32.0.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |
| Number of voltage swells in phase L1 | 1-0:32.36.0.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |
| Number of voltage swells in phase L2 | 1-0:52.36.0.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |
| Number of voltage swells in phase L3 | 1-0:72.36.0.255 | 2 Value | 1 Data | F5(0,0), tag 18 | |
| Text message max 1024 characters. | 0-0:96.13.0.255 | 2 Value | 1 Data | Sn (n=0..2048), tag 9 | |
| Instantaneous voltage L1 in V resolution | 1-0:32.7.0.255 | 2 Value | 3 Register | F4(1,1), tag 18 | V |
| Instantaneous voltage L2 in V resolution | 1-0:52.7.0.255 | 2 Value | 3 Register | F4(1,1), tag 18 | V |
| Instantaneous voltage L3 in V resolution | 1-0:72.7.0.255 | 2 Value | 3 Register | F4(1,1), tag 18 | V |
| Instantaneous current L1 in A resolution. | 1-0:31.7.0.255 | 2 Value | 3 Register | F3(0,0), tag 18 | A |
| Instantaneous current L2 in A resolution. | 1-0:51.7.0.255 | 2 Value | 3 Register | F3(0,0), tag 18 | A |
| Instantaneous current L3 in A resolution. | 1-0:71.7.0.255 | 2 Value | 3 Register | F3(0,0), tag 18 | A |
| Instantaneous active power L1 (+P) | 1-0:21.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |

| Value | OBIS reference | Attribute | Class ID | Value Format | Value Unit |
|---|----------------|-------------------|------------------------|---|----------------|
| in W resolution | | | | | |
| Instantaneous active power L2 (+P) in W resolution | 1-0:41.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |
| Instantaneous active power L3 (+P) in W resolution | 1-0:61.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |
| Instantaneous active power L1 (-P) in W resolution | 1-0:22.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |
| Instantaneous active power L2 (-P) in W resolution | 1-0:42.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |
| Instantaneous active power L3 (-P) in W resolution | 1-0:62.7.0.255 | 2 Value | 3 Register | F5(3,3), tag 18 | kW |
| Device-Type | 0-n:24.1.0.255 | 9 Device type | 72 M-Bus client | F3(0,0), tag 17 | |
| Equipment identifier (Gas) | 0-n:96.1.0.255 | 2 Value | 1 Data | Sn (n=0..96), tag 9 | |
| Last 5-minute value (temperature converted), gas delivered to client in m3, including decimal values and capture time | 0-n:24.2.1.255 | 5 Capture time | 4 Extended Register | TST | |
| | 0-n:24.2.1.255 | 2 Value | 4 Extended Register | F8(2,2)/F8(3,3), tag 18 (See note 2) | m ³ |
| Device-Type | 0-n:24.1.0.255 | 9 Device type | 72 M-Bus client | F3(0,0), tag 17 | |
| Equipment identifier (Thermal: Heat or Cold) | 0-n:96.1.0.255 | 2 Value | 1 Data | Sn (n=0..96), tag 9 | |
| Last 5-minute Meter reading Heat or Cold in 0,01 GJ and capture time | 0-n:24.2.1.255 | 5 Capture time | 4 Extended Register | TST | |
| | 0-n:24.2.1.255 | 2 Value | 4 Extended | Fn(2,2) (See note 1) | GJ |

| Value | OBIS reference | Attribute | Class ID | Value Format | Value Unit |
|---|----------------|-------------------|------------------------|-------------------------|------------|
| | | | Register | | |
| Device-Type | 0-n:24.1.0.255 | 9 Device type | 72 M-Bus client | F3(0,0), tag 17 | |
| Equipment identifier (Water) | 0-n:96.1.0.255 | 2 Value | 1 Data | Sn (n=0..96), tag 9 | |
| Last 5-minute Meter reading in 0,001 m3 and capture time | 0-n:24.2.1.255 | 5 Capture time | 4 Extended Register | TST | |
| | 0-n:24.2.1.255 | 2 Value | 4 Extended Register | Fn(3,3) (See Note 1) | m3 |
| Device-Type | 0-n:24.1.0.255 | 9 Device type | 72 M-Bus client | F3(0,0), tag 17 | |
| Equipment identifier | 0-n:96.1.0.255 | 2 Value | 1 Data | Sn (n=0..96), tag 9 | |
| Last 5-minute Meter reading and capture time (e.g. slave E meter) | 0-n:24.2.1.255 | 5 Capture time | 4 Extended Register | TST | |
| | 0-n:24.2.1.255 | 2 Value | 4 Extended Register | Fn(3,3) (See Note 1) | kWh |

Table 6-3: P1 Telegram Representation

Note 1: Where n is the number of digits before the decimal point on the display of the meter + the required number of decimals. So for example if on the physical display of a Heat meter is shown 1234 GJ (without decimals) the n=6 and the format of the P1 output will be 1234,56 GJ.

Note 2: For Gas meters with a capacity up to 10 m³/h (G4 and G6) F8(3,3) is applicable. For Gas meters with higher capacities F8(2,2) is applicable.

6.13 Example P1 telegram

The following table shows an example of the P1 telegram that is in accordance to IEC 62056-21 Mode D.

Be aware of the fact that the number of OBIS codes and the order of OBIS codes is not fixed. The P1 device must be able to interpret the OBIS codes and understand the representation.

For example: depending on installation, the OBIS codes for a heat/cold meter might be sent before the OBIS codes of a Gas meter.

The example telegram below is based on:

- DSMR version 5.0 (value 50 behind OBIS code 1-3:0.2.8.255)
- It is send at 2010, December 9th, 11h30m20s
- Gas value of 2010, December 9th, 11:25h is presented
- 4 power failures in any phase
- 2 long power failure in any phase
- Power Failure Event log:
Failure at 2010, December 8th, 15h20m15s, duration 240 seconds
Failure at 2010, December 8th, 15h05m03s, duration 301 seconds
- 2 voltage sags in phase L1
- 1 voltage sag in phase L2 (polyphase meters only)
- 0 voltage sags in phase L3 (polyphase meters only)
- 0 voltage swells in phase L1
- 3 voltage swells in phase L2 (polyphase meters only)
- 0 voltage swells in phase L3 (polyphase meters only)
- Only one M-Bus device is connected to the Electricity meter. The register value of the Gas meter is 12785,123 m³. This value is captured by the G meter at 2010, December 9th, at 11h25m00s Wintertime.
- Instantaneous voltage per phase
- Instantaneous current per phase
- Instantaneous active power (+P) per phase
- Instantaneous active power (-P) per phase

```
/ISk5\2MT382-1000
```

```
1-3:0.2.8(50)
0-0:1.0.0(101209113020W)
0-0:96.1.1(4B384547303034303436333935353037)
1-0:1.8.1(123456.789*kWh)
1-0:1.8.2(123456.789*kWh)
1-0:2.8.1(123456.789*kWh)
1-0:2.8.2(123456.789*kWh)
0-0:96.14.0(0002)
1-0:1.7.0(01.193*kW)
1-0:2.7.0(00.000*kW)
0-0:96.7.21(00004)
0-0:96.7.9(00002)
1-0:99.97.0(2)(0-0:96.7.19)(101208152415W)(0000000240*s)(101208151004W)(0000000301*s)
1-0:32.32.0(00002)
```



```

1-0:52.32.0(00001)
1-0:72.32.0(00000)
1-0:32.36.0(00000)
1-0:52.36.0(00003)
1-0:72.36.0(00000)
0-
0:96.13.0(303132333435363738393A3B3C3D3E3F303132333435363738393A3B3C3D3E3F303132333435363738393A3B3C3D3E3F303132333435363738393A3B3C3D3E3F)
1-0:32.7.0.255(220.1*V)
1-0:52.7.0.255(220.2*V)
1-0:72.7.0.255(220.3*V)
1-0:31.7.0.255(001*A)
1-0:51.7.0.255(002*A)
1-0:71.7.0.255(003*A)
1-0:21.7.0.255(01.111*kW)
1-0:41.7.0.255(02.222*kW)
1-0:61.7.0.255(03.333*kW)
1-0:22.7.0.255(04.444*kW)
1-0:42.7.0.255(05.555*kW)
1-0:62.7.0.255(06.666*kW)
0-1:24.1.0(003)
0-1:96.1.0(3232323241424344313233343536373839)
0-1:24.2.1(101209112500W)(12785.123*m3)
!62FD

```

7 DATA OBJECTS

Data Objects are defined in NEN-EN-IEC 62056-61:2002 Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: OBIS Object Identification System. The following tables hold data objects and references to the OBIS. Note that this table assumes two tariffs. Currently two tariffs (Rate 1 low tariff and Rate 2 normal/high tariff) are defined, support for up to sixteen tariffs should be included.

7.1 Electricity data

Electricity –P1 transfers every second

| Value | OBIS reference | |
|--|-----------------|--|
| Equipment identifier | 0-0:96.1.1.255 | |
| Meter Reading electricity delivered to client (low tariff) in 0,001 kWh | 1-0:1.8.1.255 | |
| Meter Reading electricity delivered to client (normal tariff) in 0,001 kWh | 1-0:1.8.2.255 | |
| Meter Reading electricity delivered by client (low tariff) in 0,001 kWh | 1-0:2.8.1.255 | |
| Meter Reading electricity delivered by client (normal tariff) in 0,001 kWh | 1-0:2.8.2.255 | |
| Tariff indicator electricity. The tariff indicator can be used to switch tariff dependent loads e.g boilers. This is responsibility of the P1 user | 0-0:96.14.0.255 | |
| Actual electricity power delivered (+P) in 1 Watt resolution | 1-0:1.7.0.255 | |
| Actual electricity power received (-P) in 1 Watt resolution | 1-0:2.7.0.255 | |
| Number of power failures in any phases | 0-0:96.7.21.255 | |
| Number of long power failures in any phases | 0-0:96.7. 9.255 | |
| Power failure event log | 1-0:99:97.0.255 | |
| Number of voltage sags in phase L1 | 1-0:32.32.0.255 | |
| Number of voltage sags in phase L2 | 1-0:52.32.0.255 | |
| Number of voltage sags in phase L3 | 1-0:72.32.0.255 | |
| Number of voltage swells in phase L1 | 1-0:32.36.0.255 | |
| Number of voltage swells in phase | 1-0:52.36.0.255 | |

| Value | OBIS reference | |
|--------------------------------------|-----------------|--|
| L2 | | |
| Number of voltage swells in phase L3 | 1-0:72.36.0.255 | |
| Instantaneous voltage L1 | 1-0:32.7.0.255 | |
| Instantaneous voltage L2 | 1-0:52.7.0.255 | |
| Instantaneous voltage L3 | 1-0:72.7.0.255 | |
| Instantaneous current L1 | 1-0:31.7.0.255 | |
| Instantaneous current L2 | 1-0:51.7.0.255 | |
| Instantaneous current L3 | 1-0:71.7.0.255 | |
| Instantaneous active power L1 (+P) | 1-0:21.7.0.255 | |
| Instantaneous active power L2 (+P) | 1-0:41.7.0.255 | |
| Instantaneous active power L3 (+P) | 1-0:61.7.0.255 | |
| Instantaneous active power L1 (-P) | 1-0:22.7.0.255 | |
| Instantaneous active power L2 (-P) | 1-0:42.7.0.255 | |
| Instantaneous active power L3 (-P) | 1-0:62.7.0.255 | |

Note: Tariff code 1 is used for low tariff and tariff code 2 is used for normal tariff.

7.2 Messages

Text messages, transfer every second

| Value | OBIS reference | |
|-----------------------------------|-----------------|--|
| Text message max 1024 characters. | 0-0:96.13.0.255 | |

The Meter will have storage capacity for one 1024 character text message.

If a device is connected, the meter will send the message over the P1 interface every second. The text message may not contain CR, LF (0A,0Dh) to split the message.

7.3 Gas Data

The following is only applicable if Gas meters are connected. The OBIS reference Channel number (n) will be defined by the installing order of the M-Bus devices. So a Gas meter can be installed on channel 1, 2, 3 or 4.

Gas – P1 transfers every second the latest received 5-minute value & timestamp

| Value | OBIS reference | |
|---|----------------|--|
| Device-Type | 0-n:24.1.0.255 | |
| Equipment identifier | 0-n:96.1.0.255 | |
| Last 5-minute value (temperature converted), gas delivered to client in m3, including decimal values and capture time | 0-n:24.2.1.255 | |

7.4 Thermal Data

The following is only applicable if Thermal (Heat or Cold) meters are connected. Combined Heat and Cold meters are not supported. The OBIS reference Channel number (n) will be defined by the installing order of the M-Bus devices. So a Thermal meter can be installed on channel 1, 2, 3 or 4.

Thermal (Heat or Cold)– P1 transfers every second the latest received 5-minute value & timestamp

| Value | OBIS reference | |
|--|----------------|--|
| Device-Type | 0-n:24.1.0.255 | |
| Equipment identifier | 0-n:96.1.0.255 | |
| Last 5-minute Meter reading Heat or Cold in 0,01 GJ and capture time | 0-n:24.2.1.255 | |

7.5 Water Data

The following is only applicable if water meters are connected. The OBIS reference Channel number (n) will be defined by the installing order of the M-Bus devices. So a water meter can be installed on channel 1, 2, 3 or 4.

Water –P1 transfers every second the latest received 5-minute value & timestamp

| Value | OBIS reference | |
|--|----------------|--|
| Device-Type | 0-n:24.1.0.255 | |
| Equipment identifier | 0-n:96.1.0.255 | |
| Last 5-minute Meter reading in 0,001 m3 and capture time | 0-n:24.2.1.255 | |

7.6 M-Bus Data of a fourth M-Bus device (for example a slave E-meter to measure electricity production)

The following is only applicable if a fourth M-Bus device is connected. The OBIS reference Channel number (n) will be defined by the installing order of the M-Bus devices. So the fourth M-Bus device can be installed on channel 1, 2, 3 or 4.

Fourth M-Bus device –P1 transfers every second the latest received 5-minute value & timestamp

| Value | OBIS reference | |
|--|----------------|--|
| Device-Type 4 th M-Bus device | 0-n:24.1.0.255 | |
| Equipment identifier | 0-n:96.1.0.255 | |
| Last 5-minute Meter reading and capture time | 0-n:24.2.1.255 | |

7.7 Change of M-Bus device

If an M-Bus device is exchanged by another device type, the OBIS codes on P1 have to be changed accordingly.