Smart Metering System

eMUCs – P1

extended Multi-Utility Companion Specification for the Consumer Interface P1

V1.7.1

Change summary

This document is continuously improved and revised if needed. To keep track, the version numbers are increased at every change in following way:

The version number is formatted X.Y.Z where:

- X reflects a major version change: expl. HW change possibly not backwards compatible
- Y reflects a minor version change: expl. Extra data-objects, telegram change with backwards compatibility
- Z reflects a textual change without impact on the content / behavior of the P1-port and is only related to the document itself

The version number is also part of the P1 telegram. In section 3.3 is described how this version number is built in the P1-telegram. Note that "Z" is not part of the version number published in the P1-port

Technical changes against previous version are highlighted to make them more clear.

Version	Change	Publishing date
1.3(beta)	• First Edition	26/04/2018
1.3	• Major textual clean up based on field experience • No technical changes since (unofficial) 1.3 beta (version number unchanged)	01/04/2020
1.4	• Improved resolution of the objects for instantaneous currents	01/04/2020
1.5	• Addition of power per phase and direction to the P1-telegram • Minor textual corrections	01/09/2020
1.6	• Addition of water meter objects • Minor textual corrections	01/11/2020
1.7	• Addition of Maximum demand objects (peak)	08/08/2022
1.7.1	• Solved copy/paste error in telegram examples	05/09/2022

In annex A you can find an overview of meters and corresponding version history.

Application

The version of this specification is applicable to following DSO's:

fluvius.	ORES	resa	Sibelga
X	X	X	X

Content

Table list

Figure list

1 Introduction

1.1 Scope

This document is part of a set of companion specification documents for a smart meter system for electricity and gas.

The goal of this companion specification is to reach an open, standardized protocol implementation related to the communication between several types of electricity meters and other smart metering systems and devices.

This document describes the protocol and the data model of the Belgian P1 interface. The Belgian P1 interface is based upon (but not the same as) the DSMR P1 specification.

The interface periodically provide measurement data (and status information) to one or more customer applications. These applications can be used to store, monitor, analyse and display the provided data or use it as trigger for home automation systems to control other devices in home. The objects (internal in the electricity meter) to configure and manage this interface by the DSO are out of scope of this document, but are described in e-MUCs M_{DLMS}. The functionalities of the customer applications that can be connected to these interfaces are also out of scope of this document.

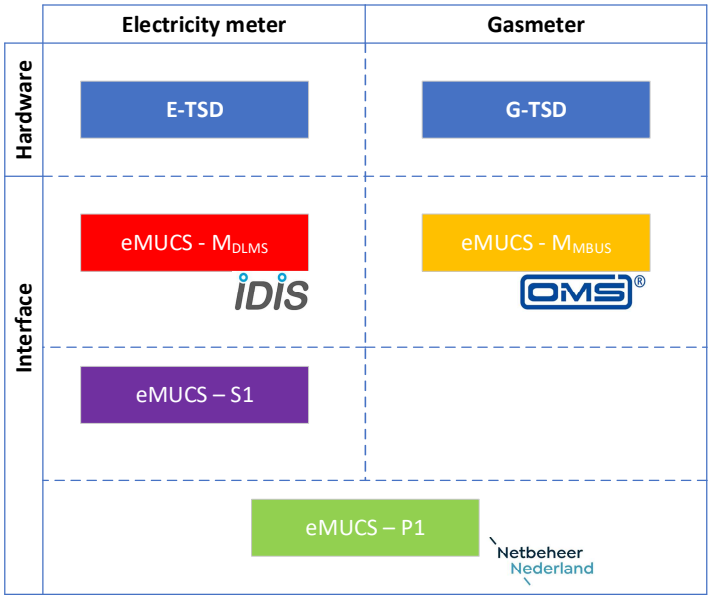

Figure 1 'Set of Requirements' structure of the Smart Metering Solution

1.2 Related Documents

The following standards are referred to in this companion specification.

- For undated references the latest edition applies.
- If a corrigendum for one of these documents is issued, then it is also applicable.

Reference	Document Title	Editor	Version
DSMR P1	Dutch Smart Meter Requirements – P1 Companion Standard	Netbeheer Nederland	5.0.2
e-MUCS M_{DLMS}	Companion Specification for I3 Interface	Fluvius / ORES / Resa / Sibelga	
IDIS Pack3	Package 3, IP Profile	IDIS association	Ed. 1.0
DIN 43863-5	Identification number for measuring devices applying for all manufacturers	DIN	2012-04

1.3 Definitions and abbreviations

AMM	Automatic Meter Management system
ASCII	American Standard Code for Information Interchange
CEMS	Consumer Energy Management System
DIN	Deutsches Institut für Normung
DLMS	Device Language Message Specification
DSMR	Dutch Smart Meter Requirements
DSO	Distribution System Operator
e-MUCs	extended Multi-Utility Companion Specification
E-TSD	Electricity meter Technical Specification Document
G-TSD	Gas meter Technical Specification Document
GND	Ground
HES	Head-End System
IDIS	Interoperability Device Interface Specification
IHD	In Home Display
M-bus	Meter bus
NC	Not Connected
OBIS	Object Information System
OMS	Open Meter Specification

2 Architecture and interfaces

The system architecture follows the interface mentioned in Figure 2. This document describes the Belgian P1 interface and is defined as the interface between a Electricity Meter and customer applications, in example an In-Home Display (IHD) or a CEMS device, as used in home automation systems.

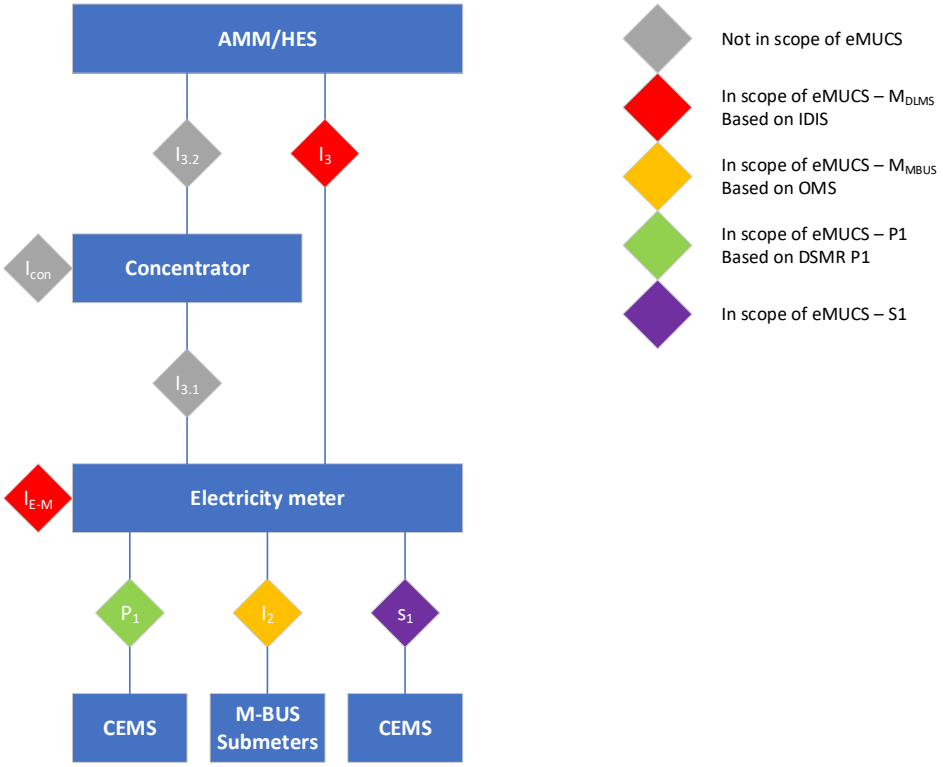

Figure 2: Communication interfaces

Remark 1: The E-meter acts as a concentrator for up to four M-bus devices (e.g. gas meters) via the I2 interface, therefore the data of these M-bus devices can also be provided to the customer via the Belgian P1 interface.

Remark 2: The S1 interface only provides electricity related data from the primary electricity meter (blue block in figure 2). M-bus related data, even if this device is an secondary electricity meter, is not in scope for the S1 interface. The S1 interface is described in eMUCs – S1

3 The Belgian P1 interface description

This section specifies the main characteristics of the Belgian P1 interface. The Belgian P1 interface provides electrical and gas related measurements as power, energy, voltage, current, … and status information coming from the measurement system.

The Belgian P1 interface provides every second instantaneous values.

3.1 Physical interface

Section 5 of DSMR P1 is fully applicable. Only some high-lights and attention points out of section 5 of DSMR P1 are given in this document

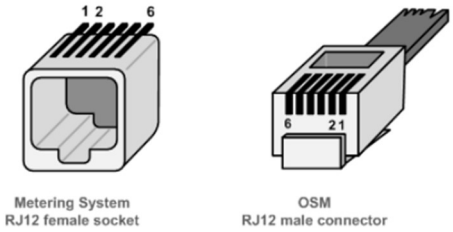

Figure 3: P1 Physical connector

Pin	Signal name	Description	Remark
1	+5V	+5V power supply	
2	Data Request	Data Request	
3	Data GND	Data ground	
4	NC	Not Connected	
5	Data	Data line	Open Collector
6	GND	Power ground	

Table 1: S1 physical connector pin assignment

Note 1: The Belgian P1 interface can be deactivated by the DSO. This means in case the Belgian P1 interface is deactivated also the power supply on the physical interface is cut off.

Note 2: To request data from the Belgian P1 interface, the CEMS should make the Data Request line high (even when the Belgian P1 interface is activated, see note 1)

Note 3: The Data line is an output with “open collector” this means that the CEMS should make this line “high” via a pull-up resistor. The value of this resistor is chosen this way that the “data line” max. current ($I_{D\_0\_MAX}$) is not exceeded as specified in DSMR P1.

The Belgian P1 interface transfers data with following settings:

Parameter	Setting
Data rate (fixed)	115200 Baud
Startbits	1
Databits	8
Parity	none
Stopbit	1

Table 2: P1 interface port settings

3.2 Protocol description

Section 6 of DSMR P1 is applicable. In subsection 6.12 of DSMR P1 all possible data-objects are listed that can appear on the Belgian P1 interface. Additional to these objects, following objects will be supported by the Belgian P1 interface

Medium	Value	OBIS reference	Attribute	Class ID	Value Format	Value Unit
General	Version information	0-0:96.1.4*255 (see note 4)	2 (Value)	1 (Data)	S5, tag 10	
	Consumer message code	0-0:96.13.1*255	2 (Value)	1 (Data)	Sn (n=0..128), tag 9	
E	Breaker state	0-0:96.3.10*255	3 (control state)	70 (Disconnector control)	I1, tag 22	
	Limiter threshold	0-0:17.0.0*255	3 (Threshold active)	71 (Limiter)	F4(1,1), tag 18	kW
	Fuse supervision threshold (L1)	1-0:31.4.0*255 (See note 3)	2 (Thresholds)	21 (Register Monitor)	F3(0,0), tag 18	A
	Instantaneous current L1	1-0:31.7.0*255	2 (Value)	3 (Register)	F5(2,2), tag 18	A
	Instantaneous current L2	1-0:51.7.0*255	2 (Value)	3 (Register)	F5(2,2), tag 18	A
	Instantaneous current L3	1-0:71.7.0*255	2 (Value)	3 (Register)	F5(2,2), tag 18	A
	Current average demand - Active energy import	1-0:1.4.0.255	2 (current average value)	5 (Demand register)	F5(3,3), tag 6	kW
	Maximum demand – Active energy import of the running month	1-0:1.6.0*255	5 (Capture time)	4 (Extended register)	TST	
			2 (Value)	4 (Extended register)	F5(3,3), tag 6	kW
	Maximum demand – Active energy import of the last 13 months	0-0:98.1.0*255	2 (Buffer) capture obj. 1 {4,1-0:1.6.0.255,2,0}	7 (Profile Generic)	TST	
			2 (Buffer) capture_obj. 2 {4,1-0:1.6.0.255,5,0}	7 (Profile Generic)	F5(3,3), tag 6	kW
G	M-Bus Device ID 2	0-n:96.1.1*255 (See note 2)	2 (Value)	1 (Data)	Sn (n=0..96), tag 9	
	Valve state	0-n:24.4.0*255 (See note 2)	3 (control state)	70 (Disconnector control)	I1, tag 22	

Medium	Value	OBIS reference	Attribute	Class ID	Value Format	Value Unit
	Last value of 'not temperature corrected' gas volume in m³, including decimal values and capture time	0-n:24.2.3*255 (See note 2)	5 (Capture time)	4 (Extended register)	TST	
			2 (Value)	4 (Extended register)	F8(2,2)/F8(3,3), tag 18 (See note 1)	m³
W	M-Bus Device ID 2	0-n:96.1.1*255 (See note 2)	2 (Value)	1 (Data)	Sn (n=0..96), tag 9	m³

Table 3: Data object representation

Note 1: 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.

Note 2: The M-bus channel number is indicated with 'n' in the OBIS code (e.g. 0-**n**:24.4.0.255).

Note 3: only the fuse supervision threshold for phase one is displayed, but the same threshold is applicable to phase 2 and 3 in case of a polyphase meter.

Note 4: This OBIS code is used to provide the version number instead of the one specified in DSMR P1, because that one (1-3:0.2.8.255) has a reserved meaning in the IDIS Pack3 specification.

3.3 Data objects

Section 7 of DSMR P1 lists the data objects that are published on the DSMR P1 port. This list is not valid for the Belgian P1 interface. Instead of applying section 7 of DSMR P1, in Belgium a selection of the published data objects is done out of subsection 6.12 of DSMR P1 and Table 3 of this document.

Table 4 gives the overview of the electricity meter related data objects, Table 5 gives the overview of the gas meter related data objects for the coupled gas meters and Table 6 gives the overview of the water meter related data objects for the coupled water meters that are published on the Belgian P1 interface. Other submeter types are for now out of scope[1].

Value	OBIS reference	Remarks
Version Information	0-0:96.1.4*255	Encoded as XXXYY where XXX is the DSMR P1 version number and YY the first two digits of the version of the e-MUCs – H specification. Expl. 50215
Equipment identifier	0-0:96.1.1*255	HEX encoded equipment identifier according DIN 43863-5
Date-time stamp of P1 message	0-0:1.0.0*255	Encoded as YYMMDDhhmmssX where X is S = summer, W = winter
Meter Reading electricity delivered to client (Tariff 1)	1-0:1.8.1*255 (see note 2, 3)	
Meter Reading electricity delivered to client (Tariff 2)	1-0:1.8.2*255 (see note 2, 3)	
Meter Reading electricity delivered by client (Tariff 1)	1-0:2.8.1*255 (see note 2, 3)	

[1] Introduction of new submeter-types will come together with a new version of eMUCS – P1 or as an addendum

Meter Reading electricity delivered by client (Tariff 2)	1-0:2.8.2*255 (see note 2, 3)	
Tariff indicator	0-0:96.14.0*255 (see note 2, 3)	(1) = High (2) = low
Current average demand - Active energy import	1-0:1.4.0*255	
Maximum demand – Active energy import of the running month	1-0:1.6.0*255	
Maximum demand – Active energy import of the last 13 months	0-0:98.1.0*255 (1-0:1.6.0*255 ,2) (1-0:1.6.0*255, 5)	Last 13 months of the maximum demand register (Time of appearance & Value)
Actual electricity power delivered to client from the grid (+P)	1-0:1.7.0*255 (see note 3)	
Actual electricity power injected by client in the grid (-P)	1-0:2.7.0*255 (see note 3)	
Instantaneous active power L1 (+P)	1-0:21.7.0.255 (see note 6)	
Instantaneous active power L2 (+P)	1-0:41.7.0.255 (see note 5)	
Instantaneous active power L3 (+P)	1-0:61.7.0.255 (see note 6)	
Instantaneous active power L1 (-P)	1-0:22.7.0.255 (see note 6)	
Instantaneous active power L2 (-P)	1-0:42.7.0.255 (see note 5)	
Instantaneous active power L3 (-P)	1-0:62.7.0.255 (see note 6)	
Instantaneous voltage L1	1-0:32.7.0*255	
Instantaneous voltage L2	1-0:52.7.0*255 (see note 5)	
Instantaneous voltage L3	1-0:72.7.0*255	
Instantaneous current L1	1-0:31.7.0*255 (see note 4)	
Instantaneous current L2	1-0:51.7.0*255 (see note 4)	
Instantaneous current L3	1-0:71.7.0*255 (see note 4)	
Breaker state	0-0:96.3.10*255	(0) = Disconnected (1) = Connected (2) = Ready for reconnection
Limiter threshold	0-0:17.0.0*255	0-999,8 = threshold 999,9 = deactivated
Fuse supervision threshold	1-0:31.4.0*255	0-998 = threshold 999 = deactivated
Text message	0-0:96.13.0*255	For future use (empty)

Table 4: Published electricity meter content

Note 1: Be aware of the fact that the number of OBIS codes and the order of the OBIS codes in the messages is not fixed. The customer application must be able to interpret the OBIS codes and to understand the representation.

Note 2: DSMR P1, mentions that "'Tariff code 1' is used for low tariff and 'Tariff code 2' is used for high tariff" is not valid in Belgium. Currently in Belgium 'Tariff code 1' is generally used for normal tariff and 'Tariff code 2' for low tariff. In general, assignment of tariffs to the tariff codes depends on the contract of the customer. Therefore it is advised to indicate the registers by their tariff number in the external application instead of a fixed assignment to High or Low.

Note 3: When there is simultaneous power consumption in one phase and power injection in another phase, the meter determines the netto value (= algebraic sum of the energy in the 3 phases) and stores it in the appropriate single register (1.x.0 or 2.x.0)

Note 4: In deviation to the DSMR P1, the resolution for the instantaneous currents (1-0:x1.7.0*255 with x =3, 5, 7) is improved from F3(0,0) to F5 (2,2)

Note 5: In case the polyphase meter is connected to a 3x230V grid, the value is 0. In a 3x230V grid, the meter sensors are configured in a two-wattmeter setup for power measurement (Aron connection). L2 is the common connection/reference

Note 6: In case the polyphase meter is connected to a 3x230V grid, the power of L1 and L2 shall be the result of the power measurement by the meter configured in a two-wattmeter setup for power measurement (Aron connection)

Value	OBIS reference	Remarks
Device type	0-n:24.1.0*255 (see note 1)	Device type 'Code', as specified in OMS 4.1.2 table 2
Equipment identifier	0-n:96.1.1*255 (see note 1)	ASCII encode equipment identifier according DIN 43863-5
Valve state	0-n:24.4.0*255 (see note 1)	(0) = Disconnected (1) = Connected (2) = Ready for reconnection
Last value of 'not temperature corrected' gas volume in m³, including decimal values and capture time	0-n:24.2.3*255 (see note 1, 2)	Timestamp of last MBUS communication followed by the volume at that moment

Table 5: Published gas meter content

Note 1: The M-bus channel number is indicated with 'n' in the OBIS code

Note 2: Be aware that for the gas volume, another OBIS-code is published than the one listed in section 7 of DSMR P1. This is due to the fact that in Belgium the not-temperature corrected gas volume is used while in the Netherlands, the temperature corrected gas volume is used.

Value	OBIS reference	Remarks
Device type	0-n:24.1.0*255 (see note 1)	Device type 'Code', as specified in OMS 4.1.2 table 2 (Gas meter = 0x03, Water meter = 0x07)
Equipment identifier	0-n:96.1.1*255 (see note 1)	ASCII encode equipment identifier according DIN 43863-5
Last 5-minute water meter Reading including decimal values and capture time	0-n:24.2.1*255 (see note 1)	Timestamp of last MBUS communication followed by the volume at that moment

Table 6: Published water meter content

Note 1: The M-bus channel number is indicated with 'n' in the OBIS code

4 Annex A: Implementation matrix

e-MUCs – P1 is continuously evolving, always with backwards compatibility in mind. This results in several versions of the document but also in several versions implemented in the field. Depending on the evolution, the DSO decides to upgrade or not upgrade meters that are already in the field.

Table 7 gives an overview of the versions that are applicable per DSO and per meter vendor / meter-type.

Producer / type	Roll-out	Fluvius P1	ORES P1	RESA P1	SIBELGA P1
Sagemcom S211	2019 - 202x	V1.3 V1.4 V1.5 V1.6 V1.7	V1.3 V1.4 V1.5 V1.6 V1.7	V1.3 V1.4 V1.5 V1.6 V1.7	V1.3 V1.4 V1.5 V1.6 V1.7
Sagemcom T211	2019 - 202x	V1.3 V1.4 V1.5 V1.6 V1.7	V1.3 V1.4 V1.5 V1.6 V1.7	V1.3 V1.4 V1.5 V1.6 V1.7	V1.3 V1.4 V1.5 V1.6 V1.7

Table 7: P1 Implementation matrix

Note 1: The DSO will put effort in upgrading the meters in the field to the most recent version of the e-MUCs – P1 that is listed in the table per DSO and meter vendor / meter -type but be aware that it's not possible to have a coverage for 100% of the meter park. It can be that some meters are never upgrade to the most recent version for technical reasons.

5 Annex B: Example telegram

5.1 1-phase meter

Example with a Gas meter on CH1 and a Water meter on CH2.

```
/FLU5\253770234_A

0-0:96.1.4(50217)
0-0:96.1.1(3153414731313030303030323331)
0-0:1.0.0(200512145552S)
1-0:1.8.1(000000.915*kWh)
1-0:1.8.2(000001.955*kWh)
1-0:2.8.1(000000.000*kWh)
1-0:2.8.2(000000.030*kWh)
1-0:1.4.0(02.351*kW)
1-0:1.6.0(200509134558S)(02.589*kW)
0-0:98.1.0(3)(1-0:1.6.0)(1-0:1.6.0)(200501000000S)(200423192538S)(03.695*kW)(2
00401000000S)(200305122139S)(05.980*kW)(200301000000S)(200210035421W)(04.318*k
W)
0-0:96.14.0(0001)
1-0:1.7.0(00.000*kW)
1-0:2.7.0(00.000*kW)
1-0:21.7.0(00.000*kW)
1-0:22.7.0(00.000*kW)
1-0:32.7.0(234.6*V)
1-0:31.7.0(000.00*A)
0-0:96.3.10(1)
0-0:17.0.0(999.9*kW)
1-0:31.4.0(999*A)
0-0:96.13.0()
0-1:24.1.0(003)
0-1:96.1.1(37464C4F32313139303333373333)
0-1:24.4.0(1)
0-1:24.2.3(200512134558S)(00112.384*m3)
0-2:24.1.0(007)
0-2:96.1.1(38534147313233334353637383930)
0-2:24.2.1(200512134558S)(00872.234*m3)


!XXX
```

5.2 3-phase meter

Example with a Gas meter on CH1 and a Water meter on CH2.

```
/FLU5\253769484_A

0-0:96.1.4(50217)
0-0:96.1.1(3153414733313031303231363035)
0-0:1.0.0(200512135409S)
1-0:1.8.1(000000.034*kWh)
1-0:1.8.2(000015.758*kWh)
1-0:2.8.1(000000.000*kWh)
1-0:2.8.2(000000.011*kWh)
1-0:1.4.0(02.351*kW)
1-0:1.6.0(200509134558S)(02.589*kW)
0-0:98.1.0(3)(1-0:1.6.0)(1-0:1.6.0)(200501000000S)(200423192538S)(03.695*kW)(2
00401000000S)(200305122139S)(05.980*kW)(200301000000S)(200210035421W)(04.318*k
W)
1-0:2.7.0(00.000*kW)
1-0:21.7.0(00.000*kW)
1-0:41.7.0(00.000*kW)
1-0:61.7.0(00.000*kW)
1-0:22.7.0(00.000*kW)
1-0:42.7.0(00.000*kW)
1-0:62.7.0(00.000*kW)
1-0:32.7.0(234.7*V)
1-0:52.7.0(234.7*V)
1-0:72.7.0(234.7*V)
1-0:31.7.0(000.00*A)
1-0:51.7.0(000.00*A)
1-0:71.7.0(000.00*A)
0-0:96.3.10(1)
0-0:17.0.0(999.9*kW)
1-0:31.4.0(999*A)
0-0:96.13.0()
0-1:24.1.0(003)
0-1:96.1.1(37464C4F32313139303333373333)
0-1:24.4.0(1)
0-1:24.2.3(200512134558S)(00112.384*m3)
0-2:24.1.0(007)
0-2:96.1.1(3853414731323334353637383930)
0-2:24.2.1(200512134558S)(00872.234*m3)

!XXX
```