P1 Companion Standard

Dutch Smart Meter Requirements

By order of:	**Netbeheer Nederland**
Reference:	**B1041**
Date:	**March 24th, 2010**
Version:	**3.0**
Status:	**Final**

Change Summary

Re-vi-sion	Created / Modified	Comment
2.1	H. Pille	Final version
2.2	H. Pille	4.5: max current changed from 5 to 30 mA
2.2	H. Pille	OBIS codes added for thermal and water meters
2.2	H. Pille	Meter identifier replaced by equipment identifier
2.2	H. Pille	References to use cases updated
2.3	R. Lassche	Changed logo to Netbeheer Nederland
2.31	R. Lassche	Only version number update
3.0	R. Lassche	In section 4.3 the text was adjusted with “The P1 port must therefore be able to handle multiple connected P1 devices, and such P1 devices must be able to handle partial messages.”
3.0	R. Lassche	In figure 2 in section 4.3 the splitter was removed.
3.0	R. Lassche	Changed header text of section 4.4 to “Measuring device transfer time”
3.0	R. Lassche	Clarified text in section 4.4 to explain where the 8 seconds was based on.
3.0	R. Lassche	In section 4.4 the note was added that P1 does not specify date and time to be included in the list of objects.
3.0	R. Lassche	In section 4.5 added a table with the operating range per device
3.0	R. Lassche	Chapter 5 “Protocol Description” was entirely rewritten
3.0	R. Lassche	In section 6.1 changed the resolution of the actual meter readings from 0.01 kWh to 0,001 kWh
3.0	R. Lassche	In section 6.1 changed the resolution of the actual electricity power from 1 Watt to 10 Watt
		In section 6.1 changed the descriptions and OBIS codes for Actual electricity power delivered (+P) in 10 Watt resolution, and Actual electricity power received (-P) in 10 Watt resolution
3.0	R. Lassche	In section 6.1 changed the OBIS codes for: - Equipment Identifier from 0-0:42.0.0.255 to 0-0:96.1.1.255 - Actual Electricity power from 1-0:1.7.0.255 to 1-0:15.7.0.255 - Actual switch position from 0-0:24.4.0.255 to 0-0:96.3.10.255
3.0	R. Lassche	In section 6.3 changed all gas data OBIS codes
3.0	R. Lassche	In section 6.4 changed all thermal data OBIS codes

3.0	R. Lassche	In section 6.5 changed all water data OBIS codes
3.0	P. Neelis	In sections 5.11, 6.3, 6.4, 6.5 changed the specific DLMS channels of M-bus devices into general channels for M-bus devices. As a result of that Capture Definition information (VIF/DIF) is added to the P1 messages
3.0	P. Neelis	In section 4.5. added logical levels of Mark and Space
3.0	R. Lassche	In section 6.3 changed the gas 24 hourly meter readings to Actual meter reading (temperature compensated or not, depending on the display setting of the gasmeter)
3.0	R. Lassche	In section 6.4 added Valve position Thermal (on/off/released) to the table.
3.0	R. Lassche	In section 6.5 added Valve position Water (on/off/released) to the table.
3.0	P. Neelis	Added section 6.6. fourth M-bus device
3.0	R. Lassche	Added section 6.7 “Change of M-bus device”

Contents

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 and gas valve
- Residential water meters

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

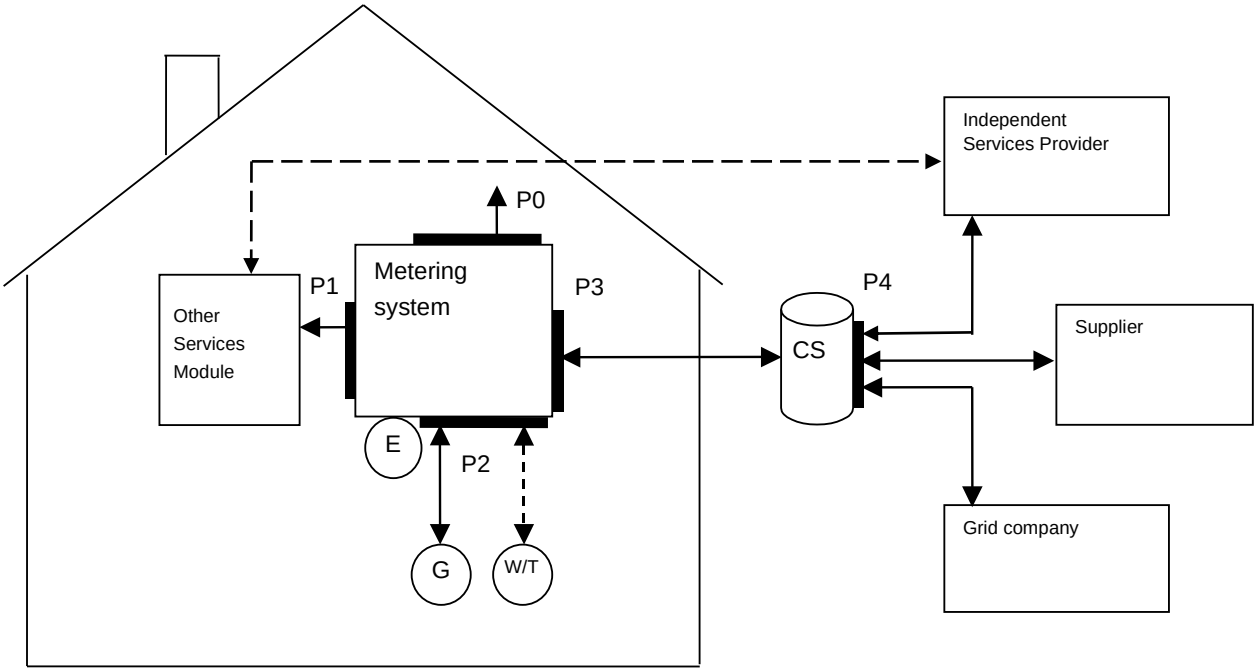


Figure 1. : Meter interfaces overview.

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).
Functional and technical requirements are given in the NTA 8130 document (see section 3).
This companion standard holds physical characteristics and protocol definitions for the interface.

3 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.	DIN 43863-3	Electricity meters – Parts 3: Tariff metering device as additional equipment for electricity meters – EDIS – Energy Data Identification System
4.	VDEW-Lastenheft “Elektronische Lastgangzahler”	VDEW-Lastenheft „Elektronische Lastgangzähler“, Erweiterte Version 2.1.2, November 2003
5.	NTA 8130 NL:2007	Basisfuncties voor de meetinrichting voor elektriciteit, gas en thermische energie voor kleinverbruikers
6.	DSMR 2.2	Dutch Smart Meter Requirements Version 2.2
7.	DSMR 2.31	Dutch Smart Meter Requirements Version 2.31

Table 3-1: Normative References

4 PHYSICAL INTERFACE CHARACTERISTICS

4.1 Galvanic Isolation

To protect the Metering System and to lower the possibility of influencing the Metering System through the P1 port, the P1 port will be equipped with an opto-coupler. The opto-coupler must be installed in the Metering System. The opto-couplers must adhere to the relevant legislation and standards for measuring equipment. The interface must be protected against reversed connection and necessary over-voltage protection.

4.2 Connection

To ensure a safe, stable solution the connection will consist of three wires: one request signal, one data signal and signal ground. Activating the port is by activating (raising) the request signal (~5V). While receiving data the requesting Service Module will keep the request port activated (raised).
Dropping the request line by connecting to ground is not allowed, to prevent short circuit. Modulating the request signal is not allowed. Data transfer will stop immediately after the request signal is dropped.

Note: the electrical interface is not conforming to EN-IEC 62056-21 Mode D.

More than one system may be connected to the measuring device, each system may request data input and all systems will receive the same data sent by the measuring device.

4.3 Addressing the measuring device

Since a measuring device will have no more than one P1 port, there is no need to address it. It is possible to connect more than one device with OSM (Other Service Module) activated or not. The P1 port must therefore be able to handle multiple connected P1 devices, and such P1 devices must be able to handle partial messages. The meter has only one P1 port, connecting more devices will need a hub. The hub is outside the scope of the P1 document, but a basic schematic is shown in Appendix I.

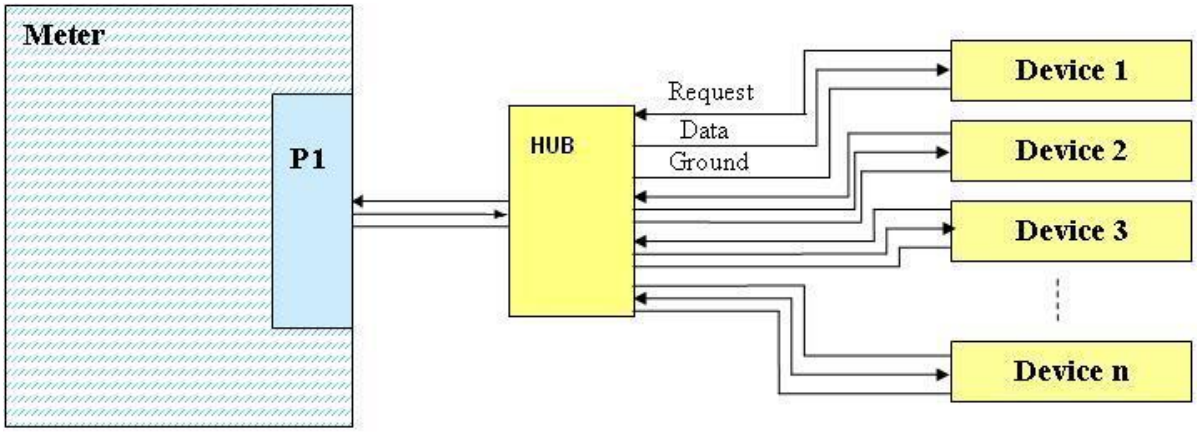


Figure 2. : Diagram for connecting more than one device to P1 port.

4.4 Measuring device transfer time

The measuring device must complete a data transfer within eight seconds. This is because the data will be made available on the P1 port every 10 seconds. There must be time in between the data hence the requirement that the data transfer must be complete within 8 seconds. If the data can be transmitted faster then the suppliers are free to do so.
Note: P1 does not specify date and time to be included in the list of objects.

4.5 Signals

All signals are compliant with following levels (different from the NTA8130!) Operating range per (P1) device as seen from the meter:

		Meter			OSM			
Symbol	**Parameter**	**Min**	**Typ**	**Max**	**Min**	**Typ**	**Max**	**Units**
Vi request	Request voltage				4	5	5.5	*V*
Ii request	Current supplied to the request pin				4	5	10	mA
Voh data	High level input voltage of the Data pin	4						V
Vol data	Low level input voltage of the Data pin			1				V
Ii data	Input current sinked, supplied by the Data pin per OSM		5	6				mA

Table 4-1: Signal Levels

Limit values:
Max Voltage: opto coupler: 30V, driver 6V
Max current sink (data output) : max = 30mA
Logical levels are specified as follows:

SPACE “0” as > 4V
MARK “1” as < 1 V

4.6 Physical connector

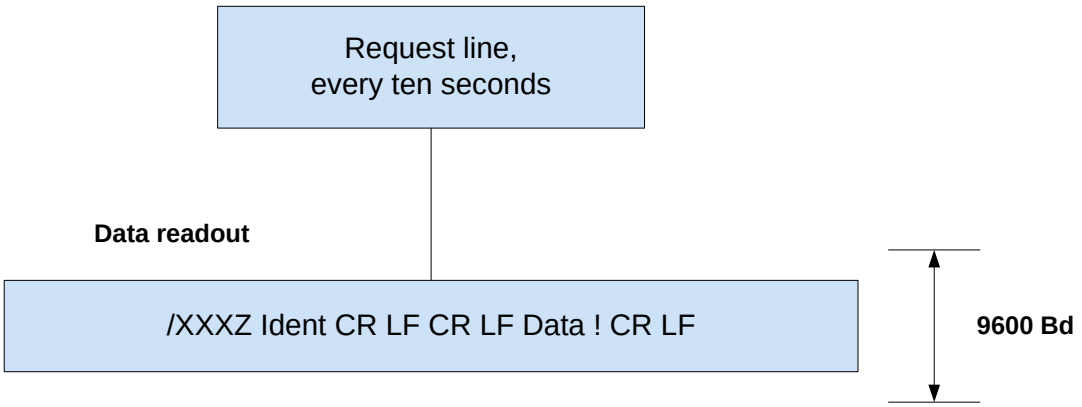
The connector is RJ11. The Metering System holds a female connector, the customer can plug in a standard RJ11 plug. Note that the connector in the metering system is physically accessible at all times and should not be sealed or protected by a sealed cover.

Pin #	Signal name	Description
1		
2	Request	Input
3	GND	Ground
4	N.C.	Not Connected
5	Data	Output
6		

Table 4-2: Physical Connector

5 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 ten seconds until request line is released.



5.1 Transfer speed

The interface will use a fixed transfer speed of 9600 bps. There are no options to switch the transmission speed. Note this is not conforming to EN-IEC 62056-21 Mode D.

5.2 Data readout

The Metering System transmits the data message immediately following the activation through the Request signal. A series of blocks containing the following are sent:

/	X	X	X	5	Identification	CR	LF	CR	LF	Data	!	CR	LF

5.3 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.

5.4 Representation of COSEM objects using Reduced ID-codes

IEC 62056-61 [2] specifies the logical names of COSEM objects using OBIS, the Object Identification System. Datasets in IEC 62056-21 Mode D use Reduced ID codes without letter replacement:

OBIS value groups:	A	B	C	D	E	F
OBIS for IEC 62056-21:	A-	B:	C.	D	.E	*F

Note: C and D are mandatory value groups.

The following Value Formats are used for P1 Data Readout value representations:

Value Format	Format/Example	Meaning
Fn(x,y)	F7(0,3) – YYYY,YYY	Floating decimal number
In	I4 - YYYY	Integer number
Sn	S6 - CCCCCC	Alphanumeric string
TST12	YYMMDDhhmmss	Time stamp with Year, Month, Day, Hour, Minute and Second.

Table 5-1: Value Formats

Value Formats used are defined in VDEW-Lastenheft “Elektronische Lastgangzahler [4].

COSEM object attribute values are using the following Value Formats:

COSEM Data Type	Tag	Value Format
null-data	0	empty
boolean	3	I
bit-string	4	Sn
double-long	5	Fn(x,y), I
double-long-unsigned	6	Fn(x,y), I
floating-point	7	Fn(x,y), I
octet-string	9	Sn
visible-string	10	Sn
bcd	13	S2
integer	15	Fn(x,y), I
long	16	Fn(x,y), I
unsigned	17	Fn(x,y), I
long-unsigned	18	Fn(x,y), I
long64	20	Fn(x,y), I
long64-unsigned	21	Fn(x,y), I
enum	22	I
float-32	23	Fn(x,y), I
float-64	24	Fn(x,y), I

Table 5-2: Cosem Object Attributes

5.5 Representation of COSEM Data Type octet-string

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) Hexadecimal characters for first octet
2) Hexadecimal characters for second octet
3) Hexadecimal characters for n-th octet (n is octet-string length)

5.6 Representation of COSEM Data Type bit-string

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) Hexadecimal characters for first octet (number of unused bits)
2) Hexadecimal characters for second octet (first 8 bits)
3) Hexadecimal characters for n-th octet (last 8 -number of unused bits)

5.7 Representation of COSEM Data Type boolean

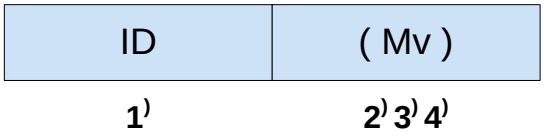
COSEM Data Type boolean is represented with I1 format where value false is represented as 0 and value true as 1.

5.8 Representation of COSEM Data Type enum

COSEM Data Type enum is represented with I1 format where enum values are represented as integer values.

5.9 Representation of COSEM objects

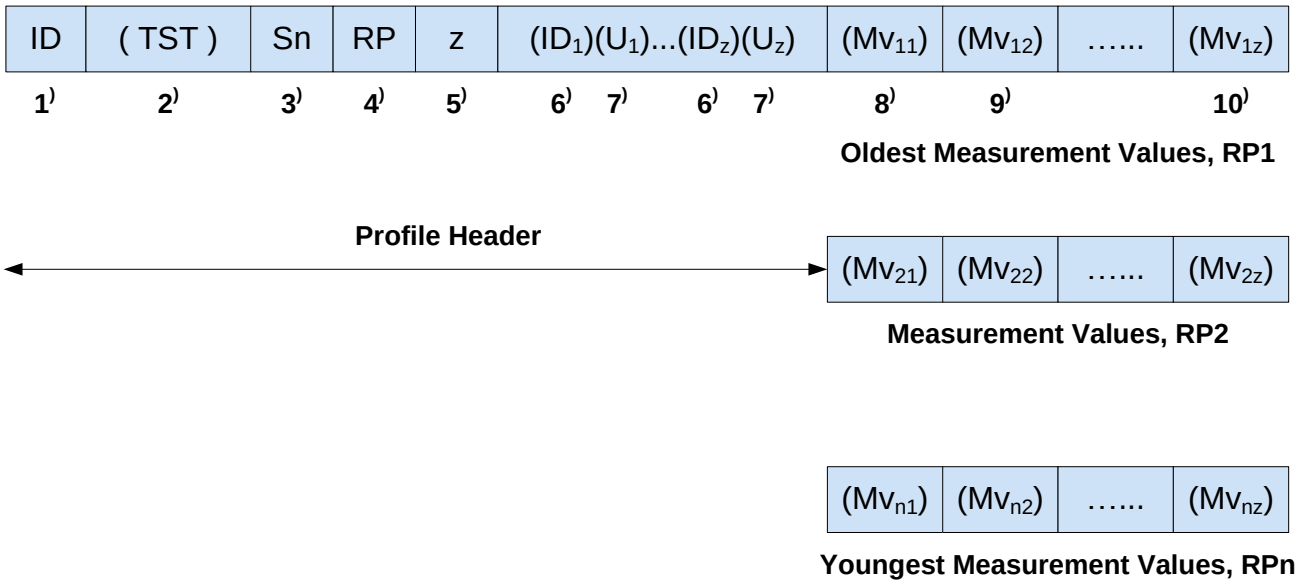
COSEM objects identified with OBIS Reduced ID use the following Dataset formatting for representation:



1) OBIS Reduced ID-code
2) Separator (ASCII 28_h)
3) COSEM object attribute value
4) Separator (ASCII 29_h)

5.10 Representation of Profile Generic

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



1) OBIS Reduced ID-code
2) Time Stamp (TST12) of oldest measurement value(s)m, RP1
3) Profile Status Sn.
4) Recording Period in Minutes.(capture period attribute).
5) Number of measurement values z.
6) Identifications of measurement values (OBIS Reduced ID codes of capture objects attribute)
7) Units of measurement values (Units of capture_objects attribute)
8) Measurement value 1 (entry 1 of buffer attribute without unit)
9) Measurement value 2 (entry 2 of buffer attribute without unit)
10) Measurement value z (entry z of buffer attribute without unit)

5.11 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.

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 installed M-Bus devices will lead automatically to an export on P1.

Value	OBIS reference	Attribute	Value Format	Value Unit
Header information	-	-	Manufacturer specific	
Equipment identifier	0-0:96.1.1.255	2	Sn (n=0..96)	
Meter Reading electricity delivered to client normal tariff) in 0,001 kWh	1-0:1.8.1.255	2	F8(0,3)	kWh
Meter Reading electricity delivered to client (low tariff) in 0,001 kWh	1-0:1.8.2.255	2	F8(0,3)	kWh
Meter Reading electricity delivered by client (normal tariff) in 0,001 kWh	1-0:2.8.1.255	2	F8(0,3)	kWh
Meter Reading electricity delivered by client (low tariff) in 0,001 kWh	1-0:2.8.2.255	2	F8(0,3)	kWh
Tariff indicator electricity. The tariff indicator can 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	Sn (n=4)	
Actual electricity power delivered (+P) in 10 Watt resolution	1-0:1.7.0.255	2	F6(0,2)	kW
Actual electricity power received (-P) in 10 Watt resolution	1-0:2.7.0.255	2	F6(0,2)	kW
The actual threshold Electricity in A	0-0:17.0.0.255	3	I3	A
Actual switch position Electricity (in/out/enabled).	0-0:96.3.10.255	3	I1	
Text message codes: numeric 8 digits	0-0:96.13.1.255	2	Sn (n=0..32)	
Text message max 1024 characters.	0-0:96.13.0.255	2	Sn (n=0..2048)	
Device-Type	0-n:24.1.0.255	9	I	
Equipment identifier (Gas)	0-n:96.1.0.255	2	Sn (n=0..96)	

Last hourly value (temperature compensated or not, depending on the display setting of the gasme-ter), gas delivered to client in m3, including decimal values	0-n:24.3.0.255	2	F8(0,2)/ F8(0,3)	
Valve position Gas (on/off/released).	0-n:24.4.0.255	3	I1	
Device-Type	0-n:24.1.0.255	9	I	
Equipment identifier (Thermal)	0-n:96.1.0.255	2	Sn (n=0..96)	
Last hourly Meter reading Heat in 0,01 GJ	0-n:24.3.0.255	2	F8(0,2)	GJ
Last hourly Meter reading Cold in 0,01 GJ	0-n:24.3.1.255	2	F8(0,2)	GJ
Valve position (on/off/released).	0-n:24.4.0.255	3	I1	
Device-Type	0-n:24.1.0.255	9	I	
Equipment identifier (Water)	0-n:96.1.0.255	2	Sn (n=0..96)	
Last hourly Meter reading in 0,001 m3	0-n:24.3.0.255	2	F8(0,3)	m3
Valve position (on/off/released).	0-n:24.4.0.255	3	I1	
Device-Type	0-n:24.1.0.255	9	I	
Equipment identifier	0-n:96.1.0.255	2	Sn (n=0..96)	
Last hourly Meter reading	0-n:24.3.0.255	2	F8(0,3)	
Valve/Switch position (on/off/released).	0-n:24.4.0.255	3	I1	

Table 5-3: P1 Telegram Representation

Note: Valve position only applicable when present.

5.12 Example P1 telegram

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

```
/ISk5\2MT382-1000

0-0:96.1.1(4B384547303034303436333935353037)
1-0:1.8.1(12345.678*kWh)
1-0:1.8.2(12345.678*kWh)
1-0:2.8.1(12345.678*kWh)
1-0:2.8.2(12345.678*kWh)
0-0:96.14.0(0002)
1-0:1.7.0(001.19*kW)
1-0:2.7.0(000.00*kW)
0-0:17.0.0(016*A)
0-0:96.3.10(1)
0-0:96.13.1(303132333435363738)
0-0:96.13.0(303132333435363738393A3B3C3D3E3F303132333435363738393A3B3C3D3E3F
303132333435363738393A3B3C3D3E3F303132333435363738393A3B3C3D3E3F
303132333435363738393A3B3C3D3E3F)
```

```
0-1:96.1.0(3232323241424344313233343536373839)
0-1:24.1.0(03)
0-1:24.3.0(090212160000)(00)(60)(1)(0-1:24.2.1)(m3)
(00000.000)
0-1:24.4.0(1)
!
```

6 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 and Rate 2) are defined, support for up to four tariffs should be included.

6.1 Electricity data

Electricity –P1 transfers every ten seconds

Value	OBIS reference	NTA Use Case reference
Equipment identifier	0-0:96.1.1.255	Use case 3: Provide actual meter reads through P1 Use case 5: Provide equipment status to P1
Meter Reading electricity delivered to client normal tariff) in 0,001 kWh	1-0:1.8.1.255	Use case 3: Provide actual meter reads through P1
Meter Reading electricity delivered to client (low tariff) in 0,001 kWh	1-0:1.8.2.255	Use case 3: Provide actual meter reads through P1
Meter Reading electricity delivered by client (normal tariff) in 0,001 kWh	1-0:2.8.1.255	Use case 3: Provide actual meter reads through P1
Meter Reading electricity delivered by client (low tariff) in 0,001 kWh	1-0:2.8.2.255	Use case 3: Provide actual meter reads through P1
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	Use case 5: Provide equipment status to P1
Actual electricity power delivered (+P) in 10 Watt resolution	1-0:1.7.0.255	Use case 3: Provide actual meter reads through P1
Actual electricity power received (-P) in 10 Watt resolution	1-0:2.7.0.255	Use case 3: Provide actual meter reads through P1
The actual threshold Electricity in A	0-0:17.0.0.255	Use case 5: Provide equipment status to P1
Actual switch position Electricity (in/out/enabled).	0-0:96.3.10.255	Use case 5: Provide equipment status to P1

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

6.2 Messages

Text messages, transfer every ten seconds

Value	OBIS reference	NTA Use Case reference
Text message codes: numeric 8 digits	0-0:96.13.1.255	Use case 12: Display standard messages on meter display and P1
Text message max 1024 characters.	0-0:96.13.0.255	Use case 13: Sending long messages to port P1

The Meter will have storage capacity for one numeric message code and one 1024 character text message. Message codes and text messages are handled independently, but in the same way.

If a device is connected, the meter will send the message (code and/or text) over the P1 interface every ten seconds. The text messages may not contain the control character sequence <cr><lf> (ASCII codes 0Dh 0Ah).

6.3 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 ten seconds the latest received hourly values & timestamps

Value	OBIS reference	NTA Use Case reference
Device-Type	0-n:24.1.0.255	
Equipment identifier	0-n:96.1.0.255	Use case 3: Provide actual meter reads through P1
Last hourly value (temperature compensated or not, depending on the display setting of the gasmeter), gas delivered to client in m3, including decimal values	0-n:24.3.0.255	Use case 3: Provide actual meter reads through P1
Valve position gas (on/off/released).	0-n:24.4.0.255	Use case 5: Provide equipment status to P1

Note: Only one of the two Gas Meter Readings (temperature compensated or not) will be used.

6.4 Thermal Data

The following is only applicable if Thermal (H/C) meters are connected. 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 (H/C)– P1 transfers every ten seconds the latest received hourly values & timestamps

Value	OBIS reference	NTA Use Case reference
Device-Type	0-n:24.1.0.255	
Equipment identifier	0-n:96.1.0.255	Use case 3: Provide actual meter reads through P1 (x=5:Heat; x=6: Cooling)
Last hourly Meter reading Heat/Cold in 0,01 GJ	0-n:24.3.0.255	Use case 3: Provide actual meter reads through P1
Valve position Thermal (on/off/released).	0-n:24.4.0.255	Use case 5: Provide equipment status to P1

6.5 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 ten seconds the latest received hourly values & timestamps

Value	OBIS reference	NTA Use Case reference
Device-Type	0-n:24.1.0.255	
Equipment identifier	0-n:96.1.0.255	Use case 3: Provide actual meter reads through P1
Last hourly Meter reading in 0,001 m3	0-n:24.3.0.255	Use case 3: Provide actual meter reads through P1
Valve position Water (on/off/released).	0-n:24.4.0.255	Use case 5: Provide equipment status to P1

6.6 M-bus Data of a fourth M-bus device

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 ten seconds the latest received hourly values & timestamps

Value	OBIS reference	NTA Use Case reference
Device-Type 4th M-bus device	0-n:24.1.0.255	

Value	OBIS reference	NTA Use Case reference
Equipment identifier	0-n:96.1.0.255	Use case 3: Provide actual meter reads through P1
Last hourly Meter reading	0-n:24.3.0.255	Use case 3: Provide actual meter reads through P1
If applicable, Valve/Switch position (on/off/released).	0-n:24.4.0.255	Use case 5: Provide equipment status to P1

6.7 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.

7 DOCUMENT LIST

Following table shows the complete set of documents that build up the Dutch Smart Meter Requirements, of which this Companion standard P1 document is a part of.

#	Document name postfix	description
[1]	Main	The main document of the Dutch Smart Meter Requirements, containing all definitions and most of the use cases and requirements
[2]	P1	Companion standard P1
[3]	P2	Companion standard P2
[4]	P3	Companion standard P3
[5]	P3.2	Companion standard P3.2
[6]	GPRS	Additional document describing the requirements for the GPRS infra-structure as part of the Dutch Smart Meter Specification.
[7]	IP	Additional document describing the requirements for IP via Ethernet.

Table 7-1: Document List

APPENDIX I HUB BASIC SCHEMATIC