EXCERPT FROM

Companion Specification
for Energy Metering

Blue Book - 7th edition

COSEM

Identification System and Interface Objects

DLMS User Association

dlms
device
language
message
specification ™

Reference number: EXCERPT FROM DLMS UA 1000-1:2005, Seventh Edition

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1. Foreword

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Acknowledgement

The actual document has been established by a team of experts working for the meter manufacturers DZG, Enermet, Schlumberger/Actaris and Siemens/Landis&Gyr, with input from other members of the DLMS User Association and from working group members of standardization bodies, mainly IEC TC13 WG14 and CEN TC294 WG2.

Status of standardization

This seventh edition of the “Blue Book” includes the specification of the COSEM objects and the Object Identification System (OBIS) and is aligned with the contents of:

- draft IEC 62056-61, 13/1341/CDV, Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: OBIS Object identification system;
- draft IEC 62056-62, 13/1342/CDV, Electricity metering – Data exchange for meter reading, tariff and load control – Part 62: Interface classes;
- EN 13757-1:2002, Communication system for meters and remote reading of meters – Part 1: Data exchange.

For easier use, in this edition, changes compared to the sixth edition are marked by higlighted text.

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2. Scope

This document specifies the functionality of the meter which is available at its interfaces (internal issues concerning the implementation are not covered by the specification) and how the functions and the data can be accessed from the outside. The complex functionality of the meter is divided into generic building blocks. The COSEM specifications follow a three step approach as illustrated in Figure 1:

Step 1: The meter model and data identification (data model);

Step 2: The mapping of the model into protocol data units (PDU);

Step 3: The transportation of the bits and bytes through the communication channel.

The data model uses generic building blocks to define the complex functionality of the metering equipment. It provides a view of this functionality of the meter, as it is available at its interface(s). The model does not cover internal, implementation specific issues.

The communication protocol defines how the data can be accessed and exchanged.

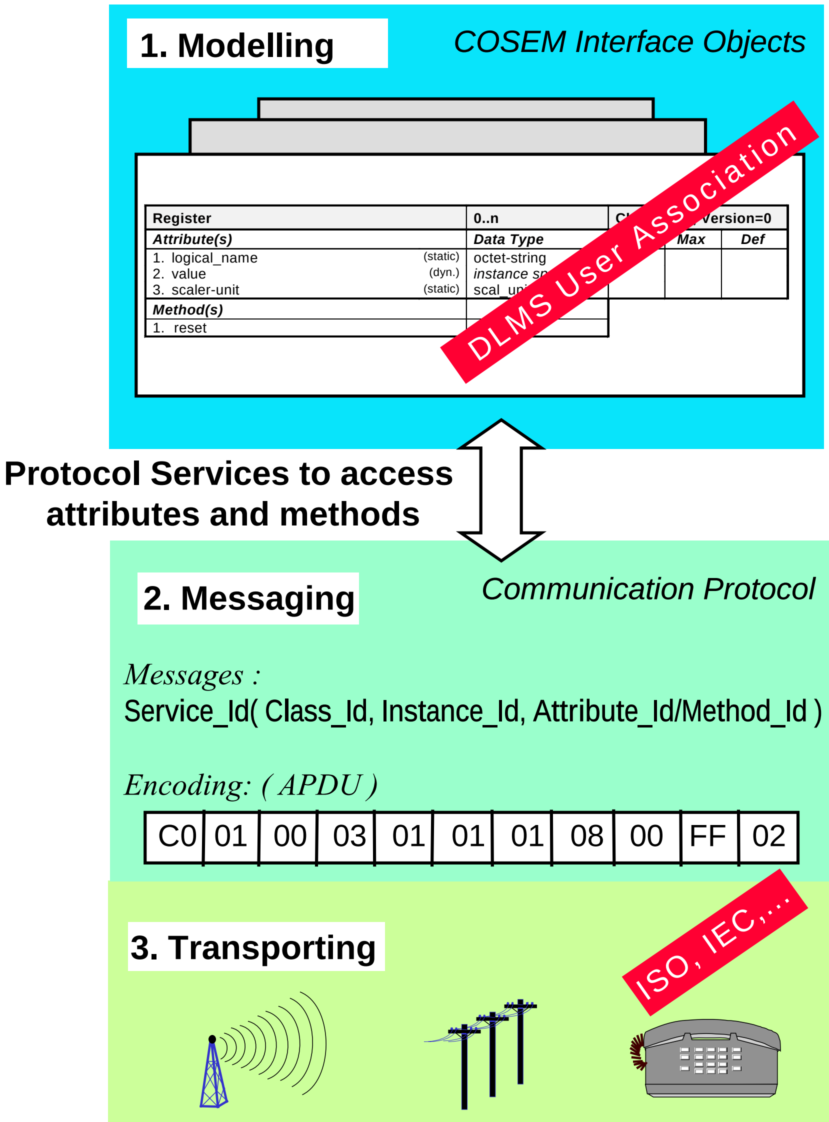

Figure 1 – The three steps approach of COSEM: Modelling – Messaging – Transporting

- The COSEM specification specifies metering domain specific interface classes. The functionality of the meter is defined by the instances of these interface classes, called COSEM objects. This is defined in the first part of this document. Logical names (OBIS codes), identifying the COSEM objects are defined in the second part of this document.
- The attributes and methods of these COSEM objects can be accessed and used via the messaging services of the application layer.
- The lower layers of the protocol transport the information.

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3. Introduction

Driven by the need of the utilities to optimise their business processes, the meter becomes more and more part of an integrated metering and billing system. Whereas in the past the commercial value of a meter was mainly generated by its data acquisition and processing capabilities, nowadays the critical issues are system integration and interoperability.

The Companion Specification for Energy Metering (COSEM) addresses these challenges by looking at the meter as an integrated part of a commercial process, which starts with the measurement of the delivered product (energy) and ends with the revenue collection.

The meter is specified by its "behaviour" as seen from the utility's business processes. The formal specification of the behaviour is based on object modelling techniques (interface classes and objects). The specification of these objects forms a major part of COSEM.

The COSEM server model (see 4.1.5) represents only the externally visible elements of the meter. The client applications that support the business processes of the utilities, customers and meter manufacturers make use of this server model. The meter offers means to retrieve its structural model (the list of objects visible through the interface), and provides access to the attributes and specific methods of these objects.

The set of different interface classes form a standardized library from which the manufacturer can assemble (model) its individual products. The elements are designed so that with them the entire range of products (from residential to commercial and industrial applications) can be covered. The choice of the subset of interface classes used to build a meter, their instantiation, and their implementation are part of the product design and therefore left to the manufacturer. The concept of the standardized metering interface class library provides the different users and manufacturers with a maximum of diversity without having to sacrifice interoperability.

The competitive electricity market requires an ever-increasing amount of timely information concerning the usage of electrical energy. Recent technology developments enable to build intelligent static metering equipment, which are capable of capturing, processing and communicating this information to all parties involved.

For further analysis of this information, for the purposes of billing, load-, customer- and contract management, it is necessary to uniquely identify all data in a manufacturer independent way collected manually or automatically, via local or remote data exchange.

The definition of identification codes is based on DIN 43863-3:1997, *Electricity meters – Part 3: Tariff metering device as additional equipment for electricity meters – EDIS – Energy Data Identification System.*

3.1 Referenced documents

Ref.	Title
DLMS UA 1000-2 Ed. 5.0, 2005	*COSEM Architecture and Protocols*
DLMS UA 1001-1, Ed. 2.0, 2002	*COSEM Conformance test process*
DLMS UA 1002, Ed. 1.0, 2003	*COSEM Glossary of terms*
EN 834:1994	*Heat cost allocators for the determination of the consumption of room heating radiators – Appliances with electrical energy supply*
EN 1434-1: 1997	*Heat meters – Part 1: General requirements*

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Ref.	Title
EN 1434-2: 1997	*Heat meters – Part 2: Constructional requirements*
EN 12405: 2002	*Gas meters – Gas volume electronic conversion devices*
EN 13757-1:2002	*Communication system for meters and remote reading of meters – Part 1: Data exchange*
EN13757-2:2002	*Communication system for meters and remote reading of meters – Part 2: Physical and Link layer, Twisted Pair Baseband (M-Bus)*
IEC 60559:1989	*Binary floating-point arithmetic for microprocessor systems*
IEC/TR 61000-2-8:2002	*Electromagnetic compatibility (EMC) - Part 2-8: Environment - Voltage dips and short interruptions on public electric power supply systems with statistical measurement results*
IEC 61334-4-41:1996	*Distribution automation using distribution line carrier systems - Part 4: Data communication protocols - Section 41: Application protocols - Distribution line message specification*
IEC 62051 Ed. 1.0:1999	*Electricity metering – Glossary of terms*
IEC 62051-1 Ed.1.0:2004	*Electricity metering – Data exchange for meter reading, tariff and load control – Glossary of terms – Part 1: Terms related to data exchange with metering equipment using DLMS/COSEM*
IEC 62053-23 Ed. 1.0:2003	*Electricity metering equipment (a.c.) – Particular requirements – Part 23: Static meters for reactive energy (classes 2 and 3)*
IEC 62056-21 Ed.1.0:2002	*Electricity metering - Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange*
IEC 62056-31 Ed. 1.0:1999	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 31: Using local area networks on twisted pair with carrier signalling*
IEC 62056-46 Ed.1.0:2002	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC-protocol*
IEC 62056-46 Amd. 1 [1]	
IEC 62056-47 Ed. 1.0 [1]	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 47: COSEM transport layers for IPv4 networks*
IEC 62056-53 Ed.2.0 [1]	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 53: COSEM Application layer*
IEC 62056-61 Ed.2.0 [1]	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: Object identification system (OBIS)*
IEC 62056-62 Ed.2.0 [1]	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 62: Interface classes*
ANSI C12.19:1997	*IEEE 1377:1997, Utility industry end device data tables*
ISO/IEC 646:1991	*Information technology – ISO 7 bit coded character set for information exchange*
STD 0005:1981	*Internet Protocol (Also: IETF RFC 0791, RFC 0792, RFC 0919, RFC 0922, RFC 0950, RFC 1112)*
STD 0051:1994	*The Point-to-Point Protocol (PPP) (Also: IETF RFC 1661, RFC 1662)*
NOTE See also Bibliography for other related Internet RFC-s.	

[1] To be published

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3.2 Terms, Definitions and Abbreviations

Abbreviation	Explanation
AARE	Application Association Response
AARQ	Application Association ReQuest
ACSE	Application Control Service Element
APDU	Application Protocol Data Unit
ASE	Application Service Element
A-XDR	Adapted Extended Data Representation
base_name	The short_name corresponding to the first attribute (“logical_name”) of a COSEM object.
CHAP	Challenge Handshake Authentication Protocol
Class_id	Interface class identification code
COSEM	Companion Specification for Energy Metering
COSEM object	An instance of an interface class
CtoS	Client to Server challenge
DHCP	Dynamic Host Control Protocol
DLMS	Device Language Message Specification
DNS	Domain Name Server
EAP	Extensible Authentication Protocol
GMT	Greenwich Mean Time
GPS	Global Positioning System
HLS	High Level Security
IANA	Internet Assigned Numbers Authority
IC	Interface Class
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPCP	Internet Protocol Control Protocol
LCP	Link Control Protocol
LLS	Low Level Security
LN	Logical Name
LSB	Least Significant Bit
m	mandatory
MD5	Message Digest Algorithm 5
MSB	Most Significant Bit
o	optional
OBIS	OBject Identification System
PAP	Password Authentication Protocol
PDU	Protocol Data Unit
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephone Network

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Abbreviation	**Explanation**
ROHC	Robust Header Compression
SAP	Service Access Point
SHA-1	Secure Hash Algorithm
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
SN	Short Name
StoC	Server to Client Challenge
UTC	Universal Time Co-ordinated

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4. COSEM Interface Classes

4.1 Basic principles

4.1.1 General

This subclause describes the basic principles on which the COSEM interface classes are built. It also gives a short overview on how interface objects (instantiations of the interface classes) are used for communication purposes. Data collection systems and metering equipment from different vendors, following these specifications, can exchange data in an interoperable way.

Object modelling: for specification purposes this standard uses the technique of object modelling. An object is a collection of attributes and methods.

The information of an object is organized in attributes. They represent the characteristics of an object by means of attribute values. The value of an attribute may affect the behaviour of an object. The first attribute in any object is the “logical_name”. It is one part of the identification of the object. An object may offer a number of methods to either examine or modify the values of the attributes.

Objects that share common characteristics are generalized as an interface class with a class_id. Within a specific class, the common characteristics (attributes and methods) are described once for all objects. Instantiations of an interface class are called COSEM objects.

Manufacturers may add proprietary methods or attributes to any object, using negative numbers.

Figure 2 illustrates these terms by means of an example:

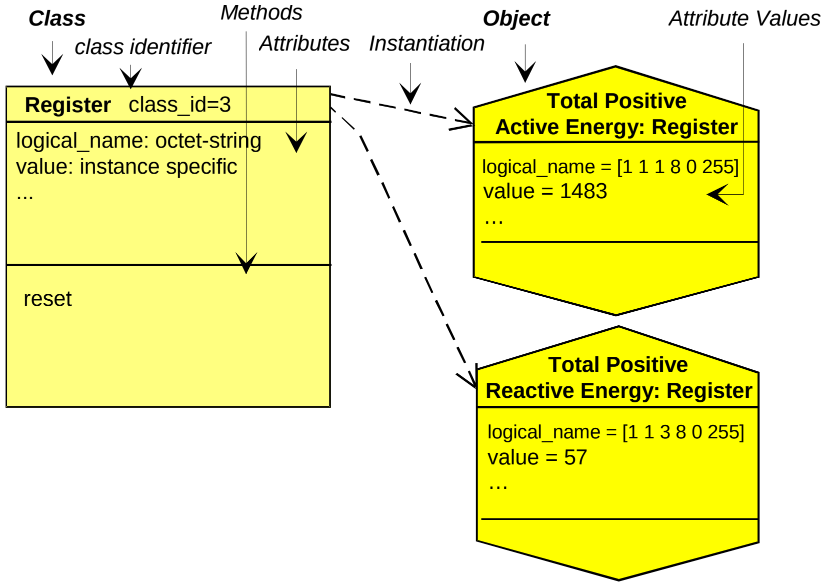

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Figure 2 – An interface class and its instances

The interface class “Register” is formed by combining the features necessary to model the behaviour of a generic register (containing measured or static information) as seen from the client (central unit, hand held terminal). The contents of the register are identified by the attribute “logical_name”. The logical_name contains an OBIS identifier (see Clause 5). The actual (dynamic) content of the register is carried by its “value” attribute.

Defining a specific meter means defining several specific registers. In the example of Figure 2, the meter contains two registers; i.e. two specific COSEM objects of the class “Register” are instantiated. This means that specific values are assigned to the different attributes. Through the instantiation one COSEM object becomes a “total, positive, active energy register” whereas the other becomes a “total, positive, reactive energy register”.

REMARK The COSEM objects (instances of interface classes) represent the behaviour of the meter as seen from the “outside”. Therefore, modifying the value of an attribute must always be initiated from the outside (for example resetting the value of a register). Internally initiated changes of the attributes are not described in this model (for example updating the value of a register).

4.1.2 Class description notation

This subclause describes the notation used to define the interface classes.

A short text describes the functionality and application of the class. A table gives an overview of the class including the class name, the attributes, and the methods (class description template).

Class name		**Cardinality**	**class_id, version**		
Attribute(s)		***Data type***	***Min.***	***Max.***	***Def.***
1. logical_name	(static)	octet-string			
2. …	(…)	…			
3. …	(...)	…			
Specific method(s) (if required)		***m/o***			
1. …		…			
2. …		…			

Each attribute and method must be described in detail.

Class name	Describes the class (for example “Register”, “Clock”, “Profile generic”,...)	
Cardinality	Specifies the number of instances of the class within a logical device (see 4.1.6).	
	value	The class shall be instantiated exactly “value” times.
	min...max.	The class shall be instantiated at least “min.” times and at most “max.” times. If min. is zero (0) then the class is optional, otherwise (min. > 0) "min." instantiations of the class are mandatory.
class_id	Identification code of the class (range 0 to 65 535). The class_id of each object is retrieved together with the logical name by reading the object_list attribute of an “Association LN” / ”Association SN” object. The class_id-s from 0 to 8 191 are reserved to be specified by the DLMS UA. Class_id-s from 8 192 to 32 767 are reserved for manufacturer specific interface classes. Class_id-s from 32 768 to 65 535 are reserved for user group specific interface classes. DLMS UA reserves the right to assign ranges to individual manufacturers or user groups.	
Version	Identification code of the version of the class. The version of each object is retrieved together with the logical name and the class_id by reading the object_list attribute of an “Association LN” / ”Association SN” object.	

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	Within one logical device, all instances of a certain class must be of the same version	
Attribute(s)	Specifies the attribute(s) that belong to the class.	
	(*dyn*.)	Classifies an attribute that carries a process value, which is updated by the meter itself.
	(static)	Classifies an attribute, which is not updated by the meter itself (for example configuration data).
logical_name	octet-string	The logical name is always the first attribute of a class. It identifies the instantiation (COSEM object) of this class. The value of the logical_name conforms to OBIS (see Clause 5).
Data type	Defines the data type of an attribute (see 4.1.3).	
Min.	Specifies if the attribute has a minimum value.	
	x	The attribute has a minimum value.
	<empty>	The attribute has no minimum value.
Max.	Defines if the attribute has a maximum value.	
	x	The attribute has a maximum value.
	<empty>	The attribute has no maximum value.
Def.	Specifies if the attribute has a default value. This is the value of the attribute after reset.	
	x	The attribute has a default value.
	<empty>	The default value is not defined by the class definition.
Specific method(s)	Provides a list of the specific methods that belong to the object.	
	Method Name ()	The method has to be described in the subsection "Method description".
m/o	Defines if the method is mandatory or optional.	
	m (mandatory)	The method is mandatory.
	o (optional)	The method is optional.

Attribute description

Describes each attribute with its data type (if the data type is not simple), its data format and its properties (minimum, maximum and default values).

Method description

Describes each method and the invoked behaviour of the instantiated COSEM object(s).

NOTE Services for accessing attributes or methods by the protocol are described in Clause 9 of the Green Book.

Selective access

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The xDLMS services Read, Write, UnconfirmedWrite (used with SN referencing) and GET, SET (used with LN referencing) typically reference the entire attribute. However, for certain attributes selective access to just a part of the attribute may be provided. The part of the attribute is identified by specific selective access parameters. These are defined as part of the attribute specification.

4.1.3 Common data types

The following table contains the list of data types usable for attributes of COSEM objects.

Table 1 – Common data types

Type description	Tag [a]	Definition	Value range
--simple data types			
null-data	[0]		
boolean	[3]	boolean	TRUE or FALSE
bit-string	[4]	An ordered sequence of boolean values	
double-long	[5]	Integer32	-2 147 483 648… 2 147 483 647
double-long-unsigned	[6]	Unsigned32	0…4 294 967 295
octet-string	[9]	An ordered sequence of octets (8 bit bytes)	
visible-string	[10]	An ordered sequence of ASCII characters	
bcd	[13]	binary coded decimal	
integer	[15]	Integer8	-128…127
long	[16]	Integer16	-32 768…32 767
unsigned	[17]	Unsigned8	0…255
long-unsigned	[18]	Unsigned16	0…65 535
long64	[20]	Integer64	- 2^{63}…2^{63}-1
long64-unsigned	[21]	Unsigned64	0…2^{64}-1
enum	[22]	The elements of the enumeration type are defined in the “Attribute description” section of a COSEM interface class specification.	
float32	[23]	OCTET STRING (SIZE(4))	For formatting, see 4.1.4.2.
float64	[24]	OCTET STRING (SIZE(8))	
date_time	[25]	OCTET STRING SIZE(12))	For formatting, see 4.1.4.1.
date	[26]	OCTET STRING SIZE(5))	
time	[27]	OCTET STRING SIZE(4))	
--complex data types			
array	[1]	The elements of the array are defined in the “Attribute description” section of a COSEM interface class specification.	
structure	[2]	The elements of the structure are defined in the “Attribute description” section of a COSEM interface class specification.	
compact array	[19]	The elements of the compact array are defined in the “Attribute description” section of a COSEM interface class specification.	
--CHOICE		For some attributes of some COSEM interface objects, the data type may be chosen at COSEM object instantiation, in the implementation phase of the COSEM server. The Server always shall send back the data type	

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Type description	Tag [a]	Definition	Value range
		and the value of each attribute, so that together with the logical name, an unambiguous interpretation is ensured. The list of possible data types is defined in the “Attribute description” section of a COSEM interface class specification.	
[a] The tags are as defined in Clause 9.4.3 of the Green Book.			

4.1.4 Data formats

4.1.4.1 Date and time formats

Date and time information may be represented with data type octet-string, or using the data types *date, time* and *date_time*, as defined in the relevant interface class definition.

NOTE 1 In future versions of interface classes and in newly defined interface classes, only the data types *date, time* and *date_time* will be used.

NOTE 2 The (SIZE( )) specification do not apply if *date*, *time* or *date_time* are represented by data type octet-string.

date

OCTET STRING (SIZE(5))
{
year highbyte,
year lowbyte,
month,
day of month,
day of week
}

year: interpreted as long-unsigned
range 0…big
0xFFFF = not specified
year highbyte and year lowbyte reference the 2 bytes of the long-unsigned

month: interpreted as unsigned
range 1…12, 0xFD, 0xFE, 0xFF
1 is January
0xFD= daylight_savings_end
0xFE= daylight_savings_begin
0xFF = not specified

dayOfMonth: interpreted as unsigned
range 1…31, 0xFD, 0xFE, 0xFF
0xFD = 2nd last day of month
0xFE = last day of month
0xE0 to 0xFC = reserved
0xFF = not specified

dayOfWeek: interpreted as unsigned
range 1…7, 0xFF
1 is Monday
0xFF = not specified

For repetitive dates, the unused parts must be set to “not specified”.

The elements dayOfMonth and dayOfWeek have to be interpreted together.

- if last day of month is specified (0xFE) and day of week is

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wildcard, this specifies the last calendar day of the month;

- if last day of month is specified (0xFE) and an explicit day of week is specified (for example 7, Sunday) then it is the last occurrence of the weekday specified in the month, i.e. the last Sunday;

- if the dayOfMonth and dayOfWeek elements are both explicitly defined and they are not consistent, (for example 24th of the month is not Wednesday in the given year and month) it shall be considered as an error.

time

OCTET STRING (SIZE(4))
{
hour,
minute,
second,
hundredths
}

hour: interpreted as unsigned
range 0…23, 0xFF
0xFF = not specified,
minute: interpreted as unsigned
range 0…59, 0xFF
0xFF = not specified,
second: interpreted as unsigned
range 0…59, 0xFF
0xFF = not specified,
hundredths: interpreted as unsigned
range 0…99, 0xFF
0xFF = not specified

For repetitive times the unused parts must be set to “not specified”.

deviation

long –720…720:
in minutes of local time to GMT
0x8000 = not specified

clock_status

unsigned interpreted as 8 bit string

The status bits are defined as follows:

bit 0 (LSB):	invalid [a] value,
bit 1:	doubtful [b] value,
bit 2:	different clock base [c],
bit 3:	invalid clock status [d],
bit 4:	reserved,
bit 5:	reserved,
bit 6:	reserved,
bit 7 (MSB):	daylight saving active [e]

date_time

OCTET STRING (SIZE(12))
{
year highbyte,
year lowbyte,
month,
day of month,
day of week,
hour,
minute,
second,
hundredths of second,

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deviation highbyte,
deviation lowbyte,
clock status
}
Individual fields of *date_time* are encoded as defined above. Some may be set to “not specified“ as described above in *date* and *time*.

[a] Time could not be recovered after an incident. Detailed conditions are manufacturer specific (for example after the power to the clock has been interrupted).

[b] Time could be recovered after an incident but the value cannot be guaranteed. Detailed conditions are manufacturer specific.

[c] Bit is set if the basic timing information for the clock is at the actual moment taken from a timing source different from the source specified in clock_base.

[d] This bit indicates that at least one bit of the clock status is invalid. Some bits may be correct. The exact meaning shall be explained in the manufacturer’s documentation.

[e] Flag set to true: the transmitted time contains the daylight saving deviation (summer time), Flag set to false: the transmitted time does not contain daylight saving deviation (normal time).

4.1.4.2 Floating point number formats

Floating point number formats are defined in IEC 60559.

The single format is:

1	8	23	…widths
s	*e*	*f*	
	msb *lsb*	*msb* *lsb*	*…order*

where:
- s is the sign bit;
- e is the exponent; it is 8 bits wide and the exponent bias is +127;
- f is the fraction, it is 23 bits.

With this, the value is (if 0 < *e* < 255):

$$\upsilon = (-1)^s \cdot 2^{e-127} \cdot (1.f)$$

The double format is:

1	11	52	…widths
s	*e*	*f*	
	msb *lsb*	*msb* *lsb*	*…order*

where:
- s is the sign bit;
- e is the exponent; it is 11 bits wide and the exponent bias is +1 023;
- f is the fraction, it is 52 bits.

With this, the value is (of 0 < *e* < 2 047):

$$\upsilon = (-1)^s \cdot 2^{e-1023} \cdot (1.f)$$

For more detail, see IEC 60559.

Floating-point numbers shall be represented as a fixed length octet-string, containing the 4 bytes (float32) of the single format or 8 the bytes (float64) of the double format floating-point number as specified above, most significant byte first.

Example 1: The decimal value “1” represented in single floating-point format is:

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Bit 31 Sign bit **0** 0: + 1: -	Bits 30-23 Exponent field **01111111** Decimal value of exponent field and exponent: **127**-127 = 0	Bits 22-0 Significand 1.**00000000000000000000000** Decimal value of the significand: 1.0000000

NOTE The significand is the binary number 1 followed by the radix point followed by the binary bits of the fraction.

The encoding, including the tag of the data type is (all values are hexadecimal): 17 3F 80 00 00.

Example 2: The decimal value “1” represented in double floating-point format is:

Bit 63 Sign bit **0** 0: + 1: -	Bits 62-52 Exponent field **01111111111** Decimal value of exponent field and exponent: **1023**-1023 = 0	Bits 51-0 Significand 1.**0000000000000000000000000000000000000000000000000000** Decimal value of the significand: 1.0000000000000000

The encoding, including the tag of the data type is (all values are hexadecimal): 18 3F F0 00 00 00 00 00 00.

Example 3: The decimal value “62056” represented in single floating-point format is:

Bit 31 Sign bit **0** 0: + 1: -	Bits 30-23 Exponent field **10001110** Decimal value of exponent field and exponent: **142**-127 = 15	Bits 22-0 Significand 1.**11100100110100000000000** Decimal value of the significand: 1.8937988

The encoding, including the tag of the data type is (all values are hexadecimal): 17 47 72 68 00.

Example 4: The decimal value “62056” represented in double floating-point format is:

Bit 63 Sign bit **0** 0: + 1: -	Bits 62-52 Exponent field **10000001110** Decimal value of exponent field and exponent: **1038**-1023 = 15	Bits 51-0 Significand 1.**1110010011010000000000000000000000000000000000000000** Decimal value of the significand: 1.8937988281250000

The encoding, including the tag of the data type is (all values are hexadecimal): 18 40 EE 4D 00 00 00 00 00.

4.1.5 The COSEM server model

The COSEM server is structured into three hierarchical levels as shown in Figure 3:

Level 1: Physical device;

Level 2: Logical device;

Level 3: Accessible COSEM objects.

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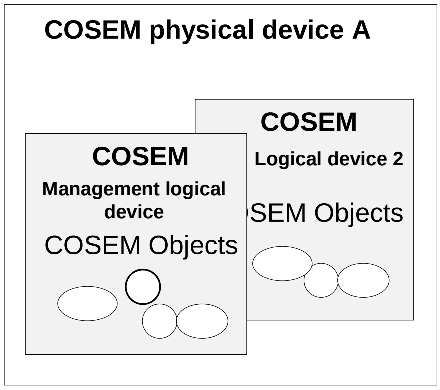

Figure 3 – The COSEM server model

The following example (see Figure 4) shows how a combined metering device can be structured using the COSEM server model.

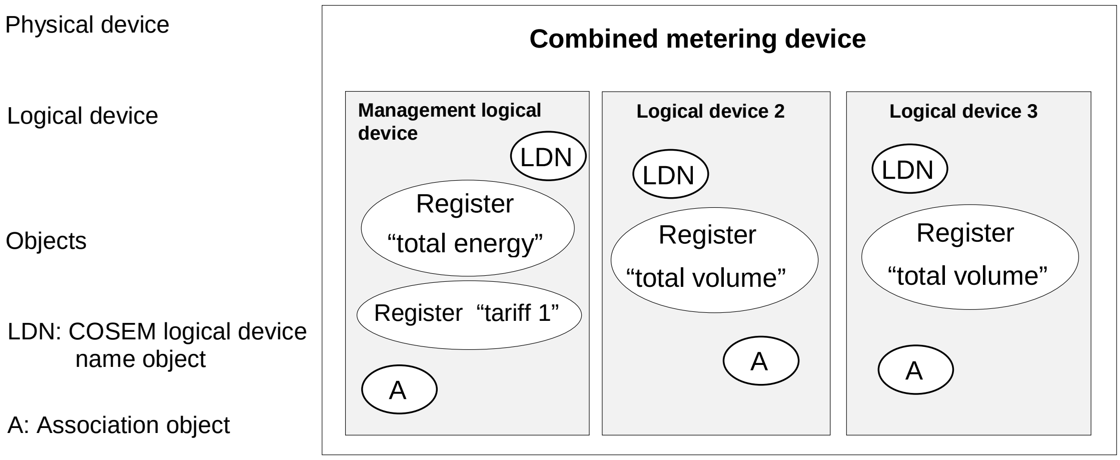

Figure 4 – Combined metering device

4.1.6 COSEM logical device

4.1.6.1 General

The COSEM logical device is a set of COSEM objects. Each physical device shall contain a "Management logical device".

The addressing of COSEM logical devices shall be provided by the addressing scheme of the lower layers of the protocol used.

4.1.6.2 COSEM logical device name

The COSEM logical device can be identified by its unique COSEM logical device name. This name can be retrieved from an instance of IC "SAP assignment" (see 4.2.14), or of a COSEM object "COSEM logical device name".

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This name is defined as an octet-string of up to 16 octets. The first three octets uniquely identify the manufacturer of the device [2]. The manufacturer is responsible for guaranteeing the uniqueness of the octets that follow (up to 13 octets).

4.1.6.3 The “association view” of the logical device

In order to access COSEM objects in the server, an application association shall first be established. This characterizes the context within which the associated applications will communicate. The major parts of this context are:

- the application context;
- the authentication context;
- the xDLMS context.

This information is contained in a special COSEM object, the “Association” object. There are two types of this association object defined. One for associations using short name referencing (“Association SN”) and one for using logical name referencing (“Association LN”).

Depending on the association established between the client and the server, different access rights may be granted by the server. Access rights concern a set of COSEM objects – the visible objects – that can be accessed (‘seen’) within the given association. In addition, access to attributes and methods of these COSEM objects may also be restricted within the association (for example a certain type of client can only read a particular attribute of a COSEM object).

The list of the visible COSEM objects – the “association view” – can be obtained by the client by reading the “*object_list*” attribute of the appropriate association object. Additional information about the access rights (read only, write only, read and write) to the attributes and the availability of the methods (within the established association) can be found via specific attributes (logical name referencing, see 4.2.12) or special methods (short name referencing, see 4.2.13) provided by the association objects.

4.1.6.4 Mandatory contents of a COSEM logical device

The following objects shall be part of each COSEM logical device. They shall be accessible for GET/READ in all application associations with this logical device:

- COSEM logical device name object;
- current association (LN or SN) object.

4.1.6.5 Management logical device

As specified in 4.1.6.1, the management logical device is a mandatory element of any physical device, and it has a reserved address. As defined in Clause 9.2.3.4 of the Green Book, it must support an application association to a public client with the lowest security level. Its role is to support revealing the internal structure of the physical device and to support notification of events in the server.

In addition to the “Association” object modelling the association with the public client, the management logical device shall contain a “SAP assignment” object, giving its SAP and the SAP of all other logical devices within the physical device. The SAP assignment object must be readable at least by the public client.

If there is only one logical device within the physical device, the “SAP assignment” object” may be omitted.

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4.1.7 Authentication procedures

4.1.7.1 Low Level Security (LLS) authentication

more details, see complete Blue Book DLMS UA 1000-1 ...

4.1.7.2 High Level Security (HLS) authentication

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2 The interface classes

The currently defined interface classes for meters and the relations between them are illustrated in Figure 5.

NOTE 1 The interface class “base” itself is not specified explicitly. It contains only one attribute "logical_name".

NOTE 2 In the description of the "Demand register", “Clock” and “Profile generic” interface classes, the 2nd attributes are labelled differently from that of the 2nd attribute of the “Data” interface class, namely "current_average_value", “time” and “buffer” vs. “value”. This is to emphasize the specific nature of the “value”.

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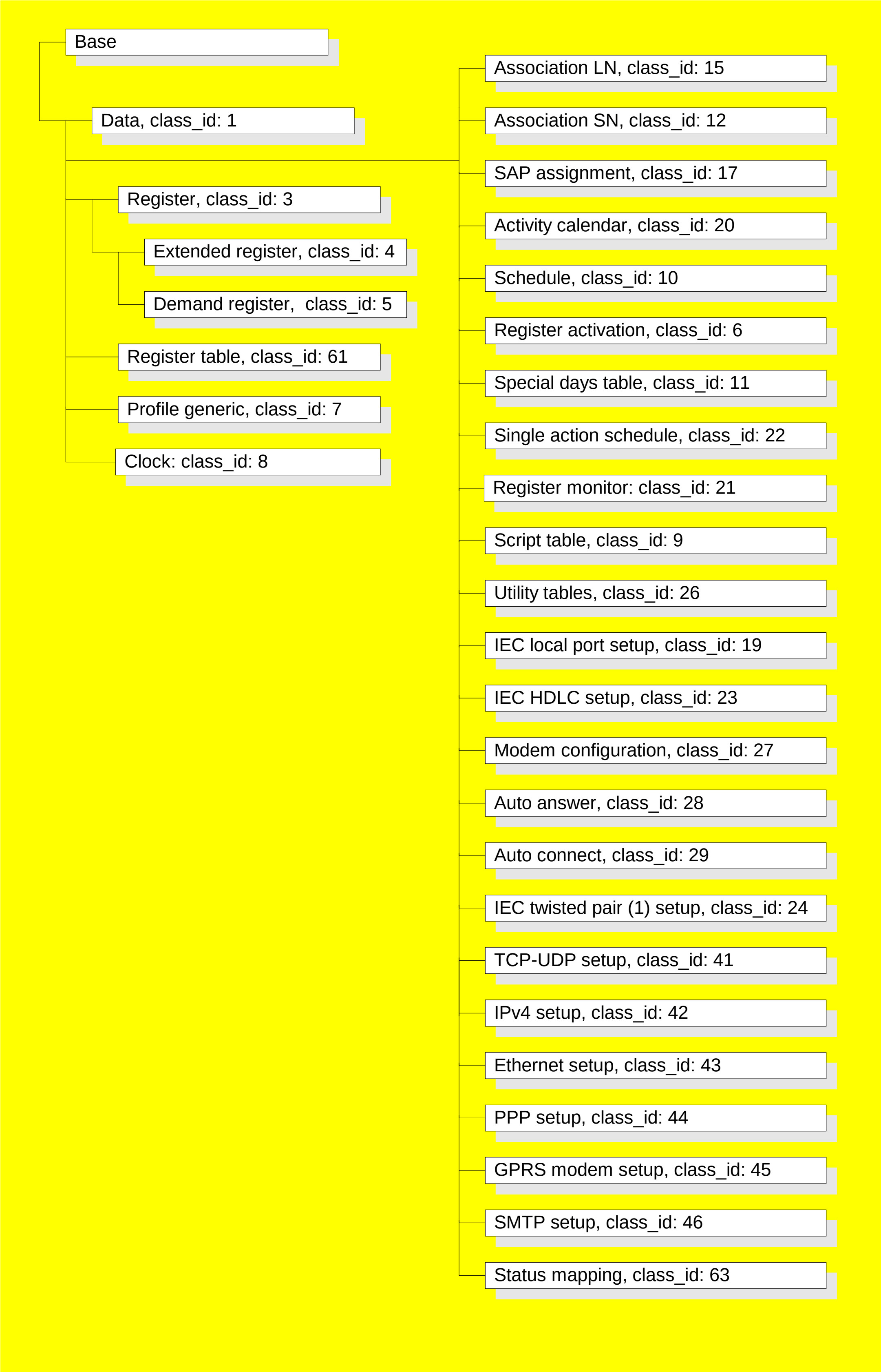

Figure 5 – Overview of the interface classes

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4.2.1 Data (class_id: 1)

A “Data” object stores data related to internal meter object(s). The meaning of the value is identified by the logical_name. The data type of the value is CHOICE. “Data” is typically used to store configuration data and parameters.

Data	**0...n**	**class_id = 1, version = 0**		
Attribute(s)	***Data type***	***Min.***	***Max.***	***Def.***
1. logical_name (static)	octet-string			
2. value	*CHOICE*			
Specific method(s)	***m/o***			

Attribute description

logical_name	Identifies the “Data” object instance. Identifiers are specified in Clauses 4.6.1 and 5.
value	Contains the data.

CHOICE
{
--simple data types
null-data [0],
boolean [3],
bit-string [4],
double-long [5],
double-long-unsigned [6],
octet-string [9],
visible-string [10],
bcd [13],
integer [15],
long [16],
unsigned [17],
long-unsigned [18],
long64 [20],
long64-unsigned [21],
enum [22],
float32 [23],
float64 [24],
date-time [25],
date [26],
time [27],
--complex data types
array [1],
structure [2],
compact-array [19]
}

The data type depends on the instantiation defined by the “logical name” and possibly from the manufacturer. It has to be chosen so, that together with the logical name, an unambiguous interpretation is possible. Any simple and complex data types listed in 4.1.3 can be used, unless the choice is restricted.

4.2.2 Register (class_id: 3)

A “Register” object stores a process value or a status value with its associated unit. The register object knows the nature of the process value or of the status value. The nature of the value is described by the attribute “logical name” using the OBIS identification system (see Clauses 4.6.1 and 5).

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Register		0...n	class_id = 3, version = 0		
Attribute(s)		***Data type***	***Min.***	***Max.***	***Def.***
1. logical_name	(static)	octet-string			
2. value	(dyn.)	CHOICE			
3. scaler_unit	(static)	scal_unit_type			
Specific method(s)		***m/o***			
1. reset (data)		o			

Attribute description

logical_name	Identifies the "Register" object instance. Identifiers are specified in Clauses 4.6.1 and 5.

value	Contains the current process or status value.
	
	CHOICE
	{
	--simple data types
	null-data [0],
	bit-string [4],
	double-long [5],
	double-long-unsigned [6],
	octet-string [9],
	visible-string [10],
	integer [15],
	long [16],
	unsigned [17],
	long-unsigned [18],
	long64 [20]
	long64-unsigned [21],
	float32 [23],
	float64 [24]
	}
	
	The data type of the value depends on the instantiation defined by "logical_name" and possibly on the choice of the manufacturer. It has to be chosen so that, together with the logical_name, an unambiguous interpretation of the value is possible.
	
	When instead of a "Data" object a "Register" object is used, (with the scaler_unit attribute not used or with scaler = 0, unit = 255) then the data types allowed for the Value attribute of the "Data" interface class are allowed.

scaler_unit	Provides information on the unit and the scaler of the value.
	
	scal_unit_type: structure
	{
	scaler,
	unit
	}
	
	scaler: integer — This is the exponent (to the base of 10) of the multiplication factor.
	REMARK If the value is not numerical, then the scaler shall be set to 0.
	
	unit: enum — Enumeration defining the physical unit; for details see below.

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Method description

reset (data)	This method forces a reset of the object. By invoking this method, the value is set to the default value. The default value is an instance specific constant. data ::= integer(0)

unit ::= enum

Code	*// Unit*		*Quantity*	*Unit name*	*SI definition (comment)*
(1)	a	//	time	year	
(2)	mo	//	time	month	
(3)	wk	//	time	week	7*24*60*60 s
(4)	d	//	time	day	24*60*60 s
(5)	h	//	time	hour	60*60 s
(6)	min.	//	time	min	60 s
(7)	s	//	time (*t*)	second	s
(8)	°	//	(phase) angle	degree	rad*180/π
(9)	°C	//	temperature (*Θ*)	degree celsius	K-273.15
(10)	currency	//	(local) currency		
(11)	m	//	length (*l*)	metre	m
(12)	m/s	//	speed (*v*)	metre per second	m/s
(13)	m^3	//	volume (*V*) r_V , meter constant or pulse value (volume)	cubic metre	m^3
(14)	m^3	//	corrected volume	cubic metre	m^3
(15)	m^3/h	//	volume flux	cubic metre per hour	$m^3/(60*60s)$
(16)	m^3/h	//	corrected volume flux	cubic metre per hour	$m^3/(60*60s)$
(17)	m^3/d	//	volume flux		$m^3/(24*60*60s)$
(18)	m^3/d	//	corrected volume flux		$m^3/(24*60*60s)$
(19)	l	//	volume	litre	10^{-3} m^3
(20)	kg	//	mass (*m*)	kilogram	
(21)	N	//	force (*F*)	newton	
(22)	Nm	//	energy	newtonmeter	J = Nm = Ws
(23)	Pa	//	pressure (*p*)	pascal	N/m^2
(24)	bar	//	pressure (*p*)	bar	10^5 N/m^2
(25)	J	//	energy	joule	J = Nm = Ws
(26)	J/h	//	thermal power	joule per hour	J/(60*60s)
(27)	W	//	active power (*P*)	watt	W = J/s
(28)	VA	//	apparent power (*S*)	volt-ampere	
(29)	var	//	reactive power (*Q*)	var	
(30)	Wh	//	active energy r_W , active energy meter constant or pulse value	watt-hour	W*(60*60s)
(31)	VAh	//	apparent energy r_S , apparent energy meter constant or pulse value	volt-ampere-hour	VA*(60*60s)
(32)	varh	//	reactive energy r_B , reactive energy meter constant or pulse value	var-hour	var*(60*60s)
(33)	A	//	current (*I*)	ampere	A
(34)	C	//	electrical charge (*Q*)	coulomb	C = As
(35)	V	//	voltage (*U*)	volt	V

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Code	*// Unit*		*Quantity*	*Unit name*	*SI definition (comment)*
(36)	V/m	//	electrical field strength (*E*)	volt per metre	V/m
(37)	F	//	capacity (*C*)	farad	C/V = As/V
(38)	Ω	//	resistance (*R*)	ohm	Ω = V/A
(39)	$\Omega m^2/m$	//	resistivity (□)		Ωm
(40)	Wb	//	magnetic flux (□)	weber	Wb = Vs
(41)	T	//	induction (*T*)	tesla	Wb/m^2
(42)	A/m	//	magnetic field strength (*H*)	ampere per metre	A/m
(43)	H	//	inductivity (*L*)	henry	H = Wb/A
(44)	Hz	//	frequency (*f, ω*)	hertz	1/s
(45)	1/(Wh)	//	R_W , active energy meter constant or pulse value		
(46)	1/(varh)	//	R_B , reactive energy meter constant or pulse value		
(47)	1/(VAh)	//	R_S , apparent energy meter constant or pulse value		
(48)	V^2h	//	volt-squared hour r_{U2h} , volt-squared hour meter constant or pulse value	volt-squared-hours	$V^2(60*60s)$
(49)	A^2h	//	ampere-squared hour r_{I2h} , ampere-squared hour meter constant or pulse value	ampere-squared-hours	$A^2(60*60s)$
(50)	kg/s	//	mass flux	kilogram per second	kg/s
(51)	S, mho	//	conductance	siemens	1/Ω
(52)	K	//	temperature (*Θ*)	kelvin	
(53)	$1/(V^2h)$	//	R_{U2h} , volt-squared hour meter constant or pulse value		
(54)	$1/(A^2h)$	//	R_{I2h} , ampere-squared hour meter constant or pulse value		
(55)	$1/m^3$	//	R_V , meter constant or pulse value (volume)		
(56)		//	percentage	%	
(57)	Ah	//	ampere-hours	Ampere-hour	
(60)	Wh/m^3	//	energy per volume	$3{,}6*10^3\ J/m^3$	
(61)	J/m^3	//	calorific value, wobbe		
(62)	Mol %	//	molar fraction of gas composition	mole percent	(Basic gas composition unit)
(63)	g/m^3	//	mass density, quantity of material		(Gas analysis, accompanying elements)
(64)	Pa s	//	dynamic viscosity	pascal second	(Characteristic of gas stream)
….					
(253)		//	reserved		
(254)	other	//	other unit		
(255)	count	//	no unit, unitless, count		

Examples of values:

Value	Scaler	Unit	Data
263788	-3	m^3	263,788 m^3

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593	3	Wh	593 kWh
3467	0	V	3467 V

4.2.3 Extended register (class_id: 4)

Instances of an "Extended register" class store a process value with its associated status, unit, and time information. The extended register object knows the nature of the process value. The nature of the value is described by the attribute "logical name" using the OBIS identification system.

Extended register		**0...n**	**class_id = 4, version = 0**		
Attribute(s)		***Data type***	***Min.***	***Max.***	***Def.***
1. logical_name	(static)	octet-string			
2. value	(dyn.)	CHOICE			
3. scaler_unit	(static)	scal_unit_type			
4. status	(dyn.)	CHOICE			
5. capture_time	(dyn.)	octet-string			
Specific method(s)		***m/o***			
1. reset (data)		o			

Attribute description

For the definition of the attribute *value* and *scaler_unit*, see description of class "Register".

logical_name	Identifies the "Extended register" object instance.

status	Provides "Extended register" specific status information. The meaning of the elements of the status shall be provided for each "Extended register" object instance.
	CHOICE
	{
	--simple data types
	null-data [0],
	bit-string [4],
	double-long-unsigned [6],
	octet-string [9],
	visible-string [10],
	unsigned [17],
	long-unsigned [18],
	long64-unsigned [21]
	}
	The data type and the encoding depend on the instantiation and possibly on the choice of the manufacturer. For the interpretation, extra information from the manufacturer may be necessary.
	Def. Depending on the status type definition.

capture_time	Provides an "Extended register" specific date and time information showing when the value of the attribute "value" has been captured. octet-string, formatted as set in 4.1.4.1 for *date_time*

Method description

reset (data)	This method forces a reset of the object. By invoking this method, the attribute value is set to the default value. The default value is an instance specific constant. The attribute capture_time is set to the time of the reset execution. data ::= integer(0)

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4.2.4 Demand register (class_id: 5)

Instances of a “Demand register” class store a demand value with its associated status, unit, and time information. The demand register measures and computes its *current_average_value* periodically. The time interval *T* over which the demand is measured or computed is defined by specifying “number_of_periods” and “period”.

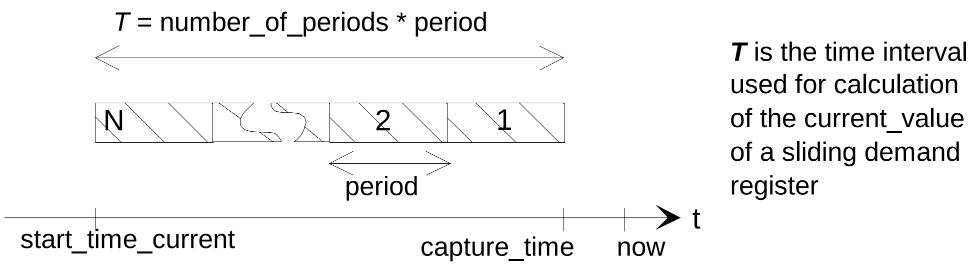

Figure 6 – The attributes when measuring sliding demand

The demand register delivers two types of demand: the current_average_value and the last_average_value (see Figure 7).

The demand register knows its type of process value, which is described in “logical name" using the OBIS identification system.

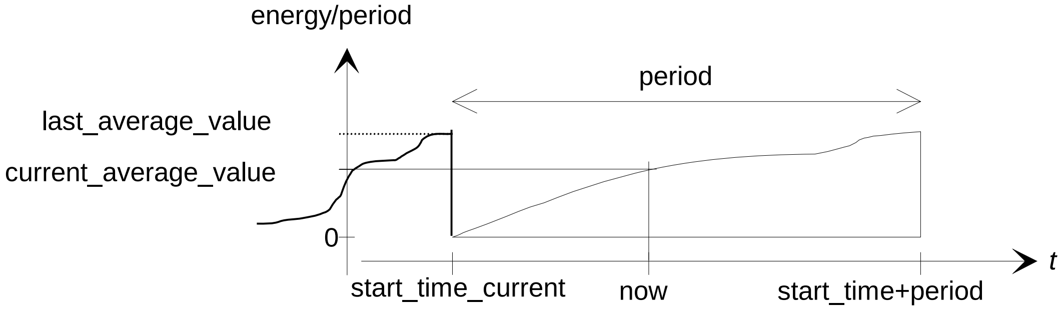

Figure 7 – The attributes when measuring current_average_value if number of periods is 1

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.5 Register Activation (class_id: 6)

Instances of the “Register activation” class are used to handle different tariffication structures. To each “Register activation” object, groups of “Register”, “Extended register” or “Demand register” objects, modelling different kind of quantities (for example active energy, active demand, reactive energy, etc.) are assigned. Subgroups of these registers, defined by the activation_masks define different tariff structures (for example day tariff, night tariff). One of these activation masks, the active_mask, defines which subset of the registers, assigned to the

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activation masks, the active_mask, defines which subset of the registers, assigned to the “Register activation” object instance is active. Registers, which are not defined in the register_assignment attribute of any “Register activation” object, are always enabled by default.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.6 Profile Generic (class_id: 7)

The “Profile generic” class defines a generalized concept to store dynamic process values of capture objects. Capture objects are appropriate attributes or element of (an) attribute(s) of COSEM objects. The capture objects are collected periodically or occasionally.

A profile has a buffer to store the captured data. To retrieve only a part of the buffer, either a value range or an entry range may be specified, asking to retrieve all entries whose values or entry numbers fall within the given range.

The list of capture objects defines the values to be stored in the buffer (using the method *capture*). The list is defined statically to ensure homogenous buffer entries (all entries have the same size and structure). If the list of capture objects is modified, the buffer is cleared. If the buffer is captured by other “Profile generic” objects, their buffer is cleared as well, to guarantee the homogeneity of their buffer entries.

The buffer may be defined as sorted by one of the registers or by a clock, or the entries are stacked in a “last in first out” order. So for example, it is very easy to build a “maximum demand register” with a one entry deep sorted profile capturing and sorted by a demand register. It is just as simple to define a profile retaining the three largest values of some period.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.7 Clock (class_id: 8)

An instance of the “Clock” interface class handles all information that is related to date and time, including leap years and the deviation of the local time to a generalized time reference (Greenwich Mean Time, GMT). The deviation from the local time to the generalized time reference can change depending on the season (for example summertime vs. wintertime). The interface to an external client is based on date information specified in day, month and year, time information given in hundredths of seconds, seconds, minutes and hours and the deviation from the local time to the generalized time reference.

It also handles the daylight saving function in that way; i.e. it modifies the deviation of local time to GMT depending on the attributes. The start and end point of that function is normally set once. An internal algorithm calculates the real switch point depending on these settings.

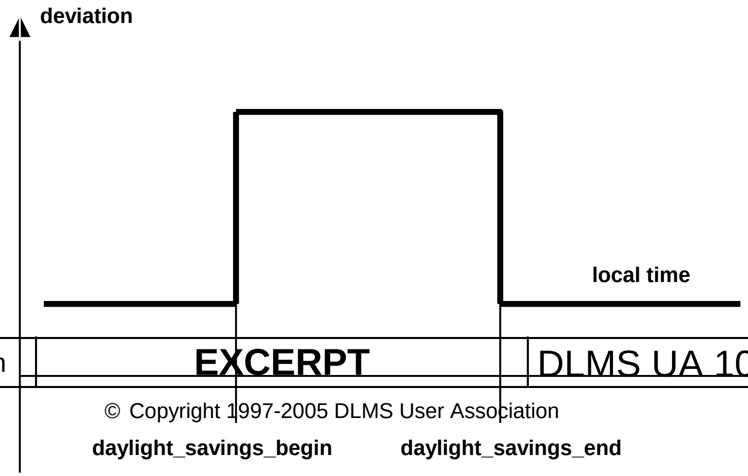

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Figure 8 – The generalized time concept

Clock		**0…1**	**class_id = 8, version = 0**		
Attribute(s)		***Data type***	***Min.***	***Max.***	***Def.***
1. logical_name	(static)	octet-string			
2. time	(dyn.)	octet-string			
3. time_zone	(static)	long			
4. status	(dyn.)	unsigned			
5. daylight_savings_begin	(static)	octet-string			
6. daylight_savings_end	(static)	octet-string			
7. daylight_savings_deviation	(static)	integer			
8. daylight_savings_enabled	(static)	boolean			
9. clock_base	(static)	enum			
Specific method(s)		***m/o***			
1. adjust_to_quarter (data)		o			
2. adjust_to_measuring_period (data)		o			
3. adjust_to_minute (data)		o			
4. adjust_to_preset_time (data)		o			
5. preset_adjusting_time (data)		o			
6. shift_time (data)		o			

Attribute description

logical_name	Identifies the “Clock” object instance.
time	Contains the meter’s local date and time, its deviation to GMT and the status. See 4.1.4.1. When this value is set, only specified fields of the *date_time* are changed. For example for setting the date without changing the time, all time relevant octets of the *date_time* shall be set to “not specified”. The clock_status shall always be set when writing the time. octet-string, formatted as set in 4.1.4.1 for *date_time*
time_zone	The deviation of local, normal time to GMT in minutes. long
status	The status is equal to the status read in *time*. See 4.1.4.1. unsigned, formatted as set in 4.1.4.1 for *clock_status*
daylight_savings_ begin	Defines the local switch date and time when the local time has to be deviated from the normal time. For generic definitions, wildcards are allowed. octet-string, formatted as set in 4.1.4.1 for *date_time*
daylight_savings_end	See above.

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	octet-string, formatted as set in 4.1.4.1 for *date_time*
daylight_savings_ deviation	Contains the number of minutes by which the deviation in generalized time must be corrected at daylight savings begin. integer Deviation range of up to ± 120 min
daylight_savings_ enabled	TRUE enables daylight savings function. boolean
clock_base	Defines where the basic timing information comes from. enum (0) not defined, (1) internal crystal, (2) mains frequency 50 Hz, (3) mains frequency 60 Hz, (4) GPS (global positioning system), (5) radio controlled

Method description

adjust_to_quarter (data)	Sets the meter’s time to the nearest (+/-) quarter of an hour value (*:00, *:15, *:30, *:45). data ::= integer (0)
adjust_to_measuring_period (data)	Sets the meter’s time to the nearest (+/-) starting point of a measuring period. data ::= integer (0)
adjust_to_minute (data)	Sets the meter’s time to the nearest minute. If second_counter < 30 s, so second_counter is set to 0. If second_counter ≥ 30 s, so second_counter is set to 0, and minute_counter and all depending clock values are incremented if necessary. data ::= integer(0)
adjust_to_preset_ time (data)	This method is used in conjunction with the preset_adjusting_time method. If the meter’s time lies between validity_interval_start and validity_interval_end, then time is set to preset_time. data ::= integer(0)

preset_adjusting_ time (data)	Presets the time to a new value (preset_time) and defines a validity_interval within which the new time can be activated.
	
	data ::= structure
	{
	preset_time: octet-string,
	validity_interval_start: octet-string,
	validity_interval_end: octet-string
	}
	all octet-strings formatted as set in 4.1.4.1 for *date_time*

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shift_time (data)	Shifts the time by *n* (-900 <= *n* <= 900) s. data ::= long

4.2.8 Script Table (class_id: 9)

The IC script table provides the possibility to trigger a series of actions by executing scripts using the execute (data) method.

For that purpose, script table contains a table of script entries. Each table entry (script) consists of a script_identifier and a series of action_specifications. An action_specification activates a method of a COSEM object or modifies attributes of a COSEM object within the logical device.

A specific script may be activated by other COSEM objects within the same logical device or from the outside.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.9 Schedule (class_id: 10)

The IC “Schedule” together with an object of the IC “Special days” table handles time and date driven activities within a device.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.10 Special Days Table (class_id: 11)

The interface class allows defining dates, which will override normal switching behaviour for special days. The interface class works in conjunction with the class "Schedule" or "Activity calendar" and the linking data item is day_id.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.11 Activity Calendar (class_id: 20)

An instance of the “Activity calendar” class is typically used to handle different tariff structures. It is a definition of scheduled actions inside the meter, which follow the classical way of calendar based schedules by defining seasons, weeks… It can coexist with the more general object “Schedule” and can even overlap with it. If actions are scheduled for the same activation time in an object “Schedule” and in the object “Activity calendar”, the actions triggered by the “Schedule” object are executed first.

After a power failure, only the “last action” missed from the object “Activity calendar” is executed (delayed). This is to ensure proper tariffication after power up. If a “Schedule” object is present, then the missed “last action” of the “Activity calendar” must be executed at the correct time within the sequence of actions requested by the “Schedule” object.

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The “Activity calendar” defines the activation of certain scripts, which can perform different activities inside the logical device. The interface to the object “Script table” is the same as for the object “Schedule” (see 4.2.9).

If an instance of the interface class “Special days table” (see 4.2.10) is available, relevant entries there take precedence over the “Activity calendar” object driven selection of a day profile. The day profile referenced in the “Special days table” activates the day_schedule of the day_profile_table in the “Activity calendar” object by referencing through the day_id.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.12 Association LN (class_id: 15)

COSEM logical devices able to establish application associations within a COSEM context using logical name referencing, model the associations through instances of the “Association LN” class. A COSEM logical device has one instance of this IC for each association the device is able to support.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.13 Association SN (class_id: 12)

COSEM logical devices able to establish application associations within a COSEM context using short name references, model the associations through instances of the “Association SN” class. A COSEM logical device may have one instance of this IC for each association the device is able to support.

The **short_name** of the “Association SN object itself is fixed within the COSEM context. It is given in Clause 4.5.3 as 0x**FA00**.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.14 SAP Assignment (class_id: 17)

The interface class “SAP assignment” contains the information on the assignment of the logical devices to their SAP-s (see Green Book Clause 9).

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.15 Register Monitor (class_id: 21)

This interface class allows defining a set of scripts that are executed when the value of an attribute of a monitored register type object “Data”, “Register”, “Extended register”, Demand register, etc. crosses a set of threshold values.

The IC “Register monitor” requires an instantiation of the IC “Script table” in the same logical device.

more details, see complete Blue Book DLMS UA 1000-1 ...

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4.2.16 Utility Tables (class_id: 26)

An instance of the “Utility tables” class encapsulates ANSI C12.19 table data.

With this interface class definition, each “table” is represented as an instance. The specific instance is identified by its logical_name.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.17 Single Action Schedule (class_id: 22)

Many applications request periodic actions within a meter. These actions are not necessarily linked to tariffication (activity calendar or schedule). The IC “Single action schedule “ models such actions.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.18 Register table (class_id: 61)

Instances of the “Register table” interface class store homogenous entries, identical attributes of multiple objects, which are all instances of the same interface class, and the value in value groups A to D and F of their logical name (OBIS code) is identical. The possible values in value group E are defined in Clause 5 in a tabular form: the table header defines the common part of the OBIS code and each table cell defines one possible value of value group E. A “Register table” object may capture attributes of some or all of those objects.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.2.19 Status mapping (class_id: 63)

Instances of the “Status mapping” class store status words together with the mapping of each bit in the status word to positions in a reference status table.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.3 Maintenance of the Interface Classes

more details, see complete Blue Book DLMS UA 1000-1 ...

4.3.1 New interface classes

The DLMS UA reserves the right to be the exclusive administrator of interface classes.

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4.3.2 New versions of interface classes

Any modification of an existing interface class affecting the transmission of service requests or responses results in a new version (version ::= version+1) and shall be documented accordingly. The following rules shall be followed:

1. new attributes and methods may be added;
2. existing attributes and methods may be invalidated BUT the indices of the invalidated attributes and methods shall not be re-used by other attributes and methods;
3. if these rules cannot be met, then a new interface class shall be created;
4. new versions of COSEM interface classes are administered by the DLMS UA.

4.3.3 Removal of interface classes

Besides one association object and the logical device name object no instantiation of an interface class is mandatory within a meter. Therefore, even unused interface classes will not be removed from the standard. They will be kept to ensure compatibility with possibly existing implementations.

4.4 Protocol related Interface Classes

Each communication device and / or communication profile needs some setup parameters to be defined for proper operation.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.5 Using Short Names for accessing attributes and methods

4.5.1 Introduction – referencing methods

Attributes and methods of COSEM objects can be referenced in two different ways:

Using COSEM logical names: In this case, the attributes and methods of a COSEM object are referenced via the identifier of the COSEM object instance to which they belong.

The reference for an attribute is:

- class_id, value of the 'logical_name' attribute, attribute_index;

The reference for a method is:

- class_id, value of the 'logical_name' attribute, method_index

where:

- attribute_index is used as the identifier of the required attribute;
- method_index is used as the identifier of the required method.

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Using short names: This kind of referencing is intended for use in simple devices. In this case, each attribute and method of a COSEM object is identified with a 13-bit integer. The syntax for the short name is the same as the syntax of the name of a DLMS named variable.

4.5.2 Guidelines for assigning short names

This clause gives guidelines for assigning short names for public attributes and methods.

Data **class_id = 1, version = 0**	Short name	Remarks
Attribute(s)		
logical_name	*x*	*x* is the base_name of the object.
value	*x*+8	
Specific method(s)		

Register **class_id = 3, version = 0**	Short name	Remarks
Attribute(s)		
logical_name	*x*	*x* is the base_name of the object.
value	*x*+8	
scaler_unit	*x*+16	
Specific method(s)		
reset (data)	*x*+40	

more details, see complete Blue Book DLMS UA 1000-1 ...

4.5.3 Reserved base_names for Special COSEM Objects

In order to grant access for devices offering accessing by short_names some short_names are reserved as base_names for special COSEM objects. The reserved range of names is from 0x**FA00** to 0x**FFF8**.

The following specific base_names are defined:

Base_name (object-Name)	**COSEM object**
0x **FA00**	Association SN
0x **FB00**	Script table (instantiation: “broad-cast_receiver script”)
0x **FC00**	SAP assignment
0x **FD00**	“Data” or “Register” object containing the “COSEM logical device name” in the attribute "value"

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4.6 Relation to OBIS

The OBIS identification system serves as a basis for the COSEM logical names. The system of naming COSEM objects is defined in the basic principles (see Clause 4.1), the identification of real data items is specified in Clause 5.

The following clauses define the usage of those definitions in the COSEM environment.

All codes, which are not explicitly listed, but outside the manufacturer specific range are reserved for future use.

4.6.1 Mapping of data items to COSEM objects and attributes

This clause defines the usage of OBIS identifications and their mapping to COSEM objects of certain interface classes and their attributes.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.6.2 Coding of OBIS Identifications

To identify different instances of the same interface class, their logical_name must be different. In COSEM, the logical_name is taken from the OBIS definition (see Clause 5).

OBIS codes are used within the COSEM environment as an *octet-string [6].* Each octet contains the unsigned value of the corresponding OBIS value group, coded without tags.

If a data item is identified by less than six value groups, all unused value groups must be filled with 255.

more details, see complete Blue Book DLMS UA 1000-1 ...

4.7 Previous Versions of Interface Classes

This chapter lists those interface class definitions which where included in previous editions of this document. The previous interface class versions differ form the current versions by at least one attribute and/or method and by the version number.

For new implementations in metering devices only the current versions shall be used.

Communication drivers at the client side must also support previous versions.

more details, see complete Blue Book DLMS UA 1000-1 ...

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5. COSEM Object Identification System (OBIS)

5.1 Introduction

The competitive electricity market requires an ever-increasing amount of timely information concerning the usage of electrical energy. Recent technology developments enable to build intelligent static metering equipment, which are capable of capturing, processing and communicating this information to all parties involved.

For further analysis of this information, for the purposes of billing, load-, customer- and contract management, it is necessary to uniquely identify all data in a manufacturer independent way collected manually or automatically, via local or remote data exchange.

The definition of identification codes is based on DIN 43863-3:1997, *Electricity meters – Part 3: Tariff metering device as additional equipment for electricity meters – EDIS – Energy Data Identification System.*

5.2 Scope

The OBject Identification System (OBIS) defines the identification codes (ID-codes) for commonly used data items in electricity metering equipment. This Clause 5 specifies the overall structure of the identification system and the mapping of all data items to their identification codes.

OBIS provides a unique identifier for all data within the metering equipment, including not only measurement values, but also abstract values used for configuration or obtaining information about the behaviour of the metering equipment. The ID codes defined In this Technical Report are used for the identification of:

- logical names of the various instances of the interface classes, or objects;
- data transmitted through communication lines, see Clause 5.7.1;
- data displayed on the metering equipment, see Clause 5.7.2.

This standard applies to all types of metering equipment, such as fully integrated meters, modular meters, tariff attachments, data concentrators etc.

To cover metering equipment measuring energy types other than electricity, combined metering equipment measuring more than one type of energy or metering equipment with several physical measurement channels, the concept of medium and channels are introduced. This allows meter data originating from different sources to be identified. While this standard fully defines the structure of the identification system for other media, the mapping of non-electrical energy related data items to ID codes needs to be completed separately.

NOTE EN 13757-1:2002 defines identifiers for metering equipment other than electricity: heat cost allocators, cooling, heating, gas, cold water and hot water.

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5.3 OBIS structure

5.3.1 General

OBIS codes identify data items used in energy metering equipment, in a hierarchical structure using six value groups A to F, see Figure 9.

A	B	C	D	E	F

Figure 9 – OBIS code structure

5.3.2 Value group A

The value group A defines the media (energy type) to which the metering is related. Non-media related information is handled as abstract data.

5.3.3 Value group B

The value group B defines the channel number, i.e. the number of the input of a metering equipment having several inputs for the measurement of energy of the same or different types (for example in data concentrators, registration units). Data from different sources can thus be identified. The definitions for this value group are independent from the value group A.

5.3.4 Value group C

The value group C defines the abstract or physical data items related to the information source concerned, for example current, voltage, power, volume, temperature. The definitions depend on the value of the value group A .

Further processing, classification and storage methods are defined by value groups D, E and F.

For abstract data, value groups D to F provide further classification of data identified by value groups A to C.

5.3.5 Value group D

The value group D defines types, or the result of the processing of physical quantities identified with the value groups A and C, according to various specific algorithms. The algorithms can deliver energy and demand quantities as well as other physical quantities.

5.3.6 Value group E

The value group E defines further processing or classification of quantities identified by value groups A to D.

5.3.7 Value group F

The value group F defines the storage of data, identified by value groups A to E, according to different billing periods. Where this is not relevant, this value group can be used for further classification.

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5.3.8 Manufacturer specific codes

In value groups B, C, D, E and F the following ranges are available for manufacturer-specific purposes:

- group B: 128…199;
- group C: 128…199, 240;
- group D: 128…254;
- group E: 128…254;
- group F: 128…254.

If any of these value groups contain a value in the manufacturer specific range, then the whole OBIS code shall be considered as manufacturer specific, and the value of the other groups does not necessarily carry a meaning defined in Clause 5.

In addition, manufacturer specific ranges are defined in Table 23 with A = 0, C = 96 and Table 28 with A = 1, C = 96.

5.3.9 Reserved ranges

By default, all codes not allocated are reserved. [3]

5.3.10 Summary of rules for manufacturer, utility, consortia and country specific codes

Table 2 summarizes the rules for handling manufacturer specific codes defined in 5.3.8, utility specific codes defined in 5.4.2, consortia specific codes defined in Table 6 and country specific codes defined in Table 7.

Table 2 – Rules for manufacturer, utility, consortia and country specific codes

Code type	**Value group**						**Note**
	A	**B**	**C**	**D**	**E**	**F**	
Manufacturer specific	0, 1, 4..9	128…199	x	x	x	x	See Note 1
		x	128… 199, 240	x	x	x	
		x	x	128…254	x	x	
		x	x	x	128…254	x	
		x	x	x	x	128…254	
Manufacturer specific abstract	0	0…64	96	50…99	0…255	0…255	See Note 2
Manufacturer specific, media related general purpose	1, 4..9	0…64	96	50…99	0…255	0…255	See Note 2
Utility specific		65…127					See Note 3
Consortia specific	0, 1, 4..9	1…64	93	See Table 6			See Note 4
Country specific		1…64	94	See Table 7			See Note 5

[3] Administered by the DLMS User Association (see Foreword).

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NOTE 1 “x” means any value.

NOTE 2 The range D = 50…99 is available for identifying objects, which are not represented by another defined code, but need representation on the display as well. If this is not required, the range D= 128…254 should be used.

NOTE 3 If the value of B is 65…127, the whole OBIS code should be considered as utility specific and the value of other groups does not necessarily carry a meaning defined in Clause 5.

NOTE 4 The usage of value group E and F are defined in consortia specific documents.

NOTE 5 The usage of value group E and F are defined in country specific documents.

Objects for which this Technical Report defines standard identifiers shall not be re-identified by manufacturer, utility, consortia or country specific identifiers.

On the other hand, an object previously identified by a manufacturer-, utility-, consortia- or country- specific identifier may receive a standard identifier in the future, if its use is of common interest for the users of this standard.

5.4 Value group definitions common to all media

5.4.1 Value group A

The range for value group A is 0 to 15, see Table 3.

Table 3 – Value group A codes

Value group A	
0	Abstract objects
1	Electricity related objects
4	Heat cost allocator related objects
5	Cooling related objects
6	Heat related objects
7	Gas related objects
8	Cold water related objects
9	Hot water related objects
All other	Reserved

The following subclauses contain value group definitions common for all media.

5.4.2 Value group B

The range for value group B is 1 to 255, see Table 4.

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Table 4 – Value group B codes

Value group B	
0	No channel specified
1	Channel 1
...	
64	Channel 64
65...127	Utility specific codes
128...199	Manufacturer specific codes
200...255	Reserved

If channel information is not essential, the value 0 shall be assigned.

The range 65...127 is available for utility specific use. If the value of group B is in this range, the whole OBIS code shall be considered as utility specific and the value of other groups does not necessarily carry a meaning defined in Clause 5.

5.4.3 Value group C

5.4.3.1 General

The range for value group C is 0 to 255, see Table 5 and Table 9.

5.4.3.2 Abstract objects

Abstract objects are data items, which are not related to a certain type of physical quantity.

Table 5 – Value group C codes – Abstract objects

Value group C Abstract objects (A = 0)	
0...89	Context specific identifiers [a]
93	Consortia specific identifiers (See 5.4.4.2).
94	Country specific identifiers (See 5.4.4.3)
96	General service entries (See 5.6.2.1)
97	General error messages (See 5.6.2.2)
98	General list objects (See 5.6.2.3)
99	Abstract data profiles (See 5.6.2.4)
127	Inactive objects [b]
128...199, 240	Manufacturer specific codes
All other	Reserved

[a] Context specific identifiers identify objects specific to a certain protocol and/or application.

[b] An inactive object is an object, which is defined and present in a meter, but which has no assigned functionality.

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5.4.4 Value group D

5.4.4.1 General

The range for value group D is 0 to 255. The definitions depend on the value groups A and C.

5.4.4.2 Consortia specific identifiers

Table 6 specifies the use of value group D for consortia specific applications. In this table, there are no reserved ranges for manufacturer specific codes. The usage of value group E and F are defined in consortia specific documents.

Table 6 – Value group D codes – Consortia specific identifiers

Value group D Consortia specific identifiers (A = any, C = 93)	
01	SELMA Consortium
All other	Reserved
NOTE 1 Objects that are already identified in this Technical Report must not be re-identified by consortia specific identifiers. NOTE 2 The SELMA Consortium is an associated member of the DLMS UA.	

5.4.4.3 Country specific identifiers

Table 7 specifies the use of value group D for country specific applications. Wherever possible, the phone codes are used. In this table, there are no reserved ranges for manufacturer specific codes. The usage of value group E and F are defined in country specific documents.

Table 7 – Value group D codes – Country specific identifiers

Value group D Country specific identifiers [a] (A = any, C = 94)	
00	Finnish identifiers
01	USA identifiers
02	Canadian identifiers
07	Russian identifiers
10	Czech identifiers
11	Bulgarian identifiers
12	Croatian identifiers
13	Irish identifiers
14	Israeli identifiers
15	Ukraine identifiers
16	Yugoslavian identifiers
27	South African identifiers
30	Greek identifiers
31	Dutch identifiers
32	Belgian identifiers
33	French identifiers
34	Spanish identifiers
35	Portuguese identifiers

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Value group D Country specific identifiers [a] (A = any, C = 94)	
36	Hungarian identifiers
38	Slovenian identifiers
39	Italian identifiers
40	Romanian identifiers
41	Swiss identifiers
42	Slovakian identifiers
43	Austrian identifiers
44	United Kingdom identifiers
45	Danish identifiers
46	Swedish identifiers
47	Norwegian identifiers
48	Polish identifiers
49	German identifiers
55	Brazilian identifiers
61	Australian identifiers
62	Indonesian identifiers
64	New Zealand identifiers
65	Singapore identifiers
81	Japanese identifiers
86	Chinese identifiers
90	Turkish identifiers
91	Indian identifiers
All other	Reserved
NOTE Objects that are already identified in this Recnical Report must not be re-identified by country specific identifiers.	

5.4.5 Value group E

5.4.5.1 General

The range for value group E is 0 to 255. It can be used for identifying further classification or processing of values defined by value groups A to D, as specified in the paragraphs below. The various classifications and processing methods are exclusive.

5.4.5.2 Identification of tariff rates

Table 8 shows the use of value group E for identification of tariff rates typically used for energy (consumption) and demand quantities.

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Table 8 – Value group E codes – Tariff rates

Value group E Electricity related objects (A = 1)	
0	Total
1	Rate 1
2	Rate 2
3	Rate 3
…	…
9	Rate 9
…	…
63	Rate 63
128…254	Manufacturer specific codes
All other	Reserved

5.4.6 Value group F

5.4.6.1 General

The range for value group F is 0 to 255.

In all cases, if value group F is not used, it is set to 255.

5.4.6.2 Identification of billing periods

Value group F specifies the allocation to different billing periods (sets of historical values) for the objects defined by value groups A to E, where storage of historical values is relevant.

A blling period scheme is identified with its billing period counter, number of available billing periods, time stamp of the billing period and billing period length.

NOTE For Electricity, two billing period schemes are available, for example to store weekly and monthly values

For more, see 5.7.3.

5.5 Value group definitions related to specific media

5.5.1 Electricity related definitions

5.5.1.1 Value group C codes for Electricity

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Table 9 – Value group C codes – Electricity objects

Value group C Electricity related objects (A = 1)	
0	General purpose objects (See 5.6.3.1)
1	ΣL_i Active power+ (QI+QIV) (See also Note 2)
2	ΣL_i Active power– (QII+QIII)
3	ΣL_i Reactive power+ (QI+QII)
4	ΣL_i Reactive power– (QIII+QIV)
5	ΣL_i Reactive power Q I
6	ΣL_i Reactive power QII
7	ΣL_i Reactive power QIII
8	ΣL_i Reactive power QIV
9	ΣL_i Apparent power+ (QI+QIV) (See also Note 3)
10	ΣL_i Apparent power– (QII+QIII)
11	Current : any phase [a]
12	Voltage : any phase [a]
13	ΣL_i power factor (See also Note 4)
14	Supply frequency
15	ΣL_I Active power (abs(QI+QIV)+(abs(QII+QIII)) [a]
16	ΣL_I Active power (abs(QI+QIV)-abs(QII+QIII))
17	ΣL_i Active power QI
18	ΣL_i Active power QII
19	ΣL_i Active power QIII
20	ΣL_i Active power QIV
21	L_1 Active power+ (See also Note 1)
22	L_1 Active power–
23	L_1 Reactive power+
24-30	L_1 etc. (See 4-10)
31	L_1 Current [a]
32	L_1 Voltage [a]
33	L_1 Power factor
34	L_1 Supply frequency
35-40	L_1 Active power… etc. (See 15-20)
41	L_2 Active power+
42	L_2 Active power–
43	L_2 Reactive power+
44-60	L_2 etc. (See 24-40)
61	L_3 Active power+
62	L_3 Active power–
63	L_3 Reactive power+
64-80	L_3 etc. (See 24-40)

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Value group C Electricity related objects (A = 1)	
81	Angles[b]
82	Unitless quantity (pulses or pieces)
83	Transformer and line loss quantities[c]
84	ΣL_i power factor– (See also Note 4)
85	L_1 power factor–
86	L_2 power factor–
87	L_3 power factor–
88	ΣL_i Ampere-squared hours (QI+QII+QIII+QIV)
89	ΣL_i Volt-squared hours (QI+QII+QIII+QIV)
91	L_0 current (neutral) [a]
92	L_0 voltage (neutral) [a]
93	Consortia specific identifiers (See 5.4.4.2)
94	Country specific identifiers (See 5.4.4.3)
96	Electricity-related service entries (See 5.6.3.1)
97	Electricity-related error messages (See 5.6.3.2)
98	Electricity list (See 5.6.3.3)
99	Electricity data profile (See 5.6.3.4)
100...127	Reserved
128...199, 240	Manufacturer specific codes
All other	Reserved

NOTE 1 L_i *Quantity* is the value (to be measured) of a measurement system connected between the phase *i* and a reference point. In 3-phase 4-wire systems, the reference point is the neutral. In 3-phase 3-wire systems, the reference point is the phase L_2.

NOTE 2 ΣL_i *Quantity* is the total measurement value across all systems.

NOTE 3 If just one apparent energy/demand value is calculated over the four quadrants, C = 9 shall be used.

NOTE 4 Power factor quantities with C = 13, 33, 53, 73 are calculated either as PF = Active power+ (C = 1, 21, 41, 61) / Apparent power+ (C = 9, 29, 49, 69) or PF = Active power– (C = 2, 22, 42, 62) / Apparent power- (C= 10, 30, 50, 70).

In the first case, the sign is positive (no sign), it means power factor in the import direction (PF+).

In the second case, the sign is negative, it means power factor in the export direction (PF–).

Power factor quantities C = 84, 85, 86 and 87 are always calculated as PF– = Active power– / Apparent power–. This quantity is the power factor in the export direction; it has no sign.

[a] For details of extended codes, see 5.5.1.3.2.

[b] For details of extended codes, see 5.5.1.3.3.

[c] For details of extended codes, see 0.

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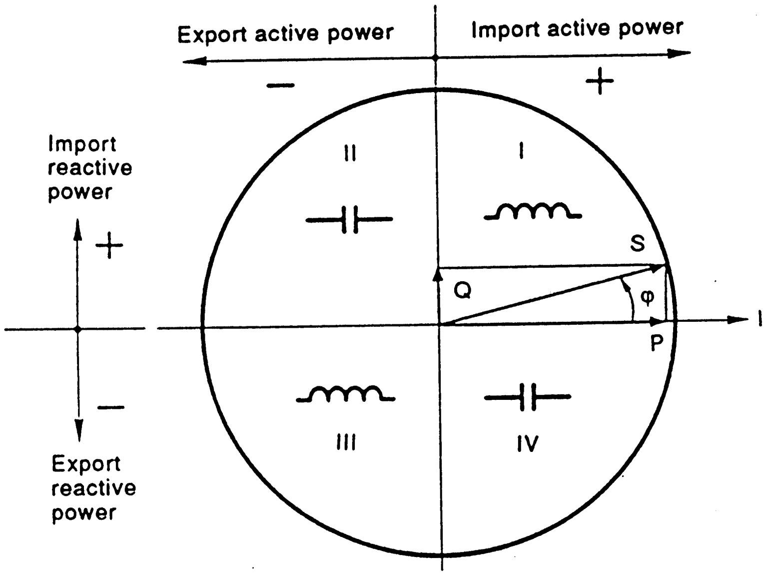

NOTE The quadrant definitions are according to IEC 62053-23 Figure C1.

Figure 10 – Quadrant definitions for active and reactive power

5.5.1.2 Value group D codes for Electricity

5.5.1.2.1 Processing of measurement values

Table 10 – Value group D codes – Electricity objects

Value group D Electricity related objects A = 1, C <> 0, 93, 94, 96, 97, 98, 99	
0	Billing period average (since last reset)
1	Cumulative minimum 1
2	Cumulative maximum 1
3	Minimum 1
4	Current average 1
5	Last average 1
6	Maximum 1
7	Instantaneous value
8	Time integral 1
9	Time integral 2
10	Time integral 3
11	Cumulative minimum 2
12	Cumulative maximum 2
13	Minimum 2
14	Current average 2
15	Last average 2
16	Maximum 2
17	Time integral 7
18	Time integral 8
19	Time integral 9
20	Time integral 10
21	Cumulative minimum 3

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Value group D Electricity related objects A = 1, C <> 0, 93, 94, 96, 97, 98, 99	
22	Cumulative maximum 3
23	Minimum 3
24	Current average 3
25	Last average 3
26	Maximum 3
27	Current average 5
28	Current average 6
29	Time integral 5
30	Time integral 6
31	Under limit threshold
32	Under limit occurrence counter
33	Under limit duration
34	Under limit magnitude
35	Over limit threshold
36	Over limit occurrence counter
37	Over limit duration
38	Over limit magnitude
39	Missing threshold
40	Missing occurrence counter
41	Missing duration
42	Missing magnitude
55	Test average
58	Time integral 4
128...254	Manufacturer specific codes
All other	Reserved

NOTES

Averaging scheme 1

Controlled by measurement period 1 (see Table 28), a set of registers is calculated by a metering device (codes 1...6). The typical usage is for billing purposes.

Averaging scheme 2

Controlled by measurement period 2, a set of registers is calculated by a metering device (codes 11...16). The typical usage is for billing purposes.

Averaging scheme 3

Controlled by measurement period 3, a set of registers is calculated by a metering device (codes 21...26). The typical usage is for instantaneous values.

Averaging scheme 4

Controlled by measurement period 4, a test average value (code 55) is calculated by the metering device.

Current average 1, 2, 3

See the definition of the “Demand register” interface class in 4.2.4.

The value is calculated using measurement period 1, 2 and/or 3 respectively.

Last average 1,2,3

See the definition of the “Demand register” interface class in 4.2.4.

The value is calculated using measurement period 1, 2 or 3 respectively.

Minimum

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Value group D Electricity related objects A = 1, C <> 0, 93, 94, 96, 97, 98, 99
The smallest of last average values during a billing period, see Table 28. **Maximum** The largest of last average values during a billing period. **Cumulative minimum** The cumulative sum of minimum values over all the past billing periods. **Cumulative maximum** The cumulative sum of maximum values over all the past billing periods. **Current average 5** See the definition of the "Demand register" interface class in 4.2.4. The value is calculated using recording interval 1, see Table 28. **Current average 6** See the definition of the "Demand register" interface class in 4.2.4. The value is calculated using recording interval 2. **Time integral 1** For a current billing period (F=255): Time integral of the *quantity* calculated from the origin (first start of measurement) to the instantaneous time point. For a historical billing period (F=0…99): Time integral of the *quantity* calculated from the origin to the end of the billing period given by the billing period code. **Time integral 2** For a current billing period (F=255): Time integral of the *quantity* calculated from the beginning of the current billing period to the instantaneous time point. For a historical billing period (F=0…99): Time integral of the *quantity* calculated over the billing period given by the billing period code. **Time integral 3** Time integral of the positive difference between the *quantity* and a prescribed threshold value. **Time integral 4 (**"Test time integral"**)** Time integral of the *quantity* calculated over a time specific to the device or determined by test equipment. **Time integral 5** Used as a base for load profile recording: Time integral of the *quantity* calculated from the beginning of the current recording interval to the instantaneous time point for recording period 1, see Table 28. **Time integral 6** Used as a base for load profile recording: Time integral of the *quantity* calculated from the beginning of the current recording interval to the instantaneous time point for recording period 2, see Table 28. **Time integral 7** Time integral of the *quantity* calculated from the origin (first start of measurement) up to the end of the last recording period with recording period 1, see Table 28. **Time integral 8** Time integral of the *quantity* calculated from the origin (first start of measurement) up to the end of the last recording period with recording period 2, see Table 28. **Time integral 9** Time integral of the *quantity* calculated from the beginning of the current billing period up to the end of the last recording period with recording period 1, see Table 28. **Time integral 10** Time integral of the *quantity* calculated from the beginning of the current billing period up to the end of the last recording period with recording period 2, see Table 28. **Under limit values** Values under a certain threshold (for example dips). **Over limit values** Values above a certain threshold (for example swells).

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Value group D Electricity related objects A = 1, C <> 0, 93, 94, 96, 97, 98, 99
Missing values Values considered as missing (for example interruptions).

5.5.1.2.2 Use of value group D for identification of other objects

For identifiers of electricity related general-purpose objects see 5.6.3.1.

5.5.1.3 Value group E codes for Electricity

5.5.1.3.1 General

The following clauses define the use of value group E for identifying further classification or processing the measurement quantities defined by value groups A to D. The various classifications and processing methods are exclusive.

5.5.1.3.2 Identification of harmonics

Table 11 shows the use of value group E for the identification of harmonics of instantaneous values of voltage, current or active power.

Table 11 – Value group E codes – Harmonics

Value group E **Electricity related objects (A = 1), measurement of harmonics of voltage (C = 12, 32, 52, 72, 92), current (C = 11, 31, 51, 71, 91) or active power (C = 15, 35, 55, 75), D = 7 or D = 24**	
0	Total (fundamental + all harmonics)
1	1st harmonic (fundamental)
2	2nd harmonic
…	*n*th harmonic
120	120th harmonic
124	Total Harmonic Distortion (THD) [a]
125	Total Demand Distortion (TDD) [b]
126	All harmonics [c]
127	All harmonics to nominal value ratio [d]
128…254	Manufacturer specific codes
All other	Reserved
[a] THD is calculated as the ratio of the square root of the sum of the squares of each harmonic to the value of the fundamental quantity, expressed as a percent of the value of the fundamental. [b] TDD is calculated as the ratio of the square root of the sum of the squares of each harmonic to the maximum value of the fundamental quantity, expressed as percent of the maximum value of the fundamental. [c] Calculated as the square root of the sum of the squares of each harmonic. [d] This is calculated as ratio of the square root of the sum of the squares of each harmonic, to the nominal value of the fundamental quantity, expressed as percent of the nominal value of the fundamental.	

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5.5.1.3.3 Identification of phase angles

The following table shows the use of value group E for identification of phase angles.

Table 12 – Value group E codes – Extended phase angle measurement

Value group E **Electricity related objects (A= 1); angle measurement (C = 81; D = 7)**								
Angle	**U(L1)**	**U(L2)**	**U(L3)**	**I(L1)**	**I(L2)**	**I(L3)**	**I(L0)**	**<= From**
U(L1)	(00)	01	02	04	05	06	07	
U(L2)	10	(11)	12	14	15	16	17	
U(L3)	20	21	(22)	24	25	26	27	
I(L1)	40	41	42	(44)	45	46	47	
I(L2)	50	51	52	54	(55)	56	57	
I(L3)	60	61	62	64	65	(66)	67	
I(L0)	70	71	72	74	75	76	(77)	
^ To (reference)								

5.5.1.3.4 Identification of transformer and line loss quantities

Table 13 shows the meaning of value group E for the identification of transformer and line loss quantities. The use of value group D shall be according to Table 10, the use of value group F shall be according to **Fehler! Verweisquelle konnte nicht gefunden werden.**. For these quantities, no tarification is available.

The model of the line and the transformer used for loss calculation is shown on Figure 11.

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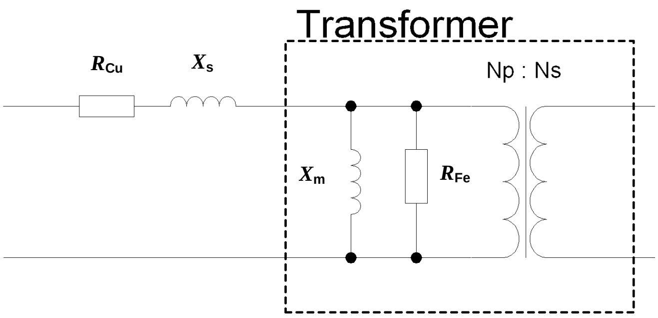

Legend:

- R_{Cu} Line resistance losses, OBIS code 1.x.0.10.2.VZ
- X_s Line reactance losses, OBIS code 1.x.0.10.3.VZ
- X_m Transformer magnetic losses, OBIS code 1.x.0.10.0.VZ
- R_{Fe} Transformer iron losses, OBIS code 1.x.0.10.1.VZ

NOTE Serial elements of the transformer are normally low compared to that of the line, therefore they are not considered here.

Figure 11 – Model of the line and transformer for calculation of loss quantities

Table 13 – Value group E codes – Transformer and line loss quantities

Value group E Electricity related objects (A = 1); transformer and line loss quantities (C = 83)			
E=	**Quantity**	**Formula**	**Quadrant / comment**
1	ΣL_i Active line losses+	On Load Active, positive OLA+ = $(CuA_1+) + (CuA_2+) + (CuA_3+)$	QI+QIV
2	ΣL_i Active line losses–	On Load Active, negative OLA– = $(CuA_1–) + (CuA_2–) + (CuA_3–)$	QII+QIII
3	ΣL_i Active line losses	On Load Active OLA = $(CuA_1) + (CuA_2) + (CuA_3)$	QI+QII+QIII+QIV
4	ΣL_i Active transformer losses+	No Load Active, positive NLA+ = $(FeA_1+) + (FeA_2+) + (FeA_3+)$	QI+QIV
5	ΣL_i Active transformer losses–	No Load active, negative NLA– = $(FeA_1–) + (FeA_2–) + (FeA_3–)$	QII+QIII
6	ΣL_i Active transformer losses	No Load Active NLA = $(FeA_1) + (FeA_2) + (FeA_3)$	QI+QII+QIII+QIV
7	ΣL_i Active losses+	Total Losses Active, positive TLA+ = (OLA+) + (NLA+)	QI+QIV
8	ΣL_i Active losses–	Total Losses Active, negative TLA– = (OLA–) + (NLA–)	QII+QIII
9	ΣL_i Active losses	Total Losses Active TLA = OLA + NLA = $TLA_1 + TLA_2 + TLA_3$	QI+QII+QIII+QIV
10	ΣL_i Reactive line losses+	On Load Reactive, positive OLR+ = $(CuR_1+) + (CuR_2+) + (CuR_3+)$	QI+QII
11	ΣL_i Reactive line losses–	On Load Reactive, negative OLR– = $(CuR_1–) + (CuR_2–) + (CuR_3–)$	QIII+QIV
12	ΣL_i Reactive line losses	On Load Reactive OLR = (CuR1) + (CuR2) + (CuR3)	QI+QII+QIII+QIV
13	ΣL_i Reactive transformer losses+	No Load reactive, positive NLR+ = $(FeR_1+) + (FeR_2+) + (FeR_3+)$	QI+QII
14	ΣL_i Reactive transformer losses–	No Load Reactive, negative NLR– = $(FeR_1–) + (FeR_2–) + (FeR_3–)$	QIII+QIV
15	ΣL_i Reactive transformer losses	No Load Reactive NLR = $(FeR_1) + (FeR_2) + (FeR_3)$	QI+QII+QIII+QIV

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Value group E Electricity related objects (A = 1); transformer and line loss quantities (C = 83)			
E=	**Quantity**	**Formula**	**Quadrant / comment**
16	ΣL_i Reactive losses+	Total Losses Reactive, positive TLR+ = (OLR+) + (NLR+)	QI+QII
17	ΣL_i Reactive losses–	Total Losses Reactive, negative TLR– = (OLR–) + (NLR–)	QIII+QIV
18	ΣL_i Reactive losses	Total Losses Reactive TLR = OLR + NLR = $TLR_1 + TLR_2 + TLR_3$	QI+QII+QIII+QIV
19	Total transformer losses with normalized R_{Fe} = 1 MOhm	U^2h $1/R_{Fe}$ x ($U^2h_{L1}+U^2h_{L2}+U^2h_{L3}$)	QI+QII+QIII+QIV
20	Total line losses with normalized R_{Cu} = 1 Ohm	I^2h R_{Cu} x (I^2h_{L1} + I^2h_{L2} + I^2h_{L3})	QI+QII+QIII+QIV
21	Compensated active brutto+	CA+ = (A+) + (TLA+)	QI+QIV; A+ is the quantity A = 1, C = 1
22	Compensated active netto+	CA+ = (A+) - (TLA+)	QI+QIV
23	Compensated active brutto–	CA– = (A–) + (TLA–)	QII+QIII, A– is the quantity A = 1, C = 2
24	Compensated active netto–	CA – = (A–) - (TLA–)	QII+QIII
25	Compensated reactive brutto+	CR+ = (R+) + (TLR+)	QI+QII; R+ is the quantity A = 1, C = 3
26	Compensated reactive netto+	CR+ = (R+) - (TLR+)	QI+QII
27	Compensated reactive brutto–	CR– = (R–) + (TLR–)	QIII+QIV;R0– is the quantity A = 1, C = 4
28	Compensated reactive netto–	CR– = (R–) - (TLR–)	QIII+QIV
29	Reserved		
30	Reserved		
31	L_1 Active line losses+	$CuA_1+ = I^2h_{L1}$ x R_{Cu}	QI+QIV R_{Cu} is the serial resistive element of the line loss, OBIS code 1.x.0.10.2.VZ
32	L_1 Active line losses–	$CuA_1– = I^2h_{L1}$ x R_{Cu}	QII+QIII
33	L_1 Active line losses	$CuA_1 = I^2h_{L1}$ x R_{Cu}	QI+QII+QIII+QIV
34	L_1 Active transformer losses+	$FeA_1+ = U^2h_{L1}/R_{Fe}$	QI+QIV R_{Fe} is the parallel resistive element of the transformer loss, OBIS code 1.x.0.10.1.VZ
35	L_1 Active transformer losses–	$FeA_1– = U^2h_{L1}/R_{Fe}$	QII+QIII
36	L_1 Active transformer losses	$FeA_1 = U^2h_{L1}/R_{Fe}$	QI+QII+QIII+QIV
37	L_1 Active losses+	$TLA_1+ = (CuA_1+) + (FeA_1+)$	QI+QIV
38	L_1 Active losses–	$TLA_1– = (CuA_1–) + (FeA_1–)$	QII+QIII
39	L_1 Active losses	$TLA_1 = CuA_1 + FeA_1$	QI+QII+QIII+QIV
40	L_1 Reactive line losses+	$CuR_1+ = I^2hL_1$ x X_s	QI+QII X_s is the serial reactive element of the line loss, OBIS code 1.x.0.10.3.VZ
41	L_1 Reactive line losses–	$CuR_1– = I^2h_{L1}$ x X_s	QIII+QIV
42	L_1 Reactive line losses	$CuR_1 = I^2h_{L1}$ x X_s	QI+QII+QIII+QIV
43	L_1 Reactive transformer losses+	$FeR_1+ = U^2h_{L1}/X_m$	QI+QII X_m is the parallel reactive element of the transformer loss, OBIS code

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Value group E Electricity related objects (A = 1); transformer and line loss quantities (C = 83)			
E=	**Quantity**	**Formula**	**Quadrant / comment**
			1.x.0.10.0.VZ
44	L_1 Reactive transformer losses–	$\mathrm{FeR}_1– = U^2\mathrm{h}_{L1}/X_m$	QIII+QIV
45	L_1 Reactive transformer losses	$\mathrm{FeR}_1 = U^2\mathrm{h}_{L1}/X_m$	QI+QII+QIII+QIV
46	L_1 Reactive losses+	$\mathrm{TLR}_1+ = (\mathrm{CuR}_1+) + (\mathrm{FeR}_1+)$	QI+QII
47	L_1 Reactive losses–	$\mathrm{TLR}_1– = (\mathrm{CuR}_1–) + (\mathrm{FeR}_1–)$	QIII+QIV
48	L_1 Reactive losses	$\mathrm{TLR}_1 = \mathrm{CuR}_1 + \mathrm{FeR}_1$	QI+QII+QIII+QIV
49	L_1 Ampere-squared hours	$\mathrm{A}^2\mathrm{h}_{L1}$	QI+QII+QIII+QIV
50	L_1 Volt-squared hours	$\mathrm{V}^2\mathrm{h}_{L1}$	QI+QII+QIII+QIV
51	L_2 Active line losses+	$\mathrm{CuA}_2+ = I^2\mathrm{h}_{L2} \times R_{Cu}$	QI+QIV R_{Cu} is the serial resistive element of the line loss, OBIS code 1.x.0.10.2.VZ
52	L_2 Active line losses–	$\mathrm{CuA}_2– = I^2\mathrm{h}_{L2} \times R_{Cu}$	QII+QIII
53…70	L_2 quantities, (See 33…48)		
71	L_3 Active line losses +	$\mathrm{CuA}_3+ = I^2\mathrm{h}_{L3} \times R_{Cu}$	QI+QIV R_{Cu} is the serial resistive element of the line loss, OBIS code 1.x.0.10.2.VZ
72	L_3 Active line losses -	$\mathrm{CuA}_3– = I^2\mathrm{h}_{L3} \times R_{Cu}$	QII+QIII
73…90	L_3 quantities (See 33…48)		
91… 255	Reserved		
NOTE In this table, no manufacturer specific range is available.			

5.5.1.3.5 Identification of UNIPEDE voltage dips

The following table shows the use of value group E for the identification of voltage dips according to the UNIPEDE classification.

Table 15 – Value group E codes – UNIPEDE voltage dip quantities

Value group E Electricity related objects (A = 1), Voltage dips measurement (C = 12, 32, 52, 72, D = 32)							
Depth in % of U_n	Residual voltage U in % of U_n	Duration Δt s					
		0,01 < Δt ≤ 0,1	0,1 < Δt ≤ 0,5	0,5 < Δt ≤ 1	1 < Δt ≤ 3	3 < Δt ≤ 20	20 < Δt ≤ 60
10%…<15%	90 > u ≥ 85	00	01	02	03	04	05
15%…<30%	85 > u ≥ 70	10	11	12	13	14	15
30%…<60%	70 > u ≥ 40	20	21	22	23	24	25
60%…<90%	40 > u ≥ 10	30	31	32	33	34	35
90%…<100%	10 > u ≥ 0	40	41	42	43	44	45
NOTE These classes form a subset of the classes defined in IEC/TR 61000-2-8, Table 2.							

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5.5.1.3.6 Use of value group E for the identification of other objects

For identifiers of electricity related general purpose objects see 5.6.3.1.

5.5.1.4 Value group F codes for Electricity

5.5.1.4.1 Identification of billing periods

Value group F specifies the allocation to different billing periods (sets of historical values) for the objects with following codes:

- value group A: 1;
- value group C: as defined in Table 9;
- value group D: 0 to 3; 6; 8 to 13; 16; 21 to 23; 26.

There are two billing period schemes available (for example to store weekly and monthly values), identified with the following OBIS codes:

- billing period counter: 1.x.0.1.0.VZ or 255, or 1.x.0.1.3.VZ or 255;
- number of available billing periods 1.x.0.1.1.255 or 1.x.0.1.4.255;
- time stamp of the billing period: 1.x.0.1.2.VZ or 255 or 1.x.0.1.5.VZ or 255;
- billing period length 1.x.0.8.6.255 or 1.x.0.8.7.255.

For more, see Clause 5.7.3.

5.5.1.4.2 Identification of multiple thresholds

Value group F is also used to identify several thresholds for the same quantity, identified with the following codes:

- value group A = 1;
- value group C = 1…20, 21…40, 41…60, 61…80, 82, 84…89, 91, 92;
- value group D = 31, 35, 39 (under limit, over limit and missing thresholds);
- value group F = 0…99.

NOTE All quantities monitored are instantaneous values: D = 7 or D = 24.

5.5.2 Heat Cost Allocator (HCA) related definitions

5.5.2.1 General

HCA's are mounted on radiators in the area to be monitored. The HCA must be mounted with in free air and radiators should not be enclosed. There will normally also be multiple HCA's, even for a single customer. This makes at, the present, direct connection to all HCA's using a two way connections an infeasible solution. It is never the less important, that data coming from a (number of) HCA's (via a concentrator) can be handled in the same way as data from other meters for remote reading.

The current subsection describes the naming of objects carrying HCA information in an COSEM environment. The words used in this clause are those used in EN 834:1994 the corresponding media standard.

The output from an HCA's is "the temperature integral with respect to time", and it is only a relative sum. The main parameter from a HCA is this integral. Time series of this integral may be stored in the HCA for later readout. Other media related information available from a HCA are temperature and rating factors.

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5.5.2.2 Value group C codes for HCA

The name of the different objects in the table for HCA objects corresponds to the name used in the meter standard, EN 834:1994.

Table 16 – Value group C codes – HCA objects

Value group C HCA related objects (A = 4)	
0	General purpose objects [a]
1	Unrated integral [b]
2	Rated integral [c]
3	Radiator surface temperature [d]
4	Heating medium temperature, t_m
5	Flow (forward) temperature, t_V
6	Return temperature, t_R
7	Room temperature, t_L
93	Consortia specific identifiers, see Table 6.
94	Country specific identifiers, see Table 7.
96	HCA related service entries, see 5.6.4.1.
97	HCA related error messages, see 5.6.4.2.
98	HCA related lists
99	HCA related data profiles, see 5.6.4.3
128...199, 240	Manufacturer specific codes
All other	Reserved

[a] Settings like time constant, thresholds etc. See the table of object codes in Clause 13.3.1 of EN 13757-1:2002

[b] Readout prior to compensation as specified in EN 834:1994.

[c] Readout after compensation as specified in EN 834:1994.

[d] Temperature measured prior to any rating

NOTE 1 The radiator surface (C = 3) temperature and the heating media (C=4) temperature, are mutually exclusive.

NOTE 2 The forward flow (C = 5) and reverse flow (C = 6) temperatures are exclusive to the radiator surface (C = 3) temperature.

NOTE 3 The room temperature measurement (C = 7) must always be accompanied by either a radiator surface (C = 3) temperature, a heating media (C = 4) temperature or a pair of forward / return flow (C = 5 / C = 6) temperatures.

5.5.2.3 Value group D codes for HCA

This value group specifies the result of processing a *Quantity* according to a specific algorithm for Heat Cost Allocator related values.

Table 17 – Value group D codes – HCA objects

Value group D HCA related objects (A = 4, C <> 0, 96...99)	
0	Current value
1	Periodical value [a]
2	Set date value

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Value group D HCA related objects (A = 4, C <> 0, 96...99)	
3	Billing date value
4	Minimum of value
5	Maximum of value
6	Test value [b]
All other	Reserved
[a] A set of values periodically stored (this may be once or twice a month) [b] A value specially processed for test purpose. This may be due to a increased precision of the data, or to a faster (but less precise) processing of data.	

For HCA related object codes, see 5.6.4.

5.5.3 Heat or cooling related definitions

5.5.3.1 General

The current subsection describes the naming of objects carrying heat meter information in a COSEM environment. It covers the handling of heat, as well as the handling of cooling. The media specific words used in this clause are those used in EN 1434-1: 1997 and EN 1434-2: 1997 and parts of the corresponding media standard. The output from a heat or cooling meter is "the integral of power, i.e. the enthalphy difference times the mass flow-rate, with respect to time".

Value group A = 5 has been set aside for metering of cooling specific objects, and value group A = 6 for the metering of heat specific objects. The other value groups are identical for heating and cooling.

5.5.3.2 Value group C codes for Heat / cooling

The name of the different objects in the table for heat metering and cooling metering objects corresponds to the name used in EN 1434-1: 1997.

Table 18 – Value group C codes – Heat / cooling objects

Value group C Heat / cooling related objects (A = 5 or A = 6)	
0	General purpose objects [a]
1	Energy
2	Accounted volume
3	Accounted mass [b]
4	Flow volume
5	Flow mass
6	Return volume
7	Return mass
8	Power
9	Flow rate
10	Flow temperature
11	Return temperature
12	Differential temperature, $\Delta\theta$ [c]

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Value group C Heat / cooling related objects (A = 5 or A = 6)	
13	Media pressure [d]
93	Consortia specific identifiers, see Table 6.
94	Country specific identifiers, see Table 7.
96	Heat / cooling related service entries, see 5.6.5.1
97	Heat / cooling related error messages, see 5.6.5.2
98	Heat / cooling lists, see
99	Heat / cooling data profiles, see 5.6.5.3
128...199, 240	Manufacturer specific codes
All other	Reserved

[a] Settings like time constant, thresholds etc. See the table of object codes in Clause 13.4.1 of EN 13757-1:2002.

[b] Used when metering steam.

[c] Will often be available with a higher precision and accuracy than flow and return temperature.

[d] Pressure of the media, if measured. The backup value, to use if pressure cannot be measured, is a general purpose object (C = 0).

5.5.3.3 Value group D codes for heat / cooling

This value group specifies the result of processing a *Quantity* according to a specific algorithm for heat or cooling related values.

Table 19 – Value group D codes – Heat / cooling objects

Value group D Heat / cooling related objects, (A = 5 or A = 6), (C <> 0, 96...99)	
0	Current value
1	Periodical value 1[a]
2	Set date value
3	Billing date value
4	Minimum of value 1
5	Maximum of value 1
6	Test value [b]
7	Instantaneous value [c]
8	Time integral 1 [d]
9	Time integral 2 [e]
10	Current average [f]
11	Last average [g]
12	Periodical value 2 [a]
13	Periodical value 3 [a]
14	Minimum of value 2
15	Maximum of value 2
20	Under limit occurrence counter

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Value group D Heat / cooling related objects, (A = 5 or A = 6), (C <> 0, 96...99)	
21	Under limit duration
22	Over limit occurrence counter
23	Over limit duration
24	Missing data occurrence counter [h]
25	Missing data duration [h]
All other	Reserved

[a] A set of data that is collected periodically. Recording of data in this way is directly supported by 'profiles'.

[b] A value specially processed for test purpose. This may be due to a increased precision of the data, or to a faster (but less precise) processing of data.

[c] An immediate readout from the system, typically with a shorter measuring time than the current value.

[d] For a current billing period (F = 255): Time integral of the *quantity* calculated from the origin (first start of measurement) to the instantaneous time point.

For a historical billing period (F = 0...99): Time integral of the *quantity* calculated from the origin to the end of the billing period given by the billing period code.

[e] For a current billing period (F = 255): Time integral of the *quantity* calculated from the beginning of the current billing period to the instantaneous time point.

For a historical billing period (F = 0...99): Time integral of the *quantity* calculated over the billing period given by the billing period code.

[f] The value of a current demand register.

[g] The value of a demand register at the end of the last measurement period.

[h] Values considered as missing (for instance due to sensor failure).

For Heat /cooling related object codes, see 5.6.5.

5.5.4 Gas related definitions

5.5.4.1 General

The current subsection describes the naming of objects carrying gas metering information in a COSEM environment. It covers the handling of meters, volume converters as well as data loggers.

Annex B of EN 13757-1:2002 gives a detailed description of the data flow in gas metering as specified in EN 12405: 2002.

5.5.4.2 Value group C codes for Gas

Table 20 – Value group C codes – Gas objects

Value group C Gas related objects (A = 7)	
0	General purpose objects
1	Forward undisturbed meter volume
2	Forward disturbed meter volume
3	Forward absolute meter volume
4	Reverse undisturbed meter volume
5	Reverse disturbed meter volume

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Value group C Gas related objects (A = 7)	
6	Reverse absolute meter volume
11	Forward undisturbed converter volume
12	Forward disturbed converter volume
13	Forward absolute converter volume
14	Reverse undisturbed converter volume
15	Reverse disturbed converter volume
16	Reverse absolute converter volume
21	Forward undisturbed logger volume
22	Forward disturbed logger volume
23	Forward absolute logger volume
24	Reverse undisturbed logger volume
25	Reverse disturbed logger volume
26	Reverse absolute logger volume
31	Forward undisturbed Energy
32	Forward disturbed Energy
33	Forward absolute Energy
34	Reverse undisturbed Energy
35	Reverse disturbed Energy
36	Reverse absolute Energy
41	Absolute temperature
42	Absolute pressure
43	Flowrate
44	Velocity of Sound
45	Density
51	Correction factor
52	Conversion factor
53	Compressibility factor
54	Calorific value
93	Consortia specific identifiers, see Table 6.
94	Country specific identifiers, see Table 7.
96	Gas related service entries, see 5.6.6.1
97	Gas related error messages, see 5.6.6.2
98	Gas related lists, see
99	Gas related data profiles, see 5.6.6.3

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Value group C Gas related objects (A = 7)	
128...199, 240	Manufacturer specific codes
All other	Reserved

5.5.4.3 Value group D codes for Gas

The result of processing a *Quantity* according to a specific algorithm for gas related values or a further subdivision for general values

Table 21 – Value group D codes – Gas objects

Value group D Gas related objects (A = 7) and (C <> 0, 96...99)	
0	Actual value at measuring conditions
1	Corrected volume
2	Value at base conditions /"Converted Value"
3	Backup value
4	Minimum of actual value
5	Maximum of actual value
10	Actual value
11	Preset value
12	Method
All other	Reserved

For gas related object codes, see 5.6.5.4.

5.5.5 Water related definitions

5.5.5.1 General

The current subsection describes the naming of objects carrying water meter information in a COSEM environment. It covers the handling of hot, as well as the handling of cold water.

5.5.5.2 Value group C codes for Water

Table 21 – Value group C codes – Water volume objects

Value group C Water volume related objects (A=8 or A=9)	
0	General purpose objects
1	Accumulated volume
2	Flow rate
3	Forward temperature
93	Consortia specific identifiers, see Table 6.
94	Country specific identifiers, see Table 7.

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Value group C Water volume related objects (A=8 or A=9)	
96	Water related service entries, see, 5.6.7.1
97	Water related error messages, see 5.6.7.2
98	Water list
99	Water data profile, see 5.6.7.3
128...199, 240	Manufacturer specific codes
All other	Reserved

5.5.5.3 Value group D codes for Water

This value group specifies the result of processing a *Quantity* according to a specific algorithm for water related values.

Table 22 – Value group D codes – Water volume objects

Value group D Water volume related objects (A = 8 or A = 9), (C <> 0, 96...99)	
0	Current value
1	Periodical value
2	Set date value
3	Billing date value
4	Minimum of value
5	Maximum of value
6	Test value
All other	Reserved

For water related object codes, see 5.6.6.4.

5.6 Object codes

5.6.1 Standard object codes

Standard object codes are meaningful combinations of defined values of the six value groups.

The tables below contain standard object codes of abstract objects and media specific general purpose objects.

The DLMS UA maintains a list of standard OBIS codes at www.dlms.com. These codes are tested during conformance testing.

5.6.2 Abstract objects

5.6.2.1 Abstract object codes

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Table 23 – Abstract object codes

Abstract objects, general service entries	OBIS code					
	A	B	C	D	E	F
Device ID numbers (non-energy/channel related)						
Complete device ID	0	0	96	1		
Device ID 1 (manufacturing number)	0	0	96	1	0	
…			…	…	…	
Device ID 10	0	0	96	1	9	
Metering point ID (abstract)	0	0	96	1	10	
Parameter changes, calibration and access						
Number of configuration program changes	0	x	96	2	0	
Date [a] of last configuration program change	0	x	96	2	1	
Date [a] of last time switch program change	0	x	96	2	2	
Date [a] of last ripple control receiver program change	0	x	96	2	3	
Status of security switches	0	x	96	2	4	
Date [a] of last calibration	0	x	96	2	5	
Date [a] of next configuration program change	0	x	96	2	6	
Date [a] of activation of the passive calendar	0	x	96	2	7	
Number of protected configuration program changes [b]	0	x	96	2	10	
Date [a] of last protected configuration program change [b]	0	x	96	2	11	
Date [a] (corrected) of last clock synchronization/setting	0	x	96	2	12	
Input/output control signals						
State of input/output control signals, global [c]	0	x	96	3	0	
State of input control signals (status word 1)	0	x	96	3	1	
State of output control signals (status word 2)	0	x	96	3	2	
State of input/output control signals (status word 3)	0	x	96	3	3	
State of input/output control signals (status word 4)	0	x	96	3	4	
Internal control signals						
State of the internal controsignals, global [c]	0	x	96	4	0	
State of internal control signals (status word 1)	0	x	96	4	1	
State of internal control signals (status word 2)	0	x	96	4	2	
State of internal control signals (status word 3)	0	x	96	4	3	
State of internal control signals (status word 4	0	x	96	4	4	
Internal operating status signals						
Internal operating status, global [c]	0	x	96	5	0	
Internal operating status (status word 1)	0	x	96	5	1	
Internal operating status (status word 2)	0	x	96	5	2	
Internal operating status (status word 3)	0	x	96	5	3	
Internal operating status (status word 4)	0	x	96	5	4	
Battery entries						
Battery use time counter	0	x	96	6	0	
Battery charge display	0	x	96	6	1	
Date of next change	0	x	96	6	2	
Battery voltage	0	x	96	6	3	
Number of power failures events						
In all three phases	0	0	96	7	0	
In phase L1	0	0	96	7	1	
In phase L2	0	0	96	7	2	
In phase L3	0	0	96	7	3	
Auxiliary supply	0	0	96	7	4	

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Abstract objects, general service entries	OBIS code					
	A	B	C	D	E	F
Number of long power failures						
In all three phases	0	0	96	7	5	
In phase L1	0	0	96	7	6	
In phase L2	0	0	96	7	7	
In phase L3	0	0	96	7	8	
In any phase	0	0	96	7	9	
Time of power failure [d]						
In all three phases	0	0	96	7	10	
In phase L1	0	0	96	7	11	
In phase L2	0	0	96	7	12	
In phase L3	0	0	96	7	13	
In any phase	0	0	96	7	14	
Duration of long power failure [e]						
In all three phases	0	0	96	7	15	
In phase L1	0	0	96	7	16	
In phase L2	0	0	96	7	17	
In phase L3	0	0	96	7	18	
In any phase	0	0	96	7	19	
Time threshold for long power failure						
Time threshold for long power failure	0	0	96	7	20	
Operating time						
Time of operation	0	x	96	8	0	
Time of registration rate 1	0	x	96	8	1	
Time of registration rate 2	0	x	96	8	2	
…	…	…	…	…	…	
Time of registration rate 63	0	x	96	8	63	
Environmental related parameters						
Ambient temperature	0	x	96	9	0	
Status register						
Status register (status register 1 if several status registers are used)	0	x	96	10	1	
Status register 2	0	x	96	10	2	
…	0	x	96	10		
Status register 10	0	x	96	10	10	
Communication port log parameters						
Reserved	0	x	96	12	0	
Number of connections	0	x	96	12	1	
Reserved	0	x	96	12	2	
Reserved	0	x	96	12	3	
Communication port parameter 1	0	x	96	12	4	
Reserved	0	x	96	12	5	
Manufacturer specific [f]	0	x	96	50	x	x
…						
Manufacturer specific	0	x	96	99	x	x

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Abstract objects, general service entries	OBIS code					
	A	B	C	D	E	F
NOTE If a value field is shaded, then this value group is not used. “*x*” is equal to any value within the range.						
[a] Date of the event may contain the date only, the time only or both, encoded as specified in 4.1.4.1.						
[b] Protected configuration is characterized by the need to open the main meter cover to modify it, or to break a metrological seal.						
[c] Global status words with E = 0 contain the individual status words E = 1…4. The contents of the status words is not defined In this Technical Report.						
[d] Time of power failure is recorded when either a short or long power failure occurs.						
[e] Duration of long power failure holds the duration of the last long power failure.						
[f] The range D = 50…99 is available for identifying objects, which are not represented by another defined code, but need representation on the display as well. If this is not required, the range D= 128…254 should be used.						

5.6.2.2 General error messages

Table 24 – General error messages

Abstract objects, general error messages	OBIS code					
	A	B	C	D	E	F
Error object	0	x	97	97	x [a]	
NOTE If a value field is shaded, then this value group is not used. “*x*” is equal to any value within the range.						
[a] If only one object is instantiated, the value shall be 0.						

NOTE The information to be included in the error objects is not defined in this document.

5.6.2.3 General list objects

Lists – identified with one single OBIS code – are defined as a series of any kind of data (for example measurement value, constants, status, events).

Table 25 – General list objects

General list objects	OBIS code					
	A	B	C	D	E	F
Data of billing period (with billing period scheme 1 if there are two schemes available)	0	x	98	1	x [a]	255 [b]
Data of billing period (with billing period scheme 2)	0	x	98	2	x [a]	255 [b]
[a] If only one object is instantiated, the value shall be 0.						
[b] F = 255 means a wildcard here. See 5.7.3.						

5.6.2.4 Abstract data profiles

Abstract data profiles – identified with one single OBIS code – are used to hold a series of measurement values of one or more similar quantities and/or to group various data.

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Table 26 – Profile codes – Abstract

Abstract data profile objects	OBIS-code					
	A	B	C	D	E	F
Load profile with recording period 1 [b]	0	X	99	1	x [a]	
Load profile with recording period 2 [b]	0	X	99	2	x [a]	
Load profile during test [b]	0	X	99	3	0	
Connection profile	0	X	99	12	x [a]	
Event log [b]	0	x	99	98	x [a]	
[a] "x" is equal to any value within the range.						
[b] These objects should be used if they (also) hold data not specific to the energy type.						

5.6.2.5 Register table objects - abstract

Register tables - identified with a single OBIS code - are defined to hold a number of values of the same type.

Table 27 – Register table object codes – Abstract

Register table objects	OBIS-code					
	A	B	C	D	E	F
General use, abstract	0	x	98	10	x	
[a] "x" is equal to any value within the range. If only one object of each kind is instantiated, the value shall be 0.						

5.6.3 Electricity related objects

5.6.3.1 General purpose objects – Electricity

Table 28 – General purpose codes – Electricity

Electricity-related general purpose objects	OBIS-code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined electricity ID	1	x	0	0		
Electricity ID 1	1	x	0	0	0	
…						
Electricity ID 10	1	x	0	0	9	
Billing period values/reset counter entries (First billing period scheme if there are two)						
Billing period counter (1)	1	x	0	1	0	VZ or 255
Number of available billing periods (1)	1	x	0	1	1	
Time stamp of the most recent billing period (1)	1	x	0	1	2	
Time stamp of the billing period (1) VZ (last reset)	1	x	0	1	2	VZ
Time stamp of the billing period (1) VZ_{-1}	1	x	0	1	2	VZ_{-1}
…	…	…	…	…	…	…
Time stamp of the billing period (1) VZ_{-n}	1	x	0	1	2	VZ_{-n}
Billing period values/reset counter entries (Second billing period scheme)						
Billing period counter (2)	1	x	0	1	3	VZ or 255
Number of available billing periods (2)	1	x	0	1	4	

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Electricity-related general purpose objects	OBIS-code					
	A	B	C	D	E	F
Time stamp of the most recent billing period (2)	1	x	0	1	5	
Time stamp of the billing period (2) VZ (last reset)	1	x	0	1	5	VZ
Time stamp of the billing period (2) VZ_{-1}	1	x	0	1	5	VZ_{-1}
…	…	…	…	…	…	…
Time stamp of the billing period (2) VZ_{-n}	1	x	0	1	5	VZ_{-n}
Program entries						
Configuration program version number	1	x	0	2	0	
Parameter record number	1	x	0	2	1	
Parameter record number, line 1	1	x	0	2	1	1
Reserved for future use	1	x	0	2	1	2… 127
Manufacturer specific	1	x	0	2	1	128… 254
Time switch program number	1	x	0	2	2	
RCR program number	1	x	0	2	3	
Meter connection diagram ID	1	x	0	2	4	
Passive calendar name	1	x	0	2	7	
Output pulse values or constants NOTE For units, see 4.2.2.						
Active energy, metrological LED	1	x	0	3	0	
Reactive energy, metrological LED	1	x	0	3	1	
Apparent energy, metrological LED	1	x	0	3	2	
Active energy, output pulse	1	x	0	3	3	
Reactive energy, output pulse	1	x	0	3	4	
Apparent energy, output pulse	1	x	0	3	5	
Volt-squared hours, metrological LED	1	x	0	3	6	
Ampere-squared hours, metrological LED	1	x	0	3	7	
Volt-squared hours, output pulse	1	x	0	3	8	
Ampere-squared hours, output pulse	1	x	0	3	9	
Ratios						
Reading factor for power	1	x	0	4	0	
Reading factor for energy	1	x	0	4	1	
Transformer ratio – current (numerator) [a]	1	x	0	4	2	VZ
Transformer ratio – voltage (numerator) [a]	1	x	0	4	3	VZ
Overall transformer ratio (numerator) [a]	1	x	0	4	4	VZ
Transformer ratio – current (denominator) [a]	1	x	0	4	5	VZ
Transformer ratio – voltage (denominator) [a]	1	x	0	4	6	VZ
Overall transformer ration (denominator) [a]	1	x	0	4	7	VZ
Demand limits for excess consumption metering						
Reserved for Germany	1	x	0	5		
Nominal values						
Voltage	1	x	0	6	0	
Basic/nominal current	1	x	0	6	1	
Frequency	1	x	0	6	2	
Maximum current	1	x	0	6	3	
Reference voltage for power quality measurement	1	x	0	6	4	VZ
Input pulse values or constants [b] NOTE For units, see 4.2.2.						
Active energy	1	x	0	7	0	
Reactive energy	1	x	0	7	1	
Apparent energy	1	x	0	7	2	

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Electricity-related general purpose objects	OBIS-code					
	A	B	C	D	E	F
Volt-squared hours	1	x	0	7	3	
Ampere-squared hours	1	x	0	7	4	
Unitless quantities	1	x	0	7	5	
Active energy, export	1	x	0	7	10	
Reactive energy, export	1	x	0	7	11	
Apparent energy, export	1	x	0	7	12	
Measurement period- / recording interval- / billing period duration						
Measurement period 1, for average value 1	1	x	0	8	0	VZ
Measurement period 2, for average value 2	1	x	0	8	1	VZ
Measurement period 3, for instantaneous value	1	x	0	8	2	VZ
Measurement period 4, for test value	1	x	0	8	3	VZ
Recording interval 1, for load profile	1	x	0	8	4	VZ
Recording interval 2, for load profile	1	x	0	8	5	VZ
Billing period (Billing period 1 if there are two billing period schemes)	1	x	0	8	6	VZ
Billing period 2	1	x	0	8	7	VZ
Time entries						
Time expired since last end of billing period	1	x	0	9	0	
Local time	1	x	0	9	1	
Local date	1	x	0	9	2	
Reserved for Germany	1	x	0	9	3	
Reserved for Germany	1	x	0	9	4	
Week day (0…7)	1	x	0	9	5	
Time of last reset	1	x	0	9	6	
Date of last reset	1	x	0	9	7	
Output pulse duration	1	x	0	9	8	
Clock synchronization window	1	x	0	9	9	
Clock synchronization method	1	x	0	9	10	
Coefficients						
Transformer magnetic losses, X_m	1	x	0	10	0	VZ
Transformer iron losses, R_{Fe}	1	x	0	10	1	VZ
Line resistance losses, R_{Cu}	1	x	0	10	2	VZ
Line reactance losses, X_s	1	x	0	10	3	VZ
Measurement methods						
Algorithm for active power measurement	1	x	0	11	1	
Algorithm for active energy measurement	1	x	0	11	2	
Algorithm for reactive power measurement	1	x	0	11	3	
Algorithm for reactive energy measurement	1	x	0	11	4	
Algorithm for apparent power measurement	1	x	0	11	5	
Algorithm for apparent energy measurement	1	x	0	11	6	
Algorithm for power factor calculation	1	x	0	11	7	
Metering point ID (electricity related)						
Metering point ID 1 (electricity related)	1	0	96	1	0	
………						
Metering point ID 10 (electricity related)	1	0	96	1	9	
Internal operating status signals, electricity related						
Internal operating status, global [c]	1	x	96	5	0	
Internal operating status (status word 1)	1	x	96	5	1	
Internal operating status (status word 2)	1	x	96	5	2	
Internal operating status (status word 3)	1	x	96	5	3	

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Electricity-related general purpose objects	OBIS-code					
	A	B	C	D	E	F
Internal operating status (status word 4)	1	x	96	5	4	
Meter started status flag	1	x	96	5	5	
Electricity related status data						
Status information missing voltage	1	0	96	10	0	
Status information missing current	1	0	96	10	1	
Status information current without voltage	1	0	96	10	2	
Status information auxiliary power supply	1	0	96	10	3	
Manufacturer specific [d]	1	x	96	50	x	x
....						
Manufacturer specific	1	x	96	99	x	x

NOTE If a value field is shaded, then this value group is not used . “x” is equal to any value within the range.

[a] If a transformer ratio is expressed as a fraction the ratio is numerator, divided by denominator. If the transformer ratio is expressed by an integer or real figure, only the numerator is used.

[b] The codes for export active, reactive and apparent energy shall be used only if meters measuring import energy and meters measuring export energy are connected to the pulse inputs.

[c] Global status words with E = 0 contain the individual status words E = 1...5. The contents of the status words is not defined In this Technical Report.

[d] The range D = 50...99 is available for identifying objects, which are not represented by another defined code, but need representation on the display as well. If this is not required, the range D= 128...254 should be used.

It should be noted, that some of the codes above are normally used for display purposes only, as the related data items are attributes of objects having their own OBIS name.

5.6.3.2 Error messages – Electricity

Table 29 – Electricity related error messages

Electricity related error messages	OBIS code					
	A	B	C	D	E	F
Error object	1	x	97	97	x [a]	

NOTE If a value field is shaded, then this value group is not used. “x” is equal to any value within the range.

[a] If only one object is instantiated, the value shall be 0.

NOTE The information to be included in the error objects is not defined in this document.

5.6.3.3 List objects – Electricity

Table 30 – Electricity related list objects

General list objects	OBIS code					
	A	B	C	D	E	F
Electricity related data of billing period (with billing period scheme 1 if there are two schemes available)	1	x	98	1	x [a]	255 [b]
Electricity related data of billing period (with billing period scheme 2)	1	x	98	2	x [a]	255 [b]

[a] If only one object is instantiated, the value shall be 0.

[b] F = 255 means a wildcard here. See 5.7.3.

5.6.3.4 Data profile objects – Electricity

Electricity related data profiles – identified with one single OBIS code – are used to hold a series of measurement values of one or more similar quantities and/or to group various data.

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Table 31 – Profile codes – Electricity

Electricity data profile objects	OBIS-code					
	A	B	C	D	E	F
Load profile with recording period 1	1	X	99	1	x [a]	
Load profile with recording period 2	1	X	99	2	x [a]	
Load profile during test	1	X	99	3	0	
Dips voltage profile	1	X	99	10	1	
Swells voltage profile	1	X	99	10	2	
Cuts voltage profile	1	X	99	10	3	
Voltage harmonic profile	1	X	99	11	n[th]	
Current harmonic profile	1	X	99	12	n[th]	
Voltage unbalance profile	1	X	99	13	0	
Power failure event log	1	x	99	97	x [a]	
Event log	1	x	99	98	x [a]	
Certification data log	1	x	99	99	x [a]	

[a] "x" is equal to any value within the range. If only one object of each kind is instantiated, the value shall be 0.

5.6.3.5 Register table objects – Electricity

Register tables - identified with a single OBIS code - are defined to hold a number of values of the same type.

Table 32 – Register table object codes – Electricity

Register table objects	OBIS-code					
	A	B	C	D	E	F
UNIPEDE voltage dips, any phase	1	x	12	32		
UNIPEDE voltage dips, L_1	1	x	32	32		
UNIPEDE voltage dips, L_2	1	x	52	32		
UNIPEDE voltage dips, L_3	1	x	72	32		
Extended angle measurement	1	x	81	7		
General use, electricity related	1	x	98	10	x	

[a] "x" is equal to any value within the range. If only one object of each kind is instantiated, the value shall be 0.

5.6.4 Heat cost allocator related objects

5.6.4.1 General purpose objects – HCA

Table 33 – General purpose codes – Heat Cost Allocator

Heat Cost Allocator general purpose objects	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined ID	4	X	0	0		
ID 1	4	X	0	0	0	
…			…	…	…	
ID 10	4	X	0	0	9	
Storage information						

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Heat Cost Allocator general purpose objects	OBIS code					
	A	**B**	**C**	**D**	**E**	**F**
Status (VZ) of the historical value counter	4	X	0	1	1	
Number of available historical values	4	X	0	1	2	
Target date	4	X	0	1	10	
Billing date	4	X	0	1	11	
Configuration						
Program version no.	4	X	0	2	0	
Firmware version no.	4	X	0	2	1	
Software version no.	4	X	0	2	2	
Device measuring principle [a]	4	X	0	2	3	
Conversion factors						
Resulting rating factor, K	4	X	0	4	0	
Thermal output rating factor, K_Q	4	X	0	4	1	
Thermal coupling rating factor overall, K_C	4	X	0	4	2	
Thermal coupling rating factor room side, K_{CR}	4	X	0	4	3	
Thermal coupling rating factor heater side, K_{CH}	4	X	0	4	4	
Low temperature rating factor, K_T	4	X	0	4	5	
Display output scaling factor	4	X	0	4	6	
Threshold values						
Start temperature threshold	4	X	0	5	10	
Difference temperature threshold	4	X	0	5	11	
Period information						
Measuring period for average value	4	X	0	8	0	
Recording interval for consumption profile	4	X	0	8	4	
Billing period	4	X	0	8	6	
Manufacturer specific [b]	4	x	96	50	x	x
....						
Manufacturer specific	4	x	96	99	x	x

[a] This is an object of the type 'Data' enumerated, (0) single sensor, (1) single sensor + start sensor, (2) dual sensor, (3) tripple sensor

REMARK If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range

5.6.4.2 Error messages – HCA

Table 34 – HCA related error messages

HCA related error messages	OBIS code					
	A	**B**	**C**	**D**	**E**	**F**
Error object	4	x	97	97	x [a]	

NOTE If a value field is shaded, then this value group is not used. "*x*" is equal to any value within the range.

[a] If only one object is instantiated, the value shall be 0.

NOTE The information to be included in the error objects is not defined in this document.

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5.6.4.3 Data profile objects – HCA

HCA related data profiles – identified with one single OBIS code – are used to hold a series of measurement values of one or more similar quantities and/or to group various data.

Table 35 – Profile codes – HCA

HCA related data profile objects	OBIS code					
	A	B	C	D	E	F
Consumption profile	4	X	99	1	x [a]	
[a] "x" is equal to any value within the range. If only one object of each kind is instantiated, the value shall be 0.						

5.6.4.4 Object codes – HCA (examples)

Table 36 –Heat Cost Allocator related object codes (examples)

Heat Cost Allocator Media related objects	OBIS - code					
	A	B	C	D	E	F
Consumption						
Current unrated integral	4	X	1	0	0	
Current rated integral	4	X	2	0	0	
Rated integral, last set date	4	X	2	2	0	V_Z
Unrated integral, previous billing date	4	X	1	3	0	V_{Z-1}
Rated integral, two most recent periodical values	4	X	2	1	0	102
Monitoring values						
Radiator temperature, current value	4	X	3	0		
Flow temperature, test value	4	X	5	6		
Room temperature, minimum value	4	X	7	4		
REMARK If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range.						

5.6.5 Heat / cooling related objects

5.6.5.1 General purpose objects – Heat / cooling

Table 37 – General purpose codes – Heat / cooling

Heat / cooling related general purpose objects	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined ID	5/6	X	0	0		
ID 1	5/6	X	0	0	0	
…			…	…	…	
ID 10	5/6	X	0	0	9	
Storage information						
Status (VZ) of the historical /periodical value counter	5/6	X	0	1	1	[f]
Status (VZ) of the periodical value counter, period 1	5/6	X	0	1	1	1 [f]

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Heat / cooling related general purpose objects	OBIS code					
	A	B	C	D	E	F
Number of available historical / periodical values	5/6	X	0	1	2	[f]
Number of available periodical values for period 2	5/6	X	0	1	2	2 [f]
Set date	5/6	X	0	1	10	
Billing date	5/6	X	0	1	11	
Configuration						
Program version	5/6	X	0	2	0	
Firmware version	5/6	X	0	2	1	
Software version	5/6	X	0	2	2	
Meter location (flow or return) [a]	5/6	X	0	2	3	
Device version	5/6	X	0	2	4	
Serial number of flow temperature transducer	5/6	X	0	2	10	
Serial number of return temperature transducer	5/6	X	0	2	11	
Serial number of forward flow transducer	5/6	X	0	2	12	
Serial number of return flow transducer	5/6	X	0	2	13	
Conversion factors						
Heat koefficient, k	5/6	X	0	4	1	
Media pressure (backup value) [b]	5/6	X	0	4	2	
Media enthalphy [c]	5/6	X	0	4	3	
Threshold values						
Threshold value limit for rate 1 [d]	5/6	X	0	5	1	
…			…	…	…	
Threshold value limit for rate 9 [d]	5/6	X	0	5	9	
Maximum contracted flow rate [e]	5/6	X	0	5	21	
Maximum contracted power [e]	5/6	X	0	5	22	
Maximum contracted $\Delta\theta$ [e]	5/6	X	0	5	23	
Minimum contracted return temperature [e]	5/6	X	0	5	24	
Timing information						
Averaging period for measurements, generic	5/6	X	0	8	0	
Averaging period for instantaneous measurements	5/6	X	0	8	1	
Averaging period for volume / flow measurements	5/6	X	0	8	2	
Averaging period for temperature measurements	5/6	X	0	8	3	
Averaging period for pressure measurements	5/6	X	0	8	4	
Averaging period, power	5/6	X	0	8	5	
Averaging period, flow rate	5/6	X	0	8	6	
Averaging period, test values	5/6	X	0	8	7	
Measurement period, peak values, period 1(short) [g]	5/6	X	0	8	11	
Measurement period, peak values, period 2 [g]	5/6	X	0	8	12	
Measurement period, peak values, period 3 [g]	5/6	X	0	8	13	
Measurement period, peak values, period 4 [g]	5/6	X	0	8	14	
Measurement period, periodical values, period 1(short) [g]	5/6	X	0	8	21	
Measurement period, periodical values, period 2 [g]	5/6	X	0	8	22	
Measurement period, periodical values, period 3 [g]	5/6	X	0	8	23	
Measurement period, periodical values, period 4 [g]	5/6	X	0	8	24	

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Heat / cooling related general purpose objects	OBIS code					
	A	B	C	D	E	F
Measurement period, test values	5/6	X	0	8	25	
Recording interval 1 for profiles [h]	5/6	X	0	8	31	
Recording interval 2 for profiles [h]	5/6	X	0	8	32	
Recording interval 3 for profiles [h]	5/6	X	0	8	33	
Billing period	5/6	X	0	8	34	
Manufacturer specific [b]	5/6	x	96	50	x	x
....						
Manufacturer specific	5/6	x	96	99	x	x

[a] Information about where the (single) flow meter is inserted. A non-zero value is used when the flow meter is located in the flow path.

[b] Defines the pressure of the media, if not measured. The default value is 16 bar according to EN 1434-2: 1997

[c] The enthalpy of the thermal conveying liquid. This will be necessary when using media other than pure water. The enthalpy is a part of the calculations when converting from mass to power.

[d] Part of the contract between the customer and the supplier. The threshold defines when to switch rate, and can be used for diagnostic purposes, or to control limiting valves as well.

[e] Part of the contract between the customer and the supplier. The threshold may be used to set a 'flag', for diagnostic purposes, or to control limiting valves.

[f] Value group 'F' may be left unused, if there is only one set of historical / periodical values in the meter.

[g] The instantiation of periods in a meter shall always start at period 1.

[h] If only one recording interval is implemented, then it shall be recording interval 1. If multiple recording intervals are implemented, the recording interval 1 shall be the interval with the shorter period.

REMARKS

If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range.

This table is applicable to heat as well as cooling metering.

5.6.5.2 Error messages – Heat / cooling

Table 38 – Heat / cooling related error messages

Heat / cooling related error messages	OBIS code					
	A	B	C	D	E	F
Error object	5/6	x	97	97	x [a]	

NOTE If a value field is shaded, then this value group is not used. “*x*” is equal to any value within the range.

[a] If only one object is instantiated, the value shall be 0.

NOTE The information to be included in the error objects is not defined in this document.

5.6.5.3 Data profile objects – Heat / cooling

Heat / cooling related data profiles – identified with one single OBIS code – are used to hold a series of measurement values of one or more similar quantities and/or to group various data.

Table 39 – Profile codes – Heat / cooling

Heat / cooling related data profile objects	OBIS code					
	A	B	C	D	E	F
Consumption / load profile with recording interval 1	5/6	X	99	1	1	X [a]
Consumption / load profile with recording interval 2	5/6	X	99	1	2	X [a]
Consumption / load profile with recording interval 3	5/6	X	99	1	3	X [a]

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Heat / cooling related data profile objects	OBIS code					
	A	B	C	D	E	F
Profile of maxima with recording interval 1	5/6	X	99	2	1	X [a]
Profile of maxima with recording interval 2	5/6	X	99	2	2	X [a]
Profile of maxima with recording interval 3	5/6	X	99	2	3	X [a]
Consumption / load profile during test	5/6	X	99	3	1	X [a]
Certification data log	5/6	X	99	99	X [j]	
[a] "x" is equal to any value within the range. If only one object of each kind is instantiated, the value shall be 0.						

5.6.5.4 Object codes – Heat / cooling (examples)

Table 41 – Heat / cooling related object codes (examples)

Heat / cooling Media related objects	OBIS - code					
	A	B	C	D	E	F
Consumption						
Energy, current value, total	5/6	X	1	0	0	
Energy, current value, rate 1	5/6	X	1	0	1	
Energy, periodical, total, the two last storages	5/6	X	1	1	0	102
Energy, billing date value, total, last storage, rate 1	5/6	X	1	3	1	V_Z
Monitoring values						
Energy, maximum value (current period)	5/6	X	1	5		
Flow rate, Period value 2, previous storage	5/6	X	9	12		V_{Z-1}
Power, Max value, previous period	5/6	X	8	5		V_{Z-1}
Energy, Missing duration [c]	5/6	X	1	25		
Differential temperature, Test value	5/6	X	12	6		
Flow path, temperature transducers serial no.	5/6	X	0	2	10	
Collection of data with interval 1using a profile [a]	5/6	X	99	1	1	0
Error handling						
Overall error status [b]	5/6	X	97	97	0	
Subsystem where error has occurred [d]	5/6	X	97	97	1	
Duration of error condition [c]	5/6	X	97	97	2	

[a] This show the use of the object type profile, designed to capture objects periodically. No profiles have been predefined for heat meters.

[b] This object is a 'mirror' of the object 0.X.97.97.0.

[c] This is the time during which the meter has not been able to calculate energy.

[d] A further subdivision of error information.

REMARK If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range.

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5.6.6 Gas related objects

5.6.6.1 General purpose objects – Gas

Table 41 – General purpose codes – Gas

Gas related general purpose objects	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined ID	7	X	0	0		
ID 1	7	X	0	0	0	
…			…	…	…	
ID 10	7	X	0	0	9	
Historical value/reset counter entries						
Status (VZ) of the historical value counter	7	X	0	1	0	
Number of available historical values	7	X	0	1	1	
Time stamp of the historical value VZ (last reset)	7	X	0	1	2	VZ
Time stamp of the historical value VZ_{-1}	7	X	0	1	2	VZ_1
…			…	…	…	
Time stamp of the historical value VZ_{-n}	7	X	0	1	2	VZ_n
Configuration						
Program version	7	X	0	2	0	
Firmware version	7	X	0	2	1	
Software version	7	X	0	2	2	
Device version	7	X	0	2	3	
Pressure sensor, serial no.	7	X	0	2	11	
Temperature sensor, serial no.	7	X	0	2	12	
Calculator, serial no.	7	X	0	2	13	
Volume sensor, serial no.	7	X	0	2	14	
Output pulse constants converted/unconverted						
Volume Forward Unconverted	7	X	0	3	0	
Volume Reverse Unconverted	7	X	0	3	1	
Volume Absolute [b] Unconverted	7	X	0	3	2	
Volume Forward Converted	7	X	0	3	3	
Volume Reverse Converted	7	X	0	3	4	
Volume Absolute [b] Converted	7	X	0	3	5	
Conversion factors						
{This area is to be used for polynomials, constants	7	X	0	4	0	
for conversion, and similar}	7	X	0	4	1	
…	7	X	0	4	2	
	7	X	0	4	3	
	7	X	0	4	4	
Threshold values						
Threshold power for over-consumption limit 1	7	X	0	5	1	1

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Gas related general purpose objects	OBIS code					
	A	B	C	D	E	F
…			…	…	…	…
limit 4	7	X	0	5	1	4
Threshold limit for rate 1	7	X	0	5	2	1
…			…	…	…	
limit for rate 9	7	X	0	5	2	9
Maximum contracted consumption for rec. interval 1	7	X	0	5	3	
Maximum contracted consumption for rec. interval 2	7	X	0	5	4	
Absolute temperature, minimum limit setting [c]	7	X	0	5	11	
Absolute temperature, maximum limit setting [c]	7	X	0	5	12	
Absolute pressure, minimum limit setting [c]	7	X	0	5	13	
Absolute pressure, maximum limit setting [c]	7	X	0	5	14	
Nominal values volume sensor						
Pressure	7	X	0	6	1	
Temperature	7	X	0	6	2	
Qmin	7	X	0	6	3	
Qmax	7	X	0	6	4	
Input pulse constants						
Volume Forward Unconverted	7	X	0	7	0	
Volume Reverse Unconverted	7	X	0	7	1	
Volume Absolute Unconverted	7	X	0	7	2	
Volume Forward Converted	7	X	0	7	3	
Volume Reverse Converted	7	X	0	7	4	
Volume Absolute Converted	7	X	0	7	5	
Measurement-/registration-period duration						
Measurement period 1, for average value 1	7	X	0	8	3	
Measurement period 2, for average value 2	7	X	0	8	4	
Measurement period 3, for instantaneous value	7	X	0	8	5	
Measurement period 4, for test value	7	X	0	8	6	
Recording interval 1, for profile [d]	7	X	0	8	1	
Recording interval 2, for profile [d]	7	X	0	8	2	
Billing period	7	X	0	8	10	
Time entries						
Number of days since last reset	7	X	0	9	0	
Manufacturer specific [b]	7	x	96	50	x	x
....						
Manufacturer specific	7	x	96	99	x	x

[a] Absolute in the sense that negative volume is summed as positive ABS()

[b] A volume sensor, could be an external mechanical meter/encoder/electronic index.

[c] An absolute temperature outside these limits may affect the error status of the device

[d] If multiple recording intervals are implemented, then recording interval 1 shall be the shorter

[e] A sequence of maximum value sets

REMARK If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range

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5.6.6.2 Error messages – Gas

Table 42 – Gas related error messages

Gas related error messages	OBIS code					
	A	B	C	D	E	F
Error object	7	x	97	97	x [a]	
NOTE If a value field is shaded, then this value group is not used. "*x*" is equal to any value within the range.						
[a] If only one object is instantiated, the value shall be 0.						

NOTE The information to be included in the error objects is not defined in this document.

5.6.6.3 Data profile objects – Gas

Gas related data profiles – identified with one single OBIS code – are used to hold a series of measurement values of one or more similar quantities and/or to group various data.

Table 43 – Profile codes – Gas

Gas related data profile objects	OBIS code					
	A	B	C	D	E	F
Load profile with recording interval 1	7	X	99	1	0	
Load profile with recording interval 2	7	X	99	2	0	
Profile of maxima with recording interval 1	7	X	99	3	0	
Profile of maxima with recording interval 2	7	X	99	4	0	
Event log	7	X	99	98	0	
Certification data log	7	X	99	99	0	
[a] "x" is equal to any value within the range. If only one object of each kind is instantiated, the value shall be 0.						

5.6.6.4 Object codes – Gas (examples)

Table 44 – Gas related object codes (examples)

Gas Media related objects	OBIS - code					
	A	B	C	D	E	F
Consumption						
Unconverted Volume "Index", (V_m)	7	X	23	0	0	
Error-Corrected Volume, (V_c)	7	X	23	1	0	
Converted Volume, (V_b) [a]	7	X	23	2	0	
Energy "Index", (E)	7	X	33	2	0	
Monitoring values						
Maximum consumption in current interval 1, (V_m) [j]	7	X	23	0	3	
Maximum consumption in current interval 1, (V_b) [j]	7	X	23	2	3	
Maximum consumption in current interval 1, (E) [j]	7	X	33	2	3	
Maximum consumption in current interval 2, (V_m) [j]	7	X	23	0	4	
Maximum consumption in current interval 2, (V_b) [j]	7	X	23	2	4	
Maximum consumption in current interval 2, (E) [j]	7	X	33	2	4	

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Gas	OBIS - code					
Media related objects	**A**	**B**	**C**	**D**	**E**	**F**
Constants and calculated results						
Correction Factor, (C_f) [b]	7	X	51	0	0	
Calorific Value, measured (CalValue) [c]	7	X	54	0	0	
Conversion Factor, (C) [d]	7	X	52	0	0	
Actual compressibility (Z) [e]	7	X	53	0	0	
Base compressibility(Z_b) [e]	7	X	53	2	0	
Preset compressibility: used where a fixed value of Z is assumed [e]	7	X	53	11	0	
Compressibility method:Usually a text string, SGERG88, AGA8, AGANX19, etc [e]	7	X	53	12	0	
Metering Site Condition Information						
Current Pressure (P) [f]	7	X	42	0	0	
Base Pressure (P_b) [f]	7	X	42	2	0	
Backup Pressure value [f]	7	X	42	3	0	
Preset Pressure value: used for conversion devices without a pressure sensor [f]	7	X	42	11	0	
Current Temperature (T) [g]	7	X	41	0	0	
Base Temperature (T_b) [g]	7	X	41	2	0	
Backup Temperature (Used if temp sensor fails) [g]	7	X	41	3	0	
Velocity of sound [h]	7	X	44	0	0	

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Gas Media related objects	OBIS - code					
	A	B	C	D	E	F

[a] The “C” field value is 23, because it is assumed that the most common arrangement of commercial/industrial meter installation applies : that is a Meter, connected to a Volume Converter, connected to a Datalogger.

[b] A fixed value used to correct a scalar error on a meter : for example, if a meter under-registers volume by 0,5 %, then a correction factor value of 1,005 will compensate for the error.

[c] CV is the energy that may be gained from the combustion of a standard volume of gas at base conditions, or at a pre-set density.

[d] Conversion factor. A factor that is used to convert “unconverted volume” to “converted volume”. This factor is usually calculated as :

$Pm \times Tb \times Zm \,/\, Pb \times Tm \times Zb$, where

Pm = measured pressure ;
Pb = base pressure ;
Tm = measured temperature ;
Tb = base temperature ;
Zm = “measured” compressibility ;
Zb = base compressibility.

Annex B gives full information on this topic.

[e] Compressibility : Z: effectively, the “difference” in compressibility between the gas being measured and “noble” gas. SGERG-88 and EN 12405 give full information on this, though below 1,5 Bar (a) this is usually set to 1.

[f] Pressure of Gas, expressed in a suitable unit, in absolute terms, for example Bar(a). This means that the value is referenced to a perfect vacuum, as opposed to “Gauge” pressure, which is referenced to current atmospheric conditions. This may represent a measured value or a base condition, dependent on the value of value group D.

[g] Temperature of Gas, expressed in Kelvin. Volume conversion depends on Kelvin temperature measurement. This may represent a measured value or a base condition, dependent on the value of value group D.

[h] Velocity of sound. Ultrasonic meters can almost always determine the velocity of sound of the gas, and it is a useful indication of the gas condition. It is worth noting that large changes of Velocity of sound in the gas may represent changes in gas composition, or condition.

[j] The interval is related to a tariff, as a part of the contract between the customer and the supplier. The interval is typically hour and day.

REMARK If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range.

5.6.7 Water related objects

5.6.7.1 General purpose objects – Water

Table 45 – General purpose codes – Water

Water related general purpose objects	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined ID	8/9	X	0	0		
ID 1	8/9	X	0	0	0	
…			…	…	…	
ID 10	8/9	X	0	0	9	
Storage information						
Status (VZ) of the historical value counter	8/9	X	0	1	1	
Number of available historical values	8/9	X	0	1	2	
Due date	8/9	X	0	1	10	
Billing date	8/9	X	0	1	11	
Billing date period	8/9	X	0	1	12	
Program Entries						
Program version no.	8/9	X	0	2	0	
Device version no.	8/9	X	0	2	3	

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Water related general purpose objects	OBIS code					
	A	B	C	D	E	F
Threshold values						
Contracted maximum consumption	8/9	X	0	5	1	
Input pulse constants						
Volume forward	8/9	X	0	7	1	
Measurement-/registration-period duration						
Recording interval for load profile	8/9	X	0	8	1	
Manufacturer specific [b]	8/9	x	96	50	x	x
....						
Manufacturer specific	8/9	x	96	99	x	x
REMARK If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range						

5.6.7.2 Error messages – Water

Table 46 – Water related error messages

Water related error messages	OBIS code					
	A	B	C	D	E	F
Error object	8/9	x	97	97	x [a]	
NOTE If a value field is shaded, then this value group is not used. "*x*" is equal to any value within the range.						
[a] If only one object is instantiated, the value shall be 0.						

NOTE The information to be included in the error objects is not defined in this document.

5.6.7.3 Data profile objects – Water

Water related data profiles – identified with one single OBIS code – are used to hold a series of measurement values of one or more similar quantities and/or to group various data.

Table 47 – Profile codes – Water

Water related data profile objects	OBIS code					
	A	B	C	D	E	F
Consumption/load profile	8/9	X	99	1	x [a]	
[a] "x" is equal to any value within the range. If only one object of each kind is instantiated, the value shall be 0.						

5.6.7.4 Object codes – Water (examples)

Table 48 – Water related object codes (examples)

Water meters Media related objects	OBIS - code					
	A	B	C	D	E	F
Consumption						
Current index, total	8/9	X	1	0	0	
Current index, tariff 1	8/9	X	1	0	1	
Current index, periodical, total, the two last periods	8/9	X	1	1	0	102

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Water meters	**OBIS - code**					
Media related objects	**A**	**B**	**C**	**D**	**E**	**F**
Monitoring values						
Flow rate, maximum value, prev. period	8/9	X	2	5	0	V_{Z-1}
Forward temperature, billing date value, last billing period	8/9	X	3	3	0	101
REMARK If a value field is shaded, then this value group is not used. "X" is equal to any value inside the allowed range						

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5.7 Code presentation

5.7.1 Reduced ID codes (e.g. for IEC 62056-21)

To comply with the syntax defined for protocol modes A to D of IEC 62056-21, the range of ID codes is reduced to fulfil the limitations which are usually applied to the number of digits and the ASCII representation of them. All value groups are limited to a range of 0…99 and within that range, to the limits given in the relevant chapters.

Some value groups may be suppressed, if they are not relevant to an application:

optional value groups: A, B, E, F;
mandatory value groups: C, D.

To allow the interpretation of shortened codes delimiters are inserted between all value groups, see Figure 12:

A -	**B :**	**C .**	**D**	**. E**	*** F**

IEC 304/02

Figure 12 – Reduced ID code presentation

The delimiter between value groups E and F can be modified to carry some information about the source of a reset (& instead of * if the reset was performed manually).

The manufacturer shall ensure that the combination of the OBIS code and the interface class uniquely identifies each COSEM object.

5.7.2 Display

The usage of OBIS codes to display values is normally limited in a similar way as for data transfer, for example according to IEC 62056-21.

Some codes may be replaced by letters to clearly indicate the differences from other data items [4]:

Table 49 – Example of display code replacement

Value group C	
OBIS code	**Display code**
96	C
97	F
98	L
99	P

5.7.3 Special handling of value group F

Unless otherwise specified, the value group F is used for the identification of values of billing periods.

[4] The letter codes may also be used in protocol modes A to D.

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The billing periods can be identified relative to the status of the billing period counter or relative to the current billing period.

For electricity, there are two billing period schemes available in Table 28, each scheme defined by the length of the billing period, the billing period counter, the number of available billing periods and the time stamps of the billing period. See also 5.4.6.2.

With $0 \leq F \leq 99$, a single billing period is identified relative to the value of the billing period counter, VZ. If the value of the value group of any OBIS code is equal to VZ, this identifies the most recent (youngest) billing period. VZ_{-1} identifies the second youngest, etc. The billing period counter may have different operating modes, for example modulo-12 or modulo-100. The value after reaching the limit of the billing period counter is 0 for the operating mode modulo-100 and 1 for other operating modes (for example modulo-12).

With $101 \leq F \leq 125$, a single billing period or a set of billing periods are identified relative to the current billing period. F=101 identifies the last billing period, F = 102 the second last / two last billing periods, etc., F = 125 identifies the 25th last / 25 last billing periods.

F = 126 identifies an unspecified number of last billing periods, therefore it can be used as a wildcard.

F=255 means that the value group F is not used, or identifies the current billing period value(s).

For use of interface classes for representing values of historical billing periods, see 4.6.1.

.

Table 50 – Value group F - Billing periods

Value group F	
VZ	Most recent value
VZ_{-1}	Second most recent value
VZ_{-2}	Third most recent value
VZ_{-3}	Fourth most recent value
VZ_{-4}	…
etc.	
101	Last value
102	Second / two last value(s)
….	
125	25th/25 last value(s)
126	Unspecified number of last values

5.7.4 COSEM

The usage of OBIS codes in the COSEM environment is defined in Clause 4.6.

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