EXCERPT FROM

Companion Specification
for Energy Metering

COSEM

Identification System and Interface Classes

DLMS User Association

device
language
message
specification

Reference number: EXCERPT FROM DLMS UA 1000-1:2010, Ed. 10.0, 2010-08-26

Table of Contents

1. Foreword

Copyright

Acknowledgement

The actual document has been established by the DLMS UA Working Groups.

2. Scope

The DLMS/COSEM specification specifies a data model and communication protocols for data exchange with metering equipment. It follows a three-step approach as illustrated in Figure 1:

Step 1, Modelling: This covers the data model of metering equipment as well as rules for data identification. The data model provides a view of the functionality of the meter, as it is available at its interface(s). It uses generic building blocks to model this functionality. The model does not cover internal, implementation-specific issues.

Step 2, Messaging: This covers the communication services and protocols for mapping the elements of the data model to application protocol data units (APDU).

Step 3, Transporting: This covers the services and protocols for the transportation of the messages through the communication channel.

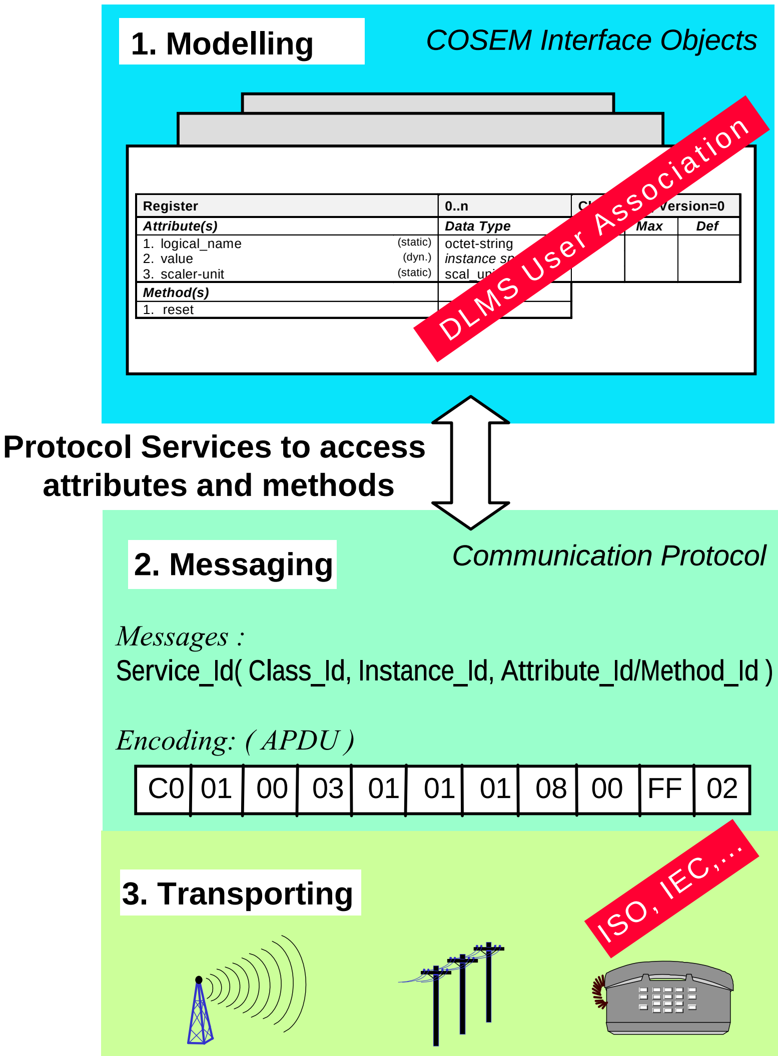


Figure 1 – The three steps approach of DLMS/COSEM: Modelling – Messaging – Transporting

Step 1 is specified in this document. It specifies the COSEM interface classes (ICs), the OBIS object identification system, and the use of interface objects for modelling the various functions of the metering equipment.

Step 2 and 3 are specified in DLMS UA 1000-2 Ed. 7.0. It specifies communication profiles for various communication media and the protocol layers of these communication profiles. The top layer in any profile is the COSEM application layer. It provides services to establish a logical connection between the client and the server(s). It also provides the xDLMS messaging services to access attributes and methods of the COSEM interface objects. The lower, communication profile specific protocol layers transport the information.

Rules for conformance testing are specified in the “Yellow Book”, DLMS UA 1001-1 "DLMS/COSEM Conformance Test Process".

Terms are explained in the “White book” DLMS UA 1002, "COSEM Glossary of Terms".

3. Introduction

3.1 Object modelling and data identification

Driven not only by the business needs of utilities – often in a deregulated competitive market – but also by the increasing desire to manage natural resources efficiently as regards production, distribution and use, the utility meter is increasingly part of an integrated metering, control, and billing system. Not only at grid level but, with the advent of initiatives to involve consumers in energy and resource management, in industry and even down to the domestic level, the meter is no simple data recording device but relies critically on communication capabilities, system integration and interoperability.

COSEM, the Companion Specification for Energy Metering, addresses these challenges by looking at the meter as an integrated part of a communication system which requires above all the ability to convey measurements of the delivered product (energy) from the diverse points where these measurements are made to the business processes which use them, over a variety of connecting media. Such systems must also have the scope to include a gamut of additional information and to support setup and control functions which allow to operate the meter remotely at virtually all times.

COSEM achieves all this in a way which is essentially non-proprietary and does not make assumptions about the technical processes in place within the meter. Using *object modelling* techniques established in the world of information science the data to be supplied by the meter is defined in a standard way that is accessible to the utility's business processes and relevant parts of its behaviour are similarly represented, while the communications is defined following the *Open Systems Interconnection* that is fundamental to the telecommunications world. The formal specification of interface classes and objects, which enables this, forms a major part of COSEM.

To allow further analysis of information, for the purposes of billing, load-, customer- and contract management, it is necessary to uniquely identify data items, whether collected manually or automatically, via local or remote data exchange, in a manufacturer-independent way. The definition of identification codes to achieve this – the OBIS 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.*

The COSEM model represents the meter as a server – see 4.1.7– used by client applications that retrieve data from, provide control information to, and instigate known actions within the meter via controlled access to the attributes and specific methods of objects making up the server interface. This client may be supporting the business processes of utilities, customers, meter operators, or meter manufacturers.

The information content and abilities of the server are not fixed; instead the standardized objects and interface classes (ICs) form an extensible library from which the manufacturer can assemble (model) its products according to national specifications or contract requirements. As a key element the server offers means to retrieve its particular structural model (the list of logical devices and the list of objects visible through the interface). The library is designed so that the entire range of products (from residential to commercial, industrial, and transmission and distribution applications) can be covered. The choice of the subset of ICs used to build a meter, and the instantiation and implementation of those ICs 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.

3.2 Referenced documents

Ref.	Title
DLMS UA 1000-2 Ed. 7.0:2009	*DLMS/COSEM Architecture and Protocols, the "Green Book"*
DLMS UA 1001-1, Ed. 3.0:2007	*DLMS/COSEM Conformance test and certification process, the "Yellow Book"* *NOTE The Yellow Bok is under revision to be aligned with Green Book Edition 7.0 and Blue Book Edition 10.0.*
DLMS UA 1002, Ed. 1.0:2003	*COSEM Glossary of terms, the "White Book"*
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*
EN 1434-2:1997	*Heat meters – Part 2: Constructional requirements*
EN 12405-1:2005 + EN 12405-1/A1:2006	*Gas meters – Conversion devices – Part 1: Volume conversion*
EN 13757-1:2002	*Communication system for meters and remote reading of meters – Part 1: Data exchange*
EN 13757-2:2002	*Communication system for meters and remote reading of meters – Part 2: Physical and Link layer*
EN 13757-3:2004	*Communication systems for and remote reading of meters – Part 3: Dedicated application layer*
EN 13757-5:2008	*Wireless meter readout — Communication systems for meters and remote reading of meters — Part 5: Relaying*
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 61334-4-1 Ed. 1.0:1996	*Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 1: Reference model of the communication system*
IEC 61334-4-32 Ed. 1.0:1996	*Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 32: Data link layer – Logical link control (LLC)*
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 61334-4-511 Ed. 1.0:2000	*Distribution automation using distribution line carrier systems – Part 4-511: Data communication protocols – Systems management – CIASE protocol*
IEC 61334-4-512 Ed. 1.0:2001	*Distribution automation using distribution line carrier systems – Part 4-512: Data communication protocols – System management using profile 61334-5-1 – Management Information Base (MIB)*
IEC 61334-5-1 Ed. 2.0:2001	*Distribution automation using distribution line carrier systems – Part 5-1: Lower layer profiles – The spread frequency shift keying (S-FSK) profile*
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. 1.1:2007	*Electricity metering – Data exchange for meter reading, tariff and load control –*

Ref.	Title
	Part 46: Data link layer using HDLC protocol
IEC 62056-47 Ed. 1.0:2006	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 47: COSEM transport layers for IPv4 networks*
IEC 62056-53 Ed. 2.0:2006	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 53: COSEM Application layer*
IEC 62056-61 Ed. 2.0:2006	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: Object identification system (OBIS)*
IEC 62056-62 Ed. 2.0:2006	*Electricity metering – Data exchange for meter reading, tariff and load control – Part 62: Interface classes*
ISO/IEC 8802-2 Ed. 3.0:1998	*IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements – Part 2: Logical Link Control*
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*
ISO/IEC 10646:2003(E)	*ISO/CEI 10646:2003(E) Information technology – Universal Multiple-Octet Coded Character Set (UCS)*
IETF STD 0005:1981	Internet Engineering Task Force (IETF): *Internet Protocol. J. Postel. September 1981. (Also IETF RFC0791, RFC0792, RFC0919, RFC0922, RFC0950, RFC1112)* Available from: http://www.faqs.org/rfcs/std/std5.html
IETF STD 0051:1994	Internet Engineering Task Force (IETF): *The Point-to-Point Protocol (PPP). W. Simpson, Ed.. July 1994. (Also RFC1661, RFC1662)* Available from: http://www.faqs.org/rfcs/std/std51.html
NOTE See also the Bibliography.	

3.3 Terms, Definitions and Abbreviations

Abbreviation	Explanation
AA	Application Association
AARE	Application Association Response
AARQ	Application Association ReQuest
ACSE	Association Control Service Element
AGA	American Gas Association
AGA 8	Method for calculation of compressibility (Gas metering)
AL	Application layer
AP	Application process
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 a COSEM interface class
CtoS	Client to Server challenge
DHCP	Dynamic Host Control Protocol
DLMS	Device Language Message Specification

Abbreviation	Explanation
DNS	Domain Name Server
EAP	Extensible Authentication Protocol
GCM	Galois/Counter Mode, an algorithm for authenticated encryption with associated data
GMT	Greenwich Mean Time. Replaced by Coordinated Universal Time (UTC).
GPS	Global Positioning System
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HART	Highway Addressable Remote Transducer see http://www.hartcomm.org/ (in relation with the Sensor manager interface class)
HDLC	High-level Data Link Control
HLS	High Level Security
IANA	Internet Assigned Numbers Authority
IC	Interface Class
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IETF	Internet Engineering Task Force
IP	Internet Protocol
IPCP	Internet Protocol Control Protocol
IT	Information Technology
ISO	International Organization for Standardization
KEK	Key Encryption Key
LCP	Link Control Protocol
LLC	Logical Link Control (Sublayer)
LLS	Low Level Security
LN	Logical Name
LSB	Least Significant Bit
m	mandatory
MD5	Message Digest Algorithm 5
MID	Measuring Instruments Directive 2004/22/EC
MSB	Most Significant Bit
o	optional
OBIS	OBject Identification System
PAP	Password Authentication Protocol
PDU	Protocol Data Unit
PIN	Personal Identity Number
PLMN	Public Land Mobile Network
PPP	Point-to-Point Protocol
PSTN	Public Switched Telephone Network
PUK	Personal Unblocking Key
ROHC	Robust Header Compression
SAP	Service Access Point
SGERG88	Method for calculation of compressibility (Gas metering)
SMS	Short Message Service

Abbreviation	Explanation
SMTP	Simple Mail Transfer Protocol
SN	Short Name
StoC	Server to Client Challenge
UTC	Coordinated Universal Time

4. COSEM interface classes

4.1 Basic principles

4.1.1 General

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

For specification purposes, this standard uses the technique of object modelling.

An object is a collection of attributes and methods. Attributes represent the characteristics of an object. The value of an attribute may affect the behaviour of an object. The first attribute of 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 IC, identified with a class_id. Within a specific IC, the common characteristics (attributes and methods) are described once for all objects. Instantiations of ICs are called COSEM interface objects.

Manufacturers may add proprietary methods and attributes to any object; see 4.1.2.

Figure 2 illustrates these terms by means of an example:

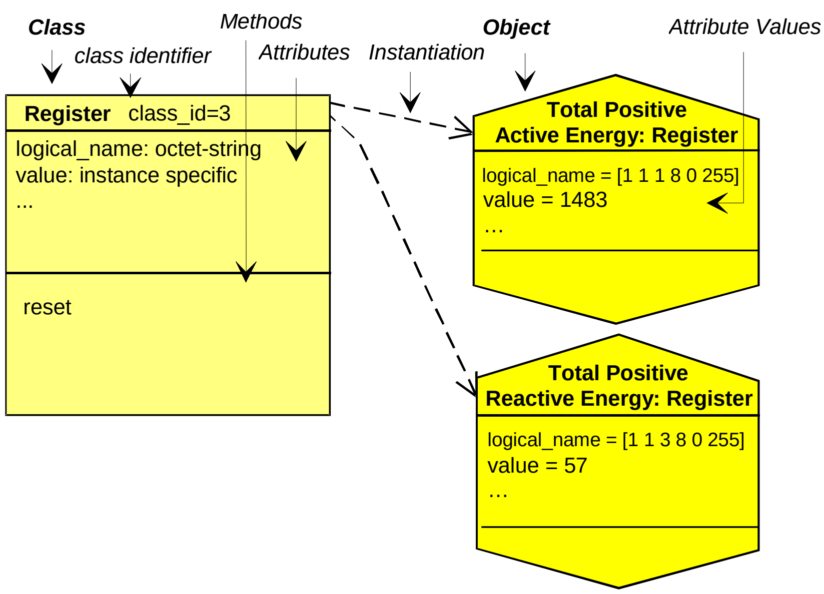


Figure 2 – An interface class and its instances

The IC “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 (data collection system, 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 objects. In the example of Figure 2, the meter contains two registers; i.e. two specific instances of the IC "Register" are instantiated. Through the instantiation, one COSEM object becomes a "total, positive, active energy register" whereas the other becomes a "total, positive, reactive energy register".

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

4.1.2 Referencing methods

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

Using logical names (LN referencing): In this case, the attributes and methods of a COSEM interface 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 attribute required. Attribute indexes are specified in the definition of each IC. They are positive numbers starting with one. Proprietary attributes may be added: these shall be identified with negative numbers;
- method_index is used as the identifier of the method required. Method indexes are specified in the definition of each IC. They are positive numbers starting with one. Proprietary methods may be added: these shall be identified with negative numbers.

Using short names (SN referencing): 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. See IEC 61334-4-41:1996 and Clause 9.5 of DLMS UA 1000-2 Ed. 7.0.

4.1.3 Reserved base_names for special COSEM objects

In order to facilitate access to devices using SN referencing, some short_names are reserved as base_names for special COSEM objects. The range for reserved base_names is from 0x**FA00** to 0x**FFF8**. The following specific base_names are defined:

Table 1 – Reserved base_names for SN referencing

Base_name (objectName)	COSEM object
0xFA00	Association SN
0xFB00	Script table (instantiation: "broadcast_script_table")
0xFC00	SAP assignment
0xFD00	"Data" or "Register" object containing the "COSEM logical device name" in the attribute "value"

4.1.4 Class description notation

This subclause describes the notation used to define the ICs.

A short text describes the functionality and application of the IC. A table gives an overview of the IC including the class name, the attributes, and the methods. Each attribute and method must be described in detail. The template is shown below.

Class name		**Cardinality**	**class_id, version**			
Attribute(s)		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. …	(…)	…				x + 0x…
3. …	(…)	…				x + 0x…
Specific methods (if required)		***m/o***				
1.		…				x + 0x…
2.		…				x + 0x…
3.		…				x + 0x…

Class name	Describes the interface class (for example “Register”, “Clock”, “Profile generic”...)
Cardinality	Specifies the number of instances of the IC within a logical device (see 4.1.8). *value* The IC shall be instantiated exactly “value” times. *min...max.* The IC shall be instantiated at least “min.” times and at most “max.” times. If min. is zero (0) then the IC is optional, otherwise (min. > 0) "min." instantiations of the IC are mandatory.
class_id	Identification code of the IC (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. 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 ICs. Class_id-s from 32 768 to 65 535 are reserved for user group specific ICs. The DLMS UA reserves the right to assign ranges to individual manufacturers or user groups.
Version	Identification code of the version of the IC. The version of each object is retrieved together with the class_id and the logical name by reading the object_list attribute of an “Association LN” / ”Association SN” object. **Within one logical device, all instances of a certain IC must be of the same version.**
Attribute(s)	Specifies the attribute(s) that belong to the IC. (*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). NOTE There are some attributes which may be either static or dynamic depending on the application. In these cases this property is not indicated.

logical_name	octet-string	The logical name is always the first attribute of an IC. It identifies the instantiation (COSEM object) of this IC. The value of the logical_name conforms to OBIS; see clauses 4.12 and 5.
Data type	Defines the data type of an attribute; see 4.1.5.	
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 IC definition.
Short name	When Short Name (SN) referencing is used, each attribute and method of object instances have to be mapped to short names. The base_name x of each object instance is the DLMS named variable the logical name attribute is mapped to. It is selected in the implementation phase. The IC definition specifies the offsets for the other attributes and for the methods.	
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 COSEM object(s) instantiated.

NOTE Services for accessing attributes or methods by the protocol are described in Clause 9 of DLMS UA 1000-2 Ed. 7.0.

Selective access

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.

4.1.5 Common data types

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

Table 2 – 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	
	[11]	Tag of the “time” type in IEC 61334-4-41:1996, not usable in DLMS/COSEM. See tag [27]	
UTF8-string	[12]	An ordered sequence of characters encoded as UTF-8	
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 IC specification.	
float32	[23]	OCTET STRING (SIZE(4))	For formatting, see 4.1.6.2.
float64	[24]	OCTET STRING (SIZE(8))	
date_time	[25]	OCTET STRING SIZE(12))	For formatting, see 4.1.6.1.
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 IC specification.	
structure	[2]	The elements of the structure are defined in the “Attribute description” section of a COSEM IC specification.	
compact array	[19]	The elements of the compact array are defined in the “Attribute description” section of a COSEM IC 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 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 IC specification.	

[a] The tags are as defined in Clause 9.5 of DLMS UA 1000-2 Ed. 7.0.

4.1.6 Data formats

4.1.6.1 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 IC definition.

NOTE 1 In future versions of ICs and in newly defined ICs, the data types *date, time* and *date_time* will be used as appropriate.

NOTE 2 The (SIZE( )) specifications 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 dayOfMonth and dayOfWeek:

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

The elements dayOfMonth and dayOfWeek shall be interpreted together:

- if last dayOfMonth is specified (0xFE) and dayOfWeek is wildcard, this specifies the last calendar day of the month;
- if last dayOfMonth is specified (0xFE) and an explicit dayOfWeek 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 year is not specified (FFFF), and dayOfMonth and dayOfWeek are both explicitly specified, this shall be interpreted as the dayOfWeek on, or following dayOfMonth;
- if the year and month are specified, and both the dayOfMonth and dayOfWeek are explicitly specified but the values are not consistent it shall be considered as an error.

Examples:

- year = 0xFFFF, month = FF, dayOfMonth = 0xFE, dayofWeek = 0xFF: last day of the month in every year and month;
- year = 0xFFFF, month = FF, dayOfMonth = 0xFE, dayofWeek = 0x07: last Sunday in every year and month;
- year = 0xFFFF, month = 0x03, dayOfMonth = 0xFE, dayofWeek = 0x07: last Sunday in March in every year;
- year = 0xFFFF, month = 0x03, dayOfMonth = 0x01, dayofWeek = 0x07: first Sunday in March in every year;
- year = 0xFFFF, month = 0x03, dayOfMonth = 0x16, dayofWeek = 0x05: fourth Friday in March in every year;
- year = 0xFFFF, month = 0x0A, dayOfMonth = 0x16, dayofWeek = 0x07: fourth Sunday in October in every year;
- year = 0x07D9, month = 0x01, dayOfMonth = 0x13, dayofWeek = 0x01: 2009.01.19, Monday;
- year = 0x07D9, month = 0x01, dayOfMonth = 0x13, dayofWeek = 0x02 : error, as the dayOfMonth and dayOfWeek in the given year and month do not match.

time OCTET STRING (SIZE(4))

```
{
        hour,
        minute,
        second,
        hundredths
}
```

hour:	interpreted as unsigned range 0…23, 0xFF,
minute:	interpreted as unsigned range 0…59, 0xFF
second:	interpreted as unsigned range 0…59, 0xFF,
hundredths:	interpreted as unsigned range 0…99, 0xFF

For hour, minute, second and hundredths: 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,
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 at the actual moment is 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).

4.1.6.2 Floating point number formats

Floating point number formats are defined in IEC 60559.

NOTE For the following, IEC 60559 is equivalent to **Fehler! Verweisquelle konnte nicht gefunden werden.**.

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 (if 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:

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.

4.1.7 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.

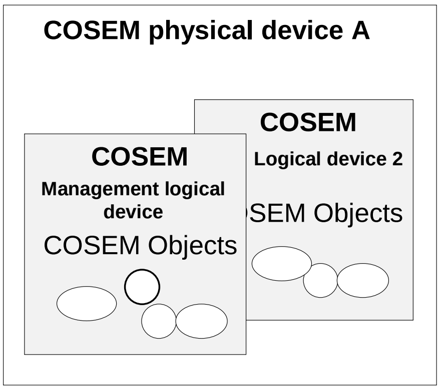


Figure 3 – The COSEM server model

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

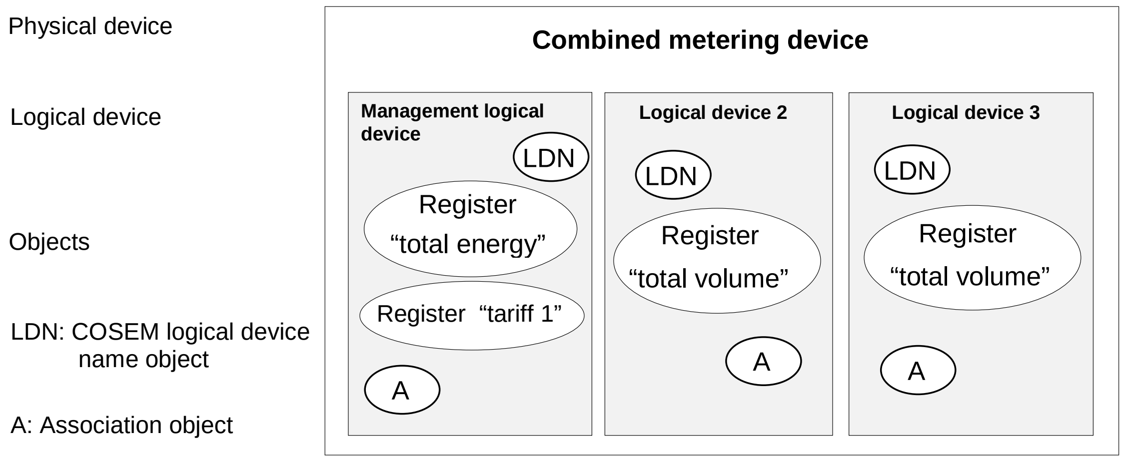


Figure 4 – Combined metering device

4.1.8 The COSEM logical device

4.1.8.1 General

The COSEM logical device contains 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 stack used.

4.1.8.2 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 4.4.3), or from a COSEM object “COSEM logical device name” (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

The logical device name is defined as an octet-string of up to 16 octets. The first three octets shall carry the manufacturer identifier [1]. The manufacturer shall ensure that the logical device name, starting with the three octets identifying the manufacturer and followed by up to 13 octets, is unique.

4.1.8.3 The “association view” of the logical device

In order to access COSEM objects in the server, an application association (AA) shall first be established with a client. This identifies the partners and 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.

The AA is modelled by special COSEM objects: the “Association” objects. There are two types of thes objects defined:

- one for using SN referencing (“Association SN”, see 4.4.1);
- and one for using LN referencing (“Association LN”, see 4.4.2).

Depending on the AA 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 AA. In addition, access to attributes and methods of these COSEM objects may also be restricted within the AA (for example a certain type of client can only read a particular attribute of a COSEM object, but cannot write it).

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.

4.1.8.4 Mandatory contents of a COSEM logical device

The following objects shall be present in each COSEM logical device. They shall be accessible for GET/Read in all AAs with this logical device:

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

NOTE If the SAP Assignment object is present, then the COSEM logical device name object does not have to be present.

4.1.8.5 Management logical device

As specified in 4.1.8.1, the management logical device is a mandatory element of any physical device. It has a reserved address. It must support an AA 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 AA 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.

[1] Administered by the DLMS User Association

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

4.1.9 Data security

DLMS/COSEM provides several information security features for accessing and transporting data:

- *data access security* controls access to the data held by a DLMS/COSEM server;
- *data transport security* allows the sending party to apply cryptographic protection to the xDLMS APDUs sent. This requires ciphered ADPUs. The receiving party can remove or check this protection.

For a description of these security mechanisms, see DLMS UA 1000-2 Ed. 7.0.

Data security is provided by the COSEM Application layer and it is supported / managed by the following objects:

- Association SN, see 4.4.1;
- Association LN, see 4.4.2; and
- Security setup, see 4.4.5.

4.2 Overview of the COSEM interface classes

The interface classes defined currently and the relations between them are shown in Figure 5 and Figure 6.

NOTE 1 The IC “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” ICs, the 2nd attributes are labelled differently from that of the 2nd attribute of the “Data” IC, namely "current_average_value", “time” and “buffer” vs. “value”. This is to emphasize the specific nature of the “value”.

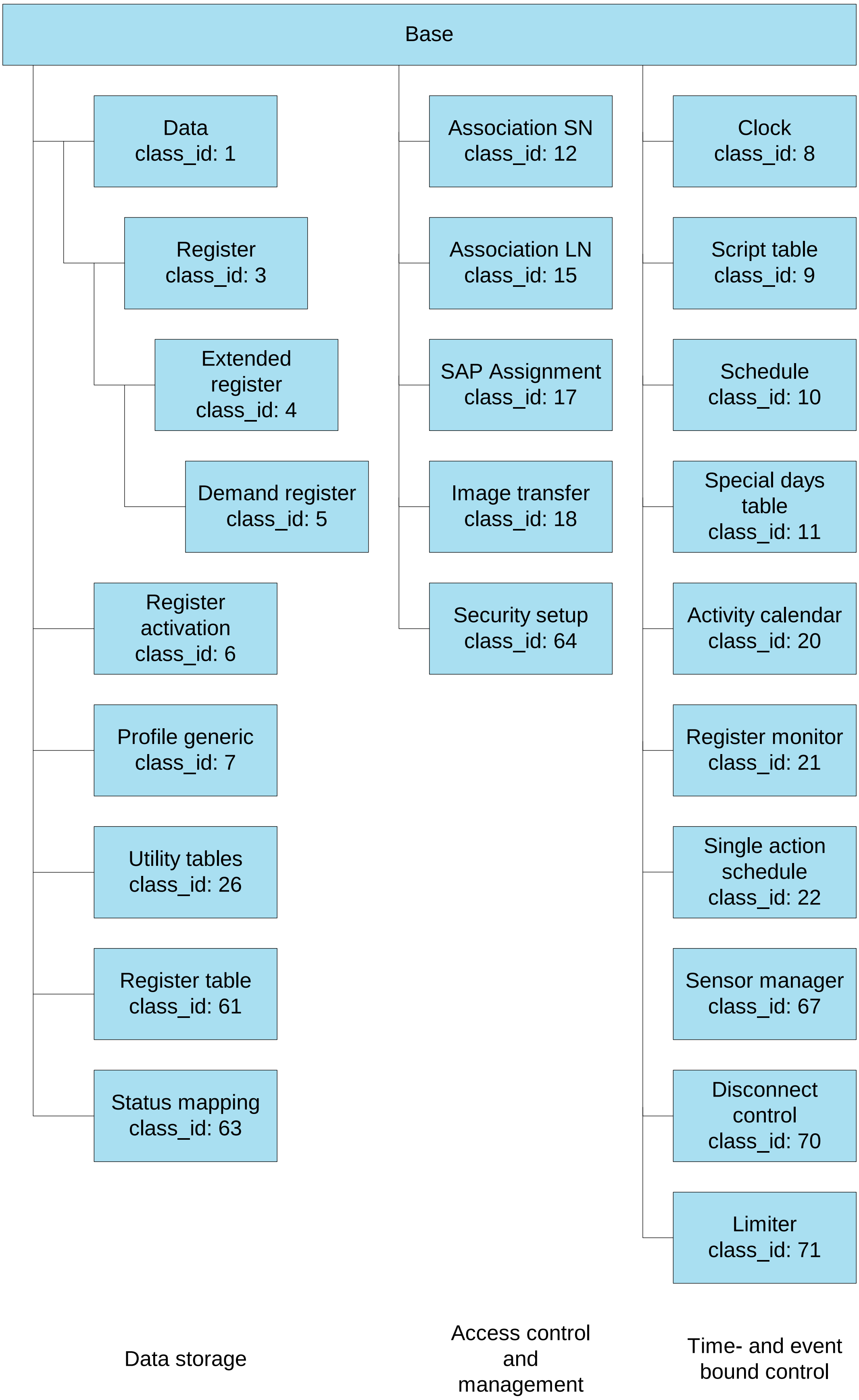


Figure 5 – Overview of the interface classes – Part 1

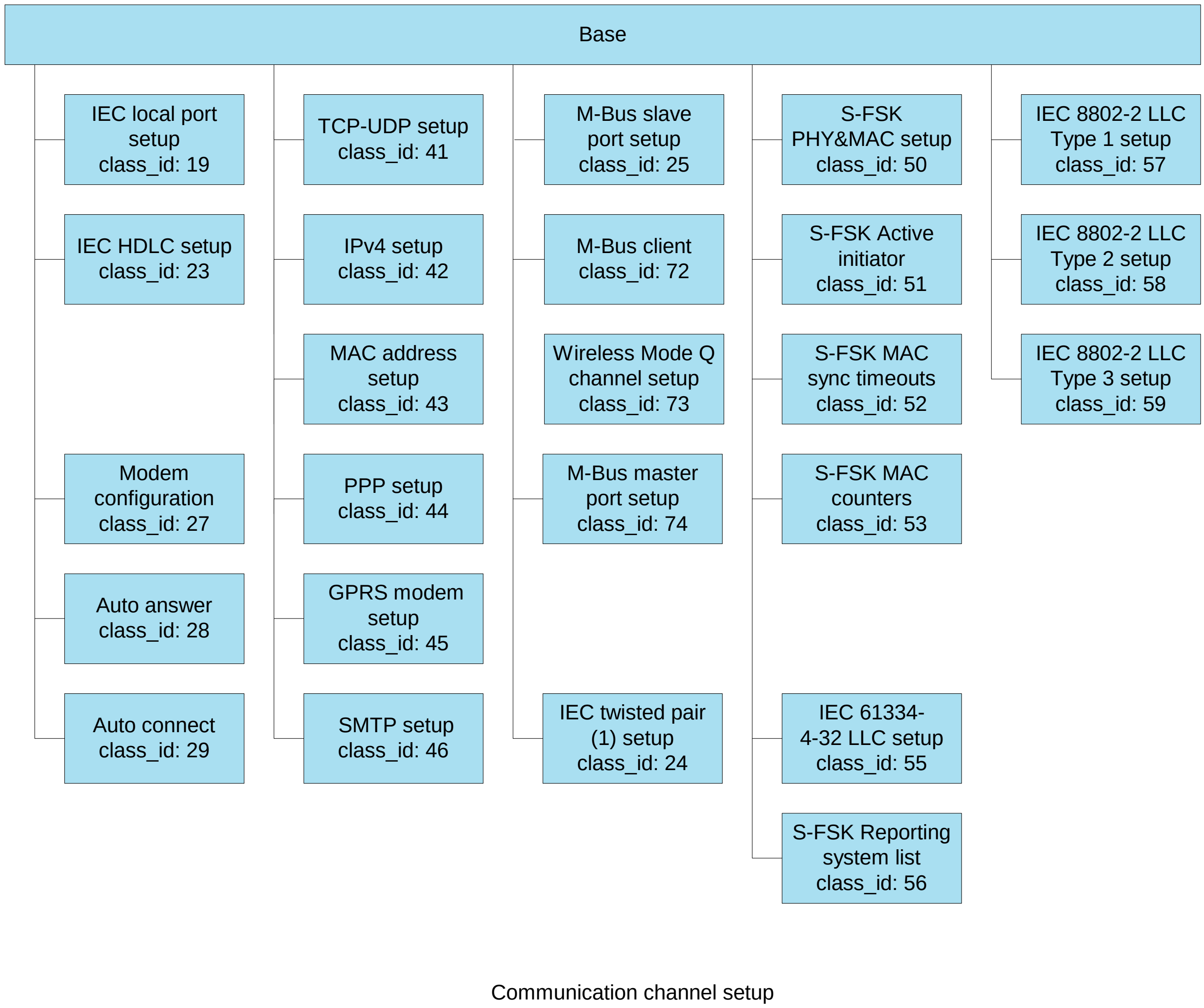


Figure 6 – Overview of the interface classes – Part 2

4.3 Interface classes for parameters and measurement data

4.3.1 Data (class_id: 1, version: 0)

This IC allows modelling various data, such as configuration data and parameters. The data are identified by the attribute *logical_name*.

Data		0...n	class_id = 1, version = 0			
Attributes		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. value		*CHOICE*				x + 0x08
Specific methods		**m/o**				

Attribute description

logical_name	Identifies the “Data” object instance. See clauses 4.12 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],
        UTF8-string            [12],
        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 4.1.5 can be used, unless the choice is restricted in 4.12.

4.3.2 Register (class_id: 3, version: 0)

This IC allows modelling a process or a status value with its associated scaler and unit. “Register” objects know the nature of the process or status value. It is identified by the attribute *logical_name*.

Register		0...n	class_id = 3, version = 0			
Attributes		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. value	(dyn.)	CHOICE				x + 0x08
3. scaler_unit	(static)	scal_unit_type				x + 0x10
Specific methods		**m/o**				
1. reset (data)		o				x + 0x28

Attribute description

logical_name	Identifies the "Register" object instance. See clauses 4.12 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],
        UTF8-string                  [12],
        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" IC 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 Table 3 below.

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)

Table 3 – Enumerated values for physical units

unit ::= enum	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 (T)	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
(36)	V/m	electric field strength (E)	volt per metre	V/m
(37)	F	capacitance (C)	farad	C/V = As/V
(38)	Ω	resistance (R)	ohm	Ω = V/A
(39)	$\Omega m^2/m$	resistivity (ρ)		Ωm
(40)	Wb	magnetic flux (Φ)	weber	Wb = Vs

unit ::= enum	Unit	Quantity	Unit name	SI definition (comment)
(41)	T	magnetic flux density (B)	tesla	Wb/m^2
(42)	A/m	magnetic field strength (H)	ampere per metre	A/m
(43)	H	inductance (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 (T)	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)
(65)	J/kg	Specific energy NOTE The amount of energy per unit of mass of a substance	Joule / kilogram	$m^2 \cdot kg \cdot s^{-2}$ / kg = $m^2 \cdot s^{-2}$
….				
(70)	dBm	Signal strength (e.g. of GSM radio systems)		
…				
(253)		reserved		
(254)	other	other unit		
(255)	count	no unit, unitless, count		

Some examples are shown in Table 4 below.

Table 4 – Examples for scaler_unit

Value	Scaler	Unit	Data
263788	-3	m^3	263,788 m^3
593	3	Wh	593 kWh
3467	0	V	3467 V

4.3.3 Extended register (class_id: 4, version: 0)

This IC allows modelling a process value with its associated scaler, unit, status and capture time information. “Extended register” objects know the nature of the process value. It is described by the attribute *logical_name*.

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

4.3.4 Demand register (class_id: 5, version: 0)

This IC allows modelling a demand value, with its associated scaler, unit, status and time information. A “Demand register” object measures and computes a *current_average_value* periodically, and it stores a *last_average_value.* The time interval *T* over which the demand is measured or computed is defined by specifying “*number_of_periods*” and “*period*”.

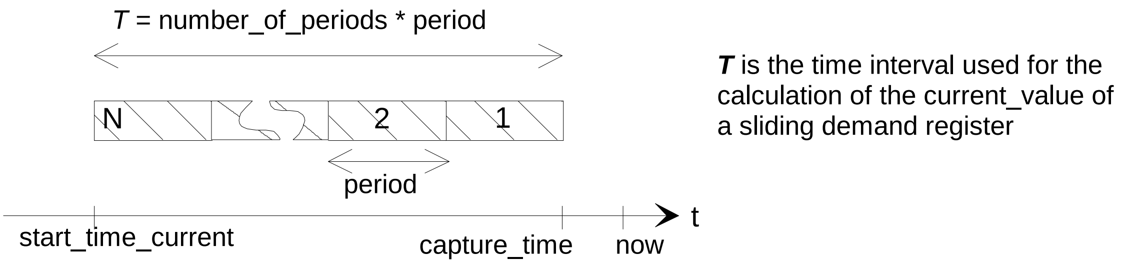


Figure 7 – The time attributes when measuring sliding demand

The demand register delivers two types of demand: *current_average_value* and *last_average_value* (see Figure 8 and **Fehler! Verweisquelle konnte nicht gefunden werden.**).

“Demand register” objects know the nature the of process value, which is described by the attribute logical_name.

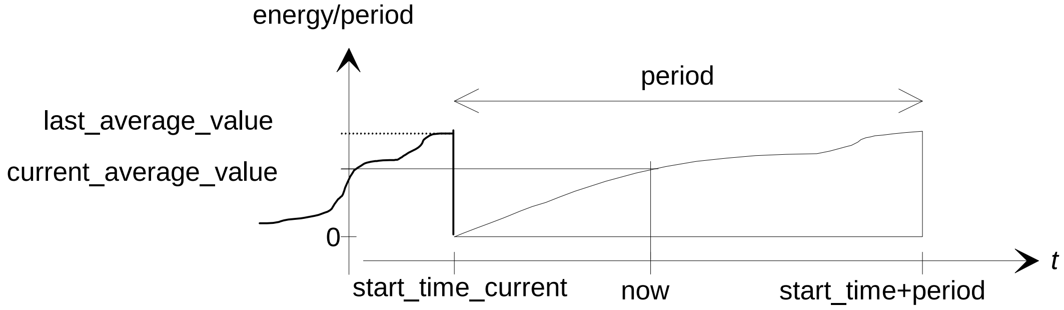


Figure 8 – The attributes in the case of block demand

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

4.3.5 Register activation (class_id: 6, version: 0)

This IC allows modelling the handling of 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 "Register activation" object instance is active. Registers not included 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 ...

4.3.6 Profile generic (class_id: 7, version: 1)

This IC provides a generalized concept allowing to store, sort and access data groups or data series, called *capture objects*. Capture objects are appropriate attributes or elements 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 that fall within the range specified.

The list of *capture objects* defines the values to be stored in the *buffer* (using auto capture or 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 *capture objects*, e.g. the clock, or the entries are stacked in a "last in first out" order. 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" *last_average_value* attribute. 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 ...

4.3.7 Utility tables (class_id: 26, version: 0)

This IC allows encapsulating ANSI C12.19 table data. Each "table" is represented by an instance of this IC, identified by its *logical name*.

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

4.3.8 Register table (class_id: 61, version: 0)

This IC allows to group homogenous entries, identical attributes of multiple objects, which are all instances of the same IC, and in their logical name (OBIS code) the value in value groups A to D and F 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 ..

4.3.9 Status mapping (class_id: 63, version: 0)

This IC allows modelling the mapping of bits of a status words to entries in a reference status table.

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

4.4 Interface classes for access control and management

4.4.1 Association SN (class_id: 12, version: 2)

COSEM logical devices able to establish AAs within a COSEM context using SN referencing, model the AAs through instances of the "Association SN" IC. A COSEM logical device may have one instance of this IC for each AA the device is able to support.

The **short_name** of the "Association SN" object itself is fixed within the COSEM context. See 4.1.3.

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

4.4.2 Association LN (class_id: 15, version: 1)

COSEM logical devices able to establish AAs within a COSEM context using LN referencing, model the AAs through instances of the "Association LN" IC. A COSEM logical device has one instance of this IC for each AA the device is able to support.

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

4.4.3 SAP assignment (class_id: 17, version: 0)

This IC allows modelling the logical structure of physical devices, by providing information on the assignment of the logical devices to their SAP-s. See DLMS UA 1000-2 Ed. 7.0 Clause 10.

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

4.4.4 Image transfer (class_id: 18, version: 0)

4.4.4.1 Introduction

Instances of the Image transfer IC model the mechanism of transferring binary files, called firmware Images to COSEM servers. The Image transfer takes place in several steps:

Step 1: The client gets the ImageBlockSize from each server individually;

Step 2: The client initiates the Image transfer process individually or using broadcast;

Step 3: The client transfers ImageBlocks to (a group of) server(s) individually or using broadcast;

Step 4: The client checks the completeness of the Image in each server individually and transfers any ImageBlocks not (yet) transferred;

Step 5: The Image is verified;

Step 6: Before activation, the Image is checked;

Step 7: The Image(s) is (are) activated.

4.4.4.2 Definitions related to the Image transfer process

4.4.4.2.1
Image
binary data of specified size. An Image may be transferred, verified and activated

NOTE The Image data transferred and the Image(s) that will be activated are not necessarily identical.

4.4.4.2.2
ImageSize
size of the Image expressed in bytes

NOTE The Image can be transferred in ImageBlocks.

4.4.4.2.3
ImageBlock
part of the Image of size ImageBlockSize. Each block is identified by its ImageBlockNumber

4.4.4.2.4
ImageBlockSize
size of ImageBlock expressed in bytes

4.4.4.2.5
ImageBlockNumber
identifier of an ImageBlock. ImageBlocks are numbered sequentially, starting from 0.

The meaning of the definitions above is illustrated in Figure 9.

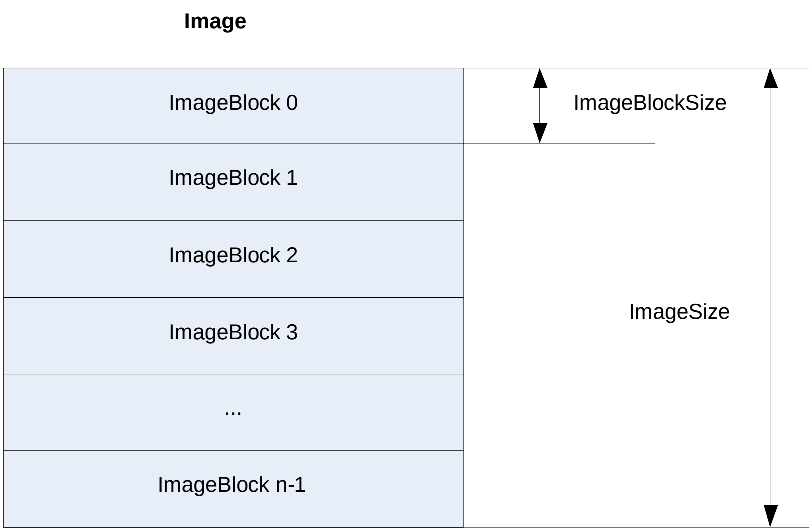


Figure 9 – The meaning of the definitions concerning the Image

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

4.4.5 Security setup (class_id: 64, version: 0)

Instances of this IC contain the necessary information on the security policy applicable and the security suite in use within a particular AA, between two systems identified by their client system title and server system title respectively. They also contain methods to increase the level of security and to transfer the global keys. See also DLMS UA 1000-2 Ed. 7.0 Clause 9.2.

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

4.5 Interface classes for time- and event bound control

4.5.1 Clock (class_id: 8, version: 0)

This IC models the device clock, managing all information related to date and time, including deviations of the local time to a generalized time reference (Coordinated Universal Time, UTC), due to time zones and daylight saving time schemes. The IC also offers various methods to adjust the clock.

The date information includes the elements year, month, day of month and day of week. The time information includes the elements hour, minutes, seconds, hundredths of seconds, and the deviation of the local time from UTC. The daylight saving time function modifies the deviation of local time to UTC 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.

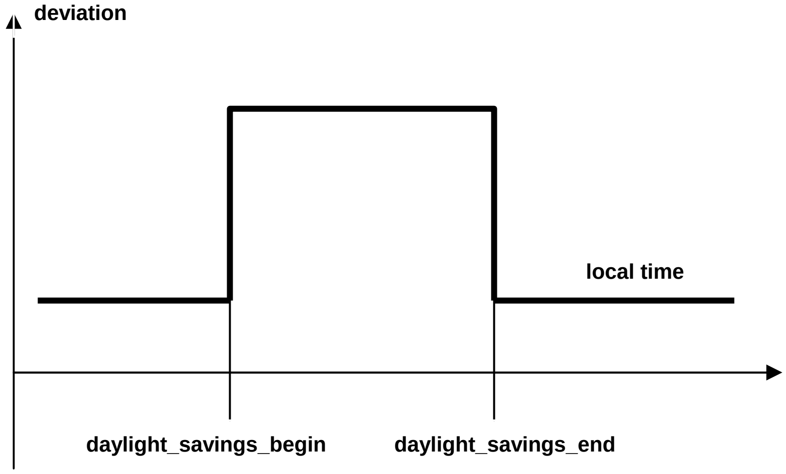


Figure 10 – The generalized time concept

Clock		0...1	class_id = 8, version = 0			
Attributes		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. time	(dyn.)	octet-string				x + 0x08
3. time_zone	(static)	long				x + 0x10
4. status	(dyn.)	unsigned				x + 0x18
5. daylight_savings_begin	(static)	octet-string				x + 0x20
6. daylight_savings_end	(static)	octet-string				x + 0x28
7. daylight_savings_deviation	(static)	integer				x + 0x30
8. daylight_savings_enabled	(static)	boolean				x + 0x38

9. clock_base (static)	enum				x + 0x40
Specific methods	***m/o***				
1. adjust_to_quarter (data)	o				x + 0x60
2. adjust_to_measuring_period (data)	o				x + 0x68
3. adjust_to_minute (data)	o				x + 0x70
4. adjust_to_preset_time (data)	o				x + 0x78
5. preset_adjusting_time (data)	o				x + 0x80
6. shift_time (data)	o				x + 0x88

Attribute description

logical_name	Identifies the "Clock" object instance. See **Fehler! Verweisquelle konnte nicht gefunden werden.**.
time	Contains the meter's local date and time, its deviation to UTC and the status. See 4.1.6.1. 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 4.1.6.1 for date_time
time_zone	The deviation of local, normal time to UTC in minutes.
status	The status is equal to the status read in time. See 4.1.6.1. unsigned, formatted as set in 4.1.6.1 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 4.1.6.1 for date_time
daylight_savings_end	See above. octet-string, formatted as set in 4.1.6.1 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	boolean: TRUE = DST enabled FALSE = DST disabled
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 4.1.6.1 for *date_time*

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

4.5.2 Script table (class_id: 9, version: 0)

This IC allows modelling the triggering of a series of actions by executing scripts using the execute (data) method.

Script table objects contain a table of script entries. Each entry consists of a *script identifier* and a series of *action specifications*. An action specification activates a method or modifies an attribute of a COSEM object within the logical device.

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

If two scripts have to be executed at the same time instance, then the one with the smaller index is executed first.

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

4.5.3 Schedule (class_id: 10, version: 0)

This IC, together with the IC "Special days", allows modelling time- and date-driven activities within a device. The following tables provide an overview and show the interactions between the two ICs.

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

4.5.4 Special days table (class_id: 11, version: 0)

This IC allows defining special dates. On such dates, a special switching behaviour overrides the normal one. The IC works in conjunction with the class "Schedule" or "Activity calendar". The linking data item is *day_id*.

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

4.5.5 Activity calendar (class_id: 20, version: 0)

This IC allows modelling the handling of various tariff structures in the meter. The IC provides a list of scheduled actions, following the classical way of calendar based schedules by defining seasons, weeks…

An “Activity calendar” object may coexist with the more general “Schedule” object and it can even overlap with it. If actions in a “Schedule” object are scheduled for the same activation time as in an “Activity calendar” object, 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.

The “Activity calendar” object defines the activation of certain scripts, which can perform different activities inside the logical device. The interface to the IC “Script table” is the same as for the IC “Schedule” (see 4.5.3).

If an instance of the IC “Special days table” (see 4.5.4) 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 ...

4.5.6 Register monitor (class_id: 21, version: 0)

This IC allows modelling the function of monitoring of values modelled by “Data”, “Register”, “Extended register” or “Demand register” objects. It allows specifying thresholds, the value monitored, and a set of scripts (see 4.5.2) that are executed when the value monitored crosses a threshold.

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 ...

4.5.7 Single action schedule (class_id: 22, version: 0)

This IC allows modelling the execution of periodic actions within a meter. Such actions are not necessarily linked to tariffication (see “Activity calendar” or “Schedule”).

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

4.5.8 Disconnect control (class_id: 70, version: 0)

Instances of the Disconnect control IC manage an internal or external disconnect unit of the meter (e.g. electricity breaker, gas valve) in order to connect or disconnect – partly or entirely – the premises of the consumer to / from the supply. The state diagram and the possible state transitions are shown in Figure 11.

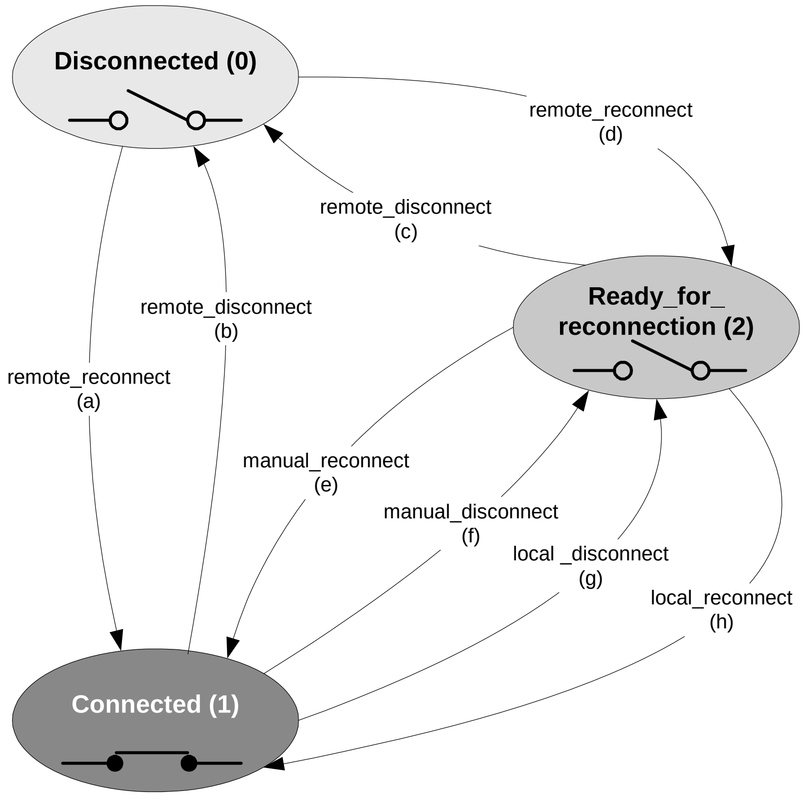


Figure 11 – State diagram of the Disconnect control IC

Disconnect and reconnect can be requested:

- Remotely, via a communication channel: remote_disconnect, remote_reconnect;
- Manually, using e.g. a push button: manual_disconnect, manual_reconnect;
- Locally, by a function of the meter, e.g. limiter, prepayment: local_disconnect, local_reconnect.

The states and state transitions of the Disconnect control IC are shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**. The possible state transitions depend on the control mode. The Disconnect control object doesn't feature a memory, i.e. any commands are executed immediately.

To define the behaviour of the disconnect control object for each trigger, the control mode must be set.

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

4.5.9 Limiter (class_id: 71, version: 0)

Instances of the Limiter IC allow defining a set of actions that are executed when the value of a *value* attribute of a monitored object "Data", "Register", "Extended Register", "Demand Register", etc. crosses the threshold value for at least minimal duration time.

The threshold value can be normal or emergency threshold. The *emergency threshold* is activated via the *emergency profile* defined by *emergency profile id*, *emergency activation time*, and *emergency duration*. The *emergency profile id* element is matched to an *emergency profile group* *id*: this mechanism enables the activation of the emergency threshold only for a specific emergency group.

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

4.5.10 Sensor manager interface class (class_id:67, version: 0)

4.5.10.1 Introduction

Most measuring instruments under the scope of the MID operate with dedicated sensors (transducers and transmitters) connected to the processing unit. These sensors have to be permanently supervised concerning their functioning and limits to fulfil the metrological requirements for subsequent calculation of monetary values.

In addition, the measured values have to be monitored. These values may be related to a physical quantity – raw values of voltage, current, resistance, frequency, digital output – provided by the sensor, and the measured quantities resulting from the processing of the information provided by the sensor.

It is necessary to monitor and often to log the relevant values in order to obtain diagnostic information that allows:

- the identification of the sensor device;
- the connection and the sealing status of the sensor;
- the configuration of the sensors;
- the monitoring of the operation of the sensors;
- the monitoring of the result of the processing.

The Sensor manager interface class allows managing detailed information related to a sensor by a single object.

For simpler sensors / devices, already existing COSEM objects – identifying the sensors, holding measurement values and monitoring those measurement values – can be used.

4.5.10.2 The Sensor manager interface class specification

Instances of the “Sensor manager” IC manage complex information related to sensors. They also allow monitoring the raw data and the processed value, derived by processing the raw-data using appropriate algorithms as required by the particular application. This IC includes a number of functions:

- nameplate data of the sensor and site information (attributes 2 to 6);
- an “Extended register” function for the raw-data (attributes 7 to 10);
- a “Register monitor” function for the raw data (attributes 11-12);

  NOTE The raw data (e.g. the voltage output of a pressure sensor) may not have its own OBIS code / object. This is the reason to include it in the Sensor manager class.

- a “Register monitor” function for the processed value (attributes 13 to 15).

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

4.5.10.3 Example for absolute pressure sensor

Figure 12 illustrates the definition of relevant upper and lower thresholds.

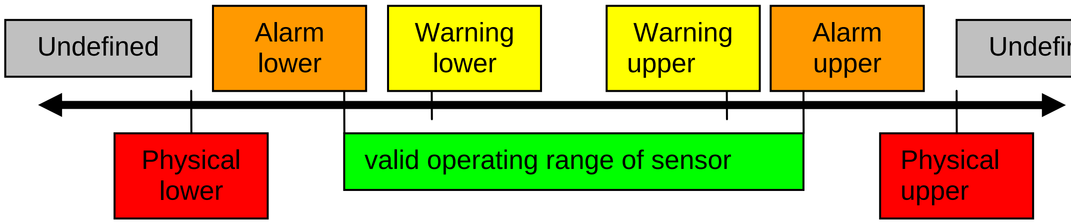


Figure 12 – Definition of upper and lower thresholds

Table 5 shows an example of the various thresholds.

Table 5 – Explicit presentation of threshold value arrays

Threshold	Physical lower	Physical upper	Alarm lower	Alarm upper	Warning lower	Warning upper
value	1,0	5,5	1,2	5,0	1,4	4,8
scaler_unit	1, Volt	1, Volt	1, bar	1, bar	1, bar	1, bar

Table 6 shows an example of actions to be performed when the thresholds are crossed.

Table 6 – Explicit presentation of action_sets

action_set	Physical lower	Physical upper	Alarm lower	Alarm upper	Warning lower	Warning upper
action_up	clr_phys_alarm_bit	set_phys_alarm_bit	clr_alarm_bit	set_alarm_bit	clr_warn_bit	set_warn_bit
action_down	set_phys_alarm_bit	clr_phys_alarm_bit	set_alarm_bit	clr_alarm_bit	set_warn_bit	clr_warn_bit

4.6 Interface classes for setting up data exchange via local ports and modems

4.6.1 IEC local port setup (class_id: 19, version: 1)

This IC allows modelling the configuration of communication ports using the protocols specified in IEC 62056-21. Several ports can be configured.

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

4.6.2 IEC HDLC setup (class_id: 23, version: 1)

This IC allows modelling and configuring communication channels according to Clause 8 of DLMS UA 1000-2 Ed. 7.0. Several communication channels can be configured.

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

4.6.3 IEC twisted pair (1) setup (class_id: 24, version: 0)

This IC allows modelling and configuring communication channels according to IEC 62056-31. Several communication channels can be configured.

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

4.6.4 Modem configuration (class_id: 27, version: 1)

This IC allows modelling the configuration and initialisation of modems used for data transfer from/to a device. Several modems can be configured.

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

4.6.5 Auto answer (class_id: 28, version: 0)

This IC allows modelling how the device manages the “Auto answer” function of the modem, i.e. answering of incoming calls. Several modems can be configured.

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

4.6.6 Auto connect (class_id: 29, version: 1)

This IC allows modelling the management of data transfer from the device to one or several destinations.

The messages to be sent, the conditions on which they shall be sent and the relation between the various modes, the calling windows and destinations are not defined here.

Depending on the mode, one or more instances of this IC may be necessary to perform the function of sending out messages.

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

4.7 Interface classes for setting up data exchange via M-Bus

4.7.1 M-Bus slave port setup (class_id: 25, version: 0)

NOTE The name of this IC has been changed from “M-BUS port setup” to “M-Bus slave port setup”, to indicate that it serves to set up data exchange when a COSEM server communicates with a COSEM client using wired M-Bus.

This IC allows modelling and configuring communication channels according to EN 13757-2. Several communication channels can be configured.

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

4.7.2 M-Bus client (class_id: 72, version: 0)

Instances of this IC allow setting up M-Bus slave devices and to exchange data with them. Each M-Bus client object controls one M-Bus slave device. For details on the M-Bus dedicated application layer, see EN 13757-3:2004.

The M-Bus client device may have one or more physical M-Bus interfaces, which can be configured using instances of the M-Bus master port setup IC, see 4.7.4.

An M-Bus slave device is identified with its Primary Address, Identification Number, Manufacturer ID etc. as defined in EN 13757-3:2004 Clause 5, *Variable Data respond*. These parameters are carried by the respective attributes of the M-Bus client IC, see 4.7.2.

Values to be captured from an M-Bus slave device are identified by the capture_definition attribute, containing a list of data identifiers (DIB, VIB) for the M-Bus slave device. The data are captured periodically or on an appropriate trigger. Each data element is stored in an M-Bus value object, of IC “Extended register”. M-Bus value objects may be captured in M-Bus Profile generic objects, eventually along with other, not M-Bus specific objects.

Using the methods of M-Bus client objects, M-Bus slave devices can be installed and de-installed.

It is also possible to send data to M-Bus slave devices and to perform operations like resetting alarms, setting the clock, transferring an encryption key etc.

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

4.7.3 Wireless Mode Q channel (class_id: 73, version: 1)

Instances of this IC define the operational parameters for communication using the mode Q interfaces. See also EN 13757-5:2008.

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

4.7.4 M-Bus master port setup (class_id: 74, version: 0)

Instances of this IC define the operational parameters for communication using the EN 13757-2 interfaces if the device acts as an M-bus master.

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

4.8 Interface classes for setting up data exchange over the Internet

4.8.1 TCP-UDP setup (class_id: 41, version: 0)

This IC allows modelling the setup of the TCP or UDP sub-layer of the COSEM TCP or UDP based transport layer of a TCP-UDP/IP based communication profile.

In TCP-UDP/IP based communication profiles, all AAs between a physical device hosting one or more COSEM client application processes and a physical device hosting one or more COSEM server APs rely on a single TCP or UDP connection. The TCP or UDP entity is wrapped in the

COSEM TCP-UDP based transport layer. Within a physical device, each AP – client AP or server logical device – is bound to a Wrapper Port (WPort). The binding is done with the help of the SAP Assignment object. See 4.4.3.

On the other hand, a COSEM TCP or UDP based transport layer may be capable to support more than one TCP or UDP connections, between a physical device and several peer physical devices hosting COSEM APs.

NOTE When a COSEM physical device supports various data link layers – for example Ethernet and PPP – an instance of the TCP-UDP setup object is necessary for each of them.

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

4.8.2 IPv4 setup (class_id: 42, version: 0)

This IC allows modelling the setup of the IPv4 layer, handling all information related to the IP Address settings associated to a given device and to a lower layer connection on which these settings are used.

There shall be an instance of this IC in a device for each different network interface implemented. For example, if a device has two interfaces (using the TCP/IP profile on both of them), there shall be two instances of the IPv4 setup IC in that device: one for each of these interfaces.

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

4.8.3 MAC address setup (class_id: 43, version: 0)

NOTE The name and the use of this interface class has been changed from “Ethernet setup” to “MAC address setup” to allow amore general use, without changing the version.

Instances of this IC hold the MAC address of the physical device. (Or, more generally, a device or software.) There shall be an instance of this IC for each network interface of a physical device.

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

4.8.4 PPP setup (class_id: 44, version: 0)

This IC allows modelling the setup of interfaces using the PPP protocol, by handling all information related to PPP settings associated to a given physical device and to a lower layer connection on which these settings are used. There shall be an instance of this IC for each network interface of a physical device.

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

4.8.5 GPRS modem setup (class_id: 45, version: 0)

This IC allows setting up GPRS modems, by handling all data necessary data for modem management.

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

4.8.6 SMTP setup (class_id: 46, version: 0)

This IC allows setting up data exchange using the SMTP protocol.

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

4.9 Interface classes for setting up data exchange using S-FSK PLC

4.9.1 Introduction

This section specifies COSEM interface classes to set up and manage the protocol layers of DLMS/COSEM PLC communication profiles:

- the S-FSK Physical layer and the MAC sub-layer as defined in IEC 61334-5-1 and IEC 61334-4-512;

  NOTE ICs for setting up other PLC lower layer profiles may be added later.

- the LLC sub-layer as specified in IEC 61334-4-32;
- the LLC sub-layer as specified in ISO/IEC 8802-2.

The MIB variables / logical link parameters specified in IEC 61334-4-512, IEC 61334-5-1, IEC 61334-4-32 and ISO/IEC 8802-2 respectively have been mapped to attributes and/or methods of COSEM ICs. The specification of these elements has been taken from the above standards and the text has been adapted to the DLMS/COSEM environment.

NOTE IEC 61334-4-512 also specifies some management variables to be used on the Client side. However, the Client side object model is not covered in this document.

4.9.2 Definitions and abbreviations related to the S-FSK PLC profile

4.9.2.1
initiator
user-element of a client System Management Application Entity (SMAE). It uses the CIASE and xDLMS ASE and is identified by its system title [IEC 61334-4-511 3.8.1 modified]

4.9.2.2
active initiator
initiator which issues or has last issued a CIASE Register request when the server is in the unconfigured state [IEC 61334-4-511 3.9.1]

4.9.2.3
new system
server system which is in the unconfigured state: its MAC address equals "NEW-address" [IEC 61334-4-511 3.9.3]

4.9.2.4
new system title
system-title of a new system [IEC 61334-4-511 3.9.4]

NOTE This is the system title of a system, which is in the new state.

4.9.2.5
registered system
server system which has an individual valid MAC address (therefore, different from "NEW Address", see IEC 61334-5-1: Medium Access Control) [IEC 61334-4-511 3.9.5]

4.9.2.6
reporting system
server system which issues a DiscoverReport [IEC 61334-4-511 3.9.6 modified]

4.9.2.7
sub-slot
the time needed to transmit two bytes by the physical layer

NOTE Timeslots are divided to sub-slots in the RepeaterCall mode of the physical layer.

4.9.2.8
timeslot
the time needed to transmit a physical frame

NOTE As specified in IEC 61334-5-1 clause 3.3.1, a physical frame comprises 2 bytes preamble, 2 bytes start subframe delimiter, 38 bytes PSDU and 3 bytes pause.

Abbreviation	Explanation
CC	Current Credit (in the case of the S-FSK PLC profile)
DC	Delta credit
IC	Initial credit
CIASE	Configuration Initiation Application Service Element
FIFO	First-In-First-Out
LLC	Logical Link Control
MAC	Medium Access Control
MIB	Management Information Base
UNC	Unconfigured (server, in the case of the S-FSK PLC profile)

4.9.3 Overview

COSEM objects for setting up the PLC channel and the LLC layer, if implemented, shall be located in the Management Logical Device of COSEM servers.

Figure 13 shows an example with a COSEM physical device comprising three logical devices.

Each logical device shall contain a Logical Device Name (LDN) object.

NOTE As in this example there is more than one logical device, the mandatory Management Logical Device contains a SAP Assignment object instead of a Logical Device object.

Each logical device contains one or more Association objects, one for each client supported.

The management logical device contains the setup objects of the physical and MAC layers of the PLC channel, as well as setup objects for the intermediate layer(s). It may contain further application objects.

The other logical devices, in addition to the Association and Logical Device Name objects mentioned above, contain further application objects, holding parameters and measurement values.

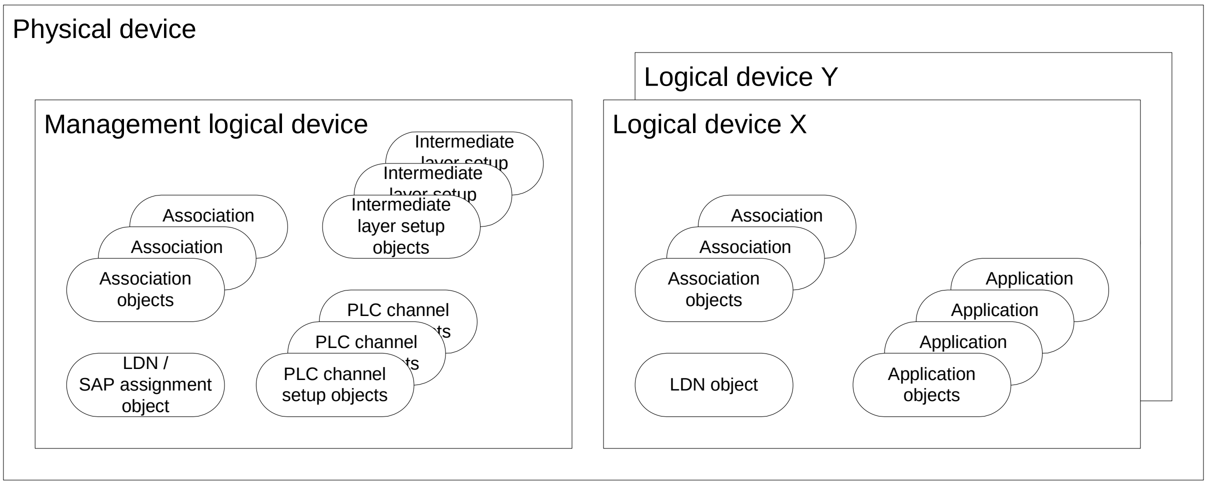


Figure 13 – Object model of DLMS/COSEM servers

IEC 61334-4-512 uses DLMS named variables to model the MIB objects and specifies their DLMS name in the range 8…184. For compatibility with existing implementations, the short names 8…400 [sic] are reserved for devices using the IEC 61334-5-1 S-FSK PLC profiles without COSEM. Therefore, when mapping the attributes and methods of the COSEM objects specified in this document to DLMS named variables (SN mapping), this range shall not be used.

Table 7 below shows the mapping of MIB variables to attributes and/or methods of COSEM ICs.

Note, that on the one hand, not all MIB variables specified in IEC 61334-4-512 have been mapped to attributes and methods of COSEM ICs. On the other hand, some new management variables are specified in this document.

Table 7 – Mapping IEC 61334-5-512 MIB variables to COSEM IC attributes / methods

Name	Reference (unless otherwise indicated)	Interface class	class_id / attribute / method
S-FSK Physical layer management			
delta-electrical-phase	variable 1	S-FSK Phy&MAC set-up (class_id: 50, version: 1)	50 / Attr. 3
max-receiving-gain	variable 2		50 / Attr. 4
max-transmitting-gain	–		50 / Attr. 5
search-initiator-threshold	–		50 / Attr. 6
frequencies	–		50 / Attr. 7
transmission-speed	–		50 / Attr. 15
MAC layer management			
mac-address	variable 3	S-FSK Phy&MAC set-up (class_id: 50, version: 1)	50 / Attr. 8
mac-group-addresses	variable 4		50 / Attr. 9
repeater	variable 5		50 / Attr. 10
repeater-status	–		50 / Attr. 11
search-initiator time-out	–	S-FSK MAC synchronization timeouts (class_id: 52, version: 0)	52 / Attr. 2
synchronization-confirmation-time-out	variable 6		52 / Attr. 3
time-out-not-addressed	variable 7		52 / Attr. 4
time-out-frame-not-OK	variable 8		52 / Attr. 5

Name	Reference (unless otherwise indicated)	Interface class	class_id / attribute / method
min-delta-credit	variable 9	S-FSK Phy&MAC set-up (class_id: 50, version: 1)	50 / Attr. 12
initiator-mac-address	IEC 61334-5-1 4.3.7.6		50 / Attr. 13
synchronization-locked	variable 10		50 / Attr. 14
IEC 61334-4-32 LLC layer management			
max-frame-length	IEC 61334-4-32 5.1.4	IEC 61334-4-32 LLC setup (class_id: 55, version: 1)	55 / Attr. 2
reply-status-list	variable 11		55 / Attr. 3
broadcast-list	variable 12	–	–
L-SAP-list	variable 13	NOTE In DLMS/COSEM, L-SAPs of logical devices are held by a SAP Assignment object	
ACSE management			
application-context-list	variable 14	NOTE In DLMS/COSEM the Association objects play a similar role.	
Application management			
active-initiator	variable 15	S-FSK Active initiator (class_id: 51, version: 0)	51 / Attr. 2
MIB system objects			
reporting-system-list	variable 16	S-FSK Reporting system list (class_id: 56, version: 0)	56 / Attr. 2
Other MIB objects			
reset-NEW-not-synchronized	variable 17	S-FSK Active initiator (class_id: 51, version: 0)	51 / Method 1
new-synchronization	IEC 61334-5-1 4.3.7.6	–	
initiator-electrical-phase	variable 18		50 / Attr. 2
broadcast-frames-counter	variable 19	S-FSK MAC counters (class_id: 53, version: 0)	53 / Attr. 4
repetitions-counter	variable 20		53 / Attr. 5
transmissions-counter	variable 21		53 / Attr. 6
CRC-OK-frames-counter	variable 22		53 / Attr. 7
CRC-NOK-frames-counter	–		53 / attr. 8
synchronization-register	variable 23		53 / Attr. 2
desynchronization-listing	variable 24		53 / Attr. 3

4.9.4 S-FSK Phy&MAC set-up (class_id: 50, version: 1)

NOTE The use of version 0 of this interface class is is deprecated.

An instance of the “S-FSK Phy&MAC set-up” class stores the data necessary to set up and manage the physical and the MAC layer of the PLC S-FSK lower layer profile.

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

4.9.5 S-FSK Active initiator (class_id: 51, version: 0)

An instance of the “S-FSK Active initiator” IC stores the data of the active initiator. The active initiator is the client system, which has last registered the server system with a CIASE Register request. See IEC 61334-4-511 7.2.

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

4.9.6 S-FSK MAC synchronization timeouts (class_id: 52, version: 0)

An instance of the “S-FSK synchronization timeouts” IC stores the timeouts related to the synchronization process.

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

4.9.7 S-FSK MAC counters (class_id: 53, version: 0)

An instance of the “S-FSK counters” IC stores counters related to the frame exchange, transmission and repetition phases.

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

4.9.8 IEC 61334-4-32 LLC setup (class_id: 55, version: 1)

An instance of the “IEC 61334-4-32 LLC setup” IC holds parameters necessary to set up and manage the LLC layer as specified in IEC 61334-4-32.

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

4.9.9 S-FSK Reporting system list (class_id: 56, version: 0)

An instance of the “S-FSK Reporting system list” IC holds the list of reporting systems.

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

4.10 Interface classes for setting up the LLC layer for ISO/IEC 8802-2

4.10.1 General

This clause specifies the ICs available for setting up the ISO/IEC 8802-2 LLC layer, used in some DLMS/COSEM communication profiles, in the various types of operation.

4.10.2 Definitions related to the ISO/IEEE 8802-2 LLC layer

See clause 1.4.2 of ISO/IEC 8802-2.

4.10.3 ISO/IEC 8802-2 LLC Type 1 setup (class_id: 57, version: 0)

An instance of the ISO/IEC 8802-2 LLC Type 1 setup IC holds the parameters necessary to set up the ISO/IEC 8802-2 LLC layer in Type 1 operation.

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

4.10.4 ISO/IEC 8802-2 LLC Type 2 setup (class_id: 58, version: 0)

An instance of the ISO/IEC 8802-2 LLC Type 2 setup IC holds the parameters necessary to set up the ISO/IEC 8802-2 LLC layer in Type 2 operation.

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

4.10.5 ISO/IEC 8802-2 LLC Type 3 setup (class_id: 59, version: 0)

An instance of the ISO/IEC 8802-2 LLC Type 3 setup IC holds the parameters necessary to set up the ISO/IEC 8802-2 LLC layer in Type 3 operation.

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

4.11 Maintenance of the interface classes

4.11.1 New versions of interface classes

Any modification of an existing IC 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:

a) new attributes and methods may be added;
b) 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;
c) if these rules cannot be met, then a new IC shall be created;

Any modification of ICs will be recorded by moving the old version of an IC into Clause 4.14.

4.11.2 New interface classes

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

4.11.3 Removal of interface classes

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

4.12 Relation to OBIS

4.12.1 General

This clause specifies the use of COSEM interface objects to model various data items.

It also specifies the logical names of the objects. The naming system is based on OBIS, the Object Identification System: each logical name is an OBIS code.

OBIS codes are specified in the following clauses:

- 4.12.2 specifies the use and the logical names of abstract COSEM objects, i.e. objects not related to an energy type;
- 4.12.3 specifies the use and logical names for electricity related COSEM objects;
- 4.12.4 specifies the use and logical names for gas related COSEM objects;
- the detailed OBIS code allocations are specified in clause 5.

Unless otherwise specified the use of value group B shall be:

- if just one object is instantiated, the value in value group B shall be 0;
- if more than one object is instantiated in the same physical device, the value group B shall number the measurement or communication channels as appropriate, from 1…64. This is indicated by the letter “b”.

Unless otherwise specified the use of value group E shall be:

- if just one object is instantiated, value in value group E shall be 0;
- if more than one object is instantiated in the same physical device, the value group E shall number the instantiations from zero to the maximum value needed. This is indicated by the letter “e”. For the values allocated, see clause 5.

All codes, which are not explicitly listed, but which are outside the manufacturer, utility or consortia specific ranges are reserved for future use.

4.12.2 Abstract COSEM objects

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

4.12.3 Electricity related COSEM objects

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

4.12.4 Gas related COSEM objects

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

4.13 Coding of OBIS identifications

To identify different instances of the same IC, 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 ...

4.14 Previous versions of interface classes

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

NOTE For new implementations in metering devices, only the current versions should be used.

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

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

5. COSEM Object Identification System (OBIS)

5.1 Scope

The OBject Identification System (OBIS) defines the identification codes (ID-codes) for commonly used data items in 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 standard are used for the identification of:

- logical names of the various instances of the ICs, or objects, as defined in Clause 4;
- data transmitted through communication lines, see Clause 5.10.1;
- data displayed on the metering equipment, see Clause 5.10.2.

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.

5.2 OBIS code structure

5.2.1 General

OBIS codes identify data items used in energy metering equipment, in a hierarchical structure using six value groups A to F, see Figure 14.

A	B	C	D	E	F

Figure 14 – OBIS code structure

5.2.2 Value group A

Value group A is used to identify the media (energy type) to which the metering is related. Non-media related information is handled as abstract data.

5.2.3 Value group B

Value group B is generally used to identify the measurement 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.

Value group B may also be used to identify the communication channel, and in some cases for other purposes.

The definitions for this value group are independent from the value group A.

5.2.4 Value group C

Value group C is used to identify 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 in 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.

5.2.5 Value group D

Value group D is used to identify types, or the result of the processing of physical quantities identified by values in value groups A and C, according to various specific algorithms. The algorithms can deliver energy and demand quantities as well as other physical quantities.

5.2.6 Value group E

Value group E is used to identify further processing or classification of quantities identified by values in value groups A to D.

5.2.7 Value group F

Value group F is used to identify historical data, identified by values in value groups A to E, according to different billing periods. Where this is not relevant, this value group can be used for further classification.

5.2.8 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 4 or 5.

In addition, manufacturer specific ranges are defined in Table 14 with A = 0, C = 96, in Table 26 with A = 1, C = 96, in Table 33 with A = 4, C = 96, in Table 39 with A = 5/6, C = 96, in Table 53 with A = 7, C = 96 and in Table 59 with A = 8/9, C = 96.

5.2.9 Reserved ranges

By default, all codes not allocated are reserved. [2]

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

Table 8 summarizes the rules for handling manufacturer specific codes specified in 5.2.8, utility specific codes specified in 5.3.2, consortia specific codes specified in 5.3.4.2 and country specific codes specified in 5.3.4.3.

Table 8 – Rules for manufacturer, utility, consortia and country specific codes

Code type	Value group					
	A	B	C	D	E	F
Manufacturer specific [1]	0, 1, 4…9	128…199	*c*	*d*	*e*	*f*
		b	128… 199, 240	*d*	*e*	*f*
		b	*c*	128…254	*e*	*f*
		b	*c*	*d*	128…254	*f*
		b	*c*	*d*	*e*	128…254
Manufacturer specific abstract [2]	0	0…64	96	50…99	0…255	0…255
Manufacturer specific, media related general purpose [2]	1, 4…9	0…64	96	50…99	0…255	0…255
Utility specific [3]		65…127				
Consortia specific [4]	0, 1, 4…9	1…64	93	See Table 12		
Country specific [5]		1…64	94	See Table 13		

NOTE 1 "b", "c", "d", "e", "f" means any value in the relevant value group.

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 in value group 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 neither in Clause 4 nor 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.

5.2.11 Standard object codes

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

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

Notation: In the following tables, in the various value groups, *"b", "c", "d", "e", "f"* is equal to any value in the respective value group. If only one object is instantiated, the value shall be 0. If a value group is shaded, then this value group is not used.

NOTE The DLMS UA maintains a list of standard COSEM object definitions at www.dlms.com. The validity of the combination of OBIS codes and class_id-s as well as the data types of the attributes are tested during conformance testing.

5.3 Value group definitions common to all media

5.3.1 Value group A

The range for value group A is 0 to 15; see Table 9.

Table 9 – 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.

5.3.2 Value group B

The range for value group B is 0 to 255; see Table 10.

Table 10 – Value group B codes

Value group B	
0	No channel specified
1…64	Channel 1..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 value 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 neither in Clause 4 nor in Clause 5.

5.3.3 Value group C

5.3.3.1 General

The range for value group C is 0 to 255. The definitions depend on the value in value group A. The codes for abstract objects are specified in 5.3.3.2. See also:

- electricity related codes specified in 5.5.1;
- heat cost allocator related codes specified in 5.6.2;
- heat and cooling related codes specified in 5.7.2
- gas related codes specified in 5.8.2;
- water related codes specified in 5.9.2.

5.3.3.2 Abstract objects

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

Table 11 – Value group C codes – Abstract objects

Value group C **Abstract objects (A = 0)**	
0…89	Context specific identifiers [a]
93	Consortia specific identifiers (See 5.3.4.2).
94	Country specific identifiers (See 5.3.4.3)
96	General service entries (See 5.4.1)
97	General Error registers (See 5.4.2)
98	General list objects (See 5.4.3)
99	Abstract data profiles (See 5.4.4)
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. For the COSEM context, the identifiers are defined in 4.12.2.

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

5.3.4 Value group D

5.3.4.1 General

The range for value group D is 0 to 255.

5.3.4.2 Consortia specific identifiers

Table 12 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 12 – 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 standard must not be re-identified by consortia specific identifiers. NOTE 2 The SELMA Consortium is an associated member of the DLMS UA.	

5.3.4.3 Country specific identifiers

Table 13 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 13 – Value group D codes – Country specific identifiers

Value group D Country specific identifiers [a] (A = any, C = 94)	
00	Identifiers for Finland
01	Identifiers for the USA
02	Identifiers for Canada
03	Identifiers for Serbia
07	Identifiers for Russia
10	Identifiers for Czech
11	Identifiers for Bulgaria
12	Identifiers for Croatia
13	Identifiers for Ireland
14	Identifiers for Israel
15	Identifiers for Ukraine
16	Identifiers for Yugoslavia NOTE With the dissolution of the former Yugoslavia into separate nations, country code 16 was decommissioned.
20	Identifiers for Egypt
27	Identifiers for South Africa
30	Identifiers for Greece
31	Identifiers for the Netherlands
32	Identifiers for Belgium
33	Identifiers for France
34	Identifiers for Spain
35	Identifiers for Portugal
36	Identifiers for Hungary
37	Identifiers for Lithuania
38	Identifiers for Slovenia
39	Identifiers for Italy
40	Identifiers for Romania

Value group D Country specific identifiers [a] (A = any, C = 94)	
41	Identifiers for Switzerland
42	Identifiers for Slovakia
43	Identifiers for Austria
44	Identifiers for the United Kingdom
45	Identifiers for Denmark
46	Identifiers for Sweden
47	Identifiers for Norway
48	Identifiers for Poland
49	Identifiers for Germany
52	Identifiers for South Korea
54	Identifiers for Argentina
55	Identifiers for Brazil
61	Identifiers for Australia
62	Identifiers for Indonesia
63	Identifiers for the Philippines
64	Identifiers for New Zealand
65	Identifiers for Singapore
73	Identifiers for Moldova
75	Identifiers for Belarus
81	Identifiers for Japan
85	Identifiers for Hong Kong
86	Identifiers for China
87	Bosnia and Herzegovina
90	Identifiers for Turkey
91	Identifiers for India
92	Identifiers for Pakistan
96	Identifiers for Saudi Arabia
97	Identifiers for the United Arab Emirates
98	Identifiers for Iran
All other	Reserved
NOTE Objects that are already identified in this standard must not be re-identified by country specific identifiers.	

5.3.5 Value group E

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

5.3.6 Value group F

5.3.6.1 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.

5.3.6.2 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 billing period scheme is identified with its billing period counter, number of available billing periods, time stamp of the billing period and billing period length. Several billing period schemes may be possible. For more, see **Fehler! Verweisquelle konnte nicht gefunden werden.** and 5.10.3.

5.4 Abstract objects (A = 0)

5.4.1 Abstract objects, general service entries

Table 14 below specifies object codes for abstract objects. See also **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Table 14 – OBIS codes for abstract objects, general service entries

Abstract objects, general service entries	OBIS code					
	A	B	C	D	E	F
Billing period values/reset counter entries (First billing period scheme if there are two)						
Billing period counter (1)	0	*b*	0	1	0	VZ or 255
Number of available billing periods (1)	0	*b*	0	1	1	
Time stamp of the most recent billing period (1)	0	*b*	0	1	2	
Time stamp of the billing period (1) VZ (last reset)	0	*b*	0	1	2	VZ
Time stamp of the billing period (1) VZ_{-1}	0	*b*	0	1	2	VZ_{-1}
…	…	…	…	…	…	…
Time stamp of the billing period (1) VZ_{-n}	0	*b*	0	1	2	VZ_{-n}
Billing period values/reset counter entries (Second billing period scheme)						
Billing period counter (2)	0	*b*	0	1	3	VZ or 255
Number of available billing periods (2)	0	*b*	0	1	4	
Time stamp of the most recent billing period (2)	0	*b*	0	1	5	
Time stamp of the billing period (2) VZ (last reset)	0	*b*	0	1	5	VZ
Time stamp of the billing period (2) VZ_{-1}	0	*b*	0	1	5	VZ_{-1}
…	…	…	…	…	…	…
Time stamp of the billing period (2) VZ_{-n}	0	*b*	0	1	5	VZ_{-n}
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	*b*	96	2	0	
Date [a] of last configuration program change	0	*b*	96	2	1	
Date [a] of last time switch program change	0	*b*	96	2	2	
Date [a] of last ripple control receiver program change	0	*b*	96	2	3	
Status of security switches	0	*b*	96	2	4	
Date [a] of last calibration	0	*b*	96	2	5	
Date [a] of next configuration program change	0	*b*	96	2	6	
Date [a] of activation of the passive calendar	0	*b*	96	2	7	
Number of protected configuration program changes [b]	0	*b*	96	2	10	
Date [a] of last protected configuration program change [b]	0	*b*	96	2	11	

Abstract objects, general service entries	OBIS code					
	A	B	C	D	E	F
Date [a] (corrected) of last clock synchronization/setting	0	*b*	96	2	12	
Date of last firmware activation	0	*b*	96	2	13	
Input/output control signals						
State of input/output control signals, global [c]	0	*b*	96	3	0	
State of input control signals (status word 1)	0	*b*	96	3	1	
State of output control signals (status word 2)	0	*b*	96	3	2	
State of input/output control signals (status word 3)	0	*b*	96	3	3	
State of input/output control signals (status word 4)	0	*b*	96	3	4	
Disconnect control	0	*b*	96	3	10	
Internal control signals						
State of the internal control signals, global [c]	0	*b*	96	4	0	
State of internal control signals (status word 1)	0	*b*	96	4	1	
State of internal control signals (status word 2)	0	*b*	96	4	2	
State of internal control signals (status word 3)	0	*b*	96	4	3	
State of internal control signals (status word 4)	0	*b*	96	4	4	
Internal operating status signals						
Internal operating status, global [c]	0	*b*	96	5	0	
Internal operating status (status word 1)	0	*b*	96	5	1	
Internal operating status (status word 2)	0	*b*	96	5	2	
Internal operating status (status word 3)	0	*b*	96	5	3	
Internal operating status (status word 4)	0	*b*	96	5	4	
Battery entries						
Battery use time counter	0	*b*	96	6	0	
Battery charge display	0	*b*	96	6	1	
Date of next change	0	*b*	96	6	2	
Battery voltage	0	*b*	96	6	3	
Battery initial capacity	0	*b*	96	6	4	
Battery installation date and time	0	*b*	96	6	5	
Battery estimated remaining use time	0	*b*	96	6	6	
Aux. supply use time counter	0	*b*	96	6	10	
Aux. voltage (measured)	0	*b*	96	6	11	
Power failure monitoring						
Number of power failures						
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	
In any phase [sic]	0	0	96	7	21	
Auxiliary supply	0	0	96	7	4	
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	

Abstract objects, general service entries	OBIS code					
	A	B	C	D	E	F
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	
NOTE See Number of power failures in any phase, 0.b.96.7.21.255 above in the Number of power failures group.						
Operating time						
Time of operation	0	b	96	8	0	
Time of operation rate 1…rate 63	0	b	96	8	1…63	
Environmental related parameters						
Ambient temperature	0	*b*	96	9	0	
Ambient pressure	0	*b*	96	9	1	
Relative humidity	0	*b*	96	9	2	
Status register						
Status register (Status register 1 if several status registers are used)	0	*b*	96	10	1	
Status register 2	0	*b*	96	10	2	
…	0	*b*	96	10	…	
Status register 10	0	*b*	96	10	10	
Event code						
Event code objects # 1…#10	0	*b*	96	11	0…9	
Communication port log parameters						
Reserved	0	*b*	96	12	0	
Number of connections	0	*b*	96	12	1	
Reserved	0	*b*	96	12	2	
Reserved	0	*b*	96	12	3	
Communication port parameter 1	0	*b*	96	12	4	
GSM field strength	0	*b*	96	12	5	
Telephone number / Communication address of the physical device	0	*b*	96	12	6	
Consumer messages						
Consumer message via local consumer information port	0	*b*	96	13	0	
Consumer message via the meter dispay and / or via consumer information port	0	*b*	96	13	1	
Currently active tariff						
Currently active tariff objects # 1…#16 NOTE Object #16 (E = 15) carries the name of register with the lowest tariff (default tariff register)	0	*b*	96	14	0…15	
Event counter objects						
Event counter objects #1…#10	0	*b*	96	15	0…9	
Manufacturer specific [f]	0	*b*	96	50	*e*	*f*
…						
Manufacturer specific	0	*b*	96	99	*e*	*f*

Abstract objects, general service entries	OBIS code					
	A	B	C	D	E	F
[a] Date of the event may contain the date only, the time only or both, encoded as specified in 4.1.6.1.						
[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 are not defined in this standard.						
[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.						

5.4.2 Error registers, alarm registers and alarm filters – Abstract

Table 15 – OBIS codes for error registers, alarm registers and alarm filters – Abstract

Error registers, alarm registers and alarm filters – Abstract	OBIS code					
	A	B	C	D	E	F
Error register objects 1…10	0	*b*	97	97	0…9	
Alarm register objects 1…10	0	*b*	97	98	0…9	
Alarm filter objects 1…10	0	*b*	97	98	10…19	
NOTE The information to be included in the error objects is not defined in this document.						

5.4.3 List objects – Abstract

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

Table 16 – OBIS codes for list objects – Abstract

List objects – Abstract	OBIS code					
	A	B	C	D	E	F
Data of billing period (with billing period scheme 1 if there are more than one schemes available)	0	*b*	98	1	*e*	255 [a]
Data of billing period (with billing period scheme 2)	0	*b*	98	2	*e*	255 [a]
[a] F = 255 means a wildcard here. See 5.10.3.						

5.4.4 Register table objects – Abstract

Register tables are defined to hold a number of values of the same type.

Table 17 – OBIS codes for register table objects – Abstract

Register table objects – Abstract	OBIS code					
	A	B	C	D	E	F
General use, abstract	0	*b*	98	10	*e*	

5.4.5 Data profile objects – Abstract

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.

Table 18 – OBIS codes for data profile objects – Abstract

Data profile objects – Abstract	OBIS code					
	A	B	C	D	E	F
Load profile with recording period 1 [b]	0	*b*	99	1	*e*	
Load profile with recording period 2 [b]	0	*b*	99	2	*e*	
Load profile during test [b]	0	*b*	99	3	0	
Connection profile	0	*b*	99	12	*e*	
Event log [b]	0	*b*	99	98	*e*	
[b] These objects should be used if they (also) hold data not specific to the energy type.						

5.5 Electricity (A = 1)

5.5.1 Value group C codes – Electricity

Table 19 – Value group C codes – Electricity

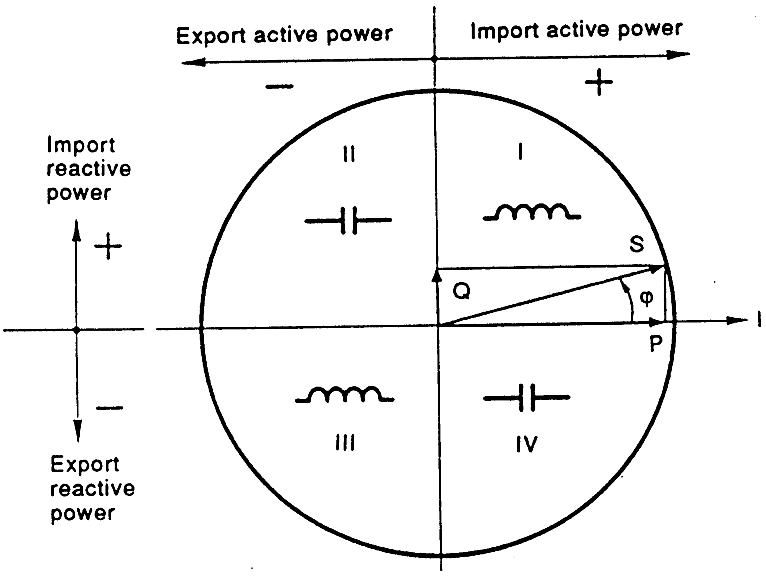
Value group C codes – Electricity (A = 1)	
0	General purpose objects (See 5.5.5.1)
1	ΣL_i Active power+ (QI+QIV) (See also Note 2)
2	ΣL_i Active power– (QII+QIII)
3	ΣL_i Reactive power+ (QI+QII)
4	ΣL_i Reactive power– (QIII+QIV)
5	ΣL_i Reactive power QI
6	ΣL_i Reactive power QII
7	ΣL_i Reactive power 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–

Value group C codes – Electricity (A = 1)	
63	L_3 Reactive power+
64-80	L_3 etc. (See 24-40)
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)
90	ΣL_i current (algebraic sum of the – unsigned – value of the currents in all phases)
91	L_0 current (neutral) [a]
92	L_0 voltage (neutral) [a]
93	Consortia specific identifiers (See 5.3.4.2)
94	Country specific identifiers (See 5.3.4.3)
96	General purpose – Electricity (See 5.5.5.1)
97	Error registers – Electricity (See 5.5.5.2)
98	List object – Electricity (See 5.5.5.3)
99	Data profiles – Electricity (See 5.5.5.4)
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 5.5.3.3.

[b] For details of extended codes, see 5.5.3.4.

[c] For details of extended codes, see 5.5.3.5.



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

Figure 15 – Quadrant definitions for active and reactive power

5.5.2 Value group D codes – Electricity

5.5.2.1 Processing of measurement values

Table 20 – Value group D codes – Electricity

Value group D codes – Electricity (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

	Value group D codes – Electricity (A = 1, C <> 0, 93, 94, 96, 97, 98, 99)
20	Time integral 10
21	Cumulative minimum 3
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
43	Time threshold for under limit
44	Time threshold for over limit
45	Time threshold for missing magnitude
46	Contracted value
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 26), 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.

Value group D codes – Electricity (A = 1, C <> 0, 93, 94, 96, 97, 98, 99)	
Current average 1, 2, 3	See the definition of the "Demand register" IC in 4.3.4. 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" IC in 4.3.4. The value is calculated using measurement period 1, 2 or 3 respectively.
Minimum	The smallest of last average values during a billing period, see Table 26.
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" IC in 4.3.4. The value is calculated using recording interval 1; see Table 26.
Current average 6	See the definition of the "Demand register" IC in 4.3.4. 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 26.
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 26.
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 26.
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 26.
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 26.
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 26.
Under limit values	Values under a certain threshold (for example dips).
Over limit values	Values above a certain threshold (for example swells).
Missing values	Values considered as missing (for example interruptions).

5.5.2.2 Use of value group D for identification of other objects

For identifiers of electricity related general purpose objects see 5.5.5.1.

5.5.3 Value group E codes – Electricity

5.5.3.1 General

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

5.5.3.2 Tariff rates

Table 21 shows the use of value group E for identification of tariff rates typically used for energy (consumption) and demand quantities.

Table 21 – Value group E codes – Electricity – Tariff rates

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

5.5.3.3 Harmonics

Table 22 shows the use of value group E for the identification of harmonics of instantaneous values of voltage, current or active power.

Table 22 – Value group E codes – Electricity – Harmonics

Value group E codes – Electricity – Measurement of harmonics of voltage, current or active power (A = 1, C = 12, 32, 52, 72, 92, 11, 31, 51, 71, 91, 15, 35, 55, 75, D = 7, 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.

5.5.3.4 Phase angles

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

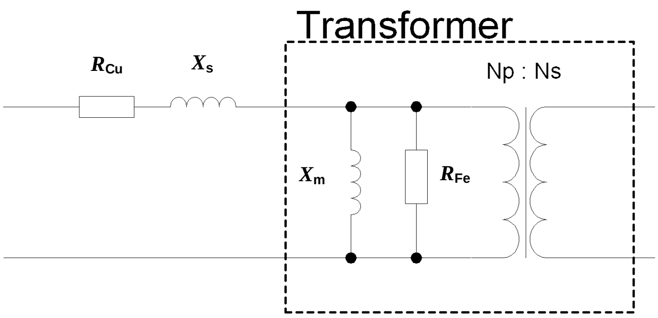
Table 23 – Value group E codes – Electricity – Extended phase angle measurement

Value group E codes – Electricity – Extended phase angle measurement (A = 1, 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)								

5.5.3.5 Transformer and line loss quantities

Table 24 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 20, the use of value group F shall be according to Table 64. For these quantities, no tariffication is available.

The model of the line and the transformer used for loss calculation is shown on Figure 16.



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 16 – Model of the line and the transformer for calculation of loss quantities

Table 24 – Value group E codes – Electricity – Transformer and line losses

Value group E codes – Electricity – Transformer and line losses (A = 1, 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 = (CuR_1) + (CuR_2) + (CuR_3)	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
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 gross+	CA+ = (A+) + (TLA+)	QI+QIV; A+ is the quantity A = 1, C = 1
22	Compensated active net+	CA+ = (A+) - (TLA+)	QI+QIV
23	Compensated active gross–	CA– = (A–) + (TLA–)	QII+QIII, A– is the quantity A = 1, C = 2
24	Compensated active net–	CA – = (A–) - (TLA–)	QII+QIII
25	Compensated reactive gross+	CR+ = (R+) + (TLR+)	QI+QII; R+ is the quantity A = 1, C = 3
26	Compensated reactive net+	CR+ = (R+) - (TLR+)	QI+QII
27	Compensated reactive gross–	CR– = (R–) + (TLR–)	QIII+QIV;R– is the quantity A = 1, C

Value group E codes – Electricity – Transformer and line losses (A = 1, C = 83)			
E=	**Quantity**	**Formula**	**Quadrant / comment**
			= 4
28	Compensated reactive net–	CR– = (R–) - (TLR–)	QIII+QIV
29	Reserved		
30	Reserved		
31	L_1 Active line losses+	$CuA_1+ = I^2h_{L1} \times R_{Cu}$	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–	$CuA_1– = I^2h_{L1} \times R_{Cu}$	QII+QIII
33	L_1 Active line losses	$CuA_1 = I^2h_{L1} \times R_{Cu}$	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+	$CuR_1+ = I^2hL_1 \times X_s$	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–	$CuR_1– = I^2h_{L1} \times X_s$	QIII+QIV
42	L_1 Reactive line losses	$CuR_1 = I^2h_{L1} \times X_s$	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 1.x.0.10.0.VZ
44	L_1 Reactive transformer losses–	$FeR_1– = U^2h_{L1}/X_m$	QIII+QIV
45	L_1 Reactive transformer losses	$FeR_1 = U^2h_{L1}/X_m$	QI+QII+QIII+QIV
46	L_1 Reactive losses+	$TLR_1+ = (CuR_1+) + (FeR_1+)$	QI+QII
47	L_1 Reactive losses–	$TLR_1– = (CuR_1–) + (FeR_1–)$	QIII+QIV
48	L_1 Reactive losses	$TLR_1 = CuR_1 + FeR_1$	QI+QII+QIII+QIV
49	L_1 Ampere-squared hours	A^2h_{L1}	QI+QII+QIII+QIV
50	L_1 Volt-squared hours	V^2h_{L1}	QI+QII+QIII+QIV
51	L_2 Active line losses+	$CuA_2+ = I^2h_{L2} \times R_{Cu}$	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–	$CuA_2– = I^2h_{L2} \times R_{Cu}$	QII+QIII
53…70	L_2 quantities, (See 33…48)		
71	L_3 Active line losses +	$CuA_3+ = I^2h_{L3} \times R_{Cu}$	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 -	$CuA_3– = I^2h_{L3} \times R_{Cu}$	QII+QIII

Value group E codes – Electricity – Transformer and line losses (A = 1, C = 83)			
E=	**Quantity**	**Formula**	**Quadrant / comment**
73…90	L_3 quantities (See 33…48)		
91…255	Reserved		
NOTE In this table, no manufacturer specific range is available.			

5.5.3.6 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 25 – Value group E codes – Electricity – UNIPEDE voltage dips

Value group E codes – Electricity – UNIPEDE voltage dips measurement (A = 1, 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 interface classes form a subset of the interface classes defined in IEC/TR 61000-2-8, Table 2.							

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

For identifiers of electricity related general purpose objects see 5.5.5.1.

5.5.4 Value group F codes – Electricity

5.5.4.1 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 19;
- 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.b.0.1.0.VZ or 255, or 1.b.0.1.3.VZ or 255;
- number of available billing periods 1.b.0.1.1.255 or 1.b.0.1.4.255;
- time stamp of the billing period: 1.b.0.1.2.VZ or 255 or 1.b.0.1.5.VZ or 255;
- billing period length 1.b.0.8.6.255 or 1.b.0.8.7.255.

For more, see Clause **Fehler! Verweisquelle konnte nicht gefunden werden.** and 5.10.3.

5.5.4.2 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.

5.5.5 OBIS codes – Electricity

5.5.5.1 General purpose objects – Electricity

Table 26 – OBIS codes for general purpose objects – Electricity

General purpose objects – Electricity	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined electricity ID	1	*b*	0	0		
Electricity ID 1	1	*b*	0	0	0	
…	…	…	…	…	…	
Electricity ID 10	1	*b*	0	0	9	
Billing period values/reset counter entries (First billing period scheme if there are more than one)						
Billing period counter (1)	1	*b*	0	1	0	VZ or 255
Number of available billing periods (1)	1	*b*	0	1	1	
Time stamp of the most recent billing period (1)	1	*b*	0	1	2	
Time stamp of the billing period (1) VZ (last reset)	1	*b*	0	1	2	VZ
Time stamp of the billing period (1) VZ_{-1}	1	*b*	0	1	2	VZ_{-1}
…	…	…	…	…	…	…
Time stamp of the billing period (1) VZ_{-n}	1	*b*	0	1	2	VZ_{-n}
Billing period values/reset counter entries (Second billing period scheme)						
Billing period counter (2)	1	*b*	0	1	3	VZ or 255
Number of available billing periods (2)	1	*b*	0	1	4	
Time stamp of the most recent billing period (2)	1	*b*	0	1	5	
Time stamp of the billing period (2) VZ (last reset)	1	*b*	0	1	5	VZ
Time stamp of the billing period (2) VZ_{-1}	1	*b*	0	1	5	VZ_{-1}
…	…	…	…	…	…	…
Time stamp of the billing period (2) VZ_{-n}	1	*b*	0	1	5	VZ_{-n}
Program entries						
Active firmware identifier (Previously: Configuration program version number)	1	*b*	0	2	0	
Parameter record number	1	*b*	0	2	1	
Parameter record number, line 1	1	*b*	0	2	1	1
Reserved for future use	1	*b*	0	2	1	2… 127
Manufacturer specific	1	*b*	0	2	1	128… 254
Time switch program number	1	*b*	0	2	2	

General purpose objects – Electricity	OBIS code					
	A	B	C	D	E	F
RCR program number	1	*b*	0	2	3	
Meter connection diagram ID	1	*b*	0	2	4	
Passive calendar name	1	*b*	0	2	7	
Active firmware signature	1	*b*	0	2	8	
Output pulse values or constants NOTE For units, see 4.3.2.						
Active energy, metrological LED	1	*b*	0	3	0	
Reactive energy, metrological LED	1	*b*	0	3	1	
Apparent energy, metrological LED	1	*b*	0	3	2	
Active energy, output pulse	1	*b*	0	3	3	
Reactive energy, output pulse	1	*b*	0	3	4	
Apparent energy, output pulse	1	*b*	0	3	5	
Volt-squared hours, metrological LED	1	*b*	0	3	6	
Ampere-squared hours, metrological LED	1	*b*	0	3	7	
Volt-squared hours, output pulse	1	*b*	0	3	8	
Ampere-squared hours, output pulse	1	*b*	0	3	9	
Ratios						
Reading factor for power	1	*b*	0	4	0	
Reading factor for energy	1	*b*	0	4	1	
Transformer ratio – current (numerator) [a]	1	*b*	0	4	2	VZ
Transformer ratio – voltage (numerator) [a]	1	*b*	0	4	3	VZ
Overall transformer ratio (numerator) [a]	1	*b*	0	4	4	VZ
Transformer ratio – current (denominator) [a]	1	*b*	0	4	5	VZ
Transformer ratio – voltage (denominator) [a]	1	*b*	0	4	6	VZ
Overall transformer ration (denominator) [a]	1	*b*	0	4	7	VZ
Demand limits for excess consumption metering						
Reserved for Germany	1	*b*	0	5		
Nominal values						
Voltage	1	*b*	0	6	0	
Basic/nominal current	1	*b*	0	6	1	
Frequency	1	*b*	0	6	2	
Maximum current	1	*b*	0	6	3	
Reference voltage for power quality measurement	1	*b*	0	6	4	VZ
Reference voltage for aux. power supply	1	*b*	0	6	5	
Input pulse values or constants [b] NOTE For units, see 4.3.2.						
Active energy	1	*b*	0	7	0	
Reactive energy	1	*b*	0	7	1	
Apparent energy	1	*b*	0	7	2	
Volt-squared hours	1	*b*	0	7	3	
Ampere-squared hours	1	*b*	0	7	4	
Unitless quantities	1	*b*	0	7	5	
Active energy, export	1	*b*	0	7	10	
Reactive energy, export	1	*b*	0	7	11	
Apparent energy, export	1	*b*	0	7	12	
Measurement period- / recording interval- / billing period duration						
Measurement period 1, for averaging scheme 1	1	*b*	0	8	0	VZ
Measurement period 2, for averaging scheme 2	1	*b*	0	8	1	VZ
Measurement period 3, for instantaneous value	1	*b*	0	8	2	VZ
Measurement period 4, for test value	1	*b*	0	8	3	VZ

General purpose objects – Electricity	OBIS code					
	A	B	C	D	E	F
Recording interval 1, for load profile	1	*b*	0	8	4	VZ
Recording interval 2, for load profile	1	*b*	0	8	5	VZ
Billing period (Billing period 1 if there are two billing period schemes)	1	*b*	0	8	6	VZ
Billing period 2	1	*b*	0	8	7	VZ
Time entries						
Time expired since last end of billing period (First billing period scheme if there are more than one)	1	*b*	0	9	0	
Local time	1	*b*	0	9	1	
Local date	1	*b*	0	9	2	
Reserved for Germany	1	*b*	0	9	3	
Reserved for Germany	1	*b*	0	9	4	
Week day (0…7)	1	*b*	0	9	5	
Time of last reset (First billing period scheme if there are more than one)	1	*b*	0	9	6	
Date of last reset (First billing period scheme if there are more than one)	1	*b*	0	9	7	
Output pulse duration	1	*b*	0	9	8	
Clock synchronization window	1	*b*	0	9	9	
Clock synchronization method	1	*b*	0	9	10	
Clock time shift limit (default value: s)	1	*b*	0	9	11	
Billing period reset lockout time (First billing period scheme if there are more than one)	1	*b*	0	9	12	
Time expired since last end of billing period (Second billing period scheme)	1	*b*	0	9	13	
Time of last reset (Second billing period scheme)	1	*b*	0	9	14	
Date of last reset (Second billing period scheme)	1	*b*	0	9	15	
Billing period reset lockout time (Second billing period scheme)	1	*b*	0	9	16	
Coefficients						
Transformer magnetic losses, X_m	1	*b*	0	10	0	VZ
Transformer iron losses, R_{Fe}	1	*b*	0	10	1	VZ
Line resistance losses, R_{Cu}	1	*b*	0	10	2	VZ
Line reactance losses, X_s	1	*b*	0	10	3	VZ
Measurement methods						
Algorithm for active power measurement	1	*b*	0	11	1	
Algorithm for active energy measurement	1	*b*	0	11	2	
Algorithm for reactive power measurement	1	*b*	0	11	3	
Algorithm for reactive energy measurement	1	*b*	0	11	4	
Algorithm for apparent power measurement	1	*b*	0	11	5	
Algorithm for apparent energy measurement	1	*b*	0	11	6	
Algorithm for power factor calculation	1	*b*	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	*b*	96	5	0	
Internal operating status (status word 1)	1	*b*	96	5	1	
Internal operating status (status word 2)	1	*b*	96	5	2	
Internal operating status (status word 3)	1	*b*	96	5	3	
Internal operating status (status word 4)	1	*b*	96	5	4	

General purpose objects – Electricity	OBIS code					
	A	B	C	D	E	F
Meter started status flag	1	*b*	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	*b*	96	50	*e*	*f*
....	…	…	…	…	…	…
Manufacturer specific	1	*b*	96	99	*e*	*f*

[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 are 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. See Clause 4.

5.5.5.2 Error register objects – Electricity

Table 27 – OBIS codes for error register objects – Electricity

Error registers – Electricity	OBIS code					
	A	B	C	D	E	F
Error register objects electricity	1	*b*	97	97	*e*	

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

5.5.5.3 List objects – Electricity

Table 28 – OBIS codes for list objects – Electricity

List objects – Electricity	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	*b*	98	1	*e*	255 [a]
Electricity related data of billing period (with billing period scheme 2)	1	*b*	98	2	*e*	255 [a]

[a] F = 255 means a wildcard here. See 5.10.3.

5.5.5.4 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.

Table 29 – OBIS codes for data profile objects – Electricity

Data profile objects – Electricity	OBIS code					
	A	B	C	D	E	F
Load profile with recording period 1	1	*b*	99	1	*e*	
Load profile with recording period 2	1	*b*	99	2	*e*	
Load profile during test	1	*b*	99	3	0	
Dips voltage profile	1	*b*	99	10	1	
Swells voltage profile	1	*b*	99	10	2	
Cuts voltage profile	1	*b*	99	10	3	
Voltage harmonic profile	1	*b*	99	11	n^{th}	
Current harmonic profile	1	*b*	99	12	n^{th}	
Voltage unbalance profile	1	*b*	99	13	0	
Power failure event log	1	*b*	99	97	*e*	
Event log	1	*b*	99	98	*e*	
Certification data log	1	*b*	99	99	*e*	

5.5.5.5 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 30 – OBIS codes for Register table objects – Electricity

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

5.6 Heat Cost Allocators (A = 4)

5.6.1 General

NOTE The following introductory text is from EN 13757-1:2002 Clause 12.6.

Heat Cost Allocators (HCAs) 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 HCAs, even for a single customer. This makes at, the present, direct connection to all HCAs using a two way connections an infeasible solution. It is nevertheless important, that data coming from a (number of) HCAs (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 a COSEM environment. The words used in this clause are those used in EN 834:1994 the corresponding media standard.

The output from an HCA 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.

5.6.2 Value group C codes – HCA

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

Table 31 – Value group C codes – HCA

Value group C codes – HCA (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 12.
94	Country specific identifiers, see Table 13.
96	HCA related service entries, see 5.6.4.1.
97	HCA related Error registers, 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

Value group C codes – HCA (A = 4)
[a] Settings like time constant, thresholds etc. See the table of object codes in EN 13757-1:2002Clause 13.3.1.
[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.

5.6.3 Value group D codes – HCA

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

Table 32 – Value group D codes – HCA

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

5.6.4 OBIS codes – HCA

5.6.4.1 General purpose objects – HCA

Table 33 – OBIS codes for general purpose objects – HCA

General purpose objects – HCA	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined ID	4	*b*	0	0		
ID 1	4	*b*	0	0	0	
…			…	…	…	
ID 10	4	*b*	0	0	9	
Storage information						
Status (VZ) of the historical value counter	4	*b*	0	1	1	
Number of available historical values	4	*b*	0	1	2	
Target date	4	*b*	0	1	10	
Billing date	4	*b*	0	1	11	
Configuration						
Program version no.	4	*b*	0	2	0	
Firmware version no.	4	*b*	0	2	1	
Software version no.	4	*b*	0	2	2	
Device measuring principle [a]	4	*b*	0	2	3	
Conversion factors						
Resulting rating factor, K	4	*b*	0	4	0	
Thermal output rating factor, K_Q	4	*b*	0	4	1	
Thermal coupling rating factor overall, K_C	4	*b*	0	4	2	
Thermal coupling rating factor room side, K_{CR}	4	*b*	0	4	3	
Thermal coupling rating factor heater side, K_{CH}	4	*b*	0	4	4	
Low temperature rating factor, K_T	4	*b*	0	4	5	
Display output scaling factor	4	*b*	0	4	6	
Threshold values						
Start temperature threshold	4	*b*	0	5	10	
Difference temperature threshold	4	*b*	0	5	11	
Period information						
Measuring period for average value	4	*b*	0	8	0	
Recording interval for consumption profile	4	*b*	0	8	4	
Billing period	4	*b*	0	8	6	
Manufacturer specific [b]	4	*b*	96	50	*e*	*f*
…………………						
Manufacturer specific	4	*b*	96	99	*e*	*f*

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

5.6.4.2 Error register objects – HCA

Table 34 – OBIS codes for error register objects – HCA

Error registers objects – HCA	OBIS code					
	A	B	C	D	E	F
Error registers	4	*b*	97	97	*e*	

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 – OBIS codes for data profile objects – HCA

Data profile objects – HCA	OBIS code					
	A	B	C	D	E	F
Data profile objects	4	*b*	99	1	*e*	

5.6.4.4 OBIS codes for HCA related objects (examples)

Table 36 – OBIS codes for HCA related objects (examples)

HCA related objects	OBIS code					
	A	B	C	D	E	F
Consumption						
Current unrated integral	4	*b*	1	0	0	
Current rated integral	4	*b*	2	0	0	
Rated integral, last set date	4	*b*	2	2	0	V_Z
Unrated integral, previous billing date	4	*b*	1	3	0	V_{Z-1}
Rated integral, two most recent periodical values	4	*b*	2	1	0	102
Monitoring values						
Radiator temperature, current value	4	*b*	3	0		
Flow temperature, test value	4	*b*	5	6		
Room temperature, minimum value	4	*b*	7	4		

5.7 Heat / cooling (A = 5 or A = 6)

5.7.1 General

NOTE The following introductory text is from EN 13757-1:2002 Clause 12.7.

The section describes the naming of objects carrying heat meter information in a COSEM environment. It covers the handling of heat, as well as cooling. The media specific terms 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 enthalpy 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.

5.7.2 Value group C codes – 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 37 – Value group C codes – Heat / cooling

Value group C codes – 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]
13	Media pressure [d]
93	Consortia specific identifiers, see Table 12.
94	Country specific identifiers, see Table 13.
96	Heat / cooling related service entries, see 5.7.4.1
97	Heat / cooling related Error registers, see 5.7.4.2
98	Heat / cooling lists
99	Heat / cooling data profiles, see 5.7.4.3

Value group C codes – Heat / cooling related objects (A = 5 or A = 6)	
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).	

5.7.3 Value group D codes – Heat / cooling

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

Table 38 – Value group D codes – Heat / cooling

Value group D codes – Heat / cooling (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
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

Value group D codes – Heat / cooling (A = 5 or A = 6), (C <> 0, 96...99)
[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).

5.7.4 OBIS codes – Heat / cooling

5.7.4.1 General purpose objects – Heat / cooling

Table 39 – OBIS codes for general purpose objects – Heat / cooling

General purpose objects – Heat / cooling	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined ID	5/6	*b*	0	0		
ID 1	5/6	*b*	0	0	0	
…			…	…	…	
ID 10	5/6	*b*	0	0	9	
Storage information						
Status (VZ) of the historical /periodical value counter	5/6	*b*	0	1	1	[f]
Status (VZ) of the periodical value counter, period 1	5/6	*b*	0	1	1	1 [f]
Number of available historical / periodical values	5/6	*b*	0	1	2	[f]
Number of available periodical values for period 2	5/6	*b*	0	1	2	2 [f]
Set date	5/6	*b*	0	1	10	
Billing date	5/6	*b*	0	1	11	
Configuration						
Program version	5/6	*b*	0	2	0	
Firmware version	5/6	*b*	0	2	1	
Software version	5/6	*b*	0	2	2	
Meter location (flow or return) [a]	5/6	*b*	0	2	3	
Device version	5/6	*b*	0	2	4	
Serial number of flow temperature transducer	5/6	*b*	0	2	10	
Serial number of return temperature transducer	5/6	*b*	0	2	11	
Serial number of forward flow transducer	5/6	*b*	0	2	12	

General purpose objects – Heat / cooling	OBIS code					
	A	B	C	D	E	F
Serial number of return flow transducer	5/6	b	0	2	13	
Conversion factors						
Heat coefficient, k	5/6	*b*	0	4	1	
Media pressure (backup value) [b]	5/6	*b*	0	4	2	
Media enthalpy [c]	5/6	*b*	0	4	3	
Threshold values						
Threshold value limit for rate 1 [d]	5/6	*b*	0	5	1	
…			…	…	…	
Threshold value limit for rate 9 [d]	5/6	*b*	0	5	9	
Maximum contracted flow rate [e]	5/6	*b*	0	5	21	
Maximum contracted power [e]	5/6	*b*	0	5	22	
Maximum contracted $\Delta\theta$ [e]	5/6	*b*	0	5	23	
Minimum contracted return temperature [e]	5/6	*b*	0	5	24	
Timing information						
Averaging period for measurements, generic	5/6	*b*	0	8	0	
Averaging period for instantaneous measurements	5/6	*b*	0	8	1	
Averaging period for volume / flow measurements	5/6	*b*	0	8	2	
Averaging period for temperature measurements	5/6	*b*	0	8	3	
Averaging period for pressure measurements	5/6	*b*	0	8	4	
Averaging period, power	5/6	*b*	0	8	5	
Averaging period, flow rate	5/6	*b*	0	8	6	
Averaging period, test values	5/6	*b*	0	8	7	
Measurement period, peak values, period 1(short) [g]	5/6	*b*	0	8	11	
Measurement period, peak values, period 2 [g]	5/6	*b*	0	8	12	
Measurement period, peak values, period 3 [g]	5/6	*b*	0	8	13	
Measurement period, peak values, period 4 [g]	5/6	*b*	0	8	14	
Measurement period, periodical values, period 1(short) [g]	5/6	*b*	0	8	21	
Measurement period, periodical values, period 2 [g]	5/6	*b*	0	8	22	
Measurement period, periodical values, period 3 [g]	5/6	*b*	0	8	23	
Measurement period, periodical values, period 4 [g]	5/6	*b*	0	8	24	
Measurement period, test values	5/6	*b*	0	8	25	
Recording interval 1 for profiles [h]	5/6	*b*	0	8	31	
Recording interval 2 for profiles [h]	5/6	*b*	0	8	32	
Recording interval 3 for profiles [h]	5/6	*b*	0	8	33	
Billing period	5/6	*b*	0	8	34	
Manufacturer specific [b]	5/6	*b*	96	50	*e*	*f*
…………………						
Manufacturer specific	5/6	*b*	96	99	*e*	*f*

General purpose objects – Heat / cooling	OBIS code					
	A	B	C	D	E	F

[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.

5.7.4.2 Error register objects – Heat / cooling

Table 40 – OBIS codes for error register objects – Heat / cooling

Error register objects – Heat / cooling	OBIS code					
	A	B	C	D	E	F
Error register	5/6	*b*	97	97	*e*	
NOTE The information to be included in the error objects is not defined in this document.						

5.7.4.3 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 41 – OBIS codes for data profile objects – Heat / cooling

Data profile objects – Heat / cooling	OBIS code					
	A	B	C	D	E	F
Consumption / load profile with recording interval 1	5/6	*b*	99	1	1	
Consumption / load profile with recording interval 2	5/6	*b*	99	1	2	
Consumption / load profile with recording interval 3	5/6	*b*	99	1	3	
Profile of maxima with recording interval 1	5/6	*b*	99	2	1	
Profile of maxima with recording interval 2	5/6	*b*	99	2	2	
Profile of maxima with recording interval 3	5/6	*b*	99	2	3	
Consumption / load profile during test	5/6	*b*	99	3	1	
Certification data log	5/6	*b*	99	99	*e*	

5.7.4.4 OBIS codes for heat / cooling related objects (examples)

Table 42 – OBIS codes for heat / cooling related objects (examples)

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

[a] been This shows the use of the object type profile, designed to capture objects periodically. No profiles have 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.

5.8 Gas (A = 7)

5.8.1 General introduction to gas measurement

5.8.1.1 Overview

Measurement of the energy supplied in the form of gas to customers is a complex process. It has to take into account the characteristics of the measuring site, the gas measurement technology, the conditions and the properties of the gas and the characteristics of the billing process.

Energy measurement is generally a multi step process.

The first step is to measure either the amount of the volume or the mass of gas based on various measuring principles, like volume, flow, density or mass measurement. Accuracy can be improved by correcting the measurement error of the meter.

In the case of volume measurement, the next step is to convert the volume measured at metering conditions to volume at base conditions.

In the final step, the energy is calculated from the volume at base conditions or the mass, and the calorific value. The calorific value – either per volume unit or per mass unit – is determined using gas analysis techniques.

The measurement technology and the implementation of the volume conversion and energy calculation process depend on the application segment.

Conversion and calculation steps can take place at the measuring site by electronic devices, or in the IT system.

For measurement of larger volumes, there are several devices involved in the process, depending on installation and hazardous area requirements. Not only the final results, but also interim values in the conversion and calculation process are of interest for checking and controlling purposes.

5.8.1.2 Typical gas metering installations

5.8.1.2.1 Residential application

A typical residential gas metering installation is shown in Figure 17.

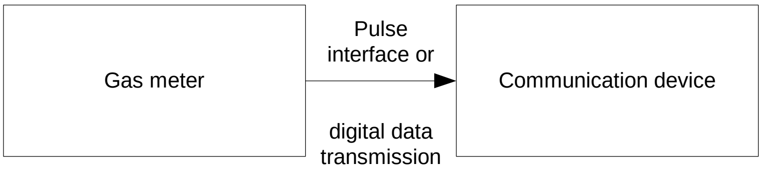


Figure 17 – Residential gas metering installation

The meter is typically a diaphragm (positive displacement) meter, which may perform mechanical temperature correction.

The information from the gas meter to the communication device may be transferred in the form of pulses. Alternatively, the meter may be equipped with a digital interface, e.g. an encoder turning the index reading to digital information.

Volume conversion and energy calculation takes place in the IT system.

5.8.1.2.2 Industrial application

A typical industrial gas metering installation is shown in Figure 18.

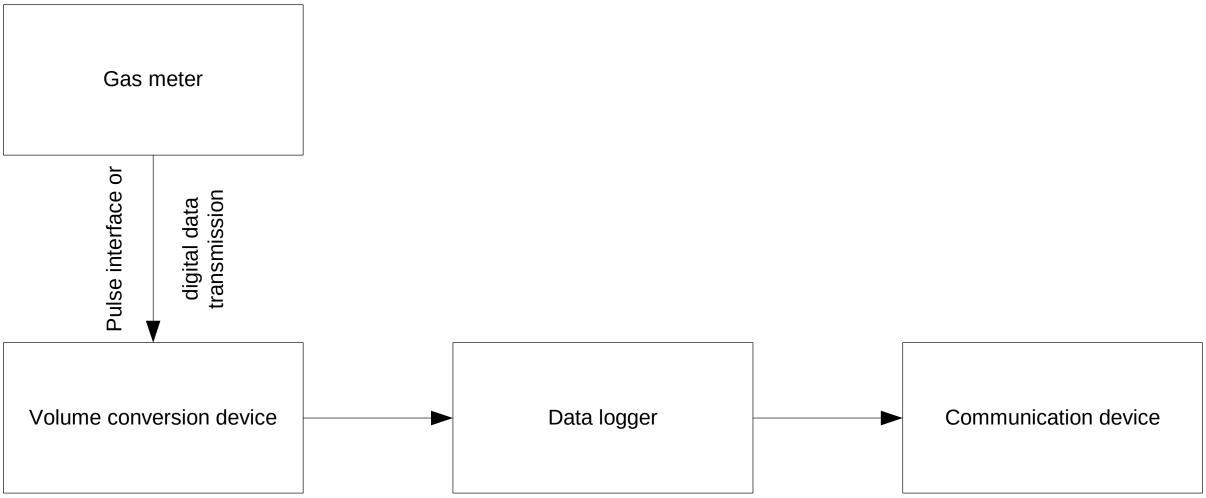


Figure 18 – Industrial gas metering installation (single stream)

In industrial applications, typically more functions are implemented at the measuring site than in residential applications. This may include the calculation of the volume at base conditions, and, if the calorific value is available (e.g. via remote communication), the calculation of the energy.

The data logger stores data relevant for billing, data validation and process control.

The functions may be integrated in less devices, depending on the hazardous zone restrictions and the level of integration of electronics.

5.8.1.2.3 Gas transport application

A typical gas transport metering “city gate” installation – also used for very large consumers – is shown in Figure 19.

Such gas stations are equipped with more than one pipe for the gas flow (multi stream).Typically, volume conversion devices are installed on each pipe, because the measurement is closely pipe related. Generally, there is one data logger and a device used to determine the calorific value (e.g. gas chromatograph).

All devices are connected via a bus system.

Depending on the design of these devices, selected functions may be implemented in a single cabinet or physical device.

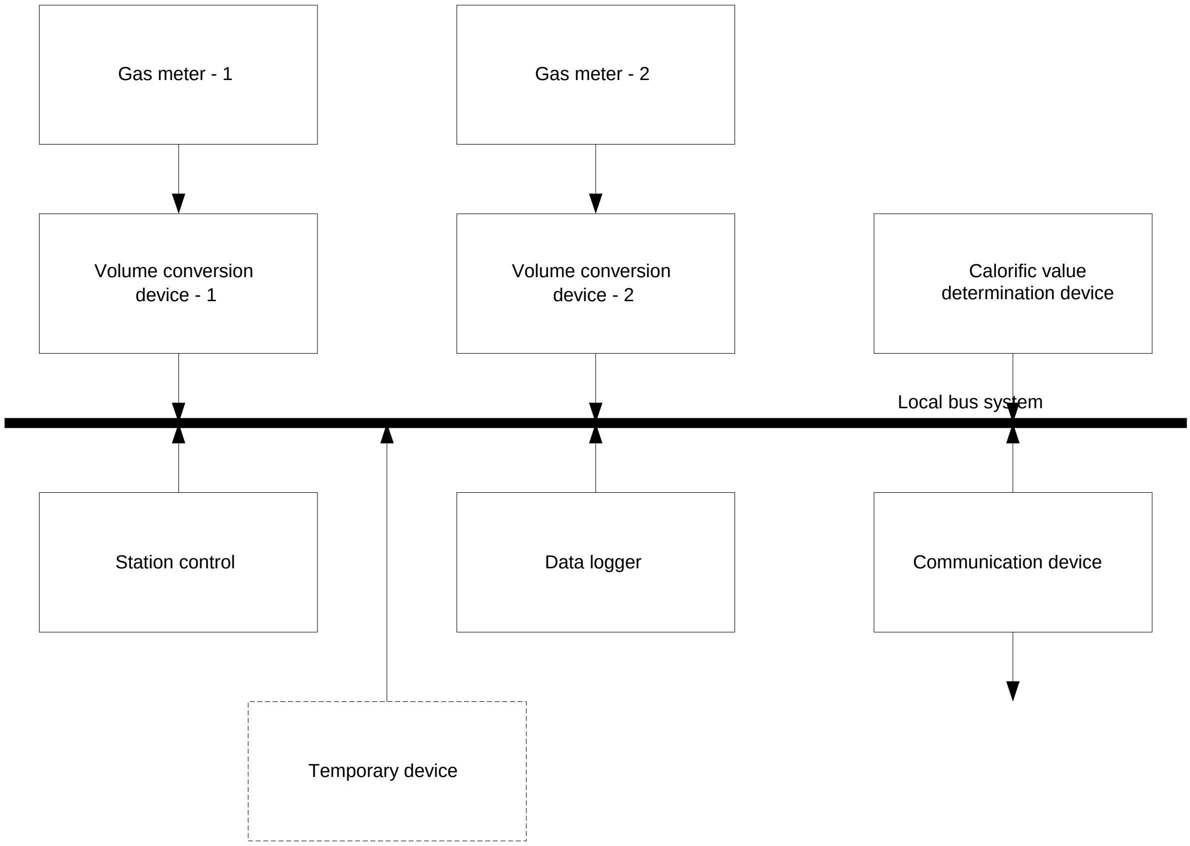


Figure 19 – City gate or border crossing installation (multi stream)

5.8.1.3 Gas volume conversion

5.8.1.3.1 General

The gas volume conversion process needs the following inputs:

- the volume information from a gas meter;
- the temperature of the gas measured;
- the pressure of the gas measured; this may be replaced by a constant;
- the compressibility, this may be replaced by a constant.

When the process is implemented in a gas conversion device, it is assumed to be capable of:

- performing error correction (optionally);
- measuring the temperature;
- measuring the pressure of the gas (optionally); and
- calculating the compressibility according to agreed algorithms, in function of temperature, pressure and gas composition (optionally).

The volume conversion device may handle bidirectional gas flows. The main direction of flow is *forward*.

It may be equipped with *disturbance registers* used when the value of temperature, pressure or compressibility is outside permissible metrological limits of plausibility, leading to an *alert condition*. When such alert condition occurs, the gas conversion process switches to store results in disturbance registers, until the alert conditions disappears.

5.8.1.3.2 Step 1: Error correction (optional)

The error curve of the gas meter is corrected by a correction factor:

$$V_c = C_f * V_m$$

where:

- V_c is the corrected volume;
- C_f is the correction factor given by an equation $C_f = f(q)$; where q is the flow;
- V_m is the volume at metering conditions.

The error correction method is generally manufacturer specific.

5.8.1.3.3 Step 2: Volume conversion to base conditions

Volume at base conditions is calculated using the equation:

$$V_b = C \times V$$

where:

- V_b is the volume at base conditions,
- V may be V_m or V_c (Volume at metering conditions or corrected volume);
- C is the conversion factor given by the relationship:

$$C = (P / P_b) \times (T_b / T) \times (Z_b / Z)$$

where Z is the compressibility factor allowing to take into account the difference in compressibility between the gas measured and the ideal gas. It is a function of the pressure and the temperature:

$$Z = f\,(P,\ T)$$

Settable gas properties and components are used for the compressibility calculation, combined into one of several existing calculation methods. If the compressibility factor is not calculated, it may be included as a fixed value in the calculation of the conversion factor. Below 1,5 bar, the value of Z is usually set to 1.

If the pressure is not measured, it may be included as a fixed value in the calculation of the conversion factor.

5.8.1.3.4 Step 3: Energy conversion

The final step is to calculate the energy, using the equation:

$$E = \text{CalValue} \times V_b$$

where CalValue is the calorific value, expressed in J/m^3. Typically, it is measured by calorimeter or gas chromatograph devices.

5.8.1.3.5 Model of data flow for volume conversion and energy calculation

The model of data flow for volume conversion and energy calculation is shown in Figure 20.

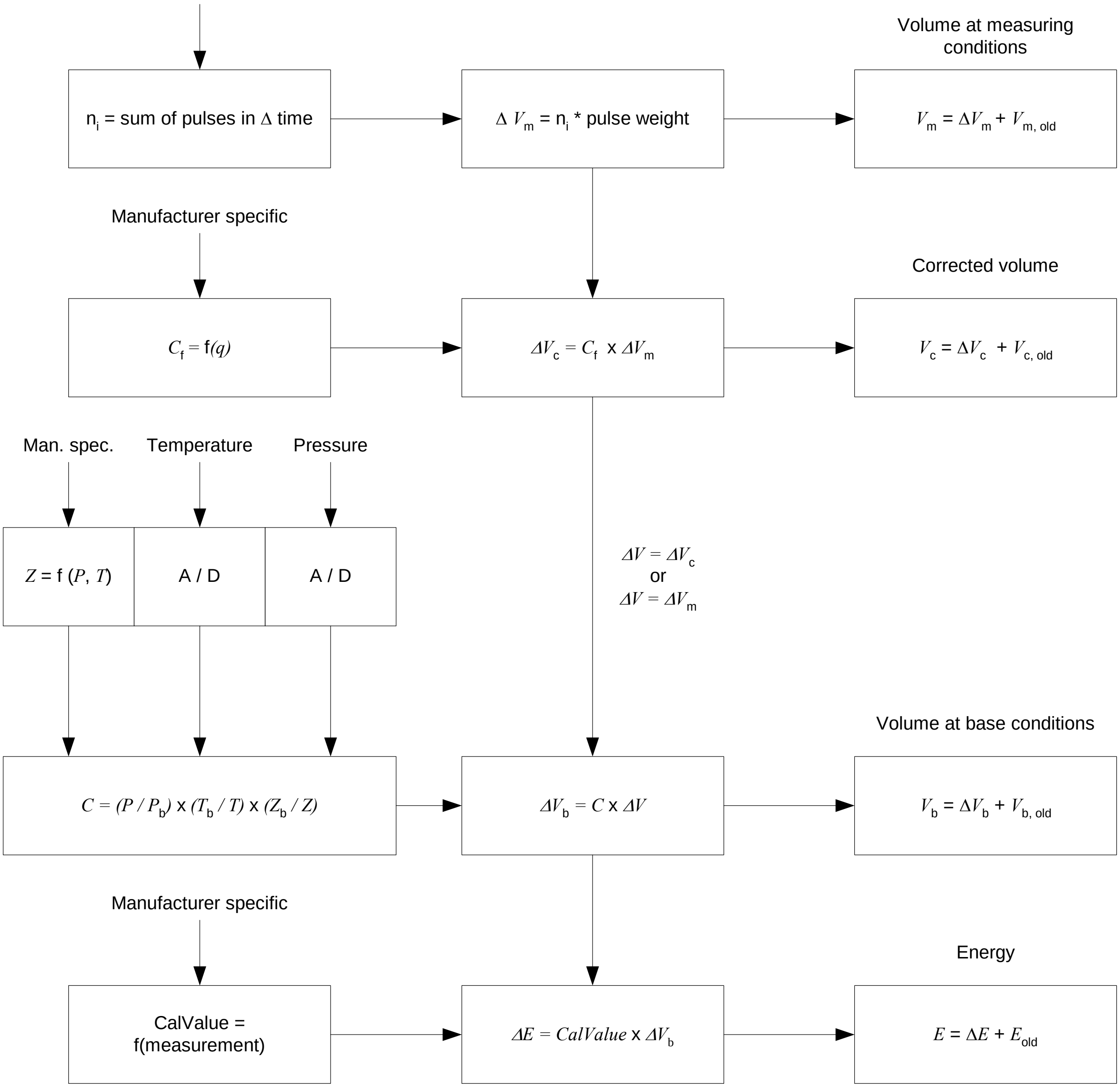


Figure 20 – Data flow of volume conversion and energy calculation

The OBIS codes of the main objects in the data flow are shown in Table 43, with the following assumptions:

- the volume conversion is implemented in a device providing energy calculation;
- the device has one single channel;
- the direction of the gas flow is forward;
- energy is the result of the conversion process from volume at base conditions to energy, by applying the calorific value as factor;
- the data of interest are current values of undisturbed indexes and the gas process data.

Table 43 – OBIS codes of the main objects in the gas conversion process data flow

Name	Symbol	OBIS code
Indexes		
Forward absolute meter volume, index, at metering conditions	V_{m}	7.0.3.0.0.255
Forward absolute meter volume, index, corrected value	V_{c}	7.0.3.1.0.255
Forward absolute converter volume, index, at metering conditions	V_{m}	7.0.13.0.0.255
Forward absolute converter volume, index, corrected value	V_{c}	7.0.13.1.0.255
Forward absolute converter volume, index, at base conditions	V_{b}	7.0.13.2.0.255
Forward absolute energy, index, at base conditions	E	7.0.33.2.0.255
Compressibility, correction and conversion values		
Correction factor [a]	C_{f}	7.0.51.0.0.255
Conversion factor [b]	C	7.0.52.0.0.255
Compressibility factor, current value at metering conditions [c]	Z	7.0.53.0.0.255
Compressibility factor, current value at base conditions [c]	Z_{b}	7.0.53.2.0.255
Compressibility factor, preset value [c]	Z_{b}	7.0.53.11.0.255
Compressibility factor, calculation method [c]		7.0.53.12.0.255
Superior calorific value [d]	CalVal	7.0.54.0.0.255
Metering site condition information		
Gas temperature (absolute), value at metering conditions [e]	T	7.0.41.0.0.255
Gas temperature (absolute), value at base conditions [e]	T_{b}	7.0.41.2.0.255
Gas temperature (absolute), backup value [e]	T	7.0.41.3.0.255
Gas pressure (absolute), value at metering conditions [f]	P	7.0.42.0.0.255
Gas pressure (absolute), value at base conditions [f]	P_{b}	7.0.42.2.0.255
Gas pressure (absolute), backup value [f]	P	7.0.42.3.0.255

[a] 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.

[b] See 5.8.1.3.3.

[c] 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.

[d] The superior (or gross) calorific value can be seen as a conversion factor for converting volume to energy although it is also used for the conversion algorithm.

[e] Temperature of the gas, expressed in Kelvin. Volume conversion depends on Kelvin temperature measurement. This may represent a measured value or a base condition, or a backup value, used if the temperature sensor fails, as identified by the value of value group D.

[f] Pressure of the 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, or a backup value, used if the pressure sensor fails, as identified by the value of value group D.

5.8.1.4 Data logging

5.8.1.4.1 General

The data logging process captures, generates and makes available the data necessary for billing, as well as the data necessary for managing the measurement process and the gas grid.

5.8.1.4.2 Time bound processing

Quantities measured by the gas meter, calculated in the data logger or in the IT system may be:

- indexes, index differences and maxima of index differences; and
- average, minimum and maximum values

related to various intervals and periods. A distinction is made between:

- recording intervals for profiles;
- measurement periods for average values;
- process intervals;
- measurement periods for indexes and index differences;
- billing periods for indexes and index differences;
- averaging periods.

Some of these periods and intervals may have a default length, or otherwise their length can be held by specific objects. See 5.8.5.1, Table 53.

The processing methods depend on the kind of the quantity:

- indexes and index differences; see 5.8.3.2;
- flow rate, see 5.8.3.3;
- process values, see 5.8.3.4; and
- compressibility, correction and conversion values, see 5.8.3.5;
- natural gas analysis, see 5.8.3.6.

5.8.1.4.3 Gas day

One specific element in gas metering is that the start of a gas day may be different from the start of a calendar day.

NOTE For example the gas day starts at 6:00 in Germany.

Therefore, taking the example above, a gas month lasts from 6:00 of the first day of a calendar month to 6:00 of the first day of the next calendar month. Similarly, a gas year starts at 6:00 on 1^{st} of January and ends at 6:00 on 1^{st} January of the next year.

5.8.1.4.4 Data profiles

COSEM *Profile generic* objects may capture one or several values – attributes of COSEM objects – in their buffer.

For gas metering, both *general purpose* and *dedicated* profiles are available:

- a general purpose Profile generic object captures one or several values. Such objects have a general OBIS code / logical name that do not provide specific information on the values captured. These profiles are also available with some fixed recording intervals;
- a dedicated Profile generic object captures only one value. The OBIS code / logical name of such a dedicated Profile generic object is “self-explanatory”, i.e. it reflects the OBIS code of the object the value attribute of which is captured.

  NOTE A time stamp and a status attribute may be captured in addition to the value(s) of interest.

In any case, the values captured are identified by the capture_objects attribute.

See 5.8.5.4.

5.8.2 Value group C codes – Gas

The allocations in the value group C take into account the different combinations of measuring and calculating devices located at a metering point, to allow identifying the source where the data are generated.

For the purposes of volume / mass / energy measurement, value group C identifies:

- the location of the device in the measurement chain: meter (encoder), converter, logger;
- the direction of the gas flow: forward or reverse;
- the qualifier of the measurement: undisturbed, disturbed, or absolute.

Value group C is also used for identifying process data.

For the purposes of gas analysis, a distinction is made between measured values generated by gas analysing systems (C = 70) and parameters used for calculation (C = 0, D = 12).

Table 44 – Value group C codes – Gas

Value group C codes – Gas (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
6	Reverse absolute meter volume
7	Forward absolute meter volume (encoder)
8	Reverse absolute meter volume (encoder)
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

Value group C codes – Gas (A = 7)	
42	Absolute pressure
43	Flow rate
44	Velocity of sound
45	Density (of gas)
46	Relative density
47	Gauge pressure
48	Differential pressure
49	Density of air
51	Correction factor
52	Conversion factor
53	Compressibility factor
54	Superior calorific value [a]
55	Gas law deviation coefficient (= compressibility factor ratio)
61	Forward undisturbed mass
62	Forward disturbed mass
63	Forward absolute mass
64	Reverse undisturbed mass
65	Reverse disturbed mass
66	Reverse absolute mass
70	Natural gas analysis
93	Consortia specific identifiers
94	Country specific identifiers
96	Gas related service entries, see 5.8.5.1
97	Gas related Error registers, see 5.8.5.2
98	Gas related lists (reserved)
99	Gas related data profiles, see 5.8.5.4
128...199, 240	Manufacturer specific codes
All other	Reserved
Notes	
[a] The superior (or gross) caloric value can be seen as a conversion factor for converting volume to energy although it is also used for the conversion algorithm.	

5.8.3 Value group D codes – Gas

5.8.3.1 General

Allocations in value group D allow to further classify quantities identified by codes in value group A to C. The allocations depend on the kind of quantity:

- indexes and index differences; see 5.8.3.2;
- flow rate, see 5.8.3.3;
- process values, see 5.8.3.4; and
- compressibility, correction and conversion values, see 5.8.3.5;
- natural gas analysis values, see 5.8.3.6.

5.8.3.2 Gas indexes and index differences

The allocations allow identifying the various volume, mass and energy quantities measured along the measuring chain and the gas volume conversion process, relative to various measurement and billing periods:

- indexes: current values and historical values relative to various billing periods;
- index differences: current and last values relative to measurement periods and billing periods;

  NOTE Index difference over a certain measurement or billing period is also known as consumption. For consumption, thresholds may be defined, see Table 53.

- maximum of index differences over various measurement periods, relative to various billing periods;

A distinction is made between *value at metering conditions*, *corrected value* and *value at base conditions (converted value)*. The applicability of these qualifiers depends on the location in the measuring chain and in the gas volume conversion process.

Three measurement periods are available:

- measurement period 1: default value 15 min;
- measurement period 2: default value 1 hour;
- measurement period 3: no default value specified.

Four billing periods are available:

- billing period 1: default value 1 day;
- billing period 2: default value 1 month;
- billing period 3: default value 1 year;
- billing period 4: no default value specified.

The default values specified reflect the most common applications. If other values are used, they may be held by COSEM objects specified for this purpose; see **Fehler! Verweisquelle konnte nicht gefunden werden.** and Table 53.

In addition to the current values of the indexes, the following values are available:

For measurement periods 1 to 3:

- index differences for the current and the last measurement period (6 - 6 values).

For billing periods 1, 3 and 4:

- historical indexes (3 - 3 values);
- index differences for the current and the last billing period (6 - 6 values);
- maximum of index differences over measurement periods 1, 2 and 3 (9 - 9 values);
- in total, 18 - 18 values.

For billing period 2:

- historical indexes (3 values);
- index differences for the current and the last billing period (6 values);
- maximum of index differences over measurement periods 1, 2 and 3, as well as over billing period 1 (12 values);
- in total, 21 values.

For all these values, tariffs may be applied. See 5.8.4.2.

Table 45 – Value group D codes – Gas – Indexes and index differences

Value group D codes – Gas – Indexes and index differences (A= 7, C = 1…8, 11…16, 21…26, 31…36, 61…66)			
	Quantity	**Qualifier**	**Period**
0	Index	Value at metering conditions	Current
1	Index	Corrected value [a]	Current
2	Index	Value at base conditions / “Converted value”	Current
3	Index	Current redundant value at metering conditions [b]	Current
Values relative to measurement period 1 (default value = 15 minutes)			
6	Index difference	Value at metering conditions	Current
7	Index difference	Corrected value	Current
8	Index difference	Value at base conditions	Current
9	Index difference	Value at metering conditions	Last
10	Index difference	Corrected value	Last
11	Index difference	Value at base conditions	Last
Values relative to measurement period 2 (default value = 1 hour)			
12	Index difference	Value at metering conditions	Current
13	Index difference	Corrected value	Current
14	Index difference	Value at base conditions	Current
15	Index difference	Value at metering conditions	Last
16	Index difference	Corrected value	Last
17	Index difference	Value at base conditions	Last
Values relative to measurement period 3 (no default value)			
18	Index difference	Value at metering conditions	Current
19	Index difference	Corrected value	Current
20	Index difference	Value at base conditions	Current
21	Index difference	Value at metering conditions	Last
22	Index difference	Corrected value	Last
23	Index difference	Value at base conditions	Last
Values relative to billing period 1 (default value = 1 day)			
24	Index	Value at metering conditions	Historical [c]
25	Index	Corrected value	Historical [c]
26	Index	Value at base conditions	Historical [c]
27	Index difference	Value at metering conditions	Current
28	Index difference	Corrected value	Current
29	Index difference	Value at base conditions	Current
30	Index difference	Value at metering conditions	Last
31	Index difference	Corrected value	Last
32	Index difference	Value at base conditions	Last

Value group D codes – Gas – Indexes and index differences (A= 7, C = 1…8, 11…16, 21…26, 31…36, 61…66)			
	Quantity	**Qualifier**	**Period**
33	Maximum of Index differences over measurement period 1 [c]	Value at metering conditions	
34	Maximum of Index differences over measurement period 1 [c]	Corrected value	
35	Maximum of Index differences over measurement period 1 [c]	Value at base conditions	
36	Maximum of Index differences over measurement period 2 [c]	Value at metering conditions	
37	Maximum of Index differences over measurement period 2 [c]	Corrected value	
38	Maximum of Index differences over measurement period 2 [c]	Value at base conditions	
39	Maximum of Index differences over measurement period 3 [c]	Value at metering conditions	
40	Maximum of Index differences over measurement period 3 [c]	Corrected value	
41	Maximum of Index differences over measurement period 3 [c]	Value at base conditions	
Values relative to billing period 2 (default value = 1 month)			
42	Index	Value at metering conditions	Historical [c]
43	Index	Corrected value	Historical [c]
44	Index	Value at base conditions	Historical [c]
45	Index difference	Value at metering conditions	Current
46	Index difference	Corrected value	Current
47	Index difference	Value at base conditions	Current
48	Index difference	Value at metering conditions	Last
49	Index difference	Corrected value	Last
50	Index difference	Value at base conditions	Last
51	Maximum of Index differences over measurement period 1 [c]	Value at metering conditions	
52	Maximum of Index differences over measurement period 1 [c]	Corrected value	
53	Maximum of Index differences over measurement period 1 [c]	Value at base conditions	
54	Maximum of Index differences over measurement period 2 [c]	Value at metering conditions	
55	Maximum of Index differences over measurement period 2 [c]	Corrected value	
56	Maximum of Index differences over measurement period 2 [c]	Value at base conditions	
57	Maximum of Index differences over measurement period 3 [c]	Value at metering conditions	
58	Maximum of Index differences over measurement period 3 [c]	Corrected value	
59	Maximum of Index differences over measurement period 3 [c]	Value at base conditions	
60	Maximum of Index differences over billing period 1 [c]	Value at metering conditions	
61	Maximum of Index differences over billing period 1	Corrected value	

Value group D codes – Gas – Indexes and index differences (A= 7, C = 1…8, 11…16, 21…26, 31…36, 61…66)			
	Quantity	**Qualifier**	**Period**
	[c]		
62	Maximum of Index differences over billing period 1 [c]	Value at base conditions	
Values relative to billing period 3 (default value = 1 year)			
63	Index	Value at metering conditions	Historical [c]
64	Index	Corrected value	Historical [c]
65	Index	Value at base conditions	Historical [c]
66	Index difference	Value at metering conditions	Current
67	Index difference	Corrected value	Current
68	Index difference	Value at base conditions	Current
69	Index difference	Value at metering conditions	Last
70	Index difference	Corrected value	Last
71	Index difference	Value at base conditions	Last
72	Maximum of Index differences over measurement period 1 [c]	Value at metering conditions	
73	Maximum of Index differences over measurement period 1 [c]	Corrected value	
74	Maximum of Index differences over measurement period 1 [c]	Value at base conditions	
75	Maximum of Index differences over measurement period 2 [c]	Value at metering conditions	
76	Maximum of Index differences over measurement period 2 [c]	Corrected value	
77	Maximum of Index differences over measurement period 2 [c]	Value at base conditions	
78	Maximum of Index differences over measurement period 3 [c]	Value at metering conditions	
79	Maximum of Index differences over measurement period 3 [c]	Corrected value	
80	Maximum of Index differences over measurement period 3 [c]	Value at base conditions	
Values relative to billing period 4 (no default value)			
81	Index	Value at metering conditions	Historical [c]
82	Index	Corrected value	Historical [c]
83	Index	Value at base conditions	Historical [c]
84	Index difference	Value at metering conditions	Current
85	Index difference	Corrected value	Current
86	Index difference	Value at base conditions	Current
87	Index difference	Value at metering conditions	Last
88	Index difference	Corrected value	Last
89	Index difference	Value at base conditions	Last
90	Maximum of Index differences over measurement period 1 [c]	Value at metering conditions	
91	Maximum of Index differences over measurement period 1 [c]	Corrected value	
92	Maximum of Index differences over measurement period 1 [c]	Value at base conditions	

Value group D codes – Gas – Indexes and index differences (A= 7, C = 1…8, 11…16, 21…26, 31…36, 61…66)			
	Quantity	**Qualifier**	**Period**
93	Maximum of Index differences over measurement period 2 [c]	Value at metering conditions	
94	Maximum of Index differences over measurement period 2 [c]	Corrected value	
95	Maximum of Index differences over measurement period 2 [c]	Value at base conditions	
96	Maximum of Index differences over measurement period 3 [c]	Value at metering conditions	
97	Maximum of Index differences over measurement period 3 [c]	Corrected value	
98	Maximum of Index differences over measurement period 3 [c]	Value at base conditions	
All other	Reserved		
Notes			
[a]	Error correction of meter curves can be allocated to meters (e.g. temperature compensation of a diaphragm gas meter) or subsequent connected devices (e.g. high pressure correction curve of a turbine meter implemented in an associated volume conversion device).		
[b]	From data logger (parallel recording) for use in case of a measurement device fails.		
[c]	With F = 255, current value. With F = 1…12, 0…99 value(s) of (a) previous billing period (day), relative to the billing period counter. With F = 101…126 value(s) of (a) previous billing period(s) (day) relative to the current billing period.		

5.8.3.3 Flow rate

The allocations allow identifying values associated with the flow rate of the gas. The flow rate is a process information. It is not linked to a physical device. No tariffication is applicable.

A distinction is made between:

- current average, last average, and maximum of last average values measured over various averaging periods, relative to various measurement and billing periods. Measurement period 2 and 3 shall be multiple of the averaging period of block demand / sliding demand measurement.
- values at metering conditions, corrected value, value at base conditions (converted value) and value at standard conditions;

NOTE Standard conditions refer to national regulations, which may differ from ISO standards reference values for base conditions.

Example: gas reference temperature at standard conditions is 0°C, gas reference temperature at base conditions is +15°C.

For averaging period 2, block demand (default) or sliding demand is available. In the case of sliding demand, the averaging period is split to sub-periods. The number of sub-periods is carried by the object 7.b.0.8.35.255; see Table 53.

The last average values of the various flow rate quantities can be captured to load profiles, with self-explanatory OBIS codes, see 5.8.5.4.

Table 46 – Value group D codes – Gas – Flow rate

Value group D codes – Gas – Flow rate (A = 7, C = 43)		
	Quantity	**Qualifier**
0	Instantaneous	Current value at metering conditions
1	Instantaneous	Corrected value
2	Instantaneous	Value at base conditions / “Converted value”
13	Instantaneous	Value at standard conditions
Averaging period 1, default value = 5 minutes		
15	Current average for averaging period 1	Value at metering conditions
16		Corrected value
17		Value at base conditions
18		Value at standard conditions
19	Last average for averaging period 1	Value at metering conditions
20		Corrected value
21		Value at base conditions
22		Value at standard conditions
23	Maximum of last averages for averaging period 1 relative to measurement period 2 (default value = 1 hour)	Value at metering conditions
24		Corrected value
25		Value at base conditions
26		Value at standard conditions
27	Maximum of last averages for averaging period 1 relative to measurement period 3 (no default value)	Value at metering conditions
28		Corrected value
29		Value at base conditions
30		Value at standard conditions
31	Maximum of last averages for averaging period 1 relative to billing period 1 (default value = 1 day)	Value at metering conditions
32		Corrected value
33		Value at base conditions
34		Value at standard conditions
Averaging period 2, default value = 15 minutes (block demand or sliding demand)		
35	Current average for averaging period 2	Value at metering conditions
35		Corrected value
37		Value at base conditions
38		Value at standard conditions
39	Last average for averaging period 2	Value at metering conditions
40		Corrected value
41		Value at base conditions
42		Value at standard conditions

Value group D codes – Gas – Flow rate (A = 7, C = 43)		
43	Maximum of last averages for averaging period 2 relative to measurement period 2 (default value = 1 hour)	Value at metering conditions
44		Corrected value
45		Value at base conditions
46		Value at standard conditions
47	Maximum of last averages for averaging period 2 relative to measurement period 3 (no default value)	Value at metering conditions
48		Corrected value
49		Value at base conditions
50		Value at standard conditions
51	Maximum of last averages for averaging period 2 relative to billing period 1 (default value = 1 day)	Value at metering conditions
52		Corrected value
53		Value at base conditions
54		Value at standard conditions
Averaging period 3, default value = 1 hour		
55	Current average for averaging period 3	Value at metering conditions
56		Corrected value
57		Value at base conditions
58		Value at standard conditions
59	Last average for averaging period 3	Value at metering conditions
60		Corrected value
61		Value at base conditions
62		Value at standard conditions
Averaging period 4, (no default value)		
63	Current average for averaging period 4	Value at metering conditions
64		Corrected value
65		Value at base conditions
66		Value at standard conditions
67	Last average for averaging period 4	Value at metering conditions
68		Corrected value
69		Value at base conditions
70		Value at standard conditions
All other	Reserved	

5.8.3.4 Process values

For process values, a distinction is made between:

- instantaneous values;
- average, minimum and maximum values over various process intervals;
- value at metering conditions, value at base conditions; and value at standard conditions;

NOTE Standard conditions refer to national regulations, which may differ from ISO standards reference values for base conditions.

Example: gas reference temperature at standard conditions is 0°C, gas reference temperature at base conditions is +15°C.

- for some quantities, backup, actual and preset values are available.

Table 47 – Value group D codes – Gas – Process values

Value group D codes – Gas – Process values (A = 7, C = 41, 42, 44…49)		
	Quantity	**Qualifier**
0	Instantaneous	Current value at metering conditions [a]
2	Instantaneous	Value at base conditions / “Converted value” [b]
3	Instantaneous	Backup value
10	Instantaneous	Actual value
11	Instantaneous	Preset value
13	Instantaneous	Value at standard conditions
Process interval 1 (default value = 15 minutes)		
15	Average, current interval, process interval 1	Value at metering conditions
16		Value at base conditions
17		Value at standard conditions
18	Minimum, current interval, process interval 1	Value at metering conditions
19		Value at base conditions
20		Value at standard conditions
21	Maximum, current interval, process interval 1	Value at metering conditions
22		Value at base conditions
23		Value at standard conditions
24	Average, last interval, process interval 1	Value at metering conditions
25		Value at base conditions
26		Value at standard conditions
27	Minimum, last interval, process interval 1	Value at metering conditions
28		Value at base conditions
29		Value at standard conditions
30	Maximum, last interval, process interval 1	Value at metering conditions
31		Value at base conditions
32		Value at standard conditions

Value group D codes – Gas – Process values (A = 7, C = 41, 42, 44…49)		
Process interval 2 (default value = 1 hour)		
33	Average, current interval, process interval 2	Value at metering conditions
34		Value at base conditions
35		Value at standard conditions
36	Minimum, current interval, process interval 2	Value at metering conditions
37		Value at base conditions
38		Value at standard conditions
39	Maximum, current interval, process interval 2	Value at metering conditions
40		Value at base conditions
41		Value at standard conditions
42	Average, last interval, process interval 2	Value at metering conditions
43		Value at base conditions
44		Value at standard conditions
45	Minimum, last interval, process interval 2	Value at metering conditions
46		Value at base conditions
47		Value at standard conditions
48	Maximum, last interval, process interval 2	Value at metering conditions
49		Value at base conditions
50		Value at standard conditions
Process interval 3 (default value = 1 day)		
51	Average, current interval, process interval 3	Value at metering conditions
52		Value at base conditions
53		Value at standard conditions
54	Minimum, current interval, process interval 3	Value at metering conditions
55		Value at base conditions
56		Value at standard conditions
57	Maximum, current interval, process interval 3	Value at metering conditions
58		Value at base conditions
59		Value at standard conditions
60	Average, last interval, process interval 3	Value at metering conditions
61		Value at base conditions
62		Value at standard conditions
63	Minimum, last interval, process interval 3	Value at metering conditions
64		Value at base conditions
65		Value at standard conditions
66	Maximum, last interval, process interval 3	Value at metering conditions
67		Value at base conditions

Value group D codes – Gas – Process values (A = 7, C = 41, 42, 44…49)		
68		Value at standard conditions
Process interval 4 (default value = 1 month)		
69	Average, current interval, process interval 4	Value at metering conditions
70		Value at base conditions
71		Value at standard conditions
72	Minimum, current interval, process interval 4	Value at metering conditions
73		Value at base conditions
74		Value at standard conditions
75	Maximum, current interval, process interval 4	Value at metering conditions
76		Value at base conditions
77		Value at standard conditions
78	Average, last interval, process interval 4	Value at metering conditions
79		Value at base conditions
80		Value at standard conditions
81	Minimum, last interval, process interval 4	Value at metering conditions
82		Value at base conditions
83		Value at standard conditions
84	Maximum, last interval, process interval 4	Value at metering conditions
85		Value at base conditions
86		Value at standard conditions
Process interval 5, since last event		
87	Average, process interval 5, interval since last event	Value at metering conditions
88		Value at base conditions
89		Value at standard conditions
90	Average, process interval 6, interval between last two events	Value at metering conditions
91		Value at base conditions
92		Value at standard conditions
All other	Reserved	
Notes		
a	To be used for e.g. velocity of sound.	
b	Value of the base conditions is associated with reference values for volume conversion: C = 41, 42.	

5.8.3.5 Correction, conversion and compressibility values

For correction, conversion and compressibility values, various allocations are made taking into consideration the specifics of the measuring process.

For these values, average values over various averaging periods are also defined; see 5.8.4.5.

Table 48 – Value group D codes – Gas – Correction, conversion and compressibility values

Value group D codes – Gas – Correction, conversion and compressibility values (A = 7, C = 51...55)	
0	Current value at metering conditions
2	Current value at base conditions / “Converted Value”
3	Backup
10	Actual
11	Preset
12	Method
All other	Reserved

5.8.3.6 Natural gas analysis values

For natural gas analysis, allocations in value group D identify the key parameters and the components of the natural gas.

For these values, average values over various averaging periods are also defined; see 5.8.4.6.

Table 49 – Value group D codes – Gas – Natural gas analysis values

Value group D codes – Gas – Natural gas analysis values (A = 7, C = 70)	
8	Reference pressure of gas analysis
9	Reference temperature of gas analysis
10	Superior [a] Wobbe index 0 °C
11	Inferior [b] Wobbe index 0 °C
12	Methane number
13	Total sulphur
14	Hydrogen sulphide H_2S
15	Mercaptans
16	Water dew point (DP H_2O)
17	Water (H_2O) dew point outlet / normalised
18	Hydrocarbon dew point (DP C_XH_Y)
19	Inferior [c] calorific value $H_{i,n}$
20	Water H_2O
60	Nitrogen N_2
61	Hydrogen H_2
62	Oxygen O_2
63	Helium He
64	Argon Ar
65	Carbon monoxide CO
66	Carbon dioxide CO_2

Value group D codes – Gas – Natural gas analysis values (A = 7, C = 70)	
67	Methane CH_4
68	Ethene C_2H_4
69	Ethane C_2H_6
70	Propene C_3H_6
71	Propane C_3H_8
72	i-butane i-C_4H_{10}
73	n-butane n-C_4H_{10}
74	neo-pentane neo-C_5H_{12}
75	i-pentane i-C_5H_{12}
76	n-pentane n-C_5H_{12}
77	Hexane C_6H_{14}
78	Hexane share higher hydrocarbons C_6H_{14} %
79	Hexane+ C_6H_{14}+
80	Heptane C_7H_{16}
81	Octane C_8H_{18}
82	Nonane C_9H_{20}
83	Decane $C_{10}H_{22}$
84	Tetrahydrothiophene C_4H_8S
All other	Reserved
Notes	
a	Superior (gross) Wobbe index
b	Inferior (net) Wobbe index
c	Inferior (net) calorific value

5.8.4 Value group E codes – Gas

5.8.4.1 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.

5.8.4.2 Indexes and index differences – Tariff rates

Table 50 shows the use of value group E for identification of tariff rates typically used for indexes and index differences of volume, mass and energy, specified in Table 45.

Table 50 – Value group E codes – Gas – Indexes and index differences – Tariff rates

Value group E codes – Gas – Indexes and index differences – Tariff rates (A = 7, C = 1…8, 11…16, 21…26, 31…36, 61…66, D = 0…3, 6…98)	
0	Total
1	Rate 1
...	
63	Rate 63
128...254	Manufacturer specific codes
All other	Reserved

5.8.4.3 Flow rate

No further classification in value group E are made. Therefore E shall be 0.

5.8.4.4 Process values

No further classification in value group E are made. Therefore, E shall be 0.

5.8.4.5 Correction, conversion and compressibility values – Averages

Table 51 shows the use of value group E for the identification of average values of correction, conversion and compressibility values – as specified in 5.8.3.5 – over various averaging periods.

Table 51 – Value group E codes – Gas – Correction, conversion and compressibility values – Averages

	Value group E codes – Gas – Compressibility, correction and conversion values – Averages (A = 7, C = 51…55, D = 0, 2, 3, 10, 11, 12)
0	Process independent current value[a]
1	Weighted value (e.g. Superior calorific value)[b]
11	Average, current interval, averaging period 1 (default 5 minutes)
12	Average, last interval, averaging period 1 (default 5 minutes)
13	Average, current interval, averaging period 2 (default 15 minutes)
14	Average, last interval, averaging period 2 (default 15 minutes)
15	Average, current interval, averaging period 3 (default 1 hour)
16	Average, last interval, averaging period 3 (default 1 hour)
17	Average, current interval, averaging period 4 (no default value)
18	Average, last interval, averaging period 4 (no default value)
19	Average, current interval, averaging period 5 (default 1 day)
20	Average, last interval, averaging period 5 (default 1 day)
21	Average, current interval, averaging period 6 (default 1 month)
22	Average, last interval, averaging period 6 (default 1 month)
23	Average, current interval, averaging period 7 (default 1 year)
24	Average, last interval, averaging period 7 (default 1 year)

	Value group E codes – Gas – Compressibility, correction and conversion values – Averages (A = 7, C = 51...55, D = 0, 2, 3, 10, 11, 12)
25	Average, current interval, averaging period 8 (no default value)
26	Average, last interval, averaging period 8 (no default value)
27	Average, averaging period 9, interval since last event
28	Average, averaging period 10, interval between last two events
All other	Reserved
Notes	
[a]	Process independent current value is a gas analysis technology independent value, which is generated asynchronous to processing cycles, but used for further calculations.
[b]	Weighted value is the result of specific algorithms taking into account different values by weighting their influence on the algorithm result.

5.8.4.6 Natural gas analysis values – Averages

Table 52 shows the use of value group E for the identification of natural gas analysis values – as specified in 5.8.3.6 – over various averaging periods.

Table 52 – Value group E codes – Gas – Natural gas analysis values – Averages

Value group E codes – Gas – Natural gas analysis values – Averages (A = 7, C = 70, D = 8...20, 60...84)	
0	Process independent current value [a]
1	Weighted value (e.g. CO_2 in [GJ / t]) [b]
11	Average, current interval, averaging period 1 (default 5 minutes)
12	Average, last interval, averaging period 1 (default 5 minutes)
13	Average, current interval, averaging period 2 (default 15 minutes)
14	Average, last interval, averaging period 2 (default 15 minutes)
15	Average, current interval, averaging period 3 (default 1 hour)
16	Average, last interval, averaging period 3 (default 1 hour)
17	Average, current interval, averaging period 4 (no default value)
18	Average, last interval, averaging period 4 (no default value)
19	Average, current interval, averaging period 5 (default 1 day)
20	Average, last interval, averaging period 5 (default 1 day)
21	Average, current interval, averaging period 6 (default 1 month)
22	Average, last interval, averaging period 6 (default 1 month)
23	Average, current interval, averaging period 7 (default 1 year)
24	Average, last interval, averaging period 7 (default 1 year)
25	Average, current interval, averaging period 8 (no default value)
26	Average, last interval, averaging period 8 (no default value)
27	Average, averaging period 9, interval since last event
28	Average, averaging period 10, interval between last two events
All other	Reserved
Notes	

Value group E codes – Gas – Natural gas analysis values – Averages (A = 7, C = 70, D = 8…20, 60…84)	
a	Process independent current value is a gas analysis technology independent value, which is generated asynchronous to processing cycles, but used for further calculations.
b	Weighted value is the result of specific algorithms taking into account different values by weighting their influence on the algorithm result.

5.8.5 OBIS codes – Gas

5.8.5.1 General purpose objects – Gas

Table 53 – OBIS codes for general purpose objects – Gas

General purpose objects – Gas	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined gas ID	7	*b*	0	0		
Gas ID 1	7	*b*	0	0	0	
…	…	…	…	…	…	
Gas ID 10	7	*b*	0	0	9	
Billing period values / reset counter entries (First billing period scheme if there are more than one)						
Billing period counter (1)	7	*b*	0	1	0	VZ or 255
Number of available billing periods (1)	7	*b*	0	1	1	
Time stamp of the most recent billing period (1)	7	*b*	0	1	2	
Time stamp of the billing period (1) VZ (last reset)	7	*b*	0	1	2	VZ
Time stamp of the billing period (1) VZ-1	7	*b*	0	1	2	VZ_{-1}
…			…	…	…	
Time stamp of the billing period (1) VZ-n	7	*b*	0	1	2	VZ_{-n}
Billing period values / reset counter entries (Second billing period scheme)						
Billing period counter (2)	7	*b*	0	1	3	VZ or 255
Number of available billing periods (2)	7	*b*	0	1	4	
Time stamp of the most recent billing period (2)	7	*b*	0	1	5	
Time stamp of the billing period (2) VZ (last reset)	7	*b*	0	1	5	VZ
Time stamp of the billing period (2) VZ-1	7	*b*	0	1	5	VZ_{-1}
…			…	…	…	
Time stamp of the billing period (2) VZ-n	7	*b*	0	1	5	VZ_{-n}
Billing period values / reset counter entries (Third billing period scheme)						
Billing period counter (3)	7	*b*	0	1	6	VZ or 255
Number of available billing periods (3)	7	*b*	0	1	7	
Time stamp of the most recent billing period (3)	7	*b*	0	1	8	
Time stamp of the billing period (3) VZ (last reset)	7	*b*	0	1	8	VZ

General purpose objects – Gas	OBIS code					
	A	B	C	D	E	F
Time stamp of the billing period (3) VZ-1	7	*b*	0	1	8	VZ_{-1}
…			…	…	…	
Time stamp of the billing period (3) VZ-n	7	b	0	1	8	VZ_{-n}
Billing period values / reset counter entries (Fourth billing period scheme)						
Billing period counter (4)	7	*b*	0	1	9	VZ or 255
Number of available billing periods (4)	7	*b*	0	1	10	
Time stamp of the most recent billing period (4)	7	*b*	0	1	11	
Time stamp of the billing period (4) VZ (last reset)	7	*b*	0	1	11	VZ
Time stamp of the billing period (4) VZ-1	7	*b*	0	1	11	VZ_{-1}
…			…	…	…	
Time stamp of the billing period (4) VZ-n	7	*b*	0	1	11	VZ_{-n}
Configuration						
Program version	7	*b*	0	2	0	
Firmware version	7	*b*	0	2	1	
Software version	7	*b*	0	2	2	
Device version	7	*b*	0	2	3	
Active firmware signature	7	*b*	0	2	8	
Number of device channels	7	*b*	0	2	10	
Pressure sensor, serial no.	7	*b*	0	2	11	
Temperature sensor, serial no.	7	*b*	0	2	12	
Calculator, serial no.	7	*b*	0	2	13	
Volume sensor [a], serial no.	7	*b*	0	2	14	
Density sensor, serial no.	7	b	0	2	15	
Sensor (medium irrespective), serial no.	7	*b*	0	2	16	
Digital output configuration	7	*b*	0	2	17	
Analogue output configuration	7	*b*	0	2	18	
Output pulse constants converted / unconverted						
Volume forward at metering conditions	7	*b*	0	3	0	
Volume reverse at metering conditions	7	*b*	0	3	1	
Volume absolute [b] at metering conditions	7	*b*	0	3	2	
Volume forward at base conditions	7	*b*	0	3	3	
Volume reverse at base conditions	7	*b*	0	3	4	
Volume absolute [b] at base conditions	7	*b*	0	3	5	
Conversion factors						
	7	*b*	0	4	0	
{This area is to be used for polynomials, constants	7	*b*	0	4	1	
for conversion, and similar}	7	*b*	0	4	2	
…	7	*b*	0	4	3	
	7	*b*	0	4	4	
Threshold values						

General purpose objects – Gas	OBIS code					
	A	B	C	D	E	F
Threshold power for over-consumption relative to measurement period 2 for indexes and index differences						
limit 1	7	*b*	0	5	1	1
…			…	…	…	…
limit 4	7	*b*	0	5	1	4
Threshold power for over-consumption relative to measurement period 3 for indexes and index differences						
limit 1	7	*b*	0	5	1	11
…			…	…	…	…
limit 4	7	*b*	0	5	1	14
Threshold limit for rate 1 for over-consumption relative to measurement period 2 for indexes and index differences	7	*b*	0	5	2	1
…			…	…	…	…
limit for rate 9	7	*b*	0	5	2	9
Threshold limit for rate 1 for over-consumption relative to measurement period 3 for indexes and index differences	7	*b*	0	5	2	11
…			…	…	…	…
limit for rate 9	7	*b*	0	5	2	19
Maximum contracted consumption for rec. interval 1	7	*b*	0	5	3	
Maximum contracted consumption for rec. interval 2	7	*b*	0	5	4	
Absolute temperature, minimum limit setting [c]	7	*b*	0	5	11	
Absolute temperature, maximum limit setting [c]	7	*b*	0	5	12	
Absolute pressure, minimum limit setting [c]	7	*b*	0	5	13	
Absolute pressure, maximum limit setting [c]	7	*b*	0	5	14	
Nominal values volume sensor						
Pressure	7	*b*	0	6	1	
Temperature	7	*b*	0	6	2	
Q_{min}	7	*b*	0	6	3	
Q_{max}	7	*b*	0	6	4	
Input pulse constants						
Volume forward at metering conditions	7	*b*	0	7	0	
Volume reverse metering conditions	7	*b*	0	7	1	
Volume absolute [b] at metering conditions	7	*b*	0	7	2	
Volume forward at base conditions	7	*b*	0	7	3	
Volume reverse at base conditions	7	*b*	0	7	4	
Volume absolute [b] at base conditions	7	*b*	0	7	5	
Intervals and periods						
Recording interval 1, for profile [d]	7	*b*	0	8	1	
Recording interval 2, for profile [d]	7	*b*	0	8	2	
Measurement period 1, for average value 1	7	*b*	0	8	3	
Measurement period 2, for average value 2	7	*b*	0	8	4	
Measurement period 3, for instantaneous value	7	*b*	0	8	5	

General purpose objects – Gas	**OBIS code**					
	A	**B**	**C**	**D**	**E**	**F**
Measurement period 4, for test value	7	*b*	0	8	6	
Billing period	7	*b*	0	8	10	
NOTE Codes 7.b.0.8.11...35 are newly defined in Blue Book Edition 9.						
Process interval 1, default value 15 minutes	7	*b*	0	8	11	
Process interval 2, default value 1 hour	7	*b*	0	8	12	
Process interval 3, default value 1 day	7	*b*	0	8	13	
Process interval 4, default value 1 month	7	*b*	0	8	14	
Process interval 5, for process value, since last event	7	*b*	0	8	15	
Process interval 6, between last two events	7	*b*	0	8	16	
Measurement period 1, for indexes and index differences, default value 15 minutes	7	*b*	0	8	17	
Measurement period 2, for indexes and index differences, default value 1 hour	7	*b*	0	8	18	
Measurement period 3, for indexes and index differences, no default value	7	*b*	0	8	19	
Billing period 1, for indexes and index differences, default value 1 day	7	*b*	0	8	20	
Billing period 2, for indexes and index differences, default value 1 month	7	*b*	0	8	21	
Billing period 3, for indexes and index differences, default value 1 year,	7	*b*	0	8	22	
Billing period 4, for indexes and index differences, no default value	7	*b*	0	8	23	
Averaging period 1, default value 5 minutes	7	*b*	0	8	25	
Averaging period 2, default value 15 minutes	7	*b*	0	8	26	
Averaging period 3, default value 1 hour	7	*b*	0	8	27	
Averaging period 4, no default value	7	*b*	0	8	28	
Averaging period 5, default value 1 day	7	*b*	0	8	29	
Averaging period 6, default value 1 month	7	*b*	0	8	30	
Averaging period 7, default value 1 year	7	*b*	0	8	31	
Averaging period 8, no default value	7	*b*	0	8	32	
Averaging period 9, since last event	7	*b*	0	8	33	
Averaging period 10, between two last events	7	*b*	0	8	34	
Number of sub-periods for averaging period 2	7	*b*	0	8	35	
Time entries						
Number of days (time expired) since last reset	7	*b*	0	9	0	
Local time	7	*b*	0	9	1	
Local date	7	*b*	0	9	2	
Start of conventional gas day	7	*b*	0	9	3	
Residual time shift [e]	7	*b*	0	9	4	

General purpose objects – Gas	OBIS code					
	A	B	C	D	E	F
Time of last reset (First billing period scheme if there are more than one)	7	*b*	0	9	6	
Date of last reset (First billing period scheme if there are more than one)	7	*b*	0	9	7	
Clock time shift limit	7	*b*	0	9	11	
Billing period reset lockout time (First billing period scheme if there are more than one)	7	*b*	0	9	12	
Number of days (time expired) since last end of billing period (Second billing period scheme)	7	*b*	0	9	13	
Time of last reset (Second billing period scheme)	7	*b*	0	9	14	
Date of last reset (Second billing period scheme)	7	*b*	0	9	15	
Billing period reset lockout time (Second billing period scheme)	7	*b*	0	9	16	
Mumber of days (Time expired) since last end of billing period (Third billing period scheme)	7	*b*	0	9	17	
Time of last reset (Third billing period scheme)	7	*b*	0	9	18	
Date of last reset (Third billing period scheme)	7	*b*	0	9	19	
Billing period reset lockout time (Third billing period scheme)	7	*b*	0	9	20	
Number of days (time expired) since last end of billing period (Fourth billing period scheme)	7	*b*	0	9	21	
Time of last reset (Fourth billing period scheme)	7	*b*	0	9	22	
Date of last reset (Fourth billing period scheme)	7	*b*	0	9	23	
Billing period reset lockout time (Fourth billing period scheme)	7	*b*	0	9	24	
Station management information objects						
Heating temperature [f], current value	7	*b*	0	10	0	
Heating temperature, average 15 minutes	7	*b*	0	10	1	
Heating temperature, average 60 minutes	7	*b*	0	10	11	
Heating temperature, average day	7	*b*	0	10	21	
Heating temperature, average month	7	*b*	0	10	31	
Ambient device temperature [g], current value	7	*b*	0	11	0	
Ambient device temperature, average 15 minutes	7	*b*	0	11	1	
Ambient device temperature, average 60 minutes	7	*b*	0	11	11	
Ambient device temperature, average day	7	*b*	0	11	21	
Ambient device temperature, average month	7	*b*	0	11	31	
Gas parameters for volume conversion, currently used in compressibility calculation						
Reference pressure of gas analysis	7	*b*	0	12	8	
Reference temperature of gas analysis	7	*b*	0	12	9	
Superior Wobbe number 0 °C	7	*b*	0	12	10	
Inferior Wobbe number 0 °C	7	*b*	0	12	11	
Methane number	7	*b*	0	12	12	
Total sulphur	7	*b*	0	12	13	
Hydrogen sulphide H_2S	7	*b*	0	12	14	
Mercaptans	7	*b*	0	12	15	
Water dew point (DP H_2O)	7	*b*	0	12	16	

General purpose objects – Gas	OBIS code					
	A	B	C	D	E	F
Water (H_2O) dew point outlet / normalised	7	*b*	0	12	17	
Hydrocarbon dew point (DP C_XH_Y)	7	*b*	0	12	18	
Inferior calorific value $H_{i,n}$	7	*b*	0	12	19	
Water H_2O	7	*b*	0	12	20	
Density (of gas), base conditions	7	*b*	0	12	45	
Relative density	7	*b*	0	12	46	
Superior calorific value $H_{s,n}$	7	*b*	0	12	54	
Nitrogen N_2	7	*b*	0	12	60	
Hydrogen H_2	7	*b*	0	12	61	
Oxygen O_2	7	*b*	0	12	62	
Helium He	7	*b*	0	12	63	
Argon Ar	7	*b*	0	12	64	
Carbon monoxide CO	7	*b*	0	12	65	
Carbon dioxide CO_2	7	*b*	0	12	66	
Methane CH_4	7	*b*	0	12	67	
Ethene C_2H_4	7	*b*	0	12	68	
Ethane C_2H_6	7	*b*	0	12	69	
Propene C_3H_6	7	*b*	0	12	70	
Propane C_3H_8	7	*b*	0	12	71	
i-butane i-C_4H_{10}	7	*b*	0	12	72	
n-butane n-C_4H_{10}	7	*b*	0	12	73	
neo-pentane neo-C_5H_{12}	7	*b*	0	12	74	
i-pentane i-C_5H_{12}	7	*b*	0	12	75	
n-pentane n-C_5H_{12}	7	*b*	0	12	76	
Hexane C_6H_{14}	7	*b*	0	12	77	
Hexane share higher hydrocarbons C_6H_{14} %	7	*b*	0	12	78	
Hexane+ C_6 H_{14}+	7	*b*	0	12	79	
Heptane C_7H_{16}	7	*b*	0	12	80	
Octane C_8H_{18}	7	*b*	0	12	81	
Nonane C_9H_{20}	7	*b*	0	12	82	
Decane $C_{10}H_{22}$	7	*b*	0	12	83	
Tetrahydrothiophene	7	*b*	0	12	84	
Gas parameters for Venturi measurement						
Internal pipe diameter	7	*b*	0	13	1	
Orifice diameter	7	*b*	0	13	2	
Pressure type (orifice fitting)	7	*b*	0	13	3	
Flow coefficient (alfa)	7	*b*	0	13	4	
Expansion coefficient (epsilon)	7	*b*	0	13	5	
Reflux coefficient	7	*b*	0	13	6	
Isoentropic coefficient	7	*b*	0	13	7	
Dynamic viscosity	7	*b*	0	13	8	
Differential pressure dp for cut off	7	*b*	0	13	9	

General purpose objects – Gas	**OBIS code**					
	A	**B**	**C**	**D**	**E**	**F**
Reynold number	7	*b*	0	13	10	
Gas parameters for density measurement						
K0 Densimeter Coefficient	7	*b*	0	14	1	
K2 Densimeter Coefficient	7	*b*	0	14	2	
Densimeter period for instanteneous measurement	7	*b*	0	14	10	
Densimeter period for measurement period 15 minutes	7	*b*	0	14	11	
Sensor manager						
Sensor manager objects	7	*b*	0	15	*e*	
Internal operating status signals, gas related						
Internal operating status, global [h]	7	*b*	96	5	0	
Internal operating status (status word 1) [h]	7	*b*	96	5	1	
Internal operating status (status word 2) [h]	7	*b*	96	5	2	
Internal operating status (status word 3) [h]	7	*b*	96	5	3	
Internal operating status (status word 4) [h]	7	*b*	96	5	4	
Internal operating status (status word 5) [h]	7	*b*	96	5	5	
Internal operating status (status word 6) [h]	7	*b*	96	5	6	
Internal operating status (status word 7) [h]	7	*b*	96	5	7	
Internal operating status (status word 8) [h]	7	*b*	96	5	8	
Internal operating status (status word 9) [h]	7	*b*	96	5	9	
Manufacturer specific	7	*b*	96	50	e	
....						
Manufacturer specific	7	*b*	96	99	e	

a	A volume sensor could be an external mechanical meter / encoder / electronic index.
b	Absolute in the sense that negative volume is summed as positive ABS().
c	An absolute temperature or absolute pressure 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	This value indicates the remaining time interval for soft time setting, where the clock is corrected in small steps (equivalent to Clock object method 6).
f	Temperature heating is applied by stations with gas heating systems.
g	Application for control of battery environment or volume conversion device environmental control.
h	Status words referring to a status table with fix status words or to any status table bits using mapped status (class_id = 63).

5.8.5.2 Error register objects – Gas

Table 54 – OBIS codes for error register objects – Gas

Error registers – Gas	**OBIS code**					
	A	**B**	**C**	**D**	**E**	**F**
Error register	7	*b*	97	97	*e*	
NOTE The information to be included in the error objects is not defined in this document.						

5.8.5.3 List object – Gas

Table 55 – OBIS codes for list objects - Gas

List objects – Abstract	OBIS code					
	A	B	C	D	E	F
Gas related data of billing period (with billing period scheme 1 if there are more than one schemes available)	7	*b*	98	1	*e*	255 [a]
Gas related data of billing period (with billing period scheme 2)	7	*b*	98	2	*e*	255 [a]
Gas related data of billing period (with billing period scheme 3)	7	*b*	98	3	*e*	255 [a]
Gas related data of billing period (with billing period scheme 4)	7	*b*	98	4	*e*	255 [a]
Gas related data of event triggered billing profile [b]	7	*b*	98	11	*e*	255 [a]

[a] F = 255 means a wildcard here. See 5.10.3.

[b] Event triggered means the termination of a billing period by events, e.g. by commands. (Therefore, the profile entries are not equidistant in time).

5.8.5.4 Data profile objects – Gas

Table 56 – OBIS codes for data profile objects – Gas

Data profile objects – Gas	OBIS code					
	A	B	C	D	E	F
Load profile with recording interval 1	7	*b*	99	1	4 [a]	
Load profile with recording interval 2	7	*b*	99	2	4 [a]	
Profile of maxima with recording interval 1	7	*b*	99	3	4 [a]	
Profile of maxima with recording interval 2	7	*b*	99	4	4 [a]	
Load profiles for indexes and index differences of volume, mass and energy [b]	7	*b*	99	*d* [c]	*e* [d]	
Load profiles for process values	7	*b*	99	*d* [e]	*e* [f]	
Load profiles for flow rate	7	*b*	99	43	*e* [g]	
Power failure event log	7	*b*	99	97	*e*	
Event log	7	*b*	99	98	0	
Certification data log	7	*b*	99	99	0	
Load profile with recording interval 15 minutes	7	*b*	99	99	1	
Load profile with recording interval 60 minutes	7	*b*	99	99	2	
Load profile with recording interval day	7	*b*	99	99	3	
Load profile with recording interval month	7	*b*	99	99	4	

a	The value in value group E has been changed from 0 to 4 to avoid overlaps with the self-descriptive profile OBIS codes. The use of the value 0 is deprecated.
b	Value group D and E identify the value captured in these profiles. Value group D and E of the OBIS code of the load profile is mapped to value group C and D of the OBIS code identifying the value captured. The value captured in the buffer is always attribute 2 (value) of the respective Register / Extended register object.
c	The possible values are 1…8, 11…16, 21…26, 31…36, 61…66. See Table 44.
d	The possible values are 0…3, 6…98. See Table 45. Example: Load profile OBIS code 7.b.99.11.17.255 This load profile contains the logged values from a volume conversion device: Forward undisturbed converter volume, index difference, value at base conditions, relative to measurement period 2. The values are captured at the end of each measurement period (last values).
e	The possible values are 41, 42, 44…49. See Table 44.
f	The possible values are 0, 2, 13, 24…32, 42…50, 60…68, 78…86, 90…92. See Table 47. Example: Load profile OBIS code 7.b.99.41.43.255 This load profile contains the logged values of absolute gas temperature, average, last interval, (relative to) process interval 2.
g	The possible values are 0, 1, 2, 13, 19…22, 39…42, 59…62, 67…70. See Table 46. Example: Load profile OBIS code 7.b.99.43.19.255 This load profile contains the logged values of the flow rate, last average for averaging period 1, value at metering conditions.

5.9 Water (A = 8 and A = 9)

5.9.1 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.

5.9.2 Value group C codes – Water

Table 57 – Value group C codes – Water

Value group C codes – Water (A=8 or A=9)	
0	General purpose objects
1	Accumulated volume
2	Flow rate
3	Forward temperature
93	Consortia specific identifiers, see Table 12.
94	Country specific identifiers, see Table 13.
96	Water related service entries, see, 5.9.4.1
97	Water related Error registers, see 5.9.4.2
98	Water list
99	Water data profile, see 5.9.4.3
128...199, 240	Manufacturer specific codes
All other	Reserved

5.9.3 Value group D codes – Water

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

Table 58 – Value group D codes – Water

Value group D codes – Water (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

5.9.4 OBIS codes – Water

5.9.4.1 General purpose objects – Water

Table 59 – OBIS codes for general purpose objects – Water

General purpose objects – Water	OBIS code					
	A	B	C	D	E	F
Free ID-numbers for utilities						
Complete combined ID	8/9	*b*	0	0		
ID 1	8/9	*b*	0	0	0	
…			…	…	…	
ID 10	8/9	*b*	0	0	9	
Storage information						
Status (VZ) of the historical value counter	8/9	*b*	0	1	1	
Number of available historical values	8/9	*b*	0	1	2	
Due date	8/9	*b*	0	1	10	
Billing date	8/9	*b*	0	1	11	
Billing date period	8/9	*b*	0	1	12	
Program Entries						
Program version no.	8/9	*b*	0	2	0	
Device version no.	8/9	*b*	0	2	3	
Threshold values						
Contracted maximum consumption	8/9	*b*	0	5	1	
Input pulse constants						
Volume forward	8/9	*b*	0	7	1	
Measurement-/registration-period duration						
Recording interval for load profile	8/9	*b*	0	8	1	
Manufacturer specific [b]	8/9	b	96	50	*e*	*f*
…………………						
Manufacturer specific	8/9	*b*	96	99	*e*	*f*

5.9.4.2 Error register objects – Water

Table 60 – OBIS codes for error register objects – Water

Error register objects – Water	OBIS code					
	A	B	C	D	E	F
Error register	8/9	*b*	97	97	*e*	
NOTE The information to be included in the error objects is not defined in this document.						

5.9.4.3 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 61 – OBIS codes for data profile objects – Water

Data profile objects – Water	OBIS code					
	A	B	C	D	E	F
Consumption/load profile	8/9	*b*	99	1	*e*	

5.9.4.4 OBIS codes for water related objects (examples)

Table 62 – OBIS codes for water related objects (examples)

Water related objects	OBIS code					
	A	B	C	D	E	F
Consumption						
Current index, total	8/9	*b*	1	0	0	
Current index, tariff 1	8/9	*b*	1	0	1	
Current index, periodical, total, the two last periods	8/9	*b*	1	1	0	102
Monitoring values						
Flow rate, maximum value, previous period	8/9	*b*	2	5	0	V_{Z-1}
Forward temperature, billing date value, last billing period	8/9	*b*	3	3	0	101

5.10 Code presentation

5.10.1 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 apply 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 21:

A -	B :	C .	D	. E	* F

IEC 304/02

Figure 21 – 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 class_id (see Clause 4) uniquely identifies each COSEM object.

5.10.2 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 [3]:

Table 63 – Example of display code replacement

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

5.10.3 Special handling of value group F

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

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

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 26, 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 **Fehler! Verweisquelle konnte nicht gefunden werden.** and 5.5.4.1.

For gas, there are four billing period schemes available, see Table 53.

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 25^{th} 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 ICs for representing values of historical billing periods, see **Fehler! Verweisquelle konnte nicht gefunden werden.**.

Table 64 – 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	25^{th}/25 last value(s)
126	Unspecified number of last values

5.10.4 COSEM

The usage of OBIS codes in the COSEM environment is defined in Clause 4.12.