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Electricity metering –
Data exchange for meter reading, tariff and load control –

Part 62:
Interface classes

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International Electrotechnical Commission 3, rue de Varembé Geneva, Switzerland
Telefax: +41 22 919 0300 e-mail: inmail@iec.ch IEC web site http://www.iec.ch

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRICITY METERING – DATA EXCHANGE FOR METER READING, TARIFF AND LOAD CONTROL –

Part 62: Interface classes

FOREWORD

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DLMS[1] User Association
Geneva / Switzerland
www.dlms.ch

International Standard IEC 62056-62 has been prepared by IEC technical committee 13: Equipment for electrical energy measurement and load control.

The text of this standard is based on the following documents:

FDIS	Report on voting
13/1270/FDIS	13/1276/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

[1] Device Language Message Specification.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 3.

Annexes A, B, C and D form an integral part of this standard.

Annex E is for information only.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

- reconfirmed;
- withdrawn;
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

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

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

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

The COSEM server model (see 4.5) represents only the externally visible elements of the meter. The client applications that support the business processes of the utilities, of the customers and of the meter manufacturers make use of this server model. The meter offers means to retrieve its structural model (the list of objects visible through the interface), and provides access to the attributes and specific methods of these objects.

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

ELECTRICITY METERING – DATA EXCHANGE FOR METER READING, TARIFF AND LOAD CONTROL –

Part 62: Interface classes

1 Scope

This part of IEC 62056 specifies a model of a meter as it is seen through its communication interface(s). Generic building blocks are defined using object oriented methods, in the form of interface classes to model meters from simple up to very complex functionality.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of IEC 62056. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of IEC 62056 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 60050-300:2001, *International Electrotechnical Vocabulary – Electrical and electronic measurements and measuring instruments – Chapter 311: General terms relating to measurements – Chapter 312: General terms relating to electrical measurements – Chapter 313: Types of electrical measuring instruments – Chapter 314: Specific terms according to the type of instrument*

IEC 61334-4-41:1996, *Distribution automation using distribution line carrier systems – Part 4: Data communication protocols – Section 41: Application protocols – Distribution line message specification*

IEC 62051:1999, *Electricity metering – Glossary of terms*

IEC 62056-21, *Data exchange for meter reading, tariff and load control – Part 21: Direct local data exchange* [2]

IEC 62056-31:1999, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 31: Using local area networks on twisted pair with carrier signalling*

IEC 62056-46:2001, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 46: Data link layer using HDLC-protocol*

IEC 62056-53:2001, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 53: COSEM Application layer*

IEC 62056-61:2001, *Electricity metering – Data exchange for meter reading, tariff and load control – Part 61: OBIS Object identification system*

ANSI C12.19:1997 / IEEE 1377:1997, *Utility Industry End Device Data Tables*

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[2] To be published.

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purpose of this part of IEC 62056 the terms and definitions given in IEC 60050-300 and IEC 62051, as well as the following apply.

3.1.1
base_name
the short_name corresponding to the first attribute (“logical_name”) of a COSEM object

3.1.2
class_id
class identification code

3.1.3
COSEM object
an instance of an interface class

3.2 Abbreviations

AARE	Application Association Response
AARQ	Application Association ReQuest
ACSE	Application Control Service Element
APDU	Application Protocol Data Unit
ASE	Application Service Element
A-XDR	Adapted eXtended Data Representation
COSEM	Companion Specification for Energy Metering
DLMS	Distribution Line Message Specification
GMT	Greenwich Mean Time
HLS	High-level Security
IC	Interface Class
LLS	Low Level Security
LN	Logical Name
LSB	Least Significant Bit
M	Mandatory
MSB	Most Significant Bit
O	Optional
OBIS	OBject Identification System
PDU	Protocol Data Unit
SAP	Service Access Point
SN	Short Name

4 Basic principles

4.1 General

This subclause describes the basic principles on which the COSEM interface classes are built. It also gives a short overview on how interface objects (instantiations of the interface classes) are used for communication purposes. Meters, support tools and other system components that follow these specifications can communicate with each other in an interoperable way.

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

The information of an object is organized in attributes. They represent the characteristics of an object by means of attribute values. The value of an attribute may affect the behaviour of an object. The first attribute in any object is the “logical_name”. It is one part of the identification of the object.

An object offers a number of methods to either examine or modify the values of the attributes. Objects that share common characteristics are generalized as an interface class with a class_id. Within a specific class the common characteristics (attributes and methods) are described once for all objects. Instantiations of an interface class are called COSEM objects.

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

Figure 1 illustrates these terms by means of an example:

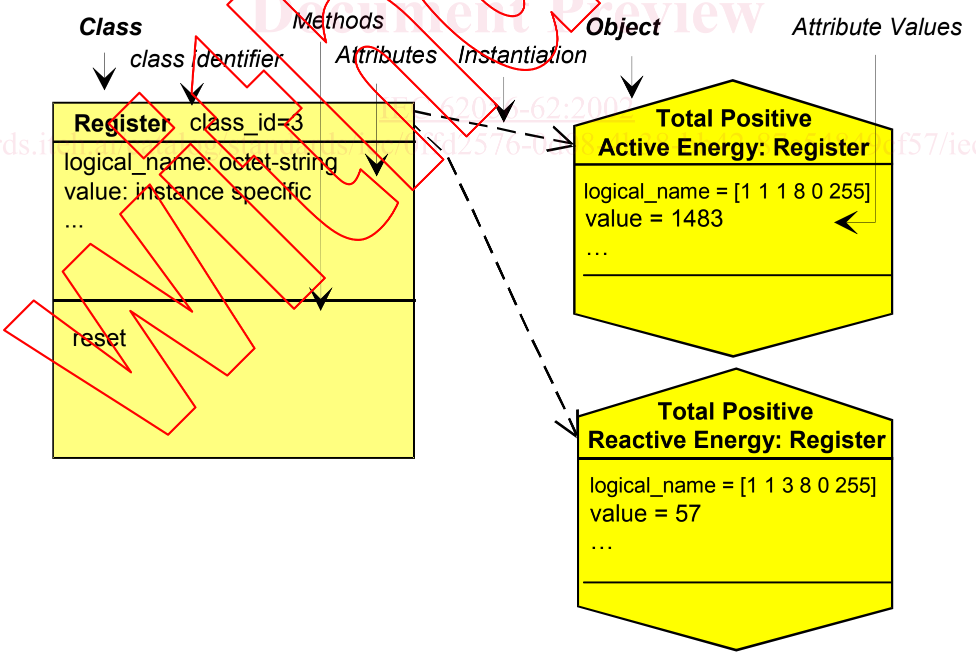

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Figure 1 – An interface class and its instances

The interface class “register” is formed by combining the features necessary to model the behaviour of a generic register (containing measured or static information) as seen from the client (central unit, hand held terminal). The contents of the register are identified by the attribute “logical_name”. The logical_name contains an OBIS identifier (see IEC 62056-61). The actual (dynamic) content of the register is carried by its “value” attribute.

Defining a specific meter means defining several specific registers. In the example of Figure 1 the meter contains two registers; i.e. two specific COSEM objects of the class “register” are instantiated. This means that specific values are assigned to the different attributes. Through the instantiation one COSEM object becomes a “total, positive, active energy register” whereas the other becomes a “total, positive, reactive energy register”.

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

4.2 Class description notation

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

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

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

Each attribute and method must be described in detail.

Class name	Describes the class (e.g. register, clock, profile, ...)
Cardinality	Specifies the number of instances of the class within a logical device (see 4.5). *value* The class shall be instantiated exactly “value” times. *min...max* The class shall be instantiated at least “min.” times and at most “max.” times. If min. is zero (0) then the class is optional, otherwise (min. > 0) "min." instantiations of the class are mandatory.
class_id	Identification code of the class (range 0 to 65 535). The class_id can be obtained from an “association” object. The class_id's from 0 to 8 191 are reserved to be specified by the DLMS UA. Class_id's from 8 192 to 32 767 are reserved for manufacturer specific interface classes. Class_id's from 32 768 to 65 535 are reserved for user group specific interface classes. DLMS UA reserves the right to assign ranges to individual manufacturers or user groups.
Version	Identification code of the version of the class. The version can be obtained from an “association” object. **Within one logical device all instances of a certain class must be of the same version.**

Attribute(s)	Specifies the attribute(s) that belong to the class.	
	(*dyn.*)	Classifies an attribute that carries a process value, which is updated by the meter itself.
	(static)	Classifies an attribute which is not updated by the meter itself (e.g. configuration data).
logical_name	octet-string	The logical name is always the first attribute of a class. It identifies the instantiation (COSEM object) of this class. The value of the logical_name conforms to OBIS (see IEC 62056-61).
Data type	Defines the data type of an attribute (see 4.3).	
Min.	Specifies if the attribute has a minimum value.	
	x	The attribute has a minimum value.
	<*empty*>	The attribute has no minimal value.
Max.	Defines if the attribute has a maximum value.	
	x	The attribute has a maximum value.
	<*empty*>	The attribute has no maximum value.
Def	Specifies if the attribute has a default value. This is the value of the attribute after reset.	
	x	The attribute has a default value.
	<*empty*>	The default value is not defined by the class definition.
Specific method(s)	Provides a list of the specific methods that belong to the object	
	Method Name ()	The method has to be described in the subsection "Method description".
m / o	Defines if the method is mandatory or optional.	
	m (mandatory)	The method is mandatory.
	o (optional)	The method is optional.

Attribute description

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

Method description

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

NOTE Services for accessing attributes or methods by the protocol are described in IEC 62056-53.

Selective access

The common methods READ/WRITE and GET/SET typically reference the entire attribute addressed. However, for certain attributes selective access to just part of the attribute may be provided. The part of the attribute is identified by specific selective access parameters. These selective access parameters are defined as part of the attribute specification.

4.3 Common data types

The following list contains some data types common to all interface classes.

Simple data types *integer, long, double-long, unsigned, long-unsigned, double-long-unsigned, boolean*	**Data types carrying one data item only** Simple data types as defined in IEC 61334-4-41, clause A.12, Data Examples: integer Integer8 1 byte long Integer16 2 bytes double-long Integer32 4 bytes
enum	The elements of the enumeration type need to be defined in the subsection “Attribute description”. Any not listed value for an enumeration is reserved by default.
real32, real64	Real data types according to the REAL specification of IEC 61334-4-41.
visible-string, octet-string	An ordered sequence of ASCII-characters respectively octets (8-bit bytes).
bit-string	An ordered sequence of boolean values.
Complex data types	**More than one data item is included, or the data item itself is not simple.**
array	The array elements need to be defined in the subsection “Attribute description”.
compact array	The array elements need to be defined in the subsection “Attribute description”.
structure	The structure type needs to be defined in the subsection “Attribute description”.
instance specific	The data type of the attribute needs to be specified in the instantiation of the object for a particular meter (instance model).

4.4 Data formats for date and time notation

Date and time notations are normally using octet-string as data type, but the formatting of the data is defined precisely.

date

octet-string{ year highbyte, year lowbyte, month, day of month, day of week }

year: interpreted as unsigned16
range 0..big
0xFFFF = not specified
year highbyte and year lowbyte reference the 2 bytes of the unsigned 16

month: interpreted as unsigned8
range 1..12, 0xFD,0xFE,0xFF
1 is January
0xFD= daylight_savings_end
0xFE= daylight_savings_begin
0xFF = not specified

dayOfMonth: interpreted as unsigned8
range 1..31, 0xFD, 0xFE, 0xFF
0xFD = 2nd last day of month
0xFE = last day of month
0xE0 to 0xFC = reserved
0xFF = not specified