IEC TS 61850-80-4

Edition 1.0 2016-03

TECHNICAL SPECIFICATION

Communication networks and systems for power utility automation – Part 80-4: Translation from the COSEM object model (IEC 62056) to the IEC 61850 data model

colour inside

IEC TS 61850-80-4:2016-03(en)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
Fax: +41 22 919 03 00
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue
The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,…). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and also once a month by email.

Electropedia - www.electropedia.org
The world's leading online dictionary of electronic and electrical terms containing 20 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary
65 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: csc@iec.ch.

IEC TS 61850-80-4

Edition 1.0 2016-03

TECHNICAL SPECIFICATION

colour inside

Communication networks and systems for power utility automation – Part 80-4: Translation from the COSEM object model (IEC 62056) to the IEC 61850 data model

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 33.200 ISBN 978-2-8322-3222-4

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

____

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 80-4: Translation from the COSEM object model (IEC 62056) to the IEC 61850 data model

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a technical specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 61850-80-4, which is a technical specification, has been prepared by IEC technical committee 57: Power systems management and associated information exchange.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
57/1602/DTS	57/1659/RVC

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

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The content of this part of IEC 61850 is based on existing or emerging standards and applications.

A list of all parts of the IEC 61850 series, published under the general title *Communication networks and systems for power utility automation*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

IEC 61850 defines communication networks and systems for power utility automation, and more specifically the communication architecture for subsystems such as substation automation systems, feeder automation systems and SCADA for distributed energy resources. In essence, IEC 61850 is a description of the communication architecture for the overall power system management when the combined total of the above mentioned subsystems are considered.

The devices in the electricity grid are becoming more intelligent with an increasing number of elements and increasing complexity of data to be processed in a distributed environment. Introduction of comprehensive data models simplifies the handling and management of the data drastically since the models can be re-used once standardized. By defining a number of standardized hierarchical names, it can drastically reduce errors in the field. The names in the standard can be directly used for the configuration of devices and the communication between devices.

This part of IEC 61850, which is a technical specification, defines the one-to-one relationship of IEC 62056 OBIS codes to IEC 61850 Logical Nodes. The purpose is to increase the availability of revenue meter information to other applications defined within the IEC 61850 framework. This increased visibility will contribute to information available for smart grid applications.

The other benefit of defining these relationships is in regards to the design of protocol converters. With a clear specification, test cases can be developed as well as end user understanding of the quantities is unambiguous. Finally, end user configuration is simplified by limiting the options for translation.

COMMUNICATION NETWORKS AND SYSTEMS FOR POWER UTILITY AUTOMATION –

Part 80-4: Translation from the COSEM object model (IEC 62056) to the IEC 61850 data model

1 Scope

Included within the IEC 61850 power utility automation architecture are its concepts, data models, communication protocols and the mapping data exchanges on the substation network. This extends beyond just IEDs to other IEC 61850 enabled devices like meters, system applications and remote access gateways.

This part of IEC 61850, which is a technical specification, considers the requirements of power utility automation applications; i.e. the scope is limited by the use cases relevant for meter data exchange in HV/MV substations and MV/LV substations. Only use cases that require the data exchange involving a revenue meter are considered. Applications not covered by the existing standards listed in Clause 2 are out of scope.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC TS 61850-2, *Communication networks and systems in substations – Part 2: Glossary*

IEC 61850-7-2, *Communication networks and systems for power utility automation – Part 7-2: Basic information and communication structure – Abstract communication service interface (ACSI)*

IEC 61850-7-3:2010, *Communication networks and systems for power utility automation – Part 7-3: Basic communication structure – Common data classes*

IEC 61850-7-4:2010, *Communication networks and systems for power utility automation – Part 7-4: Basic communication structure – Compatible logical node classes and data object classes*

IEC 62056-6-1:2015, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-1: Object Identification System (OBIS)*

IEC 62056-6-2:2016, *Electricity metering data exchange – The DLMS/COSEM suite – Part 6-2: COSEM interface classes*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61850-2 and IEC 61850-7-2 apply. In addition, the terms and definitions given in IEC 62056-6-1 and IEC 62056-6-2 apply.

Due to the fact that the same or similar terminology exist from the two standards areas and may have different meanings, the terminology to be used in this document is explicitly defined in Table 1 and Table 2. In addition, in some cases, the terms are elaborated to provide more insight on the application for users who are not experts in the standards area.

Table 1 – IEC 62056 terminology

Term	Description
COSEM	Companion Specification for Energy Metering according to IEC 62056-6-2.
OBIS Code	Object Identification System according to IEC 62056-6-1, uniquely identifying data objects within COSEM compliant metering equipment.
COSEM Interface Class (IC)	The Interface Class (IC) defines the common characteristics (by means of attributes and methods) of a set data objects. The interface class specifies the characteristics of the objects encountered at the interface through which a system interacts with the objects. Implementation issues are not considered. An IC consists of several attributes and methods. The first attribute is always the “logical name”. The set of standardised Interface Classes are defined in IEC 62056-6-2.
COSEM object	An Interface class is instantiated by assigning a specific OBIS code to the logical name of the IC. The result of the instantiation of an IC is a specific data object. The instantiation of an Interface Class may be part of the meter configuration or part of the production process. A meter operating in the field contains a set of objects. Data is exchanged by accessing these objects. Example: the IC “Register” defines the generic data structure for any metering register containing 3 attributes (logical name, measured value and the unit). By assigning the logical name “total electrical energy A+” to the IC “Register” we have formed a specific data object providing information on the totally energy consumption. The set of standardised OBIS codes are defined in IEC 62056-6-1.
Class ID(CID)	The Class ID identifies a specific class of the set of standardised Interface Classes. For example, Class_ID of 3 identifies the class type “Register”.
Physical Device	A physical device is a subsystem which has a physical connection to a communication medium and which can be addressed by a physical address. The behaviour of the physical device is modelled with a set of logical devices. A physical device must contain a “management logical device”.
Logical Device	A logical device is an abstract entity within a physical device. A logical device is addressed via its Service Access Point (SAP) provided by the communication layer below the application layer. The behaviour of the logical device is modelled with a set of COSEM objects.
Logical Name	The logical name contains an OBIS identifier; it is the first attribute of any object. By assigning a specific OBIS code to the logical name the IC is instantiated. The OBIS code, the Class ID and the version of the Interface Class uniquely identifies a data object.
COSEM Attribute	A numbered set of attributes form (together with the methods) an interface class. The first attribute is always the logical name. The nature of the value is described by the logic name using OBIS identification system. For example, a register may contain the instantaneous voltage on phase 1. This would correspond to a specific OBIS code stored in the logical name attribute. The second attribute is a value with a choice of representation among which is integer and floating point representation. The third attribute is the scaler and unit. The first method of class register is a method to reset the register.
Common Data Types	Common Data Types are made of simple and complex data types used to describe the attributes of the IC. The typical simple data types include integer and floating point numbers. Complex data types include array and structures. CHOICE is a data type that allows one of many representations for an attribute. (see IEC 62056-6-2). The data types are described in ASN1.
Metering Equipment	A physical device which may contain multiple logical devices to measure energy usage of different media. Equivalent to a Physical Meter.
+A and –A	Common abbreviation for Active Energy import and Active Energy export respectively.
+R and –R	Common abbreviation for Reactive Energy import and Reactive Energy export respectively.

Table 2 – IEC 61850 terminology

Term	Description
Logical Node Group	The group defines Logical Nodes Classes with similar functions. For example, Group M contains classes related to Metering and Measurement. (See IEC 61850-7-4).
Logical Node Class	Aggregation of data, data sets, report controls, logs, log controls, etc. They represent typical functions of a substation system. For example, Metering for commercial purposes of a 3 phase system (MMTR) is one Logical Node Class. An instance of a Logical Node Class is a Logical Node and the smallest part of a function that exchanges data. (See IEC 61850-5).
Data Object Name	This is a meaning and representation that is part of a Logical Node Class. For example, “Net reactive energy” is one of many instances of the BCR Common Data Class of the MMTR Logical Node. (see IEC 61850-7-4).
Common Data Class (CDC)	This class (See IEC 61850-7-3) is composed of Constructed Attribute Classes, other common data classes or types defined in IEC 61850-7-2 (Basic Data Types and Common ACSI Types).
Constructed Attribute Class (CAC)	These classes are defined in IEC 61850-7-3:2010, Clause 6.
DataAttribute Type	This class (see IEC 61850-7-3) is composed of relatively simply data structures that are commonly used. Examples include analog values, timestamps and Quality.
Common ACSI Types	This class is composed of types related primarily with communications and includes ObjectName, Physical Communication Address and Trigger Conditions.
Basic Data Types	This class is composed of the most fundamental types and include BOOLEAN, INT8, INT16, FLOAT32, etc. (see IEC 61850-7-2).
Physical Device	Equivalent to an Intelligent Electronic Device (IED). These devices contain processors and IO and are capable of communicating with an external device for the purpose of gather data or control.
Logical Connections	Communication link between logical nodes.
Physical connections	Communication link between physical devices.

4 Data modelling hierarchy

4.1 General

Figure 1 provides an overview of the data model hierarchy in both DLMS/COSEM (on the left) and IEC 61850-7-3 and IEC 61850-7-4 (on the right).

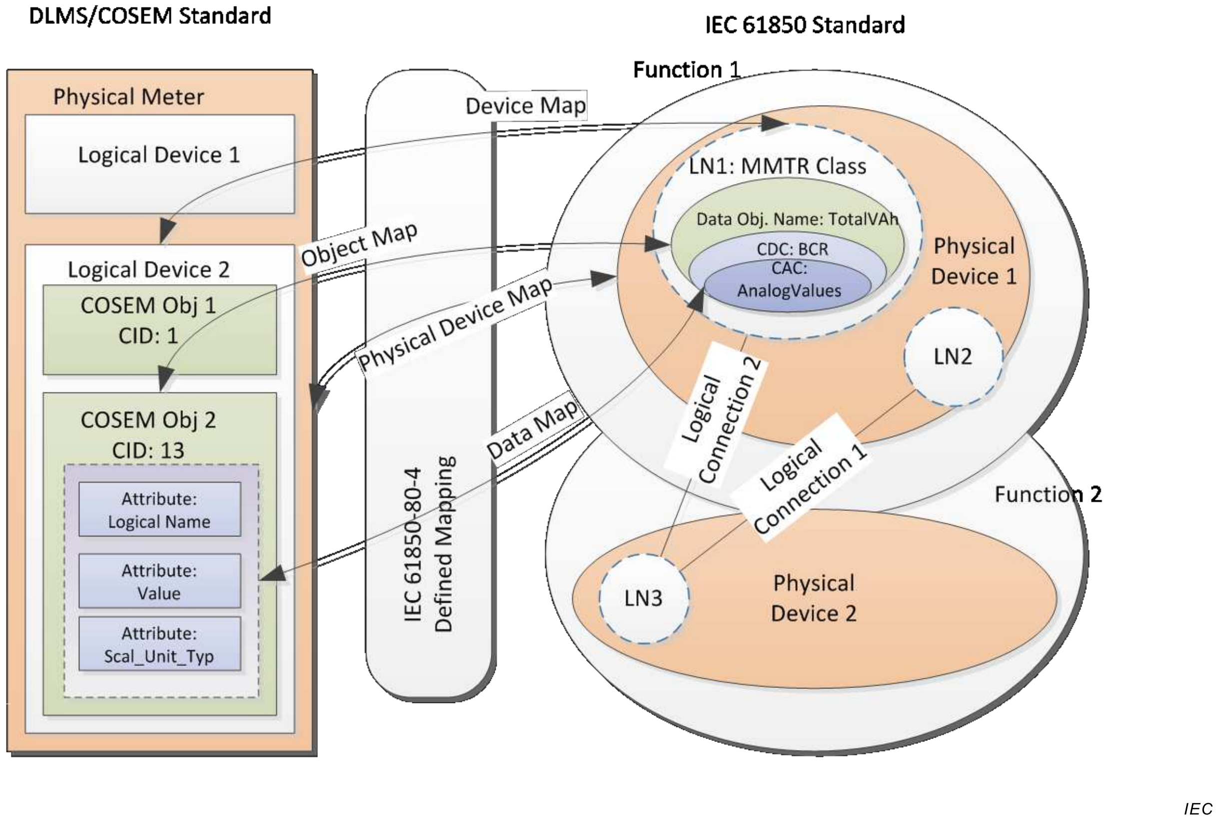

Figure 1 – Overview of relationship between data models

4.2 IEC 62056 principles

The DLMS/COSEM standards framework as defined in IEC 62056-1-0 is based on a common data model and application layer supported by several media specific communication profiles. The principle is shown in Figure 2.

The COSEM data model defines the functionality of the COSEM device as seen on the communication interface by means of data objects. OBIS codes are used to identify the semantics of the objects.

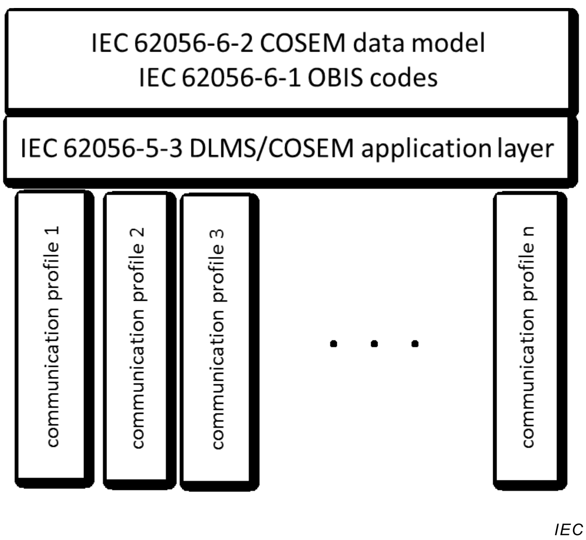

Figure 2 – The IEC 62056 framework

Since the scope of this document is limited to the specification of the mapping between the DLMS/COSEM data model and the IEC 61850 data model the communication profiles are not relevant.

The globally unique COSEM logical device name identifies each logical device. It consists of a globally administrated three letter manufacturer ID and a manufacturer specific serial number.

The identification of real data items is defined in IEC 62056-6-1 while IEC 62056-6-2 defines the usage of Interface Classes in the COSEM environment. The COSEM Objects are identified by a 6 byte OBIS code. The OBIS Codes are defined in IEC 62056-6-1. The OBIS Code is defined such that it is unambiguously related to the data that is stored in the attributes of the object.

DLMS/COSEM supports two ways of addressing attributes inside a COSEM object, namely, using COSEM logical names or using short names. Identification of COSEM object attributes requires three elements:

- class_id;
- instance-id i.e. the OBIS code;
- attribute_id.

Similarly, identification of COSEM object methods requires three elements:

- class_id;
- instance-id i.e. the OBIS code;
- method_id.

The Short Name reference requires uses a 13-bit integer. Refer to IEC 62056-6-2:2016, Annex C.

4.3 The data models and the application layer of IEC 62056

On the highest level, there is the physical device which is usually a Smart Meter. Within the physical device, multiple logical devices can be modelled as shown on the left hand side of Figure 1. The implementation of a management logical device is mandatory.

Multiple COSEM objects are modelled within a Logical Device, of which only a few are mandatory. COSEM objects are instantiations of Interface Classes defined in IEC 62056-6-2.

Each Interface Class definition contains a list of attributes and methods. The data type of the attributes (describing the data format of the contents of the attributes) can be complex (arrays, structures) or atomic (e.g. integers, Booleans as in IEC 62056-6-2 common data types) and are actually placeholders for the data elements. Attributes are identified by attribute index numbers. The syntax used to describe the data structures is ASN.1.

An Interface Class definition may include methods. Methods are used to perform certain operations on the objects that may also affect the value of the attributes (e.g. reset a buffer, close a breaker).

To be more concrete, an example of a Register Interface Class is shown in Table 3:

Table 3 – IEC 62056 Register Class

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

Where the logical_name contains the OBIS code (indentifying the instantiation of the class: e.g. total energy register or maximum demand register), the value contains the measured value (e.g. 23 456 or 12,345), the scaler_unit contains the scaler (e.g. 1 000 or 1 000 000) and the unit (Wh, V or A) corresponding to the measured value.

4.4 The IEC 61850 principles

The focus of the IEC 61850 series is the automation of the power utility domain, e.g. Substations. Distributed functions and the corresponding real-time communications are the focus of the different parts of the IEC 61850 series. With the introduction of distributed functions, a paradigm shift has taken place in substation automation.

For more information about the IEC 61850 concepts please refer to IEC 61850-7-1.

5 Translation of IEC 62056 COSEM objects into IEC 61850-Logical Nodes

5.1 General translation principles

5.1.1 General

The translation described in this document defines primarily the translation of a COSEM object to the corresponding IEC 61850 Logical Node. This will make the information within the meter available to an IEC 61850 system.

In contrast with IEC 61850, the data type associated with a COSEM attribute can be of a type CHOICE. Within the set of choices, the exact type is manufacturer specific. For example, the register holding the total active power denoted by OBIS code (1-b:16.7.0.255 (A = 1 means electricity, C = 16 means ΣLI Active power (abs(QI+QIV)-abs(QII+QIII)), D = 7 means instantaneous value, E = 0 means Total, F = 255 means unused)) has a value and scaler_unit attribute. The value may be a choice of any of approximately a dozen of common data types including octet-string, integer or 32-bit floating point representation. It is implied that the mapping process must handle the type conversion.

The key to translating between the two standards is to identify the COSEM Objects and how they map to Data Objects of an IEC 61850 Logical Node. The Data Objects of an instantiated LN Class maps to the COSEM object of a COSEM Logical Device.

For example, an instance of MMTR class may be associated with one and only one COSEM Logical Device within the physical meter. Multiple Logical Nodes, particularly of different Logical Node Classes, may be associated with a single COSEM Logical Device. One Logical Node, however, may not be associated with multiple COSEM Logical Devices.

There are three areas of mapping possibilities between IEC 61850 LN data objects and DLMS/COSEM objects and these require different treatments.

- An IEC 61850 object exists and matches a COSEM object. This may include mathematical equivalents of data objects but with different representations. This category forms the bulk of this standard.
- An IEC 61850 object does not exist but is commonly required for COSEM applications. This will require the extensions to the existing Class definitions by adding data namespaces.
- A mandatory IEC 61850 object exists but does not match any current COSEM data objects. In this case IEC 62056-6-2 should be extended with a class matching the IEC 61850 object. Doing so will maximize the overlap of data objects available to both systems.

The proposed extensions to the IEC 61850 data models are identified with the new namespace:

- Namespace Version: 2015
- Namespace Revision: A
- Namespace release date: 2015-10-5
- Namespace name: “IEC 61850-80-4:2015A”

Furthermore, there are general conventions that must be followed to simplify the configuration of the mapping functions. Table 4 lists the recommended conventions:

Table 4 – Conventions

Area	Convention
Phase numbering	PhsA to OBIS Line 1, PhsB to OBIS line 2, PhsC to OBIS line 3
Time Integrals	First set of frozen values correspond to OBIS Time Integral 5.
Single Phase system	Single phase will refer to OBIS Line 1

5.1.2 IEC 61850 DataTypeTemplates to IEC 62056 Common Data Types

This subclause describes a general convention for constructing some of the more common Constructed Attribute Classes. Table 5 illustrates Data Type mapping.

Table 5 – Data Type mapping

IEC 61850 DataTypeTemplates	IEC 62056 Common Data Type
Timestamp	Convert data and time (0.9.1) to timestamp **format**
BCR.actVal	Recasted as INT64 from other DLMS data types
q	The invalid bit must be set when status of meter or conversion function warrants it.
BCR.frVal, frTm, frEna, strTm, frPd, frRs	The frVal and frTm are equivalent to load profile or stored values functionality. In some cases, the capture period is not a constant. For example, values may be stored at the end of every month.
MV.mag.AnalogueValue.i/f	Equivalent to INT32 or FLOAT32 (preferred)

The BCR (Binary Counter Reading) data class contains both the actual value and a frozen version of the register. This is equivalent to using “Time Integral 5” where the frPD is defined by the load profile capture period. The Timestamp, frTm, is equivalent to the time stamp made during the creation of the load profile entry. The validity attribute of the Quality attribute is mapped to status registers captured at the time the register was frozen. Access to the last entry of the load profile is available.

5.2 Translation tables

5.2.1 General

IEC 61850-7-4:2010, Table 1, defines all Logical Node Groups. The groups where COSEM objects can provide system-relevant information include:

- Group L – System logical nodes
- Group M – Metering and measurement
- Group Q – Power quality events detection related
- Group G – Generic function reference

The scope of this document is limited to Group M – Metering and measurement. Other groups may be added in future versions of this document.

Table 8 to Table 11 use the same convention as the IEC 61850-7-4 series. Table 6 lists column heading descriptions used.

Table 6 – Column heading descriptions

Column heading	Description
Data object name	Name of the data object
Common data class	Common data class that defines the structure of the data object. See IEC 61850-7-3. For common data classes regarding the service tracking logical node (LTRK), see IEC 61850-7-2.
Explanation	Short explanation of the data object and how it is used.
T	Transient data objects – the status of data objects with this designation is momentary and must be logged or reported to provide evidence of their momentary state. Some T may be only valid on a modelling level. The TRANSIENT property of DATA OBJECTS only applies to BOOLEAN process data attributes (FC=ST) of that DATA OBJECTS. A transient DATA OBJECT is identical to normal DATA OBJECT, except that for the process state change from TRUE to FALSE no event may be generated for reporting and for logging. For transient data objects, the falling edge is not reported if the transient attribute is set to true in the SCL-ICD file. It is recommended to report both states (TRUE to FALSE, and FALSE to TRUE), i.e. not to set the transient attribute in the SCL-ICD file for those DOs, and that the clients filter the transitions that are not "desired".
M/O/C	This column defines whether a data object is mandatory (M) or optional (O) or conditional (C) for an instance of a specific logical node. When a data object is marked mandatory (M), it shall be contained in the instance of the logical node. When a data object is marked optional (O), it may be contained in the instance of the logical node; the decision if the data object is contained or not is outside the scope of this standard. The entry C is an indication that a condition exists for this data object, given in a note under the LN table. The condition decides what conditional data objects get mandatory. C may have an index to handle multiple conditions. NOTE 1 Procurement specifications may require specific data objects marked optional to be provided for a particular project. The amount of optional information to be provided needs to be negotiated. NOTE 2 The attributes for data objects that are instantiated may also be mandatory or optional based on the CDC (attribute type) definition in IEC 61850-7-3.

Shaded entries in Tables 7 to 9 are data objects are proposed extensions to the current IEC 61850 Logical Nodes.

5.2.2 Metering and measurement

5.2.2.1 General

The metering and measurement classes shown in Table 7 are defined in this specification but may be optional depending on the actual implementation.

Table 7 – Metering and measurement logical node classes

Logical Node Class	Description
MMTR	Metering 3 Phase
MMTN	Metering Single Phase
MMXU	Measurement
MMXN	Non-phase-related measurement
MMDC	DC measurement
MSQI	Sequence and imbalance
MHAN	Non-phase-related harmonics or interharmonics
MHAI	Harmonics or interharmonics
MFLK	Flicker measurement

All of the classes shown above are potentially in scope for this specification although the classes MMTR and MMXU have significant overlap with IEC 62056. MMDC, MSQI, MHAN, MHAI and MFLK may be treated in future versions of this part of IEC 61850.

5.2.2.2 The MMTR LN

The MMTR LN as shown in Table 8 provides information on the consumed/produced energy in a three phase system. As shown in the column “COSEM OBIS Code” of Table 8, the mapping can be done directly when the corresponding OBIS code exists or via a calculation considering several OBIS codes.

Table 8 – MMTR

Data object name	Common data class	Explanation	T	M/O/C	COSEM OBIS Code
TotVAh	BCR	Net apparent energy		O	(1-b:9.8.0.255) – (1-b:10.8.0.255)
TotWh	BCR	Net real energy		O	1-b:1.8.0.255 – 1-b:2.8.0.255 (abs(+A) –abs(-A))
TotVArh	BCR	Net reactive energy		O	1-b:3.8.0.255 – 1-b:4.8.0.255 (abs(+R) – abs(-R))
SupWh	BCR	Real energy supply (default supply direction: energy flow towards busbar and is equivalent to Energy Export[+])		O	1-b:2.8.0.255 (-A)
SupVArh	BCR	Reactive energy supply (default supply direction: energy flow towards busbar and is equivalent to Energy Export[+])		O	1-b:4.8.0.255 (-R)
DmdWh	BCR	Real energy demand (default demand direction: energy flow from busbar away and is equivalent to Energy Import[-])		O	1-b:1.8.0.255 (+A)
DmdVArh	BCR	Reactive energy demand (default demand direction: energy flow from busbar away and is equivalent to Energy Import[-])		O	1-b:3.8.0.255 (+R)

Data object name	Common data class	Explanation	T	M/O/C	COSEM OBIS Code
VArhQ1	BCR	Reactive Energy QI		O	1-b:5.8.0.255
VArhQ2	BCR	Reactive Energy QII		O	1-b:6.8.0.255
VArhQ3	BCR	Reactive Energy QIII		O	1-b:7.8.0.255
VArhQ4	BCR	Reactive Energy QIV		O	1-b:8.8.0.255
SupVAh	BCR	Apparent Energy- (QII+QIII)		O	1-b:10.8.0.255
DmdVAh	BCR	Apparent Energy+ (QI+QIV)		O	1-b:9.8.0.255
Shaded entries are proposed extension to existing IEC 61850 class.					

5.2.2.3 The MMTN LN

The MMTN LN as shown in Table 9 is used for calculation of energy in a single phase system.

Table 9 – MMTN

Data object name	Common data class	Explanation	T	M/O/C	COSEM OBIS Code
TotVAh	BCR	Net apparent energy		O	(1-b:9.8.0.255) – (1-b:10.8.0.255)
TotWh	BCR	Net real energy		O	1-b:1.8.0.255 – 1-b:2.8.0.255 (abs(+A) – abs(-A))
TotVArh	BCR	Net reactive energy		O	1-b:3.8.0.255 – 1-b:4.8.0.255 (abs(+R) – abs(-R))
SupWh	BCR	Real energy supply (default supply direction: energy flow towards busbar and is equivalent to Energy Export[+])		O	1-b:2.8.0.255 (-A)
SupVArh	BCR	Reactive energy supply (default supply direction: energy flow towards busbar and is equivalent to Energy Export[+])		O	1-b:4.8.0.255 (-R)
DmdWh	BCR	Real energy demand (default demand direction: energy flow from busbar away and is equivalent to Energy Import[-])		O	1-b:1.8.0.255 (+A)
DmdVArh	BCR	Reactive energy demand (default demand direction: energy flow from busbar away and is equivalent to Energy Import[-])		O	1-b:3.8.0.255 (+R)
VArhQ1	BCR	Reactive Energy QI		O	1-b:5.8.0.255
VArhQ2	BCR	Reactive Energy QII		O	1-b:6.8.0.255
VArhQ3	BCR	Reactive Energy QIII		O	1-b:7.8.0.255
VArhQ4	BCR	Reactive Energy QIV		O	1-b:8.8.0.255
SupVAh	BCR	Apparent Energy- (QII+QIII)		O	1-b:10.8.0.255
DmdVAh	BCR	Apparent Energy+ (QI+QIV)		O	1-b:9.8.0.255
Shaded entries proposed extension to existing IEC 61850 class.					

5.2.2.4 The MMXU LN

The MMXU LN as shown in Table 10 shall be used for calculation of currents, voltages, powers and impedances in a three-phase system. The main use is for operative applications.

Table 10 – MMXU

Data object name	Common data class	Explanation	T	M/O/C	COSEM OBIS Code
TotW	MV	Total active power (total *P*)		O	1-b:16.7.0.255
TotVAr	MV	Total reactive power (total *Q*)		O	Undefined but can be calculated by individual line reactive power import and export
TotVA	MV	Total apparent power (total *S*)		O	Undefined but can be calculated by individual line apparent power import and export
TotPF	MV	Average power factor (total *PF*)		O	1-b:13.7.0.255
Hz	MV	Frequency		O	1-b:14.7.0.255
PPV	DEL	Phase to phase voltages (*VL*1,*VL*2, …)		O	Undefined
PNV	WYE	Phase to neutral voltage		O	For the three phases, the pairs of OBIS codes denote voltage magnitude and angle relative to voltage Phase 1. These are PhsA (1-b:32.7.0.255, 1-b:81.7.1.255), PhsB (1-b:52.7.0.255, 1-b:81.7.2.255), PhsC (1-b:72.7.0.255, 1-b:81.7.2.255)
PhV	WYE	Phase to ground voltages (*VL*1ER, …)		O	Undefined
A	WYE	Phase currents (*IL*1, *IL*2, *IL*3)		O	Calculated by performing vector arithmetic using magnitude and angle of each phase current. For the three phases, the pairs of OBIS codes denote current magnitude and angle relative to phase voltage of line 1. The code pairs are PhsA (1-b:31.7.0.255, 1-b.81.7.4.255), PhsB (1-b:51.7.0.255, 1-b.81.7.5.255), PhsC (1-b:71.7.0.255, 1-b.81.7.6.255). all OBIS referenced to phase voltage line 1
W	WYE	Phase active power (*P*)		O	PhsA(1-b:36.7.0.255), PhsB(1-b:56.7.0.255), PhsC(1-b:76.7.0.255), angle are zero,
VAr	WYE	Phase reactive power (*Q*)		O	Undefined
VA	WYE	Phase apparent power (*S*)		O	PhsA(1-b:29.7.0.255), PhsB(1-b:49.7.0.255), PhsC(1-b:69.7.0.255)
PF	WYE	Phase power factor		O	PhsA(1-b:33.7.0.255), PhsB(1-b:53.7.0.255), PhsC(1-b:73.7.0.255), Just an angle. Calculated based on import.
Z	WYE	Phase impedance		O	Undefined

Data object name	Common data class	Explanation	T	M/O/C	COSEM OBIS Code
AvAPhs	MV	Arithmetic average of the magnitude of current of the 3 phases. Average(Ia,Ib,Ic)		O	Undefined
AvPPVPhs	MV	Arithmetic average of the magnitude of phase to phase voltage of the 3 phases. Average(PPVa, PPVb, PPVc)		O	Undefined
AvPhVPhs	MV	Arithmetic average of the magnitude of phase to reference voltage of the 3 phases. Average(PhVa, PhVb, PhVc)		O	Undefined
AvWPhs	MV	Arithmetic average of the magnitude of active power of the 3 phases. Average(Wa, Wb, Wc)		O	Undefined
AvVAPhs	MV	Arithmetic average of the magnitude of apparent power of the 3 phases. Average(VAa, VAb, VAc)		O	Undefined
AvVArPhs	MV	Arithmetic average of the magnitude of reactive power of the 3 phases. Average(VAra, VArb, VArc)		O	Undefined
AvPFPhs	MV	Arithmetic average of the magnitude of power factor of the 3 phases. Average(PFa, PFb, PFc)		O	Undefined
AvZPhs	MV	Arithmetic average of the magnitude of impedance of the 3 phases. Average(Za, Zb, Zc)		O	Undefined
MaxAPhs	MV	Maximum magnitude of current of the 3 phases. Max(Ia,Ib,Ic)		O	Undefined
MaxPPVPhs	MV	Maximum magnitude of phase to phase voltage of the 3 phases. Max(PPVa, PPVb, PPVc)		O	Undefined
MaxPhVPhs	MV	Maximum magnitude of phase to reference voltage of the 3 phases. Max(PhVa, PhVb, PhVc)		O	Undefined
MaxWPhs	MV	Maximum magnitude of active power of the 3 phases. Max(Wa, Wb, Wc)		O	Undefined
MaxVAPhs	MV	Maximum magnitude of apparent power of the 3 phases. Max(VAa, VAb, VAc)		O	Undefined
MaxVArPhs	MV	Maximum magnitude of reactive power of the 3 phases. Max(VAra, VArb, VArc)		O	Undefined
MaxPFPhs	MV	Maximum magnitude of power factor of the 3 phases. Max(PFa, PFb, PFc)		O	Undefined
MaxZPhs	MV	Maximum magnitude of impedance of the 3 phases. Max(Za, Zb, Zc)		O	Undefined
MinAPhs	MV	Minimum magnitude of current of the 3 phases. Min(Ia,Ib,Ic)		O	Undefined

Data object name	Common data class	Explanation	T	M/O/C	COSEM OBIS Code
MinPPVPhs	MV	Minimum magnitude of phase to phase voltage of the 3 phases. Min(PPVa, PPVb, PPVc)		O	Undefined
MinPhVPhs	MV	Minimum magnitude of phase to reference voltage of the 3 phases. Min(PhVa, PhVb, PhVc)		O	Undefined
MinWPhs	MV	Minimum magnitude of active power of the 3 phases. Min(Wa, Wb, Wc)		O	Undefined
MinVAPhs	MV	Minimum magnitude of apparent power of the 3 phases. Min(VAra, VArb, VArc)		O	Undefined
MinVArPhs	MV	Minimum magnitude of reactive power of the 3 phases. Min(VAra, VArb, VArc)		O	Undefined
MinPFPhs	MV	Minimum magnitude of power factor of the 3 phases. Min(PFa, PFb, PFc)		O	Undefined
MinZPhs	MV	Minimum magnitude of impedance of the 3 phases. Min(Za, Zb, Zc)		O	Undefined
Settings					
ClcTotVA	ENG	Calculation method used for total apparent power (TotVA)		O	Undefined
PFSign	ENG	Sign convention for VAr and power factor (PF)		O	Undefined

5.2.2.5 The MMXN LN

The MMXN LN as shown in Table 11 shall be used for calculation of currents, voltages, powers and impedances in a single-phase system, i.e. in a system where voltages and currents are not phase-related. The main use is for operative applications.

Table 11 – MMXN

Data object name	Common data class	Explanation	T	M/O/C	COSEM OBIS Code
Amp	MV	Current I not allocated to a phase		O	1-b:31.7.0.255
Vol	MV	Voltage V not allocated to a phase		O	1-b:32.7.0.255
Watt	MV	Power (*P*) not allocated to a phase		O	1-b:21.7.0.255
VolAmpr	MV	Reactive power (*Q*) not allocated to a phase		O	1-b:23.7.0.255
VolAmp	MV	Apparent power (*S*) not allocated to a phase		O	1-b:29.7.0.255
PwrFact	MV	Power factor not allocated to a phase		O	1-b:33.7.0.255
Imp	CMV	Impedance		O	Undefined
Hz	MV	Frequency		O	1-b:34.7.0.255

The OBIS code will use the first phase for the single phase system.

____

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
Fax: + 41 22 919 03 00
info@iec.ch
www.iec.ch