GUIDELINE DOCUMENT

Data Exchange for Electricity Meter Reading, Tariff and Load Control – Companion Specification

Guide line specification for R-APDRP

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Revision History

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Contents

Foreword

This guideline specification gives the rules and procedures for adapting the open protocol IEC62056 (DLMS/COSEM) standard for communication of metering data to a remote host. It takes as basis the International Standard "Energy Metering - Data exchange for meter reading, tariff, and load control" and:

- Selects options and specifies parameters of the International Standard to permit interoperability.
- Clarifies and explains elements for the chosen provisions of the International Standard.

The present document also includes recommendations concerning client services, data-collection devices (HHUs), data storage and conformance testing of any implementation.

It is the intention of this Companion Specification to provide a basis for efficient and secure transfer of energy-metering data in an open manner that will promote the practice of interoperability between equipment from diverse sources.

This document is the outcome of concerted effort of Government organisations, Electric Utilities, Manufacturers and System Integrators.

1. Scope

A. This document is the Companion Standard intended for use in India in the design and operation of an open and interoperable messaging system for reading, configuring and controlling the DLMS / COSEM energy meters meant for electricity measurements. Such meters are also referred often as Servers in the context of intelligent data collection system with the HOST end referred as Client.

B. This document covers the minimum requirements for building the intelligent meter data collection system based on the DLMS / COSEM protocol which is adopted as a standard by IEC.

C. This document is to be read with current versions of main BIS documents listed under Section 2.1 that are being adopted out of corresponding IEC standards.

D. This document includes the chosen provisions of the DLMS / COSEM protocol that are relevant and important for bringing in uniformity and interoperability in Indian meter data collection process.

E. This document specifies the requirements for reading the meter at site using the HHU as well as reading the meter from a remote location using the HOST.

F. The protocol requirements brought out in this document applies to Category of meters listed under Section 1.1.

G. The following are kept outside the purview of this document and for these; reference shall be made to the appropriate standards.

   I. Connectivity between HOST and METER – The choice of communication medium and its requirements for formation of a data channel to exchange messages between HOST and METER shall be decided among User, Manufacturer and SI.

   II. DCE - The compatible Data Communication Equipment (e.g.-MODEM) and its requirements suitable for the chosen communication medium shall be decided among User, Manufacturer and SI.

   III. Values and distribution methods of secret keys, etc. shall be decided among User, Manufacturer and SI.

   IV. The metrological properties to be complied with by the electricity meter for which appropriate Standards shall be referred.

1.1 Categories of Meter

The DLMS / COSEM meter mentioned in this companion specification is an electricity meter with messaging capabilities. The messages to be sent and received by a server are many. This document is aligned with a national report which was prepared with the objective of ushering in homogeneity and interoperability. The national reports are listed under Section – 2.2. Accordingly this version of the document has absorbed within itself the list of meters as listed in Table – 1.1.

Table-1.1

Meter Category	Meter / Server Purpose	Annexure Reference
A	Energy Accounting and Audit Metering	A2, A5,A6
B	Boundary / Bank / Ring / ABT Metering	A3, A5,A6
C	HT (PT / CT) and LT (CT) Consumer Metering	A4, A5,A6

The meters or servers listed in Table-1.1 shall be required to send or receive the parameters listed under the various tables included in the Annexure mentioned against each category in Table 1.1 These parameters are classified as electrical quantities, load survey data, billing quantities, programmable data and events.

Each of the parameter listed under the tables in Annexure cited in Table 1.1 is assigned a set of identifiers called as OBIS code. The OBIS codes are unambiguous and unique. The implication of this is that if the HOST system sends a read request with an OBIS code from any of the table to the meter (server) the latter shall respond with the corresponding data quantity. The OBIS code and the corresponding response are to be embedded in to a message packet structure defined by this open protocol and exchanged between HOST and Server.

In the process of maintaining the homogeneity and interoperability, additions and alterations that are introduced in all aspects of Table 1.1 will be posted in an exclusive website. Till such time those changes are absorbed by this document by way of amendments and made mandatory the users may visit the designated website and adopt as per their needs.

1.2 Relation to Reports of DLMS UA & Standards

The standards are currently maintained by DLMS UA which publishes the coloured books from time to time. The “Blue, Green, Yellow and White Books” form the technical reports all of which describe the rules governing modelling, messaging, transporting and testing of protocol implementation. These books are revised and updated taking in to consideration technical developments, industry needs and business processes. These are listed in 2.1 and shall form normative reference documents.

The coloured books are adopted by IEC and released as series of Standards under the IEC 62056 series, with the title as “Electricity metering: Data exchange for meter reading, tariff and load control”. The current versions of those IEC standards are given as list of non normative references in 2.1. The coloured books and the IEC standards describe all the provisions, rules, syntax and semantics for effective implementation of DLMS / COSEM protocol.

This companion specification has defined the options available so as to achieve uniformity in the DLMS/COSEM implementations for the Indian power sector. Apart from such standardising efforts nothing in this document is intended to conflict with the provisions of versions of those standards in effect, at the time of creating this document.

This is an Indian National document and therefore in the event of any conflict with the Coloured Books this document shall prevail.

2 References

2.1 Normative Reference

The following standards are referenced in this companion standard.

S.No	BIS DOC No.*	Description
1	ETD 13(6001)	Electricity metering : Data exchange for meter reading, tariff and load control Part-61: Object identification system (OBIS)
2	ETD 13(6002)	Electricity metering : Data exchange for meter reading, tariff and load control Part 62: Interface classes
3	ETD 13(6000)	Electricity metering : Data exchange for meter reading, tariff and load control Part 53: COSEM application layer
4	ETD 13(5999)	Electricity metering : Data exchange for meter reading, tariff and load control Part 46: Data link layer using HDLC protocol
5	ETD 13(5998)	Electricity metering : Data exchange for meter reading, tariff and load control Part 42: Physical layer services and procedures for connection-oriented asynchronous data exchange
6	ETD 13(5997)	Electricity metering : Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange
7	IS STD-6	Electricity metering : Data exchange for meter reading, tariff and load control Part 47: COSEM transport layers for IPv4 networks

* - It shall be replaced with Actual BIS Number when it is published.

2.2 Non-normative References

These additional references are specified for informative purposes only. The references made below to the DLMS-UA Colored books are substantiated with excerpts included in this Companion specification wherever applicable. The excerpts reproduced within this document shall be normative.

Sno	Document	Description
1.	CEA Regulations 2006	Central Electricity Authority (installation and Operation of Meters) Regulations, 2006
2.	CEA report	Report of High Level Committee on Standardization of Meter Protocol, DEC 2008
3.	CPRI report	Report on Standardization of Parameters – April 2009

4.	DLMS UA 1000-1 ed.9, 2009	Blue book, COSEM Identification System and Interface Classes
5.	DLMS UA 1000-2 ed.6, 2007	Green book, DLMS/COSEM Architecture and Protocols
6.	DLMS UA 1002: ed.1, 2003	White book, COSEM Glossary of Terms
7.	DLMS UA 1001-1:2007 ed-3	Yellow Book, Companion Testing Process
8.	IEC 62056-61 Ed 2.0 (2006-11)	Electricity metering : Data exchange for meter reading, tariff and load control Object identification system (OBIS)
9.	IEC 62056-62 Ed 2.0 (2006-11)	Electricity metering : Data exchange for meter reading, tariff and load control Part 62: Interface classes
10.	IEC 62056-53 Ed 2.0 (2006-12)	Electricity metering : Data exchange for meter reading, tariff and load control Part 53: COSEM application layer
11.	IEC 62056-46 Ed.1.1 (2002-07)	Electricity metering : Data exchange for meter reading, tariff and load control Part 46: Data link layer using HDLC protocol
12.	IEC 62056-42 Ed.1.0 (2002)	Electricity metering : Data exchange for meter reading, tariff and load control Part 42: Physical layer services and procedures for connection-oriented asynchronous data exchange
13.	IEC 62056-47 Ed 1.0 (2006-11)	Electricity metering : Data exchange for meter reading, tariff and load control Part 47: COSEM transport layers for IPv4 networks
14.	IEC 62056-21 Ed 1.0 (2005-08)	Electricity metering : Data exchange for meter reading, tariff and load control Part 21: Direct local data exchange
15.	IEC/TR 62051-1 Ed 1.0 (2004-01)	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
16.	IEC 61334-4-32 Ed. 1.0 (1996-09)	Distribution automation using distribution line carrier systems Part 4: Data communication protocols - Section 32: Data link layer - Logical link control (LLC)
17.	NIST SP 800-38-D	Recommendations for Block Cipher Modes of Operation: Galios / Counter Mode (GCM) and GMAC
18.	IEC 60051	Direct Acting Indicating Analogue Electrical Measuring Instruments and Their Accessories
19.	IS 14697	AC static Transformer operated Watt-hour and VAR-hour meters, Class 0.2S AND 0.5S specification.

3 Terminology

The following items are additional to terms found in Ref. [2], IEC/TR 62051-1, 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.

Class
The term Class is a short form of Interface Class.

DLMS
"DLMS" is the acronym for "Device Language Message Specification", and refers to the messaging system defined in IEC 61334-4-41 (named "Distribution Line Message Specification" in that specification). It is commonly used to refer to collective use of several parts of IEC 62056 including Part 53.

HOST computer
A computer system to which data collected by HHUs is returned for processing, and/or which can collect data remotely from a meter or data concentrator.

Network
The term "network" is used to indicate interconnection of a number of devices in a way concordant with the communications profile selected. It does not necessarily mean a diverse or wide-ranging set of connections, nor any routing capability. Where a wide-area or similar network is in use it is encapsulated; message routing is outside of the scope of DLMS/COSEM.

Object List
Attribute 2 of Class 12 or 15 (instantiated as the Association object) contains a list of all objects supported within the scope of the selected application association. This is commonly known as the Object List. The "Object-List" is also commonly referred to as "OBIS-List".

Parameter, parameterization
The term Parameter refers to a single identifiable metering or other quantity which may be read or altered within meter readings, tariffication, or control. A parameter may have multiple aspects such as its value, scaling, timestamp, etc.

The term Parameterization refers to the setting of those parameters that define the configuration of the metering device.

Profile
The term Profile in the context of DLMS/COSEM data access refers to a method of combining multiple parameters into a single structure, normally repetitive.

The structure is identified by a single OBIS code, and it is returned using the Profile Class. One attribute of this class defines the individual contained parameters, by means of OBIS codes, classes, and attributes.

The term Profile in the context of DLMS/COSEM communications or security refers to a combination of options to form a particular protocol suitable to the media (in one case) or security procedures (in the other case) required by the system user.

Data Concentrator

This refers to a device used to hold the data from a number of meters, in a way that identifies the data from each meter, and allows it to be accessed in real time by a higher-level data collector. Typically a concentrator is accessed in a similar manner to the meters, but supports faster or cheaper communication, and has greater storage capacity, than is available with the meters themselves. An example of use is to concentrate data from a number of electrical distribution substations.

HHU Hand Held Unit

The HHU or equivalent unit functions as a local client for collecting data from a slave (Meter).

BCS- Base Computer Software

4 Architecture

The typical connectivity scheme between the SERVER and CLIENT, considered for this specification is shown in FIG-1.

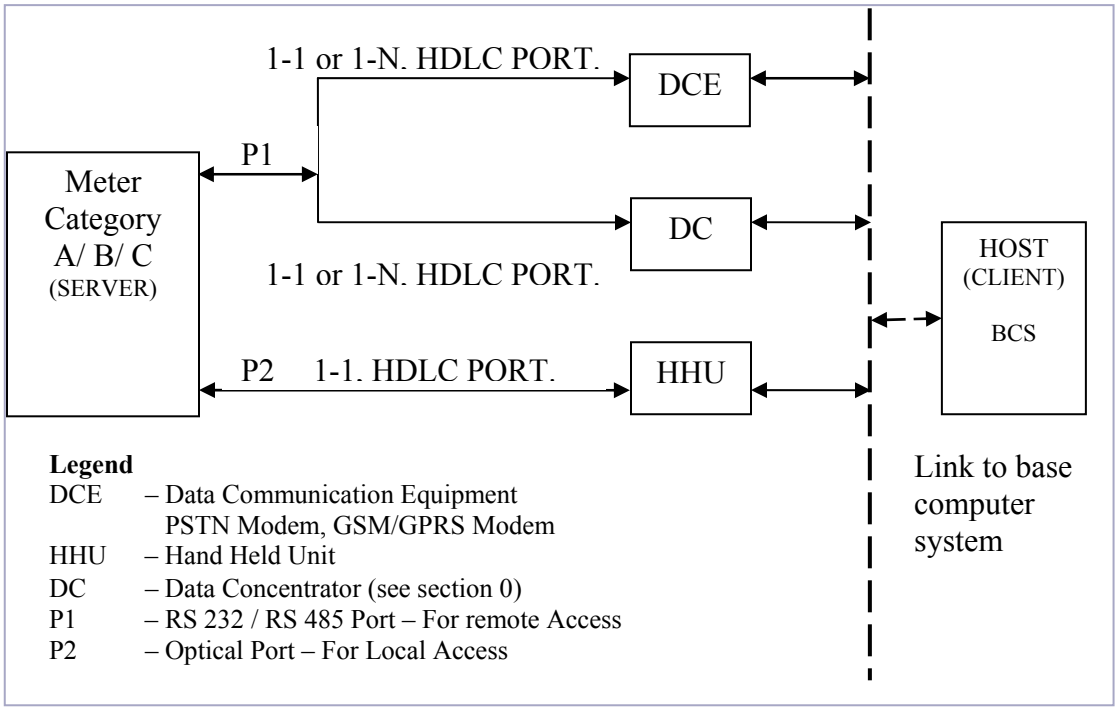

Fig 1: Message flow connectivity scheme between SERVER and CLIENT.

4.1 Physical Requirements

The server shall support a minimum of two ports for data communication, as given below and as per FIG-1.

1. P1 – A hardware port compatible with RS 232 or RS 485 specifications. This shall be used for remote access from the HOST (CLIENT) or DC (CLIENT).
2. P2 – An Optical port complying with hardware specifications detailed in IEC-62056-21. This shall be used for local access form a HHU.
3. The P1 and P2 both shall support the 3-layer Connection Oriented COSEM/HDLC profile, with a minimum and default baud rate of 9600.

The optical port is not required to support any mode of IEC-62056-21, that is, mode of usage shall be direct HDLC.

4.2 Requirements for simultaneous operation

The server is not required to allow more than one association to be open at any one time. If messages are received destined for any association other than one that is currently open then the server shall handle the new request without disruption to operations already in progress.

At any one time no more than one invocation shall be in progress. If requests are received that would cause additional invocations to exist then the server shall handle the new request without disruption to operations in progress on existing invocations. The result code 'temporary-failure' may be returned.

Optical port shall have priority when both ports are accessed simultaneously. This means that if the electrical port is connected and being accessed for data, any attempt to connect on optical port shall cause the connection on electrical port to be interrupted and the optical connection processed after sending "temporary-failure" code to HOST. Any further attempts to communicate on electrical port while the optical port is being used shall be returned with a "temporary-failure" code. This is an indication to the host that the meter is temporarily busy.

5. Logical Structure of Meters

The meter represents one physical device as mentioned in IEC 62056-21 clause 4.5.

The physical device (meter) hosts one logical device as mentioned in IEC 62056-21 clause 4.5, which is the Management logical device. This has SAP (Service Access Point) address 1, as mandated in [3] IEC 62056-53

The meter shall support the Logical Name (LN) referencing mechanism as defined in IEC 62056-62 Annex C.

Short name referencing as defined in IEC 62056-62 Annex C is not required to be supported.

The meter shall support three associations in the Management Logical Device

a. Public Client association (PC)
b. Meter Reader association (MR)
c. Utility Settings association (US)

5.1 Mandatory Objects

The following objects are mandated by [2] IEC 62056-62

Object	OBIS Code	Interface Class	Requirements
Logical device name	0.0.42.0.0.255	IC-1 (Data)	Value data type will be octet-string with maximum length 16.
Current Association	0.0.40.0.0.255	IC-15 (Association LN)	This object will refer to the currently connected association object (among the list of associations supported in the meter)

The Logical Device name shall have a maximum length of 16 characters, and shall have as its first three characters the manufacturer's 3-letter code as specified in [2] - ETD 13(6002) section 4.6.2

5.2 Association Properties

The required associations shall have the following properties.

Feature	Public Client	Meter Reader	Utility Settings
SAP Address pair in format (client, server)	(16,1)	(32,1)	(48,1)
Application Context – Basic security	LN without ciphering	LN without ciphering	LN without ciphering
Application Context – Advanced security	Not applicable	LN-Ciphered	LN-Ciphered
Signon Authentication Mechanism	Lowest Level	Low Level	High Level
Services required in conformance block	Get, Get with Block transfer	Get, Get with Block transfer, Selective Access	Get, Set, Action, Get and Set with Block transfer, Selective Access

The PC association shall contain in addition to mandatory objects

1 The meter's real-time clock;

The MR association shall contain in addition to mandatory objects

1 Profile objects allowing bulk collection of data defined by the parameter lists in Annexure A2, A3, A4, A5 and A6

2 Simple objects allowing ad-hoc access to items in the instantaneous parameters list. Ad-hoc access to the profile objects shall also be possible.

The US association shall contain in addition to mandatory objects

1 All the objects accessible via the US association;

2 Simple and compound objects allowing tariffication and configuration of the meter.

The composition of each association is detailed in Annexure A2, A3, A4, and A5. Mandatory objects do not necessarily appear in these tables.

Access rights for each data item are also shown in Annexure A2, A3, A4, and A5.

5.3 Descriptive Notes for Logical Structuring

1. Associations: Each Logical device can organize the data objects into different

associations, each having different access rights to the list of objects. Each association defines the SAP address pair of the client and server logical device addresses that participate in the data transaction.

2. Objects: All meter data is represented by objects or instances of the standard Interface classes.
3. Attributes & Methods: The actual placeholders of the different data elements of the meter are the attributes of the objects, whereas the methods exposed by the objects allow manipulating the attributes in defined manners.

Referencing Methods

DLMS/COSEM provides two referencing methods to access the meter data, Logical name referencing and Short Name referencing. Under LN referencing, data is accessed by specifying the Logical name (OBIS code) of the object and the attribute (or method) index. Under SN referencing each attribute and method of each object has its own individual address.

Access rights are specified for each attribute and each method of every data object in the meter. Attributes may have the following access rights

- No access
- Read access
- Write access
- Read-Write access

Methods may have the following access rights

- No access
- Execute access

Access rights are specific to each association. Different associations may award different access rights to the same set of data objects. Thus the grouping of data into associations is also only a logical partitioning.

6 Usage of DLMS / COSEM Provisions

6.1 Usage of Interface Classes

This Companion Standard defines the set of Interface Classes to be used in the national context for various types of data. The interface class for the identified parameters is specified in the Annexure A2 to A6.

Either requiring support or offering support for a class shall not imply support for all its attributes. Required attributes are listed under respective Annexure as Notes.

Attribute 0 (indicating access to all attributes in one request) is not required to be supported in any case.

References to classes may be made in the form of capture-IDs or register-table entries even if the corresponding classes are not supported for direct data access.

References to OBIS codes may be made in the form of capture-IDs, masks, or scripts even if the corresponding objects are not individually accessible. In this case those items will not appear in the Association object.

6.2 Requirements for interoperability.

1. A client device supporting the parameters, functions, and classes of the Minimum Specification, along with suitable configuration of system-dependent features (such as physical addresses, timeout thresholds, and secret keys), shall be able to retrieve all of the specified data items and perform any of the specified updates without particular knowledge about the server.
2. Given the knowledge that a certain client or a certain server implements particular additional features defined as in this specification, a server can be built to return data and receive updates from that client, or a client can be built to retrieve data and perform updates upon that server, respectively, without further special knowledge other than system-dependent features.
3. Interpretation of the data shall be possible by any user with adequate knowledge of electricity metering provided that a complete set of data has been retrieved.

6.3 Country-specific OBIS codes

Within this Companion Specification, country-specific variations or additions to quantities such as energy types are managed by the allocation of new codes in the full OBIS format. The country specific OBIS codes introduced in this document are in the format - a.b.94.91.e.f. along with interface class and attributes.

7. Association and Data Security

As per the provisions of the DLMS/COSEM protocol, Data access control mechanism and Encryption / Authentication mechanism shall be supported. Access control mechanisms shall be used in the Association establishment phase and Encryption / Authentication mechanism shall be used in the Data communication phase.

7.1 Security Profiles

Two Security schemes are defined in this companion standard:

1. ***Basic Security:*** The basic security profile does not provide for encryption or authentication during data communication stage. The only security provided for is the Sign-on authentication security provided by Low Level and High level security as applicable for the respective Associations.
2. ***Advanced security:*** encryption, authentication, or both can be performed by the application program and transferred using ciphered PDUs.

All systems must implement Basic Security. Implementation of Advanced security is discretionary. When implemented it shall use NIST SP 800-38-D

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

The following interface class is defined in addition to those published in the international standard [IEC 62056-62]
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.

Security setup		**0...n**	**class_id = 64, version = 0**			
Attributes		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. security_policy	(static)	enum				x + 0x08
3. security_suite	(static)	enum				x + 0x10
4. client_system_title	(dyn.)	octet-string				x + 0x18
5. server_system_title	(static)	octet-string				x + 0x20
Specific methods		***m/o***				
1. security_activate		o				x + 0x28
2. global_key_transfer		o				x + 0x30

7.3 Security Setup objects

The following object identifiers are defined in addition to those published in the international standard [IEC 62056-62]
Instances of the IC "Security setup" – see clause 0 – are used to set up the message security features. For each Association object, there is one Security setup object managing security within that AA. Value group E numbers the instances.

Security Setup objects	**IC**	**OBIS code**					
		A	**B**	**C**	**D**	**E**	**F**
Security Setup	64 – Security Setup	0	b	43	0	e	255

This companion standard defines 2 values for E corresponding to the 2 associations as below:

SNo	Security Setup object OBIS Code	Association description
1	0.b.43.0.1.255	Meter Reader Association
2	0.b.43.0.2.255	Utility Settings Association

7.4 LN Association Interface Class

This companion specification utilizes version 1 of the Association LN Interface Class (IC 15). The version 1 of IC 15 adds an extra attribute “security_setup_reference” (attribute 9) which will be used to contain the reference to an instance of a Security Setup class (namely one of the two instances defined in the table above in 7.3

The following Interface Class definition is defined in addition to those published in the international standard [IEC 62056-62]

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.

Association LN		**0...MaxNbofAss.**	**class_id = 15, version = 1**			
Attributes		***Data type***	***Min.***	***Max.***	***Def.***	**Short name**
1. logical_name	(static)	octet-string				x
2. object_list	(static)	object_list_type				x + 0x08
3. associated_partners_id		associated_partners_type				x + 0x10
4. application_context_name		application_context_name				x + 0x18
5. xDLMS_context_info		xDLMS_context_type				x + 0x20
6. authentication_mechanism_ name		mechanism_name				x + 0x28
7. secret		octet-string				x + 0x30
8. association_status		enum				x + 0x38
9. security_setup_reference	(static)	octet-string				x + 0x40
Specific methods		***m/o***				
1. reply_to_HLS_authentication (data)		o				x + 0x60
2. change_HLS_secret (data)		o				x + 0x68
3. add_object (data)		o				x + 0x70
4. remove_object (data)		o				x + 0x78

7.5 Descriptive Notes for Data Security

7.5.1 Access Control for Association

The DLMS/COSEM standard provides three different sign-on authentication mechanisms for each association’s access to meter data applied at the time of performing COSEM OPEN operation.

7.5.1.1 Lowest Level security

Open access without any authentication at sign-on.

7.5.1.2 Low Level security (LLS)

Password based sign-on where the client authenticates itself to the meter using a password. The Utility settings association shall provide access to read/write the password for all associations that utilize this authentication scheme (Currently only the Meter Reader association object). This is accomplished by providing read/write access to the "secret" attribute (attribute number 7) of the Meter Reader association LN object. This read/write access is provided only through the Utility Settings association.

7.5.1.3 High Level security (HLS)

HLS mechanism defines a 4-pass sign-on scheme where the client and server exchange challenges (a random number or code) and then reply to the challenges with a processed response. The processing performed on the challenges is an encryption using a secret "key". The key is stored under the "secret" attribute (attribute number 7) of the Association objects that utilize High Level authentication (currently only the Utility Settings associations). The Utility Settings association shall provide read/write access to the "secret" attribute of the Utility Settings association.

The encryption mechanism used for processing the challenges shall be AES-GCM-128 algorithm as provided in the information security standard NIST SP 800-38-D

7.5.2 Encryption for Data Communication

The secrecy of data communicated between the meter and the client is handled by the encryption mechanism chosen in the Application Context. Associations utilizing the "Logical Name with ciphering" application context provide encryption/decryption services for data messages.

NOTE: The encryption key referred to in the High Level authentication described above is only used to encrypt the challenges during association establishment. It is only for authentication. This has no relation to the encryption that may be used in actual data communication

8. Event handling

This section adds the definitions for the Event Code object and Event Log object in sections 8.1 and 8.2 as below.

8.1 Event Code

An event code object is used to hold the identifier corresponding to most recent event. Data, Register or Extended Register classes can be used to model this object. DLMS allows defining country specific reference table that lists all possible events with corresponding identifier (Refer to Annexure A6 – Table A6.1 to A6.7 for the Indian Event reference table entries). For the purposes of this companion standard the Interface Class used for this object is restricted to IC-1 (Data). The value attribute of the object will have a DLMS data type "long unsigned" (16 bit integer) which will contain the event identifier for the last recorded event (identifier taken from the reference tables A6.1 to A6.7.

Event code	IC	OBIS code					
		A	B	C	D	E	F
Event code	1 – Data	0	b	96	11	e	255

Value group E allows to classify events into different categories as needed. Currently DLMS allows 10 values (0...9) for value group E, enabling user to define up to 10 event categories.

This companion specification defines 7 categories for classification of events and correspondingly 7 Event code objects as below

Sno	Event Code object OBIS Code	Event Category Description
1	0.b.96.11.0.255	Voltage related events
2	0.b.96.11.1.255	Current related events
3	0.b.96.11.2.255	Power failure related events
4	0.b.96.11.3.255	Transaction related events
5	0.b.96.11.4.255	Other events
6	0.b.96.11.5.255	Non-rollover events
7	0.b.96.11.6.255	Control events for connect/disconnect

NOTE: The 7th Event code object is required only where remote load control by means of connect/disconnect are specified by agreement between the Utility and the manufacturer

Refer to Annexure A6 – Table A6.1, A6.2, A6.3, A6.4, A6.5, A6.6 and A6.7 for the valid Event Identifier values defined for the above 7 categories by this companion specification.

8.2 Event Log

These are profile generic objects to store historic values in its buffer attribute. The capture object includes object attribute definitions of associated data. Associated data includes event code and other relevant information such as timestamp, instantaneous electricity related information (such as current/voltage/energy register, contents etc at the time of the event).

For the purposes of this companion standard, the capture objects will include the entries specified in Annexure A6 – Table A6.8

Event logs	IC	OBIS code					
		A	B	C	D	E	F
Event log	7 – Profile Generic	0	b	99	98	e	255

Value group E allows to classify event logs into different categories as needed. Currently

DLMS allows 10 values (0...9) for value group E allowing to define up to 10 event log categories.

This companion specification defines 7 categories for classification of event log objects with a one-to-one correspondence with the 7 event code categories defined in section 8.1 above.

SNo	Event Log object OBIS Code	Event Category Description
1	0.b.99.98.0.255	Voltage related events
2	0.b.99.98.1.255	Current related events
3	0.b.99.98.2.255	Power failure related events
4	0.b.99.98.3.255	Transaction related events
5	0.b.99.98.4.255	Other events
6	0.b.99.98.5.255	Non-rollover events
7	0.b.99.98.6.255	Control events for connect/disconnect

NOTE: The 7th Event log category is required only where remote load control by means of connect/disconnect are specified by agreement between the Utility and the manufacturer

8.2.1 Event Log storage recommendations

This companion specification recommends a minimum total storage of 200 events in the Event logs. The division of the specified storage space across the 7 compartments specified above shall be by agreement between the Utility and the Manufacturer.

The event code and event log parameters are accessible through the MR and US associations with read-only access.

9.TOD Metering

DLMS/COSEM provides a number of Interface Classes to deal with TOD metering. These include Activity Calendars (objects that specify the time-switches for tariffs based on a season/week/day profile tree) and Schedules (a simple tabular listing of time-switch scripts associated with a date-time).

These objects associate a script (stored in a Script Table object, IC-9) with each time-switch. The script usually defines the list of registers that get enabled for that time-switch using a Register Activation object (IC-6) that stores “masks” of registers that can be selectively enabled/disabled.

For the purpose of this companion specification, the Activity Calendar (IC-20) shall be used.

Activity Calendar	**IC**	**OBIS code**					
		A	**B**	**C**	**D**	**E**	**F**
Activity Calendar	20 – Activity Calendar	0	b	13	0	0	255

An instance of a Script Table class, the Tariffication Script Table object will be used to store the scripts related to each time-switch in the Schedule.

Script Table	IC	OBIS code					
		A	B	C	D	E	F
Tariffication Script Table	9 – Script Table	0	b	10	0	100	255

This Companion specification utilizes a simple mechanism for associating TOD/TOU scripts with Tariffs, as described below. Use of the Register Activation object is not required.

Under this mechanism, script identifiers in the Tariffication Script Table are inherently associated with Tariffs, as defined below.

Script identifiers from 1 to 16 are associated with the Activation of Tariff Rate Registers 1 to 16. Implementations that do not require 16 different tariff rates shall use identifiers from 1 to the required number. For example if 8 tariffs are defined, script identifiers 1 to 8 shall be used, where scripts 9 to 16 are reserved for future use.
Scripts identifiers 17 to 32 are associated with Maximum Demand tariffs 1 to 16. Implementations that do not require 16 different tariff rates shall use identifiers from 1 to the required number.

The Activity Calendar shall be used to associate activation times to different Tariff rates simply by using the appropriate script identifiers. All scripts shall point to a dummy OBIS code and attribute index which has no associated meaning.

Use of the Special Days table is not considered presently in this companion standard.

10.Billing Periods

Billing period resets are driven by an instance of the Single Action Schedule class in conjunction with a Script Table. The Data of the Billing Period is stored in a Profile Generic object as below. Each entry in the profile buffer captures the billing period values for a specific Billing Period.

Profile Generic	IC	OBIS code					
		A	B	C	D	E	F
Data of Billing Period Profile	7 – Profile Generic	1	b	98	1	0	255

This companion specification specifies the following Single Action Schedule object to drive the end of billing period resets. The object will contain the time-date entries at

which billing period resets are scheduled.

Single Action Schedule	IC	OBIS code					
		A	B	C	D	E	F
MDI Reset / End of Billing Period	22 – Single Action Schedule	0	b	15	0	0	255

Each time-date entry in the "execution_time" array will be associated with a link to a single Script in the MDI Reset/End of Billing Period Script Table. The Script table object as specified below will be programmed with scripts to handle the Billing period resets

Script Table	IC	OBIS code					
		A	B	C	D	E	F
MDI Reset / End of Billing Period Script Table	9 – Script Table	0	b	10	0	1	255

The script table will contain a single script that specifies the "capture" method invocation for the corresponding Data of Billing Period profile (1.0.98.1.0.255). Therefore a Single Action Schedule entry will trigger a call to the Script table to execute the capture method at a specific time (viz. the end of the billing period) which will cause a billing period entry to be made in the profile for the current period and trigger the start of a new billing period. Other actions internal to the meter may also be triggered by the end of each billing period, but are not required to be expressed as scripts here.

11. Historic data

Historic data can be accessed by two mechanisms in DLMS-COSEM. One mechanism provides access to past values of specific quantities by using a VZ (billing period number) related value for F in the OBIS code of the original quantity. The other mechanism provides access to historic data stored as growing buffers in a Profile generic object.

11.1 VZ handling – Billing Period Counter

The meter will contain an instance of a Billing period counter object

Billing Period Counter	IC	OBIS code					
		A	B	C	D	E	F
Billing Period Counter	1 – Data	0	b	0	1	0	255

The value attribute of the object will have a DLMS data type “unsigned” (8-bit character) and will follow a modulo-100 scheme at a minimum. The value will thus start with 0, increment upto 99 and then rollover to 0 again. The current value of this attribute is called “VZ”. Implementations must support at least modulo-100, but higher capacities for the billing period counter value attribute may also be supported.

The meter will contain an instance of a Data object that provides the number of available billing periods in the meter

Number of Billing periods	**IC**	**OBIS code**					
		A	**B**	**C**	**D**	**E**	**F**
Available Billing periods	1 – Data	0	b	0	1	1	255

The above can be read by the client to identify how many previous billing period’s data is available in the meter. The value attribute of the above object will have a DLMS data type “unsigned” (8-bit character)

For specific data objects (especially data of the billing period objects), it is possible to retrieve the individual historic values of past billing periods using specific values for the “F” value field of the OBIS code. For example if the active energy of the current billing period is 1.0.1.8.0.255, then the active energy of the immediately previous billing period is available at 1.0.1.8.0.101. Further historic periods can be accessed by using “102”, “103”, … etc. up to the limit that is identified by the “Number of Available Billing Periods” object above. For example a value of 106 can be used to represent the data of the 6th previous billing period. Simple objects can only be used to represent values of historical billing periods, if “Profile generic” objects are not implemented

11.2 Profiles

Historic data like Load profiles etc. are supported in IEC-62056 by the Profile generic Interface Class (IC 7). This object supports capture of other meter object attributes at specific intervals or on demand. The captured data is stored in the buffer attribute (Attribute 2) of the Profile generic class. This class also supports Selective access to filter the buffer data in response to GET requests. There are two mechanisms for selective access viz. Selective access by Entry and Selective Access by Range.

This companion specification requires that the Selective Access by Range shall be supported for Block Load profile and Daily Load profile. This companion specification requires support for Selective Access by Entry for Billing data profile and Event log profiles.

In case of Selective access by Range, this companion specification imposes that the restricting object is to be an instance of the Clock interface class (IC-8) and the date-time attribute of the object is captured in the buffer.

12. Communication Profiles

IEC 62056 adopts the Open Systems Interconnection Reference Model, in a reduced three-layer form suitable for low-resource applications such as electricity metering. The Fig-12.1 below illustrates this system.

This companion specification requires that the three-layer serial Connection-Orientated (CO) profile shall at least be supported as depicted by the circled sections in Fig 12.1.

The 3-layer serial CO profile consists of COSEM, Logical Link Control (LLC), and High-Level Distribution Line Control (HDLC) on a serial physical channel. This profile may be extended by using modems to handle different carriers such as PSTN, GSM, or GPRS, Radio, Zigbee etc.

The addition of dial-up modem connections as described in IEC 62056-42 is required only where modem is fitted internal to the meter.

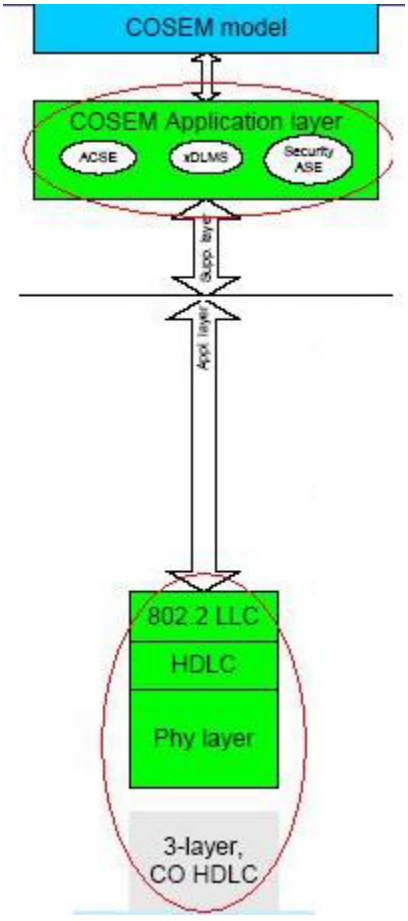

Fig 12.1: Communication profile options

13. Communication Setup Objects

This companion standard requires the following communication setup objects to be supported in the meter implementation. This document also recommends that a specific baud rate may be fixed between the utility and the manufacturer for each project. The suggested default baud rate is given in section 4.1

Communication Setup and related objects for serial communication	**IC**	**OBIS code**					
		A	**B**	**C**	**D**	**E**	**F**
IEC HDLC Setup	23 - IEC HDLC Setup	0	b	22	0	0	255

14. Connect/Disconnect control

In implementations that require remote Connect/Disconnect control, effected by operation of an output pulse from the meter, this companion specification requires support for the Disconnector class object as below

Disconnector	**IC**	**OBIS code**					
		A	**B**	**C**	**D**	**E**	**F**
Disconnect Control	70 – Disconnect Control	0	b	96	3	10	255

Annexure A1

Introduction to Standardized Meter Parameters list

The contents in this and the following Annexure are excerpts from the national "Report on Standardisation of Metering Parameters – April 2009". The report has identified three categories of meters.

A1.1] Categories of meters:

(i) **Category A Meter –** This meter is identified for use at sub-station feeders and Distribution Transformer Centers. The parameters listed for this category is for "Energy Accounting and Audit" purposes.

(ii) **Category B Meter –** This meter is identified for use at Meter Banks and Network boundaries. The parameters listed for this category is for import / export of energy. This meter is also suitable for Availability Based Tariff (ABT) regime.

(iii) **Category C Meter –** This meter is identified for use at HT (PT and CT operated) and LT (CT operated) consumers. The parameters listed for this category is for consumers who draw energy from the grid. For consumers who also supply energy to grid the category B Meter is recommended..

A1.2] Classification of Parameters

The parameters which constitute the data for communication is classified into:
a) Instantaneous Parameters
b) Block Profile / Load Survey Parameters.
c) Daily Profile Parameters.
c) Parameters for accounting / billing.
d) Abstract quantities
- Name Plate Details.
- Programmable parameters

e) Event Conditions.

For each of the above category of meter the data or parameters classification is standardized and tabulated in the Annexure against each as shown in Table – A1.1.

The measurement and computation of each of these parameters and events shall be based on standard methods or based on utilities prudent practices or as directed by respective Regulatory Commission.

Table A1.1

Meter Category	Purpose	Annexure Reference
A	Energy Accounting and Audit Metering	A2, A5, A6
B	Boundary / Bank / Ring / ABT Metering	A3, A5, A6
C	HT (PT / CT) and LT (CT) consumer Metering	A4, A5, A6

For each of the identified parameter the OBIS code, Interface Class and the attributes are given in the various tables in corresponding Annexure. The OBIS codes listed are applicable for LN referencing and is mandatory to adhere to by the SERVERS and CLIENTS.

A1.3] Instantaneous Parameters

The Instantaneous parameters are to be calculated at a particular instant of time and displayed on the meter. These values shall be continuously updated by the meter hardware / software as per internal sampling and computation time. The energy values in the table shall be cumulative readings from the date of manufacturing or installation of meter as the case may be. These shall be continuously updated and last updated value shall be available for downloading as and when required. Each of the parameters shall be readable at any instant by the HOST from remote or by HHU at site. The snap shot of all the instantaneous values of all parameters shall be readable by the HOST computer.

A1.4] Profile Generic or load survey parameters (capture time block 15 or 30 minutes)

This is an array of parameters identified for capturing and storing at specified time intervals or capture times. The capture times shall be either 15 or 30 minutes. The capture times shall be programmable by the utilities. The tables lists the parameters whose profile (survey) is to be captured and stored in the meter as per set capture time period. The profiles shall be readable at any time by the HOST from remote or by HHU at site for any specified range and time.

IN the case of Category B meters the capture time shall be of 15 minutes duration.

The data stored in the array shall be the average value for the captured time block and stored at the end of that block, except for energy values. The energy entries are the consumption during respective capture time block and posted at the end of that block. The array of data shall be retained inside the meter memory for the last 22 days for a capture period of 15 minutes or for the last 45 days for a capture period of 30 minutes. The storage days can be expanded by choosing less number of parameters.

The block load profiles shall not store or return values (typically zero values) for conditions where the meter is powered down for a full day, where a full day is defined as the 24 hour period from midnight 00 Hrs to the next midnight 00 Hrs. Under such conditions the block load profile for the entire 24 Hour period shall not be stored nor padded with zero entries. However if the meter is powered up even for a small amount of time (sufficient for it to boot up and record the Power up event) during the 24 Hour period, it shall store and return the Block load profile for the entire 24 hour duration.

A1.5] Parameters for Accounting / Billing Purpose

These are parameters identified for accounting / billing purposes. These shall be generated by the meter for each billing cycle and stored in the memory. The set of data for last 6 (six) cycles shall be stored in the memory. At the end of each cycle corresponding set of data shall be readable by the HOST from remote or by HHU at site.

A1.6] Abstract quantities

A1.6.1] Name Plate Details

These parameters are non electrical quantities and are static in nature. details are abstract parameters and are grouped as “Name Plate Details”. The parameters identified and grouped as “Name Plate Details” under this classification are applicable for all category of meters. These are readable as a profile as and when required. Some of the pertinent information about the supplied meter is included in this table.

A1.6.2] Programmable Parameters

These parameters are non electrical quantities. The parameters identified and grouped as “Programmable Parameters”. These parameters shall be programmable by the Utility engineers. For the purpose of setting / altering the values of these parameters, the security and access rights in line with the methodology described in protocol, shall be mutually agreed between utility and manufacturer. The parameters shall be programmable by HOST from remote and HHU at site. These are applicable for all categories of meters. These are readable as a profile as and when required.

A1.7] Event Conditions:

Any abnormal or a tamper condition is defined as an Event. The meters shall identify, resolve and log both occurrence and restoration of such events. The meters shall also capture some of the parameters at the instance of above said log. The report has identified the events to be logged and the parameters to be captured for each of those events.

This companion specification has further classified those events in sub groups for easy handling. The sub groups are

a. Voltage related events
b. Current related events
c. Power Failure related events
d. Transactional events
e. Other events
f. Non rollover events
g. Control events

The number of events stored in each compartment shall be decided by agreement between the Utility and Manufacturers. However the total number of events shall be 200.

The event conditions identified are listed in Table – A6.1 to A6.7 covering all the subgroups. For each type of event condition the parameters to be captured are listed in Table – A6.8. The required capture parameters for selected event condition shall be chosen by the utility as per its practices and directives.

The types of events to be recorded may be selected by the Utility out of the list provided in tables A6.1 to A6.7 as per Utility need and practice. The parameters for which Snapshot is to be recorded at time of tamper / event can also be selected out of list of parameters provided in “Capture Parameters” in table A6.8.

The event conditions identified are listed in Tables - A6.1 to A6.7 covering all the subgroups. Number of events stored in each compartment shall be decided by agreement between the Utility and Manufacturers where the total number of events shall be 200. Events are grouped in the following seven different compartments:

a. Voltage related events
b. Current related events
c. Power Failure related events
d. Transactional events
e. Other events
f. Non rollover events
g. Control events

The Table A1.2 summarizes for each category of meter the Annexure reference and Table reference for viewing the names of parameters and the assigned OBIS codes of the electrical and non-electrical parameters.

Table –A1.2

Category/ Purpose	Annexure Reference	Table reference
A - Energy Accounting and Audit Metering	A2, A5, A6	A2.1,A2.2, A5.1,A5.2 A6.1,A6.2, A6.3, A6.4, A6.5, A6.6, A6.7, A6.8
B - Boundary / Bank / Ring / ABT Metering	A3, A5, A6	A3.1, A3.2, A3.3 A5.1,A5.2 A6.1, A6.2, A6.3 A6.4, A6.5, A6.6, A6.7, A6.8
C - HT (PT / CT) and LT (CT) Consumer Metering	A4, A5, A6	A4.1, A4.2, A4.3 A5.1,A5.2 A6.1, A6.2, A6.3, A6.4, A6.5, A6.6, A6.7, A6.8

The servers shall provide the entire list of parameters listed in the respective Annexure. However the user, depending on the need, may choose required parameters from the full list. The OBIS code for such selected parameters however shall remain as assigned.

Annexure A2

Parameter List for 'Category A' meters

The parameters listed here are for Energy Accounting & Audit purposes. These meters are identified for Feeder metering and DTC metering where the power flow is unidirectional. In circumstances where bidirectional power flow is to be measured then Category B Meters shall be deployed.

The parameters identified are grouped under Instantaneous (Table-A2.1) and Block load profile (Table –A2.2). The tables include the name of the parameter, the OBIS code and Interface class.

Association Access Rights:

Public Client - Read Only for Clock and no access for other objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read & Write for Clock And Read Only for others.

TABLE- A2.1 – Instantaneous Parameters

Each of the parameters is a separate entity. The OBIS code for each parameter is identified as per DLMS /COSEM protocol.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2
2	Current - I_R	1.0.31.7.0.255	3 / 2
3	Current - I_Y	1.0.51.7.0.255	3 / 2
4	Current – I_B	1.0.71.7.0.255	3 / 2
5	Voltage - V_{RN}	1.0.32.7.0.255	3 / 2
6	Voltage – V_{YN}	1.0.52.7.0.255	3 / 2
7	Voltage – V_{BN}	1.0.72.7.0.255	3 / 2
8	Voltage - V_{RY}	1.0.32.7.0.255	3 / 2
9	Voltage – V_{BY}	1.0.52.7.0.255	3 / 2
10	Signed Power Factor –R phase	1.0.33.7.0.255	3 / 2
11	Signed Power Factor - Y phase	1.0.53.7.0.255	3 / 2
12	Signed Power Factor - B phase	1.0.73.7.0.255	3 / 2
13	Three Phase Power Factor – PF	1.0.13.7.0.255	3 / 2
14	Frequency	1.0.14.7.0.255	3 / 2
15	Apparent Power – KVA	1.0.9.7.0.255	3 / 2
16	Signed Active Power – kW (+ Forward; - Reverse)	1.0.1.7.0.255	3 / 2
17	Signed Reactive Power – kvar (+ Lag; - Lead)	1.0.3.7.0.255	3 / 2
18	Cumulative Energy – kWh	1.0.1.8.0.255	3 / 2
19	Cumulative Energy – kvarh – Lag	1.0.5.8.0.255	3 / 2
20	Cumulative Energy – kvarh – Lead	1.0.8.8.0.255	3 / 2
21	Cumulative Energy – kVAh	1.0.9.8.0.255	3 / 2
22	Cumulative power-off duration.	0.0.96.7.15.255	1 / 2
23	Cumulative tamper count	0.0.94.91.0.255	1 / 2

24	Cumulative MD resets count	0.0.0.1.0.255	1 / 2
25	Cumulative programming count	0.0.96.2.0.255	1 / 2
26	Date and time of last MD reset	0.0.0.1.2.255	8 / 2
27	Maximum Demand – kW	1.0.1.6.0.255	4 / 2, 5
28	Maximum Demand – kVA	1.0.9.6.0.255	4 / 2, 5

Note for TABLE- A2.1**:**

1. The items at 5, 6, and 7 are for 3Φ / 4W system of measurement with NEUTRAL as reference point.
2. The items at 8, 9 are for 3 Φ / 3W system of measurement with Y-PHASE as reference point.
3. Signed Power factor – (+ indicates lag) and (- indicates lead).
4. The parameters at S No. 18 to 25 hold cumulative values at that instant from the date of manufacturing or installation of meter as the case may be.
5. The above list is identified for the purpose of communication to HOST or HHU.
6. The utilities may choose, based on needs, additional parameters for display purpose ONLY.
7. Association Table

Snap shot of Instantaneous parameters: The parameters of TABLE – A2.1 shall be captured as a profile generic using the country specific OBIS code 1.0.94.91.0.255; The attribute 2 of each of the capture objects shall be copied into the profile at the instant of a request from the Host.

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A2.1. This is modeled as profile generic (IC=7) and is assigned the country specific OBIS code 1.0.94.91.3.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This profile is not required to be updated periodically.

TABLE- A2.2 – Block Load profile Parameters

This is an array of load survey data captured as a profile generic. The OBIS code is 1.0.99.1.0.255, with Interface class as 7. The capture objects of this block load profile are as per Table-A2.2 and the captured attribute shall be attribute 2 of each interface class. The capture object values will be copied into buffer of this array automatically as per capture period which shall be set through OBIS code 1.0.0.8.4.255 of recording interval 1.

Association Access Rights:

Public Client - No access for all objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read Only for all objects.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2

2	Current - I_R	1.0.31.27.0.255	3 / 2
3	Current - I_Y	1.0.51.27.0.255	3 / 2
4	Current – I_B	1.0.71.27.0.255	3 / 2
5	Voltage - V_{RN}	1.0.32.27.0.255	3 / 2
6	Voltage – V_{YN}	1.0.52.27.0.255	3 / 2
7	Voltage – V_{BN}	1.0.72.27.0.255	3 / 2
8	Voltage - V_{RY}	1.0.32.27.0.255	3 / 2
9	Voltage – V_{BY}	1.0.52.27.0.255	3 / 2
10	Block Energy – kWh	1.0.1.29.0.255	3 / 2
11	Block Energy – kvarh – lag	1.0.5.29.0.255	3 / 2
12	Block Energy – kvarh – lead	1.0.8.29.0.255	3 / 2
13	Block Energy – kVAh	1.0.9.29.0.255	3 / 2

Note (TABLE- A2.2)**:**

1. The items at 5, 6, and 7 are for 3Φ / 4W system of measurement with NEUTRAL as reference point.
2. The items at 8, 9 are for 3 Φ / 3W system of measurement with Y-PHASE as reference point.
3. The parameters at S. No. 2 to 9 are the average values during the block period time and stored at the end of that time block.
4. The parameters at S. No. 10 to 13 are the actual energy consumption during that time block.
5. Capture objects for 3 Φ / 4W are items 1, 2,3,4,5,6,7,10,11,12,13.
6. Capture objects for 3 Φ / 3W are items 1, 2,3,4,8,9,10,11,12,13.
7. Support for Selective access shall be as defined in Section 11.2

Parameters for Accounting / Billing - The list of parameters in Table – A2.1 and A2.2 shall be used for computing the daily accounting data at the HOST.

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A2.2. This is modeled as profile generic (IC=7) and is assigned the country specific OBIS code 1.0.94.91.4.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This profile is not required to be updated periodically.

Annexure A3

Parameter list for Category B meters

The parameters listed here are for Boundary / Bank / Ring Fencing / ABT Metering. The meter records parameters under import and or export conditions.

The parameters identified for this are grouped under Instantaneous (Table-A3.1), Block load profile (Table –A3.2) and Daily Load profile (Table –A3.3). The tables include the name of the parameter, the OBIS code and Interface class.

Table – A3.1 – Instantaneous Parameters

Each of the parameters is a separate entity. The OBIS code for each parameter is identified as per DLMS /COSEM protocol.

Association Access Rights:

Public Client - Read Only for Clock and no access for other objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read & Write for Clock And Read Only for others.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2
2	Current - I_R	1.0.31.7.0.255	3 / 2
3	Current - I_Y	1.0.51.7.0.255	3 / 2
4	Current – I_B	1.0.71.7.0.255	3 / 2
5	Voltage - V_{RN}	1.0.32.7.0.255	3 / 2
6	Voltage – V_{YN}	1.0.52.7.0.255	3 / 2
7	Voltage – V_{BN}	1.0.72.7.0.255	3 / 2
8	Voltage - V_{RY}	1.0.32.7.0.255	3 / 2
9	Voltage – V_{BY}	1.0.52.7.0.255	3 / 2
10	Signed Power Factor - R phase	1.0.33.7.0.255	3 / 2
11	Signed Power Factor - Y phase	1.0.53.7.0.255	3 / 2
12	Signed Power Factor - B phase	1.0.73.7.0.255	3 / 2
13	Three Phase Power Factor – PF	1.0.13.7.0.255	3 / 2
14	Frequency	1.0.14.7.0.255	3 / 2
15	Apparent Power – KVA	1.0.9.7.0.255	3 / 2
16	Active Power – kW (Export)	1.0.1.7.0.255	3 / 2
17	Active Power – kW (Import)	1.0.2.7.0.255	3 / 2
18	Reactive Power – kvar (Export)	1.0.3.7.0.255	3 / 2
19	Reactive Power – kvar (Import)	1.0.4.7.0.255	3 / 2
20	Cumulative Energy – kWh (Import)	1.0.1.8.0.255	3 / 2
21	Cumulative Energy – kWh (Export)	1.0.2.8.0.255	3 / 2
22	Cumulative Energy – kVAh(Import)	1.0.9.8.0.255	3 / 2
23	Cumulative Energy – kVAh(Export)	1.0.10.8.0.255	3 / 2
24	Cumulative power-off duration.	0.0.96.7.15.255	1 / 2

25	Cumulative tamper count	0.0.94.91.0.255	1 / 2
26	Cumulative MD resets count	0.0.0.1.0.255	1 / 2
27	Cumulative programming count	0.0.96.2.0.255	1 / 2
28	Date and time of last MD reset	0.0.0.1.2.255	8 / 2

Note (Table – A3.1)**:**

1. The items at 5, 6, and 7 are for 3Φ / 4W system of measurement with NEUTRAL as reference point.
2. The items at 8, 9 are for 3 Φ / 3W system of measurement with Y-PHASE as reference point.
3. Signed Power factor – (+ indicates lag) and (- indicates lead).
4. The parameters at S No. 20 to 27 hold cumulative values at that instant from the date of manufacturing or installation of meter as the case may be.
5. The above list is identified for the purpose of communication to HOST or HHU.
6. The utilities may choose, based on needs, additional parameters for display purpose ONLY.

Snap shot of Instantaneous parameters: The parameters of TABLE – A3.1 shall be captured as a profile generic using the country specific OBIS code 1.0.94.91.0.255; The attribute 2 of each of the capture objects shall be copied into the profile at the instant of a request from the Host.

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A3.1. This is modeled as profile generic (IC=7) and is assigned the country specific OBIS code 1.0.94.91.5.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This buffer is not required to be updated periodically.

TABLE- A3.2 – Block Load profile Parameters

This is an array of load survey data captured as a profile generic. The OBIS code is 1.0.99.1.0.255, with Interface class as 7. The capture objects of this block load profile are as per Table-A3.2 and the captured object shall be attribute 2 of each interface class. The capture object values will be copied into a buffer of this array automatically as per capture period which shall be set through OBIS code 1.0.0.8.4.255 of recording interval 1.

Association Access Rights:

Public Client – No access for all objects
Meter Reader – Read Only for all objects.
Utility Setting – Read Only for all objects.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2
2	Frequency	1.0.14.27.0.255	3 / 2
3	Voltage - V_{RN}	1.0.32.27.0.255	3 / 2
4	Voltage – V_{YN}	1.0.52.27.0.255	3 / 2

5	Voltage – V_{BN}	1.0.72.27.0.255	3 / 2
6	System Power Factor – PF	1.0.13.7.0.255	3 / 2
7	Net Energy – kWh	1.0.16.29.0.255	3 / 2
8	Energy – kvarh – Quadrant 1	1.0.5.29.0.255	3 / 2
9	Energy – kvarh – Quadrant 2	1.0.6.29.0.255	3 / 2
10	Energy – kvarh – Quadrant 3	1.0.7.29.0.255	3 / 2
11	Energy – kvarh – Quadrant 4	1.0.8.29.0.255	3 / 2

Note (TABLE- A3.2)**:**

1. The parameters listed in this table are for load survey purpose and are logged as per the block period time.
2. The Block period time for Interface meters is fixed at 15 min for which the data storage will be for 22 days.
3. The parameters at S. No. 3 to 6 are the average values of 15 min block and stored at the end of that time block.
4. The parameters at S. No. 7 to 11 are the actual energy consumption during the 15 min time block.
5. Item 2 is an ABT parameter for absolute average value.
6. Item 7 is an ABT parameter for Net energy in the current 15 min block.
7. Support for Selective access shall be as defined in Section 11.2

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A3.2. This is modeled as profile generic (IC=7) and is assigned the country specific OBIS code 1.0.94.91.6.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This profile is not required to be updated periodically.

TABLE- A3.3 – Daily Load profile Parameters

This is an array of load survey data captured as a profile generic at the end of 24 hours. The OBIS code is 1.0.99.2.0.255, with Interface class as 7. The capture objects of this daily load profile are as per Table-A3.3 and the captured attribute shall be attribute 2 of each interface class. The capture object values will be copied into a buffer of this array automatically as per capture period which shall be set through OBIS code 1.0.0.8.5.255 of recording interval 2. The capture period attribute shall be statically fixed as 24 hours.

Association Access Rights:

Public Client – No access for all objects
Meter Reader – Read Only for all objects.
Utility Setting – Read Only for all objects.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2
2	Cumulative Energy – kWh – import	1.0.1.8.0.255	3 / 2
3	Cumulative Energy – kWh – export	1.0.2.8.0.255	3 / 2

4	Cumulative Energy – kVAh while kW import	1.0.9.8.0.255	3 / 2
5	Cumulative Energy – kVAh while kW export	1.0.10.8.0.255	3 / 2
6	Reactive energy high (V > 103%)	1.0.94.91.1.255	3 / 2
7	Reactive energy low (V < 97%)	1.0.94.91.2.255	3 / 2
8	Cumulative Energy – kvarh – Quadrant 1	1.0.5.8.0.255	3 / 2
9	Cumulative Energy – kvarh – Quadrant 2	1.0.6.8.0.255	3 / 2
10	Cumulative Energy – kvarh – Quadrant 3	1.0.7.8.0.255	3 / 2
11	Cumulative Energy – kvarh – Quadrant 4	1.0.8.8.0.255	3 / 2

Note (TABLE- A3.3):

1. The parameters listed in this table are meant for billing purpose and shall be logged at midnight (00 Hrs).
2. The storage time for these parameters is 22 days.
3. The parameters are the actual energy consumption during the 24 Hrs time block.
4. These parameters shall be readable any instant by HOST/ HHU for any of the parameters for any specified range and time.
5. Selected values can be read as profile.
6. The OBIS code (d=30) may be used when daily energy readings are needed by the user.
7. Item 6 is an ABT parameter.
8. Item 7 is an ABT parameter.
9. Support for Selective access shall be as defined in Section 11.2

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A3.3. This is modeled as profile generic (IC=7) and is assigned the country specific OBIS code 1.0.94.91.7.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This profile is not required to be updated periodically.

Annexure A4

Parameter list for Category C meters

The parameters listed here are for HT (PT / CT) and LT (CT) consumer metering. This meter records energy in import mode. These meters shall be capable of recoding Import of energy. For customers who import energy and also export energy, use of category B meters is recommended.

The parameters identified for this are grouped under Instantaneous (Table-A4.1), Block load profile (Table –A4.2), and Billing (Table – A4.3). The tables include the name of the parameter, the OBIS code and Interface class.

Table – A4.1 – Instantaneous Parameters

Each of the parameters is a separate entity. The OBIS code for each parameter is identified as per DLMS /COSEM protocol.

Association Access Rights:

Public Client - Read Only for Clock and no access for other objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read & Write for Clock And Read Only for others.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2
2	Current - I_R	1.0.31.7.0.255	3 / 2
3	Current - I_Y	1.0.51.7.0.255	3 / 2
4	Current – I_B	1.0.71.7.0.255	3 / 2
5	Voltage - V_{RN}	1.0.32.7.0.255	3 / 2
6	Voltage – V_{YN}	1.0.52.7.0.255	3 / 2
7	Voltage – V_{BN}	1.0.72.7.0.255	3 / 2
8	Voltage - V_{RY}	1.0.32.7.0.255	3 / 2
9	Voltage – V_{BY}	1.0.52.7.0.255	3 / 2
10	Signed Power Factor –R phase	1.0.33.7.0.255	3 / 2
11	Signed Power Factor - Y phase	1.0.53.7.0.255	3 / 2
12	Signed Power Factor - B phase	1.0.73.7.0.255	3 / 2
13	Three Phase Power Factor – PF	1.0.13.7.0.255	3 / 2
14	Frequency	1.0.14.7.0.255	3 / 2
15	Apparent Power – KVA	1.0.9.7.0.255	3 / 2
16	Signed Active Power – kW (+ Forward; - Reverse)	1.0.1.7.0.255	3 / 2
17	Signed Reactive Power – kvar (+ Lag; - Lead)	1.0.3.7.0.255	3 / 2
18	Cumulative power-off duration.	0.0.96.7.15.255	1 / 2
19	Cumulative tamper count	0.0.94.91.0.255	1 / 2
20	Cumulative MD resets count	0.0.0.1.0.255	1 / 2
21	Cumulative programming count	0.0.96.2.0.255	1 / 2
22	Date and time of last MD reset	0.0.0.1.2.255	8 / 2

Note (Table – A4.1)**:**

1. The items at 5, 6, and 7 are for 3Φ / 4W system of measurement with NEUTRAL as reference point.
2. The items at 8, 9 are for 3 Φ / 3W system of measurement with Y-PHASE as reference point.
3. Signed Power factor – (+ indicates lag) and (- indicates lead).
4. The parameters at S No. 18 to 21 hold cumulative values at that instant from the date of manufacturing or installation of meter as the case may be.
5. The above list is identified for the purpose of communication to HOST or HHU.
6. The utilities may choose, based on needs, additional parameters for display purpose ONLY.
7. Item 22 - Data type to be as for attribute 2 of IC 8, Clock.

Snap shot of Instantaneous parameters: The parameters of TABLE – A4.1 shall be captured as a profile generic using the country specific OBIS code 1.0.94.91.0.255. The attribute 2 of each of the capture objects shall be copied into the profile at the instant of a request from the Host.

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A4.1. This is modeled as profile generic (IC=7) and is assigned the country specific OBIS code 1.0.94.91.8.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This buffer is not required to be updated periodically.

TABLE- A4.2 – Block Load profile Parameters

This is an array of load survey data captured as a profile generic. The OBIS code is 1.0.99.1.0.255, with Interface class as 7. The capture objects of this block load profile are as per Table-A4.2 and the captured attribute shall be 2 of each interface class. The capture object values will be copied into a buffer of this array automatically as per capture period which shall be set through OBIS code 1.0.0.8.4.255 of recording interval 1.

Association Access Rights:

Public Client – No access for all objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read Only for all objects.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 / 2
2	Current - I_R	1.0.31.27.0.255	3 / 2
3	Current - I_Y	1.0.51.27.0.255	3 / 2
4	Current – I_B	1.0.71.27.0.255	3 / 2
5	Voltage - V_{RN}	1.0.32.27.0.255	3 / 2
6	Voltage – V_{YN}	1.0.52.27.0.255	3 / 2
7	Voltage – V_{BN}	1.0.72.27.0.255	3 / 2
8	Voltage - V_{RY}	1.0.32.27.0.255	3 / 2

9	Voltage – V_{BY}	1.0.52.27.0.255	3 / 2
10	Block Energy – kWh	1.0.1.29.0.255	3 / 2
11	Block Energy – kvarh – lag	1.0.5.29.0.255	3 / 2
12	Block Energy – kvarh – lead	1.0.8.29.0.255	3 / 2
13	Block Energy – kVAh	1.0.9.29.0.255	3 / 2

Note (TABLE- A4.2):

1. The parameters listed in this table are for load survey purpose and are logged as per the block period time.
2. The parameters at S. No. 2 to 9 are the average values during the block period time and stored at the end of that time block.
3. The parameters at S. No. 10 to 13 are the actual energy consumption during that time block.
4. Capture objects for 3 Φ / 4W are items 1, 2,3,4,5,6,7,10,11,12,13.
5. Capture objects for 3 Φ / 3W are items 1, 2,3,4,8,9,10,11,12,13.
6. Support for Selective access shall be as defined in Section 11.2

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A4.2. This is modeled as profile generic (IC=7) and is assigned the country specific OBIS code 1.0.94.91.9.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This profile is not required to be updated periodically.

Table – A4.3 - Billing profile parameters

The contents of this table are for billing purpose.

Association Access Rights:

Public Client – No access for all objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read Only for all objects.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class No / Attribute
1	Billing date	1.0.0.1.2.255	3 / 2
2	System Power Factor for billing period	1.0.13.0.0.255	3 / 2
3	Cumulative Energy – kWh	1.0.1.8.0.255	3 / 2
4	Cumulative Energy – kWh – TZ1	1.0.1.8.1.255	3 / 2
5	Cumulative Energy – kWh – TZ2	1.0.1.8.2.255	3 / 2
6	Cumulative Energy – kWh – TZ3	1.0.1.8.3.255	3 / 2
7	Cumulative Energy – kWh – TZ4	1.0.1.8.4.255	3 / 2
8	Cumulative Energy – kWh – TZ5	1.0.1.8.5.255	3 / 2
9	Cumulative Energy – kWh – TZ6	1.0.1.8.6.255	3 / 2
10	Cumulative Energy – kWh – TZ7	1.0.1.8.7.255	3 / 2
11	Cumulative Energy – kWh – TZ8	1.0.1.8.8.255	3 / 2
12	Cumulative Energy – kvarh – Lag	1.0.5.8.0.255	3 / 2

13	Cumulative Energy – kvarh – Lead	1.0.8.8.0.255	3 / 2
14	Cumulative Energy – kVAh	1.0.9.8.0.255	3 / 2
15	Cumulative Energy – kVAH – TZ1	1.0.9.8.1.255	3 / 2
16	Cumulative Energy – kVAH – TZ2	1.0.9.8.2.255	3 / 2
17	Cumulative Energy – kVAH – TZ3	1.0.9.8.3.255	3 / 2
18	Cumulative Energy – kVAH – TZ4	1.0.9.8.4.255	3 / 2
19	Cumulative Energy – kVAH – TZ5	1.0.9.8.5.255	3 / 2
20	Cumulative Energy – kVAH – TZ6	1.0.9.8.6.255	3 / 2
21	Cumulative Energy – kVAH – TZ7	1.0.9.8.7.255	3 / 2
22	Cumulative Energy – kVAH – TZ8	1.0.9.8.8.255	3 / 2
23	MD – kW	1.0.1.6.0.255	4 / 2 ,5
24	MD – kW – TZ1	1.0.1.6.1.255	4 / 2 ,5
25	MD – kW – TZ2	1.0.1.6.2.255	4 / 2 ,5
26	MD – kW – TZ3	1.0.1.6.3.255	4 / 2 ,5
27	MD – kW – TZ4	1.0.1.6.4.255	4 / 2 ,5
28	MD – kW – TZ5	1.0.1.6.5.255	4 / 2 ,5
29	MD – kW – TZ6	1.0.1.6.6.255	4 / 2 ,5
30	MD – kW – TZ7	1.0.1.6.7.255	4 / 2 ,5
31	MD – kW – TZ8	1.0.1.6.8.255	4 / 2 ,5
32	MD – kVA	1.0.9.6.0.255	4 / 2 ,5
33	MD – kVA – TZ1	1.0.9.6.1.255	4 / 2 ,5
34	MD – kVA – TZ2	1.0.9.6.2.255	4 / 2 ,5
35	MD – kVA – TZ3	1.0.9.6.3.255	4 / 2 ,5
36	MD – kVA – TZ4	1.0.9.6.4.255	4 / 2 ,5
37	MD – kVA – TZ5	1.0.9.6.5.255	4 / 2 ,5
38	MD – kVA – TZ6	1.0.9.6.6.255	4 / 2 ,5
39	MD – kVA – TZ7	1.0.9.6.7.255	4 / 2 ,5
40	MD – kVA – TZ8	1.0.9.6.8.255	4 / 2 ,5

Note:

1. The data are stored up to 6 billing cycles. The data are the actual consumption during the billing period. The Billing profile is modeled as Profile generic (IC: = 7) object with OBIS Code 1.0.98.1.0.255. The capture objects of this load profile are as per Table-A4.3. The capture object values will be copied into buffer of this object either automatically or asynchronously. The capture period is set to zero, billing action is controlled by billing dates as provided in section 10 and table A5.2.

2. Support for Selective access shall be as defined in Section 11.2

3. The current cycle billing parameters shall be readable as the values of the latest billing period, on demand. This shall be in addition to the last 6 billing period data which shall be available in the Profile buffer as the last 6 entries in the buffer.

4 The captured attributes in case of Interface Class 4 (Extended register)used for MD values will be attributes 2 and 5 (Value and Timestamp)

Scaler Profile: This profile is meant for capturing the Scaler-unit of each of the parameter listed in Table A4.3. This is modeled as profile generic (IC=7) and is

assigned the country specific OBIS code 1.0.94.91.10.255. There shall be only one entry in the profile which is the attribute 3 of the Interface Class identified for each object. This profile is not required to be updated periodically.

Annexure A5

Abstract Parameters

Table A5.1 – Name Plate Details.

The contents of this table are common to all meters. The data are meter specific information.

Association Access Rights:

Public Client – No access for all objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read Only for all objects.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class
1	Meter Serial Number	0.0.96.1.0.255	1 (Data)
2	Manufacturer name	0.0.96.1.1.255	1
3	Firmware Version for meter	0.0.96.1.2.255	1
4	Firmware Version for communications	0.0.96.1.3.255	1
5	Internal CT ratio	1.0.0.4.2.255	1
6	Internal PT ratio	1.0.0.4.3.255	1
7	Meter year of manufacture	0.0.96.1.4.255	1

Table A5.2 – Programmable Parameters.

Association Access Rights:

Public Client – No access for all objects.
Meter Reader – Read Only for all objects.
Utility Setting – Read Write for all objects.

S.No	Parameter	OBIS code A.B.C.D.E.F	Interface Class
1	Real Time Clock – Date and Time	0.0.1.0.0.255	8 (Clock)
2	Demand Integration Period	1.0.0.8.0.255	1 (Data)
3	Profile Capture Period	1.0.0.8.4.255	1
4	Single-action Schedule for Billing Dates	0.0.15.0.0.255	22
5	Activity Calendar for Time Zones etc.	0.0.13.0.0.255	20
6	Time Zones script table	0.0.10.0.100.255	9

Note (Table A5.2)**:**

1. The parameters are programmable by the utility engineers with required access rights.
2. Programming of any of the parameters shall increment the “Cumulative programming count” value.

Annexure A6

Event Reference Table

Events

Any abnormal / fraud / tamper condition is considered as an Event and stored in an **Event code** object (OBIS: = 0.0.96.11.e.255 IC: = 1, values of E range from 0 to 5). The value (attr-2) of this object stores identifier corresponding to most recent event occurred in the meter. Unique identifier is assigned to occurrence and restoration of all possible events (identified so far) in the event reference tables (Table-A6.1 to A6.7). Thus event code object will tell only about the most recent event and to get a picture of all events and associated information (at the time of event) an **Event log** object is used. An event log object is modeled as Profile generic (OBIS: = 0.0.99.98.e.255 IC: = 7, values of E range from 0 to 5). The buffer (attr-2) of this profile object will store (asynchronously) a new entry for every event (occurrence and restoration are considered as separate events). The capture objects for the event log object is define below in Table-A6.8.

Table – A6.1] – Indian Event Reference Table – Voltage Related

EVENT ID	Descriptions
1.	R-Phase – PT link Missing (Missing Potential) – Occurrence
2.	R-Phase – PT link Missing (Missing Potential) – Restoration
3.	Y-Phase – PT link Missing (Missing Potential) – Occurrence
4.	Y-Phase – PT link Missing (Missing Potential) – Restoration
5.	B-Phase – PT link Missing (Missing Potential) – Occurrence
6.	B-Phase – PT link Missing (Missing Potential) – Restoration
7.	Over Voltage in any Phase - Occurrence
8.	Over Voltage in any Phase - Restoration
9.	Low Voltage in any Phase - Occurrence
10.	Low Voltage in any Phase - Restoration
11.	Voltage Unbalance - Occurrence
12.	Voltage Unbalance - Restoration

Table – A6.2] – Indian Event Reference Table – Current Related

EVENT ID	Descriptions
1.	Phase – R CT reverse – Occurrence
2.	Phase – R CT reverse – Restoration
3.	Phase – Y CT reverse – Occurrence
4.	Phase – Y CT reverse – Restoration

5.	Phase – B CT reverse – Occurrence
6.	Phase – B CT reverse – Restoration
7.	Phase – R CT Open - Occurrence
8.	Phase – R CT Open - Restoration
9.	Phase – Y CT Open - Occurrence
10.	Phase – Y CT Open - Restoration
11.	Phase – B CT Open - Occurrence
12.	Phase – B CT Open - Restoration
13.	Current Unbalance - Occurrence
14.	Current Unbalance - Restoration
15.	CT Bypass – Occurrence
16.	CT Bypass – Restoration
17.	Over Current in any Phase – Occurrence
18.	Over Current in any Phase – Restoration

Table – A6.3] – Indian Event Reference Table – Power Related

EVENT ID	Descriptions
1	Power failure – Occurrence
2	Power failure – Restoration

Table – A6.4] – Indian Event Reference Table – Transaction Related

EVENT ID	Descriptions
1	TOU Programming
2	Tamper resetting
3	Manual MD reset
4	Demand integration period change
5	Display change
6	RTC Programming / Change
7	Firmware upgrade
8	Modification of internal ct/pt ratio (even by manufacturer's proprietary software)
9	Communication driven MD Reset

Table – A6.5] – Indian Event Reference Table – Others

EVENT ID	Descriptions
1	Influence of permanent magnet or AC/ DC electromagnet - Occurrence
2	Influence of permanent magnet or AC/ DC electromagnet - Restoration

3	Neutral Disturbance - HF & DC - Occurrence
4	Neutral Disturbance - HF & DC - Restoration
5	Very Low PF - Occurrence
6	Very Low PF - Restoration

Table – A6.6] – Indian Event Reference Table – Non-rollover Events

EVENT ID	Descriptions
1	Meter Cover Opening – Occurrence

Table – A6.7] – Indian Event Reference Table – Control events

EVENT ID	Descriptions
1	Meter disconnected
2	Meter connected

Table- A6.8] – Capture parameters for event as applicable (Event Log Profile)

Sno	Parameter	A	B	C	D	E	F	IC
1.	Date and Time of event	0	0	1	0	0	255	8 (Clock)
2.	Event Code	0	0	96	11	0	255	1 (Data)
3.	Current - I_R	1	0	31	7	0	255	3 (Register)
4.	Current - I_Y	1	0	51	7	0	255	3 (Register)
5.	Current – I_B	1	0	71	7	0	255	3 (Register)
6.	Voltage - V_{RN} (3 Φ / 4W)	1	0	32	7	0	255	3 (Register)
7.	Voltage – V_{YN} (3 Φ / 4W)	1	0	52	7	0	255	3 (Register)
8.	Voltage – V_{BN} (3 Φ / 4W)	1	0	72	7	0	255	3 (Register)
9.	Voltage - V_{RY} (3 Φ / 3W)	1	0	32	7	0	255	3 (Register)
10.	Voltage – V_{YB} (3 Φ / 3W)	1	0	52	7	0	255	3 (Register)
11.	Power Factor – R phase	1	0	33	7	0	255	3 (Register)
12.	Power Factor – Y phase	1	0	53	7	0	255	3 (Register)
13.	Power Factor – B phase	1	0	73	7	0	255	3 (Register)
14.	Cumulative Energy – kWh	1	0	1	8	0	255	3 (Register)

NOTE for Tables – A6.1, A6.2, A6.3, A6.4, A6.5, A6.6, A6.7 and A6.8,

1. These are the event conditions generally recorded in consumer meters, utilities may select any the above event conditions based on their practice. The need and applicability of these events for other type of meters shall be considered by Utility.
2. Either Occurrence or Restoration is considered an event.
3. For each of the events a certain list of parameters will be captured.
4. The list capture parameters are given in Table-A6.8. The utility shall select the required parameters from the table A6.8 as per their practice.
5. For each of the event captured “Cumulative tamper count” value will be incremented except for events from Tables A6.3, A6.4 and A6.7

6. Capture parameters mentioned in Table A6.8 are captured when event occurrence and restoration is logged.
7. For events “Power On-OFF” and “Cover Open” no parameters shall be captured.
8. The attributes of each of the IC (Interface Class) is to be identified while finalizing the Companion Standard.
9. For 3 Φ / 4W the reference point is NEUTRAL
10. For 3 Φ / 3W the reference point is Y-Phase
11. Support for Selective access shall be as defined in Section 11.2

Annexure A7

Conformance Testing

Meters claiming conformance to this companion specification will be required to

- Conform to the DLMS/COSEM base standards (IS ….) as certified by the conformance test tool (CTT)
- Conform to the specific requirements and constraints of this companion specification as certified by CPRI or any other laboratory having facilities for the purpose.

- This certification shall ensure
    - All mandatory parameters applicable to the category of the meter under test are implemented
    - All data types where specified are conforming to this document
    - All Application Associations are implemented as specified in this document with all specified services supported
    - Association object lists conform to this document with access rights and OBIS codes as specified here
    - Event related DLMS objects are implemented with Event identifiers as specified in the Event reference tables in this document

The test report from an accredited laboratory and having membership with DLMS UA shall be considered as a proof of conformance of protocol implementation.

Systems once created in accordance with this companion specification and contemporary standards, shall be deemed acceptable, provided such systems are tested and certified through standard evaluation process.

Annexure A8

HHU Considerations

Communication standards in the Indian metering scenario require supporting considerations for the utilization of those standards in HHUs (Hand held units) or in CHHUs (Common Meter Reading Instrument). This annexure provides a suitable approach to the implementation of the IEC-62056 standards and this Indian Companion Specification in such devices

The terms of this suggested implementation are as below

1) HHUs may retrieve data from DLMS/COSEM Meters conforming to this standard using the same DLMS/COSEM communication port that is provided for remote meter reading
2) HHUs shall exclusively use the Meter Reading association (MR) and shall support all the features and specifications listed in this specification for the MR Association
3) HHUs shall have the same data access rights that are available to the MR Association, as that available for remote meter reading.
4) HHUs shall implement the DLMS/COSEM communication standard conforming to this specification to provide a DLMS/COSEM client protocol driver to communicate with the meters to download billing data or perform other services available to the MR Association
5) HHUs shall provide a DLMS/COSEM server interface to the BCS (Base Computer System – the Data collection software) over a suitable communication medium (local serial port implementing the DLMS/COSEM CO 3-layer stack is suggested)
6) HHUs shall internally map the individual meter data to Logical Devices (one Logical Device for each meter). Inside each Logical Device the structure and naming of the data shall be the same as that retrieved from the meter
7) The BCS shall maintain a mapping table that maps the individual meter identifications (the same IDs that are used to identify the meter during remote meter reading) to Logical Device addresses. During upload of data from HHU to BCS, the BCS shall query each Logical device to download the data of each meter over the local serial port
8) The mapping table described in Item 7 above shall require that the Logical device addresses allocated to each meter are at least unique across all meters that are to be retrieved using one HHU. Other HHUs may re-use the same addressing from their own range of allocated meters. The BCS shall take care to ensure that the re-use of addresses does not create conflicts in Meter identification.

Annexure A9

Descriptive Notes on Profile Generic Interface Class

"Profile generic" interface class is used to model objects which capture historic values of other objects (called "capture objects") either periodically or occasionally. The "buffer" attribute stores the historic record of values of "capture objects" in a table-like format where each capture object is a column and each new entry is a row. A DLMS Client can access the historic data using the "Get" service either fully or partially.

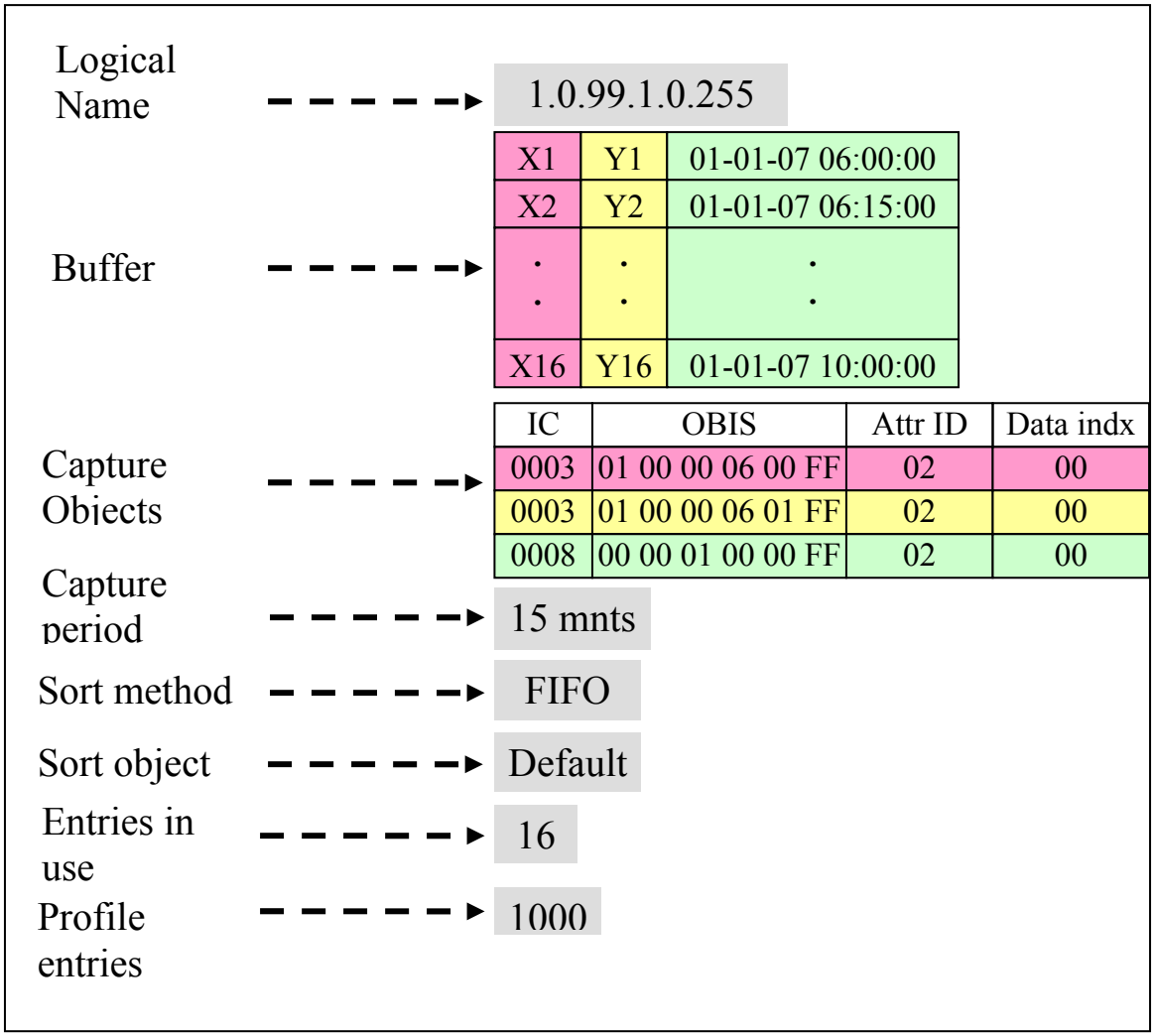

Fig 2: Illustration of a Profile Generic object containing 16 captures of 3 attributes

There are two types of selective access which allows reading the buffer selectively.

1 Selective Access by Entry

Selective Access by Entry provides a set of 4 integers to filter the contents of the "buffer" attribute in response to Get requests. The 4 integers are as below

1. From-entry : The index of the first entry to return from the buffer
2. To-Entry : The index of the last entry to return from the buffer
3. From-Value : The index of the first column to return
4. To-Value : The index of the last column to return

Thus the selective access parameters as above can be used to select not only a subset of the rows from the buffer table but also a subset of the columns from among the selected rows. Refer to the illustration in Fig3.

However this mechanism does not permit retrieving discontinuous ranges of columns from the buffer.

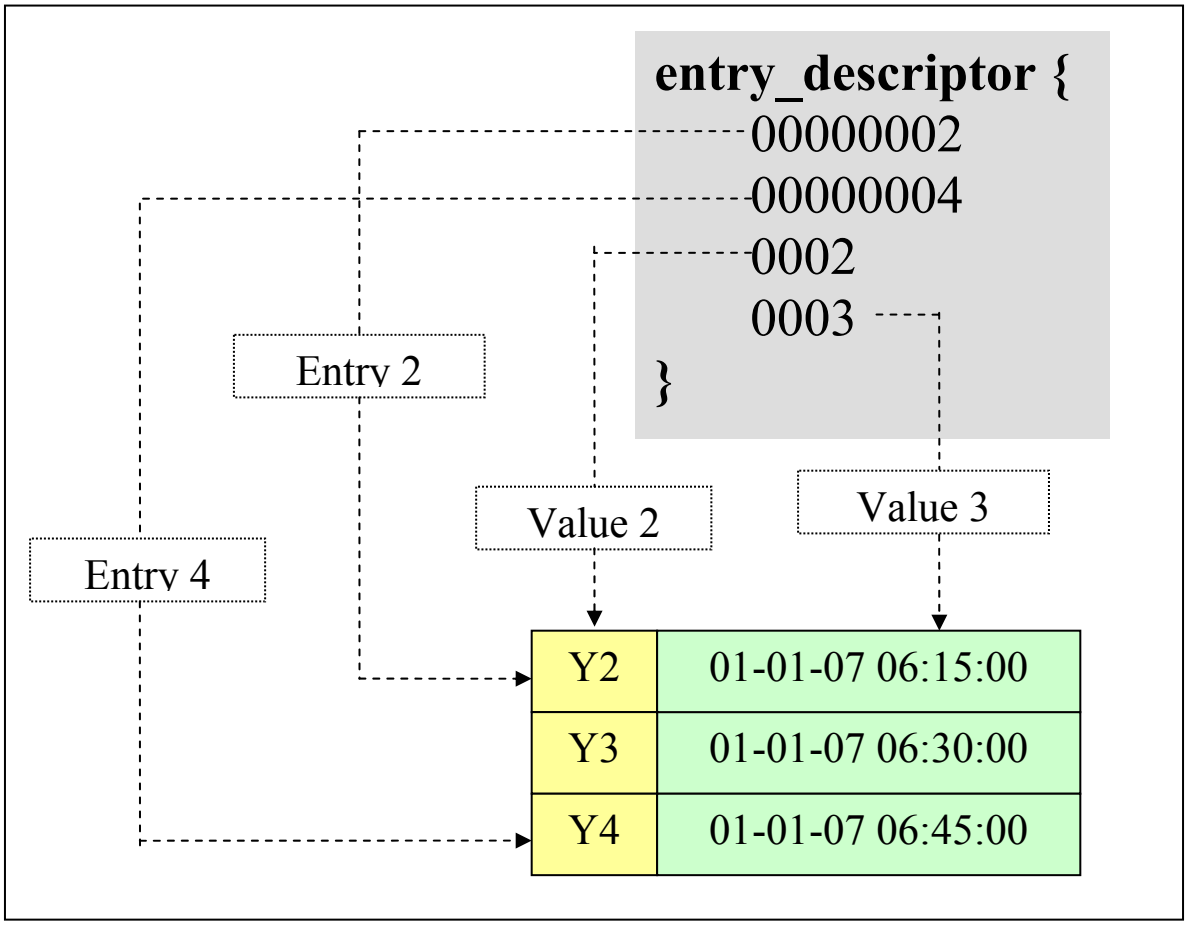

Fig 3: Illustration of Selective access of Profile buffer by entry. This illustration requests only the 2nd and 3rd columns of data from the 2nd row to the 4th row.

2 Selective Access by Range

Selective Access by Range permits a client to retrieve a subset of the rows and columns in the Profile buffer based on the value of one of the capture objects. Typically the capture object selected for this purpose is the Clock's date-time attribute which is usually one of the capture objects in most profiles. The selective access parameters in this case are as below

1. Restricting object : This parameter identifies the capture object whose value will be used to filter the buffer. The object is defined by the OBIS code and attribute index of the selected object
2. From-Value : The start-range value for the subset. All selected rows in the buffer will have a value for the restricted object that is higher than or equal to this limit
3. To-Value : The stop-range value for the subset. All selected rows in the buffer will have a value for the restricting object that is lower than or equal to this limit.
4. Selected-Values : An array of column indices specifying the columns that should be returned from the selected rows.

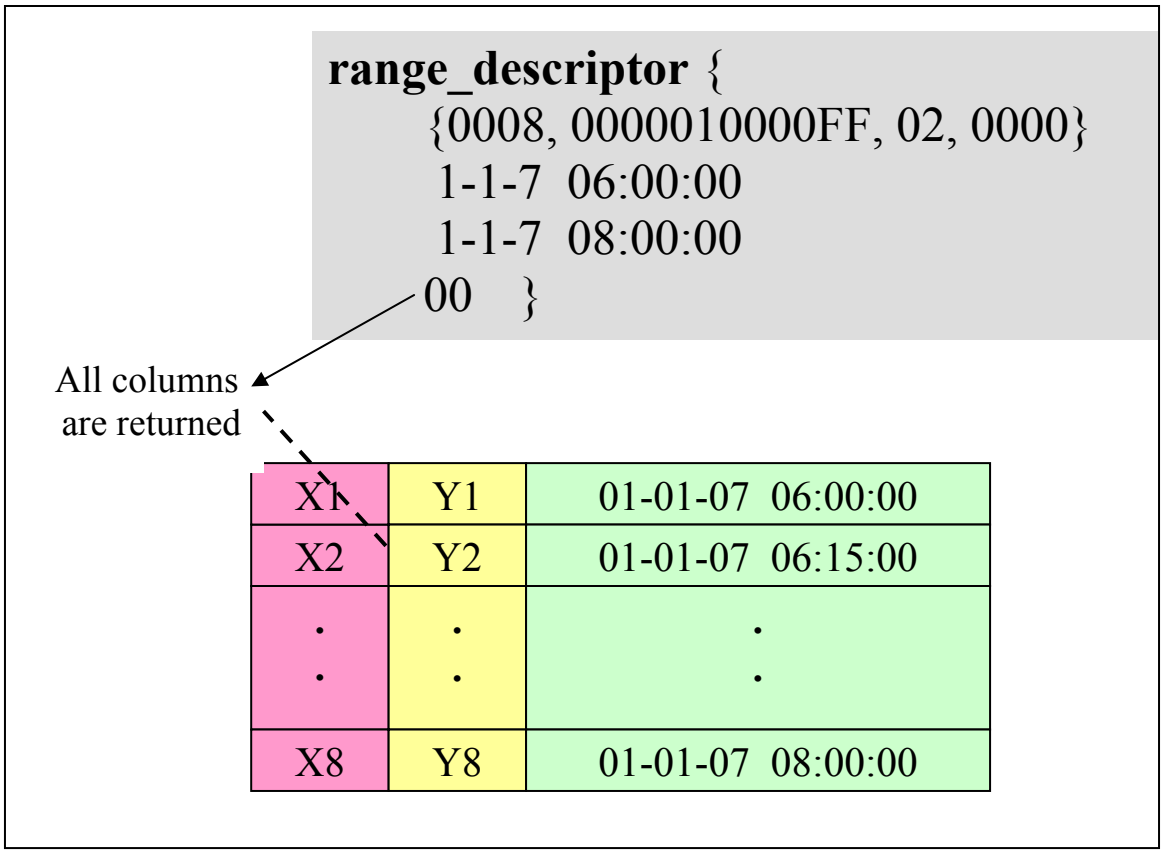

Fig 4: Illustration of selective access of profile buffer by range