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Electricity metering data exchange — The DLMS/COSEM suite — Part 6-9: Mapping between the Common Information Model message profiles (IEC 61968-9) and DLMS/COSEM (IEC 62056) data models and protocols

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National foreword

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Electricity metering data exchange – The DLMS/COSEM suite – Part 6-9: Mapping between the Common Information Model message profiles (IEC 61968-9) and DLMS/COSEM (IEC 62056) data models and protocols

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 6-9: Mapping between the Common Information Model message profiles (IEC 61968-9) and DLMS/COSEM (IEC 62056) data models and protocols

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

IEC TS 62056-6-9, which is a technical specification, has been prepared by IEC technical committee 13: Electrical energy measurement and control:

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

Enquiry draft	Report on voting
13/1647A/DTS	13/1672/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.

A list of all parts in the IEC 62056 series, published under the general title *Electricity metering data exchange – The DLSM/COSEM suite*, can be found on the IEC website.

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

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- withdrawn,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.

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INTRODUCTION

Smart grid, smart metering systems and advanced metering infrastructure are being developed and deployed worldwide in order to improve energy efficiency, better management of network assets, integrating distributed energy generation, involving customers in demand response and facilitating the operation of the deregulated energy market. Smart metering systems constitute an integral part of the smart grid. Therefore, it is important that a smooth and secure communication can be realized between ERP systems and metering end points.

IEC TC 57 develops CIM-based data models and protocols for information exchange for use in ERP integration and smart grid applications. In particular IEC 61968-9 deals with meter reading and control message profiles.

IEC TC 13 develops data models and protocols for information exchange for electrical energy measurement, and control equipment incorporating head end systems, end devices and intermediate data concentrator devices. In particular, the IEC 62056 series deals with the DLMS/COSEM data models and protocol suite.

This Technical Specification deals with the mapping between the CIM message profiles (IEC 61968-9) and DLMS/COSEM data models and protocols (IEC 62056).

In the following it is assumed that the mapping between CIM and DLMS/COSEM is performed in the metering HES. In the case where end-to-end security is established between a 3rd party CIM-based system and a DLMS/COSEM server, the mapping is performed in the 3rd party system.

ELECTRICITY METERING DATA EXCHANGE – THE DLMS/COSEM SUITE –

Part 6-9: Mapping between the Common Information Model message profiles (IEC 61968-9) and DLMS/COSEM (IEC 62056) data models and protocols

1 Scope

This part of IEC 62056, which is a Technical Specification, describes how in the utility environment an ERP system or a third party system can exchange information with a metering system. In particular, this Technical Specification covers the mapping between information interchange messages of a CIM-based ERP or third party system and a DLMS/COSEM-based metering system.

A typical metering system would comprise a HES and end devices such as meters as well as tariff and load control devices. There may be intermediate devices in the metering system such as NNAPs and LNAPs, as described in the smart metering architecture of IEC 62056-1-0. These intermediate devices are outside of the scope of this Technical Specification.

CIM ReadingType, EndDeviceControlType and EndDeviceEventType codes as specified in IEC 61968-9 are mapped to OBIS codes as specified in IEC 62056-6-1.

In some cases the CIM models and COSEM models are differently structured, in which case it is not possible to provide a one-to-one mapping between the OBIS codes and the CIM data type codes. In these cases the mapping is thus performed between the CIM UML object attributes and the COSEM object attributes (see 4.3.4 UC3).

CIM EndDeviceControlType codes as specified in IEC 61968-9 are mapped to COSEM IC attributes and methods as specified in IEC 62056-6-2.

CIM verbs and nouns as specified in IEC 61968-9 are mapped to DLMS service requests and responses as specified in IEC 62056-5-3.

Only the most commonly used UCs are given in order to illustrate possible applications. Extensions may be considered in future editions.

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

IEC 61968-9:2013, *Application integration at electric utilities – System interfaces for distribution management – Part 9: Interface for meter reading and control*

IEC 61968-100:2013, *Application integration at electric utilities – System interfaces for distribution management – Part 100: Implementation profiles*

IEC 62056-5-3:2016, *Electricity metering data exchange – The DLMS/COSEM suite – Part 5-3: DLMS/COSEM application layer*

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, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-300, IEC 61968-100, IEC 61968-9, IEC 62056-5-3, IEC 62056-6-1and IEC 62056-6-2 apply.

3.2 Abbreviations

AMI	Advanced Metering Infrastructure
CIM	Common Information Model
CIS	Customer Information System
COSEM	Companion Specification for Energy Metering
DLMS	Device Language Message Specification
ERP	Enterprise Resource Planning
HES	Head End System
IC	Interface Class
LNAP	Local Network Access Point
NNAP	Neighborhood Network Access Point
OBIS	OBject Identification System
QOS	Quality Of Supply
RCD	Remote Connect/Disconnect Switch
TOU	Time Of Use
UC	Use Case

3.3 Notation and terminology

Throughout this Technical Specification the following rules are observed regarding the naming of terms:

- the so-called “camel-notation” is preserved when terms are referenced to the CIM standards as prepared by IEC TC 57;
- similarly, capitalization combined with “under_score” joining is preserved when terms are referenced to the DLMS/COSEM standards as prepared by IEC TC 13;
- names of use cases start with a verb to indicate that the use case "does" something and is then concatenated in camel notation with descriptive text to indicate what is done;
- the expression DLMS/COSEM is used to emphasize the fact that the COSEM data model specified in IEC 62056-6-2 and the DLMS/COSEM application layer specified in IEC 62056-5-3 are closely linked.

4 Reference environment

4.1 General reference architecture

Figure 1 shows a generalized architecture for ERP and/or 3rd party systems exchanging information with metering head-end systems using CIM-based IEC 61968-9 message profiles, where metering head-end systems exchange information with end devices using the DLMS/COSEM IEC 62056 data models and protocols.

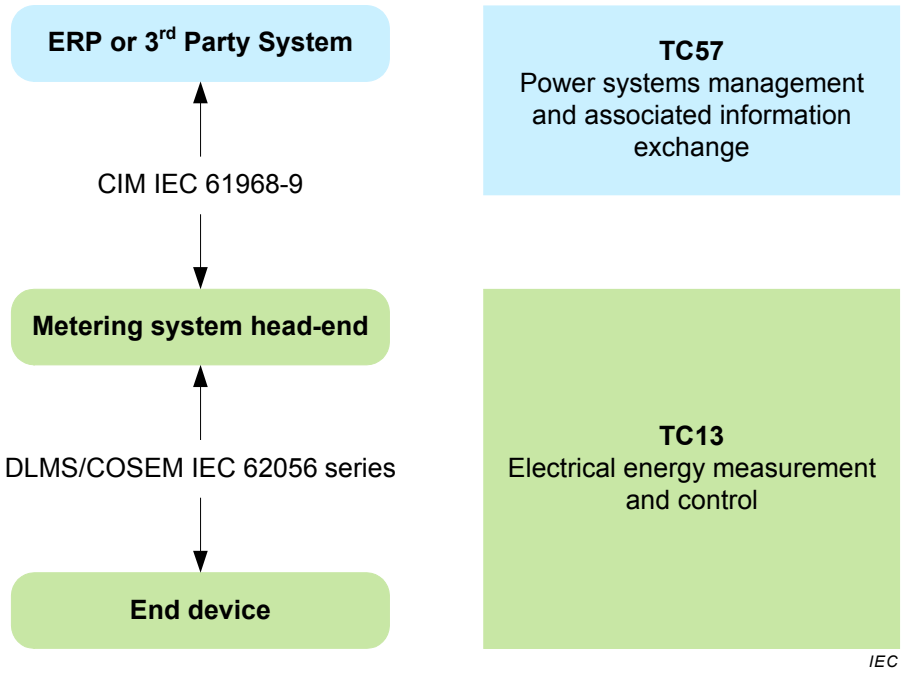

Figure 1 – General reference architecture

IEC TC 57 deals with the CIM-based message profiles and TC 13 deals with the DLMS/COSEM data models and protocols. Generally the translation between the two domains takes place at the HES. In the case where end-to-end security is established between a 3rd party CIM-based system and a DLMS/COSEM server, the mapping is performed in the 3rd party system.

The reference UCs that follow refer to the architecture shown in Figure 1 where CIM_System is located in the ERP or 3rd party system, CIM_DLMS/COSEM_Translator is located in the metering system head-end and DLMS/COSEM_Server is located in the end device.

4.2 Reference use cases – Generalized use case

Figure 2 shows a generic 3-party architecture allowing a sequence of message exchanges between the 3 parties.

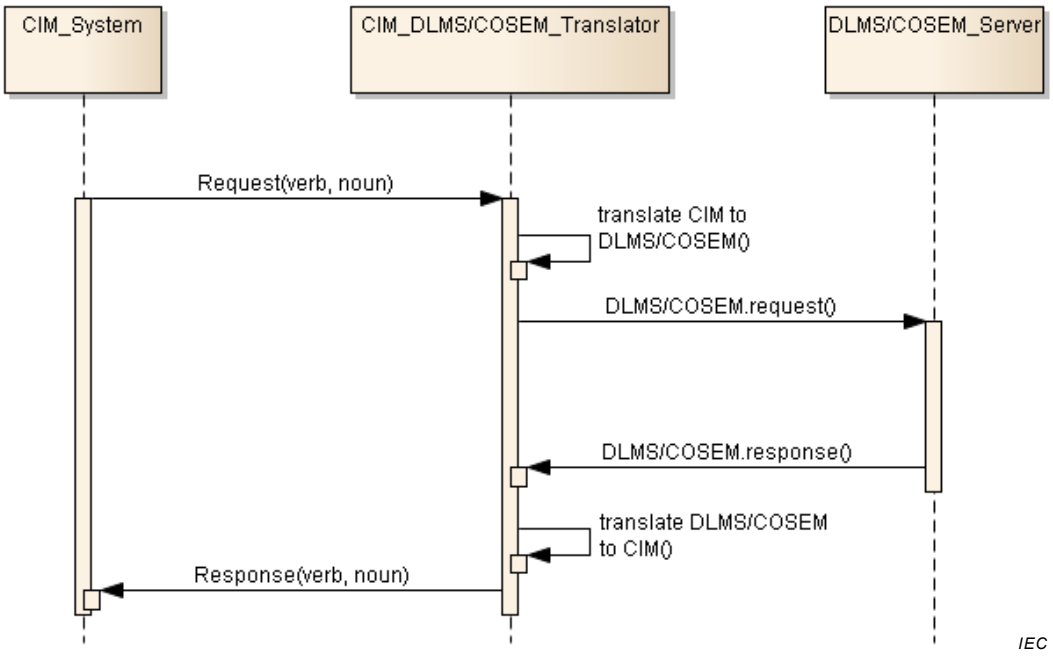

Figure 2 – Generic use case

CIM_System is any CIM-aware system (generally an enterprise system) that requires exchanging information with an end device (generally a meter) that is able to perform the role of a DLMS/COSEM server.

DLMS/COSEM_Server is a pseudonym for a DLMS/COSEM server.

CIM_System has to communicate via a proxy CIM_DLMS/COSEM_Translator, which may be any device, equipment or software that is able to perform the role of a DLMS/COSEM client.

A CIM-based request message originates at CIM_System and is received at CIM_DLMS/COSEM_Translator where the translation to a DLMS/COSEM service_request message takes place. The translated message reaches DLMS/COSEM_Server where the request is appropriately executed. A DLMS/COSEM response message is returned to CIM_DLMS/COSEM_Translator where it is translated into a CIM-based response message and sent back to CIM_System to complete the sequence.

In the case where end-to-end security is established between a 3rd party CIM-based system and a DLMS/COSEM server, CIM_DLMS/COSEM_Translator is located in the 3rd party system.

The constructs “Request(verb,noun)” and “Response(verb,noun)” are defined in IEC 61968-100:2013, Clause 4.

The constructs “DLMS/COSEM.request()” and “DLMS/COSEM.response()” are defined in IEC 62056-5-3:2016, Clause 6.

4.3 Use case examples

4.3.1 General

The following UCs serve as examples to illustrate the mapping of the messages. The set of UCs is by no means exhaustive.

4.3.2 UC1: ReadMeterOnSchedule

Figure 3 shows a sequence of message exchanges for UC1.

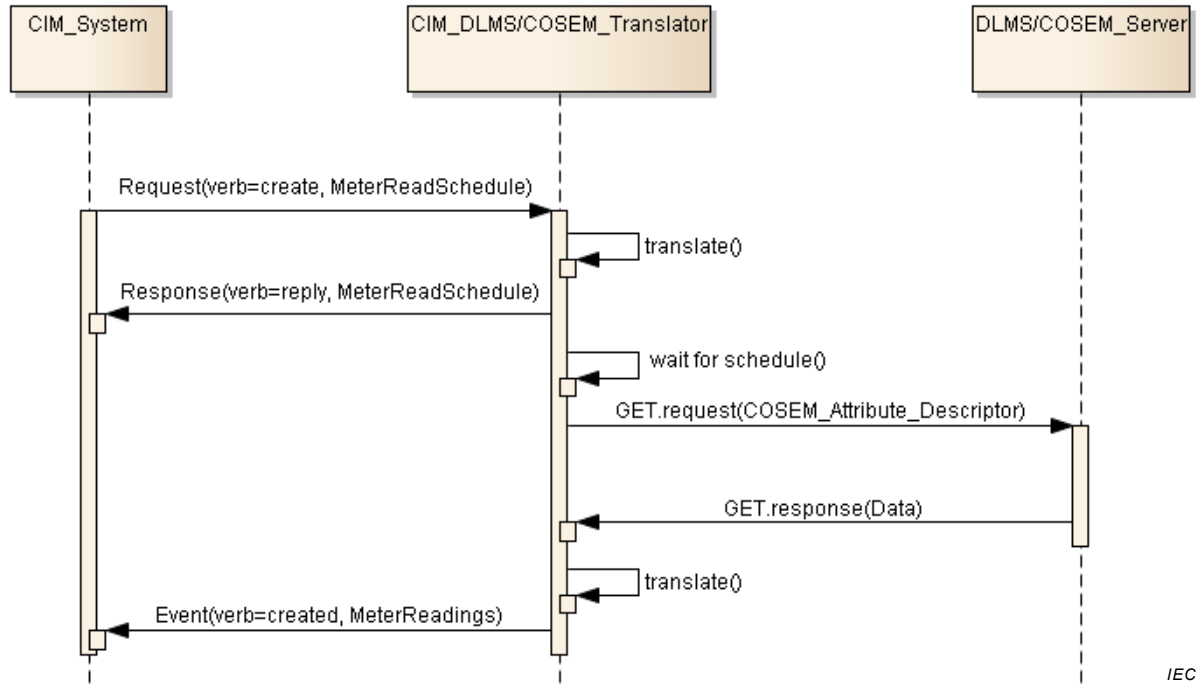

Figure 3 – UC1: ReadMeterOnSchedule

The CIS requests meter readings scheduled according to a time table. The CIS compiles the schedule and sends it to the AMI HES where the schedule is loaded. The HES may then acknowledge that the request has been appropriately loaded and is ready for execution. Once the schedule is activated, the HES obtains meter readings as scheduled from the meters specified and publishes the readings to the CIS. This continues until the schedule is inactivated or a new schedule is loaded.

Alternatively it is also possible to load the schedule directly into the meter and then utilize the DLMS/COSEM push mechanism that uses the DataNotification service instead of the GET.request / GET.response services.

In both cases the CIM message constructs with verbs and nouns remain the same as given in Figure 3.

The CIM message nouns MeterReadingSchedule and MeterReadings are used in this UC.

See IEC 61968-9:2013, 5.3 for detailed message constructs of MeterReadingSchedule and MeterReadings.

See 5.5 for OBIS code mapping to ReadingType code.

4.3.3 UC2: ReadMeterOnDemand

Figure 4 shows a sequence of message exchanges for UC2.

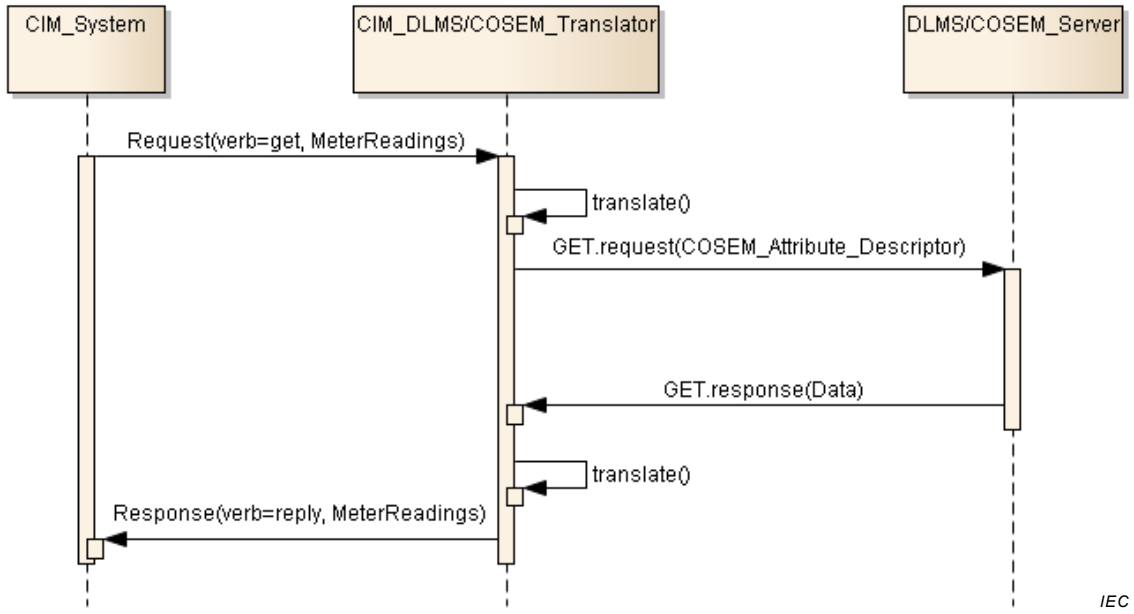

Figure 4 – UC2: ReadMeterOnDemand

A utility customer contacts the supplier in order to check that the current meter reading on his bill corresponds to the actual reading. Similarly, a customer switches to a new supplier and the old supplier requests a meter reading in order to send the closing bill. The CIS sends a request message to the AMI HES requesting a real-time reading from the particular meter. The HES connects with the meter and obtains a real-time reading, which is returned to the CIS for further evaluation of the customer query.

The CIM message noun MeterReadings is used in this example (the detailed message construct of MeterReadings can be found in IEC 61968-9:2013, 5.3). The mapping of the OBIS code to the ReadingType code is described in 5.5.

4.3.4 UC3: ConfigureTariffRemotely

Figure 5 shows a sequence of message exchanges for UC3.

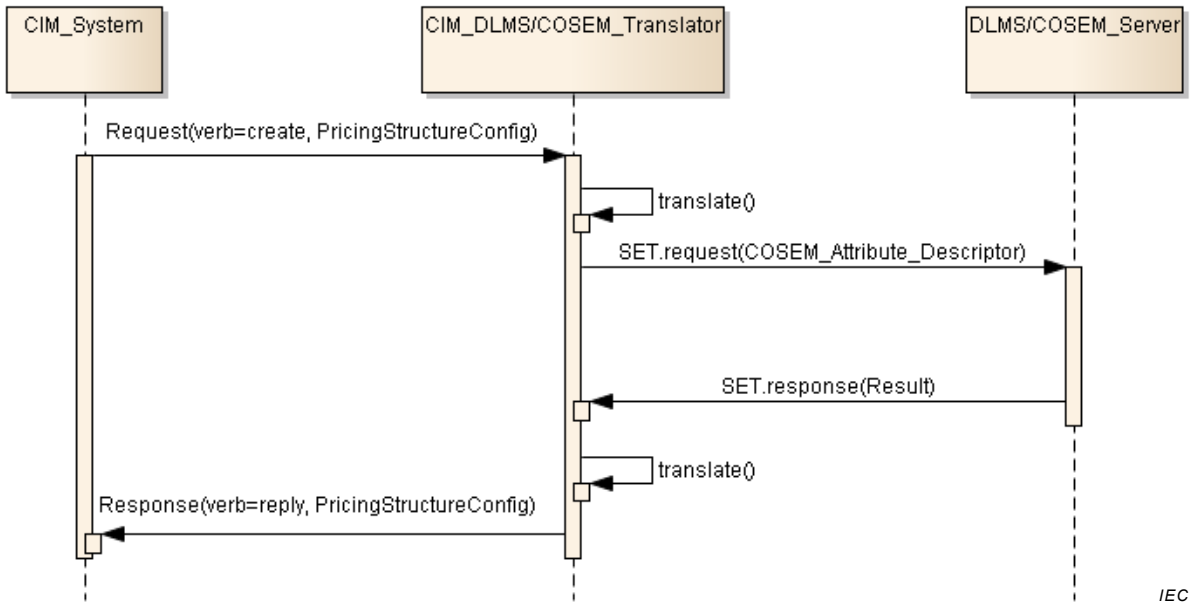

Figure 5 – UC3: ConfigureTariffRemotely

A customer changes its supply contact. As a consequence, the tariffication parameters in the meter shall be changed. The CIS sends the new tariff information to the AMI HES using the appropriate CIM message. The translator extracts the relevant tariff information, assembles the corresponding DLMS/COSEM message and sends it to the DLMS/COSEM server (meter). The meter configures the new tariff structure. An appropriate DLMS/COSEM response is returned from the meter to the HES which is then translated into a CIM message and passed back to the CIS as a response to the original request.

The CIM message noun PricingStructureConfig is used in this example (see IEC 61968-9:2013, 5.10.2.11 and 5.10.3.14 for the detailed message construct of PricingStructureConfig).

Due to the fact that the tariffication models in CIM and in DLMS/COSEM are differently structured, it is not possible to provide a one-to-one mapping of the OBIS codes to the CIM data type codes. An example of a tariffication scheme realized by means of COSEM objects is shown in Clause A.1. Those attributes of the COSEM objects which can be mapped to the CIM UML attributes of the PricingStructureConfig message profile are given in 5.8. The management of those attributes that cannot be mapped in this way is outside the scope of this Technical Specification.

4.3.5 UC4: DisconnectReconnectRemotely

Figure 6 shows a sequence of message exchanges for UC4.

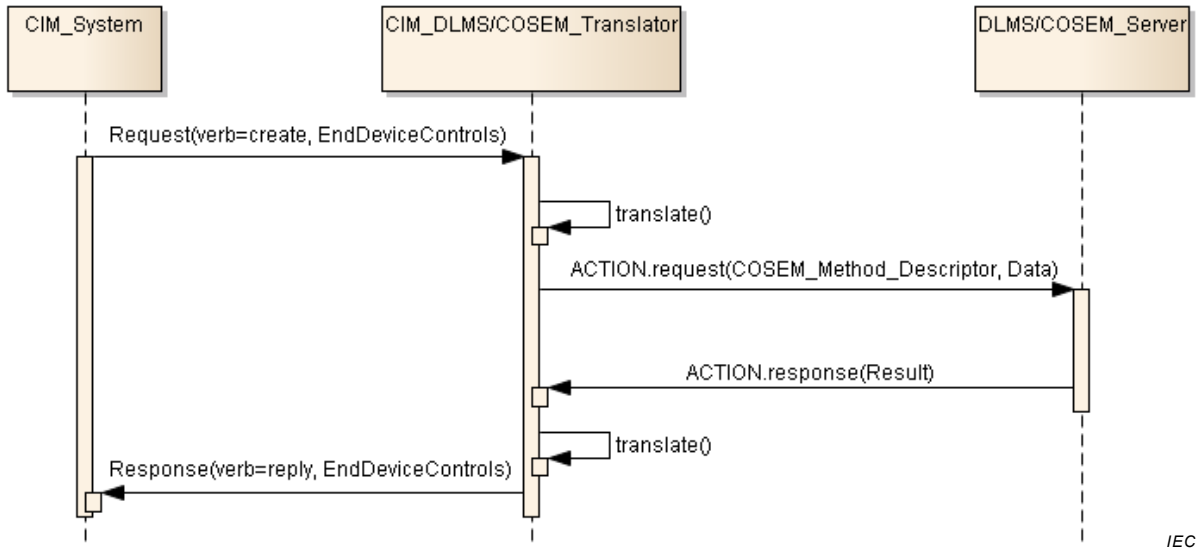

Figure 6 – UC4: DisconnectReconnectRemotely

A customer terminates his supply agreement with the utility. As a consequence of the termination the utility disconnects the service supply to the customer's premises. When the CIS receives the termination instruction, a request to disconnect the service is sent to the HES which sends the instruction on to the specified meter. The meter disconnects the service supply to the premises by means of a switch.

Conversely, a customer may enter into a new supply agreement with the utility, in which case the service supply is reconnected.

The CIM message noun EndDeviceControls and the DLMS/COSEM Disconnect control IC are used in this example. The detailed message construct of EndDeviceControls in the context of load control is given in IEC 61968-9:2013, 5.4 and the detailed rules governing the operation of the Disconnect control IC are given in IEC 62056-6-2:2016, 5.4.8.

The mapping of OBIS codes, attributes and methods to EndDeviceControlType codes is given in 5.6.

4.3.6 UC5: ManageLoadByRelayControl

Figure 7 shows a sequence of message exchanges for UC5.

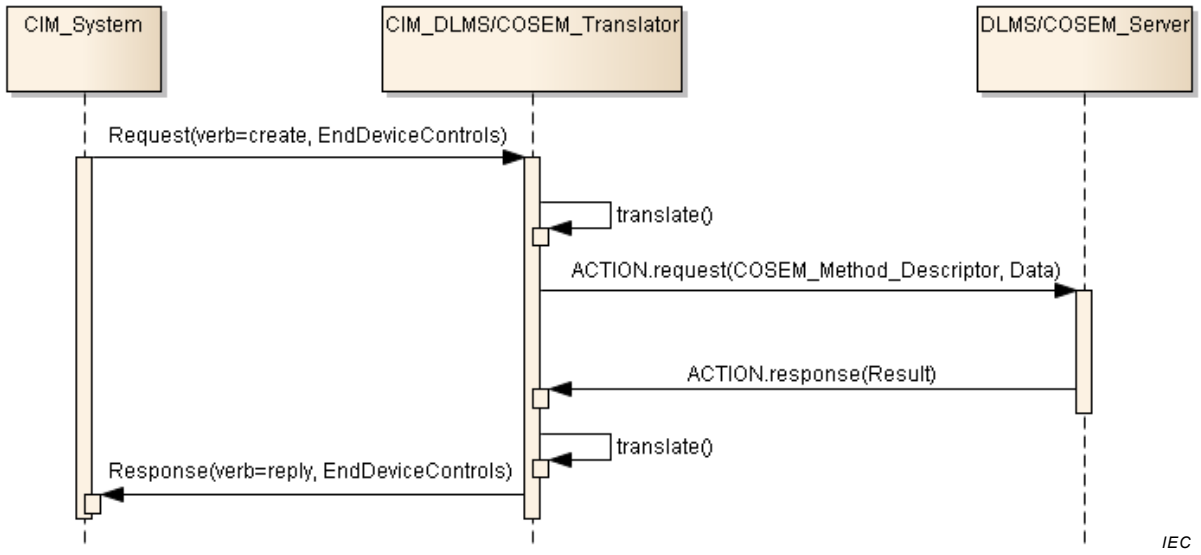

Figure 7 – UC5: ManageLoadByRelayControl

UC5 is similar to UC4, except that for UC5 only the loads connected to the relays are disconnected (or reconnected) and is mainly used for demand-side management with immediate load shedding and restoration response.

After the load-shed period has expired the customer load is restored.

An alternative would be to schedule operation of the relay, thus deferring load shedding to a time later than the actual reception of the request. This case is not covered in the present example.

The CIM message noun EndDeviceControls and the DLMS/COSEM Disconnect control IC are used in this example. The detailed message construct of EndDeviceControls in the context of load control is given in IEC 61968-9:2013, 5.4 and the detailed rules governing the operation of the Disconnect control IC are given in IEC 62056-6-2:2016, 5.4.8.

The mapping of OBIS codes, attributes and methods to EndDeviceControlType codes is given in 5.6.

4.3.7 UC6: ReportOnQualityOfSupply

Figure 8 shows a sequence of message exchanges for UC6.

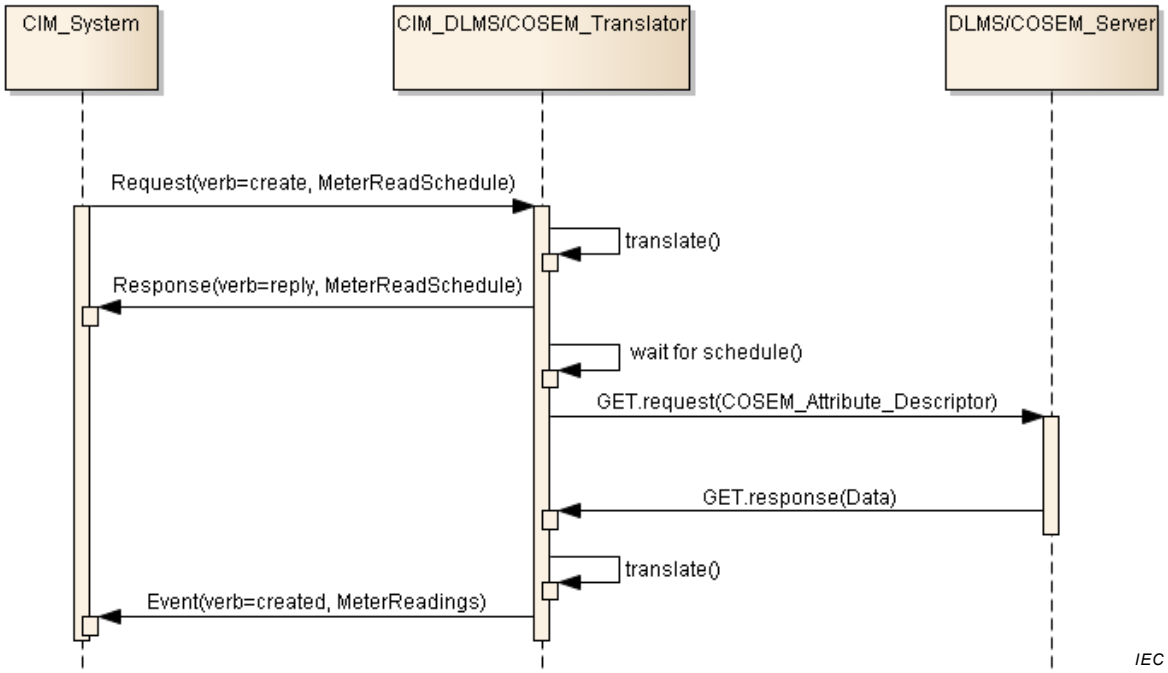

Figure 8 – UC6: ReportOnQualityOfSupply

A utility customer may have a supply agreement which stipulates that specified QOS parameters will remain within certain limits. The relevant QOS parameters are supervised/registered by the meter. The CIS sends a request to the HES, which in turn requests the QOS parameter readings from the meter. The readings are returned to the CIS via the HES for further processing.

UC8 is essentially the same as UC2, except that it uses different ReadingType codes and addresses different objects via different OBIS codes.

The CIM message noun MeterReadings is used in this UC example (see IEC 61968-9:2013, 5.3 for the detailed message construct of MeterReadings).

The OBIS code mapping to ReadingType code is given in 5.5.

4.3.8 UC7: ManageLoadByDemandLimits

Figure 9 shows a sequence of message exchanges for UC7.

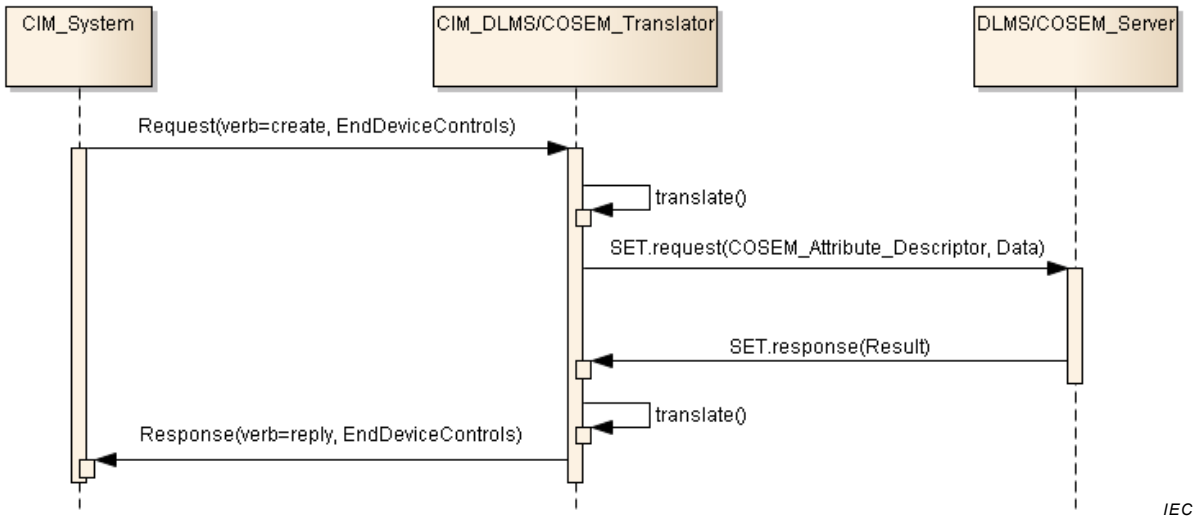

Figure 9 – UC7: ManageLoadByDemandLimits

A utility customer may participate in a DSM program where he agrees to maintain his power demand below a certain limit during specified periods of the day. If he exceeds this limit then the service supply to his premises is automatically disconnected, in which case he can reduce some of his load before he is able to reconnect the service supply. This reconnection is generally performed manually by the customer.

The CIS sends the power limit information to the HES which forwards it to the specified meter. The meter returns a response acknowledging that the limit parameters have been loaded.

The CIM message noun EndDeviceControls and DLMS/COSEM Limiter IC and Disconnect control IC are used in this UC example.

The detailed message construct of EndDeviceControls in the context of demand limitation is given in IEC 61968-9:2013, 5.4 and the detailed EndDeviceControlType codes in the context of demand control are given in IEC 61968-9:2013, Table F.4.

The operation of the Limiter IC is given in IEC 62056-6-2:2016, 5.4.9 and that of the Disconnect control IC is given in IEC 62056-6-2:2016, 5.4.8.

The OBIS code mapping to EndDeviceControlType code is given in 5.6

An example of a DLMS/COSEM model to manage load by demand limits is given in Clause A.2.

4.3.9 UC8: SynchronizeClock

Figure 10 shows a sequence of message exchanges for UC8.

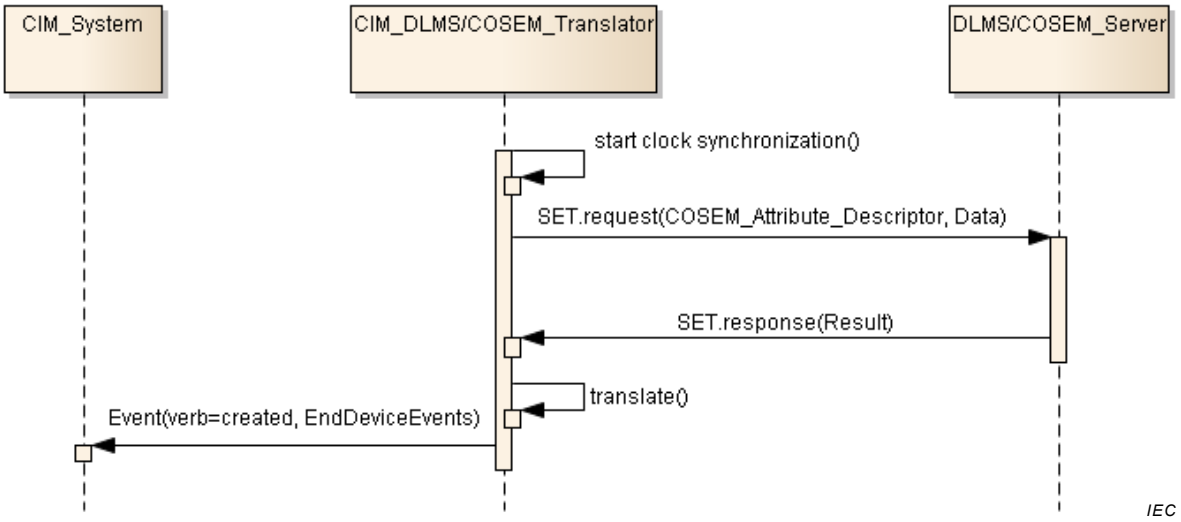

Figure 10 – UC8: SynchronizeClock

The clock in the AMI meter(s) needs to be synchronized with actual time. There is no CIM request message supporting this UC. Therefore, the clock synchronization process shall be initiated and managed by the HES. Once the synchronization between the HES and meter(s) has been completed, an appropriate event notification is sent to the CIM-based ERP system.

The DLMS/COSEM Clock IC is used in this UC example (see IEC 62056-6-2:2016, 5.4.1 for detailed operation of the Clock IC).

As alternative to using the SET.request message as given in Figure 10, the DLMS/COSEM client may also invoke the methods provided by the Clock IC by using the ACTION.request message.

The CIM message noun EndDeviceEvents is used in this example.

The detailed message construct of EndDeviceEvents in the context of clock synchronization is given in IEC 61968-9:2013, 5.4 and the detailed EndDeviceEventType codes in the context of clock synchronization are given in IEC 61968-9:2013, Table E.8.

The OBIS code mapping to EndDeviceEventType code is given in 5.7.

4.3.10 UC9: ChangeFirmware

Figure 11 shows a sequence of message exchanges for UC9.

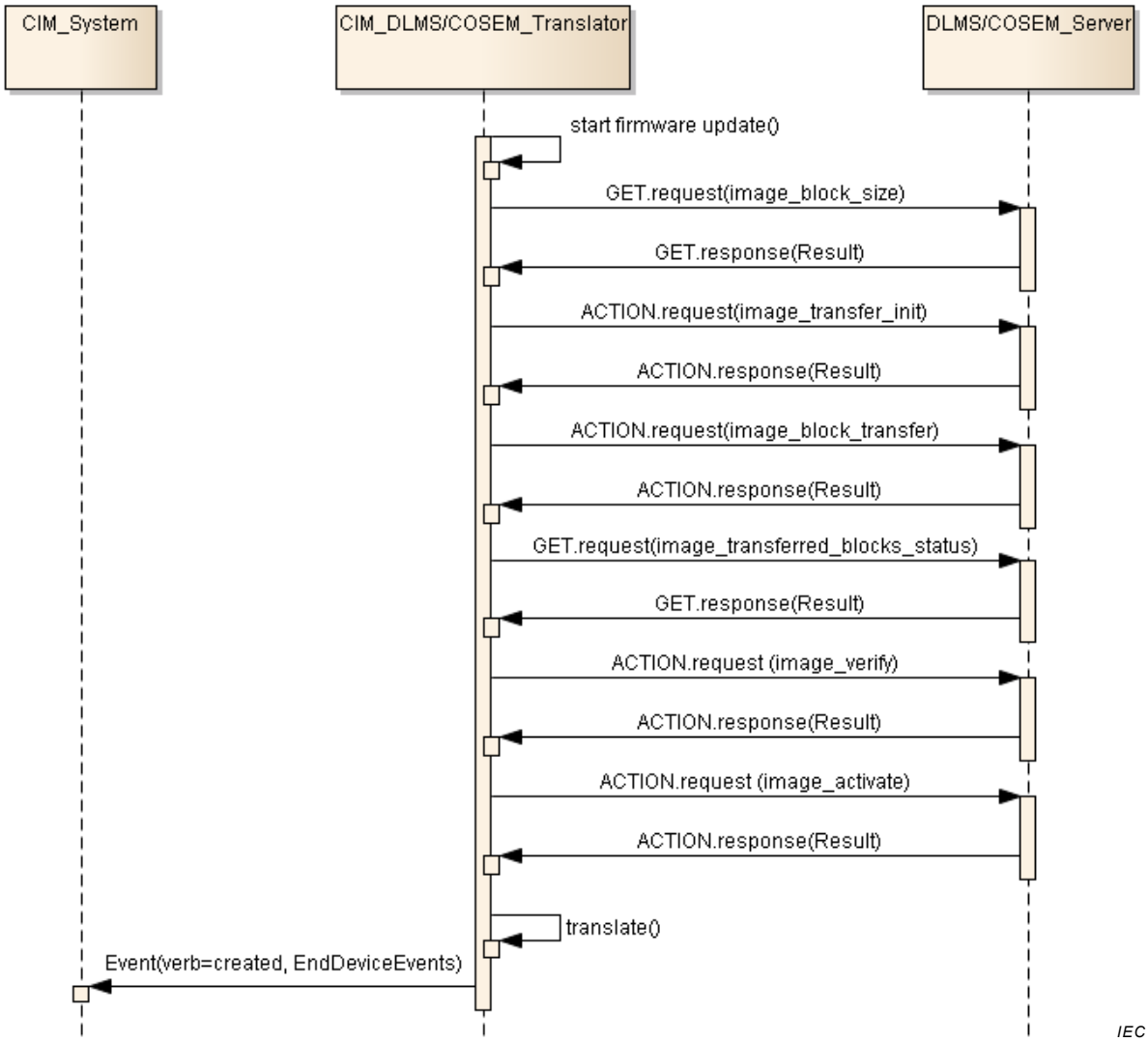

Figure 11 – UC9: ChangeFirmware

The firmware of a group of meters needs to be updated with a new version. There is no CIM request message supporting this UC. Therefore, the firmware updating process shall be managed by the HES. The firmware is initially delivered to the HES, which then loads the new firmware file and sends it to the meters. The HES uses the DLMS/COSEM image_transfer function to update the meters' firmware. The meters perform the firmware installation and return a response to the ERP system via the HES. The initial delivery of the firmware to the HES is not dealt with herein.

The CIM message noun EndDeviceEvents is used in this UC example.

The detailed message construct of EndDeviceEvents in the context of firmware changes is given in IEC 61968-9:2013, 5.6 and the detailed EndDeviceEventType codes in the context of firmware changes are given in IEC 61968-9:2013, Tables E.2, E.10 and E.12.

The operation of the Image transfer IC is given in IEC 62056-6-2:2016, 5.3.6.

The OBIS code mapping to EndDeviceEventType code is given in 5.7.

4.3.11 UC10: RegisterMeter

Figure 12 and Table 1 show a sequence of UC invocations for UC10. The message interchanges are as per each UC invoked.

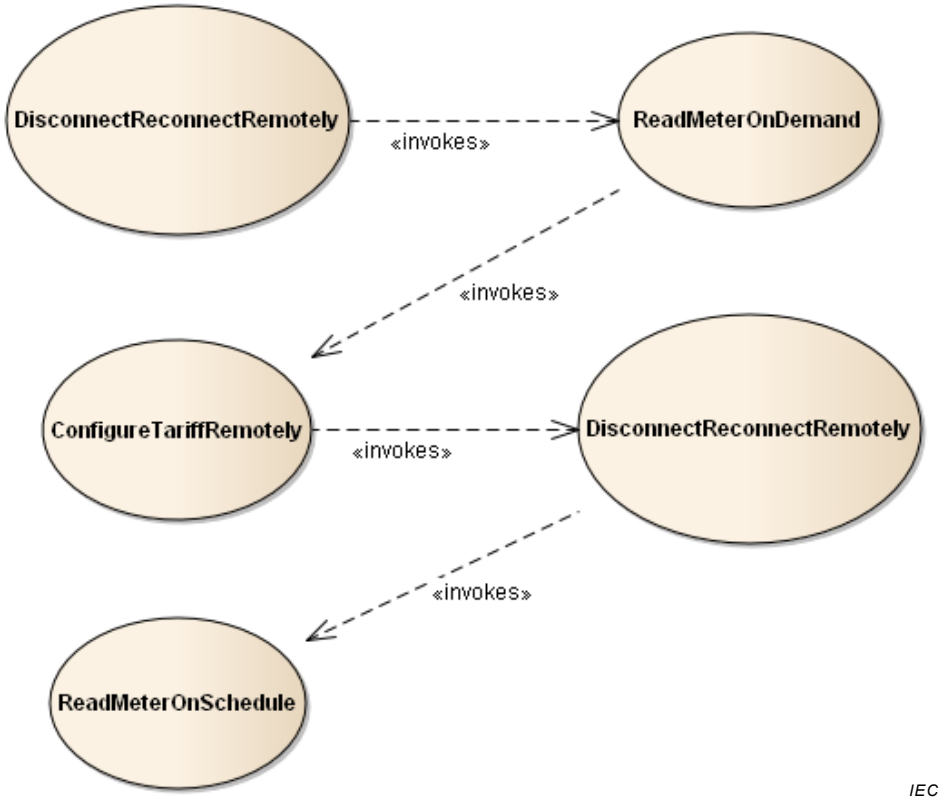

Figure 12 – UC10: RegisterMeter

An existing customer terminates his contract and moves out of the premises. A new customer moves into the premises and establishes a new contract with the supplier. This UC may be implemented by a sequential combination of previously defined UCs as given in Table 1 and Figure 12.

Table 1 – UC10 RegisterMeter

Use case	Name	Context
UC4	DisconnectReconnectRemotely	Terminate the current service supply
UC2	ReadMeterOnDemand	Take a final reading of customer moving out
UC3	ConfigureTariffRemotely	Set the tariff for the customer moving in
UC4	DisconnectReconnectRemotely	Establish the new service supply
UC1	ReadMeterOnSchedule	The meter is in normal operation

4.3.12 UC11: SuperviseMeter

Figure 13 shows a sequence of message exchanges for UC11.

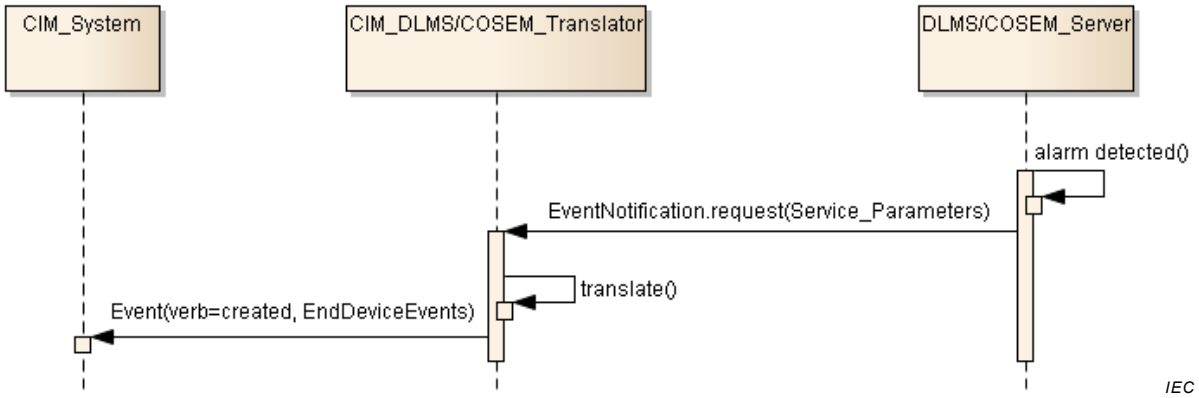

Figure 13 – UC11: SuperviseMeter

The meter has been pre-configured to monitor an internal parameter (e.g. for tamper detection) and to notify the HES in case the supervised parameter shows an uncommon behaviour. The ERP system has in turn pre-established a subscription service with the HES for it to send a notification of meter-originated events. When a meter event occurs, the meter sends a message to the HES containing all the relevant information, which is translated and sent to the enterprise system.

The CIM message noun EndDeviceEvents and the COSEM IC Register Monitor are used in this example.

The detailed message construct of EndDeviceEvents in the context of meter events is given in IEC 61968-9:2013, 5.2 and the detailed EndDeviceEventType codes in the context of meter events are given in IEC 61968-9:2013, Annex E.

Because the EventNotification service provides limited information about the event, the DLMS/COSEM "push" mechanism that uses the DataNotification service instead of the EventNotification service may alternatively be used in the case where more detailed information is required. The "push" mechanism and DataNotification service are not covered in this UC.

The OBIS code mapping to EndDeviceEventType code is given in 5.7.

5 CIM – DLMS/COSEM translation

5.1 CIM message construct

The CIM-based system sends/receives messages in the form of verb(noun) as defined in IEC 61968-9.

5.2 CIM verb mapping

CIM verbs as defined in IEC 61968-9 generally translate to DLMS/COSEM services as defined in IEC 62056-5-3 and as given in Table 2.

The mapping is implicitly many to many, and depends on the context of the message interchange (see 4.3.10 UC9 for example).

Table 2 – CIM verb mapping to DLMS/COSEM service

CIM verb	DLMS/COSEM service
get	GET.request ACTION.request
create	GET.request SET.request ACTION.request
change	SET.request ACTION.request
cancel	SET.request ACTION.request
delete	SET.request ACTION.request
execute	SET.request ACTION.request
reply	GET.response SET.response ACTION.response
created	GET.response SET.response EventNotification.request DataNotification.request
changed	SET.response ACTION.response
cancelled	SET.response ACTION.response
deleted	SET.response ACTION.response
executed	SET.response ACTION.response

5.3 CIM noun mapping

CIM nouns as defined in IEC 61968-9 translate to DLMS/COSEM service parameters as defined in IEC 62056-5-3 and as given in Table 3.

Table 3 – CIM noun mapping to DLMS/COSEM service parameters

CIM noun	DLMS/COSEM service parameter
MeterReadings	attribute_descriptor, data
EndDeviceControls	method_descriptor, invocation parameters
EndDeviceEvents	attribute_descriptor
EndDeviceConfig	attribute_descriptor, data

5.4 CIM data type mapping

CIM data type codes as defined in IEC 61968-9 translate to DLMS/COSEM service parameters as defined in IEC 62056-5-3, IEC 62056-6-1 and IEC 62056-6-2 and as given in Table 4.

Table 4 – CIM data type mapping to DLMS/COSEM service parameters

CIM data type	DLMS/COSEM service parameter	Detailed specification
ReadingType	OBIS code	5.5
EndDeviceControlType	OBIS code	5.6
EndDeviceEventType	OBIS code	5.7

5.5 OBIS code mapping to CIM ReadingType enumerated code

The OBIS value group C code set is a sub-set of ReadingType and it is thus mapped upwards to ReadingType enumerated codes. The mapping of value group C codes to ReadingType enumerated attribute values is given in Table 5.

The mapping of complete OBIS codes to complete ReadingType codes is given in Table 6. Only the most commonly used OBIS codes are listed.

For the structure of OBIS codes, see IEC 62056-6-1:2015, Clause 4.

For the definition of value group C codes, see IEC 62056-6-1:2015, 5.3 and 7.1.

For the structure and definition of ReadingType codes, see IEC 61968-9:2013, Annex C.

The content of Table 5 is taken directly from IEC 62056-6-1 and IEC 61968-9 without modification and any clarification regarding syntax and semantics should be sought in those standards.

Table 5 – OBIS value group C code mapped to CIM ReadingType enumerated attribute values

OBIS code		CIM ReadingType attributes					
C code	**Value group C codes – Electricity (A = 1)**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**#2.#5.#7.#15.#17**
0	General purpose objects						
1	SL_i Active power+ (QI+QIV) (See also Note 2)	sum	forward	power	phasesABC	Real power (w)	26.1.37.224.38
2	SL_i Active power– (QII+QIII)	sum	reverse	power	phasesABC	Real power (w)	26.19.37.224.38
3	SL_i Reactive power+ (QI+QII)	sum	forward	power	phasesABC	Reactive power (vAr)	26.1.37.224.63
4	SL_i Reactive power– (QIII+QIV)	sum	reverse	power	phasesABC	Reactive power (vAr)	26.19.37.224.63
5	SL_i Reactive power QI	sum	quadrant1	power	phasesABC	Reactive power (vAr)	26.15.37.224.63
6	SL_i Reactive power QII	sum	quadrant2	power	phasesABC	Reactive power (vAr)	26.16.37.224.63
7	SL_i Reactive power QIII	sum	quadrant3	power	phasesABC	Reactive power (vAr)	26.17.37.224.63
8	SL_i Reactive power QIV	sum	quadrant4	power	phasesABC	Reactive power (vAr)	26.18.37.224.63
9	SL_i Apparent power+ (QI+QIV) (See also Note 3)	sum	q1plusQ4	power	phasesABC	Apparent power (vA)	26.8.37.224.61
10	SL_i Apparent power– (QII+QIII)	sum	q2plusQ3	power	phasesABC	Apparent power (vA)	26.10.37.224.61
11	Current: any phase [a]	none	none	current	phaseA	Current (amp)	0.0.4.128.5
12	Voltage: any phase [a]	none	none	voltage	phaseA	Electric potential (v)	0.0.54.128.29
13	SL_i Power factor– (See also Note 4)	sum	none	powerFactor	phasesABC	Power Factor (wPerVA)	26.0.38.224.153
14	Supply frequency	none	none	frequency	phaseA	Frequency hertz (hz)	0.0.15.128.33
15	SL_I Active power (abs(QI+QIV)+(abs(QII+QIII)) [a]	sum	total	power	phasesABC	Real power (w)	26.20.37.224.38
16	SL_I Active power (abs(QI+QIV)-abs(QII+QIII))	sum	net	power	phasesABC	Real power (w)	26.4.37.224.38
17	SL_i Active power QI	sum	quadrant1	power	phasesABC	Real power (w)	26.15.37.224.38
18	SL_i Active power QII	sum	quadrant2	power	phasesABC	Real power (w)	26.16.37.224.38
19	SL_i Active power QIII	sum	quadrant3	power	phasesABC	Real power (w)	26.17.37.224.38
20	SL_i Active power QIV	sum	quadrant4	power	phasesABC	Real power (w)	26.18.37.224.38
21	L_1 Active power+ (See also Note 1)	none	forward	power	phaseA	Real power (w)	0.1.37.128.38

OBIS code		CIM ReadingType attributes					
C code	**Value group C codes – Electricity (A = 1)**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**#2.#5.#7.#15.#17**
22	L_1 Active power–	none	reverse	power	phaseA	Real power (w)	0.19.37.128.38
23	L_1 Reactive power+	none	forward	power	phaseA	Reactive power (vAr)	0.1.37.128.63
24-30	L_1 etc. (See 4-10)	none	reverse	power	phaseA	Reactive power (vAr)	0.19.37.128.63
31	L_1 Current [a]	none	none	current	phaseA	Current (amp)	0.0.4.128.5
32	L_1 Voltage [a]	none	none	voltage	phaseA	Electric potential (v)	0.0.54.128.29
33	L_1 Power factor	none	none	powerFactor	phaseA	Power Factor (wPerVA)	0.0.38.128.153
34	L_1 Supply frequency	none	none	frequency	phaseA	Frequency hertz (hz)	0.0.15.128.33
35-40	L_1 Active power... etc. (See 15-20)						
41	L_2 Active power+	none	forward	power	phaseB	Real power (w)	0.1.37.64.38
42	L_2 Active power–	none	reverse	power	phaseB	Real power (w)	0.19.37.64.38
43	L_2 Reactive power+	none	forward	power	phaseB	Reactive power (vAr)	0.1.37.64.63
44-60	L_2 etc. (See 24-40)						
61	L_3 Active power+	none	forward	power	phaseC	Real power (w)	0.1.37.32.38
62	L_3 Active power–	none	reverse	power	phaseC	Real power (w)	0.19.37.32.38
63	L_3 Reactive power+	none	forward	power	phaseC	Reactive power (vAr)	0.1.37.32.63
64-80	L_3 etc. (See 24-40)						
81	Angles [b]	none	none	none	none	Plane angle (rad)	0.0.0.0.10
82	Unitless quantity (pulses or pieces)	none	none	none	none	N/A	0.0.0.0.0
83	Transformer and line loss quantities [c]	none	none	transformerLosses	none	N/A	0.0.48.0.0
84	SL_i power factor– (See also Note 4)	sum	none	powerFactor	phasesABC	Power Factor (wPerVA)	26.0.38.224.153
85	L_1 Power factor–	none	none	powerFactor	phaseA	Power Factor (wPerVA)	0.0.38.128.153

OBIS code		CIM ReadingType attributes					
C code	**Value group C codes – Electricity (A = 1)**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**#2.#5.#7.#15.#17**
86	L_2 Power factor–	none	none	powerFactor	phaseB	Power Factor (wPerVA)	0.0.38.64.153
87	L_3 Power factor–	none	none	powerFactor	phaseC	Power Factor (wPerVA)	0.0.38.32.153
88	SL_i Ampere-squared hours (QI+QII+QIII+QIV)	sum	none	current	phasesABC	ampere-squared hour (a2h)	26.0.4.224.105
89	SL_i Volt-squared hours (QI+QII+QIII+QIV)	sum	none	voltage	phasesABC	volt-squared hour (v2h)	
90	SL_i current (algebraic sum of the – unsigned – value of the currents in all phases)	sum	total	current	phasesABC	Current (amp)	26.20.4.224.5
91	L_0 current (neutral) [a]	none	none	current	phaseN	Current (amp)	0.0.4.16.5
92	L_0 voltage (neutral) [a]	none	none	voltage	phaseN	Electric potential (v)	0.0.54.16.29
93	Consortia specific identifiers						
94	Country specific identifiers						
95	Temperature						
96	General purpose – Electricity						
97	Error registers – Electricity						
98	List object – Electricity						
99	Data profiles – Electricity						
100…127	Reserved						
128…199, 240	Manufacturer specific codes						
All other	Reserved						

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

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

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

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

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

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

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

Table 6 – OBIS values mapped to CIM ReadingType enumerated codes

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:0.8.2.255	Measurement period 3, for instantaneous value	none	none	date	none	Time (s)	0.0.0.0.0.7.0.0.0.0.0.0.0.0.27.0
1-0:1.4.0.255	Active Power + Total – Current average	none	forward	demand	phasesABC	Real power (w)	0.0.0.6.1.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:2.4.0.255	Active Power – Total – Current average	none	reverse	demand	phasesABC	Real power (w)	0.0.0.6.19.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:3.4.0.255	Reactive Power + Total – Current average 1	none	forward	demand	phasesABC	Reactive power (vAr)	0.0.0.6.1.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:4.4.0.255	Reactive Power – Total – Current average	none	reverse	demand	phasesABC	Reactive power (vAr)	0.0.0.6.19.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:1.5.0.255	Active Power + Total – Last average	none	forward	demand	phasesABC	Real power (w)	0.0.0.0.1.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:2.5.0.255	Active Power – Total – Last average	none	reverse	demand	phasesABC	Real power (w)	0.0.0.0.19.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:3.5.0.255	Reactive Power + Total – Last average	none	forward	demand	phasesABC	Reactive power (vAr)	0.0.0.0.1.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:4.5.0.255	Reactive Power – Total – Last average	none	reverse	demand	phasesABC	Reactive power (vAr)	0.0.0.0.19.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:1.6.0.255	Active Power + Total – Maximum 1	maximum	forward	demand	phasesABC	Real power (w)	0.8.0.6.1.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:1.6.1.255	Active Power + Tariff 1 – Maximum 1	maximum	forward	demand	phasesABC	Real power (w)	0.8.0.6.1.1.8.0.0.0.0.0.1.0.1.224.0.38.0
1-0:1.6.2.255	Active Power + Tariff 2 – Maximum 1	maximum	forward	demand	phasesABC	Real power (w)	0.8.0.6.1.1.8.0.0.0.0.0.2.0.1.224.0.38.0
1-0:1.6.3.255	Active Power + Tariff 3 – Maximum 1	maximum	forward	demand	phasesABC	Real power (w)	0.8.0.6.1.1.8.0.0.0.0.0.3.0.1.224.0.38.0
1-0:1.6.4.255	Active Power + Tariff 4 – Maximum 1	maximum	forward	demand	phasesABC	Real power (w)	0.8.0.6.1.1.8.0.0.0.0.0.4.0.1.224.0.38.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:1.24.0.255	Average Instantaneous Import Power	average	forward	demand	phasesABC	Real power (w)	0.2.0.12.1.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:2.6.0.255	Active Power – Total – Maximum 1	maximum	reverse	demand	phasesABC	Real power (w)	0.8.0.6.19.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:2.6.1.255	Active Power – Tariff 1 – Maximum 1	maximum	reverse	demand	phasesABC	Real power (w)	0.8.0.6.19.1.8.0.0.0.0.1.0.1.224.0.38.0
1-0:2.6.2.255	Active Power – Tariff 2 – Maximum 1	maximum	reverse	demand	phasesABC	Real power (w)	0.8.0.6.19.1.8.0.0.0.0.2.0.1.224.0.38.0
1-0:2.6.3.255	Active Power – Tariff 3 – Maximum 1	maximum	reverse	demand	phasesABC	Real power (w)	0.8.0.6.19.1.8.0.0.0.0.3.0.1.224.0.38.0
1-0:2.6.4.255	Active Power – Tariff 4 – Maximum 1	maximum	reverse	demand	phasesABC	Real power (w)	0.8.0.6.19.1.8.0.0.0.0.4.0.1.224.0.38.0
1-0:3.6.0.255	Reactive Power + Total – Maximum 1	maximum	forward	demand	phasesABC	Reactive power (vAr)	0.8.0.6.1.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:3.6.1.255	Reactive Power + Tariff 1 – Maximum 1	maximum	forward	demand	phasesABC	Reactive power (vAr)	0.8.0.6.1.1.8.0.0.0.0.1.0.1.224.0.63.0
1-0:3.6.2.255	Reactive Power + Tariff 2 – Maximum 1	maximum	forward	demand	phasesABC	Reactive power (vAr)	0.8.0.6.1.1.8.0.0.0.0.2.0.1.224.0.63.0
1-0:3.6.3.255	Reactive Power + Tariff 3 – Maximum 1	maximum	forward	demand	phasesABC	Reactive power (vAr)	0.8.0.6.1.1.8.0.0.0.0.3.0.1.224.0.63.0
1-0:3.6.4.255	Reactive Power + Tariff 4 – Maximum 1	maximum	forward	demand	phasesABC	Reactive power (vAr)	0.8.0.6.1.1.8.0.0.0.0.4.0.1.224.0.63.0
1-0:4.6.0.255	Reactive Power – Total – Maximum 1	maximum	reverse	demand	phasesABC	Reactive power (vAr)	0.8.0.6.19.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:4.6.1.255	Reactive Power – Tariff 1 – Maximum 1	maximum	reverse	demand	phasesABC	Reactive power (vAr)	0.8.0.6.19.1.8.0.0.0.0.1.0.1.224.0.63.0
1-0:4.6.2.255	Reactive Power – Tariff 2 – Maximum 1	maximum	reverse	demand	phasesABC	Reactive power (vAr)	0.8.0.6.19.1.8.0.0.0.0.2.0.1.224.0.63.0
1-0:4.6.3.255	Reactive Power – Tariff 3 – Maximum 1	maximum	reverse	demand	phasesABC	Reactive power (vAr)	0.8.0.6.19.1.8.0.0.0.0.3.0.1.224.0.63.0
1-0:4.6.4.255	Reactive Power – Tariff 4 – Maximum 1	maximum	reverse	demand	phasesABC	Reactive power (vAr)	0.8.0.6.19.1.8.0.0.0.0.4.0.1.224.0.63.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:1.7.0.255	Instantaneous Active Power +	none	forward	demand	phasesABC	Real power (w)	0.0.0.12.1.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:2.7.0.255	Instantaneous Active Power -	none	reverse	demand	phasesABC	Real power (w)	0.0.0.12.19.1.8.0.0.0.0.0.0.0.224.0.38.0
1-0:3.7.0.255	Instantaneous Reactive Power +	none	forward	demand	phasesABC	Reactive power (vAr)	0.0.0.12.1.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:4.7.0.255	Instantaneous Reactive Power -	none	reverse	demand	phasesABC	Reactive power (vAr)	0.0.0.12.19.1.8.0.0.0.0.0.0.0.224.0.63.0
1-0:9.4.0.255	Apparent Power + Total – Current Average 1	none	forward	demand	phasesABC	Apparent power (vA)	0.0.0.0.1.1.8.0.0.0.0.0.0.0.224.0.61.0
1-0:9.5.0.255	Apparent Power + Total – Last Average 1	none	forward	demand	phasesABC	Apparent power (vA)	0.0.0.0.1.1.8.0.0.0.0.0.0.0.224.0.61.0
1-0:9.6.0.255	Apparent Power + Total – Maximum 1	maximum	forward	demand	phasesABC	Apparent power (vA)	0.8.0.6.1.1.8.0.0.0.0.0.0.0.224.0.61.0
1-0:9.6.1.255	Apparent Power + Tariff 1 – Maximum 1	maximum	forward	demand	phasesABC	Apparent power (vA)	0.8.0.6.1.1.8.0.0.0.0.1.0.1.224.0.61.0
1-0:9.6.2.255	Apparent Power + Tariff 2 – Maximum 1	maximum	forward	demand	phasesABC	Apparent power (vA)	0.8.0.6.1.1.8.0.0.0.0.2.0.1.224.0.61.0
1-0:9.6.3.255	Apparent Power + Tariff 3 – Maximum 1	maximum	forward	demand	phasesABC	Apparent power (vA)	0.8.0.6.1.1.8.0.0.0.0.3.0.1.224.0.61.0
1-0:9.6.4.255	Apparent Power + Tariff 4 – Maximum 1	maximum	forward	demand	phasesABC	Apparent power (vA)	0.8.0.6.1.1.8.0.0.0.0.4.0.1.224.0.61.0
1-0:9.7.0.255	Instantaneous Apparent Power +	none	forward	power	phasesABC	Apparent power (vA)	0.0.0.12.1.1.37.0.0.0.0.0.0.0.224.0.61.0
1-0:9.8.0.255	Apparent Energy + Total	none	forward	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.1.1.12.0.0.0.0.0.0.0.224.3.71.0
1-0:9.8.1.255	Apparent Energy + Tariff 1	none	forward	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.1.1.12.0.0.0.0.1.0.1.224.3.71.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:9.8.2.255	Apparent Energy + Tariff 2	none	forward	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.1.1.12.0.0.0.0.2.0.1.224.3.71.0
1-0:9.8.3.255	Apparent Energy + Tariff 3	none	forward	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.1.1.12.0.0.0.0.3.0.1.224.3.71.0
1-0:9.8.4.255	Apparent Energy + Tariff 4	none	forward	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.1.1.12.0.0.0.0.4.0.1.224.3.71.0
1-0:10.4.0.255	Apparent Power – Total – Current Average 1	none	reverse	demand	phasesABC	Apparent power (vA)	0.0.0.0.19.1.8.0.0.0.0.0.0.0.224.0.61.0
1-0:10.5.0.255	Apparent Power – Total – Last Average 1	none	reverse	demand	phasesABC	Apparent power (vA)	0.0.0.0.19.1.8.0.0.0.0.0.0.0.224.0.61.0
1-0:10.6.0.255	Apparent Power – Total – Maximum 1	maximum	reverse	demand	phasesABC	Apparent power (vA)	0.8.0.6.19.1.8.0.0.0.0.0.0.0.224.0.61.0
1-0:10.6.1.255	Apparent Power – Tariff 1 – Maximum 1	maximum	reverse	demand	phasesABC	Apparent power (vA)	0.8.0.6.19.1.8.0.0.0.0.1.0.1.224.0.61.0
1-0:10.6.2.255	Apparent Power – Tariff 2 – Maximum 1	maximum	reverse	demand	phasesABC	Apparent power (vA)	0.8.0.6.19.1.8.0.0.0.0.2.0.1.224.0.61.0
1-0:10.6.3.255	Apparent Power – Tariff 3 – Maximum 1	maximum	reverse	demand	phasesABC	Apparent power (vA)	0.8.0.6.19.1.8.0.0.0.0.3.0.1.224.0.61.0
1-0:10.6.4.255	Apparent Power – Tariff 4 – Maximum 1	maximum	reverse	demand	phasesABC	Apparent power (vA)	0.8.0.6.19.1.8.0.0.0.0.4.0.1.224.0.61.0
1-0:10.7.0.255	Instantaneous Apparent Energy -	none	reverse	power	phasesABC	Apparent power (vA)	0.0.0.12.19.1.37.0.0.0.0.0.0.0.224.0.61.0
1-0:10.8.0.255	Apparent Energy – Total	none	reverse	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.19.1.12.0.0.0.0.0.0.0.224.3.71.0
1-0:10.8.1.255	Apparent Energy – Tariff 1	none	reverse	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.19.1.12.0.0.0.0.1.0.1.224.3.71.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:10.8.2.255	Apparent Energy – Tariff 2	none	reverse	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.19.1.12.0.0.0.0.2.0.1.224.3.71.0
1-0:10.8.3.255	Apparent Energy – Tariff 3	none	reverse	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.19.1.12.0.0.0.0.3.0.1.224.3.71.0
1-0:10.8.4.255	Apparent Energy – Tariff 4	none	reverse	energy	phasesABC	Apparent energy (vAh)	0.0.0.1.19.1.12.0.0.0.0.4.0.1.224.3.71.0
1-0:12.31.0.255	Threshold for Voltage Sag	lowThreshold	none	sag	none	Electric potential (v)	0.7.0.0.0.1.41.0.0.0.0.0.0.0.0.0.29.0
1-0:12.35.0.255	Threshold for Voltage Swell	highThreshold	none	swell	none	Electric potential (v)	0.5.0.0.0.1.42.0.0.0.0.0.0.0.0.0.29.0
1-0:12.39.0.255	Threshold for Voltage Cut	lowThreshold	none	none	none	Electric potential (v)	0.7.0.0.0.1.0.0.0.0.0.0.0.0.0.0.29.0
1-0:12.43.0.255	Time Threshold for Voltage Sag	highThreshold	none	sag	none	N/A	0.5.0.0.0.1.41.0.0.0.0.0.0.0.0.0.0.0
1-0:12.44.0.255	Time Threshold for Voltage Swell	highThreshold	none	swell	none	N/A	0.5.0.0.0.1.42.0.0.0.0.0.0.0.0.0.0.0
1-0:12.45.0.255	Time Threshold for Voltage Cut	highThreshold	none	none	none	N/A	0.5.0.0.0.1.0.0.0.0.0.0.0.0.0.0.0.0
1-0:15.24.0.255	Average Instantaneous Total Power	average	total	power	phasesABC	Real power (w)	0.2.0.12.20.1.37.0.0.0.0.0.0.0.224.0.38.0
1-0:16.24.0.255	Average instantaneous Net Power	average	net	power	phasesABC	Real power (w)	0.2.0.12.4.1.37.0.0.0.0.0.0.0.224.0.38.0
1-0:31.4.0.255	Average Current L1	average	none	current	phaseA	Current (amp)	0.2.0.0.0.1.4.0.0.0.0.0.0.0.128.0.5.0
1-0:31.7.0.255	Instantaneous current L1	none	none	current	phaseA	Current (amp)	0.0.0.0.0.1.4.0.0.0.0.0.0.0.128.0.5.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:32.7.0.255	Instantaneous voltage L1	none	none	voltage	phaseA	Electric potential (v)	0.0.0.0.0.1.54.0.0.0.0.0.0.0.128.0.29.0
1-0:32.24.0.255	Average voltage L1	none	none	voltage	phaseA	Electric potential (v)	0.0.0.0.0.1.54.0.0.0.0.0.0.0.128.0.29.0
1-0:32.32.0.255	Counter for Voltage Sags L1	none	none	sag	phaseA	N/A	0.0.0.0.0.1.41.0.0.0.0.0.0.0.128.0.0.0
1-0:32.33.0.255	Duration for Voltage Sag L1	none	none	sag	phaseA	N/A	0.0.0.0.0.1.41.0.0.0.0.0.0.0.128.0.0.0
1-0:32.34.0.255	Magnitude for Voltage Sag L1	none	none	sag	phaseA	N/A	0.0.0.0.0.1.41.0.0.0.0.0.0.0.128.0.0.0
1-0:32.36.0.255	Counter for Voltage Swells L1	none	none	swell	phaseA	N/A	0.0.0.0.0.1.42.0.0.0.0.0.0.0.128.0.0.0
1-0:32.37.0.255	Duration for Voltage Swell L1	none	none	swell	phaseA	N/A	0.0.0.0.0.1.42.0.0.0.0.0.0.0.128.0.0.0
1-0:32.38.0.255	Magnitude for Voltage Swell L1	none	none	swell	phaseA	N/A	0.0.0.0.0.1.42.0.0.0.0.0.0.0.128.0.0.0
1-0:51.4.0.255	Average Current L2	average	none	current	phaseB	Current (amp)	0.2.0.0.0.1.4.0.0.0.0.0.0.0.64.0.5.0
1-0:51.7.0.255	Instantaneous current L2	none	none	none	phaseB	Current (amp)	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.5.0
1-0:52.7.0.255	Instantaneous voltage L2	none	none	none	phaseB	Electric potential (v)	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.29.0
1-0:52.24.0.255	Average voltage L2 Scheme 3	none	none	none	phaseB	Electric potential (v)	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.29.0
1-0:52.32.0.255	Counter for Voltage Sags L2	none	none	none	phaseB	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.0.0
1-0:52.33.0.255	Duration for Voltage Sag L2	none	none	none	phaseB	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.0.0
1-0:52.34.0.255	Magnitude for Voltage Sag L2	none	none	none	phaseB	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.0.0
1-0:52.36.0.255	Counter for Voltage Swells L2	none	none	none	phaseB	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.0.0
1-0:52.37.0.255	Duration for Voltage Swell L2	none	none	none	phaseB	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.0.0
1-0:52.38.0.255	Magnitude for Voltage Swell L2	none	none	none	phaseB	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.64.0.0.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:71.4.0.255	Average Current L3	average	none	current	phaseC	Current (amp)	0.2.0.0.0.1.4.0.0.0.0.0.0.0.32.0.5.0
1-0:71.7.0.255	Instantaneous current L3	none	none	none	phaseC	Current (amp)	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.5.0
1-0:72.7.0.255	Instantaneous voltage L3	none	none	none	phaseC	Electric potential (v)	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.29.0
1-0:72.24.0.255	Average voltage L3 Scheme 3	none	none	none	phaseC	Electric potential (v)	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.29.0
1-0:72.32.0.255	Counter for Voltage Sags L3	none	none	none	phaseC	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.0.0
1-0:72.33.0.255	Duration for Voltage Sag L3	none	none	none	phaseC	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.0.0
1-0:72.34.0.255	Magnitude for Voltage Sag L3	none	none	none	phaseC	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.0.0
1-0:72.36.0.255	Counter for Voltage Swells L3	none	none	none	phaseC	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.0.0
1-0:72.37.0.255	Duration for Voltage Swell L3	none	none	none	phaseC	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.0.0
1-0:72.38.0.255	Magnitude for Voltage Swell L3	none	none	none	phaseC	N/A	0.0.0.0.0.1.0.0.0.0.0.0.0.0.32.0.0.0
1-0:1.8.0.255	Active Energy + Total	sum	forward	energy	phasesABC	Real energy (wh)	0.26.0.1.1.1.12.0.0.0.0.0.0.0.224.3.72.0
1-0:1.8.1.255	Active Energy + Tariff 1	sum	forward	energy	phasesABC	Real energy (wh)	0.26.0.1.1.1.12.0.0.0.0.1.0.1.224.3.72.0
1-0:1.8.2.255	Active Energy + Tariff 2	sum	forward	energy	phasesABC	Real energy (wh)	0.26.0.1.1.1.12.0.0.0.0.2.0.1.224.3.72.0
1-0:1.8.3.255	Active Energy + Tariff 3	sum	forward	energy	phasesABC	Real energy (wh)	0.26.0.1.1.1.12.0.0.0.0.3.0.1.224.3.72.0
1-0:1.8.4.255	Active Energy + Tariff 4	sum	forward	energy	phasesABC	Real energy (wh)	0.26.0.1.1.1.12.0.0.0.0.4.0.1.224.3.72.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:2.8.0.255	Active Energy – Total	sum	reverse	energy	phasesABC	Real energy (wh)	0.26.0.1.19.1.12.0.0.0.0.0.0.0.224.3.72.0
1-0:2.8.1.255	Active Energy – Tariff 1	sum	reverse	energy	phasesABC	Real energy (wh)	0.26.0.1.19.1.12.0.0.0.0.1.0.1.224.3.72.0
1-0:2.8.2.255	Active Energy – Tariff 2	sum	reverse	energy	phasesABC	Real energy (wh)	0.26.0.1.19.1.12.0.0.0.0.2.0.1.224.3.72.0
1-0:2.8.3.255	Active Energy – Tariff 3	sum	reverse	energy	phasesABC	Real energy (wh)	0.26.0.1.19.1.12.0.0.0.0.3.0.1.224.3.72.0
1-0:2.8.4.255	Active Energy – Tariff 4	sum	reverse	energy	phasesABC	Real energy (wh)	0.26.0.1.19.1.12.0.0.0.0.4.0.1.224.3.72.0
1-0:3.8.0.255	Reactive Energy + Total	sum	forward	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.1.1.12.0.0.0.0.0.0.0.224.3.73.0
1-0:3.8.1.255	Reactive Energy + Tariff 1	sum	forward	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.1.1.12.0.0.0.0.1.0.1.224.3.73.0
1-0:3.8.2.255	Reactive Energy + Tariff 2	sum	forward	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.1.1.12.0.0.0.0.2.0.1.224.3.73.0
1-0:3.8.3.255	Reactive Energy + Tariff 3	sum	forward	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.1.1.12.0.0.0.0.3.0.1.224.3.73.0
1-0:3.8.4.255	Reactive Energy + Tariff 4	sum	forward	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.1.1.12.0.0.0.0.4.0.1.224.3.73.0
1-0:4.8.0.255	Reactive Energy – Total	sum	reverse	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.19.1.12.0.0.0.0.0.0.0.224.3.73.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:4.8.1.255	Reactive Energy – Tariff 1	sum	reverse	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.19.1.12.0.0.0.0.1.0.1.224.3.73.0
1-0:4.8.2.255	Reactive Energy – Tariff 2	sum	reverse	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.19.1.12.0.0.0.0.2.0.1.224.3.73.0
1-0:4.8.3.255	Reactive Energy – Tariff 3	sum	reverse	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.19.1.12.0.0.0.0.3.0.1.224.3.73.0
1-0:4.8.4.255	Reactive Energy – Tariff 4	sum	reverse	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.19.1.12.0.0.0.0.4.0.1.224.3.73.0
1-0:5.8.0.255	Reactive Energy QI – Total	sum	quadrant1	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.15.1.12.0.0.0.0.0.0.0.224.3.73.0
1-0:5.8.1.255	Reactive Energy QI – Tariff 1	sum	quadrant1	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.15.1.12.0.0.0.0.0.0.1.224.3.73.0
1-0:5.8.2.255	Reactive Energy QI – Tariff 2	sum	quadrant1	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.15.1.12.0.0.0.0.0.0.1.224.3.73.0
1-0:5.8.3.255	Reactive Energy QI – Tariff 3	sum	quadrant1	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.15.1.12.0.0.0.0.0.0.1.224.3.73.0
1-0:5.8.4.255	Reactive Energy QI – Tariff 4	sum	quadrant1	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.15.1.12.0.0.0.0.0.0.1.224.3.73.0
1-0:6.8.0.255	Reactive Energy QII – Total	sum	quadrant2	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.16.1.12.0.0.0.0.0.0.0.224.3.73.0
1-0:6.8.1.255	Reactive Energy QII – Tariff 1	sum	quadrant2	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.16.1.12.0.0.0.0.0.0.1.224.3.73.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:6.8.2.255	Reactive Energy QII – Tariff 2	sum	quadrant2	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.16.1.12.0.0.0.0.0.0.1.224.3.73.0
1-0:6.8.3.255	Reactive Energy QII – Tariff 3	sum	quadrant2	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.16.1.12.0.0.0.0.0.0.1.224.3.73.0
1-0:6.8.4.255	Reactive Energy QII – Tariff 4	sum	quadrant2	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.16.1.12.0.0.0.0.0.0.1.224.3.73.0
1-0:7.8.0.255	Reactive Energy QIII – Total	sum	quadrant3	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.17.1.12.0.0.0.0.0.0.0.224.3.73.0
1-0:7.8.1.255	Reactive Energy QIII – Tariff 1	sum	quadrant3	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.17.1.12.0.0.0.0.1.0.1.224.3.73.0
1-0:7.8.2.255	Reactive Energy QIII – Tariff 2	sum	quadrant3	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.17.1.12.0.0.0.0.2.0.1.224.3.73.0
1-0:7.8.3.255	Reactive Energy QIII – Tariff 3	sum	quadrant3	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.17.1.12.0.0.0.0.3.0.1.224.3.73.0
1-0:7.8.4.255	Reactive Energy QIII – Tariff 4	sum	quadrant3	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.17.1.12.0.0.0.0.4.0.1.224.3.73.0
1-0:8.8.0.255	Reactive Energy QIV – Total	sum	quadrant4	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.18.1.12.0.0.0.0.0.0.0.224.3.73.0
1-0:8.8.1.255	Reactive Energy QIV – Tariff 1	sum	quadrant4	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.18.1.12.0.0.0.0.1.0.1.224.3.73.0
1-0:8.8.2.255	Reactive Energy QIV – Tariff 2	sum	quadrant4	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.18.1.12.0.0.0.0.2.0.1.224.3.73.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:8.8.3.255	Reactive Energy QIV – Tariff 3	sum	quadrant4	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.18.1.12.0.0.0.0.3.0.1.224.3.73.0
1-0:8.8.4.255	Reactive Energy QIV – Tariff 4	sum	quadrant4	energy	phasesABC	Reactive energy (vArh)	0.26.0.1.18.1.12.0.0.0.0.4.0.1.224.3.73.0
1-0:13.3.0.255	Mimimum Power Factor	minimum	none	powerFactor	phasesABC	Power Factor (wPerVA)	0.9.0.6.0.1.38.0.0.0.0.0.0.0.224.0.153.0
1-0:13.5.0.255	Last Average Power Factor	average	none	powerFactor	phasesABC	Power Factor (wPerVA)	0.2.1.6.0.1.38.0.0.0.0.0.0.0.224.0.153.0
1-0:13.7.0.255	Instantaneous Power Factor	none	none	powerFactor	phasesABC	Power Factor (wPerVA)	0.0.0.12.0.1.38.0.0.0.0.0.0.0.224.0.153.0
1-0:14.7.0.255	Instantaneous net Frequency; any phase	none	none	frequency	phasesABC	Frequency hertz (hz)	0.0.0.12.0.1.15.0.0.0.0.0.0.0.224.0.33.0
1-0:15.7.0.255	Instantaneous Active Power	none	forward	power	phasesABC	Real power (w)	0.0.0.12.1.1.37.0.0.0.0.0.0.0.224.0.38.0
1-0:15.8.0.255	Active Energy (|+A|+|-A|)	sum	total	energy	phasesABC	Real energy (wh)	0.26.0.1.20.1.12.0.0.0.0.0.0.0.224.3.72.0
1-0:15.8.1.255	Active Energy (|+A|+|-A|) – Tariff 1	sum	total	energy	phasesABC	Real energy (wh)	0.26.0.1.20.1.12.0.0.0.0.1.0.1.224.3.72.0
1-0:15.8.2.255	Active Energy (|+A|+|-A|) – Tariff 2	sum	total	energy	phasesABC	Real energy (wh)	0.26.0.1.20.1.12.0.0.0.0.2.0.1.224.3.72.0
1-0:15.8.3.255	Active Energy (|+A|+|-A|) – Tatiff 3	sum	total	energy	phasesABC	Real energy (wh)	0.26.0.1.20.1.12.0.0.0.0.3.0.1.224.3.72.0
1-0:15.8.4.255	Active Energy (|+A|+|-A|) – Tariff 4	sum	total	energy	phasesABC	Real energy (wh)	0.26.0.1.20.1.12.0.0.0.0.4.0.1.224.3.72.0

OBIS		CIM ReadingType					
OBIS code	**Meaning**	**#2 Data Qualifier**	**#5 Direction of flow**	**#7 Kind**	**#15 Phase**	**#17 Unit of Measure**	**ReadingType code**
1-0:15.24.0.255	Average instantaneous Total Power	average	total	power	phasesABC	Real power (w)	0.2.0.12.20.1.37.0.0.0.0.0.0.0.224.0.38.0
1-0:16.8.0.255	Active Energy (|+A|-|-A|)	sum	net	energy	phasesABC	Real energy (wh)	0.26.0.1.4.1.12.0.0.0.0.0.0.0.224.3.72.0
1-0:16.24.0.255	Average instantaneous Net Power	average	net	power	phasesABC	Real power (w)	0.2.0.12.4.1.37.0.0.0.0.0.0.0.224.0.38.0
1-0:90.7.0.255	Instantaneous Current Sum All Phases	sum	none	current	phasesABC	Current (amp)	0.26.0.12.0.1.4.0.0.0.0.0.0.0.224.0.5.0

5.6 OBIS code mapping to CIM EndDeviceControlType enumerated code

EndDeviceControlType codes are defined in IEC 61968-9 and OBIS codes are defined in IEC 62056-6-1. The mapping between these two code sets is given in Table 7.

For the structure of OBIS codes, see IEC 62056-6-1:2015, Clause 4.

For the definition and operation of Disconnect control IC, see IEC 62056-6-2:2016, 5.4.8.

For the definition and operation of Limiter IC, see IEC 62056-6-2:2016, 5.4.9. For the structure of EndDeviceControlType codes, see IEC 61968-9:2013, Table F.2.

For the context of RCD Switch and Demand Limiting formula, see IEC 61968-9:2013, Table F.4.

Table 7 – OBIS code mapped to CIM EndDeviceControlType enumerated code

DLMS/COSEM context				CIM context	
OBIS code	**IC**	**Attribute**	**Method**	**EndDeviceControlType code**	**Action requested**
0.b.96.3.10.255	Disconnect control	control_mode	remote_reconnect	*.31.0.18	Close RCD Switch
0.b.96.3.10.255	Disconnect control	control_mode	remote_disconnect	*.31.0.23	Open RCD Switch
0.b.17.0.e.255	Limiter	threshold_normal; threshold_emergency; min_over_threshold_duration; min_under_threshold_duration; emergency_profile; emergency_profile_group_id_list.	Not applicable	*.31.0.22	Disable Demand Limiting formula #1 for RCD Switch
0.b.17.0.e.255	Limiter	threshold_normal; threshold_emergency; min_over_threshold_duration; min_under_threshold_duration; emergency_profile; emergency_profile_group_id_list.	Not applicable	*.31.0.26	Enable Demand Limiting formula #2 for RCD Switch

The value of “b” denotes the measurement channel number, see IEC 62056-6-1:2015, 4.1.

The value of “e” denotes further processing or classification of quantities, see IEC 62056-6-1:2015, 4.1.

An asterisk (*) denotes any of the EndDeviceControlType values. It is assumed that the values chosen in a specific project allow the identification of the device sending the event. EndDeviceControlType values are given in IEC 61968-9:2013, Table E.1.

5.7 OBIS code mapping to CIM EndDeviceEventType enumerated code for UC8, UC9 and UC11

EndDeviceEventType codes are defined in IEC 61968-9 and the OBIS codes are defined in IEC 62056-6-1. The mapping between these two code sets is given in Table 8.

For the structure of composite OBIS codes, see IEC 62056-6-1:2015, Clause 4.

For the definition and operation of Clock IC, see IEC 62056-6-2:2016, 5.4.1.

For the definition and operation of Image transfer IC, see IEC 62056-6-2:2016, 5.3.6.

For the definition and operation of Register monitor IC, see IEC 62056-6-2:2016, 5.4.6.

For the structure of composite EndDeviceEventType codes, see IEC 61968-9:2013, Table E.8.

Table 8 – OBIS code mapped to CIM EndDeviceEventType enumerated code for UC8, UC9 and UC11

Use case	OBIS code	DLMS/COSEM context	EndDeviceEventType code	CIM context
UC8	0.b.1.0.e.255	Clock	*.36.116.58	Time synchronization of recorder
UC9	0.0.44.0.e.255	Image transfer	*.11.17.52	Firmware replaced
UC11	0.0.16.1.e.255	Alarm monitor	*.12.29.257	Intrusion detected on meter cover

The value of “b” denotes the measurement channel number, see IEC 62056-6-1:2015, 4.1.

The value of “e” denotes further processing or classification of quantities, see IEC 62056-6-1:2015, 4.1.

An asterisk (*) denotes any of the EndDeviceEventType values. It is assumed that the values chosen in a specific project allow the identification of the device sending the event. See IEC 61968-9:2013, Table E.1 for EndDeviceEventType values.

5.8 CIM attributes mapping to DLMS/COSEM attributes for UC3

Table 9 shows the mapping between CIM UML message profile attributes and corresponding COSEM IC attributes for remote tariff management UC3 as modelled in the example given in Annex A.

Table 9 – PricingStructureConfig mapped to DLMS/COSEM attributes for UC3

CIM class	CIM attribute	COSEM IC	DLMS/COSEM attribute	Context
PricingStructure	code	nothing to map	nothing to map	assign a system level identity for this pricing structure
PricingStructure	revenueKind	nothing to map	nothing to map	assign the revenue stream of this pricing structure – e.g. "residential", "commercial", "industrial", etc.
ServiceCategory	kind	nothing to map	nothing to map	assign the kind of service of this pricing structure – e.g. "electricity", "water", "gas" etc.
Tariff	mRID	nothing to map	nothing to map	assign a globally unique identifier for this tariff
Tariff	name	Register activation	mask_list	assign a name associated with this tariff
Tariff	startDate	Activity calendar	activate_passive_calendar_time	assign the date when this tariff becomes valid and active
TariffProfile	mRID	nothing to map	nothing to map	assign a globally unique identifier for this tariff profile
TariffProfile	name	Activity calendar	calendar_name_active calendar_name_passive	assign a name associated with this tariff profile
TariffProfile	tariffCycle	Single action schedule	execution_time	assign the billing cycle for this tariff profile – e.g. "daily", "weekly", "monthly", etc
TimeTariffInterval	sequenceNumber	Activity calendar	day_profile_table_passive. day_profile. day_schedule. day_profile_action	Rate1: implicitly map position in array to sequence number
TimeTariffInterval	startTime	Activity calendar	day_profile_table_passive. day_profile. day_schedule. day_profile_action. start_time	Rate1: assign starting time for day rate
TimeTariffInterval	sequenceNumber	Activity calendar	day_profile_table_passive. day_profile. day_schedule. day_profile_action	Rate2: implicitly map position in array to sequence number

CIM class	CIM attribute	COSEM IC	DLMS/COSEM attribute	Context
TimeTariffInterval	startTime	Activity calendar	day_profile_table_passive. day_profile. day_schedule. day_profile_action. start_time	Rate2: assign starting time for night rate

Annex A
(informative)

Example of a 2-rate TOU tariff

A.1 DLMS/COSEM model of a 2-rate TOU tariff example

Figure A.1 shows an example of a DLMS/COSEM model for a 2-rate TOU tariff. The Clock object drives the Activity calendar object, which drives the Tariffication Script table, which drives the Register activation object, which in turn drives the two rate Register objects.

The Activity calendar object is initialized with attribute values for calendar_name_passive, season_profile_passive, week_profile_table_passive and day_profile_table_passive. The method *activate_passive_calendar* is then invoked, which activates the calendar by copying the passive attribute values to the corresponding active attributes calendar_name_active, season_profile_active, week_profile_table_active and day_profile_table_active. There are two entries into the day_profile_table_active array – one for each rate period.

When the Clock object attribute values match the Activity calendar attribute values, then the Activity calendar object invokes the execute method of the Tariffication Script table, which in turn runs the corresponding script in the table.

The invoked script in turn interacts with the Register activation object which makes one of the masks in the mask_list attribute the active one and selects the appropriate register to activate from the register_assignment array.

According to the value of active_mask the appropriate Register object is activated where the readings for the corresponding time period gets recorded.

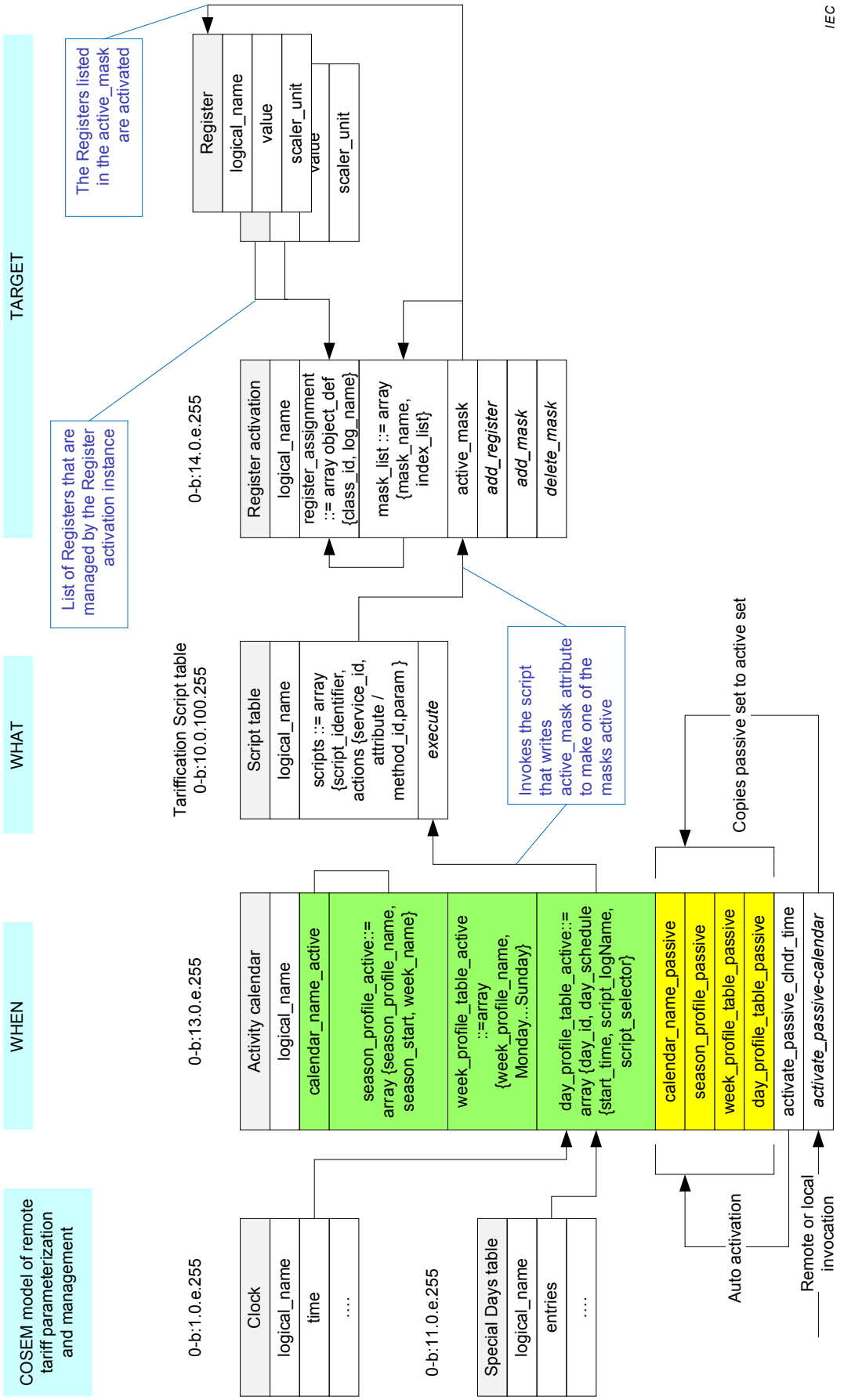

Figure A.1 – DLMS/COSEM model of a 2-rate TOU tariff example

A.2 DLMS/COSEM model example of load management by demand limits

Figure A.2 shows and example of a DLMS/COSEM model for demand limit based load management using Demand register, Clock, Limiter, Script table and Disconnect control objects. The Clock and Demand register objects drive the Limiter object, which in turn drives the Script table object, which drives the Disconnect object.

The Limiter object will operate in emergency mode when the attribute values of the emergency_profile in the Limiter object matches the attribute values of the Clock object, i.e. when the time is within the interval determined by the emergency_activation_time and emergency_duration elements of the emergency_profile. Otherwise it will operate in normal mode for all other values of the Clock object attributes.

When the current_demand attribute of the Demand register object referenced by the monitored_value attribute of the Limiter object crosses the value of the threshold_active attribute of the Limiter object, the Limiter object invokes the appropriate script in the Script table object, which in turn invokes one of the methods *remote_disconnect* or *remote_reconnect* in the Disconnect control object.

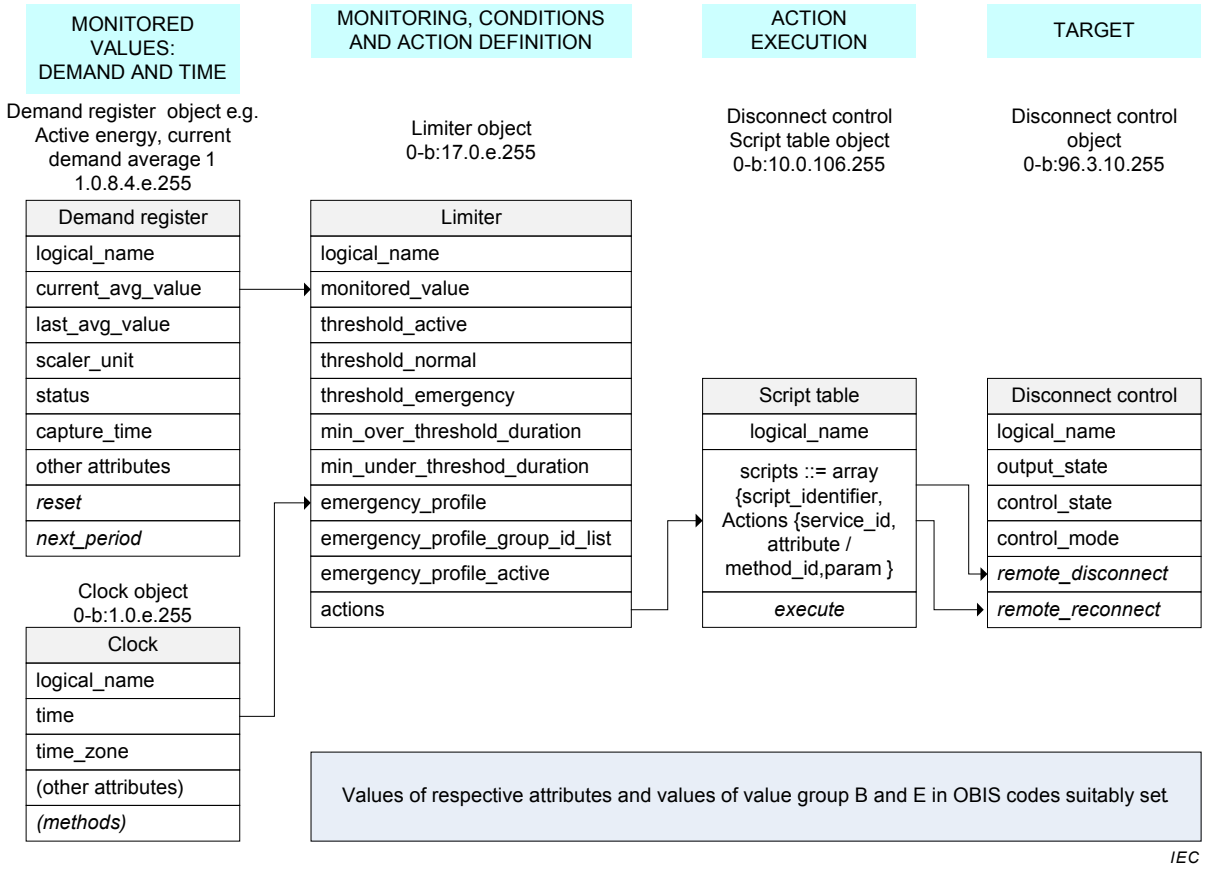

Figure A.2 – DLMS/COSEM model example of load management by demand limits

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