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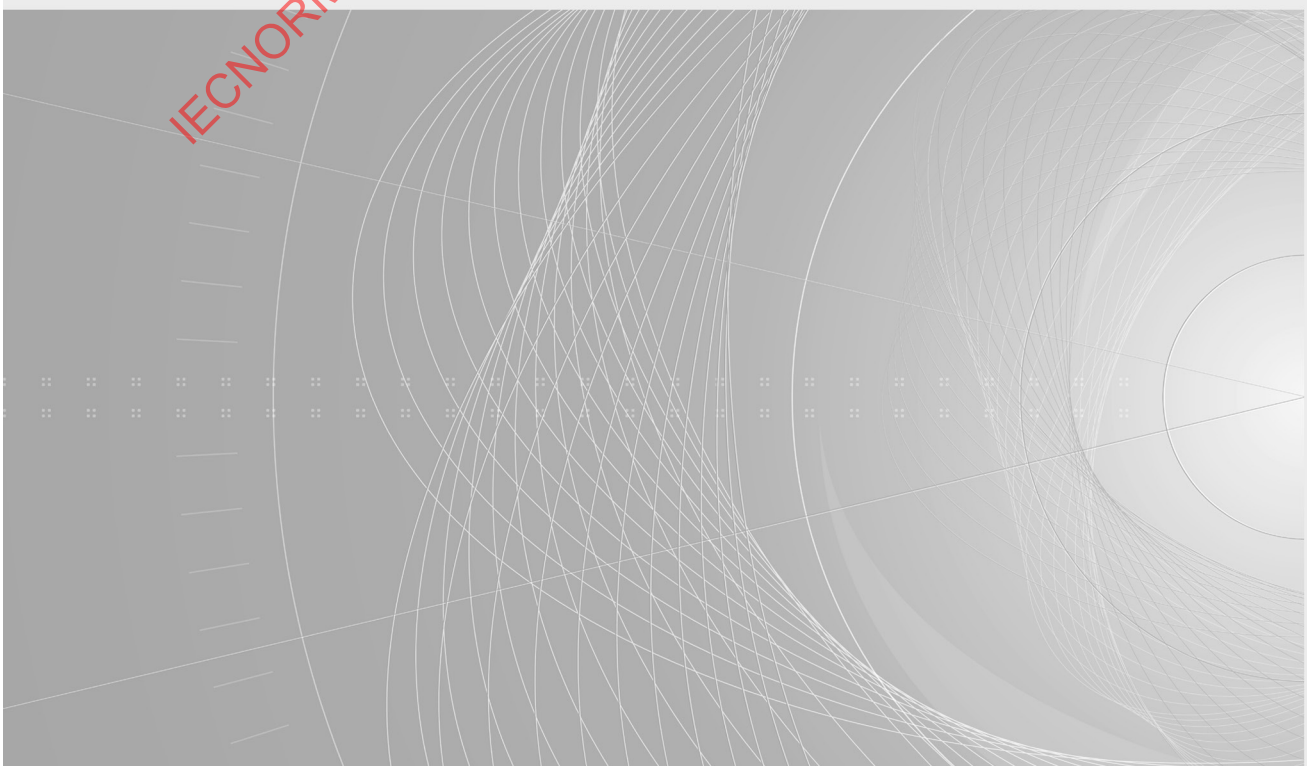
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Enterprise business function interfaces for utility operations – Part 9: Interfaces for meter reading and control

Interfaces de fonctions métier d'entreprise pour l'exploitation des services – Partie 9: Interfaces pour le relevé et la commande des compteurs



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ENTERPRISE BUSINESS FUNCTION INTERFACES FOR UTILITY OPERATIONS –

Part 9: Interfaces for meter reading and control

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IEC 61968-9 has been prepared by IEC technical committee 57: Power systems management and associated information exchange. It is an International Standard.

This third edition cancels and replaces the second edition published in 2013. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) IEC 61968-100:2022 has superseded IEC 61968-100:2013 that was used in many of the examples in IEC 61968-9:2013. Applicable portions of the current version of IEC 61968-9 have been updated to reflect message envelope and message exchange patterns specified in IEC 61968-100:2022. Although the use of IEC 61968-100 is highly recommended, it is possible to utilize IEC 61968-9 without using IEC 61968-100 message envelopes or exchange patterns. This was true for IEC 61968-9:2013 and remains true for this IEC 61968-9:2024.

b) Unless noted otherwise, the IEC 61968-9:2013 XSDs that remain in IEC 61968-9:2024 are unchanged except for changes that have been made for compatibility with IEC 61968-100:2022 as described in 61968-100:2022. This supports the abstract payload construct in the Message.xsd defined in IEC 61968-100:2022. As a result, these modified profiles have a new namespace. One notable exception is that the MeterReadSchedule.xsd has been replaced with a new MeterReadSchedules.xsd. It has structural changes to support improved functionality as described in 5.3.3. Another exception is that the GetMeterReadSchedule.xsd has been replaced with GetMeterReadSchedules.xsd. Also note that IEC 61968-8:2015 profiles listed in the table in Annex A will require edits in order to be compatible with IEC 61968-100:2022.

c) The "Verbs" listed in IEC 61968-9:2013, Annex A have been moved to IEC 61968-100:2022. Annex A now (in this third edition) instead provides a table which recommends the use of certain verbs to accompany profiles related to 61968-9;

d) The "Reply Error Codes" listed in IEC 61968:2013, Annex B have been moved to IEC 61968-100:2022. Annex B now (in this third edition) instead provides a few recommendations on how to handle certain error situations which might originate in 61968-9;

e) Customer profiles CustomerAccountConfig, CustomerAgreementConfig, CustomerConfig, GetAuxiliaryAgreementConfig, GetCustomerAccountConfig, GetCustomerAgreementConfig, GetServiceCategoryConfig, GetCustomerConfig, GetMeterServiceRequests, GetPricingStructureConfig, GetServiceLocationConfig, GetServiceSupplierConfig, MeterServiceRequests, PricingStructureConfig, ServiceCategoryConfig, ServiceLocationConfig, and ServiceSupplierConfig have been deleted from this document and moved to IEC 61968-8. However, certain references to these profiles have been retained for the sake of usability. A "MeterServiceRequest" which might by issued by a function within IEC 61968-9:2013, is now shared with 61968-8 which also could just as well have a need to issue such a request. Users of one part may have to refer to another part within the 61968 series in order to obtain a shared schema. Furthermore, certain names may change when they are moved from one part to another. For example, a "MeterServiceRequest" is now referred to as a (more generic) "ServiceRequest".;

f) Additional enumerations have been provided in the annexes for ReadingTypes (Annex C), EndDeviceEventTypes (Annex E) and EndDeviceControlTypes (Annex F);

g) Statements have been added to certain figures, tables, schemas, and enumerations throughout the document that indicate that they are reproduced with the permission of the UCA International User Group (UCAIug). These items are derived from the Common Information Model (CIM);

h) The "Conventions for naming and identifying objects" provided in IEC 61968:2013, Annex G has been deleted. The user should instead consider IEC 61968-11, *Common information model (CIM) extensions for Operation Support* or IEC 61970-301, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*. This deletion causes subsequent Annexes in IEC 61968:2013, to be renumbered in this third edition;The "Notes on extended use of IEC 61968-100" provided in Annex M of IEC 61968:2013, have been deleted. It is recommended that the reader instead obtain a copy of the most recent version of 61968-100.

i) The profiles in IEC 61968-9:2013, Annex H "(Normative) XML Schemas for Message Payloads" and IEC 61968-9:2013, Annex I "(Informative) XML Schemas for Message Payloads" have been removed from the document. Instead, there is now (in this third edition) an Annex G which provides links to the profiles at the UCAIug website,

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j) Small changes have been made to the document for better comprehension and usability;

k) Added normative and informative annexes (K,L, and M) to describe how IEC 61968-9 can be used to support European regulation regarding access to data and interoperability. In particular, these annexes describe the EUMED Metering profile, and serve to draft requirements to address provisions laid down in Articles 20, 23, and 24 of the Electricity Directive (EU) 2019/944. For more information refer to IEC 62325-451-10.

The text of this International Standard is based on the following documents:

Draft	Report on voting
57/2670/FDIS	57/2679/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

A list of all parts in the IEC 61968 series, published under the general title *Enterprise business function interfaces for utility operations*, can be found on the IEC website.

Future standards in this series will carry the new general title as cited above. Titles of existing standards in this series will be updated at the time of the next edition.

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- reconfirmed,
- withdrawn, or
- revised.

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INTRODUCTION

The purpose of this part of IEC 61968 is to define a standard for the integration of Metering Systems (MS), which would include traditional (one or two-way) Automated Meter Reading (AMR) Systems, with other systems and business functions within the scope of IEC 61968. The scope of this document is the exchange of meter reading, transactions, event and control information between systems within the utility enterprise and between enterprises. The specific details of communication protocols those systems employ are outside the scope of this document. Instead, this document will recognize and model the general capabilities that can be potentially provided by advanced and/or legacy meter infrastructures, including two-way communication capabilities such as load control, dynamic pricing, outage detection, distributed energy resource (DER) control signals and on-request read.

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ENTERPRISE BUSINESS FUNCTION INTERFACES FOR UTILITY OPERATIONS –

Part 9: Interfaces for meter reading and control

1 Scope

This part of IEC 61968 specifies the information content of a set of message types that can be used to support many of the business functions related to meter reading and control. Typical uses of the message types include meter reading, controls, events, customer data synchronization and customer switching. Although intended primarily for electrical distribution networks, IEC 61968-9 can be used for other metering applications, including non-electrical metered quantities necessary to support gas and water networks.

The purpose of this document is to define a standard for the integration of metering systems (MS), which includes traditional manual systems, and (one or two-way) automated meter reading (AMR) systems, and meter data management (MDM) systems with other enterprise systems and business functions within the scope of IEC 61968. The scope of this document is the exchange of information between metering systems, MDM systems and other systems within the utility enterprise. The specific details of communication protocols those systems employ are outside the scope of this document. Instead, this document will recognize and model the general capabilities that can be potentially provided by advanced and/or legacy meter infrastructures, including two-way communication capabilities such as load control, dynamic pricing, outage detection, distributed energy resource (DER) control signals and on-request read. In this way, this document will not be impacted by the specification, development and/or deployment of next generation meter infrastructures either through the use of standards or proprietary means.

Figure 1 describes the scope of this document from the perspective of direct and causal or indirect impacts of IEC 61968-9 messages. Where the focus of IEC 61968-9 is to define standard messages for the integration of enterprise applications, these messages may be directly or indirectly related to information flows within a broader scope. Examples would include messaging between head end systems and meters or PAN devices. The various components described later in this document will typically fall into either the category of a metering system (MS) head end, an MDM or other enterprise application (e.g. OMS, DRMS, CIS).

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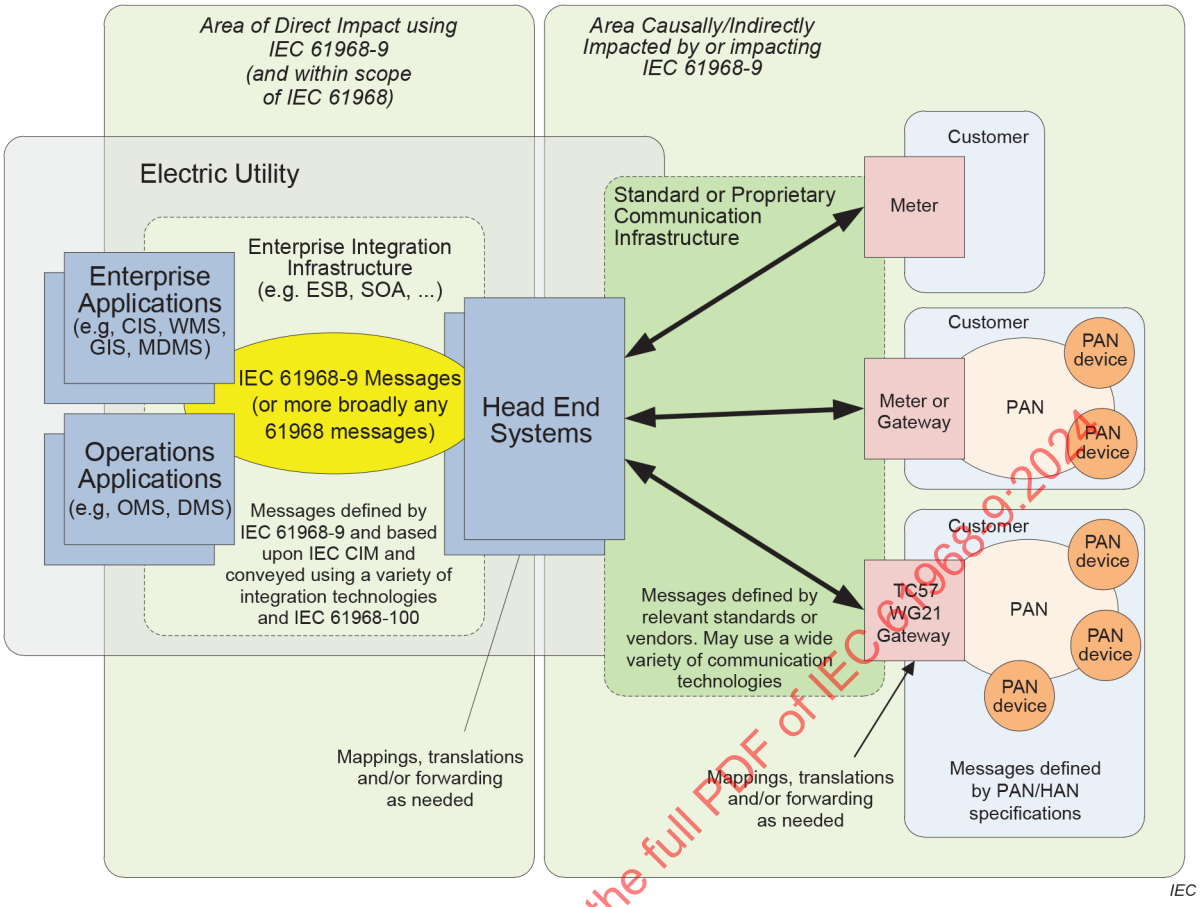


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Figure 1 – IEC 61968-9 scope

The capabilities and information provided by a meter reading and meter data management systems are important for a variety of purposes, including (but not limited to) interval data, time-based demand data, time-based energy data (usage and production), outage management, service interruption, service restoration, quality of service monitoring, distribution network analysis, distribution planning, demand response, customer billing and work management. This standard also extends the CIM (Common Information Model) to support the exchange of meter data.

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2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-112, *International Electrotechnical Vocabulary (IEV) – Part 112: Quantities and units*

IEC 60050-300, *International Electrotechnical Vocabulary (IEV) – Part 300: 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 61968-1, *Application integration at electric utilities – System interfaces for distribution management – Part 1: Interface architecture and general recommendations*

IEC TS 61968-2, *Application integration at electric utilities – System interfaces for distribution management – Part 2: Glossary*

IEC 61968-8:2015, *Application integration at electric utilities – System interfaces for distribution management – Part 8: Interfaces for customer operations*

IEC 61968-11, *Application integration at electric utilities – System interfaces for distribution management – Part 11: Common information model (CIM) extensions for distribution*

IEC 61968-100:2022, *Application integration at electric utilities – System interfaces for distribution management – Part 100: IEC implementation profiles for application integration*

IEC 61970-301, *Energy management system application program interface (EMS-API) – Part 301: Common information model (CIM) base*

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*

ISO 4217:2015, *Codes for the representation of currencies*

ISO 8601:2004, *Data Elements and Interchange Formats – Information Interchange – Representation of Dates and Times*

CIM Meter Reading and Control Profile Messages, Edition 3, available at https://cimug.ucaiug.org

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60050-300, IEC TS 61968-2, IEC TR 62051-1, IEC 62055-31 and the following apply.

Where there is a difference between the definitions in this document and those contained in other referenced IEC standards, then those defined in IEC TS 61968-2 shall take precedence over the others listed, and those defined in IEC 61968-9 shall take precedence over those defined in IEC TS 61968-2.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.1.1
demand response
set of processes and programs that are used to reduce consumption

Note 1 to entry: This may be done on an economic, mandatory or emergency basis.

3.1.2
end device
equipment located at the end of the communication system, usually on the customer premises

Note 1 to entry: An end device may perform functions such as metrology, connect/disconnect, load control, demand response, or other functions, and may have power relay and/or local communications capability. This is represented within the CIM using the EndDevice class. Meters and PAN devices are examples of end devices.

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3.1.3
head end
component of a metering system that collects data from and issues controls to end devices

Note 1 to entry: A head end may also manage the communication system used to communicate with the end devices. From the perspective of enterprise integration, the head end acts as a proxy for end devices.

3.1.4
gateway
device that may be used to manage devices on a PAN and participate in internet-based interactions

Note 1 to entry: A gateway may apply a transformation from one protocol to another.

3.1.5
load control device
type of EndDevice which can receive signals causing it to shed load for the purposes of maintaining network reliability and/or commercial agreements

3.1.6
meter
type of end device which performs metrology and supports the tariffing of the distribution and/or transmission network

Note 1 to entry: This is represented using the CIM Meter class, which is a subclass of EndDevice.

Note 2 to entry: As an end device, a meter will typically, but not always, have a communication link with a head end system.

3.1.7
meter changeout
meter exchange
process of replacing an existing meter with a new meter

Note 1 to entry: The installer will customarily follow a work order which specifies a given location, and usually requires that he or she capture readings from the old and new meters, and record the time and day in which the work was performed.

3.1.8
meter data manager
system that manages meter data, and typically provides a variety of value added functionalities such as VEE

3.1.9
premises area network
fully inclusive of the scope of a home area network (HAN) as it also covers commercial premises

3.1.10
PAN device
type of end device that is located on a customer premises and communicates using a PAN

Note 1 to entry: A PAN device can typically accept controls and/or report events.

Note 2 to entry: PAN devices commonly use meters as communication gateways.

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3.2 Abbreviated terms

AM	asset management
AMR	automated meter reading
AMI	advanced metering infrastructure
CIM	common information model
CIS	customer information system
COSEM	companion specification for energy metering
DLMS UA	device language message specification user association
DMS	distribution management system
DR	demand response
DRMS	demand response management system
HAN	home area network
IDR	interval data recorder
IEC	International Electrotechnical Commission
LC	load control
LDC	load control system
LMS	load management system
MAM	meter asset management
MDM	meter data management
MDM	master data management
MM	meter maintenance
MR	meter reading
MS	metering system
NO	network operations
OMS	outage management system
POS	point of sale
PAN	premises area network (includes scope of HAN)
RF	radio frequency
SM	smart meter
UML	unified modeling language
VEE	validating, editing, and estimating
WM	work management
XSD	XML schema

4 Reference and information models

4.1 General approach to messaging

This document does not specify a particular technology to represent text, nor does it specify a particular technology to transport messages. However IEC 61968-100 is highly recommended.

Any use of IEC 61968-100:2022 for IEC 61968-9 related messaging should use the corresponding schemas provided in Annex G. The XSDs in Annex G include modifications for compatibility with IEC 61968-100:2022. Refer to IEC 61968-100:2022, Annex C for a description of these changes and a pointer to a tool that can be used to make the required modifications. The referenced tool is open source, Apache licensed, and maintained by UCAIug.

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4.2 General approach to metering systems

The spinning disk in an electromechanical meter generally serves as a pulse initiator to the meter recorder module. In a similar fashion, solid-state meters may also employ a metrology unit that generates pulses which represent a fraction of a kWh, and if more sophisticated, the solid-state meter may have a meter recorder which is able to accumulate many different kinds of information and store it for presentation to the meter communications module using a message and table-driven protocol such as ANSI C12.19 or IEC 62056.

The most common metered data element is kWh, but many electricity meters can also capture kW, kVAr, kVArh, and other similar billing quantities. Some meters can also capture pure engineering quantities such as voltage, current, power factor, etc.

Some AMR systems attempt to add value to meters by adding functionality that the meter may lack. For simple meters (e.g. energy only) it is common for an AMR meter module to add the capability to perform demand metering, Interval Data Recording (IDR), maintain an energisation count, or even provide estimates of certain engineering quantities such as voltage.

Commercial and industrial meters often employ current transformers and voltage transformers to meter the actual service. Primary voltages and currents are scaled down using potential transformers (PTs) and current transformers (CTs) so that the meter does not have to be constructed to withstand the high voltages and currents actually delivered to the load. Secondary voltage or current values are those that are often measured directly by the meter. Secondary values are small percentage of the primary values that may actually delivered to or connected to the load. If secondary voltages and currents are measured by the meter, these can be converted back to primary values using the PT and CT ratios, which are just the ratio of primary to secondary values.

The metering system will convey meter data and other value-added data through the metering system network to the destination. Depending on the system, the journey may involve multiple steps through public or private networks, licensed or unlicensed RF spectrums, standardized or proprietary systems, in a one-way or two-way fashion.

Some general operations or services can be defined for a metering system. These general operations will translate to specific actions in the context of a given metering solution.

General operations can be scheduled or called on-demand. Each operation returns an answer with an optional status. A message encapsulates a general operation.

Readers of IEC 61968-9 interested in additional information may refer to other documents including IEC 62056, DLMS UA (Device Language Message Specification User Association) and the COSEM model: COmpanion Specification for Energy Metering.

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4.3 Meter reading and control functions and components

It should be noted that the message types defined in this document may be sent or received by any type of component within a distribution management system (DMS) system.

Table 1 shows these functions and typical abstract components that are expected to be producers of information for these message types. Typical consumers of the information include, but are not restricted to, the other components as listed in IEC 61968-1.

Table 1 – Business functions and abstract components

Business functions	Business sub-functions	Abstract components
Meter reading and control (MR)	Metering system (MS)	Data collection
		End point controls
		End point reconfiguration
		Disconnect/reconnect
		Demand reset
		On request read
		Point of sale
		Outage detection and restoration verification
		Power reliability and quality events
		Metering system events
	Meter maintenance and asset management	End point install, configure, remove, repair, disconnect, reconnect
		End point asset history
		End point reconfiguration
		Special read
		Meter service request
		Tariffs
	Meter data management (MDM)	Meter data repository
		Usage history
		Validation, estimation and editing
		Customer billing data
		End device controls and events
	Demand response (DR)	Real-time pricing
		Emergency reductions
		Economic reductions
		Program registration
	Load management (LM)	Load analysis
		Load control
		Demand response
		Performance measurements
		Risk management

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4.4 Static information model

4.4.1 General

The information model relevant to meter reading and control consists of classes that provide a template for the attributes for each message.

The classes are defined in detail in IEC 61968-11, *Common Information Model (CIM) extensions for distribution* or in IEC 61970-301, *Energy management system application program interfaces – Common Information Model core.*

4.4.2 Classes for meter reading and control

Table 2 lists classes used within message types. Usually all the attributes of these classes are contained within a message type. The descriptions provided describe usage within this document.

Classes described as type "Asset" are defined in the 61968/Assets package of the CIM.

Classes described as type "Metering" are defined in the 61968/Metering package of the CIM.

Classes described as type "Profile" are contextual profiles defined for 61968-9 that describe message definitions defined using CIM objects.

Table 2 – Classes for meter reading and control

Class/Noun	Type	Description
Channel	Metering	A single path for the collection or reporting of register values over a period of time. For example, a register which measures forward energy can have two channels, one providing bulk quantity readings and the other providing interval readings of a fixed interval size.
ComFunction	Metering	Communication function of communication equipment or a device such as a meter.
ComModuleConfig	Profile	Profile for configuring communications modules.
ConfigurationEvent	Metering	Used to report details on creation, change or deletion of an entity or its configuration.
DemandResponseProgram	Metering	Demand response program.
DeviceFunction	Metering	Function performed by a device such as a meter, communication equipment, controllers, etc.
EndDevice	Metering	The EndDevice is equipment that performs the role of an end device. It may contain functionality such as metrology, communications, load control, connect/disconnect, or other capabilities. It is known as "the meter", "a smart meter", an "advanced meter", "air conditioner", "refrigerator", "pool pump", etc. that a CommModule and/or Meter may monitor and/or control. The asset may be owned by a consumer, a service provider, utility or other party.
EndDeviceConfig	Profile	Message used to convey descriptions of one or more EndDevices.
EndDeviceControl	Metering	Used to issue commands to EndDevices such as meters. May be addressed by EndDevice or by EndDeviceGroup. EndDeviceControls may have control types and parameters.
EndDeviceControls	Profile	Message used to convey one or more EndDeviceControls
EndDeviceControlType	Metering	Defines types of EndDeviceControls
EndDeviceEvent	Metering	Used to report events detected by end devices such as meters. Each EndDeviceEvent has an event type and a timestamp.
EndDeviceEvents	Profile	Message used to convey one or more EndDeviceEvents.
EndDeviceEventType	Metering	Defines types of EndDeviceEvents
EndDeviceFirmware	Profile	Profile for EndDevice firmware configuration messages.
EndDeviceGroup	Metering	An EndDeviceGroup is used for grouping end devices for a variety of purposes including, but not limited to, load control and other types of demand response. An EndDeviceGroup may belong to another EndDeviceGroup, and an end device may belong to zero or more EndDeviceGroups. In some cases the group ID is maintained within the end device, but in other cases it can be managed by a metering system.
EndDeviceGroups	Profile	Use to convey changes in group membership

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Class/Noun	Type	Description
GetComModuleConfig	Profile	Each profile will have a corresponding ""Get" profile that is used to convey parameters on GET requests. See Annex G.
GetCustomerMeterDataSet		
GetEndDeviceConfig		
GetEndDeviceControls		
GetEndDeviceEvents		
GetEndDeviceGroups		
GetMeterConfig		
GetMeterReadings		
GetMeterReadSchedule		
GetUsagePointConfig		
GetUsagePointGroups		
GetUsagePointLocationConfig		
IntervalBlock	Metering	Time sequence of Readings of the same ReadingType. Contained IntervalReadings may need conversion through the application of an offset and a scalar defined in associated Pending.
IntervalReading	Metering	Data captured at regular intervals of time. Interval data could be captured as incremental data, absolute data, or relative data. The source for the data is usually a tariff quantity or an engineering quantity. Data is typically captured in time-tagged, uniform, fixed-length intervals of 5, 10, 15, 30, or 60 minutes. NOTE Interval Data is sometimes also called "Interval Data Readings" (IDR).
LegacyObjectIdentificationRevisionSets	Part 100	This profile is used to create, change, or delete identifiers of CIM objects as described in IEC 61968-100:2022. It replaces the ObjectNamesConfig that previously existed in IEC 61968-9:2013.
MasterDataLinkageConfig	Profile	A message profile used to establish or modify relationships between objects.
Meter	Metering	The Meter class is used to describe meters. A Meter is a type of EndDevice typically used to measure and potentially monitor a customer load. The EndDevice class definition should be used as the basis for Meter class.
MeterConfig	Profile	Message profile for Meter configuration messages.
MeterReading	Metering	A set of values obtained from the meter. Each MeterReading may have multiple ReadingTypes, and each ReadingType may contain multiple values.
MeterReadings	Profile	Profile for conveying MeterReadings.
MeterReadSchedules	Profile	A MeterReadSchedules message is used to schedule meter readings.
MeterServiceRequests	Shared with Part 8.	A meter service request is a type of work that can be used for a variety of meter service related activities. These activities would include meter installation, meter change out, customer disconnect/reconnect, , etc. The user is referred to 61968-8 for the profile for ServiceRequests.
Pending	Metering	When present, a scalar conversion that is associatied with IntervalBlock and which needs to be applied to every contained IntervalReading value. This conversion results in a new associated ReadingType, reflecting the true dimensions of interval reading values after the conversion.
Reading	Metering	Specific value measured by a meter or other asset. Each Reading is associated with a specific ReadingType.

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Class/Noun	Type	Description
ReadingQuality	Metering	Quality of a specific reading value or interval reading value. Note that more than one Quality may be applicable to a given Reading. Typically not unsed unless problems or unusual conditions occur (i.e., quality for each Reading is assumed to be 'Good' unless stated otherwise in associated ReadingQuality).
ReadingQualityType	Metering	Defines types for qualities that can be associated with a reading value.
ReadingType	Metering	Type of data conveyed by a specific Reading.
Register	Metering	Display for quantity that is metered on an end device such as a meter.
SimpleEndDeviceFunction	Metering	Simple end device function distinguished by 'kind'; use this class for instances that cannot be represented by another end device function subtype.
UsagePointLocation	Metering	Location of an individual usage point. For residential or most businesses, it is typically the location of a meter on the customer's premises. For transmission, it is the point(s) of interconnection on the transmission provider's transmission system where capacity and/or energy transmitted by the transmission provider is made available to the receiving party. The point(s) of delivery is specified in the service agreement.
UsagePointLocationConfig	Profile	Message used to establish associations to UsagePointLocations.
UsagePoint	Metering	Logical point on a Distribution Network to which Meter Readings and/or End Device Events can be attributed. Used at the place where a physical or virtual meter may be located; however, it is not required that a Meter be present.
UsagePointConfig	Profile	Message used to establish associations to UsagePoints.
UsagePointGroup	Metering	Abstraction for management of group communications within a two-way AMR system or the data for a group of related usage points. Commands can be issued to all of the usage points that belong to a usage point group using a defined group address and the underlying AMR communication infrastructure.
UsagePointGroups	Profile	Message used to establish UsagePointGroups.

4.4.3 Classes related to meter reading and control

Table 3 lists those classes that are associated with meter reading and control classes but only the name of an instance is given within messages defined in this document. The detailed attributes of these classes are used in message types defined in other parts of IEC 61968.

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Table 3 – Classes related to meter reading and control

Related Class	Reference	Description
Organisation	Common	This class is used to identify companies or divisions within companies. Organisations might have roles as utilities, contractors, suppliers, manufacturers, etc.
PowerSystemResource	Core (IEC 61970-301)	An entity that describes the logical view of a component part of the utility business. PowerSystemResources are further classified as EquipmentContainers e.g. Substations, ConductingEquipment, ProtectionEquipment etc. Instances of type PowerSystemResource may be related to instances of type Asset.
PowerTransformer	Wires (IEC 61970-301)	An electrical device consisting of two or more coupled windings, with or without a magnetic core, for introducing mutual coupling between electric circuits. Transformers can be used to control voltage and phase shift (MW flow).
ServiceLocation	Customers	A customer ServiceLocation has one or more UsagePoint(s). Meters are related to a UsagePoint. The location may be a point or a polygon depending on the specific circumstances For distribution, the ServiceLocation is typically the location of the utility customer's premises. Because a customer"s premises may have one or more meters, the UsagePoint is used to define the actual conducting equipment that the EndDevice attaches to at the utility customer"s ServiceLocation. For transmission, it is the point(s) of interconnection on the transmission provider's transmission system where capacity and/or energy transmitted by the transmission provider is made available to the receiving party.
TransformerTank	Wires (IEC 61970-301)	A transformer winding.
NOTE The class definitions provided here are for convenience purposes only. The normative definitions are provided by IEC 61968-11, which describes the distribution extensions to the IEC CIM.		

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5 Meter reading and control message types

5.1 General

The purpose of this Clause 5 is to describe the message types related to IEC 61968-9. It is important to note that some of these message types may also be used by other parts of IEC 61968. The general approach to the realization of message structures and XML schemas for IEC 61968 messages is described in IEC 61968-1 and IEC 61968-100.

Although they may be represented in sequence diagrams for context and completeness, this document does not describe message formats that are defined by other parts of IEC 61968. The message payload structures defined by this part of IEC 61968 are described in Clause 5.

The normative XML schemas for messages defined by this part are provided in Annex G, providing more detailed, annotated descriptions of the message structures. Message structures are diagrammed within Clause 5. The notation convention shows required elements with a solid outline, and optional elements with dashed outlines.

It is also important to note that the use cases and sequence diagrams provided in this document are informative in nature, and are intended to provide examples of usage for the normative messages definitions. There is no intent by this document to standardize specific business processes.

5.2 End device event messages

5.2.1 General

An event is a report of a change of state that may be of potential interest. End device event messages are designed as a means to convey changes in the state of an end device, either by the end device itself or by a proxy on behalf of an end device. End device events are viewed as a potential data stream which is not necessarily synchronized to the collection of meter reading for billing purposes. However, it may still be relevant to the billing process. A meter health alarm might be so severe that all readings from the meter have to be considered invalid. The data consumer (e.g. the MDM System) may receive the available relevant event data, and consider such during the validation, editing, and estimation process. It may also report event data to other enterprise systems and use the data to initiate actions such as creation of a MeterServiceRequest to repair or exchange a faulty meter.

5.2.2 Applications

5.2.2.1 General

This document views "events" as being different than "statuses." Most MR systems do not guarantee a timely delivery of an EndDeviceEvent. A "status" on the other hand is only useful if it is fresh. The status of an EndDevice is generally obtained using an "OnRequest" GetMeterReadings. The report of an EndDeviceEvent will eventually arrive to the utility back office and will be processed in turn. This implies that different applications will naturally fall into different types of message exchanges depending on both the underlying communication technology used by the MR system, as well as the need for having timely data. Some systems may have the ability to report an outage as an event. Other systems may treat it as a status. Most MR systems will report a change to meter health as an event, some may require it to be read as a status. Similarly most MR systems will report power quality as an event although some may treat it as a status.

5.2.2.2 Outage detection

When an outage is not due to a SCADA trip, electric utilities typically depend on the calls from the customers to identify the location of the fault. However, the use of a MS can provide another means to identify the location of trouble. It is often possible for a MS to determine that it has lost contact with a meter, in which case this can be reported as an EndDeviceEvent for potential use by an outage management system. It is important to note that loss of communications with a meter may not be sufficient to identify the existence of an outage, as it is common for some MS technologies to occasionally lose contact with meters for brief periods of time.

Some MS systems may be prone to false alarms as a result of the particular technology used to communicate with the meters. Many vendors are working to improve their technology and the accuracy of the data. The MDM, much like the role it sometimes plays in cleaning up metered data for billing applications, in many instances, can also play a role in cleaning up outage data supplied by the MS before it is relayed to the OMS. Such a decision, to route outage data through the MDM, depends on the capability of the MS to supply accurate data, the ability of the MDM to clean up data without introducing excessive delays, and the ability of the OMS to tolerate false alarms and delays. To support outage analysis and filtering of bad data, the MS may supply audit-trail data and quality of measurement data for the outage event, much like it supplies audit-trail data for billing reads.

Figure 2 describes a deployment in which the MDM is employed to broker outage information.

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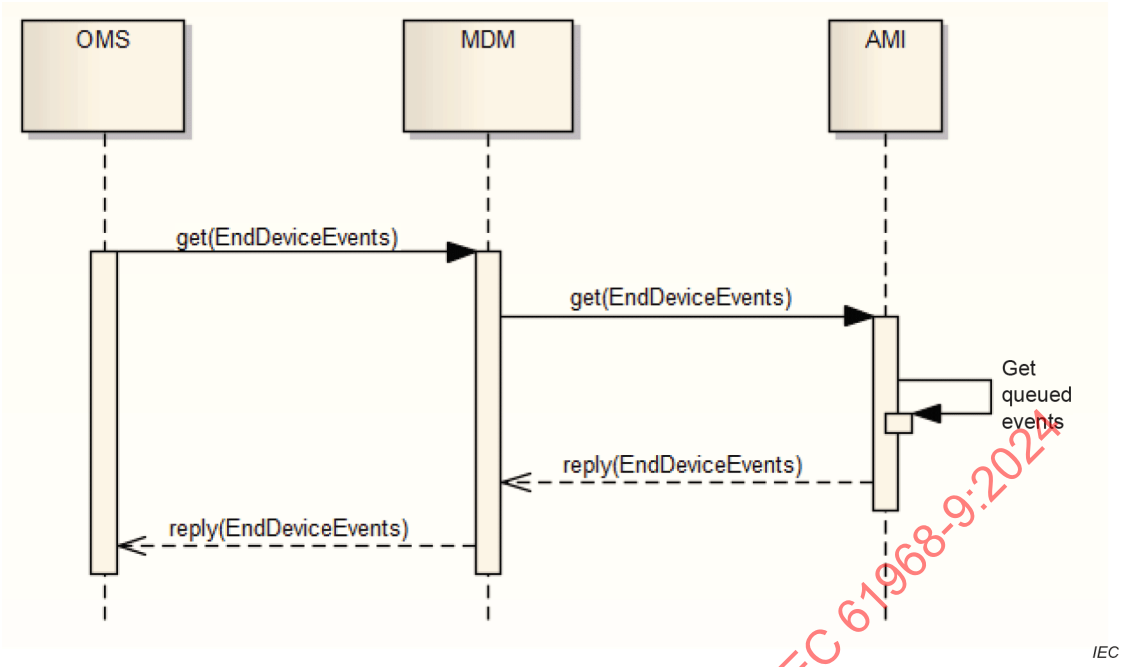


Figure 2 reproduced with the permission of UCAIug.

Figure 2 – Outage Detection, request/reply message exchange, Example 1

Outage management systems analyze the circuit in terms of network topology. The EndDeviceEventType can indicate an event as detected by an end device for consideration in the analysis, as well as other information such as trouble tickets. Where an EndDeviceEvent can indicate a condition of interest that may in fact be an outage, an outage is usually the consequence of outage analysis within an OMS that will group potentially many events together within a single outage.

The use of an MDM to broker outage data is at the discretion of the utility. In some deployments, the outage detection request from the OMS may be issued directly to the MS as in the example of Figure 3.

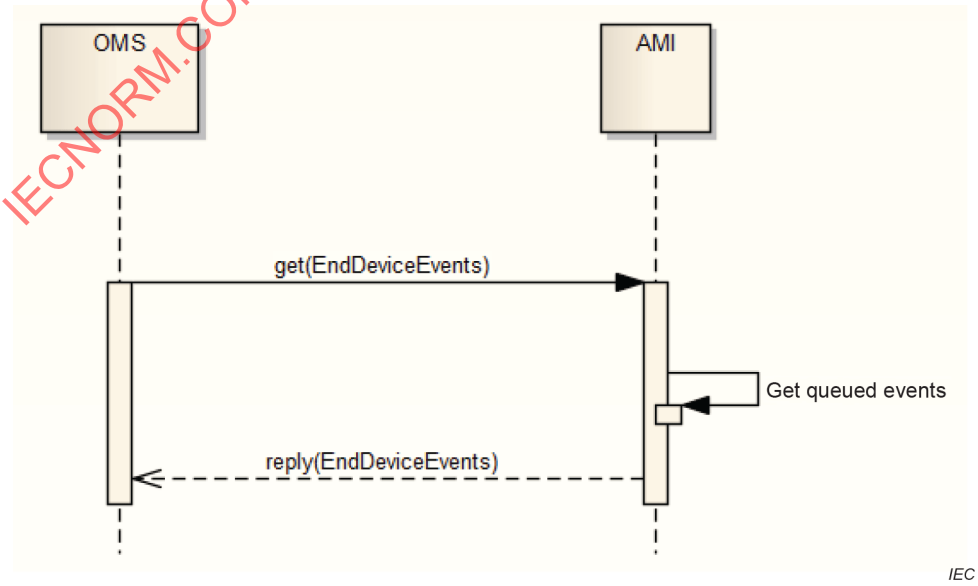


Figure 3 reproduced with the permission of UCAIug.

Figure 3 – Outage Detection, request / reply message exchange, Example 2

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A reply (synchronous or asynchronous) from the MS will likely be in the form of zero or more EndDeviceEvents. The mRID or names structure will identify the end devices (e.g. meters) affected by the outage or restoration. Some data consumers that interact with the MS might only know how to deal with meter IDs. Depending on the deployment, it may be required to limit the scope of exchanged mRIDs to that of meters IDs using the Name class and not to that of power system resources in general. EndDeviceEvent.status can indicate "live" or "dead". Some metering systems may supplement the status information with collaborative evidence using the EndDeviceEventDetails class. EndDeviceEventType can be used to indicate that the status applies to a meter or power transformer. The reason for the event can be described (e.g. EndDeviceEvent.reason = "consecutiveFailCounter") and quantified (e.g. EndDeviceEvent.severity = "3").

While the request/reply exchange is useful whenever the OMS needs supplementary information, some MS are able to self-detect outages. A pub/sub exchange is ideal in these situations. Figure 4 shows such an exchange at a deployment where the MDM serves as an information broker. Figure 5 shows a deployment with information going directly from the MS to the OMS.

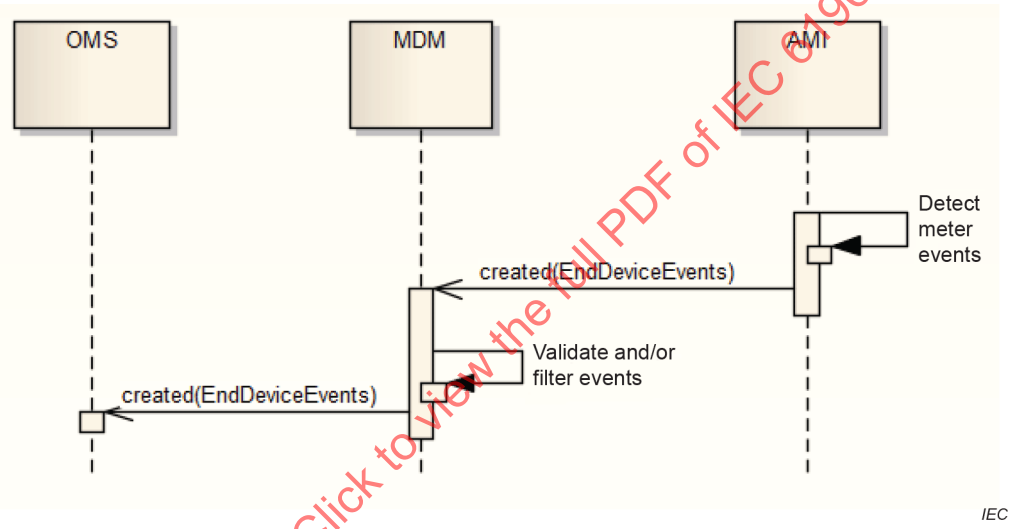


Figure 4 reproduced with the permission of UCAIug.

Figure 4 – Outage Detection, publish/subscribe exchange, Example 1

The sequence diagram in Figure 5 shows an example of event propagation without the use of an MDM.

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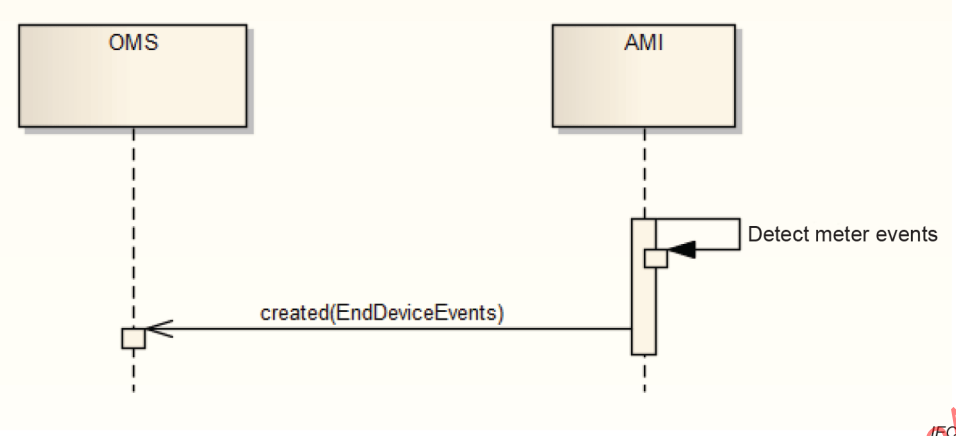


Figure 5 reproduced with the permission of UCAIug.

Figure 5 – Outage Detection, publish/subscribe exchange, Example 2

Some deployments may wish to limit the number of interfaces supported. The MeterReadings message structure also provides the means to convey EndDeviceEvents.

The preceding examples reflect the exchange of end device event messages to support outage management functions. As discussed previously, it is also frequently desirable to have an Outage Management System or MDM System make an on-demand read request to the Metering System to obtain the current energization status of a device. This is accomplished using a get(MeterReadings) exchange as described in 5.3. In such cases, the ReadingType (see Annex C) requested will indicate that it is the energization state that is being requested.

5.2.2.3 Meter Health Events

Some types of meters can sometimes generate meter health events, which can be used to identify issues with meter hardware, configuration or connection that should be resolved. The alarms include such things as diagnostic alarms, tamper alarms, or other unusual conditions. The severity of the alarm might range from a simple notification to "fatal". Often times, resolution of meter health events require a site visit, so typically they result in the creation of a MeterServiceRequest. Meter Health Events events are communicated using EndDeviceEvent messages.

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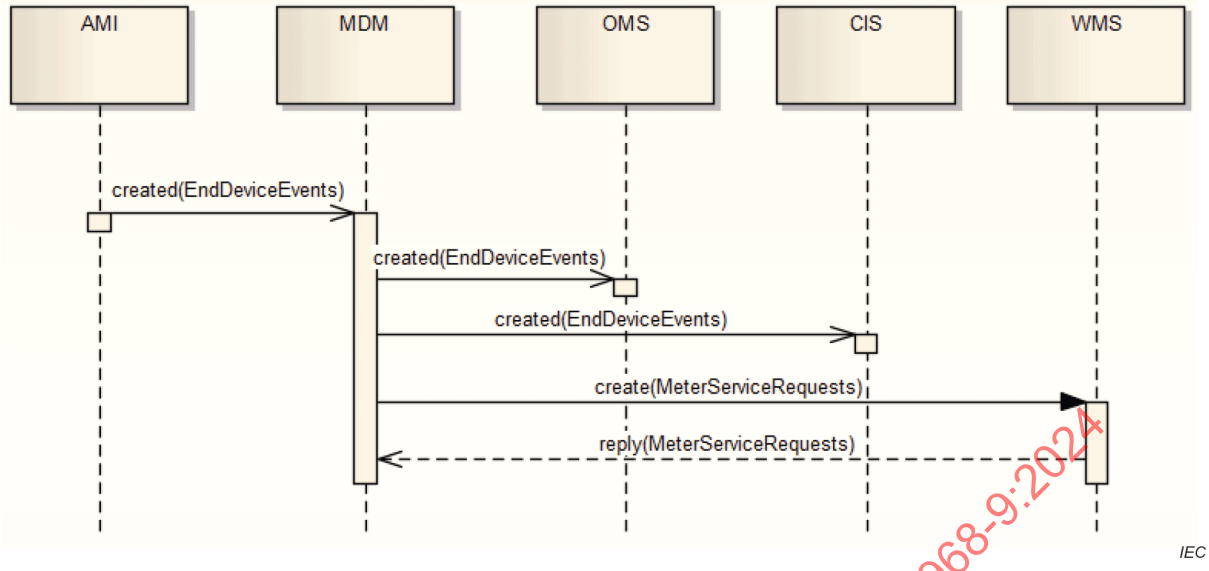


Figure 6 reproduced with the permission of UCAIug.

Figure 6 – Meter Health Event exchange, Example 1

In some deployments, the MDM will be present to broker meter health data for other stakeholders and potentially take action to initiate corrective actions as described in the scenario of Figure 6. Other installations however might not have an MDM or use it in this way. It is possible for the MS to publish data directly to the stakeholders that are equipped to receive it. Such an exchange is depicted in Figure 7.

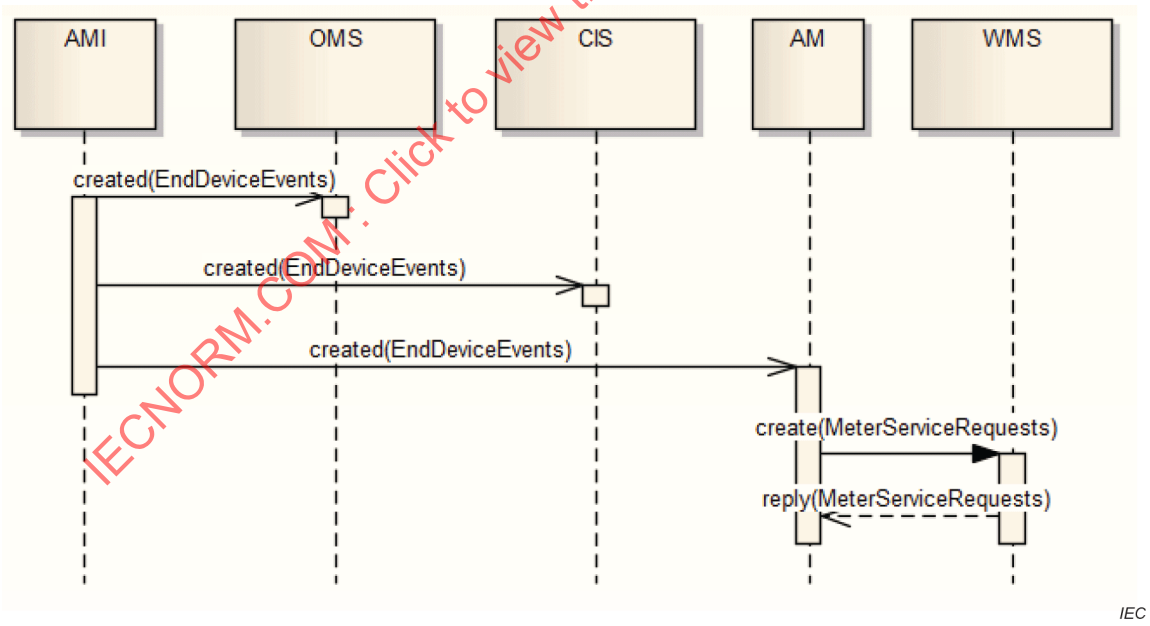


Figure 7 reproduced with the permission of UCAIug.

Figure 7 – Meter Health Event exchange, Example 2

5.2.2.4 Power Quality Event

Meters may collect information related to power quality, including but not limited to, momentary outage events, sustained outage events, low or high voltage events, and high distortion events. This information could be used for outage analysis, maintenance scheduling or capacity planning. Power quality events are a subtype of EndDeviceEvent.

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Power quality events may be brokered (i.e. publications managed) by an MDM (as described in Figure 8), or sent directly to the various stakeholders (as described in Figure 9).

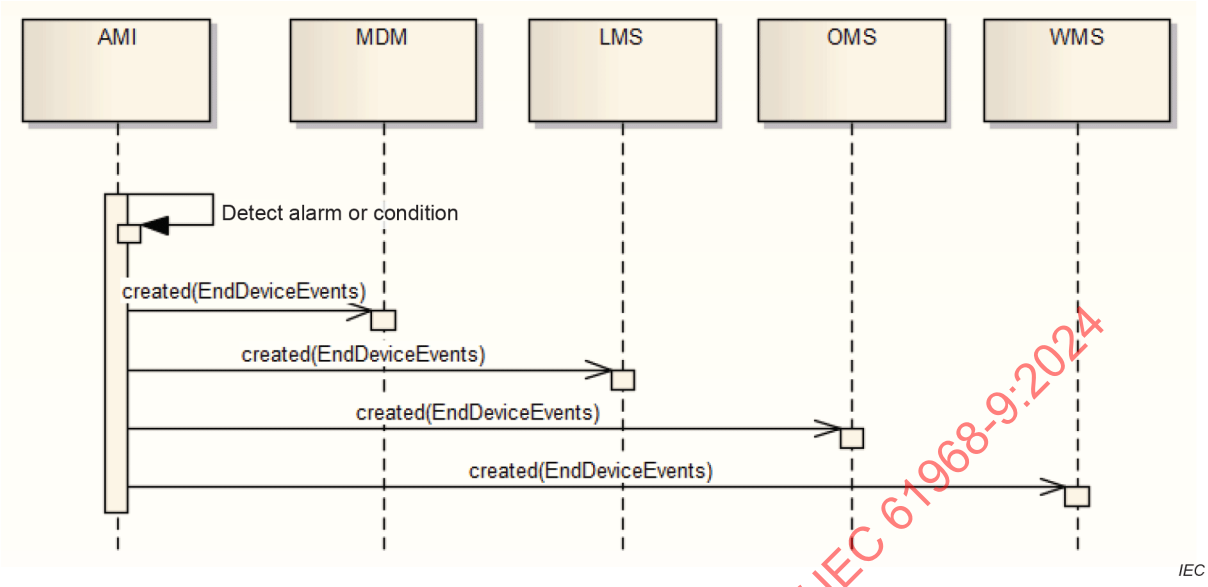


Figure 8 reproduced with the permission of UCAIug.

Figure 8 – Power quality event exchange, Example 1

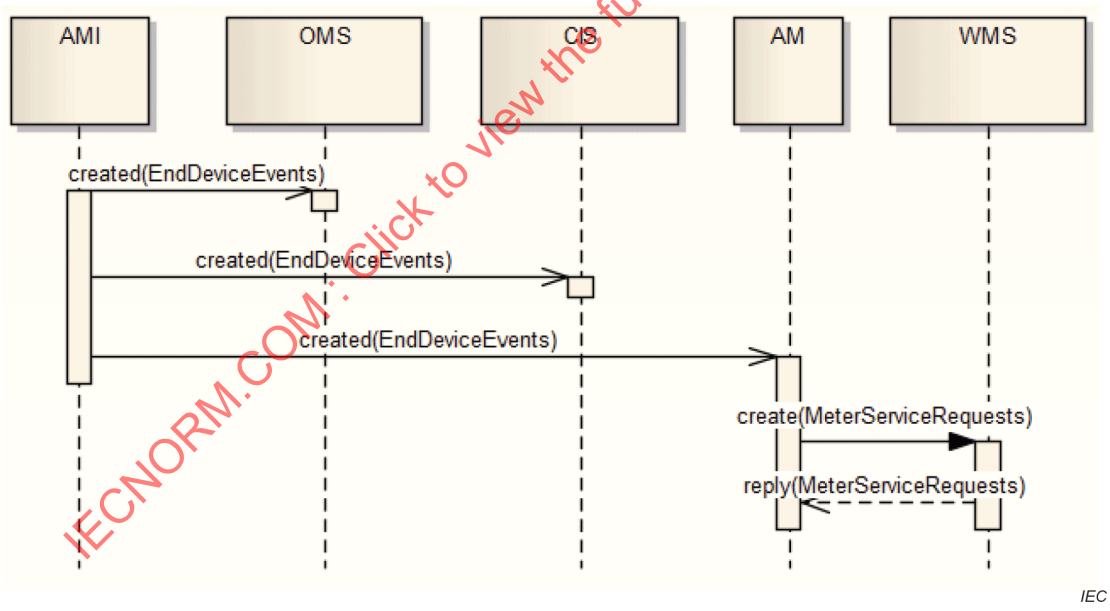


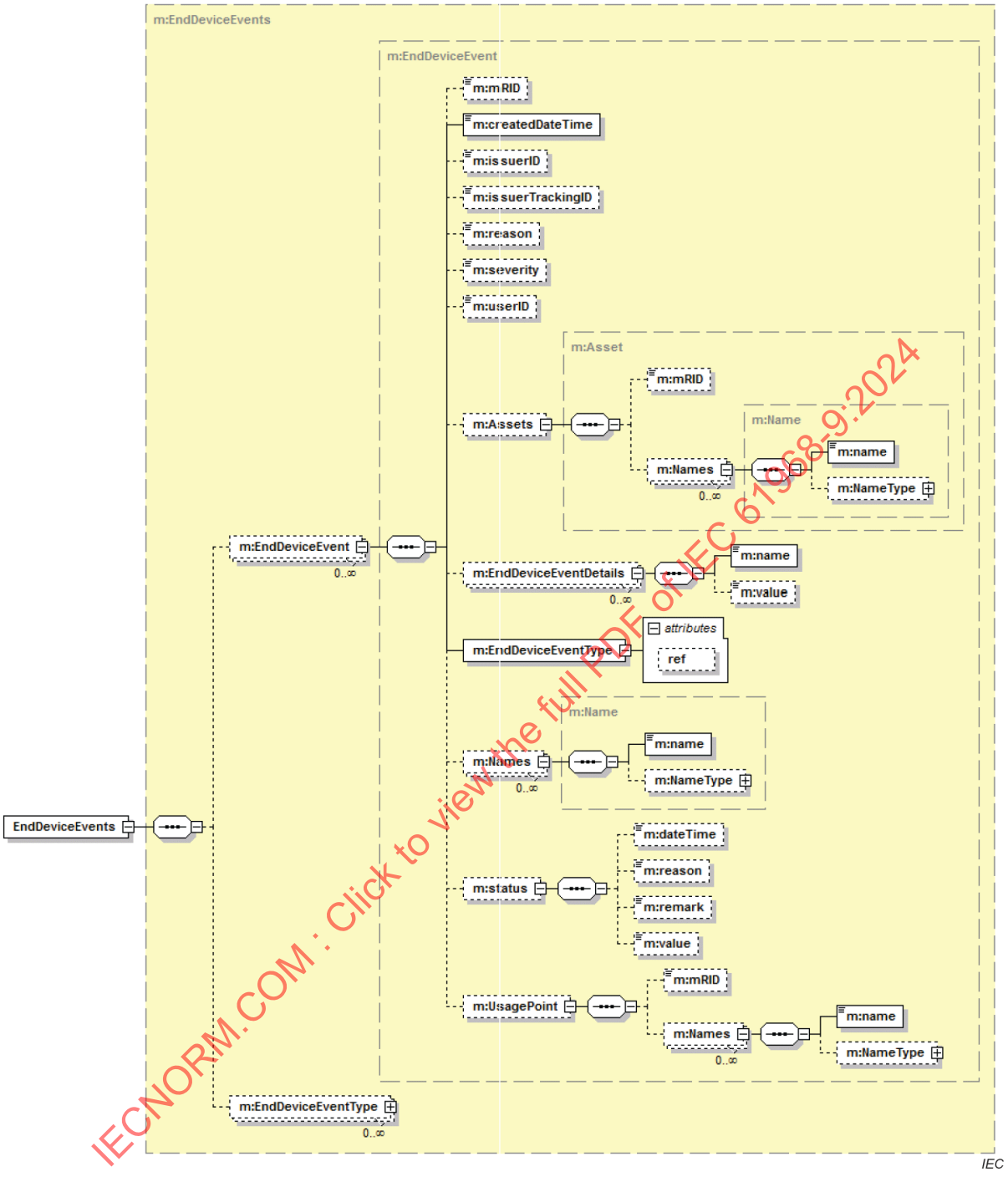
Figure 9 reproduced with the permission of UCAIug.

Figure 9 – Power quality event exchange, Example 2

5.2.3 Message format

Meter event messages are implemented using EndDeviceEvent structures in order to support a wider variety of event sources than just meters. The EndDeviceEvent.EndDeviceEventType (see Annex E) is a reference to an enumeration which indicates the type of event, such as outage detection, meter health, or power quality. The timestamp and mRID or a unique name of the end device are also required. The message format is described in Figure 10.

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Figure 10 reproduced with the permission of UCAIug.

Figure 10 – End device event message format

As noted by Figure 10, only the timestamp and EndDeviceEventType elements are required, along with either an mRID or a unique name of the end device. The EndDeviceEventType element will allow different event types (e.g. meter health, outage detection, etc.) to be differentiated. Different event types would allow for an EndDeviceEvent message to convey events related (including but not limited) to:

Sustained outage detection

Momentary outage detection

Low voltage threshold detection

High voltage threshold detection

Distortion

Meter health

Tamper detection

Revenue event

The detailed XML schema is provided in Annex G. The following is an XML example for an EndDeviceEvent.

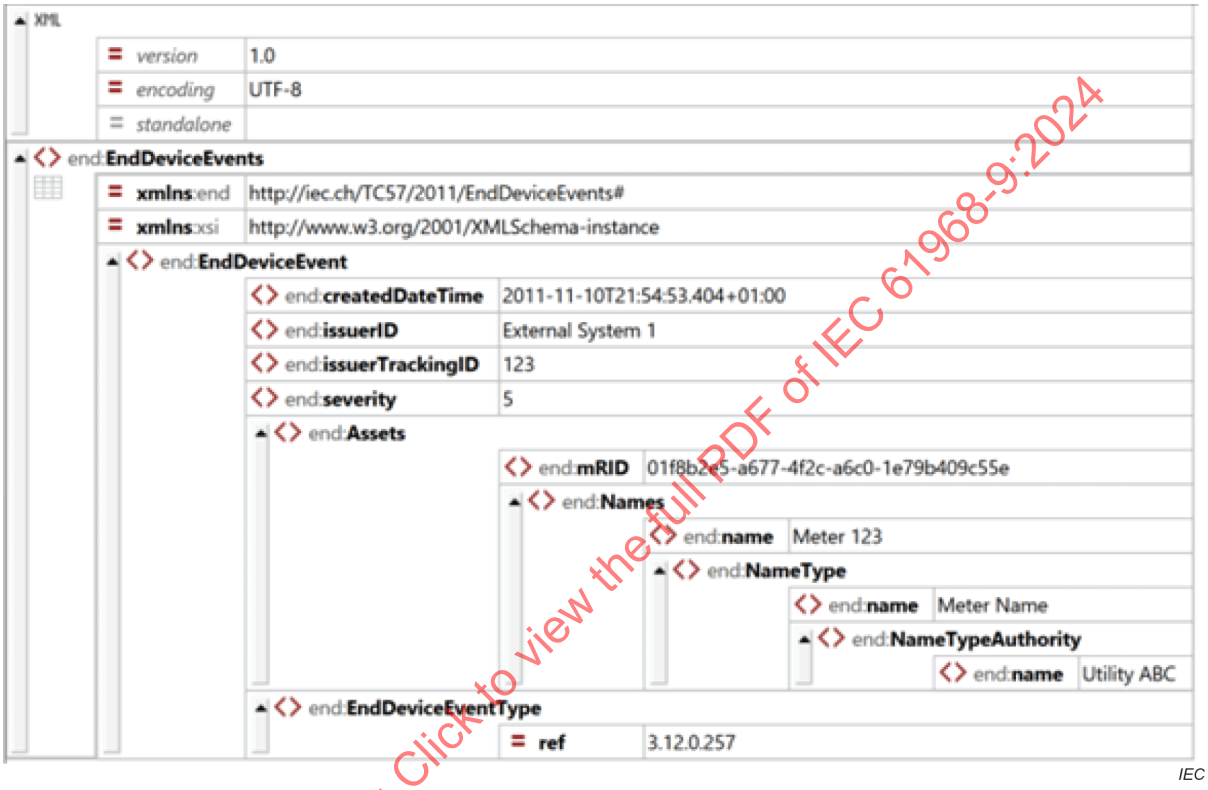


Figure 11 reproduced with the permission of the UCAIug.

Figure 11 – EndDeviceEvents example

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The EndDeviceEvent is logically associated with an EndDevice and/or a UsagePoint, either of which can be identified by mRID and/or Name. As in IEC 61968-9:2009, an EndDeviceEvent is associated with an Asset, where typically this will be an EndDevice.

5.3 Meter reading messages

5.3.1 General

Meter readings messages are designed to allow data collected by or calculated on behalf of a meter to be conveyed. This may include measured quantities, calculated quantities, state information or collected history. Whenever a "measurement" is required from an end device, a MeterReading exchange is quite likely the appropriate tool for the job. The end device may have metrology capability, and if so, is most likely called a "meter". But there are other potential applications for MeterReading. If a data consumer wishes to measure the position of the switch on a connect/disconnect switch, this can be done as a MeterReading exchange. If a data consumer wishes to measure the "energisation" status of the end device, this can be done with a MeterReading exchange or alternatively, with an EndDeviceEvent exchange as described in 5.2.

5.3.2 Applications

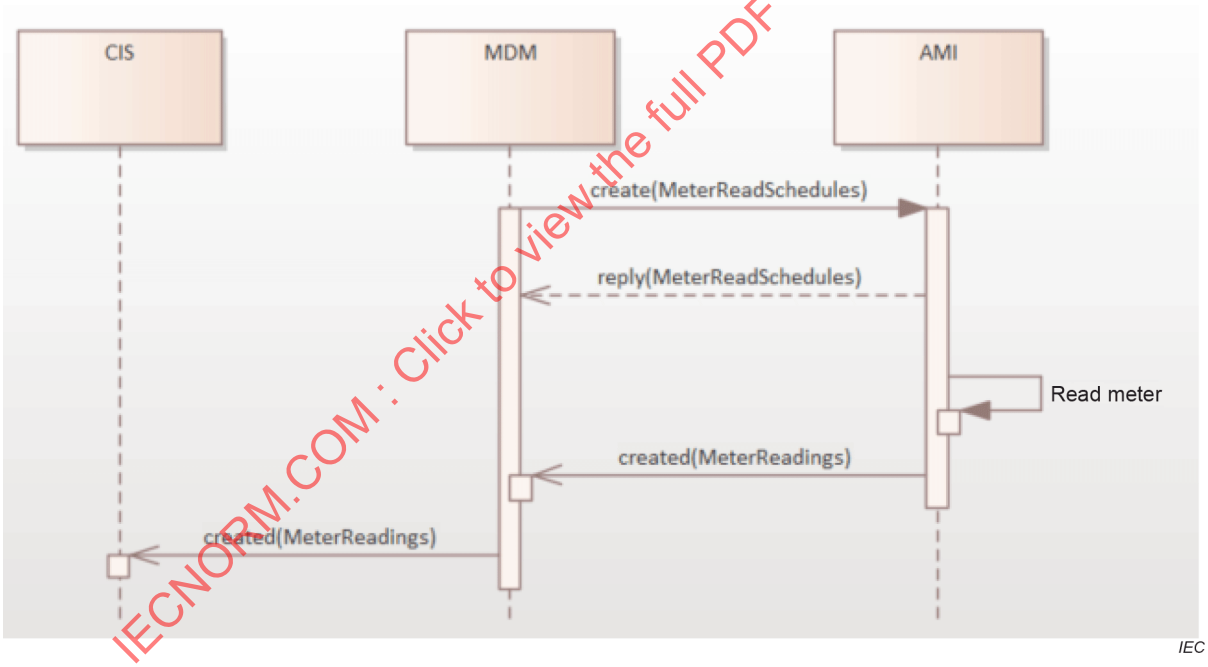
5.3.2.1 Periodic meter reads

It is necessary to periodically gather meter readings from a MS for billing through the customer billing system. The request for meter reading should specify a meter or group of meters, a type of reading to collect, and a frequency and duration of interest. The scheduled frequency may consist of regular or irregular periods. Not all deployments have systems that need to exchange the meter reading schedules, but if they do, the MeterReadSchedules profile may be used.

The MeterReadSchedules request may be initiated to the MS from any of the following:

- the CIS (in an effort to collect billing determinants);
- a planning and scheduling application (in an effort to acquire engineering data about the distribution network);
- an OMS (to establish a stream of status information);
- a meter data management system (in an effort to broker data for any or all of the above applications);
- the MS itself may also self-initiate a MeterReadSchedules.

An example for one such exchange (this one using an MDM) is shown in Figure 12.



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Figure 12 reproduced with the permission of UCAIug.

Figure 12 – Example use of meter read schedule to create subscription

In this example, the AMI system is treated as the system of record that owns the meter read schedule. It is being asked by the MDM to "create" a new schedule. In a different implementation, some other system such as the CIS may be the system of record for meter read schedules. In that case, the CIS would be the system to "create" the schedule. The "created" schedule would then be disseminated by the CIS to the other systems.

Some metering systems may have the ability to decouple MeterReading collection from MeterReading reporting. For Metering Systems without this capability, readings may be reported immediately upon collection. In the MeterReadSchedules request, MeterReadings may be requested using a variety of parameters, including:

- Specific meter, using the EndDevice mRID or Names.name. See IEC 61968-100:2022 for specification of the Names and Names related elements and for use of the LegacyObjectIdentificationRevisionSets message.
- EndDeviceGroups, where a EndDeviceGroup identifies a group address used within the Metering System
- UsagePoint where a meter is located, using UsagePoint mRID or Names.name
- UsagePointGroups, where UsagePointGroup identifies a groupAddress used within the Metering System
- As specified using a TimeSchedule
- ReadingTypes can be specified to identify the desired reading types

5.3.2.2 Manual meter reading

Meter readings can be obtained manually by a meter reader. Data collected may be maintained by the meter data manager. Meters may collect a number of different measurement types. Some types of meters may measure more than one phase, or may collect values for non-electrical measurements, such as water or gas.

A meter reader may input data shown on the panel of meter into a handheld device, which could be regarded as a metering system. Data input may occur several hundred times per day. A meter reader may present an account of the read to the customer. Note that this account is not an invoice. Billing would be generated normally by the CIS even in the manual reading case. Figure 13 shows such an exchange.

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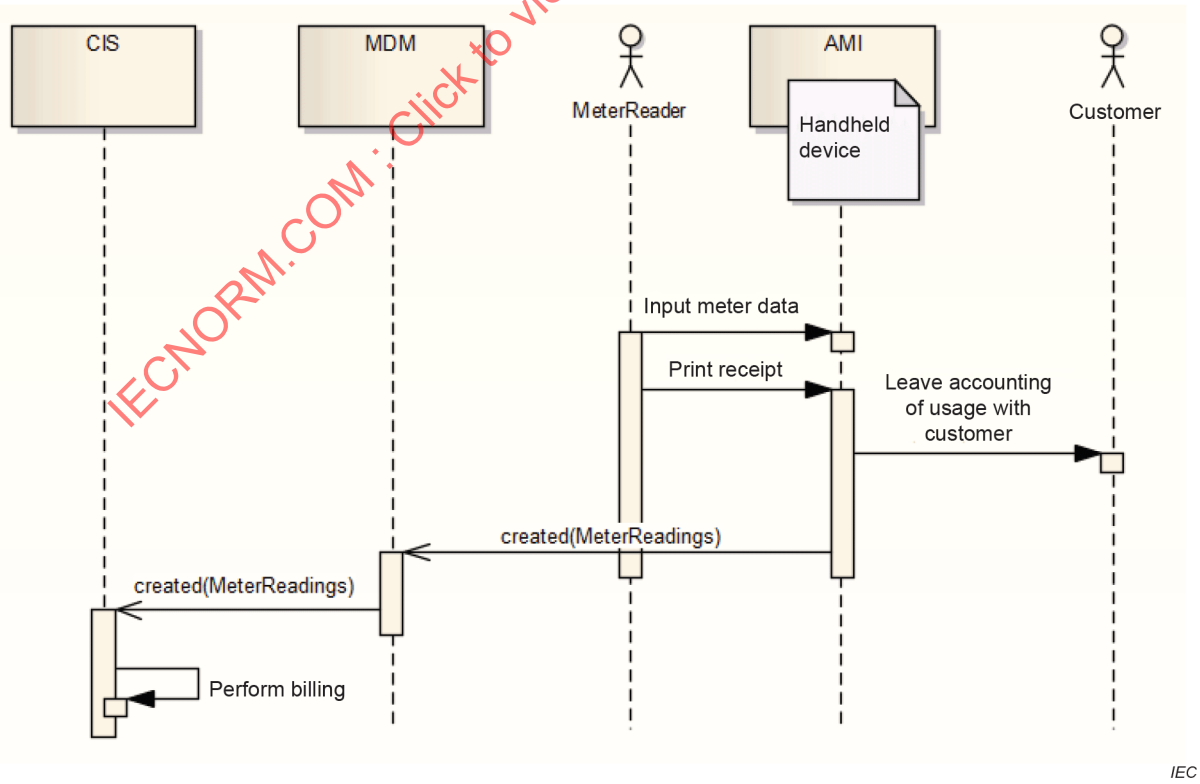


Figure 13 reproduced with the permission of UCAIug.

Figure 13 – Example manual meter reading exchange

At the end of the day of work, all data stored in the handheld device is sent to the MDM via a communication network. The MDM publishes a message to the CIS informing of the creation of MeterReading.

Schedules for walking a manual meter reading route are decided well in advance of performing the work.

5.3.2.3 On-Request meter read

Meter read requests are issued to a MS in order to obtain meter readings on a per request basis. The MS will send a request to the desired meters. These can be used for billing inquiries, outage extent verification, verification of restoration and other business purposes..

Many utilities have a policy of routing all revenue readings through the MDM so that all data will receive the same level of validation. However, not all MDM systems are able to offer validation services for outage data. For those that do, the utility shall weigh the value of MDM validation over the time delay it may introduce, as well as the ability of the particular OMS solution to reject incongruent data. For this reason, the example diagram shows revenue readings routed through the MDM, but outage data routed around it.

It is important to note that not all metering systems support ""on request" readings. For those that do, the implementation can also vary significantly.

On-request reads may be initiated to the MS from systems such as any of the following:

- The CIS (in an effort to collect billing determinants).
- A Planning and Scheduling application (in an effort to acquire engineering data about the distribution network).
- An OMS (in order to verify if a customer is affected by an outage or has been restored)
- A meter data management system (in an effort to broker data for any or all of the above applications).
- The MS itself may also directly initiate a meter read.

An example for one such exchange (this one using an MDM) is shown in Figure 14.

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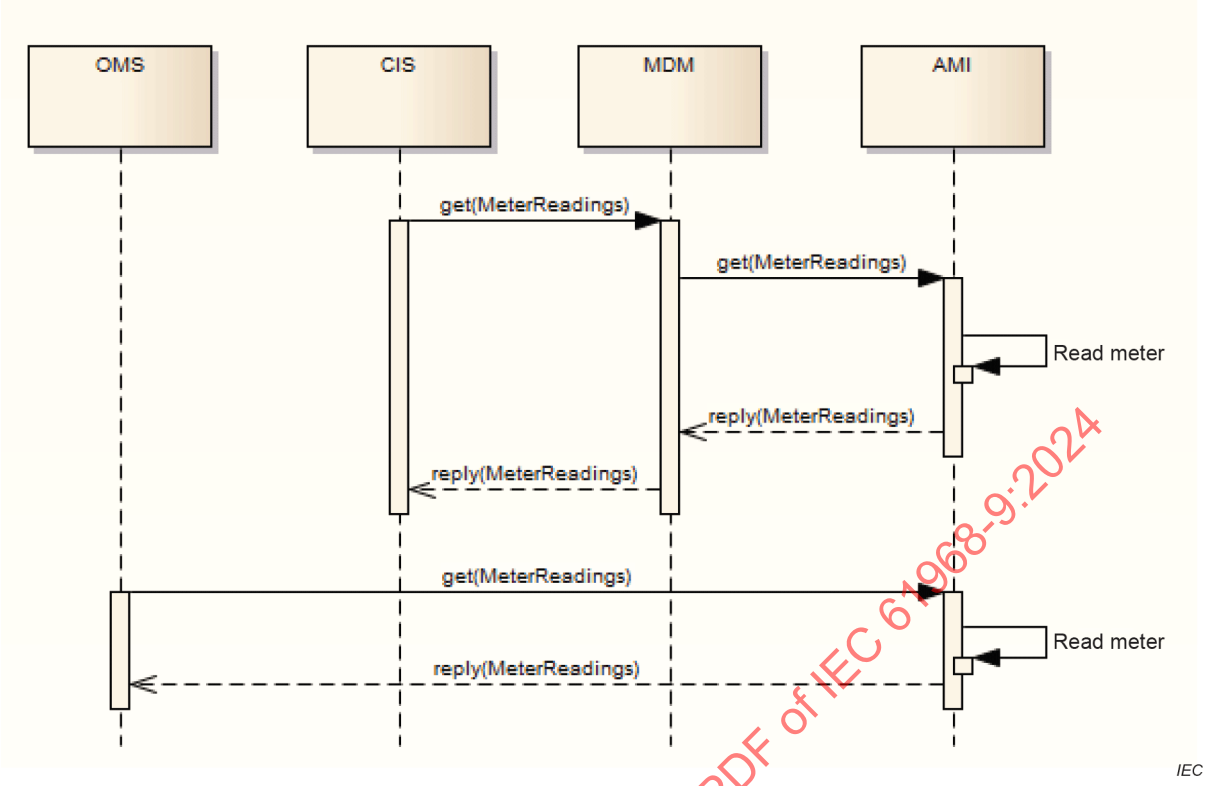


Figure 14 reproduced with the permission of UCAIug.

Figure 14 – Example On-Request meter read

In this example, the MeterReadings noun is used because a very specific meter is being addressed. However, an implementation may alternatively wish to use the GetMeterReadings noun. In comparing the two schemas (located in Annex G), one finds that the MeterReadings schema allows the requestor to specify one or more EndDeviceEventType and/or ReadingType to filter on. Meanwhile GetMeterReadings also supports named EndDevice, EndDeviceGroup, TimeSchedule, TransformerTank, UsagePoint, and UsagePointGroup. The same option applies to other types of meter readings (such as Historical meter data access below). Not all implementations will necessarily support both nouns, nor support all features possible within a given request format. More discussion of the "Get" nouns and recommended transactional patterns are described in IEC 61968-100.

5.3.2.4 Historical meter data access

A distribution network planner may use historical meter reading values as load information for capacity planning purposes. (See the request/reply example in Figure 15).This would permit usage to be aggregated to determine loads for a transformer or feeder.

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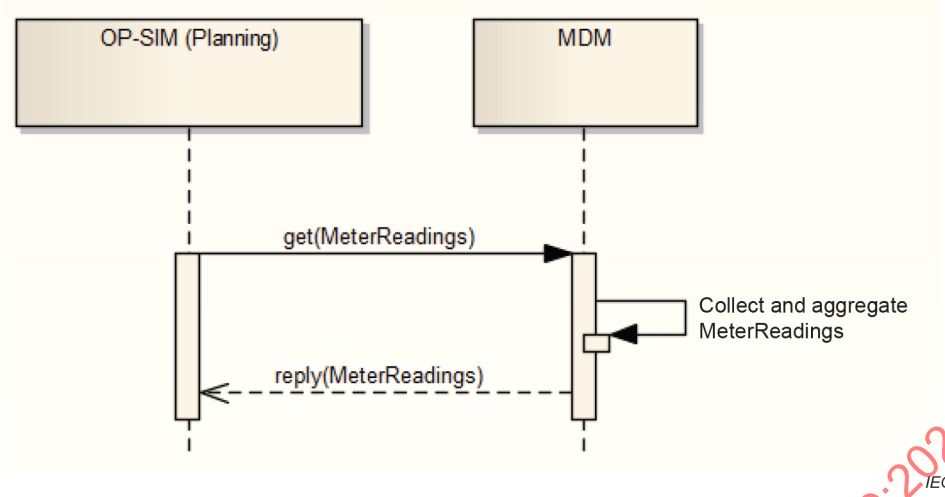


Figure 15 reproduced with the permission of UCAIug.

Figure 15 – Historical MeterData exchange

It is important to note the use of request parameters to qualify requests for meter data, filtering the results to obtain data for specific meters within specific timeframes.

5.3.2.5 Billing inquiry

A customer or an internal source may identify a customer billing issue. A meter read request in combination with historical meter reads may be used to resolve the billing issue. The top of Figure 16 shows an inquiry being satisfied by data which recently arrived, while later on in the day an inquiry is made which requires a fresh reading from the meter.

In some cases the desired data may be accessible from the MDM. In other cases, it may be necessary to issue a read request remotely through the MS, or manually through an IEC 61968-8 generic "service request."

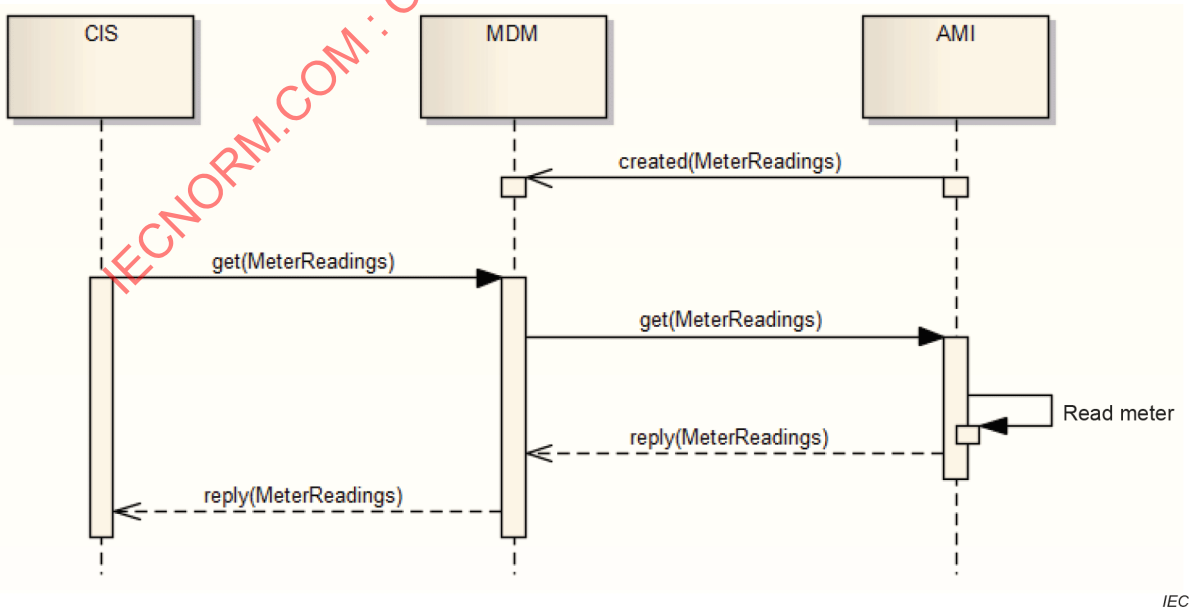


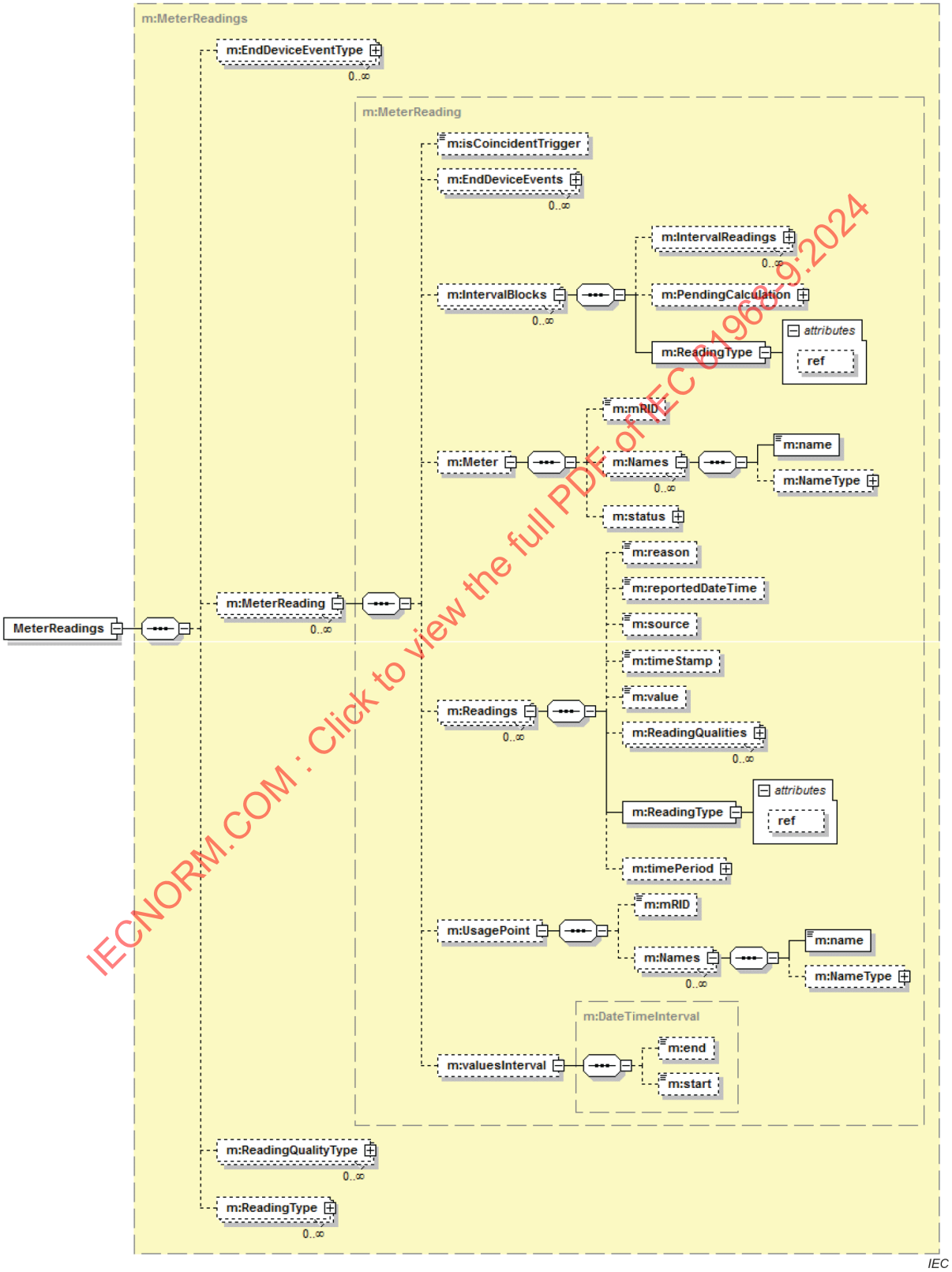
Figure 16 reproduced with the permission of UCAIug.

Figure 16 – Example billing inquiry message exchange

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5.3.3 Message formats

Figure 17 shows the message format used to present meter readings from one or more end devices. Additional information on the MeterReadings structure is available in Annex G.



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Figure 17 reproduced with the permission of UCAIug.

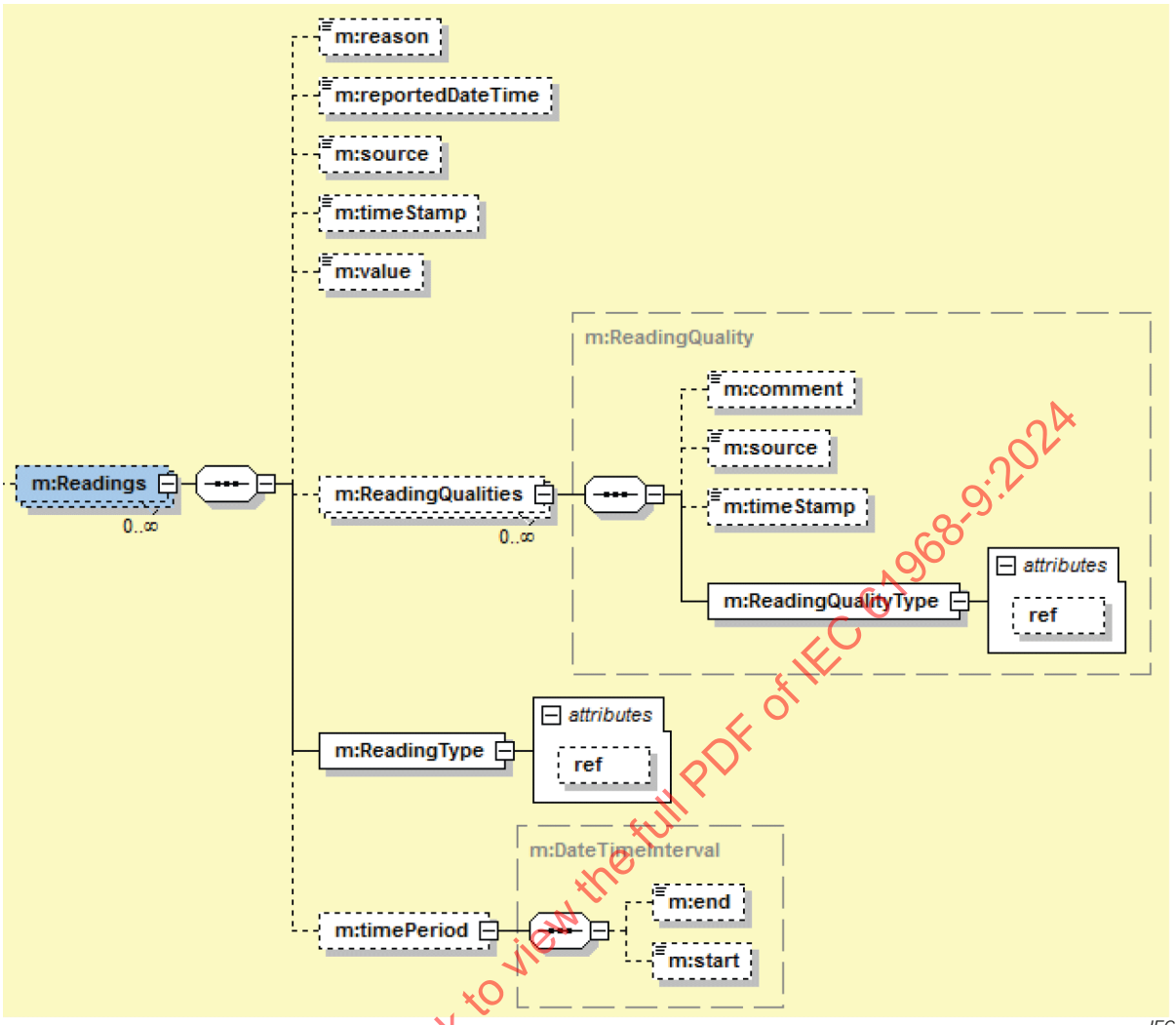
Figure 17 – Meter readings message format

The MeterReadings message structure allows for:

- readings from one or more meters
- reading values each have an associated reading type, timestamp and value
- many quality values can be associated with each reading value
- readings can be supplied in the form of interval blocks, where readings of a common reading type are grouped together
- event histories can be returned with meter readings

Figure 18 shows the details of the structure used to convey Readings, where each Reading identifies a specific ReadingType (by reference), value and optional quality codes.The timeStamp is used to identify when the reading was captured. The timePeriod can be used to identify a specific time interval. The optional reportedDateTime can be used to identify when the reading was actually reported. The ReadingType is used to identify the meaning of the reading, data type of the value and the meaning of the different time values.

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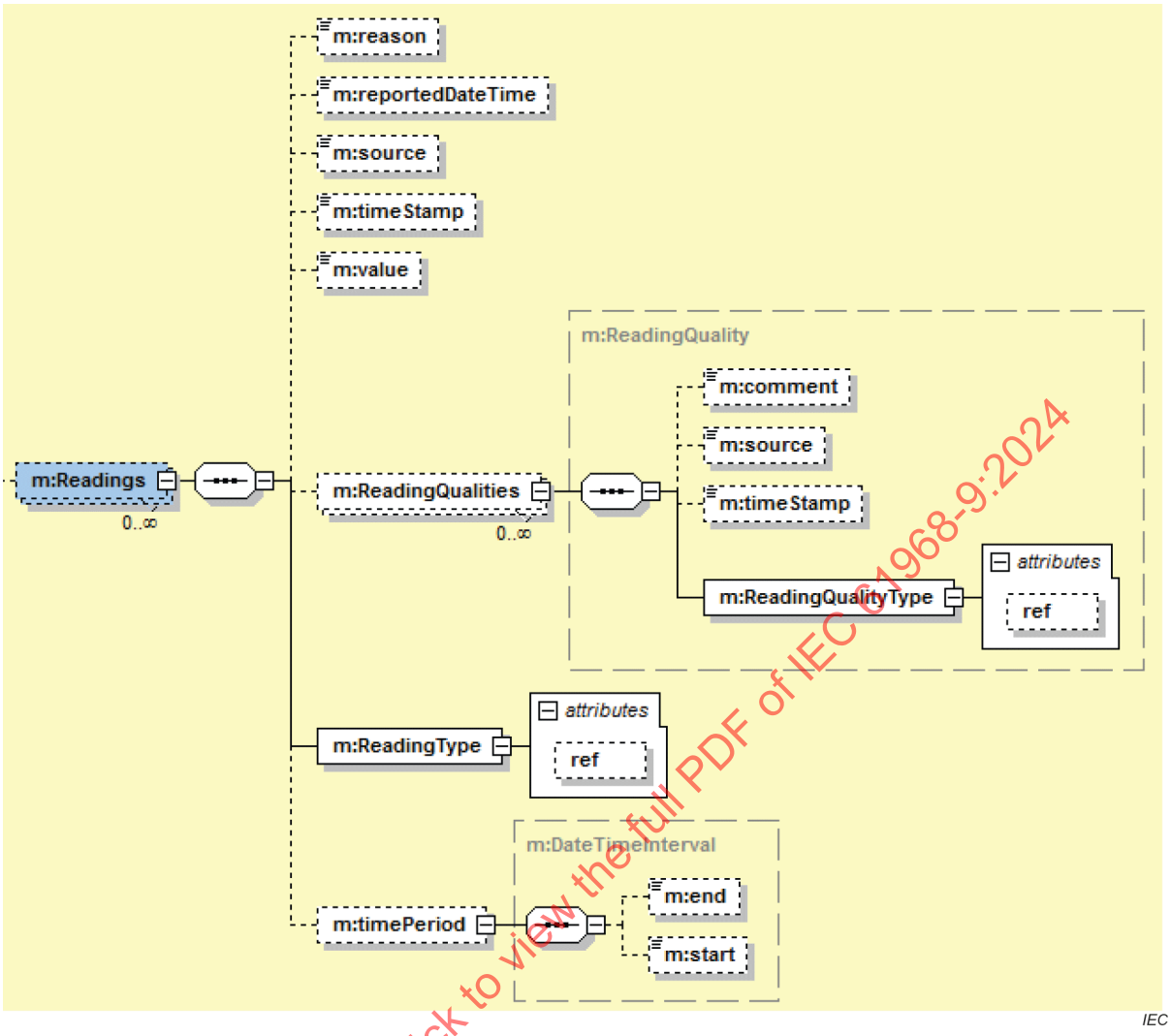


Figure 18 reproduced with the permission of UCAIug.

Figure 18 – Reading structure

Within a reading, the timeStamp and timePeriod attributes can be used to identify time-related aspects of the reading, with specific usage based upon reading type, where details are described in Annex C as needed. The examples given in Figure 19, and Figure 20 illustrate the general conventions for the use of timeStamp and timePeriod.

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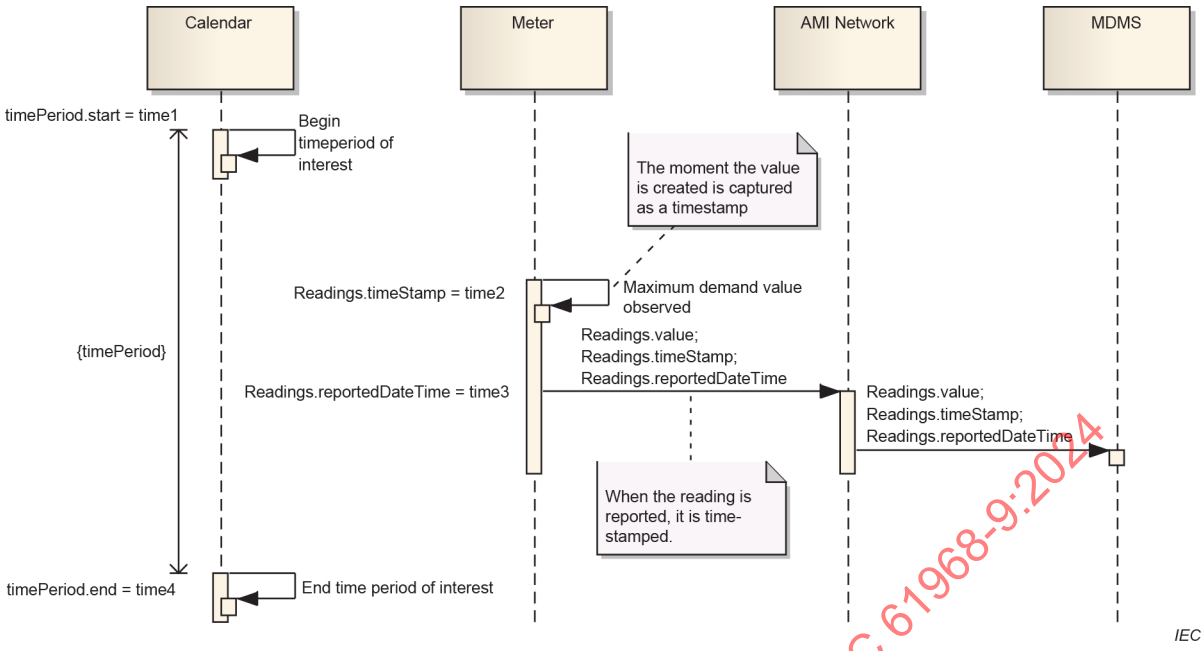


Figure 19 reproduced with the permission of UCAIug.

Figure 19 – Timestamps assigned between systems

Figure 19 shows the way that timestamps are assigned as values are created and passed between systems. From the perspective of the CIS and MDMS, there exists a "timePeriod" of interest for (perhaps) a billing period. A "get" request might specify this time range range using the <TimeSchedule> element in a get(MeterReadings) message, and the AMI or MDMS would "reply" with readings that fall within this range. Important points in time regarding the generation and reporting of the value are also timestamped. All of these timestamps are found within the meterReadings schema. Another view of the same example (with real dates and times) is expressed below in Figure 20.

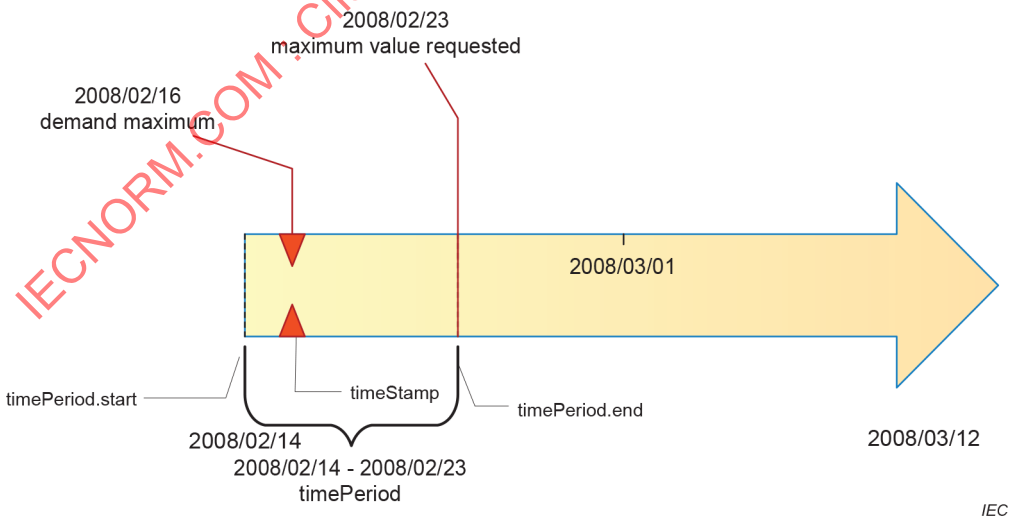


Figure 20 reproduced with the permission of UCAIug.

Figure 20 – Conventions for timeStamp and timePeriod

The IntervalBlock structure allows for a set of readings to be grouped by a common ReadingType and as a convenience for representation of a time series.

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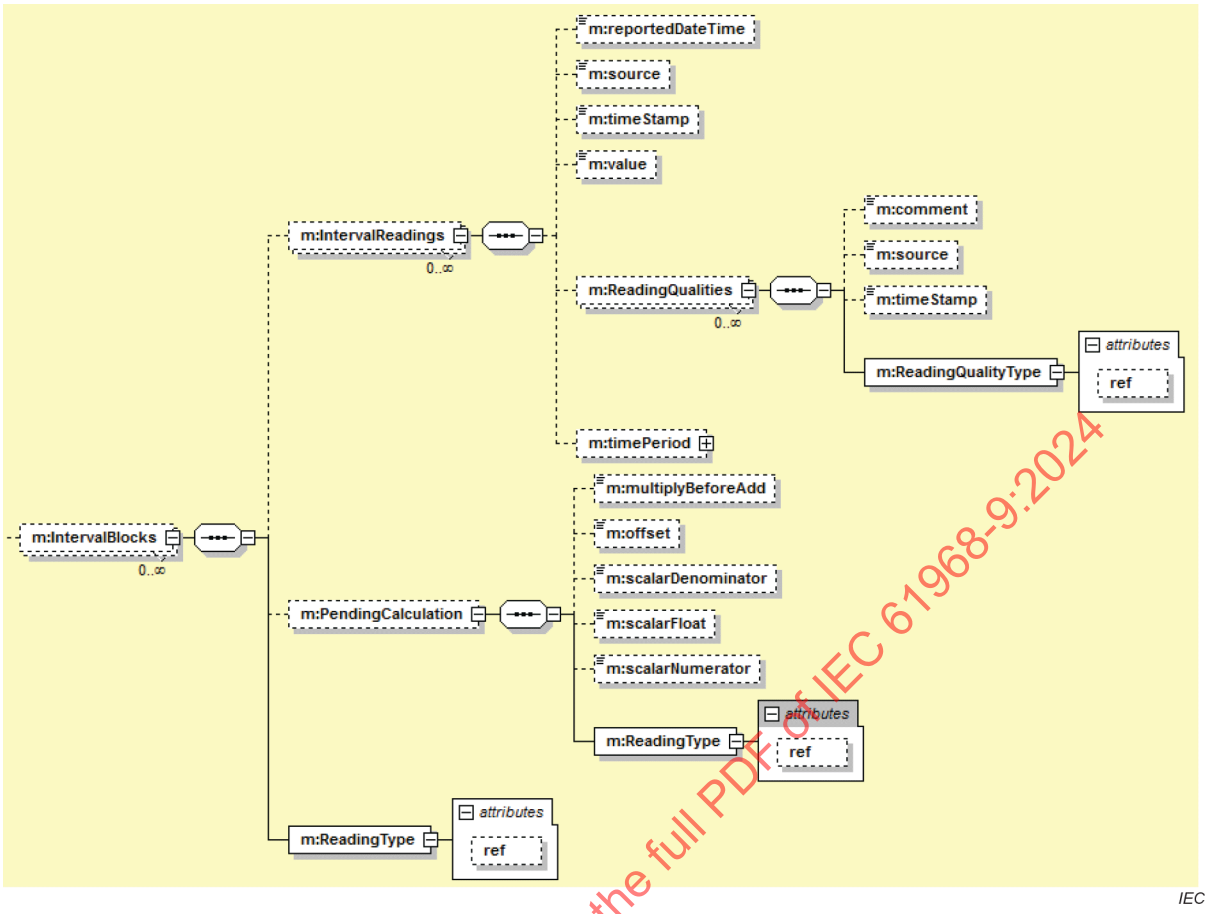


Figure 21 reproduced with the permission of UCAIug

Figure 21 – IntervalBlock structure

The following diagram shows the convention for use of a timeStamp for interval data where an associated reading type identifies that the reading value is for a specified interval.

Different MR systems work in different ways, but for the purpose of the standard, timestamps denote the end of the interval. The implied generation process is described in Figure 22.

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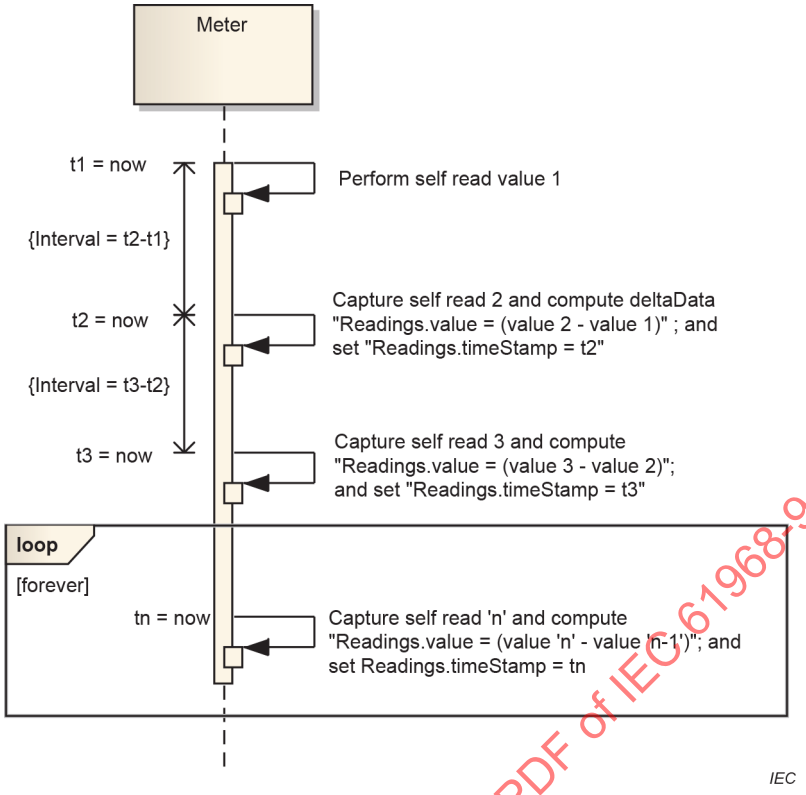


Figure 22 reproduced with the permission of UCAIug.

Figure 22 – Interval data timestamp generation

When a timestamp is used, it shall fall within a time range from 00:00:00 to 23:59:59 as depicted in Figure 23. A value of 23:59:59 plus 1 s places the time at midnight which is the start of the next day.

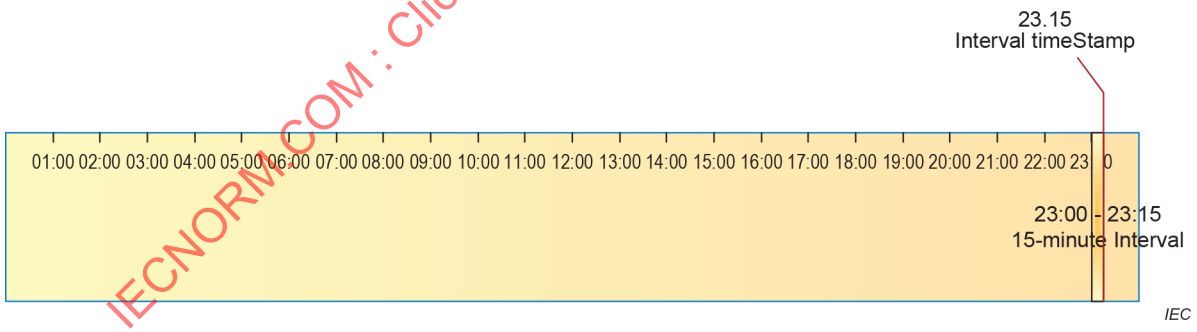


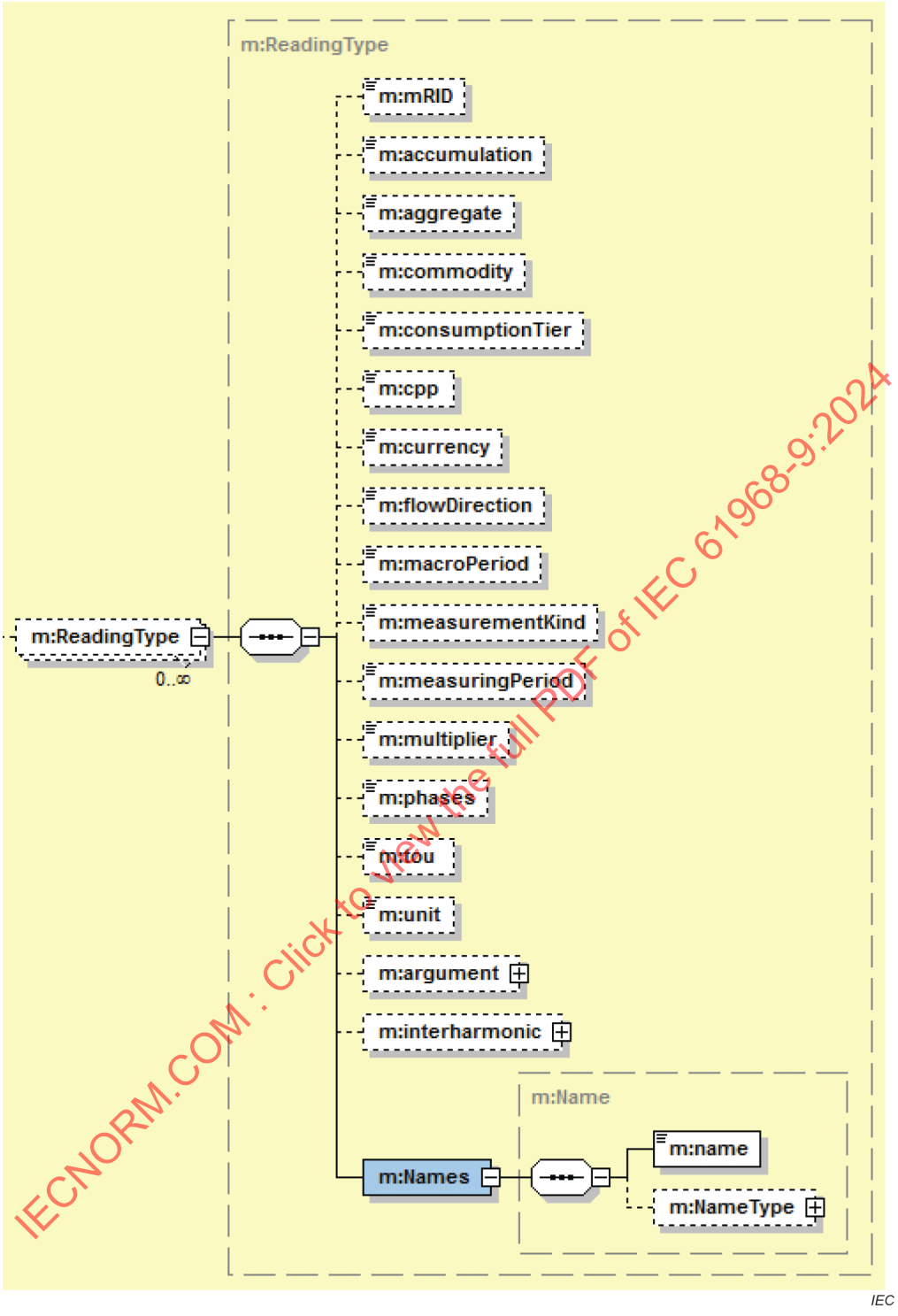
Figure 23 reproduced with the permission of UCAIug.

Figure 23 – Time interval conventions

Note that a day starts at 00:00. The day ends at 23:59:59. (Refer to ISO 8601 for more details around timekeeping.) It is important to note that interval data can be conveyed using IntervalBlocks with IntervalReadings or simply using Readings. IntervalBlocks shall be used in cases where the PendingCalculation elements are needed, otherwise they simply allow for a reduced XML footprint over Readings, which may be important in some situations.

Key to the reporting of a value from a meter is the reading type. The ReadingType class in the CIM is defined to allow capture of the information given in Figure 24 as related to the description of a reading type, as is more thoroughly defined in Annex C.

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Figure 24 reproduced with the permission of UCAIug.

Figure 24 – ReadingType structure

While the ReadingType structure is present in the MeterReadings message, it should be expected that in normal practice it will not be populated, as it is anticipated that the consuming system will already be configured with the appropriate ReadingType definitions. The details of this and other classes specific to metering are described in the Metering package of the CIM. A more thorough discussion of reading types is provided in Annex C.

Readings are not limited to metering devices. Any EndDevice may potentially produce a measurement. In this edition of IEC 61968-9, the asset producing the reading shall be identified using the Meter class, even though the device may not be a meter. It is expected that all assets have a unique mRID or Names.name so that meters can be distinguished from remote connect/disconnect switches, and from other devices. It is expected that future editions of IEC 61968-9 will provide a more explicit method of dealing with readings from devices other than Meters.

Interval data has unique timestamp requirements. The extended capabilities of ISO 8601 provide the means to specify both a formal interval length (as an ISO 8601 "period" of time), as well as a fixed reference point.

Figure 25 and Figure 26 provide some example payloads of MeterReadings messages.

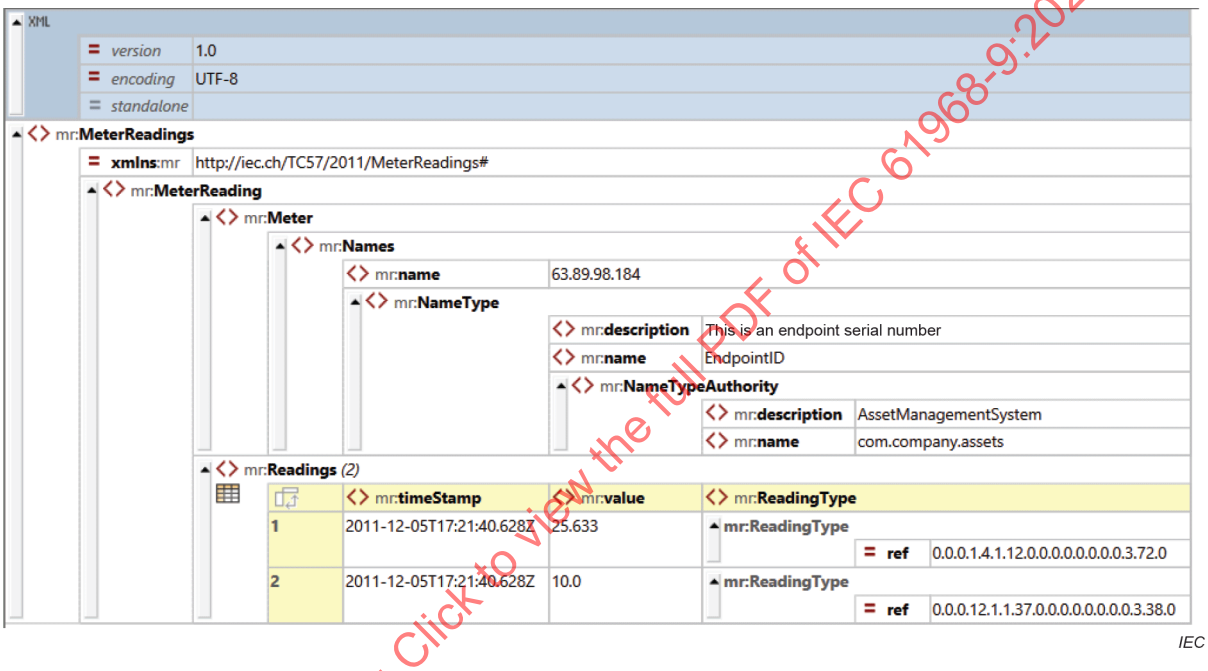


Figure 25 reproduced with the permission of UCAIug.

Figure 25 – MeterReadings Example 1

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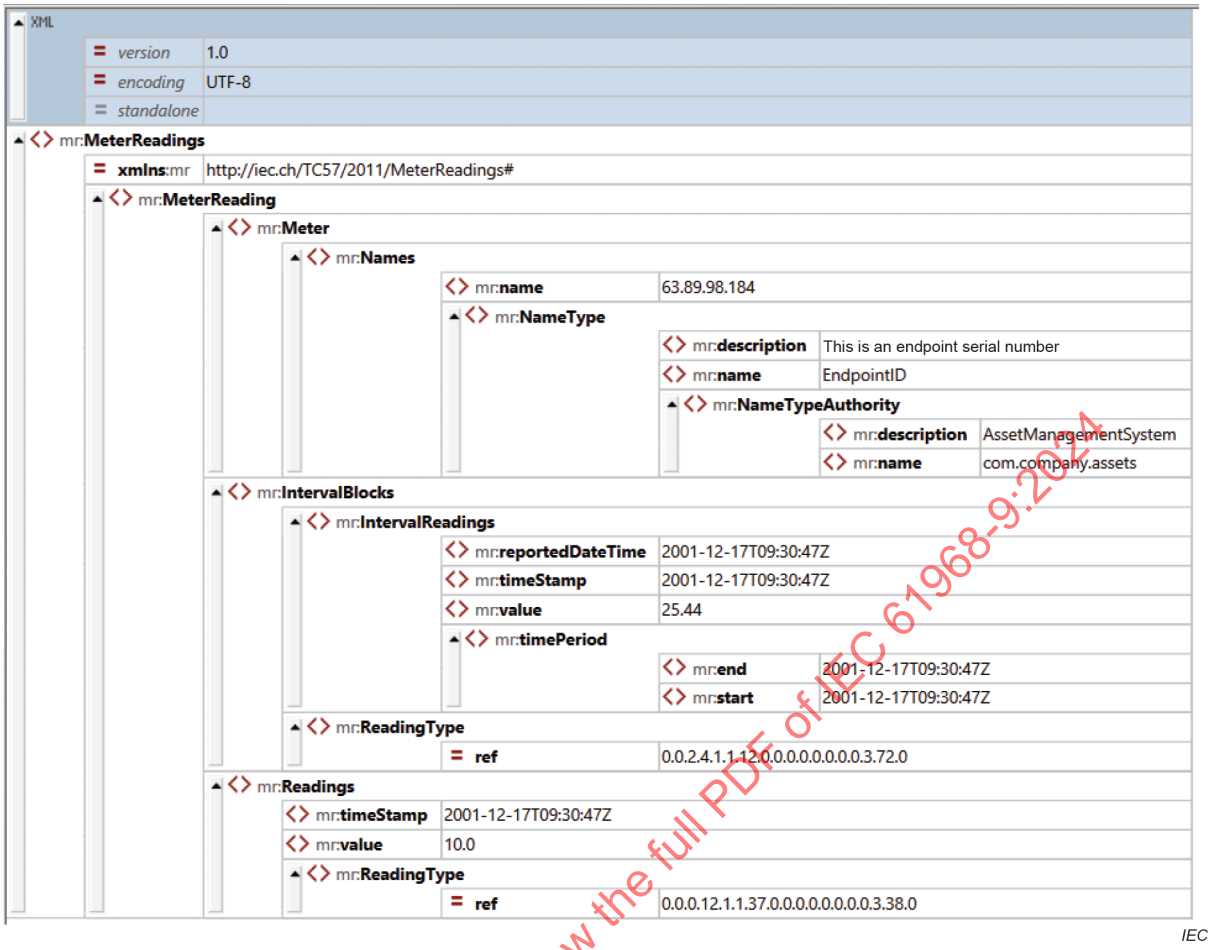


Figure 26 reproduced with the permission of UCAIug.

Figure 26 – MeterReadings Example 2

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The concept of "coincident readings" deserves some attention. A coincident reading is a MeterReading that occurs at the same point in time as some other MeterReading or EndDeviceEvent.

Some meters have the ability to report a reading that was coincident with a certain other MeterReading or EndDeviceEvent (hereinafter referred to as the "trigger"). For example, it might record the "power factor coincident with the billing period maximum demand.

Additionally, some processes call for a coincident read to be reported. For example, when a meter is installed, it is common to capture an "initial reading." Similarly, when a meter is disconnected, it is common practice to capture a "final read" coincident with the disconnection event.

Some systems may perform analysis of the data in storage to identify analytically derived coincident readings. For example:

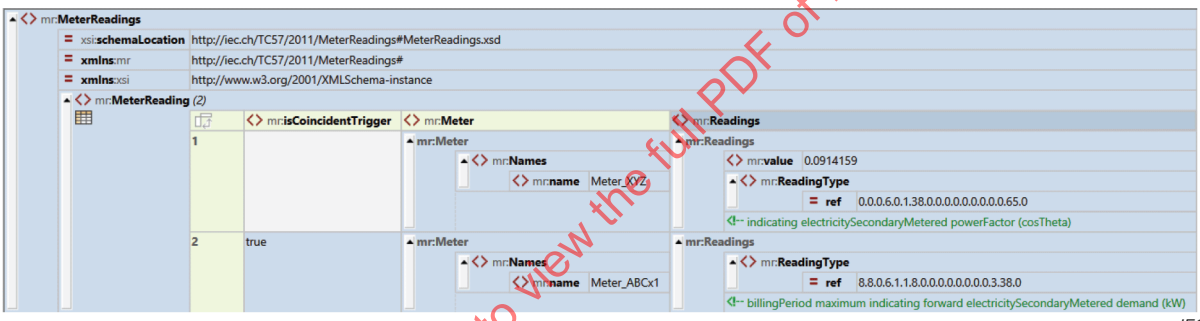
- the voltage at UsagePoint A at the time of the peak daily demand on the distribution transformer (UsagePointB) that serves UsagePoint A. (UsagePoint "B" could be either a real or a virtual UsagePoint.)
- the 15-minute interval consumption at UsagePoint A at the time of the peak demand on a distribution network (UsagePoint C) on a hot, summer day
- a BulkQuantity kwh reading for a UsagePoint at the time of an EndDeviceEvent such as a meter disconnect.

The MeterReading class has an optional Boolean element called "isCoincidentTrigger." The element doesn"t have to be used in a message, but if it is, there are rules for its interpretation. If any instance of a MeterReading message is marked with the isCoincidentTrigger Boolean set to "true", then all other MeterReadings within the same MeterReadings message are considered to be coincident with the so marked MeterReading. Only one MeterReading element within a single MeterReadings message may have its isCoincidentTrigger Boolean set to "true". If the isCoincidentTrigger Boolean is absent, it is defined to be "false". It is recommended that the "trigger" MeterReading should have a timeStamp if this information is available.

The GetMeterReadings profile can be used to request MeterReadings that are coincident with a given MeterReading. This can be accomplished by including in the GetMeterReadings message a MeterReadings element in which the isCoincidentTrigger Boolean is set to "true" – in other words by specifying the "trigger" MeterReading in the GetMeterReadings filter criteria.

NOTE It is recognized that there might be small differences in time between a coincident trigger and the reading(s) that are coincident with the trigger. For example, a reading taken in conjunction with a meter disconnect can actually be taken several seconds after the operation of the disconnect switch. It is outside the scope of this document to define the window for readings to be considered coincident.

In the following example (Figure 27,) a metering system identifies a power factor measurement that is coincident with the maximum demand for a given meter when the exact date and time of the maximum demand is not known:

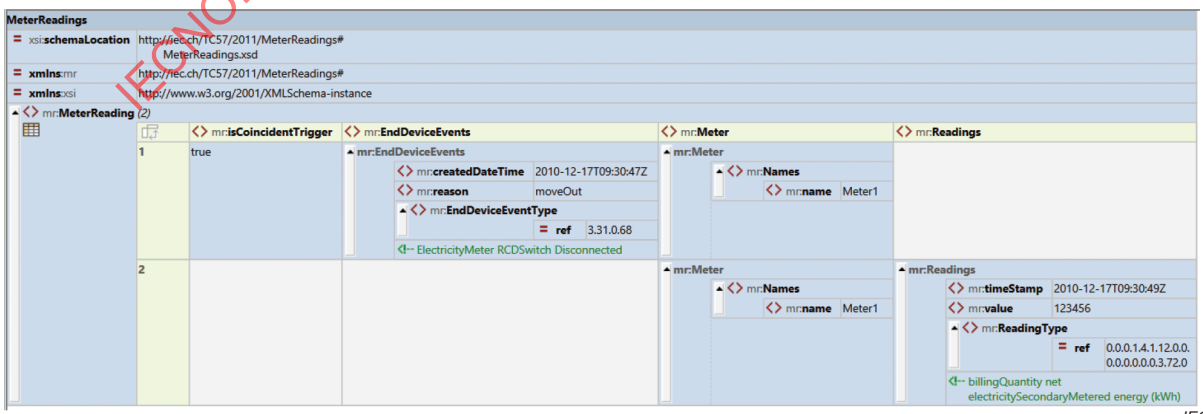


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Figure 27 reproduced with the permission of UCAIug.

Figure 27 – Coincident readings example

In the next example (Figure 28,) a metering system or MDMS identifies the final meter reading coincident with disconnection of service via RCD:



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Figure 28 – Final meter reading coincident with disconnect example

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The next example (Figure 29) demonstrates a request to get meter readings from a metering system or MDMS which are coincident with a disconnect that occurred within a specified time interval. The request is an open-ended invitation to send any type of MeterReading data which is coincident with an RCDSwitch disconnect for a given EndDevice (meter). The response to this request could very well be nothing more than the "final meter reading" example provided above. (If a more specific response was sought, it would be possible to filter for only the desired ReadingType(s) by populating the ReadingType element in the GetMeterReadings profile.)

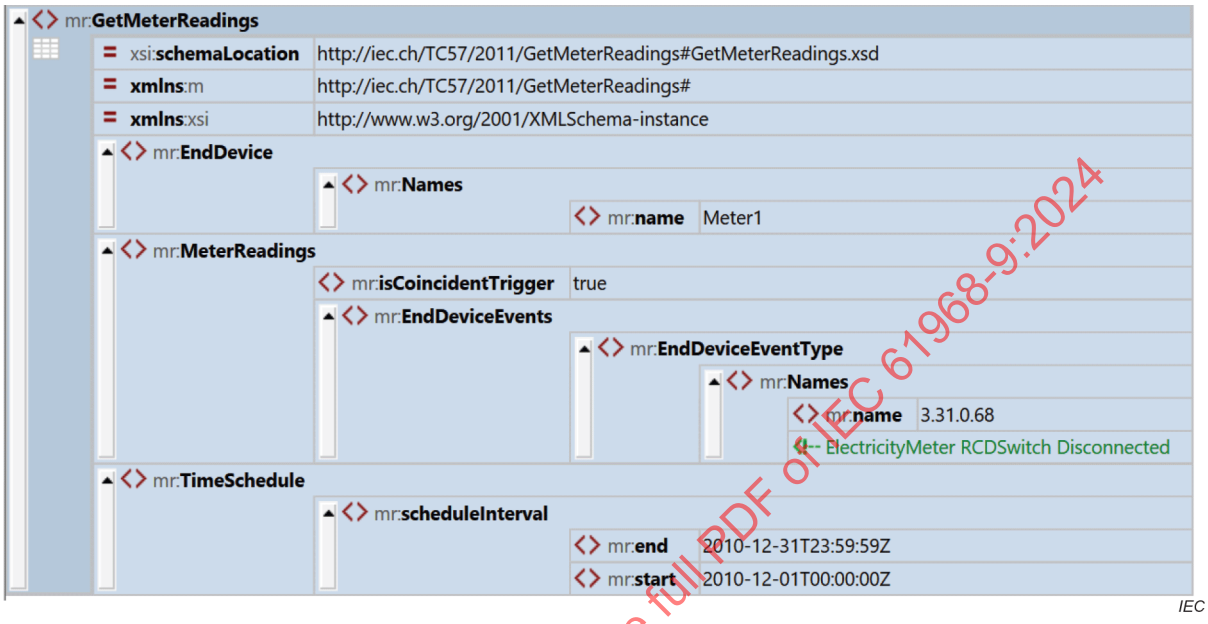


Figure 29 reproduced with the permission of UCAIug.

Figure 29 – GetMeterReadings example

When using timestamps as filters, note that the TimeSchedule.scheduleInterval elements are used to frame a request for data falling within a certain range. The MeterReadings response may populate the MeterReadings.MeterReading.valuesInterval elements to identify the range of dates offered in the response. The user will also find that interval data (which contains a time-ordered series of values) has no place in a discussion of coincident data. Only one interval may be coincident with a given event or another MeterReading. It therefore seems inappropriate to populate a series of MeterReading.IntervalBlocks.IntervalReadings elements. A single value may be presented as an interval, or the single interval value may be presented as a stand alone MeterReading.Readings instead.

The ability to schedule when meter readings are obtained is provided through the use of a MeterReadSchedules request.Note that the MeterReadSchedules.xsd depicted below replaces the MeterReadSchedule.xsd that appeared in IEC 61968-9:2013. The primary difference is that the current XSD has a new root element MeterReadSchedule that inherits from identifiedObject. This provides the ability to create, change, update, and delete individually identified MeterReadSchedules. Figure 30 describes the structure used for the payload of a MeterReadSchedules request message:

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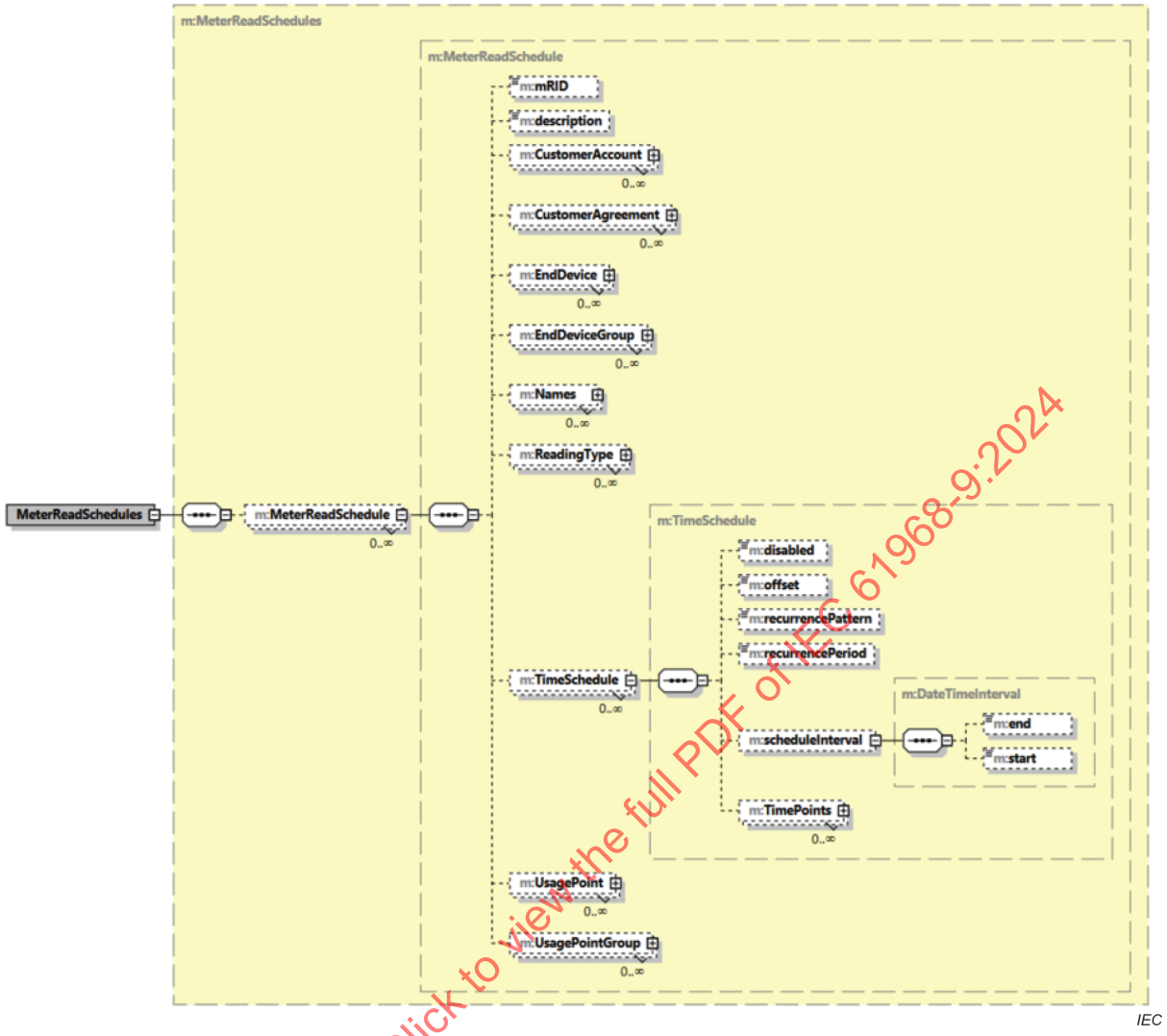


Figure 30 reproduced with the permission of UCAIug.

Figure 30 – Meter read schedules message format

Several elements in the TimeSchedule of the MeterReadSchedules are profile are unique to that profile and deserve special definition. These include:

disabled – True if this schedule is deactivated (disabled)

offset – The offset for the recurring (periodic) times in the TimeSchedule. Each point in the time series defined by scheduledInterval and either recurrencePeriod or recurrencePattern will be shifted by adding the offset value. The use of TimeSchedule.offset is not applicable when discrete TimePoints are specified in lieu of a recurrencePeriod or recurrencePattern.

recurrencePattern – Interval at which the scheduled action repeats, from the beginning of one action to the beginning of the next action (e.g., first Monday of every month, last day of the month, etc.). Used when the interval cannot be defined as a fixed number of seconds between points in time. The use of recurrencePattern is not applicable when recurrencePeriod is specified or when discrete TimePoints are specified in lieu of a recurrencePeriod or recurrencePattern.

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recurrencePeriod – Duration between time points, from the beginning of one action to the beginning of the next action. Used when the interval can be defined as a fixed number of seconds between points in time. The use of recurrencePeriod is not applicable when recurrencePattern is specified or when discrete TimePoints are specified in lieu of a recurrencePeriod or RecurrencePattern.

5.4 End device control messages

5.4.1 General

There are many types of end device control messages. These are used to send instructions to one or more end devices. EndDeviceControls may result in one or more consequential EndDeviceEvent message.

5.4.2 Applications

5.4.2.1 Load control

Load control (a.k.a. direct load control) requests can often be made to a MS for the purpose of load curtailment. This request would typically be initiated from network operations. Not all MS will have load control capabilities.

It should also be noted that this is different from a disconnect, where a disconnect results in the complete loss of power to a single customer.

A load control will typically result in the shedding of specifically configured loads (e.g. air conditioning, pumps, etc.)

The load control function executes load shed commands which are computed by load management software (contained in the network operations block). The load management software is used to compute an appropriate load-shed amount, and could potentially include many factors including the predicted duration of generation shortfalls, historical usage patterns, real-time usage data, and weather.

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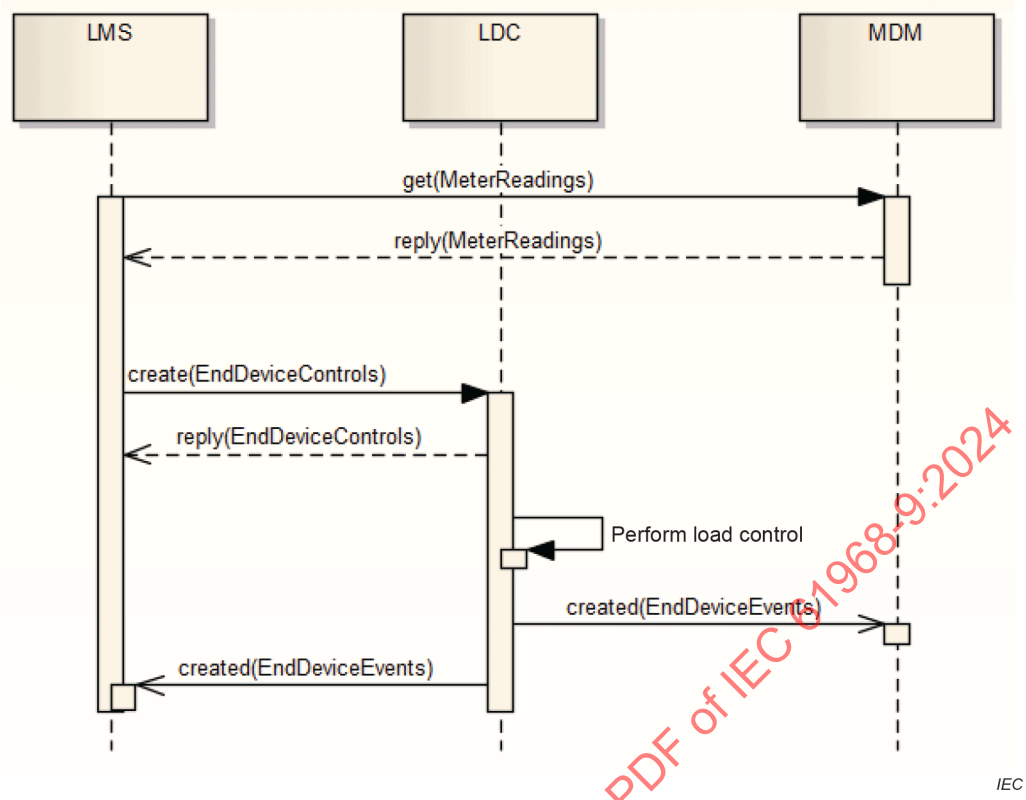


Figure 31 reproduced with the permission of UCAIug.

Figure 31 – Example load control message exchange

The example in Figure 31 shows how load history may be obtained from the MDM in the form of MeterReadings and used to perform load analysis. It also shows load control commands being issued by the LMS to the load control system. Deployments that do not support an MDM would interact directly with the MS instead.

Load control commands are implemented as a type of EndDeviceControl, where the command can be addressed by EndDeviceGroup (using a group address), by EndDevice (using mRID) or by CustomerAgreement.

Load control may also be implemented using PAN devices.

5.4.2.2 Load control device installation

The installation of load control units is usually more labour intensive than installing a meter, but the data exchange requirements are simpler. LC units are different from meters in the sense that they don't require periodic recalibration. Once an LC unit is installed it will probably remain in place for the life of the unit, even if the customer withdraws from the LC program, or if there is a change in tenancy.

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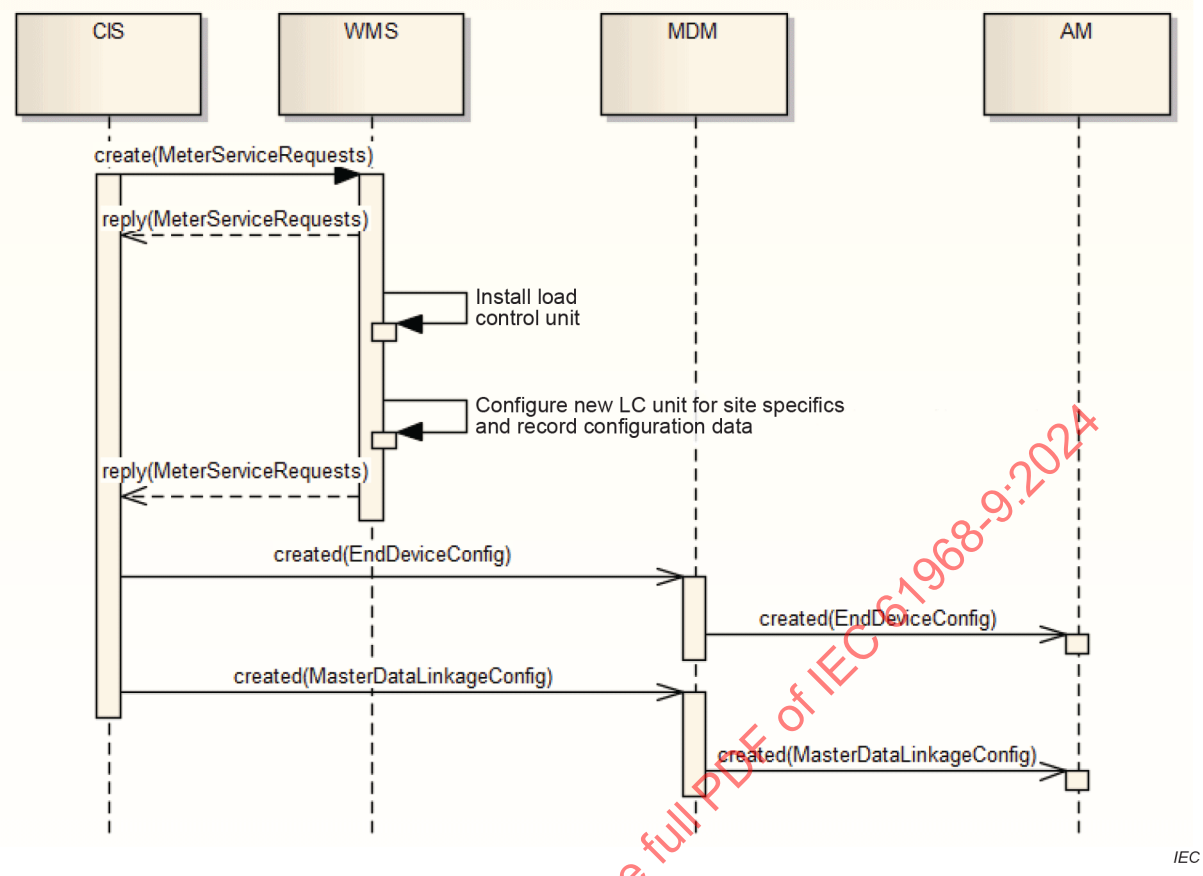


Figure 32 reproduced with the permission of UCAIug.

Figure 32 – Example message exchange for LC unit installation

Before travelling to the service location, the installer will know the customer account data, the type of load control unit to be installed, and the ratings of the device to be controlled. The installation data can confirm device ratings, and where appropriate, document the port number of the LC unit wired to the device. The results of the installation can be published to all of stakeholders as depicted in Figure 32.

5.4.2.3 Change of customer program

Particular metering solutions are usually chosen to fulfil specific metering needs as a result of customer program enrolment. In many cases, a flexible metering solution can provide coverage for a range of customer programs. When a customer transitions from enrolment in one program to another, it may simply require a change to the meter (or communication module) configuration. In extreme cases it may require a meter change out. In other cases, it may require no change at all. Changes to a configuration will need to be communicated amongst the stakeholders. An example exchange in which the deployment involves an MDM is described in Figure 33. Another example in which the deployment lacks an MDM is described in Figure 34.

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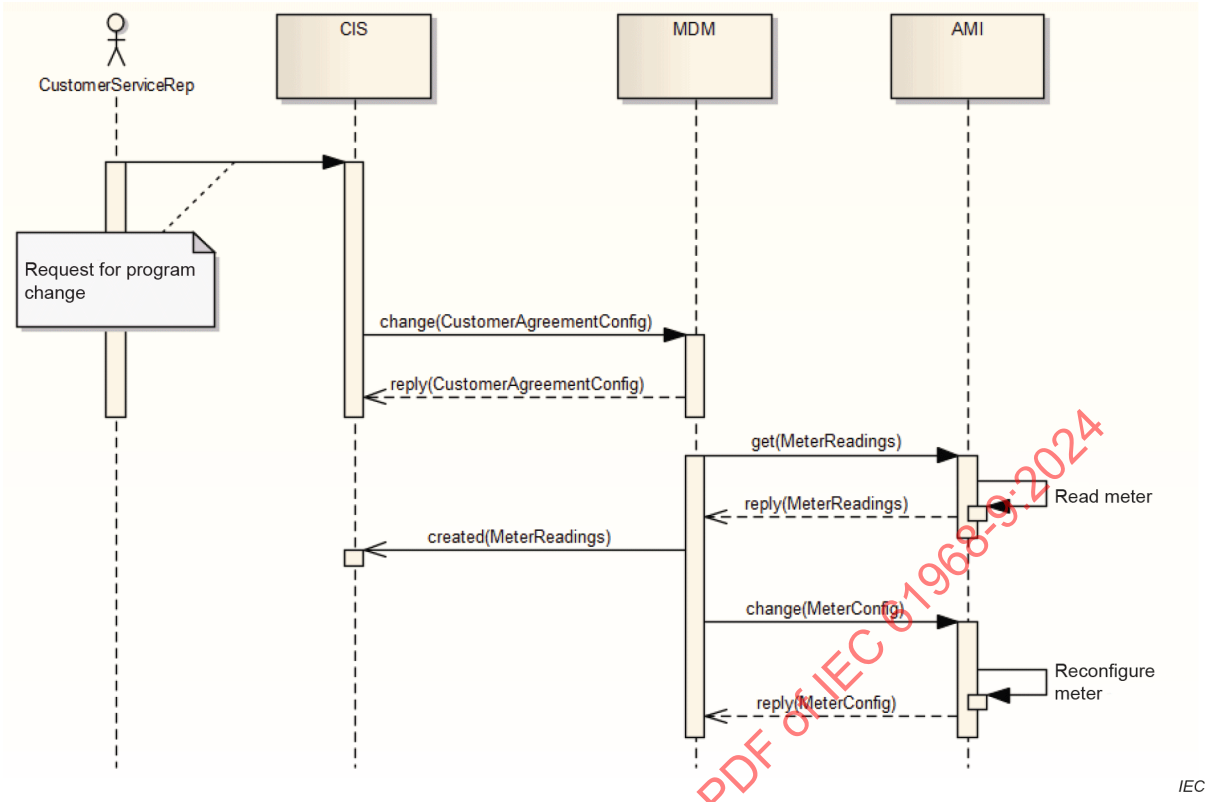


Figure 33 reproduced with the permission of UCAIug.

Figure 33 – Example message exchange for change of customer program

Changes to the meter configuration may be expressed as changes to the configuration of an EndDevice.

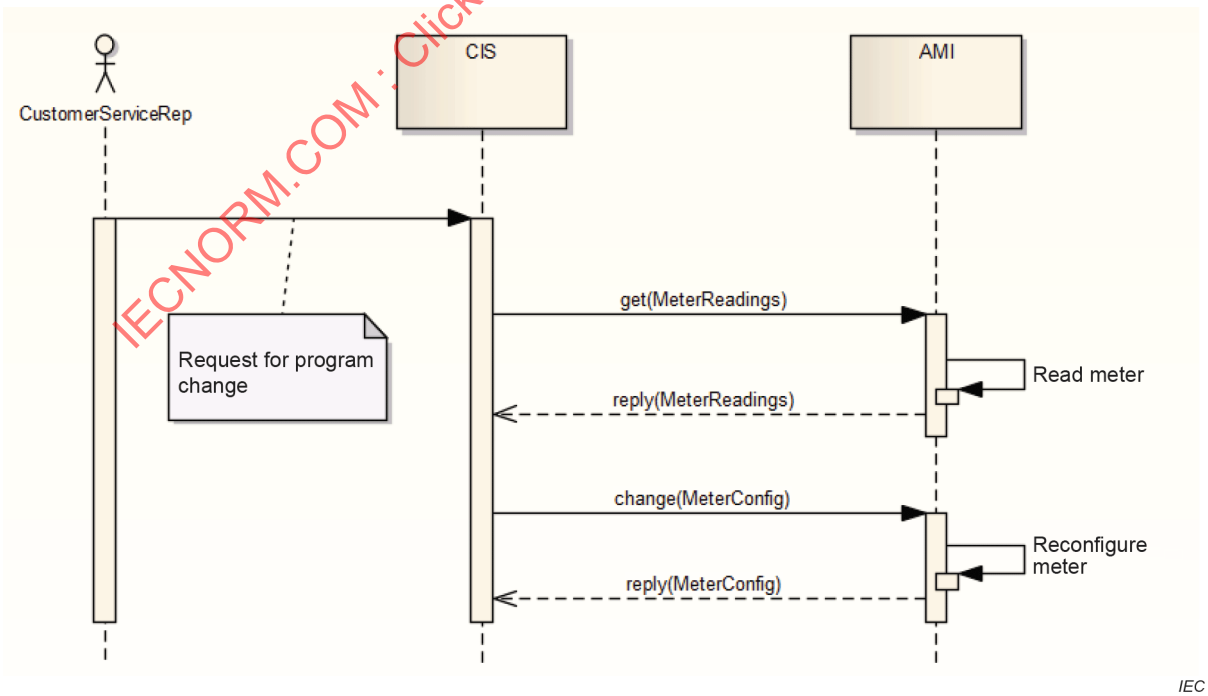


Figure 34 reproduced with the permission of UCAIug.

Figure 34 – Example message exchange for change of customer program w/o MDM

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In other cases, a change to the customer program might not be accommodated with a meter reconfiguration. The program change may require a meter changeout (refer to 5.5 for more information on meter changeouts). Meter changeouts entail a different workflow than meter reconfigurations. This will be reflected in the message exchange between systems. An example exchange is depicted in Figure 35.

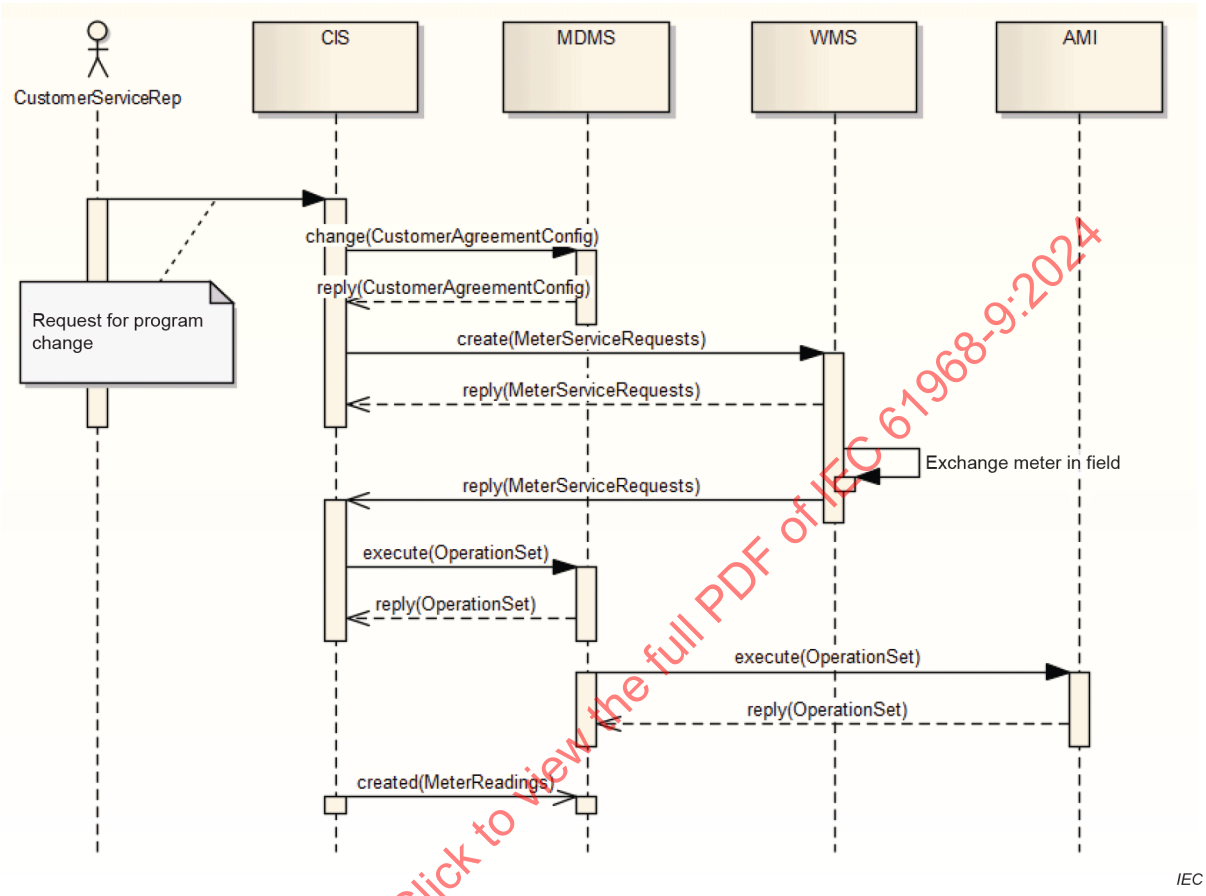


Figure 35 reproduced with the permission of UCAIug.

Figure 35 – Example for change of customer program with meter change out

See 5.6.2 on meter installation and removal for additional details on the MeterServiceRequest message.

5.4.2.4 Meter disconnect and reconnect

For a variety of reasons, such as non-payment, it may be necessary to disconnect or reconnect a customer. When disconnected, recorded usage should be zero and out of power complaints should be ignored. When it is not possible to perform a disconnect or reconnect remotely through an MS, a meter service request will typically be issued to perform the disconnect or reconnect manually. Example message exchanges for remote operation are depicted in Figure 36 and Figure 37.

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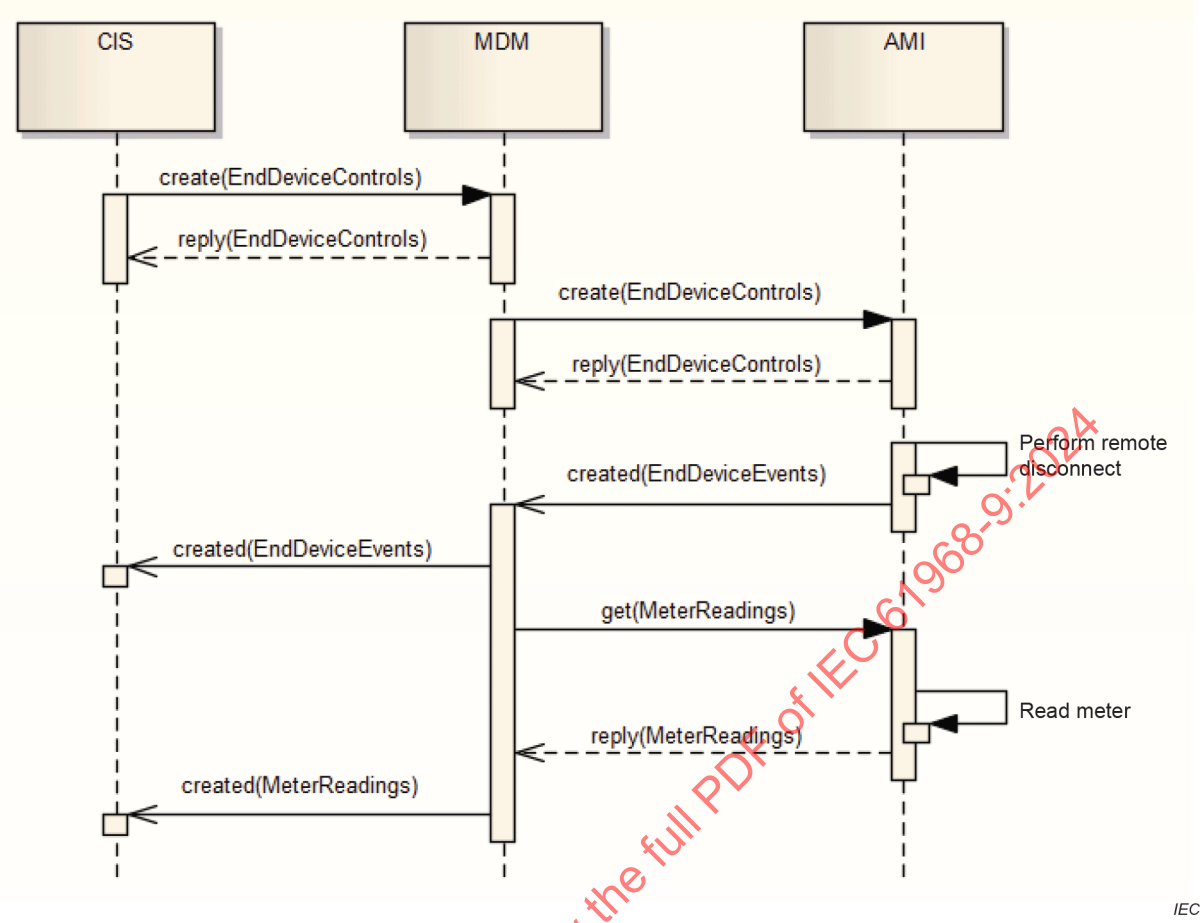
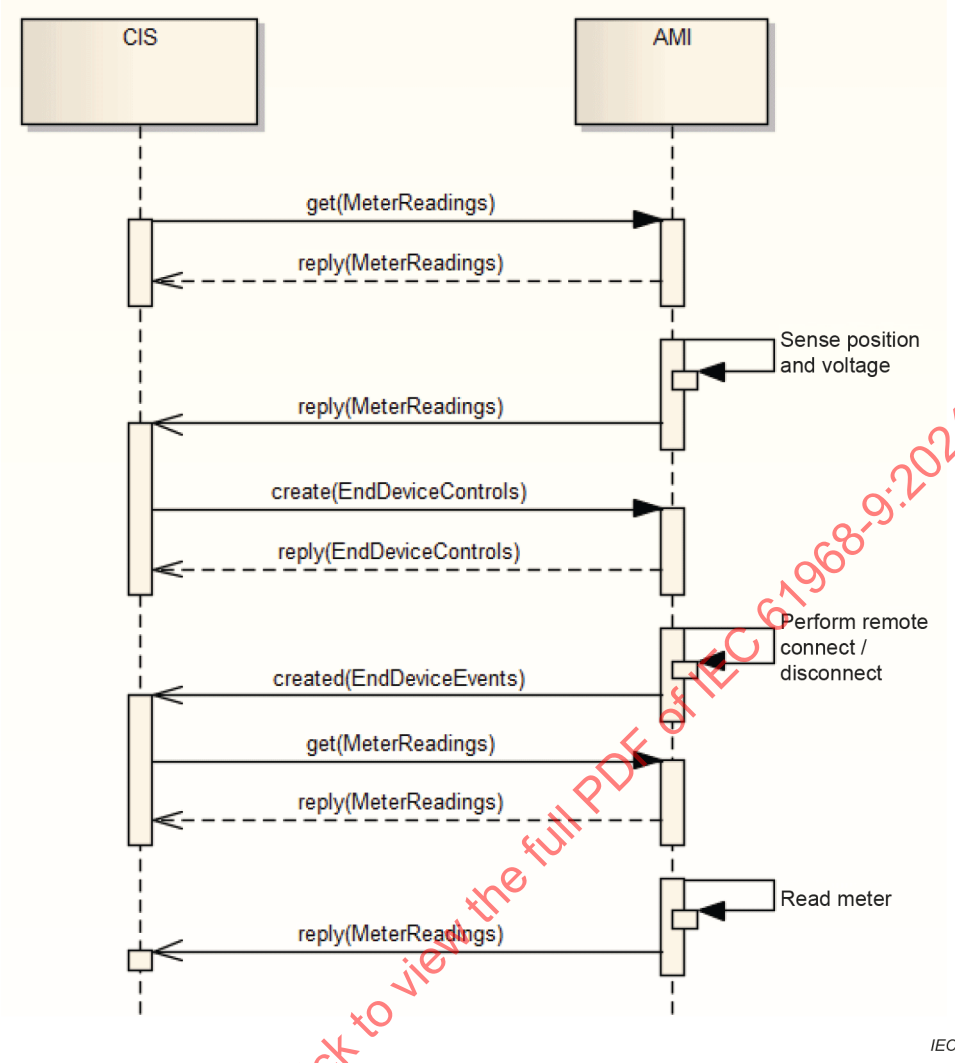


Figure 36 reproduced with the permission of UCAIug.

Figure 36 – Example message exchange for meter connect/disconnect

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Figure 37 reproduced with the permission of UCAIug.

Figure 37 – Example of remote connect/disconnect directly between CIS and MS

5.4.2.5 Real-Time pricing

Real-time pricing signals and/or schedules can be sent to an end device via the MS. There are several ways this can be accomplished, such as:

- price signal issued in real-time identifying a price for a given time interval
- time of use (TOU) schedules published, which cause changes in the accumulation for each TOU Tier
- energy price schedules published in advance.

Often the EndDeviceGroup can be used to differentiate meters with different contracts or tariffs.

The example in Figure 38 shows a price signal being sent from network operations, to the MS. The MS then acts as a network service provider to communicate the price in real time to meters and other equipment.

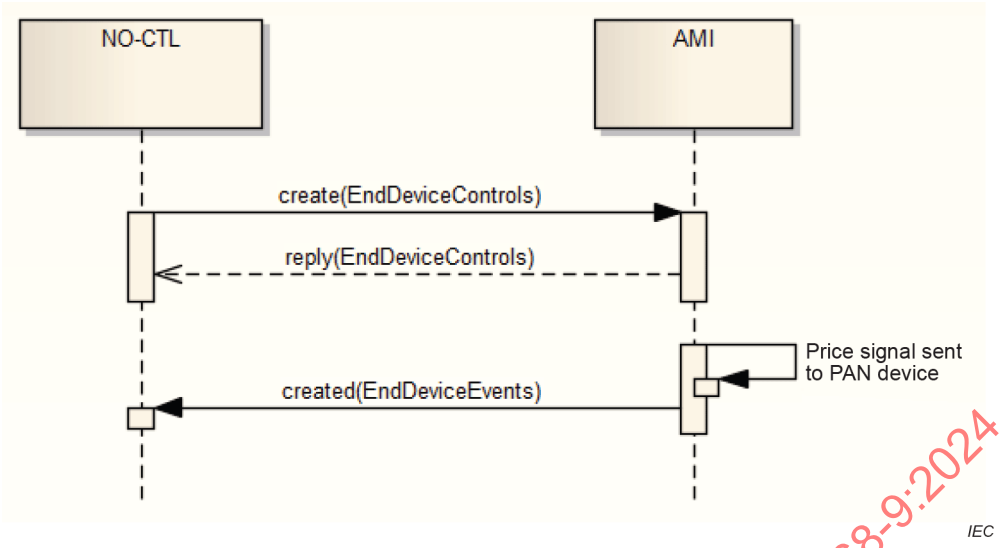


Figure 38 reproduced with the permission of UCAIug.

Figure 38 – Example message exchange for real-time price signal

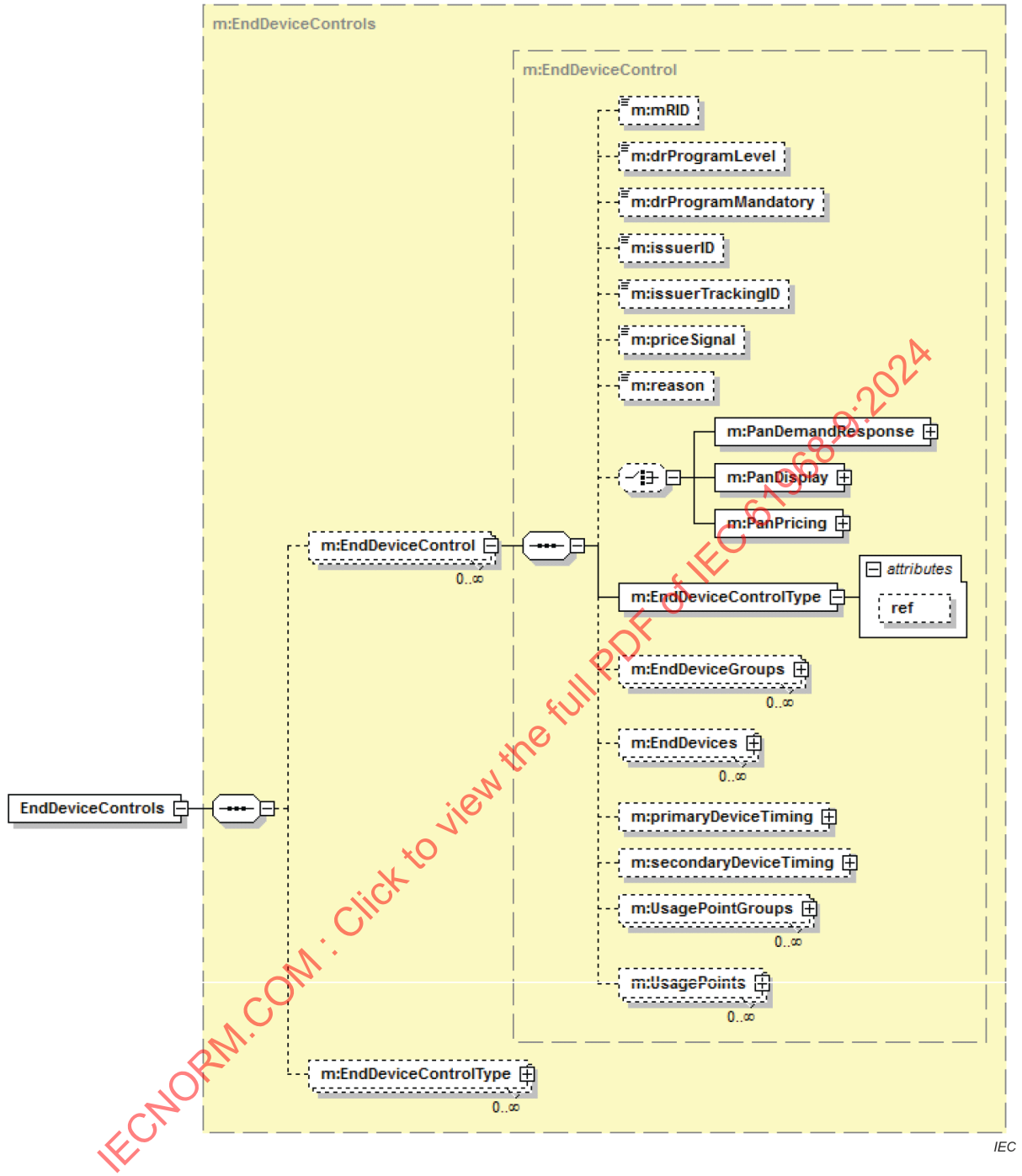
Price signals are implemented as a subtype of EndDeviceControl, where the price is a message parameter.

5.4.3 Message format

5.4.3.1 General

Figure 39 describes the structure of an EndDeviceControls message. The XML schema for the EndDeviceControls message is defined in Annex G.

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Figure 39 reproduced with the permission of UCAIug.

Figure 39 – End device controls message format

Within this message payload structure, specific meters may be addressed by EndDevice (e.g. meter) EndDeviceGroup, UsagePoint and/or UsagePointGroup. Aside from at least one address, the only required element is the EndDeviceControlType, which identifies the type of control to be performed. Examples of the different control types that could be used include, but are not limited to:

- load control signal
- price signal or schedule
- remote disconnect
- remote reconnect

- demand reset
- demand reduction signal
- sending a text message to a PAN device
- sending pricing signals to a PAN device
- sending load control / demand response events to a PAN device.

The following Subclauses 5.4.3.2, 5.4.3.3, 5.4.3.4 and 5.4.3.5 are representative XML examples for EndDeviceControls.

5.4.3.2 Example of a demand reset payload

Figure 40 is an example for a demand reset. Note that in this example there are two devices being addressed, each of these is in its own EndDevices element. One of them is addressed by mrID and the other is addressed by Names.

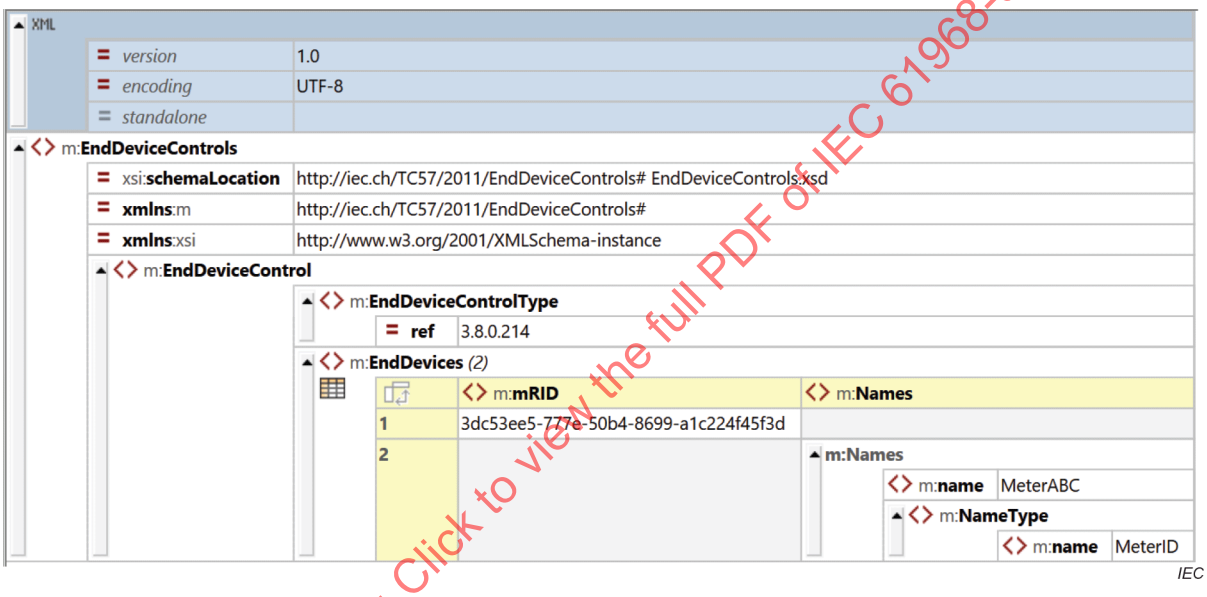


Figure 40 reproduced with the permission of UCAIug.

Figure 40 – EndDevice example

5.4.3.3 Example of a meter disconnect by group

Figure 41 is an example of a meter disconnect by group.

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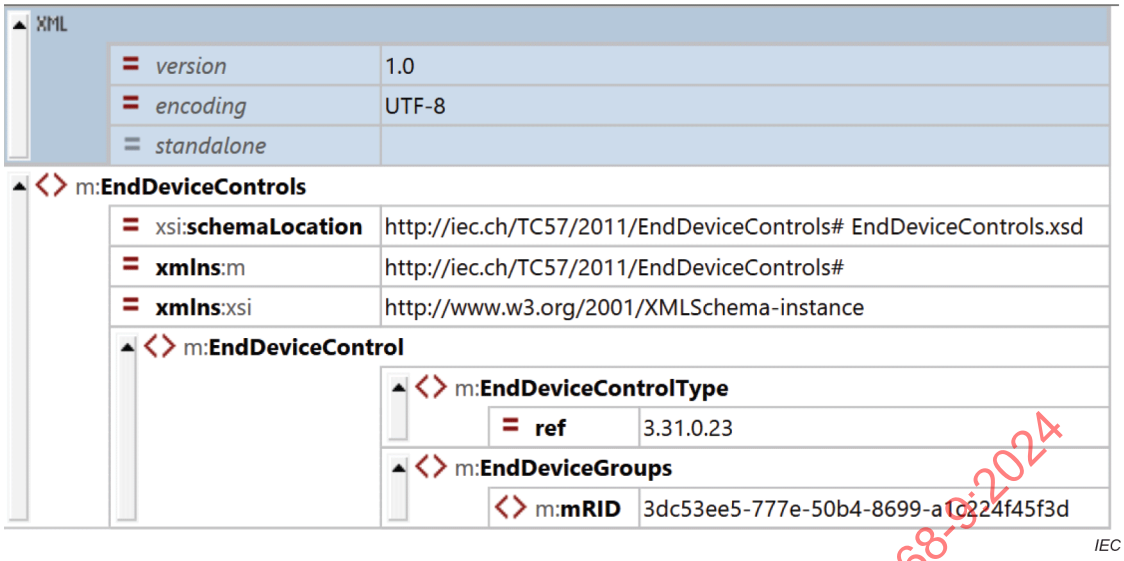


Figure 41 reproduced with the permission of UCAIug.

Figure 41 – EndDeviceControl example

5.4.3.4 Example of a scheduled disconnect by group

Figure 42 is an example of a scheduled disconnect by group.

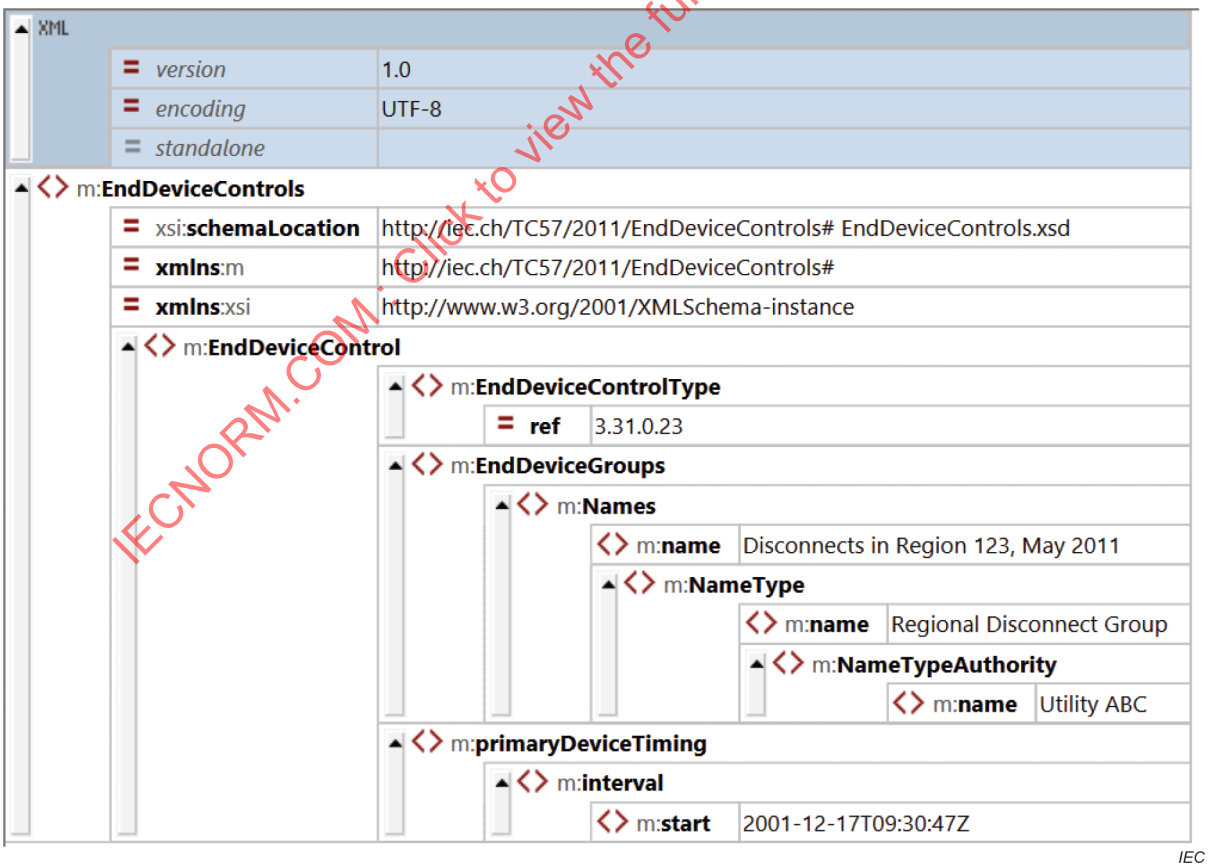


Figure 42 reproduced with the permission of UCAIug.

Figure 42 – EndDeviceControls disconnect by group example

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5.4.3.5 Example of a meter connection by name

Figure 43 shows an example of a meter connection, where the the meter is specified by name.

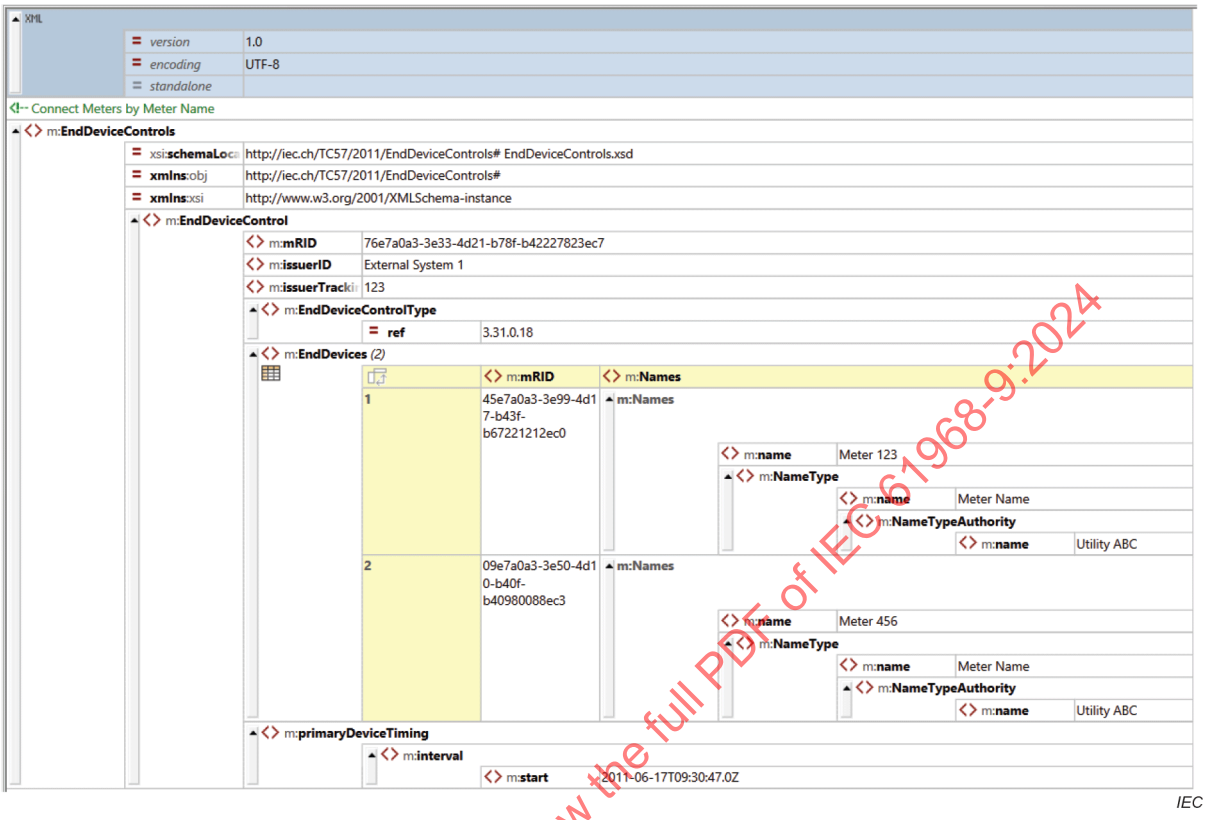


Figure 43 reproduced with the permission of UCAIug.

Figure 43 – EndDeviceControls meter connection example

5.5 Meter service requests

5.5.1 General

Meter service requests are a subclass of Work, where an EndDevice is involved. These are communicated using the ServiceRequest profile, and are defined in IEC 61968-8.

It may be necessary to install, remove or configure meters as a consequence of the registration of a new customer, removal of a customer or the switch of a customer from one supplier to another. These scenarios are discussed in IEC 61968-8. However, there may also be a need identified by the AMI system or MDM to change out an existing meter. This involves the removal of the old meter, installation of the new meter and configuration of the new meter as needed by the metering system.

EndDeviceEvents (as described in 5.2) can cause an evaluation to occur which results in a request for a meter change out. Meter events may be published from the MS or MDM. Figure 44 describes an example exchange where the MDM has identified a problem, and brought it to the attention of the WMS which decides to change out the meter.

Once again, the OperationSet steps are included to synchronize the revised Master Data (the configuration data for the new and old meters and the association changes with the UsagePoint) with the MDM System and the Metering System. See 5.8 and Annex I and Annex J for additional information related to Master Data Management.

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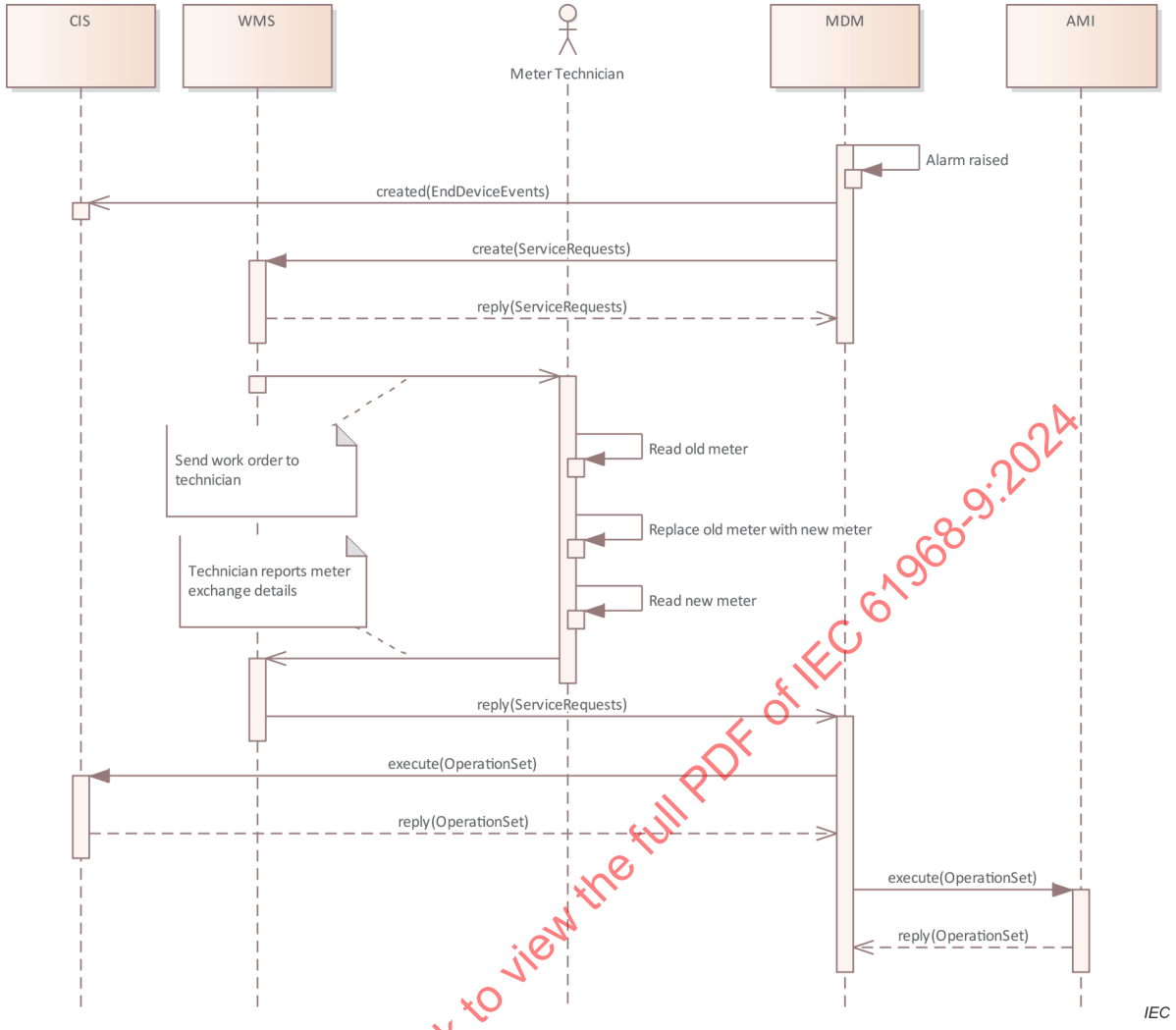


Figure 44 reproduced with the permission of UCAIug.

Figure 44 – Example end device event message exchange due to meter changeout

5.6 Metering system events

5.6.1 General

There are different levels of need within the system for different kinds of messages.

The metering system (*per se*) may develop problems within its infrastructure which require a work order to fix. The data requirements for communicating this event are similar to the requirements of EndDeviceEvent as described in 5.2. With an EndDeviceEvent, a simple error code can be used to report a problem. This mechanism works when the recipient is able to look-up and interpret the meaning of the code. However, when a more detailed description of the problem is required, a more elaborate schema shall be used. In some cases, the recipient is a human and requires a human-readable description of the problem, and the particular piece of equipment involved. When identifying the asset, it will probably be necessary to use vendor-specific terminology to describe the hardware.

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5.6.2 Applications – Firmware upgrade

For an automated Metering System capable of two-way communication, it may be possible to upgrade the firmware of MS infrastructure in the field, or in some systems the communication assets in the end devices. Changes to the metering system that materially affect its operation shall be communicated to all of the relevant stakeholders. An example of such a publication using an EndDeviceConfig message is depicted in Figure 45.

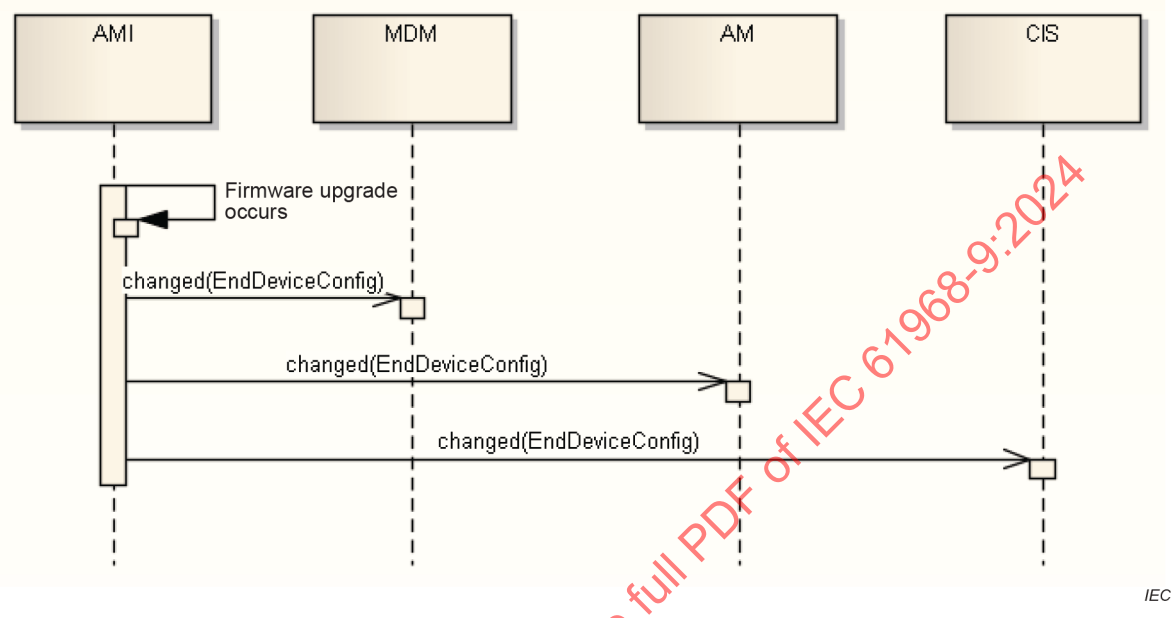


Figure 45 reproduced with the permission of UCAIug.

Figure 45 – Example firmware upgrade message exchange

The firmware upgrade may cause the EndDevice or CommEquipmentAsset to change in a number of ways, including device functional characteristics, firmware version and revision number, or configuration (expressed as a programId).

5.6.3 Message formats

Please refer to the EndDeviceConfig message format described in 5.8.3.

5.7 Premises area networks

5.7.1 General

The metering system has been expanded to include devices that have been deployed within homes and businesses that are managed using the metering infrastructure. Within this document, these devices exist within a premises area network (PAN). This is inclusive of the commonly used term home area network (HAN). The PAN/HAN devices themselves are a special type of EndDevice.

Given the evolving nature of the underlying devices and communication protocols, this document attempts to take a view that can be mapped as needed into a variety of device standards.

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5.7.2 Applications

5.7.2.1 General

The applications for PAN devices primarily include dynamic pricing, demand response and providing information to customers. There are many types of PAN devices, including smart thermostats, in home displays, relays, etc.

5.7.2.2 PAN device pairing and unpairing

The pairing of a PAN device with a meter is required before the PAN device can be sent commands by the Metering System.

PAN device pairing (and un-pairing) is performed using an EndDeviceControls message as shown in the example of Figure 46. The following special conventions relative to the EndDeviceControl message apply to pairing a PAN device with a meter:

- The appropriate EndDeviceControlType code for pairing a PAN device should be selected from Annex F.
- Two (and only two) EndDevices are identified by mRid or the Names class – one is the meter and the other is the PAN device. The isPan Boolean will be set to true for the PAN device and the install code and electronicAddress.macAddress are also normally required.
- Successful or unsuccessful results for the pairing operation are reported using EndDeviceEvents messages, with the appropriate EndDeviceEventType enumerations found in Table E.25. It is possible for more than one EndDeviceEvent to be reported as a result of the EndDeviceControl.

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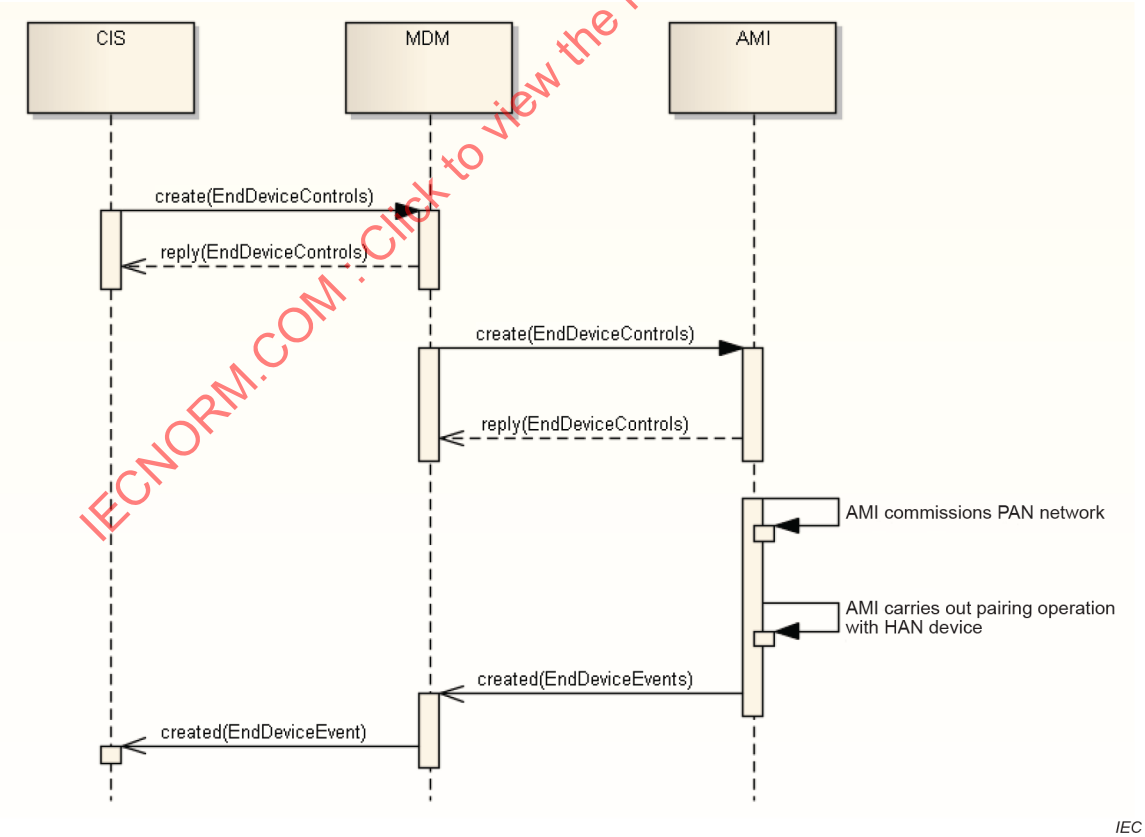


Figure 46 reproduced with the permission of UCAIug.

Figure 46 – Pairing of a PAN device

5.7.2.3 PAN Events

PAN device events are generated by a PAN device, where they are typically communicated through a meter or gateway to the metering system head end. The metering system head end will then publish the message to other enterprise applications that have subscribed. These events are conveyed using the EndDeviceEvents message. An example is shown in Figure 47.

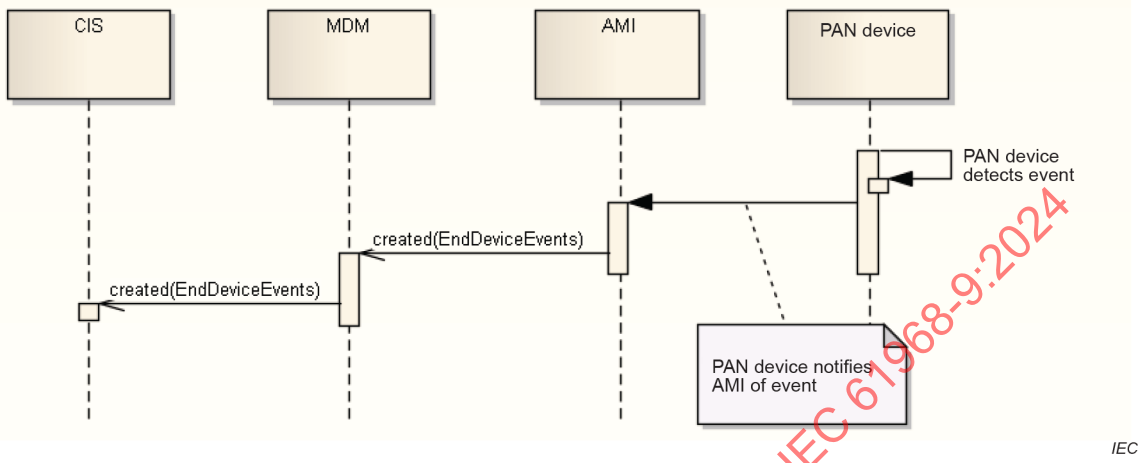


Figure 47 reproduced with the permission of UCAIug.

Figure 47 – PAN device events

5.7.2.4 PAN controls

Additional PAN device controls for purposes other than pairing may be initiated by an enterprise application such as a demand response management system to a metering system head end. These controls also use the EndDeviceControls message. Given that there are a variety of ways that the control can be addressed, there may be many target PAN devices. An example is shown in Figure 48.

EndDeviceControls messages intended for PAN devices will typically include one of the following special structures within the EndDeviceControl profile:

PanDemandResponse

PanDisplay

PanPricing

The appropriate EndDeviceControlType and EndDeviceEventType enumerations for these functions can be found in Annex E and Annex F.

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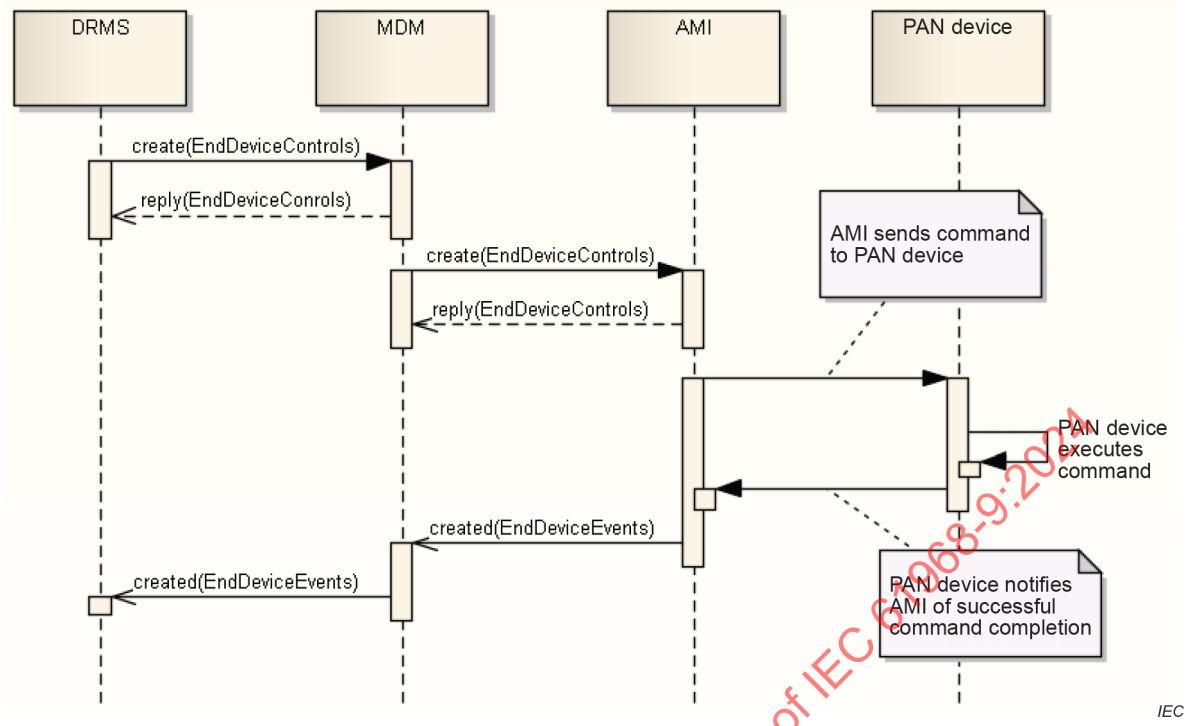


Figure 48 reproduced with the permission of UCAIug.

Figure 48 – PAN device controls

5.7.3 Message formats

There are no unique messages defined specifically for PAN devices. PAN devices are simply types of EndDevices.

5.8 Master data management messages

5.8.1 General

Enterprise systems exchanging messages in the Meter Reading and Control domain require a means of managing the non-transactional data that defines assets, other CIM objects and the relationships (or associations between them). Master Data Management (MDM) is the term used to describe the practice of creating, changing, and deleting these objects and relationships.

For IEC 61968-9 purposes, the CIM classes that fall within the scope of Master Data Management and the IEC 61968-9 profiles used to create/change/delete these objects (and their "configurations") are included in Table 4:

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Table 4 – IEC 61968-9 configuration profiles

CIM object	IEC 61968-9 profile
ComModule	ComModuleConfig
EndDevice	EndDeviceConfig
EndDeviceGroup	EndDeviceGroups
Meter	MeterConfig
TransformerTank	[a]
UsagePoint	UsagePointConfig
UsagePointGroup	UsagePointGroups
UsagePointLocation	UsagePointLocationConfig

[a] For IEC 61968-9 purposes, the TransformerTank object has applicability to use cases involving Outage Management by providing a linkage between the UsagePoint and a TransformerTank in the network model. The TransformerTank is technically outside the scope of IEC 61968-9, and there is no IEC 61968-9 profile for creation, modification or deletion of a TransformerTank. However, the TransformerTank can be referenced within other profiles including, but not necessarily limited to the UsagePointConfig, CustomerMeterDataSet, GetMeterReadings, and MasterDataLinkageConfig profiles.

ConfigurationEvents occur each time a create, change, update, or delete operation is performed using any of the "config" operations using the IEC 61968-9 profiles in Table 4 as well as any time that a MasterDataLinkageConfig transaction is executed to manage the relationships of MDM objects.

The ConfigurationEvent class in the CIM is associated with each of the CIM classes in the first column of Table 4 and is incorporated into each of the IEC 61968-9 Profiles in column 2 of that table. The function of the ConfigurationEvent class is to provide important business details about each "config" operation, including:

- the date and time at which the configuration or configuration change became effective or is to become effective,
- the entity performing the configuration operation, and
- free-form remarks providing additional business information related to the configuration event.

Refer to Annex J for detailed descriptions of Master Data Management Use Cases and sample XML messages that clarify the intended use of the messages in this subclause 5.8.

5.8.2 Applications

5.8.2.1 General

For the purposes of this standard, there are two methods used for managing the relationships between the CIM objects identified in 5.8.1. These are the MasterDataLinkage profile and, for a limited number of CIM objects, the relationships are explicitly managed using profiles identified in 5.8.1. The diagram in Figure 49 identifies the object relationships that are critical to master data management within the scope of this document and the specific method that is recommended to be used for managing each relationship.

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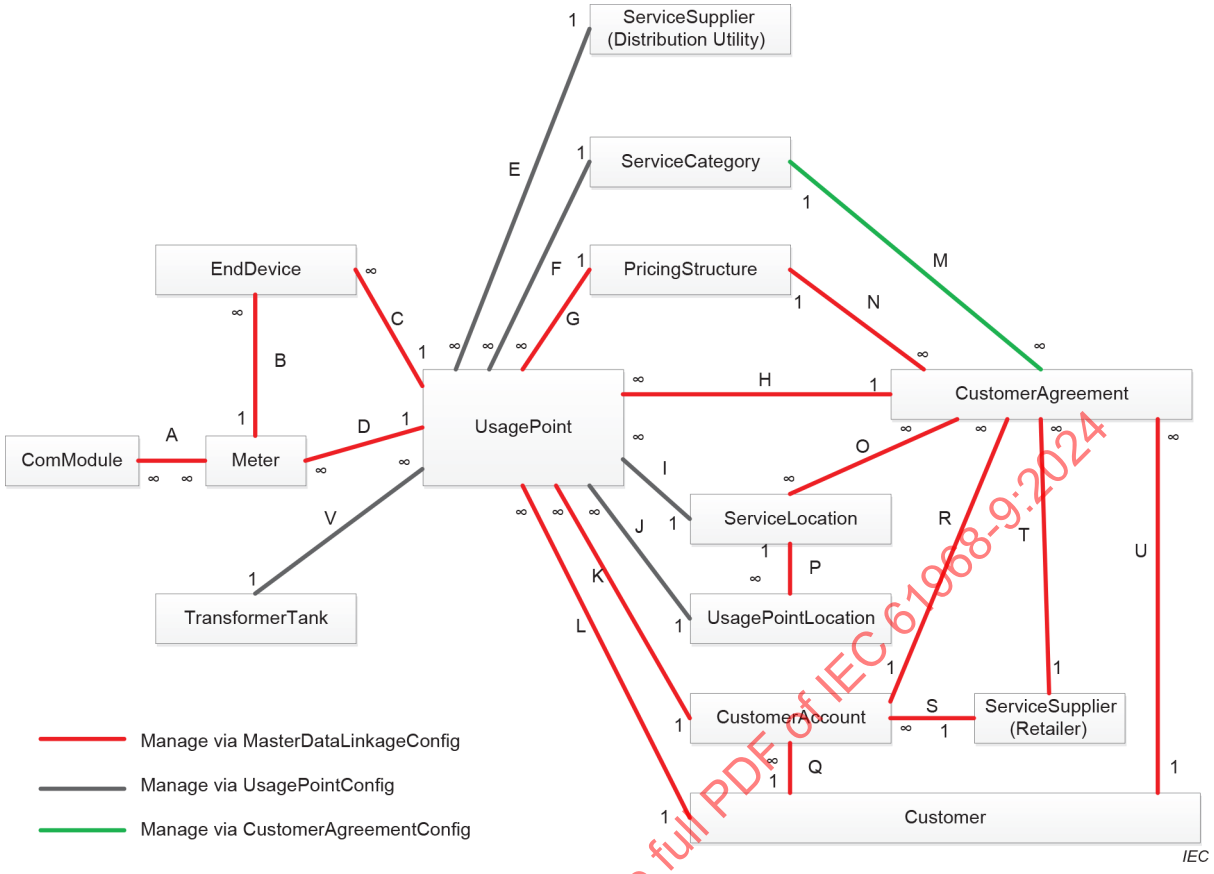


Figure 49 reproduced with the permission of UCAIug.

Figure 49 – Master data linkages

To fully comprehend Figure 49, it is necessary to understand that this document provides normative messages by which enterprise systems can exchange information; however there is no requirement that any given system implement an internal data model that is based upon or even consistent with the CIM. Accordingly, the above diagram presents the possibility of reflecting relationships in a variety of ways. For example, two systems may recognize the concepts of Customer, CustomerAccount and CustomerAgreement and choose to express the relationships between these entities and a UsagePoint by linking a Customer to a CustomerAccount (relationship Q), then linking the CustomerAccount to CustomerAgreement (relationship R) and finally linking the CustomerAgreement to the UsagePoint (relationship H). In this scenario, there may never be a need to utilize relationships K, L or U.

On the other hand, there may be two enterprise systems that do not materialize the concept of a CustomerAgreement in their internal data models. These systems may utilize messages that link a Customer to a CustomerAccount (relationship Q), and then link the CustomerAccount to the UsagePoint (relationship K). It is outside the scope of this document to be prescriptive on which of the relationships illustrated in Figure 49 are permissible or preferred. The MasterDataLinkageConfig profile may be used in a flexible manner to support the needs of any enterprise and its enterprise systems.

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It is recommended that relationships E, F, I, J, M and V be managed by the "Config" profiles called out in the legend of the figure, rather than via the MasterDataLinkageConfig profile; however this is not a requirement and enterprises may choose to use the MasterDatalinkageConfig profile to manage these relationships as well. The reason for the recommendation that these specific relationships be handled by the identified profiles rather than the MasterDataLinkageConfig is twofold:

- these specific relationships seldom change, and
- these specific relationships are viewed by almost all enterprise systems in a consistent way.

The converse is also true. Enterprises may choose to manage relationships depicted as red lines as if they were depicted by black lines provided that the relationship is supported by the CIM and is reflected in the appropriate IEC 61968-9 profile.

Figure 49 is informative. It depicts the range of relationships expected between entities. Figure 53 takes a step toward an implementation by showing how XML might be organized. Further steps are illustrated at the link in Annex G for MasterDataLinkageConfig. Entities and relationships in Figure 53 may evolve over time as use of this document is extended to support new and revised business use cases.

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5.8.2.2 Usage points

Information about the usage points may be configured into MS by means of a UsagePointConfig message payload.

An example of a message exchange is given in Figure 50 and the message format is given in 5.8.3.4.

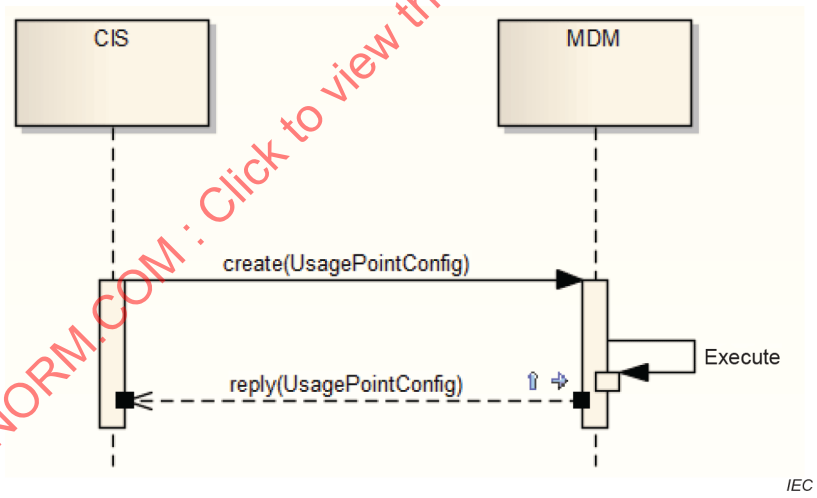


Figure 50 reproduced with the permission of UCAIug.

Figure 50 – Message exchange for transferring usage point information

5.8.2.3 Meters

Information about the meters in service may be configured into MS by means of MeterConfig message payload.

An example of a message exchange is given in Figure 51 and the message format is given in 5.8.3.7.

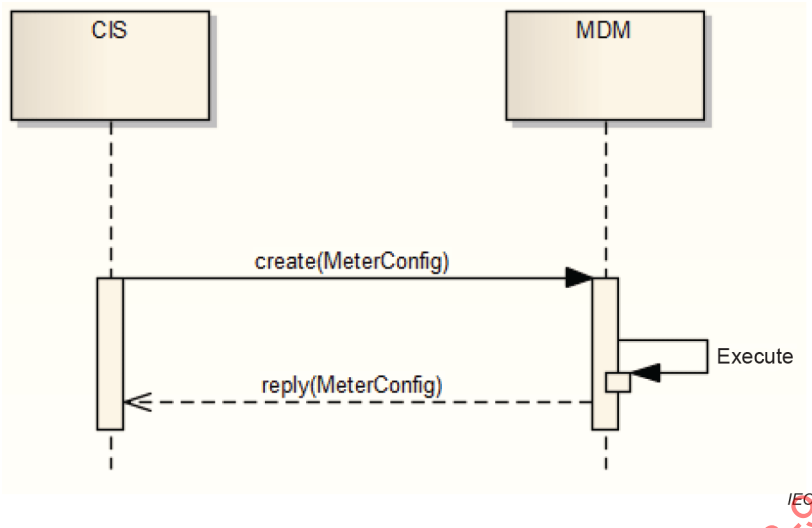


Figure 51 reproduced with the permission of UCAIug.

Figure 51 – Message exchange for transferring meter information

5.8.2.4 End devices

Information about end devices in service may be configured into MS by means of an EndDeviceConfig message payload.

An example of a message exchange is given in Figure 52 and the message format is given 5.8.3.6.

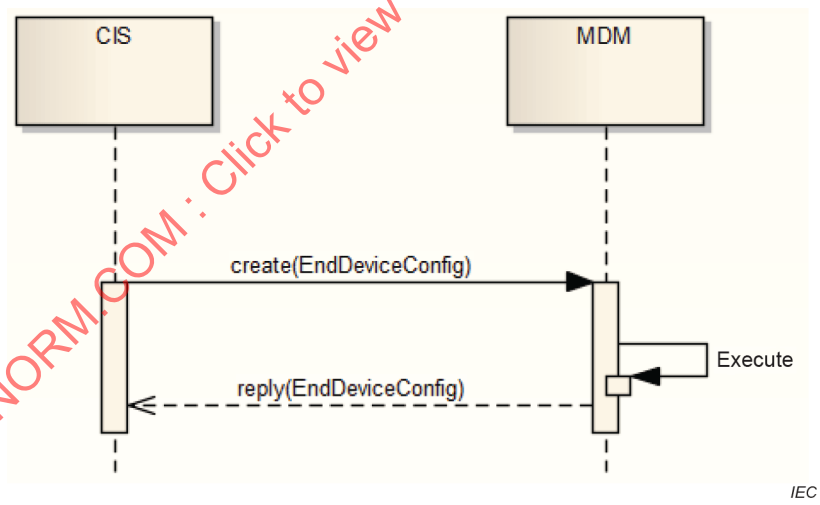


Figure 52 reproduced with the permission of UCAIug.

Figure 52 – Message exchange for transferring end device information

5.8.3 Message formats

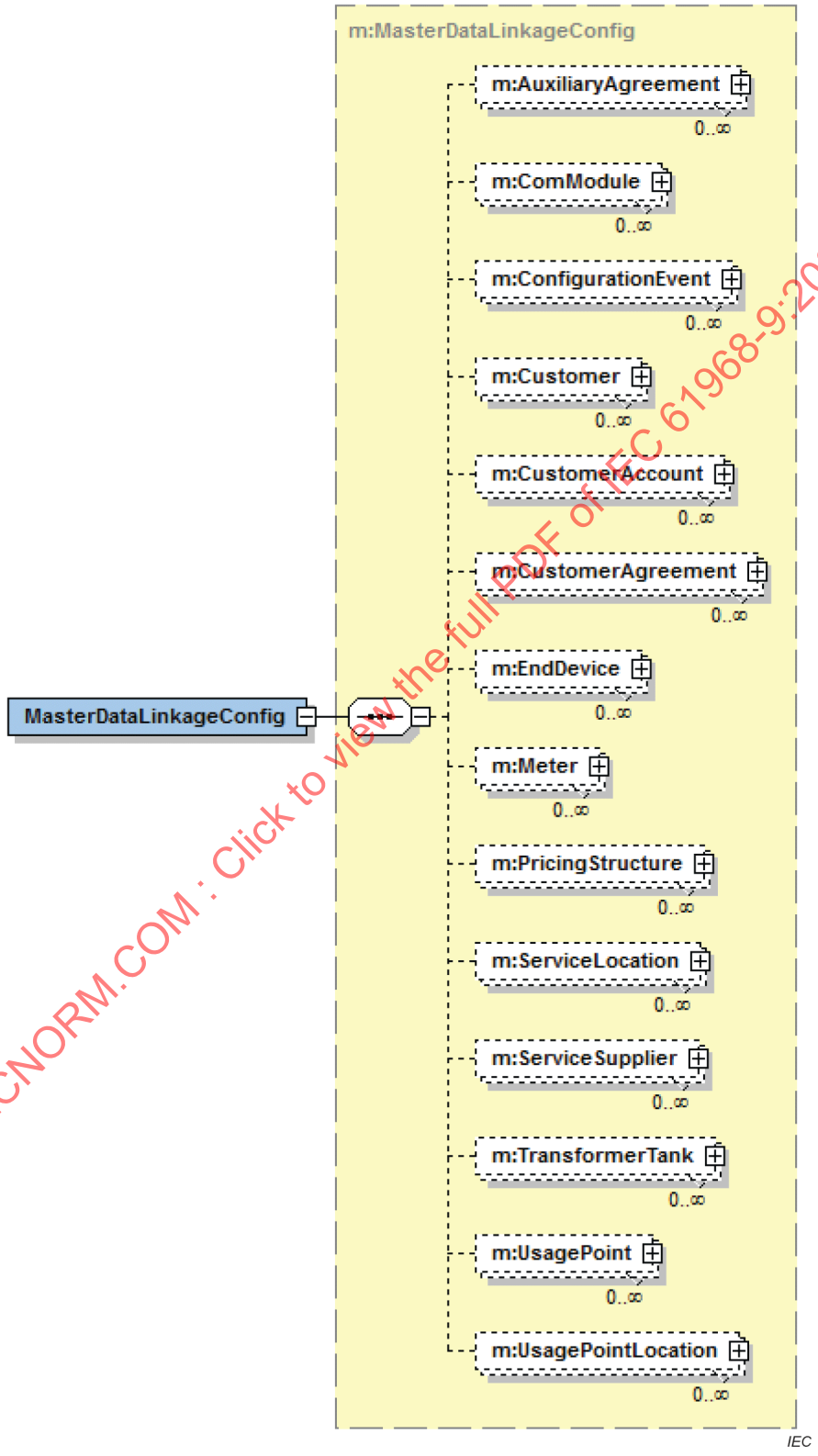
5.8.3.1 General

This subclause 5.8.3 describes the message formats for the MasterDataLinkageConfig and other Master Data Management "config" messages. The detailed specification for each class and attribute can be found in IEC 61968-11 and IEC 61970-301. The normative profiles for this edition of 61968-9 can be found in Annex G. As noted in Annex G these profiles can be serialized into XSDs, JSON schemas, as well as other serializations. The remainder of this document refers only to XSD serialization.

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5.8.3.2 MasterDataLinkageConfig

Figure 53 describes the top level structure of the Master Data Linkage Config message used to configure relationships between objects.



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Figure 53 reproduced with the permission of UCAIug

Figure 53 – MasterDataLinkageConfig message format

An example of MasterDataLinkageConfig is shown below in Figure 54. This message illustrates the "non-in-line" method of establishing an association between two CIM objects – in this case between the Meter and the UsagePoint are associated with each other using a MasterDataLinkageConfig command. This is the normative way to reflect the installation of a Meter at a UsagePoint.

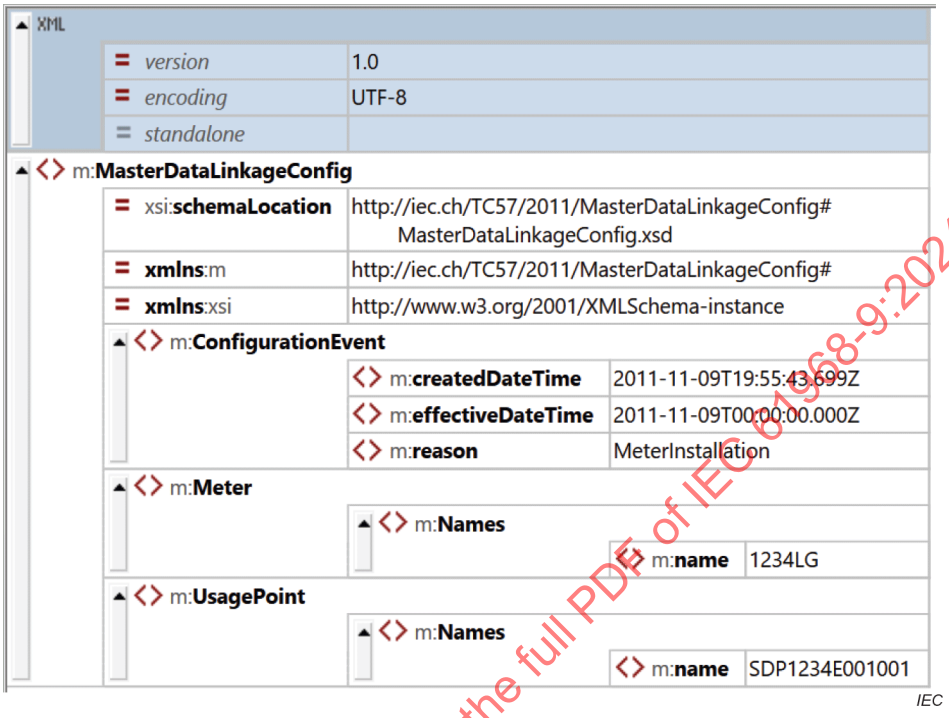


Figure 54 reproduced with the permission of UCAIug.

Figure 54 – MaterDataLinkageConfig example

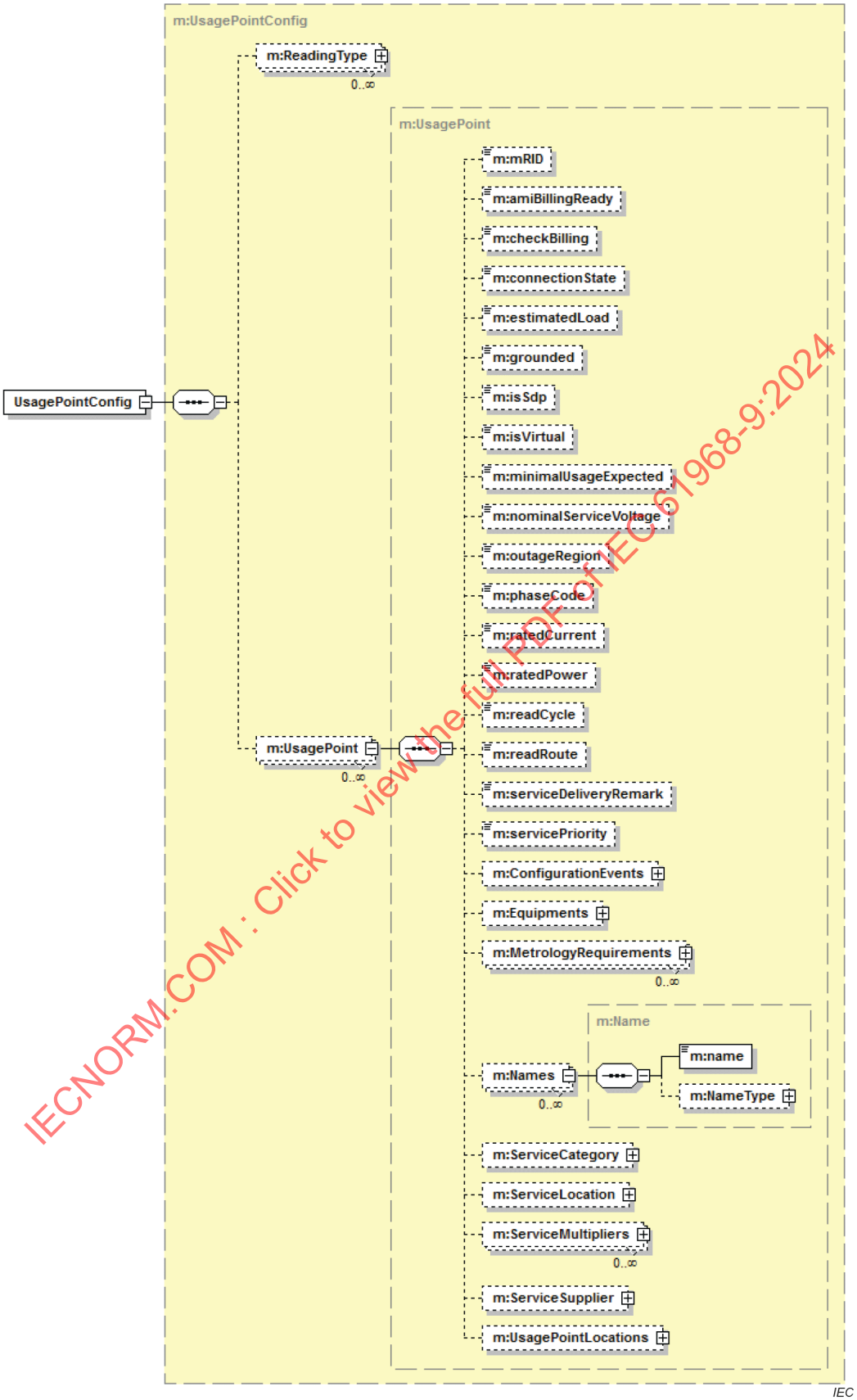
5.8.3.3 SupplierConfig

The ServiceSupplierConfig structure has been moved to IEC 61968-8:2023.

5.8.3.4 UsagePointConfig

The message structure in Figure 55 is used to configure usage points. This replaces the service delivery points message defined in IEC 61968-9:2009.

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Figure 55 reproduced with the permission of UCAIug.

Figure 55 – UsagePointConfig message format

An example of UsagePointConfig payload is shown in Figure 56.

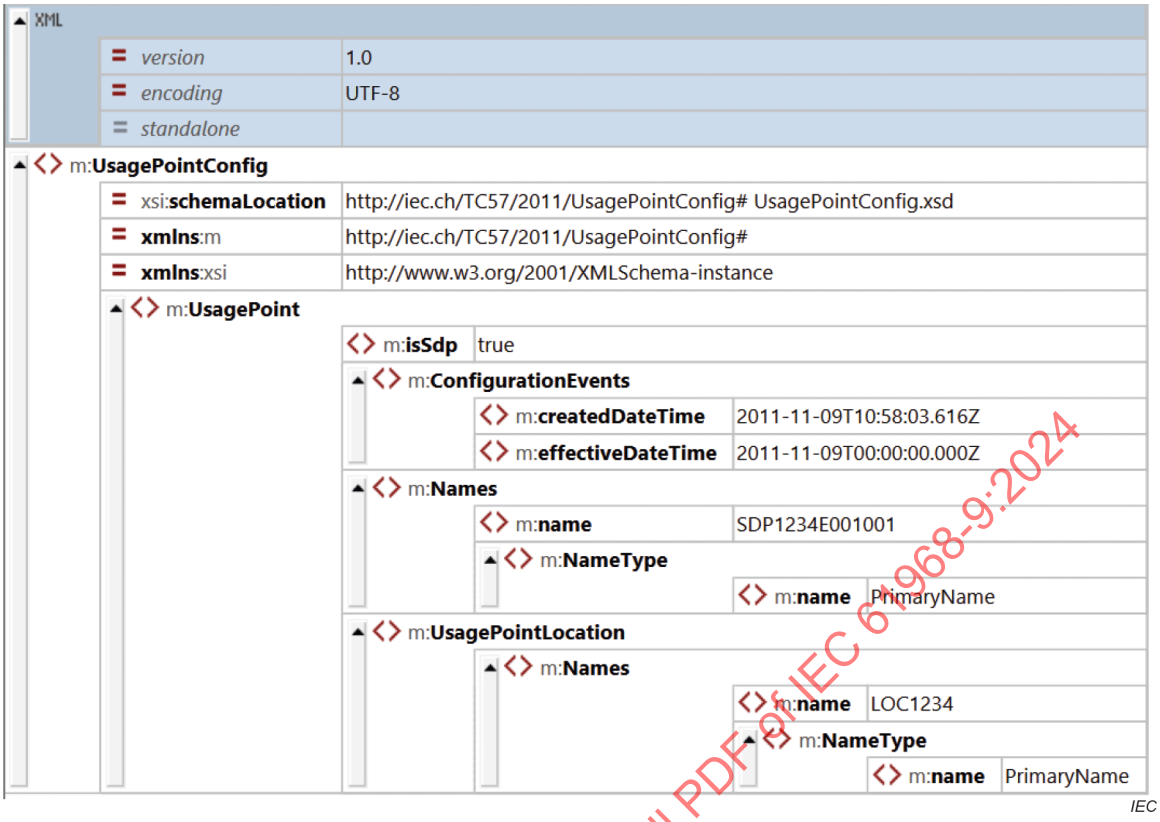


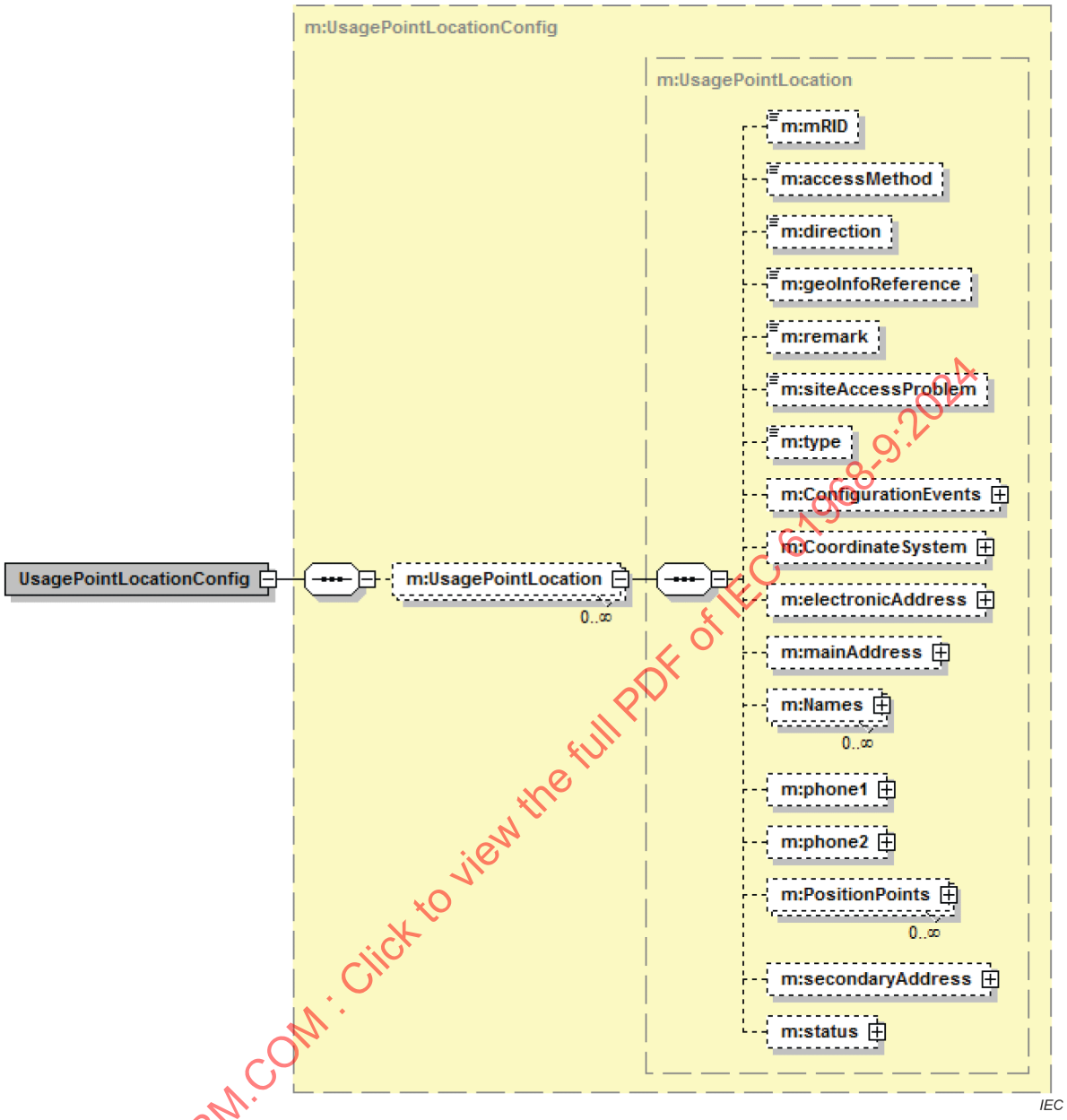
Figure 56 reproduced with the permission of UCAIug.

Figure 56 – UsagePointConfig example

5.8.3.5 UsagePointLocation

The diagram in Figure 57 describes the structure of the message used to define UsagePointLocations.

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Figure 57 reproduced with the permission of UCAIug.

Figure 57 – UsagePointLocationConfig message format

An example payload of UsagePointLocationConfig is shown in Figure 58.

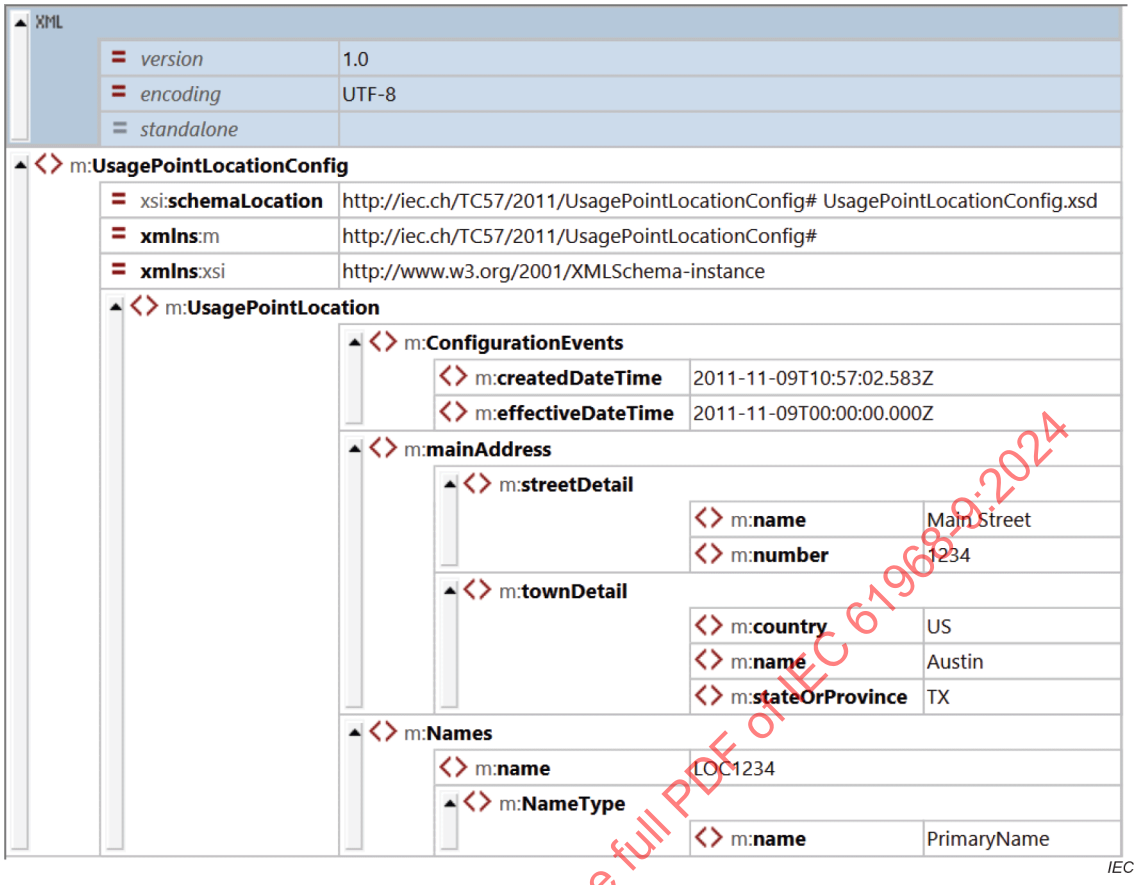


Figure 58 reproduced with the permission of UCAIug.

Figure 58 – UsagePointLocationConfig example

5.8.3.6 EndDeviceConfig

The diagram in Figure 59 describes the top level of the EndDeviceConfig message, which is used to provide for basic configuration of end devices.

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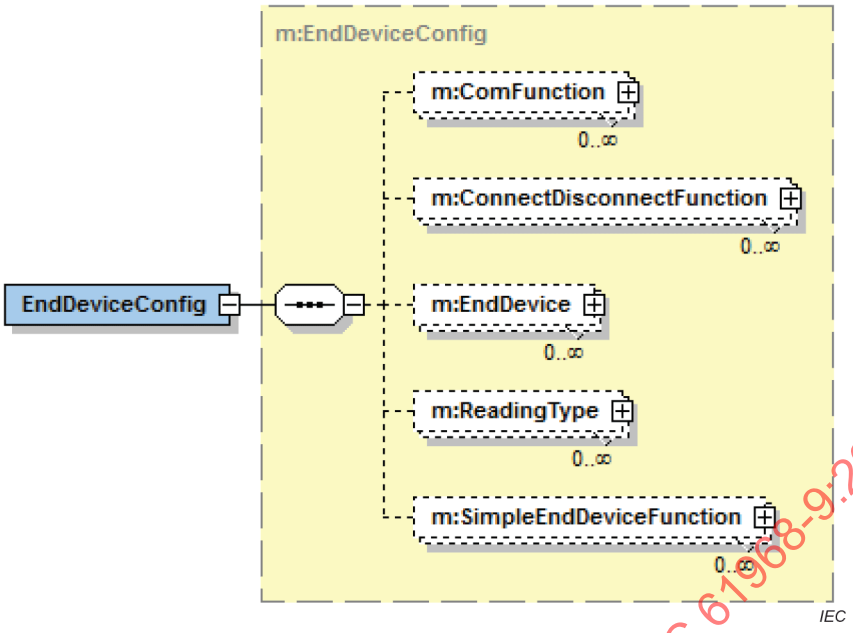


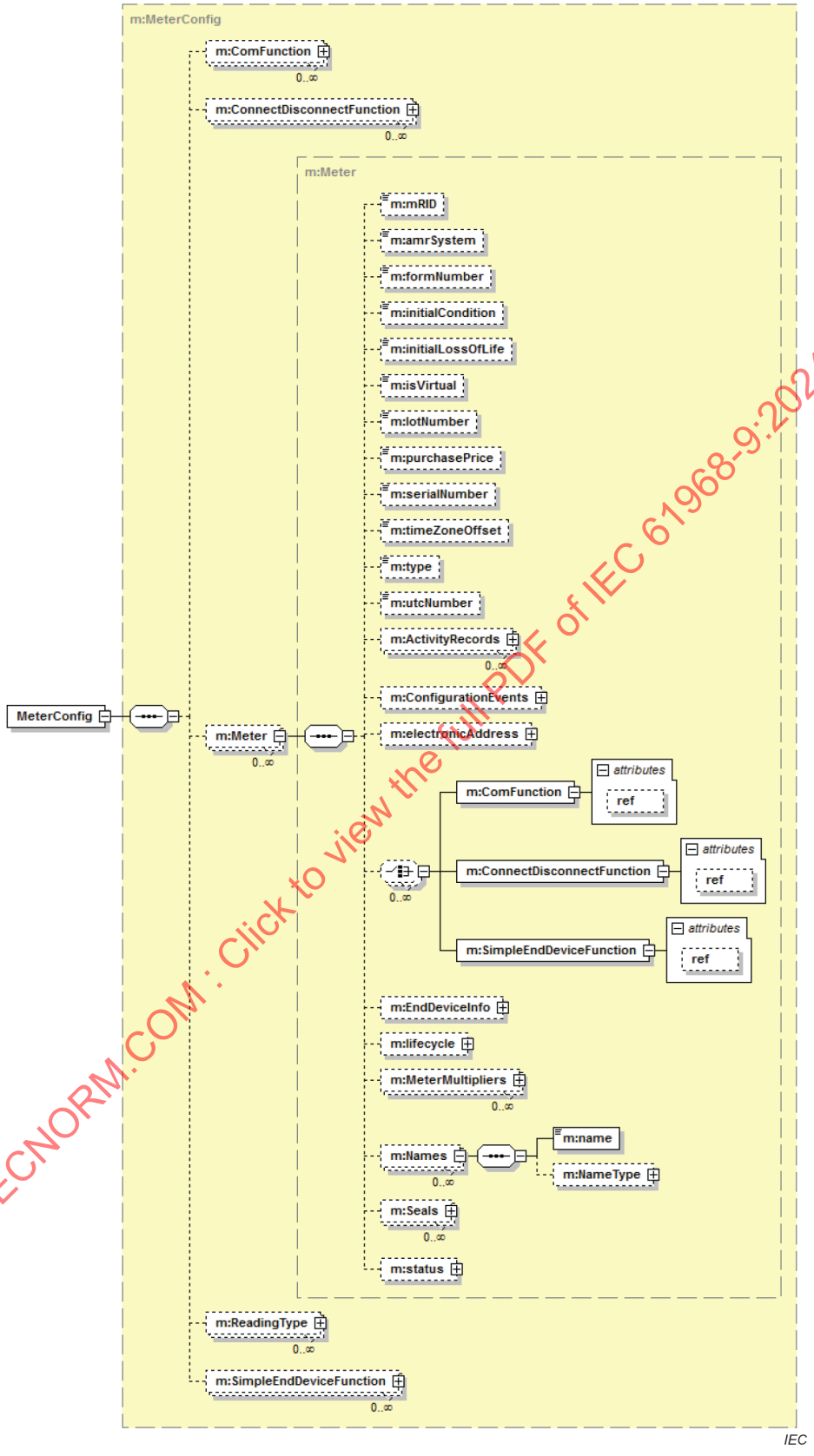
Figure 59 reproduced with the permission of UCAIug

Figure 59 – End device config message format

5.8.3.7 MeterConfig

The message structure in Figure 60 is used to configure meters, where it is possible to supply information more specific to meters.

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Figure 60 reproduced with the permission of the UCAIug.

Figure 60 – Meter configuration message

An example of a MeterConfig payload is shown in Figure 61.

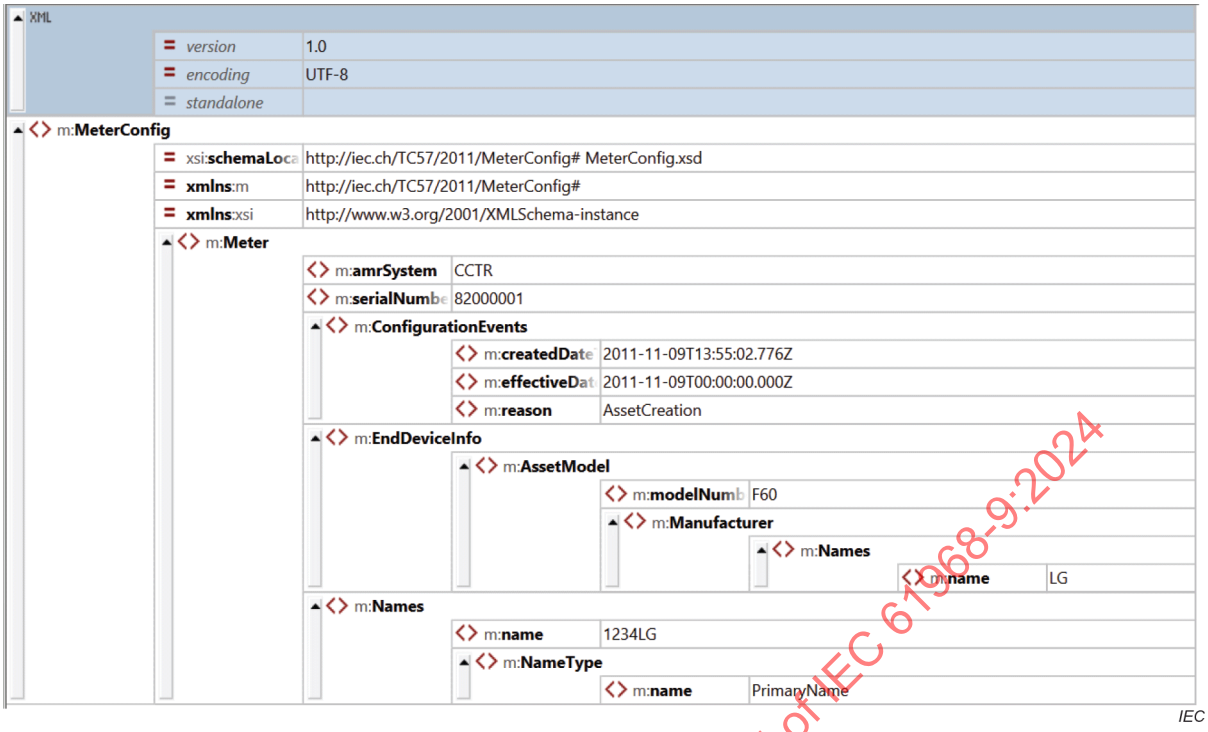


Figure 61 reproduced with the permission of UCAIug.

Figure 61 – MeterConfig example

5.8.3.8 ComModuleConfig

The diagram in Figure 62 provides the top level structure of the message used to configure communication modules.

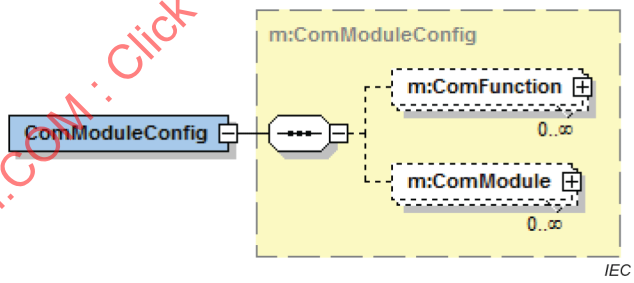


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Figure 62 – ComModuleConfig message format

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Annex A
(informative)

Recommended use of message type verbs

A list of recommended verbs that are relevant to profiles discussed in this document is provided in Table A.1. Not all interfaces on all systems will support all verbs. These verbs originate in IEC 61968-100:2022. The use of IEC 61968-100 is recommended but not required. A system may support some combination of profiles and verbs that differ from the suggestions below.

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Table A.1 – Recommended verb usage with related profiles

Owning 61968 Part	Profile / Noun	create	change	update	delete	get	reply	created	changed	updated	deleted	cancel	canceled	execute	executed
Part 8	AuxiliaryAgreement Config	X	X	X	X	X	X	X	X	X	X				
Part 9	ComModuleConfig	X	X	X	X	X	X	X	X	X	X				
Part 8	CustomerAccount Config	X	X	X	X	X	X	X	X	X	X				
Part 8	CustomerAgreement Config	X	X	X	X	X	X	X	X	X	X				
Part 8	CustomerConfig	X	X	X	X	X	X	X	X	X	X				
Part 9	CustomerMeterDataSet					X	X								
Part 9	EndDeviceConfig	X	X	X	X	X	X	X	X	X	X				
Part 9	EndDeviceControls	X					X	X				X	X		
Part 9	EndDeviceEvents	X				X	X	X							
Part 9	EndDeviceGroups	X	X	X	X	X	X	X	X	X	X				
Part 8	GetAuxiliaryAgreement Config					X	X								
Part 9	GetComModuleConfig					X	X								
Part 8	GetCustomerAccount Config					X	X								
Part 8	GetCustomer AgreementConfig					X	X								
Part 8	GetCustomerConfig					X	X								
Part 9	GetCustomer MeterDataSet					X	X								
Part 9	GetEndDeviceConfig					X	X								

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Owning 61968 Part	Profile / Noun	create	change	update	delete	get	reply	created	changed	updated	deleted	cancel	canceled	execute	executed
Part 9	GetEndDeviceControls					X	X								
Part 9	GetEndDeviceEvents					X	X								
Part 9	GetEndDeviceGroups					X	X								
Part 9	GetMeterConfig					X	X								
Part 9	GetMeterReadings					X	X					X	X		
Part 9	GetMeterRead Schedule					X	X								
Part 8	GetMeterService Requests					X	X								
Part 8	GetPricingStructure Config					X	X								
Part 8	GetReceiptRecord					X	X								
Part 8	GetServiceCategory Config					X	X								
Part 8	GetServiceLocation Config					X	X								
Part 8	GetServiceSupplier Config					X	X								
Part 8	GetTransactionRecord					X	X								
Part 9	GetUsagePointConfig					X	X								
Part 9	GetUsagePointGroups					X	X								
Part 9	GetUsagePoint LocationConfig					X	X								
Part 100	LegacyObject IdentificationRevision Sets	X	X	X	X	X	X	X	X	X	X	X	X		

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Owning 61968 Part	Profile / Noun	create	change	update	delete	get	reply	created	changed	updated	deleted	cancel	canceled	execute	executed
Part 9	MasterDataLinkage Config	X			X		X	X			X	X	X		
Part 9	MeterConfig	X	X	X	X	X	X	X	X	X	X				
Part 9	MeterReadings					X	X						X	X	
Part 9	MeterReadSchedules	X	X	X	X	X	X	X	X	X	X				
Part 8	MeterServiceRequests	X	X	X	X	X	X	X	X	X	X				
Part 100	OperationSets													X	X
Part 8	PricingStructureConfig	X	X	X	X	X	X	X	X	X	X				
Part 8	ReceiptRecord	X	X	X	X	X	X	X	X	X	X				
Part 8	ServiceCategoryConfig	X	X	X	X	X	X	X	X	X	X				
Part 8	ServiceLocationConfig	X	X	X	X	X	X	X	X	X	X				
Part 8	ServiceSupplierConfig	X	X	X	X	X	X	X	X	X	X				
Part 8	TransactionRecord	X	X	X	X	X	X	X	X	X	X				
Part 9	UsagePointConfig	X	X	X	X	X	X	X	X	X	X				
Part 9	UsagePointGroups	X	X	X	X	X	X	X	X	X	X				
Part 9	UsagePointLocation Config	X	X	X	X	X	X	X	X	X	X				

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Annex B
(informative)

Reply error codes

The codes defined in IEC 61968-9:2013 (second edition) have been moved to and replaced by codes in IEC 61968-100:2022 (second edition). The reader is encouraged to refer to IEC 61968-100 and study the structure and new Reply Codes that have been developed. The new codes have generalized what one would have found in previous editions of IEC 61968-9. In the second edition of IEC 61968-9, there were many specific codes that called out specific failures. For example, the various IEC 61968-9:2013 codes such as "Mandatory Header elements missing," and "Mandatory Payload elements missing," are replaced by a more generic "Mandatory elements missing" code in IEC 61968-100. Furthermore, the IEC 61968-100 structure allows one to report (by <ObjectID>) exactly which elements have caused the problem. When using the "6.0" code in IEC 61968-100, the <reason> field should be used to denote an issue with the business rules. For example, there might be a business rule that states "Disconnect only allowed during business hours." This business rule violation could be provided as the "reason" for the failure.

IEC 61968-100:2022 (second edition) offers important improvements over the first edition, and the smaller set of Reply error codes presented there should lead to easier multi-part integrations.

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Annex C
(normative)

Procedure for the generation of a ReadingType name

C.1 General

The ReadingType enumeration is an important identifier in MeterReading messages. This standard specifies a profile which will be considered normative. IEC 61968-9 was developed with several design principles in mind:

1) The messages should be simple and general purposed.
2) A "Readings" message should be able to carry any type of value that might be in a meter, e.g. Power, Energy, Relay actuation counts, Status information, and Currency. The Readings.ReadingType should be able to describe whatever the Readings.value is.
3) It is easier for a data consumer to throw away information it has but does not need, than it is for it to recreate information it needs but does not have.

This third principle implies that data producers should be as explicit as possible when publishing data. The data therefore should be entirely self-describing so that other consumers who access the data (perhaps when it is residing in a data warehouse) can determine for themselves the suitability for use of the data. This will help avoid the need for the data consumer to attempt to reconstruct any implicit agreements which were in place at the time of publication.

It is understood that there will be occasions in which a data consumer (making a request for information) might not know all of the specific details regarding what is being asked. For example, a requestor may wish to obtain the "voltage" at a given location. It may not know if the service is single-phase or poly-phase. It should be able to make the request with the knowledge it has, and the data producer attempt to fulfil it and in the response supply additional detail as appropriate. This may result in the ReadingType(s) used in the response to differ slightly from the ReadingType used in the request.

C.2 Understanding the important attributes of a data element name

C.2.1 General

Data elements can be described in terms of 18 key attributes (several of which are compound attributes.) Every attribute has the feature that a value of zero ("0") represents that it is not applicable to the description. The only exception to this rule is in the compound attributes. In this case dual zeros represent that the attribute is not applicable.

C.2.2 Attribute #1, macroPeriod

The macroPeriod describes an aspect of the data that reflects how it is viewed or captured over a long period of time. These are enumerated in Table C.1.

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Table C.1 – Time-period of interest enumerations

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Code	Enumeration	Comments	Normative Status
0	none	Not Applicable	N
8	billingPeriod	Captured during the billing period starting at midnight of the first day of the billing period (as defined by the billing cycle day). If during the current billing period, it specifies a period from the start of the current billing period until "now".	N
11	daily	Daily Period starting at midnight. If for the current day, this specifies the time from midnight to "now".	N
13	monthly	Monthly period starting at midnight on the first day of the month. If within the current month, this specifies the period from the start of the month until "now."	N
22	seasonal	A season of time spanning multiple months. E.g. "Summer," "Spring," "Fall," and "Winter" based cycle. If within the current season, it specifies the period from the start of the current season until "now."	N
24	weekly	Weekly period starting at midnight on the first day of the week and ending the instant before midnight the last day of the week. If within the current week, it specifies the period from the start of the week until "now."	N
32	specifiedPeriod	For the period defined by the start and end of the TimePeriod element in the message.	N

C.2.3 Attribute #2, aggregate

C.2.3.1 General

The way in which a reading is viewed in the aggregate (compared to others) serves as the second attribute. Possible enumerations include those described in Table C.2. This attribute may be used to define a mathematical operation carried out over the period of interest defined by attribute #1.

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Table C.2 – Data qualifier enumerations

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Code	Enumeration	Comments	Normative Status
0	none	Not Applicable	N
2	average		N
4	excess	The value represents an amount over which a threshold was exceeded.	I
5	highThreshold	The value represents a programmed threshold.	I
7	lowThreshold	The value represents a programmed threshold.	I
8	maximum	The highest value observed	N
9	minimum	The smallest value observed	N
11	nominal		I
12	normal		I
16	secondMaximum	The second highest value observed	N
17	secondMinimum	The second smallest value observed	N
23	thirdMaximum	The third highest value observed	N
24	fourthMaximum	The fourth highest value observed	N
25	fifthMaximum	The fifth highest value observed	N
26	sum	The accumulated sum	N
27	high	Typically used to identify the high volume flow port of a compound water meter.	I
28	low	Typically used to identify the low volume flow port of a compound water meter.	I
29	Standard Deviation Population	The standard deviation of a population (indicated by lower case sigma)	N
30	Standard Deviation Sample	The standard deviation of a sample drawn from a population (usually indicated by a lower case 's'	N
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C.2.4 Attribute #3, measuringPeriod

C.2.4.1 General

The measuringPeriod supplies an "adjective" to describe aspects of a "time period" with regard to the measurement. This attribute describes a "time attribute" which is inherent or fundamental to the reading value. The attribute refers to the way the value was originally measured and not to the frequency at which it is reported or presented. For example, an hourly interval of consumption data would have "hourly" as an attribute. However in the case of an hourly sampled voltage value the meterReadings schema would carry the "hourly" interval size information. Enumerated values include the values described in Table C.3. When compared to attribute #1, the measuringPeriod is a small interval of time which is characteristic of the way the reading was captured, while the macroPeriod is a long interval of time related to the way in which the reading is reported. Either of these attributes are invoked only as needed to describe the data. Many dial readings need only the accompanying timestamp to be meaningful.

Table C.3 – measuringPeriod enumerations

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Code	Enumeration	Comments	Normative Status
0	none	Not Applicable	N
1	tenMinute	10 min	N
2	fifteenMinute	15 min	N
3	oneMinute	1 min	N
4	twentyfourHour	24 min	N
5	thirtyMinute	30 min	N
6	fiveMinute	5 min	N
7	sixtyMinute	60 min	N
10	twoMinute	2 min	N
14	threeMinute	3 min	N
15	present	Within the present period of time	I
16	previous	Shifted within the previous monthly cycle and data set	I
31	twentyMinute	20 min interval	N
50	fixedBlock60Min	60 min Fixed Block	N
51	fixedBlock30Min	30 min Fixed Block	N
52	fixedBlock20Min	20 min Fixed Block	N
53	fixedBlock15Min	15 min Fixed Block	N
54	fixedBlock10Min	10 min Fixed Block	N
55	fixedBlock5Min	5 min Fixed Block	N
56	fixedBlock1Min	1 min Fixed Block	N
57	rollingBlock60MinIntvl30MinSubIntvl	60 min Rolling Block with 30-minute sub-intervals	N
58	rollingBlock60MinIntvl20MinSubIntvl	60 min Rolling Block with 20-minute sub-intervals	N
59	rollingBlock60MinIntvl15MinSubIntvl	60 min Rolling Block with 15-minute sub-intervals	N
60	rollingBlock60MinIntvl12MinSubIntvl	60 min Rolling Block with 12-minute sub-intervals	N
61	rollingBlock60MinIntvl10MinSubIntvl	60 min Rolling Block with 10-minute sub-intervals	N
62	rollingBlock60MinIntvl6MinSubIntvl	60 min Rolling Block with 6-minute sub-intervals	N
63	rollingBlock60MinIntvl5MinSubIntvl	60 min Rolling Block with 5-minute sub-intervals	N
64	rollingBlock60MinIntvl4MinSubIntvl	60 min Rolling Block with 4-minute sub-intervals	N
65	rollingBlock30MinIntvl15MinSubIntvl	30 min Rolling Block with 15-minute sub-intervals	N
66	rollingBlock30MinIntvl10MinSubIntvl	30 min Rolling Block with 10-minute sub-intervals	N
67	rollingBlock30MinIntvl6MinSubIntvl	30 min Rolling Block with 6-minute sub-intervals	N
68	rollingBlock30MinIntvl5MinSubIntvl	30 min Rolling Block with 5-minute sub-intervals	N
69	rollingBlock30MinIntvl3MinSubIntvl	30 min Rolling Block with 3-minute sub-intervals	N
70	rollingBlock30MinIntvl2MinSubIntvl	30 min Rolling Block with 2-minute sub-intervals	N
71	rollingBlock15MinIntvl5MinSubIntvl	15 min Rolling Block with 5-minute sub-intervals	N
72	rollingBlock15MinIntvl3MinSubIntvl	15 min Rolling Block with 3-minute sub-intervals	N
73	rollingBlock15MinIntvl1MinSubIntvl	15 min Rolling Block with 1-minute sub-intervals	N
74	rollingBlock10MinIntvl5MinSubIntvl	10 min Rolling Block with 5-minute sub-intervals	N
75	rollingBlock10MinIntvl2MinSubIntvl	10 min Rolling Block with 2-minute sub-intervals	N
76	rollingBlock10MinIntvl1MinSubIntvl	10 min Rolling Block with 1-minute sub-intervals	N

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Code	Enumeration	Comments	Normative Status
77	rollingBlock5MinIntvl1MinSubIntvl	5 min Rolling Block with 1-minute sub-intervals	N
78	twelveMinute	12 min	N
79	twoHour	2 h	N
80	fourHour	4 h	N
81	sixHour	6 h	N
82	twelveHour	12 h	N
83	threeHour	3 h	N
100	specifiedInterval	The interval length is described in attribute #10 in seconds. Attribute #11 should be "1" for whole seconds.	N
101	specifiedFixedBlock	The fixed block duration is described in attribute #10 in seconds. Attribute #11 should be "1" for whole seconds.	N
102	specifiedRollingBlock	The rolling block size is described by attribute #10 in seconds, and the sub-interval size by attribute #11 in seconds.	N
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It is common for meters to report demand in a form that is measured over the course of a portion of an hour. In Enterprise Applications however, it is commonly understood that demand (which has a unit of measure of "kW" or "kVAr") has been normalized to 1 h. The Metering System shall perform this transformation before publication and use by the other systems. The scalar used is chosen based on the block size (not any sub-interval size). These scalars are listed in Table C.4.

Table C.4 – Demand normalization scalars

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Demand block size	Normalization scalar
1 h	1
30 min	2
20 min	3
15 min	4
10 min	6
1 min	60

For example, before normalization, "15minuteFixedBlock" data might be said to have units of "kilo quarter-watt-hours" (kWh). After normalization, the unit of measure would become "kilo-watt-hours." Since "kilo quarter-watt-hours" is not a usable unit of measure, systems that find the need to communicate raw data in this form should use a unit of measure such as "count" and the PendingCalculation element to carry the scalar (or multiplier) needed and the resulting unit of measure when applied,

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C.2.4.2 Common usages

Interval data is commonly found in 60 min, 30 min, and 15 min sizes. Larger sizes such as 24 h and smaller sizes down to 1 min are also possible but are less common. Users of the standard should leverage existing interval enumerations where they exist, but if the needed interval size does "not exist, a "specifiedInterval" may be used. This allows the enumeration itself to imbed the size of the interval in the enumeration. Similarly, uncommon fixed block and rolling block sizes may be specified.

IEC 61968-9:2009 offered the terms "Shifted," "Present," and "Previous" as adjectives that might be used to describe the state of the meter. While this works well for publishing data from a Metering System, it may be difficult to use between other enterprise applications. It seems that while "present" and "previous" are important attributues of the data while it is at the meter, the further one gets away from the meter, the less important these attributes become. With this edition of IEC 61968-9 we propose that the timespan over which the data is recorded be relied upon to determine if a value belongs to the "present" billing period or the "previous" billing period rather than the enumerations "present" or "previous." Furthermore, the rules used to compute demand are quite important. A single "Daily" demand is usually not adequate to compute a customer's bill. A complete collection of "Daily" demands or a single "Billing" demand are usually required. A distinction in the Daily/Billing/Seasonal observation period should be made in the ReadingType. In all cases, the timestamp associated with the maximum demand could be used to resolve which day, month, or season a "daily," "billing," or "seasonal" demand fell into.

In a utility where multiple techniques for capturing demand exist, it becomes important to communicate between systems the definition by which demand data is captured. Enumerations are provided in this edition which enable the data producer to be as specific as it knows how in describing the type of demand data being passed.

C.2.5 Attribute #4, accumulation

C.2.5.1 General

The "accumulation" attribute indicates how the value is represented to accumulate over time. Enumerated values include those described in Table C.5.

One benefit to explicitly declaring the accumulation behaviour as part of the readingType in an exchange between a MS and MDM is to help the MDM ensure that appropriate validation rules are applied to the data supplied by the MS.

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Table C.5 – Accumulation behaviour enumerations

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Code	Enumeration	Comments	Normative status
0	none	Not Applicable, or implied by the unit of measure.	N
1	bulkQuantity	A value from a register which represents the bulk quantity of a commodity. This quantity is computed as the integral of the commodity usage rate. This value is typically used as the basis for the dial reading at the meter, and as a result, will roll over upon reaching a maximum dial value. NOTE 1 With the metering system, the roll-over behaviour typically implies a roll-under behavior so that the value presented is always a positive value (e.g. unsigned integer or positive decimal.) However, when communicating data between enterprise applications a negative value might occur in a case such as net metering. NOTE 2 A BulkQuantity refers primarily to the dial reading and not the consumption over a specific period of time.	N
2	continuousCumulative	The sum of the previous billing period values and the present period value. NOTE "ContinuousCumulative" is commonly used in conjunction with "demand." The "ContinuousCumulative Demand" would be the cumulative sum of the previous billing period maximum demand values (as occurring with each demand reset) summed with the present period maximum demand value (which has yet to be reset.)	N
3	cumulative	The sum of the previous billing period values. NOTE "Cumulative" is commonly used in conjunction with "demand." Each demand reset causes the maximum demand value for the present billing period (since the last demand reset) to accumulate as an accumulative total of all maximum demands. So instead of "zeroing" the demand register, a demand reset has the affect of adding the present maximum demand to this accumulating total.	N
4	deltaData	The difference between the value at the end of the prescribed interval and the beginning of the interval. This is used for incremental interval data. NOTE 3 One common application would be for load profile data, another use might be to report the number of events within an interval (such as the number of equipment energizations within the specified period of time.)	N
6	indicating	As if a needle is swung out on the meter face to a value to indicate the current value. (NOTE An "indicating" value is typically measured over hundreds of milliseconds or greater, or may imply a "pusher" mechanism to capture a value. Compare this to "instantaneous" which is measured over a shorter period of time.)	N
9	summation	A form of accumulation which is selective with respect to time. NOTE 4 "Summation" could be considered a specialization of "Bulk Quantity" according to the rules of inheritance where "Summation" selectively accumulates pulses over a timing pattern, and "BulkQuantity" accumulates pulses all of the time.	I
10	timeDelay	A form of computation which introduces a time delay characteristic to the data value	I

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Code	Enumeration	Comments	Normative status
12	instantaneous	Typically measured over the fastest period of time allowed by the definition of the metric (usually milliseconds or tens of milliseconds.) (NOTE "Instantaneous" was moved to attribute #4 in 61968-9Ed2 from attribute #1 in 61968-9:2009.)	N
13	latchingQuantity	When this description is applied to a metered value, it implies that the value is a time-independent cumulative quantity much a BulkQuantity, except that it latches upon the maximum value upon reaching that value. Any additional accumulation (positive or negative) is discarded until a reset occurs. NOTE 5 A LatchingQuantity may also occur in the downward direction – upon reaching a minimum value. The terms "maximum" or "minimum" will usually be included as an attribute when this type of accumulation behaviour is present. When this description is applied to an encoded value (UOM= "Code"), it implies that the value has one or more bits which are latching. The condition that caused the bit to be set may have long since evaporated. In either case, the timestamp that accompanies the value may not coincide with the moment the value was initially set. In both cases a system will need to perform an operation to clear the latched value.	N
14	boundedQuantity	A time-independent cumulative quantity much a BulkQuantity or a LatchingQuantity, except that the accumulation stops at the maximum or minimum values. When the maximum is reached, any additional positive accumulation is discarded, but negative accumulation may be accepted (thus lowering the counter.) Likewise, when the negative bound is reached, any additional negative accumulation is discarded, but positive accumulation is accepted (thus increasing the counter.)	N
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C.2.5.2 Types of IntervalReadings

In IEC 619689:2009, it was said IntervalReadings might be expressed in a number of styles qualfied by attribute #2 (i.e. "Incremental," "Relative," or "Absolute") and also described "RecordedData" and "DeltaData".

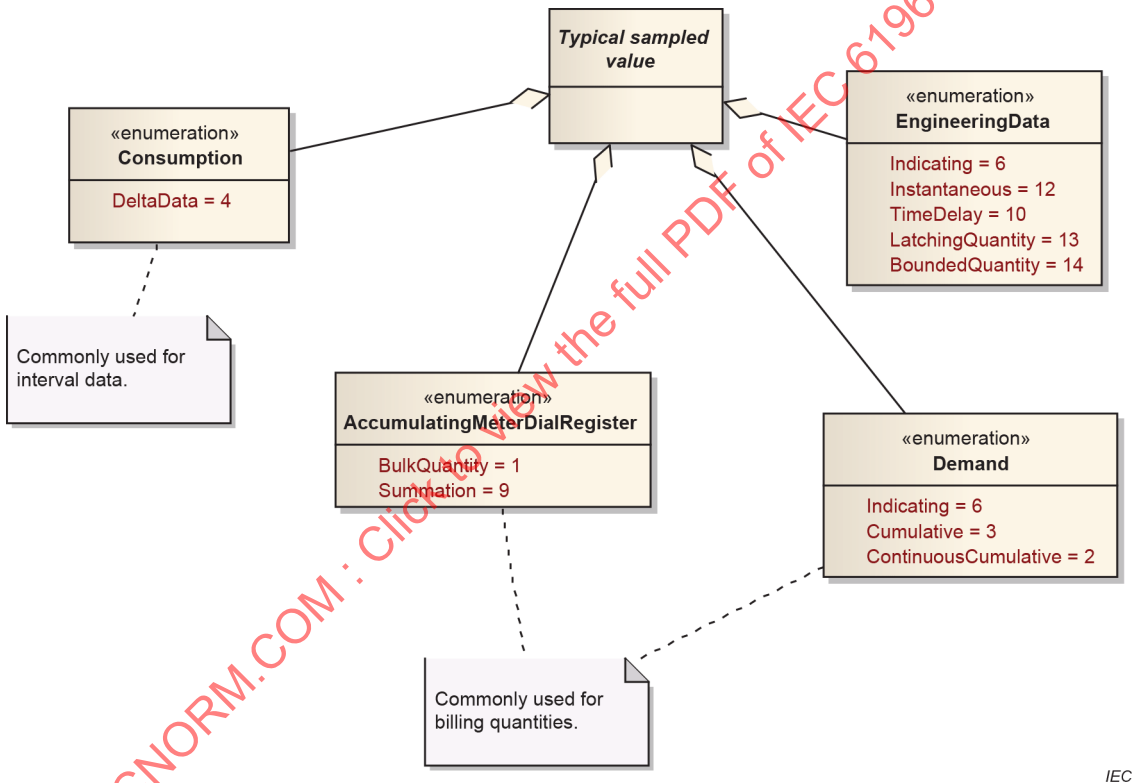
In this edition of IEC 61968-9 we have made an effort to simplify the presentation of data. A sampled value which would have been called an "absolute interval" reading in IEC 61968-9:2009 may be presented without the word "absolute." Indeed such readings may be published in the MeterReading.Readings portion of the message as ordinary readings rather than in the MeterReading.IntervalBlock.IntervalReadings portion of the message. The concept of "Relative IntervalData" is no longer found in the enumerations because the concept is supported in the message schema as a form of "pending" data scalars.

C.2.5.3 Common usages

The attributes described in Table C.5 are customarily used in particular ways to describe energy and demand values. These customs are described in Table C.6 and shown in Figure C.1.

Table C.6 – Customary accumulation behaviour enumerations

Metrology data type	Common usages
Energy (Measured by simple counting and displayed to the user on the face of the meter.)	BulkQuantity
Demand (Ordinarily measured by integrating a power value over a specific period of time.)	Indicating, Cumulative, ContinuousCumulative
Power (Ordinarily measured in real time in solid-state meters.)	Instantaneous, TimeDelay
Time Of Use (TOU) Energy data (Measured by accumulating values in assorted registers depending on the time of day and day of the week.)	Summation
Time Of Use (TOU) Demand data (Derived by integrating energy values over a specified demand interval, with additional dependencies on the TOU calendar.)	Indicating, Cumulative, or ContinuousCumulative
Counters	BulkQuantity, LatchingQuantity



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Figure C.1 – Typical enumerations for accumulation behaviourAttribute #5, flowDirection

C.2.6.1 General

Anything involving current might have a flow direction. Flow direction is very important, but when it is unknown, it should remain unspecified. Possible enumerations include those described in Table C.7.

The "flow direction" encompases the electrical concept of four quadrant metering as well as the needs of various regional tariffs to describe how energy is billed.

It should be recognized that different parts of the world operate according to different frames of reference for their tariff practices. Most regions define power delivery according to a Producer"s Reference Frame. Power is generated by the utility, flows through the utility grid, through the

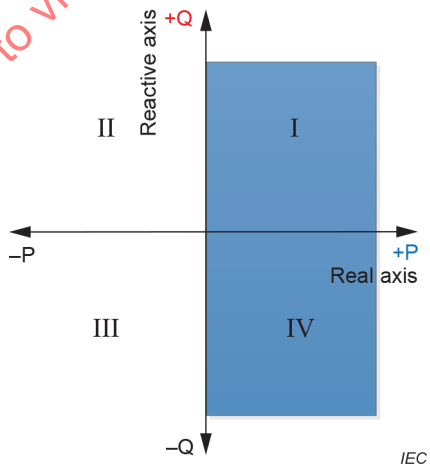
meter, and into the customer"s wiring. The meter captures the energy sold to the customer. Some regions however take a customer-centric view. A Consumer Reference Frame says that power may be purchased by a consumer from the grid. Any forward flow through the meter registers the energy purchased by the consumer.

This standard attempts to circumnavigate the frame-of-reference issue by recognizing that these two views are equivalent. The energy bought is the energy sold. The "forward" flow from the meter's "source" side to the meter's "load" side (or equivalent terminology such as "V+" and a "V–") creates a measurement that can be used for either tariff definition. This standard will leverage the numeric code for a given semantic concept to be "normative," while the text used to name the concept is considered "informative."

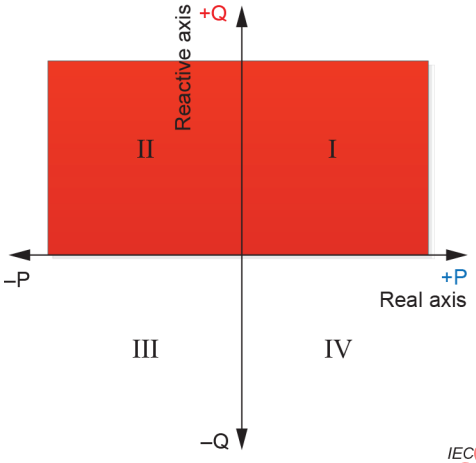
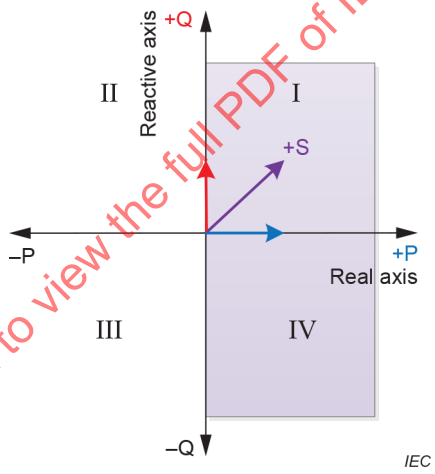
A second reason to keep the textual descriptions informative is due to the genuine language differences among the various participating countries in the IEC.

Table C.7 – Direction of flow enumeration

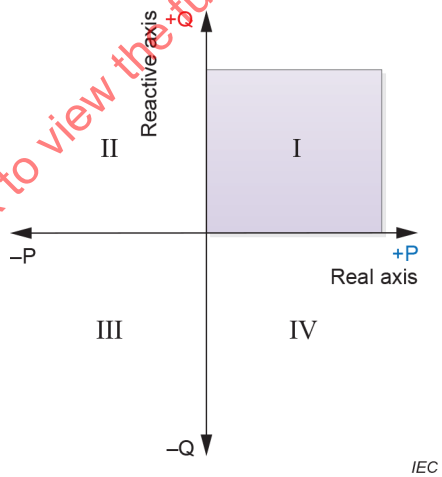
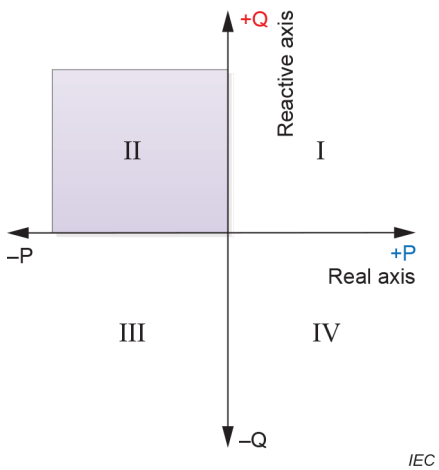
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Code	Enumeration Name (informative)	Comments	Normative status of code
0	none	Not Applicable (N/A)	N
1	forward	Also known as "Delivered," or "Imported" as defined in IEC TS 61968-2. Forward Active Energy is a positive kWh value as one would naturally expect to find as energy is supplied by the utility and consumed at the service. Forward Active Energy is accumulated in a single phase service by observing the power flow (+P) in quadrants I and IV.  Forward Reactive Energy is a positive VArh value as one would naturally expect to find in the presence of inductive loading. Forward Reactive Energy is accumulated in a single phase service by observing the power flow (+Q) in quadrants I and II.	N

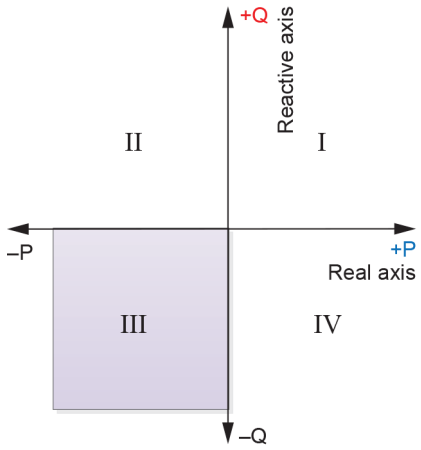
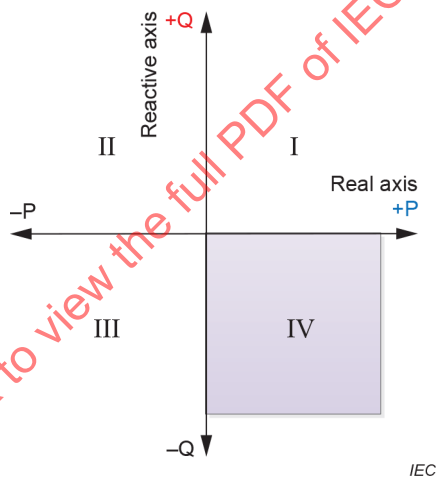
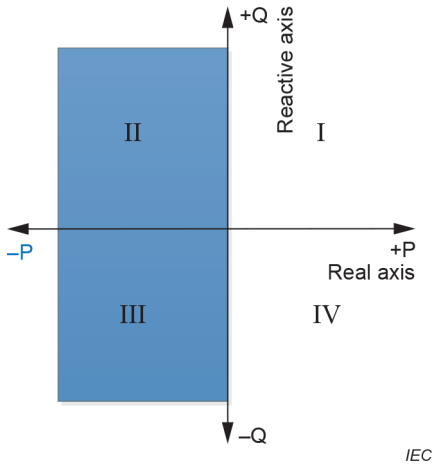
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Code	Enumeration Name (informative)	Comments	Normative status of code
		 Forward Apparent Energy is a positive VAh value much like Forward Active Energy. It is accumulated in a single phase service by observing the power flow (S = P + jQ) in quadrants I and IV.  In polyphase metering, the forward energy register is incremented when the sum of the phase energies is greater than zero: $Energy_A + Energy_B + Energy_C > 0$	
2	lagging	Typically used to describe that a power factor is lagging the reference value (or to say that the current is lagging the voltage.) NOTE 1 When used to describe power factor, the term "Lagging" implies that the PF is negative. The term "lagging" in this case takes the place of the negative sign. If a signed PF value is to be passed by the data producer, then the direction of flow enumeration zero (none) should be used in order to avoid the possibility of creating an expression that employs a double negative. The data consumer should be able to tell from the sign of the data if the PF is leading or lagging. This principle is analogous to the concept that "Reverse" energy is an implied negative value, and to publish a negative reverse value would be ambiguous. NOTE 2 Lagging power factors typically indicate inductive loading.	N

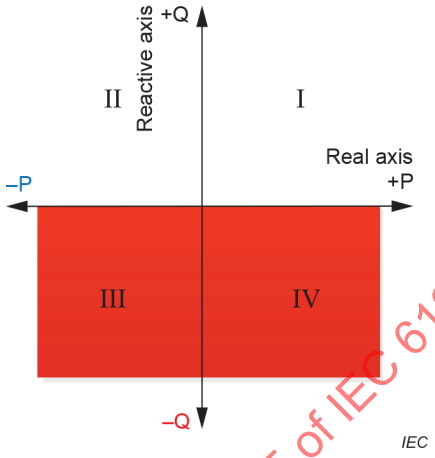
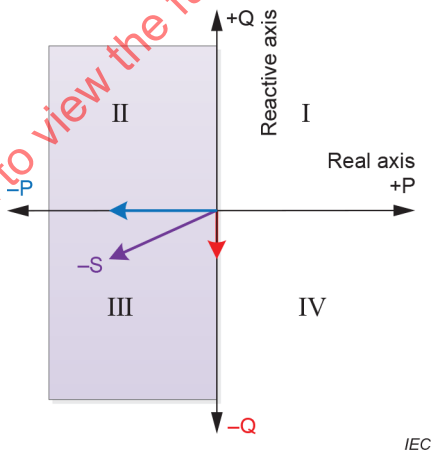
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Code	Enumeration Name (informative)	Comments	Normative status of code
3	leading	Typically used to describe that a power factor is leading the reference value (or to say that the current is leading the voltage.) NOTE 3 Leading power factors typically indicate capacitive loading.	N
4	net	Defined as |Forward| – |Reverse|, See IEC TS 61968-2. NOTE 4 In some systems, the value passed as a "net" value could become negative. In other systems the value passed as a "net" value is always a positive number, and rolls-over and rolls-under as needed.	N
5	q1plusQ2	Reactive positive quadrants.	I
7	q1plusQ3	Quadrants 1 and 3	I
8	q1plusQ4	Quadrants 1 and 4 usually represent forward active energy	I
9	q1minusQ4	Q1 minus Q4	I
10	q2plusQ3	Quadrants 2 and 3 usually represent reverse active energy	I
11	q2plusQ4	Quadrants 2 and 4	I
12	q2minusQ3	Q2 minus Q3	I
13	q3plusQ4	Reactive negative quadrants.	I
14	q3minusQ2	Q3 minus Q2	I
15	quadrant1	Q1 only 	I
16	quadrant2	Q2 only 	I

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Code	Enumeration Name (informative)	Comments	Normative status of code
17	quadrant3	Q3 only 	I
18	quadrant4	Q4 only 	I
19	reverse	Reverse Active Energy is equivalent to "Received," or "Exported" as defined in IEC TS 61968-2. Reverse Active Energy is a positive kWh value as one would expect to find when energy is produced and backfed by the service onto the utility network. Reverse Active Energy is accumulated in a single phase service by observing the power flow (-P) in quadrants II and III. 	N

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Code	Enumeration Name (informative)	Comments	Normative status of code
		Reverse Reactive Energy is a positive VArh value as one would expect to find in the presence of capacitive loading and a leading Power Factor. Reverse Reactive Energy is accumulated in a single phase service by observing the power flow (-Q) in quadrants III and IV.  Reverse Apparent Energy is a positive VAh value much as reverse active energy. It is accumulated in a single phase service by observing the power flow (S = P + jQ) in quadrants II and III.  In polyphase metering, the reverse energy register is incremented when the sum of the phase energies is less than zero: $Energy_A + Energy_B + Energy_C < 0$ NOTE 5 The value passed as a reverse value is always a positive value. It is understood by the label "reverse" that it represents negative flow.	
20	total	|Forward| + |Reverse|, See IEC TS 61968-2. The sum of the commodity in all quadrants Q1+Q2+Q3+Q4. In polyphase metering, the total energy register is incremented when the absolute value of the sum of the phase energies is greater than zero: $\lvert Energy_A + Energy_B + Energy_C \rvert > 0$	N

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Code	Enumeration Name (informative)	Comments	Normative status of code
21	totalByPhase	In polyphase metering, the total by phase energy register is incremented when the sum of the absolute values of the phase energies is greater than zero: $\lvert Energy_A \rvert + \lvert Energy_B \rvert + \lvert Energy_C \rvert > 0$ In single phase metering, the formulas for "Total" and "Total by phase" collapse to the same expression. For communication purposes however, the "Total" enumeration should be used with single phase meter data.	N
N = Normative I = Informative D = Deprecated since last edition			

C.2.6.2 Common usages

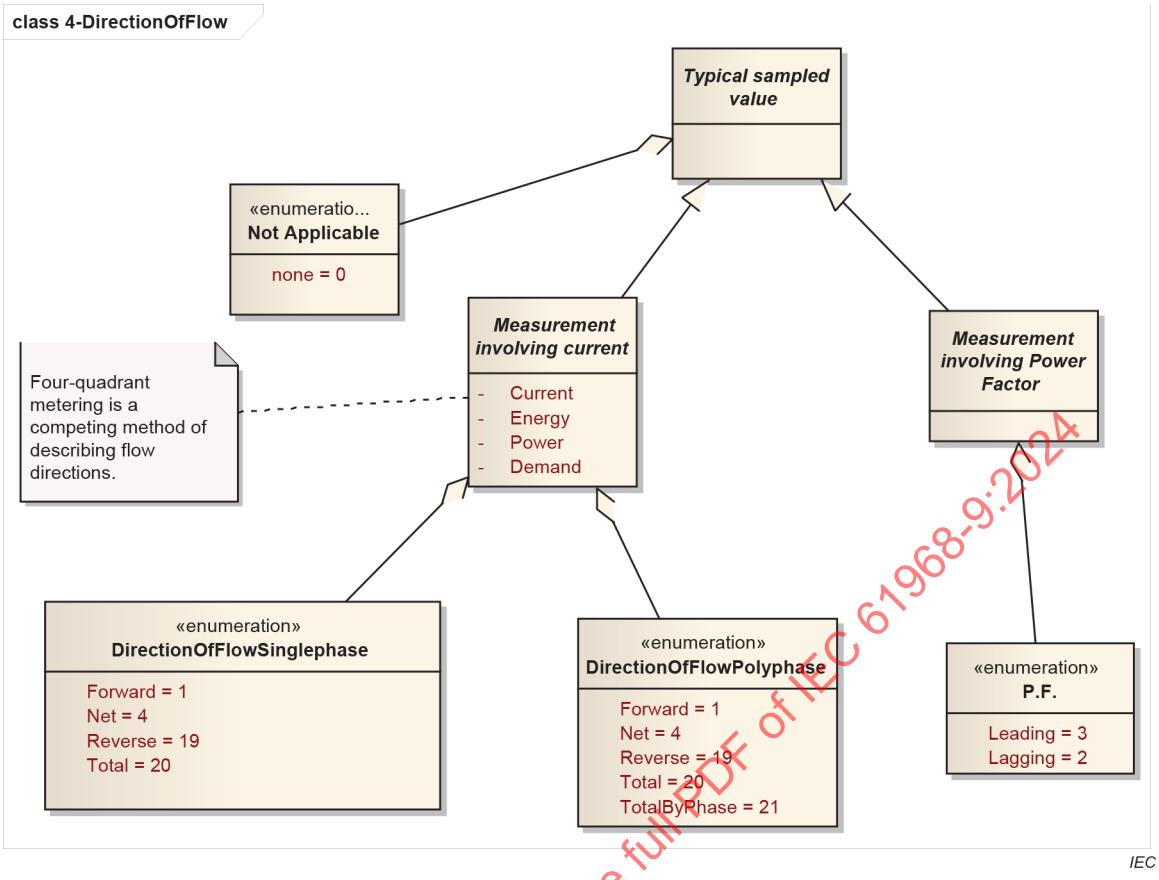
The terminology used to specify the flow direction for reactive energy and reactive power is varies considerably by vendor. Table C.8 describes a number of equivalent flow directions by power (or energy) type, and recommends a preferred flow direction enumeration for communication, as shown in Figure C.2.

Table C.8 – DirectionOfFlow enumeration equivalencies

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Type of energy or power	Unit Of Measure	Equivalent flow directions commonly used in industry	Preferred flow direction for messaging
Active or Real	W or Wh	Forward, Delivered, Positive, Q1+Q4	Forward
		Reverse, Received, Negative, Q2+Q3	Reverse
		Net, Q1+Q4-(Q2+Q3)	Net
		Total, Q1+Q2+Q3+Q4	Total
Reactive	VAr or VArh	Forward, Delivered, Positive, Lagging, Q1+Q2	Forward
		Reverse, Received, Negative, Leading, Q3+Q4	Reverse
		Net, Q1+Q2-(Q3+Q4)	Net
		Total, Q1+Q2+Q3+Q4	Total
Apparent	VA or VAh	Forward, Delivered	Forward
		Reverse, Received	Reverse
		Net	Net
		Total	Total

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Figure C.2 – Typical enumerations for direction of flow

C.2.7 Attribute #6, commodity

In this standard, the commodity which is being measured has been isolated to become an attribute by itself. It is enumerated in Table C.9.

Table C.9 – Commodity

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Code	Enumeration	Comments	Normative status
0	none	Not Applicable	N
1	electricity SecondaryMetered	All types of metered quantities. This type of reading comes from the meter and represents a "secondary" metered value.	N
2	electricity PrimaryMetered	It is possible for a meter to be outfitted with an external VT and/or CT. The meter might not be aware of these devices, and the display not compensate for their presence. Ultimately, when these scalars are applied, the value that represents the service value is called the "primary metered" value. The "index" in sub-category 3 mirrors those of sub-category 0.	N
3	communication	A measurement of the communication infrastructure itself.	N
4	air		N
5	insulativeGas	(SF_6 is found separately below.)	N
6	insulativeOil	Typically mineral oil	N

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Code	Enumeration	Comments	Normative status
7	naturalGas	Naturally occurring hydrocarbon gas	N
8	propane	C_3H_8	N
9	potableWater	Drinkable water	N
10	steam	Water in steam form, usually used for heating.	N
11	wasteWater	(Sewerage)	N
12	heatingFluid	This fluid is likely in liquid form. It is not necessarily water or water based. The warm fluid returns cooler than when it was sent. The heat conveyed may be metered.	N
13	coolingFluid	The cool fluid returns warmer than when it was sent. The heat conveyed may be metered.	N
14	nonpotableWater	Reclaimed water – possibly used for irrigation but not sufficiently treated to be considered safe for drinking. Moisture in oil	N
15	nox	Nitrous Oxides, NO_X	N
16	so2	Sulfur Dioxide, SO_2	N
17	ch4	Methane, CH_4	N
18	co2	Carbon Dioxide, CO_2	N
19	carbon	C	I
20	hch	Hexachlorocyclohexane, HCH	N
21	pfc	Perfluorocarbons, PFC	N
22	sf6	Sulfurhexafluoride, SF_6	N
23	tvLicence	Television	N
24	internet	Internet service	N
25	refuse	Trash	N
26	h2	Hydrogen, H_2	N
27	c2h2	Acetylene, C_2H_2	N
28	c2h4	Ethylene, C_2H_4	N
29	c2h6	Ethane, C_2H_6	N
30	co	Carbon monoxide, CO	N
31	o2	Oxygen, O_2	N
32	dissolvedCombustibleGas	Dissolved Combustible Gas (A combination of combustible gasses such as H_2, CH_4, C_2H_2, C_2H_4, C_2H_6, and/or CO in some mixture.)	N
33	co2e	Carbon Dioxide CO_2 Equivalent	N
34	lead	Lead, Pb	N
35	mercury	Mercury, Hg	N
36	ozone	Ozone, O_3	N
37	pm10	Particulate matter whose maximum size is 10 μm.	N
38	pm25	Particulate matter whose maximum size is 2,5 μm.	N
39	sox	Sulfur Oxides, SO_X	N
40	weather	Weather or meteorological conditions.	N

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Code	Enumeration	Comments	Normative status
41	device	Condition of the meter or end device itself. For example, this enumeration might be used in combination with an enumeration for temperature to represent the internal temperature of a meter.	N
42	pole	The power pole as an end device	I
43	conductor	A wire as an end device	I
44	acceleration	A measurement of acceleration	I
45	tilt	A measurement of tilt	I
46	magneticField	A measurement of the magnetic field	I
50	Gas	Generic commodity for gas. Note that there are specific commodities for natural gas and propane.	N
60	Water	Generic commodity for water. Note that there are specific commodities for waste water and potable water.	N
N = Normative I = Informative D = Deprecated since last edition			

C.2.8 Attribute #7, measurementKind

The "measurementKind" helps identify "what" is being measured. It further refines the commodity to provide a reading category. This attribute works in conjunction with the units attribute in creative ways to provide detail to the unit of measure. For example, "Energy" with a unit of measure of "kWh" indicates to the user that active energy is being measured, "Energy" with "kVAh" indicates apparent energy, and "Energy" with "kVArh" indicates reactive energy. "Power" can be combined in a similar way with various power units of measure. Distortion power ("DistortionVoltAmperes") with "kVA" is different from "Power" with "kVA". More information can be found by studying the examples at the end of this annex. Measurement kinds are enumerated in Table C.10.

Table C.10 – measurementKind Index

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Code	Enumeration	Comments	Normative Status
0	none	Not Applicable	N
2	apparentPowerFactor		D
3	currency	funds	N
4	current	The flow of electrons	N
5	currentAngle	A phase current zerocross timing measurement releative to a reference voltage zerocross	N
6	currentImbalance	A measurement of the departure of a phase current relative to the average current of all phases	N
7	date	A measurement of the date and/or time in a clock, or a time stamp indicating when data was captured, when a maximum or minimum occurred, or to commemorate some other important aspect of a measurement	N

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Code	Enumeration	Comments	Normative Status
8	demand	The measurement of maximum power flow which is computed as energy usage over time, the dimensions of which are defined by a tariff	N
9	distance	A linear distance or range radius	N
10	distortionVoltAmperes	A measurement in which a V^2 I^2 term has both real and reactive components removed leaving only distortion. For example, distortion VAh = Sqrt($(V^2h)(I^2h) – (Wh)^2 – (VArh)^2$)	N
11	energization	Pertaining to the presence of voltage	N
12	energy	Scalar quantity which may be increased or decreased in a system when it receives or produces work, respectively	N
13	energizationLoadSide	Measuring the presence or absence of voltage on the load side of an electricity meter	N
14	fan	A forced air moving device	N
15	frequency	Reciprocal of the period	N
17	ieee1366ASAI	A measurement of IEEE-1366 Average Service Availability Index	N
18	ieee1366ASIDI	A measurement of the IEEE-1366 Average Service Interruptio Duration Index	N
19	ieee1366ASIFI	A measurement of the IEEE-1366 Average Service Interruption Frequency Index	N
20	ieee1366CAIDI	A measurement of the IEEE-1366 Customer averate interruption duration index	N
21	ieee1366CAIFI	A measurement of the IEEE-1366 Customer average interruption frequency index	N
22	ieee1366CEMIn	A measurement of the IEEE-1366 Customers Experiencing Multiple Interruptions	N
23	ieee1366CEMSMIn	A measurement of the IEEE-1366 Customers Experiencing Multiple Sustained and Momentary Interruptions	N
24	ieee1366CTAIDI	A measurement of the IEEE-1366 Customer Total Average Interruption Duration Index	N
25	ieee1366MAIFI	A measurement of the IEEE-1366 Momentary Average Interruption Frequency Index	N
26	ieee1366MAIFIe	A measurement of the IEEE-1366 Momentary Average event Interruption Frequency Index	N
27	ieee1366SAIDI	IEEE-1366 System Average Interruption Duration Index	N
28	ieee1366SAIFI	IEEE-1366 System Average Interruption Frequency Index	N
31	lineLosses	An energy, power, voltage, or current loss attributed to transmission or distribution line impedance	N

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Code	Enumeration	Comments	Normative Status
32	losses	A quantity lost due to "technical" reasons (such as line loss) or "non-technical" reasons (such as theft.)	N
33	negativeSequence	A quantity that has a rotation sequence which is opposite to that of the power system	N
34	phasorPowerFactor	The ratio of real energy (usually net Wh) to phasor apparent energy (kVAh)	N
35	phasorReactivePower		D
36	positiveSequence	A quantity that has a rotation sequence in agreement with that of the power system	N
37	power	The derivative of energy with respect to time, where the energy is being transferred or transformed.	N
38	powerFactor	The ratio of real energy (usually net kWh) to apparent energy (kVAh)	N
40	quantityPower	A power measurement of Qh, where Qh is defined to be half of the sum of the Wh measurements on each phase plus the squareroot of 3 over two times the sum of the VArh measurements on each phase.	N
41	sag	A temporary dip in the supply voltage below the nominal value	N
42	swell	A temporary rise of the supply voltage over the nominal value	N
43	switchPosition	A physical or logical switch position status which includes "opened" and "closed", but for some products may also include "armed," or other states that indicate a temporary state due to some condition.	N
44	tapPosition	Tap changer position	I
45	tariffRate	An energy price defined in a contract. The rate might be a price for energy, for power (usually expressed as a demand value), or some other measurement. The rate might be currency based, or as a code, or as a component of a larger tariff description.	N
46	temperature	A quantity proportional to the energy of a system	N
47	totalHarmonicDistortion	The ratio of the sum of the harmonics to the fundamental. (THD may measure either voltage or current, and may isolated to a given phase)	N
48	transformerLosses	A measurement of the energy or power loss in a transformer due to inefficiency	N
49	unipedeVoltageDip10to15	A voltage dip classification per EN50160 or a similar national standard measuring the number of dips in the 10 % to 15 % range	N
50	unipedeVoltageDip15to30	A voltage dip classification per EN50160 or a similar national standard measuring the number of dips in the 15 % to 30 % range	N

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Code	Enumeration	Comments	Normative Status
51	unipedeVoltageDip30to60	A voltage dip classification per EN50160 or a similar national standard measuring the number of dips in the 30 % to 60 % range	N
52	unipedeVoltageDip60to90	A voltage dip classification per EN50160 or a similar national standard measuring the number of dips in the 60 % to 90 % range	N
53	unipedeVoltageDip90to100	A voltage dip classification per EN50160 or a similar national standard measuring the number of dips in the 90 % to 100 % range	N
54	Voltage (rms)	The difference in electric potential between two points	N
55	voltageAngle	A phase voltage zerocross timing measurement releative to a reference voltage zerocross	N
56	voltageExcursion	A measurement of the departure of the voltage from the nominal voltage	N
57	voltageImbalance	A measurement of the departure of a phase voltage relative to the average voltage of all phases.	N
58	volume	fluid volume	N
59	zeroFlowDuration	The amount of time that current flow drops to a zero level or level below the ability of the sensor to sense	N
60	zeroSequence	The zero sequence current is the vector sum of the phase currents	N
64	distortionPowerFactor	The ratio of the distortion VAh to the apparent VAh	N
81	frequencyExcursion	A measurement of the departure of the frequency from the nominal frequency	N
90	applicationContext	Information that describes the logical context in which a request, measurement, or command is made.	I
91	apTitle	An application name which is making or has made a request	I
92	assetNumber	An asset identifier	I
93	bandwidth	A measurement of dataflow	I
94	batteryVoltage	Battery voltage	N
95	broadcastAddress	A message target address implying all endpoint units within range of a particular sender	I
96	deviceAddressType1	Endpoint target address Type1	I
97	deviceAddressType2	Endpoint target address Type2	I
98	deviceAddressType3	Endpoint target address Type3	I
99	deviceAddressType4	Endpoint target address Type4	I
100	deviceClass	A unique identifier for the Endpoint's configuration	I
101	electronicSerialNumber	A device serial number	I
102	endDeviceID	A unique identifier of the endDevice – the device providing measurements or under control of the network	I
103	groupAddressType1	Group target address Type1	I
104	groupAddressType2	Group target address Type2	I

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Code	Enumeration	Comments	Normative Status
105	groupAddressType3	Group target address Type3	I
106	groupAddressType4	Group target address Type4	I
107	ipAddress	An IP address for the endpoint	I
108	macAddress	A MAC address for the endpoint	I
109	mfgAssignedConfigurationID	The configuration given to a device at time of manufacture	I
110	mfgAssignedPhysicalSerialNumber	The serial number assigned to a device at time of manufacture	I
111	mfgAssignedProductNumber	The product number assigned to a device at time of manufacture	I
112	mfgAssignedUniqueCommunicationAddress	A communication address assigned to a device at time of manufacture	I
113	multiCastAddress	A message target address implying a large group of endpoint units within range of a particular sender	I
114	oneWayAddress	A communication address of a network endpoint used in one-way communication	I
115	signalStrength	A measurement of RF signal strength	I
116	twoWayAddress	A communication address used for bidirectional communication	I
117	signaltoNoiseRatio	A measurement of received (RF) signal strength divided by the (RF) noise floor	I
118	alarm	A measurement releated to an alarm	I
119	batteryCarryover	An estimate of the battery ridethrough capacity	I
120	dataOverflowAlarm	An indication of or measurement of a loss of data	I
121	demandLimit	A threshold setting that determines the trip point that if exceeded would trigger a demand limiting action or alarm	N
122	demandReset	A count of the number of times demand has been reset (remotely, locally, and/or automatically.)	N
123	diagnostic	A measurement releated to equipment diagnostics	I
124	emergencyLimit	A setting that indicates an emergency limit	I
125	encoderTamper	An indication of tampering with a meter encoder	I
126	ieee1366MomentaryInterruption	IEEE-1366 Momentary Interruption count	N
127	ieee1366MomentaryInterruptionEvent	IEEE-1366 Momentary Interruption event count	N
128	ieee1366SustainedInterruption	IEEE-1366 Sustained Interruption duration	N
129	interruptionBehaviour	A measurement related to power interruptions (NOTE often an interruption count or duration.)	I
130	inversionTamper	A measurement related to inversion tamper (NOTE typically a count of inversions)	I

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Code	Enumeration	Comments	Normative Status
131	loadInterrupt	A measurement related to load interruption (NOTE typically a load interruption count or measurement of duration)	I
132	loadShed	A measurement related to load shed (NOTE typically a load shed count or load shed duration)	I
133	maintenance	A measurement related to the pending maintenance of equipment	I
134	physicalTamper	A measurement related to physical tampering (NOTE typically a tamper count)	I
135	powerLossTamper	Tamper indicated while power was out	I
136	powerOutage	A measurement related to power outages (NOTE typically a status)	I
137	powerQuality	A measurement related to power quality	I
138	powerRestoration	A measurement related to power restoration (NOTE typically a status)	I
139	programmed	A measurement related to device programming (NOTE typically a status measurement)	I
140	pushbutton	A measurement related to pushbutton (NOTE typically a status or count)	N
141	relayActivation	A measurement related to relay activations	N
142	relayCycle	A measurement related to relay cycling (NOTE 1 one open and one closure together is one cycle, NOTE 2 Usually expressed as a count)	N
143	removalTamper	An indication of equipment tampering that shows equipment was moved or opened	I
144	reprogrammingTamper	An indication of equipment tampering that shows equipment has been reprogrammed	I
145	reverseRotationTamper	An indication of tampering as evidenced by reverse power flow	I
146	switchArmed	A measurement of the switch arm condition	I
147	switchDisabled	A measurement of the switch enablement status	I
148	tamper	An indication of equipment tampering	I
149	watchdogTimeout	A reset triggered by a hardware "watchdog" circuit	I
150	billLastPeriod	Customer's bill for the previous billing period Expressed as currency.	N
151	billToDate	Customer's bill, as known thus far within the present billing period. Expressed as currency.	N
152	billCarryover	Customer's bill, part of a previous obligation carried over from a previous billing period. Expressed as currency.	N
153	connectionFee	Monthly fee for connection to commodity.	I
154	audibleVolume	Sound	I
155	volumetricFlow	A fluid flow rate	I

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Code	Enumeration	Comments	Normative Status
156	relativeHumidity	Most common usage is in expressing weather or meteorological conditions	N
157	skyCover	Degree of sky cover. Used in expressing weather or meteorological conditions.	N
158	voltage	Unspecified	I
159	dcVoltage		I
160	acVoltagePeak	Vp=√2 × Vrms	I
161	acVoltagePeakToPeak	Vpp=2 × Vp	I
162	pressure	Force over area	I
163	density		I
164	energyDensity		I
165	dateOfLastDemandReset		I
166	arithmeticApparentEnergy	The arithmetic sum of the per element VAh quantities, where each element apparent VAh uantity is calculated each momentary interval as: sqrt(V^2h_x)(I^2h_x), where x= each element A, B, C, and V^2h_x and I^2h_x are fundamental plus harmonics values.	I
167	arithmeticApparentPower	The rate of arithmetic Apparent Energy	I
168	arithmeticApparentDemand		I
169	phasorApparentEnergy	Sqrt((Wh_x)^2+($VArh_x$)^2) where x each element A,B,C and VArh is measured with IEEE VArs	I
170	phasorApparentPower	The rate of phasor apparent energy	I
171	phasorApparentDemand		I
172	distortionApparentEnergy	distortion VAh_x = Sqrt((V^2h_x)(I^2h_x) – (Wh_x)^2 – ($VArh_x$)^2), where x= each element A, B, or C and $V2h_x$, $I2h_x$, Wh_x, and $varh_x$ are fundamental plus harmonic values	I
173	distortionApparentPower	The rate of distortion apparent energy	I
174	distortionApparentDemand	Distoration apparent energy passed through a demand function	I
175	totalHarmonicDistortionDemand	THD treated as a demand	I
176	tddDemand	Total Demand Distortion treated as a demand	I
177	totalDemandDistortion	(RMS of harmonic content of current) / (maximum installation current)	I
178	distortionPowerFactorDemand	distortionPF treated as a demand value	I
179	fuzzyEnergy	Fuzzyvarh = sqrt((varh)^2 + (distortion VAh)^2), where varh is a fundamental plus harmonics value	I
180	fuzzyPower	The rate of fuzzy energy	I
181	fuzzyDemand	Fuzzy energy as a demand	I
183	batteryChargeMoved	Charge used or added	I
184	batteryChargeStored	Charge present	I
188	quadrant	One of four quadrants relative to the reference axis	I

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Code	Enumeration	Comments	Normative Status
189	processorReset	The type of reset	I
190	xAxis	Measurement along the x axis relative to the reference axis	I
191	yAxis	Measurement along the y axis	I
192	zAxis	Measurement along the z axis	I
193	XYPlane	Measurement in the XY Plane	I
194	YZPlane	Measurement in the YZ Plane	I
195	XZPlane	Measurement in the XZ Plane	I

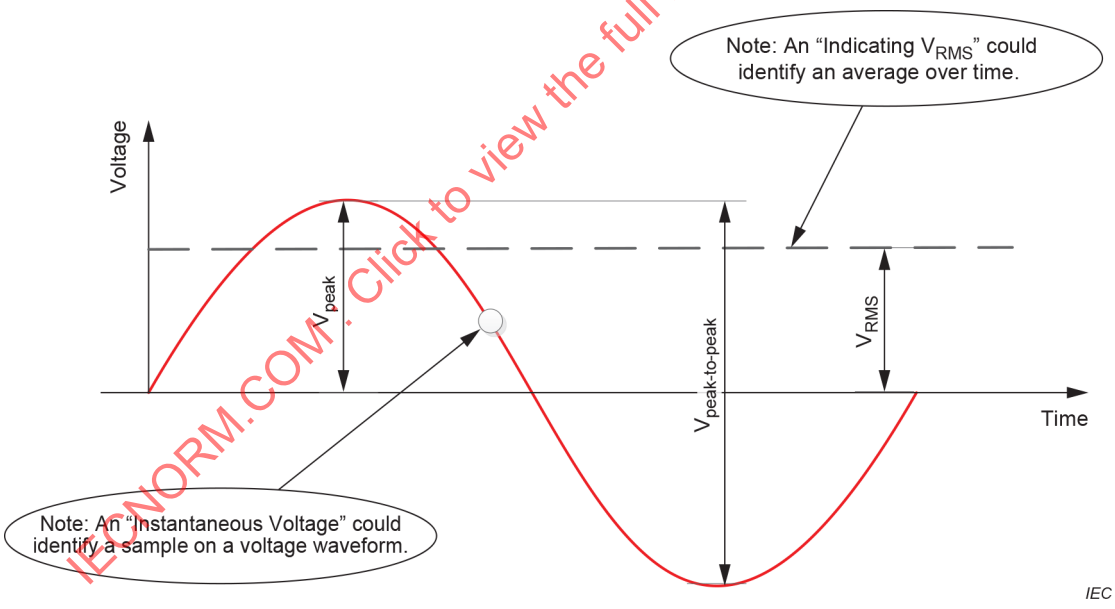
N = Normative

I = Informative

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NOTE In this edition of IEC 61968-9 additional distinction has been made with respect to the voltage frame of reference. The original enumeration for "voltage" is now explicitly used to identify $Volts_{RMS}$. This is because the most common type of measurement passed between systems is a $Volts_{RMS}$ value. However, it is not the only way to measure a voltage. New enumerations have been created to also identify Volts-peak, Volts-peak-to-peak, Volts DC, and unspecified voltage waveforms. A number of voltage measurements are defined in Figure C.3. When combined with the accumulation attribute it is possible to show an "indicating $Volts_{RMS}$" which is measured over the course of many cycles, an "instantaneous $Volts_{RMS}$" which is measured over a single cycle, or an "instantaneous voltage" which is a single point sample on the waveform captured in an instant of time.

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Figure C.3 – Voltage measurements

C.2.9 Attribute #8, interharmonicNumerator

See C.2.10.

C.2.10 Attribute #9, interharmonicDenominator

Interharmonics are represented as a rational number with a numerator and a denominator. Harmonics are represented using the same mechanism, and identified by having a denominator of "1."

This is represented formulaically as:

$$\text{Interharmonic} = \frac{\text{InterharmonicNumerator}}{\text{InterharmonicDenominator}}$$

and

$$\text{Harmonic} = \text{InterharmonicNumerator}$$

where the InterharmonicDenominator equals "1".

The harmonic or interharmonic enumeration is determined by a compound element:

<interharmonic>::= <interharmonicNumerator> <interharmonicDenominator>

The normative interharmonic numerator and denominators are defined in Table C.11. Additional values may be freely created using this approach and would be considered "informative" rather than "normative" values.

Table C.11 – Harmonic and Interharmonic enumerations

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Interharmonic Numerator	Interharmonic Denominator	Enumeration	Comments	Normative Status
0	0	none	Not Applicable	N
1	2	interharmonic1/2	Interharmonic of ½	N
1	1	fundamental	fundamental	N
2	1	harmonic2	second harmonic	N
3	1	harmonic3	third harmonic	N
4	1	harmonic4	fourth harmonic	N
5	1	harmonic5	fifth harmonic	N
6	1	harmonic6	sixth harmonic	N
7	1	harmonic7	seventh harmonic	N
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C.2.11 Attribute #10, argumentNumerator

See C.2.12.

C.2.12 Attribute #11, argumentDenominator

The argument elements are used to introduce numbers into the unit of measure description where they are needed. The definition supports a rational number with a numerator and a denominator. Most arguments used in practice however will be integers. Integers will all have a "1" as their denominator.

$$\text{argument} = \frac{\text{numerator}}{\text{denominator}}$$

The argument enumeration is determined by a compound element:

<argument>::= <numerator> <denominator>

The normative numerator and denominators are defined in Table C.12. Additional values may be freely created using this approach. For test purposes, values not shown in the table would be considered "informative" rather than "normative" values.

Table C.12 – Argument enumerations

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Numerator	Denominator	Enumeration	Comments	Normative Status
0	0	none	Not Applicable	N
1	2	n½	One-half	I
0	1	n0	"Zero" (for systems that use zero based numbering schemes)	N
1	1	n1	"One," where the measure needs an argument such as CEMI(n=1)	N
2	1	n2	"Two" where the measure needs an argument such as CEMI(n=2)	N
3	1	n3	"Three" where the measure needs an argument such as CEMI(n=3)	N
4	1	n4	"Four" where the measure needs an argument such as CEMI(n=4)	N
5	1	n5	"Five" where the measure needs an argument	N
6	1	n6	Six	N
7	1	n7	Seven	N
8	1	n8	Eight	N
9	1	n9	Nine	N
10	1	n10	Ten	N
15	1	n15	Fifteen	N
30	1	n30	Thirty	N
45	1	n45	Fourtyfive	N
60	1	n60	Sixty	N
120	1	n120	2 × 60 = 120	N
155	1	n155	One hundred fifty five	N
240	1	n240	4 × 60 = 240	N
305	1	n305	Three hundred and five.	N
360	1	n360	6 × 60 = 360	N
480	1	n480	8 × 60 = 480	N
720	1	n720	12 × 60 = 720	N
720	60	n720/60	12 × 60/1 × 60	N
720	120	n720/120	12 × 60/2 × 60	N
720	180	n720/180	12 × 60/3 × 60	N
720	240	n720/240	12 × 60/4 × 60	N
720	360	n720/360	12 × 60/6 × 60	N
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C.2.13 Attribute #12, tou

The Time Of Use (TOU) element is used to describe any attribution of the value to a specific TOU bucket. The TOU enumerations are defined in Table C.13.

Table C.13 – Time Of Use Enumerations

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Code	Enumeration	Comments	Normative Status
0	none	Not Applicable	N
1	touA	Usage in the first defined TOU bucket	N
2	touB	Usage in the second defined TOU bucket	N
3	touC	Usage in the third defined TOU bucket	N
4	touD	Usage in the fourth defined TOU bucket	N
5	touE	Usage in the fifth defined TOU bucket	N
6	touF	Usage in the sixth defined TOU bucket	N
7	touG	Etc.	I
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C.2.14 Attribute #13, cpp

The Critical Peak Period (CPP) element is used to describe any attribution of the value to a specific CPP bucket. Even though CPP is usually considered a specialized form of TOU, it is separated from TOU enumerations to facilitate modelling. The CPP enumerations are defined in Table C.14.

Table C.14 – Critical Peak Period Enumerations

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Code	Enumeration	Comments	Normative Status
0	none	Not Applicable	N
1	cppA	Consumption associated with critical peak period A	N
2	cppB	Consumption associated with critical peak period B	N
3	cppC	Consumption associated with critical peak period C	N
4	cppD	Consumption associated with critical peak period D	N
5	cppE	Consumption associated with critical peak period E	N
6	cppF	Consumption associated with critical peak period F	N
7	cppG	Etc.	I
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C.2.15 Attribute #14, consumptionTier

Consumption tier pricing refers to the method of billing in which a certain "block" of energy is purchased (or sold) at one price, after which the next block of energy is purchased at another price, and so on, all throughout a defined period. At the start of the defined period, consumption is initially zero, and any usage is measured against ConsumptionTier1. If this block of energy is consumed before the end of the period, energy consumption moves to be reconed against ConsumptionTier2. If this block of energy is consumed before the end of the period, energy consumption moves to ConsumptionTier3, and so on. At the end of the defined period the consumption accumulator is reset, and usage within ConsumptionTier1 restarts.

This is in contrast to the common "flat rate" for power, in which all purchases are at a given rate. When flat-rate pricing is used, a consumptionTier of "not applicable" should be specified.

Enumerations for Consumption Tiers are defined in Table C.15.

Table C.15 – Consumption Tier Enumerations

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Code	Enumeration	Comments	Normative Status
0	none	Not applicable	N
1	consumptionTier1	Usage in the first defined consumption bucket	N
2	consumptionTier2	Usage in the second defined consumption bucket	N
3	consumptionTier3	Usage in the third defined consumption bucket	N
4	consumptionTier4	Usage in the fourth defined consumption bucket	N
5	consumptionTier5	Usage in the fifth defined consumption bucket	N
6	consumptionTier6	Usage in the sixth defined consumption bucket	N
7	consumptionTier7	Additional consumption tiers may be created as necessary.	I
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TOU or CPP pricing may be used in conjunction with consumption tier pricing. The examples provided in Table C.16 may be useful:

Table C.16 – Example Combinations of TOU and Consumption Tier Enumerations

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Tou Code	Consumption Tier Code	Comments
1	0	TOU Period A with flat rate pricing
1	1	TOU Period A with Consumption Tier 1
1	2	TOU Period A with Consumption Tier 2
1	3	TOU Period A with Consumption Tier 3
2	1	TOU Period B with Consumption Tier 1
2	2	TOU Period B with Consumption Tier 2
2	3	TOU Period B with Consumption Tier 3
3	1	TOU Period C with Consumption Tier 1
3	2	TOU Period C with Consumption Tier 2
3	3	TOU Period C with Consumption Tier 3

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C.2.16 Attribute #15, phases

The metering phase enumerations are described in Table C.17.

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Table C.17 – Phase enumerations

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		Position	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Code	Enumeration	Comments	Networked	Open	High leg	Delta	Wye	S_1	S_2	A_1	B_1	C_1	N_1	A_2	B_2	C_2	N_2	Normative Status
0	none	Not applicable to any phase	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N
16	phaseN	Neutral	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	N
17	phaseNtoGnd	Neutral to ground	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	N
32	phaseC	Phase C	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	N
33	phaseCtoN	Phase C to Neutral	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	N
40	phaseCtoAv	Phase C current or voltage relative to Phase A voltage	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	N
41	phaseCAtoN	CA to Neutral	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	N
64	phaseB	Phase B	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	N
65	phaseBtoN	Phase B to Neutral	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	N
66	phaseBtoC	Phase B to C	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	N
72	phaseBtoAv	Phase B current or voltage relative to Phase A voltage	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	N
97	phaseBCtoN	BC to Neutral	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	N
128	phaseA	Phase A	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	N
129	phaseAtoN	Phase A to Neutral	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	N
132	phaseAtoB	Phase A to B	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	N
136	phaseAtoAv	Phase A current relative to Phase A voltage	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	N
193	phaseABtoN	AB to Neutral	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	N
224	phasesABC	Involving all phases	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	N
225	phaseABCtoN	ABC to Neutral	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	N
256	s2	Phase S2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	N
257	s2N	Phase S2 to Neutral	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	N

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		Position	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Code	Enumeration	Comments	Networked	Open	High leg	Delta	Wye	S_1	S_2	A_1	B_1	C_1	N_1	A_2	B_2	C_2	N_2	Normative Status
512	s1	Phase S1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	N
513	s1N	Phase S1 to Neutral	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	N
768	s12	Phase S1 to S2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	N
769	s12N	Phase S1, S2 to Neutral	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	N
1248	threeWireWye	3W Wye	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	N
1249	fourWireWye	4W Wye	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	N
2272	threeWireDelta	3W Delta	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	N
2273	fourWireDelta	4W Delta	0	0	0	1	0	0	0	1	1	1	0	0	0	0	1	N
6369	fourWireHLDelta	4W High-leg Delta	0	0	1	1	0	0	0	1	1	1	0	0	0	0	1	N
10465	fourWireOpenDelta	4W Open Delta	0	1	0	1	0	0	0	1	1	1	0	0	0	0	1	N
17153	networked	Networked meter	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	N

NOTE 1 The code values were computed by:

$$\text{Code} = \text{Networked} \times 2^{14} + \text{Open} \times 2^{13} + \text{HighLeg} \times 2^{12} + \text{Delta} \times 2^{11} + \text{Wye} \times 2^{10} + S_1 \times 2^9 + S_2 \times 2^8 + A_1 \times 2^7 + B_1 \times 2^6 + C_1 \times 2^5 + N_1 \times 2^4 + A_2 \times 2^3 + B_2 \times 2^2 + C_1 \times 2^1 + N_2$$

NOTE 2 Directional vectors (such as V_{AB} vs. V_{BA}) are created in the phase code by invoking the involved phase (left to right in the matrix) in the order in which they are to be described in the enumeration (left to right as one reads).

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When current is measured, it is often simple a single phase conductor indicated such as:

- A
- B
- C
- N

The Neutral-to-ground "phase" can be used to indicate current flowing from the neutral wire to ground. In this case select both N_1 and N_2. When only neutral is selected choose N_1. In all other cases when referencing neutral select N_2. The main goal is readability. These rules should provide the necessary readability.

When voltage is measured, it may contain a simple description of the phase conductor, or if measured relative to something else, an indication of the measurement being "line-to-neutral" or "line-to-line" measured. Common voltage measurements include:

- A
- B
- C
- AN
- BN
- CN
- AB
- BC
- CA
- ABC

When phase angles are measured, it is usually relative to a fixed reference such as voltage phase A. The word "angle" has already been described in a previous field. This field may therefore contain an angle designation such as:

- $A_{current}A_{volts}$
- $B_{current}A_{volts}$
- $C_{current}A_{volts}$

Where the first phase listed is understood to describe the current or voltage phase being measured, and the second phase (the "A") describes what it is being measured against (voltage phase A.) Since the fact that the measurement is an angle can be determined from the context (provided by the unit of measure), and the point of reference is always the second phase, there is no need to provide additional indications within the phase lettering. This allows the same code (such as "Phase-CA") to often be used as a line-to-line voltage descriptor, a voltage phase-angle descriptor, as well as a current phase-angle descriptor.

Residential or other two-phase secondary voltages may be identified as "S1" or "S2". These labels may be used when the "ABC" names of the phase(s) that feed the service are unknown or unimportant.

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The various polyphase network wirings may be identified as:

- Wye
- Delta
- High-leg delta
- Open delta
- Networked

The use of 3 wires or 4 wires may be determined by simply counting the number of phases (including neutral) involved in the service.

C.2.17 Attribute #16, multiplier

The ReadingType encoding offers a field to describe a power-of-ten multiplier against the data value. This is not quite the same as the customary SI-prefix, though in many cases it creates the same result. The user will have to decide what the appropriate displayable symbol is based on the dimensions of the unit of measure. The multiplier enumerations are described in Table C.18 for units of measure that have a single dimension (e.g. "V" not "V^2"). The index value represents the power of ten.

Table C.18 – Power of ten enumerations

Code	Displayable symbol for single-dimensioned UOM	Comments	Normative status
–24	y	yocto = $\times 10^{-24}$	N
–21	z	zepto = $\times 10^{-21}$	N
–18	a	atto = $\times 10^{-18}$	N
–15	f	femto = $\times 10^{-15}$	N
–12	p	pico = $\times 10^{-12}$	N
–9	n	nano = $\times 10^{-9}$	N
–6	μ	micro = $\times 10^{-6}$	N
–3	m	milli= $\times 10^{-3}$	N
–2	c	centi = $\times 10^{-2}$	N
–1	d	deci = $\times 10^{-1}$	N
0		Not applicable or "×1"	N
1	da	deca = $\times 10^{1}$	N
2	h	hecto = $\times 10^{2}$	N
3	k	kilo = $\times 10^{3}$	N
6	M	Mega = $\times 10^{6}$	N
9	G	Giga = $\times 10^{9}$	N
12	T	Tera = $\times 10^{12}$	N
15	P	Peta = $\times 10^{15}$	N
18	E	Exa = $\times 10^{18}$	N
21	Z	Zetta = $\times 10^{21}$	N
24	Y	Yotta = $\times 10^{24}$	N
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It should be remembered that this power-of-ten multiplier does not work the same way as the SI prefix. The SI prefix is considered to be part of the unit of measure. A power-of-ten multiplier is not part of the unit of measure. When an SI-Prefix is used, it is understood that "10^{-3}" is represented as "milli", and a mm^3 is the same as $(mm)^3$ which is the same as $(0{,}001\ m)^3$ or $10^{-9}\ m^3$. This is not the same result as $0{,}001 \times m^3$ (which is what a power-of-ten multiplier yields.).

Rules for the use of SI prefixes may be found in IEC 60050-112:2010, 02-03.

When the unit of measure being described is a ratio which is rendered as a dimensionless quantity (such as a concentration), it is sometimes customary to display a symbol other than the standard metric prefix symbol. The modern convention however is to use the SI-prefix symbols infront of the dimensionless ratio being described. For example, a ppm concentration by volume ("ppmv") should instead be described as "µL/L". A few historical dimensionless scalars are provided in Table C.19 for reference.

Table C.19 – Historical concentration multiplier enumerations

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Code	Displayable Symbol	Comments	Normative Status
0	PU	per unit = ×1 = 10^0	I
–2	%	percent = ×0,01 = $\times 10^{-2}$	I
–3	‰	permille = ×0,001 = $\times 10^{-3}$	I
–6	ppm	parts per million, ×0,000 001 = $\times 10^{-6}$	I
–9	ppb	parts per billion, ×0,000 000 001 = $\times 10^{-9}$	I
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C.2.18 Attribute #17, unit

Table C.20, Table C.21, Table C.22, Table C.23, Table C.24, Table C.25, Table C.26 and Table C.27 describe the unit of measure enumerations. They are organized by their relationships to the SI units of measure. SI-units are the preferred unit of measure, but as an international standard, it is understood that other units of measure shall also be supported in some regions. Definitions for common units of measure such as "voltage," current," and other quantities may be found freely online at the IEC Electropedia website.

In these tables, the "code" column is a unique value. The "normative status" indicates if the "code" is normative or informative. The "quantity" column indicates the category of measure. The "unit name" suppolies the official name for the unit, and possibly comments regarding its use or relationship to other units. The "symbol" column indicates in most cases the official displayable symbol for the unit. Where there were cases for conflict because different measurement systems have been combined, preference is given to the SI unit of measure. (This happened in the case of rad (rd) and rod (rd).) The "enumeration" column creates a unique string which could be used by CIM modelers to capture a string value for the unit. The enumeration was created based on the following rules:

- A lower camel-case transformation of the symbol column is attempted. All spaces are removed from the symbol to create the enumeration.
- The symbol set is restricted to alpha-numeric characters.
- The symbols "-", "(", and ")" are removed.
- The symbol "/" is replaced by the string "Per".

- The symbol "°" is replaced by the string "Deg".
- Other special symbols such as "¤", "'", "μ" and "ℏ" are replaced with alternative alpha text strings.
- Digits are not allowed as the first character in the enumeration.
- Text that is superscripted or subscripted is used as normal text in the enumeration (if conflicts are avoidable).
- If two different symbols would result in the same enumeration (due to capitalization rules) then one of them is changed (with preference being given to the base SI units). Exceptions were created for the symbols "A", "B", "G", "H", "ℏ", "M", "m_e", "S", and "T".

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Table C.20 – Base SI units of measure

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
2	Length	metre	m	m	N
3	Mass	gram	g	g	N
5	Current	ampere	A	a	N
6	Temperature	Kelvin	K	degK	I
7	Amount of substance	mole	mol	mol	I
8	Luminous intensity	candela	cd	cd	I
27	Time	second	s	s	N

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NOTE The British spelling "metre" and American spelling "meter" are equivalent.

Table C.21 – Derived SI units of measure with special names

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Code	Quantity	Unit name (and comments)	Displayable Symbol	Enumeration	Normative Status
10	Plane angle	Radian (m/m)	rad	rad	N
11	Solid angle	Steradian (m^2/m^2)	sr	sr	I
21	Absorbed dose	Gray (J/kg)	Gy	gy	I
22	Radioactivity	Becquerel (1/s)	Bq	bq	I
23	Temperature	degrees Celsius	°C	degC	N
24	Dose equivalent	Sievert (J/kg)	Sv	sv	I
25	Electric capacitance	Farad (C/V)	F	f	N
26	Electric charge	Coulomb (Amp second)	C	c	I

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Code	Quantity	Unit name (and comments)	Displayable Symbol	Enumeration	Normative Status
28	Electric inductance	Henry (Wb/A)	H	h	N
29	Electric potential	Volt (W/A)	V	v	N
30	Electric resistance	Ohm (V/A)	Ω	ohm	N
31	Energy joule	(N·m = C·V = W·s)	J	j	N
32	Force newton	(kg m/s^2)	N	n	N
33	Frequency	Cycles per second or (1/s)	Hz	hz	N
34	Illuminance lux	(lm/m^2)	lx	lx	I
35	Luminous flux	lumen (cd sr)	lm	lm	I
36	Magnetic flux	Weber (V s)	Wb	wb	I
37	Magnetic flux density	Tesla (Wb/m^2)	T	t	I
38	Real power	Watt. By definition, one Watt equals oneJoule per second. Electrical power may have real and reactive components. The real portion of electrical power (I^{2}R) or VIcosθ, is expressed in Watts. (See also apparent power and reactive power.)	W	w	N
39	Pressure	Pascal (N/m^2) NOTE the absolute or relative measurement of pressure is implied with this entry. See below for more explicit forms.	Pa	pa	N
53	Electric Conductance	Siemens (A / V = 1 / Ω)	S	siemens	N
155	Pressure	Pascal, absolute pressure	PaA	paA	N
140	Pressure	Pascal, gauge pressure	PaG	paG	N
158	Catalytic activity	katal = mol / s	kat	kat	I

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NOTE The British spelling "litre" and American spelling "liter" are equivalent.

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Table C.22 – Derived SI Units of Measure without Special Names

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Code	Quantity	Unit name (and comments)	Displayable Symbol	Enumeration	Normative Status
4	Rotational speed	rotations per second NOTE Compare to cycles per second, Hz	rev/s	revPerS	I
41	Area	square metre	m^2	m2	N
42	Volume	cubic metre	m^3	m3	N
43	Velocity	metre per second (m/s)	m/s	mPerS	N
44	Acceleration	metre per second squared	m/s^2	mPerS2	I
45	Volumetric flow rate	cubic metres per second	m^3/s	m3PerS	N
46	Fuel efficiency	metre / cubic metre	m/m^3	mPerM3	I
47	Moment of mass	kilogram metre (kg·m) (first moment of mass) NOTE 1 Users shall supply the "k" prefix to obtain "kg m".	g m	gM	I
48	Density	gram/cubic metre NOTE 2 Users shall supply the prefix multiplier "k" to form kg/m^3	g/m^3	gPerM3	I
49	Viscosity	metre squared / second	m^2/s	m2PerS	I
50	Thermal conductivity	Watt/metre Kelvin	W/(m K)	wPerMK	I
51	Heat capacity	Joule/Kelvin	J/K	jPerK	I
54	Angular velocity	radians per second	rad/s	radPerS	I
61	Apparent power	Volt Ampere (See also real power and reactive power.)	VA	vA	N
63	Reactive power	Volt Ampere reactive. The "reactive" or "imaginary" component of electrical power (VISinθ). (See also real power and apparent power). NOTE 3 Different meter designs use different methods to arrive at their results. Some meters may compute reactive power as an arithmetic value, while others compute the value vectorially. The data consumer should determine the method in use and the suitability of the measurement for the intended purpose.	VAr	vAr	N
66	Volt seconds	Volt seconds (Ws/A)	Vs	vS	N
67	Volts squared	Volt squared (W^2/A^2)	V^2	v2	N

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Code	Quantity	Unit name (and comments)	Displayable Symbol	Enumeration	Normative Status
68	Amp seconds	Amp seconds	As	aS	N
69	Amps squared	Amp squared	A^2	a2	N
70	Amps squared time	square Amp second	A^2s	a2S	I
71	Apparent energy	Volt Ampere hours	VAh	vAH	N
72	Real energy	Watt hours	Wh	wH	N
73	Reactive energy	Volt Ampere reactive hours	VArh	vArH	N
74	Magnetic flux	Volt per Hertz	V/Hz	vPerHz	I
75	Rate of change of frequency	Hertz per second	Hz/s	hzPerS	I
78	Moment of mass	kg m^2 (Second moment of mass, commonly called the moment of interia) NOTE 4 Users shall supply the "k" prefix to obtain "kg m^2".	gm^2	gM2	I
81	Ramp rate	Watt per second	W/s	wPerS	I
82	Volumetric flow rate	litre per second	L/s	lPerS	I
100	Quantity power	Q	Q	q	I
101	Quantity energy	Qh	Qh	qh	I
102	resistivity	Ohm metre, ρ (rho)	Ωm	ohmM	I
103	A/m	magnetic field strength, Ampere per metre	A/m	aPerM	I
104	volt-squared hour	Volt-squared-hours	V^2h	v2H	I
105	ampere-squared hour	Ampere-squared hour	A^2h	a2H	I
106	Ampere-hours	Ampere-hours	Ah	aH	I
107	Wh/m^3	energy per volume	Wh/m^3	wHPerM3	I
108	Timestamp	time and date per ISO 8601 format	timeStamp	timeStamp	N
115	Kh-Wh	active energy metering constant	Wh/rev	wHPerRev	N
116	Kh-VArh	reactive energy metering constant	VArh/rev	vArHPerRev	N
117	Kh-Vah	apparent energy metering constant	VAh/rev	vAHPerRev	N
125	Volumetric flow rate	cubic metre per hour	m^3/h	m3PerH	N
126	Volumetric flow rate	compensated cubic metre per hour	m^3 $_{(compensated)}/h$	m3CompensatedPerH	N

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Code	Quantity	Unit name (and comments)	Displayable Symbol	Enumeration	Normative Status
127	Volumetric flow rate	uncompensated cubic metre per hour	$m^3{}_{(uncompensated)}/h$	m3UncompensatedPerH	N
137	Volumetric flow rate	litre per hour	L/h	lPerH	N
139	Volumetric flow rate	litre (uncompensated) per hour	$L_{(uncompensated)}/h$	lUncompensatedPerH	N
138	Volumetric flow rate	litre (compensated) per hour	$L_{(compensated)}/h$	lCompensatedPerH	N
161	Quantity power	Q measured at 45°	Q_{45}	q45	I
162	Quantity power	Q measured at 60°	Q_{60}	q60	I
163	Quantity energy	Qh measured at 45°	$Q_{45}h$	q45H	I
164	Quantity energy	Qh measured at 60°	$Q_{60}h$	q60H	I
165	Specific energy	Joule / kg	J/kg	jPerKg	I
166	Volume	cubic metre, with the value uncompensated for weather effects.	$m^3{}_{(uncompensated)}$	m3Uncompensated	N
167	Volume	cubic metre, with the value compensated for weather effects.	$m^3{}_{(compensated)}$	m3Compensated	N
173	Wavenumber	reciprocal metre, $\sigma, \tilde{\nu}$ (1/m)	M^{-1}	m1	I
174	Specific volume	cubic metre per kilogram, v	m^3/kg	m3PerKg	I
175	Dynamic viscosity	Pascal second	Pa s	paS	I
176	Moment of force	Newton metre	N m	nM	I
177	Surface tension	Newton per metre	N/m	nPerM	I
178	Angular acceleration	radian per second squared	rad/s^2	radPerS2	I
179	Heat flux density, irradiance	Watt per square metre	W/m^2	wPerM2	I
180	Specific heat capacity, specific entropy	Joule per kilogram kelvin	J/(kg K)	jPerKgK	I
181	energy density	Joule per cubic metre	J/m^3	jPerM3	I
182	electric field strength	Volt per metre	V/m	vPerM	I
183	electric charge density	Coulomb per cubic metre	C/m^3	cPerM3	I
184	surface charge density	Coulomb per square metre	C/m^2	cPerM2	I

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Code	Quantity	Unit name (and comments)	Displayable Symbol	Enumeration	Normative Status
185	permittivity	Farad per metre	F/m	fPerM	I
186	permeability	Henry per metre	H/m	hPerM	I
187	molar energy	Joule per mole	J/mol	jPerMol	I
188	molar entropy, molar heat capacity	Joule per mole kelvin	J/(mol K)	jPerMolK	I
189	exposure (x rays)	Coulomb per kilogram	C/kg	cPerKg	I
190	absorbed dose rate	Gray per second	Gy/s	gyPerS	I
191	radiant intensity	Watt per steradian	W/sr	wPerSr	I
192	radiance	Watt per square metre steradian	$W/(m^2 sr)$	wPerM2Sr	I
193	catalytic activity concentration	katal per cubic metre	kat/m^3	katPerM3	I
280	Volt-hour	Volt hours	Vh	vH	N
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Table C.23 – Non-SI Units of Measure accepted for use with the International System of Units

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
159	Time	minute = 60 s	min	min	I
160	Time	hour = 60 min = 3 600 s	h	hr	I
195	Time	day = 24 h = 86 400 s	d	d	I
9	Plane angle	degree	°	deg	N
196	Plane angle	minute	'	angleMin	I
197	Plane angle	second	"	angleSec	I
198	Area	hectare	ha	ha	I
134	Volume	litre = dm^3 = m^3/1 000	L	l	N
199	mass	"tonne" or "metric ton" (1 000 kg = 1 Mg)	t	tonne	I

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Table C.24 – Dimensionless and Concentration Units of Measure

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
0	N/A	none (not applicable)		none	N
65	Power factor	dimensionless $\cos\theta = \frac{P}{\lvert S\rvert}$ NOTE 1 This definition of power factor only holds for balanced systems. See the alternative definition under code 153. NOTE 2 Beware of differing sign conventions in use between the IEC and EEI. It is assumed that the data consumer understands the type of meter in use and the sign convention in use by the utility.	cosθ	cosTheta	N
79	Logrithmic ratio	Bel NOTE 3 Users shall combine this unit with the multiplier prefix "d" to form decibels (dB)	B	bel	I
109	State	status, where: "1" = "true", "live", "on", "high", "set"; "0" = "false", "dead", "off", "low", "cleared" NOTE 4 A Boolean value is preferred but other values may be supported	status	status	N
111	Amount of substance	Counter value	count	count	N
113	Logrithmic ratio of signal strength	Bel-mW, normalized to 1mW. NOTE to form "dBm" combine "Bm" with multiplier "d".	Bm	bm	N
114	Application Value	Encoded value	code	code	N
118	EndDeviceEvent	Value to be interpreted as a EndDeviceEventCode	meCode	meCode	N
143	Concentration	The ratio of the volume of a solute divided by the volume of the solution. NOTE 5 Users may need use a prefix such a "μ" to express a quantitye such as "μL/L"	L/L	lPerL	N
144	Concentration	The ratio of the mass of a solute divided by the mass of the solution. NOTE 6 Users may need use a prefix such a "μ" to express a quantity such as "μg/g".	g/g	gPerG	N
145	Concentration	The amount of substance concentration, (c), the amount of solvent in moles divided by the volume of solution in m³.	mol/m³	molPerM3	I
146	Concentration	Molar fraction (χ), the ratio of the molar amount of a solute divided by the molar amount of the solution.	mol/mol	molPerMol	I

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
147	Concentration	Molality, the amount of solute in moles and the amount of solvent in kilograms.	mol/kg	molPerKg	I
148	Length	Ratio of length	m/m	mPerM	I
149	Time	Ratio of time NOTE 7 Users may need to supply a prefix such as "μ" to show rates such as "μs/s"	s/s	sPerS	N
150	Frequency	Rate of frequency change NOTE 8 Users may need to supply a prefix such as "m" to show rates such as "mHz/Hz"	Hz/Hz	hzPerHz	N
151	Voltage	Ratio of voltages NOTE 9 Users may need to supply a prefix such as "m" to show rates such as "mV/V"	V/V	vPerV	N
152	Current	Ratio of Amperages NOTE 10 Users may need to supply a prefix such as "m" to show rates such as "mA/A"	A/A	aPerA	I
153	Power factor	PF, the ratio of the active power to the apparent power. NOTE 11 The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.	W/VA	wPerVA	I
154	Amount of rotation	Revolutions	rev	rev	I
168	Signal Strength	Ratio of power NOTE 12 Users may need to supply a prefix such as "m" to show rates such as "mW/W"	W/W	wPerW	I
170	Refractive Index	n	*n*	refractiveIndexN	I
171	Relative Permeability	μ_r	μ_r	relativePermeabilityMur	I
172	Logarithmic ratio	Neper	Np	np	I
281	Humidity	Relative humidity espressed as the ratio of partial pressure of water vapor in the air-water mixture to the saturated vapor pressure of water at the prescribed temperature.	φ	realtiveHumidity	N
282	Sky Cover	Ratio of covered sky to total sky.	skyCover	skyCover	N

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Table C.25 – Non-SI units whose values in SI units shall be obtained experimentally

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
200	energy	electronvolt (1 eV = 1,602 176 × 10^{-19} J)	eV	eV	I
201	mass	dalton (1 Da = 1,660 538 × 10^{-27} kg)	Da	da	I
202	mass	unified atomic mass unit (1 u = 1 Da)	u	u	I
203	length	astronomical unit (1ua = 1,495 978 × 10^{11} m)	ua	ua	I
204	speed	natural unit of speed (speed of light in a vacuum) = 299 792 458 m/s	c_0	c0	I
205	action	natural unit of action (reduced planck constant) = 1,054 571 × 10^{-34}J s	ħ	nuH	I
206	mass	natural unit of mass (electron mass) = 9,109 382 × 10^{-31} kg	m_e	nuMe	I
207	time	natural unit of time	$ħ/(m_e c_0^2)$	nuHPerNuMeC02	I
208	charge	atomic units of charge (elementary charge) = 1,602 176 × 10^{-19} C	e	auE	I
209	mass	atomic units of mass (electron mass) = 9,109 382 × 10^{-31} kg	m_e	auMe	I
210	action	atomic unit of action (reduced planck constant) = 1,054 571 × 10^{-34} J s	ħ	auH	I
211	length	atomic unit of length, bohr (Bohr radius) = 0,529 177 × 10^{-10} m	a_0	auA0	I
212	energy	atomic unit of energy, hartree = 4,359 744	E_h	auEh	I
213	time	atomic unit of time	$ħ/E_h$	auHPerAuEh	I

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Table C.26 – Other Non-SI Units of Measure

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
76	Number of characters	characters	char	char	N
77	Data rate	characters per second	char/s	charPerSec	I
80	Monetary unit	Generic money NOTE Specific monetary units are identified the currency class	¤	money	I
119	Volume	cubic foot	ft^3	ft3	N
120	Volume	cubic foot compensated for weather	ft^3 (compensated)	ft3Compensated	N
121	Volume	cubic foot uncompensated for weather	ft^3 (uncompensated)	ft3Uncompensated	N
122	Volumetric flow rate	cubic foot per hour	ft^3/h	ft3PerH	N
123	Volumetric flow rate	compensated cubic feet per hour	ft^3 (compensated)/h	ft3CompensatedPerH	N
124	Volumetric flow rate	uncompensated cubic feet per hour	ft^3 (uncompensated)/h	ft3UncompensatedPerH	N
128	Volume	US gallon (1 gal = 231 in^3 = 128 fl oz.)	US gal	uSGal	N
129	Volumetric flow rate	US gallon per hour	US gal/h	uSGalPerH	N
130	Volume	Imperial gallon	imp gal	impGal	N
131	Volumetric flow rate	Imperial gallon per hour	imp gal/h	impGalPerH	N
132	Energy	British Thermal Unit	BTU	btu	N
133	Power	BTU per hour	BTU/h	btuPerH	N
141	Pressure	Pound per square inch, absolute	psiA	psiA	I
142	Pressure	Pound per square inch, gauge	psiG	psiG	I
156	Volume	Litre, with the value uncompensated for weather effects	$L_{(uncompensated)}$	lUncompensated	N
157	Volume	Litre, with the value compensated for weather effects	$L_{(compensated)}$	lCompensated	N
169	Energy	Therm	therm	therm	N
214	Pressure	bar (1 bar = 100 kPa)	bar	bar	I
215	Pressure	millimeter of mercury (1 mmHg ≈ 133,3 Pa)	mmHg	mmHg	I

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
216	Length	ångström (1Å = 10^{-10} m)	Å	angstrom	I
217	Length	nautical mile (1 M = 1852 m)	M	nmi	I
218	Area	barn (1 b = 100 fm^2 = 10^{-28} m^2)	b	barn	I
219	Speed	knot (1 kn = 1852/3600) m/s	kn	kn	I
220	Activity	curie (1 Ci = 3,7 × 10^{10} Bq)	Ci	ci	I
221	exposure	roentgen (1 R = 2,58 × 10^{-4} C/kg)	R	r	I
222	absorbed dose	rad (1 rd = 1 cGy)	rd	doseRad	I
223	dose equivalent	rem (1 rem = 10^{-2} Sv)	rem	rem	I
224	length	inch	in	in	I
225	length	foot (1 ft = 12 in)	ft	ft	I
226	length	rod (1 rod = 16,5 ft)	rod	rod	I
227	length	furlong (1 fur = 660 ft)	fur	fur	I
228	length	mile (1 statute mile = 8 fur = 80 chains = 320 rods = 5280 feet)	mi	mi	I
229	area	square foot (1 ft^2 = 144 in^2)	ft^2	ft2	I
230	area	square yard (1 yd^2 = 9 ft^2)	yd^2	yd2	I
231	area	square rod (1 rod^2 = 272,25 ft^2)	rod^2	rod2	I
232	area	acre (1 acre = 160 rd^2 = 43 560 ft^2)	acre	acre	I
233	area	square mile (1 mi^2 = 640 acres)	mi^2	mi2	I
234	area	section of land (1 mi^2 = 1 section of land)	section of land	sectionOfLand	I
235	area	township (1 township = 6 miles square)	township	township	I
237	Volume	cubic yard (1 yd^3 = 27 ft^3)	yd^3	yd3	I
238	length	link (1 li = 0,66 ft)	li	li	I
239	length	chain (1 ch = 100 links = 4 rods = 66 ft)	ch	ch	I
240	Volume	US liquid pint (1 pt = 28,875 in^3 = 128 fl dr)	US liq pt	uSLiqPt	I
241	Volume	US liquid quart (1 qt = 2 pt)	US liq qt	uSLiqQt	I
242	Volume	Apothecaries fluid dram	fl dr ap	flDrAp	I
243	Volume	Apothecaries fluid ounce (1 fl oz ap = 8 fl dr ap)	fl oz ap	flOzAp	I

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
244	Volume	US dry pint (1 pt = 67,2 in^3)	US dry pt	usDryPt	I
245	Volume	US dry quart (1 qt = 2 pints)	US dry qt	usDryQt	I
246	Volume	US peck (1 pk = 8 qt)	US pk	usPk	I
247	Volume	US bushel (1 bu = 4 pk)	US bu	usBu	I
248	Mass	grain (1 grain = 1/7000 avdp lb) NOTE The "grain" is the same in the avoirdupois, troy, and apothecaries units of mass.	gr	gr	I
249	Mass	Avoirdupois dram (1 Avdp dr = 27-11/32 gr) NOTE The abbreviation "dr" may be used if there is no chance of confusing the avoirdupois dram with the troy or apothecaries dram.	avdp dr	avdpDr	I
250	Mass	Avoirdupois ounce (1 Avdp oz = 16 Avdp dr) NOTE The abbreviation "oz" may be used if there is no chance of confusing the avoirdupois ounce with the troy or apothecaries ounce.	avdp oz	avdpOz	I
251	Mass	Avoirdupois pound (1 lb = 16 oz) NOTE Although the term "pound" is commonly used in many countries simply as "pound (lb)", the historical term "avoirdupois" is added to provide context and distinguish it in this setting from the troy and apothecaries systems of measure which use the same names. The abbreviation "lb" may be used instead of "avdp lb" if no confusion is possible with the pound named in these other systems.	avdp lb	avdpLb	I
252	Mass	Avoirdupois hundredweight (1 cwt = 100 lbs)	short cwt	shortCwt	I
253	Mass	Avoirdupois ton (1 short ton = 2000 lbs)	short ton	shortTon	I
254	Mass	Avoirdupois gross or long hundredweight (1 long cwt = 112 lbs)	long cwt	longCwt	I
255	Mass	Avoirdupois gross or long ton (1 long ton = 20 long cwt)	long ton	longTon	I
256	Mass	Troy pennyweight (1 dwt = 24 grains)	dwt	dwt	I
257	Mass	Troy ounce (1 oz t = 20 dwt)	oz t	ozT	I
258	Mass	Troy pound (1 lb t = 12 oz t)	lb t	lbT	I
259	Mass	Apothecaries scruple (1 s ap = 20 grains)	s ap	sAp	I

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
260	Mass	Apothecaries dram (1 dr ap = 3 s ap)	dr ap	drAp	I
261	Mass	Apothecaries ounce (1 oz ap = 8 dr ap)	oz ap	ozAp	I
262	Mass	Apothecaries pound (1 lp ap = 12 oz ap)	lb ap	lbAp	I
263	Fuel economy	mile per imperial gallon	mpg (Imp)	mpgImp	I
264	Fuel economy	mile per US gallon	mpg (US)	mpgUS	I
265	Fuel economy	mile per US gallon equivalent	MPGe (US)	mPGeUS	I
266	Fuel economy	litre per 100 km	l/(100 km)	lPer100km	I
267	Fuel economy	killowatt-hour per mile (NOTE users shall supply the "k" prefix to create "kWh/mi")	Wh/mi	wHPerMi	I
268	Fuel economy	kilowatt-hour per 100 mile (NOTE users shall supply the "k" prefix to create "kWh/(100 mi)")	Wh/(100 mi)	wHPer100Mi	I
279	Temperature	degrees Fahrenheit	°F	degF	I
284	Volume	Cubic inches	in^3	in3	I
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Table C.27 – Non-SI Units Associated with the CGS and the CGS-Gaussian System of Units

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Code	Quantity	Unit name (and comments)	Symbol	Enumeration	Normative Status
269	Energy	erg (1 erg = 10^{-7} J)	erg	erg	I
270	Force	dyne (1 dyn = 10^{-5} N)	dyn	dyn	I
271	Dynamic viscosity	poise (1 P = 0,1 Pa s)	P	p	I
272	Kinematic viscosity	stokes (1 St = 1 cm^2/s)	St	st	I
273	Luminance	stilb (1 sb = 10^4 cd/m^2)	sb	sb	I
274	Illuminance	phot (1 ph = 10^4 lx)	ph	ph	I
275	Acceleration	gal (1 Gal = 10^{-2} m s^{-2}) NOTE This "Gal" is an abbreviation for "Galileo" not "gallon"	Gal	gal	I
276	Magnetic flux	Maxwell (1 Mx = 10^{-8} Wb)	Mx	mx	I
277	Magnetic flux density	Gauss (1 G = 10^{-4} T)	G	gauss	I
278	Magnetic field	Œrsted (1 Oe = ($10^3/4\pi$) A/m)	Oe	oe	I
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C.2.19 Attribute #18, currency

Currency codes are defined in ISO 4217. A handful of codes have been repeated in Table C.28 for reference. Additional currency codes may be drawn freely from ISO 4217.

Table C.28 – Currency units of measure (from ISO 4217)

Code	Displayable Symbol	Unit name	Normative Status
0		None	N
36	AUD	Australian Dollar	I
124	CAD	Canadian Dollar	I
156	CNY	Chinese Yuan Renminbi	I
208	DKK	Danish Crown	I
356	INR	India Rupee	I
392	JPY	Japanese Yen	I
578	NOK	Norwegian Crown	I
643	RUB	Russian Ruble	I
710	ZAR	South African Rand	I
752	SEK	Swedish Krona	I
756	CHF	Swiss Franc	I
826	GBP	British Pound	I
840	USD	US Dollar	I
978	EUR	Euro	I
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C.3 Using data element attributes to define the ReadingType name – Construction formula with example ReadingType codes

The "ReadingType" may be automatically generated by judiciously populating each of the attributes and presenting them in order side-by-side. It is recommended that attributes be as explicit as possible to identify a data element, but on the other hand, not become so explicit that it overspecifies the data element.

A ReadingType Name may be generated by presenting the numeric form of each attribute in side-by-side fashion separated by dots.

<ReadingType.Name.name>::= <macroPeriod> "." <aggregate> "."<measuringPeriod>"," <accumulation> "." <flowDirection> "." <commodity> "." <measurementKind> "." <interharmonicNumerator> "." <interharmonicDenominator> "." <argumentNumerator> "." <argumentDenominator> "." <tou> "." <cpp> "." <consumptionTier> "." <phases> "." <multiplier> "." <unit> "." <currency>

These fields can be converted to a regionalized pronounceable name by using the regional text form for each non-zero attribute, and presenting them in order, side-by-side, separated by spaces and other symbols as appropriate. For most applications, this usually provides more information than needs to be said (verbally) about the data. It is accepted practice in common speech to suppress descriptive adjectives which are mutually understood by the context of the communication. Table C.29 provides examples of such conversions into English. It can be noted that in the EBNF formula below, symbols such as "(", and ")" are introduced to improve readability. Spaces around the unit of measure are also omitted to improve readability.

<Name.description>::= [<macroPeriod> " "] [<aggregate> " "] [<measuringPeriod> " "] [<accumulation> " "] [<flowDirection> " "] [<commodity> " "] [<measurementKind> " "] [<interharmonicNumerator> " "] [<interharmonicDenominator> " "] [<argumentNumerator> " "] [<argumentDenominator> " "] [<tou> " "] [<cpp> " "] [<consumptionTier> " "] [<phases> " "] "(" [<multiplier>] [<unit>] [<currency>] ")"

While a good interface will eliminate ambiguity, and not publish "anonymous" data, a good interface will also not go to the other extreme and overspecify the data it publishes. The concept is similar to the practice of publishing an appropriate number of digits of resolution for a numerical value. One system may know (for example) the phase on which a voltage was measured and supply it as an attribute of the measurement. Another system might not know the phase with good authority and simply publish the voltage measured at a given meter. The ReadingTypeIDs used in a response may (therefore) differ slightly than the ReadingTypeIDs used in a request. The ReadingType codes used by a data publisher should be appropriate for the data supplied.

The examples listed in Table C.29 are by no means an exhaustive list of what can be constructed given the enumeration values listed above. After searching the examples (below), and searching the lists of enumerations (above), and a needed enumeration cannot be found, custom made enumerations may be made. Some of the fields (such a "numerator") are naturally an integer field. If the needed enumeration is merely an integer, then the user should supply the integer required. However, if the field is a list-type enumeration, some care should be used. Rather than merely using the next available number on the list, custom user enumerations should be created numbered 9 000 or above.

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Table C.29 – ReadingType Examples

ReadingType ID Code	Description	Normative Status
8.0.0.0.0.1.152.0.0.0.0.0.0.0.0.0.0.840	billingPeriod electricitySecondaryMetered billCarryover (USD)	N
8.0.0.0.0.1.150.0.0.0.0.0.0.0.0.0.0.840	billingPeriod electricitySecondaryMetered billLastPeriod (USD)	N
8.8.0.3.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum cumulative forward electricitySecondaryMetered demand (kW)	N
8.8.53.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum fixedBlock15Min indicating forward electricitySecondaryMetered demand (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.0.0.0.3.63.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand (kVAr)	N
8.8.0.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.1.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touA (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.2.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touB (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.3.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touC (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.4.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touD (kW)	N
8.8.0.6.19.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum indicating reverse electricitySecondaryMetered demand (kW)	N
8.8.71.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum rollingBlock15MinIntvl5MinSubIntvl indicating forward electricitySecondaryMetered demand (kW)	N
8.8.101.6.1.1.8.0.0.720.1.0.0.0.0.3.38.0	billingPeriod maximum specifiedFixedBlock indicating forward electricitySecondaryMetered demand n720 (kW)	N
8.8.102.6.1.1.8.0.0.720.240.0.0.0.0.3.38.0	billingPeriod maximum specifiedRollingBlock indicating forward electricitySecondaryMetered demand n720/240 (kW)	N
8.0.0.9.1.1.12.0.0.0.0.1.0.0.0.3.72.0	billingPeriod summation forward electricitySecondaryMetered energy touA (kWh)	N
8.0.0.9.1.1.12.0.0.0.0.2.0.0.0.3.72.0	billingPeriod summation forward electricitySecondaryMetered energy touB (kWh)	N
8.0.0.9.1.1.12.0.0.0.0.3.0.0.0.3.72.0	billingPeriod summation forward electricitySecondaryMetered energy touC (kWh)	N
0.0.0.1.0.1.122.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered demandReset (count)	N
0.0.0.1.0.1.11.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered energization (count)	N
0.0.0.1.0.1.131.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered loadInterrupt (count)	N
0.0.0.1.0.1.141.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered relayActivation (count)	N
0.0.0.1.0.1.142.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered relayCycle (count)	N
0.0.0.1.1.1.12.0.0.0.0.0.0.0.0.3.73.0	bulkQuantity forward electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.1.1.12.0.0.0.0.0.0.0.0.3.72.0	bulkQuantity forward electricitySecondaryMetered energy (kWh)	N
0.0.0.1.1.7.58.0.0.0.0.0.0.0.0.2.120.0	bulkQuantity forward naturalGas volume (hft³(compensated))	N
0.0.0.1.1.7.58.0.0.0.0.0.0.0.0.2.121.0	bulkQuantity forward naturalGas volume (hft³(uncompensated))	N
0.0.0.1.1.7.58.0.0.0.0.0.0.0.0.3.120.0	bulkQuantity forward naturalGas volume (kft³(compensated))	N

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ReadingType ID Code	Description	Normative Status
0.0.0.1.1.7.58.0.0.0.0.0.0.0.3.121.0	bulkQuantity forward naturalGas volume (kft³(uncompensated))	N
0.0.0.1.4.1.12.0.0.0.0.0.0.0.3.73.0	bulkQuantity net electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.4.1.12.0.0.0.0.0.0.0.3.72.0	bulkQuantity net electricitySecondaryMetered energy (kWh)	N
0.0.0.1.19.1.12.0.0.0.0.0.0.0.3.73.0	bulkQuantity reverse electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.19.1.12.0.0.0.0.0.0.0.3.72.0	bulkQuantity reverse electricitySecondaryMetered energy (kWh)	N
0.0.0.1.20.1.12.0.0.0.0.0.0.0.3.73.0	bulkQuantity total electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.20.1.12.0.0.0.0.0.0.0.3.73.0	bulkQuantity total electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.20.1.12.0.0.0.0.0.0.0.3.72.0	bulkQuantity total electricitySecondaryMetered energy (kWh)	N
0.0.0.0.0.3.97.0.0.0.1.0.0.0.0.0.114.0	communication deviceAddressType2 n0 (code)	N
0.0.0.0.0.3.123.0.0.0.0.0.0.0.0.0.114.0	communication diagnostic (code)	N
0.0.0.0.0.3.104.0.0.0.1.0.0.0.0.0.114.0	communication groupAddressType2 n0 (code)	N
0.0.0.0.0.3.133.0.0.0.0.0.0.0.0.0.114.0	communication maintenance (code)	N
0.0.0.0.0.3.114.0.0.0.1.0.0.0.0.0.114.0	communication oneWayAddress n0 (code)	N
0.0.0.0.0.3.114.0.0.1.1.0.0.0.0.0.114.0	communication oneWayAddress n1 (code)	N
11.0.0.1.4.1.12.0.0.0.0.0.0.0.3.72.0	daily bulkQuantity net electricitySecondaryMetered energy (kWh)	N
11.0.0.4.0.1.126.0.0.0.0.0.0.0.0.111.0	daily deltaData electricitySecondaryMetered ieee1366MomentaryInterruption (count)	N
11.0.0.4.0.1.127.0.0.0.0.0.0.0.0.111.0	daily deltaData electricitySecondaryMetered ieee1366MomentaryInterruptionEvent (count)	N
11.0.0.4.0.1.128.0.0.0.0.0.0.0.0.111.0	daily deltaData electricitySecondaryMetered ieee1366SustainedInterruption (count)	N
11.0.0.4.0.1.128.0.0.0.0.0.0.0.0.27.0	daily deltaData electricitySecondaryMetered ieee1366SustainedInterruption (s)	N
11.8.0.6.1.1.8.0.0.0.0.0.0.0.3.38.0	daily maximum indicating forward electricitySecondaryMetered demand (kW)	N
11.0.0.9.4.1.12.0.0.0.0.1.0.0.0.3.72.0	daily summation net electricitySecondaryMetered energy touA (kWh)	N
0.0.0.4.1.1.12.0.0.0.0.0.0.0.3.73.0	deltaData forward electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.1.1.12.0.0.0.0.0.0.0.3.72.0	deltaData forward electricitySecondaryMetered energy (kWh)	N
0.0.0.4.4.1.12.0.0.0.0.0.0.0.3.73.0	deltaData net electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.4.1.12.0.0.0.0.0.0.0.3.72.0	deltaData net electricitySecondaryMetered energy (kWh)	N
0.0.0.4.19.1.12.0.0.0.0.0.0.0.3.73.0	deltaData reverse electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.19.1.12.0.0.0.0.0.0.0.3.72.0	deltaData reverse electricitySecondaryMetered energy (kWh)	N
0.0.0.4.20.1.12.0.0.0.0.0.0.0.3.73.0	deltaData total electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.20.1.12.0.0.0.0.0.0.0.3.72.0	deltaData total electricitySecondaryMetered energy (kWh)	N
0.0.0.0.0.1.5.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered currentAngle (count)	N

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ReadingType ID Code	Description	Normative Status
0.0.0.0.0.1.6.0.0.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered currentImbalance (count)	N
0.0.0.0.0.1.11.0.0.0.0.0.0.0.0.0.0.109.0	electricitySecondaryMetered energization (status)	N
0.0.0.0.0.1.13.0.0.0.0.0.0.0.0.0.0.109.0	electricitySecondaryMetered energizationLoadSide (status)	N
0.0.0.0.0.1.43.0.0.0.0.0.0.0.0.0.0.109.0	electricitySecondaryMetered switchPosition (status)	N
0.0.0.0.0.1.57.0.0.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered voltageImbalance (count)	N
0.0.0.0.0.1.59.0.0.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered zeroFlowDuration (count)	N
0.4.0.0.0.1.55.0.0.0.0.0.0.0.0.0.0.111.0	excess electricitySecondaryMetered voltageAngle (count)	N
0.0.2.4.1.1.12.0.0.0.0.0.0.0.0.3.72.0	fifteenMinute deltaData forward electricitySecondaryMetered energy (kWh)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.0.5.0	indicating electricitySecondaryMetered current (A)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.128.0.5.0	indicating electricitySecondaryMetered current phaseA (A)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.64.0.5.0	indicating electricitySecondaryMetered current phaseB (A)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.32.0.5.0	indicating electricitySecondaryMetered current phaseC (A)	N
0.0.0.6.0.1.5.0.0.0.0.0.0.0.136.0.9.0	indicating electricitySecondaryMetered currentAngle phaseAtoAv (deg)	N
0.0.0.6.0.1.5.0.0.0.0.0.0.0.72.0.9.0	indicating electricitySecondaryMetered currentAngle phaseBtoAv (deg)	N
0.0.0.6.0.1.5.0.0.0.0.0.0.0.40.0.9.0	indicating electricitySecondaryMetered currentAngle phaseCtoAv (deg)	N
0.0.0.6.0.1.15.0.0.0.0.0.0.0.0.33.0	indicating electricitySecondaryMetered frequency (Hz)	N
0.0.0.6.0.1.38.0.0.0.0.0.0.0.0.65.0	indicating electricitySecondaryMetered powerFactor (cosθ)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.0.29.0	indicating electricitySecondaryMetered voltage (V)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.128.0.29.0	indicating electricitySecondaryMetered voltage phaseA (V)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.64.0.29.0	indicating electricitySecondaryMetered voltage phaseB (V)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.32.0.29.0	indicating electricitySecondaryMetered voltage phaseC (V)	N
0.0.0.6.0.1.55.0.0.0.0.0.0.0.72.0.9.0	indicating electricitySecondaryMetered voltageAngle phaseBtoAv (deg)	N
0.0.0.6.0.1.55.0.0.0.0.0.0.0.40.0.9.0	indicating electricitySecondaryMetered voltageAngle phaseCtoAv (deg)	N
0.0.0.6.19.1.8.0.0.0.0.0.0.0.0.3.38.0	indicating reverse electricitySecondaryMetered demand (kW)	N
0.0.0.12.1.1.37.0.0.0.0.0.0.0.0.3.63.0	instantaneous forward electricitySecondaryMetered power (kVAr)	N
0.0.0.12.1.1.37.0.0.0.0.0.0.0.0.3.38.0	instantaneous forward electricitySecondaryMetered power (kW)	N
0.0.0.12.20.1.37.0.0.0.0.0.0.0.0.3.38.0	instantaneous total electricitySecondaryMetered power (kW)	N
0.0.0.13.0.1.140.0.0.0.0.0.0.0.0.108.0	latchingQuantity electricitySecondaryMetered pushbutton (timeStamp)	N
0.8.0.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	maximum indicating forward electricitySecondaryMetered demand (kW)	N
0.9.0.6.0.1.38.0.0.0.0.0.0.0.0.65.0	minimum indicating electricitySecondaryMetered powerFactor (cosθ)	N

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ReadingType ID Code	Description	Normative Status
0.0.0.0.19.1.4.0.0.0.0.0.0.0.0.0.111.0	reverse electricitySecondaryMetered current (count)	N
22.0.0.1.1.1.12.0.0.0.0.0.0.0.0.3.73.0	seasonal bulkQuantity forward electricitySecondaryMetered energy (kVArh)	N
22.8.0.6.1.1.8.0.0.0.0.1.0.0.0.3.38.0	seasonal maximum indicating forward electricitySecondaryMetered demand touA (kW)	N
22.8.0.6.1.1.8.0.0.0.0.2.0.0.0.3.38.0	seasonal maximum indicating forward electricitySecondaryMetered demand touB (kW)	N
22.8.0.6.1.1.8.0.0.0.0.3.0.0.0.3.38.0	seasonal maximum indicating forward electricitySecondaryMetered demand touC (kW)	N
22.0.0.9.1.1.12.0.0.0.0.1.0.0.0.3.72.0	seasonal summation forward electricitySecondaryMetered energy touA (kWh)	N
22.0.0.9.1.1.12.0.0.0.0.2.0.0.0.3.72.0	seasonal summation forward electricitySecondaryMetered energy touB (kWh)	N
22.0.0.9.1.1.12.0.0.0.0.3.0.0.0.3.72.0	seasonal summation forward electricitySecondaryMetered energy touC (kWh)	N
0.0.7.4.1.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData forward electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.1.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData forward electricitySecondaryMetered energy (kWh)	N
0.0.7.4.4.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData net electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.4.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData net electricitySecondaryMetered energy (kWh)	N
0.0.7.4.19.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData reverse electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.19.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData reverse electricitySecondaryMetered energy (kWh)	N
0.0.7.4.20.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData total electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.20.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData total electricitySecondaryMetered energy (kWh)	N
0.0.100.4.1.1.12.0.0.30.1.0.0.0.0.3.72.0	specifiedInterval deltaData forward electricitySecondaryMetered energy n30 (kWh)	N
32.0.0.4.0.1.12.0.0.0.0.0.0.0.0.3.72.0	specifiedPeriod deltaData electricitySecondaryMetered energy (kWh)	N
32.0.0.0.0.1.151.0.0.0.0.0.0.0.0.0.0.840	specifiedPeriod electricitySecondaryMetered billToDate (USD)	N
0.0.0.9.20.1.12.0.0.0.0.1.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touA (kWh)	N
0.0.0.9.20.1.12.0.0.0.0.2.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touB (kWh)	N
0.0.0.9.20.1.12.0.0.0.0.3.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touC (kWh)	N
0.0.0.9.20.1.12.0.0.0.0.4.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touD (kWh)	N
N = Normative I = Informative D = Deprecated since last edition		

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Annex D
(normative)

Quality code enumerations

D.1 General

Quality codes may be returned with a Reading.value to indicate that there is something remarkable about the data. This Annex D describes a profile of enumerations for quality codes to be used in this context.

The presence of a quality code is optional. A missing element implies that no assertion regarding the goodness of the data is being offered by the data producer. Some systems (such as a MS) may have a policy of "no news is good news" and only add quality codes when problems are found. This keeps the volume of data to a minimum. Other systems (such a MDM) will add value to the data by validating it. At this point quality codes may be added to the data to explicitly declare that the data is "valid" or has passed formal "validation" tests.

The quality code values defined by this Annex D are conveyed within a message using the ReadingQuality.quality element.

D.2 Identification of the system offering commentary on the data

Concievably, any piece of equipment which touches the data could introduce error, or offer remarks regarding the veracity of the data. For example, a meter might record interval data, and offer this data to the data collection system, but in doing so also indicate that something remarkable (such as a power outage or clock adjustment) occurred during some of the intervals. A meter data collection system might obtain readings from the field, but perform a sanity check on the values to find that some of them are unreasonable. A meter data management system, armed with a knowledge of the account history and usage patterns might scrutinize the data to find that certain values are suspect or possibly suggest that tampering may have occurred. All of these systems need an opportunity to comment on the data without (necessarily) changing it. When a system does change the data, this too can be noted in the quality codes.

D.3 Construction

The North American profile defines the ReadingQuality.quality code to be built from a three part field:

ReadingQuality.quality::= <System Identifier> "." <Categorization> "." <Index>

This creates a name with 3 fields. The mappings to CIM ReadingQualityType are defined by IEC 61968-11 as follows:

System Identifier = ReadingQualityType.systemId

Categorization = ReadingQualityType.category

Index = ReadingQualityType.subCategory

D.4 Quality code system identifier

The first of the three fields provides an identification of the system which has declared the issue with the data. This is described in Table D.1. Other systems, outside of an IEC 61968-9 subsystem, may also identify problems with data.

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Table D.1 – System identifier

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System Identifier Code	Description	Normative Status
0	Not Applicable	N
1	End Device	N
2	Metering system (data collection) network	N
3	Meter Data Management System	N
4	Other system (not listed)	N
5	Externally specified (see accompany data)	I
I = Informative N = Normative D = Deprecated		

D.5 Quality code categorization

The second of the three fields in the quality code identifies a category for the issue. These are described individually in Table D.2.

Table D.2 – Example quality code categories

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Category	Description	Comment	Normative Status
0	Valid	Data valid	N
1	Diagnostics related	The equipment producing or handling the data has identified a diagnostics related issue which may have some effect on this value.	N
2	Power quality related issues at the data collection point	The equipment producing the data has identified power quality related issues which may have some effect on the veracity of the data.	N
3	Tamper / Revenue Protection related	A system identifies that the data is questionable due to tamper or revenue-protection related reasons.	N
4	Data collection related	A significant event or condition has occurred (which is not tamper related, power quality related, or diagnostics related) which may effect the veracity of the data.	N
5	Failed reasonability testing	Data at first blush appears to be invalid.	N
6	Failed validation testing	Data fails one or more validation rules.	N
7	Edited	Replaced or approved by a human.	N
8	Estimated	Replaced by a machine computed value based on analysis of historical data using the same type of measurement.	N
9	~~Oscillatory~~	This category appears to be covered by other categories in this standard.	D

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Category	Description	Comment	Normative Status
10	Questionable	The veracity of the data is suspect for a reason other than those described by categories 1 to 6.	N
11	Derived	Value has been calculated (using logic or mathematical operations) based upon one or more readings from the meter or device to which the value is attributed and/or readings from meter(s) or device(s) other than the meter or device to which the value is attributed.	N
12	Projected	Forecasted value.	N
I = Informative N = Normative D = Deprecated			

D.6 Quality code index

Each category provides the context with which to understand a particular index.

Table D.3 elaborates on the "category 0" defined in Table D.2.

Table D.3 – Validity related codes

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Category	Index	Description	Definition	Normative Status
0	0	Data Valid	No data quality problems have been detected; however, the data has not been processed by a formal Validation, Editing, and Estimation (VEE) process.	N
0	1	Validated	Reading has successfully passed the validation portion of a formal Validation, Editing and Estimation (VEE) process and has not been subsequently edited or estimated.	N
I = Informative N = Normative D = Deprecated				

Table D.4 elaborates on the "category 1" defined in Table D.2.

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Table D.4 – Diagnostics related codes

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Category	Index	Description	Comments	Normative Status
1	0	DiagnosticsFlag	One or more diagnostics have been generated from the originating equipment.	N
1	1	BatteryLow		N
1	3	SensorFailure		N
1	4	WatchdogFlag	A timeout of the watchdog timer or another failure of the watchdog function has occurred in the originating equipment.	N
1	5	ParityError	A parity error has been generated from the originating equipment.	N
1	6	CRCError	A cyclic redundancy check error has been generated from the originating equipment.	N
1	7	RAMChecksumError	A checksum error has been detected in the random access memory of the equipment.	N
1	8	ROMChecksumError	A checksum error has been detected in the read only memory of the equipment.	N
1	9	ClockError	A failure or abnormality has been detected with the clock in the equipment.	N
I = Informative N = Normative D = Deprecated NOTE Diagnostic related codes may produce corresponding EndDeviceEvents to be generated.				

Table D.5 elaborates on the "category 2" defined in Table D.2.

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Table D.5 – Power quality related codes

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Category	Index	Description	Comments	Normative Status
2	0	PowerQualityFlag	Look for related MeterEvent(s)	N
2	1	ExcessiveOutageCount	Power outage threshold count exceeded	N
2	2	PqCounter	Power quality threshould count exceeded	N
2	3	ServiceDisconnectSwitching	Service Disconnect operation during data collection interval	N
2	32	PowerFail	Power fail occurred during or at the start of this interval. ANSI C12.19. If power is out for the entire interval, the data value presented should be zero.	N
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Table D.6 elaborates on the "category 3" defined in Table D.2.

Table D.6 – Tamper / revenue protection related codes

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Category	Index	Description	Comments	Normative Status
3	0	RevenueProtection	Generic	N
3	1	CoverOpened	The meter reports that a sealed cover has been opened.	N
3	2	LogicalDisconnect	Value originates from a meter which (in theory) should have no flow or very minimal flow.	N
3	3	RevenueProtectionSuspect		N
3	4	ReverseRotation	Reverse flow of the measured commodity has been detected. This may indicate tampering at sites which have not been identified as being capable of customer-side generation.	N
3	5	StaticDataFlag	The meter shows very little (if any) historical usage.	N
I = Informative N = Normative D = Deprecated				

Table D.7 elaborates on the "category 4" defined in Table D.2.

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Table D.7 – Data collection related codes

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Category	Index	Description	Comments	Normative Status
4	0	AlarmFlag	Generic alarm	N
4	1	OverflowConditionDetected	A numeric overflow condition for a reading value or pulse counter was detected.	N
4	2	PartialInterval	Partial (short) interval due to clock change, power outage, or some similar event.	N
4	3	LongInterval	Long interval recorded due to a clock change or some similar event.	N
4	4	SkippedInterval	Skipped interval by the meter due to a clock change or similar event.	N
4	5	TestData	Data value was obtained while the equipment was in test mode.	N
4	6	ConfigurationChanged	A configuration change has occurred that may affect the reading value or its interpretation.	N
4	7	NotRecording	Load profile recording stopped	N
4	8	ResetOccurred	A reset has occurred that may affect the reading value or its interpretation.	N
4	9	ClockChanged	A change in the clock time has occurred.	N
4	10	LoadControlOccurred	Data value was obtained at a time when load control was in effect.	N
4	16	DstInEffect	Daylight saving time in effect during or at start of this interval	N
4	64	ClockSetForward	Clock set forward during or at the start of this interval. The interval may be short.	N
4	128	ClockSetBackward	Clock set backward during or at the start of this interval. The interval may be long.	N
4	129	FailedProbeAttempt	A failure occurred that prevented the reading from being obtained through a manual probe.	N
4	130	CustomerRead	The reading value was provided by a customer.	N
4	131	ManualRead	The reading value was obtained by a utility employee performing a manual read.	N
4	259	DstChangeOccurred	Data has been adversely affected by a change in Daylight Saving Time. Timestamps and/or data values may be incorrect. NOTE Compared to the ANSI C12.19 approach in which the DST flag is set for the entire Summer, this flag is only set for the affected data when the DST change occurs in the Spring and Fall.	N
I = Informative N = Normative D = Deprecated				

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Table D.8 elaborates on the "category 5" defined in Table D.2.

Table D.8 – Failed reasonability testing related codes

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Category	Index	Description	Comments	Normative Status
5	256	DataOutsideExpectedRange	Presented data was identified as "invalid" by the originating system.	N
5	257	ErrorCode	Data was identified as "invalid" by the originating system and replaced with a special coded value to indicate an error.	N
5	258	Suspect	Data should be scrutinized and considered suspect	N
5	259	KnownMissingRead	NOTE 1 The "value" element should be empty when the quality code indicates that it is (obviously) missing. NOTE 2 If a reason is known, this can be supplied in the MeterReadings.Reason element.	N
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Table D.9 elaborates on the "category 6" defined in Table D.2.

Table D.9 – Failed validation testing related codes

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Category	Index	Enumeration	Comments	Normative Status
6	0	Failed validation – Generic	The reading failed one or more unspecified validation checks. This is a generic code that can be used if a more specific code is not available in this table.	N
6	1	Failed validation – ZeroUsageOn ActiveMeter	The reading failed validation due to zero usage on an active meter.	N
6	2	Failed validation – UsageOn InactiveMeter	The reading failed validation due to non-zero usage on an inactive meter.	N
6	3	Failed validation – UsageAbove Maximum	The reading failed validation because it represents usage greater than an allowed absolute maximum.	N
6	4	Failed validation – UsageBelow Minimum	The reading failed validation because it represents usage less than a required absolute minimum.	N
6	5	Failed validation – UsageAbove MaximumPct	The reading failed validation because it represents usage greater than an allowed maximum percentage.	N
6	6	Failed validation – UsageBelow MinimumPct	The reading failed validation because it represents usage less than a required minimum percentage.	N
6	9	Failed Validation – TOU SumCheck Failure	The reading failed validation because the sum of interval values failed a comparison with the corresponding difference in register readings.	N

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Category	Index	Enumeration	Comments	Normative Status
6	y	Failed Validation Rule Y	The reading failed one or more defined validation checks. "y" is to be replaced by a positive integer indicating which validation rule was failed. It is recommended that values for y begin at 1001 to allow for the build-out over time of the list of normative enumerations in the IEC standard up to 1000. There is no limit to how large a number can be used for "y"; however; the parties exchanging this code shall have a common understanding of what each validation rule #y means.	I
I = Informative N = Normative D = Deprecated				

Individual deployments will subscribe to particular sets of formal validation rules. While there is no one worldwide standard regarding validation rules, this standard provides a placeholder where the first rule for a given deployment can be defined as "rule #1," the second rule "rule #2," and so on as necessary until all of the rules are numbered. Each system then, operating at a given utility under a given set of rules, will all be subject to the same set of rules which have been formally listed and numbered.

Table D.10 describes the "category 7" defined in Table D.2.

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Table D.10 – Edit related codes

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Category	Index	Description	Comments	Normative Status
7	0	Manually Edited – Generic	The reading value was edited by a person using an unspecified manual estimation method. This is a generic code that can be used if a more specific code is not available in this table.	N
7	1	Manually Added	A reading value was added by a person.	N
7	3	Manually Rejected	A value was proposed by the system or failed some level of quality checking. The value was reviewed and rejected by a human user	N
7	Y	Manually Edited – Method Y	The reading value was edited by a person using a defined manual estimation method. "y" is to be replaced by a positive integer indicating which manual estimation method was used. It is recommended that values for y begin at 1001 to allow for the build-out over time of the list of normative enumerations in the IEC standard up to 1 000. There is no limit to how large a number can be used for "y"; however; the parties exchanging this code shall have a common understanding of what each manual editing method #y means.	I
I = Informative N = Normative D = Deprecated				

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The concept of "edited" means that a human was involved in creating the value. It may be hand-keyed into the system. It may be suggested by the system using one of many approaches, but ultimately approved by a human. Values that are computer generated and never approved by a human belong to the "estimated" category. Values that are originally from a meter, identified as suspect, yet nonetheless accepted for use by a human fall into the "questionable" category.

Different systems may find different ways to assist the user in creating a new value. The numbering scheme allows the various ways to be listed and formally identified for a given deployment.

Table D.11 describes the "category 8" defined in Table D.2.

Table D.11 – Estimation related codes

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Category	Index	Enumeration	Comments	Normative Status
8	0	Estimated – Generic	The reading value was machine-estimated by a computing algorithm using an unspecified estimation method. This is a generic code that can be used if a more specific code is not available in this table.	N
8	Y	Machine Estimated – Method Y	The reading value was machine-estimated by a computing algorithm using a defined estimation method. "y" is to be replaced by a positive integer indicating which estimation method was used. It is recommended that values for y begin at 1001 to allow for the build-out over time of the list of normative enumerations in the IEC standard up to 1000. There is no limit to how large a number can be used for "y"; however; the parties exchanging this code shall have a common understanding of what each estimation method #y means.	I
I = Informative N = Normative D = Deprecated				

There are a number of ways in which estimates may be generated. For example, an estimate might be based on a combination of historical usage, trend analysis, and weather patterns. Another approach would be to create a value for one meter by leveraging a measurement of equivalent information from a different different meter. (For example there may be multiple feeder voltage measurement sources available. When the preferred source fails, a different source could be used with an equivalent outcome.) Some of the techniques used may be proprietary. Other estimation techniques may be a matter of public record and may be legally required by certain regulators in certain locations. The numbering scheme "approach #1," "approach #2," etc provides a placeholder in which the approaches used may be formally listed at a given deployment and identified as a specific technique.

Table D.12 describes the "category 10" defined in Table D.2.

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Table D.12 – Questionable related codes

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Category	Index	Description	Comments	Normative Status
10	0	Indeterminate	Quality is unknown or cannot be determined. NOTE 1 This is similar to the case in which no quality codes are supplied at all, but in this case other codes may be present which cast doubt on the veracity of the data, or a situation may have arisen which prevents any kind of analysis from being performed on the data or the equipment which supplied the data. NOTE 2 When used in response to a request for Power (Energization) Status or Switch Position, an "Indeterminate" quality means that the energization state or switch position is unknown or cannot be determined. When used in response to a request for other reading types, "Indeterminate" means that the quality of the value supplied is explicitly unknown.	N
10	1	Manually accepted	Indicates that a value failed some level of quality checking, but the failure was overridden by a human user.	N
I = Informative N = Normative D = Deprecated				

Table D.13 describes the "category 11" defined in Table D.2.

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Table D.13 – Derived related codes

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Category	Index	Enumeration	Comments	Normative Status
11	0	Derived – Deterministic	"Derived" indicates that the value has been calculated (using logic or mathematical operations) based upon one or more readings from the meter or device to which the value is attributed and/or readings from meter(s) or device(s) other than the meter or device to which the value is attributed. "Deterministic" (as differentiated from "Inferred" – see next entry) is used when a significant degree of uncertainty in the resulting value does not exist. For example, a quality of "x.11.0" or "Derived – Deterministic" can be used when a value for a virtual meter is computed as the sum of the values from two or more other meters.	N
11	1	Derived – Inferred	"Derived" indicates that the value has been calculated (using logic or mathematical operations) based upon one or more readings from the meter or device to which the value is attributed and/or readings from meter(s) or device(s) other than the meter or device to which the value is attributed. "Inferred" (as differentiated from "Deterministic" – see previous entry) is used when a significant degree of uncertainty in the resulting value may exist. When used in response to Power (Energization) Status Checks, "x.11.1" or "Derived – Inferred" is synonymous with "Inferred". For example, a UsagePoint may be determined to have a value of "De-energized" and a Reading Quality of "Derived-Inferred" if it is being inferred as de-energized because one or more other UsagePoints on the same distribution transformer are confirmed to be "De-Energized". In this case, there is a more than a negligible probability that the inference is incorrect.	N
I = Informative N = Normative D = Deprecated				

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Table D.14 describes the "category 12" defined in Table D.2.

Table D.14 – Projected related codes

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Category	Index	Enumeration	Comments	Normative Status
12	0	Projected – Generic	The reading value was projected (forecast) by a computing algorithm using an unspecified projection (forecast) method. This is a generic code that can be used if a more specific code is not available in this table.	N
12	Y	Projected – Method Y	The reading value was projected (forecast) by a computing algorithm using a defined projection (forecast) method. "y" is to be replaced by a positive integer indicating which projection (forecast) method was used. It is recommended that values for y begin at 1001 to allow for the build-out over time of the list of normative enumerations in the IEC standard up to 1000. There is no limit to how large a number can be used for "y"; however, the parties exchanging this code shall have a common understanding of what each projection method #y means.	I
I = Informative N = Normative D = Deprecated				

Much like in the way "estimated" creates a computer generated value based on a historical view of the data for an event that has occurred in the past, "projected" creates a computer generated value which is forecast into the future. The numbering scheme "approach #1," "approach #2," etc. provides a placeholder in which the approaches used may be formally listed at a given deployment and identified as a specific technique.

D.7 Example quality codes

Some of the codes described in Table D.15 have been found to be in use in systems since the publication of IEC 61968-9:2009.

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Table D.15 – Example Quality Codes

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Quality Code	Origin (From Table D.1)		Category (From Table D.2)		Index (From Tables D.3 to D.15)		Normative Status
Not provided	Not provided		Not provided		AssumedValid	none	N
1.0.0	End Device	1	0	Validity	DataValid	0	N
1.1.4	End Device	1	1	Diag	WatchdogFlag	4	N
1.4.1	End Device	1	4	Data Collection	OverflowConditionDetected	1	N
1.4.16	End Device	1	4	Data Collection	DstInEffect	16	N
1.4.2	End Device	1	4	Data Collection	Partial (short) Interval	2	N
1.4.3	End Device	1	4	Data Collection	LongInterval	3	N
1.4.4	End Device	1	4	Data Collection	SkippedInterval	4	N
1.4.5	End Device	1	4	Data Collection	TestData	5	N
1.5.257	End Device	1	5	Reasonablity	ErrorCode	257	N
2.0.0	Ms Network	2	0	Validity	DataValid	0	N
2.3.4	Ms Network	2	3	Tamper	ReverseRotation	4	N
2.3.5	Ms Network	2	3	Tamper	StaticDataFlag	5	N
2.4.259	Ms Network	2	4	Data Collection	DstChangeOccurred	259	N
2.5.256	Ms Network	2	5	Reasonablity	DataOutsideExpectedRange	256	N
2.5.257	Ms Network	2	5	Reasonablity	ErrorCode	257	N
3.0.0	MDM	3	0	Validity	DataValid	0	N
3.10.0	MDM	3	10	Questionable	Indeterminate	0	N
3.10.1	MDM	3	7	Edited	Manually accepted	1	N
3.11.0	MDM	3	11	Derived	Derived – generic	0	N
3.11.1	MDM	3	11	Derived	Derived – inferred	1	N
3.3.3	MDM	3	3	Tamper	RevenueProtectionSuspect	3	N
3.3.5	MDM	3	3	Tamper	StaticDataFlag	5	N
3.5.259	MDM	3	5	Reasonablity	Known missing read	259	N
3.6.0	MDM	3	6	Validation	Failed validation – Generic	0	N
3.7.0	MDM	3	7	Edited	Manually edited – Generic	0	N
3.8.0	MDM	3	8	Estimated	Estimated – Generic	0	N

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Annex E
(normative)

EndDeviceEventType enumerations

E.1 General

Metering systems not only collect readings from meters, but also report events. This Annex E describes recommended codes to be used for properly identifying IEC 61968 events.

Codes for EndDeviceEventTypes are categorized in a manner that divides the enumerated code into four parts:

```
EndDeviceEventType:=
<EndDeviceType>.<EndDeviceDomain>.<EndDeviceSubdomain>.<EndDeviceEventOrAction>

where
      <EndDeviceType>           = a numeric value from the EndDeviceType
                                  enumeration (see EndDeviceType section)
      <EndDeviceDomain>         = a numeric value from the EndDeviceDomain
                                  enumeration (see EndDeviceDomain section)
      <EndDeviceSubdomain>      = a numeric value from the EndDeviceSubdomain
                                  enumeration (see EndDeviceSubdomain section)
      <EndDeviceEventOrAction>  = a numeric value from the EndDeviceEventOrAction
                                  enumeration (see EndDeviceEventOrAction section)
```

E.2 Alarm conditions

E.2.1 General

While the EndDeviceEventType defines the event that has occurred, there is also a need to specify the severity of an event (Alarm, Advisory, Normal, etc.). These values should be set in the EndDeviceEvent.severity field. This allows each system implementing CIM events to classify the severity of its events specific to its intentions, rather than being forced to classify it according to something rigidly defined by IEC 61968-9.

E.2.2 Clearing alarm conditions and communicating state/condition changes

There are scenarios where the state change for a particular setting shall be communicated to an external system. In the small number of cases that we have uncovered, we have simply added a concise EndDeviceEventOrAction to describe it. The events shown in Table E.1 support this method of communication.

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Table E.1 – Example pairings between meter events and EndDeviceEvent enumerated mnemonics

Event or Control Description	EndDeviceEvent Category (using enum mnemonics)
Diagnostic 8 Condition High Neutral Current Cleared	*.Power.NeutralCurrent. MaxLimitReachedCleared
Leading kvarh cleared Caution 040000 Leading kvarh Condition Cleared	*.Power.PowerFactor.OutofRangeCleared
High Distortion Cleared Diagnostic 5 High Distortion Cleared	*.Power.PowerQuality.HighDistortionCleared
Voltage Imbalance Cleared Diagnostic 2 Voltage Imbalance Cleared	*.Power.Voltage.ImbalanceCleared
Phase alert cleared, Condition Phase Angle Alert Cleared	*.Power.PhaseAngle.OutofRangeCleared
Cross phase cleared Diagnostic 1 Condition Polarity, Cross Phase, Rv Energy Flow Cleared	*.Power.Phase.CrossPhaseCleared
Inactive phase cleared Diagnostic 3 Inactive Phase Current Condition Cleared	*.Power.Phase.InactiveCleared
Voltage Swell Started (Phase A)	*.Power.PhaseAVoltage.SwellStarted
Voltage Swell Started (Phase B)	*.Power.PhaseBVoltage.SwellStarted
Voltage Swell Started (Phase C)	*.Power.PhaseCVoltage.SwellStarted
Voltage swell cleared Caution 004000 Demand Overload Condition Cleared	*.Power. Voltage.SwellStopped
Voltage Swell Stopped (Phase A); Diagnostic 7 Condition Over Voltage, Phase A Cleared	*.Power.PhaseAVoltage.SwellStopped
Voltage Swell Stopped (Phase B)	*.Power.PhaseBVoltage.SwellStopped
Voltage Swell Stopped (Phase C)	*.Power.PhaseCVoltage.SwellStopped
Voltage Sag Started (Phase A)	*.Power.PhaseAVoltage.SagStarted
Voltage Sag Started (Phase B)	*.Power.PhaseBVoltage.SagStarted
Voltage Sag Started (Phase C)	*.Power.PhaseCVoltage.SagStarted
Voltage sag cleared Caution 000400 Under Voltage Condition Cleared	*.Power.Voltage.SagStopped
Voltage Sag Stopped (Phase A);Diagnostic 6 Condition UnderVoltage, Phase A Cleared	*.Power.PhaseAVoltage.SagStopped
Voltage Sag Stopped (Phase B)	*.Power.PhaseBVoltage.SagStopped
Voltage Sag Stopped (Phase C)	*.Power.PhaseCVoltage.SagStopped

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E.3 Event data

Certain events require or contain more details than just a description and a category. For example, specification of a particular channel number, alarm number, relay number, port number, formula number, version number, etc. These should be set on the EndDeviceEvent.EndDeviceEventDetails name/value pair element.

However, this construct should not be overused or misused. The intention for this construct is only to capture some ancilliary data related to the event. It should not be used in place of sending a full set of EndDeviceEvent information, for example (see Figure E.1).

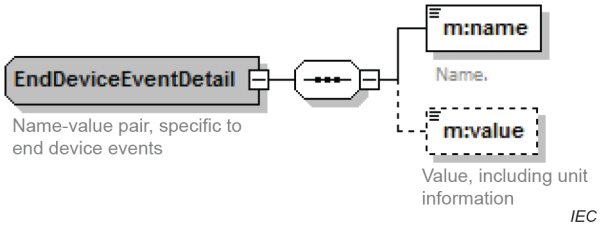


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Figure E.1 – Event data

Some examples of its use:

A [PAN Pairing Completed] event may also provide the data given in Figure E.2.

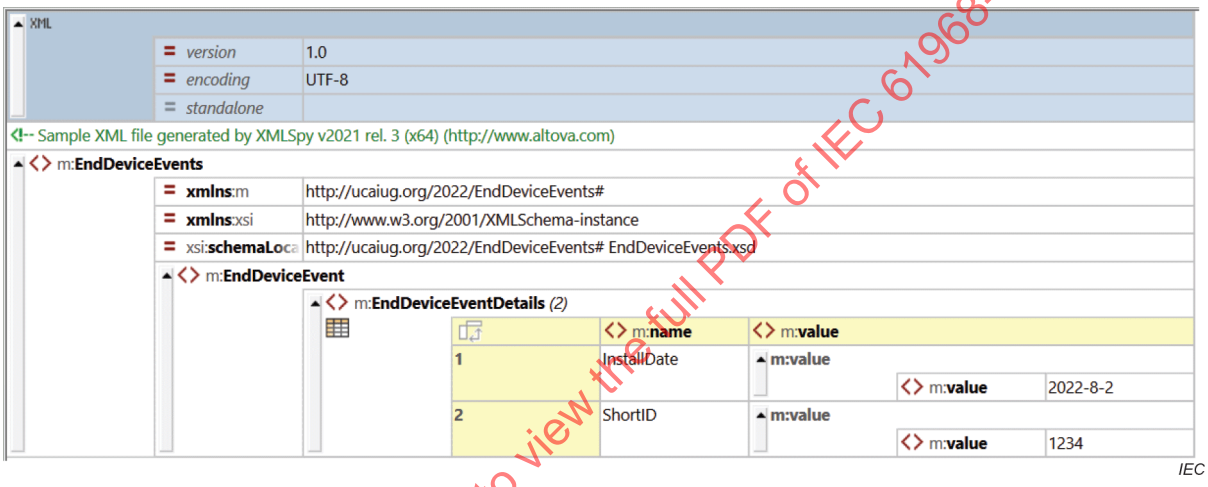


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Figure E.2 – Multiple EndDeviceEventDetails Example 1

A [Firmware Downloaded] event may also provide the data given in Figure E.3.

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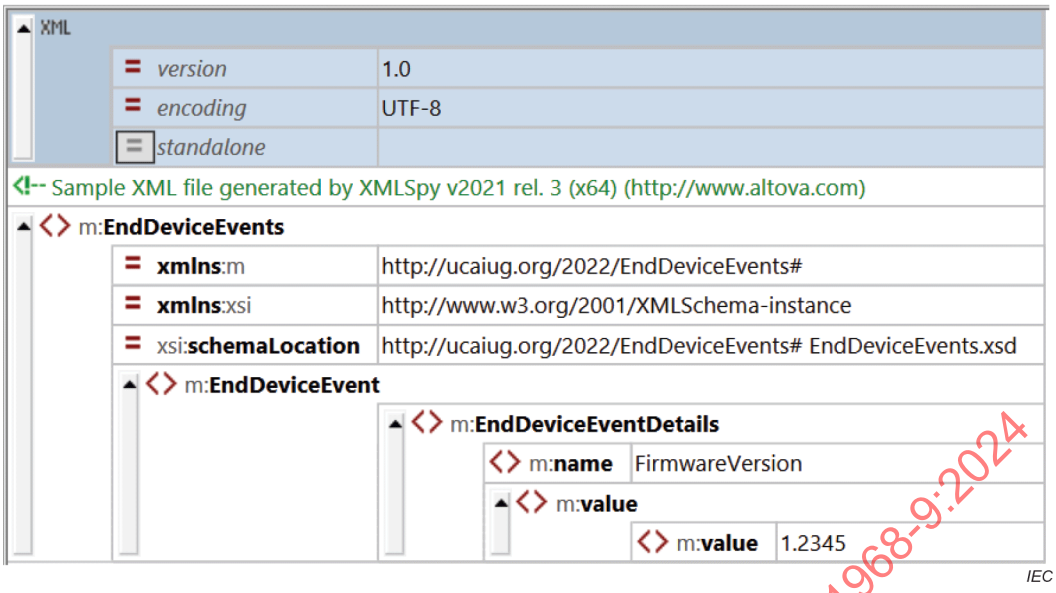


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Figure E.3 – EndDeviceEventDetails example 2

A [Voltage Exception] event may also provide the data described in Figure E.4.



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Figure E.4 – EndDeviceEvent Example 3

E.4 The 4-Part ID: EndDeviceEventType

Clauses E.5 to E.8 describe each part of the EndDeviceEventType enumeration:

- <EndDeviceType>
- <EndDeviceDomain>
- <EndDeviceSubdomain>
- <EndDeviceEventOrAction>

E.5 EndDeviceType

At the highest level, it is helpful to identify the type of device from which the event was created. Each of these should represent a physical device, although a value of zero (0) can be used in special cases. EndDeviceType codes are enumerated and described in Table E.2.

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Table E.2 – EndDeviceType codes

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EndDeviceType Enumeration		
mnemonic	**Value**	**Description**
n/a	0	Not applicable. Use when a device type is not known.
Cabinet	30	A Smart Cabinet Device
Collector	10	A device that acts as a central point of communication between HES and devices located on premises.
ComDevice	26	A communication device
DAPDevice	1	A data aggregation point device
DERDevice	2	A demand response device
DSPDevice	6	A digital signal processing device
ElectricMeter	3	A device located on premises to measure electricity usage.
ElectricVehicle	58	(or Plug-in Electric Vehicle, PEV) a vehicle that can be plugged into the grid.
EnergyRouter	23	An energy router, analogous to the familiar data and communications router, automatically detects demand for power and delivers processed electricity in the required form (AC or DC) at the correct voltage and frequency on an electrical power system.
Feeder	13	Feeders carry three-phase power, and tend to follow the major streets near the substation.
GasMeter	4	A device located on premises to measure gas usage.
Gateway	5	A gateway device.
Generator	14	Typically a spinning electrical generator. Something has to spin the generator -- it might be a water wheel in a hydroelectric dam, a large diesel engine or a gas turbine.
InPremisesDisplay(IPD/IHD)	15	The In-Premises (In-Home) Display (IPD/IHD) allows utility customers to track their energy usage in chart or graph form based upon kwH used.
LoadControlDevice	16	A device used to implement "deferrable" services – commonly referred to as "off-peak".
Luminaire	31	A lamp (fixture and bulb) that provides light to the surrounding area
NetworkRouter	11	A router distributes Digital computer information that is contained within a data packet on a network.
PANDevice	12	A "premises area network" device that is not specifically described in further detail.
PANGateway	7	A PAN gateway connects an external communications network to energy management devices within the premises.
PANMeter	17	A "premises area network" device whose function is to measure (e.g. electricity usage).
PrepaymentTerminal	18	A device that enables the customer to make advance payment before energy can be used.
ProgCtlThermostat(PCT)	19	A thermostat device whose settings can be controlled via an API (ie. without human intervention).
RangeExtender	20	Wireless range-extenders or wireless repeaters can extend the range of an existing wireless network.
Regulator	21	A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level.
Sensor	32	A defines that measures a physical condition and reports an alarm or measurement as a result
Substation	22	An electrical substation is a subsidiary station of an electricity generation, transmission and distribution system where voltage is transformed from high to low or the reverse using transformers.

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EndDeviceType Enumeration		
mnemonic	**Value**	**Description**
Transformer	8	A device that converts a generator's voltage (which is at the thousands of volts level) up to extremely high voltages for long-distance transmission on the transmission grid.
WasteWaterMeter	25	A device that measures waste water usage.
WaterMeter	24	A device that measures water usage.

E.6 EndDeviceDomain

After the type of device is known, the event should be classified by an EndDeviceDomain code. This code provides an indication as to the high-level nature of the event. Careful consideration shall given to the EndDeviceDomain in which an event is classified By properly classifying events by a small set of EndDeviceDomain codes, a system can more easily run reports based on the types of events that have occurred or been received. EndDeviceDomain codes are enumerated and described in Table E.3.

Table E.3 – EndDeviceDomain Codes

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EndDeviceDomain Enumeration		
mnemonic	**Value**	**Description**
n/a	0	Not applicable. Use when a domain is not needed. This should rarely be used.
AssociatedDevice	39	A device (for example, a relay) that can be associated with an end device.
Battery	2	Any events or controls related to a device battery.
Billing	20	Events or controls related to cost of energy (Including Pricing, Tariff, TOU, etc.).
Brighten	75	Events or controls related to a dim / brighten function
Cartridge	3	Events or controls related to type solid-state pulse recorders for metering
Channel 1	50	Events or controls related to channel one
Channel 2	51	Events or controls related to channel two
Channel 3	52	Events or controls related to channel three
Channel 4	53	Events or controls related to channel four
Channel 5	54	Events or controls related to channel five
Channel 6	55	Events or controls related to channel six
Channel 7	56	Events or controls related to channel seven
Channel 8	57	Events or controls related to channel eight
Clock	36	Events or controls related to a device internal clock.
Communication	1	Events or controls related to purely communication isssues. Consider other domains before using this one.
Conductor	74	Events related to a conductor
Configuration	7	Events or controls related to device configuration.
Demand	8	Events or controls related to demand (ie. kW) and demand settings (as opposed to consumption (ie. kWh).
Dim	71	Control command to dim a luminaire and ignore any motion sense capability

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EndDeviceDomain Enumeration		
mnemonic	**Value**	**Description**
DimWithMotionSense	72	Control command to dim a luminaire and respond to any nearby motion
Dimmer	70	Events related to a dimming function
Firmware	11	Events or controls related to device firmware.
GasSupply	4	Events or controls related to the supply of natural gas or propane.
Humidity	42	Events or controls related to humidity
Installation	6	Events or controls related to device installation.
KYZPulseCounter	38	Pulse counting function inside a meter or other end device.
LoadControl	15	Events or controls related to the automatic restriction or control of a customer's energy consumption.
LoadProfile	16	Events or controls related to the energy consumption (ie. "load") over time on a device.
Logs	17	Events or controls related to device internal logs.
Memory	18	Events or controls related to device memory.
Metrology	21	Events or controls related to any type of measurement captured by a device.
MobileSecurity	14	Events or controls related to device security when the device is accessed via a mobile tool or device.
Modem	19	Events or controls related to a device's modem.
Network	23	Events or controls generally related to a device's status on the network. Also used for general network events, such as commissioning of a PAN Area network.
Pairing	10	Events or controls related to linking devices together (e.g. PANDevice to Meter, ComDevice to Meter, etc.).
Pole	73	Events related to a distribution power pole
Power	26	Events or controls related to device energization status.
Pressure	29	Events or controls related to device pressure thresholds.
RCDSwitch	31	Events or controls related to device remote connect/disconnect activities.
Recoder	41	A device for encoding
Security	12	Events or controls related to device security (including SecurityKey, HMAC, Parity, Rotation, other TamperDetection, etc.).
Subcomponent	9	Events or controls related to firmware on a module contained by a device.
Temperature	35	Events or controls related to device
VideoDisplay	13	Events or controls related to device CRT/display.
Voltage Fuse	60	Events or controls related to voltage fuse
Volume	40	A quantity of 3-dimensional space enclosed by a boundary; the space occupied by a liquid or gas.
Watchdog	37	A hardware or software function triggered by a timer expiring.
WaterSupply	5	Events or controls related to the supply of water.

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E.7 EndDeviceSubDomain

EndDeviceDomain can be subcategorized by EndDeviceSubdomain codes. EndDeviceSubdomain codes are enumerated and described in Table E.4.

Table E.4 – EndDeviceSubdomain codes

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EndDeviceSubdomain enumeration		
mnemonic	**Value**	**Description**
n/a	0	Not applicable. Use when a subdomain is not needed. This should rarely be used
Access	1	Related to physical security (ie. Accessability) or electronic permission to read/write digital media
Activation	283	Initiation of a function
AlarmTable	285	A table in a device for the tracking of alarms
ADConverter	142	Related to analog-to-digital conversion
AllEvents	148	Related to a set of events (typically used in a Load Control Cancel All Events scenario)
ApparentPower	290	The magnitude of the complex power measured in volt-amps
Allocation	2	Related to designation or allotment; Typically related to memory (RAM/ROM)
Association	74	Related to the linking/pairing of one device/object to another device/object
AUTDProcess	3	Related to Always Up To Date processes; watchdog or keep-alive processes
AutoRegistration	5	Related to automatic registration process
AutoTime	7	Related to automatic setting of time
BTU	13	Related to British Thermal Units
Buffer	14	Related to temporary data storage
Cable	15	Related to a physical cable
Calculation	16	Related to mathematical computation
Calibration	18	Related to a set of gradations that show positions or values
Certificate	21	Related to a document testifying to the truth of something; typically a security certificate
Channel	350	Related to a meter channel
Charge	22	Related to electrical charge; Related to billing charge
Checksum	284	A fixed-size datum computed from an arbitrary block of digital data for the purpose of detecting accidental errors
Concentration	39	Related to the density or composition of something
Constants	23	Related to statically defined values
ControlPoint	26	Related to load control settings
Cover	29	Related to something that provides shelter; a covering
CRC	30	Related to cyclical redundancy check
Credit	8	Related to the right-hand side of an account; billing
Current	6	Related to electrical power measured in amperes
Data	31	Related to factual information
DataLog	33	Related to a record (ie. Log) of factual information
Date	34	Related to calendar time
Day	35	Related to the day portion of calendar time
DaylightSavingTime	56	Related to the practice of setting the clock forward one hour in the spring.
DayLimit	299	A limit established for a daily period
Decryption	36	Related to making encrypted data readable

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EndDeviceSubdomain enumeration		
mnemonic	**Value**	**Description**
Display	143	Related to a CRT, LED, or other form of video device
DLMS/COSEM Key	405	Related to a DLMS/COSEM key.
Door	128	Related to a moveable barrier used to cover an opening; as in a door to a meter or collector
Emergency Codes	361	Relating to global emergency codes in prepayment metering.
Emergency Override	362	Relating to emergency override in prepayment metering.
EmergencySupplyCapacityLimit	138	Related to emergency supply capacity limits
Encoder	40	Related to the thing that converts information from one format to another
EncoderRegister	41	Related to the encoder register (ie. On a meter)
EPROM	42	Related to erasable programmable read-only memory
Event	43	Related to something that has happened; other, more specific subdomains should be used before using this one
EventLog	44	Related to a record (ie. Log) of event data
EWM	45	Related to an external wireless module
Feature	46	Related to a non-specific characteristic
FirmwareReset	47	Related to reverting of firmware to original state
Flow	48	Related to the movement of a substance (electricity, gas, water, etc.)
FPV	49	Related to a form of super-compressibility
Frames	50	Related to fixed-sized blocks; as in memory
Frequency	4	Related to the number of cycles per unit of time
GCAnalyzer	51	Related to gas chromatograph analyzer which is use to measure the component mixture of the natural gas delivers to a site
Groups	390	Relating to groups or teams.
HeadEndSystem	52	Related to the metering/AMI system
Hardware	401	Related to metering hardware
HistoryLog	53	Related to a record (ie. Log) of historical data
HMAC	54	Related to hash-based message authentication code; a specific method for calculated a MAC
Holiday	97	Related to days set aside having special significance
Identity	10	Related to a unique identifier
Imax	400	Related to Imax or maximum current
Initialisation	298	Start-up function
Input	55	Related to data entered into the system
InstallDate	57	Related to the prepared for use date
IntelligentRegister	58	Related to a specific register on a device
Interval	59	Related to interval energy data; the time between to events
IO	60	Related to general input/output
IPAddress	127	Related to an IP Address (Internet Protocol Address)
LANAddress	61	Related to a unique identification of a device on a network of devices
LastRead	62	Related to the final reading from a meter
List	63	Related to an internal list [contained in memory or on firmware]
ListPointers	64	Related to a specific set of values kept by a meter

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EndDeviceSubdomain enumeration		
mnemonic	**Value**	**Description**
Login	65	Related to the process by which access is gained to a device, computer, or system
LowSpeedBus	145	Related to a circuit that connects CPU with other devices; low-speed transmission
MagneticSwitch	66	Related to any type of magnetic switch
MaintMode	11	Related to a specific mode of operation into which a device can be set
Measurement	67	Relating to the magnitude of a quantity
MeasurementType	286	A code defining the kind of data under measurement
Mesh	68	Typically related to the type of meter network
MeterBus	147	Related to a circuit that connects a devices or module to a meter
MeteringMode	12	Related to a specific mode of operation into which a device can be set
Mobile	69	Related to devices that are not confined to one place
MOL%	70	Related to percentage of moles
NetworkId	71	Related to a unique identification of a device on a network of devices
NeutralCurrent	137	Related to the essential part of electroweak unification
NVRAM	72	Related to non-volatile random access memory
OptionBoard	146	Related to a type of module in a meter
Parameter	75	Related to a variable passed to a function
ParentDevice	76	Related to a device's owner
Parity	77	Typically related to an odd/even or on/off state; a symmetry property
Password	24	Related to a secret word used for authentication
Phase	25	Typically related to a means of distributing alternating current; When the specific phase is irrelevant, this should be used as the EndDeviceSubdomain
PhaseAngle	130	Related to the angular component of the polar coordinates
PhaseAngleA	306	Related to the angular A component of coordinates
PhaseAngleB	308	Related to the angular B component of coordinates
PhaseAngleC	310	Related to the angular C component of coordinates
PhaseAngleAB	312	Related to the angular AB component of coordinates
PhaseAngleBC	314	Related to the angular BC component of coordinates
PhaseAngleCA	316	Related to the angular CA component of coordinates
PhaseA	126	Related to the A phase of a multi-phase circuit
PhaseAApparentPower	291	The apparent power on phase A of a multi-phase circuit
PhaseAActivePower	324	The active power on phaseA of a multi-phase circuit
PhaseABvoltage	301	Related to the voltage of phase AB
PhaseACurrent	287	Related to the current of the first phase of 3-phase power
PhaseAReactivePower	295	The reactive power on phase A of a multi-phase circuit
PhaseAVoltage	131	Related to the voltage of the first phase of 3-phase power
PhaseAVoltagePotential	126	Related to the voltage potential of the first phase of 3-phase power
PhaseB	134	Related to the B phase of a multi-phase circuit
PhaseBApparentPower	292	The apparent power on phase B of a multi-phase circuit
PhaseBActivePower	326	The active power on phase B of a multi-phase circuit.

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EndDeviceSubdomain enumeration		
mnemonic	**Value**	**Description**
PhaseBCurrent	288	Related to the current of the second phase of 3-phase power
PhaseBCVoltage	302	Related to the voltage of phase BC.
PhaseBReactivePower	296	The reactive power on phase B of a multi-phase circuit
PhaseBVoltage	132	Related to the voltage of the second phase of 3-phase power
PhaseBVoltagePotential	134	Related to the voltage potential of the second phase of 3-phase power
PhaseC	135	Related to the C phase of a multi-phase circuit
PhaseCApparentPower	293	The apparent power on phase C of a multi-phase circuit
PhaseCActivePower	328	The active power on phase C of a multi-phase circuit.
PhaseCAVoltage	304	Related to the voltage of phase CA.
PhaseCCurrent	289	Related to the current of the third phase of 3-phase power
PhaseCReactivePower	297	The reactive power on phase C of a multi-phase circuit
PhaseCVoltage	133	Related to the voltage of the third phase of 3-phase power
PhaseCVoltagePotential	135	Related to the voltage potential of the third phase of 3-phase power
PhaseSequence	78	Related to the order of the phases in multi-phase power
PhaseVoltage	79	In single-phase or in situations where the specific phase is irrelevant, this is related to voltage across the phase
PLC	402	Related to power line carrier
Position	365	Related to a relative position or geographic position
PowerFactor	27	Related to the ratio of the real power flowing to the load to the apparent power in the circuit
PowerFactorPhaseA	318	Related to the ratio of the real power flowing to the load to the apparent power in the circuit related to phase A.
PowerFactorPhaseB	320	Related to the ratio of the real power flowing to the load to the apparent power in the circuit related to phase B.
PowerFactorPhaseC	322	Related to the ratio of the real power flowing to the load to the apparent power in the circuit related to phase C.
PowerQuality	28	Related to the set of limits of electrical properties that allows electrical systems to function in their intended manner without significant loss of performance
PowerQualityRecording	80	Related to the capture and storage of power quality data
PrepayData	360	Related to data involving prepayment metering.
PrepaymentCredit	81	Related to the right-hand side of an account; billing for prepayment accounts
Pricing	9	Related to billing
Processor	82	Related to a CPU, typically
Program	83	Related to a pre-defined set of instructions
Pulse	84	Related to a means by which energy is measured
Queue	197	Related to a relatively temporary storage area used to hold requests or tasks until they can be processed
Radio	136	Related to a physical device that processes radio signals
RAM	85	Related to random access memory
Rate	86	Related to the speed or velocity
ReadAccess	202	Related to the permission level one has; as in read, write, update
Readings	87	Related to the collection of consumption, diagnostic, and status data from a meter
ReactivePower	294	Power that does not perform work measured in VA reactive (VAr)

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EndDeviceSubdomain enumeration		
mnemonic	**Value**	**Description**
Recoder	300	A device for encoding
Recovery	88	Related to a process of restoring from a broken state
Register	89	Related to a placeholder for information
Registration	90	Related to a process by which a device is recognized or added
Relay	91	Related to an electrically operated switch
RemoteAccess	211	Related to physical security (ie. accessability) or electronic permission to read/write digital media from a mobile device or from a location other than where the object being accessed is
ROM	92	Related to read-only memory
Rotation	93	Related to the movement of an object in a circular motion
RTP	94	Related to real-time pricing
Schedule	95	Related to a timetable or plan of future events
Season	228	Related to the division of a year marked by changes in weather; typically winter, spring, summer, and fall
SecondaryCredit	96	Related to a non-primary amount of credit
SecuredRegister	98	Related to a specific register on a device
SecuredTable	99	Related a table that requires authorization prior to access being granted
SecurityKey	32	Related to a piece of information that determines the functional output of a cryptographic cipher
SecurityKeyLength	119	Related to the length of a security key
SecurityKeyVersion	120	Related to the version of a security key
SelfDetermination	366	Operation based upon parameters that were self determined, e.g. automatic.
SelfRead	231	Related to a process where a device will read itself
SelfTest	100	Related to a process where a device will run an internal test on itself
Sensor	144	Related to a mechanical device that transmits a signal to a measuring device
Session	129	Related to a communication session, typically
SetPoint	101	Related to the threshold at which a feature is engaged; typically related to load control
SigmaticMessage	102	Related to sigmatic messages
Signature	103	Related to electronic security and signing of messages
SignatureLength	104	Related to the length of a security signature
SignatureTimestamp	105	Related to the timeframe within which a security signature is valid
SignatureUsage	106	Related to how a signature is being used
SpecificGravity	240	Related to the ratio of the density of a substance to the density of water
StandardTime	107	Related to the opposite of daylight savings time
StandbyMode	108	Related to a specific mode of operation into which a device can be set
Status	17	Related to the current state of something
Storage	109	Related to the medium on which information is kept; also related to the act of storing information
SupplyCapacityLimit	139	Related to supply capacity limits
Table	110	Relating to a structure containing rows and columns
Tariff	140	Billing term relating to cost or amount chaged

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EndDeviceSubdomain enumeration		
mnemonic	**Value**	**Description**
Test	111	Related to a classification that specifies non-production
TestMode	19	Related to a specific mode of operation into which a device can be set
TextMessage	112	Related to a message or set of characters that are sent to a device
Threshold	261	Related to a level or point at which something will happen
Tier	113	Related to a level
Time	114	Related to time of day, as in hours:minutes:seconds:miliseconds
Timeout	125	Related to a specific threshold specifying when to automatically return after having received no response
TimeReset	115	Related to the resetting of the time of day
TimeSync	116	Related to the process of adjusting the time of day value on a device to match that of a trusted source for time of day
TimeVariance	117	Related to the acceptable difference of a device time of day as compared to a trusted source for time of day
TimeZone	118	Related to the time regions around the Earth defined by the lines of longitude
TOU	121	Related to time of use
Tranceiver	122	Related to a device that has both a transmitter and a receiver
Usage	123	Related to how something is used
Version	124	Related to a specific iteration or translation
Voltage	38	Related to the electrical force that would drive an electric current between two points
Watchdog	370	Related to a watchdog procedure or process.
Window	73	Related to a period of time during which a device can be linked/paired with a meter or other device
WriteAccess	282	Related to the permission level one has; as in read, write, update

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E.8 EndDeviceEventOrAction

The most specific part of the EndDeviceEventType is its EndDeviceEventOrAction value. This part of the EndDeviceEventType enumeration is generally in the form of a verb that gives action to the event that just occurred.

EndDeviceEventOrAction codes are enumerated and described in Table E.5.

Table E.5 – EndDeviceEventOrAction codes

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
n/a	0	Not applicable. Use when a EndDeviceEventOrAction is not needed. This should rarely be used.
Aborted	1	An event that occurs when some intervention causes the item (identified by the EndDeviceDomain/EndDeviceSubdomain) to stop.
Accessed	2	Typically a security event that occurs when physical access or access to data has been obtained (whether permitted or not).
Acknowledged	3	An event that indicates the receipt of the item (identified by the EndDeviceDomain/EndDeviceSubdomain).
Activated	4	An event that indicates that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) that was inactive is now active.
Added	370	An event indicating that a device or service was added
AlmostFull	283	An event to indicate that a resource is near capacity
ArmedForClosure	11	An event that indicates that an ArmForClosure command has been completed successfully.
ArmedForOpen	12	An event that indicates that an ArmForOpen command has been completed successfully.
ArmForClosure	5	A command to indicate a request to arm a switch for closure.
ArmForClosureFailed	226	An event that indicates that an ArmForClosure has failed.
ArmForOpen	6	A command to indicate a request to arm a switch for open.
ArmForOpenFailed	222	An event that indicates that an ArmFor Open has failed.
Attempted	7	An event that indicates that the item (identified by the EndDeviceDomain/EndDeviceSubdomain), based on the EndDeviceDomain and EndDeviceSubdomain combination, has been tried.
Calculated	21	An event that indicates that the item (identified by the EndDeviceDomain/EndDeviceSubdomain), based on the EndDeviceDomain and EndDeviceSubdomain combination, has been computed.
Cancel	8	A command to indicate a request to terminate a prior issued command.
CancelFailed	86	An event that indicates that a Cancel has failed.
Cancelled	10	An event that indicates that a prior issued command or set of commands was terminated successfully.
Change	13	A command to indicate a request to make modifications.
Changed	24	An event that indicates that a related Change request has completed successfully.
ChangedOut	284	An event to indicate that an asset has been replaced
ChangeOutRequired	27	A command to request that a device is replaced by a new device of the same kind.
ChangePending	14	An event that indicates that an update has not yet been performed.
Charged	15	An event that can indicate a billing-related state or in the form of being electrically charged.
Cleared	28	An event that indicates that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) on the device has been either resolved or emptied.

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
Close	299	A control command for the item described by EndDeviceDomain/EndDeviceSubdomain. NOTE This command might be used to close a pairing window. It should not be used to close a switch. The "Connect" command should be used instead.
Closed	16	An event that indicates the item (identified by the EndDeviceDomain/EndDeviceSubdomain) on the device that had been open is not open anymore.
ColdStarted	31	An event that indicates the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been started from a stopped state (as opposed to a WarmStart which implies that it was started from an already started state).
Confirmed	17	An event that indicates the receipt and agreement of the item (identified by the EndDeviceDomain/EndDeviceSubdomain).
Connect	18	A command to request that a device be put into service. NOTE This would effectively "close" an electrical switch or "open" a water valve.
Connected	42	An event to indicate that a device has been put into service.
ConnectFailed	67	An event that indicates a Connect request has failed.
Corrupted	43	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been altered from a correct state to an incorrect state.
CorruptionCleared	281	An event to indicate that a corruption condition has been cleared
Create	82	A command to request that something be created.
Created	83	An event that indicates that a Create request succeeded.
CreateFailed	297	An event that indicates that a Create request failed.
CrossPhaseCleared	70	An event that indicates that instability due to cross-phase modulation has been corrected.
CrossPhaseDetected	45	An event that indicates instability due to cross-phase modulation.
Deactivated	19	An event that indicates that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) on the device that had previously been in an active state is no longer active.
Decreased	57	An event that indicates that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has a lower value or magnitude.
Delayed	20	An event that indicates the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is slower than expected or will complete later than expected.
Disable	22	A command to request that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) be rendered incapable.
Disabled	66	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) was successfully rendered incapable.
DisableFailed	220	An event that indicates that a Disable request has failed.
Disallowed	161	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) was not allowed.
Disconnect	23	A command to request that a device be pulled from service; can also mean a request to sever connection to the item (identified by the EndDeviceDomain/EndDeviceSubdomain). NOTE This would effectively "open" an electrical switch or "close" a water valve.
Disconnected	68	An event to indicate that a device was successfully pulled from service; can also mean that connection to the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been severed or terminated.

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
DisconnectFailed	84	An event that indicates that a Disconnect request has failed.
Display	77	A command to request the display of something (as in a TextMessage).
Displayed	78	An event that indicates that a Display request completed successfully.
DisplayFailed	87	An event that indicates that a Display request failed.
Distorted	91	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been altered from its expected state.
Downloaded	25	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) transmitted from the network to the device.
Enable	26	A command to request that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) be rendered capable.
Enabled	76	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) was successfully rendered capable.
EnableFailed	221	An event that indicates that an Enable request failed.
Error	79	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) did not complete successfully.
ErrorCleared	279	An event to indicate that an error condition has been cleared
Established	29	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been recognized.
EventStarted	287	An event to indicate that an event (for example, demand response event) has begun
EventStopped	288	An event to indicate that an event (for example, demand response event) has halted
Exceeded	139	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has gone higher than its expected value.
Execute	30	A command to request that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) be performed.
Expired	64	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has come to an end, typically by date or time.
Failed	85	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has not succeeded.
Fault	375	An event to indicate a fault
FaultCleared	366	An event to indicate the the previously declared fault has cleared
FireAlarm	376	An event to indicate the detection of smoke or flames
FireAlarmCleared	371	An event to indicate that the previously reported FireAlarm has cleared.
Frozen	88	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is in a static state.
Full	32	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is at capacity.
Galloping	367	An event to indicate a resonant vibration has been detected
GallopingCeased	368	An event to indicate that the previously reported vibration has ceased.
HighDistortion	69	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has had an undesired change in the waveform of a signal.

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
HighDistortionCleared	71	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is back to normal after having been in a HighDistortion state.
ImbalanceCleared	75	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is back in balance after having been in an imbalanced state.
Imbalanced	98	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is not balanced.
Impact	372	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been struck
ImpactCleared	377	An event to indicate that the previously reported Impact is no longer being reported or has cleared.
Inactive	100	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is at a dormant state.
InactiveCleared	72	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is now in an active state after having been in a dormant state.
Increased	102	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has gotten larger.
Initialized	33	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been set to starting values.
InProgress	34	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is currently advancing toward a goal or an end.
Installed	105	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been prepared for use.
Interruption (temporary)	350	An event to indicate a temporary interruption of service or communication.
Interruption (long)	351	An event to indicate a long interruption of service or communication.
Invalid	35	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is in a faulty state.
LimitChanged	296	An event to indicate that the set point for a limit has been changed
LimitReached	286	An event to indicate that an upper or lower limit has been breached
Loaded	36	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is now engaged.
LossDetected	47	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has experienced a deprived condition. This is typically used in relation to power, voltage, or current.
MaxLimitChanged	295	An event to indicate that the set point for a maximum limit has been changed
MaxLimitCleared	293	An event to indicate that a previous MaxLimitReached event has been cleared
MaxLimitReached	93	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has reached a maximum acceptable value.
MaxLimitReachedCleared	73	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has returned to an acceptable state after having been as a MaxLimitReached state.
MinLimitChanged	294	An event to indicate that the set point for a minimum limit has been changed

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
MinLimitCleared	292	An event to indicate that a previous MinLimitReached event has been cleared
MinLimitReached	150	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has reached a minimum acceptable value.
Mismatched	159	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is not compatible with itself or something within its environment.
Missing	285	An event to indicate that an entity (for example, asset, measurement, etc.) is missing
Normal	37	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is in its typical state (or norm).
NotArmed	290	An event to indicate that a device is longer in an armed state
NotAuthorized	38	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been accessed without permission.
NotFound	160	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is lost or missing.
Open	298	A control command for the item described by EndDeviceDomain/EndDeviceSubdomain. NOTE This command might be used to open a pairing window. It should not be used to open a switch. The "Disconnect" command should be used instead.
Opened	39	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is accessible.
Opted-In	80	An event that indicates that a consumer has agreed to join a program.
Opted-Out	81	An event that indicates that a consumer does not want to join a program.
OutofRange	40	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has gone outside of acceptable values.
OutofRangeCleared	74	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has gone back to acceptable values.
Overflow	177	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has exceeded its size or volume.
PositionDropped	373	An event to indicate a decrease in elevation
PositionDropCleared	374	An event to indicate that the previously reported PositionDropped has cleared.
Preempted	41	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) been replaced by another that has precedence over it.
Processed	44	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been successfully been put through the steps of a prescribed procedure.
Read	46	This can be an event (if treated as the past-tense of the verb, read) or a command (if treated as the verb, read).
Ready	48	An event that indicates that a ready condition has been reached on a device.
ReadyForActivation	280	An event to indicate that a device has been made ready
Re-established	49	An event that indicates that a condition, typically a connection, has achieved after having been lost.

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
Registered	50	An event that indicates that a device or condition of a device has been recorded.
Released	51	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been freed.
Removed	212	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been pulled out of service.
Replaced	52	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) replaced by an new item, usually as a consequence of being old or worn out.
Reprogrammed	213	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has had a change to its directions or program.
Reset	214	A command to request that the item (identified by the EndDeviceDomain.EndDeviceSubdomain) should be set back to a zero-state or original-state.
ResetFailed	65	An event that indicates that a Reset request has failed.
ResetOccurred	215	An event that indicates that a Reset request has completed successfully.
Restarted	53	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has started again typically from an already started state.
Restored	216	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been put back to its prior state.
Reversed	219	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has changed to be the opposite of its normal state. This is typically used for rotation.
SagStarted	223	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has dipped or shrunk from its expected state.
SagStopped	224	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has stopped sagging. Typically used in conjunction with the SagStarted event.
Same Phase Detected	365	An event to indicate that a similar phase was detected in relation to a request.
Schedule	300	A control command to ask that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) will be set to execute at a future date.
Scheduled	225	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been set to execute at a future date.
ScheduleFailed	301	An event to indicate that the command to ask that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) to execute at a future date failed to schedule.
Sealed	227	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is in an airtight enclosure or cannot be accessed directly.
Set to Credit	355	A command to request that a meter be set for credit mode.
Set to Credit Failed	357	An event indicating that the request to change to credit mode failed.
Set to Credit Successful	359	An event indicating that the request to change to credit mode was successful.
Set to Prepay	354	A command to request that a meter be set for prepayment mode.
Set to Prepay Failed	356	An event indicating that the request to change to prepay mode failed.

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
Set to Prepay for Provisioning	361	A command to request that a meter be provisioned for prepayment metering.
Set to Prepay Successful (Block)	360	An event indicating that the request to set a meter to prepayment (block) was successful.
Set to Prepay Successful (TOU)	358	An event indicating that the request to set a meter to prepayment (TOU) was successful.
Start	54	A command to request that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) be triggered or begun.
Started	242	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has started.
StartFailed	217	An event that indicates that a Start request has failed.
Stop	55	A command to request that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) be shut down normally.
StopFailed	218	An event that indicates that a Stop request has failed.
Stopped	243	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has ceased. When this has resulted from a Stop command, it is assumed that things have stopped normally (ie. With no errors).
Substituted	56	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) replaced by an alternate item.
Succeeded	58	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) was accomplished.
SwellStarted	248	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has grown from its expected state.
SwellStopped	249	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has stopped swelling. Typically used in conjunction with the SwellStarted event.
SwitchPositionChanged	289	An event to indicate that a switch position has changed
TamperCleared	291	An event to indicate that a tamper alarm has been cleared
TamperDetected	257	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been secretly modified or altered. These events are typically associated with security or billing.
Terminate	302	A control command to request that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) end immediately and abruptly.
Terminated	59	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has ended abruptly.
TerminateFailed	303	An event to indicate that the attempt to terminate the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has failed.
Tilted	263	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been caused to lean, incline, slope, or slant.
TiltCleared	369	The previously identified tilt has ceased
Under Voltage Cleared	353	An event to indicate that an under voltage condition was cleared.
Under Voltage Detected	352	An even tto indicate that an under voltage condition was detected.
Uninitialized	61	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has all its values in their starting state.
Unlocked	62	An event to indicate that the item's (identified by the EndDeviceDomain/EndDeviceSubdomain) lock, physical or software, is undone.

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EndDeviceEventOrAction enumeration		
mnemonic	**Value**	**Description**
Unsealed	269	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is not sealed.
Unsecure	63	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is in an unprotected state.
Unstable	270	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) is in an irregular state.
Uploaded	60	An event to indicate that the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been transmitted from the device to the network.
WarmStarted	278	An event that indicates the item (identified by the EndDeviceDomain/EndDeviceSubdomain) has been started from an already started state (as opposed to a ColdStart which implies that it was started from a stopped state).
WriteFailed	282	An event to indicate that a write operation has failed

E.9 Normative EndDeviceEventTypes

EndDeviceType, EndDeviceDomain, EndDeviceSubdomain, and EndDeviceEventOrAction fields are combined and presented as a single string. The normative events are listed in the following Table E.6, Table E.7, Table E.8, Table E.9, Table E.10, Table E.11, Table E.12, Table E.13, Table E.14, Table E.15, Table E.16, Table E.17, Table E.18, Table E.19, Table E.20, Table E.21, Table E.22, Table E.23, Table E.24, Table E.25, Table E.26, Table E.27, Table E.28, Table E.29, Table E.30, Table E.31 and Table E.32, grouped by EndDeviceDomain.

Table E.6 – Battery events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Battery low condition detected Module Low Battery Detected Low Battery Module Low Battery Detected	*.2.22.150	*	Battery	Charge	MinLimitReached
Battery OK Rf Battery OK	*.2.22.37	*	Battery	Charge	Normal
Battery failed	*.2.0.85	*	Battery	n/a	Failed
Battery installed	*.2.0.105	*	Battery	n/a	Installed
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.7 – Billing events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Adjusted the remaining credit	*.20.8.24	*	Billing	Credit	Changed
Subtracted from remaining credit	*.20.8.57	*	Billing	Credit	Decreased
Added to remaining credit	*.20.8.102	*	Billing	Credit	Increased
Pre-payment emergency credit	*.20.81.102	*	Billing	PrepaymentCredit	Increased
Tariff program changed	*.20.83.24	*	Billing	Program	Changed
RTP activation	*.20.94.4	*	Billing	RTP	Activated
RTP deactivation	*.20.94.19	*	Billing	RTP	Deactivated
Special schedule activation	*.20.95.4	*	Billing	Schedule	Activated
Secondary emergency credit	*.20.96.102	*	Billing	SecondaryCredit	Increased
Daily tariff changed Week tariff changed Rate change	*.20.140.24	*	Billing	Tariff	Changed
Unscheduled billing reset Billing reset	*.20.140.214	*	Billing	Tariff	Reset
Tier changed	*.20.113.24	*	Billing	Tier	Changed
TOU start mismatch TOU mismatch TOU years mismatch	*.20.121.159	*	Billing	TOU	Mismatched
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.8 – Cartridge events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Cartridge error	*.3.17.79	*	Cartridge	Status	Error
Cartridge frozen	*.3.17.88	*	Cartridge	Status	Frozen
Cartridge installed	*.3.17.105	*	Cartridge	Status	Installed
No cartridge inserted	*.3.17.160	*	Cartridge	Status	NotFound
Cartridge removed	*.3.17.212	*	Cartridge	Status	Removed
Cartridge changed Pushbutton cartridge changed Handheld terminal cartridge Cartridge change mode, unable to read	*.3.17.52	*	Cartridge	Status	Replaced
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.9 – Clock events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Auto time set performed	*.36.7.58	*	Clock	AutoTime	Succeeded
Date setting changed	*.36.34.24	*	Clock	Date	Changed
Invalid execution date and time Invalid complete date and time range	*.36.34.35	*	Clock	Date	Invalid
Day change error	*.36.35.79	*	Clock	Day	Error
Day of wrong length	*.36.35.35	*	Clock	Day	Invalid
DST change to new time	*.36.56.24	*	Clock	DaylightSavingsTime	Changed
Daylight savings or standard time variance error	*.36.56.40	*	Clock	DaylightSavingsTime	OutofRange
DST change to previous time	*.36.56.214	*	Clock	DaylightSavingsTime	Reset
Change to Spring daylight savings time	*.36.56.242	*	Clock	DaylightSavingsTime	Started
Holiday changed Holidays changed	*.36.97.24	*	Clock	Holiday	Changed
Invalid installation date	*.36.57.35	*	Clock	InstallDate	Invalid
Temporary clock problem	*.36.0.79	*	Clock	n/a	Error
Clock malfunction E-clock failure	*.36.0.85	*	Clock	n/a	Failed
Season changed	*.36.228.24	*	Clock	Season	Changed
Change to Fall standard time	*.36.107.242	*	Clock	StandardTime	Started
Time setting changed to new time Working register time set to new time Time setting changed (old time) Time setting changed Collector Radio Set TimeKeeper Meter Time Adjustment	*.36.114.24	*	Clock	Time	Changed
Time change > 10 seconds	*.36.114.40	*	Clock	Time	OutofRange
Time setting reset to previous time Working register time set to previous time Time reset	*.36.114.214	*	Clock	Time	Reset
Unable to reset time	*.36.115.85	*	Clock	TimeReset	Failed
Time synchronization error	*.36.116.79	*	Clock	TimeSync	Error
Time sync failed:Meter I/O/clock failure(38)	*.36.116.85	*	Clock	TimeSync	Failed
Time synchronization of recorder	*.36.116.58	*	Clock	TimeSync	Succeeded

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Time variance exceeded limits even after module tries to correct it Time variance exceeded limits without attempt to correct automatically	*.36.117.139	*	Clock	TimeVariance	Exceeded
Invalid time zone ID	*.36.118.35	*	Clock	TimeZone	Invalid
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.10 – Communication events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Watch dog or keep-alive failure detected	*.1.3.85	*	Communication	AUTDProcess	Failed
Cut cable	*.1.15.85	*	Communication	Cable	Failed
Encoder register communication failure	*.1.41.85	*	Communication	EncoderRegister	Failed
RF HES Comm Established	*.1.52.29	*	Communication	HeadEndSystem	Established
Rf No HES Comm	*.1.52.85	*	Communication	HeadEndSystem	Failed
Intelligent register communication failure	*.1.58.85	*	Communication	IntelligentRegister	Failed
Communications between modules within a meter lost	*.1.60.85	*	Communication	IO	Failed
I/O board definition mismatch	*.1.60.159	*	Communication	IO	Mismatched
Rf No Mesh Comm	*.1.68.85	*	Communication	Mesh	Failed
Call-in failure Communications failure	*.1.0.85	*	Communication	n/a	Failed
Communications re-established	*.1.0.49	*	Communication	n/a	Re-established
Communication terminated normally	*.1.0.59	*	Communication	n/a	Terminated
Queue alarm	*.1.197.85	*	Communication	Queue	Failed
Collector Communication Delay	*.1.17.20	*	Communication	Status	Delayed
Rf Tranceiver Reset	*.1.122.214	*	Communication	Tranceiver	Reset
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.11 – Configuration events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Constants changed Primary constant changed Secondary constant changed Output constant changed	*.7.23.24	*	Configuration	Constants	Changed
Meter hard ID changed	*.7.10.24	*	Configuration	Identity	Changed
Invalid gateway ID Invalid Transformer ID	*.7.10.35	*	Configuration	Identity	Invalid
Missing node	*.7.10.160	*	Configuration	Identity	NotFound
Collector Radio Set IP List	*.7.127.24	*	Configuration	IPAddress	Changed
Maintenance mode Meter shop mode started	*.7.11.242	*	Configuration	MaintMode	Started
Meter shop mode stopped	*.7.11.243	*	Configuration	MaintMode	Stopped
Begin recording meter readings Begin idle mode	*.7.12.242	*	Configuration	MeteringMode	Started
Metering mode stopped	*.7.12.243	*	Configuration	MeteringMode	Stopped
Request customer configuration	*.7.0.13	*	Configuration	n/a	Change
Collector Radio Set Network Settings	*.7.0.24	*	Configuration	n/a	Changed
Configuration error detected	*.7.0.79	*	Configuration	n/a	Error
Configuration Initialized	*.7.0.33	*	Configuration	n/a	Initialized
Gateway reprogrammed	*.7.0.213		Configuration	n/a	Reprogrammed
Sum definition changed Sum type changed Meter counts synch Sum counts synch Output link changed Energy format changed Power format changed	*.7.75.24	*	Configuration	Parameter	Changed
Meter program change complete	*.7.83.24	*	Configuration	Program	Changed
Rate changed	*.7.86.24	*	Configuration	Rate	Changed
Setpoint exceeded, channel #	*.7.101.139	*	Configuration	SetPoint	Exceeded
Standby mode started	*.7.108.242	*	Configuration	StandbyMode	Started
Storage medium changed	*.7.109.24	*	Configuration	Storage	Changed
Test button pushed	*.7.19.76	*	Configuration	TestMode	Enabled
Test mode started	*.7.19.242	*	Configuration	TestMode	Started
Test mode ended	*.7.19.243	*	Configuration	TestMode	Stopped
Invalid timeout date and time	*.7.125.35	*	Configuration	Timeout	Invalid
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.12 – Demand events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Unable to reset demand	*.8.0.65	*	Demand	n/a	ResetFailed
Demand reset detected	*.8.0.215	*	Demand	n/a	ResetOccurred
Demand definitions mismatch	*.8.0.159	*	Demand	n/a	Mismatched
Demand overload threshold	*.8.261.139	*	Demand	Threshold	Exceeded
Demand threshold caution	*.8.261.93	*	Demand	Threshold	MaxLimitReached
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.13 – Firmware events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
A/D converter error	*.11.142.79	*	Firmware	ADConverter	Error
Constants invalid	*.11.23.35	*	Firmware	Constants	Invalid
Unknown in analysis Diagnostic marker	*.11.31.79	*	Firmware	Data	Error
Unrecognized recorder event code Unintelligible message received	*.11.31.35	*	Firmware	Data	Invalid
Frozen error display	*.11.143.88	*	Firmware	Display	Frozen
Alarm acknowledged, alarm #	*.11.43.3	*	Firmware	Event	Acknowledged
Alarm activated, alarm # Area alarm	*.11.46.4	*	Firmware	Feature	Activated
Alarm disabled, alarm # Remote setup disabled Remote synch disabled	*.11.46.66	*	Firmware	Feature	Disabled
Alarm enabled, alarm # Remote setup enabled Remote synch enabled Alarm value set, alarm #	*.11.46.76	*	Firmware	Feature	Enabled
Delayed command failure	*.11.46.85	*	Firmware	Feature	Failed
Illegal command	*.11.46.35	*	Firmware	Feature	Invalid
Unable to reset	*.11.47.85	*	Firmware	FirmwareReset	Failed
Internal device ID mismatch	*.11.10.159	*	Firmware	Identity	Mismatched
Unstable input, input #	*.11.55.270	*	Firmware	Input	Unstable
Read item list error	*.11.63.79	*	Firmware	List	Error
No protocol list, unable to find type No read items in list	*.11.63.160	*	Firmware	List	NotFound
Low speed bus error	*.11.145.79	*	Firmware	LowSpeedBus	Error
Meter bus alarm	*.11.147.79	*	Firmware	MeterBus	Error
Cold start	*.11.0.31	*	Firmware	n/a	ColdStarted
Firmware image corrupted	*.11.0.43	*	Firmware	n/a	Corrupted

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Configuration lost	*.11.0.79	*	Firmware	n/a	Error
Collector Radio Load DCW	*.11.0.85	*	Firmware	n/a	Failed
Meter reprogram End device programmed Configuration written/changed Reprogrammed Meter reconfigured Device has been synchronized	*.11.0.213	*	Firmware	n/a	Reprogrammed
Last reset by watchdog Metering equipment reset	*.11.0.214	*	Firmware	n/a	Reset
Unscheduled restart	*.11.0.53	*	Firmware	n/a	Restarted
Meter not programmed	*.11.0.61	*	Firmware	n/a	Uninitialized
Warm start	*.11.0.278	*	Firmware	n/a	WarmStarted
Option board error	*.11.146.79	*	Firmware	OptionBoard	Error
Parameter error Configuration error	*.11.75.79	*	Firmware	Parameter	Error
Invalid re-programming data Invalid device type, e.g. not TOU	*.11.75.35	*	Firmware	Parameter	Invalid
Miscellaneous configuration mismatch	*.11.75.159	*	Firmware	Parameter	Mismatched
Alternate phone number used	*.11.75.56	*	Firmware	Parameter	Substituted
Register processor failed	*.11.82.85	*	Firmware	Processor	Failed
Illegal command processor state	*.11.82.35	*	Firmware	Processor	Invalid
Processor reset	*.11.82.214	*	Firmware	Processor	Reset
Un-programmed caution	*.11.83.79	*	Firmware	Program	Error
Program malfunction	*.11.83.85	*	Firmware	Program	Failed
Self-check error Diagnostic failure	*.11.100.79	*	Firmware	SelfTest	Error
Self test failure	*.11.100.85	*	Firmware	SelfTest	Failed
Sensor malfunction	*.11.144.85	*	Firmware	Sensor	Failed
Alter option command executed	*.11.17.24	*	Firmware	Status	Changed
Firmware update pending	*.11.17.14	*	Firmware	Status	ChangePending
Firmware downloaded	*.11.17.25	*	Firmware	Status	Downloaded
Firmware download status Meter health checked	*.11.17.37	*	Firmware	Status	Normal
Firmware replaced firmware change complete	*.11.17.52	*	Firmware	Status	Replaced
Device reset occurred	*.11.17.214	*	Firmware	Status	Reset
End of data event table reached	*.11.110.79	*	Firmware	Table	Error
Display table mismatch	*.11.110.159	*	Firmware	Table	Mismatched
Test call-in	*.11.111.58	*	Firmware	Test	Succeeded

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Test mode display mismatch	*.11.19.159	*	Firmware	TestMode	Mismatched
Invalid down limit	*.11.261.35	*	Firmware	Threshold	Invalid
Calculation correction factor > max	*.11.261.40	*	Firmware	Threshold	OutofRange
Invalid meter software version	*.11.124.35	*	Firmware	Version	Invalid
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.14 – GasSupply events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Complete loss of gas supply	*.4.0.85	*	GasSupply	n/a	Failed
Gas supply restored	*.4.0.216	*	GasSupply	n/a	Restored
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.15 – Installation events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Auto registration status	*.6.5.34	*	Installation	AutoRegistration	InProgress
Auto registration confirmation	*.6.5.58	*	Installation	AutoRegistration	Succeeded
Meter change-out	*.6.0.27	*	Installation	n/a	ChangeOut
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.16 – LoadControl events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Control point changed by condition Control point changed by command Control point changed due to prepayment Control point changed by schedule	*.15.26.24	*	Loadcontrol	ControlPoint	Changed
Abort command executed	*.15.0.1	*	Loadcontrol	n/a	Aborted
Load Control User opt-in	*.15.83.4	*	LoadControl	Program	Activated
Load control relay momentary closure, relay # Output control relay toggled, relay #	*.15.91.24	*	Loadcontrol	Relay	Changed

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Switch schedule aborted	*.15.95.1	*	Loadcontrol	Schedule	Aborted
Schedule loaded	*.15.95.36	*	Loadcontrol	Schedule	Loaded
Load control restore	*.15.17.216	*	Loadcontrol	Status	Restored
Load control initiate Load control relay closed Load control relay permanent closure, relay # Load control pattern started	*.15.17.242	*	Loadcontrol	Status	Started
Load control relay opened Load control relay opened, relay #	*.15.17.243	*	Loadcontrol	Status	Stopped
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.17 – LoadProfile events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
List Pointers reset	*.16.64.214	*	Loadprofile	ListPointers	Reset
Load survey readings failed	*.16.87.85	*	Loadprofile	Readings	Failed
Load profile data corrupt	*.16.109.43	*	Loadprofile	Storage	Corrupted
Load profile data area almost full	*.16.109.32	*	Loadprofile	Storage	Full
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.18 – Logs events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Data log uploaded	*.17.33.60	*	Logs	DataLog	Transmitted
Event log last read entry updated	*.17.44.24	*	Logs	EventLog	Changed
Event log cleared	*.17.44.28	*	Logs	EventLog	Cleared
Event log error	*.17.44.79	*	Logs	EventLog	Error
Event log full	*.17.44.32	*	Logs	EventLog	Full
Event log uploaded Event call-in	*.17.44.60	*	Logs	EventLog	Transmitted
History log last read entry updated	*.17.53.24	*	Logs	HistoryLog	Changed
History log cleared	*.17.53.28	*	Logs	HistoryLog	Cleared
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.19 – Memory events

Event or Control Description	EndDeviceEven Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Memory allocation error	*.18.2.79	*	Memory	Allocation	Error
Buffer overflow/overrun error	*.18.14.177	*	Memory	Buffer	Overflow
EPROM read	*.18.42.2	*	Memory	EPROM	Accessed
EPROM written	*.18.42.24	*	Memory	EPROM	Changed
EPROM failure	*.18.42.85	*	Memory	EPROM	Failed
Framing error	*.18.50.79	*	Memory	Frames	Error
Interval overflow – pulses > 65,535	*.18.59.177	*	Memory	Interval	Overflow
Data corruption detection	*.18.0.43	*	Memory	n/a	Corrupted
Mass memory mismatch	*.18.0.159	*	Memory	n/a	Mismatched
NVRAM failure	*.18.72.85	*	Memory	NVRAM	Failed
Family definitions mismatch	*.18.75.159	*	Memory	Parameter	Mismatched
Redundant pulse monitoring error	*.18.84.79	*	Memory	Pulse	Error
RAM error	*.18.85.79	*	Memory	RAM	Error
RAM failure	*.18.85.85	*	Memory	RAM	Failed
RAM memory full	*.18.85.32	*	Memory	RAM	Full
Data recovery error	*.18.88.85	*	Memory	Recovery	Failed
ROM error	*.18.92.79	*	Memory	ROM	Error
ROM failure	*.18.92.85	*	Memory	ROM	Failed
Disk almost full	*.18.109.32	*	Memory	Storage	Full
Data table full	*.18.110.32	*	Memory	Table	Full
Table slot overflow	*.18.110.177	*	Memory	Table	Overflow
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.20 – Metrology events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
BTU alarm BTU out of range	*.21.13.40	*	Metrology	BTU	OutofRange
Corrected volume calculation error	*.21.16.79	*	Metrology	Calculation	Error
Calibration change Calibration value set, #	*.21.18.24	*	Metrology	Calibration	Changed
Calibration over-deviation, #	*.21.18.40	*	Metrology	Calibration	OutofRange
Calibration expired	*.21.18.64	*	Metrology	Calibration	Expired
Concentration alarm	*.21.39.40	*	Metrology	Concentration	OutofRange
Event Log Cleared	*.21.44.28	*	Metrology	EventLog	Cleared
EWM potential failure	*.21.45.85	*	Metrology	EWM	Failed
FPV calculated unreasonably	*.21.49.40	*	Metrology	FPV	OutofRange
GC analyzer failure	*.21.51.85	*	Metrology	GCAnalyzer	Failed
History Log Cleared	*.21.53.28	*	Metrology	HistoryLog	Cleared
Form C error, input #	*.21.55.79	*	Metrology	Input	Error

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Invalid value, channel #	*.21.55.35	*	Metrology	Input	Invalid
Interval read succeeded	*.21.59.58	*	Metrology	Interval	Succeeded
Last read entry updated	*.21.62.24	*	Metrology	LastRead	Changed
Update list pointers	*.21.63.24	*	Metrology	List	Changed
List cleared	*.21.63.28	*	Metrology	List	Cleared
Reset list pointers	*.21.63.214	*	Metrology	List	Reset
Measurement error detected	*.21.67.79	*	Metrology	Measurement	Error
Measurement failed	*.21.67.85	*	Metrology	Measurement	Failed
Total MOL % out of range	*.21.70.40	*	Metrology	MOL%	OutofRange
Measurement error detected	*.21.0.79	*	Metrology	n/a	Error
Meter return within limits, channel #	*.21.0.37	*	Metrology	n/a	Normal
Meter reprogrammed End Device Programmed	*.21.0.213	*	Metrology	n/a	Reprogrammed
Nonvolatile memory failure detected	*.21.72.85	*	Metrology	NVRAM	Failed
Turbine Pulse Error	*.21.84.79	*	Metrology	Pulse	Error
Pulse initiator	*.21.84.85	*	Metrology	Pulse	Failed
Pulse overflow, channel #	*.21.84.177	*	Metrology	Pulse	Overflow
Meter readings failed	*.21.87.85	*	Metrology	Readings	Failed
kWh received – alarm cleared	*.21.87.37	*	Metrology	Readings	Normal
Expected read missed	*.21.87.160	*	Metrology	Readings	NotFound
Scheduled call-in	*.21.87.225	*	Metrology	Readings	Scheduled
Register error	*.21.89.79	*	Metrology	Register	Error
Previous kW > register capacity	*.21.89.139	*	Metrology	Register	Exceeded
Register full	*.21.89.32	*	Metrology	Register	Full
Register definitions mismatch	*.21.89.159	*	Metrology	Register	Mismatched
Register read succeeded	*.21.89.58	*	Metrology	Register	Succeeded
Self meter read	*.21.231.58	*	Metrology	SelfRead	Succeeded
Invalid sigmatic message	*.21.102.35	*	Metrology	SigmaticMessage	Invalid
Specific gravity alarm	*.21.240.40	*	Metrology	SpecificGravity	OutofRange
Self check error detected	*.21.17.79	*	Metrology	Status	Error
Pending table activation	*.21.110.4	*	Metrology	Table	Activated
Table written to	*.21.110.24	*	Metrology	Table	Changed
Pending table clear	*.21.110.28	*	Metrology	Table	Cleared

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Meter over hi-hi threshold, channel # Meter over threshold, channel # Delta rate over threshold, channel #	*.21.261.139	*	Metrology	Threshold	Exceeded
Limit alarm reported	*.21.261.93	*	Metrology	Threshold	MaxLimitReached
Meter under threshold, channel # Meter over lo-lo threshold, channel # Low limit alarm	*.21.261.150	*	Metrology	Threshold	MinLimitReached
Meter over/under threshold	*.21.261.40	*	Metrology	Threshold	OutofRange
Gas day high limit exceeded	*.21.123.139	*	Metrology	Usage	Exceeded
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.21 – MobileSecurity events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
MAT Token Random Data or Target LAN Error	*.14.31.79	*	MobileSecurity	Data	Error
MAT Token Invalid LAN Address Block	*.14.61.35	*	MobileSecurity	LANAddress	Invalid
MAT Token Invalid Network ID	*.14.71.35	*	MobileSecurity	NetworkId	Invalid
MAT Token Message Generation Error	*.14.32.79	*	MobileSecurity	SecurityKey	Error
MAT Token Expired MAT Token Expired, Keep Alive Timeout Exceeded	*.14.32.64	*	MobileSecurity	SecurityKey	Expired
MAT Token Invalid Options	*.14.32.35	*	MobileSecurity	SecurityKey	Invalid
MAT Token pre-empted	*.14.32.41	*	MobileSecurity	SecurityKey	Preempted
MAT Token Processed	*.14.32.44	*	MobileSecurity	SecurityKey	Processed
MAT Token released	*.14.32.51	*	MobileSecurity	SecurityKey	Released
MAT Token Invalid Length	*.14.119.35	*	MobileSecurity	SecurityKeyLength	Invalid
MAT Token Invalid Version	*.14.120.35	*	MobileSecurity	SecurityKeyVersion	Invalid
Prior session already established	*.14.129.161	*	MobileSecurity	Session	Disallowed
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.22 – Modem events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Power outage modem battery low	*.19.22.150	*	Modem	Charge	MinLimitReached
Modem failure detected	*.19.17.85	*	Modem	Status	Failed
Modem initialized	*.19.17.33	*	Modem	Status	Initialized
Modem change-out	*.19.17.105	*	Modem	Status	Installed
No modem	*.19.17.160	*	Modem	Status	NotFound
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.23 – ModuleFirmware events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Module firmware replaced	*.9.17.52	*	ModuleFirmware	Status	Replaced
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.24 – Network events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Network association failure	*.23.74.85	*	Network	Association	Failed
Collector First Connect	*.23.52.42	*	Network	HeadEndSystem	Connected
Parent device not enabled	*.23.76.66	*	Network	ParentDevice	Disabled
Radio faults	*.23.136.85	*	Network	Radio	Failed
Collector Radio Registration Data	*.23.136.50	*	Network	Radio	Registered
Optional input closure, generator	*.23.17.42	*	Network	Status	Connected
Device not enabled Gateway not enabled	*.23.17.66	*	Network	Status	Disabled
Optional input opening, generator Device disconnected	*.23.17.68	*	Network	Status	Disconnected
DAP error DSP error	*.23.17.79	*	Network	Status	Error
Node failure Node link failure	*.23.17.85	*	Network	Status	Failed
Meter installed Gateway installed	*.23.17.105	*	Network	Status	Installed
End device sealed	*.23.17.227	*	Network	Status	Sealed
End device unsealed	*.23.17.269	*	Network	Status	Unsealed
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.25 – PAN / HAN events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
PAN pairing window closed	*.10.73.16	*	Pairing	Window	Closed
PAN pairing window opened (Ready To Pair)	*.10.73.39	*	Pairing	Window	Opened
PAN pairing succeeded	*.10.0.58	*	Pairing	n/a	Succeeded
PAN pairing failed	*.10.0.85	*	Pairing	n/a	Failed
PAN text message canceled	*.13.112.10	*	VideoDisplay	TextMessage	Canceled
PAN text message displayed	*.13.112.78	*	VideoDisplay	TextMessage	Displayed
PAN pricing succeeded	*.20.9.58	*	Billing	Pricing	Succeeded
PAN pricing failed	*.20.9.85	*	Billing	Pricing	Failed
PAN load control all events cancel failed	*.15.148.86	*	LoadControl	AllEvents	CancelFailed
PAN load control all events canceled	*.15.148.10	*	LoadControl	AllEvents	Canceled
PAN load control event ancel failed	*.15.43.86	*	LoadControl	Event	CancelFailed
PAN load control event canceled	*.15.43.10	*	LoadControl	Event	Canceled
PAN load control event scheduled	*.15.43.225	*	LoadControl	Event	Scheduled
PAN load control event opt-in	*.15.43.80	*	LoadControl	Event	Opt-In
PAN load control event opt-out	*.15.43.81	*	LoadControl	Event	Opt-Out
PAN device removed PAN load control device removed PAN gateway removed	*.0.0.212	*	n/a	n/a	Removed
PAN network enabled	*.23.0.76	*	Network	n/a	Enabled
PAN network disabled	*.23.0.66	*	Network	n/a	Disabled
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.26 – Power events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Low current limit exceeded	*.26.6.150	*	Power	Current	MinLimitReached
Line Frequency Unstable	*.26.4.270	*	Power	Frequency	Unstable
High neutral current	*.26.137.93	*	Power	NeutralCurrent	MaxLimitReached
High neutral current Cleared	*.26.137.73	*	Power	NeutralCurrent	MaxLimitReachedCleared
Cross phase condition	*.26.25.45	*	Power	Phase	CrossPhaseDetected
Cross phase condition Cleared	*.26.25.70	*	Power	Phase	CrossPhaseCleared
Loss of phase, Phase drop out	*.26.25.85	*	Power	Phase	Failed
Inactive phase condition (voltage is present, current is not)	*.26.25.100	*	Power	Phase	Inactive
Inactive phase condition Cleared	*.26.25.72	*	Power	Phase	InactiveCleared
Phase alert cleared	*.26.25.37	*	Power	Phase	Normal
Phase threshold	*.26.25.40	*	Power	Phase	OutofRange
Phase restoration	*.26.25.216	*	Power	Phase	Restored
Phase angle limit above/below threshold	*.26.130.40	*	Power	PhaseAngle	OutofRange
Phase angle limit above/below threshold Cleared	*.26.130.74	*	Power	PhaseAngle	OutofRangeCleared
Phase angle limit exceeded	*.26.130.139	*	Power	PhaseAngle	Exceeded
Voltage Sag Started (PhaseA)	*.26.131.223	*	Power	PhaseAVoltage	SagStarted
Voltage Sag Stopped (PhaseA)	*.26.131.224	*	Power	PhaseAVoltage	SagStopped
Voltage Swell Started (PhaseA)	*.26.131.248	*	Power	PhaseAVoltage	SwellStarted
Voltage Swell Stopped (PhaseA)	*.26.131.249	*	Power	PhaseAVoltage	SwellStopped
Phase A inactive	*.26.126.100	*	Power	PhaseA	Inactive

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Voltage Sag Started (PhaseB)	*.26.132.223	*	Power	PhaseBVoltage	SagStarted
Voltage Sag Stopped (PhaseB)	*.26.132.224	*	Power	PhaseBVoltage	SagStopped
Voltage Swell Started (PhaseB)	*.26.132.248	*	Power	PhaseBVoltage	SwellStarted
Voltage Swell Stopped (PhaseB)	*.26.132.249	*	Power	PhaseBVoltage	SwellStopped
Phase B inactive	*.26.134.100	*	Power	PhaseB	Inactive
Voltage Sag Started (PhaseC)	*.26.133.223	*	Power	PhaseCVoltage	SagStarted
Voltage Sag Stopped (PhaseC)	*.26.133.224	*	Power	PhaseCVoltage	SagStopped
Voltage Swell Started (PhaseC)	*.26.133.248	*	Power	PhaseCVoltage	SwellStarted
Voltage Swell Stopped (PhaseC)	*.26.133.249	*	Power	PhaseCVoltage	SwellStopped
PhaseC inactive	*.26.135.100	*	Power	PhaseC	Inactive
Phase Sequence Error	*.26.78.79	*	Power	PhaseSequence	Error
Loss of voltage transducer on one phase Loss of voltage per phase	*.26.79.47	*	Power	PhaseVoltage	LossDetected
Power factor exceeded limits	*.26.27.139	*	Power	PowerFactor	Exceeded
Leading kvarh cleared Leading kvarh Condition Cleared	*.26.27.24	*	Power	PowerFactor	OutofRangeCleared
Leading kvarh caution Leading kvarh Condition	*.26.27.40	*	Power	PowerFactor	OutofRange
High distortion detected	*.26.28.69	*	Power	PowerQuality	HighDistortion
High Distortion Cleared	*.26.28.71	*	Power	PowerQuality	HighDistortionCleared
Generic Power Quality Event	*.26.28.40	*	Power	PowerQuality	OutofRange
Recording disabled	*.26.80.66	*	Power	PowerQualityRecording	Disabled
Recording enabled	*.26.80.76	*	Power	PowerQualityRecording	Enabled

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Verify Section Power Verify Meter Power Verify Feeder Power Verify Transformer Power	*.26.17.68	*	Power	Status	Disconnected
Rf Collector Power Outage Power outage Power out Undetected power outage Last gasp outage alarm Transformer Outage	*.26.0.85	*	Power	n/a	Failed
Loss of power or voltage on phase A	*.26.126.85	*	Power	PhaseA	Failed
Loss of power or voltage on phase B	*.26.134.85	*	Power	PhaseB	Failed
Loss of power or voltage on phase C	*.26.135.85	*	Power	PhaseC	Failed
Meter Restoration Power on / restored Transformer Restoration	*.26.0.216	*	Power	n/a	Restored
Restoration of power or voltage on phase A	*.26.126.216	*	Power	PhaseA	Restored
Restoration of power or voltage on phase B	*.26.134.216	*	Power	PhaseB	Restored
Restoration of power or voltage on phase C	*.26.135.216	*	Power	PhaseC	Restored
Voltage exception	*.26.38.139	*	Power	Voltage	Exceeded
Voltage Imbalance Condition	*.26.38.98	*	Power	Voltage	Imbalanced
Voltage Imbalance Condition Cleared	*.26.38.75	*	Power	Voltage	ImbalanceCleared
Loss of voltage transducer VT Low loss potential detected	*.26.38.47	*	Power	Voltage	LossDetected
High Voltage	*.26.38.93	*	Power	Voltage	MaxLimitReached
Low voltage	*.26.38.150	*	Power	Voltage	MinLimitReached

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Voltage Imbalance Cleared	*.26.38.37	*	Power	Voltage	Normal
Voltage swell cleared	*.26.38.37	*	Power	Voltage	Normal
Voltage sag	*.26.38.223	*	Power	Voltage	SagStarted
Voltage sag cleared	*.26.38.224	*	Power	Voltage	SagStopped
Voltage swell condition	*.26.38.248	*	Power	Voltage	SwellStarted
Voltage swell cleared	*.26.38.249	*	Power	Voltage	SwellStopped
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.27 – Pressure events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Sensed pressure equals P max	*.29.261.93	*	Pressure	Threshold	MaxLimitReached
Sensed pressure equals P min	*.29.261.150	*	Pressure	Threshold	MinLimitReached
Pressure is out of range	*.29.261.40	*	Pressure	Threshold	OutofRange
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.28 – RCDSwitch events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Service turn-on Status input closure, # Meter connected Connect executed	*.31.0.42	*	RCDswitch	n/a	Connected
Connect failed	*.31.0.67	*	RCDSwitch	n/a	ConnectFailed
Service turn-off Status input opening, # Meter disconnected Breaker operation Disconnect executed	*.31.0.68	*	RCDswitch	n/a	Disconnected
Connect failed Disconnect failed	*.31.0.84	*	RCDswitch	n/a	DisconnectFailed
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.29 – Security events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Unauthorized access attempted	*.12.1.38	*	Security	Access	NotAuthorized
Unit accessed Unit accessed by reader Unit accessed by recorder	*.12.1.58	*	Security	Access	Succeeded
Certificate expiration alert Certificate expiration	*.12.21.64	*	Security	Certificate	Expired
Cover removal detected	*.12.29.212	*	Security	Cover	Removed
CRC error	*.12.30.79	*	Security	CRC	Error
Decryption Error Plain Text	*.12.31.63	*	Security	Data	Unsecure
Decryption Error General	*.12.36.79	*	Security	Decryption	Error
Decryption Failure	*.12.36.85	*	Security	Decryption	Failed
Collector Door Event	*.12.128.2	*	Security	Door	Accessed
Door closed	*.12.141.16	*	Security	Enclosure	Closed
Door opened	*.12.141.39	*	Security	Enclosure	Opened
Encoder tamper	*.12.40.257	*	Security	Encoder	TamperDetected
Crypto Init Failure	*.12.298.85	*	Security	Initialisation	Failed
Reverse flow detected	*.12.48.219	*	Security	Flow	Reversed
Decryption Error HMAC Failure	*.12.54.85	*	Security	HMAC	Failed
User login failure Gateway login failure	*.12.65.85	*	Security	Login	Failed
Magnetic switch alarm	*.12.66.257	*	Security	MagneticSwitch	TamperDetected
Physical tamper Tamper indication Tamper attempt suspected	*.12.0.257	*	Security	n/a	TamperDetected
Tilt detected	*.12.0.263	*	Security	n/a	Tilted
Configuration Token Invalid Network ID	*.12.71.35	*	Security	NetworkId	Invalid
Parity error	*.12.77.79	*	Security	Parity	Error
Password changed	*.12.24.24	*	Security	Password	Changed
Invalid password	*.12.24.35	*	Security	Password	Invalid
Unit accessed remotely	*.12.211.58	*	Security	RemoteAccess	Succeeded
Inverted meter or reverse rotation detected Reverse Rotation detected	*.12.93.219	*	Security	Rotation	Reversed
Read secured register Read secured table	*.12.98.2	*	Security	SecuredRegister	Accessed
Local key disable	*.12.32.66	*	Security	SecurityKey	Disabled
Local key enable	*.12.32.76	*	Security	SecurityKey	Enabled
Configuration Token Message Generation Error	*.12.32.79	*	Security	SecurityKey	Error

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Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Invalid security key	*.12.32.35	*	Security	SecurityKey	Invalid
Configuration Token Invalid Options	*.12.32.35	*	Security	SecurityKey	Invalid
Previous Key Used	*.12.32.41	*	Security	SecurityKey	Preempted
Configuration Token Processed	*.12.32.44	*	Security	SecurityKey	Processed
Local key unlock	*.12.32.62	*	Security	SecurityKey	Unlocked
Configuration Token Invalid Length	*.12.119.35	*	Security	SecurityKeyLength	Invalid
Configuration Token Invalid Version	*.12.120.35	*	Security	SecurityKeyVersion	Invalid
Signature General Error	*.12.103.79	*	Security	Signature	Error
Signature Algorithm Error Signature Verify Failure Signature Algorithm Error Signature Verify Failure Signature Algorithm Error Signature Verify Failure	*.12.103.85	*	Security	Signature	Failed
Invalid Signature Key Specified Signature Verification Error Invalid Signature Key Specified Signature Verification Error Invalid Signature Key Specified Signature Verification Error	*.12.103.35	*	Security	Signature	Invalid
Signature Missing	*.12.103.160	*	Security	Signature	NotFound
Invalid Length	*.12.104.35	*	Security	SignatureLength	Invalid
Invalid Signature Timestamp	*.12.105.35	*	Security	SignatureTimestamp	Invalid
Signature Usage Error	*.12.106.79	*	Security	SignatureUsage	Error
End device accessed for write	*.12.282.58	*	Security	WriteAccess	Succeeded
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Table E.30 – Temperature events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Temperature returns within range	*.35.0.37	*	Temperature	n/a	Normal
Temperature is out of range	*.35.0.40	*	Temperature	n/a	OutofRange
Sensed temperature equals T max	*.35.261.93	*	Temperature	Threshold	MaxLimitReached
Sensed temperature equals T min	*.35.261.150	*	Temperature	Threshold	MinLimitReached
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.31 – VideoDisplay events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Display failure	*.13.17.85	*	VideoDisplay	Status	Failed
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table E.32 – WaterSupply events

Event or Control Description	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Complete loss of water supply	*.5.0.47	*	WaterSupply	n/a	Failed
Water supply restored	*.5.0.270	*	WaterSupply	n/a	Restored
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Annex F
(normative)

EndDeviceControlType enumerations

F.1 General

Many metering systems have the capability to issue a command to equipment in the field that takes an action. The action might be to perform a demand-reset, open or close a switch, or a number of other activities. This Annex F describes example codes that may be used for such applications.

EndDeviceControlType enumerations are categorized in the same manner as the EndDeviceEventType enumerations described in Annex E. The code is divided into four parts:

```
EndDeviceControl.type:=
<EndDeviceType>.<EndDeviceDomain>.<EndDeviceSubdomain>.<EndDeviceEventOrAction>

where
      <EndDeviceType>           a numeric value from the EndDeviceType enumeration
                                (see EndDeviceType section in Annex E)
      <EndDeviceDomain>         a numeric value from the EndDeviceDomain
                                enumeration (see EndDeviceDomain section in
                                Annex E)
      <EndDeviceSubdomain>      a numeric value from the EndDeviceSubdomain
                                enumeration (see EndDeviceSubdomain section in
                                Annex E)
      <EndDeviceEventOrAction>  a numeric value from the EndDeviceEventOrAction
                                enumeration (see EndDeviceEventOrAction section in
                                Annex E)
```

These control types are inclusive of the control types used for PAN device controls. Controls may cause an event to be generated by the end device, which would then be reported using a EndDeviceEvents message.

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F.2 Normative EndDeviceControlType Enumerations

EndDeviceType, EndDeviceDomain, EndDeviceSubdomain, and EndDeviceEventOrAction fields are combined and presented as a single string. The normative events are listed in Table F.1, Table F.2, Table F.3 and Table F.4, grouped by EndDeviceDomain.

Table F.1 – Demand Controls

Event or Control Description	EndDeviceControl Type	Expected Events	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Reset Demand	*.8.0.214	*.8.0.215 *.8.0.65	Demand	n/a	Reset
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table F.2 – LoadControl Controls

Event or Control Description	EndDeviceControl Type	Expected Events	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Load control initiate, port 0	*.15.0.54	*.15.17.242 *.15.17.217	LoadControl	n/a	Start
Load control stop/terminate, port 1	*.15.0.55	*.15.17.216 *.15.17.218	LoadControl	n/a	Stop
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table F.3 – PAN / HAN Controls

Event or Control Description	EndDeviceControl Type	Expected Events	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
PAN Pairing Window Open	*.10.73.298	*.10.73.39	Pairing	Window	Open
PAN Pairing Window Close	*.10.73.299	*.10.73.16	Pairing	Window	Close
PAN Text Message Display	*.13.112.77	*.13.112.78	VideoDisplay	TextMessage	Display
PAN Text Message Cancel	*.13.112.8	*.13.112.10	VideoDisplay	TextMessage	Cancel
PAN Price Signal Create	*.20.9.82	*.20.9.58	Billing	Pricing	Create
PAN Load Control All Event Cancel	*.15.148.8	*.15.148.10	LoadControl	AllEvents	Cancel
PAN Load Control Event Cancel	*.15.43.8	*.15.43.10	LoadControl	Event	Cancel
PAN Load Control Event Schedule	*.15.43.300	*.15.43.225	LoadControl	Event	Schedule
PAN Network Enable	*.23.0.26	*.23.0.76	Network	n/a	Enable
PAN Network Disable	*.23.0.22	*.23.0.66	Network	n/a	Disable
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

Table F.4 – RCDSwitch Controls

Event or Control Description	EndDeviceControl Type	Expected Events	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Disable RCD Emergency Supply Capacity Limit	*.31.138.22	*.31.138.66 *.31.138.220	RCDSwitch	EmergencySupplyCapacityLimit	Disable
Enable RCD Emergency Supply Capacity Limit	*.31.138.26	*.31.138.76 *.31.138.221	RCDSwitch	EmergencySupplyCapacityLimit	Enable
Arm Remote Connect/Disconnect Switch for Closure	*.31.0.5	*.31.0.11 *.31.0.226	RCDSwitch	n/a	ArmForClosure
Arm Remote Connect/Disconnect Switch for Open	*.31.0.6	*.31.0.12 *.31.0.222	RCDSwitch	n/a	ArmForOpen
Close Remote Connect/Disconnect Switch	*.31.0.18	*.31.0.42 *.31.0.67	RCDSwitch	n/a	Connect

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Event or Control Description	EndDeviceControl Type	Expected Events	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Disable Demand Limiting formula #1 for RCD Switch Disable RCD Switch	*.31.0.22	*.31.0.66 *.31.0.220	RCDSwitch	n/a	Disable
Open Remote Connect/Disconnect Switch	*.31.0.23	*.31.0.68 *.31.0.84	RCDSwitch	n/a	Disconnect
Enable Demand Limiting formula #2 for RCD Switch Enable RCD Switch	*.31.0.26	*.31.0.76 *.31.0.221	RCDSwitch	n/a	Enable
Disable RCD Supply Capacity Limit	*.31.139.22	*.31.139.66 *.31.139.220	RCDSwitch	SupplyCapacityLimit	Disable
Enable RCD Supply Capacity Limit	*.31.139.26	*.31.139.76 *.31.139.221	RCDSwitch	SupplyCapacityLimit	Enable
An asterisk (*) denotes any of the EndDeviceType values. It is assumed that the value used in any production use of these events will be relevant to the device that is actually sending this event.					

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Annex G
(normative)

XML schemas for message payloads

G.1 General

The purpose of this Annex G is to provide links to the XSD serializations of the profiles of message payloads to augment the descriptions provided earlier in this document. These XSDs are normative, but may be extended as needed for specific implementation needs.

NOTE 1 There is no requirement to use IEC 61968-100:2022 when doing IEC 61869-9 messaging. However, if IEC 61968-100:2022 is to be employed in doing IEC 61869-9 messaging, these profiles will need to be extended to reference the AbstractPayload as defined in IEC 61968-100:2022. Refer to IEC 61968-100:2022, Annex C for examples.

NOTE 2 The referenced schemas were created from CIM Version iec61970cim17v40_iec61968cim13v13b_iec62325cim03v17b_cim100.1.1.1, with CIMTool Version 1.10.0. The user of the standard who wishes to utilize these schemas exactly or to modify them for specific implementation purposes will find these products as well as the current and historical versions of the CIM and CIMTool at https://cimug.ucaiug.org/Standards%20Artifacts/Forms/AllItems.aspx.

A library of *CIM Meter Reading and Control Profile Messages* are available at https://cimug.ucaiug.org. The website[1] may have other useful artefacts for the developer including (but not limited to) owl files and tabular representations of the owl files for the profiles.

G.2 ComModuleConfig

The ComModuleConfig schema is available online at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/ComModuleConfig.xsd

G.3 EndDeviceConfig

The EndDeviceConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/EndDeviceConfig.xsd

G.4 EndDeviceControls

The EndDeviceControls schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/EndDeviceControls.xsd

G.5 EndDeviceEvents

The EndDeviceEvents schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/EndDeviceEvents.xsd

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[1] The links will be hosted as long as the 2023 (third) edition of IEC 61869-9 remains in effect. When this document is superceded or withdrawn, the links may become invalid.

G.6 GetComModuleConfig

The GetComModuleConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetComModuleConfig.xsd

G.7 GetEndDeviceConfig

The GetEndDeviceConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetEndDeviceConfig.xsd

G.8 GetEndDeviceControls

The GetEndDeviceControls schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetEndDeviceControls.xsd

G.9 GetEndDeviceEvents

The GetEndDeviceEvents schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetEndDeviceEvents.xsd

G.10 GetEndDeviceGroups

The GetEndDeviceGroups schemas is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetEndDeviceGroups.xsd

G.11 GetMeterConfig

The GetMeterConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetMeterConfig.xsd

G.12 GetMeterReadings

The GetMeterReadings schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetMeterReadings.xsd

G.13 GetMeterReadSchedules

The GetMeterReadSchedules schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetMeterReadSchedules.xsd

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G.14 GetUsagePointConfig

The GetUsagePointConfig is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetUsagePointConfig.xsd

G.15 GetUsagePointGroups

The GetUsagePointGroups schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetUsagePointGroups.xsd

G.16 GetUsagePointLocationConfig

The GetUsagePointLocationsConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetUsagePointLocationConfig.xsd

G.17 MasterDataLinkageConfig

The MasterDataLinkageConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MasterDataLinkageConfig.xsd

G.18 MeterConfig

The MeterConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MeterConfig.xsd

G.19 MeterReadings

The MeterReadings schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MeterReadings.xsd

G.20 MeterReadSchedules

The MeterReadSchedules schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MeterReadSchedules.xsd

G.21 UsagePointConfig

The UsagePointConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/UsagePointConfig.xsd

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G.22 UsagePointGroups

The UsagePointGroups schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/UsagePointGroups.xsd

G.23 UsagePointLocationConfig

The UsagePointLocationConfig schema is available at

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/UsagePointLocationConfig.xsd

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Annex H
(normative)

Querying data using Get profiles

H.1 General

The purpose of this Annex H is to describe the use of Get messages to retrieve data. Get messages utilize a Get profile to provide the parameters used to specify the request. These parameters serve as filters for the data set returned in the REPLY message. This is in effect a "query" pattern. If needed, these filters can be defined as contextual profiles in a manner similar to those used to define payloads. Those structures are then realized as XML schemas.

Please refer to 8.4 of IEC 61968-100:2022 for proper usage of Get profiles within a larger messaging context. Annex D of IEC 61968-100:2022 contains examples of message exchanges using Get profiles.

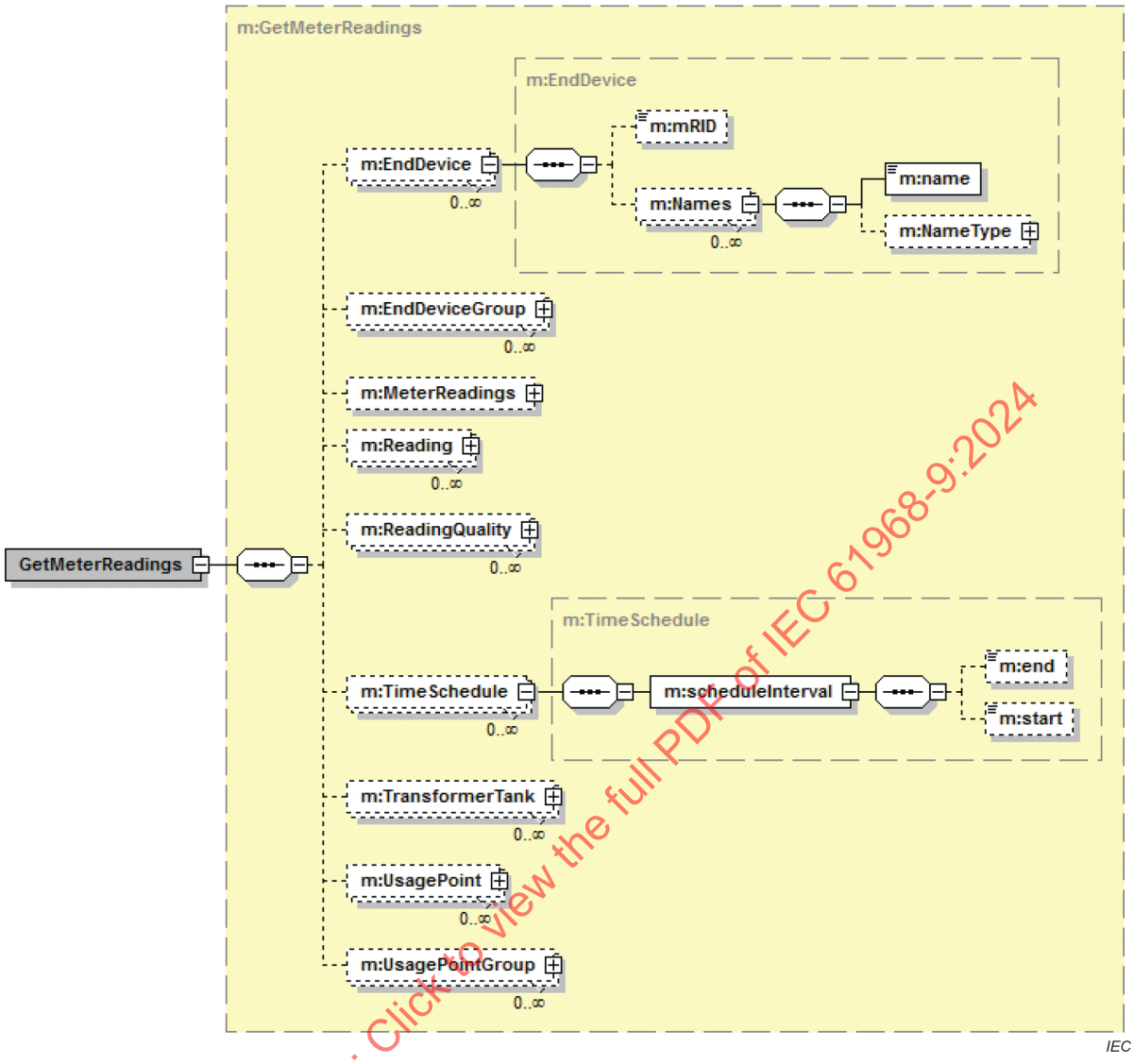
Clauses H.2 and H.3 illustrate the structure of two Get profiles listed in Table 2. Examples of the use of these two profiles are contained in Clauses D.7 and D.4 of IEC 61968-100:2022.

Users of this standard may define additional Get profiles to meet their data exchange requirements.

H.2 GetMeterReadings

The structure in Figure H.1 is a contextual profile that can be used to qualify "Get MeterReadings" requests. This provides a representative example of how mRIDs, names and time may be specified within a "Get" profile to qualify a query.

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Figure H.1 – GetMeterReadings

H.3 GetEndDeviceConfig

The structure in Figure H.2 is a contextual profile that can be used to qualify "GET MeterConfig" requests.

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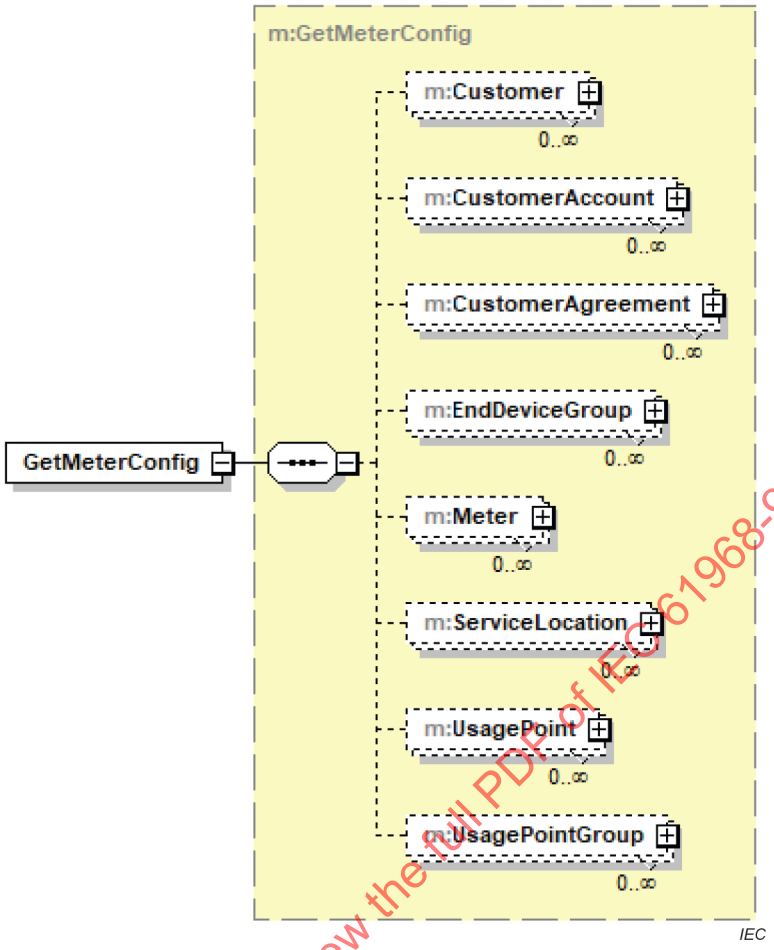


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Figure H.2 – GetMeterConfig

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Annex I
(informative)

Master data management transaction processing

The purpose of this Annex I is to describe how transaction processing is performed in order to support the master data management needs of IEC 61968-9. The introduction of the "update" verb in IEC 61968-100:2022 takes care of the issues created when deleting one or more attributes or instances of associated CIM object in an operation set. However, in this document, care still must be taken when performing two or more related Master Data Management actions that must be handled in a specific sequence and/or with overall transactional integrity (i.e., either all actions must succeed or all must be rolled back).

An IEC 61968-9 message utilizing the OperationSet construct always has a Header verb of either "execute" or "executed" and a noun of "OperationSet". An OperationSet in turn contains one or more Operations, and each Operation has an operationId which supplements the overall message CorrelationID to provide a fine-grained ability to correlate the contents of one or more reply messages with the individual Operations in an OperationSet. Individual Operations within an OperationSet have OperationSet-level verbs and nouns. Allowable verbs are create, created, change, changed, delete, deleted, update and updated.

Each OperationSet may have either an EnforceMsgSequence boolean or an EnforceTransactionalIntegrity boolean, or both. The EnforceMsgSequence boolean is to be set to "true" when the Operations in the OperationSet must be executed in ascending order of their operationID. The EnforceTransactionalIntegrity boolean is to be set to "true" if all Operations in the OperationSet must succeed. In this case, if all such Operations do not succeed, all must be aborted or rolled back. If either or both of these booleans are omitted, they are assumed to be "false".

For additional information on performing Master Data Management transactions and for a full description of the new message XSD and normative exchange patterns, refer to IEC 61968-100:2022.

It should also be noted that while this document provides the means to convey Master Data Management transactions using XML schema-based data structures, it is also technically possible to leverage IEC 61970-552 for transactions based upon RDF. Such capability may or may not be provided in future editions of IEC 61968-9 and IEC 61968-100.

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Annex J
(informative)

Master data management use cases

J.1 General

The purpose of this Annex J is to provide a description of informative use cases related to master data management.

IEC 61968-100 contains verbs and constructs which are useful in performing master data management, and the examples below utilize this standard. However, it is possible to use other common practices in IT such as the common Create, Read, Update, and Delete (CRUD) verbs, as well as other methods to perform data management.

Table J.1 identifies Master Data Management / Data Synchronization use cases and provides guidance on how to construct and populate the request or event stereotype message for each use case.

Managing master data between multiple systems may often involve the use of profiles from multiple IEC 61968 parts. For example, Customer Management (IEC 61968-8) functions include billing of customers using Meter Reading and Control Data (IEC 61968-9). As such, IEC 61968-8 business functions and systems may need to utilize IEC 61968-9 profiles and vice versa. Annex J illustrates the use of profiles from multiple IEC 61968 parts to provide a comprehensive set of master data management scenarios that may apply to IEC 61968-9 business functions and systems. For profiles appearing in Annex J that are owned by other IEC 61968 parts, the owning part has been identified for convenience.

Although the intent is to not create a dependency in this part on other parts, the manipulation of master data requires the formation of relationships between data sets, and this is most easily done with IEC 61968-100. This annex therefore will use IEC 61968-100 in its examples.

It is not the intent of these use cases to provide full configuration details for these objects; it is simply to illustrate the techniques involved in creating, modifying, and deleting these objects as well as the techniques for managing the relationships between these objects using the MasterDataLinkageConfig profile.

In Table J.1, entries in the row "Relationship Line" refer to the relationship lines in Figure 49.

Please refer also to IEC 61968-100:2022 for additional information related to master data management / data synchronization.

NOTE The introduction of the "update" and "updated" verbs in IEC 61968-100:2022 fundamentally changed the way that individual attributes and instances of elements can be added, deleted, or removed from a configured item. Use of the "change" and "changed" verbs now (in IEC 61968-100:2022) requires specification of a complete replacement payload. In the table below usecases that previously used the "change/changed" verbs have been modified to use the "update/updated" verbs. When using the "update" and "updated" verbs, the IEC 61968-100:2022 message envelope contains an UpdateAction that has enumerated values of "add", "remove", or "modify" to indicate whether the attributes and/or elements specified in the payload are to be added, removed, or modified in the configuration item.

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Table J.1 – Exemplary master data management / data synchronization use cases

Use Case #	DS-1	DS-2	DS-3	DS-4
Use Case Description	Create a meter and / or receive meter into Inventory	Add or update one or more simple attributes for a meter in inventory	Delete one or more simple attributes for a meter in inventory	Add an additional instance of a class such as Register to a meter in inventory
Header Verb	create/created	update/updated	update/updated	update/updated
Header Noun	MeterConfig	MeterConfig	MeterConfig	MeterConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	add/modify	remove	add
Payload Description	1) ID of the Meter 2) As many details about the Meter as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the Meter 2) Attributes and/or instances of elements that are being added or modified 3) Effectivity dates and reason as appropriate	1) ID of the Meter 2) Attributes that are being deleted 3) Effectivity dates and reason as appropriate	1) ID of the Meter 2) ID and details of the Register being added 3) Effectivity dates and reason as appropriate
Relationship Line	n/a	n/a	n/a	n/a
Comments	Meter ID can be either an mRID and/or one or more Names.name. Present tense of verbs used for request/reply patterns; past tense used for published notifications (no reply).	Simple attributes have only one occurrence at any given location within the schema.		

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Use Case #	DS-5	DS-6	DS-7	DS-8
Use Case Description	Delete an instance of a class such as Register from a meter in inventory	Configure meter with no previously defined registers to collect fwd kWh register and 15-minute interval readings	Re-configure meter to have Channel 2 of Register 1 collect 5-minute fwd kWh register readings rather than 15-minute fwd kWh interval readings	Delete a meter from inventory
Header Verb	update/updated	update/updated	update/updated	delete/deleted
Header Noun	MeterConfig	MeterConfig	MeterConfig	MeterConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	remove	n/a	n/a	n/a
Payload Description	1) ID of the Meter 2) ID of the Register being deleted 3) Effectivity dates and reason as appropriate	1) ID of meter 2) ID of Register 1 3) As many details of Register 1 as available / desired 4) ID of Channel 1 of Register 1 5) As many details of Channel 1 of Register 1 as available / desired, including ReadingType for BulkQuantity fwd kWh 6) ID of Channel 2 of Register 1 7) As many details of Channel 2 of Register 1 as available / desired, including ReadingType for 15-minute DeltaData fwd kWh 8) Effectivity dates and reason as appropriate	1) ID of meter 2) ID of Register 1 3) ID of Channel 2 of Register 1 4) As many details of Channel 2 of Register 1 as available / desired, including ReadingType for 5minute DeltaData fwd kWh 5) Effectivity dates and reason as appropriate	1) ID of meter 2) Effectivity dates and reason as appropriate
Relationship Line	n/a	n/a	n/a	n/a
Comments				Many systems may choose not to delete meters but to mark the meters as removed and/or retired.

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Use Case #	DS-9	DS-10	DS-11	DS-12
Use Case Description	Receive com module into inventory	Create a service category	Create a service supplier	Create a service location
Header Verb	create/created	create/created	create/created	create/created
Header Noun	ComModuleConfig	ServiceCategoryConfig (IEC 61968-8)	SupplierConfig (IEC 61968-8)	ServiceLocationConfig (IEC 61968-8)
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the ComModule 2) As many details about the ComModule as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the ServiceCategory 2) As many details about the ServiceCategory as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the ServiceSupplier 2) As many details about the ServiceSupplier as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the ServiceLocation 2) As many details about the ServiceLocation as available / desired 3) Effectivity dates and reason as appropriate
Relationship Line	n/a	n/a	n/a	n/a
Comments	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a ComModule after it is in inventory.	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a ServiceCategory.	In de-regulated markets, the distribution utility and the retailer may be separate ServiceSuppliers (having different ServiceSupplier.kind) Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a ServiceSupplier.	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a Servicelocation.

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Use Case #	DS-13	DS-14	DS-15
Use Case Description	Create a usage point location	Create a usage point	Create a customer
Header Verb	create/created	create/created	create/created
Header Noun	UsagePointLocationConfig	UsagePointConfig	CustomerConfig (IEC 61968-8)
Enforce Seq	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a
Payload Description	1) ID of the UsagePointLocation 2) As many details about the UsagePointLocation as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the UsagePoint 2) As many details about the UsagePoint as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the Customer 2) As many details about the Customer as available / desired 3) Effectivity dates and reason as appropriate
Relationship Line	n/a	n/a	n/a
Comments	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a UsagePointLocation.	If the UsagePoint is also a service delivery point (point of demarcation between utility and customer ownership), set the isSdp Boolean to "true". If any of the following are to be included as part of the creation of the UsagePoint, they shall exist in advance of the create / created UsagePointConfig message: ServiceSupplier, ServiceCategory, ServiceLocation, UsagePointLocation. Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a UsagePoint.	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a Customer.

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Use Case #	DS-16	DS-17	DS-18	DS-19
Use Case Description	Create a customer account	Create a customer agreement	Create a pricing structure	Create a non-meter end device (including a PAN device)
Header Verb	create/created	create/created	create/created	create/created
Header Noun	CustomerAccountConfig (IEC 61968-8)	CustomerAgreementConfig (IEC 61968-8)	Pricing StructureConfig (IEC 61968-8)	EndDeviceConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the CustomerAccount 2) As many details about the CustomerAccount as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAgreement 2) As many details about the Customer Agreement as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the PricingStructure 2) As many details about the PricingStructure as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the EndDevice 2) As many details about the EndDevice as available / desired 3) Effectivity dates and reason as appropriate
Relationship Line	n/a	n/a	n/a	n/a
Comments	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a CustomerAccount.	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a CustomerAgreement.	Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of a PricingStructure.	If the EndDevice is a PAN device, set the isPan Boolean to "true"or meters, see Use Case DS-1. Follow the examples of Use Cases DS-2 through DS-8 for changes to or deletion of an EndDevice.

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Use Case #	DS-20	DS-21	DS-22	DS-23
Use Case Description	Shop install a com module into a meter	Remove a com module from a meter	Reflect the pairing of an end device (e.g., a PAN device) to a meter	Reflect the unpairing of an end device (e.g., a PAN device) from a meter
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the ComModule 2) ID of the Meter 3) Effectivity dates and reason as appropriate	1) ID of the ComModule 2) ID of the Meter 3) Effectivity dates and reason as appropriate	1) ID of the EndDevice 2) ID of the Meter 3) Effectivity dates and reason as appropriate	1) ID of the EndDevice 2) ID of the Meter 3) Effectivity dates and reason as appropriate
Relationship Line	A	A	B	B
Comments	Assumes the Meter and the ComModule already exist. ComModules may not exist for meters with integral communications capabilities. Multiple com modules (e.g., one for AMI network and amodule for Home Area Networking) may be installed into a meter. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	ComModules may not exist for meters with integral communications capabilities. This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes the EndDevice and the Meter already exist. Multiple EndDevices devices may be paired with a given meter. An EndDevice may optionally be "paired" with a UsagePoint rather than a meter. This would most typically be done when the communication with a PAN device is not via the meter. See Use Case DS25. At any given time, a EndDevice should not be paired with both a Meter and a UsagePoint. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Multiple EndDevices may be paired with a given meter. Un-pairing an EndDevice does not delete the EndDevice but only takes it out-of-service for that meter. This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-24	DS-25	DS-26	DS-27
Use Case Description	Reflect the pairing of an end device (e.g., a PAN device) to a usage point	Reflect the unpairing of an end device (e.g., a PAN device) from a a usage point	Reflect the installation of a meter at usage point	Reflect the removal of a meter from a usage point
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the EndDevice 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the EndDevice 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the Meter 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the Meter 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate
Relationship Line	C	C	D	D
Comments	Assumes the EndDevice and the UsagePoint already exist. Multiple end devices may be paired with a given UsagePoint. A EndDevice may optionally be "paired" with a meter rather than a UsagePoint. This would most typically be done when the communication with a PAN device is via the meter. See Use Case DS-23. At any given time, an EndDevice should not be paired with both a Meter and a UsagePoint. This transaction accomplishes only the "linkage" of these objects. I there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Multiple end devices may be paired with a given Usage Point. Un-pairing an EndDevice does not delete the EndDevice but only takes it out-of-service for that UsagePoint. This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes that both the Meter and the UsagePoint already exist. Multiple meters may be installed at a given UsagePoint, although some enterprise systems do not support doing so. This is the master data synchronization transaction reflecting the meter installation. It may be preceded by or accompanied by another Part 9 message associated with a service request for the field work associated with the installation. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Multiple meters may be installed at a given UsagePoint, although some enterprise systems do not support doing so. Removing (uninstalling) a meter does not delete the Meter but only takes it out-of-service for that UsagePoint. This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-28	DS-29	DS-30	DS-31
Use Case Description	Associate a pricing structure with a usage point	Disassociate a pricing structure from a usage point	Associate a customer agreement with a usage point	Disassociate a customer agreement from a usage point
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the PricingStructure 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the PricingStructure 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAgreement 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAgreement 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate
Relationship Line	G	G	H	H
Comments	Assumes that both the PricingStructure and the UsagePoint already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes that both the CustomerAgreement and the UsagePoint already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-32	DS-33	DS-34	DS-35
Use Case Description	Associate a customer account with a usage point	Disassociate a customer account from a usage point	Associate a customer with a usage point	Disassociate a customer from a usage point
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the CustomerAccount 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAccount 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the Customer 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of the Customer 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate
Relationship Line	K	K	L	L
Comments	Assumes that both the CustomerAccount and the UsagePoint already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes that both the Customer and the UsagePoint already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-36	DS-37	DS-38	DS-39
Use Case Description	Associate a pricing structure with a customer agreement	Disassociate a pricing structure from a customer agreement	Associate a service location with a customer agreement	Disassociate a service location from a customer agreement
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the PricingStructure 2) ID of the CustomerAgreement 3) Effectivity dates and reason as appropriate	1) ID of the PricingStructure 2) ID of the CustomerAgreement 3) Effectivity dates and reason as appropriate	1) ID of the ServiceLocation 2) ID of the CustomerAgreement 3) Effectivity dates and reason as appropriate	1) ID of the ServiceLocation 2) ID of the CustomerAgreement 3) Effectivity dates and reason as appropriate
Relationship Line	N	N	O	O
Comments	Assumes that both the PricingStructure and the CustomerAgreement already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes that both the ServiceLocation and the CustomerAgreement already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-40	DS-41	DS-42	DS-43
Use Case Description	Associate a usage point location with a service location	Disassociate a usage point location from a service location	Associate a customer account with a customer	Disassociate a customer account from a customer
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the UsagePointLocation 2) ID of the ServiceLocation 3) Effectivity dates and reason as appropriate	1) ID of the UsagePointLocation 2) ID of the ServiceLocation 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAccount 2) ID of the Customer 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAccount 2) ID of the Customer 3) Effectivity dates and reason as appropriate
Relationship Line	P	P	Q	Q
Comments	Assumes that both the UsagePointLlocation and the ServiceLocation already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes that both the CustomerAccount and the Customer already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-44	DS-45	DS-46	DS-47
Use Case Description	Associate a customer agreement with a customer account	Disassociate a customer agreement from a customer account	Associate a service supplier with a customer account	Disassociate a service supplier from a customer account
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the CustomerAgreement 2) ID of the CustomerAccount 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAgreement 2) ID of the CustomerAccount 3) Effectivity dates and reason as appropriate	1) ID of the ServiceSupplier 2) ID of the CustomerAccount 3) Effectivity dates and reason as appropriate	1) ID of the ServiceSupplier 2) ID of the CustomerAccount 3) Effectivity dates and reason as appropriate
Relationship Line	R	R	S	S
Comments	Assumes that both the CustomerAgreement and the Customer account already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes that both the ServiceSupplier and the CustomerAccount already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-48	DS-49	DS-50	DS-51
Use Case Description	Associate a service supplier with a customer agreement	Disassociate a service supplier from a customer agreement	Associate a customer agreement with a customer	Disassociate a customer agreement from a customer account
Header Verb	create/created	delete/deleted	create/created	delete/deleted
Header Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig	MasterDataLinkageConfig
Enforce Seq	n/a	n/a	n/a	n/a
Enforce Trans	n/a	n/a	n/a	n/a
Op Set Verb	n/a	n/a	n/a	n/a
Op Set Noun	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Payload Description	1) ID of the ServiceSupplier 2) ID of the CustomerAgreement 3) Effectivity dates and reason as appropriate	1) ID of the ServiceSupplier 2) ID of the CustomerAgreement 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAgreement 2) ID of the Customer 3) Effectivity dates and reason as appropriate	1) ID of the CustomerAgreement 2) ID of the Customer 3) Effectivity dates and reason as appropriate
Relationship Line	T	T	U	U
Comments	Assumes that both the ServiceSupplier and the CustomerAgreement already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	Assumes that both the CustomerAgreement and the Customer already exist. This transaction accomplishes only the "linkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.	This transaction accomplishes only the "delinkage" of these objects. If there is a desire to update either or both of the object records, additional messages can be created. Additionally, the multiple actions may be combined with control over sequence and overall transaction integrity using the OperationSet construct in Message.xsd. This approach is illustrated in a number of separate use cases.

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Use Case #	DS-52			
Use Case Description	Exchange meter 2 for meter 1 at a usage point and update the install date for meter 2 and the removal date for meter 1			
Header Verb	execute/executed			
Header Noun	OperationSet (IEC 61968-100)			
Enforce Seq	"true"			
Enforce Trans	"true"			
Op Set Verb	delete/deleted	create/created	update/updated	update/updated
Op Set Noun	MasterDataLinkageConfig	MasterDataLinkageConfig	MeterConfig	MeterConfig
UpdateAction	n/a	n/a	modify	modify
Payload Description	1) ID of Meter 1 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of Meter 2 2) ID of the UsagePoint 3) Effectivity dates and reason as appropriate	1) ID of Meter 1 2) Removal date for Meter 1 3) Effectivity dates and reason as appropriate	1) ID of Meter 2 2) Installation date for Meter 2 3) Effectivity dates and reason as appropriate
Relationship Line	D	D	n/a	n/a
Comments	Assumes creation / configuration of meter 2 occurred in advance of ithe meter exchange transaction. The enforceMessageSequence flag is set to "true" to ensure that meter 1 is removed before meter 2 is installed. The EnforceTransactionalIntegrity flag is set to "true" to ensure that all portions of this transaction are rolled back (voided) if any of the transactions fail. This ensures overall integrity of the database in the receiving system.			

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Use Case #	DS-53	
Use Case Description	Reflect the creation of a PAN device and its pairing with an existing meter	
Header Verb	execute/executed	
Header Noun	OperationSet (IEC 61968-100)	
Enforce Seq	"true"	
Enforce Trans	"true"	
Op Set Verb	create/created	create/created
Op Set Noun	EndDeviceConfig	MasterDataLinkageConfig
UpdateAction	n/a	n/a
Payload Description	1) ID of the EndDevice (PAN device) 2) As many details about the EndDevice (PAN device) as available / desired 3) Effectivity dates and reason as appropriate	1) ID of the EndDevice (PAN device) 2) ID of the Meter 3) Effectivity dates and reason as appropriate
Relationship Line	n/a	B
Comments	For this Pan device example, the isPan Boolean in the EndDeviceConfig will be set to "true". Assumes the meter was created in advance of the this composite transaction. The EnforceMessageSequence flag is set to "true" to ensure that the PAN device is created before it is associated with the meter. The EnforceTransactionalIntegrity flag is set to "true" to ensure that all portions of this transaction are rolled back (voided) if any of the transactions fail. This ensures overall integrity of the database in the receiving system.	

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J.2 Sample XML for Exemplary Master Data Management use cases

J.2.1 General

The remainder of this Annex provides sample XML for a set of use cases that illustrates the intended use of the IEC 61869-9 Master Data Management Transaction profile set.

Although only a small subset of the available profiles is included, the examples are applicable to the remaining Master Data Management use cases and profiles.

In most of the examples below, there are four steps for each use case:

- a CIS system sends a message to the Meter Data Management System (MDMS) to synchronize certain master data,
- the MDMS sends a simple acknowledgment response message to the CIS to indicate it has received the request. (This is an optional step that is bypassed when using JMS messaging if the AckRequired in the Header of the Step 1 request message is set to "false"),
- the MDMS sends a response message to the CIS to indicate that the request was completed successfully, or
- the MDMS sends a response message to the CIS to indicate that the request failed to complete successfully.

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J.2.2 Create MeterConfig – Two Meters – Step 1

The first step for instantiating two meters using a MeterConfig message is illustrated in Figure J.1. This figure is large and shows several columns collapsed in the top part, and expanded in the bottom part.



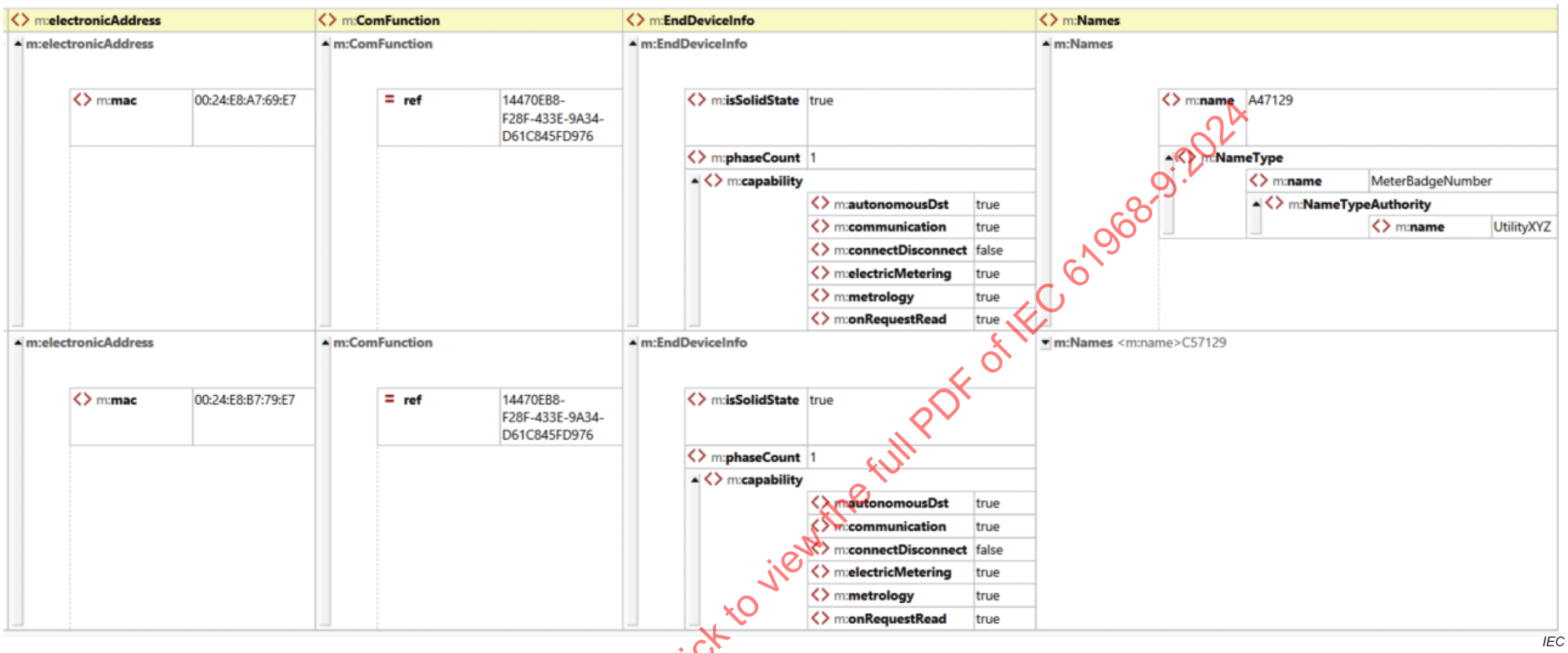


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Figure J.1 – Create MeterConfig – Two Meters – Step 1

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J.2.3 Create MeterConfig – Two Meters – Step 2

The second step for instantiating two meters using a MeterConfig message is illustrated in Figure J.2.

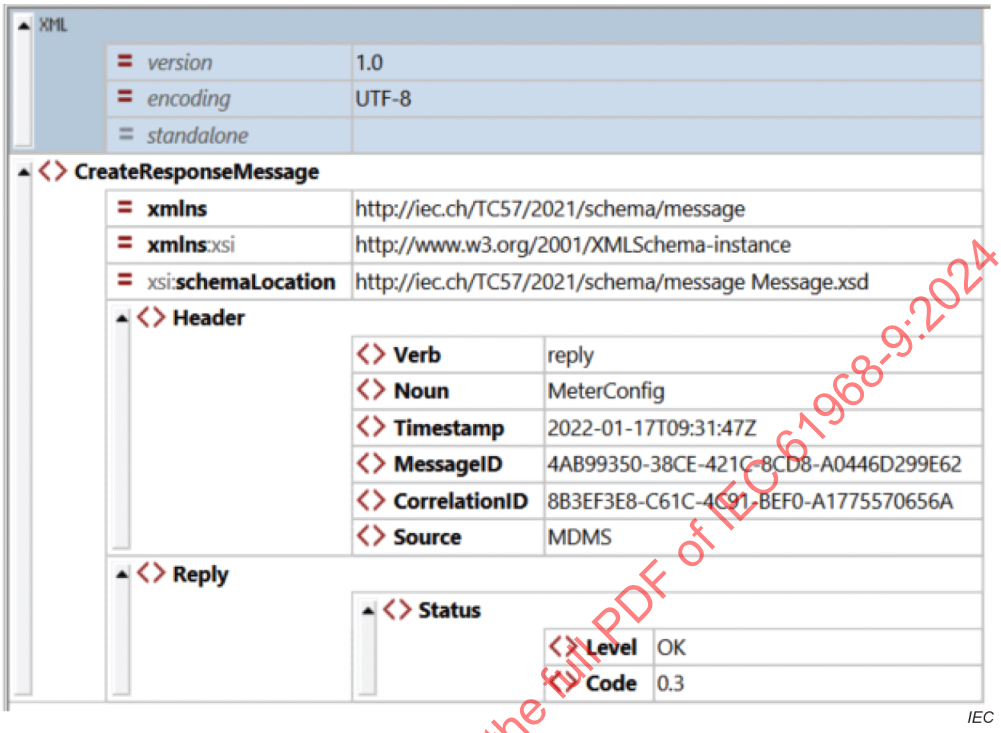


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Figure J.2 – Create MeterConfig – Two Meters – Step 2

J.2.4 Create MeterConfig – Two Meters – Step 3

The third step for instantiating two meters using a MeterConfig message is illustrated in Figure J.3.

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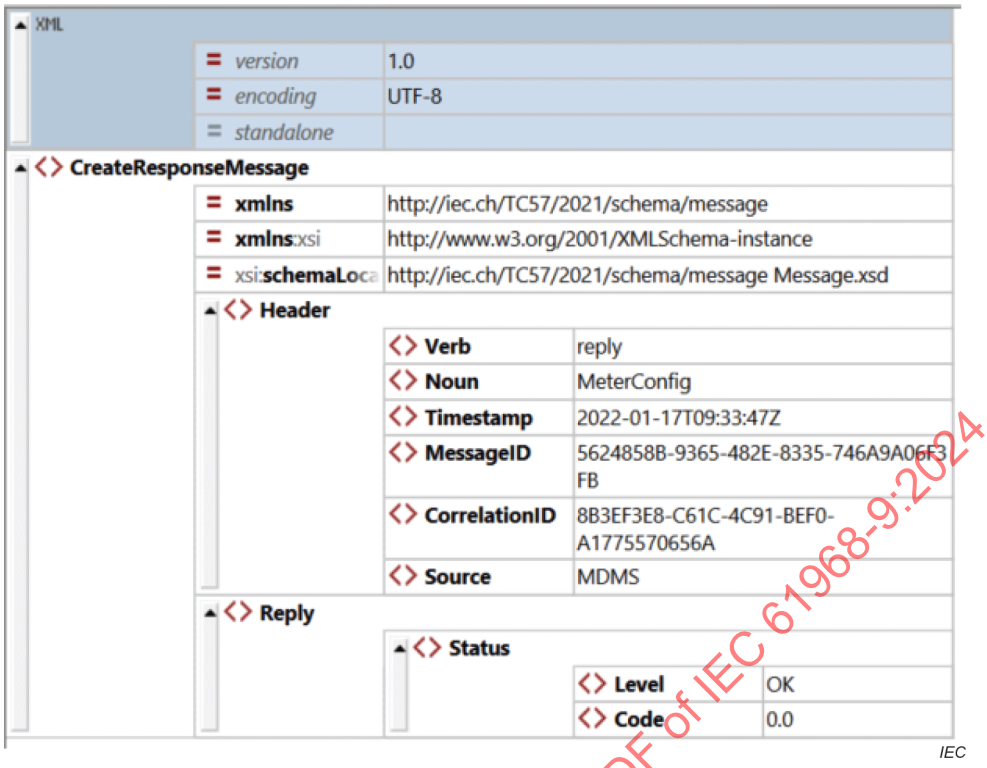


Figure J.3 reproduced with the permission of UCAIug.

Figure J.3 – Create MeterConfig – Two Meters – Step 3

J.2.5 Create MeterConfig – Two Meters – Step 4

The fourth step for instantiating two meters using a MeterConfig message is illustrated in Figure J.4.

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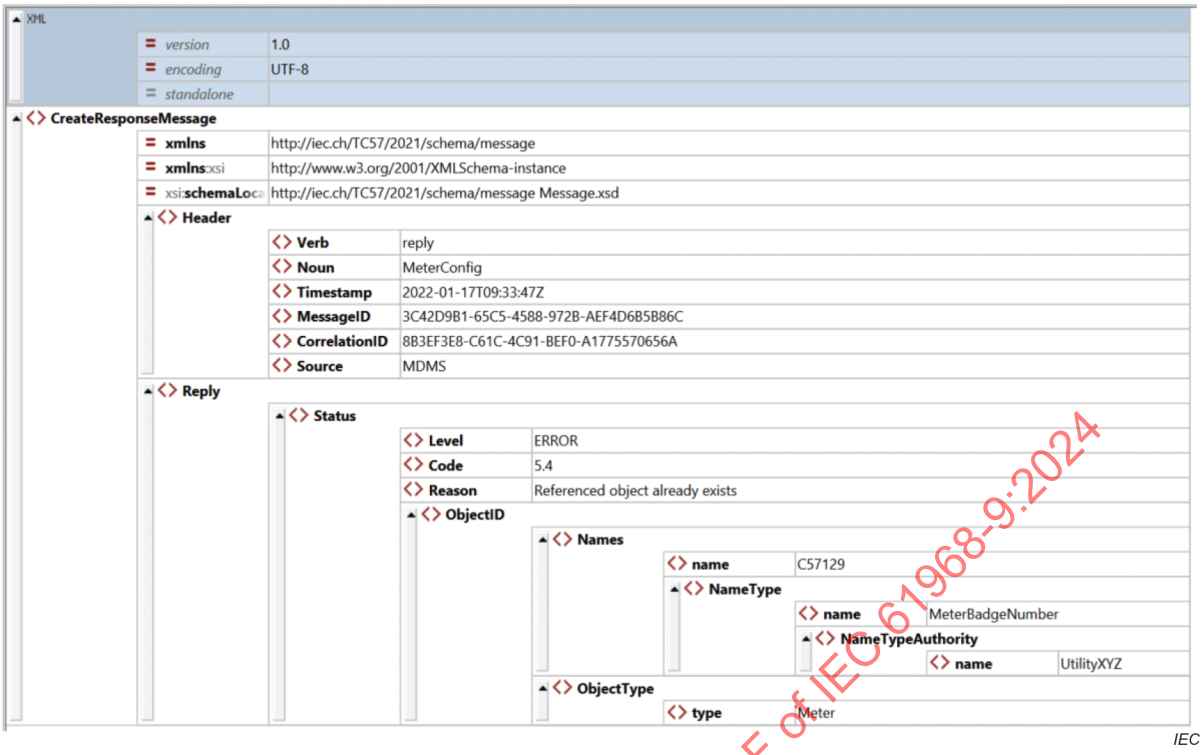


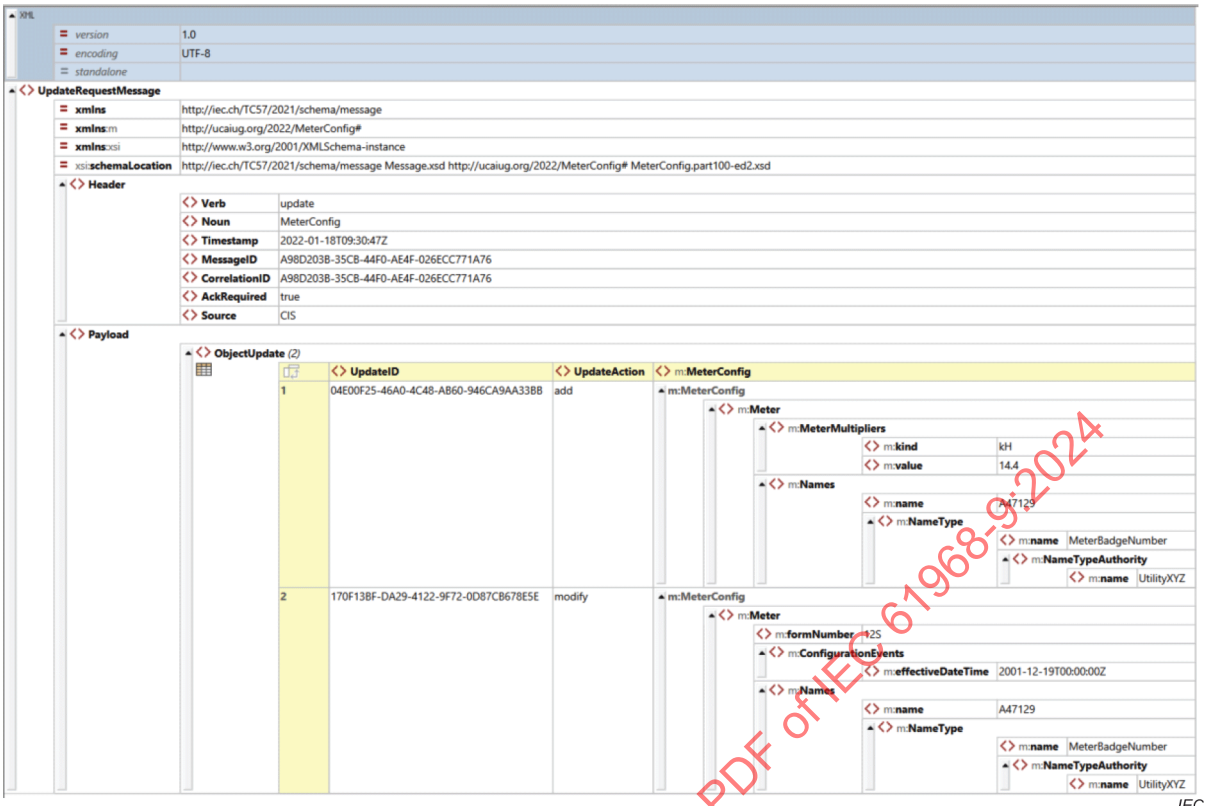
Figure J.4 reproduced with the permission of UCAIug.

Figure J.4 – Create MeterConfig – Two Meters – Step 4

J.2.6 **Update MeterConfig** (add MeterMultipliers, modify formNumber and ConfigurationEvent) **– Step 1**

The first step for updating a meter configuration using MeterConfig message is illustrated in Figure J.5.

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IEC

Figure J.5 reproduced with the permission of UCAIug.

Figure J.5 – Create MeterConfig – Update MeterConfig (add MeterMultiplies, modify formNumber and ConfigurationEvent) Step 1

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J.2.7 **Update MeterConfig** (add MeterMultipliers, modify formNumber and ConfigurationEvent) **– Step 2**

The second step for updating a meter configuration using MeterConfig message is illustrated in Figure J.6.

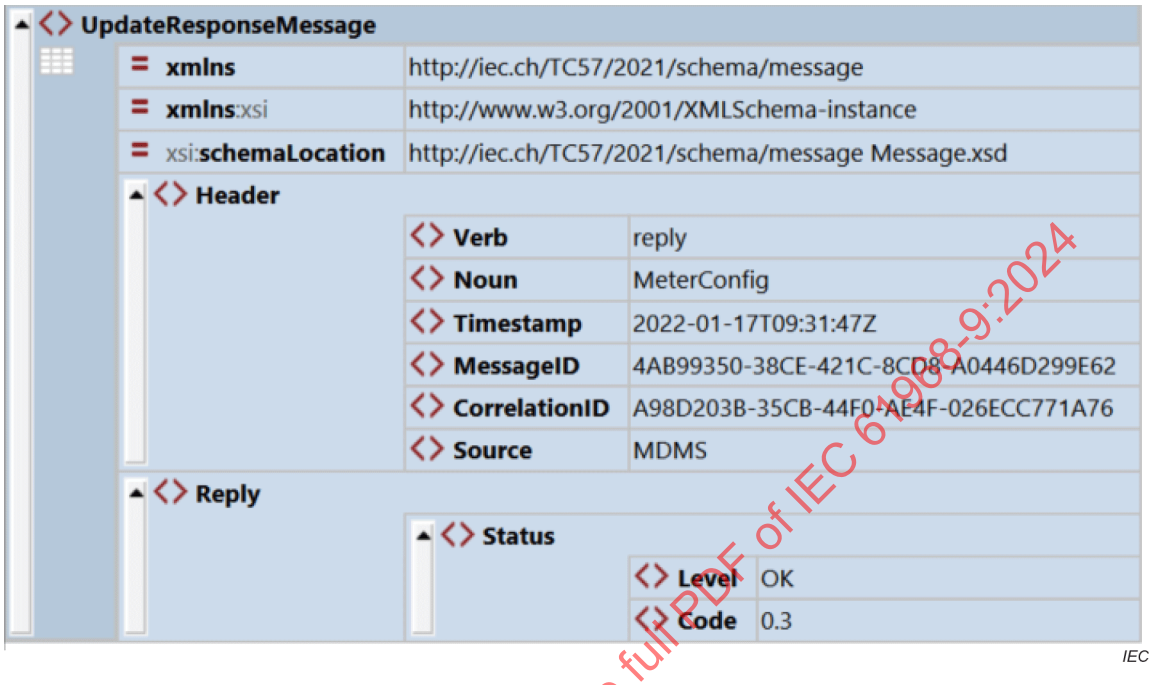


Figure J.6 reproduced with the permission of UCAIug.

Figure J.6 – Update MeterConfig (add MeterMultiplies, modify formNumber and ConfigurationEvent) Step 2

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J.2.8 **Update MeterConfig** (add MeterMultipliers, modify formNumber and ConfigurationEvent) **– Step 3**

The third step for updating a meter configuration using MeterConfig message is illustrated in Figure J.7.

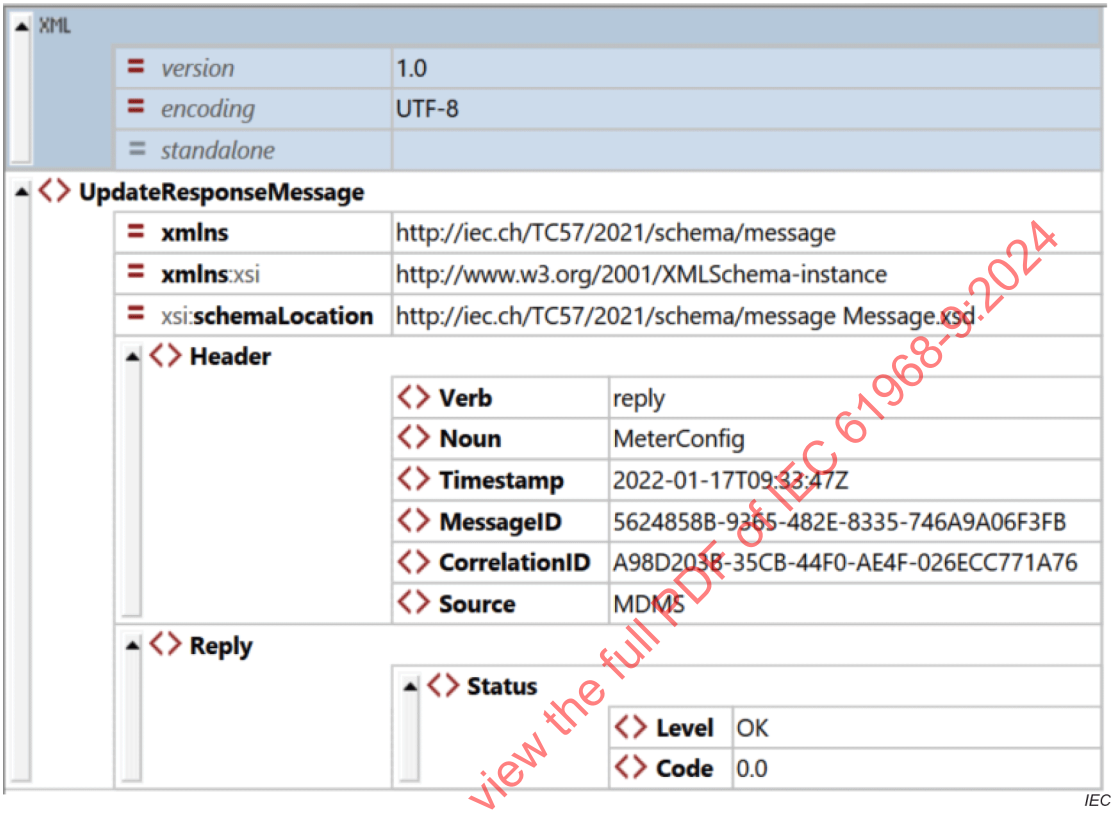


Figure J.7 reproduced with the permission of UCAIug.

Figure J.7 – Update MeterConfig (add MeterMultiplies, modify formNumber and ConfigurationEvent) Step 3

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J.2.9 **UpdateMeterConfig** (add MeterMultipliers, modify formNumber and ConfigurationEvent) **– Step 4**

The fourth step for updating a meter configuration using MeterConfig message is illustrated in Figure J.8.

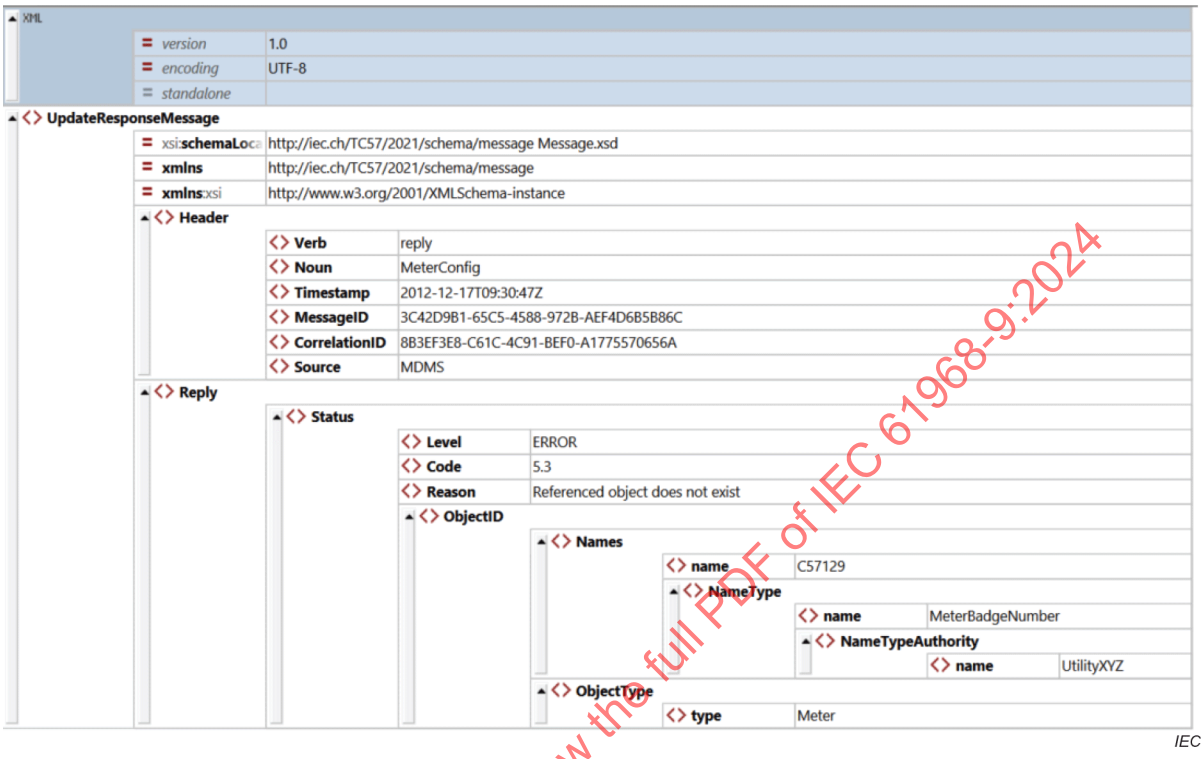


Figure J.8 reproduced with the permission of UCAIug.

Figure J.8 – Update MeterConfig (add MeterMultiplies, modify formNumber and ConfigurationEvent) Step 4

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J.2.10 **Update MeterConfig** (delete details) **– Step 1**

The first step for deleting a meter configuration using a MeterConfig message is illustrated in Figure J.9. This use case deletes information concerning a Meter – not the Meter itself.

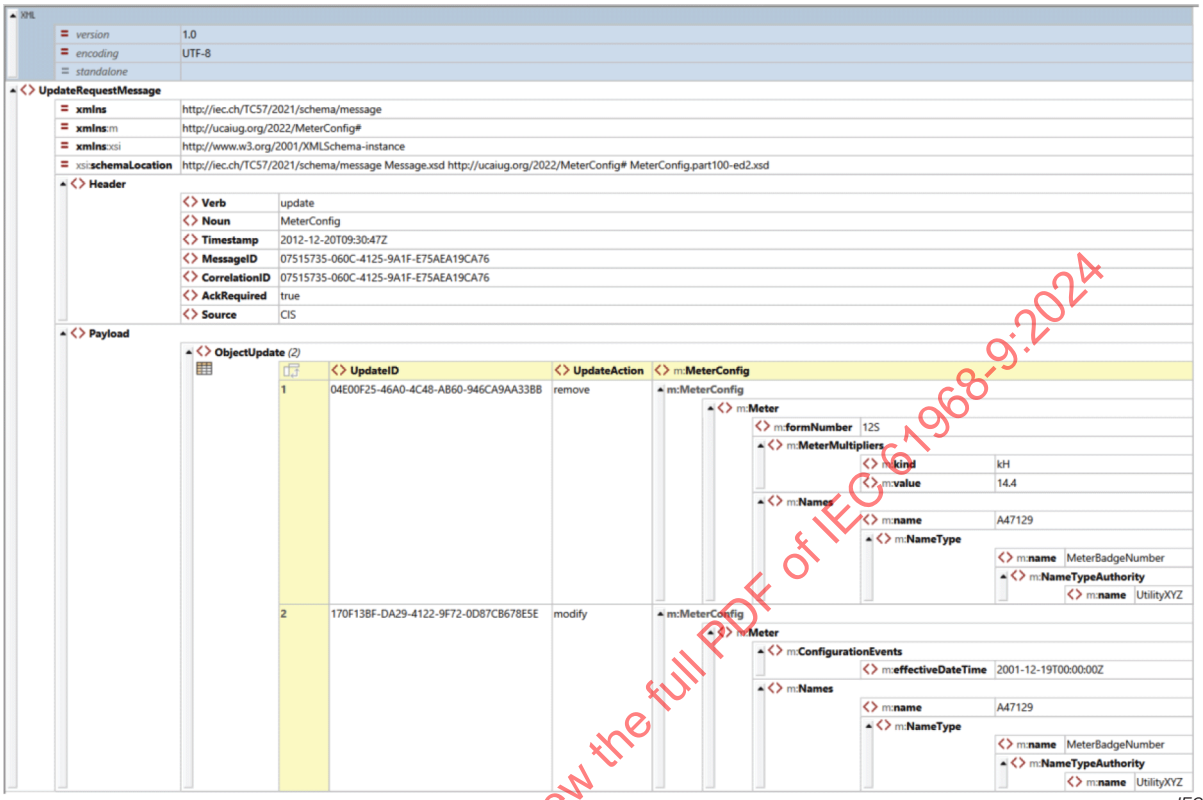


Figure J.9 reproduced with the permission of UCAIug.

Figure J.9 – Update MeterConfig (delete details) – Step 1

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J.2.11 **Update MeterConfig** (delete details) **– Step 2**

The first step for deleting a meter configuration using a MeterConfig message is illustrated in Figure J.10.

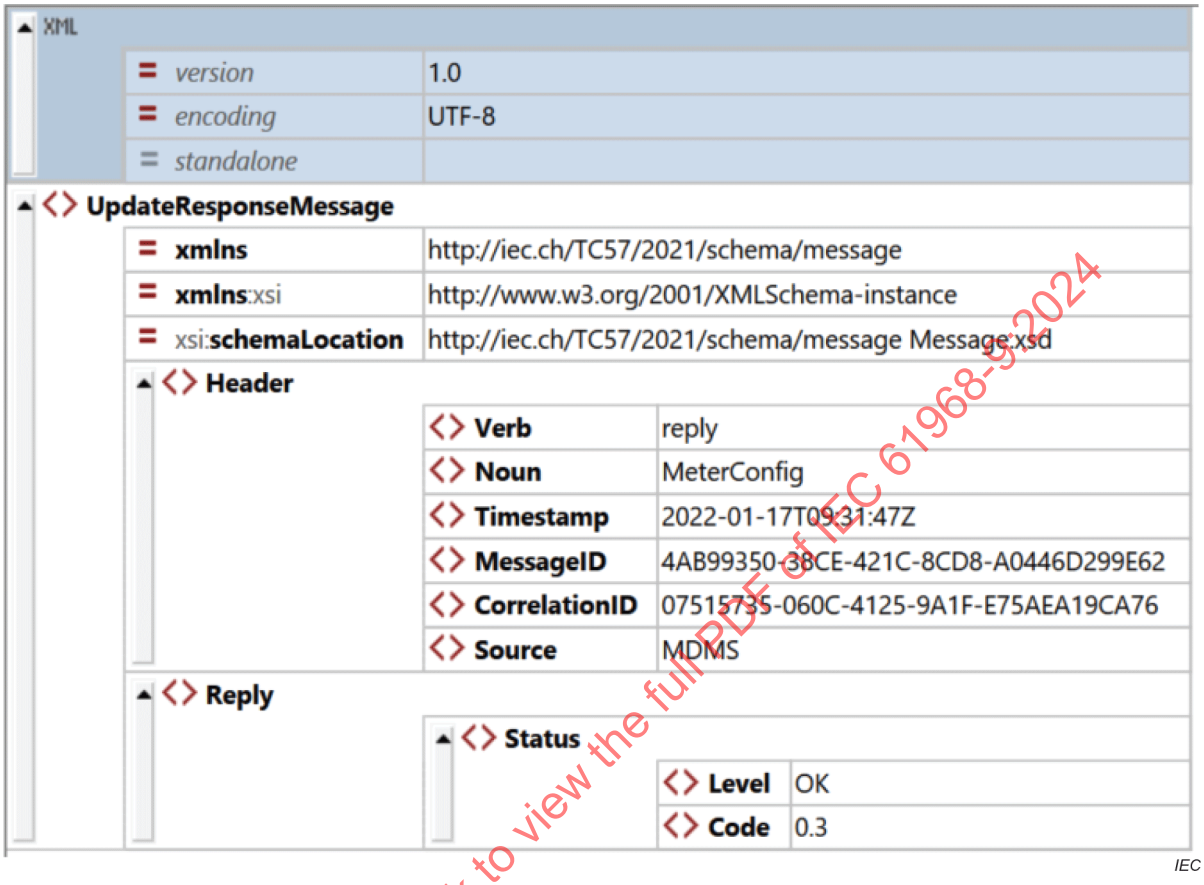


Figure J.10 reproduced with the permission of UCAIug.

Figure J.10 – Update MeterConfig (delete details) – Step 2

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J.2.12 **Update MeterConfig** (delete details) **– Step 3**

The third step for deleting a meter configuration using a MeterConfig message is illustrated in Figure J.11.

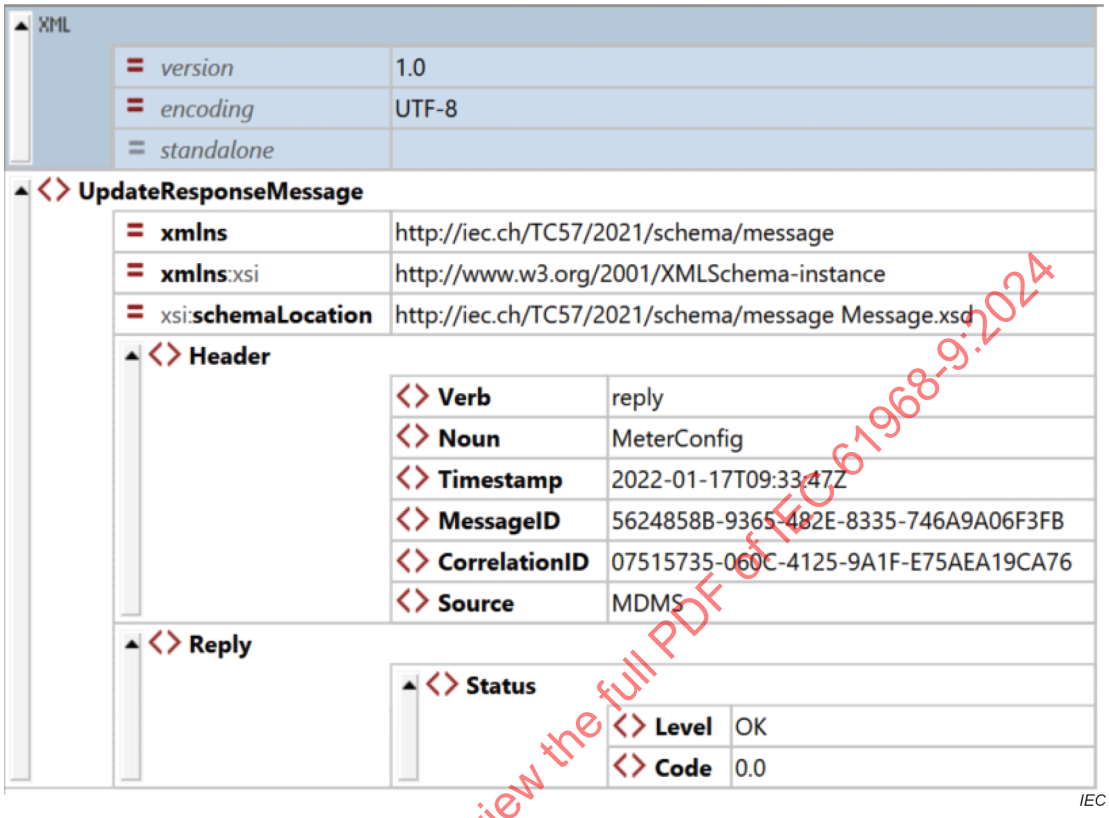


Figure J.11 reproduced with the permission of UCAIug.

Figure J.11 – Update MeterConfig (delete details) – Step 3

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J.2.13 **Update MeterConfig** (delete details) **– Step 4**

The fourth step for deleting a meter configuration using a MeterConfig message is illustrated in Figure J.12.

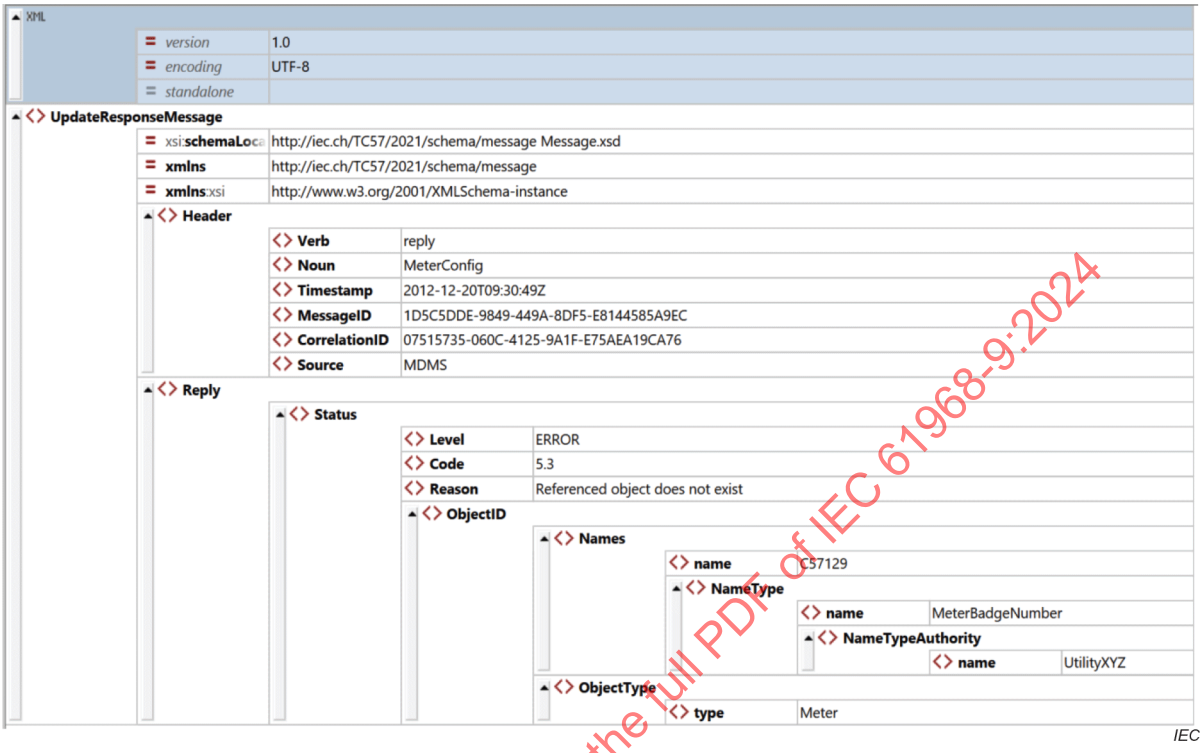


Figure J.12 reproduced with the permission of UCAIug.

Figure J.12 – Update MeterConfig (delete details) – Step 4

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J.2.14 Delete MeterConfig – Step 1

The first step for deleting a meter is illustrated in Figure J.13.

This use case deletes the Meter itself – not just information concerning a Meter. Note that this may involve marking the meter as deleted rather than actually purging it from a system.

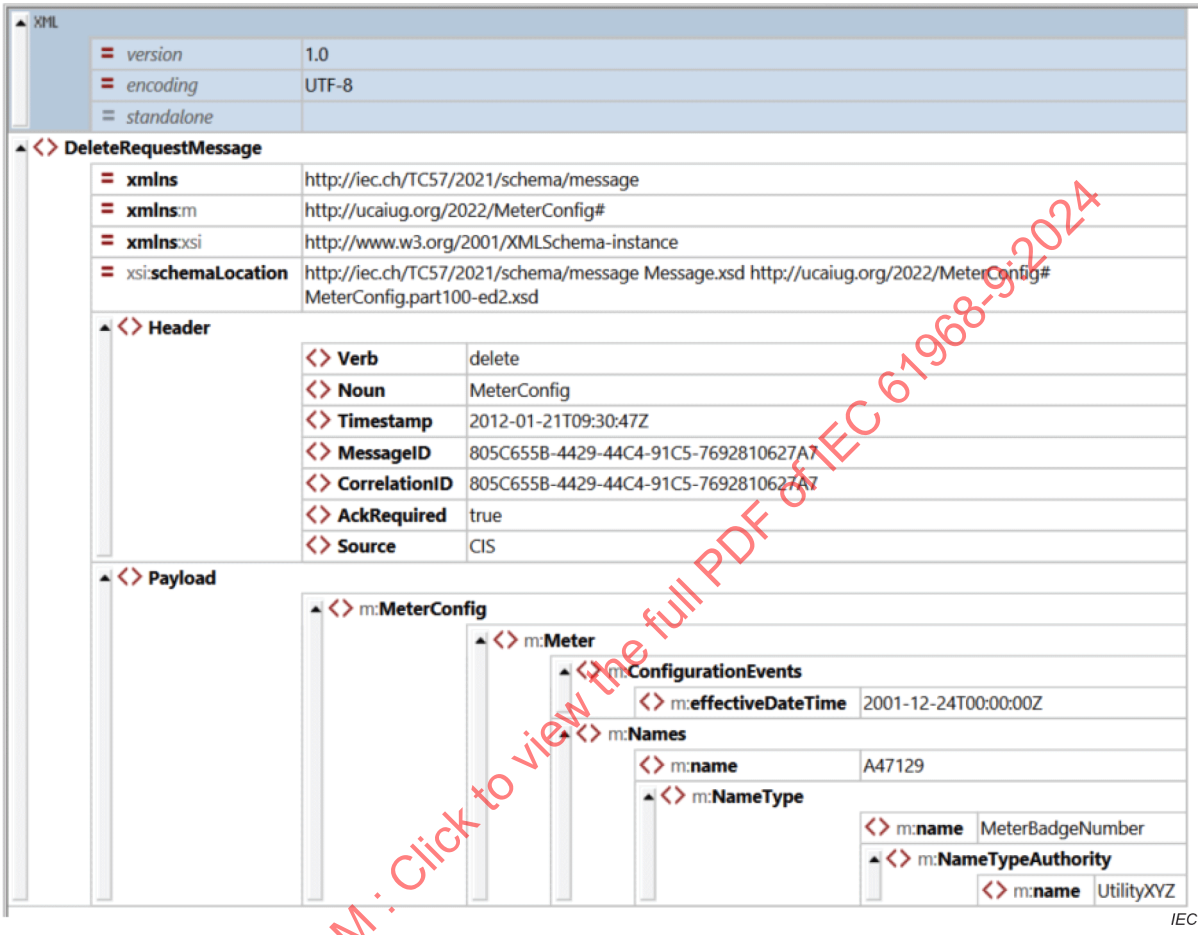


Figure J.13 reproduced with the permission of UCAIug.

Figure J.13 – Delete MeterConfig – Step 1

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J.2.15 Delete MeterConfig – Step 2

The second step for deleting a meter is illustrated in Figure J.14.

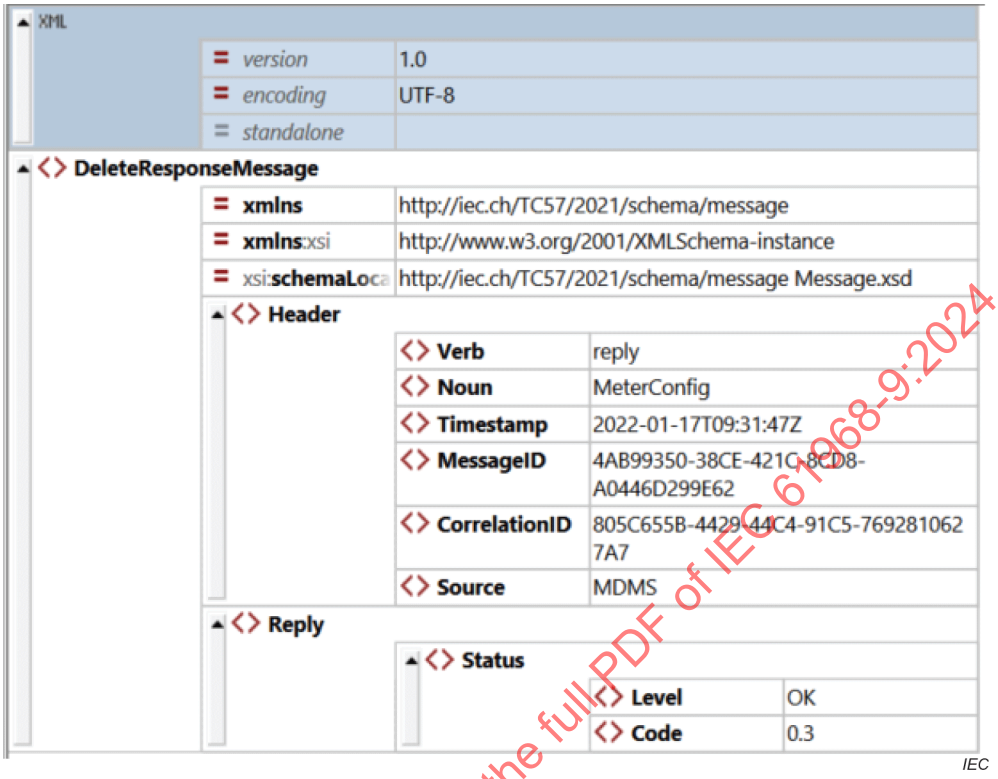


Figure J.14 reproduced with the permission of UCAIug.

Figure J.14 – Delete MeterConfig – Step 2

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J.2.16 Delete MeterConfig – Step 3

The third step for deleting a meter is illustrated in Figure J.15.

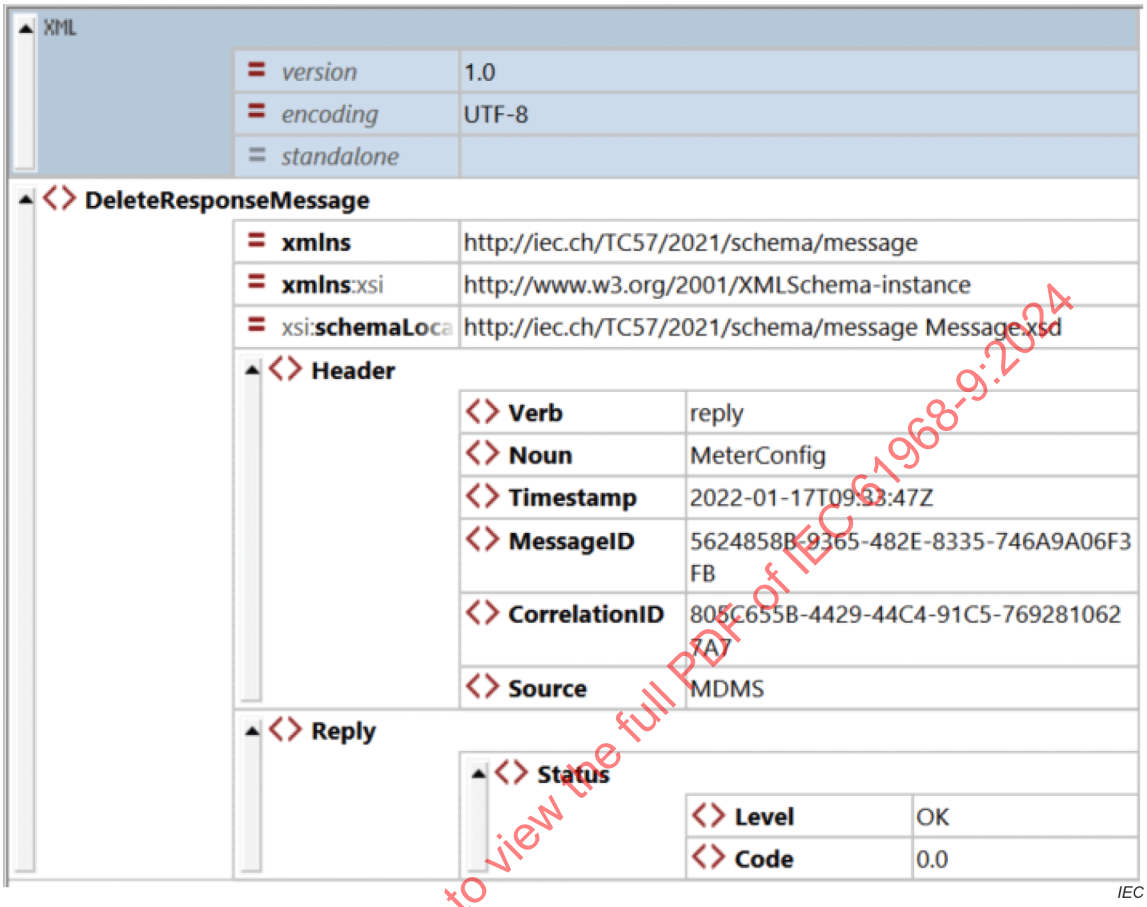


Figure J.15 reproduced with the permission of UCAIug.

Figure J.15 – Delete MeterConfig – Step 3

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J.2.17 Delete MeterConfig – Step 4

The fourth step for deleting a meter is illustrated in Figure J.16.

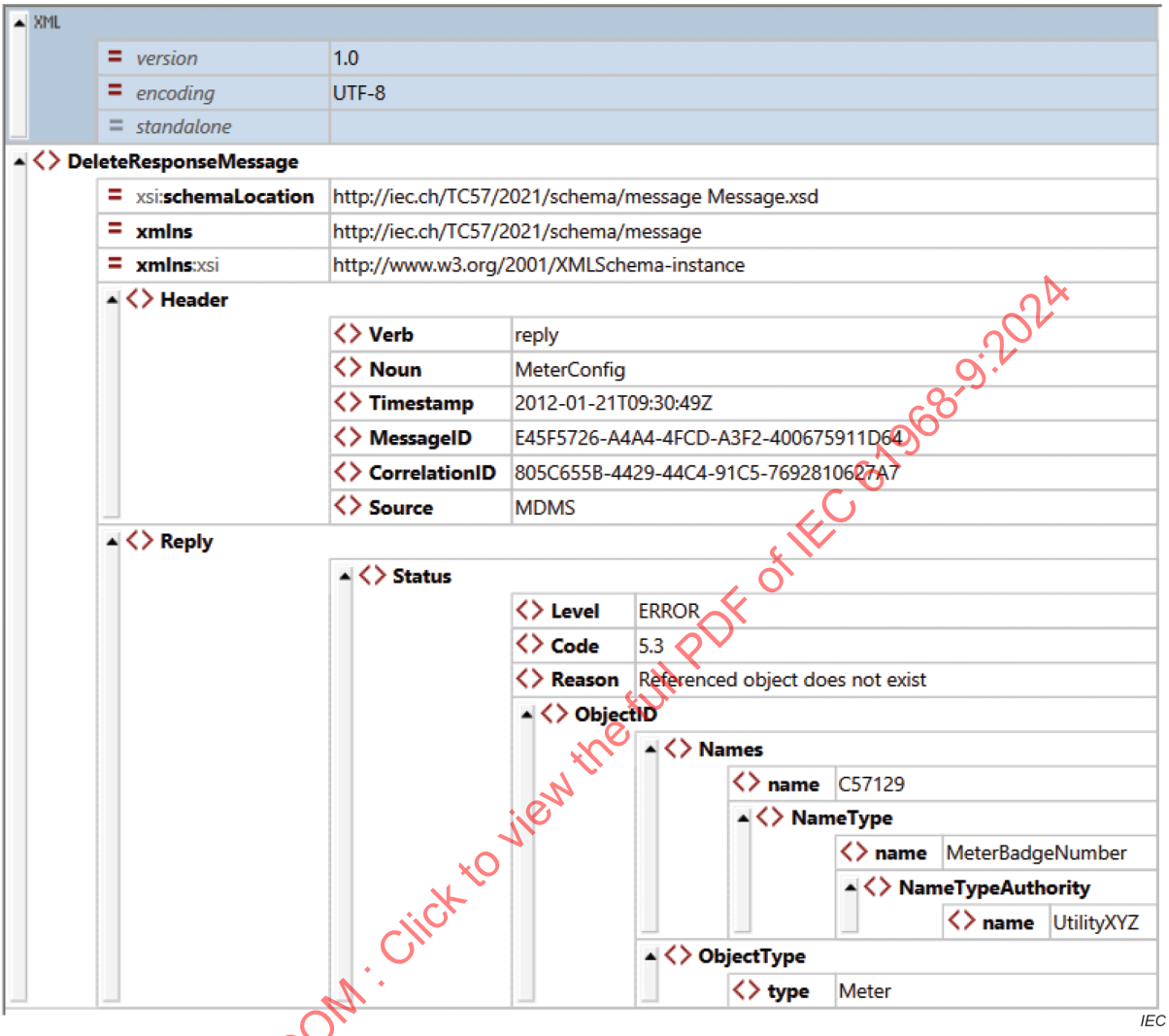


Figure J.16 reproduced with the permission of UCAIug.

Figure J.16 – Delete MeterConfig – Step 4

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J.2.18 Create UsagePointConfig – Step 1

The first step for instantiating a usage point using a UsagePointConfig message is illustrated in Figure J.17.

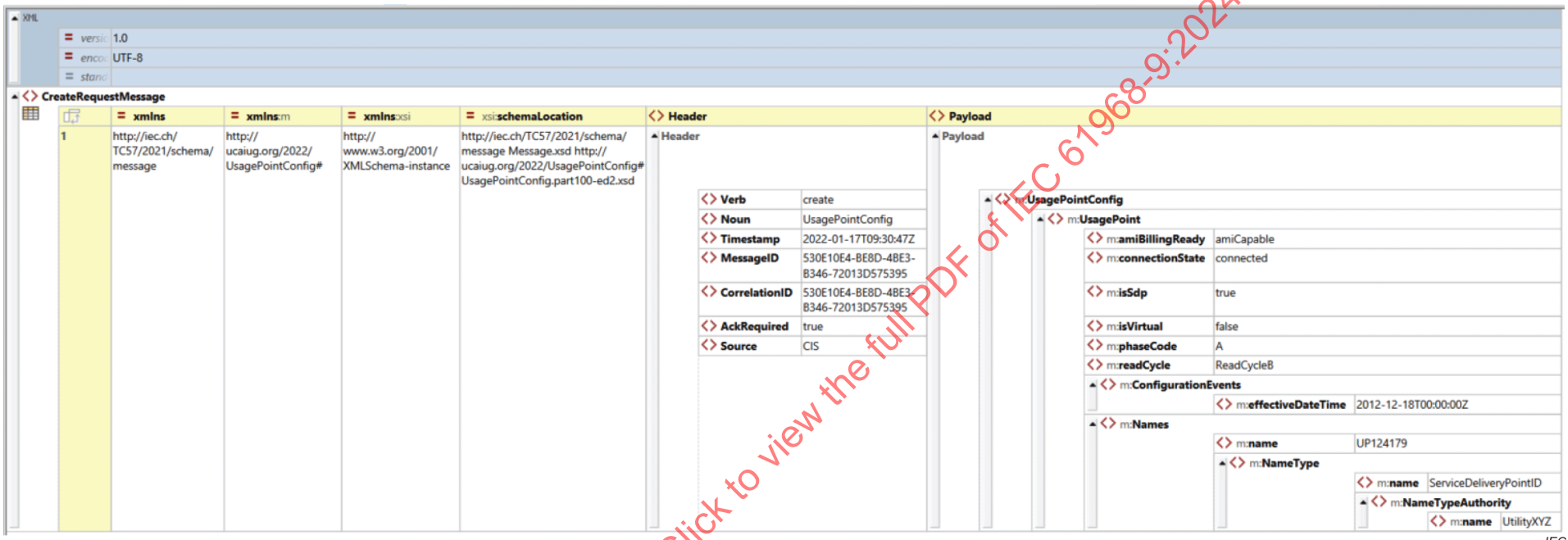


Figure J.17 reproduced with the permission of UCAIug.

Figure J.17 – Create UsagePointConfig – Step 1

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J.2.19 Create UsagePointConfig – Step 2

The second step for instantiating a usage point using a UsagePointConfig message is illustrated in Figure J.18.

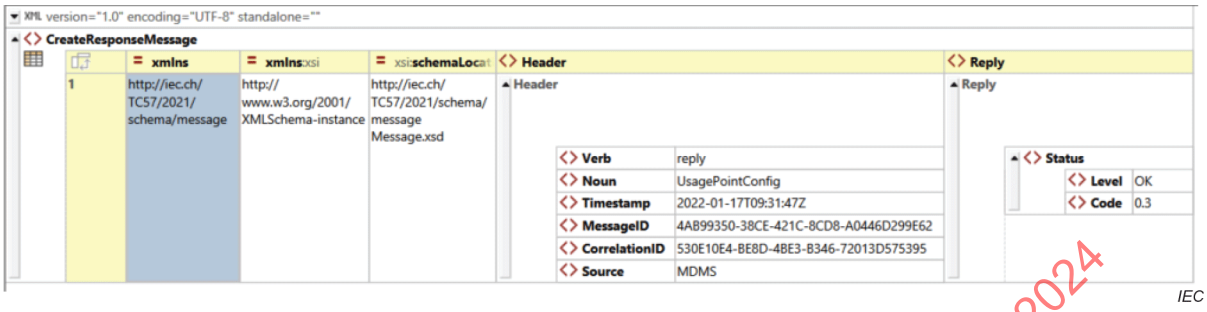


Figure J.18 reproduced with the permission of UCAIug.

Figure J.18 – Create UsagePointConfig – Step 2

J.2.20 Create UsagePointConfig – Step 3

The third step for instantiating a usage point using a UsagePointConfig message is illustrated in Figure J.19.

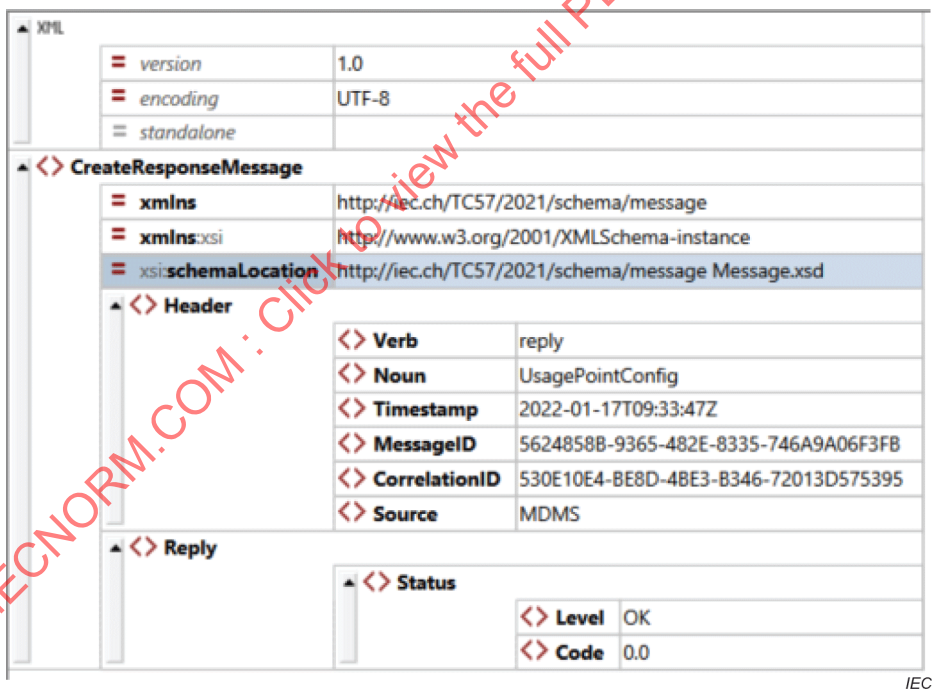


Figure J.19 reproduced with the permission of UCAIug.

Figure J.19 – Create UsagePointConfig – Step 3

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J.2.21 Create UsagePointConfig – Step 4

The fourth step for instantiating a usage point using a UsagePointConfig message is illustrated in Figure J.20.

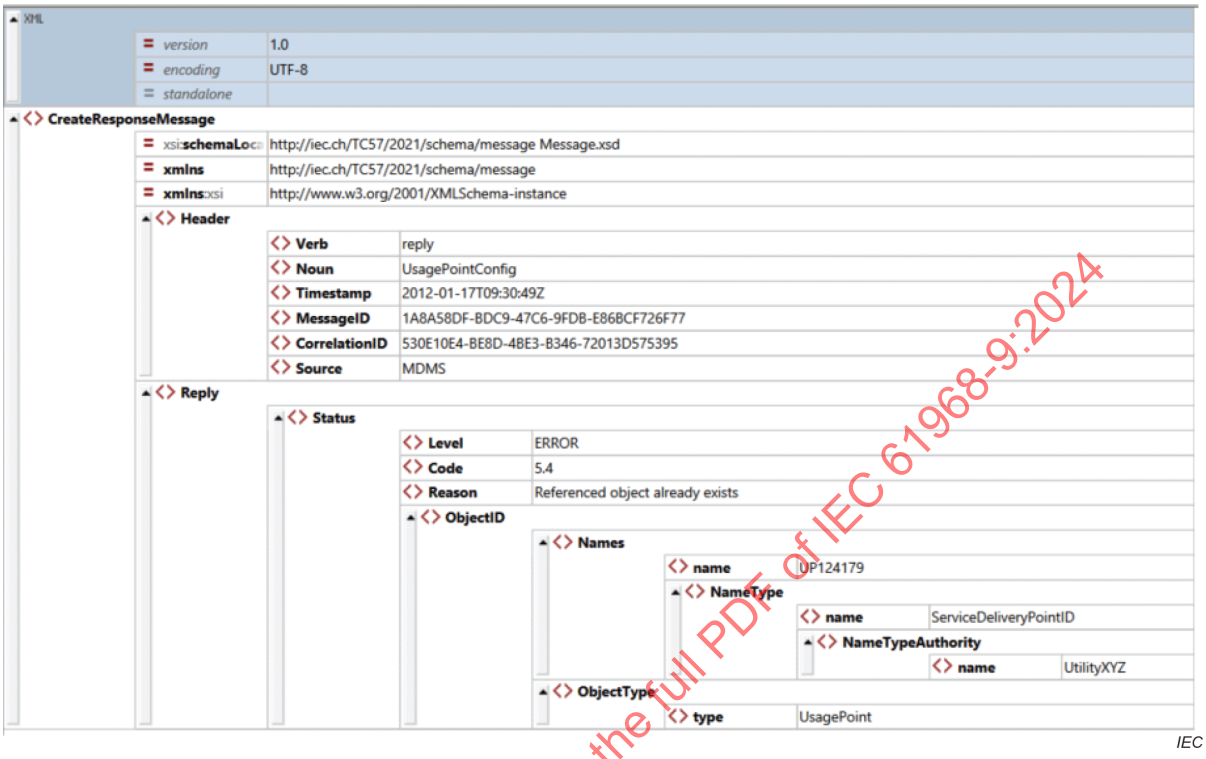


Figure J.20 reproduced with the permission of UCAIug.

Figure J.20 – Create UsagePointConfig – Step 4

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J.2.22 Create MasterDataLinkageConfig – Step 1

The first step in creating linkages to reflect a meter installation is shown in Figure J.21.

This use case links the previously created Meter with the previously created UsagePoint (reflecting a meter installation).

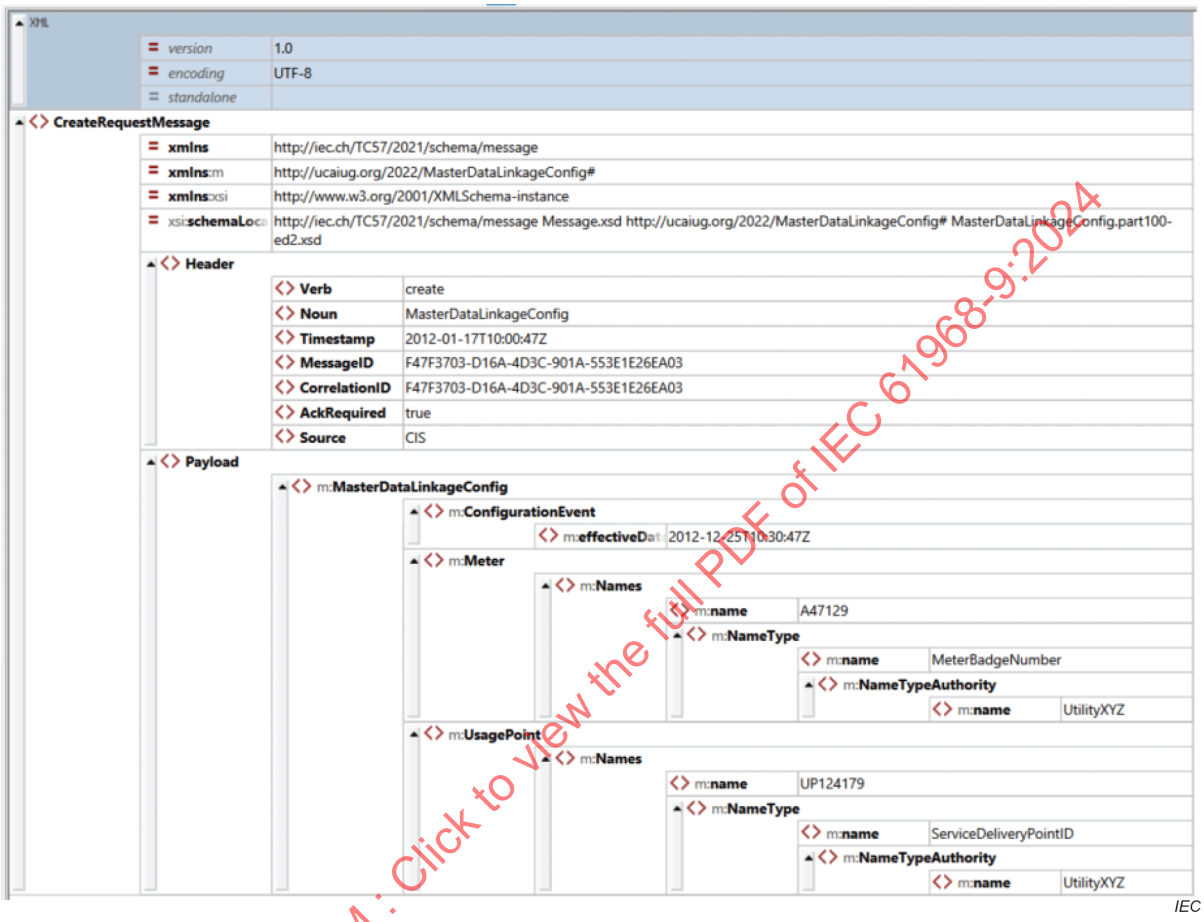


Figure J.21 reproduced with the permission of UCAIug.

Figure J.21 – Create MasterDataLinkageConfig – Step 1

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J.2.23 Create MasterDataLinkageConfig – Step 1

The second step in creating linkages to reflect a meter installation is shown in Figure J.22.

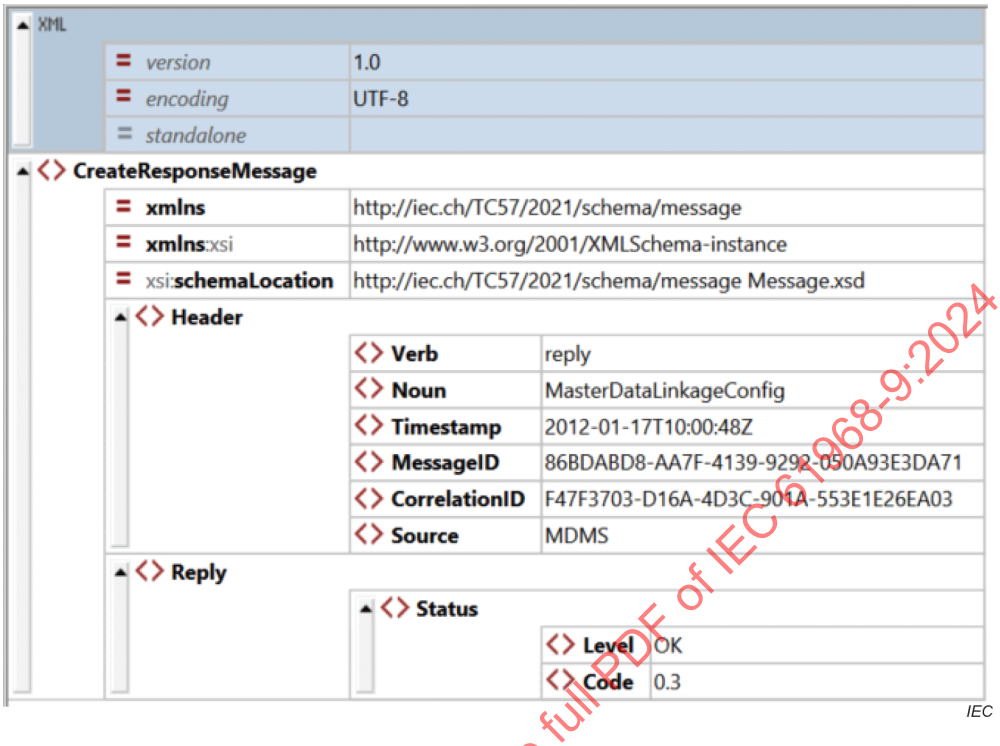


Figure J.22 reproduced with the permission of UCAIug.

Figure J.22 – Create MasterDataLinkageConfig – Step 2

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J.2.24 Create MasterDataLinkageConfig – Step 3

The third step in creating linkages to reflect a meter installation is shown in Figure J.23.

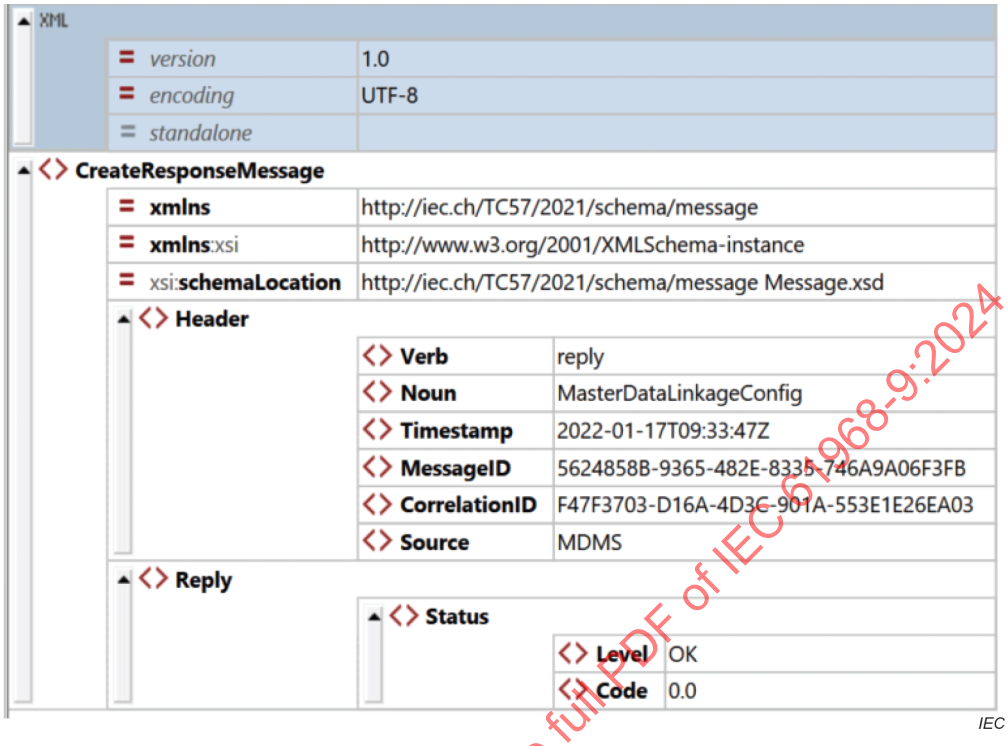


Figure J.23 reproduced with the permission of UCAIug.

Figure J.23 – Create MasterDataLinkageConfig – Step 3

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J.2.25 Create MasterDataLinkageConfig – Step 4

The fourth step in creating linkages to reflect a meter installation is shown in Figure J.24.

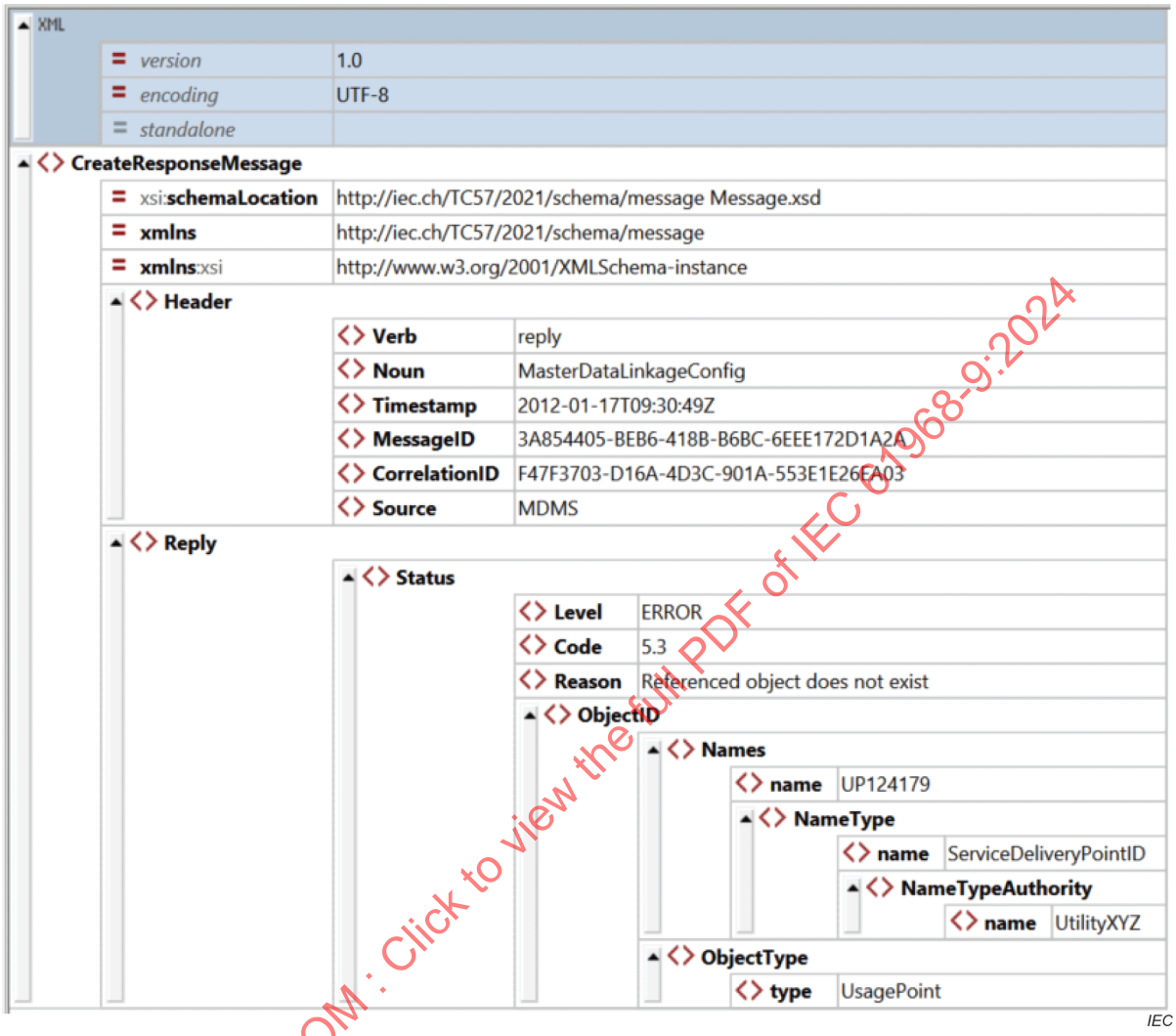


Figure J.24 reproduced with the permission of UCAIug.

Figure J.24 – Create MasterDataLinkageConfig – Step 4

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J.2.26 Delete MasterDataLinkageConfig – Step 1

The first step in destroying linkages is shown in Figure J.25. This reflects a meter removal.

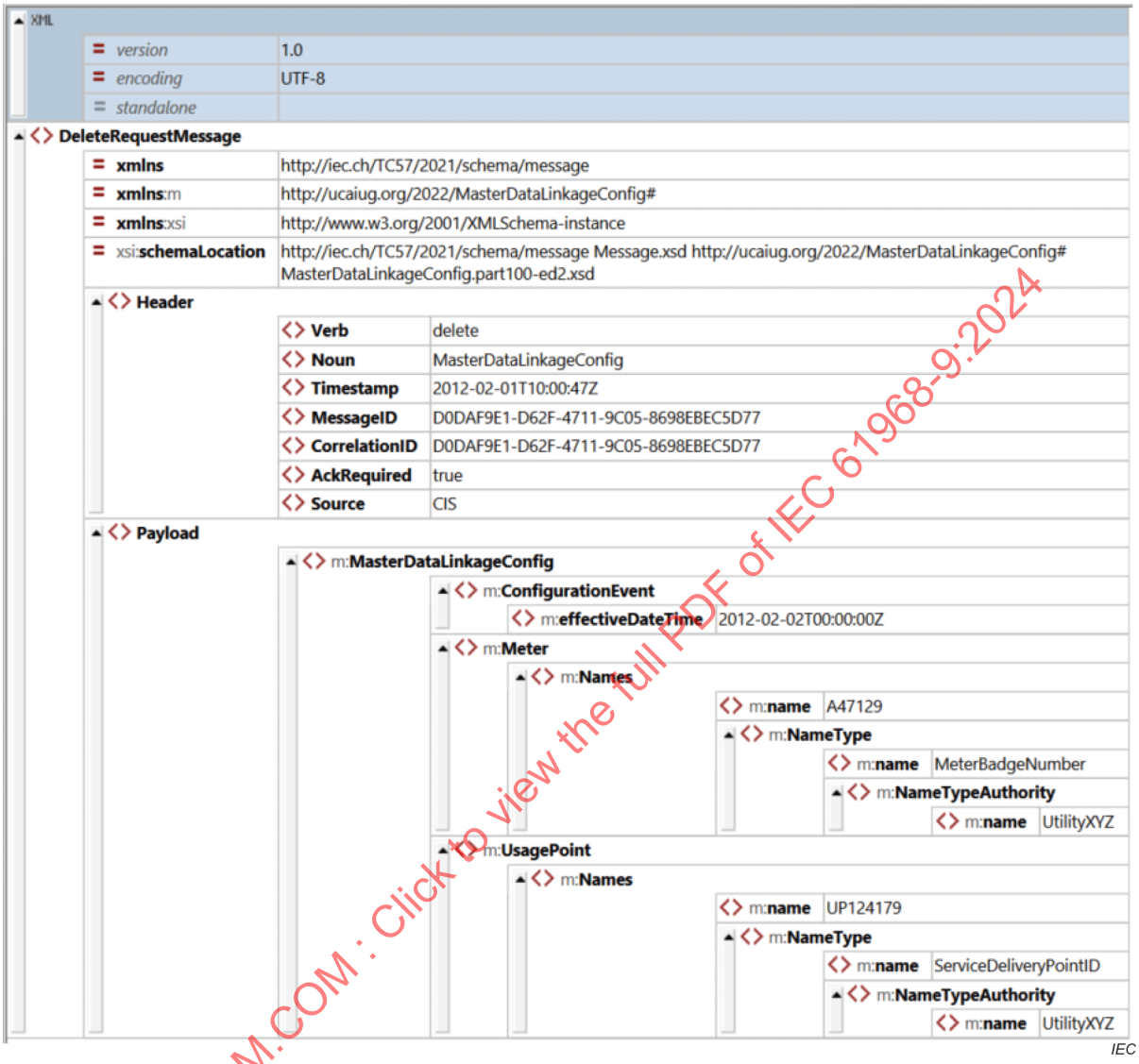


Figure J.25 reproduced with the permission of UCAIug.

Figure J.25 – Delete MasterDataLinkageConfig – Step 1

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J.2.27 Delete MasterDataLinkageConfig – Step 2

The second step in destroying linkages is shown in Figure J.26.

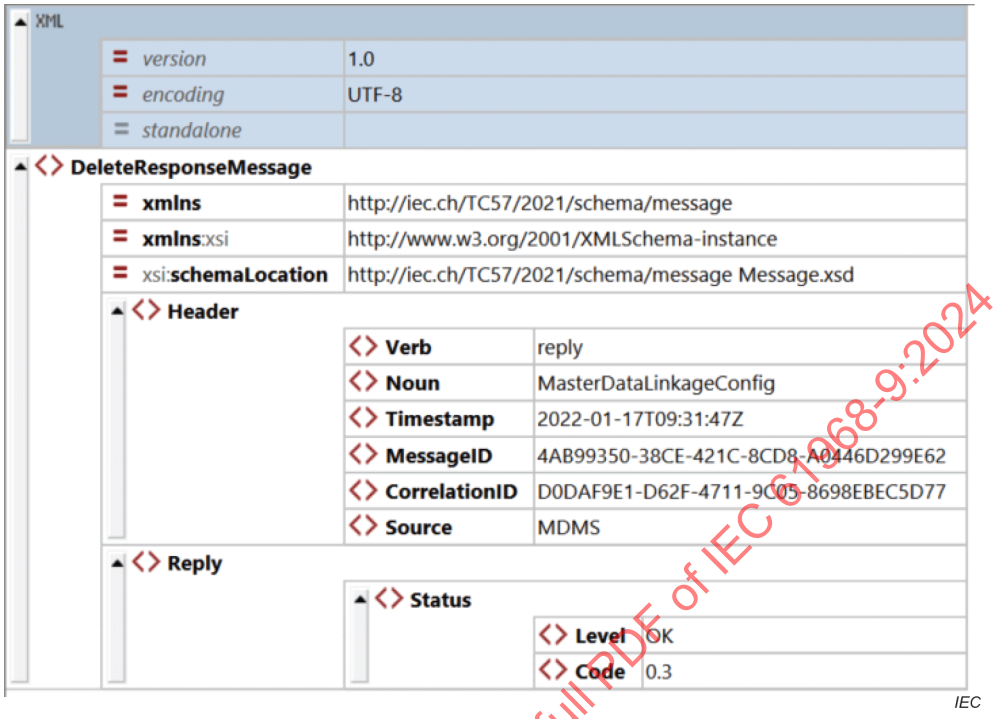


Figure J.26 reproduced with the permission of UCAIug.

Figure J.26 – Delete MasterDataLinkageConfig – Step 2

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J.2.28 Delete MasterDataLinkageConfig – Step 3

The third step in destroying linkages is shown in Figure J.27

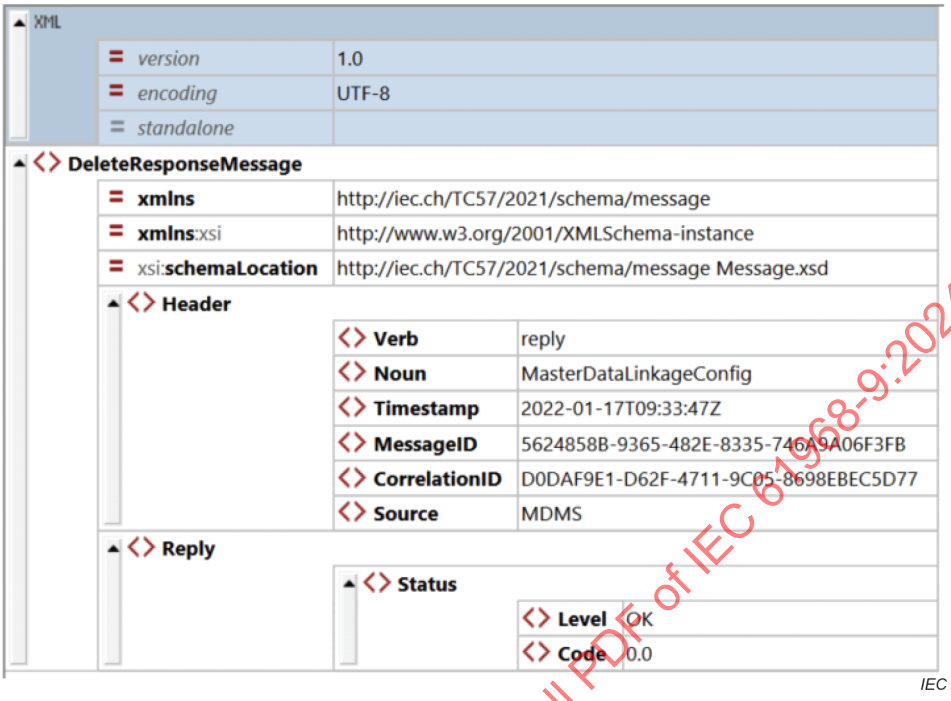


Figure J.27 reproduced with the permission of UCAIug.

Figure J.27 – Delete MasterDataLinkageConfig – Step 3

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J.2.29 Delete MasterDataLinkageConfig – Step 4

The fourth step in destroying linkages is shown in Figure J.28.

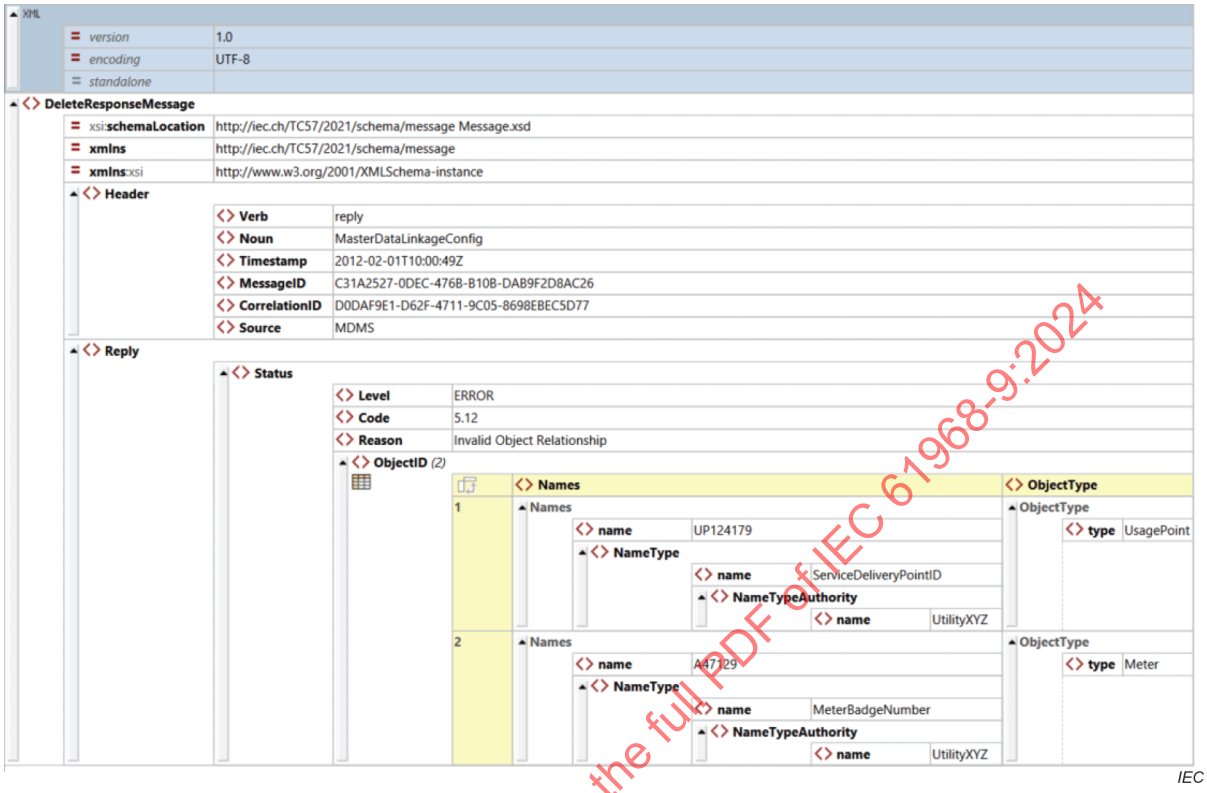


Figure J.28 reproduced with the permission of UCAIug.

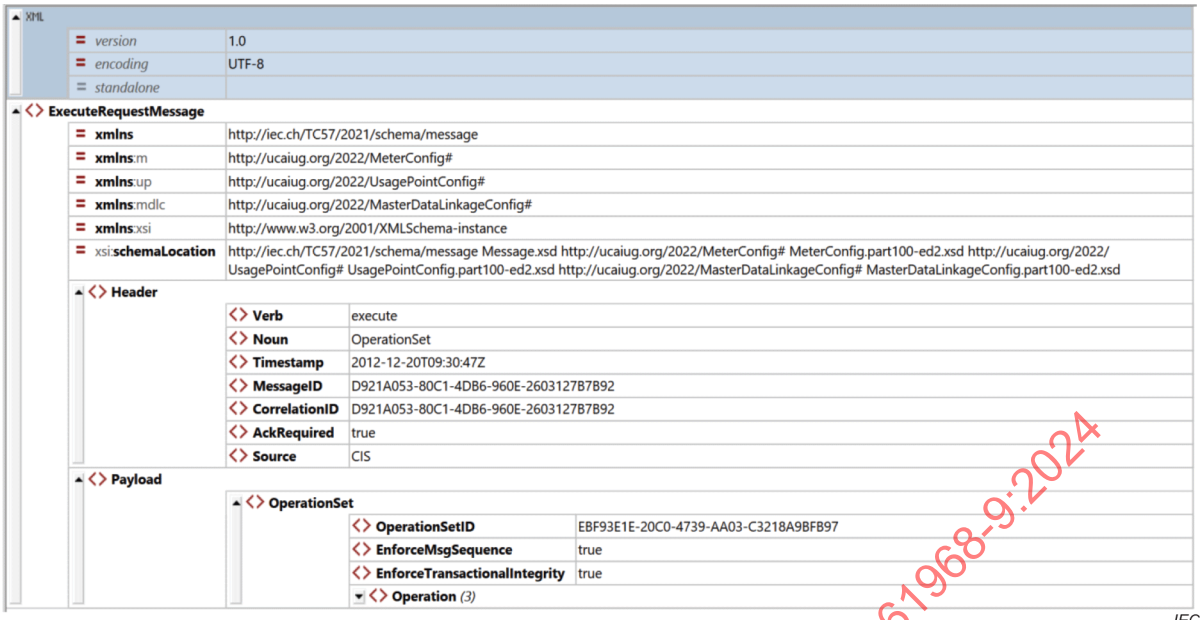
Figure J.28 – Delete MasterDataLinkageConfig – Step 4

J.2.30 Execute OperationSet – Step 1

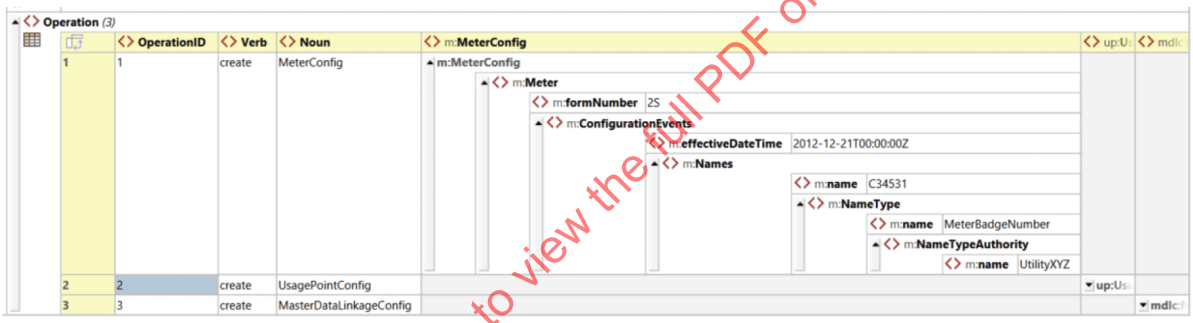
This use case utilizes an Operation Set to first create a Meter, then create a UsagePoint, and then link the Meter and the UsagePoiint (reflecting a meter installation). In essence, it performs the same functions as several of the previous use cases, but does so in a single message. This example uses the appropriate Booleans to ensure that the steps are executed in the prescribed order and that all three steps shall succeed or the entire transaction shall fail.

The first step in this process is depicted in Figure J.29. This figure is large with the ExecuteRequestMessage shown in a segment above the Operation payload. The Operation payload consists of three elements, each of which are expanded in turn in the segments which follow.

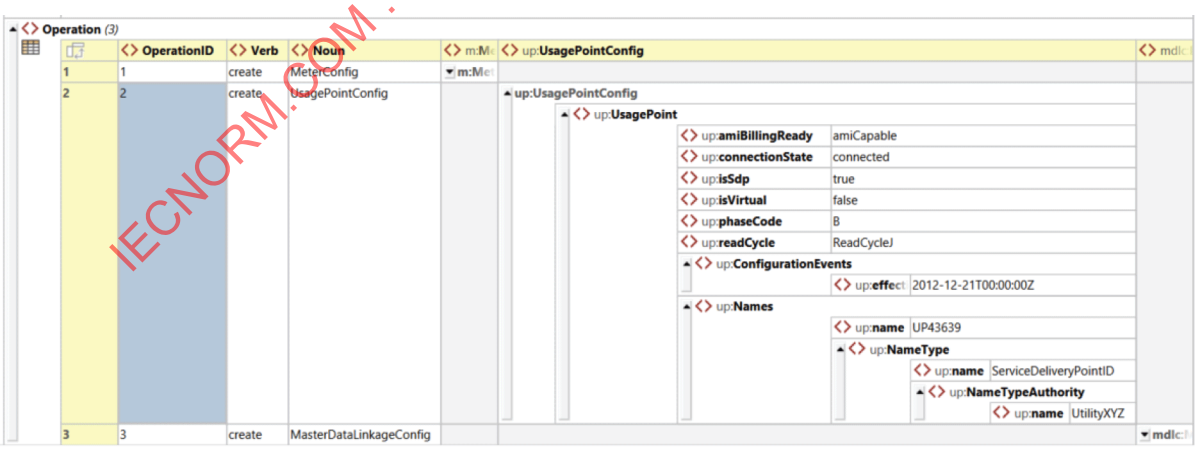
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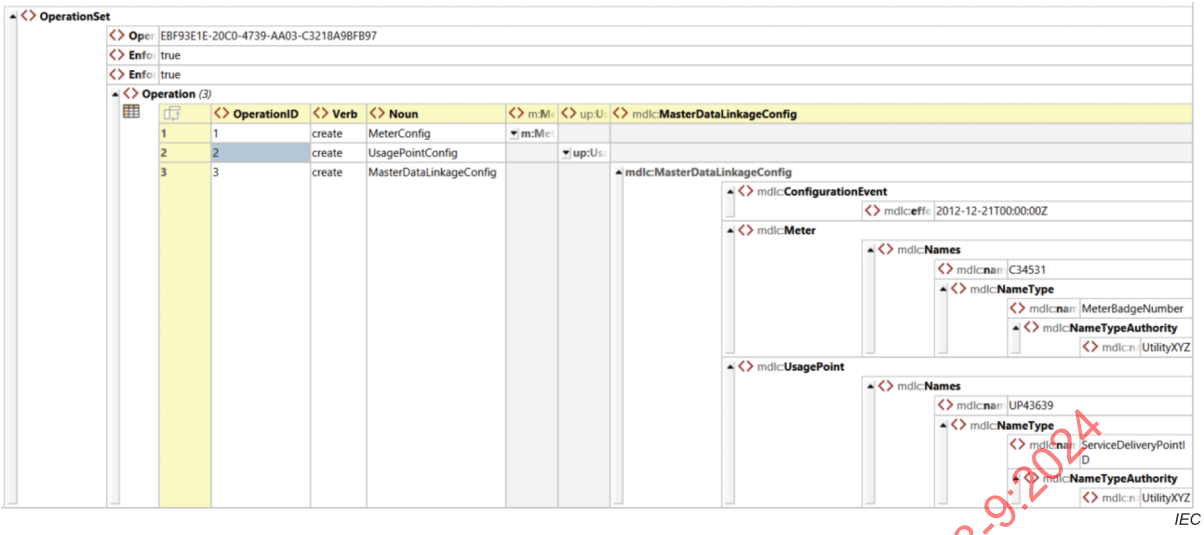


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Figure J.29 – Execute OperationSet – Step 1

J.2.31 Execute OperationSet – Step 2

The second step for executing the OperationSet is illustrated in Figure J.30.

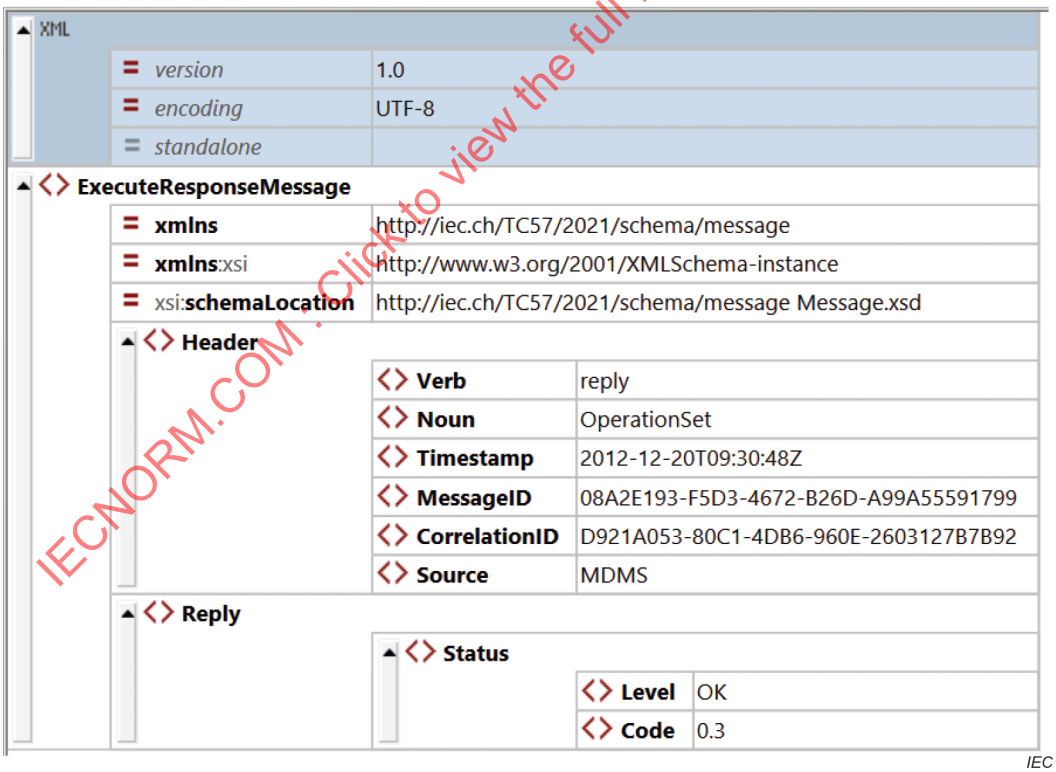


Figure J.30 reproduced with the permission of UCAIug.

Figure J.30 – Execute OperationSet – Step 2

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J.2.32 Execute OperationSet – Step 3

The third step for executing the OperationSet is illustrated in Figure J.31.

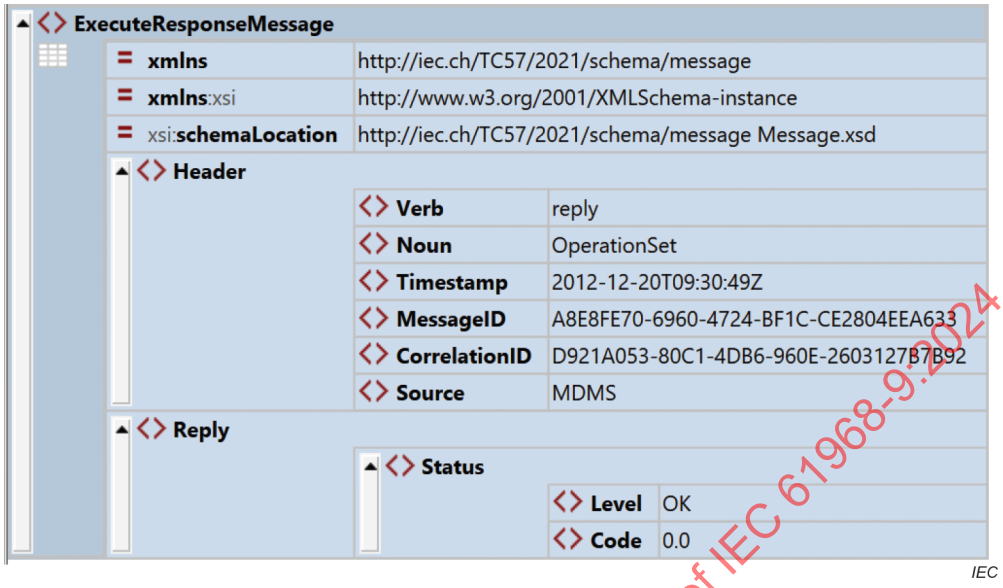


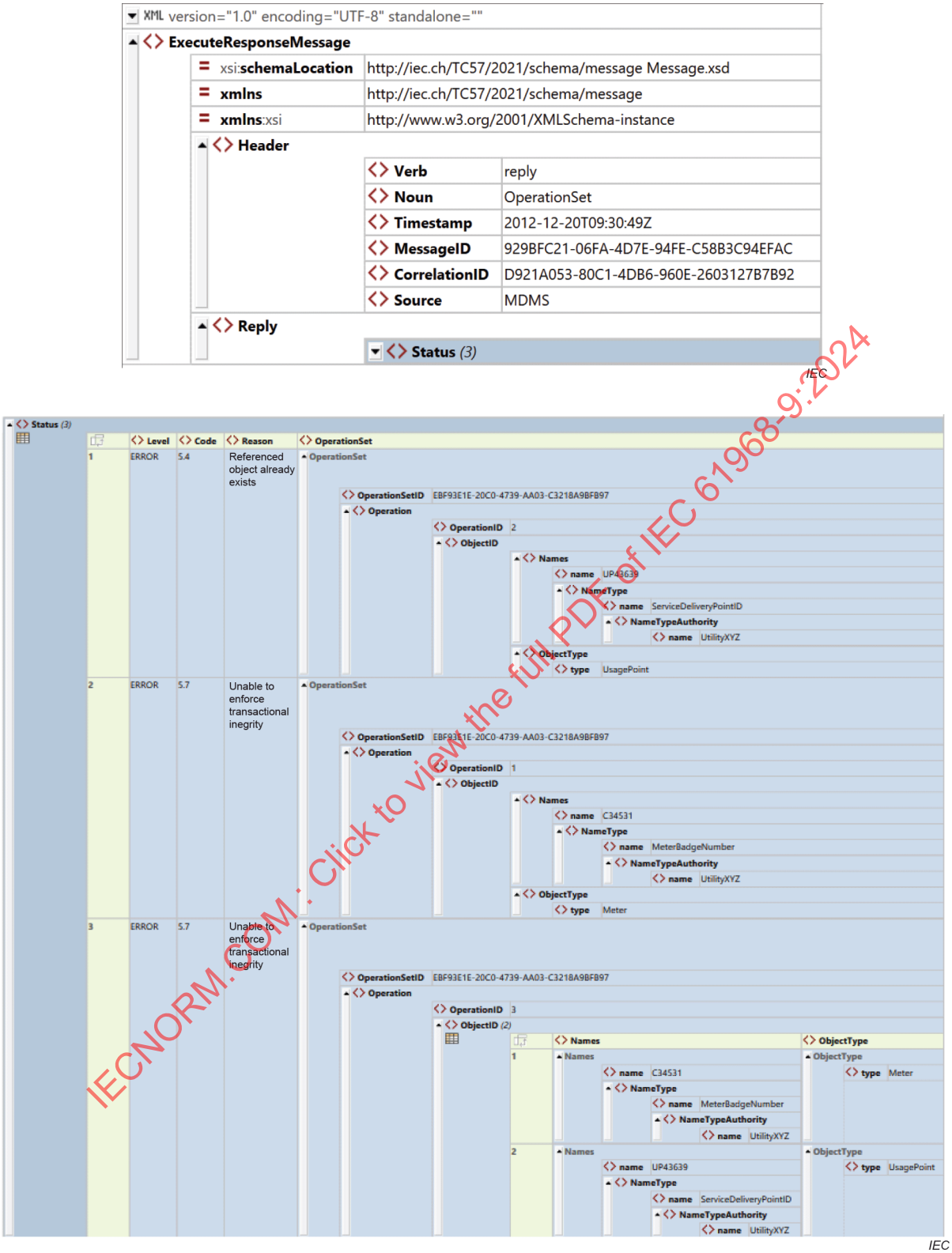
Figure J.31 is reproduced with the permission of UCAIug.

Figure J.31 – Execute OperationSet – Step 3

J.2.33 Execute OperationSet – Step 4

The third step for executing the OperationSet is illustrated in Figure J.32. This figure is a large one with the status element collapsed in the top segment, and shown expanded in the bottom segment.

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Figure J.32 – Execute OperationSet – Step 4

J.2.34 Change ObjectNamesConfig

ObjectNamesConfig has been deprecated. Please refer to IEC 61968-100:2022.

Annex K
(normative)

EUMED Metering UML Model

K.1 EUMED Metering profile and associated European regulation

K.1.1 The EUMED Metering profile

The European Union has released its implementing regulation on interoperability requirements and non-discriminatory and transparent procedures for access to metering and consumption data[2]. This Annex K proposes a customized profile of IEC 61968-9:2023 supporting implementing act requirements. Additional supporting information can be found in Annex L and Annex M. This customized profile is called the EUMED (EUropean My Energy Data) Metering profile. Annex K, Annex L, and Annex M are intended to stand together and operate independent from the other Annexes in this document. These three annexes will appear to be similar to the others, but have been modified specifically for EUMED Metering purposes. Some of the more significant modifications include:

– The profiling methodology is based on IEC 62361-103 Standard Profiling.

– The profiling tool used is MODSARUS©[3], a licence free tool[4] and Sparx Systems Enterprise Architect third party extension.

– Only a subset of IEC 61968-9:2024 functionality is supported by the EUMED Metering profile.

– The use of IEC 61968-100:2022 to carry EUMED Metering profile messages is recommended but not required.

– The CIM UML models used are:

  - Input UML Model:

    iec61970cim17v40_iec61968cim13v13b_iec62325cim03v17b_CIM100.1.1.1.eap

  - Output UML Model

    20220609_EUMEDMetering_iec61970cim17v40_iec61968cim13v13b_iec62325cim03v17b_CIM100.1.1.1.eap

The output UML Model contains the EUMED metering contextual model with several packages created by the MODSARUS© tool. A future implementation guide will describe the tool usage.

The reader should also note that the CIM Name, NameType, and NameTypeAuthority classes have been utilized in the EUMED Metering profile in a way specific to the European regulation.

K.1.2 The Associated European regulation

European Commission develops Implementing Acts (IAs) that further define data interoperability requirements and procedures as stated in Articles 20, 23 and 24 of the Electricity Directive (EU) 2019/944:

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2 https://energy.ec.europa.eu/publications/implementing-regulation-interoperability-requirements-and-non-discriminatory-and-transparent_en

3 Modsarus© is the trade name of a product supplied by Sparx Systems. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4 https://sparxsystems.com/products/3rdparty.html#modsarus

– Article 24(1) states: *"In order to promote competition in the retail market and to avoid excessive administrative costs for the eligible parties, Member States shall facilitate the full interoperability of energy services within the Union."*

– Article 24(2) states: *"The Commission shall adopt, by means of implementing acts, interoperability requirements and non-discriminatory and transparent procedures for access to data referred to in Article 23(1)."*

– Article 23(1) states *"When laying down the rules regarding the management and exchange of data, Member States or, where a Member State has so provided, the designated competent authorities shall specify the rules on the access to data of the final customer by eligible parties in accordance with this Article and the applicable Union legal framework. For the purpose of this Directive, data shall be understood to include metering and consumption data as well as data required for customer switching, demand response and other services."*

IEC 62325-451-10 was published as an IEC standard in 2020 and is named the "EUMED (EUropean My Energy Data) Market profile". The "EUMED Metering profile" complements the "EUMED Market profile" as explained in IEC 62325-451-10.

K.2 EUMED Metering global view

A global view of EUMED Metering model is given in this Clause K.2. It can be broadly decomposed in 5 groups of Entities (EUMED Metering entities are generally represented as UML CIM classes with possible restrictions).

– **Root group**: composed of MeterReadingSet class. MeterReadingSet is not a CIM class (pure virtual root). Its purpose is to encapsulate a set of MeterReadings (container of measured values), UsagePoints (points related to the measurements) and ReadingTypes (characterization of the kind of the measured values). If UsagePoint and ReadingType are implicit, they may be omitted and only MeterReadings are given. But, if UsagePoint and ReadingType are present, they are supposed to be referred to by MeterReadings resp. by IntervalBlocks. In case of multiple UsagePoints and ReadingTypes, this means that the value container may contain measured values related to several UsagePoints and several ReadingTypes.

– **Meter Reading group**: composed of MeterReading, Meter, Customer and IntervalBlock classes. MeterReading is a CIM class (restriction on attributes: isCoincidentTrigger attribute is not used) giving the period of measurement (valuesInterval) for a given point (reference to UsagePoint). It has optional and limited capabilities of identification for outside reference (either mRID or name inherited from Identified object). It may be further characterized by Meter (reference to the physical device) and Customer (reference to the category/kind). IntervalBlock is a CIM class with no capabilities of identification for outside reference. Its only purpose is to allow reference to ReadingType and access to individual readings.

– **Interval Reading group**: composed of IntervalReading and ReadingQuality classes. IntervalReading is the CIM class used to contain the measured value and the time interval of the measurement (value and timePeriod inherited from BaseReading) or the timestamp of the measurement (timestamp inherited from MeasurementValue). It may be associated to several reading quality attributes (association to ReadingQuality). It has optional and limited capabilities of identification for outside reference (either mRID or name inherited from Identified object).

– **Usage Point group**: composed of UsagePoint, UsagePointLocation, Name, NameType and NameTypeAuthority classes. UsagePoint is a CIM class but none of its 20 owned attributes is used. Its purpose is to identify points related to the measurements (using either mRID or name) optionally characterized by a location. mRID (inherited from IdentifiedObject) is the only allowed attribute in the specialization (name, aliasName or description are not allowed). Name / NameType / NameTypeAuthority (association inherited from IdentifiedObject) is restricted to one (this is an alternative way to identify the UsagePoint). Usage point is related to a set of measured values (referenced at the MeterReading level).

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– **Reading Type group**: composed of ReadingType, Name, NameType and NameTypeAuthority classes. This is the full CIM class (no restriction on owned attributes). The only restrictions are related to identification or naming capabilities (either mRID or name should be used). mRID (inherited from IdentifiedObject) is the only allowed attribute in the specialization (name, aliasName or description not allowed). Name / NameType / NameTypeAuthority (association inherited from IdentifiedObject) is restricted to one (this is an alternative way to identify the ReadingType). 16 attributes that permit to characterize a set of measured values (referenced at the IntervalBlock level).

The list of EUMED Metering Entities derived from CIM Classes is given in Table K.1.

Table K.1 – Entities of the EUMED Metering Model

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Name	Description
MeterReadingSet	Root of the message.
MeterReading	Set of values obtained from the meter.
Meter	Physical asset that performs the metering role of the usage point. Used for measuring consumption and detection of events.
Customer	Organisation receiving services from service supplier.
IntervalBlock	Time sequence of readings of the same reading type. Contained interval readings may need conversion through the application of an offset and a scalar defined in associated pending.
IntervalReading	Data captured at regular intervals of time. Interval data could be captured as incremental data, absolute data, or relative data. The source for the data is usually a tariff quantity or an engineering quantity. Data is typically captured in time-tagged, uniform, fixed-length intervals of 5 min, 10 min, 15 min, 30 min, or 60 min. NOTE Interval Data is sometimes also called "Interval Data Readings" (IDR).
ReadingQuality	Quality of a specific reading value or interval reading value. Note that more than one quality may be applicable to a given reading. Typically not used unless problems or unusual conditions occur (i.e., quality for each reading is assumed to be good unless stated otherwise in associated reading quality type). It can also be used with the corresponding reading quality type to indicate that the validation has been performed and succeeded.
UsagePoint	Logical or physical point in the network to which readings or events may be attributed. Used at the place where a physical or virtual meter may be located; however, it is not required that a meter be present.
UsagePointLocation	Location of an individual usage point.
ReadingType	Detailed description for a type of a reading value. Values in attributes allow for the creation of recommended codes to be used for identifying reading value types as follows: <macroPeriod>.<aggregate>.<measuringPeriod>.<accumulation>. <flowDirection>.<commodity>.<measurementKind>. <interharmonic.numerator>.<interharmonic.denominator>. <argument.numerator>.<argument.denominator>.<tou>.<cpp>. <consumptionTier>.<phases>.<multiplier>.<unit>.<currency>.
Name	The Name class provides the means to define any number of human readable names for an object. A name is **not** to be used for defining inter-object relationships. For inter-object relationships instead use the object identification 'mRID'.
NameType	Type of name. Possible values for attribute 'name' are implementation dependent but standard profiles may specify types. An enterprise may have multiple IT systems each having its own local name for the same object, e.g. a planning system may have different names from an EMS. An object may also have different names within the same IT system, e.g. localName as defined in CIM version 14. The definition from CIM14 is: The localName is a human readable name of the object. It is a free text name local to a node in a naming hierarchy similar to a file directory structure. A power system related naming hierarchy may be: Substation, VoltageLevel, Equipment etc. Children of the same parent in such a hierarchy have names that typically are unique among them.
NameTypeAuthority	Authority responsible for creation and management of names of a given type; typically an organization or an enterprise system.

The structure of the EUMED Metering model is given in Figure K.1.

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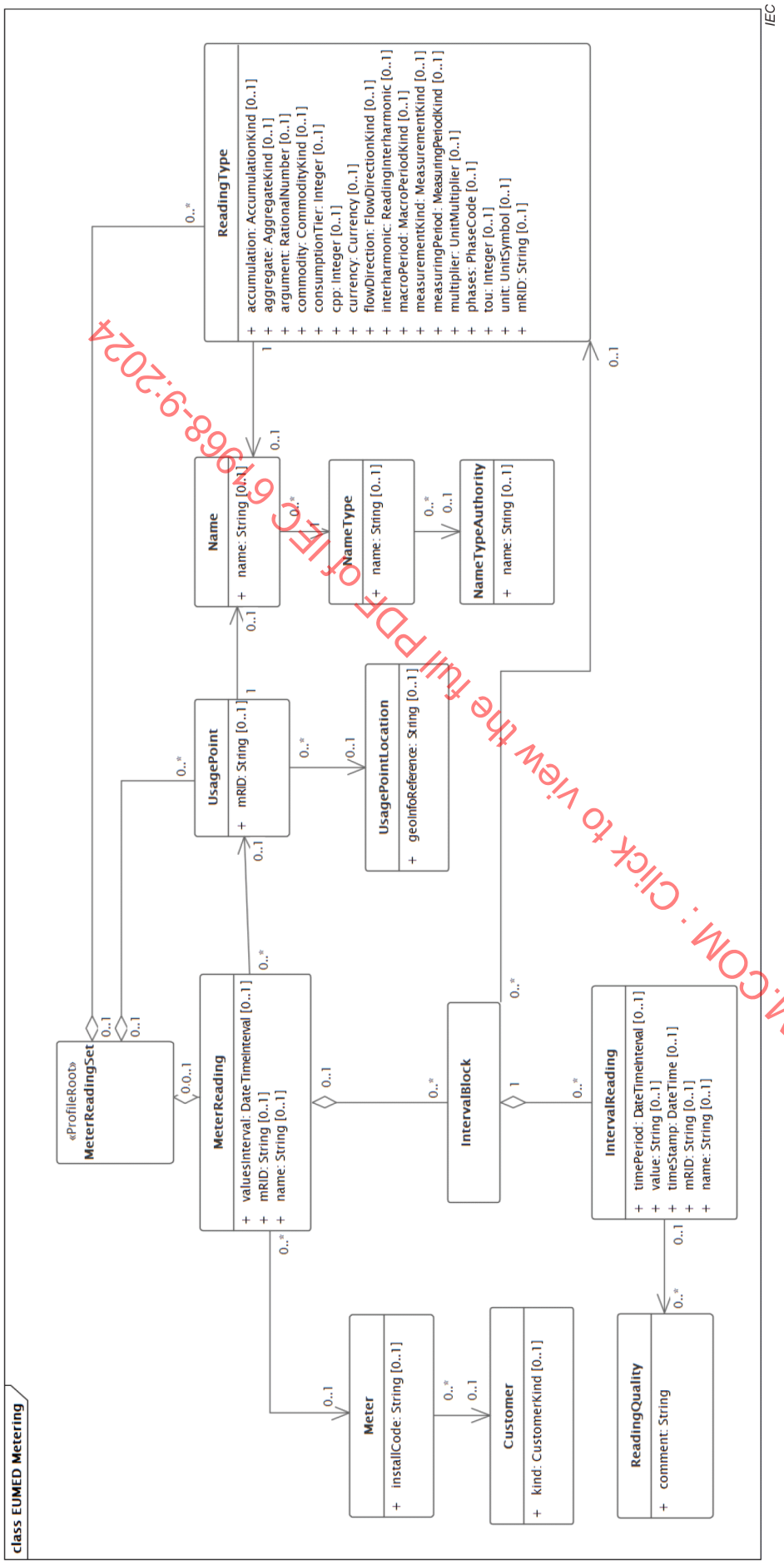


Figure K.1 reproduced with the permission of the UCAIug.

Figure K.1 – EUMED Metering Class diagram

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K.3 EUMED Metering Entities

K.3.1 General

EUMED Metering Entities are detailed in Clause K.3. Specific data types used in these entities are detailed in Clause K.4 ‘EUMED Metering Data Types’.

K.3.2 MeterReadingSet Entity

The MeterReadingSet is the root of the message. It has no attributes. It has associations to other classes.

Table K.2 shows all association ends of MeterReadingSet with other classes.

Table K.2 – Association ends of EUMED Metering ENTITIES::MeterReadingSet with other classes

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mult from	name	mult to	type	description
0..1	MeterReading	0..*	MeterReading	All meter readings contained in this meter reading set.
0..1	UsagePoint	0..*	UsagePoint	All usage points contained in this meter reading set.
0..1	ReadingType	0..*	ReadingType	All reading types contained in this meter reading set.

K.3.3 MeterReading Entity

Set of values obtained from the meter.

Table K.3 shows all attributes of MeterReading.

Table K.3 – Attributes of EUMED Metering ENTITIES::MeterReading

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name	type	mult	description
valuesInterval	DateTimeInterval	0..1	Date and time interval of the data items contained within this meter reading.
mRID	String	0..1	Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.
name	String	0..1	The name is any free human readable and possibly non unique text naming the object.

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Table K.4 shows all association ends of MeterReading with other classes.

Table K.4 – Association ends of EUMED Metering ENTITIES:: MeterReading with other classes

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mult from	name	mult to	type	description
0..*		0..1	MeterReadingSet	
0..*	UsagePoint	0..1	UsagePoint	Usage point from which this meter reading (set of values) has been obtained.
0..1	IntervalBlock	0..*	IntervalBlock	All interval blocks contained in this meter reading.
0..*	Meter	0..1	Meter	Meter providing this reading.

K.3.4 Meter Entity

Physical asset that performs the metering role of the usage point. Used for measuring consumption and detection of events.

Table K.5 shows all attributes of Meter.

Table K.5 – Attributes of EUMED Metering ENTITIES::Meter

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name	type	mult	description
installCode	String	0..1	Installation code.

Table K.6 shows all association ends of Meter with other classes.

Table K.6 – Association ends of EUMED Metering ENTITIES::Meter with other classes

Reprinted with the permission of UCAIug.

mult from	name	mult to	type	description
0..1	MeterReadings	0..*	MeterReading	All meter readings provided by this meter.
0..*	Customer	0..1	Customer	Customer owning this end device.

K.3.5 Customer Entity

Organisation receiving services from service supplier.

Table K.7 shows all attributes of Customer.

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Table K.7 – Attributes of EUMED Metering ENTITIES::Customer

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name	type	mult	description
kind	CustomerKind	0..1	Kind of customer.

See K.4.6 for EUMED CustomerKind enumerations.

Table K.8 shows all association ends of Customer with other classes.

Table K.8 – Association ends of EUMED Metering ENTITIES:: Customer with other classes

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mult from	name	mult to	type	description
0..1	EndDevices	0..*	Meter	All end devices of this customer.

K.3.6 IntervalBlock Entity

Time sequence of readings of the same reading type. Contained interval readings may need conversion through the application of an offset and a scalar defined in associated pending.

Table K.9 shows all association ends of IntervalBlock with other classes.

Table K.9 – Association ends of Metering::IntervalBlock with other classes

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mult from	name	mult to	type	description
0..*	MeterReading	0..1	MeterReading	Meter reading containing this interval block.
0..*	ReadingType	0..1	ReadingType	Type information for interval reading values contained in this block.
1..1	IntervalReading	0..*	IntervalReading	Interval reading contained in this block.

K.3.7 IntervalReading Entity

Data captured at regular intervals of time. Interval data could be captured as incremental data, absolute data, or relative data. The source for the data is usually a tariff quantity or an engineering quantity. Data is typically captured in time-tagged, uniform, fixed-length intervals of 5 min, 10 min, 15 min, 30 min, or 60 min.

NOTE Interval Data is sometimes also called "Interval Data Readings" (IDR).

Table K.10 shows all attributes of IntervalReading.

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Table K.10 – Attributes of EUMED Metering ENTITIES::IntervalReading

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name	type	mult	description
timePeriod	DateTimeInterval	0..1	Start and end of the period for those readings whose type has a time attribute such as 'billing', seasonal' or 'forTheSpecifiedPeriod'.
value	String	0..1	Value of this reading.
timeStamp	DateTime	0..1	The time when the value was last updated.
mRID	String	0..1	Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.
name	String	0..1	The name is any free human readable and possibly non unique text naming the object.

Table K.11 shows all association ends of IntervalReading with other classes.

Table K.11 – Association ends of EUMED Metering ENTITIES:: IntervalReading with other classes

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mult from	name	mult to	type	description
0..*	IntervalBlocks	1..1	IntervalBlock	All blocks containing this interval reading.
0..1	ReadingQualities	0..*	ReadingQuality	All qualities of this reading.

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K.3.8 ReadingQuality Entity

The ReadingQuality Entity provides quality information for a specific reading value or interval reading value. Note that more than one quality may be applicable for a given reading. The ReadingQuality is typically not used unless problems or unusual conditions occur (i.e., quality for each reading is assumed to be good unless stated otherwise in associated reading quality type). It can also be used with the corresponding reading quality type to indicate that the validation has been performed and succeeded.

Table K.12 shows all attributes of ReadingQuality.

Table K.12 – Attributes of EUMED Metering ENTITIES::ReadingQuality

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name	type	mult	description
comment	String	1..1	Elaboration on the quality code.

Table K.13 shows all association ends of ReadingQuality with other classes.

Table K.13 – Association ends of EUMED Metering ENTITIES:: ReadingQuality with other classes

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mult from	name	mult to	type	description
0..*	Reading	0..1	IntervalReading	Reading value to which this quality applies.

K.3.9 UsagePoint Entity

The UsagePoint is a logical or physical point in the network to which readings or events may be attributed. It is used to identify the place where a physical or virtual meter may be located; however, it is not required that a meter actually be present.

Table K.14 shows all attributes of UsagePoint.

Table K.14 – Attributes of EUMED Metering ENTITIES::UsagePoint

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name	type	mult	description
mRID	String	0..1	Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.

Table K.15 shows all association ends of UsagePoint with other classes.

Table K.15 – Association ends of EUMED Metering ENTITIES:: UsagePoint with other classes

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mult from	name	mult to	type	description
0..*		0..1	MeterReadingSet	
0..*	UsagePointLocation	0..1	UsagePointLocation	Location of this usage point.
1..1	Names	0..1	Name	All names of this identified object.
0..1	MeterReadings	0..*	MeterReading	All meter readings obtained from this usage point.

K.3.10 UsagePointLocation Entity

Location of an individual usage point.

Table K.16 shows all attributes of UsagePointLocation.

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Table K.16 – Attributes of EUMED Metering ENTITIES::UsagePointLocation

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name	type	mult	description
geoInfoReference	String	0..1	(if applicable) Reference to geographical information source, often external to the utility.

Table K.17 shows all association ends of UsagePointLocation with other classes.

Table K.17 – Association ends of EUMED Metering ENTITIES:: UsagePointLocation with other classes

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mult from	name	mult to	type	description
0..1	UsagePoints	0..*	UsagePoint	All usage points at this location.

K.3.11 ReadingType Entity

Detailed description for a type of a reading value. Values in attributes allow for the creation of recommended codes to be used for identifying reading value types as follows:

Table K.18 shows all attributes of ReadingType.

Table K.18 – Attributes of EUMED Metering ENTITIES::ReadingType

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name	type	mult	description
accumulation	AccumulationKind	0..1	Accumulation behaviour of a reading over time, usually 'measuringPeriod', to be used with individual endpoints (as opposed to 'macroPeriod' and 'aggregate' that are used to describe aggregations of data from individual endpoints). NOTE See K.4.2 for AccumulationKind enumerations specified in the EUMED profile.
aggregate	AggregateKind	0..1	Salient attribute of the reading data aggregated from individual endpoints. This is mainly used to define a mathematical operation carried out over 'macroPeriod', but may also be used to describe an attribute of the data when the 'macroPeriod' is not defined. NOTE See K.4.3 for AggregateKind enumerations specified in the EUMED profile.
argument	RationalNumber	0..1	Argument used to introduce numbers into the unit of measure description where they are needed (e.g., 4 where the measure needs an argument such as CEMI(n=4)). Most arguments used in practice however will be integers (i.e., 'denominator'=1). Value 0 in 'numerator' and 'denominator' means not applicable. NOTE See K.4.13 for RationalNumber enumerations specified in the EUMED profile.

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name	type	mult	description
commodity	CommodityKind	0..1	Commodity being measured. NOTE See K.4.4 for CommodityKind enumerations specified in the EUMED profile.
consumptionTier	integer	0..1	In case of common flat-rate pricing for power, in which all purchases are at a given rate, 'consumptionTier'=0. Otherwise, the value indicates the consumption tier, which can be used in conjunction with TOU or CPP pricing. Consumption tier pricing refers to the method of billing in which a certain "block" of energy is purchased/sold at one price, after which the next block of energy is purchased at another price, and so on, all throughout a defined period. At the start of the defined period, consumption is initially zero, and any usage is measured against the first consumption tier ('consumptionTier'=1). If this block of energy is consumed before the end of the period, energy consumption moves to be reconed against the second consumption tier ('consumptionTier'=2), and so on. At the end of the defined period, the consumption accumulator is reset, and usage within the 'consumptionTier'=1 restarts.
cpp	Integer	0..1	Critical peak period (CPP) bucket the reading value is attributed to. Value 0 means not applicable. Even though CPP is usually considered a specialised form of time of use 'tou', this attribute is defined explicitly for flexibility.
currency	Currency	0..1	Metering-specific currency. NOTE See K.4.5 for currency enumerations specified in the EUMED profile.
flowDirection	FlowDirectionKind	0..1	Flow direction for a reading where the direction of flow of the commodity is important (for electricity measurements this includes current, energy, power, and demand). NOTE See K.4.8 for FlowDirectionKind enumerations specified in the EUMED profile.
interharmonic	ReadingInterharmonic	0..1	Indication of a "harmonic" or "interharmonic" basis for the measurement. Value 0 in 'numerator' and 'denominator' means not applicable. NOTE See K.4.8 for interharmonic enumerations specified in the EUMED profile..
macroPeriod	MacroPeriodKind	0..1	Time period of interest that reflects how the reading is viewed or captured over a long period of time. NOTE See K.4.9 for macroPeriodKind enumerations specified in the EUMED profile.
measurementKind	MeasurementKind	0..1	Identifies "what" is being measured, as refinement of 'commodity'. When combined with 'unit', it provides detail to the unit of measure. For example, 'energy' with a unit of measure of 'kWh' indicates to the user that active energy is being measured, while with 'kVAh' or 'kVArh', it indicates apparent energy and reactive energy, respectively. 'power' can be combined in a similar way with various power units of measure: Distortion power ('distortionVoltAmperes') with 'kVA' is different from 'power' with 'kVA'. NOTE See K.4.10 for measurementKind enumerations specified in the EUMED profile.

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name	type	mult	description
measuringPeriod	MeasuringPeriodKind	0..1	Time attribute inherent or fundamental to the reading value (as opposed to 'macroPeriod' that supplies an "adjective" to describe aspects of a time period with regard to the measurement). It refers to the way the value was originally measured and not to the frequency at which it is reported or presented. For example, an hourly interval of consumption data would have value 'hourly' as an attribute. However in the case of an hourly sampled voltage value, the meterReadings schema would carry the 'hourly' interval size information. It is common for meters to report demand in a form that is measured over the course of a portion of an hour, while enterprise applications however commonly assume the demand (in kW or kVAr) normalised to 1 hour. The system that receives readings directly from the meter therefore shall perform this transformation before publishing readings for use by the other enterprise systems. The scalar used is chosen based on the block size (not any sub-interval size). NOTE See K.4.11 for measuringPeriod enumerations specified in the EUMED profile.
multiplier	UnitMultiplier	0..1	Metering-specific multiplier. NOTE See K.4.15 for power of ten multipliers supported in the EUMED profile.
phases	PhaseCode	0..1	Metering-specific phase code. NOTE See K.4.12 for phase code enumerations specified in the EUMED profile..
tou	Integer	0..1	Time of use (TOU) bucket the reading value is attributed to. A value of "0" means that TOU is not applicable to this measurement.
unit	UnitSymbol	0..1	Metering-specific unit. NOTE See K.4.16 for unit of measure enumerations specified in the EUMED profile.
mRID	String	0..1	Master resource identifier issued by a model authority. The mRID is unique within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC 4122, for the mRID. The use of UUID is strongly recommended. For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or rdf:about attributes that identify CIM object elements.

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Table K.19 shows all association ends of ReadingType with other classes.

Table K.19 – Association ends of EUMED Metering ENTITIES:: ReadingType with other classes

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mult from	name	mult to	type	description
0..1	IntervalBlocks	0..*	IntervalBlock	All blocks containing interval reading values with this type information.
0..*		0..1	MeterReadingSet	
1..1	Names	0..1	Name	All names of this identified object.

K.3.12 Name Entity

The Name class provides the means to define any number of human readable names for an object. A name is not to be used for defining inter-object relationships. For inter-object relationships instead use the object identification 'mRID'.

Table K.20 shows all attributes of Name.

Table K.20 – Attributes of EUMED Metering ENTITIES::Name

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name	type	mult	description
name	String	0..1	Any free text that name the object.

Table K.21 shows all association ends of Name with other classes.

Table K.21 – Association ends of EUMED Metering ENTITIES::Name with other classes

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mult from	name	mult to	type	description
0..1	IdentifiedObject	1..1	ReadingType	Identified object that this name designates.
0..1	IdentifiedObject	1..1	UsagePoint	Identified object that this name designates.
0..*	NameType	1..1	NameType	Type of this name.

K.3.13 NameType Entity

Type of name. Possible values for attribute 'name' are implementation dependent but standard profiles may specify types. An enterprise may have multiple IT systems each having its own local name for the same object, e.g. a planning system may have different names from an EMS. An object may also have different names within the same IT system, e.g. localName as defined in CIM version 14. The definition from CIM14 is:

The localName is a human readable name of the object. It is a free text name local to a node in a naming hierarchy similar to a file directory structure. A power system related naming hierarchy may be: Substation, VoltageLevel, Equipment etc. Children of the same parent in such a hierarchy have names that typically are unique among them.

Table K.22 shows all attributes of NameType.

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Table K.22 – Attributes of EUMED Metering ENTITIES::NameType

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name	type	mult	description
name	String	0..1	Name of the name type.

Table K.23 shows all association ends of NameType with other classes.

Table K.23 – Association ends of EUMED Metering ENTITIES:: NameType with other classes

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mult from	name	mult to	type	description
1..1	Names	0..*	Name	All names of this type.
0..*	NameTypeAuthority	0..1	NameTypeAuthority	Authority responsible for managing names of this type.

K.3.14 NameTypeAuthority Entity

Authority responsible for creation and management of names of a given type; typically an organization or an enterprise system.

Table K.24 shows all attributes of NameTypeAuthority.

Table K.24 – Attributes of EUMED Metering ENTITIES::NameTypeAuthority

Reprinted with the permission of UCAIug.

name	type	mult	description
name	String	0..1	Name of the name type authority.

Table K.25 shows all association ends of NameTypeAuthority with other classes.

Table K.25 – Association ends of EUMED Metering ENTITIES:: NameTypeAuthority with other classes

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mult from	name	mult to	type	description
0..1	NameTypes	0..*	NameType	All name types managed by this authority.

Table K.26 shows all association ends of MeterReadingSet with other classes.

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Table K.26 – Association ends of EUMED Metering ENTITIES:: MeterReadingSet with other classes

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mult from	name	mult to	type	description
0..1		0..*	ReadingType	
0..1		0..*	MeterReading	
0..1		0..*	UsagePoint	

K.4 EUMED Metering Datatypes

K.4.1 General

Table K.27 gives the list of the EUMED Metering datatypes.

Table K.27 – Datatypes of EUMED Metering Model

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Name	Description
AccumulationKind	Kind of accumulation behaviour for read / measured values from individual end points.
AggregateKind	Kind of aggregation for read / measured values from multiple end points.
CommodityKind	Code for commodity classification of readings of Reading Type.
Currency	Monetary currencies. ISO 4217 standard including 3-character currency code.
CustomerKind	Kind of customer.
DateTime	Date and time as "yyyy-mm-ddThh:mm:ss.sss", which conforms with ISO 8601. UTC time zone is specified as "yyyy-mm-ddThh:mm:ss.sssZ". A local timezone relative UTC is specified as "yyyy-mm-ddThh:mm:ss.sss-hh:mm". The second component (shown here as "ss.sss") could have any number of digits in its fractional part to allow any kind of precision beyond seconds.
DateTimeInterval	Interval of date and time. Duration is not included because it can be derived from the start and the end.
FlowDirectionKind	Direction associated with current related readings.
MacroPeriodKind	Kind of macro period for calculations on read / measured values.
MeasurementKind	Name of physical measurement.
MeasuringPeriodKind	Kind of period for reading / measuring values.
PhaseCode	An unordered enumeration of phase identifiers. Allows designation of phases for both transmission and distribution equipment, circuits and loads. The enumeration, by itself, does not describe how the phases are connected together or connected to ground. Ground is not explicitly denoted as a phase. Residential and small commercial loads are often served from single-phase, or split-phase, secondary circuits. For the example of s12N, phases 1 and 2 refer to hot wires that are 180 degrees out of phase, while N refers to the neutral wire. Through single-phase transformer connections, these secondary circuits may be served from one or two of the primary phases A, B, and C. For three-phase loads, use the A, B, C phase codes instead of s12N. The integer values are from IEC 61968-9 to support revenue metering applications.
RationalNumber	Rational number = 'numerator' / 'denominator'.
ReadingInterharmonic	Interharmonics are represented as a rational number 'numerator' / 'denominator', and harmonics are represented using the same mechanism and identified by 'denominator'=1.

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Name	Description
UnitMultiplier	The unit multipliers defined for the CIM. When applied to unit symbols that already contain a multiplier, both multipliers are used. For example, to exchange kilograms using unit symbol of kg, one uses the "none" multiplier, to exchange metric ton (Mg), one uses the "k" multiplier.
UnitSymbol	The units defined for usage in the CIM.

K.4.2 AccumulationKind enumeration Datatype

Kind of accumulation behaviour for read / measured values from individual end points.

Table K.28 shows all literals of AccumulationKind.

Table K.28 – Literals of EUMED Metering DATA TYPES::AccumulationKind

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literal	description
none	Not applicable, or implied by the unit of measure.
bulkQuantity	A value from a register which represents the bulk quantity of a commodity. This quantity is computed as the integral of the commodity usage rate. This value is typically used as the basis for the dial reading at the meter, and as a result, will roll over upon reaching a maximum dial value. NOTE 1 With the metering system, the roll-over behaviour typically implies a roll-under behavior so that the value presented is always a positive value (e.g. unsigned integer or positive decimal.) However, when communicating data between enterprise applications a negative value might occur in a case such as net metering. NOTE 2 A 'bulkQuantity' refers primarily to the dial reading and not the consumption over a specific period of time.
continuousCumulative	The sum of the previous billing period values and the present period value. NOTE 'continuousCumulative' is commonly used in conjunction with 'demand', and it would represent the cumulative sum of the previous billing period maximum demand values (as occurring with each demand reset) summed with the present period maximum demand value (which has yet to be reset.)
cumulative	The sum of the previous billing period values. NOTE 'cumulative' is commonly used in conjunction with "demand." Each demand reset causes the maximum demand value for the present billing period (since the last demand reset) to accumulate as an accumulative total of all maximum demands. So instead of 'zeroing' the demand register, a demand reset has the effect of adding the present maximum demand to this accumulating total.
deltaData	The difference between the value at the end of the prescribed interval and the beginning of the interval. This is used for incremental interval data. NOTE One common application would be for load profile data, another use might be to report the number of events within an interval (such as the number of equipment energisations within the specified period of time.)
indicating	As if a needle is swung out on the meter face to a value to indicate the current value. NOTE An 'indicating' value is typically measured over hundreds of milliseconds or greater, or may imply a "pusher" mechanism to capture a value. Compare this to 'instantaneous' which is measured over a shorter period of time.
summation	A form of accumulation which is selective with respect to time. NOTE 'summation' could be considered a specialisation of 'bulkQuantity' as it selectively accumulates pulses over a timing pattern (while 'bulkQuantity' accumulates pulses all of the time).

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literal	description
timeDelay	A form of computation which introduces a time delay characteristic to the data value.
instantaneous	Typically measured over the fastest period of time allowed by the definition of the metric (usually milliseconds or tens of milliseconds.) NOTE 'instantaneous' was moved to attribute #3 in IEC 61968-9:2013, from attribute #1 in IEC 61968-9:2009.
latchingQuantity	When this description is applied to a metered value, it implies that the value is a time-independent cumulative quantity much like a 'bulkQuantity', except that it latches upon the maximum value upon reaching that value. Any additional accumulation (positive or negative) is discarded until a reset occurs. NOTE A 'latchingQuantity' may also occur in the downward direction – upon reaching a minimum value. The terms 'maximum' or 'minimum' (for 'aggregate') will usually be included when this type of accumulation behaviour is present. When this description is applied to an encoded value (UOM= 'Code'), it implies that the value has one or more bits which are latching. The condition that caused the bit to be set may have long since evaporated. In either case, the timestamp that accompanies the value may not coincide with the moment the value was initially set. In both cases a system will need to perform an operation to clear the latched value.
boundedQuantity	A time-independent cumulative quantity much like a 'bulkQuantity' or a 'latchingQuantity', except that the accumulation stops at the maximum or minimum values. When the maximum is reached, any additional positive accumulation is discarded, but negative accumulation may be accepted (thus lowering the counter.) Likewise, when the negative bound is reached, any additional negative accumulation is discarded, but positive accumulation is accepted (thus increasing the counter.)

K.4.3 AggregateKind enumeration Datatype

Kind of aggregation for read / measured values from multiple end points.

Table K.29 shows all literals of AggregateKind.

Table K.29 – Literals of EUMED Metering DATA TYPES::AggregateKind

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literal	description
none	Not applicable.
average	The value represents average.
excess	The value represents an amount over which a threshold was exceeded.
highThreshold	The value represents a programmed high threshold.
lowThreshold	The value represents a programmed low threshold.
maximum	The highest value observed.
minimum	The smallest value observed.
nominal	The nominal value.
normal	The normal value.
secondMaximum	The second highest value observed.
secondMinimum	The second smallest value observed.
thirdMaximum	The third highest value observed.

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literal	description
fourthMaximum	The fourth highest value observed.
fifthMaximum	The fifth highest value observed.
sum	The accumulated sum.

K.4.4 CommodityKind enumeration Datatype

Kind of commodity being measured.

Table K.30 shows all literals of CommodityKind.

Table K.30 – Literals of EUMED Metering DATA TYPES::CommodityKind

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literal	description
none	Not Applicable
electricitySecondaryMetered	All types of metered quantities. This type of reading comes from the meter and represents a "secondary" metered value.
electricityPrimaryMetered	It is possible for a meter to be outfitted with an external VT and/or CT. The meter might not be aware of these devices, and the display not compensate for their presence. Ultimately, when these scalars are applied, the value that represents the service value is called the "primary metered" value. The "index" in sub-category 3 mirrors those of sub-category 0.
communication	A measurement of the communication infrastructure itself.
air	
insulativeGas	(SF6 is found separately below.)
insulativeOil	
naturalGas	
propane	
potableWater	Drinkable water
steam	Water in steam form, usually used for heating.
wasteWater	(Sewerage)
heatingFluid	This fluid is likely in liquid form. It is not necessarily water or water based. The warm fluid returns cooler than when it was sent. The heat conveyed may be metered.
coolingFluid	The cool fluid returns warmer than when it was sent. The heat conveyed may be metered.
nonpotableWater	Reclaimed water – possibly used for irrigation but not sufficiently treated to be considered safe for drinking.
nox	Nitrous Oxides NOX
so2	Sulfur Dioxide SO2
ch4	Methane CH4
co2	Carbon Dioxide CO2
carbon	
hch	Hexachlorocyclohexane HCH
pfc	Perfluorocarbons PFC
sf6	Sulfurhexafluoride SF6
tvLicence	Television
internet	Internet service
refuse	trash

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K.4.5 Currency enumeration Datatype

Monetary currencies which are potentially used by EUMED are described in Table K.31. Table K.31 extends Table C.28, and also calls upon the ISO 4217 standard to supply the 3-character currency code as well as the numeric code used in the ReadingTypeID.

Table K.31 – Literals of EUMED Metering DATA TYPES::Currency

literal	description
AED	United Arab Emirates dirham.
AFN	Afghan afghani.
ALL	Albanian lek.
AMD	Armenian dram.
ANG	Netherlands Antillean guilder.
AOA	Angolan kwanza.
ARS	Argentine peso.
AUD	Australian dollar.
AWG	Aruban florin.
AZN	Azerbaijani manat.
BAM	Bosnia and Herzegovina convertible mark.
BBD	Barbados dollar.
BDT	Bangladeshi taka.
BGN	Bulgarian lev.
BHD	Bahraini dinar.
BIF	Burundian franc.
BMD	Bermudian dollar (customarily known as Bermuda dollar).
BND	Brunei dollar.
BOB	Boliviano.
BOV	Bolivian Mvdol (funds code).
BRL	Brazilian real.
BSD	Bahamian dollar.
BTN	Bhutanese ngultrum.
BWP	Botswana pula.
BYR	Belarusian ruble.
BZD	Belize dollar.
CAD	Canadian dollar.
CDF	Congolese franc.
CHF	Swiss franc.
CLF	Unidad de Fomento (funds code), Chile.
CLP	Chilean peso.
CNY	Chinese yuan.
COP	Colombian peso.
COU	Unidad de Valor Real.
CRC	Costa Rican colon.
CUC	Cuban convertible peso.
CUP	Cuban peso.
CVE	Cape Verde escudo.

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literal	description
CZK	Czech koruna.
DJF	Djiboutian franc.
DKK	Danish krone.
DOP	Dominican peso.
DZD	Algerian dinar.
EEK	Estonian kroon.
EGP	Egyptian pound.
ERN	Eritrean nakfa.
ETB	Ethiopian birr.
EUR	Euro.
FJD	Fiji dollar.
FKP	Falkland Islands pound.
GBP	Pound sterling.
GEL	Georgian lari.
GHS	Ghanaian cedi.
GIP	Gibraltar pound.
GMD	Gambian dalasi.
GNF	Guinean franc.
GTQ	Guatemalan quetzal.
GYD	Guyanese dollar.
HKD	Hong Kong dollar.
HNL	Honduran lempira.
HRK	Croatian kuna.
HTG	Haitian gourde.
HUF	Hungarian forint.
IDR	Indonesian rupiah.
ILS	Israeli new sheqel.
INR	Indian rupee.
IQD	Iraqi dinar.
IRR	Iranian rial.
ISK	Icelandic króna.
JMD	Jamaican dollar.
JOD	Jordanian dinar.
JPY	Japanese yen.
KES	Kenyan shilling.
KGS	Kyrgyzstani som.
KHR	Cambodian riel.
KMF	Comoro franc.
KPW	North Korean won.
KRW	South Korean won.
KWD	Kuwaiti dinar.
KYD	Cayman Islands dollar.
KZT	Kazakhstani tenge.
LAK	Lao kip.

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literal	description
LBP	Lebanese pound.
LKR	Sri Lanka rupee.
LRD	Liberian dollar.
LSL	Lesotho loti.
LTL	Lithuanian litas.
LVL	Latvian lats.
LYD	Libyan dinar.
MAD	Moroccan dirham.
MDL	Moldovan leu.
MGA	Malagasy ariary.
MKD	Macedonian denar.
MMK	Myanma kyat.
MNT	Mongolian tugrik.
MOP	Macanese pataca.
MRO	Mauritanian ouguiya.
MUR	Mauritian rupee.
MVR	Maldivian rufiyaa.
MWK	Malawian kwacha.
MXN	Mexican peso.
MYR	Malaysian ringgit.
MZN	Mozambican metical.
NAD	Namibian dollar.
NGN	Nigerian naira.
NIO	Cordoba oro.
NOK	Norwegian krone.
NPR	Nepalese rupee.
NZD	New Zealand dollar.
OMR	Omani rial.
PAB	Panamanian balboa.
PEN	Peruvian nuevo sol.
PGK	Papua New Guinean kina.
PHP	Philippine peso.
PKR	Pakistani rupee.
PLN	Polish zloty.
PYG	Paraguayan guaraní.
QAR	Qatari rial.
RON	Romanian new leu.
RSD	Serbian dinar.
RUB	Russian rouble.
RWF	Rwandan franc.
SAR	Saudi riyal.
SBD	Solomon Islands dollar.
SCR	Seychelles rupee.
SDG	Sudanese pound.

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literal	description
SEK	Swedish krona/kronor.
SGD	Singapore dollar.
SHP	Saint Helena pound.
SLL	Sierra Leonean leone.
SOS	Somali shilling.
SRD	Surinamese dollar.
STD	São Tomé and Príncipe dobra.
SYP	Syrian pound.
SZL	Lilangeni.
THB	Thai baht.
TJS	Tajikistani somoni.
TMT	Turkmenistani manat.
TND	Tunisian dinar.
TOP	Tongan pa'anga.
TRY	Turkish lira.
TTD	Trinidad and Tobago dollar.
TWD	New Taiwan dollar.
TZS	Tanzanian shilling.
UAH	Ukrainian hryvnia.
UGX	Ugandan shilling.
USD	United States dollar.
UYU	Uruguayan peso.
UZS	Uzbekistan som.
VEF	Venezuelan bolívar fuerte.
VND	Vietnamese Dong.
VUV	Vanuatu vatu.
WST	Samoan tala.
XAF	CFA franc BEAC.
XCD	East Caribbean dollar.
XOF	CFA Franc BCEAO.
XPF	CFP franc.
YER	Yemeni rial.
ZAR	South African rand.
ZMK	Zambian kwacha.
ZWL	Zimbabwe dollar.

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K.4.6 CustomerKind enumeration Datatype

Kind of customer.

Table K.32 shows all literals of CustomerKind.

Table K.32 – Literals of EUMED Metering DATA TYPES::CustomerKind

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literal	description
residential	Residential customer.
residentialAndCommercial	Residential and commercial customer.
residentialAndStreetlight	Residential and streetlight customer.
residentialStreetlightOthers	Residential streetlight or other related customer.
residentialFarmService	Residential farm service customer.
commercialIndustrial	Commercial industrial customer.
pumpingLoad	Pumping load customer.
windMachine	Wind machine customer.
energyServiceSupplier	Customer as energy service supplier.
energyServiceScheduler	Customer as energy service scheduler.
internalUse	Internal use customer.
enterprise	
regionalOperator	
subsidiary	
other	Other kind of customer.

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K.4.7 DateTimeInterval compound Datatype

Interval between two date and time points, where the interval includes the start time but excludes end time.

Table K.33 shows all attributes of DateTimeInterval.

Table K.33 – Attributes of EUMED Metering DATA TYPES::DateTimeInterval

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name	type	mult	description
end	DateTime	0..1	End date and time of this interval. The end date and time where the interval is defined up to, but excluded.
start	DateTime	0..1	Start date and time of this interval. The start date and time is included in the defined interval.

K.4.8 FlowDirectionKind enumeration Datatype

Kind of flow direction for reading/measured values proper to some commodities such as, for example, energy, power, demand.

Table K.34 shows all literals of FlowDirectionKind.

Table K.34 – Literals of EUMED Metering DATA TYPES::FlowDirectionKind

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literal	description
none	Not Applicable (N/A)
forward	"Delivered," or "Imported" as defined in IEC TS 61968-2. Forward Active Energy is a positive kWh value as one would naturally expect to find as energy is supplied by the utility and consumed at the service. Forward Reactive Energy is a positive VArh value as one would naturally expect to find in the presence of inductive loading. In polyphase metering, the forward energy register is incremented when the sum of the phase energies is greater than zero:
lagging	Typically used to describe that a power factor is lagging the reference value. NOTE 1 When used to describe VA, "lagging" describes a form of measurement where reactive power is considered in all four quadrants, but real power is considered only in quadrants I and IV. NOTE 2 When used to describe power factor, the term "Lagging" implies that the PF is negative. The term "lagging" in this case takes the place of the negative sign. If a signed PF value is to be passed by the data producer, then the direction of flow enumeration zero (none) should be used in order to avoid the possibility of creating an expression that employs a double negative. The data consumer should be able to tell from the sign of the data if the PF is leading or lagging. This principle is analogous to the concept that "Reverse" energy is an implied negative value, and to publish a negative reverse value would be ambiguous. NOTE 3 Lagging power factors typically indicate inductive loading.
leading	Typically used to describe that a power factor is leading the reference value. NOTE Leading power factors typically indicate capacitive loading.
net	|Forward| – |Reverse|, See IEC TS 61968-2. NOTE In some systems, the value passed as a "net" value could become negative. In other systems the value passed as a "net" value is always a positive number, and rolls-over and rolls-under as needed.
q1plusQ2	Reactive positive quadrants. (The term "lagging" is preferred.)
q1plusQ3	Quadrants 1 and 3
q1plusQ4	Quadrants 1 and 4 usually represent forward active energy
q1minusQ4	Q1 minus Q4
q2plusQ3	Quadrants 2 and 3 usually represent reverse active energy
q2plusQ4	Quadrants 2 and 4
q2minusQ3	Q2 minus Q3
q3plusQ4	Reactive negative quadrants. (The term "leading" is preferred.)
q3minusQ2	Q3 minus Q2
quadrant1	Q1 only
quadrant2	Q2 only
quadrant3	Q3 only
quadrant4	Q4 only

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literal	description
reverse	Reverse Active Energy is equivalent to "Received," or "Exported" as defined in IEC TS 61968-2. Reverse Active Energy is a positive kWh value as one would expect to find when energy is backfed by the service onto the utility network. Reverse Reactive Energy is a positive VArh value as one would expect to find in the presence of capacitive loading and a leading Power Factor. In polyphase metering, the reverse energy register is incremented when the sum of the phase energies is less than zero: NOTE The value passed as a reverse value is always a positive value. It is understood by the label "reverse" that it represents negative flow.
total	|Forward| + |Reverse|, See IEC TS 61968-2. The sum of the commodity in all quadrants Q1+Q2+Q3+Q4. In polyphase metering, the total energy register is incremented when the absolute value of the sum of the phase energies is greater than zero:
totalByPhase	In polyphase metering, the total by phase energy register is incremented when the sum of the absolute values of the phase energies is greater than zero: In single phase metering, the formulas for "Total" and "Total by phase" collapse to the same expression. For communication purposes however, the "Total" enumeration should be used with single phase meter data.

K.4.9 MacroPeriodKind enumeration Datatype

Kind of macro period for calculations on read / measured values.

Table K.35 shows all literals of MacroPeriodKind.

Table K.35 – Literals of EUMED Metering DATA TYPES::MacroPeriodKind

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literal	description
none	Not applicable.
billingPeriod	Captured during the billing period starting at midnight of the first day of the billing period (as defined by the billing cycle day). If during the current billing period, it specifies a period from the start of the current billing period until "now".
daily	Daily period starting at midnight. If for the current day, this specifies the time from midnight to "now".
monthly	Monthly period starting at midnight on the first day of the month. If within the current month, this specifies the period from the start of the month until "now."
seasonal	A season of time spanning multiple months. E.g. "Summer," "Spring," "Fall," and "Winter" based cycle. If within the current season, it specifies the period from the start of the current season until "now."
weekly	Weekly period starting at midnight on the first day of the week and ending the instant before midnight the last day of the week. If within the current week, it specifies the period from the start of the week until "now."
specifiedPeriod	For the period defined by the start and end of the TimePeriod element in the message.

K.4.10 MeasurementKind enumeration Datatype

Kind of read / measured value.

Table K.36 shows all literals of MeasurementKind.

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Table K.36 – Literals of EUMED Metering DATA TYPES::MeasurementKind

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literal	description
none	Not Applicable
apparentPowerFactor	
currency	funds
current	
currentAngle	
currentImbalance	
date	
demand	
distance	
distortionVoltAmp	
energization	
energy	
energizationLoadSide	
fan	
frequency	
ieee1366ASAI	
ieee1366ASIDI	
ieee1366ASIFI	
ieee1366CAIDI	
ieee1366CAIFI	
ieee1366CEMIn	
ieee1366CEMSMIn	
ieee1366CTAIDI	
ieee1366MAIFI	
ieee1366MAIFIe	
ieee1366SAIDI	
ieee1366SAIFI	
lineLoss	
loss	
negativeSequence	
phasorPowerFactor	
phasorReactivePower	
positiveSequence	
power	
powerFactor	
quantityPower	
sag	or Voltage Dip
swell	
switchPosition	
tapPosition	
tariffRate	

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literal	description
temperature	
totalHarmonicDistortion	
transformerLoss	
unipedeVoltageDip10to15	
unipedeVoltageDip15to30	
unipedeVoltageDip30to60	
unipedeVoltageDip60to90	
unipedeVoltageDip90to100	
voltage	
voltageAngle	
voltageExcursion	
voltageImbalance	
volume	Clarified from Ed. 1. to indicate fluid volume
zeroFlowDuration	
zeroSequence	
distortionPowerFactor	
frequencyExcursion	Usually expressed as a "count"
applicationContext	
apTitle	
assetNumber	
bandwidth	
batteryVoltage	
broadcastAddress	
deviceAddressType1	
deviceAddressType2	
deviceAddressType3	
deviceAddressType4	
deviceClass	
electronicSerialNumber	
endDeviceID	
groupAddressType1	
groupAddressType2	
groupAddressType3	
groupAddressType4	
ipAddress	
macAddress	
mfgAssignedConfigurationID	
mfgAssignedPhysicalSerialNumber	
mfgAssignedProductNumber	
mfgAssignedUniqueCommunicationAddress	
multiCastAddress	
oneWayAddress	
signalStrength	
twoWayAddress	

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literal	description
signaltoNoiseRatio	Moved here from Attribute #9 UOM
alarm	
batteryCarryover	
dataOverflowAlarm	
demandLimit	
demandReset	Usually expressed as a count as part of a billing cycle
diagnostic	
emergencyLimit	
encoderTamper	
ieee1366MomentaryInterruption	
ieee1366MomentaryInterruptionEvent	
ieee1366SustainedInterruption	
interruptionBehaviour	
inversionTamper	
loadInterrupt	
loadShed	
maintenance	
physicalTamper	
powerLossTamper	
powerOutage	
powerQuality	
powerRestoration	
programmed	
pushbutton	
relayActivation	
relayCycle	Usually expressed as a count
removalTamper	
reprogrammingTamper	
reverseRotationTamper	
switchArmed	
switchDisabled	
tamper	
watchdogTimeout	
billLastPeriod	Customer's bill for the previous billing period (Currency)
billToDate	Customer's bill, as known thus far within the present billing period (Currency)
billCarryover	Customer's bill for the (Currency)
connectionFee	Monthly fee for connection to commodity.
audibleVolume	Sound
volumetricFlow	

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K.4.11 MeasuringPeriodKind enumeration Datatype

Kind of period for reading / measuring values.

Table K.37 shows all literals of MeasuringPeriodKind.

Table K.37 – Literals of EUMED Metering DATA TYPES::MeasuringPeriodKind

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literal	description
none	Not applicable.
tenMinute	10-minute
fifteenMinute	15-minute
oneMinute	1-minute
twentyfourHour	24-hour
thirtyMinute	30-minute
fiveMinute	5-minute
sixtyMinute	60-minute
twoMinute	2-minute
threeMinute	3-minute
present	Within the present period of time
previous	Shifted within the previous monthly cycle and data set
twentyMinute	20-minute interval
fixedBlock60Min	60-minute Fixed Block
fixedBlock30Min	30-minute Fixed Block
fixedBlock20Min	20-minute Fixed Block
fixedBlock15Min	15-minute Fixed Block
fixedBlock10Min	10-minute Fixed Block
fixedBlock5Min	5-minute Fixed Block
fixedBlock1Min	1-minute Fixed Block
rollingBlock60MinIntvl30MinSubIntvl	60-minute Rolling Block with 30-minute sub-intervals
rollingBlock60MinIntvl20MinSubIntvl	60-minute Rolling Block with 20-minute sub-intervals
rollingBlock60MinIntvl15MinSubIntvl	60-minute Rolling Block with 15-minute sub-intervals
rollingBlock60MinIntvl12MinSubIntvl	60-minute Rolling Block with 12-minute sub-intervals
rollingBlock60MinIntvl10MinSubIntvl	60-minute Rolling Block with 10-minute sub-intervals
rollingBlock60MinIntvl6MinSubIntvl	60-minute Rolling Block with 6-minute sub-intervals
rollingBlock60MinIntvl5MinSubIntvl	60-minute Rolling Block with 5-minute sub-intervals
rollingBlock60MinIntvl4MinSubIntvl	60-minute Rolling Block with 4-minute sub-intervals
rollingBlock30MinIntvl15MinSubIntvl	30-minute Rolling Block with 15-minute sub-intervals
rollingBlock30MinIntvl10MinSubIntvl	30-minute Rolling Block with 10-minute sub-intervals
rollingBlock30MinIntvl6MinSubIntvl	30-minute Rolling Block with 6-minute sub-intervals
rollingBlock30MinIntvl5MinSubIntvl	30-minute Rolling Block with 5-minute sub-intervals.
rollingBlock30MinIntvl3MinSubIntvl	30-minute Rolling Block with 3-minute sub-intervals
rollingBlock30MinIntvl2MinSubIntvl	30-minute Rolling Block with 2-minute sub-intervals
rollingBlock15MinIntvl5MinSubIntvl	15-minute Rolling Block with 5-minute sub-intervals
rollingBlock15MinIntvl3MinSubIntvl	15-minute Rolling Block with 3-minute sub-intervals
rollingBlock15MinIntvl1MinSubIntvl	15-minute Rolling Block with 1-minute sub-intervals
rollingBlock10MinIntvl5MinSubIntvl	10-minute Rolling Block with 5-minute sub-intervals
rollingBlock10MinIntvl2MinSubIntvl	10-minute Rolling Block with 2-minute sub-intervals
rollingBlock10MinIntvl1MinSubIntvl	10-minute Rolling Block with 1-minute sub-intervals
rollingBlock5MinIntvl1MinSubIntvl	5-minute Rolling Block with 1-minute sub-intervals

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K.4.12 PhaseCode enumeration Datatype

An unordered enumeration of phase identifiers. Allows designation of phases for both transmission and distribution equipment, circuits and loads. The enumeration, by itself, does not describe how the phases are connected together or connected to ground. Ground is not explicitly denoted as a phase.

Residential and small commercial loads are often served from single-phase, or split-phase, secondary circuits. For the example of s12N, phases 1 and 2 refer to hot wires that are 180 degrees out of phase, while N refers to the neutral wire. Through single-phase transformer connections, these secondary circuits may be served from one or two of the primary phases A, B, and C. For three-phase loads, use the A, B, C phase codes instead of s12N.

The integer values are from IEC 61968-9 to support revenue metering applications.

Table K.38 shows all literals of PhaseCode.

Table K.38 – Literals of EUMED Metering DATA TYPES::PhaseCode

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literal	description
ABCN	Phases A, B, C, and N.
ABC	Phases A, B, and C.
ABN	Phases A, B, and neutral.
ACN	Phases A, C and neutral.
BCN	Phases B, C, and neutral.
AB	Phases A and B.
AC	Phases A and C.
BC	Phases B and C.
AN	Phases A and neutral.
BN	Phases B and neutral.
CN	Phases C and neutral.
A	Phase A.
B	Phase B.
C	Phase C.
N	Neutral phase.
s1N	Secondary phase 1 and neutral.
s2N	Secondary phase 2 and neutral.
s12N	Secondary phases 1, 2, and neutral.
s1	Secondary phase 1.
s2	Secondary phase 2.
s12	Secondary phase 1 and 2.
none	No phases specified.
X	Unknown non-neutral phase.
XY	Two unknown non-neutral phases.
XN	Unknown non-neutral phase plus neutral.
XYN	Two unknown non-neutral phases plus neutral.

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K.4.13 RationalNumber compound Datatype

Rational number = 'numerator' / 'denominator'.

Table K.39 shows all attributes of RationalNumber.

Table K.39 – Attributes of EUMED Metering DATA TYPES::RationalNumber

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name	type	mult	description
denominator	Integer	0..1	Denominator. Value 1 indicates the number is a simple integer.
numerator	Integer	0..1	Numerator.

K.4.14 ReadingInterharmonic compound Datatype

Interharmonics are represented as a rational number 'numerator' / 'denominator', and harmonics are represented using the same mechanism and identified by 'denominator'=1.

Table K.40 shows all attributes of ReadingInterharmonic.

Table K.40 – Attributes of EUMED Metering DATA TYPES::ReadingInterharmonic

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name	type	mult	description
denominator	Integer	0..1	Interharmonic denominator. Value 0 means not applicable. Value 2 is used in combination with 'numerator'=1 to represent interharmonic 1/2. Finally, value 1 indicates the harmonic of the order specified with 'numerator'.
numerator	Integer	0..1	Interharmonic numerator. Value 0 means not applicable. Value 1 is used in combination with 'denominator'=2 to represent interharmonic 1/2, and with 'denominator'=1 it represents fundamental frequency. Finally, values greater than 1 indicate the harmonic of that order (e.g., 'numerator'=5 is the fifth harmonic).

K.4.15 UnitMultiplier enumeration Datatype

The unit multipliers defined for the CIM. When applied to unit symbols, the unit symbol is treated as a derived unit. Regardless of the contents of the unit symbol text, the unit symbol shall be treated as if it were a single-character unit symbol. Unit symbols should not contain multipliers, and it should be left to the multiplier to define the multiple for an entire data type.

For example, if a unit symbol is "m2Pers" and the multiplier is "k", then the value is k(m**2/s), and the multiplier applies to the entire final value, not to any individual part of the value. This can be conceptualized by substituting a derived unit symbol for the unit type. If one imagines that the symbol "Þ" represents the derived unit "m2Pers", then applying the multiplier "k" can be conceptualized simply as "kÞ".

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For example, the SI unit for mass is "kg" and not "g". If the unit symbol is defined as "kg", then the multiplier is applied to "kg" as a whole and does not replace the "k" in front of the "g". In this case, the multiplier of "m" would be used with the unit symbol of "kg" to represent one gram. As a text string, this violates the instructions in IEC 80000-1. However, because the unit symbol in CIM is treated as a derived unit instead of as an SI unit, it makes more sense to conceptualize the "kg" as if it were replaced by one of the proposed replacements for the SI mass symbol. If one imagines that the "kg" were replaced by a symbol "Þ", then it is easier to conceptualize the multiplier "m" as creating the proper unit "mÞ", and not the forbidden unit "mkg".

Table K.41 shows all literals of UnitMultiplier.

Table K.41 – Literals of EUMED Metering DATA TYPES::UnitMultiplier

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literal	description
y	Yocto 10**-24.
z	Zepto 10**-21.
a	Atto 10**-18.
f	Femto 10**-15.
p	Pico 10**-12.
n	Nano 10**-9.
micro	Micro 10**-6.
m	Milli 10**-3.
c	Centi 10**-2.
d	Deci 10**-1.
none	No multiplier or equivalently multiply by 1.
da	Deca 10**1.
h	Hecto 10**2.
k	Kilo 10**3.
M	Mega 10**6.
G	Giga 10**9.
T	Tera 10**12.
P	Peta 10**15.
E	Exa 10**18.
Z	Zetta 10**21.
Y	Yotta 10**24.

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K.4.16 UnitSymbol enumeration Datatype

The derived units defined for usage in the CIM. In some cases, the derived unit is equal to an SI unit. Whenever possible, the standard derived symbol is used instead of the formula for the derived unit. For example, the unit symbol Farad is defined as "F" instead of "CPerV". In cases where a standard symbol does not exist for a derived unit, the formula for the unit is used as the unit symbol. For example, density does not have a standard symbol and so it is represented as "kgPerm3". With the exception of the "kg", which is an SI unit, the unit symbols do not contain multipliers and therefore represent the base derived unit to which a multiplier can be applied as a whole.

Every unit symbol is treated as an unparseable text as if it were a single-letter symbol. The meaning of each unit symbol is defined by the accompanying descriptive text and not by the text contents of the unit symbol.

To allow the widest possible range of serializations without requiring special character handling, several substitutions are made which deviate from the format described in IEC 80000-1. The division symbol "/" is replaced by the letters "Per". Exponents are written in plain text after the unit as "m3" instead of being formatted as "m" with a superscript of 3 or introducing a symbol as in "m^3". The degree symbol "°" is replaced with the letters "deg". Any clarification of the meaning for a substitution is included in the description for the unit symbol.

Non-SI units are included in list of unit symbols to allow sources of data to be correctly labelled with their non-SI units (for example, a GPS sensor that is reporting numbers that represent feet instead of meters). This allows software to use the unit symbol information correctly convert and scale the raw data of those sources into SI-based units.

The integer values are used for harmonization with IEC 61850.

Table K.42 shows all literals of UnitSymbol.

Table K.42 – Literals of EUMED Metering DATA TYPES::UnitSymbol

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literal	description
none	Dimension less quantity, e.g. count, per unit, etc.
m	Length in metres.
kg	Mass in kilograms. NOTE multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
s	Time in seconds.
A	Current in amperes.
K	Temperature in kelvins.
mol	Amount of substance in moles.
cd	Luminous intensity in candelas.
deg	Plane angle in degrees.
rad	Plane angle in radians (m/m).
sr	Solid angle in steradians (m2/m2).
Gy	Absorbed dose in grays (J/kg).
Bq	Radioactivity in becquerels (1/s).
degC	Relative temperature in degrees Celsius. In the SI unit system the symbol is °C. Electric charge is measured in coulomb that has the unit symbol C. To distinguish degree Celsius from coulomb the symbol used in the UML is degC. The reason for not using °C is that the special character ° is difficult to manage in software.
Sv	Dose equivalent in sieverts (J/kg).
F	Electric capacitance in farads (C/V).
C	Electric charge in coulombs (A·s).
S	Conductance in siemens.
H	Electric inductance in henrys (Wb/A).
V	Electric potential in volts (W/A).
ohm	Electric resistance in ohms (V/A).
J	Energy in joules (N·m = C·V = W·s).
N	Force in newtons (kg·m/s²).
Hz	Frequency in hertz (1/s).
lx	Illuminance in lux (lm/m²).

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literal	description
lm	Luminous flux in lumens (cd·sr).
Wb	Magnetic flux in webers (V·s).
T	Magnetic flux density in teslas (Wb/m2).
W	Real power in watts (J/s). Electrical power may have real and reactive components. The real portion of electrical power (I^2R or VIcos(phi)), is expressed in Watts. See also apparent power and reactive power.
Pa	Pressure in pascals (N/m^2). NOTE the absolute or relative measurement of pressure is implied with this entry. See below for more explicit forms.
m2	Area in square metres (m^2).
m3	Volume in cubic metres (m^3).
mPers	Velocity in metres per second (m/s).
mPers2	Acceleration in metres per second squared (m/s^2).
m3Pers	Volumetric flow rate in cubic metres per second (m^3/s).
mPerm3	Fuel efficiency in metres per cubic metres (m/m^3).
kgm	Moment of mass in kilogram metres (kg·m) (first moment of mass). NOTE multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
kgPerm3	Density in kilogram/cubic metres (kg/m^3). NOTE multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
m2Pers	Viscosity in square metres / second (m^2/s).
WPermK	Thermal conductivity in watt/metres kelvin.
JPerK	Heat capacity in joules/kelvin.
ppm	Concentration in parts per million.
rotPers	Rotations per second (1/s). See also Hz (1/s).
radPers	Angular velocity in radians per second (rad/s).
WPerm2	Heat flux density, irradiance, watts per square metre.
JPerm2	Insulation energy density, joules per square metre or watt second per square metre.
SPerm	Conductance per length (F/m).
KPers	Temperature change rate in kelvins per second.
PaPers	Pressure change rate in pascals per second.
JPerkgK	Specific heat capacity, specific entropy, joules per kilogram Kelvin.
VA	Apparent power in volt amperes. See also real power and reactive power.
VAr	Reactive power in volt amperes reactive. The "reactive" or "imaginary" component of electrical power (VIsin(phi)). (See also real power and apparent power). NOTE Different meter designs use different methods to arrive at their results. Some meters may compute reactive power as an arithmetic value, while others compute the value vectorially. The data consumer should determine the method in use and the suitability of the measurement for the intended purpose.
cosPhi	Power factor, dimensionless. NOTE 1 This definition of power factor only holds for balanced systems. See the alternative definition under code 153. NOTE 2 Beware of differing sign conventions in use between the IEC and EEI. It is assumed that the data consumer understands the type of meter in use and the sign convention in use by the utility.
Vs	Volt seconds (Ws/A).
V2	Volt squared (W^2/A^2).
As	Ampere seconds (A·s).
A2	Amperes squared (A^2).

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literal	description
A2s	Ampere squared time in square amperes (A²s).
VAh	Apparent energy in volt ampere hours.
Wh	Real energy in watt hours.
VArh	Reactive energy in volt ampere reactive hours.
VPerHz	Magnetic flux in volt per hertz.
HzPers	Rate of change of frequency in hertz per second.
character	Number of characters.
charPers	Data rate (baud) in characters per second.
kgm2	Moment of mass in kilogram square metres (kg·m²) (Second moment of mass, commonly called the moment of inertia). NOTE multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
dB	Sound pressure level in decibels. NOTE multiplier "d" is included in this unit symbol for compatibility with IEC 61850-7-3.
WPers	Ramp rate in watts per second.
lPers	Volumetric flow rate in litres per second.
dBm	Power level (logarithmic ratio of signal strength , Bel-mW), normalized to 1mW. NOTE multiplier "d" is included in this unit symbol for compatibility with IEC 61850-7-3.
h	Time in hours, hour = 60 min = 3 600 s.
min	Time in minutes, minute = 60 s.
Q	Quantity power, Q.
Qh	Quantity energy, Qh.
ohmm	Resistivity, ohm metres, (rho).
APerm	A/m, magnetic field strength, amperes per metre.
V2h	Volt-squared hour, volt-squared-hours.
A2h	Ampere-squared hour, ampere-squared hour.
Ah	Ampere-hours, ampere-hours.
count	Amount of substance, Counter value.
ft3	Volume, cubic feet.
m3Perh	Volumetric flow rate, cubic metres per hour.
gal	Volume in gallons, US gallon (1 gal = 231 in3 = 128 fl ounce).
Btu	Energy, British Thermal Units.
l	Volume in litres, litre = dm3 = m3/1 000.
lPerh	Volumetric flow rate, litres per hour.
lPerl	Concentration, The ratio of the volume of a solute divided by the volume of the solution. NOTE Users may need use a prefix such a ‘µ’ to express a quantity such as ‘µL/L’.
gPerg	Concentration, The ratio of the mass of a solute divided by the mass of the solution. NOTE Users may need use a prefix such a ‘µ’ to express a quantity such as ‘µg/g’.
molPerm3	Concentration, The amount of substance concentration, (c), the amount of solvent in moles divided by the volume of solution in m³.
molPermol	Concentration, Molar fraction, the ratio of the molar amount of a solute divided by the molar amount of the solution.
molPerkg	Concentration, Molality, the amount of solute in moles and the amount of solvent in kilograms.
sPers	Time, Ratio of time. NOTE Users may need to supply a prefix such as ‘µ’ to show rates such as ‘µs/s’.
HzPerHz	Frequency, rate of frequency change. NOTE Users may need to supply a prefix such as ‘m’ to show rates such as ‘mHz/Hz’.

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literal	description
VPerV	Voltage, ratio of voltages. NOTE Users may need to supply a prefix such as 'm' to show rates such as 'mV/V'.
APerA	Current, ratio of amperages. NOTE Users may need to supply a prefix such as 'm' to show rates such as 'mA/A'.
VPerVA	Power factor, PF, the ratio of the active power to the apparent power. NOTE The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
rev	Amount of rotation, revolutions.
kat	Catalytic activity, katal = mol / s.
JPerkg	Specific energy, Joules / kg.
m3Uncompensated	Volume, cubic metres, with the value uncompensated for weather effects.
m3Compensated	Volume, cubic metres, with the value compensated for weather effects.
WPerW	Signal Strength, ratio of power. NOTE Users may need to supply a prefix such as 'm' to show rates such as 'mW/W'.
therm	Energy, therms.
onePerm	Wavenumber, reciprocal metres, (1/m).
m3Perkg	Specific volume, cubic metres per kilogram, v.
Pas	Dynamic viscosity, pascal seconds.
Nm	Moment of force, newton metres.
NPerm	Surface tension, newton per metre.
radPers2	Angular acceleration, radians per second squared.
JPerm3	Energy density, joules per cubic metre.
VPerm	Electric field strength, volts per metre.
CPerm3	Electric charge density, coulombs per cubic metre.
CPerm2	Surface charge density, coulombs per square metre.
FPerm	Permittivity, farads per metre.
HPerm	Permeability, henrys per metre.
JPermol	Molar energy, joules per mole.
JPermolK	Molar entropy, molar heat capacity, joules per mole kelvin.
CPerkg	Exposure (x rays), coulombs per kilogram.
GyPers	Absorbed dose rate, grays per second.
WPersr	Radiant intensity, watts per steradian.
WPerm2sr	Radiance, watts per square metre steradian.
katPerm3	Catalytic activity concentration, katals per cubic metre.
d	Time in days, day = 24 h = 86400 s.
anglemin	Plane angle, minutes.
anglesec	Plane angle, seconds.
ha	Area, hectares.
tonne	Mass in tons, "tonne" or "metric ton" (1 000 kg = 1 Mg).
bar	Pressure in bars, (1 bar = 100 kPa).
mmHg	Pressure, millimetres of mercury (1 mmHg is approximately 133,3 Pa).
M	Length, nautical miles (1 M = 1 852 m).
kn	Speed, knots (1 kn = 1 852/3 600) m/s.
Mx	Magnetic flux, maxwells (1 Mx = 10-8 Wb).
G	Magnetic flux density, gausses (1 G = 10-4 T).

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literal	description
Oe	Magnetic field in oersteds, (1 Oe = (103/4p) A/m).
Vh	Volt-hour, Volt hours.
WPerA	Active power per current flow, watts per Ampere.
onePerHz	Reciprocal of frequency (1/Hz).
VPerVAr	Power factor, PF, the ratio of the active power to the apparent power. NOTE The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters. It is assumed that the data consumers understand the type of meter being used and agree on the sign convention in use at any given utility.
ohmPerm	Electric resistance per length in ohms per metre ((V/A)/m).
kgPerJ	Weight per energy in kilograms per joule (kg/J). NOTE multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-3.
JPers	Energy rate in joules per second (J/s).

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Annex L
(normative)

EUMED Metering XSD schema

L.1 EUMED Metering Entities global view

L.1.1 General

This Annex L describes the XSD Schemas derived from IEC 61968-9 in order to support the EUMED Metering profile. The EUMED Metering Entities description is given in Clause L.2. The EUMED Metering Datatypes used in the schema are described in Clause L.3. The XSDs are generated from MODSARUS©. Two XSD files are generated: one from the EUMED Metering entities, and the second one for the Data Types. A future implementation guide will describe MODSARUS© tool usage.

L.1.2 MeterReadingSet Entity

Figure L.1 describes the profile used for the MeterReadingSet in EUMED Metering.

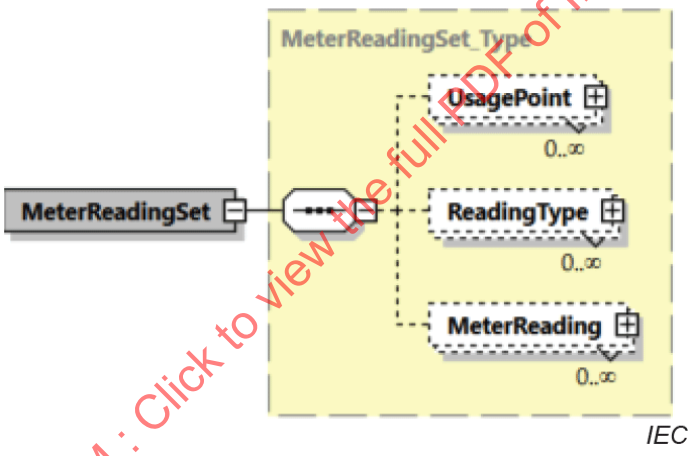


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Figure L.1 – MeterReadingSet schema for EUMED Metering

L.1.3 MeterReading Entity

Figure L.2 describes the MeterReading profile used in EUMED Metering.

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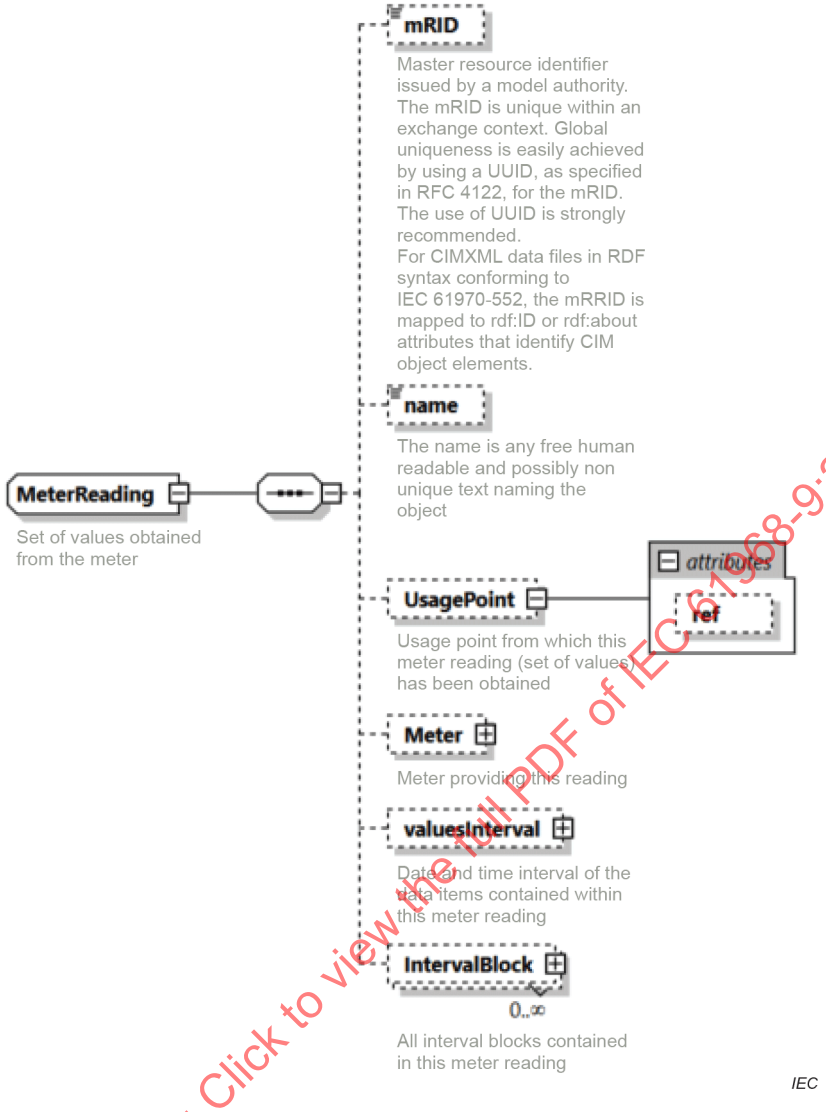


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Figure L.2 – The MeterReading schema used for EUMED Metering

L.1.4 Meter Entity

Figure L.3 describes the profile used for the Meter schema in EUMED Metering.

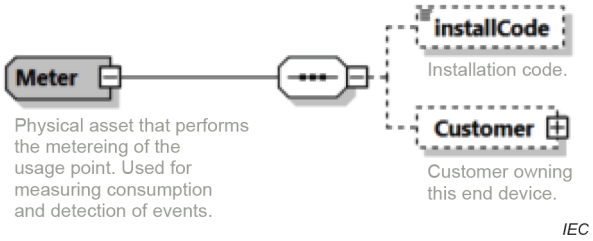


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Figure L.3 – Meter Entity

L.1.5 Customer Entity

Figure L.4 describes the profile used for the Meter schema in EUMED Metering.

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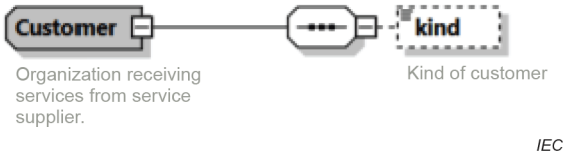


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Figure L.4 – Customer Schema used for EUMED Metering

L.1.6 IntervalBlock Entity

Figure L.5 describes the profile used for the IntervalBlock schema in EUMED Metering.

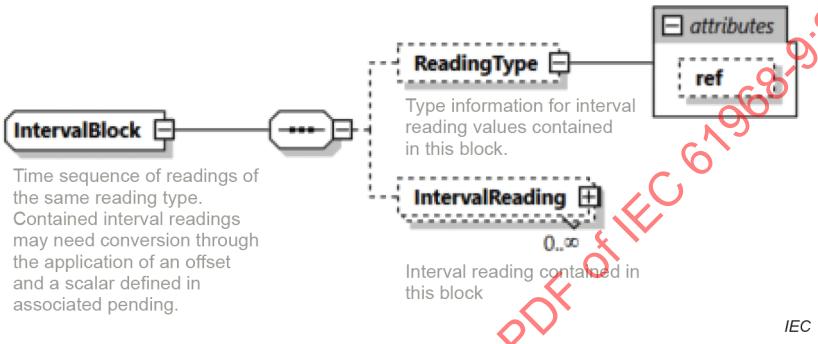


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Figure L.5 – IntervalBlock Schema used for EUMED Metering

Time sequence of readings of the same reading type. Contained interval readings may need conversion through the application of an offset and a scalar defined in associated pending.

Table L.1 shows all association ends of IntervalBlock with other classes.

Table L.1 – Association ends of EUMED Metering ENTITIES:: IntervalBlock with other classes

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mult from	name	mult to	type	description
0..*	MeterReading	0..1	MeterReading	Meter reading containing this interval block.
0..*	ReadingType	0..1	ReadingType	Type information for interval reading values contained in this block.
1..1	IntervalReading	0..*	IntervalReading	Interval reading contained in this block.

L.1.7 IntervalReading Entity

Figure L.6 describes the profile used for the MeterReadingSet in EUMED Metering.

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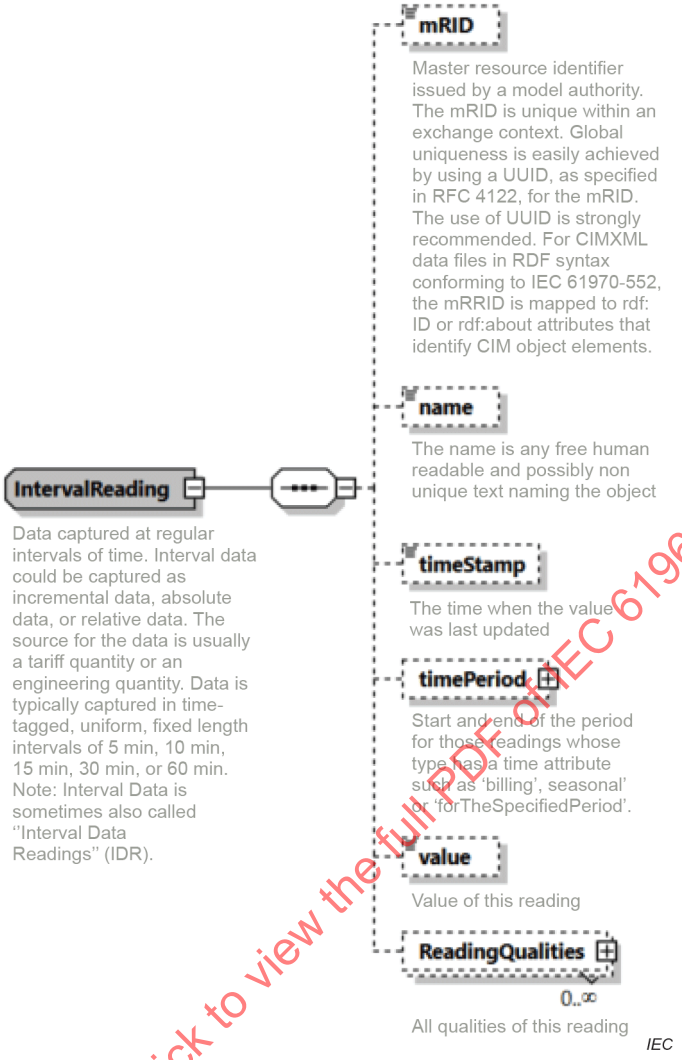


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Figure L.6 – IntervalReading schema used for EUMED metering

L.1.8 ReadingQuality Entity

Figure L.7 describes the profile used for the ReadingQuality element in EUMED Metering.

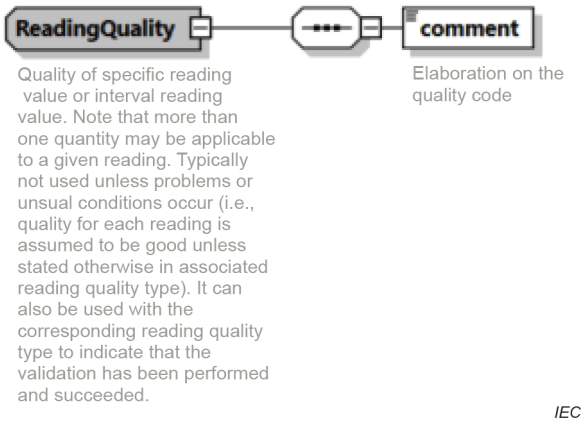


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Figure L.7 – ReadingQuality element for EUMED Metering

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L.1.9 UsagePoint Entity

Figure L.8 describes the profile used for the UsagePoint element in EUMED Metering.

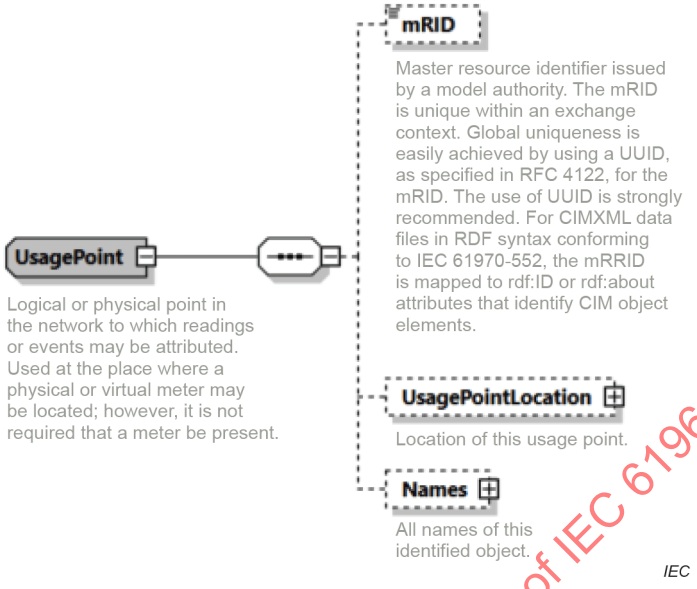


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Figure L.8 – UsagePoint element used in EUMED Metering

L.1.10 UsagePointLocation Entity

Figure L.9 describes the profile used for the UsagePointLocation element used in EUMED Metering.

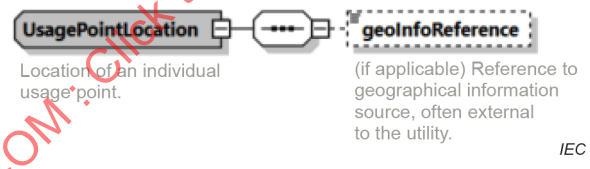


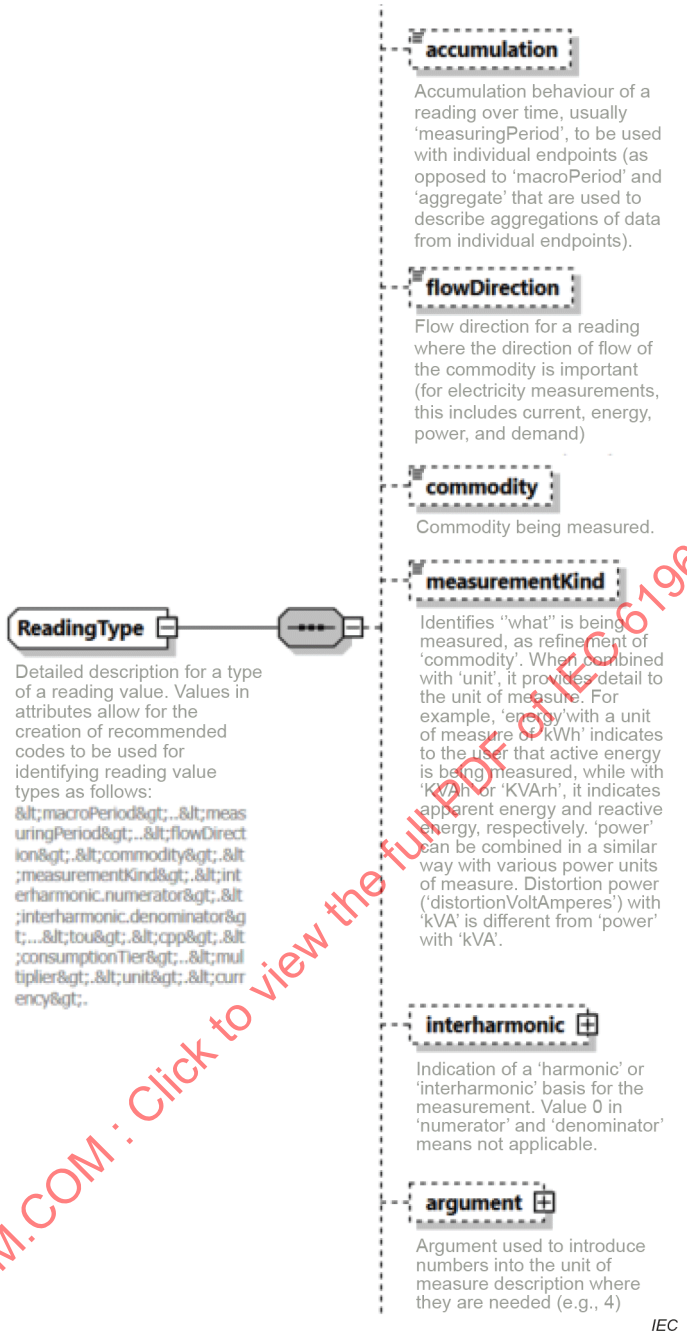
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Figure L.9 – UsagePointLocation element used in EUMED Metering

L.1.11 ReadingType Entity

Figure L.10 describes the profile used for the ReadingType in EUMED Metering.

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Figure L.10 – ReadingType element used in EUMED Metering

L.1.12 Name Entity

Figure L.11 describes the profile used for the Name element in EUMED Metering.

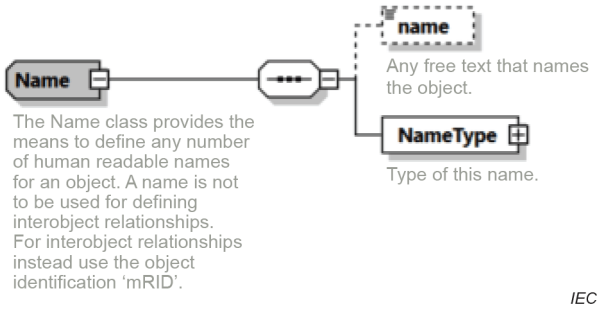


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Figure L.11 – Name element used in EUMED Metering

L.1.13 NameType Entity

Figure L.12 describes the profile used for the NameType element in EUMED Metering.

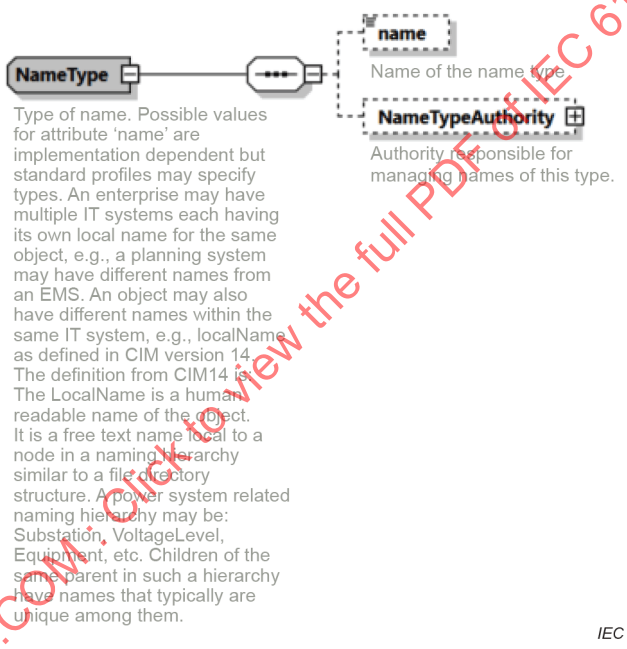


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Figure L.12 – NameType element used in EUMED Metering

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L.1.14 NameTypeAuthority Entity

Figure L.13 describes the profile used for the NameTypeAuthority element in EUMED Metering.

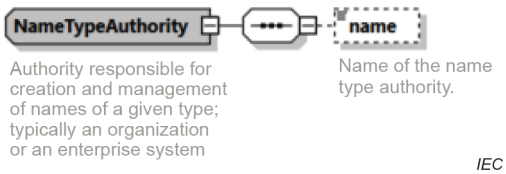


Figure L.13 is reproduced with the permission of UCAIug.

Figure L.13 – NameTypeAuthority element used in EUMED Metering

L.2 EUMED Metering Entities description

This XSD contains elements that are derived from the Common Information Model (CIM) and is reproduced with the permission of the UCAIug.

<CODE BEGINS>

<!--

. This version of this XSD is part of IEC 61968-9:2024, and this whole document has to be taken into account to have a full description of this code component.

-->

```
<?xml version="1.0" encoding="utf-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified">
  <xsd:include schemaLocation="./eumedMeteringDataType.xsd"/>
  <xsd:element name="MeterReadingSet" type="ns1:MeterReadingSet_Type"/>
  <xsd:complexType name="Customer">
    <xsd:annotation>
      <xsd:documentation>Organisation receiving services from service supplier.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="kind" type="ns1:CustomerKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Kind of customer.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="IntervalBlock">
    <xsd:annotation>
      <xsd:documentation>Time sequence of readings of the same reading type. Contained interval
readings may need conversion through the application of an offset and a scalar defined in associated
pending.
</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="ReadingType" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Type information for interval reading values contained in this
block.</xsd:documentation>
        </xsd:annotation>
        <xsd:complexType>
          <xsd:attribute name="ref" type="xsd:string"/>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="IntervalReading" type="ns1:IntervalReading" minOccurs="0"
maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>Interval reading contained in this block.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="IntervalReading">
    <xsd:annotation>
      <xsd:documentation>Data captured at regular intervals of time. Interval data could be captured as
incremental data, absolute data, or relative data. The source for the data is usually a tariff quantity
or an engineering quantity. Data is typically captured in time-tagged, uniform, fixed-length intervals
of 5 min, 10 min, 15 min, 30 min, or 60 min.
Note: Interval Data is sometimes also called "Interval Data Readings" (IDR).</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="mRID" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Master resource identifier issued by a model authority. The mRID is unique
within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC
4122, for the mRID. The use of UUID is strongly recommended.
For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or
rdf:about attributes that identify CIM object elements.</xsd:documentation>
        </xsd:annotation>
```

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```
      </xsd:element>
      <xsd:element name="name" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>The name is any free human readable and possibly non unique text naming
the object.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="timeStamp" type="xsd:dateTime" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>The time when the value was last updated.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="timePeriod" type="ns1:DateTimeInterval" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Start and end of the period for those readings whose type has a time
attribute such as 'billing', seasonal' or 'forTheSpecifiedPeriod'.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="value" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Value of this reading.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="ReadingQualities" type="ns1:ReadingQuality" minOccurs="0"
maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>All qualities of this reading.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="Meter">
    <xsd:annotation>
      <xsd:documentation>Physical asset that performs the metering role of the usage point. Used for
measuring consumption and detection of events.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="installCode" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Installation code.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="Customer" type="ns1:Customer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Customer owning this end device.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="MeterReading">
    <xsd:annotation>
      <xsd:documentation>Set of values obtained from the meter.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="mRID" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Master resource identifier issued by a model authority. The mRID is unique
within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC
4122, for the mRID. The use of UUID is strongly recommended.
For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or
rdf:about attributes that identify CIM object elements.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="name" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>The name is any free human readable and possibly non unique text naming
the object.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="UsagePoint" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Usage point from which this meter reading (set of values) has been
obtained.</xsd:documentation>
        </xsd:annotation>
        <xsd:complexType>
          <xsd:attribute name="ref" type="xsd:string"/>
```

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```
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="Meter" type="ns1:Meter" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Meter providing this reading.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="valuesInterval" type="ns1:DateTimeInterval" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Date and time interval of the data items contained within this meter
reading.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="IntervalBlock" type="ns1:IntervalBlock" minOccurs="0" maxOccurs="unbounded">
        <xsd:annotation>
          <xsd:documentation>All interval blocks contained in this meter reading.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="MeterReadingSet_Type">
    <xsd:sequence>
      <xsd:element name="UsagePoint" type="ns1:UsagePoint" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element name="ReadingType" type="ns1:ReadingType" minOccurs="0" maxOccurs="unbounded"/>
      <xsd:element name="MeterReading" type="ns1:MeterReading" minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="Name">
    <xsd:annotation>
      <xsd:documentation>The Name class provides the means to define any number of human readable
names for an object. A name is not to be used for defining inter-object relationships. For inter-object
relationships instead use the object identification 'mRID'.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="name" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Any free text that name the object.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="NameType" type="ns1:NameType" minOccurs="1" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Type of this name.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="NameType">
    <xsd:annotation>
      <xsd:documentation>Type of name. Possible values for attribute 'name' are implementation
dependent but standard profiles may specify types. An enterprise may have multiple IT systems each
having its own local name for the same object, e.g. a planning system may have different names from an
EMS. An object may also have different names within the same IT system, e.g. localName as defined in
CIM version 14. The definition from CIM14 is:
The localName is a human readable name of the object. It is a free text name local to a node in a
naming hierarchy similar to a file directory structure. A power system related naming hierarchy may be:
Substation, VoltageLevel, Equipment etc. Children of the same parent in such a hierarchy have names
that typically are unique among them.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="name" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Name of the name type.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="NameTypeAuthority" type="ns1:NameTypeAuthority" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Authority responsible for managing names of this type.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="NameTypeAuthority">
    <xsd:annotation>
      <xsd:documentation>Authority responsible for creation and management of names of a given type;
typically an organization or an enterprise system.</xsd:documentation>
    </xsd:annotation>
```

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```
    <xsd:sequence>
      <xsd:element name="name" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Name of the name type authority.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="ReadingQuality">
    <xsd:annotation>
      <xsd:documentation>Quality of a specific reading value or interval reading value. Note that more
than one quality may be applicable to a given reading. Typically not used unless problems or unusual
conditions occur (i.e., quality for each reading is assumed to be good unless stated otherwise in
associated reading quality type). It can also be used with the corresponding reading quality type to
indicate that the validation has been performed and succeeded.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="comment" type="xsd:string" minOccurs="1" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Elaboration on the quality code.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="ReadingType">
    <xsd:annotation>
      <xsd:documentation>Detailed description for a type of a reading value. Values in attributes allow
for the creation of recommended codes to be used for identifying reading value types as follows:
&lt;macroPeriod&gt;.&lt;measuringPeriod&gt;.&lt;flowDirection&gt;.&lt;commodity&gt;.&lt;measurementKi
nd&gt;.&lt;interharmonic.numerator&gt;.&lt;interharmonic.denominator&gt;...&lt;tou&gt;.&lt;cpp&gt;.&lt;
consumptionTier&gt;.&lt;multiplier&gt;.&lt;unit&gt;.&lt;currency&gt;.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="mRID" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Master resource identifier issued by a model authority. The mRID is unique
within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC
4122, for the mRID. The use of UUID is strongly recommended.
For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or
rdf:about attributes that identify CIM object elements.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="Names" type="ns1:Name" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>All names of this identified object.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="macroPeriod" type="ns1:MacroPeriodKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Time period of interest that reflects how the reading is viewed or
captured over a long period of time.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="aggregate" type="ns1:AggregateKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Salient attribute of the reading data aggregated from individual
endpoints. This is mainly used to define a mathematical operation carried out over 'macroPeriod', but
may also be used to describe an attribute of the data when the 'macroPeriod' is not
defined.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="measuringPeriod" type="ns1:MeasuringPeriodKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Time attribute inherent or fundamental to the reading value (as opposed to
'macroPeriod' that supplies an "adjective" to describe aspects of a time period with regard to the
measurement). It refers to the way the value was originally measured and not to the frequency at which
it is reported or presented. For example, an hourly interval of consumption data would have value
'hourly' as an attribute. However in the case of an hourly sampled voltage value, the meterReadings
schema would carry the 'hourly' interval size information.
It is common for meters to report demand in a form that is measured over the course of a portion of an
hour, while enterprise applications however commonly assume the demand (in kW or kVAr) normalised to 1
hour. The system that receives readings directly from the meter therefore shall perform this
transformation before publishing readings for use by the other enterprise systems. The scalar used is
chosen based on the block size (not any sub-interval size).</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
```

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```
      <xsd:element name="accumulation" type="ns1:AccumulationKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Accumulation behaviour of a reading over time, usually 'measuringPeriod',
to be used with individual endpoints (as opposed to 'macroPeriod' and 'aggregate' that are used to
describe aggregations of data from individual endpoints).</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="flowDirection" type="ns1:FlowDirectionKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Flow direction for a reading where the direction of flow of the commodity
is important (for electricity measurements this includes current, energy, power, and
demand).</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="commodity" type="ns1:CommodityKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Commodity being measured.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="measurementKind" type="ns1:MeasurementKind" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Identifies "what" is being measured, as refinement of 'commodity'. When
combined with 'unit', it provides detail to the unit of measure. For example, 'energy' with a unit of
measure of 'kWh' indicates to the user that active energy is being measured, while with 'kVAh' or
'kVArh', it indicates apparent energy and reactive energy, respectively. 'power' can be combined in a
similar way with various power units of measure: Distortion power ('distortionVoltAmperes') with 'kVA'
is different from 'power' with 'kVA'.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="interharmonic" type="ns1:ReadingInterharmonic" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Indication of a "harmonic" or "interharmonic" basis for the measurement.
Value 0 in 'numerator' and 'denominator' means not applicable.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="argument" type="ns1:RationalNumber" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Argument used to introduce numbers into the unit of measure description
where they are needed (e.g., 4 where the measure needs an argument such as CEMI(n=4)). Most arguments
used in practice however will be integers (i.e., 'denominator'=1).
Value 0 in 'numerator' and 'denominator' means not applicable.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="tou" type="xsd:integer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Time of use (TOU) bucket the reading value is attributed to. Value 0 means
not applicable.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="cpp" type="xsd:integer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Critical peak period (CPP) bucket the reading value is attributed to.
Value 0 means not applicable. Even though CPP is usually considered a specialised form of time of use
'tou', this attribute is defined explicitly for flexibility.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="consumptionTier" type="xsd:integer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>In case of common flat-rate pricing for power, in which all purchases are
at a given rate, 'consumptionTier'=0. Otherwise, the value indicates the consumption tier, which can be
used in conjunction with TOU or CPP pricing.
Consumption tier pricing refers to the method of billing in which a certain "block" of energy is
purchased/sold at one price, after which the next block of energy is purchased at another price, and so
on, all throughout a defined period. At the start of the defined period, consumption is initially zero,
and any usage is measured against the first consumption tier ('consumptionTier'=1). If this block of
energy is consumed before the end of the period, energy consumption moves to be reconed against the
second consumption tier ('consumptionTier'=2), and so on. At the end of the defined period, the
consumption accumulator is reset, and usage within the 'consumptionTier'=1
restarts.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="phases" type="ns1:PhaseCode" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Metering-specific phase code.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
```

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```
      <xsd:element name="multiplier" type="ns1:UnitMultiplier" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Metering-specific multiplier.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="unit" type="ns1:UnitSymbol" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Metering-specific unit.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="currency" type="ns1:Currency" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Metering-specific currency.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="UsagePoint">
    <xsd:annotation>
      <xsd:documentation>Logical or physical point in the network to which readings or events may be
attributed. Used at the place where a physical or virtual meter may be located; however, it is not
required that a meter be present.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="mRID" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Master resource identifier issued by a model authority. The mRID is unique
within an exchange context. Global uniqueness is easily achieved by using a UUID, as specified in RFC
4122, for the mRID. The use of UUID is strongly recommended.
For CIMXML data files in RDF syntax conforming to IEC 61970-552, the mRID is mapped to rdf:ID or
rdf:about attributes that identify CIM object elements.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="UsagePointLocation" type="ns1:UsagePointLocation" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Location of this usage point.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="Names" type="ns1:Name" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>All names of this identified object.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="UsagePointLocation">
    <xsd:annotation>
      <xsd:documentation>Location of an individual usage point.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="geoInfoReference" type="xsd:string" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>(if applicable) Reference to geographical information source, often
external to the utility.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
</xsd:schema>
```

<CODE ENDS>

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L.3 EUMED Metering Datatypes Description

This XSD contains elements that are dervied from the Common Information Model (CIM) and is reproduced with the permission of the UCAIug.

<CODE BEGINS>

```
<?xml version="1.0" encoding="utf-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified">
  <xsd:simpleType name="AccumulationKind">
    <xsd:annotation>
      <xsd:documentation>Kind of accumulation behaviour for read / measured values from individual end
points.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Not applicable, or implied by the unit of measure.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="bulkQuantity">
        <xsd:annotation>
          <xsd:documentation>A value from a register which represents the bulk quantity of a commodity.
This quantity is computed as the integral of the commodity usage rate. This value is typically used as
the basis for the dial reading at the meter, and as a result, will roll over upon reaching a maximum
dial value.
Note 1: With the metering system, the roll-over behaviour typically implies a roll-under behavior so
that the value presented is always a positive value (e.g. unsigned integer or positive decimal.)
However, when communicating data between enterprise applications a negative value might occur in a case
such as net metering.
Note 2: A 'bulkQuantity' refers primarily to the dial reading and not the consumption over a specific
period of time.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="continuousCumulative">
        <xsd:annotation>
          <xsd:documentation>The sum of the previous billing period values and the present period
value.
Note: 'continuousCumulative' is commonly used in conjunction with 'demand', and it  would represent the
cumulative sum of the previous billing period maximum demand values (as occurring with each demand
reset) summed with the present period maximum demand value (which has yet to be
reset.)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="cumulative">
        <xsd:annotation>
          <xsd:documentation>The sum of the previous billing period values.
Note: 'cumulative' is commonly used in conjunction with "demand." Each demand reset causes the maximum
demand value for the present billing period (since the last demand reset) to accumulate as an
accumulative total of all maximum demands. So instead of 'zeroing' the demand register, a demand reset
has the effect of adding the present maximum demand to this accumulating total. </xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="deltaData">
        <xsd:annotation>
          <xsd:documentation>The difference between the value at the end of the prescribed interval and
the beginning of the interval. This is used for incremental interval data.
Note: One common application would be for load profile data, another use might be to report the number
of events within an interval (such as the number of equipment energisations within the specified period
of time.)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="indicating">
        <xsd:annotation>
          <xsd:documentation>As if a needle is swung out on the meter face to a value to indicate the
current value.
Note: An 'indicating' value is typically measured over hundreds of milliseconds or greater, or may
imply a "pusher" mechanism to capture a value. Compare this to 'instantaneous' which is measured over a
shorter period of time.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="summation">
        <xsd:annotation>
```

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```
          <xsd:documentation>A form of accumulation which is selective with respect to time.
Note: 'summation' could be considered a specialisation of 'bulkQuantity' as it selectively accumulates
pulses over a timing pattern (while 'bulkQuantity' accumulates pulses all of the
time).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="timeDelay">
        <xsd:annotation>
          <xsd:documentation>A form of computation which introduces a time delay characteristic to the
data value.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="instantaneous">
        <xsd:annotation>
          <xsd:documentation>Typically measured over the fastest period of time allowed by the
definition of the metric (usually milliseconds or tens of milliseconds.)
Note: 'instantaneous' was moved to attribute #3 in Ed.2 of IEC 61968-9, from attribute #1 in Ed.1 of
IEC 61968-9.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="latchingQuantity">
        <xsd:annotation>
          <xsd:documentation>When this description is applied to a metered value, it implies that the
value is a time-independent cumulative quantity much like a 'bulkQuantity', except that it latches upon
the maximum value upon reaching that value. Any additional accumulation (positive or negative) is
discarded until a reset occurs.
Note: A 'latchingQuantity' may also occur in the downward direction – upon reaching a minimum value.
The terms 'maximum' or 'minimum' (for 'aggregate') will usually be included when this type of
accumulation behaviour is present.
When this description is applied to an encoded value (UOM= 'Code'), it implies that the value has one
or more bits which are latching. The condition that caused the bit to be set may have long since
evaporated.
In either case, the timestamp that accompanies the value may not coincide with the moment the value was
initially set.
In both cases a system will need to perform an operation to clear the latched
value.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="boundedQuantity">
        <xsd:annotation>
          <xsd:documentation>A time-independent cumulative quantity much like a 'bulkQuantity' or a
'latchingQuantity', except that the accumulation stops at the maximum or minimum values. When the
maximum is reached, any additional positive accumulation is discarded, but negative accumulation may be
accepted (thus lowering the counter.) Likewise, when the negative bound is reached, any additional
negative accumulation is discarded, but positive accumulation is accepted (thus increasing the
counter.) </xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="AggregateKind">
    <xsd:annotation>
      <xsd:documentation>Kind of aggregation for read / measured values from multiple end
points.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Not applicable.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="average">
        <xsd:annotation>
          <xsd:documentation>The value represents average.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="excess">
        <xsd:annotation>
          <xsd:documentation>The value represents an amount over which a threshold was
exceeded.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="highThreshold">
        <xsd:annotation>
          <xsd:documentation>The value represents a programmed high threshold. </xsd:documentation>
        </xsd:annotation>
```

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```
      </xsd:enumeration>
      <xsd:enumeration value="lowThreshold">
        <xsd:annotation>
          <xsd:documentation>The value represents a programmed low threshold. </xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="maximum">
        <xsd:annotation>
          <xsd:documentation>The highest value observed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="minimum">
        <xsd:annotation>
          <xsd:documentation>The smallest value observed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="nominal">
        <xsd:annotation>
          <xsd:documentation>The nominal value.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="normal">
        <xsd:annotation>
          <xsd:documentation>The normal value.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="secondMaximum">
        <xsd:annotation>
          <xsd:documentation>The second highest value observed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="secondMinimum">
        <xsd:annotation>
          <xsd:documentation>The second smallest value observed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="thirdMaximum">
        <xsd:annotation>
          <xsd:documentation>The third highest value observed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="fourthMaximum">
        <xsd:annotation>
          <xsd:documentation>The fourth highest value observed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="fifthMaximum">
        <xsd:annotation>
          <xsd:documentation>The fifth highest value observed.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="sum">
        <xsd:annotation>
          <xsd:documentation>The accumulated sum.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="CommodityKind">
    <xsd:annotation>
      <xsd:documentation>Kind of commodity being measured.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Not Applicable</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="electricitySecondaryMetered">
        <xsd:annotation>
          <xsd:documentation>All types of metered quantities. This type of reading comes from the meter
and represents a "secondary" metered value.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="electricityPrimaryMetered">
        <xsd:annotation>
```

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```
          <xsd:documentation>It is possible for a meter to be outfitted with an external VT and/or CT.
The meter might not be aware of these devices, and the display not compensate for their presence.
Ultimately, when these scalars are applied, the value that represents the service value is called the
"primary metered" value. The "index" in sub-category 3 mirrors those of sub-category
0.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="communication">
        <xsd:annotation>
          <xsd:documentation>A measurement of the communication infrastructure
itself.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="air"/>
      <xsd:enumeration value="insulativeGas">
        <xsd:annotation>
          <xsd:documentation>(SF6 is found separately below.)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="insulativeOil"/>
      <xsd:enumeration value="naturalGas"/>
      <xsd:enumeration value="propane"/>
      <xsd:enumeration value="potableWater">
        <xsd:annotation>
          <xsd:documentation>Drinkable water</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="steam">
        <xsd:annotation>
          <xsd:documentation>Water in steam form, usually used for heating.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="wasteWater">
        <xsd:annotation>
          <xsd:documentation>(Sewerage)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="heatingFluid">
        <xsd:annotation>
          <xsd:documentation>This fluid is likely in liquid form. It is not necessarily water or water
based. The warm fluid returns cooler than when it was sent. The heat conveyed may be
metered.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="coolingFluid">
        <xsd:annotation>
          <xsd:documentation>The cool fluid returns warmer than when it was sent. The heat conveyed may
be metered.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="nonpotableWater">
        <xsd:annotation>
          <xsd:documentation>Reclaimed water – possibly used for irrigation but not sufficiently
treated to be considered safe for drinking.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="nox">
        <xsd:annotation>
          <xsd:documentation>Nitrous Oxides NOX</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="so2">
        <xsd:annotation>
          <xsd:documentation>Sulfur Dioxide SO2</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ch4">
        <xsd:annotation>
          <xsd:documentation>Methane CH4</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="co2">
        <xsd:annotation>
          <xsd:documentation>Carbon Dioxide CO2</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
```

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```
      <xsd:enumeration value="carbon"/>
      <xsd:enumeration value="hch">
        <xsd:annotation>
          <xsd:documentation>Hexachlorocyclohexane HCH</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="pfc">
        <xsd:annotation>
          <xsd:documentation>Perfluorocarbons PFC</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="sf6">
        <xsd:annotation>
          <xsd:documentation>Sulfurhexafluoride SF6</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="tvLicence">
        <xsd:annotation>
          <xsd:documentation>Television</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="internet">
        <xsd:annotation>
          <xsd:documentation>Internet service</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="refuse">
        <xsd:annotation>
          <xsd:documentation>trash</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="Currency">
    <xsd:annotation>
      <xsd:documentation>Monetary currencies. ISO 4217 standard including 3-character currency
code.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="AED">
        <xsd:annotation>
          <xsd:documentation>United Arab Emirates dirham.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AFN">
        <xsd:annotation>
          <xsd:documentation>Afghan afghani.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ALL">
        <xsd:annotation>
          <xsd:documentation>Albanian lek.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AMD">
        <xsd:annotation>
          <xsd:documentation>Armenian dram.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ANG">
        <xsd:annotation>
          <xsd:documentation>Netherlands Antillean guilder.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AOA">
        <xsd:annotation>
          <xsd:documentation>Angolan kwanza.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ARS">
        <xsd:annotation>
          <xsd:documentation>Argentine peso.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AUD">
        <xsd:annotation>
```

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```
          <xsd:documentation>Australian dollar.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AWG">
        <xsd:annotation>
          <xsd:documentation>Aruban florin.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AZN">
        <xsd:annotation>
          <xsd:documentation>Azerbaijani manat.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BAM">
        <xsd:annotation>
          <xsd:documentation>Bosnia and Herzegovina convertible mark.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BBD">
        <xsd:annotation>
          <xsd:documentation>Barbados dollar.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BDT">
        <xsd:annotation>
          <xsd:documentation>Bangladeshi taka.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BGN">
        <xsd:annotation>
          <xsd:documentation>Bulgarian lev.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BHD">
        <xsd:annotation>
          <xsd:documentation>Bahraini dinar.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BIF">
        <xsd:annotation>
          <xsd:documentation>Burundian franc.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BMD">
        <xsd:annotation>
          <xsd:documentation>Bermudian dollar (customarily known as Bermuda
dollar).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BND">
        <xsd:annotation>
          <xsd:documentation>Brunei dollar.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BOB">
        <xsd:annotation>
          <xsd:documentation>Boliviano.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BOV">
        <xsd:annotation>
          <xsd:documentation>Bolivian Mvdol (funds code).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BRL">
        <xsd:annotation>
          <xsd:documentation>Brazilian real.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BSD">
        <xsd:annotation>
          <xsd:documentation>Bahamian dollar.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BTN">
        <xsd:annotation>
```

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```
      <xsd:documentation>Bhutanese ngultrum.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="BWP">
    <xsd:annotation>
      <xsd:documentation>Botswana pula.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="BYR">
    <xsd:annotation>
      <xsd:documentation>Belarusian ruble.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="BZD">
    <xsd:annotation>
      <xsd:documentation>Belize dollar.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CAD">
    <xsd:annotation>
      <xsd:documentation>Canadian dollar.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CDF">
    <xsd:annotation>
      <xsd:documentation>Congolese franc.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CHF">
    <xsd:annotation>
      <xsd:documentation>Swiss franc.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CLF">
    <xsd:annotation>
      <xsd:documentation>Unidad de Fomento (funds code), Chile.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CLP">
    <xsd:annotation>
      <xsd:documentation>Chilean peso.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CNY">
    <xsd:annotation>
      <xsd:documentation>Chinese yuan.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="COP">
    <xsd:annotation>
      <xsd:documentation>Colombian peso.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="COU">
    <xsd:annotation>
      <xsd:documentation>Unidad de Valor Real.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CRC">
    <xsd:annotation>
      <xsd:documentation>Costa Rican colon.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CUC">
    <xsd:annotation>
      <xsd:documentation>Cuban convertible peso.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CUP">
    <xsd:annotation>
      <xsd:documentation>Cuban peso.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="CVE">
    <xsd:annotation>
      <xsd:documentation>Cape Verde escudo.</xsd:documentation>
```

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```
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="CZK">
  <xsd:annotation>
    <xsd:documentation>Czech koruna.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="DJF">
  <xsd:annotation>
    <xsd:documentation>Djiboutian franc.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="DKK">
  <xsd:annotation>
    <xsd:documentation>Danish krone.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="DOP">
  <xsd:annotation>
    <xsd:documentation>Dominican peso.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="DZD">
  <xsd:annotation>
    <xsd:documentation>Algerian dinar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="EEK">
  <xsd:annotation>
    <xsd:documentation>Estonian kroon.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="EGP">
  <xsd:annotation>
    <xsd:documentation>Egyptian pound.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="ERN">
  <xsd:annotation>
    <xsd:documentation>Eritrean nakfa.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="ETB">
  <xsd:annotation>
    <xsd:documentation>Ethiopian birr.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="EUR">
  <xsd:annotation>
    <xsd:documentation>Euro.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="FJD">
  <xsd:annotation>
    <xsd:documentation>Fiji dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="FKP">
  <xsd:annotation>
    <xsd:documentation>Falkland Islands pound.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="GBP">
  <xsd:annotation>
    <xsd:documentation>Pound sterling.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="GEL">
  <xsd:annotation>
    <xsd:documentation>Georgian lari.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="GHS">
  <xsd:annotation>
    <xsd:documentation>Ghanaian cedi.</xsd:documentation>
  </xsd:annotation>
```

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```
</xsd:enumeration>
<xsd:enumeration value="GIP">
  <xsd:annotation>
    <xsd:documentation>Gibraltar pound.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="GMD">
  <xsd:annotation>
    <xsd:documentation>Gambian dalasi.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="GNF">
  <xsd:annotation>
    <xsd:documentation>Guinean franc.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="GTQ">
  <xsd:annotation>
    <xsd:documentation>Guatemalan quetzal.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="GYD">
  <xsd:annotation>
    <xsd:documentation>Guyanese dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="HKD">
  <xsd:annotation>
    <xsd:documentation>Hong Kong dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="HNL">
  <xsd:annotation>
    <xsd:documentation>Honduran lempira.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="HRK">
  <xsd:annotation>
    <xsd:documentation>Croatian kuna.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="HTG">
  <xsd:annotation>
    <xsd:documentation>Haitian gourde.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="HUF">
  <xsd:annotation>
    <xsd:documentation>Hungarian forint.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="IDR">
  <xsd:annotation>
    <xsd:documentation>Indonesian rupiah.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="ILS">
  <xsd:annotation>
    <xsd:documentation>Israeli new sheqel.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="INR">
  <xsd:annotation>
    <xsd:documentation>Indian rupee.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="IQD">
  <xsd:annotation>
    <xsd:documentation>Iraqi dinar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="IRR">
  <xsd:annotation>
    <xsd:documentation>Iranian rial.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
```

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```
<xsd:enumeration value="ISK">
  <xsd:annotation>
    <xsd:documentation>Icelandic króna.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="JMD">
  <xsd:annotation>
    <xsd:documentation>Jamaican dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="JOD">
  <xsd:annotation>
    <xsd:documentation>Jordanian dinar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="JPY">
  <xsd:annotation>
    <xsd:documentation>Japanese yen.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KES">
  <xsd:annotation>
    <xsd:documentation>Kenyan shilling.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KGS">
  <xsd:annotation>
    <xsd:documentation>Kyrgyzstani som.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KHR">
  <xsd:annotation>
    <xsd:documentation>Cambodian riel.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KMF">
  <xsd:annotation>
    <xsd:documentation>Comoro franc.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KPW">
  <xsd:annotation>
    <xsd:documentation>North Korean won.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KRW">
  <xsd:annotation>
    <xsd:documentation>South Korean won.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KWD">
  <xsd:annotation>
    <xsd:documentation>Kuwaiti dinar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KYD">
  <xsd:annotation>
    <xsd:documentation>Cayman Islands dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="KZT">
  <xsd:annotation>
    <xsd:documentation>Kazakhstani tenge.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LAK">
  <xsd:annotation>
    <xsd:documentation>Lao kip.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LBP">
  <xsd:annotation>
    <xsd:documentation>Lebanese pound.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="LKR">
```

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```
      <xsd:annotation>
        <xsd:documentation>Sri Lanka rupee.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="LRD">
      <xsd:annotation>
        <xsd:documentation>Liberian dollar.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="LSL">
      <xsd:annotation>
        <xsd:documentation>Lesotho loti.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="LTL">
      <xsd:annotation>
        <xsd:documentation>Lithuanian litas.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="LVL">
      <xsd:annotation>
        <xsd:documentation>Latvian lats.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="LYD">
      <xsd:annotation>
        <xsd:documentation>Libyan dinar.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MAD">
      <xsd:annotation>
        <xsd:documentation>Moroccan dirham.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MDL">
      <xsd:annotation>
        <xsd:documentation>Moldovan leu.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MGA">
      <xsd:annotation>
        <xsd:documentation>Malagasy ariary.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MKD">
      <xsd:annotation>
        <xsd:documentation>Macedonian denar.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MMK">
      <xsd:annotation>
        <xsd:documentation>Myanma kyat.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MNT">
      <xsd:annotation>
        <xsd:documentation>Mongolian tugrik.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MOP">
      <xsd:annotation>
        <xsd:documentation>Macanese pataca.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MRO">
      <xsd:annotation>
        <xsd:documentation>Mauritanian ouguiya.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MUR">
      <xsd:annotation>
        <xsd:documentation>Mauritian rupee.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="MVR">
      <xsd:annotation>
```

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```
      <xsd:documentation>Maldivian rufiyaa.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="MWK">
    <xsd:annotation>
      <xsd:documentation>Malawian kwacha.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="MXN">
    <xsd:annotation>
      <xsd:documentation>Mexican peso.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="MYR">
    <xsd:annotation>
      <xsd:documentation>Malaysian ringgit.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="MZN">
    <xsd:annotation>
      <xsd:documentation>Mozambican metical.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="NAD">
    <xsd:annotation>
      <xsd:documentation>Namibian dollar.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="NGN">
    <xsd:annotation>
      <xsd:documentation>Nigerian naira.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="NIO">
    <xsd:annotation>
      <xsd:documentation>Cordoba oro.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="NOK">
    <xsd:annotation>
      <xsd:documentation>Norwegian krone.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="NPR">
    <xsd:annotation>
      <xsd:documentation>Nepalese rupee.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="NZD">
    <xsd:annotation>
      <xsd:documentation>New Zealand dollar.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="OMR">
    <xsd:annotation>
      <xsd:documentation>Omani rial.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="PAB">
    <xsd:annotation>
      <xsd:documentation>Panamanian balboa.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="PEN">
    <xsd:annotation>
      <xsd:documentation>Peruvian nuevo sol.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="PGK">
    <xsd:annotation>
      <xsd:documentation>Papua New Guinean kina.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="PHP">
    <xsd:annotation>
      <xsd:documentation>Philippine peso.</xsd:documentation>
```

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```
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="PKR">
    <xsd:annotation>
      <xsd:documentation>Pakistani rupee.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="PLN">
    <xsd:annotation>
      <xsd:documentation>Polish zloty.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="PYG">
    <xsd:annotation>
      <xsd:documentation>Paraguayan guaraní.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="QAR">
    <xsd:annotation>
      <xsd:documentation>Qatari rial.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="RON">
    <xsd:annotation>
      <xsd:documentation>Romanian new leu.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="RSD">
    <xsd:annotation>
      <xsd:documentation>Serbian dinar.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="RUB">
    <xsd:annotation>
      <xsd:documentation>Russian rouble.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="RWF">
    <xsd:annotation>
      <xsd:documentation>Rwandan franc.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="SAR">
    <xsd:annotation>
      <xsd:documentation>Saudi riyal.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="SBD">
    <xsd:annotation>
      <xsd:documentation>Solomon Islands dollar.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="SCR">
    <xsd:annotation>
      <xsd:documentation>Seychelles rupee.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="SDG">
    <xsd:annotation>
      <xsd:documentation>Sudanese pound.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="SEK">
    <xsd:annotation>
      <xsd:documentation>Swedish krona/kronor.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="SGD">
    <xsd:annotation>
      <xsd:documentation>Singapore dollar.</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="SHP">
    <xsd:annotation>
      <xsd:documentation>Saint Helena pound.</xsd:documentation>
    </xsd:annotation>
```

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```
</xsd:enumeration>
<xsd:enumeration value="SLL">
  <xsd:annotation>
    <xsd:documentation>Sierra Leonean leone.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="SOS">
  <xsd:annotation>
    <xsd:documentation>Somali shilling.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="SRD">
  <xsd:annotation>
    <xsd:documentation>Surinamese dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="STD">
  <xsd:annotation>
    <xsd:documentation>São Tomé and Príncipe dobra.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="SYP">
  <xsd:annotation>
    <xsd:documentation>Syrian pound.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="SZL">
  <xsd:annotation>
    <xsd:documentation>Lilangeni.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="THB">
  <xsd:annotation>
    <xsd:documentation>Thai baht.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TJS">
  <xsd:annotation>
    <xsd:documentation>Tajikistani somoni.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TMT">
  <xsd:annotation>
    <xsd:documentation>Turkmenistani manat.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TND">
  <xsd:annotation>
    <xsd:documentation>Tunisian dinar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TOP">
  <xsd:annotation>
    <xsd:documentation>Tongan pa'anga.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TRY">
  <xsd:annotation>
    <xsd:documentation>Turkish lira.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TTD">
  <xsd:annotation>
    <xsd:documentation>Trinidad and Tobago dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TWD">
  <xsd:annotation>
    <xsd:documentation>New Taiwan dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="TZS">
  <xsd:annotation>
    <xsd:documentation>Tanzanian shilling.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
```

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```
<xsd:enumeration value="UAH">
  <xsd:annotation>
    <xsd:documentation>Ukrainian hryvnia.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="UGX">
  <xsd:annotation>
    <xsd:documentation>Ugandan shilling.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="USD">
  <xsd:annotation>
    <xsd:documentation>United States dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="UYU">
  <xsd:annotation>
    <xsd:documentation>Uruguayan peso.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="UZS">
  <xsd:annotation>
    <xsd:documentation>Uzbekistan som.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="VEF">
  <xsd:annotation>
    <xsd:documentation>Venezuelan bolívar fuerte.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="VND">
  <xsd:annotation>
    <xsd:documentation>Vietnamese Dong.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="VUV">
  <xsd:annotation>
    <xsd:documentation>Vanuatu vatu.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="WST">
  <xsd:annotation>
    <xsd:documentation>Samoan tala.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="XAF">
  <xsd:annotation>
    <xsd:documentation>CFA franc BEAC.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="XCD">
  <xsd:annotation>
    <xsd:documentation>East Caribbean dollar.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="XOF">
  <xsd:annotation>
    <xsd:documentation>CFA Franc BCEAO.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="XPF">
  <xsd:annotation>
    <xsd:documentation>CFP franc.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="YER">
  <xsd:annotation>
    <xsd:documentation>Yemeni rial.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="ZAR">
  <xsd:annotation>
    <xsd:documentation>South African rand.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="ZMK">
```

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```
      <xsd:annotation>
        <xsd:documentation>Zambian kwacha.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="ZWL">
      <xsd:annotation>
        <xsd:documentation>Zimbabwe dollar.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
  </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="CustomerKind">
  <xsd:annotation>
    <xsd:documentation>Kind of customer.</xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="residential">
      <xsd:annotation>
        <xsd:documentation>Residential customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="residentialAndCommercial">
      <xsd:annotation>
        <xsd:documentation>Residential and commercial customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="residentialAndStreetlight">
      <xsd:annotation>
        <xsd:documentation>Residential and streetlight customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="residentialStreetlightOthers">
      <xsd:annotation>
        <xsd:documentation>Residential streetlight or other related customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="residentialFarmService">
      <xsd:annotation>
        <xsd:documentation>Residential farm service customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="commercialIndustrial">
      <xsd:annotation>
        <xsd:documentation>Commercial industrial customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="pumpingLoad">
      <xsd:annotation>
        <xsd:documentation>Pumping load customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="windMachine">
      <xsd:annotation>
        <xsd:documentation>Wind machine customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="energyServiceSupplier">
      <xsd:annotation>
        <xsd:documentation>Customer as energy service supplier.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="energyServiceScheduler">
      <xsd:annotation>
        <xsd:documentation>Customer as energy service scheduler.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="internalUse">
      <xsd:annotation>
        <xsd:documentation>Internal use customer.</xsd:documentation>
      </xsd:annotation>
    </xsd:enumeration>
    <xsd:enumeration value="enterprise"/>
    <xsd:enumeration value="regionalOperator"/>
    <xsd:enumeration value="subsidiary"/>
    <xsd:enumeration value="other">
      <xsd:annotation>
```

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```
          <xsd:documentation>Other kind of customer.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="FlowDirectionKind">
    <xsd:annotation>
      <xsd:documentation>Kind of flow direction for reading/measured  values proper to some commodities
such as, for example, energy, power, demand.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Not Applicable (N/A)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="forward">
        <xsd:annotation>
          <xsd:documentation>"Delivered," or "Imported" as defined 61968-2.
Forward Active Energy is a positive kWh value as one would naturally expect to find as energy is
supplied by the utility and consumed at the service.
Forward Reactive Energy is a positive VArh value as one would naturally expect to find in the presence
of inductive loading.
In polyphase metering, the forward energy register is incremented when the sum of the phase energies is
greater than zero:
&lt;img src="HTS_1.PNG" width="209" height="16" border="0" alt="graphic"/&gt;</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="lagging">
        <xsd:annotation>
          <xsd:documentation>Typically used to describe that a power factor is lagging the reference
value.
Note 1: When used to describe VA, "lagging" describes a form of measurement where reactive power is
considered in all four quadrants, but real power is considered only in quadrants I and IV.
Note 2: When used to describe power factor, the term "Lagging" implies that the PF is negative. The
term "lagging" in this case takes the place of the negative sign. If a signed PF value is to be passed
by the data producer, then the direction of flow enumeration zero (none) should be used in order to
avoid the possibility of creating an expression that employs a double negative. The data consumer
should be able to tell from the sign of the data if the PF is leading or lagging. This principle is
analogous to the concept that "Reverse" energy is an implied negative value, and to publish a negative
reverse value would be ambiguous.
Note 3: Lagging power factors typically indicate inductive loading.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="leading">
        <xsd:annotation>
          <xsd:documentation>Typically used to describe that a power factor is leading the reference
value.
Note: Leading power factors typically indicate capacitive loading.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="net">
        <xsd:annotation>
          <xsd:documentation>|Forward| - |Reverse|, See 61968-2.

Note: In some systems, the value passed as a "net" value could become negative. In other systems the
value passed as a "net" value is always a positive number, and rolls-over and rolls-under as needed.
</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q1plusQ2">
        <xsd:annotation>
          <xsd:documentation>Reactive positive quadrants. (The term "lagging" is
preferred.)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q1plusQ3">
        <xsd:annotation>
          <xsd:documentation>Quadrants 1 and 3</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q1plusQ4">
        <xsd:annotation>
          <xsd:documentation>Quadrants 1 and 4 usually represent forward active
energy</xsd:documentation>
        </xsd:annotation>
```

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```
      </xsd:enumeration>
      <xsd:enumeration value="q1minusQ4">
        <xsd:annotation>
          <xsd:documentation>Q1 minus Q4</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q2plusQ3">
        <xsd:annotation>
          <xsd:documentation>Quadrants 2 and 3 usually represent reverse active
energy</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q2plusQ4">
        <xsd:annotation>
          <xsd:documentation>Quadrants 2 and 4</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q2minusQ3">
        <xsd:annotation>
          <xsd:documentation>Q2 minus Q3</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q3plusQ4">
        <xsd:annotation>
          <xsd:documentation>Reactive negative quadrants. (The term "leading" is
preferred.)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="q3minusQ2">
        <xsd:annotation>
          <xsd:documentation>Q3 minus Q2</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="quadrant1">
        <xsd:annotation>
          <xsd:documentation>Q1 only</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="quadrant2">
        <xsd:annotation>
          <xsd:documentation>Q2 only</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="quadrant3">
        <xsd:annotation>
          <xsd:documentation>Q3 only</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="quadrant4">
        <xsd:annotation>
          <xsd:documentation>Q4 only</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="reverse">
        <xsd:annotation>
          <xsd:documentation>Reverse Active Energy is equivalent to "Received," or "Exported" as
defined in 61968-2.
Reverse Active Energy is a positive kWh value as one would expect to find when energy is backfed by the
service onto the utility network.
Reverse Reactive Energy is a positive VArh value as one would expect to find in the presence of
capacitive loading and a leading Power Factor.
In polyphase metering, the reverse energy register is incremented when the sum of the phase energies is
less than zero:
&lt;img src="HTS_1.PNG" width="209" height="16" border="0" alt="graphic"/&gt;
Note: The value passed as a reverse value is always a positive value. It is understood by the label
"reverse" that it represents negative flow.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="total">
        <xsd:annotation>
          <xsd:documentation>|Forward| + |Reverse|, See 61968-2.
The sum of the commodity in all quadrants Q1+Q2+Q3+Q4.
In polyphase metering, the total energy register is incremented when the absolute value of the sum of
the phase energies is greater than zero:
&lt;img src="HTS_1.PNG" width="217" height="16" border="0" alt="graphic"/&gt;</xsd:documentation>
        </xsd:annotation>
```

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```
      </xsd:enumeration>
      <xsd:enumeration value="totalByPhase">
        <xsd:annotation>
          <xsd:documentation>In polyphase metering, the total by phase energy register is incremented
when the sum of the absolute values of the phase energies is greater than zero:
&lt;img src="HTS_1.PNG" width="234" height="16" border="0" alt="graphic"/&gt;
In single phase metering, the formulas for "Total" and "Total by phase" collapse to the same
expression. For communication purposes however, the "Total" enumeration should be used with single
phase meter data.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="MacroPeriodKind">
    <xsd:annotation>
      <xsd:documentation>Kind of macro period for calculations on read / measured
values.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Not applicable.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="billingPeriod">
        <xsd:annotation>
          <xsd:documentation>Captured during the billing period starting at midnight of the first day
of the billing period (as defined by the billing cycle day). If during the current billing period, it
specifies a period from the start of the current billing period until "now".</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="daily">
        <xsd:annotation>
          <xsd:documentation>Daily period starting at midnight. If for the current day, this specifies
the time from midnight to "now".</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="monthly">
        <xsd:annotation>
          <xsd:documentation>Monthly period starting at midnight on the first day of the month. If
within the current month, this specifies the period from the start of the month until
"now."</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="seasonal">
        <xsd:annotation>
          <xsd:documentation>A season of time spanning multiple months. E.g. "Summer," "Spring,"
"Fall," and "Winter" based cycle. If within the current season, it specifies the period from the start
of the current season until "now."</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="weekly">
        <xsd:annotation>
          <xsd:documentation>Weekly period starting at midnight on the first day of the week and ending
the instant before midnight the last day of the week. If within the current week, it specifies the
period from the start of the week until "now."</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="specifiedPeriod">
        <xsd:annotation>
          <xsd:documentation>For the period defined by the start and end of the TimePeriod element in
the message.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="MeasurementKind">
    <xsd:annotation>
      <xsd:documentation>Kind of read / measured value.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Not Applicable</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
```

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```
<xsd:enumeration value="apparentPowerFactor"/>
<xsd:enumeration value="currency">
  <xsd:annotation>
    <xsd:documentation>funds</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="current"/>
<xsd:enumeration value="currentAngle"/>
<xsd:enumeration value="currentImbalance"/>
<xsd:enumeration value="date"/>
<xsd:enumeration value="demand"/>
<xsd:enumeration value="distance"/>
<xsd:enumeration value="distortionVoltAmp"/>
<xsd:enumeration value="energization"/>
<xsd:enumeration value="energy"/>
<xsd:enumeration value="energizationLoadSide"/>
<xsd:enumeration value="fan"/>
<xsd:enumeration value="frequency"/>
<xsd:enumeration value="fund">
  <xsd:annotation>
    <xsd:documentation>Dup with "currency"</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="ieee1366ASAI"/>
<xsd:enumeration value="ieee1366ASIDI"/>
<xsd:enumeration value="ieee1366ASIFI"/>
<xsd:enumeration value="ieee1366CAIDI"/>
<xsd:enumeration value="ieee1366CAIFI"/>
<xsd:enumeration value="ieee1366CEMIn"/>
<xsd:enumeration value="ieee1366CEMSMIn"/>
<xsd:enumeration value="ieee1366CTAIDI"/>
<xsd:enumeration value="ieee1366MAIFI"/>
<xsd:enumeration value="ieee1366MAIFIe"/>
<xsd:enumeration value="ieee1366SAIDI"/>
<xsd:enumeration value="ieee1366SAIFI"/>
<xsd:enumeration value="lineLoss"/>
<xsd:enumeration value="loss"/>
<xsd:enumeration value="negativeSequence"/>
<xsd:enumeration value="phasorPowerFactor"/>
<xsd:enumeration value="phasorReactivePower"/>
<xsd:enumeration value="positiveSequence"/>
<xsd:enumeration value="power"/>
<xsd:enumeration value="powerFactor"/>
<xsd:enumeration value="quantityPower"/>
<xsd:enumeration value="sag">
  <xsd:annotation>
    <xsd:documentation>or Voltage Dip</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="swell"/>
<xsd:enumeration value="switchPosition"/>
<xsd:enumeration value="tapPosition"/>
<xsd:enumeration value="tariffRate"/>
<xsd:enumeration value="temperature"/>
<xsd:enumeration value="totalHarmonicDistortion"/>
<xsd:enumeration value="transformerLoss"/>
<xsd:enumeration value="unipedeVoltageDip10to15"/>
<xsd:enumeration value="unipedeVoltageDip15to30"/>
<xsd:enumeration value="unipedeVoltageDip30to60"/>
<xsd:enumeration value="unipedeVoltageDip60to90"/>
<xsd:enumeration value="unipedeVoltageDip90to100"/>
<xsd:enumeration value="voltage"/>
<xsd:enumeration value="voltageAngle"/>
<xsd:enumeration value="voltageExcursion"/>
<xsd:enumeration value="voltageImbalance"/>
<xsd:enumeration value="volume">
  <xsd:annotation>
    <xsd:documentation>Clarified  from Ed. 1. to indicate fluid volume</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="zeroFlowDuration"/>
<xsd:enumeration value="zeroSequence"/>
<xsd:enumeration value="distortionPowerFactor"/>
<xsd:enumeration value="frequencyExcursion">
  <xsd:annotation>
    <xsd:documentation>Usually expressed as a "count"</xsd:documentation>
```

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```
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="applicationContext"/>
      <xsd:enumeration value="apTitle"/>
      <xsd:enumeration value="assetNumber"/>
      <xsd:enumeration value="bandwidth"/>
      <xsd:enumeration value="batteryVoltage"/>
      <xsd:enumeration value="broadcastAddress"/>
      <xsd:enumeration value="deviceAddressType1"/>
      <xsd:enumeration value="deviceAddressType2"/>
      <xsd:enumeration value="deviceAddressType3"/>
      <xsd:enumeration value="deviceAddressType4"/>
      <xsd:enumeration value="deviceClass"/>
      <xsd:enumeration value="electronicSerialNumber"/>
      <xsd:enumeration value="endDeviceID"/>
      <xsd:enumeration value="groupAddressType1"/>
      <xsd:enumeration value="groupAddressType2"/>
      <xsd:enumeration value="groupAddressType3"/>
      <xsd:enumeration value="groupAddressType4"/>
      <xsd:enumeration value="ipAddress"/>
      <xsd:enumeration value="macAddress"/>
      <xsd:enumeration value="mfgAssignedConfigurationID"/>
      <xsd:enumeration value="mfgAssignedPhysicalSerialNumber"/>
      <xsd:enumeration value="mfgAssignedProductNumber"/>
      <xsd:enumeration value="mfgAssignedUniqueCommunicationAddress"/>
      <xsd:enumeration value="multiCastAddress"/>
      <xsd:enumeration value="oneWayAddress"/>
      <xsd:enumeration value="signalStrength"/>
      <xsd:enumeration value="twoWayAddress"/>
      <xsd:enumeration value="signaltoNoiseRatio">
        <xsd:annotation>
          <xsd:documentation>Moved here from Attribute #9 UOM</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="alarm"/>
      <xsd:enumeration value="batteryCarryover"/>
      <xsd:enumeration value="dataOverflowAlarm"/>
      <xsd:enumeration value="demandLimit"/>
      <xsd:enumeration value="demandReset">
        <xsd:annotation>
          <xsd:documentation>Usually expressed as a count as part of a billing
cycle</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="diagnostic"/>
      <xsd:enumeration value="emergencyLimit"/>
      <xsd:enumeration value="encoderTamper"/>
      <xsd:enumeration value="ieee1366MomentaryInterruption"/>
      <xsd:enumeration value="ieee1366MomentaryInterruptionEvent"/>
      <xsd:enumeration value="ieee1366SustainedInterruption"/>
      <xsd:enumeration value="interruptionBehaviour"/>
      <xsd:enumeration value="inversionTamper"/>
      <xsd:enumeration value="loadInterrupt"/>
      <xsd:enumeration value="loadShed"/>
      <xsd:enumeration value="maintenance"/>
      <xsd:enumeration value="physicalTamper"/>
      <xsd:enumeration value="powerLossTamper"/>
      <xsd:enumeration value="powerOutage"/>
      <xsd:enumeration value="powerQuality"/>
      <xsd:enumeration value="powerRestoration"/>
      <xsd:enumeration value="programmed"/>
      <xsd:enumeration value="pushbutton"/>
      <xsd:enumeration value="relayActivation"/>
      <xsd:enumeration value="relayCycle">
        <xsd:annotation>
          <xsd:documentation>Usually expressed as a count</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="removalTamper"/>
      <xsd:enumeration value="reprogrammingTamper"/>
      <xsd:enumeration value="reverseRotationTamper"/>
      <xsd:enumeration value="switchArmed"/>
      <xsd:enumeration value="switchDisabled"/>
      <xsd:enumeration value="tamper"/>
      <xsd:enumeration value="watchdogTimeout"/>
      <xsd:enumeration value="billLastPeriod">
```

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```
        <xsd:annotation>
          <xsd:documentation>Customer’s bill for the previous billing period
(Currency)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="billToDate">
        <xsd:annotation>
          <xsd:documentation>Customer’s bill, as known thus far within the present billing period
(Currency)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="billCarryover">
        <xsd:annotation>
          <xsd:documentation>Customer’s bill for the (Currency)</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="connectionFee">
        <xsd:annotation>
          <xsd:documentation>Monthly fee for connection to commodity.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="audibleVolume">
        <xsd:annotation>
          <xsd:documentation>Sound</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="volumetricFlow"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="MeasuringPeriodKind">
    <xsd:annotation>
      <xsd:documentation>Kind of period for reading / measuring values.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Not applicable.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="tenMinute">
        <xsd:annotation>
          <xsd:documentation>10-minute</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="fifteenMinute">
        <xsd:annotation>
          <xsd:documentation>15-minute</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="oneMinute">
        <xsd:annotation>
          <xsd:documentation>1-minute</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="twentyfourHour">
        <xsd:annotation>
          <xsd:documentation>24-hour</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="thirtyMinute">
        <xsd:annotation>
          <xsd:documentation>30-minute</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="fiveMinute">
        <xsd:annotation>
          <xsd:documentation>5-minute</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="sixtyMinute">
        <xsd:annotation>
          <xsd:documentation>60-minute</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="twoMinute">
        <xsd:annotation>
```

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```
      <xsd:documentation>2-minute</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="threeMinute">
    <xsd:annotation>
      <xsd:documentation>3-minute</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="present">
    <xsd:annotation>
      <xsd:documentation>Within the present period of time</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="previous">
    <xsd:annotation>
      <xsd:documentation>Shifted within the previous monthly cycle and data set</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="twentyMinute">
    <xsd:annotation>
      <xsd:documentation>20-minute interval</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="fixedBlock60Min">
    <xsd:annotation>
      <xsd:documentation>60-minute Fixed Block</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="fixedBlock30Min">
    <xsd:annotation>
      <xsd:documentation>30-minute Fixed Block</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="fixedBlock20Min">
    <xsd:annotation>
      <xsd:documentation>20-minute Fixed Block</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="fixedBlock15Min">
    <xsd:annotation>
      <xsd:documentation>15-minute Fixed Block</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="fixedBlock10Min">
    <xsd:annotation>
      <xsd:documentation>10-minute Fixed Block</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="fixedBlock5Min">
    <xsd:annotation>
      <xsd:documentation>5-minute Fixed Block</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="fixedBlock1Min">
    <xsd:annotation>
      <xsd:documentation>1-minute Fixed Block</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="rollingBlock60MinIntvl30MinSubIntvl">
    <xsd:annotation>
      <xsd:documentation>60-minute Rolling Block with 30-minute sub-intervals</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="rollingBlock60MinIntvl20MinSubIntvl">
    <xsd:annotation>
      <xsd:documentation>60-minute Rolling Block with 20-minute sub-intervals</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="rollingBlock60MinIntvl15MinSubIntvl">
    <xsd:annotation>
      <xsd:documentation>60-minute Rolling Block with 15-minute sub-intervals</xsd:documentation>
    </xsd:annotation>
  </xsd:enumeration>
  <xsd:enumeration value="rollingBlock60MinIntvl12MinSubIntvl">
    <xsd:annotation>
      <xsd:documentation>60-minute Rolling Block with 12-minute sub-intervals</xsd:documentation>
```

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```
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock60MinIntvl10MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>60-minute Rolling Block with 10-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock60MinIntvl6MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>60-minute Rolling Block with 6-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock60MinIntvl5MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>60-minute Rolling Block with 5-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock60MinIntvl4MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>60-minute Rolling Block with 4-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock30MinIntvl15MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>30-minute Rolling Block with 15-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock30MinIntvl10MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>30-minute Rolling Block with 10-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock30MinIntvl6MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>30-minute Rolling Block with 6-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock30MinIntvl5MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>30-minute Rolling Block with 5-minute sub-intervals.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock30MinIntvl3MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>30-minute Rolling Block with 3-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock30MinIntvl2MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>30-minute Rolling Block with 2-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock15MinIntvl5MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>15-minute Rolling Block with 5-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock15MinIntvl3MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>15-minute Rolling Block with 3-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock15MinIntvl1MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>15-minute Rolling Block with 1-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock10MinIntvl5MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>10-minute Rolling Block with 5-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="rollingBlock10MinIntvl2MinSubIntvl">
  <xsd:annotation>
    <xsd:documentation>10-minute Rolling Block with 2-minute sub-intervals</xsd:documentation>
  </xsd:annotation>
```

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```
      </xsd:enumeration>
      <xsd:enumeration value="rollingBlock10MinIntvl1MinSubIntvl">
        <xsd:annotation>
          <xsd:documentation>10-minute Rolling Block with 1-minute sub-intervals</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="rollingBlock5MinIntvl1MinSubIntvl">
        <xsd:annotation>
          <xsd:documentation>5-minute Rolling Block with 1-minute sub-intervals</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="PhaseCode">
    <xsd:annotation>
      <xsd:documentation>An unordered enumeration of phase identifiers. Allows designation of phases
for both transmission and distribution equipment, circuits and loads.  The enumeration, by itself, does
not describe how the phases are connected together or connected to ground. Ground is not explicitly
denoted as a phase.
Residential and small commercial loads are often served from single-phase, or split-phase, secondary
circuits. For the example of s12N, phases 1 and 2 refer to hot wires that are 180 degrees out of phase,
while N refers to the neutral wire. Through single-phase transformer connections, these secondary
circuits may be served from one or two of the primary phases A, B, and C. For three-phase loads, use
the A, B, C phase codes instead of s12N.
The integer values are from IEC 61968-9 to support revenue metering applications.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="ABCN">
        <xsd:annotation>
          <xsd:documentation>Phases A, B, C, and N.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ABC">
        <xsd:annotation>
          <xsd:documentation>Phases A, B, and C.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ABN">
        <xsd:annotation>
          <xsd:documentation>Phases A, B, and neutral.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ACN">
        <xsd:annotation>
          <xsd:documentation>Phases A, C and neutral.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BCN">
        <xsd:annotation>
          <xsd:documentation>Phases B, C, and neutral.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AB">
        <xsd:annotation>
          <xsd:documentation>Phases A and B.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AC">
        <xsd:annotation>
          <xsd:documentation>Phases A and C.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BC">
        <xsd:annotation>
          <xsd:documentation>Phases B and C.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="AN">
        <xsd:annotation>
          <xsd:documentation>Phases A and neutral.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="BN">
        <xsd:annotation>
          <xsd:documentation>Phases B and neutral.</xsd:documentation>
        </xsd:annotation>
```

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```
</xsd:enumeration>
<xsd:enumeration value="CN">
  <xsd:annotation>
    <xsd:documentation>Phases C and neutral.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="A">
  <xsd:annotation>
    <xsd:documentation>Phase A.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="B">
  <xsd:annotation>
    <xsd:documentation>Phase B.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="C">
  <xsd:annotation>
    <xsd:documentation>Phase C.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="N">
  <xsd:annotation>
    <xsd:documentation>Neutral phase.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="s1N">
  <xsd:annotation>
    <xsd:documentation>Secondary phase 1 and neutral.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="s2N">
  <xsd:annotation>
    <xsd:documentation>Secondary phase 2 and neutral.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="s12N">
  <xsd:annotation>
    <xsd:documentation>Secondary phases 1, 2, and neutral.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="s1">
  <xsd:annotation>
    <xsd:documentation>Secondary phase 1.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="s2">
  <xsd:annotation>
    <xsd:documentation>Secondary phase 2.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="s12">
  <xsd:annotation>
    <xsd:documentation>Secondary phase 1 and 2.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="none">
  <xsd:annotation>
    <xsd:documentation>No phases specified.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="X">
  <xsd:annotation>
    <xsd:documentation>Unknown non-neutral phase.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="XY">
  <xsd:annotation>
    <xsd:documentation>Two unknown non-neutral phases.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
<xsd:enumeration value="XN">
  <xsd:annotation>
    <xsd:documentation>Unknown non-neutral phase plus neutral.</xsd:documentation>
  </xsd:annotation>
</xsd:enumeration>
```

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```
      <xsd:enumeration value="XYN">
        <xsd:annotation>
          <xsd:documentation>Two unknown non-neutral phases plus neutral.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="UnitMultiplier">
    <xsd:annotation>
      <xsd:documentation>The unit multipliers defined for the CIM. When applied to unit symbols, the
unit symbol is treated as a derived unit. Regardless of the contents of the unit symbol text, the unit
symbol shall be treated as if it were a single-character unit symbol. Unit symbols should not contain
multipliers, and it should be left to the multiplier to define the multiple for an entire data type.

For example, if a unit symbol is "m2Pers" and the multiplier is "k", then the value is k(m**2/s), and
the multiplier applies to the entire final value, not to any individual part of the value. This can be
conceptualized by substituting a derived unit symbol for the unit type. If one imagines that the symbol
"Þ" represents the derived unit "m2Pers", then applying the multiplier "k" can be conceptualized simply
as "kÞ".

For example, the SI unit for mass is "kg" and not "g". If the unit symbol is defined as "kg", then the
multiplier is applied to "kg" as a whole and does not replace the "k" in front of the "g". In this
case, the multiplier of "m" would be used with the unit symbol of "kg" to represent one gram. As a text
string, this violates the instructions in IEC 80000-1. However, because the unit symbol in CIM is
treated as a derived unit instead of as an SI unit, it makes more sense to conceptualize the "kg" as if
it were replaced by one of the proposed replacements for the SI mass symbol. If one imagines that the
"kg" were replaced by a symbol "Þ", then it is easier to conceptualize the multiplier "m" as creating
the proper unit "mÞ", and not the forbidden unit "mkg".</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="y">
        <xsd:annotation>
          <xsd:documentation>Yocto 10**-24.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="z">
        <xsd:annotation>
          <xsd:documentation>Zepto 10**-21.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="a">
        <xsd:annotation>
          <xsd:documentation>Atto 10**-18.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="f">
        <xsd:annotation>
          <xsd:documentation>Femto 10**-15.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="p">
        <xsd:annotation>
          <xsd:documentation>Pico 10**-12.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="n">
        <xsd:annotation>
          <xsd:documentation>Nano 10**-9.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="micro">
        <xsd:annotation>
          <xsd:documentation>Micro 10**-6.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m">
        <xsd:annotation>
          <xsd:documentation>Milli 10**-3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="c">
        <xsd:annotation>
          <xsd:documentation>Centi 10**-2.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="d">
```

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```
        <xsd:annotation>
          <xsd:documentation>Deci 10**-1.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>No multiplier or equivalently multiply by 1.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="da">
        <xsd:annotation>
          <xsd:documentation>Deca 10**1.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="h">
        <xsd:annotation>
          <xsd:documentation>Hecto 10**2.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="k">
        <xsd:annotation>
          <xsd:documentation>Kilo 10**3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="M">
        <xsd:annotation>
          <xsd:documentation>Mega 10**6.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="G">
        <xsd:annotation>
          <xsd:documentation>Giga 10**9.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="T">
        <xsd:annotation>
          <xsd:documentation>Tera 10**12.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="P">
        <xsd:annotation>
          <xsd:documentation>Peta 10**15.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="E">
        <xsd:annotation>
          <xsd:documentation>Exa 10**18.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Z">
        <xsd:annotation>
          <xsd:documentation>Zetta 10**21.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Y">
        <xsd:annotation>
          <xsd:documentation>Yotta 10**24.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="UnitSymbol">
    <xsd:annotation>
      <xsd:documentation>The derived units defined for usage in the CIM. In some cases, the derived
unit is equal to an SI unit. Whenever possible, the standard derived symbol is used instead of the
formula for the derived unit. For example, the unit symbol Farad is defined as "F" instead of "CPerV".
In cases where a standard symbol does not exist for a derived unit, the formula for the unit is used as
the unit symbol. For example, density does not have a standard symbol and so it is represented as
"kgPerm3". With the exception of the "kg", which is an SI unit, the unit symbols do not contain
multipliers and therefore represent the base derived unit to which a multiplier can be applied as a
whole.
Every unit symbol is treated as an unparseable text as if it were a single-letter symbol. The meaning
of each unit symbol is defined by the accompanying descriptive text and not by the text contents of the
unit symbol.
To allow the widest possible range of serializations without requiring special character handling,
several substitutions are made which deviate from the format described in IEC 80000-1. The division
```

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```
symbol "/" is replaced by the letters "Per". Exponents are written in plain text after the unit as "m3"
instead of being formatted as "m" with a superscript of 3  or introducing a symbol as in "m^3". The
degree symbol "°" is replaced with the letters "deg". Any clarification of the meaning for a
substitution is included in the description for the unit symbol.
Non-SI units are included in list of unit symbols to allow sources of data to be correctly labelled
with their non-SI units (for example, a GPS sensor that is reporting numbers that represent feet
instead of meters). This allows software to use the unit symbol information correctly convert and scale
the raw data of those sources into SI-based units.
The integer values are used for harmonization with IEC 61850.</xsd:documentation>
    </xsd:annotation>
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="none">
        <xsd:annotation>
          <xsd:documentation>Dimension less quantity, e.g. count, per unit, etc.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m">
        <xsd:annotation>
          <xsd:documentation>Length in metres.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="kg">
        <xsd:annotation>
          <xsd:documentation>Mass in kilograms. Note: multiplier "k" is included in this unit symbol
for compatibility with IEC 61850-7-3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="s">
        <xsd:annotation>
          <xsd:documentation>Time in seconds.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="A">
        <xsd:annotation>
          <xsd:documentation>Current in amperes.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="K">
        <xsd:annotation>
          <xsd:documentation>Temperature in kelvins.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="mol">
        <xsd:annotation>
          <xsd:documentation>Amount of substance in moles.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="cd">
        <xsd:annotation>
          <xsd:documentation>Luminous intensity in candelas.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="deg">
        <xsd:annotation>
          <xsd:documentation>Plane angle in degrees.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="rad">
        <xsd:annotation>
          <xsd:documentation>Plane angle in radians (m/m).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="sr">
        <xsd:annotation>
          <xsd:documentation>Solid angle in steradians (m2/m2).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Gy">
        <xsd:annotation>
          <xsd:documentation>Absorbed dose in grays (J/kg).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Bq">
        <xsd:annotation>
          <xsd:documentation>Radioactivity in becquerels (1/s).</xsd:documentation>
        </xsd:annotation>
```

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```
      </xsd:enumeration>
      <xsd:enumeration value="degC">
        <xsd:annotation>
          <xsd:documentation>Relative temperature in degrees Celsius.
In the SI unit system the symbol is °C. Electric charge is measured in coulomb that has the unit symbol
C. To distinguish degree Celsius from coulomb the symbol used in the UML is degC. The reason for not
using °C is that the special character ° is difficult to manage in software.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Sv">
        <xsd:annotation>
          <xsd:documentation>Dose equivalent in sieverts (J/kg).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="F">
        <xsd:annotation>
          <xsd:documentation>Electric capacitance in farads (C/V).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="C">
        <xsd:annotation>
          <xsd:documentation>Electric charge in coulombs (A·s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="S">
        <xsd:annotation>
          <xsd:documentation>Conductance in siemens.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="H">
        <xsd:annotation>
          <xsd:documentation>Electric inductance in henrys (Wb/A).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="V">
        <xsd:annotation>
          <xsd:documentation>Electric potential in volts (W/A).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ohm">
        <xsd:annotation>
          <xsd:documentation>Electric resistance in ohms (V/A).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="J">
        <xsd:annotation>
          <xsd:documentation>Energy in joules (N·m = C·V = W·s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="N">
        <xsd:annotation>
          <xsd:documentation>Force in newtons (kg·m/s²).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Hz">
        <xsd:annotation>
          <xsd:documentation>Frequency in hertz (1/s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="lx">
        <xsd:annotation>
          <xsd:documentation>Illuminance in lux (lm/m²).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="lm">
        <xsd:annotation>
          <xsd:documentation>Luminous flux in lumens (cd·sr).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Wb">
        <xsd:annotation>
          <xsd:documentation>Magnetic flux in webers (V·s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="T">
        <xsd:annotation>
```

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```
          <xsd:documentation>Magnetic flux density in teslas (Wb/m2).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="W">
        <xsd:annotation>
          <xsd:documentation>Real power in watts (J/s). Electrical power may have real and reactive
components. The real portion of electrical power (I&amp;amp;#178;R or VIcos(phi)), is expressed in Watts.
See also apparent power and reactive power.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Pa">
        <xsd:annotation>
          <xsd:documentation>Pressure in pascals (N/m²). Note: the absolute or relative measurement of
pressure is implied with this entry. See below for more explicit forms.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m2">
        <xsd:annotation>
          <xsd:documentation>Area in square metres (m²).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m3">
        <xsd:annotation>
          <xsd:documentation>Volume in cubic metres (m³).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="mPers">
        <xsd:annotation>
          <xsd:documentation>Velocity in metres per second (m/s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="mPers2">
        <xsd:annotation>
          <xsd:documentation>Acceleration in metres per second squared (m/s²).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m3Pers">
        <xsd:annotation>
          <xsd:documentation>Volumetric flow rate in cubic metres per second
(m³/s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="mPerm3">
        <xsd:annotation>
          <xsd:documentation>Fuel efficiency in metres per cubic metres (m/m³).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="kgm">
        <xsd:annotation>
          <xsd:documentation>Moment of mass in kilogram metres (kg·m) (first moment of mass). Note:
multiplier "k" is included in this unit symbol for compatibility with IEC 61850-7-
3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="kgPerm3">
        <xsd:annotation>
          <xsd:documentation>Density in kilogram/cubic metres (kg/m³). Note: multiplier "k" is included
in this unit symbol for compatibility with IEC 61850-7-3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m2Pers">
        <xsd:annotation>
          <xsd:documentation>Viscosity in square metres / second (m²/s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="WPermK">
        <xsd:annotation>
          <xsd:documentation>Thermal conductivity in watt/metres kelvin.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPerK">
        <xsd:annotation>
          <xsd:documentation>Heat capacity in joules/kelvin.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ppm">
```

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```
        <xsd:annotation>
          <xsd:documentation>Concentration in parts per million.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="rotPers">
        <xsd:annotation>
          <xsd:documentation>Rotations per second (1/s). See also Hz (1/s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="radPers">
        <xsd:annotation>
          <xsd:documentation>Angular velocity in radians per second (rad/s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="WPerm2">
        <xsd:annotation>
          <xsd:documentation>Heat flux density, irradiance, watts per square metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPerm2">
        <xsd:annotation>
          <xsd:documentation>Insulation energy density, joules per square metre or watt second per
square metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="SPerm">
        <xsd:annotation>
          <xsd:documentation>Conductance per length (F/m).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="KPers">
        <xsd:annotation>
          <xsd:documentation>Temperature change rate in kelvins per second.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="PaPers">
        <xsd:annotation>
          <xsd:documentation>Pressure change rate in pascals per second.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPerkgK">
        <xsd:annotation>
          <xsd:documentation>Specific heat capacity, specific entropy, joules per kilogram
Kelvin.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VA">
        <xsd:annotation>
          <xsd:documentation>Apparent power in volt amperes. See also real power and reactive
power.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VAr">
        <xsd:annotation>
          <xsd:documentation>Reactive power in volt amperes reactive. The "reactive" or "imaginary"
component of electrical power (VIsin(phi)). (See also real power and apparent power).
Note: Different meter designs use different methods to arrive at their results. Some meters may compute
reactive power as an arithmetic value, while others compute the value vectorially. The data consumer
should determine the method in use and the suitability of the measurement for the intended
purpose.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="cosPhi">
        <xsd:annotation>
          <xsd:documentation>Power factor, dimensionless.
Note 1: This definition of power factor only holds for balanced systems. See the alternative definition
under code 153.
Note 2: Beware of differing sign conventions in use between the IEC and EEI. It is assumed that the
data consumer understands the type of meter in use and the sign convention in use by the
utility.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Vs">
        <xsd:annotation>
          <xsd:documentation>Volt seconds (Ws/A).</xsd:documentation>
        </xsd:annotation>
```

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```
      </xsd:enumeration>
      <xsd:enumeration value="V2">
        <xsd:annotation>
          <xsd:documentation>Volt squared (W²/A²).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="As">
        <xsd:annotation>
          <xsd:documentation>Ampere seconds (A·s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="A2">
        <xsd:annotation>
          <xsd:documentation>Amperes squared (A²).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="A2s">
        <xsd:annotation>
          <xsd:documentation>Ampere squared time in square amperes (A²s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VAh">
        <xsd:annotation>
          <xsd:documentation>Apparent energy in volt ampere hours.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Wh">
        <xsd:annotation>
          <xsd:documentation>Real energy in watt hours.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VArh">
        <xsd:annotation>
          <xsd:documentation>Reactive energy in volt ampere reactive hours.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VPerHz">
        <xsd:annotation>
          <xsd:documentation>Magnetic flux in volt per hertz.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="HzPers">
        <xsd:annotation>
          <xsd:documentation>Rate of change of frequency in hertz per second.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="character">
        <xsd:annotation>
          <xsd:documentation>Number of characters.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="charPers">
        <xsd:annotation>
          <xsd:documentation>Data rate (baud) in characters per second.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="kgm2">
        <xsd:annotation>
          <xsd:documentation>Moment of mass in kilogram square metres (kg·m²) (Second moment of mass,
commonly called the moment of inertia). Note: multiplier "k" is included in this unit symbol for
compatibility with IEC 61850-7-3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="dB">
        <xsd:annotation>
          <xsd:documentation>Sound pressure level in decibels. Note:  multiplier "d" is included in
this unit symbol for compatibility with IEC 61850-7-3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="WPers">
        <xsd:annotation>
          <xsd:documentation>Ramp rate in watts per second.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="lPers">
        <xsd:annotation>
```

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```
          <xsd:documentation>Volumetric flow rate in litres per second.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="dBm">
        <xsd:annotation>
          <xsd:documentation>Power level (logarithmic ratio of signal strength , Bel-mW), normalized to
1mW. Note:  multiplier "d" is included in this unit symbol for compatibility with IEC 61850-7-
3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="h">
        <xsd:annotation>
          <xsd:documentation>Time in hours, hour = 60 min = 3600 s.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="min">
        <xsd:annotation>
          <xsd:documentation>Time in minutes, minute  = 60 s.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Q">
        <xsd:annotation>
          <xsd:documentation>Quantity power, Q.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Qh">
        <xsd:annotation>
          <xsd:documentation>Quantity energy, Qh.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ohmm">
        <xsd:annotation>
          <xsd:documentation>Resistivity, ohm metres, (rho).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="APerm">
        <xsd:annotation>
          <xsd:documentation>A/m, magnetic field strength, amperes per metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="V2h">
        <xsd:annotation>
          <xsd:documentation>Volt-squared hour, volt-squared-hours.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="A2h">
        <xsd:annotation>
          <xsd:documentation>Ampere-squared hour, ampere-squared hour.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Ah">
        <xsd:annotation>
          <xsd:documentation>Ampere-hours, ampere-hours.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="count">
        <xsd:annotation>
          <xsd:documentation>Amount of substance, Counter value.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ft3">
        <xsd:annotation>
          <xsd:documentation>Volume, cubic feet.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m3Perh">
        <xsd:annotation>
          <xsd:documentation>Volumetric flow rate, cubic metres per hour.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="gal">
        <xsd:annotation>
          <xsd:documentation>Volume in gallons, US gallon (1 gal = 231 in3 = 128 fl
ounce).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
```

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```
      <xsd:enumeration value="Btu">
        <xsd:annotation>
          <xsd:documentation>Energy, British Thermal Units.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="l">
        <xsd:annotation>
          <xsd:documentation>Volume in litres, litre = dm3 = m3/1000.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="lPerh">
        <xsd:annotation>
          <xsd:documentation>Volumetric flow rate, litres per hour.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="lPerl">
        <xsd:annotation>
          <xsd:documentation>Concentration, The ratio of the volume of a solute divided by the volume
of  the solution. Note: Users may need use a prefix such a ‘µ’ to express a quantity such as
‘µL/L’.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="gPerg">
        <xsd:annotation>
          <xsd:documentation>Concentration, The ratio of the mass of a solute divided by the mass of
the solution. Note: Users may need use a prefix such a ‘µ’ to express a quantity such as
‘µg/g’.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="molPerm3">
        <xsd:annotation>
          <xsd:documentation>Concentration, The amount of substance concentration, (c), the amount of
solvent in moles divided by the volume of solution in m³.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="molPermol">
        <xsd:annotation>
          <xsd:documentation>Concentration, Molar fraction, the ratio of the molar amount of a solute
divided by the molar amount of the solution.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="molPerkg">
        <xsd:annotation>
          <xsd:documentation>Concentration, Molality, the amount of solute in moles and the amount of
solvent in kilograms.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="sPers">
        <xsd:annotation>
          <xsd:documentation>Time, Ratio of time. Note: Users may need to supply a prefix such as
‘&amp;#181;’ to show rates such as ‘&amp;#181;s/s’.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="HzPerHz">
        <xsd:annotation>
          <xsd:documentation>Frequency, rate of frequency change.  Note: Users may need to supply a
prefix such as ‘m’ to show rates such as ‘mHz/Hz’.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VPerV">
        <xsd:annotation>
          <xsd:documentation>Voltage, ratio of voltages. Note: Users may need to supply a prefix such
as ‘m’ to show rates such as ‘mV/V’.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="APerA">
        <xsd:annotation>
          <xsd:documentation>Current, ratio of amperages.  Note: Users may need to supply a prefix such
as ‘m’ to show rates such as ‘mA/A’.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VPerVA">
        <xsd:annotation>
          <xsd:documentation>Power factor, PF, the ratio of the active power to the apparent power.
```

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```
Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters.
It is assumed that the data consumers understand the type of meter being used and agree on the sign
convention in use at any given utility.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="rev">
        <xsd:annotation>
          <xsd:documentation>Amount of rotation, revolutions.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="kat">
        <xsd:annotation>
          <xsd:documentation>Catalytic activity, katal = mol / s.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPerkg">
        <xsd:annotation>
          <xsd:documentation>Specific energy, Joules / kg.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m3Uncompensated">
        <xsd:annotation>
          <xsd:documentation>Volume, cubic metres, with the value uncompensated for weather
effects.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m3Compensated">
        <xsd:annotation>
          <xsd:documentation>Volume, cubic metres, with the value compensated for weather
effects.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="WPerW">
        <xsd:annotation>
          <xsd:documentation>Signal Strength, ratio of power.  Note: Users may need to supply a prefix
such as ‘m’ to show rates such as ‘mW/W’.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="therm">
        <xsd:annotation>
          <xsd:documentation>Energy, therms.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="onePerm">
        <xsd:annotation>
          <xsd:documentation>Wavenumber, reciprocal metres,  (1/m).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="m3Perkg">
        <xsd:annotation>
          <xsd:documentation>Specific volume, cubic metres per kilogram, v.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Pas">
        <xsd:annotation>
          <xsd:documentation>Dynamic viscosity, pascal seconds.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Nm">
        <xsd:annotation>
          <xsd:documentation>Moment of force, newton metres.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="NPerm">
        <xsd:annotation>
          <xsd:documentation>Surface tension, newton per metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="radPers2">
        <xsd:annotation>
          <xsd:documentation>Angular acceleration, radians per second squared.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPerm3">
        <xsd:annotation>
          <xsd:documentation>Energy density, joules per cubic metre.</xsd:documentation>
```

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```
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VPerm">
        <xsd:annotation>
          <xsd:documentation>Electric field strength, volts per metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="CPerm3">
        <xsd:annotation>
          <xsd:documentation>Electric charge density, coulombs per cubic metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="CPerm2">
        <xsd:annotation>
          <xsd:documentation>Surface charge density, coulombs per square metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="FPerm">
        <xsd:annotation>
          <xsd:documentation>Permittivity, farads per metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="HPerm">
        <xsd:annotation>
          <xsd:documentation>Permeability, henrys per metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPermol">
        <xsd:annotation>
          <xsd:documentation>Molar energy, joules per mole.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPermolK">
        <xsd:annotation>
          <xsd:documentation>Molar entropy, molar heat capacity, joules per mole
kelvin.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="CPerkg">
        <xsd:annotation>
          <xsd:documentation>Exposure (x rays), coulombs per kilogram.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="GyPers">
        <xsd:annotation>
          <xsd:documentation>Absorbed dose rate, grays per second.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="WPersr">
        <xsd:annotation>
          <xsd:documentation>Radiant intensity, watts per steradian.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="WPerm2sr">
        <xsd:annotation>
          <xsd:documentation>Radiance, watts per square metre steradian.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="katPerm3">
        <xsd:annotation>
          <xsd:documentation>Catalytic activity concentration, katals per cubic
metre.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="d">
        <xsd:annotation>
          <xsd:documentation>Time in days, day = 24 h = 86400 s.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="anglemin">
        <xsd:annotation>
          <xsd:documentation>Plane angle, minutes.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="anglesec">
        <xsd:annotation>
```

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```
          <xsd:documentation>Plane angle, seconds.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ha">
        <xsd:annotation>
          <xsd:documentation>Area, hectares.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="tonne">
        <xsd:annotation>
          <xsd:documentation>Mass in tons, "tonne" or "metric  ton" (1000 kg = 1
Mg).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="bar">
        <xsd:annotation>
          <xsd:documentation>Pressure in bars, (1 bar = 100 kPa).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="mmHg">
        <xsd:annotation>
          <xsd:documentation>Pressure, millimetres of mercury (1 mmHg is approximately 133.3
Pa).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="M">
        <xsd:annotation>
          <xsd:documentation>Length, nautical miles (1 M = 1852 m).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="kn">
        <xsd:annotation>
          <xsd:documentation>Speed, knots (1 kn = 1852/3600) m/s.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Mx">
        <xsd:annotation>
          <xsd:documentation>Magnetic flux, maxwells (1 Mx = 10-8 Wb).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="G">
        <xsd:annotation>
          <xsd:documentation>Magnetic flux density, gausses (1 G = 10-4 T).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Oe">
        <xsd:annotation>
          <xsd:documentation>Magnetic field in oersteds, (1 Oe = (103/4p) A/m).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="Vh">
        <xsd:annotation>
          <xsd:documentation>Volt-hour, Volt hours.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="WPerA">
        <xsd:annotation>
          <xsd:documentation>Active power per current flow, watts per Ampere.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="onePerHz">
        <xsd:annotation>
          <xsd:documentation>Reciprocal of frequency (1/Hz).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="VPerVAr">
        <xsd:annotation>
          <xsd:documentation>Power factor, PF, the ratio of the active power to the apparent power.
```

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```
Note: The sign convention used for power factor will differ between IEC meters and EEI (ANSI) meters.
It is assumed that the data consumers understand the type of meter being used and agree on the sign
convention in use at any given utility.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="ohmPerm">
        <xsd:annotation>
          <xsd:documentation>Electric resistance per length in ohms per metre
((V/A)/m).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="kgPerJ">
        <xsd:annotation>
          <xsd:documentation>Weight per energy in kilograms per joule (kg/J). Note: multiplier "k" is
included in this unit symbol for compatibility with IEC 61850-7-3.</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
      <xsd:enumeration value="JPers">
        <xsd:annotation>
          <xsd:documentation>Energy rate in joules per second (J/s).</xsd:documentation>
        </xsd:annotation>
      </xsd:enumeration>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:complexType name="DateTimeInterval">
    <xsd:annotation>
      <xsd:documentation>Interval between two date and time points, where the interval includes the
start time but excludes end time. </xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="start" type="xsd:dateTime" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Start date and time of this interval. The start date and time is included
in the defined interval.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="end" type="xsd:dateTime" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>End date and time of this interval. The end date and time where the
interval is defined up to, but excluded.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="RationalNumber">
    <xsd:annotation>
      <xsd:documentation>Rational number = 'numerator' / 'denominator'.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="numerator" type="xsd:integer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Numerator.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="denominator" type="xsd:integer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Denominator. Value 1 indicates the number is a simple
integer.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="ReadingInterharmonic">
    <xsd:annotation>
      <xsd:documentation>Interharmonics are represented as a rational number 'numerator' /
'denominator', and harmonics are represented using the same mechanism and identified by
'denominator'=1.</xsd:documentation>
    </xsd:annotation>
    <xsd:sequence>
      <xsd:element name="numerator" type="xsd:integer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Interharmonic numerator. Value 0 means not applicable. Value 1 is used in
combination with 'denominator'=2 to represent interharmonic 1/2, and with 'denominator'=1 it represents
fundamental frequency. Finally, values greater than 1 indicate the harmonic of that order (e.g.,
'numerator'=5 is the fifth harmonic).</xsd:documentation>
```

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```
        </xsd:annotation>
      </xsd:element>
      <xsd:element name="denominator" type="xsd:integer" minOccurs="0" maxOccurs="1">
        <xsd:annotation>
          <xsd:documentation>Interharmonic denominator. Value 0 means not applicable. Value 2 is used
in combination with 'numerator'=1 to represent interharmonic 1/2. Finally, value 1 indicates the
harmonic of the order specified with 'numerator'.</xsd:documentation>
        </xsd:annotation>
      </xsd:element>
    </xsd:sequence>
  </xsd:complexType>
</xsd:schema>
```

<CODE ENDS>

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Annex M
(informative)

Contextualization and examples of EUMED metering messages

M.1 Overview

This Annex M gives some additional information in support of Annex K – EUMED Metering UML Model and Annex L – EUMED Metering XSD Description. Clauses M.2, M.3 and M.4 give typical examples of EUMED Metering message payloads.

M.2 EUMED Metering Load Curve message payload

The load curve gives the instantaneous consumed power metered at a specific Usage Point at regular time intervals. Figure M.1 illustrates this load curve.

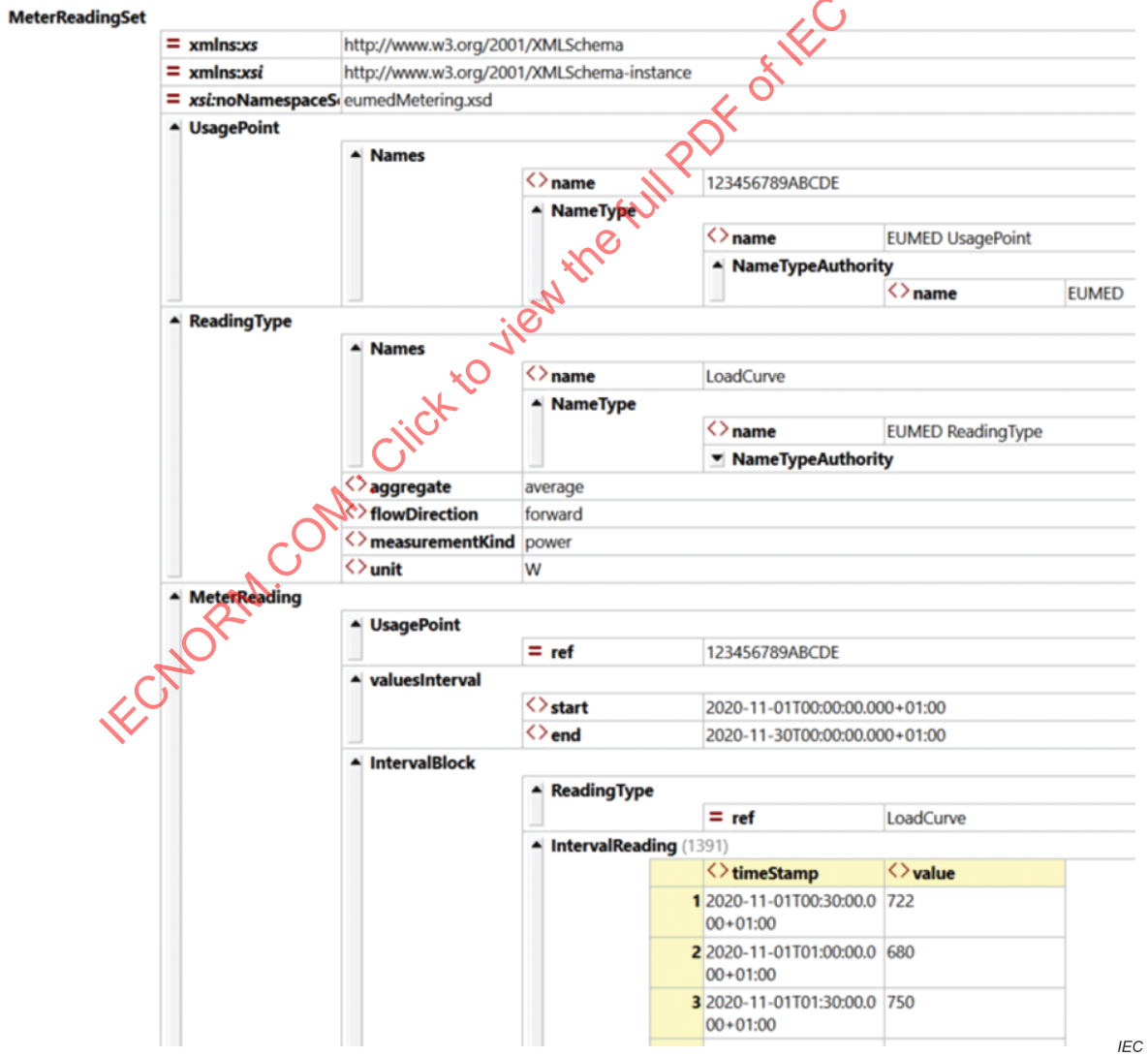


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Figure M.1 – Load curve XML message payload

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M.3 EUMED Metering Max Power message payload

The Max Power series gives the maximum value of consumed power which is metered daily at a given Usage Point. The timestamp value provides the exact date and time when the maximum was reached during the day. Figure M.2 illustrates this Max Power series.

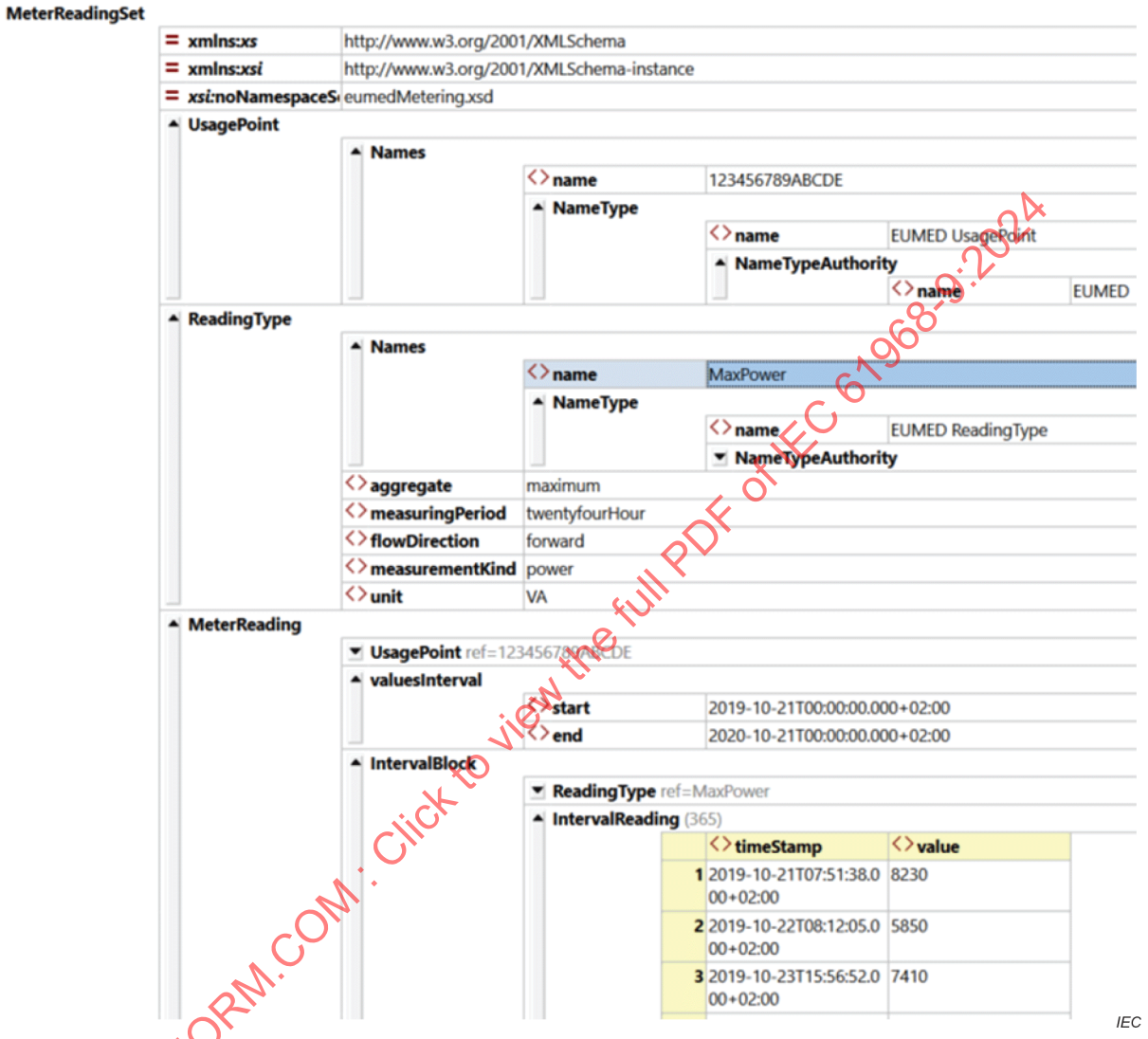


Figure M.2 is reproduced with the permission of UCAIug.

Figure M.2 – Max power XML message payload

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M.4 EUMED Metering Index message payload

The index curves provide the (historical) past period consumed energy which was metered at a specific UsagePoint at regular periods of time. The ReadingType referred by the curve provides additional information on the tariff applied and the register used during the measurement period. Figure M.3 shows an index curve with a base tariff and F1 register. Figure M.4 shows an index curve with a seasonal time-of-use tariff (peak hour, low season) and D2 register.

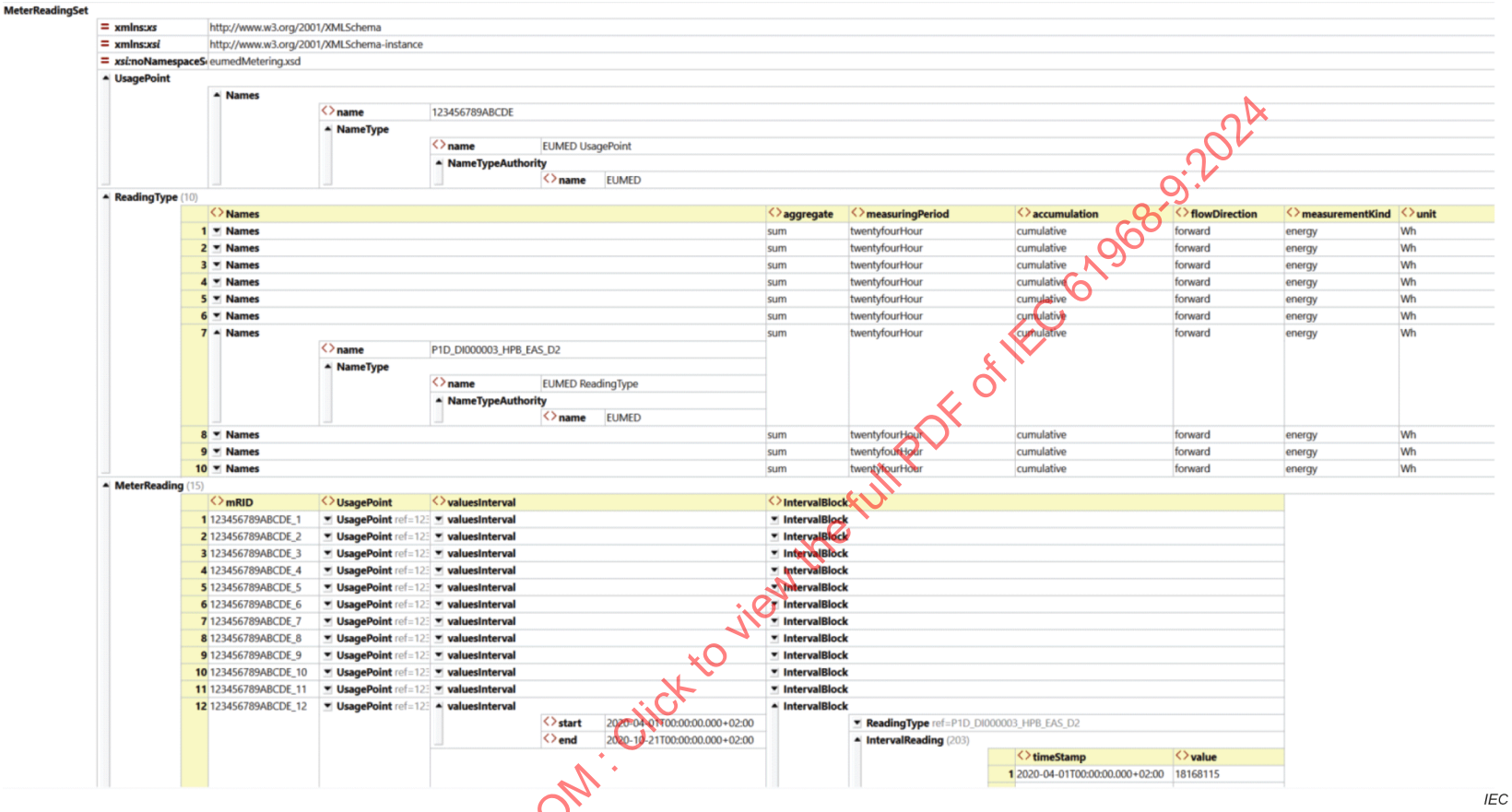


Figure M.3 is reproduced with the permission of UCAIug.

Figure M.3 – Index XML message payload (extract 1)

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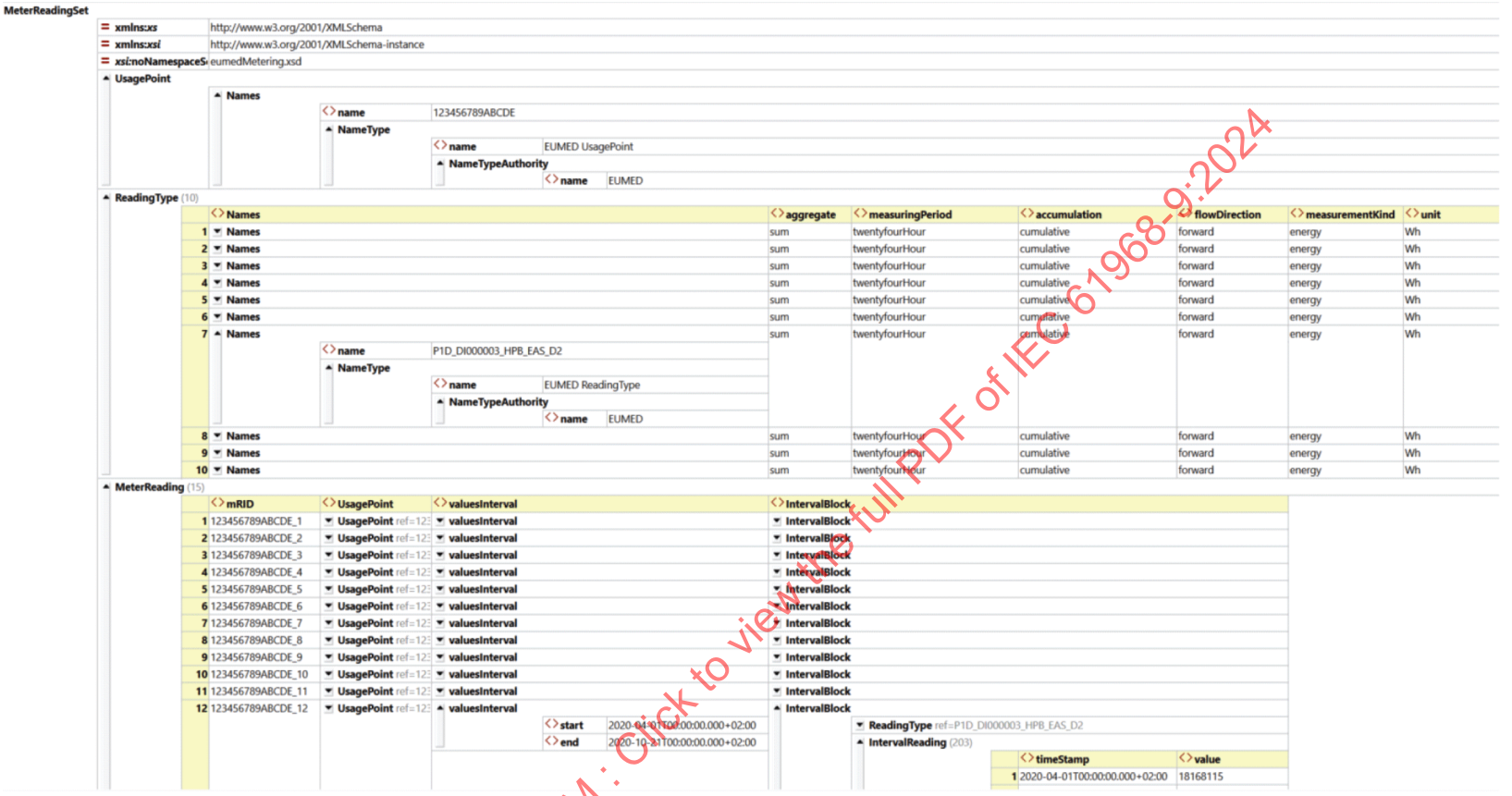


Figure M.4 is reproduced with the permission of UCAIug.

Figure M.4 – Index XML message payload (extract 2)

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COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

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INTERFACES DE FONCTIONS MÉTIER D'ENTREPRISE POUR L'EXPLOITATION DES SERVICES –

Partie 9: Interfaces pour le relevé et la commande des compteurs

AVANT-PROPOS

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8) L'attention est attirée sur les références normatives citées dans cette publication. L'utilisation de publications référencées est obligatoire pour une application correcte de la présente publication.
9) L'attention est attirée sur le fait que certains des éléments du présent document de l'IEC peuvent faire l'objet de droits de brevets. L'IEC ne prend pas position quant à la preuve, à la validité et à la portée de ces droits de propriété. À la date de publication du présent document, l'IEC n'a reçu aucune déclaration relative à des droits de brevets, qui pourraient être exigés pour la mise en œuvre du présent document. Toutefois, il est rappelé aux responsables de cette mise en œuvre qu'il ne s'agit peut-être pas des informations les plus récentes, qui peuvent être obtenues dans la base de données disponible à l'adresse https://patents.iec.ch. L'IEC ne saurait être tenue pour responsable de ne pas avoir identifié de tels droits de brevets.

La norme Internationale IEC 61968-9 a été établie par le comité d'études 57 de l'IEC: Gestion des systèmes de puissance et échanges d'informations associés.

Cette troisième édition annule et remplace la deuxième édition parue en 2013. Cette édition constitue une révision technique.

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Cette édition inclut les modifications techniques majeures suivantes par rapport à l'édition précédente:

a) l'IEC 61968-100:2022 a remplacé l'IEC 61968-100:2013 qui a été utilisée dans de nombreux exemples de l'IEC 61968-9:2013. Les parties applicables de la version actuelle de l'IEC 61968-9 ont été actualisées afin de refléter les modèles d'enveloppe et d'échange de messages spécifiés dans l'IEC 61968-100:2022. Bien que l'utilisation de l'IEC 61968-100 soit fortement recommandée, il est possible d'utiliser l'IEC 61968-9 sans appliquer les modèles d'enveloppe et d'échange de messages de l'IEC 61968-100. Ce principe était vrai pour l'IEC 61968-9:2013 et le reste pour la présente IEC 61968-9:2024;

b) sauf indication contraire, les schémas XSD de l'IEC 61968-9:2013 qui demeurent dans l'IEC 61968-9:2022 ne sont pas modifiés à l'exception des modifications apportées pour assurer la compatibilité avec l'IEC 61968-100:2022 comme cela est décrit dans l'IEC 61968-100:2022. Cette disposition vient à l'appui de la construction abstraite de charge utile du fichier Message.xsd défini dans l'IEC 61968-100:2022. De ce fait, ces profils modifiés ont un nouvel espace de nom; Le remplacement du fichier MeterReadSchedule.xsd par un nouveau fichier MeterReadSchedules.xsd constitue une exception notable. Ce fichier comporte des modifications structurelles qui permettent la prise en charge d'une fonctionnalité améliorée comme cela est décrit au 5.3.3. Le remplacement du fichier GetMeterReadSchedule.xsd par le fichier GetMeterReadSchedules.xsd constitue une autre exception. Noter également que les profils de l'IEC 61968-8:2015 énumérés dans le tableau de l'Annexe A exigent des modifications afin d'être compatibles avec l'IEC 61968-100:2022;

c) les "Verbes" énumérés à l'Annexe A de l'IEC 61968-9:2013 ont été intégrés à l'IEC 61968-100:2022. L'Annexe A (de cette troisième édition) fournit désormais un tableau qui recommande l'utilisation de certains verbes pour accompagner les profils liés à l'IEC 61968-9;

d) les "Codes d'erreur de réponse" énumérés à l'Annexe B de l'IEC 61968:2013 ont été intégrés à l'IEC 61968-100:2022. L'Annexe B (de cette troisième édition) fournit désormais quelques recommandations sur la façon de traiter certaines situations d'erreur qui peuvent provenir de l'IEC 61968-9;

e) les profils clients CustomerAccountConfig, CustomerAgreementConfig, CustomerConfig, GetAuxiliaryAgreementConfig, GetCustomerAccountConfig, GetCustomerAgreementConfig, GetServiceCategoryConfig, GetCustomerConfig, GetMeterServiceRequests, GetPricingStructureConfig, GetServiceLocationConfig, GetServiceSupplierConfig, MeterServiceRequests, PricingStructureConfig, ServiceCategoryConfig, ServiceLocationConfig et ServiceSupplierConfig ont été supprimés du présent document et intégrés à l'IEC 61968-8. Toutefois, certaines références à ces profils ont été conservées pour des raisons de facilité d'utilisation. Une "MeterServiceRequest" qui peut être émise par une fonction de l'IEC 61968-9:2013 est désormais partagée avec l'IEC 61968-8 qui peut tout aussi bien avoir besoin d'émettre une telle demande. Les utilisateurs d'une partie peuvent devoir se référer à une autre partie de la série 61968 afin d'obtenir un schéma partagé. En outre, certains noms peuvent varier lorsqu'ils sont déplacés d'une partie à l'autre. Par exemple, une "MeterServiceRequest" est désormais appelée "ServiceRequest" (plus générique);

f) des énumérations supplémentaires ont été fournies dans les annexes pour ReadingTypes (Annexe C), EndDeviceEventTypes (Annexe E) et EndDeviceControlTypes (Annexe F);

g) des déclarations ont été ajoutées à certaines figures, tableaux, schémas et énumérations tout au long du document pour indiquer qu'ils sont reproduits avec l'autorisation du groupe d'utilisateurs international de l'UCA (UCAIug – *UCA International User Group*). Ces éléments sont dérivés du modèle d'information commun (CIM – *Common Information Model*);

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h) les ‘’Conventions de désignation et d'identification des objets’’ fournies à l’Annexe G de l’IEC 61968:2013 ont été supprimées. Il convient en revanche que l’utilisateur prenne en considération l’IEC 61968-11 “Extensions du modèle d'information commun (CIM) pour la distribution” ou l’IEC 61970-301, “Interface de programmation d'application pour système de gestion d'énergie (EMS-API) – Partie 301: Base de modèle d'information commun (CIM)’’. Cette suppression entraîne la renumérotation des annexes suivantes de l’IEC 61968:2013 dans cette troisième édition. Les "Notes sur l'utilisation étendue de l’IEC 61968-100" fournies dans l'Annexe M de l’IEC 61968:2013 ont été supprimées. Il est recommandé au lecteur de se procurer plutôt une copie de la version la plus récente de l’IEC 61968-100;

i) les profils définis à l’Annexe H (Normative) et à l’Annexe I (Informative) ‘’Schémas XML pour les charges utiles de message” ont été supprimés du document. En revanche, cette troisième édition comporte désormais une Annexe G qui fournit des liens vers les profils sur le site Web de l'UCAIug;

j) de petites modifications ont été apportées au document pour une meilleure compréhension et une plus grande facilité d'utilisation;

k) ajout d'annexes normatives et informatives (K, L et M) pour décrire comment l’IEC 61968-9 peut être utilisée pour prendre en charge le règlement européen concernant l'accès aux données et l'interopérabilité. En particulier, ces annexes décrivent le profil de comptage EUMED et servent à rédiger des exigences pour répondre aux dispositions prévues aux Articles 20, 23 et 24 de la directive électricité (UE) 2019/944. Pour plus d’informations, se reporter à l’IEC 62325-451-10.

Le texte de cette norme internationale est issu des documents suivants:

Projet	Rapport de vote
57/2670/FDIS	57/2679/RVD

Le rapport de vote indiqué dans le tableau ci-dessus donne toute information sur le vote ayant abouti à son approbation.

La langue employée pour l'élaboration de cette Norme internationale est l'anglais.

La version française de cette norme n'a pas été soumise au vote.

Ce document a été rédigé selon les Directives ISO/IEC, Partie 2, il a été développé selon les Directives ISO/IEC, Partie 1 et les Directives ISO/IEC, Supplément IEC, disponibles sous www.iec.ch/members_experts/refdocs. Les principaux types de documents développés par l'IEC sont décrits plus en détail sous www.iec.ch/standardsdev/publications.

Une liste de toutes les parties de la série IEC 61968 publiées sous le titre général *Interfaces de fonctions métier d'entreprise pour l'exploitation des services* se trouve sur le site web de l’IEC.

Les futures normes de cette série porteront le nouveau titre général cité ci-dessus. Le titre des normes qui existent déjà dans cette série sera mis à jour lors de leur prochaine édition.

La présente norme IEC inclut les composants de code, c'est-à-dire les composants destinés à être traités directement par un ordinateur. Un tel contenu est tout texte qui figure entre les marqueurs <CODE BEGINS> et <CODE ENDS>, ou est clairement identifié dans la présente norme comme un composant de code.

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Le comité a décidé que le contenu de ce document ne sera pas modifié avant la date de stabilité indiquée sur le site web de l'IEC sous webstore.iec.ch dans les données relatives au document recherché. À cette date, le document sera

- reconduit,
- supprimé, ou
- révisé.

IMPORTANT – Le logo "colour inside" qui se trouve sur la page de couverture de ce document indique qu'il contient des couleurs qui sont considérées comme utiles à une bonne compréhension de son contenu. Les utilisateurs devraient, par conséquent, imprimer ce document en utilisant une imprimante couleur.

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INTRODUCTION

Le but de la présente partie de l'IEC 61968 est de définir une norme pour l'intégration des systèmes de comptage (MS – *Metering Systems*), qui incluraient les systèmes de relevés de compteur automatisés (AMR – *Automated Meter Reading*) traditionnels (à une seule voie ou à deux voies) avec d'autres systèmes et fonctions métier qui s'inscrivent dans le domaine d'application de l'IEC 61968. Le domaine d'application du présent document est l'échange d'informations concernant les transactions, les événements et les commandes liés au relevé des compteurs entre les systèmes au sein de l'entreprise de distribution et entre d'autres entreprises. Les informations détaillées spécifiques des protocoles de communications qu'utilisent les systèmes en question ne relèvent pas du domaine d'application du présent document. En revanche, le présent document reconnaîtra et modélisera les capacités générales qui peuvent être potentiellement assurées par des infrastructures de compteurs avancées et/ou héritées, y compris les capacités de communication bidirectionnelle telles que régulation de la charge, tarification dynamique, détection d'interruptions de service, signaux de commande de ressources énergétiques réparties (DER – *distributed energy resource*) et lecture sur demande.

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INTERFACES DE FONCTIONS MÉTIER D'ENTREPRISE POUR L'EXPLOITATION DES SERVICES –

Partie 9: Interfaces pour le relevé et la commande des compteurs

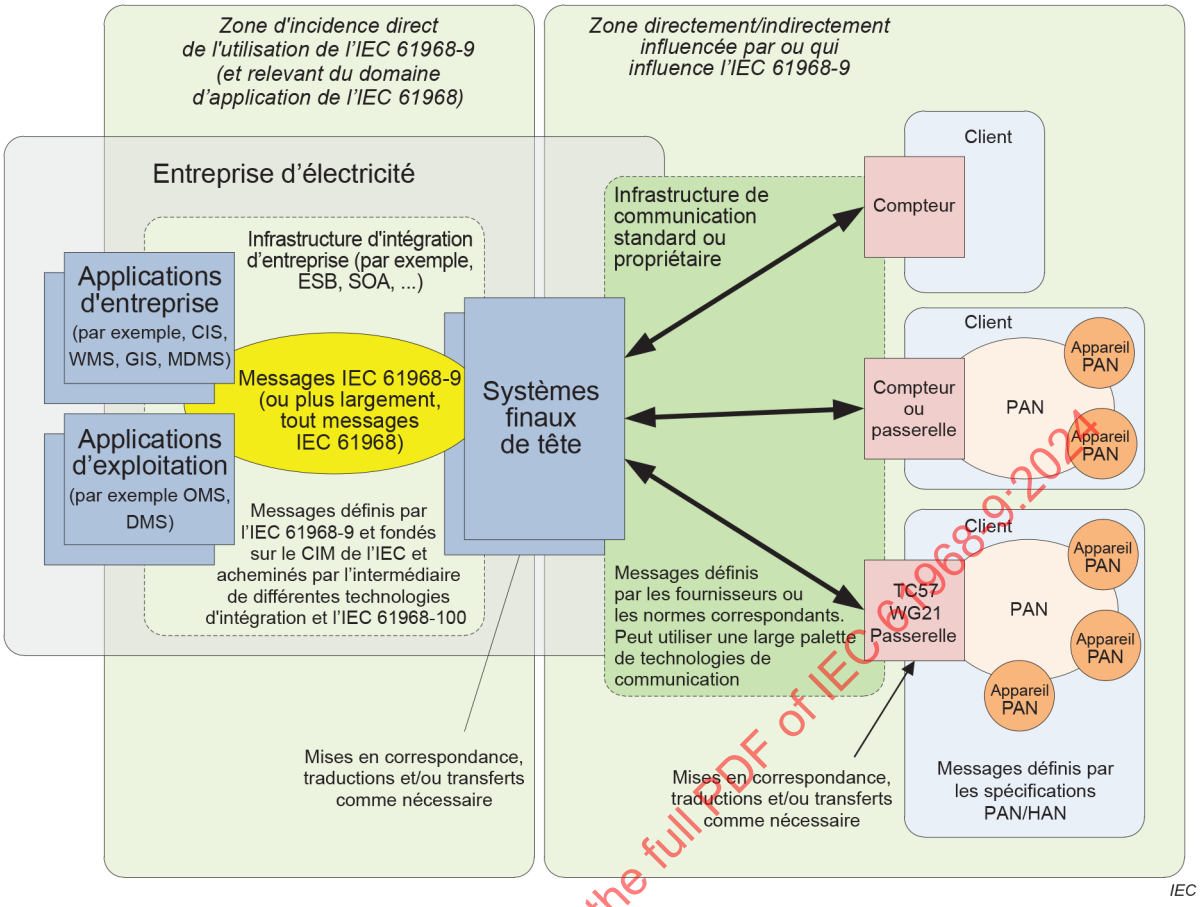
1 Domaine d'application

La présente partie de l'IEC 61968 spécifie le contenu informationnel d'un ensemble de types de messages qui peuvent être utilisés pour prendre en charge de nombreuses fonctions métier relatives au relevé et à la commande des compteurs. Les utilisations typiques des types de messages comprennent le relevé de compteurs, les commandes, les événements, la synchronisation des données client et la commutation de clientèle. Bien qu'elle soit principalement destinée aux réseaux de distribution électrique, l'IEC 61968-9 peut être utilisée pour d'autres applications de comptage, y compris les grandeurs comptées non électriques qui sont nécessaires pour prendre en charge les réseaux de gaz et d'eau.

Le but du présent document est de définir une norme pour l'intégration des systèmes de comptage (MS), qui inclut les systèmes manuels traditionnels et les systèmes de relevés de compteur automatisés (AMR) (à une seule voie ou à deux voies), ainsi que les systèmes de gestion des données de compteur (MDM – *meter data management*) avec d'autres systèmes et fonctions métier qui s'inscrivent dans le domaine d'application de l'IEC 61968. Le domaine d'application du présent document est l'échange d'informations entre les systèmes de comptage, les systèmes MDM et d'autres systèmes au sein de l'entreprise de distribution. Les informations détaillées spécifiques relatives aux protocoles de communications qu'utilisent les systèmes en question ne relèvent pas du domaine d'application du présent document. En revanche, la présente Norme internationale reconnaîtra et modélisera les capacités générales qui peuvent être potentiellement assurées par des infrastructures de compteurs avancées et/ou héritées, y compris les capacités de communication bidirectionnelle telles que régulation de la charge, tarification dynamique, détection d'interruptions de service, signaux de commande de ressources énergétiques réparties (DER) et lecture sur demande. Ainsi, le présent document ne sera pas influencé par la spécification, le développement et/ou le déploiement d'infrastructures de compteurs de prochaine génération, et ce, ni par l'utilisation de normes ni par des moyens propriétaires.

La Figure 1 décrit le domaine d'application du présent document du point de vue des effets directs et causals ou indirects des messages IEC 61968-9. Alors que l'axe de l'IEC 61968-9 est de définir les messages standard pour l'intégration des applications d'entreprise, lesdits messages peuvent être directement ou indirectement liés aux flux d'information d'un domaine d'application plus large. Des exemples peuvent inclure la messagerie entre les systèmes de tête de réseau et les compteurs ou les appareils PAN. Les différents composants décrits ultérieurement dans le présent document relèvent généralement de la catégorie d'une tête de réseau de système de comptage (MS), d'une MDM ou de toute autre application d'entreprise (par exemple, OMS, DRMS, CIS).

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La Figure 1 est reproduite avec l'autorisation de l'UCAIug.

Figure 1 – Domaine d'application de l'IEC 61968-9

Les capacités et les informations fournies par des systèmes de relevés de compteurs et de gestion de données de compteur sont importantes pour une diversité d'applications, y compris (entre autres) les données d'intervalles, les données de demande fondées sur la durée, les données d'énergie fondées sur la durée (utilisation et production), la gestion des interruptions de service, l'interruption de service, le rétablissement du service, la surveillance de la qualité de service, l'analyse du réseau de distribution, la planification de la distribution, la réduction de la demande, la facturation des clients et la gestion des travaux. La présente norme étend également le CIM (Common Information Model, c'est-à-dire Modèle d'Information Commun) pour prendre en charge l'échange des données de compteurs.

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2 Références normatives

Les documents suivants sont cités dans le texte de sorte qu'ils constituent, pour tout ou partie de leur contenu, des exigences du présent document et sont indispensables pour son application. Pour les références datées, seule l'édition citée s'applique. Pour les références non datées, la dernière édition du document de référence s'applique (y compris les éventuels amendements).

IEC 60050-112, *Vocabulaire Électrotechnique International (IEV) – Partie 112: Grandeurs et unités*

IEC 60050-300, *Vocabulaire Électrotechnique International (IEV) – Mesures et appareils de mesure électriques et électroniques – Partie 311: Termes généraux concernant les mesures – Partie 312: Termes généraux concernant les mesures électriques – Partie 313: Types d'appareils électriques de mesure – Partie 314: Termes spécifiques selon le type d'appareil*

IEC 61968-1, *Intégration d'applications pour les services électriques – Interfaces système pour la gestion de la distribution – Partie 1: Architecture des interfaces et recommandations générales.*

IEC/TS 61968-2, *Application integration at electric utilities – System interfaces for distribution management – Part 2: Glossary* (disponible en anglais seulement)

IEC 61968-8:2015, *Intégration d'applications pour les services électriques – Interfaces système pour la gestion de distribution – Partie 8: Interfaces pour l'assistance à la clientèle*

IEC 61968-11, *Intégration d'applications pour les services électriques – Interfaces système pour la gestion de distribution– Partie 11: Extensions du modèle d'information commun (CIM) pour la distribution*

IEC 61968-100:2022, *Intégration d'applications pour les services électriques – Interfaces système pour la gestion de la distribution – Partie 100: profils de mise en œuvre IEC pour l'intégration d'application*

IEC 61970-301, *Interface de programmation d'application pour système de gestion d'énergie (EMS-API) – Partie 301: Base de modèle d'information commun (CIM)*

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* (disponible en anglais seulement)

ISO 4217:2015, *Codes pour la représentation des monnaies*

ISO 8601:2004, *Éléments de données et formats d'échange — Échange d'information — Représentation de la date et de l'heure*

CIM Meter Reading and Control Profile Messages, Édition 3, disponible à l'adresse https://cimug.ucaiug.org

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3 Termes, définitions et abréviations

3.1 Termes et définitions

Pour les besoins du présent document, les termes et définitions de l'IEC 60050-300, l'IEC/TS 61968-2, l'IEC/TR 62051-1, l'IEC 62055-31, ainsi que les suivants s'appliquent.

En cas de différence entre les définitions du présent document et les définitions contenues dans d'autres normes IEC référencées, les définitions contenues dans l'IEC/TS 61968-2 doivent alors prévaloir sur les autres définitions répertoriées et les définitions contenues dans l'IEC 61968-9 doivent prévaloir sur les définitions répertoriées dans l'IEC/TS 61968-2.

L'ISO et l'IEC tiennent à jour des bases de données terminologiques destinées à être utilisées en normalisation, consultables aux adresses suivantes:

- IEC Electropedia: disponible à l'adresse http://www.electropedia.org/
- ISO Online browsing platform: disponible à l'adresse http://www.iso.org/obp

3.1.1
réponse à la demande
ensemble de processus et de programmes utilisés pour réduire la consommation

Note 1 à l'article: Cette gestion peut être effectuée sur une base économique, obligatoire ou d'urgence.

3.1.2
dispositif terminal
équipement situé à l'extrémité du système de communication, habituellement dans les locaux du client

Note 1 à l'article: Un dispositif terminal peut accomplir des fonctions telles que les fonctions de métrologie, connexion/déconnexion, régulation de la charge, réponse à la demande ou autres fonctions, et peut avoir une capacité de relais de puissance et/ou de communications locales. Cela est représenté au sein du CIM par l'utilisation de la classe EndDevice. Les compteurs et les appareils PAN sont des exemples de dispositifs terminaux.

3.1.3
tête de réseau
composant d'un système de comptage qui collecte les données à partir de dispositifs terminaux et émet des commandes vers ces dispositifs

Note 1 à l'article: Une tête de réseau peut également gérer le système de communication utilisé pour communiquer avec les dispositifs terminaux. Du point de vue de l'intégration d'entreprise, la tête de réseau sert de proxy aux dispositifs terminaux.

3.1.4
passerelle
appareil qui peut être utilisé pour gérer les appareils sur un PAN et participer aux interactions fondées sur Internet

Note 1 à l'article: Une passerelle peut appliquer une transformation d'un protocole à un autre.

3.1.5
dispositif de régulation de la charge
type de EndDevice qui peut recevoir des signaux l'amenant à délester la charge aux fins de maintenir la fiabilité du réseau et/ou des accords commerciaux

3.1.6
compteur
type de dispositif terminal qui accomplit la métrologie et prend en charge la tarification du réseau de distribution et/ou de transport

Note 1 à l'article: Cela est représenté par utilisation de la classe Meter du CIM, qui est une sous-classe de la classe EndDevice.

Note 2 à l'article: En tant que dispositif terminal, un compteur comporte généralement, mais pas toujours, un lien de communication avec un système de tête de réseau.

3.1.7
remplacement de compteur
échange de compteur
processus qui consiste à remplacer un compteur existant par un nouveau compteur

Note 1 à l'article: La personne chargée de l'installation suit habituellement un bon de travail (ordre d'exécution) qui spécifie un emplacement donné et exige habituellement qu'elle saisisse les relevés de lecture des anciens et nouveaux compteurs et enregistre l'heure et la date d'exécution du travail.

3.1.8
gestionnaire des données de compteur
système qui gère les données de compteur et fournit généralement diverses fonctionnalités à valeur ajoutée telles que VEE

3.1.9
réseau dans un local
comprend l'ensemble du domaine d'application d'un réseau domestique (HAN – home area network), car il couvre également les locaux commerciaux

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3.1.10
appareil PAN
type de dispositif terminal situé sur un local de client qui communique à l'aide d'un PAN

Note 1 à l'article: En général, un appareil PAN peut accepter des commandes et/ou des événements de rapport.

Note 2 à l'article: Les appareils PAN utilisent couramment les compteurs comme passerelles de communication.

3.2 Abréviations

AM	(asset management) gestion d'actifs
AMR	(automated meter reading) relevé de compteur automatisé
AMI	(advanced metering infrastructure) infrastructure de comptage avancée
CIM	(common information model) modèle d'information commun
CIS	(customer information system) système d'informations clients
COSEM	(companion specification for energy metering) spécification d'accompagnement pour le comptage d'énergie
DLMS UA	(device language message specification user association) spécification de message de langue d'appareil – association des utilisateurs
DMS	(distribution management system) système de gestion de distribution
DR	(demand response) réponse à la demande
DRMS	(demand response management system) système de gestion de réponse à la demande
HAN	(home area network) réseau domestique
IDR	(interval data recorder) enregistreur de données d'intervalles
IEC	(International Electrotechnical Commission) Commission Électrotechnique Internationale
LC	(load control) régulation de la charge
LDC	(load control system) système de régulation de la charge
LMS	(load management system) système de gestion de la charge
MAM	(meter asset management) gestion d'actifs de compteur
MDM	(meter data management) gestion de données de compteur
MDM	(master data management) gestion de données de référence
MM	(meter maintenance) maintenance de compteur
MR	(meter reading) relevé de compteur
MS	(metering system) système de comptage
NO	(network operations) exploitation du réseau
OMS	(outage management system) système de gestion des interruptions de service
POS	(point of sale) point de vente
PAN	(premises area network (includes scope of HAN)) réseau dans un local (comprend le domaine d'application du HAN)
RF	(radio frequency) fréquence radio
SM	(smart meter) compteur intelligent
UML	(unified modeling language) langage de modélisation unifié
VEE	(validating, editing, and estimating) validation, édition et estimation
WM	(work management) gestion des travaux
XSD	(XML schema) schéma XML

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4 Modèles de référence et d'informations

4.1 Approche générale de la messagerie

Le présent document ne spécifie pas de technique particulière de représentation de texte, ni ne spécifie de technique particulière de transport de messages. Toutefois, l'IEC 61968-100 est fortement recommandée.

Il convient que toute utilisation de l'IEC 61968-100:2022 pour la messagerie liée à l'IEC61968-9 applique les schémas correspondants présentés à l'Annexe G. Les schémas XSD présentés à l'Annexe G incluent les modifications pour la compatibilité avec l'IEC 61968-100:2022. Se reporter à l'Annexe C de l'IEC 61968-100:2022 pour une description de ces modifications et un pointeur vers un outil qui peut être utilisé pour effectuer les modifications exigées. L'outil référencé est un logiciel libre, sous licence Apache, et maintenu par UCAIug.

4.2 Approche générale des systèmes de comptage

Le disque rotatif dans un compteur électromécanique sert généralement d'initiateur d'impulsions pour le module enregistreur du compteur. De même, les compteurs à semi-conducteurs peuvent aussi utiliser une unité de métrologie qui génère des impulsions qui représentent une fraction de kWh. En outre, s'il est plus sophistiqué, le compteur à semi-conducteur peut comporter un enregistreur de comptage capable d'accumuler un grand nombre de différentes sortes d'informations et de les stocker en vue de les présenter au module de communications du compteur à l'aide d'un protocole piloté par des messages et des tableaux tel que l'ANSI C12.19 ou l'IEC 62056.

L'élément de donnée compté le plus commun est le kWh, mais de nombreux compteurs d'électricité peuvent aussi saisir les kW, kVAr, kVArh et autres grandeurs de facturation similaires. Certains compteurs peuvent aussi saisir des grandeurs techniques pures telles que tension, courant, facteur de puissance, etc.

Certains systèmes AMR tentent d'ajouter de la valeur à des compteurs en ajoutant la fonctionnalité dont le compteur peut manquer. Pour les compteurs simples (par exemple, compteur d'énergie seulement), il est courant pour un module de compteur AMR d'ajouter la capacité d'accomplir le comptage à la demande, l'enregistrement de données d'intervalle (IDR – *Interval Data Recording*), de maintenir un compte d'alimentation en énergie ou même de fournir des estimations de certaines grandeurs techniques telles que la tension.

Les compteurs commerciaux et industriels utilisent souvent des transformateurs de courant et des transformateurs de tension pour compter le service réel. Les courants et tensions primaires sont réduits en proportion à l'aide de transformateurs de potentiel (PT – *potential transformers*) et de transformateurs de courant (CT – *current transformer*) et, de ce fait, il n'est pas obligatoire de construire le compteur pour qu'il supporte les forts courants et tensions réellement délivrés à la charge. Les valeurs secondaires de tension ou de courant sont souvent mesurées directement par le compteur. Les valeurs secondaires représentent un petit pourcentage des valeurs primaires qui peuvent être effectivement délivrées ou connectées à la charge. Si les tensions et courants secondaires sont mesurés par le compteur, ils peuvent être reconvertis en valeurs primaires à l'aide des rapports de transformation PT et CT, qui sont juste le rapport des valeurs primaires sur secondaires.

Le système de comptage achemine les données des compteurs et autres données à valeur ajoutée jusqu'à la destination par l'intermédiaire du réseau du système de comptage. En fonction du système, le trajet peut impliquer plusieurs étapes à travers des réseaux publics ou privés, des spectres RF sous licence ou sans licence, des systèmes normalisés ou propriétaires, d'une façon unidirectionnelle ou bidirectionnelle.

Certains services ou opérations généraux peuvent être définis pour un système de comptage. Ces opérations générales se traduisent en des actions spécifiques dans le contexte d'une solution de comptage donnée.

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Les opérations générales peuvent être programmées ou appelées sur demande. Chaque opération retourne une réponse avec un statut facultatif. Un message encapsule une opération générale.

Les lecteurs de l'IEC 61968-9 intéressés par des informations complémentaires peuvent se référer à d'autres documents, y compris l'IEC 62056, la DLMS UA (spécification de message de langue d'appareil – association des utilisateurs) et le modèle COSEM: Spécification d'accompagnement pour le comptage d'énergie.

4.3 Fonctions et composants de relevé et de commande de compteurs

Il convient de noter que les types de messages définis dans le présent document peuvent être envoyés ou reçus par tout type de composant d'un système de gestion de distribution (DMS).

Le Tableau 1 indique les fonctions et les composants abstraits habituels qui sont réputés être des sources d'informations pour ces types de messages. Les consommateurs habituels d'informations comprennent, mais de manière non exhaustive, les autres composants énumérés dans l'IEC 61968-1.

Tableau 1 – Fonctions métier et composants abstraits

Fonctions métier	Sous-fonctions métier	Composants abstraits
Relevé et commande des compteurs (MR)	Système de comptage (MS)	Collecte de données
		Commandes de points d'extrémité
		Reconfiguration de points d'extrémité
		Débranchement/rebranchement
		Réinitialisation de la demande
		Relevé sur demande
		Point de vente
		Détection des interruptions de service et vérification du rétablissement
		Événements relatifs à la fiabilité et à la qualité de l'énergie
		Événements relatifs au système de comptage
	Maintenance de compteur et gestion d'actifs	Installation, configuration, suppression, réparation, débranchement et rebranchement de point d'extrémité
		Historique des actifs de points d'extrémité
		Reconfiguration de points d'extrémité
		Relevé spécial
		Demande de services de compteur
		Tarifs
	Gestion de données de compteur (MDM)	Référentiel de données de compteur
		Historique d'utilisation
		Validation, estimation et édition
		Données de facturation client
		Commandes et événements de dispositif terminal
	Réponse à la demande (DR)	Tarification en temps réel
		Réductions d'urgence
		Réductions économiques
		Enregistrement du programme

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Fonctions métier	Sous-fonctions métier	Composants abstraits
	Gestion de charge (LM)	Analyse de la charge
		Régulation de la charge
		Réponse à la demande
		Mesurages de performance
		Gestion du risque

4.4 Modèle statique d'informations

4.4.1 Généralités

Le modèle d'informations concernant le relevé et la commande des compteurs se compose de classes qui fournissent un modèle relatif aux attributs de chaque message.

Les classes sont définies en détail dans l'IEC 61968-11, *Extensions du modèle d'information commun (CIM) pour la distribution*' ou dans l'IEC 61970-301, *Interface de programmation d'application pour système de gestion d'énergie (EMS-API) – Base de Modèle d'Information Commun*.

4.4.2 Classes pour le relevé et la commande des compteurs

Le Tableau 2 énumère les classes utilisées dans les types de messages. Habituellement tous les attributs de ces classes sont contenus dans un type de message. Les descriptions fournies décrivent l'utilisation qui en est faite dans le présent document.

Les classes décrites comme type "Asset" sont définies dans le paquetage "61968/Assets" du CIM.

Les classes décrites comme type "Metering" sont définies dans le paquetage "61968/Metering" du CIM.

Les classes décrites comme type "Profile" sont des profils contextuels définis pour l'IEC 61968-9 qui décrivent les définitions de message établies au moyen d'objets du CIM.

Tableau 2 – Classes pour le relevé et la commande des compteurs

Classe/Nom	Type	Description
Channel	Metering	Chemin simple utilisé pour la collecte ou la consignation des valeurs de registre sur une durée donnée. Par exemple, un registre qui mesure la puissance active peut avoir deux channels (canaux), à savoir un qui fournit les relevés de grandeurs et l'autre qui fournit des relevés d'intervalle d'une taille fixe.
ComFunction	Metering	Fonction de communication du matériel de communication ou d'un appareil tel qu'un compteur.
ComModuleConfig	Profile	Profil de configuration des modules de communications.
ConfigurationEvent	Metering	Utilisé pour consigner les informations détaillées sur la création, la modification ou la suppression d'une entité ou de sa configuration.
DemandResponseProgram	Metering	Programme de réponse à la demande.
DeviceFunction	Metering	Fonction accomplie par un appareil tel qu'un compteur, un équipement de communication, des contrôleurs, etc.

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Classe/Nom	Type	Description
EndDevice	Metering	L'EndDevice est l'équipement qui joue le rôle d'un dispositif terminal. Il peut contenir des fonctionnalités telles que métrologie, communications, régulation de la charge, branchement/débranchement, ou autres capacités. Il est connu comme étant "le compteur", "un compteur intelligent", un "compteur avancé", "climatiseur", "réfrigérateur", "pompe de piscine", etc. qu'un CommModule et/ou Meter peut surveiller et/ou commander. L'actif peut être la propriété d'un client, d'un fournisseur de service, d'une entreprise de distribution ou autre partie.
EndDeviceConfig	Profile	Message utilisé pour acheminer les descriptions d'un ou plusieurs EndDevice.
EndDeviceControl	Metering	Sert à émettre des commandes vers les EndDevice tels que les compteurs. Peut être traitée par EndDevice ou par EndDeviceGroup. Les commandes EndDeviceControl peuvent avoir des types et paramètres de commande.
EndDeviceControls	Profile	Message utilisé pour acheminer une ou plusieurs EndDeviceControls
EndDeviceControlType	Metering	Définit les types d'EndDeviceControls
EndDeviceEvent	Metering	Sert à rapporter des événements détectés par les dispositifs terminaux tels que les compteurs. Chaque EndDeviceEvent comprend un type d'événement et un horodatage.
EndDeviceEvents	Profile	Message utilisé pour acheminer un ou plusieurs EndDeviceEvents.
EndDeviceEventType	Metering	Définit les types d'EndDeviceEvents
EndDeviceFirmware	Profile	Profil pour les messages de configuration de microprogramme d'EndDevice.
EndDeviceGroup	Metering	Un EndDeviceGroup est utilisé pour regrouper des dispositifs terminaux pour une diversité de besoins, y compris entre autres, la régulation de la charge et autres types de réponse à la demande. Un EndDeviceGroup peut appartenir à un autre EndDeviceGroup et un dispositif terminal peut appartenir à zéro, à un ou à plusieurs EndDeviceGroup. Dans certains cas, l'ID de groupe est maintenu au sein du dispositif terminal; dans d'autres cas, il peut toutefois être géré par un système de comptage.
EndDeviceGroups	Profile	Utiliser pour transmettre les modifications apportées aux adhésions au groupe
GetComModuleConfig	Profile	Chaque profil a un profil "Get" correspondant utilisé pour transmettre les paramètres des demandes GET. Voir l'Annexe G.
GetCustomerMeterDataSet		
GetEndDeviceConfig		
GetEndDeviceControls		
GetEndDeviceEvents		
GetEndDeviceGroups		
GetMeterConfig		
GetMeterReadings		
GetMeterReadSchedule		
GetUsagePointConfig		
GetUsagePointGroups		
GetUsagePointLocationConfig		
IntervalBlock	Metering	Séquence temporelle de Readings du même ReadingType. Les IntervalReading contenus peuvent nécessiter une conversion par le biais de l'application d'un décalage et d'un scalaire définis dans l'élément en attente associé.

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Classe/Nom	Type	Description
IntervalReading	Metering	Données saisies à intervalles de temps réguliers. Des données d'intervalles peuvent être saisies comme données différentielles, données absolues ou données relatives. La source pour les données est habituellement une grandeur tarifaire ou une grandeur technique. Les données sont typiquement saisies en des intervalles datés et uniformes, de longueur fixe, de 5, 10, 15, 30 ou 60 min. NOTE: Les données d'intervalles sont parfois également appelées "Relevés de données d'intervalles" (IDR – *Interval Data Readings*).
LegacyObjectIdentificationRevisionSets	Part 100	Ce profil sert à créer, modifier ou supprimer les identifiants des objets CIM comme cela est décrit dans l'IEC 61968-100:2022. Il remplace l'ancien profil ObjectNamesConfig défini dans l'IEC 61968-9:2013.
MasterDataLinkageConfig	Profile	Un profil de message utilisé pour établir ou modifier les relations entre les objets.
Meter	Metering	La classe Meter est utilisée pour décrire les compteurs. Un Meter est un type d'EndDevice utilisé typiquement pour mesurer et surveiller potentiellement une charge client. Il convient d'utiliser la définition de la classe EndDevice comme base pour la classe Meter.
MeterConfig	Profile	Profil de messages relatif aux messages de configuration des Meter.
MeterReading	Metering	Ensemble de valeurs relevées du compteur. Chaque MeterReading peut avoir plusieurs ReadingTypes, et chaque ReadingType peut contenir plusieurs valeurs.
MeterReadings	Profile	Profil pour acheminer des MeterReadings.
MeterReadSchedules	Profile	Un message MeterReadSchedule est utilisé pour programmer les relevés des compteurs.
MeterServiceRequests	Partagé avec la partie 8.	Une demande de services de compteur est un type de tâche qui peut être utilisé pour une diversité d'activités liées aux services des compteurs. Ces activités incluent la pose des compteurs, le remplacement des compteurs, le débranchement/rebranchement de client, etc. L'utilisateur est renvoyé à l'IEC 61968-8 pour le profil de ServiceRequests.
Pending	Metering	Lorsqu'il est présent, conversion scalaire qui est associée à IntervalBlock et qu'il est nécessaire d'appliquer à chaque valeur IntervalReading contenue. Cette conversion se traduit en un nouveau ReadingType associé, qui reflète les véritables dimensions des valeurs de relevés d'intervalles après la conversion.
Reading	Metering	Valeur spécifique mesurée par un compteur ou autre élément d'actif. Chaque Reading (relevé) est associé à un ReadingType spécifique.
ReadingQuality	Metering	Qualité d'une valeur de relevé spécifique ou d'une valeur de relevé d'intervalle. Noter que plusieurs qualités peuvent être applicables à un Reading donné. En général non utilisé sauf s'il se produit des problèmes ou des conditions inhabituelles (c'est-à-dire, la qualité pour chaque Reading est réputée être "Good" (bonne) sauf indication contraire dans le ReadingQuality associé).
ReadingQualityType	Metering	Définit les types des qualités qui peuvent être associées à une valeur de relevé.
ReadingType	Metering	Type de données véhiculé par un Reading spécifique.
Register	Metering	Affichage pour la grandeur qui est comptée sur un dispositif terminal tel qu'un compteur.
SimpleEndDeviceFunction	Metering	Fonction simple d'un dispositif terminal qui se différencie par "type"; utilisation de cette classe pour des instances qui ne peuvent pas être représentées par un autre sous-type de fonction de dispositif terminal.

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Classe/Nom	Type	Description
UsagePointLocation	Metering	Emplacement d'un point individuel d'usage. Pour les résidences ou la plupart des entreprises, il s'agit typiquement de l'emplacement d'un compteur dans les locaux d'un client. Pour le transport, il s'agit du ou des points d'interconnexion sur le système de transport du fournisseur auquel/auxquels la capacité et/ou l'énergie transmise par le fournisseur de transport sont mises à la disposition de la partie réceptrice. Le ou les points de livraison sont spécifiés dans l'accord de service.
UsagePointLocationConfig	Profile	Message utilisé pour établir les associations aux UsagePointLocations.
UsagePoint	Metering	Point logique sur un réseau de distribution auquel les relevés de compteurs et/ou les événements de dispositifs terminaux peuvent être attribués. Utilisé à l'emplacement auquel un compteur physique ou virtuel peut être installé; la présence d'un compteur n'est cependant pas exigée.
UsagePointConfig	Profile	Message utilisé pour établir les associations aux UsagePoints.
UsagePointGroup	Metering	Abstraction applicable à la gestion des communications de groupe au sein d'un système AMR bidirectionnel ou des données pour un groupe de points d'usage associés. Les commandes peuvent être émises à tous les points d'usage qui appartiennent à un groupe de points d'usage qui utilise une adresse de groupe définie et l'infrastructure de communication AMR sous-jacente.
UsagePointGroups	Profile	Message utilisé pour établir les UsagePointGroups.

4.4.3 Classes relatives au relevé et à la commande des compteurs

Le Tableau 3 énumère les classes qui sont associées aux classes relatives au relevé et à la commande des compteurs, mais seul le nom d'une instance est donné dans les messages définis dans le présent document. Les attributs détaillés de ces classes sont utilisés dans les types de messages définis dans d'autres parties de l'IEC 61968.

Tableau 3 – Classes relatives au relevé et à la commande des compteurs

Classe connexe	Référence	Description
Organisation	Common	Cette classe est utilisée pour identifier des sociétés ou des divisions/départements au sein des sociétés. Les organisations peuvent jouer des rôles tels que ceux des entreprises de distribution, des entrepreneurs, des fournisseurs, des constructeurs, etc.
PowerSystemResource	Core (IEC 61970-301)	Une entité qui décrit la représentation logique d'une partie de composant d'une activité de Distribution. PowerSystemResources sont classés en plus comme EquipmentContainers, par exemple, Substations, ConductingEquipment, ProtectionEquipment, etc. Les instances de type PowerSystemResource peuvent être relatives à des instances du type Asset.
PowerTransformer	Wires (IEC 61970-301)	Appareil électrique constitué de deux enroulements couplés ou plus, avec ou sans cœur magnétique, destiné à introduire un couplage mutuel entre les circuits électriques. Les transformateurs peuvent être utilisés pour contrôler la tension et le déplacement de phase (flux MW).
ServiceLocation	Customers	Un ServiceLocation de client possède un ou plusieurs UsagePoint. Les compteurs sont liés à un UsagePoint. L'emplacement peut être un point ou un polygone, selon les circonstances spécifiques. Pour la distribution, le ServiceLocation est typiquement l'emplacement du local du client de l'entreprise de distribution. Dans la mesure où un local de client peut avoir un ou plusieurs compteurs, l'UsagePoint est utilisé pour définir l'équipement conducteur réel auquel l'EndDevice se fixe en l'emplacement ServiceLocation du client de l'entreprise de distribution. Pour le transport, il s'agit du ou des points d'interconnexion sur le système de transport du fournisseur auquel/auxquels la capacité et/ou l'énergie transmise par le fournisseur de transport sont mises à la disposition de la partie réceptrice.

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Classe connexe	Référence	Description
TransformerTank	Wires (IEC 61970-301)	Un enroulement de transformateur.
NOTE Les définitions de classes fournies ici sont données uniquement pour des raisons pratiques. Les définitions normatives sont fournies par l'IEC 61968-11, qui décrit les extensions de distribution au CIM de l'IEC.		

5 Types de messages de relevé et de commande des compteurs

5.1 Généralités

Le présent Article 5 a pour but de décrire les types de messages relatifs à l'IEC 61968-9. Il est important de noter que certains de ces types de messages peuvent aussi être utilisés par d'autres parties de l'IEC 61968. L'approche générale relative à la réalisation des structures de message et des schémas XML pour les messages IEC 61968 est décrite dans l'IEC 61968-1 et l'IEC 61968-100.

Bien qu'ils puissent être représentés dans des diagrammes de séquences pour le contexte et l'exhaustivité, le présent document ne décrit pas les formats de message qui sont définis par d'autres parties de l'IEC 61968. Les structures de la charge utile des messages qui sont définies par la présente partie de l'IEC 61968 sont décrites à l'Article 5.

Les schémas XML normatifs pour les messages définis par la présente partie sont donnés à l'Annexe G, qui fournit des descriptions annotées plus détaillées des structures de messages. Les structures de messages sont présentées sous forme de diagramme à l'Article 5. La convention de notation présente les éléments exigés avec un contour en trait plein et les éléments facultatifs avec des contours en traits tiretés.

Il est également important de noter que les cas d'utilisation et les diagrammes de séquences fournis dans le présent document sont de nature informative et sont réputés présenter des exemples d'utilisation pour les définitions de message normatives. Le présent document ne vise nullement à normaliser des processus métier spécifiques.

5.2 Messages d'événements de dispositif terminal

5.2.1 Généralités

Un événement est un rapport d'une modification d'état qui peut avoir un intérêt potentiel. Les messages d'événement de dispositif terminal sont conçus comme un moyen de transmettre les modifications d'état d'un dispositif terminal par le biais de l'appareil lui-même ou d'un proxy pour le compte d'un dispositif terminal. Les événements de dispositif terminal sont considérés comme un flot potentiel de données qui n'est pas nécessairement synchronisé à la collecte de relevés de compteur à des fins de facturation. Cependant, il peut encore être pertinent pour le processus de facturation. Une alarme relative à l'état physique du compteur peut être si sévère que tous les relevés du compteur doivent être considérés comme non valides. Le consommateur de données (par exemple le système MDM) peut recevoir les données d'un événement pertinentes disponibles et les considérer lors du processus de validation, d'édition et d'estimation. Il peut également rapporter les données d'un événement à d'autres systèmes d'entreprise, puis les utiliser pour déclencher des actions telles que la création d'une MeterServiceRequest en vue de réparer ou de remplacer un compteur défectueux.

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5.2.2 Applications

5.2.2.1 Généralités

Le présent document considère les "événements" comme différents des "statuts". La plupart des systèmes MR ne garantissent pas une livraison dans les délais d'un EndDeviceEvent. Par ailleurs, un "statut" n'est utile que lorsqu'il est frais. Le statut d'un EndDevice est généralement obtenu à l'aide d'un GetMeterReadings "OnRequest". Le rapport d'un EndDeviceEvent arrive finalement au service d'administration de l'entreprise de distribution et est traité à son tour. Cela implique que différentes applications sont naturellement divisées en différents types d'échanges de messages selon la technologie de communication sous-jacente utilisée par le système MR et la nécessité de disposer de données opportunes. Certains systèmes peuvent avoir la capacité de rapporter une interruption de service en tant qu'événement. D'autres systèmes peuvent la traiter en tant que statut. La plupart des systèmes MR rapportent une modification de l'état physique du compteur en tant qu'événement, mais certains peuvent exiger qu'elle soit relevée en tant que statut. De la même manière, la plupart des systèmes MR rapportent la qualité de l'énergie en tant qu'événement, bien que certains puissent la traiter en tant que statut.

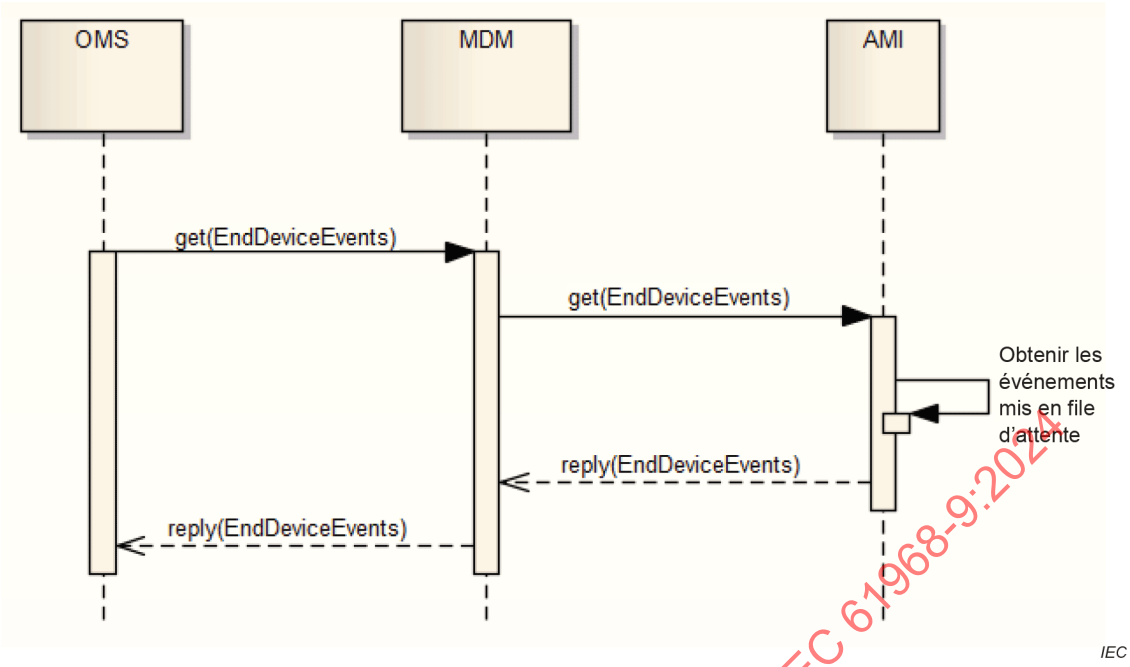
5.2.2.2 Détection des interruptions de service

Lorsqu'une interruption de service n'est pas due à un déclenchement par le système SCADA, les entreprises de distribution d'électricité dépendent typiquement des appels émis par les clients pour identifier l'emplacement du défaut. Cependant, l'utilisation d'un MS peut fournir un autre moyen d'identifier l'emplacement du problème. Il est souvent possible pour un MS de déterminer qu'il a perdu le contact avec le compteur, auquel cas cela peut être consigné dans un rapport en tant qu'EndDeviceEvent afin d'être potentiellement utilisé par un système de gestion des interruptions de service. Il est important de noter que la perte de communications avec un compteur peut ne pas être suffisante pour identifier l'existence d'une interruption de service, car il est courant que certaines technologies MS perdent occasionnellement le contact avec les compteurs pendant de courtes durées.

Certains systèmes MS peuvent être enclins aux fausses alarmes à cause de la technologie particulière utilisée pour communiquer avec les compteurs. De nombreux fournisseurs travaillent à améliorer leur technologie et l'exactitude de leurs données. Avec beaucoup de ressemblance avec le rôle qu'elle joue parfois dans le nettoyage des données comptées pour des applications de facturation, la MDM peut, dans nombre de cas, aussi jouer un rôle dans le nettoyage des données relatives aux interruptions de service fournies par le MS avant qu'elles ne soient relayées à l'OMS. Une telle décision, à savoir acheminer par l'intermédiaire de la MDM les données relatives aux interruptions de service, dépend de la capacité du MS à fournir des données exactes, de l'aptitude de la MDM à nettoyer les données sans introduire de retards excessifs et de l'aptitude de l'OMS à tolérer les fausses alarmes et les retards. Afin de prendre en charge l'analyse des interruptions de service et le filtrage des données de mauvaise qualité, le MS peut fournir des données de vérification rétrospective et des données relatives à la qualité de mesure pour l'événement d'interruption de service, de la même manière qu'il fournit des données de vérification rétrospective pour les relevés pour facturation.

La Figure 2 décrit un déploiement dans lequel la MDM est utilisée pour diffuser des informations relatives aux interruptions de service.

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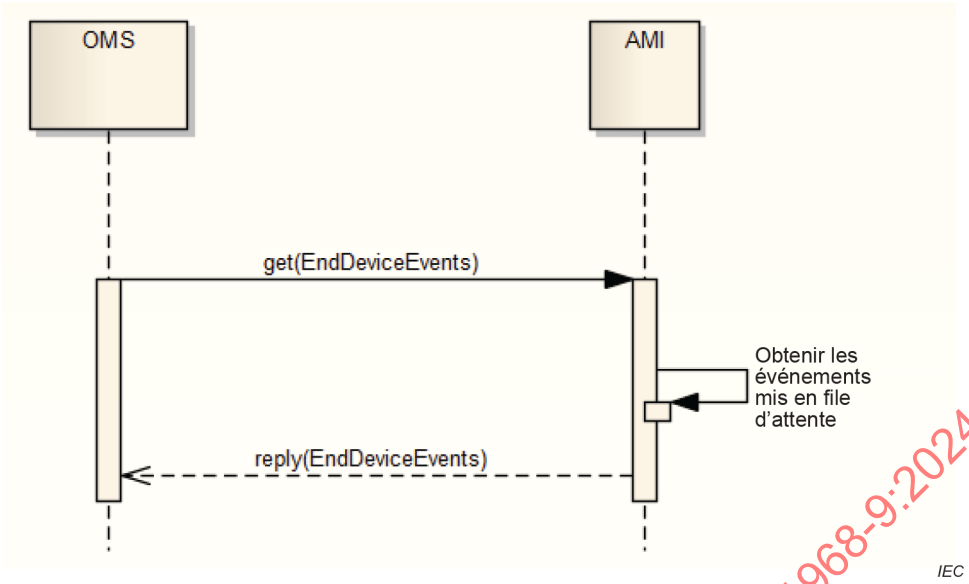
La Figure 2 est reproduite avec l'autorisation de l'UCAIug.

Figure 2 – Détection d'interruptions de service, échange de messages de demande/réponse, exemple 1

Les systèmes de gestion des interruptions de service analysent le circuit en matière de topologie de réseau. "EndDeviceEventType" peut indiquer un événement tel qu'il est détecté par un dispositif terminal en vue de sa prise en considération dans l'analyse, ainsi que d'autres informations telles que les tickets d'incident. Lorsqu'un EndDeviceEvent peut indiquer un état intéressant qui peut s'avérer être une interruption de service, une interruption de service est habituellement le résultat de l'analyse de ladite interruption au sein d'un OMS qui regroupe potentiellement de nombreux événements dans une seule interruption de service.

L'utilisation d'une MDM pour diffuser des données relatives aux interruptions de service est à la discrétion de l'entreprise de distribution. Dans certains déploiements, la demande de détection d'interruptions de service peut être émise directement de l'OMS vers le MS comme dans l'exemple de la Figure 3.

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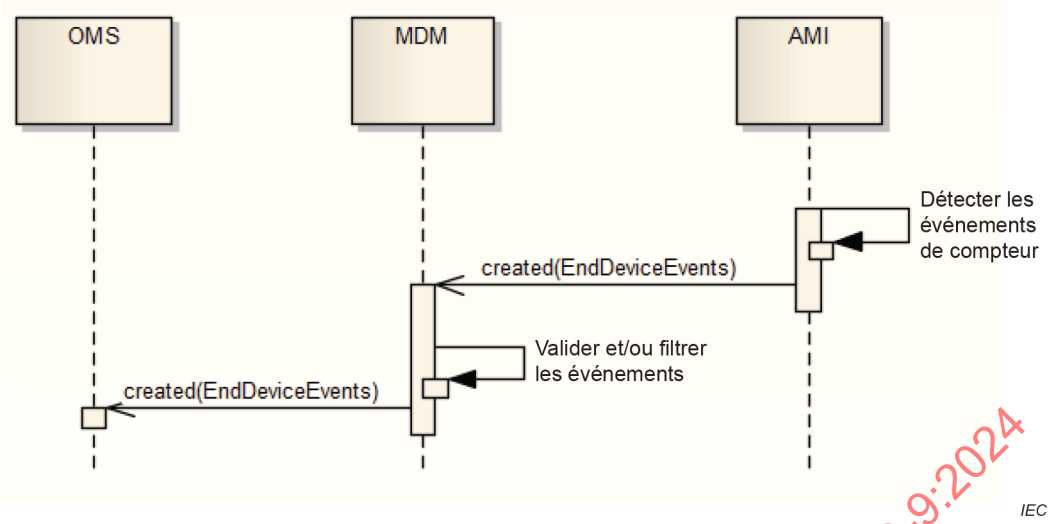
La Figure 3 est reproduite avec l'autorisation de l'UCAIug.

Figure 3 – Détection d'interruptions de service, échange de messages de demande/réponse, exemple 2

Une réponse (synchrone ou asynchrone) de la part du MS se présente vraisemblablement sous la forme de zéro, un ou plusieurs EndDeviceEvents. Le mRID ou la structure de noms identifie les dispositifs terminaux (par exemple, les compteurs) affectés par l'interruption de service ou la restauration. Certains consommateurs de données qui interagissent avec le MS peuvent savoir seulement comment traiter les ID des compteurs. Selon le déploiement, il peut être exigé de limiter l'étendue des mRID échangés à celle des ID de compteurs à l'aide de la classe Nom, non à celle des ressources du réseau électrique en général. Le statut "EndDeviceEvent.status" peut indiquer "live" (c'est-à-dire actif) ou "dead" (c'est-à-dire hors tension). Certains systèmes de comptage peuvent compléter les informations de statut avec une preuve de collaboration à l'aide de la classe EndDeviceEventDetails. EndDeviceEventType peut être utilisé pour indiquer que le statut s'applique à un compteur ou à un transformateur de puissance. La raison de l'événement peut être décrite (par exemple, EndDeviceEvent.reason = "consecutiveFailCounter") et quantifiée (par exemple, EndDeviceEvent.severity = "3").

Alors que l'échange de demande/réponse est utilisable chaque fois que l'OMS a besoin d'informations supplémentaires, certains MS sont capables de détecter automatiquement les interruptions de service. Un échange pub/sub (c'est-à-dire publication/abonnement) est théorique dans ces situations. La Figure 4 représente un tel échange en un déploiement auquel la MDM sert de courtier d'informations. La Figure 5 représente un déploiement avec des informations transmises directement du MS à l'OMS.

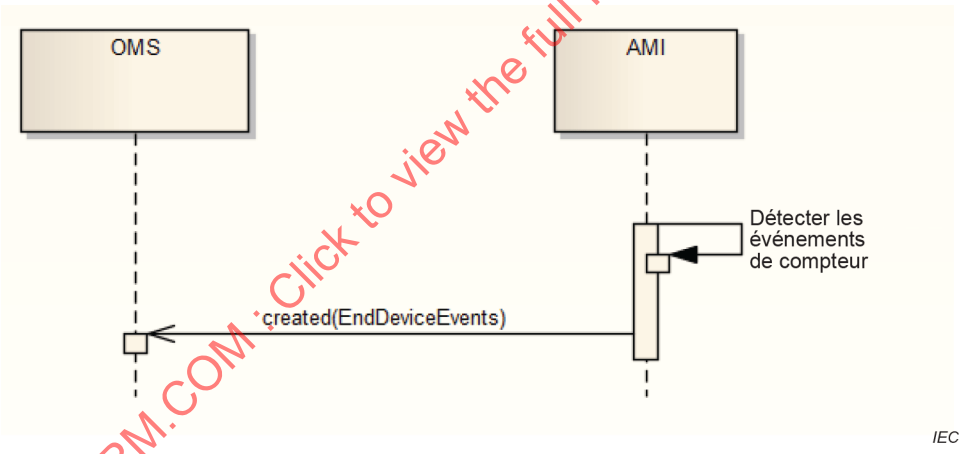
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La Figure 4 est reproduite avec l'autorisation de l'UCAIug.

Figure 4 – Détection d'interruptions de service, échange de publication/abonnement, exemple 1

Le diagramme de séquence de la Figure 5 présente un exemple de propagation d'événements sans avoir recours à une MDM.



La Figure 5 est reproduite avec l'autorisation de l'UCAIug.

Figure 5 – Détection d'interruptions de service, échange de publication/abonnement, exemple 2

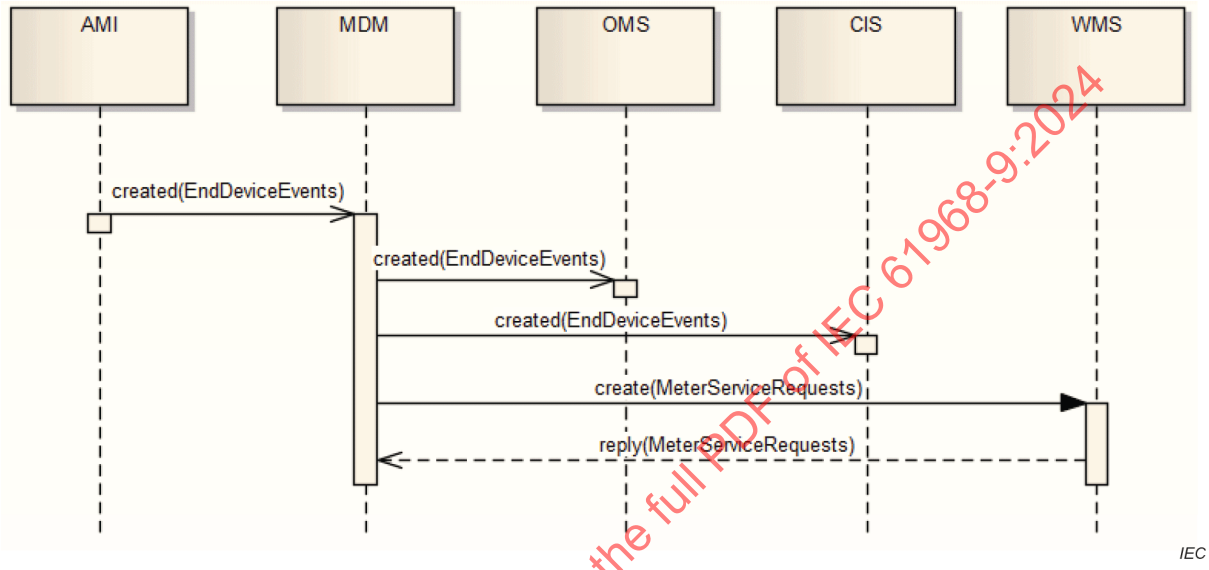
Certains déploiements peuvent souhaiter limiter le nombre d'interfaces prises en charge. La structure des messages MeterReadings fournit également le moyen d'acheminer des EndDeviceEvents.

Les exemples précédents reflètent l'échange de messages d'événement de dispositif terminal afin de prendre en charge les fonctions de gestion des interruptions de service. Comme cela a été expliqué auparavant, il est également souvent préférable de disposer d'un système de gestion des interruptions de service ou un système MDM qui effectue une requête de lecture sur demande au système de comptage en vue d'obtenir le statut d'excitation actuel d'un dispositif. Cela est réalisé par un échange get(MeterReadings) tel qu'il est décrit au 5.3. Dans de tels cas, le ReadingType (voir l'Annexe C) demandé indique que l'état d'excitation fait l'objet de la demande en cours.

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5.2.2.3 Événements d'état physique des compteurs

Certains types de compteurs peuvent parfois générer des événements d'état physique de compteurs, qui peuvent être utilisés pour identifier les problèmes de matériel, de configuration ou de branchement de compteurs qu'il convient de résoudre. Les alarmes comprennent des éléments tels que les alarmes de diagnostic, alarmes de fraude ou autres conditions inhabituelles. La sévérité de l'alarme peut aller d'une simple notification à "fatal". Fréquemment, la résolution des événements liés à l'état physique du compteur exige une visite sur site et débouche généralement sur la création d'une MeterServiceRequest. Les événements d'état physique des compteurs sont communiqués à l'aide des messages EndDeviceEvent.

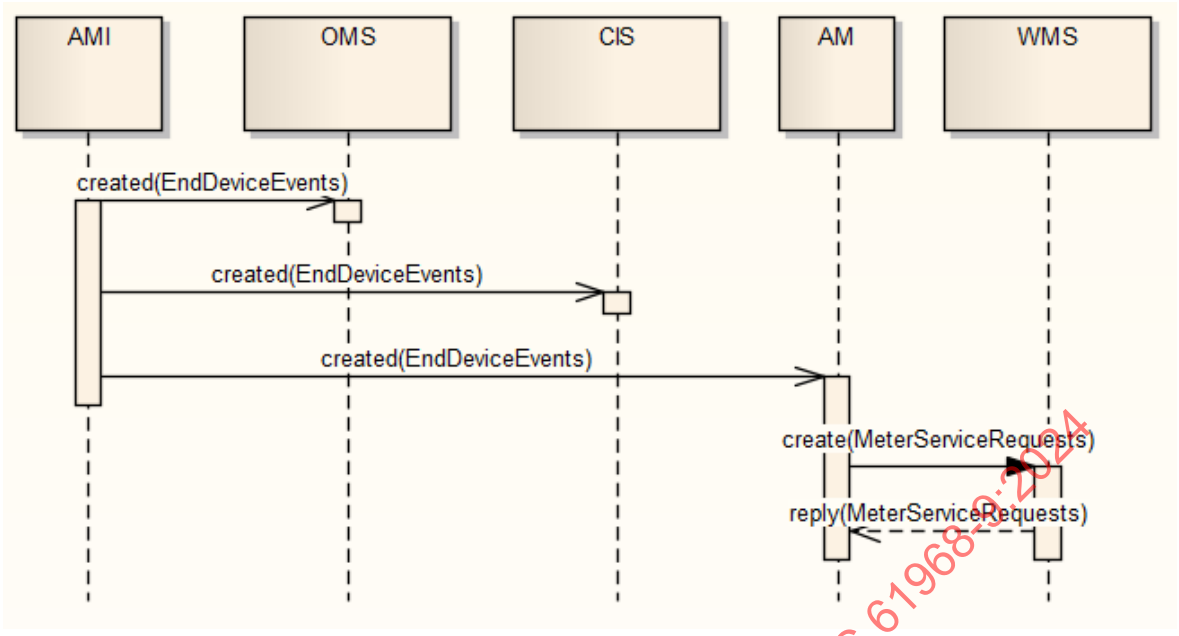


La Figure 6 est reproduite avec l'autorisation de l'UCAIug.

Figure 6 – Échange d'événements liés à l'état physique des compteurs, exemple 1

Lors de certains déploiements, la MDM est présente pour diffuser les données d'état physique des compteurs pour d'autres parties prenantes et agit probablement en vue de déclencher des actions correctives comme cela est décrit dans le scénario de la Figure 6. Toutefois, d'autres installations peuvent ne pas avoir une MDM ou l'utiliser de cette manière. Il est possible pour le MS d'éditer des données directement à l'attention des parties prenantes qui sont équipées pour les recevoir. Un tel échange est représenté à la Figure 7.

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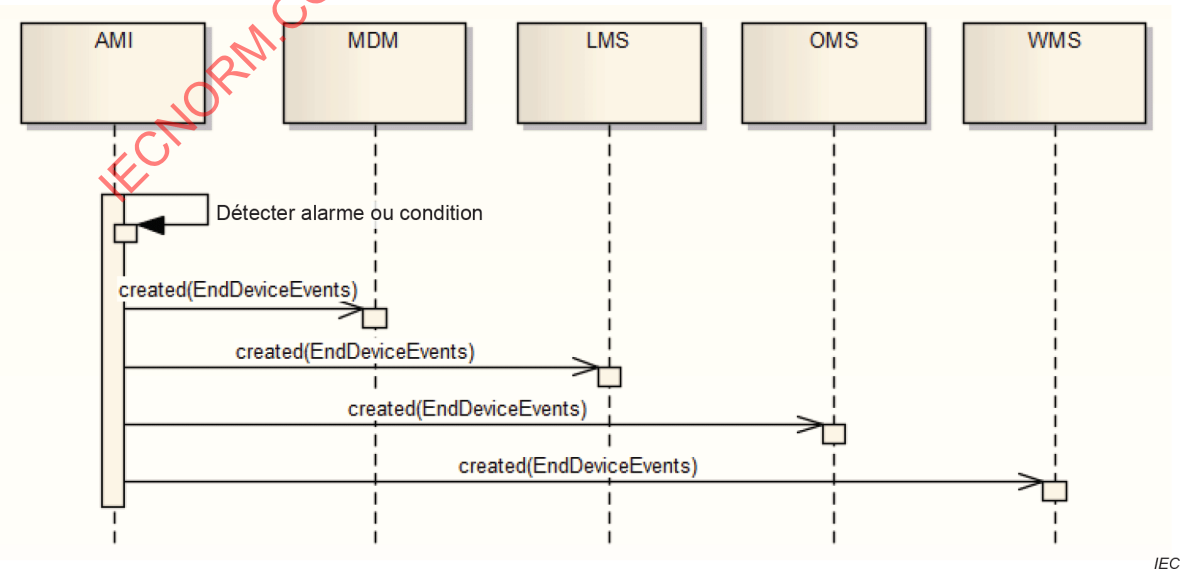
La Figure 7 est reproduite avec l'autorisation de l'UCAIug.

Figure 7 – Échange d'événements liés à l'état physique des compteurs, exemple 2

5.2.2.4 Événement relatif à la qualité de l'énergie

Les compteurs peuvent recueillir des informations relatives à la qualité de l'énergie, y compris entre autres, les événements d'interruption momentanée du service, événements d'interruption durable du service, événements de haute ou basse tension et événements de forte distorsion. Ces informations peuvent être utilisées pour l'analyse des interruptions de service, la programmation de la maintenance ou la planification de la capacité. Les événements relatifs à la qualité de l'énergie sont un sous-type d'EndDeviceEvent.

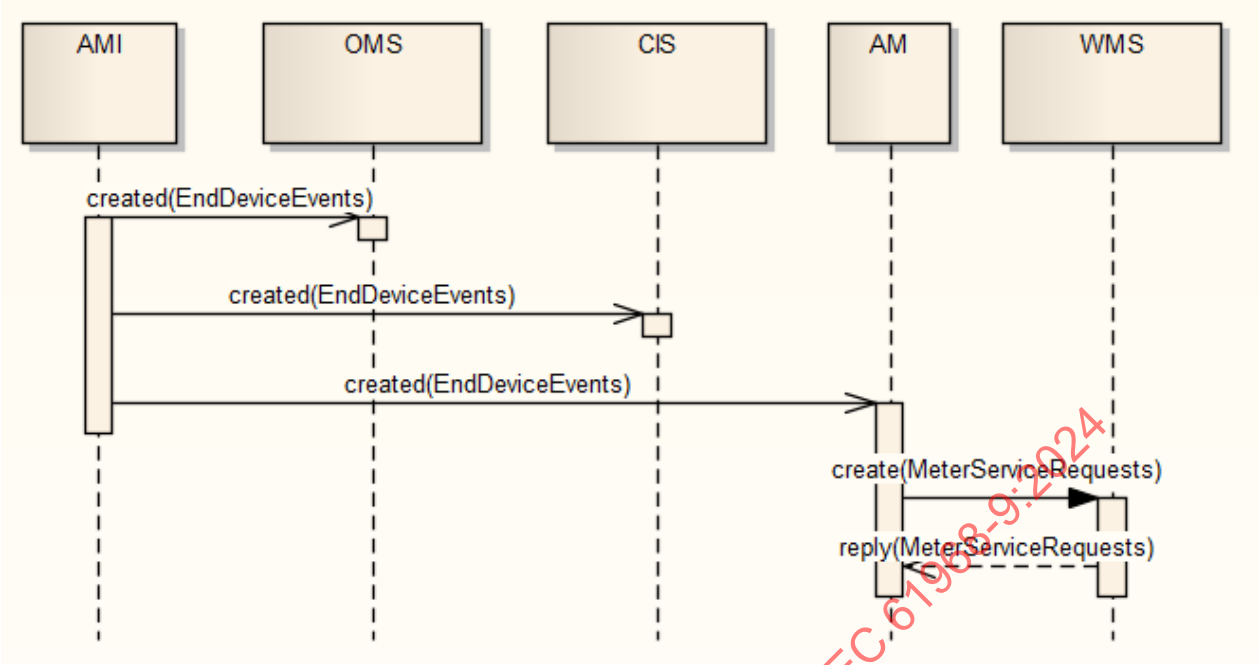
Les événements relatifs à la qualité de l'énergie peuvent être diffusés (c'est-à-dire les publications gérées) par une MDM (comme cela est décrit à la Figure 8), ou envoyés directement aux différentes parties prenantes (comme cela est décrit à la Figure 9).



La Figure 8 est reproduite avec l'autorisation de l'UCAIug.

Figure 8 – Échange d'événements liés à la qualité de l'énergie, exemple 1

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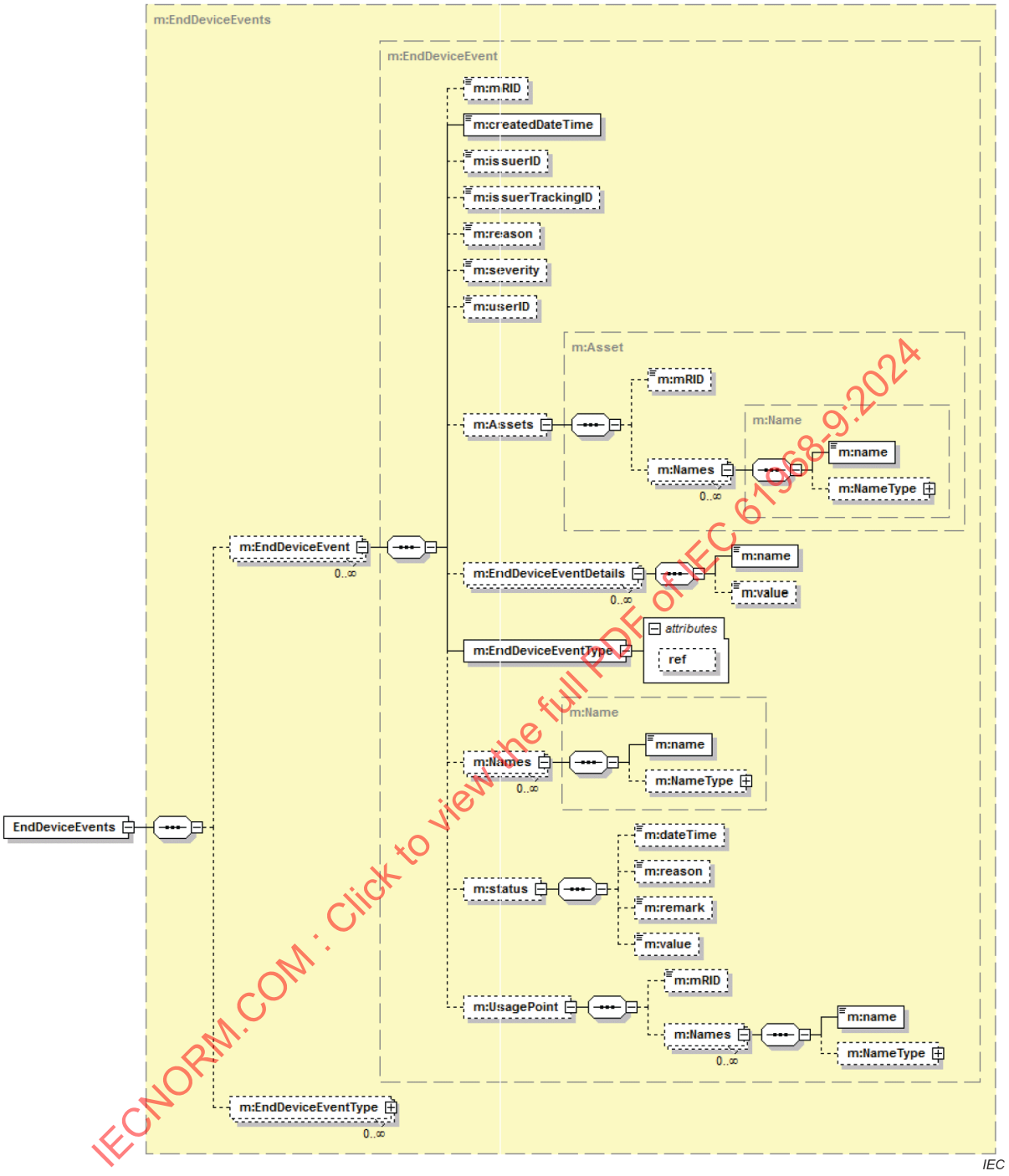
La Figure 9 est reproduite avec l'autorisation de l'UCAIug.

Figure 9 – Échange d'événements liés à la qualité de l'énergie, exemple 2

5.2.3 Format des messages

Les messages d'événements compteur sont mis en œuvre à l'aide de structures EndDeviceEvent afin de prendre en charge une plus vaste diversité de sources d'événements que les seuls compteurs. EndDeviceEvent.EndDeviceEventType (voir l'Annexe E) est une référence à une énumération qui indique le type d'événement, tel que détection d'interruption de service, état physique de compteur ou qualité de l'énergie. L'horodatage et le mRID ou un nom unique du dispositif terminal sont également exigés. Le format des messages est décrit à la Figure 10.

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La Figure 10 est reproduite avec l'autorisation de l'UCAIug.

Figure 10 – Format des messages d'événements de dispositif terminal

Comme noté par la Figure 10, seuls les éléments timestamp et EndDeviceEventType sont exigés, avec un mRID ou un nom unique du dispositif terminal. L'élément EndDeviceEventType permet de différencier différents types d'événements (par exemple état physique de compteur, détection d'interruption de service, etc.). Différents types d'événements permettent à un message EndDeviceEvent d'acheminer des événements liés (y compris notamment) à:

la détection d'interruptions prolongées de service;

la détection d'interruptions momentanées de service;

la détection de seuil basse tension;

la détection de seuil haute tension;

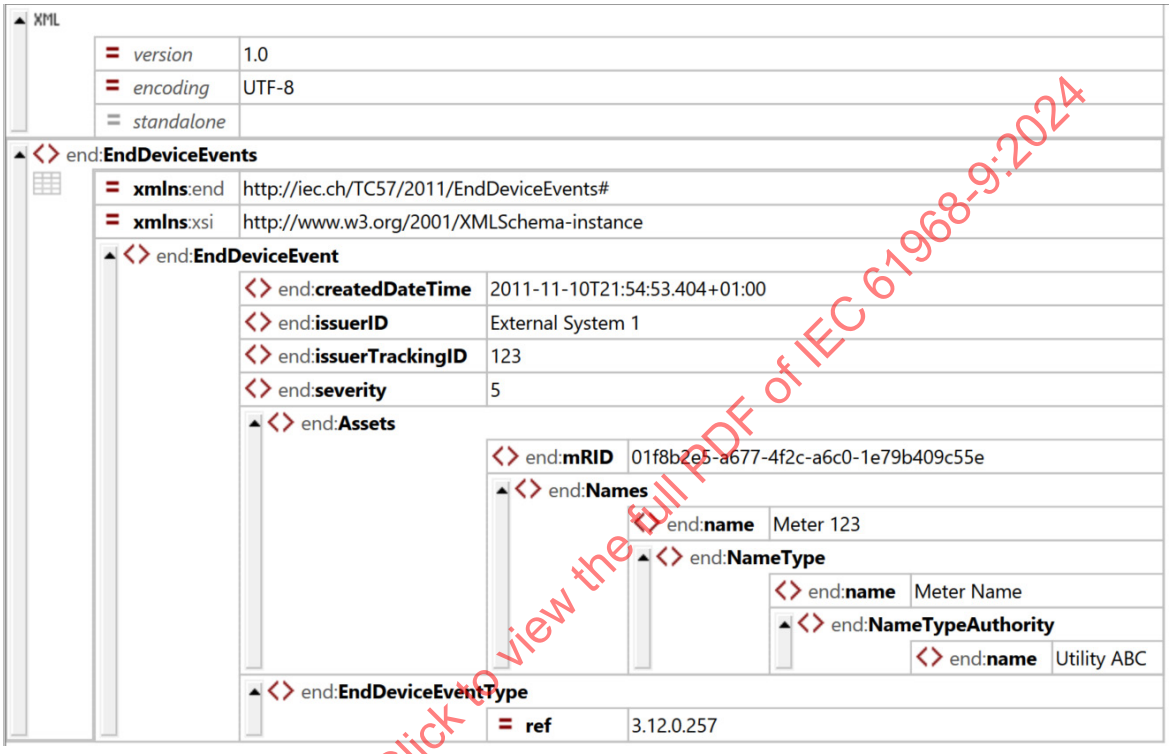
la déformation;

l'état physique du compteur;

la détection de fraude;

l'événement recettes.

Le schéma XML détaillé est fourni à l'Annexe G. Le schéma XML suivant est un exemple d'EndDeviceEvent.



La Figure 11 est reproduite avec l'autorisation de l'UCAIug.

Figure 11 – Exemple d'EndDeviceEvents

L'EndDeviceEvent est associé logiquement à un EndDevice et/ou un UsagePoint, et l'un ou l'autre peut être identifié par mRID et/ou Name. Tout comme dans l'IEC 61968-9, un EndDeviceEvent est associé à un Asset, qui est généralement un EndDevice.

5.3 Messages de relevés de compteur

5.3.1 Généralités

Les messages de relevés de compteur sont conçus pour pouvoir transmettre les données collectées par ou calculées pour le compte d'un compteur. Cela peut inclure les grandeurs mesurées et calculées, ainsi que les informations d'état ou l'historique collecté. À chaque fois qu'un "measurement" (un mesurage) est exigé d'un dispositif terminal, un échange MeterReading est vraisemblablement l'outil tout à fait approprié pour la tâche. Le dispositif terminal peut avoir une capacité de métrologie et dans ce cas, est le plus probablement appelé "compteur". Mais il existe d'autres applications potentielles pour MeterReading. Si un consommateur de données souhaite mesurer la position du commutateur sur un commutateur de branchement/débranchement, cela peut être accompli sous la forme d'un échange de MeterReading. Si un consommateur de données souhaite mesurer le statut "energisation" (c'est-à-dire alimentation en énergie ou non) du dispositif terminal, cela peut être accompli avec un échange de MeterReading ou, en variante, avec un échange d'EndDeviceEvent comme cela est décrit au 5.2.

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5.3.2 Applications

5.3.2.1 Relevés périodiques de compteur

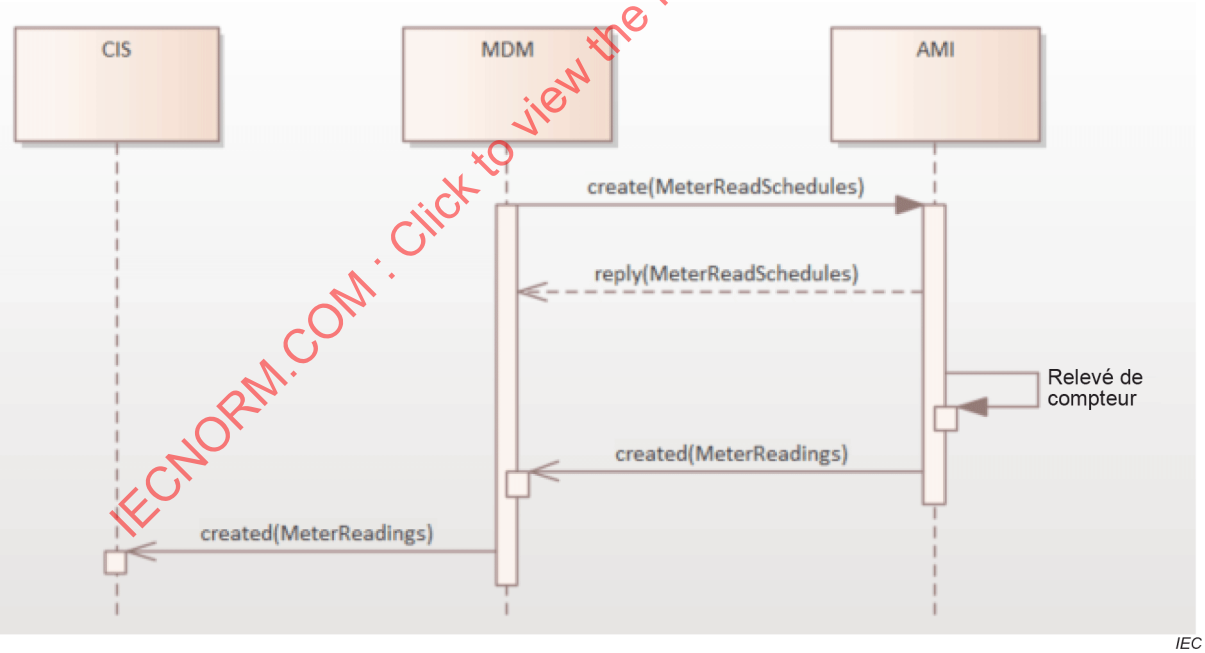
Il est nécessaire de rassembler périodiquement les relevés de compteur d'un MS pour facturation à travers un système de facturation client. Il convient que la demande de relevé de compteur spécifie un compteur ou un groupe de compteurs, un type de relevé à recueillir, ainsi qu'une fréquence et la durée concernée. La fréquence programmée peut consister en des périodes régulières ou irrégulières. Les déploiements n'ont pas tous des systèmes pour lesquels il est nécessaire d'échanger les programmes de relevés de compteurs, mais si tel est le cas, le profil MeterReadSchedules peut être utilisé.

La demande MeterReadSchedules peut être lancée vers le MS à partir d'un nombre quelconque des éléments suivants:

- le CIS (dans un effort qui vise à recueillir les déterminants de facturation);
- une application de planification et de programmation (dans un effort qui vise à acquérir des données techniques relatives au réseau de distribution);
- un OMS (afin d'établir un flot d'informations de statut);
- un système de gestion de données de compteur (dans un effort qui vise à diffuser les données pour tout ou partie des applications ci-dessus);
- le MS proprement dit, qui peut lancer de lui-même un MeterReadSchedules.

Un exemple d'un tel échange (celui-ci utilisant en l'occurrence une MDM) est représenté à la Figure 12.

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La Figure 12 est reproduite avec l'autorisation de l'UCAIug.

Figure 12 – Exemple d'utilisation d'un programme de relevé de compteur pour créer un abonnement

Dans cet exemple, le système AMI est traité comme le système d'enregistrement qui possède le programme de relevé de compteur. La MDM demande de ''créer'' un nouveau programme. Dans une mise en œuvre différente, un autre système tel que le CIS peut être le système d'enregistrement des programmes de relevé de compteur. Dans ce cas, le CIS est le système qui permet de ''créer'' le programme. Le programme ''créé'' est alors diffusé par le CIS aux autres systèmes.

Certains systèmes de comptage peuvent avoir la capacité de dissocier collecte de MeterReading et compte-rendu de MeterReading. Pour les systèmes de comptage sans cette capacité, les relevés peuvent être consignés immédiatement dès leur collecte. Dans la demande MeterReadSchedules, des MeterReadings peuvent être sollicités à l'aide d'une diversité de paramètres, y compris:

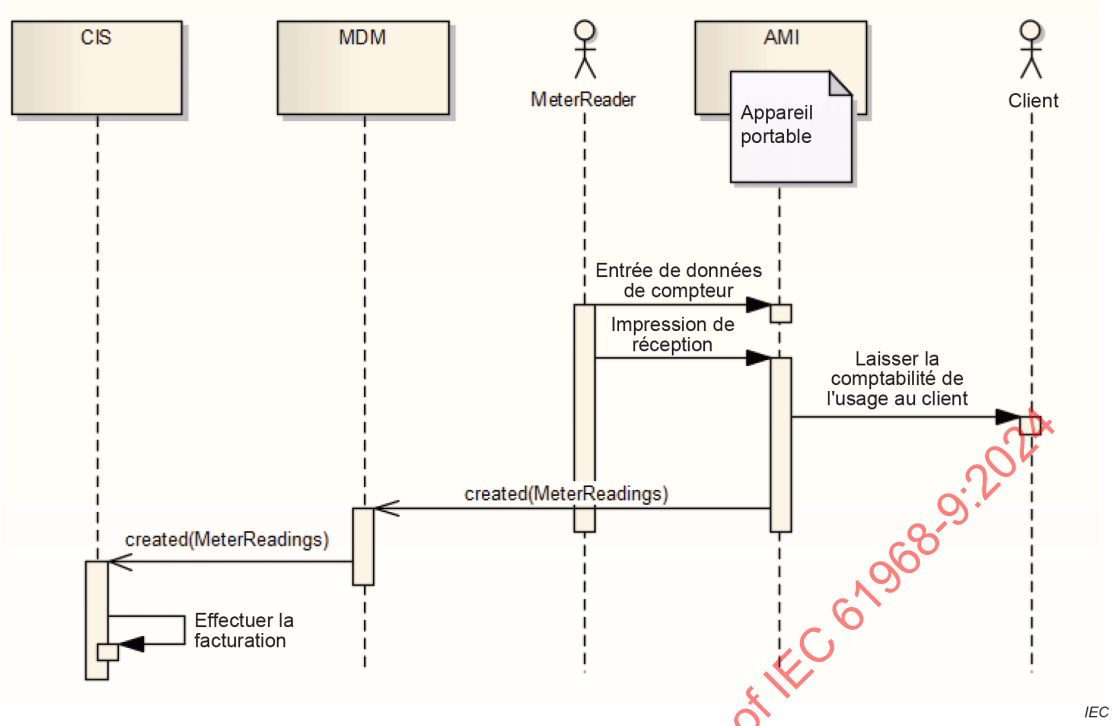
- un compteur spécifique, en utilisant le mRID EndDevice ou Names.name. Voir l'IEC 61968-100:2022 pour la spécification des Names et des éléments associés aux Names, ainsi que pour l'utilisation du message LegacyObjectIdentificationRevisionSets message;
- des EndDeviceGroups, avec lesquels un EndDeviceGroup identifie une adresse de groupe utilisée au sein du système de comptage;
- un UsagePoint dans lequel se situe un compteur, à l'aide du mRID UsagePoint ou de Names.name;
- des UsagePointGroups, avec lesquels UsagePointGroup identifie une groupAddress utilisée au sein du système de comptage;
- comme indiqué lors de l'utilisation d'un TimeSchedule;
- les ReadingTypes peuvent être précisés pour identifier les types de relevé souhaités.

5.3.2.2 Relevé manuel de compteur

Les relevés de compteur peuvent être obtenus manuellement par un releveur de compteur. Les données recueillies peuvent être maintenues par le gestionnaire de données de compteur. Les compteurs peuvent collecter plusieurs types de mesure différents. Certains types de compteurs peuvent mesurer plus d'une phase ou peuvent recueillir des valeurs pour des mesurages non électriques, tels que l'eau ou le gaz.

Un releveur de compteur peut entrer les données présentées sur le panneau du compteur dans un appareil portable qui peut être considéré comme un système de comptage. L'entrée de données peut se produire plusieurs centaines de fois par jour. Un releveur de compteur peut présenter un rapport du relevé au client. Noter que ce rapport n'est pas une facture. La facturation est générée normalement par le CIS même dans le cas du relevé manuel. La Figure 13 représente un tel échange.

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La Figure 13 est reproduite avec l'autorisation de l'UCAIug.

Figure 13 – Exemple d'échange de relevé manuel de compteur

À la fin de la journée de travail, toutes les données stockées dans l'appareil portable sont envoyées vers la MDM par l'intermédiaire d'un réseau de communications. La MDM édite un message à l'attention du CIS qui informe de la création du MeterReading.

Les programmes pour emprunter un itinéraire de relevé manuel de compteur sont décidés bien avant d'accomplir le travail.

5.3.2.3 Relevé de compteur sur demande

Les demandes de relevé de compteur sont émises à l'attention d'un MS afin d'obtenir des relevés de compteur sur demande. Le MS envoie une demande aux compteurs souhaités. Ceux-ci peuvent être utilisés pour des demandes de renseignements de facturation, la vérification de l'étendue des interruptions de service, la vérification de la restauration et à d'autres fins commerciales.

De nombreuses entreprises de distribution ont une politique qui consiste à acheminer, par l'intermédiaire de la MDM, tous les relevés générateurs de recettes. Ainsi, toutes les données reçoivent le même niveau de validation. Cependant, tous les systèmes MDM ne sont pas capables de proposer des services de validation pour les données relatives aux interruptions de service. Pour ceux qui en sont capables, l'entreprise de distribution doit pondérer la valeur de validation de la MDM en fonction du retard qui peut être introduit et de la capacité d'une solution OMS particulière à refuser les données incohérentes. Pour cette raison, l'exemple de diagramme présente les relevés générateurs de recettes acheminés par l'intermédiaire de la MDM, mais les données relatives aux interruptions de service la contournent.

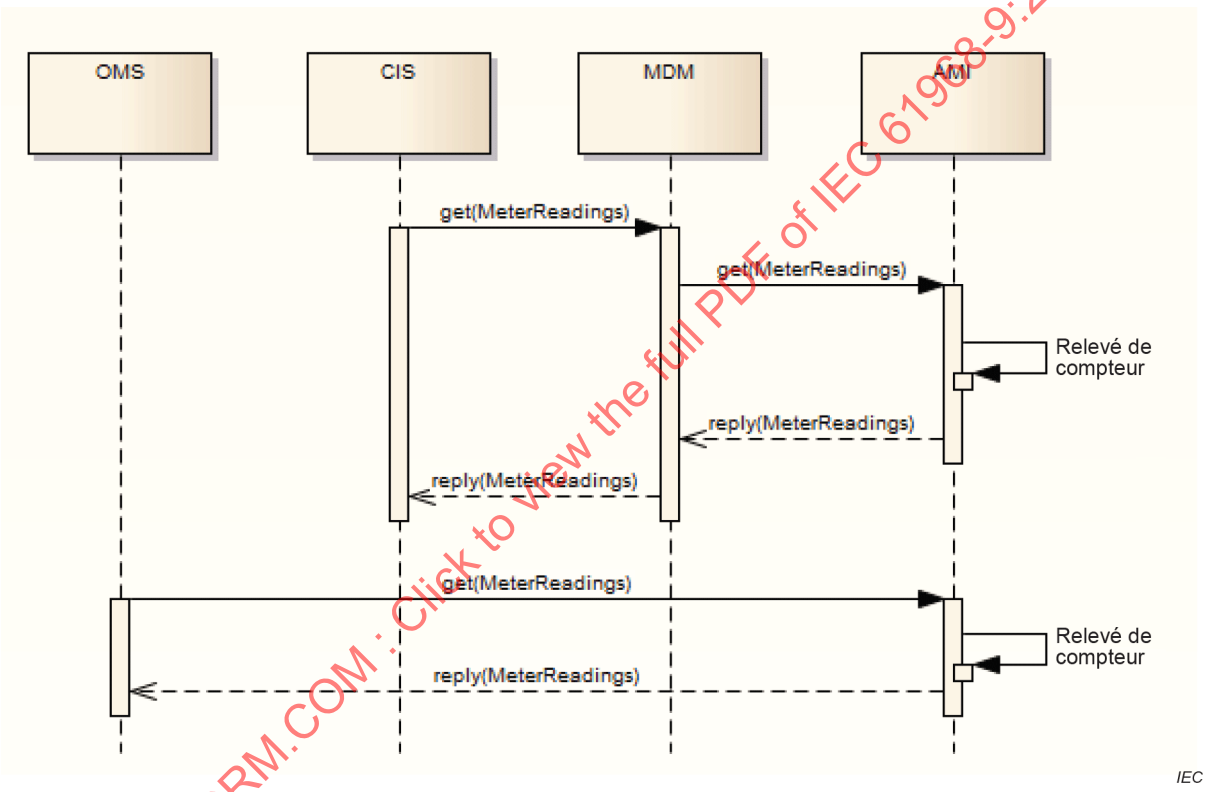
Il est important de noter que tous les systèmes de comptage ne prennent pas en charge les relevés "sur demande". Pour ceux qui le font, la mise en œuvre peut également varier de manière considérable.

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Les relevés sur demande peuvent être lancés vers le MS à partir de systèmes tels que les suivants:

- le CIS (dans un effort qui vise à recueillir les déterminants de facturation);
- une application de planification et de programmation (dans un effort qui vise à acquérir des données techniques relatives au réseau de distribution);
- un OMS (afin de vérifier si un client est affecté par une interruption de service ou s'il a été rétabli);
- un système de gestion de données de compteur (dans un effort qui vise à diffuser les données pour tout ou partie des applications ci-dessus);
- le MS proprement dit, qui peut lancer de lui-même un relevé de compteur.

Un exemple d'un tel échange (celui-ci utilisant en l'occurrence une MDM) est représenté à la Figure 14.



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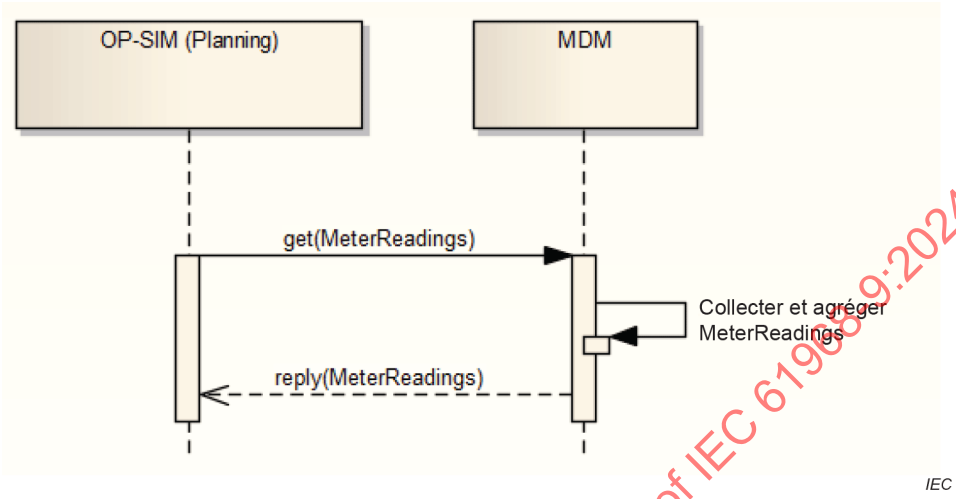
La Figure 14 est reproduite avec l'autorisation de l'UCAIug.

Figure 14 – Exemple de relevé de compteur sur demande

Cet exemple utilise le nom MeterReadings du fait de l'adressage d'un compteur très spécifique. Toutefois, une mise en œuvre peut souhaiter en variante utiliser le nom GetMeterReadings. La comparaison des deux schémas (présentés à l'Annexe G) permet d'établir que le schéma de MeterReadings permet au demandeur de spécifier un ou plusieurs EndDeviceEventType et/ou ReadingType à filtrer. Dans l'intervalle, GetMeterReadings prend également en charge les noms EndDevice, EndDeviceGroup, TimeSchedule, TransformerTank, UsagePoint et UsagePointGroup. La même option s'applique aux autres types de relevés de compteurs (tels que Accès aux données historiques de compteur ci-dessous). Toutes les mises en œuvre ne prennent pas nécessairement en charge les deux noms, ni ne prennent en charge toutes les fonctions possibles dans un format de demande donné. L'IEC 61968-100 décrit plus en détail les noms "Get" et les modèles transactionnels recommandés.

5.3.2.4 Accès aux données historiques de compteur

Un planificateur de réseau de distribution peut utiliser les valeurs de relevés historiques de compteur comme informations relatives à la charge à des fins de planification de la capacité. (Voir l'exemple de demande/réponse présenté à la Figure 15). Cela permet d'agréger l'usage afin de déterminer les charges pour un transformateur ou un départ.



La Figure 15 est reproduite avec l'autorisation de l'UCAIug.

Figure 15 – Échange de MeterData d'historique

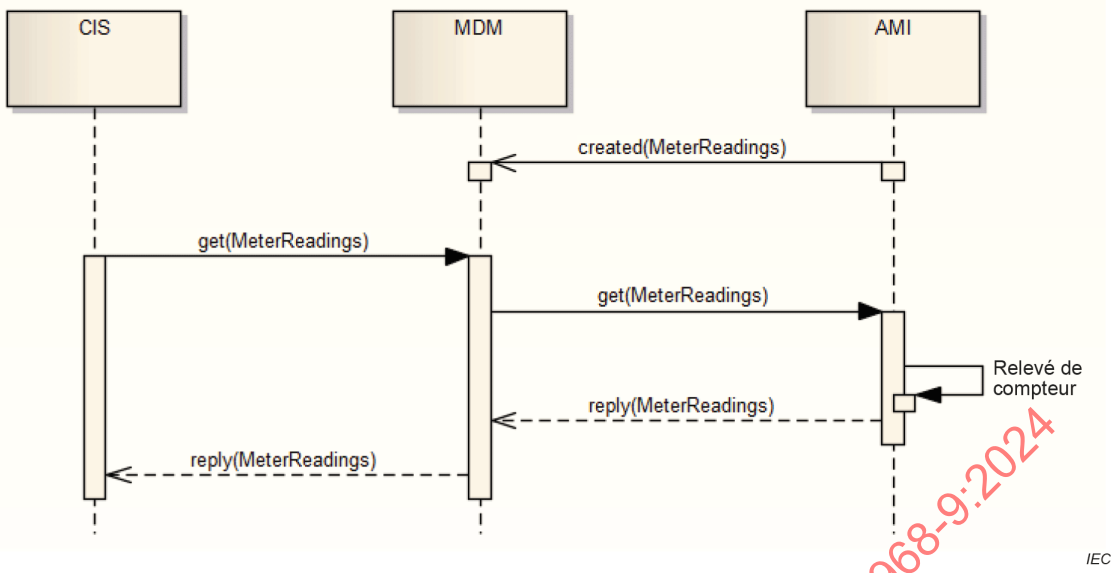
Il est important de noter l'utilisation de paramètres de demande pour qualifier les demandes de données de compteur, filtrant les résultats pour obtenir des données pour des compteurs spécifiques dans les limites de délais spécifiques.

5.3.2.5 Demande de renseignements de facturation

Un client ou une source interne peut identifier une question de facturation client. Une demande de relevé de compteur en combinaison avec des relevés historiques de compteur peut être utilisée pour résoudre le problème de facturation. Le haut de la Figure 16 représente une demande de renseignements satisfaite par des données qui sont arrivées récemment, alors que plus tard dans la journée, une demande de renseignements qui exige un relevé frais du compteur est formulée.

Dans certains cas, les données souhaitées peuvent être accessibles depuis la MDM. Dans d'autres cas, il peut être nécessaire d'émettre une demande de relevé à distance par l'intermédiaire du MS ou manuellement par le biais d'une ''demande de service'' générique de l'IEC 61968-8.

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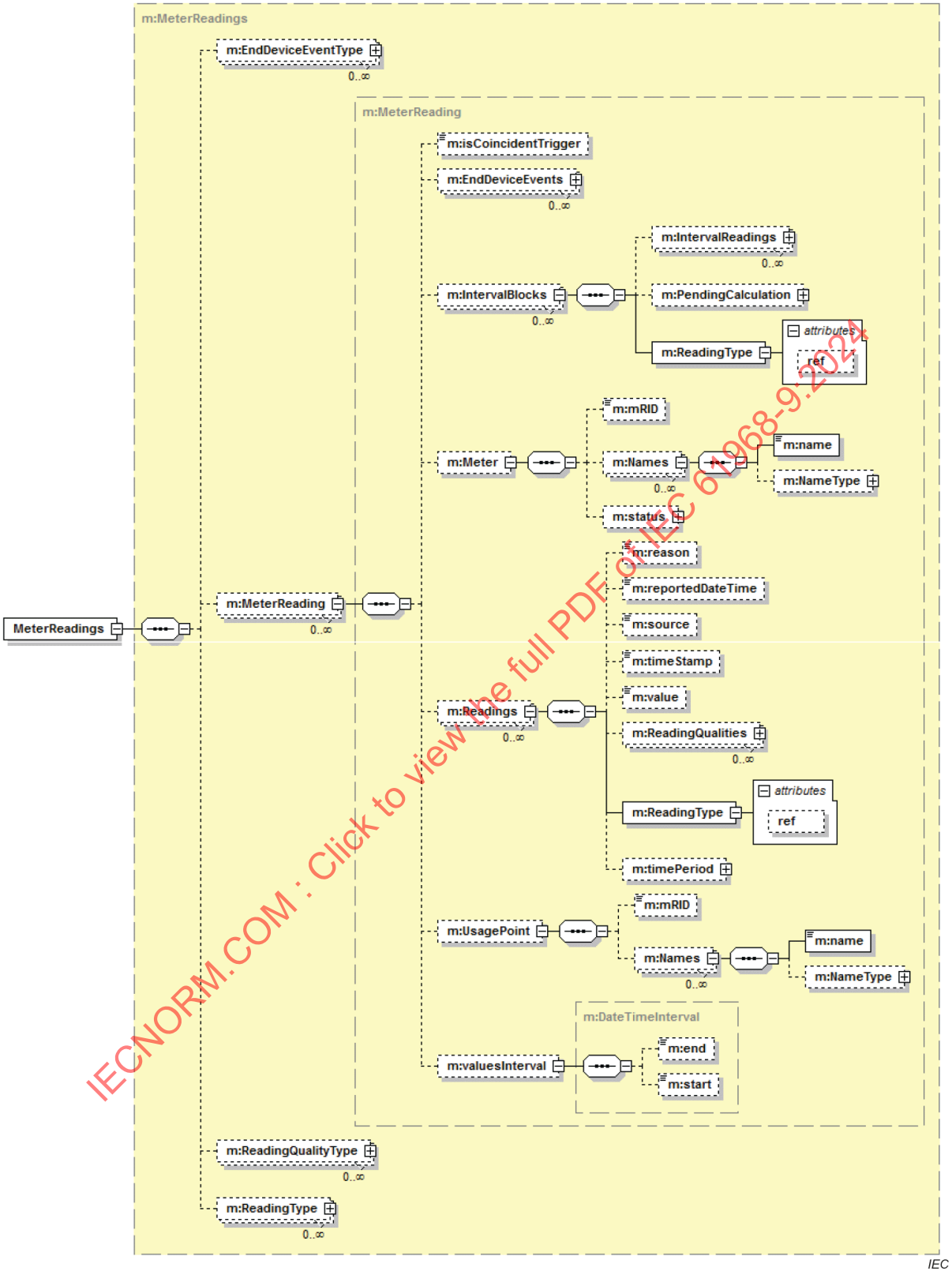
La Figure 16 est reproduite avec l'autorisation de l'UCAIug.

Figure 16 – Exemple d'échange de message de demande de renseignements de facturation

5.3.3 Formats de messages

La Figure 17 représente le format de message utilisé pour présenter les relevés de compteur à partir d'un ou de plusieurs dispositifs terminaux. L'Annexe G fournit des informations supplémentaires concernant la structure de MeterReadings.

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La Figure 17 est reproduite avec l'autorisation de l'UCAIug.

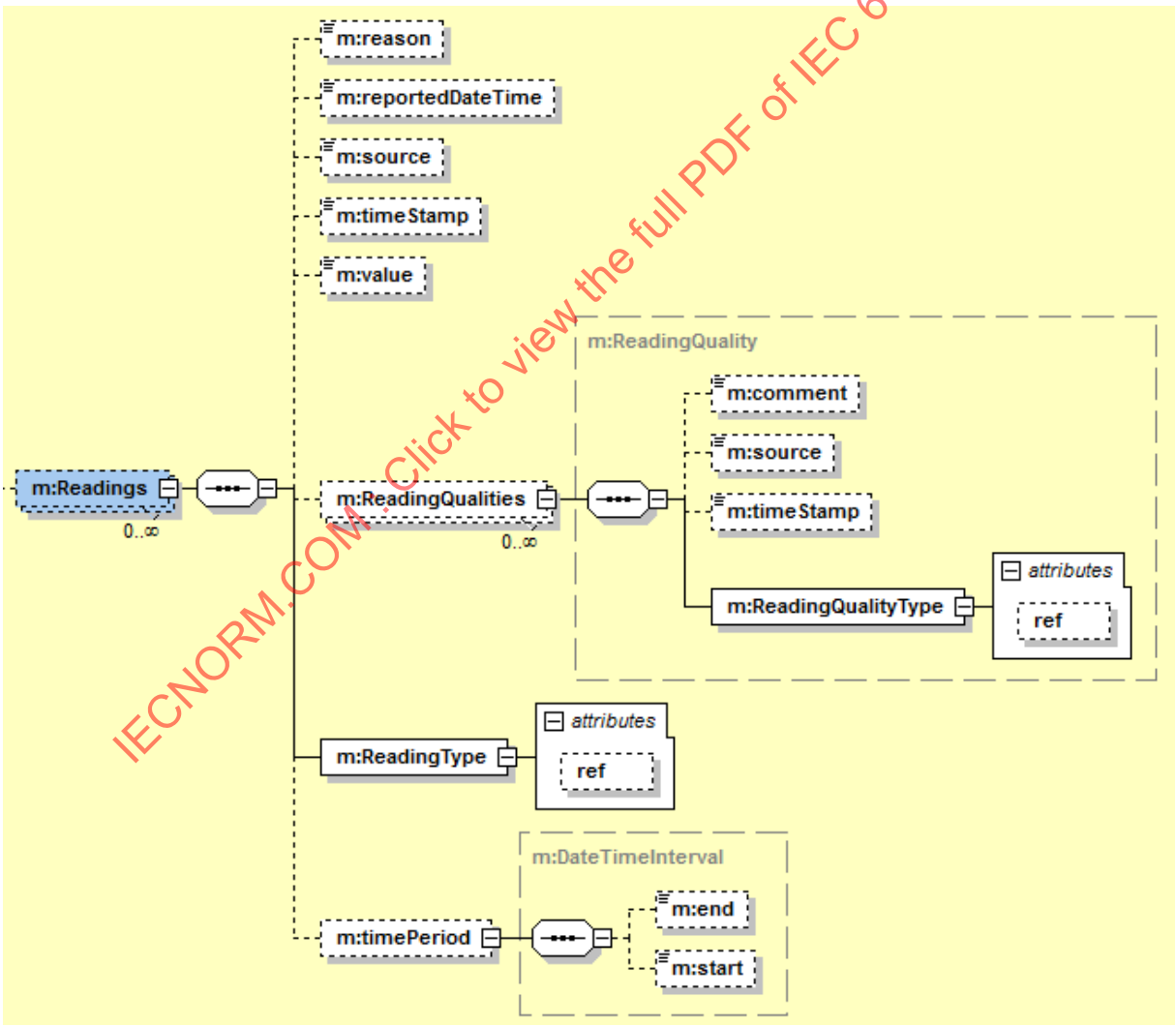
Figure 17 – Format de message pour les relevés de compteur

La structure du message pour les MeterReadings permet de prend en compte les éléments suivants:

- les relevés provenant d'un ou plusieurs compteurs;
- les valeurs de relevé ont chacune un type de relevé, un horodatage et une valeur associés;
- de nombreuses valeurs de qualité peuvent être associées à chaque valeur de relevé;
- les relevés peuvent être présentés sous la forme de blocs d'intervalles, dans lesquels des relevés d'un même type de relevé sont groupés ensemble;
- les historiques d'événements peuvent être retournés avec les relevés de compteur.

La Figure 18 représente les informations détaillées de la structure qui transmet les relevés, avec laquelle chaque relevé identifie un ReadingType spécifique (par référence), une valeur et des codes de qualité facultatifs. Le timeStamp permet d'identifier le moment de capture du relevé. La timePeriod peut être utilisée pour identifier un intervalle de temps spécifique. Le reportedDateTime facultatif peut être utilisé pour identifier le moment effectif de consignation du relevé. Le ReadingType est utilisé pour identifier la signification du relevé, le type de données de la valeur et la signification des différentes valeurs temporelles.

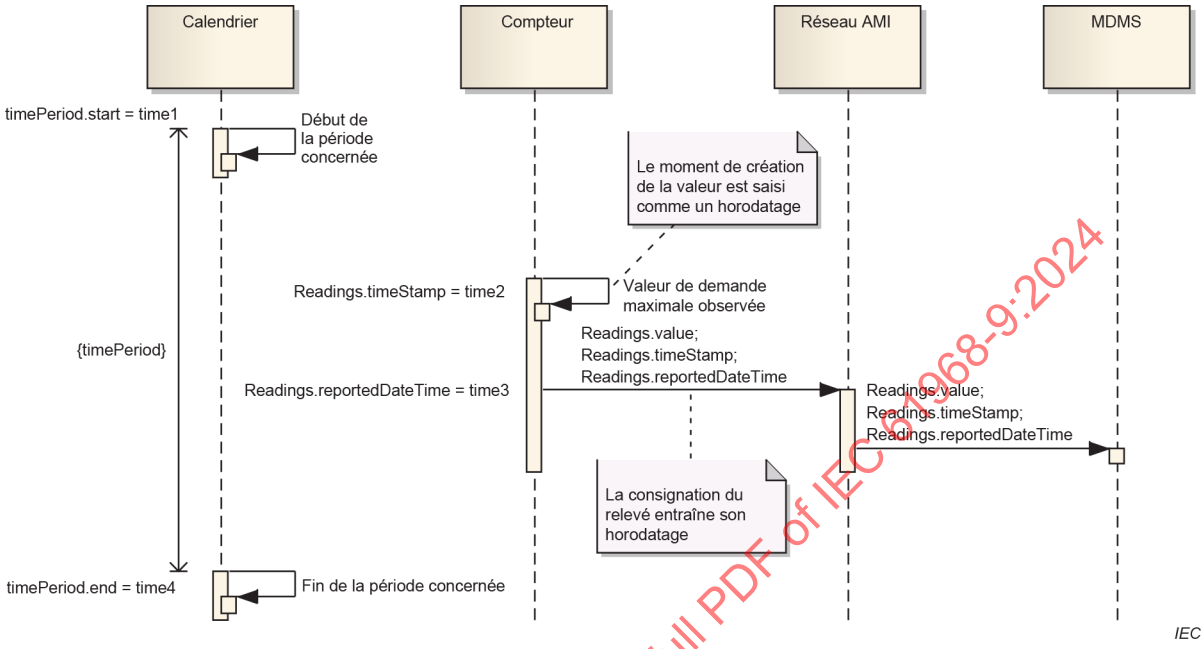
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La Figure 18 est reproduite avec l'autorisation de l'UCAIug.

Figure 18 – Structure Reading

Dans un relevé, les attributs timeStamp et timePeriod peuvent être utilisés pour identifier les aspects temporels du relevé, avec un usage spécifique fondé sur le type de relevé, dont les informations détaillées sont décrites à l'Annexe C selon les besoins. Les exemples donnés à la Figure 19 et à la Figure 20 représentent les conventions générales d'utilisation de timeStamp et timePeriod.

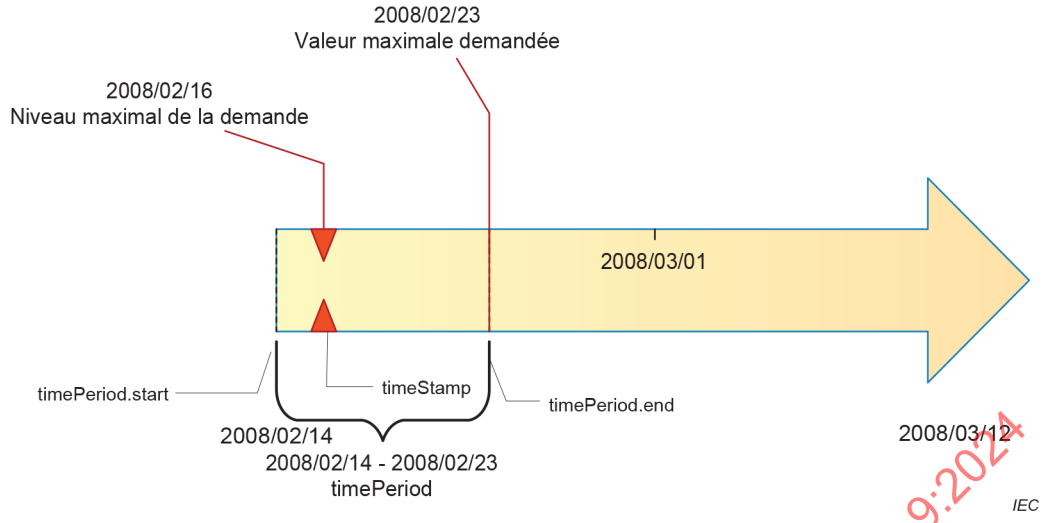


La Figure 19 est reproduite avec l'autorisation de l'UCAIug.

Figure 19 – Horodatages affectés entre les systèmes

La Figure 19 représente la façon dont les horodatages sont affectés lorsque les valeurs sont créées et transmises entre les systèmes. Du point de vue des CIS et MDMS, il existe une "timePeriod" intéressante pour (peut-être) une période de facturation. Une demande "get" peut préciser cette plage de temps à l'aide de l'élément <TimeSchedule> dans un message get(MeterReadings), et l'AMI ou le MDMS "répond" à l'aide de relevés qui s'inscrivent dans cette plage. Les points importants dans le temps concernant la production et le compte-rendu de la valeur sont également horodatés. L'ensemble de ces horodatages sont donnés dans le schéma meterReadings. Une autre perspective du même exemple (avec des dates et des heures réelles) est représentée ci-dessous à la Figure 20.

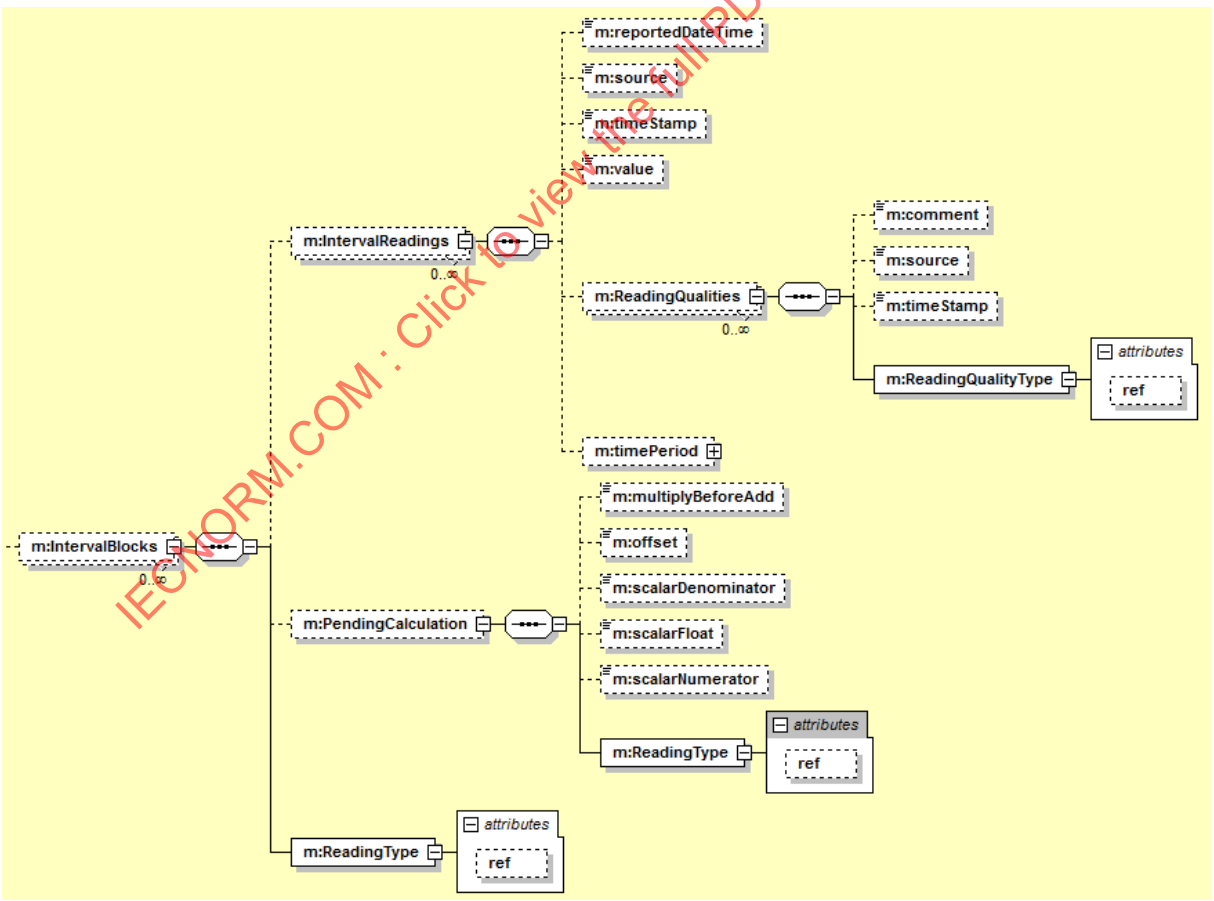
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La Figure 20 est reproduite avec l'autorisation de l'UCAIug.

Figure 20 – Conventions pour timeStamp et timePeriod

La structure IntervalBlock permet de regrouper un ensemble de relevés selon un ReadingType commun et sert d'exemple pour représenter une série chronologique.



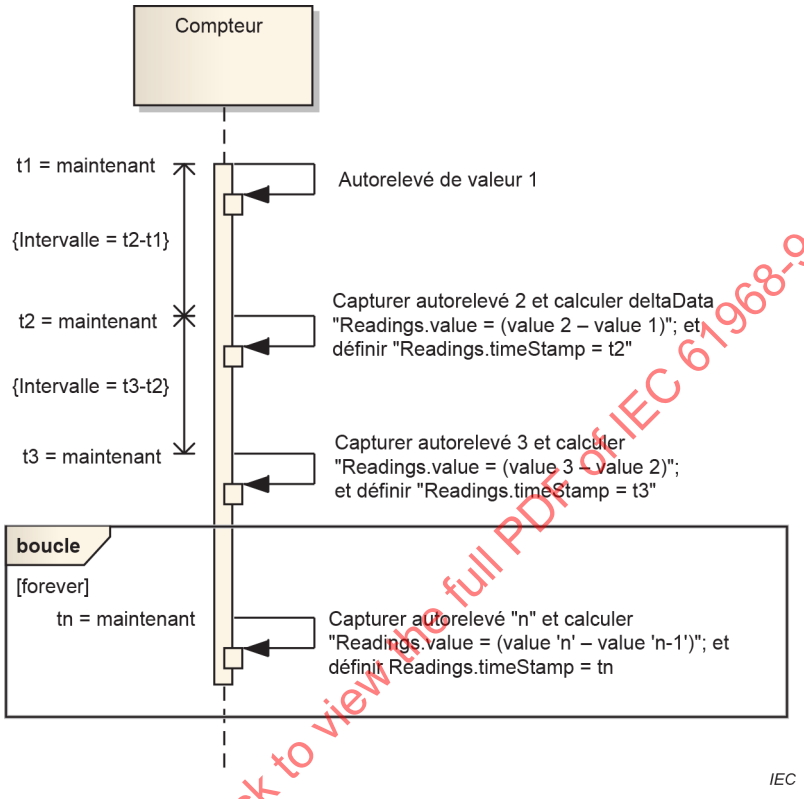
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La Figure 21 est reproduite avec l'autorisation de l'UCAIug.

Figure 21 – Structure IntervalBlock

Le diagramme suivant représente la convention d'utilisation d'un timeStamp pour les données d'intervalles qui comprennent un type de relevé associé qui identifie que la valeur de relevé correspond à un intervalle précis.

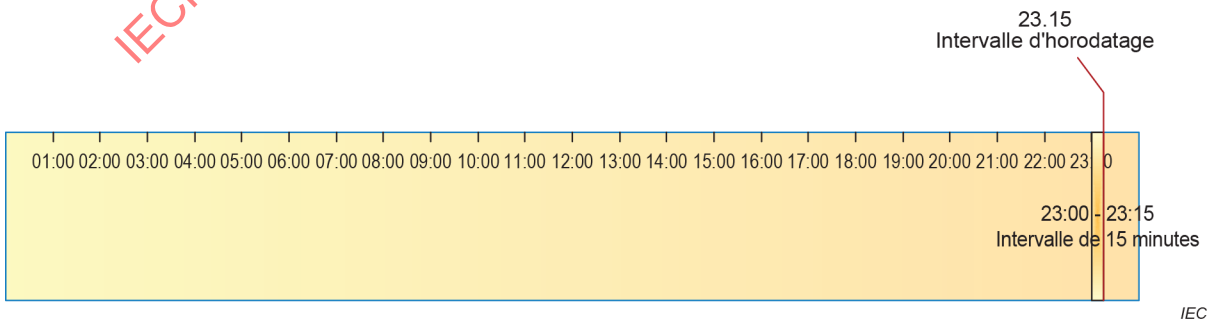
Les différents systèmes MR fonctionnent de diverses manières, mais pour les besoins de la norme, les horodatages représentent la fin de l'intervalle. Le processus de production implicite est décrit à la Figure 22.



La Figure 22 est reproduite avec l'autorisation de l'UCAIug.

Figure 22 – Production d'horodatages pour les données d'intervalles

Lorsqu'un horodatage est utilisé, il doit relever d'une plage temporelle comprise entre 00:00:00 et 23:59:59 telle qu'elle est représentée à la Figure 23. Une valeur égale à 23:59:59 plus 1 s place l'heure à minuit, ce qui correspond au début du jour suivant.



La Figure 23 est reproduite avec l'autorisation de l'UCAIug.

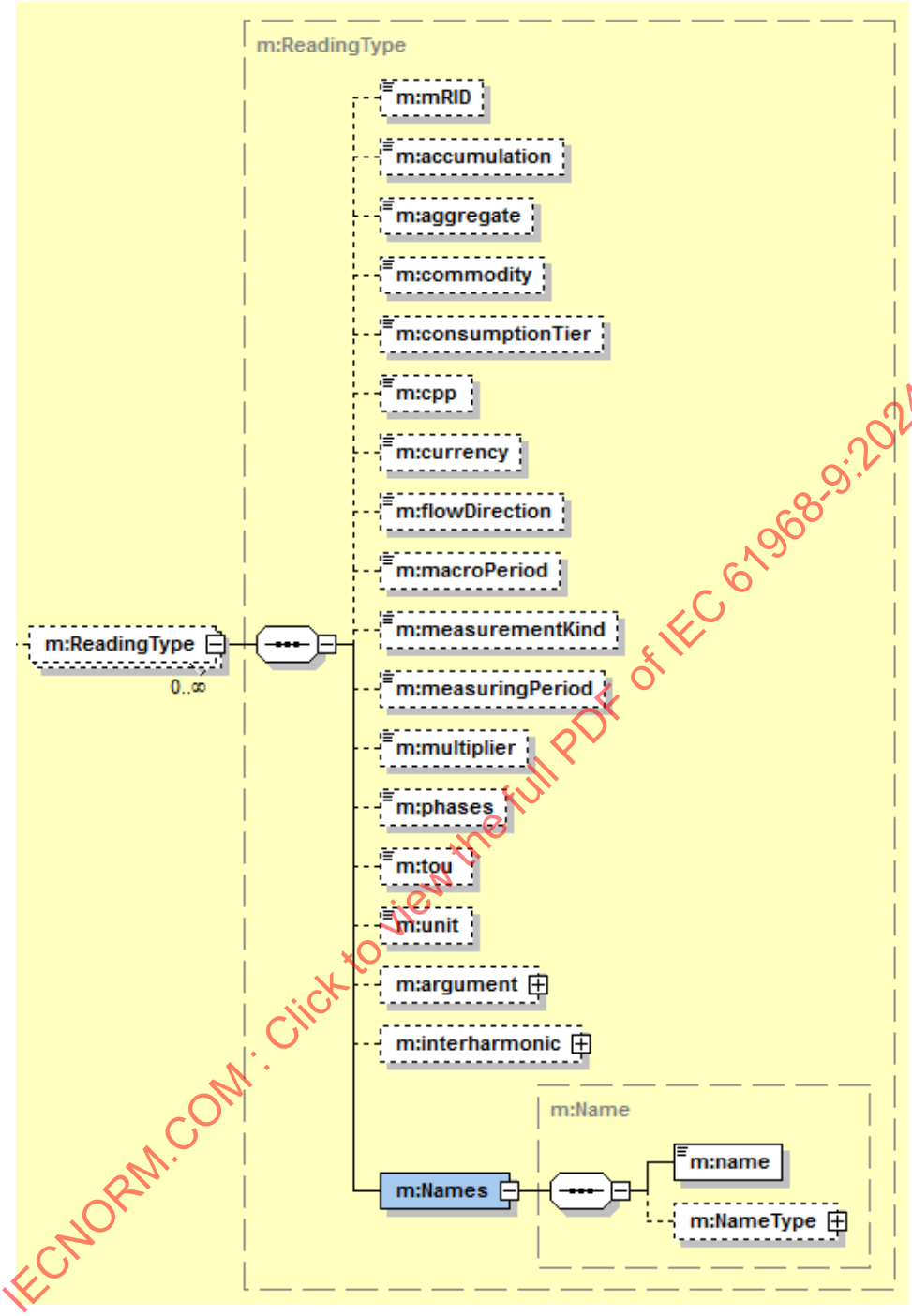
Figure 23 – Conventions relatives aux intervalles de temps

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Noter qu'une journée commence à 00:00, et finit à 23:59:59. (Se reporter à l'ISO 8601 pour de plus amples informations concernant le chronométrage.) Il est important de noter que les données d'intervalles peuvent être transmises à l'aide des IntervalBlocks avec les IntervalReadings ou à l'aide simplement des Readings. Les IntervalBlocks doivent être utilisés lorsque les éléments PendingCalculation sont nécessaires, sinon ils permettent simplement une empreinte XML réduite sur Readings, ce qui peut s'avérer important dans certaines situations.

La clé pour le compte-rendu d'une valeur issue d'un compteur est le type de relevé. La classe ReadingType dans le CIM est définie pour permettre la saisie des informations données à la Figure 23 relatives à la description d'un type de relevé, ce qui est défini plus en détail à l'Annexe C.

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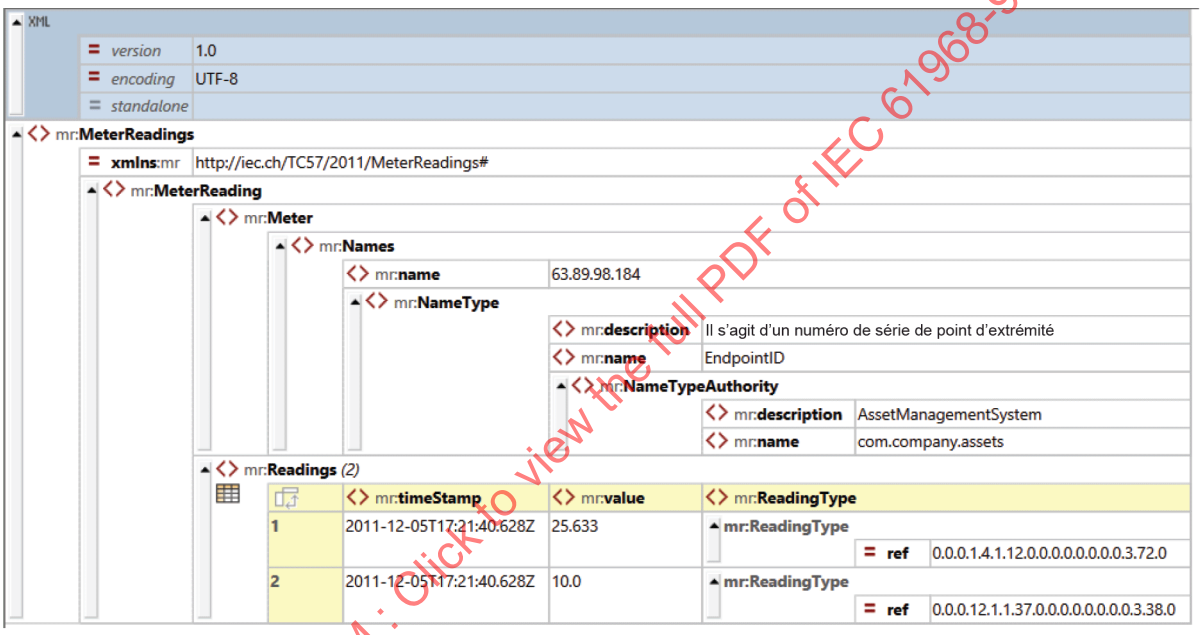
Figure 24 – Structure ReadingType

Tandis que la structure ReadingType est présente dans le message MeterReadings, il convient de prévoir que dans le cadre d'une pratique normale elle n'est pas remplie, puisqu'il est anticipé que le système consommateur est déjà configuré avec les définitions ReadingType appropriées. Les informations détaillées relatives à cette classe et à d'autres classes spécifiques au comptage sont décrites dans le paquetage Metering du CIM. L'Annexe C présente de manière plus détaillée les types de relevé.

Les relevés ne sont pas limités aux appareils de comptage. Tout EndDevice peut potentiellement produire un mesurage. Dans la présente édition de l'IEC 61968-9, l'actif qui produit le relevé doit être identifié à l'aide de la classe Meter, bien que l'appareil puisse ne pas être un compteur. Il est prévu que tous les actifs ont un mRID unique ou un Names.name afin que les compteurs puissent être différenciés des commutateurs de branchement/débranchement à distance et d'autres appareils. Il est convenu que la future édition de l'IEC 61968-9 fournira une méthode plus explicite de gestion des relevés issus d'appareils autres que les Meters.

Les données d'intervalle ont des exigences d'horodatage unique. Les fonctionnalités étendues selon l'ISO 8601 fournissent le moyen de spécifier une longueur d'intervalle formelle (telle qu'une "période" de temps selon l'ISO 8601), ainsi qu'un point de référence fixe.

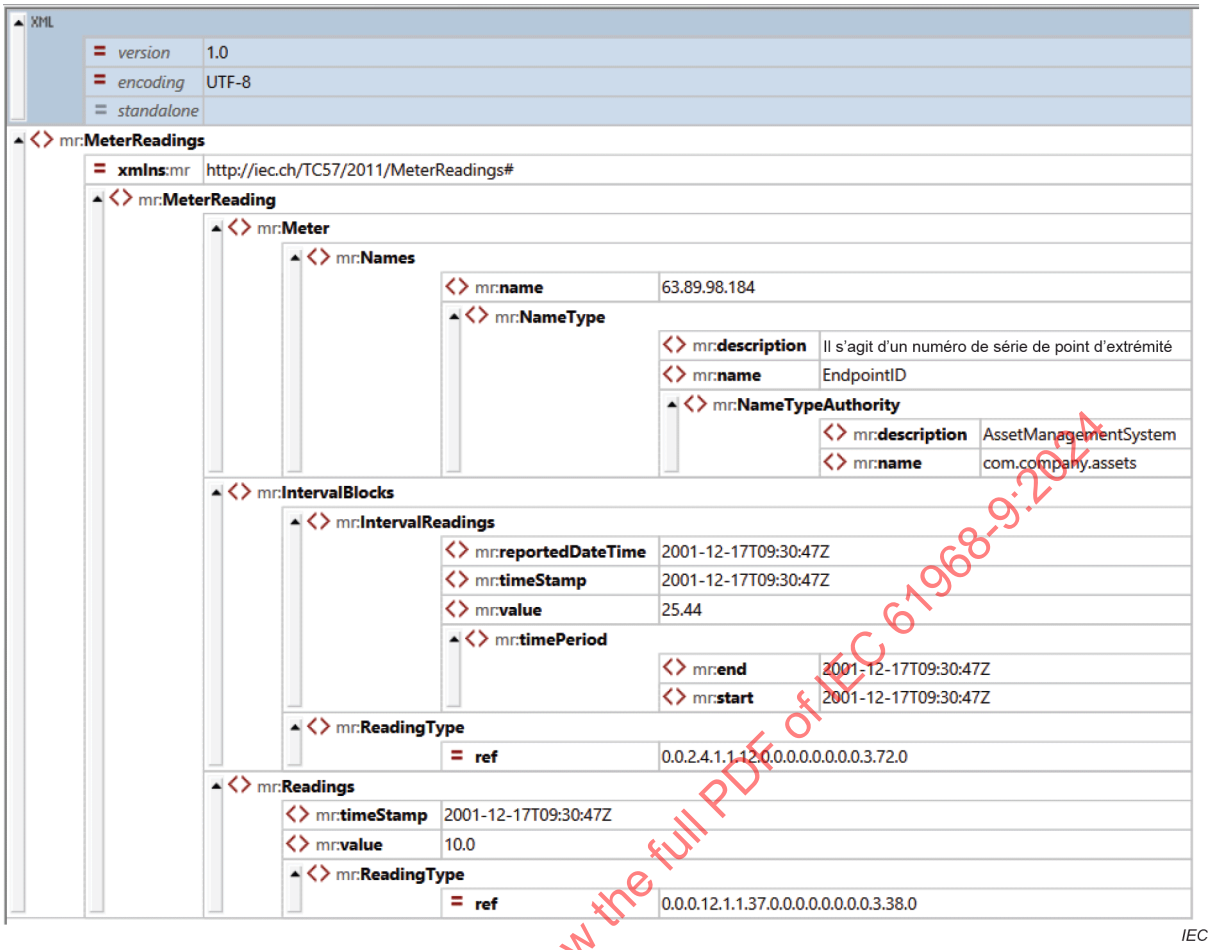
La Figure 25 et la Figure 26 fournissent certains exemples de charge utile pour des messages MeterReadings.



La Figure 25 est reproduite avec l'autorisation de l'UCAIug.

Figure 25 – Exemple 1 de MeterReadings

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La Figure 26 est reproduite avec l'autorisation de l'UCAIug.

Figure 26 – Exemple 2 de MeterReadings

Le concept de "relevés coïncidents" mérite une certaine attention. Un relevé coïncident est un MeterReading qui survient au même instant que certains autres MeterReading ou EndDeviceEvent.

Certains compteurs ont la capacité de consigner un relevé qui était coïncident avec un autre MeterReading ou EndDeviceEvent (ci-après dénommé "déclencheur"). Par exemple, il peut éventuellement enregistrer le "facteur de puissance coïncident avec la demande maximale de période de facturation."

En outre, certains processus demandent de consigner un relevé coïncident. Par exemple, lorsqu'un compteur est installé, il est courant de capturer un "relevé initial." De même, lorsqu'un compteur est déconnecté, il est courant de capturer un "relevé final" coïncident avec l'événement de déconnexion.

Certains systèmes peuvent réaliser une analyse des données stockées pour identifier analytiquement les relevés coïncidents dérivés. Par exemple:

- la tension de l'UsagePoint A au moment de demande quotidienne maximale sur le transformateur de distribution (UsagePointB) qui dessert UsagePoint A. (UsagePoint "B" peut être un UsagePoint réel ou virtuel.);
- la consommation toutes les 15 min au UsagePoint A au moment de demande quotidienne maximale sur le réseau de distribution (UsagePoint C) une chaude journée d'été;
- un relevé en kWh BulkQuantity pour un UsagePoint au moment auquel un EndDeviceEvent, comme un compteur, se déconnecte.

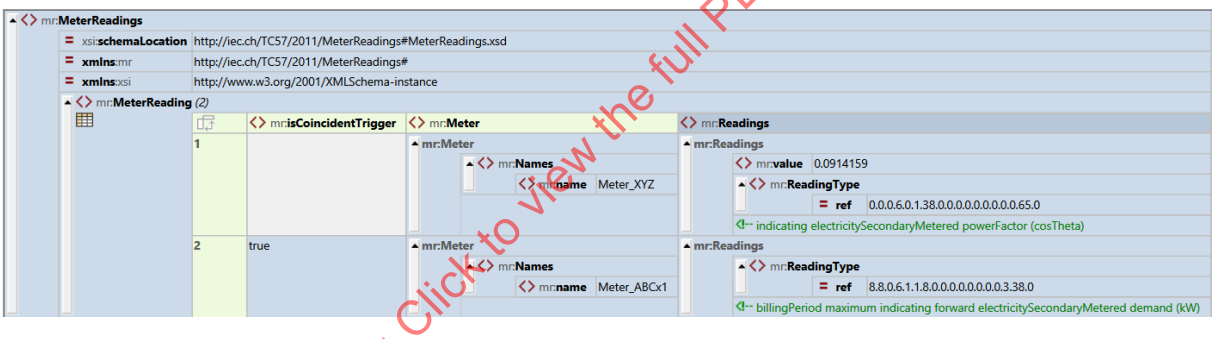
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La classe MeterReading dispose d'un élément booléen facultatif appelé "isCoincidentTrigger." Il n'est pas obligatoire d'utiliser l'élément dans un message, mais si c'est le cas, des règles existent aux fins de son interprétation. Si toute instance d'un message MeterReading est marquée de l'isCoincidentTrigger booléen défini sur "vrai", tous les autres MeterReadings du même message MeterReadings sont alors considérés comme coïncidents avec le MeterReading marqué de la sorte. Un seul élément MeterReading au sein d'un seul message MeterReadings peut avoir son isCoincidentTrigger booléen défini sur "vrai". Si l'isCoincidentTrigger booléen est absent, il est défini comme "faux". Il convient que le "déclencheur" MeterReading dispose d'un timeStamp si ces informations sont disponibles.

Le profil GetMeterReadings peut être utilisé pour demander les MeterReadings coïncidents avec un MeterReading donné. Cela peut être réalisé en incluant dans le message GetMeterReadings un élément MeterReadings dans lequel le CoincidentTrigger booléen est défini sur "vrai;" en d'autres termes, en spécifiant le "déclencheur" MeterReading dans les critères de filtre du GetMeterReadings.

NOTE Il est admis que de légères différences temporelles peuvent exister entre un déclencheur coïncident et le ou les relevés qui sont coïncidents avec le déclencheur. Par exemple, un relevé pris conjointement au débranchement d'un compteur peut être réellement pris plusieurs secondes après l'utilisation du commutateur de débranchement. Définir la fenêtre des relevés qui seront considérés comme coïncidents ne relève pas du domaine d'application du présent document.

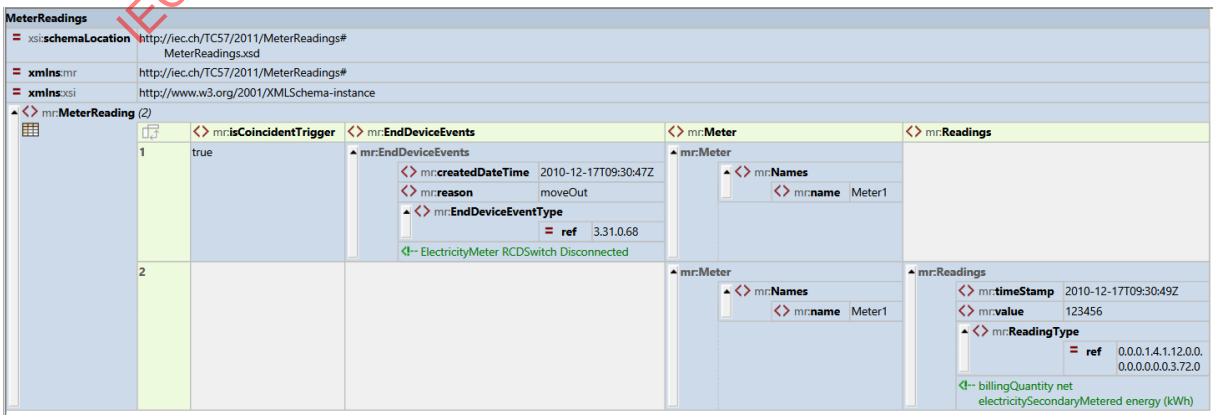
Dans l'exemple suivant (Figure 27), un système de comptage identifie le mesurage d'un facteur de puissance qui est coïncident avec la demande maximale d'un compteur donné, sans connaître la date et l'heure exactes de la demande maximale:



La Figure 27 est reproduite avec l'autorisation de l'UCAIug.

Figure 27 – Exemple de relevés coïncidents

Dans l'exemple suivant (Figure 28), un système de comptage ou un MDMS identifie le relevé de compteur final coïncident avec le débranchement du service par l'intermédiaire de RCD:

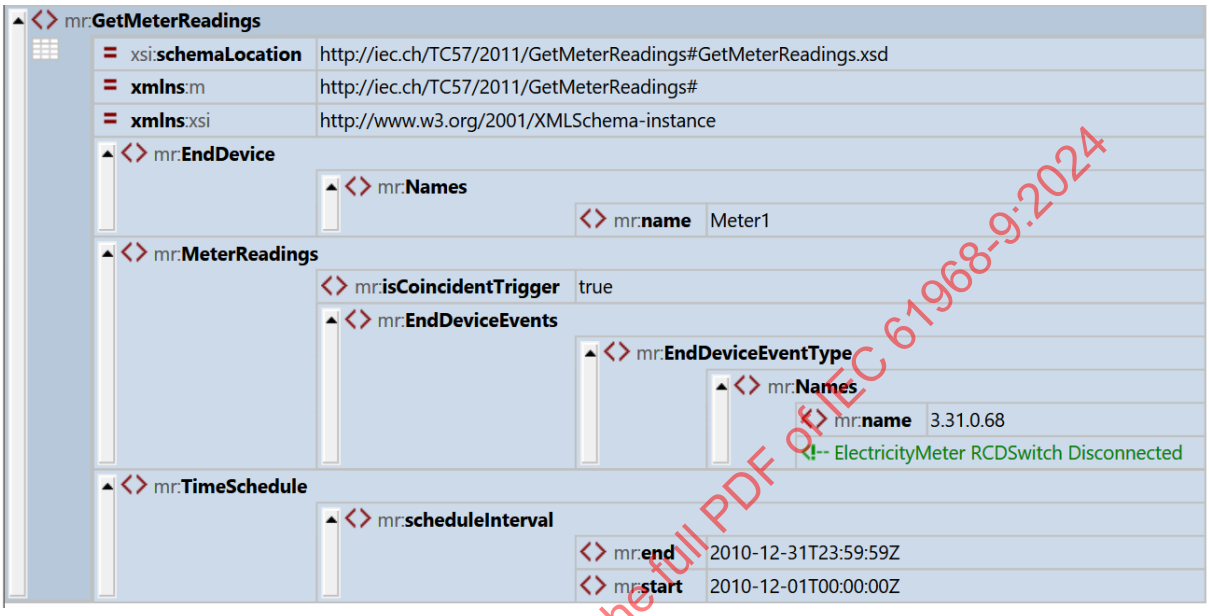


La Figure 28 est reproduite avec l'autorisation de l'UCAIug.

Figure 28 – Relevé de compteur final coïncident avec l'exemple de débranchement

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L'exemple suivant (Figure 29) représente une demande d'obtention de relevés de compteur à partir d'un système de comptage ou MDMS qui sont coïncidents avec un débranchement survenu dans un intervalle de temps précis. La demande est une invitation ouverte à envoyer tout type de données MeterReading coïncidentes avec un RCDSwitch Disconnect pour un EndDevice donné (compteur). La réponse à cette demande peut parfaitement n'être rien de plus que l'exemple de "relevé de compteur final" fourni ci-dessus. (Si une réponse plus spécifique était souhaitée, il serait possible de filtrer uniquement le ou les ReadingTypes souhaités en remplissant l'élément ReadingType dans le profil GetMeterReadings.)



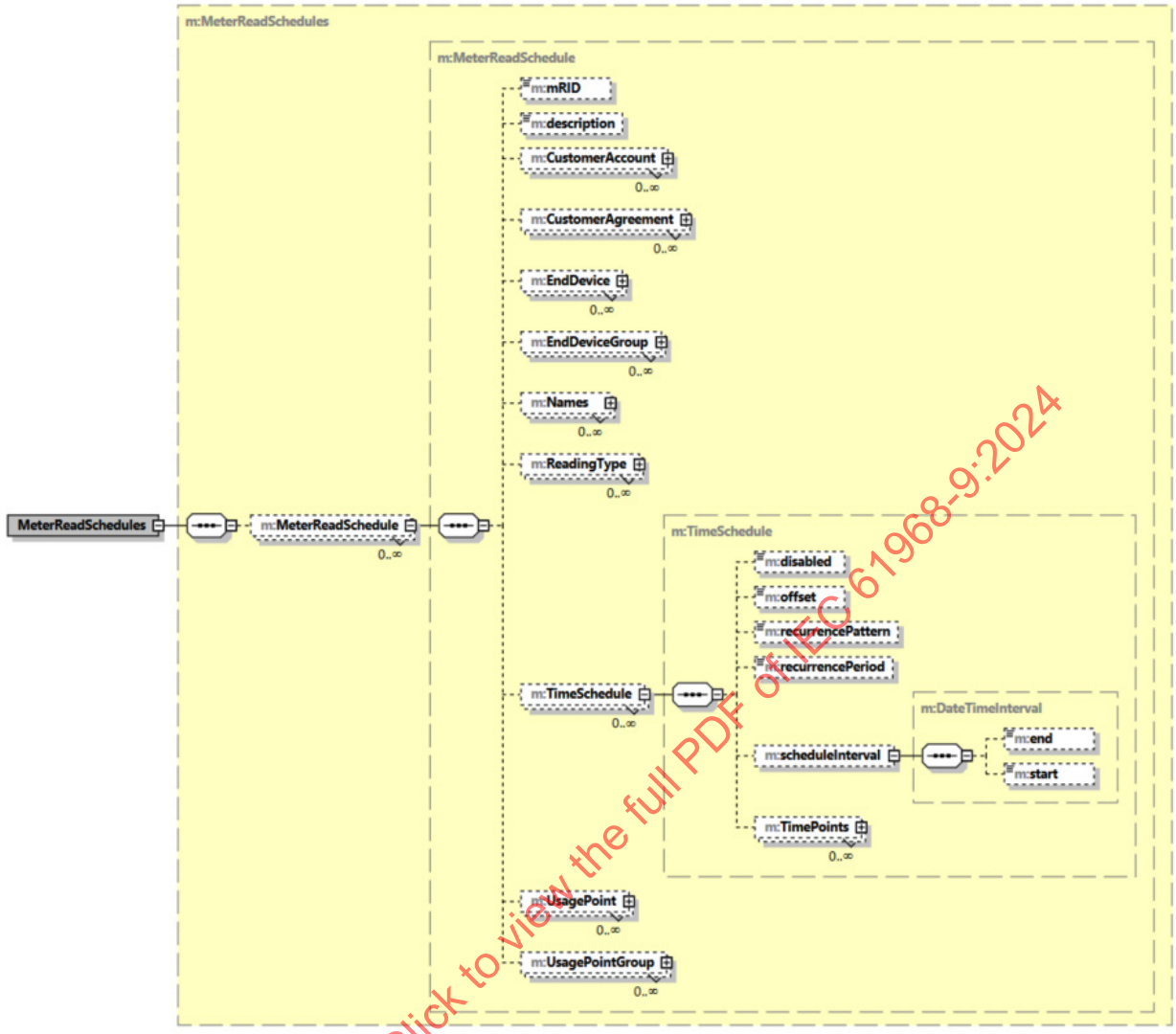
La Figure 29 est reproduite avec l'autorisation de l'UCAIug.

Figure 29 – Exemple de GetMeterReadings

Lors de l'utilisation des horodatages comme filtres, les éléments TimeSchedule.scheduleInterval sont utilisés pour concevoir une demande de données qui s'inscrivent dans une certaine plage. La réponse MeterReadings peut remplir les éléments MeterReadings.MeterReading.valuesInterval afin d'identifier la plage de dates proposée dans la réponse. L'utilisateur constatera également que les données d'intervalles (qui contiennent une série de valeurs chronologiques) n'ont pas leur place dans une discussion traitant des données coïncidentes. Un seul intervalle peut être coïncident avec un événement donné ou un autre MeterReading. Par conséquent, il paraît inapproprié de remplir une série d'éléments MeterReading.IntervalBlocks.IntervalReadings. Une seule valeur peut être présentée en tant qu'intervalle, ou bien l'unique valeur d'intervalle peut être présentée en tant que MeterReading.Readings autonome.

L'aptitude à programmer le moment d'obtention des relevés de compteur est possible par l'utilisation d'une demande MeterReadSchedules. Noter que le MeterReadSchedules.xsd représenté ci-dessous remplace le MeterReadSchedule.xsd présenté dans l'IEC 61968-9:2013. La principale différence est que le XSD actuel comporte un nouvel élément racine, MeterReadSchedule, qui hérite de identifiedObject. Cela permet de créer, de modifier, de mettre à jour et de supprimer des MeterReadSchedules identifiés individuellement. La Figure 30 décrit la structure de la charge utile d'un message de demande MeterReadSchedules:

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Figure 30 – Format de message de programmes de relevé de compteur

Plusieurs éléments dans le TimeSchedule du profil MeterReadSchedules sont uniques pour ce profil et méritent une définition spéciale. Notamment:

disabled – True (c'est-à-dire vrai) si ce programme est désactivé.

offset – Le décalage correspondant aux heures (périodiques) récurrentes dans le TimeSchedule. Chaque instant dans la série chronologique définie par scheduledInterval, et recurrencePeriod ou recurrencePattern est décalé par ajout de la valeur de décalage. L'utilisation de TimeSchedule.offset n'est pas applicable lorsque les TimePoints discrets sont spécifiés en lieu et place d'un recurrencePeriod ou recurrencePattern.

recurrencePattern – Intervalle auquel l'action programmée se répète, du début d'une action au début de l'action suivante (par exemple, premier lundi de chaque mois, dernier jour du mois, etc.). Utilisé lorsque l'intervalle ne peut pas être défini comme un nombre de secondes fixe entre différents instants. L'utilisation de recurrencePattern n'est pas applicable lorsque recurrencePeriod est spécifié ou lorsque les TimePoints discrets sont spécifiés en lieu et place d'un recurrencePeriod ou d'un recurrencePattern.

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recurrencePeriod – Durée entre les instants, du début d'une action au début de l'action suivante. Utilisé lorsque l'intervalle peut être défini comme un nombre de secondes fixe entre différents instants. L'utilisation de recurrencePeriod n'est pas applicable lorsque recurrencePattern est spécifié ou lorsque les TimePoints discrets sont spécifiés en lieu et place d'un recurrencePeriod ou d'un RecurrencePattern.

5.4 Messages de commande de dispositif terminal

5.4.1 Généralités

Il existe de nombreux types de messages de commande de dispositifs terminaux. Ils sont utilisés pour envoyer des instructions à un ou plusieurs dispositifs terminaux. EndDeviceControls peut produire un ou plusieurs messages EndDeviceEvent consécutifs.

5.4.2 Applications

5.4.2.1 Régulation de la charge

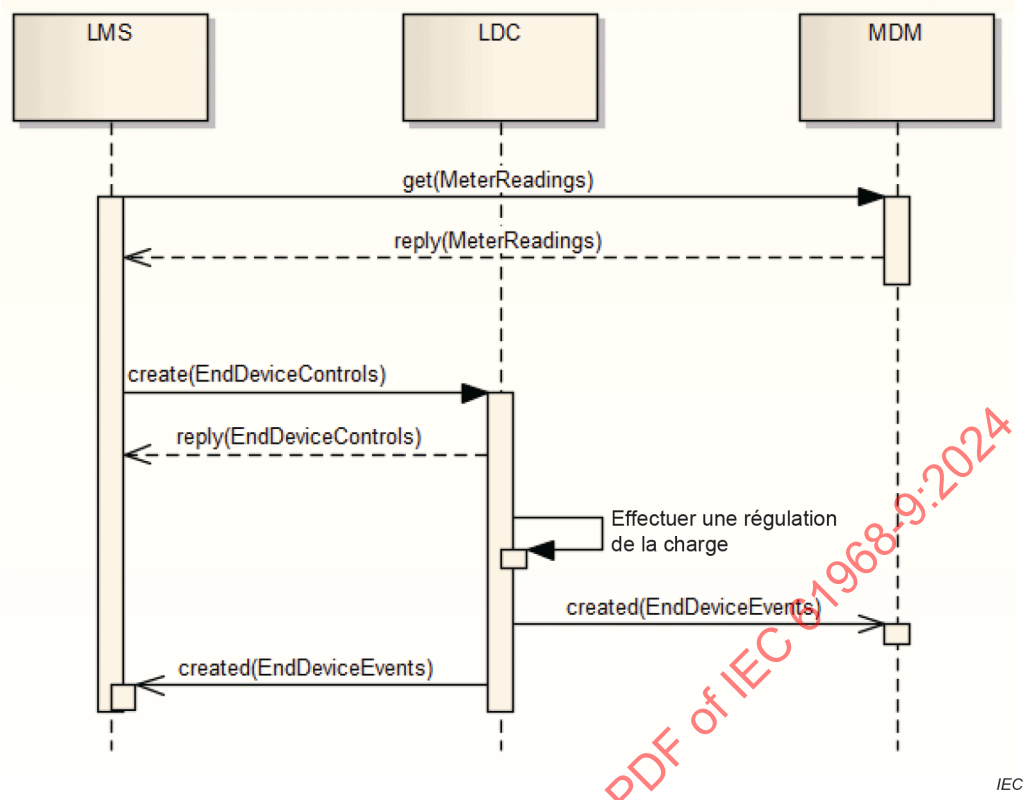
Les demandes de régulation de la charge (également appelé régulation directe de charge) peuvent souvent être faites à un MS à des fins de restriction des charges. Cette demande est typiquement lancée à partir de l'exploitation du réseau. Tous les MS ne comportent pas de fonctionnalités de régulation de la charge.

Il convient aussi de noter que cela diffère d'un débranchement qui donne lieu à la perte complète de puissance pour un seul client.

Une régulation de la charge se traduit typiquement par le délestage de charges spécifiquement configurées (par exemple, climatisation, pompes, etc.).

La fonction de régulation de la charge exécute des commandes de délestage de charge qui sont calculées par le logiciel de gestion de charge (contenu dans le bloc d'exploitation du réseau). Le logiciel de gestion de charge est utilisé pour calculer une quantité de charge délestée appropriée et peut potentiellement inclure de nombreux facteurs, notamment la durée prévue des déficits de production, les modèles d'utilisation historique, les données d'utilisation en temps réel et les conditions météorologiques

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Figure 31 – Exemple d'échange de message de régulation de la charge

L'exemple à la Figure 31 représente la façon dont un historique de charge peut être obtenu de la MDM sous la forme de MeterReadings et utilisé pour réaliser une analyse de charge. Il représente également des commandes de régulation de la charge émises par le LMS vers le système de régulation de la charge. En revanche, les déploiements qui ne prennent pas en charge une MDM interagissent directement avec le MS.

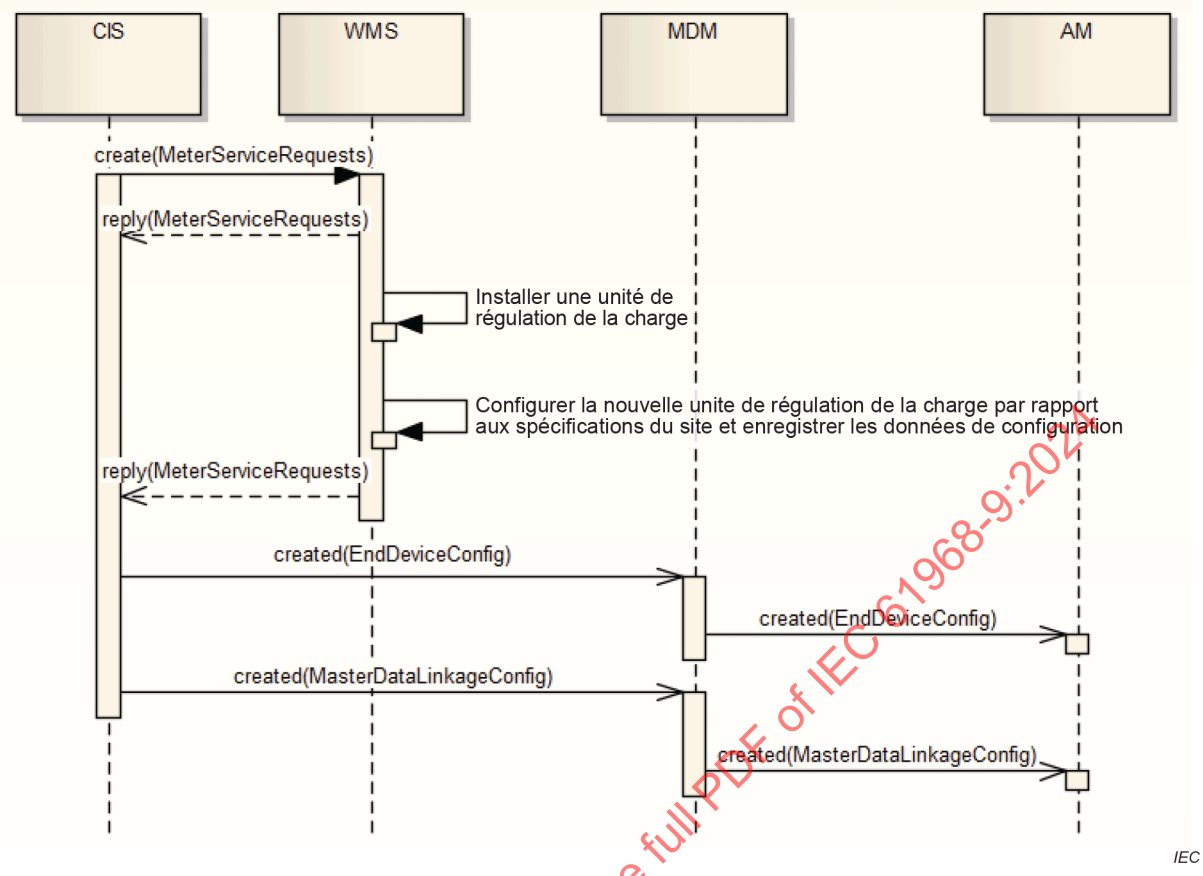
Les commandes de régulation de la charge sont mises en œuvre comme un type de EndDeviceControl, avec lequel la commande peut être traitée par EndDeviceGroup (en utilisant une adresse de groupe), par EndDevice (en utilisant le mRID) ou par CustomerAgreement.

La régulation de la charge peut également être mise en œuvre à l'aide des appareils PAN.

5.4.2.2 Installation d'un appareil de régulation de la charge

L'installation d'unités de régulation de la charge utilise habituellement plus de main-d'œuvre que l'installation d'un compteur, mais les exigences relatives à l'échange de données sont plus simples. Les unités LC diffèrent des compteurs en ce sens qu'elles n'exigent pas de réétalonnage périodique. Dès lors qu'elle est installée, l'unité LC restera probablement en place pendant toute sa durée de vie, même si le client se retire du programme LC ou s'il y a changement de locataire.

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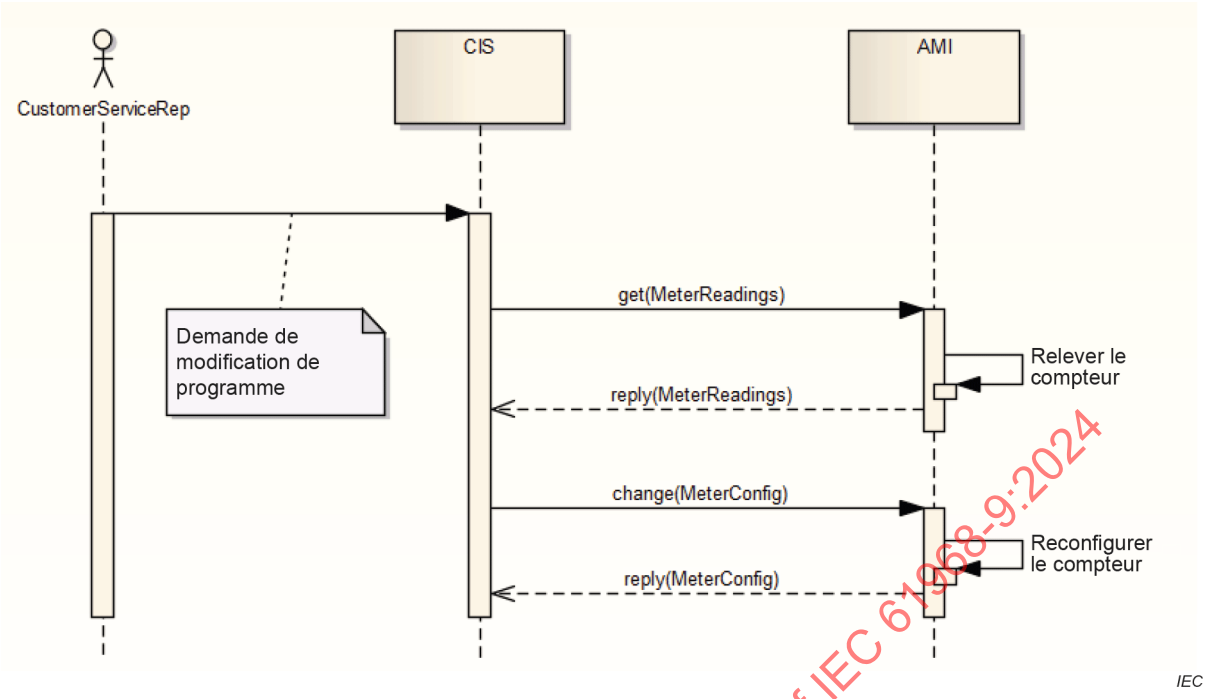
Figure 32 – Exemple d'échange de message pour l'installation de l'unité de LC

Avant de se rendre à l'emplacement du service, la personne chargée de l'installation connaîtra les données du compte client, le type d'unité de régulation de la charge à installer et les caractéristiques assignées de l'appareil à commander. Les données d'installation peuvent confirmer les caractéristiques assignées de l'appareil et, lorsque cela est approprié, documenter le numéro de port de l'unité LC raccordée à l'appareil. Les résultats de l'installation peuvent être publiés à l'attention de toutes les parties prenantes comme cela est représenté à la Figure 32.

5.4.2.3 Modification de programme client

Des solutions de comptage particulières sont habituellement choisies pour satisfaire à des besoins de comptage spécifiques par suite de l'inscription du programme client. Dans un grand nombre de cas, une solution de comptage flexible peut assurer un traitement pour une gamme de programmes client. Lorsqu'un client passe de l'inscription à un certain programme à un autre programme, cela peut simplement exiger une modification de configuration du compteur (ou du module de communication). Dans les cas extrêmes, cela peut exiger un remplacement du compteur. Dans d'autres cas, cela peut n'exiger aucune modification. Il est nécessaire de communiquer aux parties prenantes les modifications apportées à une configuration. Un exemple d'échange dans lequel le déploiement implique une MDM est décrit à la Figure 33. Un autre exemple dans lequel le déploiement manque d'une MDM est décrit à la Figure 34.

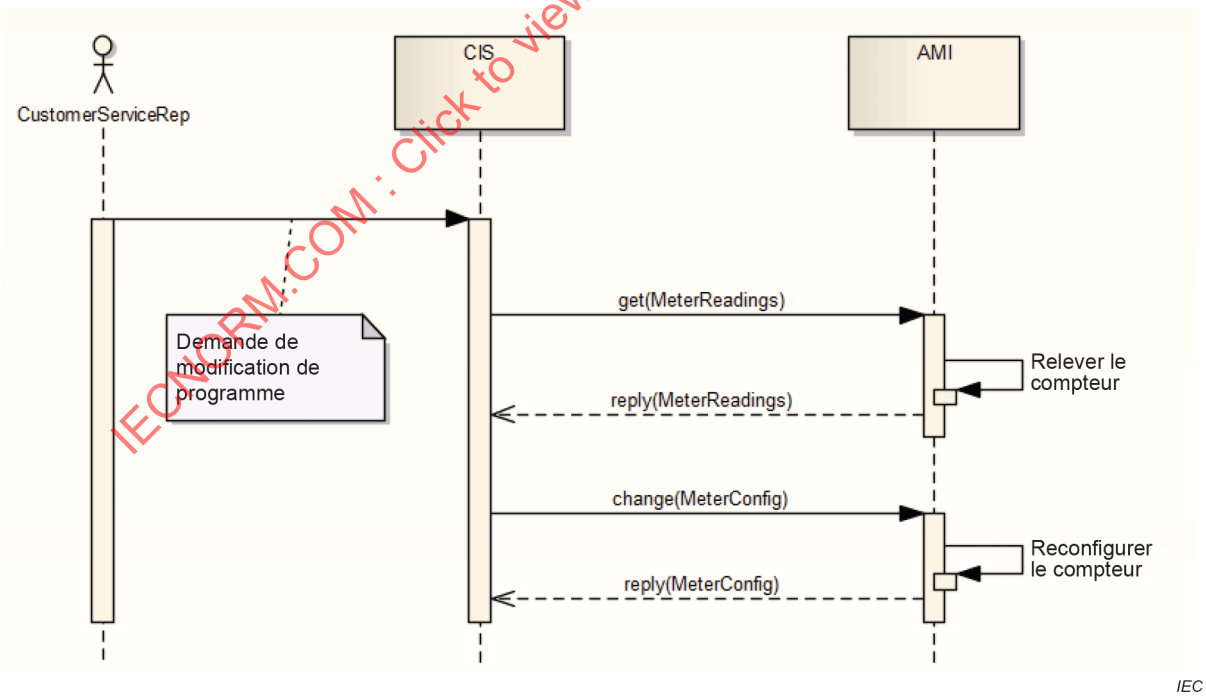
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La Figure 33 est reproduite avec l'autorisation de l'UCAIug.

Figure 33 – Exemple d'échange de message en vue de modifier le programme client

Les modifications apportées à la configuration du compteur peuvent être exprimées comme étant des modifications de la configuration d'un EndDevice.

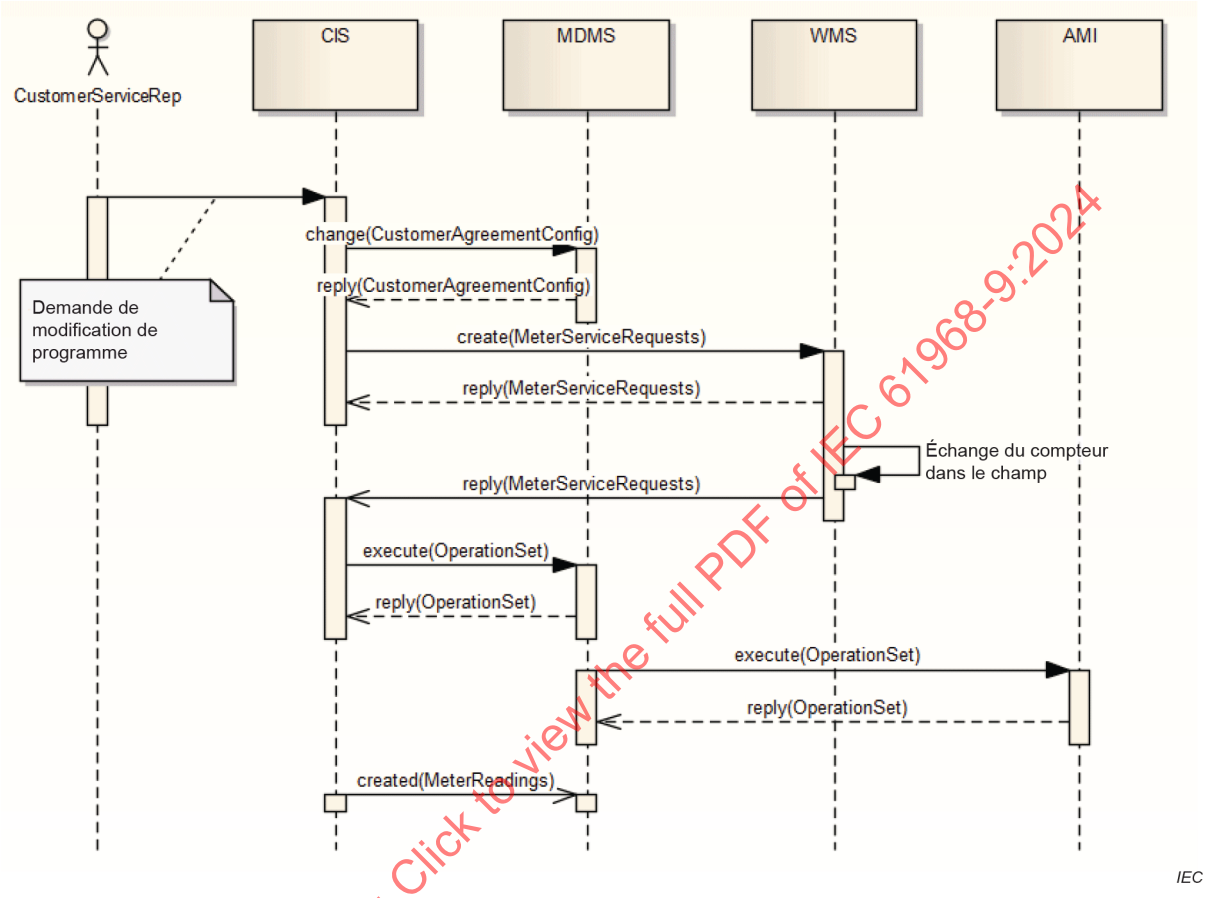


La Figure 34 est reproduite avec l'autorisation de l'UCAIug.

Figure 34 – Exemple d'échange de message en vue de changer le programme client sans la MDM

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Dans d'autres cas, une modification du programme client peut ne pas être pris en charge par une reconfiguration de compteur. La modification du programme peut exiger un remplacement du compteur (se reporter au 5.5 pour plus d'informations sur les remplacements de compteur). Les remplacements de compteur impliquent un flux de travail différent de celui des reconfigurations de compteur. Cette situation est reflétée dans l'échange de messages entre les systèmes. Un exemple d'échange est représenté à la Figure 35.



La Figure 35 est reproduite avec l'autorisation de l'UCAIug.

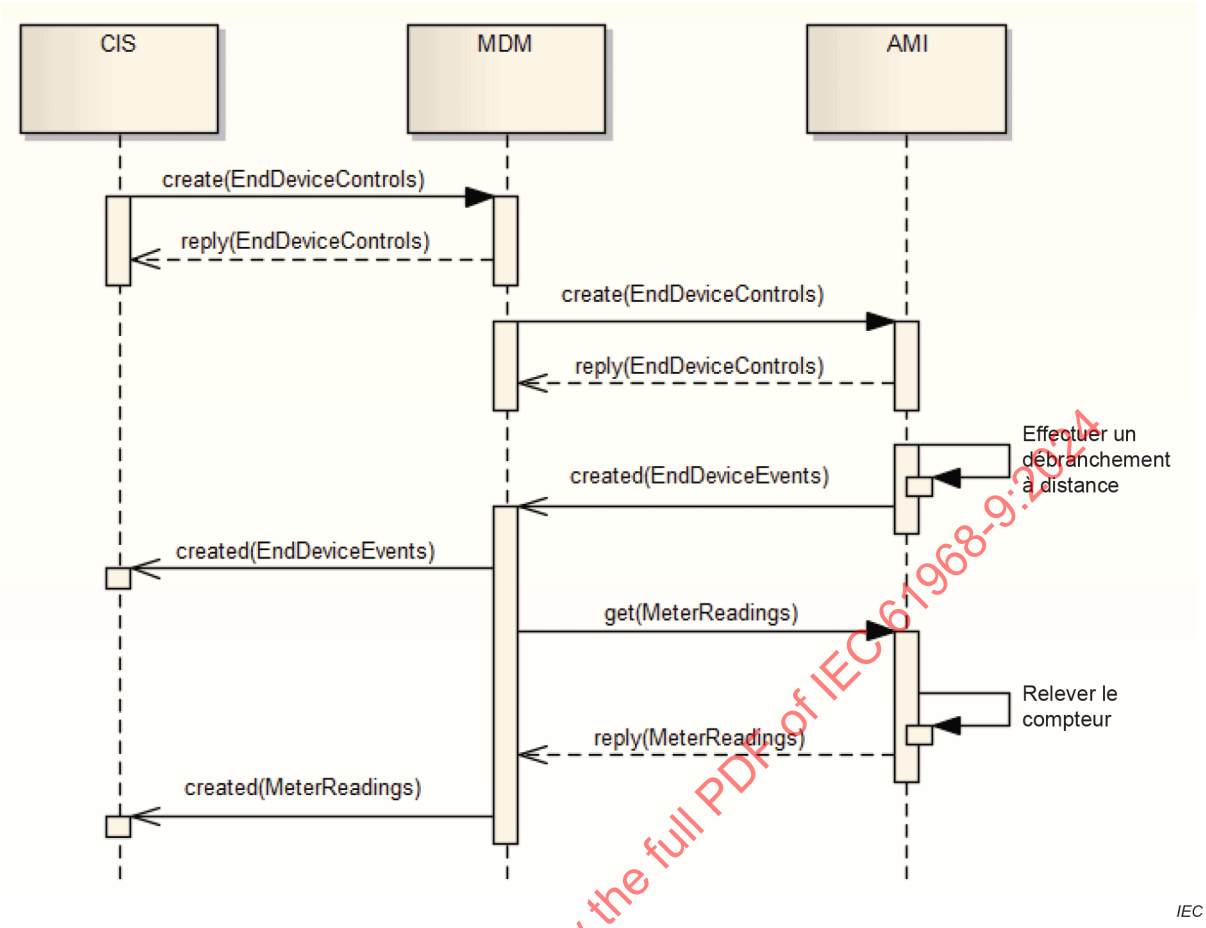
Figure 35 – Exemple de modification du programme client avec un remplacement du compteur

Voir 5.6.2 sur la pose et dépose de compteur pour des informations détaillées complémentaires concernant le message MeterServiceRequest.

5.4.2.4 Débranchement et rebranchement de compteur

Pour diverses raisons, telles que non-paiement, il peut être nécessaire de débrancher ou rebrancher un client. Lorsqu'il est débranché, il convient que l'usage enregistré soit de zéro et il convient d'ignorer les plaintes relatives aux coupures de courant. Lorsqu'il n'est pas possible d'effectuer un débranchement ou un rebranchement à distance au moyen d'un MS, une demande de service de compteur est typiquement produite pour effectuer manuellement le débranchement ou le rebranchement. Des exemples d'échanges de messages pour une exploitation à distance sont représentés à la Figure 36 et à la Figure 37.

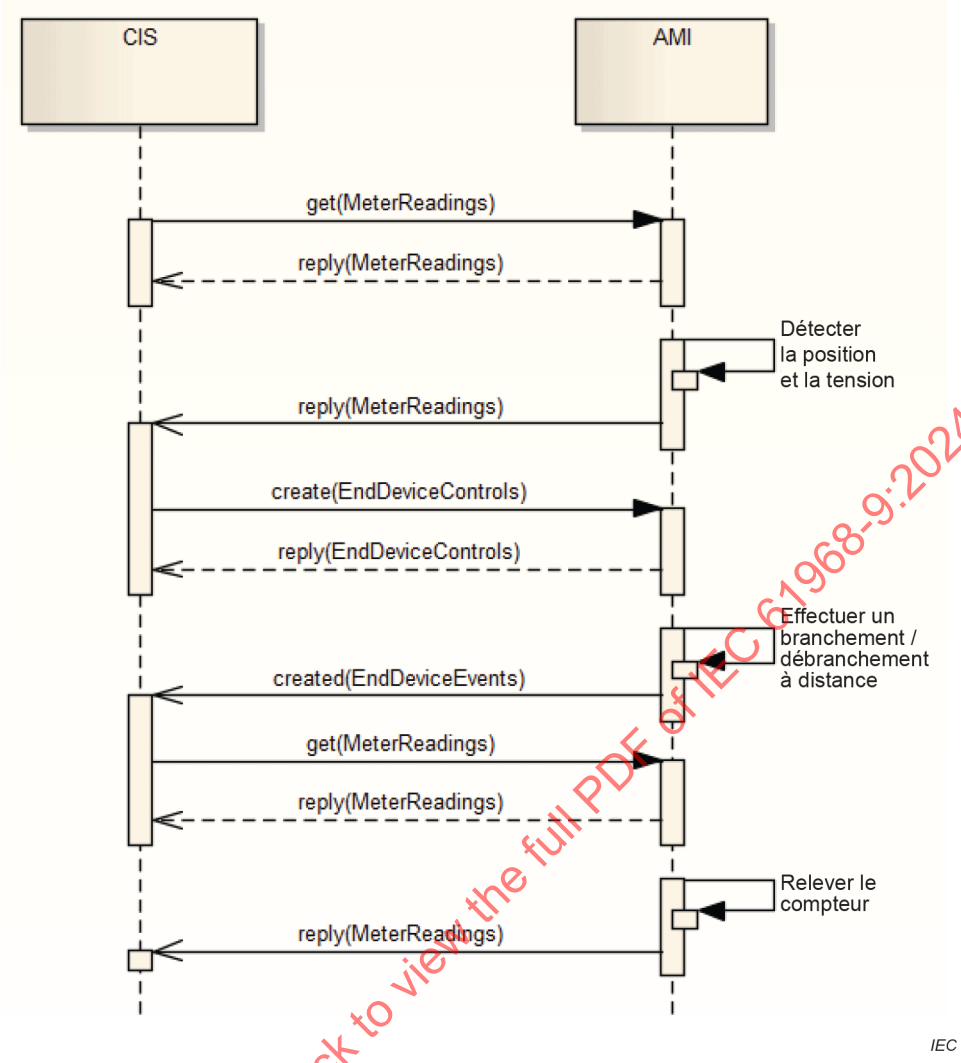
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La Figure 36 est reproduite avec l'autorisation de l'UCAIug.

Figure 36 – Exemple d'échange de messages pour le branchement/débranchement de compteur

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La Figure 37 est reproduite avec l'autorisation de l'UCAIug.

Figure 37 – Exemple de branchement/débranchement à distance entre le CIS et le MS

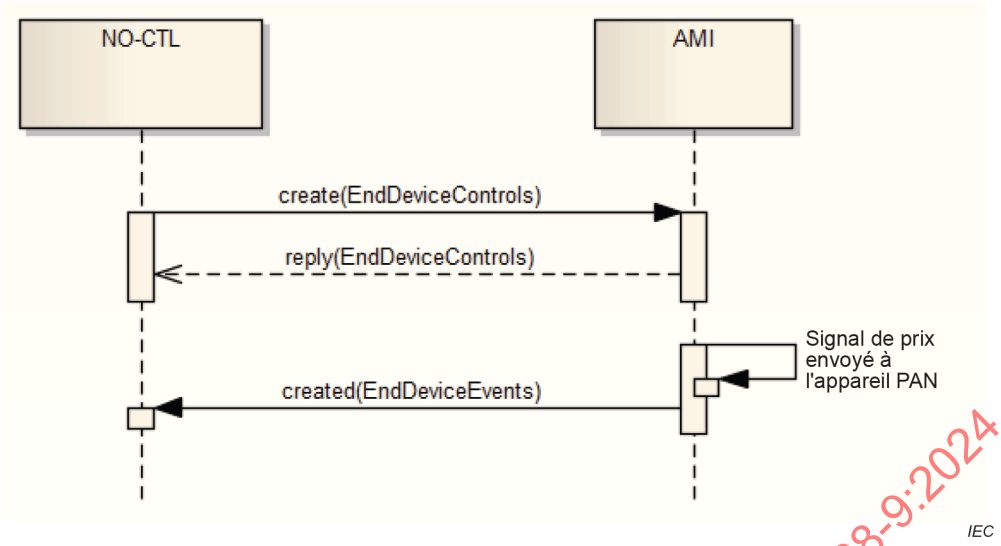
5.4.2.5 Tarification en temps réel

Les signaux et/ou bordereaux de tarification en temps réel peuvent être envoyés à un dispositif terminal par l'intermédiaire du MS. Cette opération peut se faire de plusieurs façons, telles que:

- signal de prix émis en temps réel identifiant un prix pour une durée déterminée;
- programmes selon le temps d'utilisation (TOU – *time of use*) publiés, qui entraînent des variations de cumul pour chaque étage de TOU;
- programmes de prix de l'énergie publiés à l'avance.

Souvent, l'EndDeviceGroup peut être utilisé pour différencier des compteurs avec des contrats ou des tarifs différents.

L'exemple de la Figure 38 représente un signal de prix envoyé vers le MS à partir de l'exploitation du réseau. Le MS agit alors comme un fournisseur de service réseau pour communiquer le prix en temps réel aux compteurs et autres équipements.



La Figure 38 est reproduite avec l'autorisation de l'UCAIug.

Figure 38 – Exemple d'échange de message pour le signal de tarification en temps réel

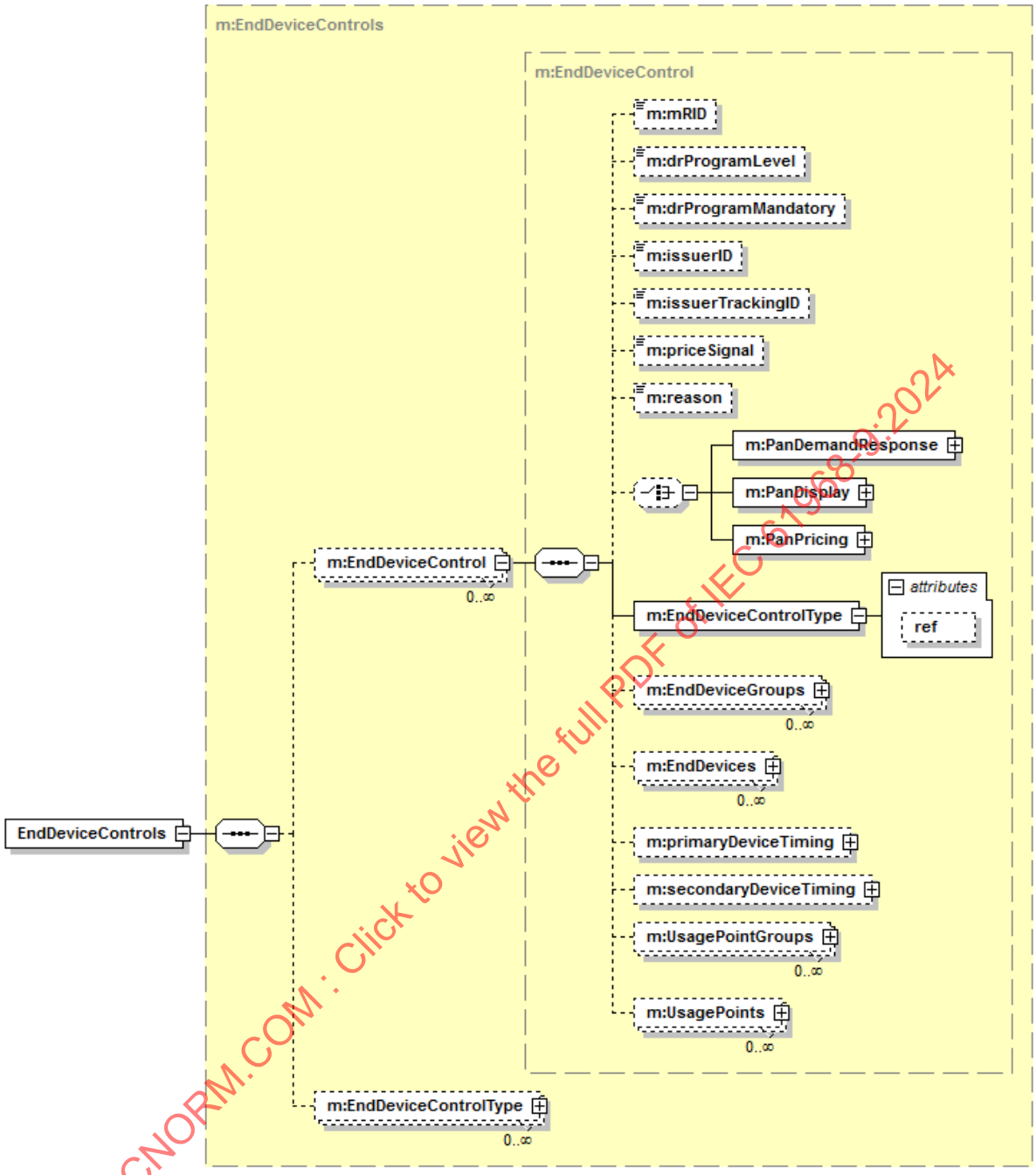
Les signaux de prix sont mis en œuvre comme un sous-type d'EndDeviceControl, avec lequel le prix est un paramètre de message.

5.4.3 Format des messages

5.4.3.1 Généralités

La Figure 39 décrit la structure d'un message EndDeviceControls message. Le schéma XML du message EndDeviceControls est défini à l'Annexe G.

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La Figure 39 est reproduite avec l'autorisation de l'UCAIug.

Figure 39 – Format des messages de commandes de dispositif terminal

Dans la structure de charge utile de message, des compteurs spécifiques peuvent être adressés par EndDevice (par exemple, compteur), EndDeviceGroup, UsagePoint et/ou UsagePointGroup. A part une adresse au moins, le seul élément exigé est l'EndDeviceControlType, qui identifie le type de commande à exécuter. Les exemples des différents types de commandes qui peuvent être utilisés comprennent, y compris entre autres:

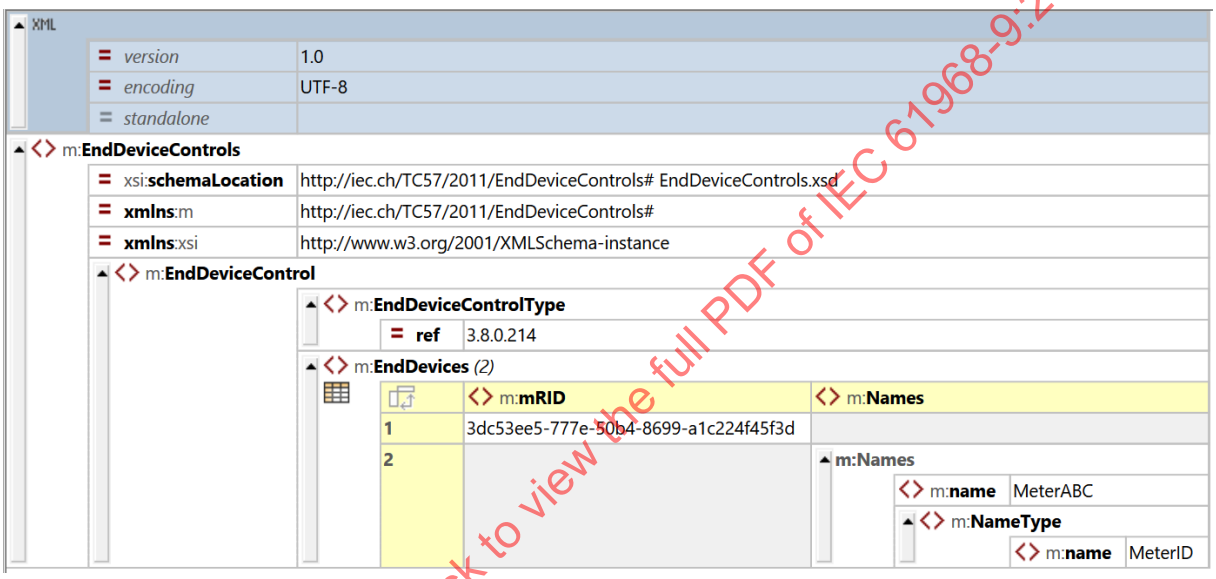
- signal de commande de charge;
- signal ou bordereau de prix;
- débranchement à distance;
- rebranchement à distance;
- réinitialisation de la demande;

- signal de réduction de demande;
- envoi d'un message textuel à un appareil PAN;
- envoi des signaux de tarification vers un appareil PAN;
- envoi des événements de commande de charge / réponse à la demande à un appareil PAN.

Les paragraphes 5.4.3.2, 5.4.3.3, 5.4.3.4 et 5.4.3.5 suivants sont des exemples XML représentatifs des EndDeviceControls.

5.4.3.2 Exemple d'une charge utile de réinitialisation de la demande

La Figure 40 est un exemple de réinitialisation de la demande. Note: Dans le présent exemple, deux appareils sont adressés et chacun est dans son propre élément EndDevices. L'un d'eux est adressé par mrID et l'autre est adressé par Names.



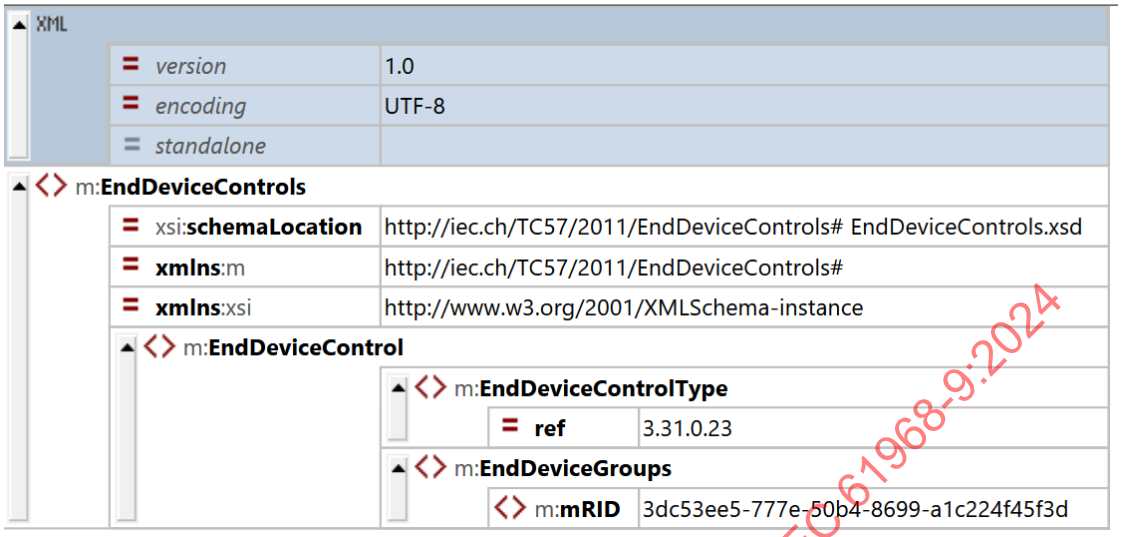
La Figure 40 est reproduite avec l'autorisation de l'UCAIug.

Figure 40 – Exemple de EndDevice

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5.4.3.3 Exemple de débranchement de compteur par groupe

La Figure 41 est un exemple de débranchement de compteur par groupe.



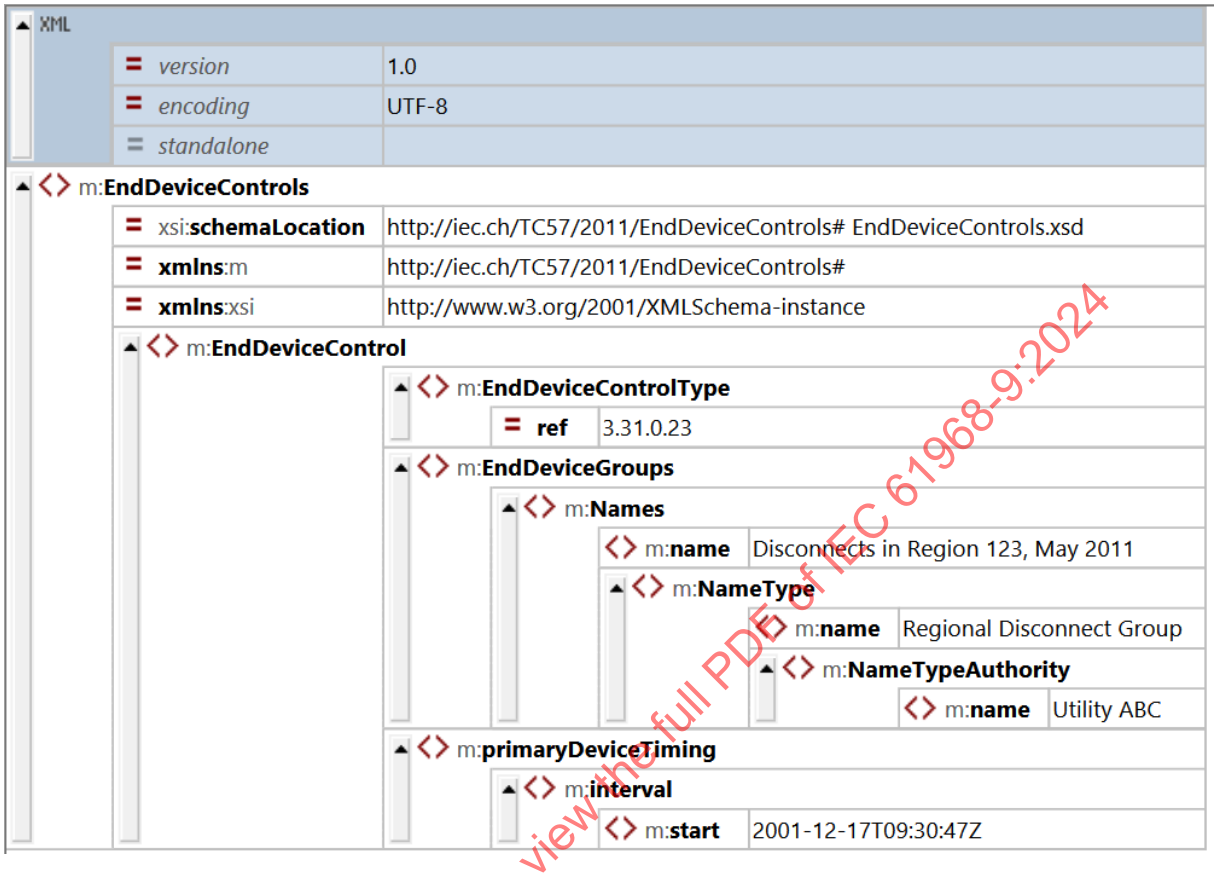
La Figure 41 est reproduite avec l'autorisation de l'UCAIug.

Figure 41 – Exemple de EndDeviceControl

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5.4.3.4 Exemple de débranchement programmé par groupe

La Figure 42 est un exemple de débranchement programmé par groupe.



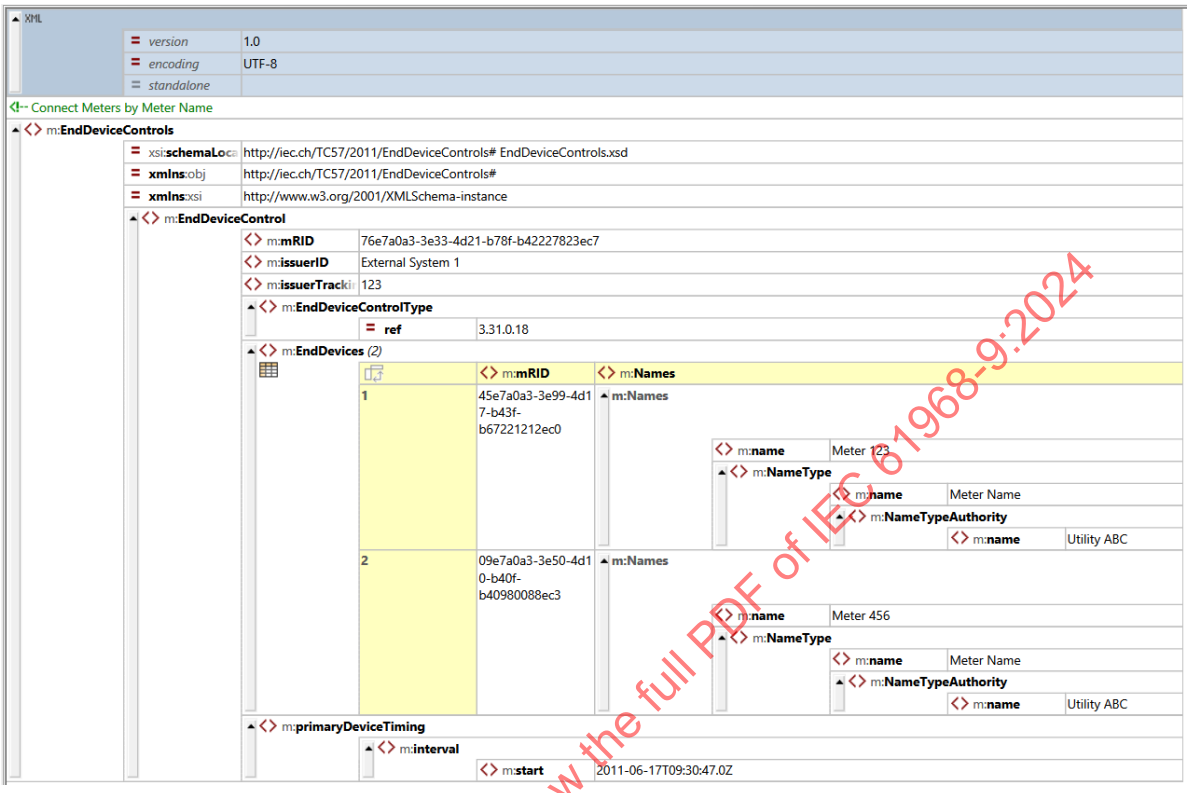
La Figure 42 est reproduite avec l'autorisation de l'UCAIug.

Figure 42 – Exemple de débranchemment des EndDeviceControls par groupe

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5.4.3.5 Exemple de branchement de compteur par nom

La Figure 43 présente un exemple de branchement de compteur, avec lequel le compteur est spécifié par nom.



La Figure 43 est reproduite avec l'autorisation de l'UCAIug.

Figure 43 – Exemple de branchement de compteur de EndDeviceControls

5.5 Demande de services de compteur

5.5.1 Généralités

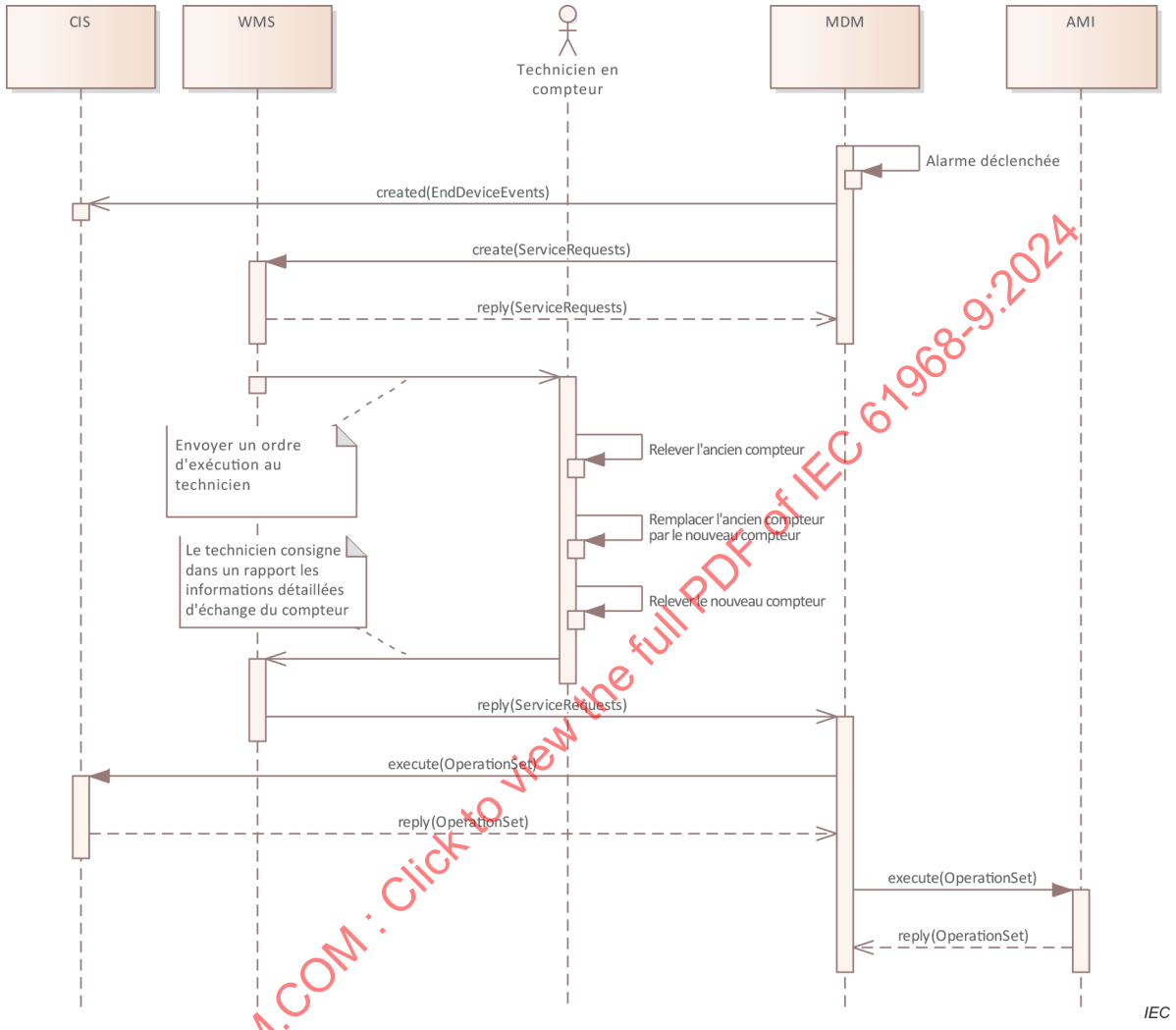
Les demandes de services de compteur sont une sous-classe de Work, dans laquelle un EndDevice est impliqué. Ces demandes sont communiquées à l'aide du profil ServiceRequest, et sont définies dans l'IEC 61968-8.

Il peut être nécessaire de poser, déposer ou configurer des compteurs par suite de l'enregistrement d'un nouveau client, du retrait d'un client ou du passage d'un client d'un fournisseur à un autre. Ces scénarii sont traités dans l'IEC 61968-8. Toutefois, le système AMI ou la MDM peut également identifier la nécessité de remplacer un compteur existant. Ce remplacement implique la dépose de l'ancien compteur, la pose du nouveau compteur et la configuration du nouveau compteur dont a besoin le système de comptage.

Des EndDeviceEvents (tels qu'ils sont décrits au 5.2) peuvent entraîner une évaluation qui débouche sur une demande de remplacement de compteur. Les événements du compteur peuvent être publiés à partir de MS ou MDM. La Figure 44 décrit un exemple d'échange avec lequel la MDM a identifié un problème et l'a porté à l'attention du WMS qui décide de remplacer le compteur.

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De nouveau, les étapes OperationSet sont incluses pour synchroniser les Master Data révisées (les données de configuration des compteurs neufs et anciens et les modifications d'association avec l'UsagePoint) avec le système MDM et le système de comptage. Voir 5.8 et l'Annexe I et l'Annexe J pour obtenir des informations complémentaires relatives à la gestion de données de référence.



La Figure 44 est reproduite avec l'autorisation de l'UCAIug.

Figure 44 – Exemple d'échange de messages d'événement de dispositif terminal en raison d'un remplacement de compteur

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5.6 Événements relatifs au système de comptage

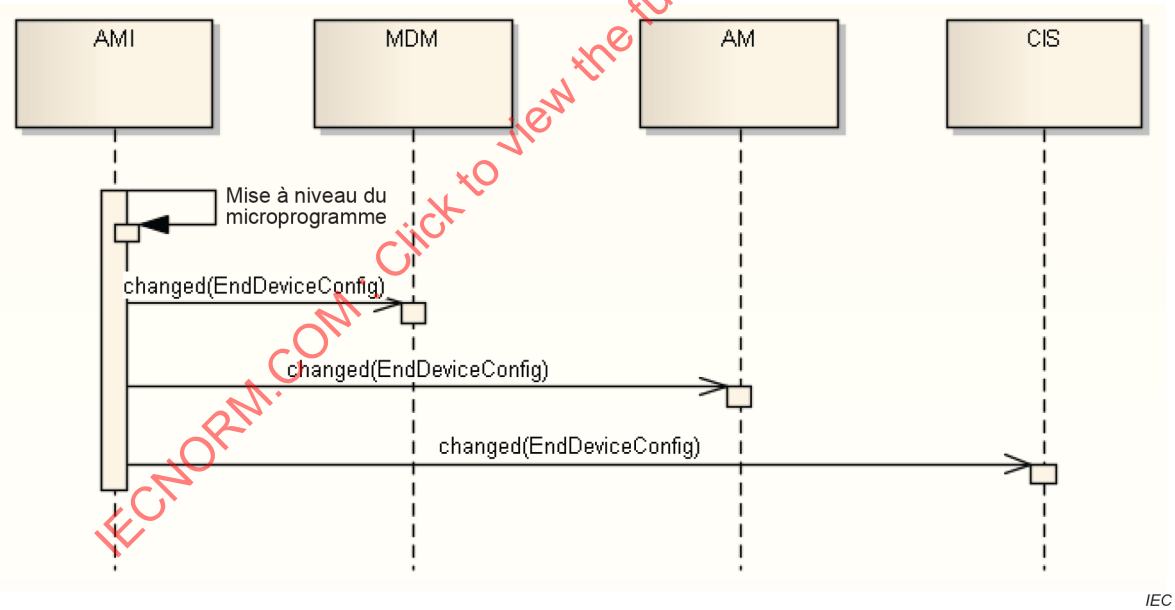
5.6.1 Généralités

Il existe des niveaux différents de besoin dans un système pour différentes sortes de messages.

Le système de comptage (*en soi*) peut présenter des problèmes au sein de son infrastructure qui exigent un ordre d'exécution pour être réglés. Les exigences relatives aux données pour communiquer cet événement sont similaires aux exigences d'EndDeviceEvent comme cela est décrit au 5.2. Avec un EndDeviceEvent, un simple code d'erreur peut être utilisé pour consigner un problème. Ce mécanisme fonctionne lorsque le destinataire est capable de consulter et interpréter la signification du code. Cependant, lorsqu'une description plus détaillée du problème est exigée, un schéma plus élaboré doit être utilisé. Dans certains cas, le destinataire est un être humain et exige une description lisible par l'homme du problème et de l'équipement particulier impliqué. Lors de l'identification de l'actif, l'emploi d'une terminologie spécifique au fournisseur est probablement nécessaire pour décrire le matériel.

5.6.2 Applications – Mise à niveau du microprogramme

Pour un système de comptage automatisé capable de communication bidirectionnelle, il peut être possible de mettre à niveau le microprogramme de l'infrastructure de MS sur le terrain ou, dans certains systèmes, les actifs de communication dans les dispositifs terminaux. Les modifications apportées au système de comptage qui altèrent matériellement son fonctionnement doivent être communiquées à toutes les parties prenantes concernées. Un exemple de ladite publication obtenue à l'aide d'un message EndDeviceConfig est représenté à la Figure 45.



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La Figure 45 est reproduite avec l'autorisation de l'UCAIug.

Figure 45 – Exemple d'échange de message de mise à niveau du microprogramme

La mise à niveau du microprogramme peut entraîner une modification de l'EndDevice ou du CommEquipmentAsset de plusieurs façons, y compris les caractéristiques fonctionnelles de l'appareil, la version du microprogramme et le numéro de révision, ou la configuration (exprimée comme un programId).

5.6.3 Formats des messages

Se reporter au format des messages EndDeviceConfig décrit au 5.8.3.

5.7 Réseaux dans un local

5.7.1 Généralités

Le système de comptage a été étendu afin d'inclure les appareils qui ont été déployés dans les foyers et les entreprises gérés par l'infrastructure de comptage. Dans le présent document, ces appareils existent au sein d'un réseau dans un local (PAN). Cela comprend le terme fréquemment utilisé de réseau domestique (HAN). Les appareils PAN/HAN eux-mêmes sont un type spécial d'EndDevice.

Compte tenu de la nature évolutive des appareils sous-jacents et des protocoles de communication, le présent document tente d'adopter une vision qui peut être mise en correspondance selon les besoins avec diverses normes relatives aux appareils.

5.7.2 Applications

5.7.2.1 Généralités

Les applications des appareils PAN incluent principalement la tarification dynamique, la réponse à la demande et l'apport d'informations aux clients. Il existe de nombreux types d'appareils PAN, notamment les thermostats intelligents, les affichages domestiques, les relais, etc.

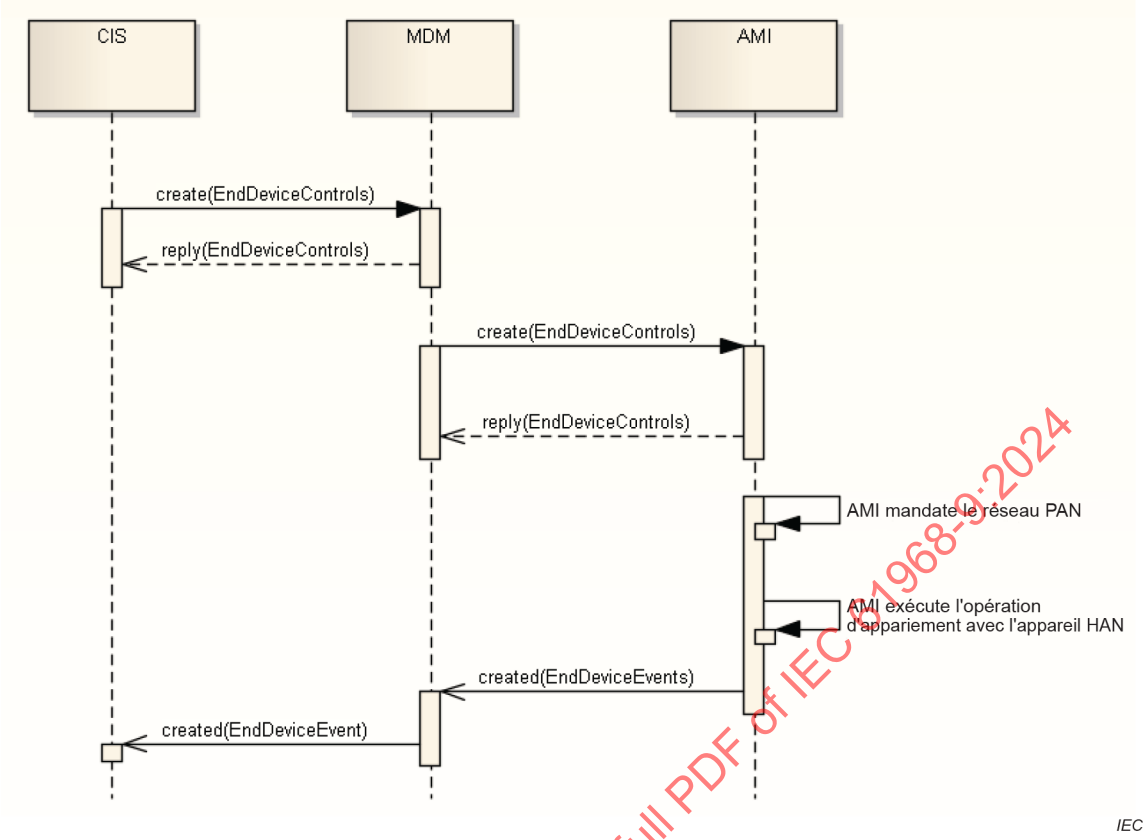
5.7.2.2 Pairage et suppression du pairage d'un appareil PAN

Le pairage d'un appareil PAN avec un compteur est exigé avant que le système de comptage ne puisse envoyer des commandes à l'appareil PAN.

Le pairage de l'appareil PAN (et la suppression du pairage) est réalisé avec un message EndDeviceControls comme le représente l'exemple de la Figure 46. Les conventions spéciales ci-après relatives au message EndDeviceControl s'appliquent au pairage d'un appareil PAN avec un compteur.

- Il convient de sélectionner le code EndDeviceControlType approprié dans le cadre du pairage d'un appareil PAN à l'Annexe F.
- Deux (et seulement deux) EndDevices sont identifiés par mRid ou la classe Names; l'un est le compteur et l'autre est l'appareil PAN. L'isPan booléen est défini sur vrai pour l'appareil PAN; le code d'installation et electronicAddress.macAddress sont normalement également exigés.
- Les résultats de réussite ou d'échec de l'opération de pairage sont consignés à l'aide des messages EndDeviceEvents, avec les énumérations EndDeviceEventType appropriées disponibles dans le Tableau E.25. Il est possible que plusieurs EndDeviceEvent soient consignés par suite de l'application de EndDeviceControl.

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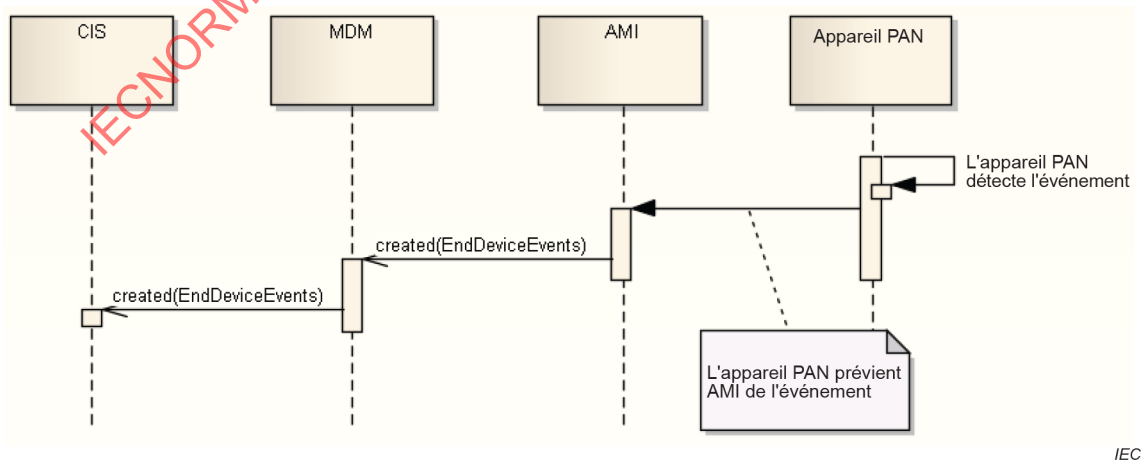


La Figure 46 est reproduite avec l'autorisation de l'UCAIug.

Figure 46 – Pairage d'un appareil PAN

5.7.2.3 Événements PAN

Les événements de l'appareil PAN sont générés par un appareil PAN et sont généralement communiqués par le biais d'un compteur ou d'une passerelle vers la tête de réseau du système de comptage. La tête de réseau du système de comptage publie ensuite le message vers d'autres applications d'entreprise qui se sont abonnées. Ces événements sont transmis à l'aide du message EndDeviceEvents. Un exemple est présenté à la Figure 47.



La Figure 47 est reproduite avec l'autorisation de l'UCAIug.

Figure 47 – Événements de l'appareil PAN

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5.7.2.4 Commandes PAN

Les commandes supplémentaires de l'appareil PAN à d'autres fins que le pairage peuvent être lancées par une application d'entreprise telle qu'un système de gestion de réponse à la demande vers une tête de réseau du système de comptage. Ces commandes ont également recours au message EndDeviceControls. Étant donné qu'il existe diverses manières d'adresser la commande, il peut y avoir de nombreux appareils PAN cible. Un exemple est présenté à la Figure 48.

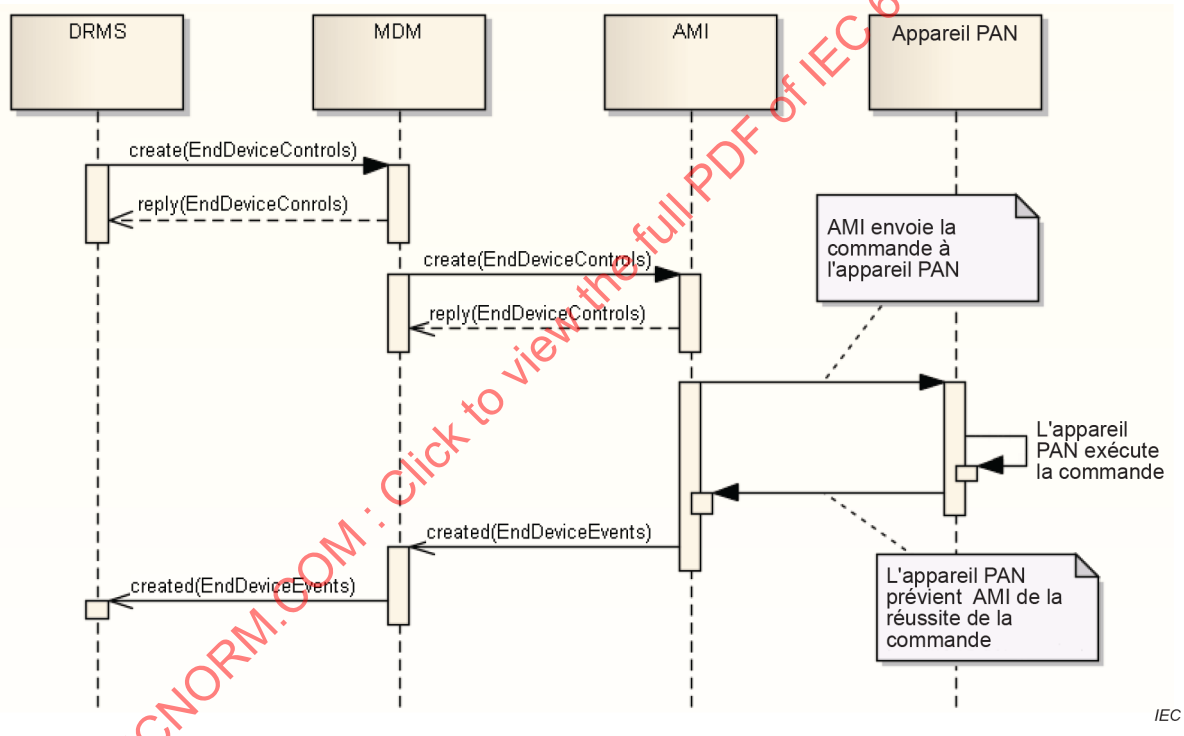
Les messages EndDeviceControls prévus pour les appareils PAN comprennent en général l'une des structures spéciales ci-après au sein du profil EndDeviceControl:

PanDemandResponse;

PanDisplay;

PanPricing.

Les énumérations appropriées EndDeviceControlType et EndDeviceEventType desdites fonctions peuvent être consultées à l'Annexe E et à l'Annexe F.



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La Figure 48 est reproduite avec l'autorisation de l'UCAIug.

Figure 48 – Commandes de l'appareil PAN

5.7.3 Formats des messages

Il n'existe aucun message unique défini spécifiquement pour les appareils PAN. Les appareils PAN sont simplement des types d'EndDevices.

5.8 Messages de gestion de données de référence

5.8.1 Généralités

Les systèmes d'entreprise qui échangent les messages dans le domaine Relevé de compteur et Commande exigent un moyen de gérer les données non transactionnelles qui définissent les actifs, d'autres objets CIM et les relations (ou les associations entre elles). La gestion de données de référence (MDM) est le terme utilisé pour décrire la pratique de création, de modification et de suppression de ces objets et relations.

Pour les besoins de l'IEC 61968-9, les classes CIM qui relèvent du domaine d'application de la gestion de données de référence et les profils IEC 61968-9 utilisés pour créer/modifier/supprimer ces objets (et leur "configuration") sont inclus dans le Tableau 4:

Tableau 4 – Profils de configuration de l'IEC 61968-9

Objet CIM	Profil de l'IEC 61968-9
ComModule	ComModuleConfig
EndDevice	EndDeviceConfig
EndDeviceGroup	EndDeviceGroups
Compteur (Meter)	MeterConfig
TransformerTank	[a]
UsagePoint	UsagePointConfig
UsagePointGroup	UsagePointGroups
UsagePointLocation	UsagePointLocationConfig

[a] Pour les besoins de l'IEC 61968-9, l'objet TransformerTank a une applicabilité pour les cas d'utilisation qui impliquent Outage Management par un lien entre le UsagePoint et un TransformerTank dans le modèle de réseau. Le TransformerTank est techniquement hors du domaine d'application de l'IEC 61968-9, et il n'existe aucun profil IEC 61968-9 concernant la création, la modification ou la suppression d'un TransformerTank. Toutefois, le TransformerTank peut être référencé dans d'autres profils, y compris, entre autres, les profils UsagePointConfig, CustomerMeterDataSet, GetMeterReadings, et MasterDataLinkageConfig.

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Les ConfigurationEvents surviennent dès qu'une opération de création, de modification ou de suppression est réalisée au moyen de toute opération "config" à l'aide des profils de l'IEC 61968-9 dans le Tableau 4 et dès qu'une transaction MasterDataLinkageConfig est exécutée pour gérer les relations des objets MDM.

La classe ConfigurationEvent dans le CIM est associée à chaque classe CIM dans la première colonne du Tableau 4 et est intégrée dans chaque profil de l'IEC 61968-9 dans la colonne 2 de ce tableau. La fonction de la classe ConfigurationEvent est de fournir des informations métier détaillées importantes concernant chaque opération "config", y compris:

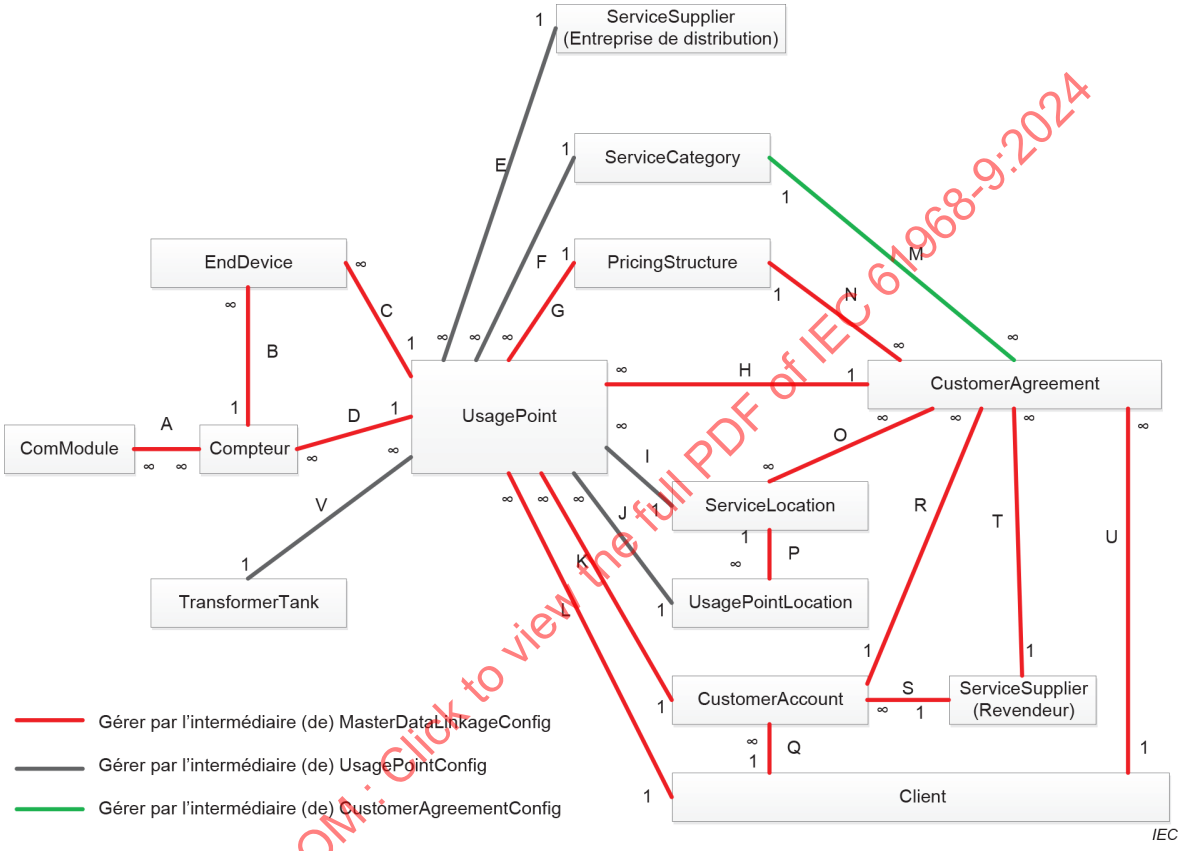
- la date et l'heure auxquelles la configuration ou la modification de configuration a pris effet ou va prendre effet;
- l'entité qui accomplit l'opération de configuration; et
- les remarques sous forme libre qui fournissent des informations métier supplémentaires relatives à l'événement de configuration.

Se reporter à l'Annexe J pour obtenir les descriptions détaillées des cas d'utilisation de gestion de données de référence et des exemples de messages XML qui représentent l'utilisation prévue des messages dans le présent paragraphe 5.8.

5.8.2 Applications

5.8.2.1 Généralités

Pour les besoins de la présente norme, deux méthodes sont utilisées pour gérer les relations entre les objets CIM identifiés au 5.8.1. Il s'agit du profil MasterDataLinkage et, pour un nombre limité d'objets CIM, les relations sont explicitement gérées à l'aide des profils identifiés au 5.8.1. Le diagramme de la Figure 49 identifie les relations d'objets qui sont importantes à la gestion des données de référence dans le domaine d'application du présent document et la méthode spécifique recommandée à utiliser pour gérer chaque relation.



La Figure 49 est reproduite avec l'autorisation de l'UCAIug.

Figure 49 – Liens de données de référence

Pour parfaitement comprendre la Figure 49, il est nécessaire de comprendre que le présent document fournit des messages normatifs par lesquels les systèmes d'entreprise peuvent échanger des informations; cependant aucune exigence n'existe pour qu'un système donné mette en œuvre un modèle de données interne fondé sur ou cohérent avec le CIM. Par conséquent, le diagramme ci-dessus présente la possibilité de refléter les relations de différentes manières. Par exemple, deux systèmes peuvent reconnaître les concepts de Customer, CustomerAccount et CustomerAgreement et choisir d'exprimer les relations entre ces entités et un UsagePoint en reliant un Customer à un CustomerAccount (relation Q), puis en reliant le CustomerAccount au CustomerAgreement (relation R) et enfin en reliant le CustomerAgreement au UsagePoint (relation H). Dans le présent scénario, le besoin d'utiliser des relations K, L ou U peut ne jamais exister.

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D'autre part, il peut y avoir deux systèmes d'entreprise qui ne matérialisent pas le concept d'un CustomerAgreement dans leurs modèles de données internes. Ces systèmes peuvent utiliser des messages qui relient un Customer à un CustomerAccount (relation Q), puis qui relient le CustomerAccount à l'UsagePoint (relation K). Le fait d'être prescriptif à propos des relations représentées à la Figure 49 (relations admissibles ou préférentielles) ne relève pas du domaine d'application du présent document. Le profil MasterDataLinkageConfig peut être utilisé avec souplesse afin de prendre en charge les besoins de toute entreprise et de ses systèmes.

Il est recommandé que les relations E, F, I, J, M et V soient gérées par les profils "Config" indiqués dans la légende de la figure, plutôt que par le biais du profil MasterDataLinkageConfig; toutefois, il ne s'agit pas d'une exigence et les entreprises peuvent également choisir d'utiliser le profil MasterDatalinkageConfig pour gérer lesdites relations. La recommandation concernant la gestion des relations spécifiques par les profils identifiés plutôt que par le profil MasterDataLinkageConfig a une double raison:

- ces relations spécifiques varient rarement; et
- ces relations spécifiques sont prises en considération par presque tous les systèmes d'entreprise de manière cohérente.

L'inverse est également vrai. Les entreprises peuvent choisir de gérer les relations représentées sous forme de lignes rouges comme si elles étaient représentées sous forme de lignes noires sous réserve que la relation soit prise en charge par le CIM et reflétée dans le profil approprié de l'IEC 61968-9.

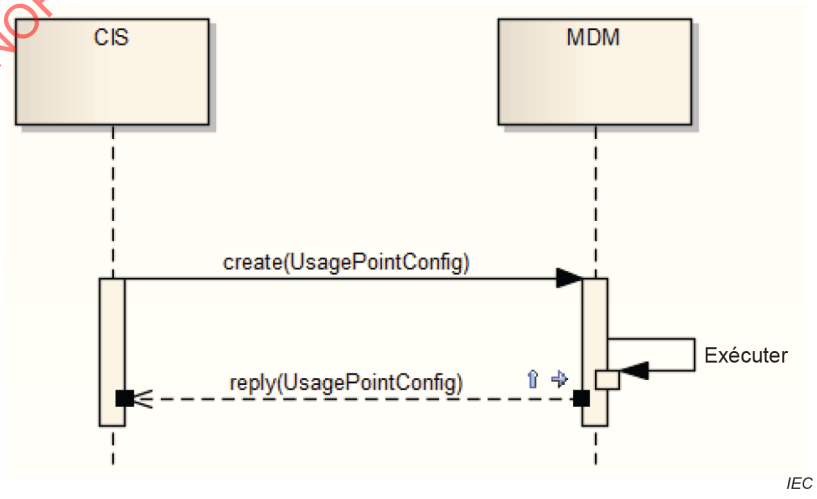
La Figure 49 est informative. Elle représente la plage des relations prévues entre les entités. La Figure 53 prévoit une étape vers une mise en œuvre en indiquant comment XML peut être organisé. D'autres étapes sont représentées au niveau du lien de l'Annexe G pour MasterDataLinkageConfig. Les entités et les relations représentées à la Figure 53 peuvent évoluer dans la durée étant donné que l'utilisation du présent document est étendue afin de prendre en charge les nouveaux cas d'usage professionnel, ainsi que les cas d'usage professionnel révisés.

5.8.2.2 Points d'usage

Les informations relatives aux points d'usage peuvent être configurées dans le MS au moyen de la charge utile de message UsagePointConfig.

Un exemple d'un échange de message est donné à la Figure 50 et le format de message est donné au 5.8.3.4.

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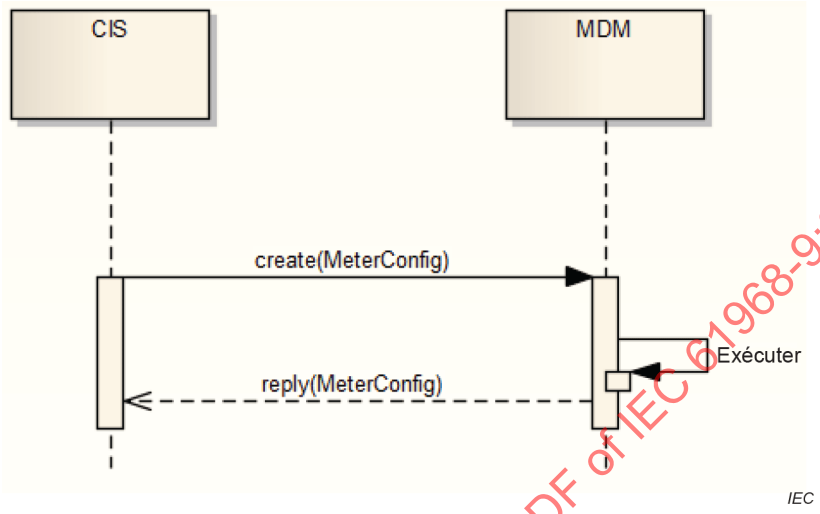
La Figure 50 est reproduite avec l'autorisation de l'UCAIug.

Figure 50 – Échange de messages pour transférer des informations de point d'usage

5.8.2.3 Compteurs

Les informations relatives aux compteurs en service peuvent être configurées dans le MS au moyen de la charge utile de message MeterConfig.

Un exemple d'un échange de message est donné à la Figure 51 et le format de message est donné au 5.8.3.7.



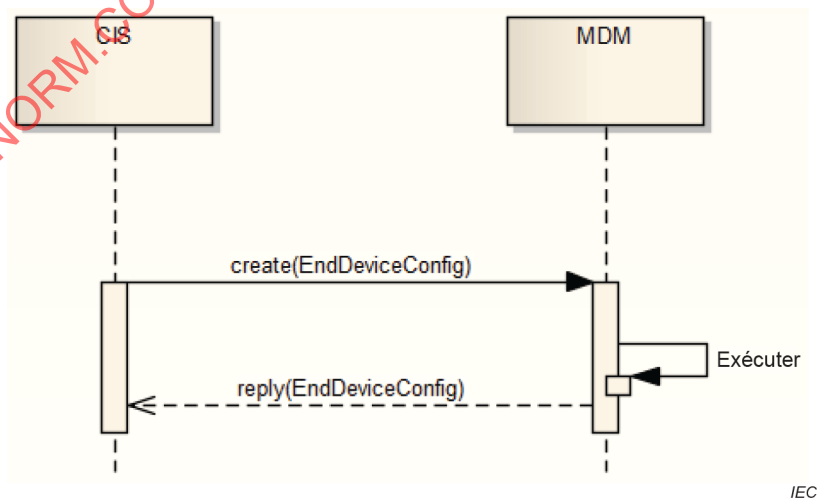
La Figure 51 est reproduite avec l'autorisation de l'UCAIug

Figure 51 – Échange de messages pour transférer des informations de compteur

5.8.2.4 Dispositifs terminaux

Les informations relatives aux dispositifs terminaux en service peuvent être configurées dans le MS au moyen de la charge utile d'un message EndDeviceConfig.

Un exemple d'un échange de message est donné à la Figure 52 et le format de message est donné au 5.8.3.6.



La Figure 52 est reproduite avec l'autorisation de l'UCAIug

Figure 52 – Échange de messages pour transférer des informations de dispositif terminal

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5.8.3 Formats des messages

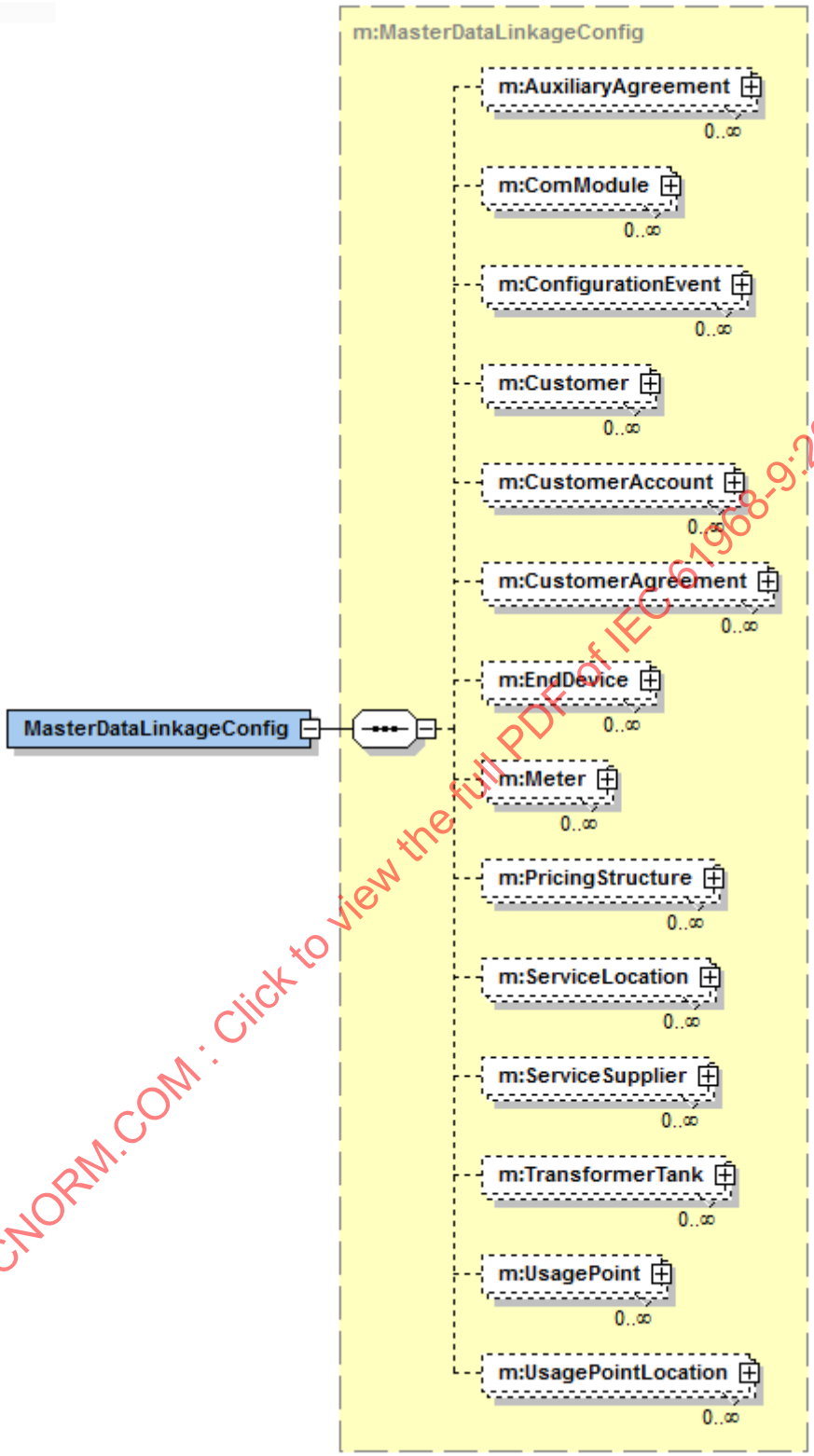
5.8.3.1 Généralités

Le présent paragraphe 5.8.3 décrit les formats des messages MasterDataLinkageConfig et autres messages "config" Master Data Management. La spécification détaillée de chaque classe et attribut est disponible dans l'IEC 61968-11 et l'IEC 61970-301. Les profils normatifs pour la présente édition de l'IEC 61968-9 peuvent être consultés à l'Annexe G. Comme indiqué à l'Annexe G, ces profils peuvent être sérialisés en formats XSD, schémas JSON, ainsi que sous d'autres formats de sérialisation. Le reste du présent document se réfère uniquement à la sérialisation XSD.

5.8.3.2 MasterDataLinkageConfig

La Figure 53 décrit la structure de haut niveau du message Master Data Linkage Config utilisé pour configurer les relations entre les objets.

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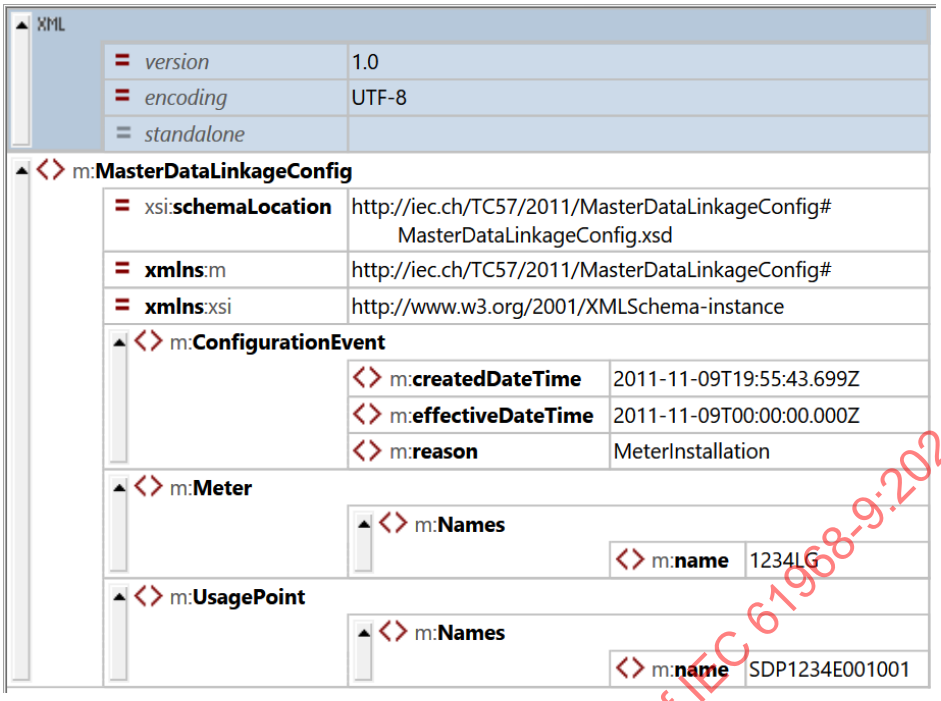


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La Figure 53 est reproduite avec l'autorisation de l'UCAIug

Figure 53 – Format de message MasterDataLinkageConfig

Un exemple de MasterDataLinkageConfig est présenté ci-dessous à la Figure 54. Ce message représente la méthode "non-in-line" (pas aligné) d'établissement d'une association entre deux objets CIM; dans ce cas, entre le compteur et le UsagePoint qui sont associés à l'aide d'une commande MasterDataLinkageConfig. Il s'agit de la façon normative de représenter l'installation d'un compteur à un UsagePoint.



La Figure 54 est reproduite avec l'autorisation de l'UCAIug.

Figure 54 – Exemple de MasterDataLinkageConfig

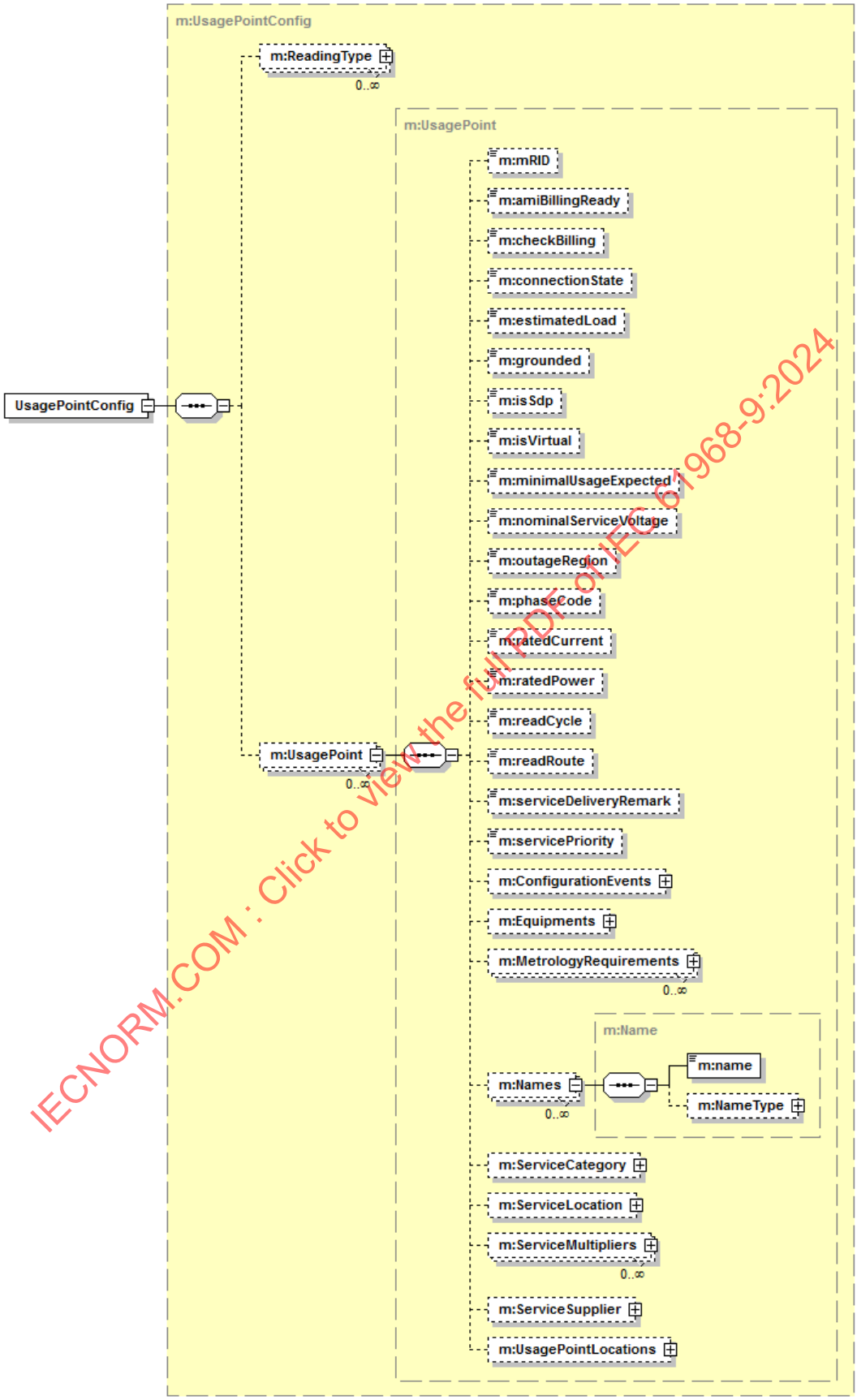
5.8.3.3 SupplierConfig

La structure ServiceSupplierConfig a été intégrée à l'IEC 61968-8:2023.

5.8.3.4 UsagePointConfig

La structure de message à la Figure 55 est utilisée pour configurer les points d'usage. Elle remplace le message des points de livraison de service défini dans l'IEC 61968-9:2009.

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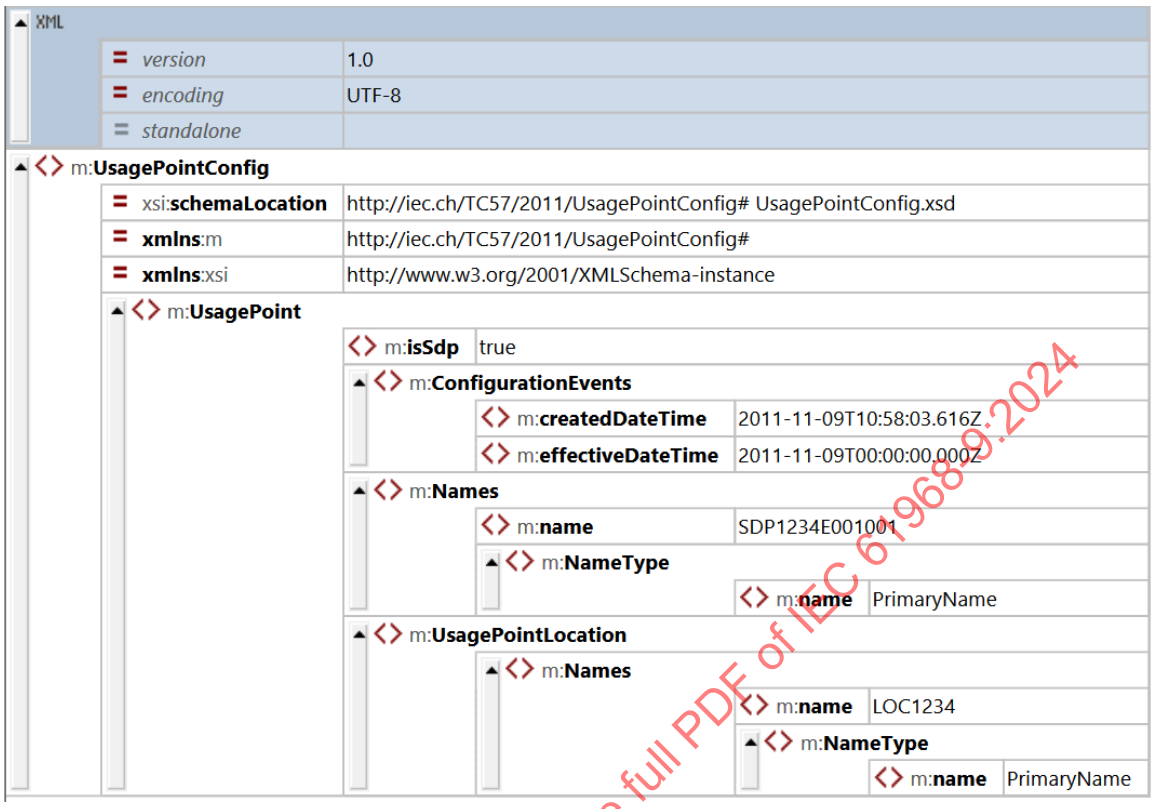


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La Figure 55 est reproduite avec l'autorisation de l'UCAIug

Figure 55 – Format de message UsagePointConfig

Un exemple de charge utile d'UsagePointConfig est présenté ci-dessous à la Figure 56.



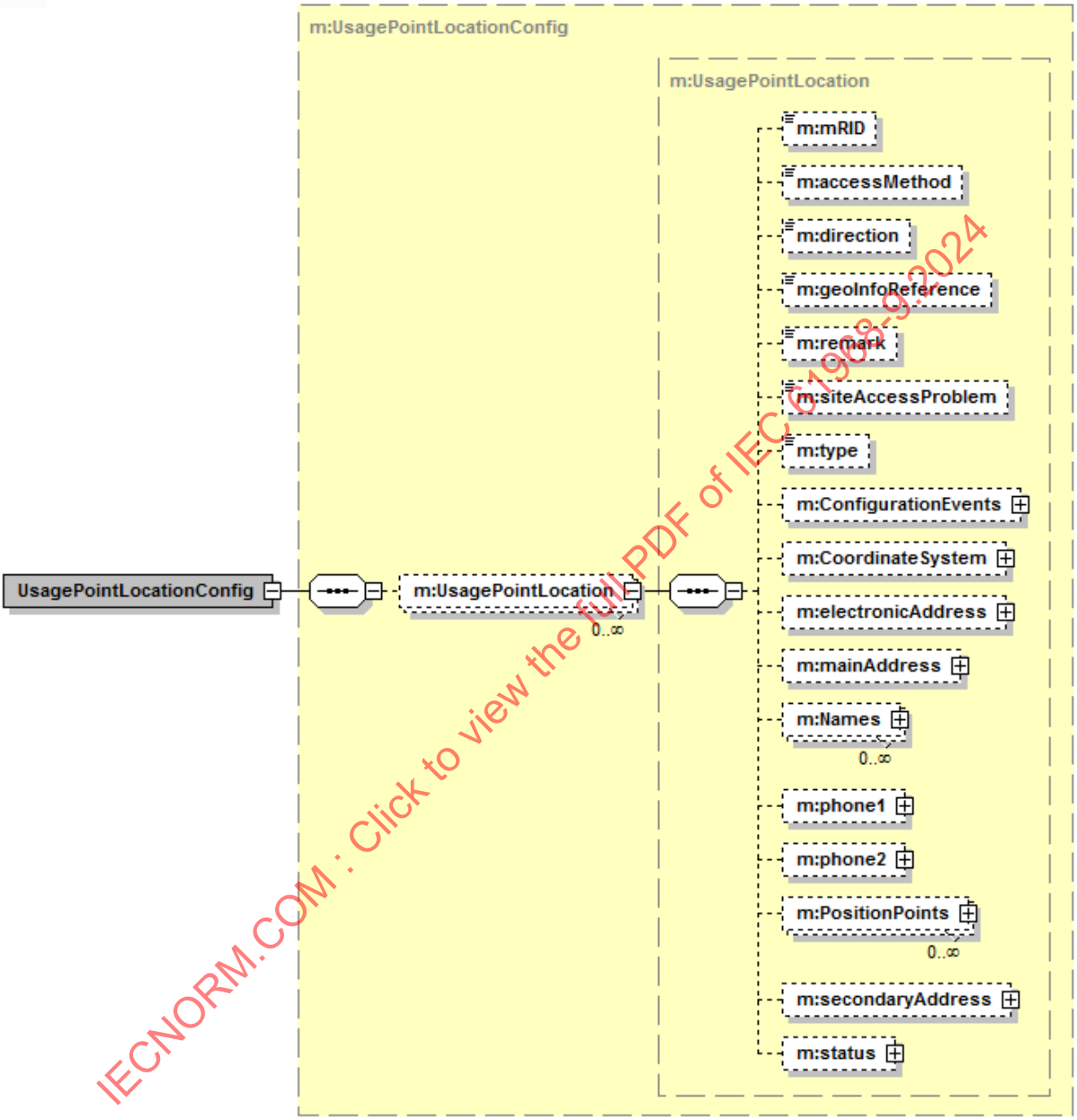
La Figure 56 est reproduite avec l'autorisation de l'UCAIug

Figure 56 – Exemple de UsagePointConfig

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5.8.3.5 UsagePointLocation

Le diagramme à la Figure 57 décrit la structure du message utilisé pour définir les UsagePointLocations.

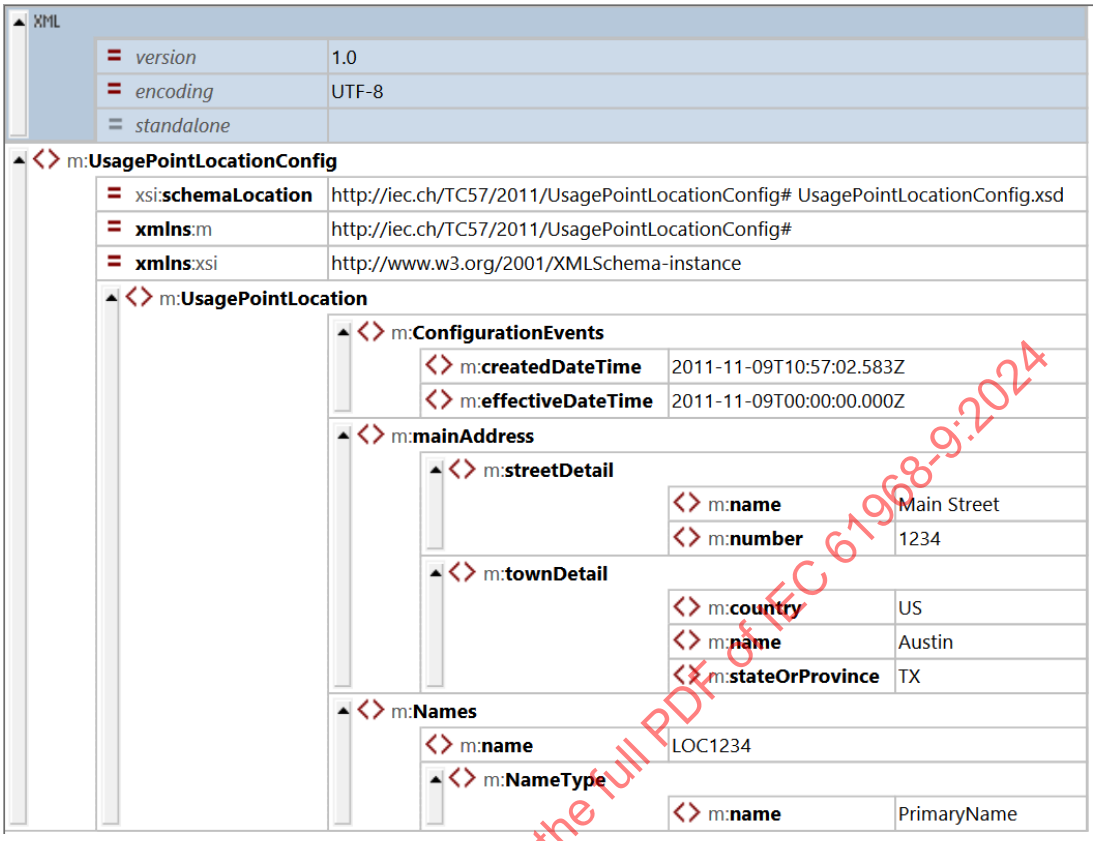


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La Figure 57 est reproduite avec l'autorisation de l'UCAIug

Figure 57 – Format de message UsagePointLocationConfig

Un exemple de charge utile d'UsagePointLocationConfig est présenté à la Figure 58.



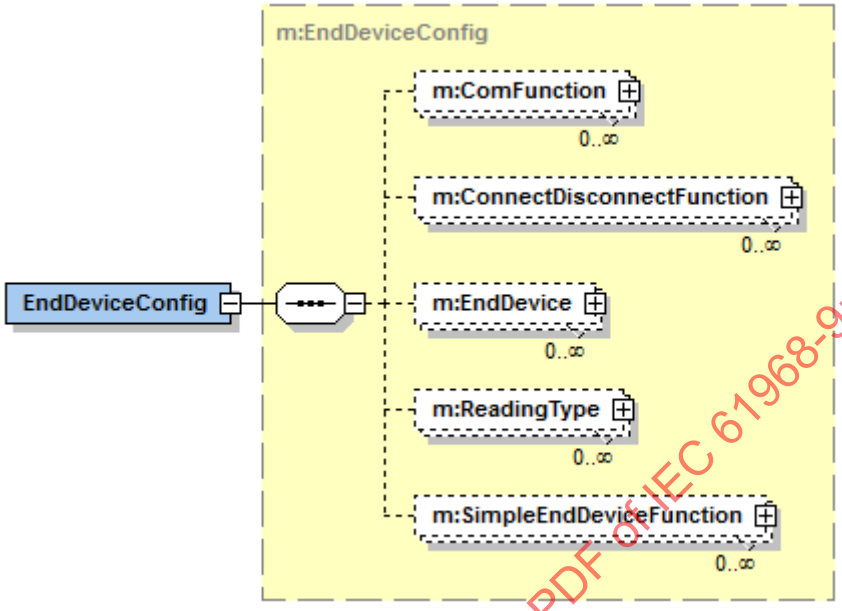
La Figure 58 est reproduite avec l'autorisation de l'UCAIug.

Figure 58 – Exemple de UsagePointLocationConfig

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5.8.3.6 EndDeviceConfig

Le diagramme à la Figure 59 décrit le haut niveau du message EndDeviceConfig qui est utilisé pour fournir une configuration basique des dispositifs terminaux.



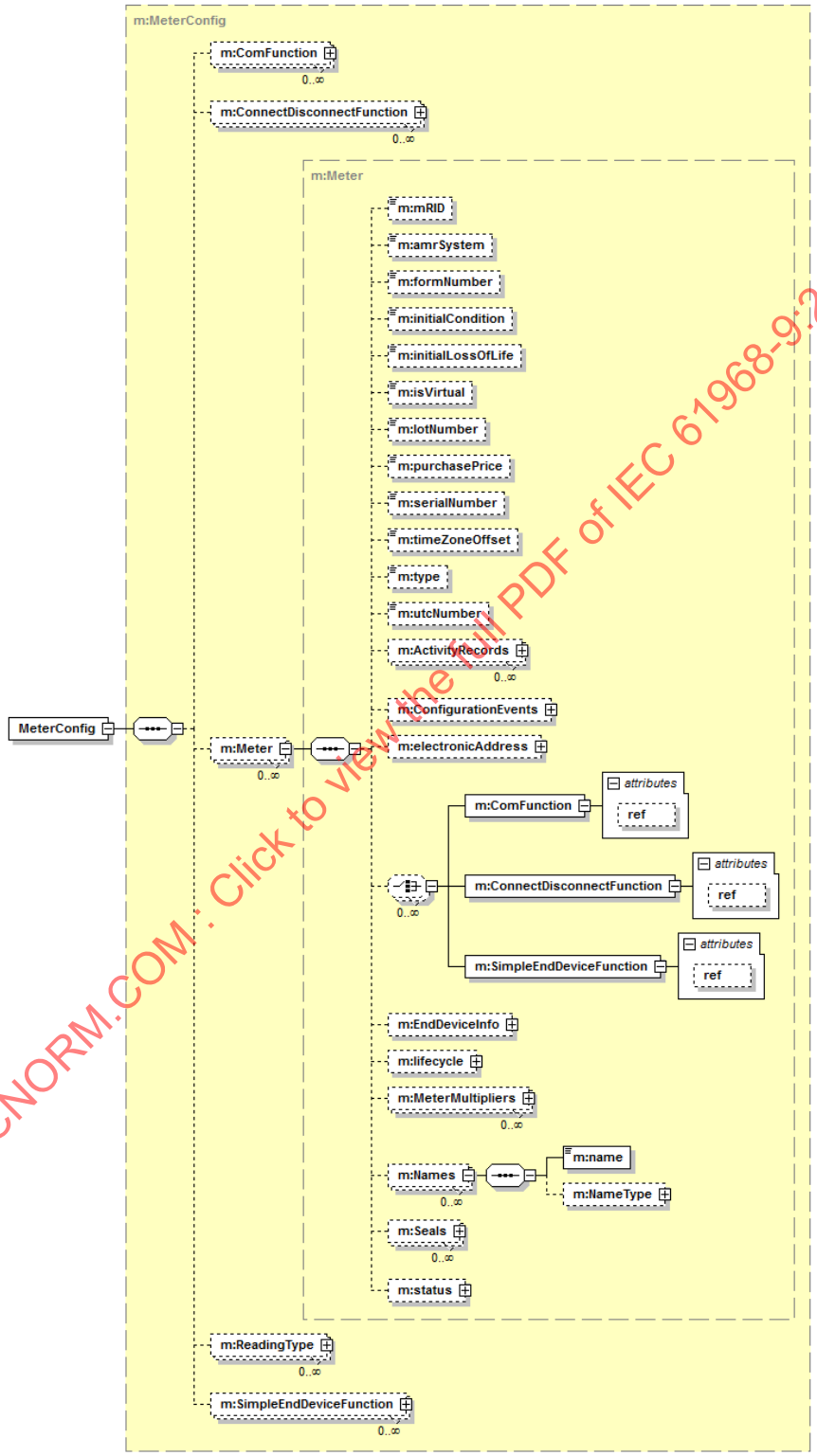
La Figure 59 est reproduite avec l'autorisation de l'UCAIug

Figure 59 – Format des messages de configuration de dispositif terminal

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5.8.3.7 MeterConfig

La structure de message à la Figure 60 est utilisée pour configurer les compteurs, avec laquelle il est possible de fournir des informations plus spécifiques aux compteurs.

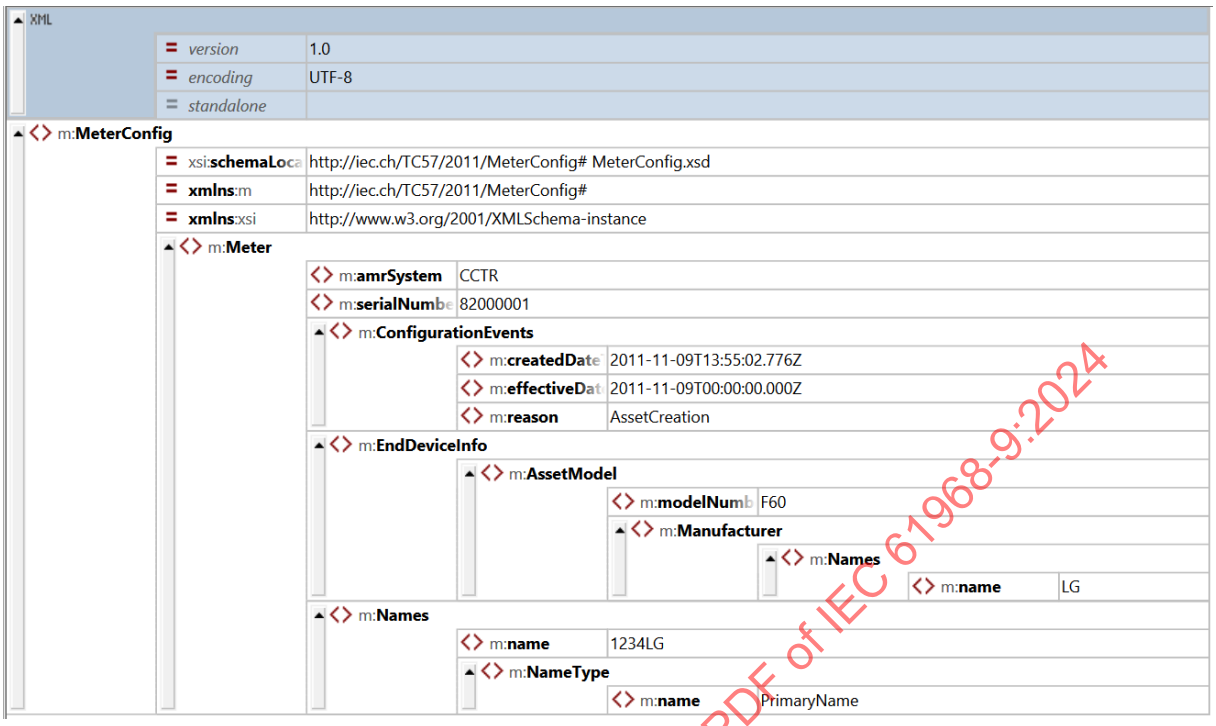


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La Figure 60 est reproduite avec l'autorisation de l'UCAIug.

Figure 60 – Message de configuration du compteur

Un exemple de charge utile de MeterConfig est présenté à la Figure 61.

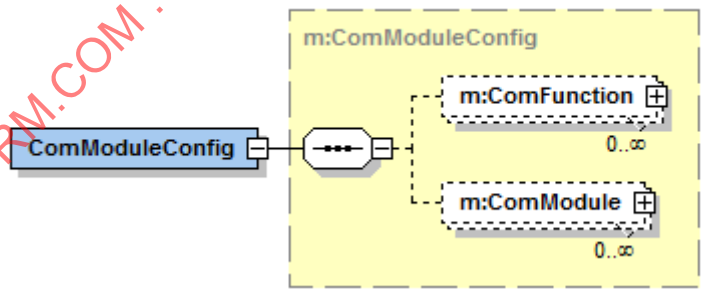


La Figure 61 est reproduite avec l'autorisation de l'UCAIug.

Figure 61 – Exemple de MeterConfig

5.8.3.8 ComModuleConfig

Le diagramme à la Figure 62 fournit la structure de haut niveau du message utilisé pour configurer les modules de communication.



La Figure 62 est reproduite avec l'autorisation de l'UCAIug.

Figure 62 – Format de message ComModuleConfig

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Annexe A
(informative)

Utilisation recommandée des verbes de types de messages

Une liste des verbes recommandés adaptés aux profils traités dans le présent document est fournie dans le Tableau A.1. Les interfaces de tous les systèmes ne prennent pas toutes en charge tous les verbes. Ces verbes sont ceux définis dans l'IEC 61968-100:2022. L'utilisation de l'IEC 61968-100 est recommandée mais non exigée. Un système peut prendre en charge une certaine combinaison de profils et de verbes qui diffèrent des suggestions ci-dessous.

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Tableau A.1 – Utilisation des verbes recommandés avec profils associés

Relève de la partie (n° de partie) de l'IEC 61968	Profil / Nom	create	change	update	delete	get	reply	created	changed	updated	deleted	cancel	canceled	execute	executed
Partie 8	AuxiliaryAgreement Config	X	X	X	X	X	X	X	X	X	X				
Partie 9	ComModuleConfig	X	X	X	X	X	X	X	X	X	X				
Partie 8	CustomerAccount Config	X	X	X	X	X	X	X	X	X	X				
Partie 8	CustomerAgreement Config	X	X	X	X	X	X	X	X	X	X				
Partie 8	CustomerConfig	X	X	X	X	X	X	X	X	X	X				
Partie 9	CustomerMeterDataSet					X	X								
Partie 9	EndDeviceConfig	X	X	X	X	X	X	X	X	X	X				
Partie 9	EndDeviceControls	X					X	X				X	X		
Partie 9	EndDeviceEvents	X				X	X	X							
Partie 9	EndDeviceGroups	X	X	X	X	X	X	X	X	X	X				
Partie 8	GetAuxiliaryAgreement Config					X	X								
Partie 9	GetComModuleConfig					X	X								
Partie 8	GetCustomerAccount Config					X	X								
Partie 8	GetCustomer AgreementConfig					X	X								
Partie 8	GetCustomerConfig					X	X								
Partie 9	GetCustomer MeterDataSet					X	X								
Partie 9	GetEndDeviceConfig					X	X								

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Relève de la partie (n° de partie) de l'IEC 61968	Profil / Nom	create	change	update	delete	get	reply	created	changed	updated	deleted	cancel	canceled	execute	executed
Partie 9	GetEndDeviceControls					X	X								
Partie 9	GetEndDeviceEvents					X	X								
Partie 9	GetEndDeviceGroups					X	X								
Partie 9	GetMeterConfig					X	X								
Partie 9	GetMeterReadings					X	X					X	X		
Partie 9	GetMeterRead Schedule					X	X								
Partie 8	GetMeterService Requests					X	X								
Partie 8	GetPricingStructure Config					X	X								
Partie 8	GetReceiptRecord					X	X								
Partie 8	GetServiceCategory Config					X	X								
Partie 8	GetServiceLocation Config					X	X								
Partie 8	GetServiceSupplier Config					X	X								
Partie 8	GetTransactionRecord					X	X								
Partie 9	GetUsagePointConfig					X	X								
Partie 9	GetUsagePointGroups					X	X								
Partie 9	GetUsagePoint LocationConfig					X	X								
Partie 100	LegacyObject IdentificationRevision Sets	X	X	X	X	X	X	X	X	X	X	X	X		

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Relève de la partie (n° de partie) de l'IEC 61968	Profil / Nom	create	change	update	delete	get	reply	created	changed	updated	deleted	cancel	canceled	execute	executed
Partie 9	MasterDataLinkage Config	X			X		X	X			X	X	X		
Partie 9	MeterConfig	X	X	X	X	X	X	X	X	X	X				
Partie 9	MeterReadings					X	X						X	X	
Partie 9	MeterReadSchedules	X	X	X	X	X	X	X	X	X	X				
Partie 8	MeterServiceRequests	X	X	X	X	X	X	X	X	X	X				
Partie 100	OperationSets													X	X
Partie 8	PricingStructureConfig	X	X	X	X	X	X	X	X	X	X				
Partie 8	ReceiptRecord	X	X	X	X	X	X	X	X	X	X				
Partie 8	ServiceCategoryConfig	X	X	X	X	X	X	X	X	X	X				
Partie 8	ServiceLocationConfig	X	X	X	X	X	X	X	X	X	X				
Partie 8	ServiceSupplierConfig	X	X	X	X	X	X	X	X	X	X				
Partie 8	TransactionRecord	X	X	X	X	X	X	X	X	X	X				
Partie 9	UsagePointConfig	X	X	X	X	X	X	X	X	X	X				
Partie 9	UsagePointGroups	X	X	X	X	X	X	X	X	X	X				
Partie 9	UsagePointLocation Config	X	X	X	X	X	X	X	X	X	X				

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Annexe B
(informative)

Codes d’erreur de réponse

Les codes définis dans l’IEC 61968-2:2013 (deuxième édition) ont été intégrés à l’IEC 61968-100:2022 (deuxième édition) et remplacés par de nouveaux codes. Le lecteur est invité à se reporter à l’IEC 61968-100 et à étudier la structure et les nouveaux codes de réponse qui ont été élaborés. Les nouveaux codes ont généralisé les codes figurant dans les éditions précédentes de l’IEC 61968-9. La deuxième édition de l’IEC 61968-9 comportait de nombreux codes spécifiques qui appelaient des défaillances spécifiques. Par exemple, les différents codes de l’IEC 61968-9:2013, tels que "éléments d'en-tête obligatoires manquants" et "éléments de charge utile obligatoires manquants", sont remplacés par un code plus générique "éléments obligatoires manquants" dans l’IEC 61968-100. En outre, la structure de l’IEC 61968-100 permet de signaler (par <ObjectID>) exactement les éléments qui ont provoqué le problème. Lorsque le code "6.0" est utilisé dans l’IEC 61968-100, il convient d’utiliser le champ <reason> pour indiquer un problème avec les règles de gestion. Par exemple, il peut exister une règle métier qui indique ‘’Débranchement autorisé uniquement pendant les heures de travail.’’ La violation de cette règle métier peut constituer le ‘’motif’’ de la défaillance.

L’IEC 61968-100:2022 (deuxième édition) offre des améliorations importantes par rapport à la première édition, et il convient que l'ensemble plus restreint de codes d'erreur de réponse qui y est présenté permette de faciliter les intégrations multipartites.

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Annexe C
(normative)

Procédure pour la création d'un nom de ReadingType

C.1 Généralités

L'énumération ReadingType est un identifiant important dans les messages MeterReading. La présente norme spécifie un profil considéré comme normatif. L'IEC 61968-9 a été élaborée compte tenu de plusieurs principes de conception à l'esprit:

1) il convient d'avoir des messages simples et à objectif général;
2) il convient qu'un message "Readings" puisse transporter tout type de valeur potentiellement présent dans un compteur, par exemple, la puissance, l'énergie, les comptes de manœuvre relais, les informations de statut et la devise. Il convient que Readings.ReadingType puisse réaliser la description, quelle que soit la valeur Readings.value;
3) il est plus simple pour un consommateur de données d'écarter les informations disponibles, mais non nécessaires, que de recréer les informations nécessaires mais non disponibles.

Ce troisième principe implique qu'il convient d'avoir des producteurs de données aussi explicites que possible lors de la publication des données. Par conséquent, il convient que les données soient totalement autodescriptives afin que d'autres consommateurs accédant aux données (peut-être lorsqu'elles résident dans un entrepôt de données) puissent déterminer par eux-mêmes la compatibilité de l'utilisation des données. Ainsi, il n'est pas nécessaire que le consommateur de données tente de reconstruire tout accord tacite en place au moment de la publication.

Il est admis qu'il existe des situations dans lesquelles un consommateur de données (qui formule une demande d'informations) peut ne pas connaître toutes les informations détaillées spécifiques concernant la demande. Par exemple, un demandeur peut souhaiter obtenir la "tension" à un emplacement donné. Il peut ne pas savoir si le service est monophasé ou polyphasé. Il convient qu'il puisse effectuer sa demande selon les connaissances dont il dispose, tout comme il convient que le producteur de données tente d'y répondre et de fournir des informations détaillées dans la réponse selon le cas. Cette situation peut donner un ou des ReadingTypes utilisés dans la réponse légèrement différents du ReadingType utilisé dans la demande

C.2 Comprendre les attributs importants d'un nom d'élément de données

C.2.1 Généralités

Les éléments de données peuvent être décrits en tant que 18 attributs clés (dont plusieurs sont des attributs composés). Chaque attribut comprend la caractéristique qu'une valeur égale à zéro ("0") signifie qu'il n'est pas applicable à la description. Les attributs composés constituent la seule exception à cette règle. Dans ce cas, deux zéros signifient que l'attribut n'est pas applicable.

C.2.2 Attribute #1, macroPeriod

L'attribut macroPeriod décrit un aspect des données qui reflète la manière dont elles sont consultées ou saisies au cours d'une longue période. Ces données sont énumérées dans le Tableau C.1.

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Tableau C.1 – Énumérations des périodes concernées

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
8	billingPeriod	Saisi pendant la période de facturation qui débute à minuit au premier jour de la période de facturation (comme cela est défini par le jour du cycle de facturation). Si cela survient pendant la période de facturation actuelle, il indique une période depuis le début de la période de facturation actuelle jusqu'à "maintenant".	N
11	daily	Période quotidienne qui débute à minuit. Si cela survient pendant la journée en cours, il indique la période à partir de minuit jusqu'à "maintenant".	N
13	monthly	Période mensuelle qui débute à minuit le premier jour du mois. Si cela survient pendant le mois en cours, il indique la période à partir du début du mois jusqu'à "maintenant".	N
22	seasonal	Une saison qui s'étend sur plusieurs mois Par exemple, un cycle fondé sur l'"été", le "printemps", l'"automne" et l'"hiver". Si cela survient pendant le mois en cours, il indique la période à partir du début de la saison actuelle jusqu'à ‘‘maintenant".	N
24	weekly	Période hebdomadaire qui débute à minuit le premier jour de la semaine et se termine l'instant avant minuit le dernier jour de la semaine. Si cela survient pendant la semaine en cours, il indique la période à partir du début de la semaine jusqu'à ‘‘maintenant".	N
32	specifiedPeriod	Pour la période définie par le début et la fin de l'élément TimePeriod dans le message.	N

C.2.3 Attribute #2, aggregate

C.2.3.1 Généralités

La méthode d'observation d'un relevé dans l'agrégat ("aggregate") (par comparaison avec d'autres) sert de second attribut. Les énumérations possibles comprennent celles décrites dans le Tableau C.2. Cet attribut peut être utilisé pour définir une opération mathématique réalisée sur la période concernée définie par l'attribute #1.

Tableau C.2 – Énumérations des qualificateurs de données

Reproduit avec l'autorisation de l'UCAIug.

Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
2	average		N
4	excess	La valeur représente une quantité au-dessus de laquelle un seuil a été dépassé.	I
5	highThreshold	La valeur représente un seuil programmé.	I
7	lowThreshold	La valeur représente un seuil programmé.	I
8	maximum	Valeur la plus élevée observée	N
9	minimum	Valeur la plus petite observée	N
11	nominal		I
12	normal		I
16	secondMaximum	Deuxième valeur la plus élevée observée	N
17	secondMinimum	Deuxième valeur la plus petite observée	N

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Code	Énumération	Commentaires	Statut normatif
23	thirdMaximum	Troisième valeur la plus élevée observée	N
24	fourthMaximum	Quatrième valeur la plus élevée observée	N
25	fifthMaximum	Cinquième valeur la plus élevée observée	N
26	sum	La somme cumulée	N
27	high	Généralement utilisé pour identifier le port du flux volumique élevé d'un compteur d'eau composé.	I
28	low	Généralement utilisé pour identifier le port du flux volumique faible d'un compteur d'eau composé.	I
29	Standard Deviation Population	L'écart-type d'une population (indiqué par un sigma minuscule)	N
30	Standard Deviation Sample	L'écart-type d'un échantillon prélevé sur une population (habituellement indiqué par un 's' minuscule)	N
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition			

C.2.4 Attribute #3, measuringPeriod

C.2.4.1 Généralités

L'attribut measuringPeriod fournit un "adjectif" pour décrire les aspects d'une "période" en relation avec le mesurage. Cet attribut décrit un "attribut temps" intrinsèque ou fondamental à la valeur de relevé. L'attribut fait référence à la manière dont la valeur a initialement été mesurée et non à la fréquence à laquelle elle est consignée ou présentée. (Par exemple, un intervalle horaire de données de consommation aurait un attribut de valeur "hourly". Cependant, dans le cas d'une valeur de tension échantillonnée sur une base horaire, le schéma meterReadings porterait les informations de taille d'intervalle "hourly".) Les valeurs énumérées comprennent les valeurs décrites dans le Tableau C.3. Par comparaison avec l'attribut #1, la measuringPeriod est un intervalle de temps de courte durée caractéristique de la méthode de saisie du relevé, tandis que la macroPeriod est un intervalle de temps de longue durée relatif à la méthode de consignation de ce même relevé. Ces attributs sont appelés uniquement si la description des données le nécessite. Pour de nombreux relevés par cadran, il est nécessaire que seul l'horodatage d'accompagnement soit significatif.

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Tableau C.3 – Énumérations de measuringPeriod

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
1	tenMinute	10 min	N
2	fifteenMinute	15 min	N
3	oneMinute	1 min	N
4	twentyfourHour	24 min	N
5	thirtyMinute	30 min	N
6	fiveMinute	5 min	N
7	sixtyMinute	60 min	N
10	twoMinute	2 min	N
14	threeMinute	3 min	N

Code	Énumération	Commentaires	Statut normatif
15	present	Dans la période présente	I
16	previous	Dans le cycle et l'ensemble de données mensuels précédents	I
31	twentyMinute	Intervalle de 20 min	N
50	fixedBlock60Min	Bloc fixe de 60 min	N
51	fixedBlock30Min	Bloc fixe de 30 min	N
52	fixedBlock20Min	Bloc fixe de 20 min	N
53	fixedBlock15Min	Bloc fixe de 15 min	N
54	fixedBlock10Min	Bloc fixe de 10 min	N
55	fixedBlock5Min	Bloc fixe de 5 min	N
56	fixedBlock1Min	Bloc fixe de 1 min	N
57	rollingBlock60MinIntvl30MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 30 min	N
58	rollingBlock60MinIntvl20MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 20 min	N
59	rollingBlock60MinIntvl15MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 15 min	N
60	rollingBlock60MinIntvl12MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 12 min	N
61	rollingBlock60MinIntvl10MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 10 min	N
62	rollingBlock60MinIntvl6MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 6 min	N
63	rollingBlock60MinIntvl5MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 5 min	N
64	rollingBlock60MinIntvl4MinSubIntvl	bloc roulant de 60 min avec des sous-intervalles de 4 min	N
65	rollingBlock30MinIntvl15MinSubIntvl	bloc roulant de 30 min avec des sous-intervalles de 15 min	N
66	rollingBlock30MinIntvl10MinSubIntvl	bloc roulant de 30 min avec des sous-intervalles de 10 min	N
67	rollingBlock30MinIntvl6MinSubIntvl	bloc roulant de 30 min avec des sous-intervalles de 6 min	N
68	rollingBlock30MinIntvl5MinSubIntvl	bloc roulant de 30 min avec des sous-intervalles de 5 min	N
69	rollingBlock30MinIntvl3MinSubIntvl	bloc roulant de 30 min avec des sous-intervalles de 3 min	N
70	rollingBlock30MinIntvl2MinSubIntvl	bloc roulant de 30 min avec des sous-intervalles de 2 min	N
71	rollingBlock15MinIntvl5MinSubIntvl	bloc roulant de 15 min avec des sous-intervalles de 5 min	N
72	rollingBlock15MinIntvl3MinSubIntvl	bloc roulant de 15 min avec des sous-intervalles de 3 min	N
73	rollingBlock15MinIntvl1MinSubIntvl	bloc roulant de 15 min avec des sous-intervalles de 1 min	N
74	rollingBlock10MinIntvl5MinSubIntvl	bloc roulant de 10 min avec des sous-intervalles de 5 min	N
75	rollingBlock10MinIntvl2MinSubIntvl	bloc roulant de 10 min avec des sous-intervalles de 2 min	N
76	rollingBlock10MinIntvl1MinSubIntvl	bloc roulant de 10 min avec des sous-intervalles de 1 min	N

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Code	Énumération	Commentaires	Statut normatif
77	rollingBlock5MinIntvl1MinSubIntvl	bloc roulant de 5 min avec des sous-intervalles de 1 min	N
78	twelveMinute	12 min	N
79	twoHour	2 h	N
80	fourHour	4 h	N
81	sixHour	6 h	N
82	twelveHour	12 h	N
83	threeHour	3 h	N
100	specifiedInterval	La durée de l'intervalle est décrite dans l'attribute #10 en secondes. Il convient que l'attribute #11 soit "1" pour les secondes entières	N
101	specifiedFixedBlock	La durée du bloc fixe est décrite dans l'attribute #10 en secondes. Il convient que l'attribute #11 soit "1" pour les secondes entières	N
102	specifiedRollingBlock	La taille du bloc roulant est décrite par l'attribute #10 en secondes et la taille du sous-intervalle par l'attribute #11 en secondes.	N
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition			

En général, les compteurs consignent la demande sous une forme qui est mesurée au cours d'une fraction d'une heure. Pour leur part cependant, les applications d'entreprise supposent généralement que la demande (qui a une unité de mesure en "kW" ou "kVAr") est normée à 1 h. Le système de comptage doit réaliser cette transformation avant la publication et l'utilisation par les autres systèmes. Le scalaire utilisé est choisi sur la base de la taille du bloc (et non d'une quelconque taille de sous-intervalle). Lesdits scalaires sont répertoriés dans le Tableau C.4.

Tableau C.4 – Scalaires de normalisation de la demande

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Dimension du bloc de demande	Scalaire de normalisation
1 h	1
30 min	2
20 min	3
15 min	4
10 min	6
1 min	60

Par exemple, avant la normalisation, il peut être indiqué que les données "15minuteFixedBlock" disposent d'unités de "kilo quart-watt-heure". Après la normalisation, l'unité de mesure devient "kilo-watt-heure". Puisque "kilo quart-watt-heure" n'est pas une unité de mesure utilisable, il convient que les systèmes qui ont besoin de communiquer les données brutes sous cette forme utilisent une unité de mesure telle que "compte" et l'élément PendingCalculation qui transporte le scalaire (ou multiplicateur) nécessaire et l'unité de mesure résultante lorsqu'elle est appliquée.

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C.2.4.2 Utilisations courantes

Les données d'intervalles figurent généralement dans les tailles "60 min", "30 min" et "15 min". Des tailles plus grandes telles que "24 h" et plus petites allant jusqu'à "1 min" sont également possibles mais moins courantes. Il convient que les utilisateurs de la norme exploitent les énumérations d'intervalles existants quand elles existent, mais si la taille d'intervalle nécessaire n'existe pas, un "specifiedInterval" peut être utilisé. Cela permet à l'énumération elle-même d'intégrer la taille de l'intervalle dans l'énumération. De la même manière, les tailles non courantes de blocs fixes et roulants peuvent être indiquées.

L'IEC 61968-9:2009 proposait d'utiliser les termes "Décalé", "Présent" et "Précédent" en tant qu'adjectifs afin de décrire l'état du compteur. Bien que cela fonctionne correctement pour publier les données à partir d'un système de comptage, ils peuvent être difficiles à utiliser entre d'autres applications d'entreprise. Il semble que si "present" et "previous" sont des attributs importants de données quand ils sont au niveau du compteur; plus l'un s'éloigne du compteur, moins ces attributs deviennent importants. La présente édition de l'IEC 61968-9 propose de reposer sur la durée pendant laquelle les données sont enregistrées pour déterminer si une valeur appartient à la période de facturation "present" ou "previous" plutôt qu'aux énumérations "present" ou "previous". En outre, les règles utilisées pour calculer la demande sont assez importantes. Une seule demande "Daily" n'est généralement pas adaptée pour calculer la facture d'un client. Un ensemble complet de demandes "Daily" ou une seule demande de "Billing'' sont généralement exigés. Il convient de faire une distinction entre les périodes d'observation Daily/Billing/Seasonal dans le ReadingType. Dans tous les cas, l'horodatage associé à la demande maximale peut être utilisé pour savoir à quel(le) jour, mois ou saison correspond une demande "daily", "billing" ou "seasonal".

Dans une entreprise de distribution dans laquelle existent plusieurs techniques de saisie de la demande, il devient important de communiquer entre les systèmes la définition selon laquelle les données de demande sont saisies. Les énumérations sont fournies dans la présente édition, ce qui permet au producteur de données d'être aussi précis que possible lors de la description du type de données de demande transmises.

C.2.5 Attribute #4, accumulation

C.2.5.1 Généralités

L'attribut de cumul ("accumulation") indique comment la valeur est représentée aux fins de cumul au fil du temps. Les valeurs énumérées comprennent celles décrites dans le Tableau C.5.

Un avantage que présente le fait de déclarer explicitement le comportement de cumul comme partie du readingType dans un échange entre un MS et une MDM est d'aider la MDM à assurer que les règles de validation appropriées sont appliquées aux données fournies par le MS.

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Tableau C.5 – Énumérations des comportements de cumul

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable ou donné implicitement par l'unité de mesure.	N
1	bulkQuantity	Une valeur issue d'un registre qui représente la quantité en gros d'un produit. Cette quantité est calculée comme l'intégrale du taux d'utilisation du produit. En général, cette valeur est utilisée comme base du relevé au cadran sur le compteur et, de ce fait, se réinitialise après avoir atteint une valeur de cadran maximale. NOTE 1 Avec le système de comptage, le comportement d'addition implique généralement un comportement de soustraction afin que la valeur présentée soit toujours une valeur positive (par exemple, un entier non signé ou un décimal positif.) Dans le cadre de la communication de données entre les applications d'entreprise, une valeur négative peut cependant survenir dans un cas tel que le comptage de réseau. NOTE 2 Un BulkQuantity fait principalement référence au relevé au cadran et non à la consommation au cours d'une période spécifique.	N
2	continuousCumulative	La somme des valeurs dans la période de facturation précédente et de la valeur dans la présente période. Note: "ContinuousCumulative" est généralement utilisé conjointement à "demand". Le "ContinuousCumulative Demand" est la somme cumulée des valeurs de demande maximale de la période de facturation précédente (qui survient à chaque réinitialisation de la demande) ajoutée à la valeur de demande maximale de la période présente (qui doit pourtant être réinitialisée).	N
3	cumulative	La somme des valeurs dans les périodes de facturation antérieures. Note: "cumulative" est généralement utilisé conjointement à "demand". Chaque réinitialisation de la demande fait que la valeur de demande maximale pour la période de facturation présente (depuis la dernière réinitialisation de la demande) s'ajoute en tant que total cumulé de toutes les demandes maximales. Ainsi, au lieu de "remettre à zéro" le registre de demande, une réinitialisation de la demande provoque l'ajout de la demande maximale présente à ce total cumulé.	N
4	deltaData	La différence entre la valeur à la fin de l'intervalle spécifié et au début de l'intervalle. Cela est utilisé pour les données d'intervalles différentielles. NOTE 3 Une application commune vise les données de profil de charge, une autre utilisation peut consister à consigner le nombre d'événements au sein d'un intervalle (tel que le nombre d'excitations de l'équipement pendant la période spécifiée.)	N
6	indicating	Comme si une aiguille pointait sur le compteur sur une valeur pour indiquer la valeur courante. (NOTE: une valeur "indicating'' est généralement mesurée sur des centaines de millisecondes ou plus, ou peut impliquer un mécanisme "poussant" pour saisir une valeur. Comparer cette valeur à "instantaneous" qui est mesuré sur une plus courte durée).	N
9	summation	Une forme de cumul qui est sélective par rapport au temps. NOTE 4 La "Somme" peut être considérée comme une spécialisation de "BulkQuantity" selon les règles d'héritage avec lesquelles la "Somme" cumule de manière sélective les impulsions au cours d'un modèle temporel et "BulkQuantity" cumule les impulsions tout le temps.	I

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Code	Énumération	Commentaires	Statut normatif
10	timeDelay	Une forme de calcul qui introduit une caractéristique de retard temporel dans la valeur de la donnée	I
12	instantaneous	Généralement mesuré sur la période la plus rapide admise par la définition de la mesure (habituellement des millisecondes ou des dizaines de millisecondes.) (NOTE: “Instantaneous” a été déplacé vers l'attribute #4 de l’IEC 61968-9 Ed2 depuis l’attribute #1 dans l’IEC 61968-9:2009.)	N
13	latchingQuantity	Lorsque cette description est appliquée à une valeur mesurée, cela signifie que la valeur est une grandeur cumulée indépendante du temps comme un BulkQuantity, hormis qu'il s'insère dans la valeur maximale lorsqu'il atteint cette valeur. Tout cumul supplémentaire (positif ou négatif) est ignoré jusqu'à ce qu’une réinitialisation se produise. NOTE 5 Un LatchingQuantity peut également survenir dans la direction descendante, lorsqu'il atteint une valeur minimale. Les termes "maximal" ou "minimal" sont généralement compris en tant qu'attribut quand ce type de comportement de cumul est présent. Lorsque cette description est appliquée à une valeur encodée (unité de mesure = "Code"), cela signifie que la valeur à un ou plusieurs bits verrouillés. La condition qui a défini le bit peut être évaporée depuis longtemps. Dans tous les cas, l’horodatage qui accompagne la valeur peut ne pas coïncider avec le moment de configuration initiale de la valeur. Dans les deux cas, il est nécessaire qu’un système doive réaliser une opération pour effacer la valeur verrouillée.	N
14	boundedQuantity	Une grandeur cumulée indépendante du temps comme un BulkQuantity ou un LatchingQuantity, sauf que le cumul s'arrête aux valeurs maximale ou minimale. Lorsque le maximum est atteint, tout cumul positif supplémentaire est ignoré, mais tout cumul négatif peut être accepté (diminuant ainsi le compteur). De la même manière, lorsque la limite négative est atteinte, tout cumul négatif supplémentaire est ignoré, mais tout cumul positif est accepté (augmentant ainsi le compteur).	N
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition			

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C.2.5.2 Types d'IntervalReadings

L’IEC 61968-9:2009 indiquait que les IntervalReadings peuvent être exprimés dans plusieurs styles qualifiés par l'attribut #2 (soit "Incremental", "Relative" ou "Absolute") et également décrits “RecordedData” et “DeltaData”.

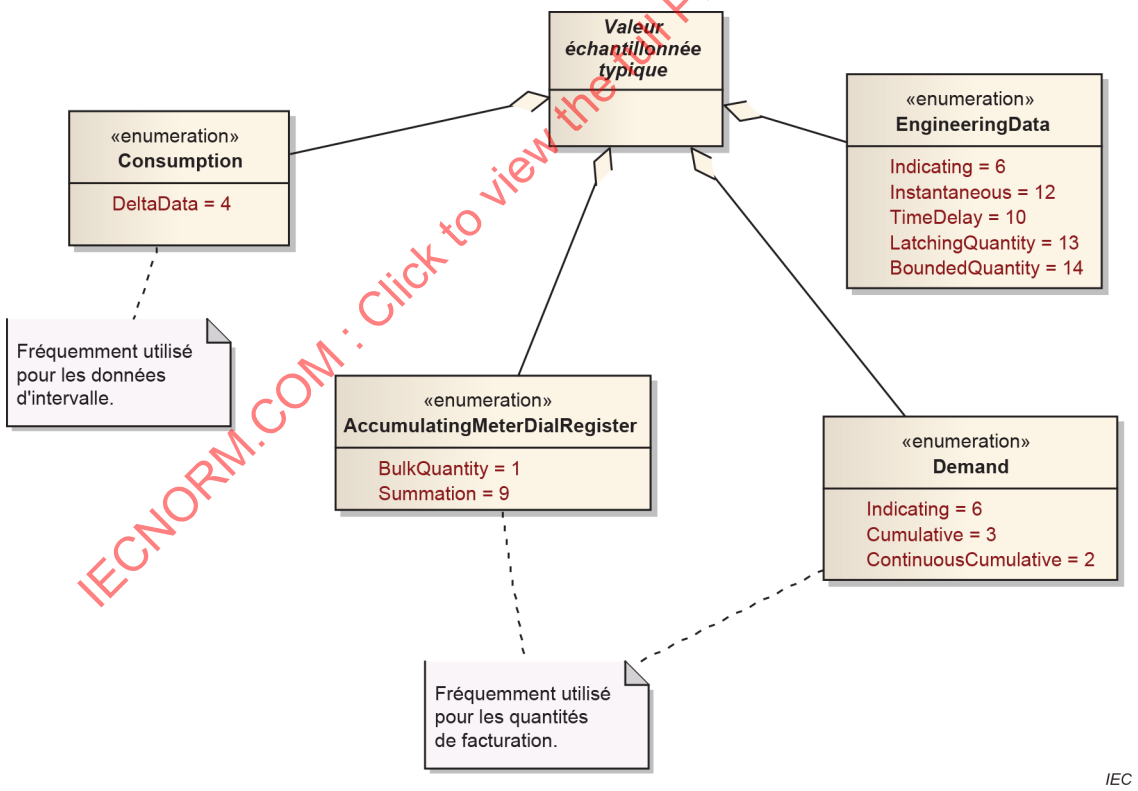
La présente édition de l’IEC 61968-9 s’est efforcée de simplifier la présentation des données. Une valeur échantillonnée appelée relevé d'"absolute interval" dans l’IEC 61968-9:2009 peut être présentée sans le mot "absolute". Effectivement, lesdits relevés peuvent être publiés dans la Partie MeterReading.Readings du message en tant que relevés ordinaires plutôt que dans la Partie MeterReading.IntervalBlock.IntervalReadings du message. Le concept de "Relative IntervalData" ne figure plus dans les énumérations car il est pris en charge dans le schéma de message en tant que forme de scalaires de données "pending’’ (en attente).

C.2.5.3 Utilisations courantes

Les attributs décrits dans le sont couramment utilisés de manières particulières pour décrire les valeurs d'énergie et de demande. Ces habitudes sont décrites dans le Tableau C.6 et représentées à la Figure C.1.

Tableau C.6 – Énumérations des comportements habituels de cumul

Type de données de métrologie	Utilisations courantes
Énergie (mesurée par le simple comptage et affichée pour l'utilisateur sur l'avant du compteur.)	BulkQuantity
Demande (généralement mesurée par intégration d'une valeur de puissance sur une période spécifique.)	Indicating, Cumulative, ContinuousCumulative
Puissance (généralement mesurée en temps réel dans les compteurs à semiconducteurs.)	Instantaneous, TimeDelay
Données d'énergie selon le temps d'utilisation (TOU) (mesurées par cumul des valeurs dans les registres assortis selon l'heure du jour et le jour de la semaine.)	Summation
Données de demande selon le temps d'utilisation (TOU) (dérivées par intégration des valeurs d'énergie sur un intervalle de demande spécifié, avec des dépendances supplémentaires sur le calendrier TOU.)	Indicating, Cumulative, ou ContinuousCumulative
Compteurs	BulkQuantity, LatchingQuantity



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Figure C.1 – Énumérations typiques des comportements de cumulAttribute #5, flowDirection

C.2.6.1 Généralités

Tout ce qui implique le courant peut avoir un sens d'écoulement ("flowDirection"). Le sens d'écoulement est très important, mais lorsqu'il est inconnu, il convient de le laisser non précisé. Les énumérations possibles comprennent celles décrites dans le Tableau C.7.

Le “sens d’écoulement” englobe le concept électrique de comptage à quatre quadrants, ainsi que la nécessité pour les différents tarifs régionaux de décrire le mode de facturation de l’énergie.

Il convient d’admettre que les pratiques tarifaires dans différentes parties du monde reposent sur différents cadres de référence. La plupart des régions définissent la fourniture d’énergie selon un cadre de référence établi par les producteurs. L’énergie générée par l’entreprise de distribution est transmise par son réseau, le compteur et dans le câblage du client. Le compteur capture l’énergie vendue au client. Cependant, certaines régions considèrent le point de vue du client. Un cadre de référence du client signifie que l’énergie peut être achetée par un consommateur à partir du réseau. Tout flux direct qui passe par le compteur enregistre l’énergie achetée par le consommateur.

La présente norme tente d’appréhender l’ensemble de la question du cadre de référence en admettant que ces deux points de vue sont équivalents. L’énergie achetée est l’énergie vendue. Le flux “direct” depuis le côté “source” du compteur vers le côté “charge” du compteur (ou dans des termes équivalents “V+” et “V–”) génère un mesurage qui peut être utilisé pour toute définition du tarif. La présente norme envisage le code numérique pour un concept sémantique donné comme “normatif” tandis que le texte utilisé pour désigner le concept est considéré comme “informatif”.

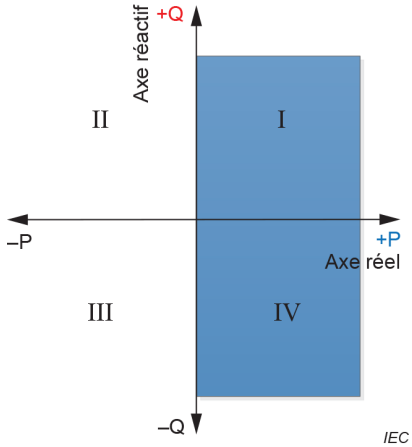
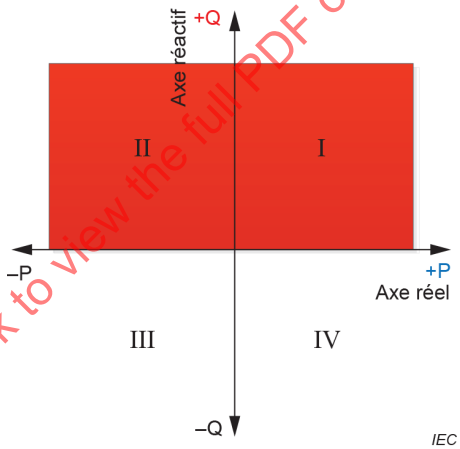
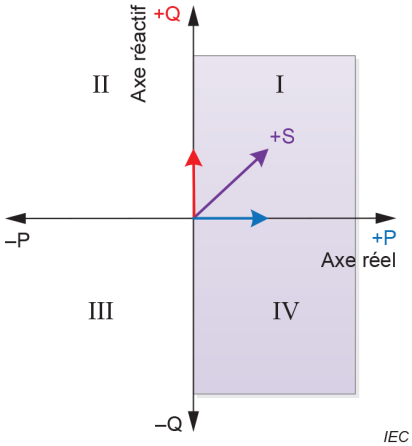
Les véritables différences linguistiques parmi les différents pays participants de l’IEC justifient en second lieu le fait de conserver le caractère informatif des descriptions textuelles.

Tableau C.7 – Énumération des sens d'écoulement

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Code	Nom d'énumération (informatif)	Commentaires	Statut normatif de code
0	none	Non applicable (N/A)	N
1	forward	Connu aussi comme "Remis" ou "importé" comme cela est défini dans l’IEC TS 61968-2. L'énergie active directe est une valeur positive en kWh qu’il est prévu de trouver naturellement lorsque l'énergie est fournie par l'entreprise de distribution et consommée au niveau du service. L’énergie active directe est cumulée dans un service monophasé par observation du débit de puissance (+P) dans les quadrants I et IV.	N

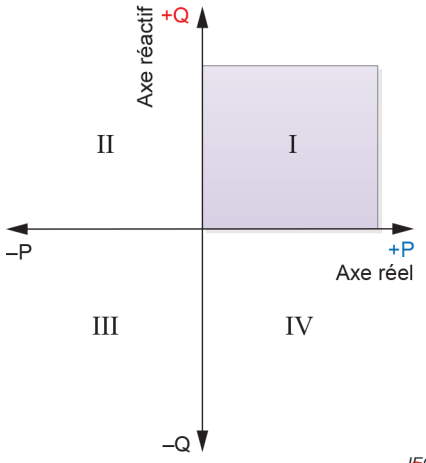
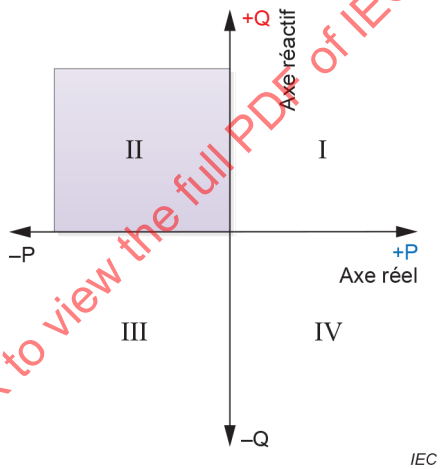
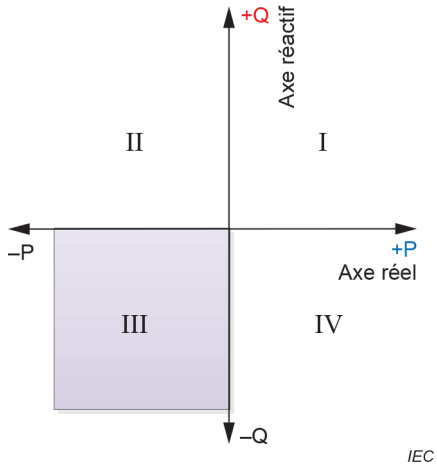
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Code	Nom d'énumération (informatif)	Commentaires	Statut normatif de code
		 IEC L'énergie réactive directe est une valeur positive en VArh qu'il est prévu de trouver naturellement en présence de charges inductives. L'énergie réactive directe est cumulée dans un service monophasé par observation du débit de puissance (+Q) dans les quadrants I et II.  IEC L'énergie apparente directe est une valeur positive en VAh tout comme l'énergie active directe. Elle est cumulée dans un service monophasé par observation du débit de puissance (S = P + jQ) dans les quadrants I et IV.  IEC Dans le comptage polyphasé, le registre d'énergie directe est incrémenté lorsque la somme des énergies phasées est supérieure à zéro: $Energy_A + Energy_B + Energy_C > 0$	

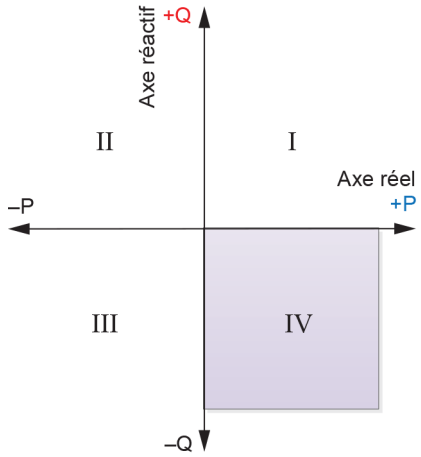
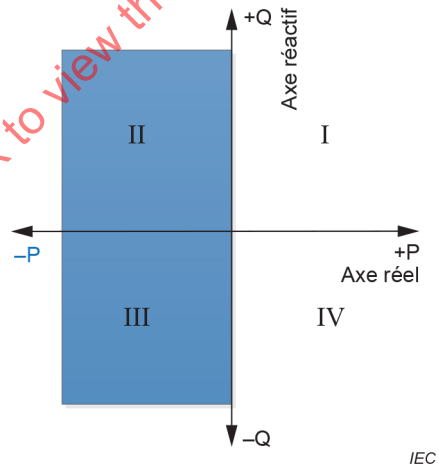
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Code	Nom d'énumération (informatif)	Commentaires	Statut normatif de code
2	lagging	Typiquement utilisé pour décrire qu'un facteur de puissance est en retard par rapport à la valeur de référence (ou indiquer que le courant est en retard par rapport à la tension.) NOTE 1 Lorsqu'il est utilisé pour décrire le facteur de puissance, le terme "lagging" implique que le FP est négatif. Dans ce cas, le terme "lagging" prend la place du signe négatif. Si une valeur FP signée doit être transmise par le producteur de données, il convient alors d'utiliser zéro énumération des sens d'écoulement (none (aucune)) afin d'éviter la création potentielle d'une expression qui emploie un double négatif. Il convient que le consommateur de données puisse dire à partir du signe des données si le FP est en avance ou en retard. Ce principe est analogue au concept qui stipule que l'énergie "inverse" est une valeur négative implicite et publier une valeur inverse négative serait ambigu. NOTE 2 Des facteurs de puissance en retard indiquent généralement des charges inductives.	N
3	leading	Typiquement utilisé pour décrire qu'un facteur de puissance est en avance par rapport à la valeur de référence (ou indiquer que le courant est en avance par rapport à la tension.) NOTE 3 Des facteurs de puissance en avance indiquent généralement des charges capacitives.	N
4	net	|Forward| – |Reverse| (c'est-à-dire, direct – inverse), voir l'IECTS 61968-2. NOTE 4 Dans certains systèmes, la valeur passée comme valeur "nette" peut devenir négative. Dans d'autres systèmes, la valeur passée comme valeur "net", toujours un nombre positif, ajoute et soustrait selon les besoins.	N
5	q1plusQ2	Quadrants positifs réactifs.	I
7	q1plusQ3	Quadrants 1 et 3	I
8	q1plusQ4	Les quadrants 1 et 4 représentent habituellement l'énergie active directe	I
9	q1minusQ4	Q1 moins Q4	I
10	q2plusQ3	Les quadrants 2 et 3 représentent habituellement l'énergie active inverse	I
11	q2plusQ4	Quadrants 2 et 4	I
12	q2minusQ3	Q2 moins Q3	I
13	q3plusQ4	Quadrants négatifs réactifs.	I
14	q3minusQ2	Q3 moins Q2	I

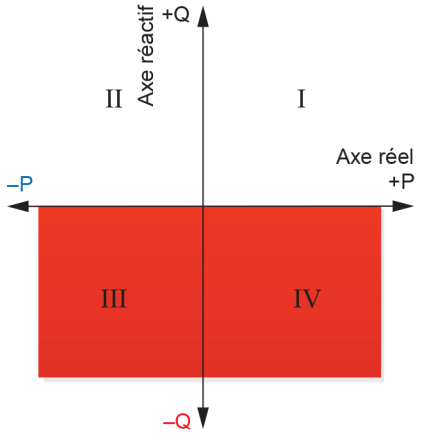
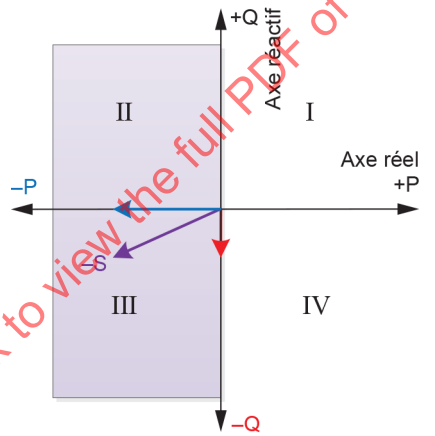
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Code	Nom d'énumération (informatif)	Commentaires	Statut normatif de code
15	quadrant1	Q1 uniquement 	I
16	quadrant2	Q2 uniquement 	I
17	quadrant3	Q3 uniquement 	I

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Code	Nom d'énumération (informatif)	Commentaires	Statut normatif de code
18	quadrant4	Q4 uniquement  	I
19	inverse	L'énergie active inverse est équivalente à "reçu" ou "exporté" comme cela est défini dans l'IEC TS 61968-2. L'énergie active inverse est une valeur positive en kWh qu'il est prévu de trouver lorsque l'énergie est produite et réalimentée par le service sur le réseau de l'entreprise de distribution. L'énergie active inverse est cumulée dans un service monophasé par observation du débit de puissance (- P) dans les quadrants II et III.  L'énergie réactive inverse est une valeur positive en VArh qu'il est prévu de trouver en présence de charges capacitives et d'un facteur de puissance en avance. L'énergie réactive inverse est cumulée dans un service monophasé par observation du débit de puissance (- Q) dans les quadrants III et IV.	N

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Code	Nom d'énumération (informatif)	Commentaires	Statut normatif de code
		 IEC L'énergie apparente inverse est une valeur positive en VAh tout comme l'énergie active inverse. Elle est cumulée dans un service monophasé par observation du débit de puissance (S = P + jQ) dans les quadrants II et III.  IEC Dans le comptage polyphasé, le registre d'énergie inverse est incrémenté lorsque la somme des énergies phasées est inférieure à zéro: $Energy_A + Energy_B + Energy_C < 0$ NOTE 5 La valeur passée en tant que valeur inverse est toujours une valeur positive. Il est entendu par l'étiquette "inverse" qu'elle représente un écoulement négatif.	
20	total	|Forward| + |Reverse| (c'est-à-dire, direct – inverse), voir l'IEC TS 61968-2. La somme des produits dans tous les quadrants Q1+Q2+Q3+Q4. Dans le comptage polyphasé, le registre d'énergie totale est incrémenté lorsque la valeur absolue de la somme des énergies phasées est supérieure à zéro: $\lvert Energy_A + Energy_B + Energy_C \rvert > 0$	N

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Code	Nom d'énumération (informatif)	Commentaires	Statut normatif de code
21	totalByPhase	Dans le comptage polyphasé, le registre d'énergie totale par phase est incrémenté lorsque la somme des valeurs absolues des énergies phasées est supérieure à zéro: $\lvert Energy_A \rvert + \lvert Energy_B \rvert + \lvert Energy_C \rvert > 0$ Dans le cadre du comptage monophasé, les formules pour "Total" et "Total par phase" sont réduites à la même expression. Toutefois, à des fins de communication, il convient d'utiliser l'énumération "Total" avec des données du compteur monophasé.	N
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition			

C.2.6.2 Utilisations courantes

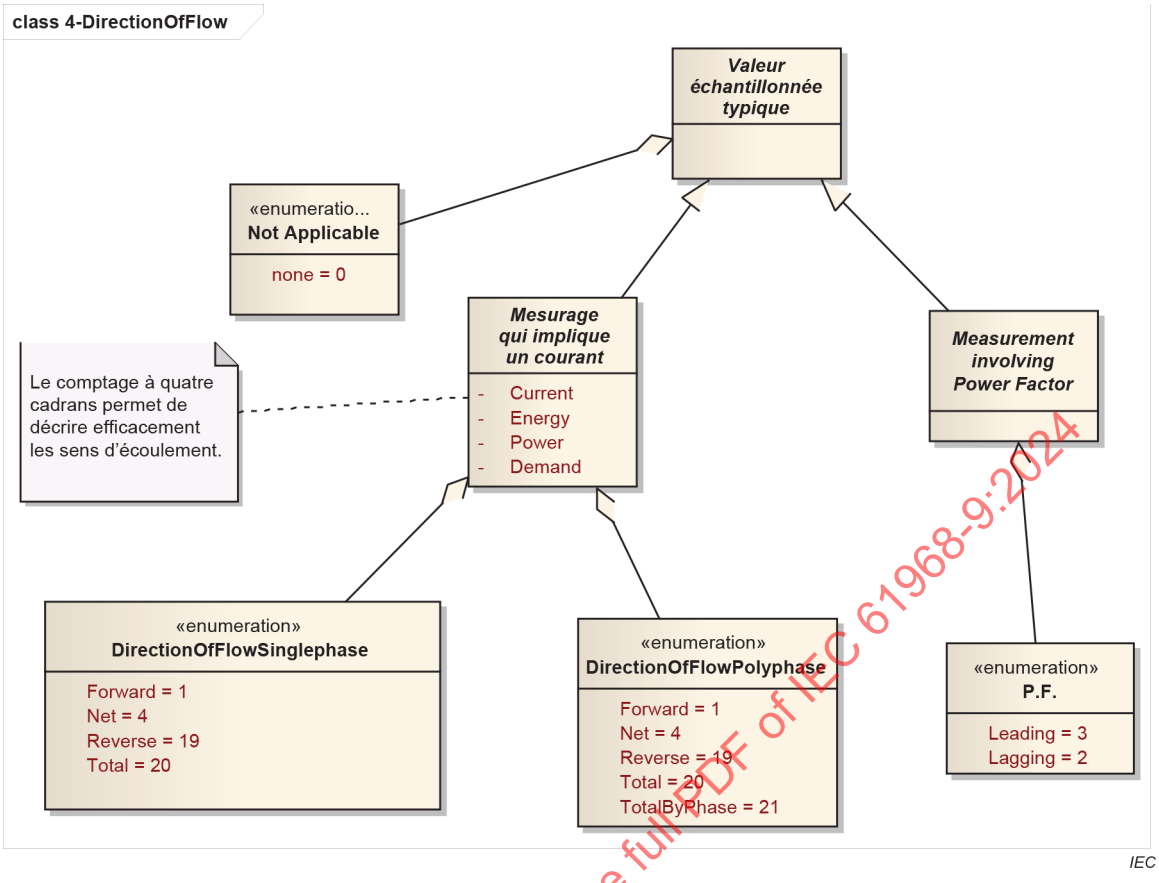
La terminologie utilisée pour indiquer le sens d'écoulement de l'énergie réactive et de la puissance réactive varie considérablement selon le fournisseur. Le Tableau C.8 décrit différents sens d'écoulement équivalents par type de puissance (ou d'énergie) et donne des recommandations concernant une énumération préférentielle des sens d'écoulement à des fins de communication, comme cela est représenté à la Figure C.2.

Tableau C.8 – Équivalences des énumérations de DirectionOfFlow

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Type d'énergie ou de puissance	Unité de mesure	Sens d'écoulement équivalents couramment utilisés dans le secteur	Sens d'écoulement préférentiel pour la messagerie
Actif ou réel	W ou Wh	Forward (Direct), Delivered (remis), Positive (positif), Q1+Q4	Forward
		Reverse (Inverse), Received (reçu), Negative (négatif), Q2+Q3	Reverse
		Net, Q1+Q4-(Q2+Q3)	Net
		Total, Q1+Q2+Q3+Q4	Total
Réactif	VAr ou VArh	Forward (Direct), Delivered (remis), Positive (positif), Lagging (retard), Q1+Q2	Forward
		Reverse (Inverse), Received (reçu), Negative (négatif), Leading (avance) Q3+Q4	Reverse
		Net, Q1+Q2-(Q3+Q4)	Net
		Total, Q1+Q2+Q3+Q4	Total
Apparent	VA ou VAh	Forward (Direct), Delivered (remis)	Forward
		Reverse (Inverse), Received (reçu),	Reverse
		Net	Net
		Total	Total

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Figure C.2 – Énumérations typiques du sens d'écoulement

C.2.7 Attribute #6, commodity

Dans la présente norme, le produit ("commodity") qui est mesuré a été isolé pour devenir un attribut par lui-même. Il est énuméré dans le Tableau C.9.

Tableau C.9 – Produit

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
1	electricity SecondaryMetered	Tous les types de grandeurs mesurées. Ce type de relevé vient du compteur et représente une valeur mesurée "secondaire".	N
2	electricity PrimaryMetered	Un compteur peut être équipé d'un VT et/ou d'un CT externe. Le compteur peut ne pas être informé de la présence de ces appareils et l'affichage ne compense pas cela. En dernier ressort, lorsque ces scalaires sont appliqués, la valeur qui représente la valeur de service est appelée valeur "primary metered'' (primaire mesurée). L'"index" dans la sous-catégorie 3 reflète ceux de la sous-catégorie 0.	N
3	communication	Un mesurage de l'infrastructure de communication elle-même.	N
4	air		N
5	insulativeGas	(SF_6 est trouvé séparément ci-après.)	N

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Code	Énumération	Commentaires	Statut normatif
6	insulativeOil	Généralement de l'huile minérale	N
7	naturalGas	Gaz hydrocarbure naturel	N
8	propane	C_3H_8	N
9	potableWater	Eau potable	N
10	steam	Eau sous forme de vapeur, utilisée habituellement pour le chauffage.	N
11	wasteWater	(Assainissement)	N
12	heatingFluid	Ce fluide est susceptible d'être sous forme liquide. Il n'est pas nécessairement de l'eau ou à base d'eau. Le liquide chaud revient plus froid que lorsqu'il a été envoyé. La chaleur transmise peut être mesurée.	N
13	coolingFluid	Le liquide froid revient plus chaud que lorsqu'il a été envoyé. La chaleur transmise peut être mesurée.	N
14	nonpotableWater	Eau récupérée: potentiellement utilisée pour l'irrigation, mais pas suffisamment traitée pour être jugée salubre pour la boisson. Humidité dans l'huile	N
15	nox	Protoxydes d'azote, NO_X	N
16	so2	Dioxyde de soufre, SO_2	N
17	ch4	Méthane, CH_4	N
18	co2	Dioxyde de carbone, CO_2	N
19	carbone	C	I
20	hch	Hexachlorocyclohexane, HCH	N
21	pfc	Hydrocarbures perfluorés, PFC	N
22	sf6	Hexafluorure de soufre, SF_6	N
23	tvLicence	Télévision	N
24	internet	Service Internet	N
25	refuse	Supprimer	N
26	h2	Hydrogène, H_2	N
27	c2h2	Acétylène, C_2H_2	N
28	c2h4	Éthylène, C_2H_4	N
29	c2h6	Éthane, C_2H_6	N
30	co	Monoxyde de carbone, CO	N
31	o2	Oxygène, O_2	N
32	dissolvedCombustibleGas	Gaz combustible dissous (une combinaison de gaz combustibles tels que H_2, CH_4, C_2H_2, C_2H_4, C_2H_6, et/ou CO dans certains mélanges.)	N
33	co2e	Équivalent du dioxyde de carbone, CO_2	N
34	lead	Plomb, Pb	N
35	mercury	Mercure Hg	N
36	ozone	Ozone, O_3	N
37	pm10	Matière particulaire dont la taille maximale est 10 μm.	N
38	pm25	Matière particulaire dont la taille maximale est 2,5 μm.	N
39	sox	Oxydes de soufre, SO_X	N

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Code	Énumération	Commentaires	Statut normatif
40	weather	Conditions climatiques ou météorologiques.	N
41	device	État du compteur ou du dispositif terminal proprement dit. Par exemple, cette énumération peut être utilisée en association avec une énumération relative à la température pour représenter la température interne d'un compteur.	N
42	pole	Le poteau électrique comme dispositif terminal	I
43	conductor	Un câble comme dispositif terminal	I
44	acceleration	Mesurage de l'accélération	I
45	tilt	Mesurage de l'inclinaison	I
46	magneticField	Mesurage du champ magnétique	I
50	Gas	Produit générique pour le gaz. Note: Il existe des produits spécifiques pour le gaz naturel et le propane.	N
60	Water	Produit générique pour l'eau. Note: Il existe des produits spécifiques pour les eaux usées et l'eau potable.	N
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition			

C.2.8 Attribute #7, measurementKind

L'attribut "measurementKind" permet d'identifier "ce qui" est mesuré. Cet attribut détaille davantage le produit afin de fournir une catégorie de relevé. Cet attribut travaille conjointement avec l'attribut "unités" de manière créative afin de fournir des informations détaillées à l'unité de mesure. Par exemple, "Energy" avec une unité de mesure de "kWh" indique à l'utilisateur que l'énergie active est en cours de mesure, tandis qu'avec "kVAh" ou "kVArh", cela indique l'énergie apparente et l'énergie réactive respectivement. "Power" peut être combiné de manière similaire à différentes unités de mesure de puissance. La puissance de distorsion ("DistortionVoltAmperes") avec "kVA" est différente de "Power" avec "kVA". Plus d'informations peuvent être consultées par l'étude des exemples à la fin de la présente annexe. Les natures de mesure sont énumérées dans le Tableau C.10.

Tableau C.10 – Index measurementKind

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
2	apparentPowerFactor		D
3	currency	fonds	N
4	current	Le flux d'électrons	N
5	currentAngle	Mesurage de la synchronisation d'un courant de phase à zéro par rapport à une tension de référence à zéro.	N
6	currentImbalance	Mesurage de l'écart d'un courant de phase par rapport au courant moyen de toutes les phases.	N

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Code	Énumération	Commentaires	Statut normatif
7	date	Mesurage de la date et/ou de l'heure dans une horloge, ou un horodatage indiquant le moment auquel les données ont été capturées, le moment auquel un maximum ou un minimum s'est produit, ou pour marquer un autre aspect important d'un mesurage	N
8	demand	Mesurage du flux de puissance maximal qui est calculé comme la consommation d'énergie dans le temps, dont les dimensions sont définies par un tarif	N
9	distance	Distance linéaire ou rayon de portée	N
10	distortionVoltAmperes	Mesurage dans lequel un terme V^2 I^2 dont les composantes réelles et réactives sont supprimées, ne laissant que la distorsion. Par exemple, distorsion VAh = Sqrt($(V^2h)(I^2h)$ – $(Wh)^2$ – $(VArh)^2$)	N
11	energization	Relatif à la présence de tension	N
12	energy	Grandeur scalaire qui peut être augmentée ou diminuée dans un système lorsqu'il reçoit ou produit du travail, respectivement.	N
13	energizationLoadSide	Mesure de la présence ou de l'absence de tension du côté de la charge d'un compteur électrique	N
14	fan	Dispositif de déplacement d'air forcé	N
15	frequency	Réciproque de la période	N
17	ieee1366ASAI	Mesurage de l'index moyen de disponibilité du service IEEE-1366	N
18	ieee1366ASIDI	Mesurage de l'index moyen de durée d'interruption du service IEEE-1366	N
19	ieee1366ASIFI	Mesurage de l'index moyen de fréquence d'interruption du service IEEE-1366	N
20	ieee1366CAIDI	Mesurage de l'index client moyen de durée d'interruption IEEE-1366	N
21	ieee1366CAIFI	Mesurage de l'index client moyen de fréquence d'interruption IEEE-1366	N
22	ieee1366CEMIn	Mesurage des interruptions multiples subies par les clients IEEE-1366	N
23	ieee1366CEMSMIn	Mesurage des interruptions durables et momentanées multiples subies par les clients IEEE-1366	N
24	ieee1366CTAIDI	Mesurage de l'index client moyen total de durée d'interruption IEEE-1366	N
25	ieee1366MAIFI	Mesurage de l'index moyen momentané de fréquence d'interruption IEEE-1366	N
26	ieee1366MAIFIe	Mesurage de l'index moyen momentané de fréquence d'interruption d'événement IEEE-1366	N
27	ieee1366SAIDI	Index moyen de durée d'interruption du système IEEE-1366	N
28	ieee1366SAIFI	Index moyen de fréquence d'interruption du système IEEE-1366	N

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Code	Énumération	Commentaires	Statut normatif
31	lineLosses	Perte d'énergie, de puissance, de tension ou de courant attribuée à l'impédance de ligne de transmission ou de distribution	N
32	losses	Perte d'une grandeur pour des raisons "techniques" (comme la perte de ligne) ou "non techniques" (comme le vol).	N
33	negativeSequence	Grandeur dont la séquence de rotation est opposée à celle du système électrique.	N
34	phasorPowerFactor	Rapport entre l'énergie réelle (généralement Wh net) et l'énergie apparente du phaseur (kVAh).	N
35	phasorReactivePower		D
36	positiveSequence	Grandeur dont la séquence de rotation est conforme à celle du système électrique.	N
37	power	Dérivée de l'énergie par rapport au temps, l'énergie étant transférée ou transformée.	N
38	powerFactor	Rapport entre l'énergie réelle (généralement kWh net) et l'énergie apparente (kVAh)	N
40	quantityPower	Mesurage de puissance de Qh, où Qh est défini comme étant la moitié de la somme des mesurages Wh sur chaque phase plus la racine carrée de 3 sur deux fois la somme des mesurages VArh sur chaque phase.	N
41	sag	Baisse temporaire de la tension d'alimentation au-dessous de la valeur nominale	N
42	swell	Augmentation temporaire de la tension d'alimentation au-dessus de la valeur nominale	N
43	switchPosition	État physique ou logique de la position d'un commutateur qui comprend "ouvert" et "fermé", mais qui peut, pour certains produits, également inclure "armé", ou d'autres états qui indiquent un état temporaire dû à une condition quelconque.	N
44	tapPosition	Position du changeur de prise	I
45	tariffRate	Prix de l'énergie défini dans un contrat. Le taux peut être un prix pour l'énergie, pour la puissance (généralement exprimé comme une valeur de demande), ou un autre mesurage. Le taux peut être fondé sur une devise, un code ou un élément d'une description tarifaire plus large.	N
46	temperature	Grandeur proportionnelle à l'énergie d'un système	N
47	totalHarmonicDistortion	Rapport entre la somme des harmoniques et la fondamentale. Le THD peut mesurer soit la tension, soit le courant, et peut être isolé d'une phase donnée).	N
48	transformerLosses	Mesurage de la perte d'énergie ou de puissance dans un transformateur en raison de son inefficacité	N

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Code	Énumération	Commentaires	Statut normatif
49	unipedeVoltageDip10to15	Classification des chutes de tension selon la norme EN 50160 ou une norme nationale similaire qui mesure le nombre de chutes dans la plage (10-15) %	N
50	unipedeVoltageDip15to30	Classification des chutes de tension selon la norme EN 50160 ou une norme nationale similaire qui mesure le nombre de chutes dans la plage (15-30) %	N
51	unipedeVoltageDip30to60	Classification des chutes de tension selon la norme EN 50160 ou une norme nationale similaire qui mesure le nombre de chutes dans la plage (30-60) %	N
52	unipedeVoltageDip60to90	Classification des chutes de tension selon la norme EN 50160 ou une norme nationale similaire qui mesure le nombre de chutes dans la plage (60-90) %	N
53	unipedeVoltageDip90to100	Classification des chutes de tension selon la norme EN 50160 ou une norme nationale similaire qui mesure le nombre de chutes dans la plage (90-100) %	N
54	Voltage (rms)	différence de potentiel électrique entre deux points	N
55	voltageAngle	Mesurage de la synchronisation d'une tension de phase à zéro par rapport à une tension de référence à zéro	N
56	voltageExcursion	Mesurage de l'écart de la tension par rapport à la tension nominale	N
57	voltageImbalance	Mesurage de l'écart d'une tension de phase par rapport à la tension moyenne de toutes les phases.	N
58	volume	volume de liquide	N
59	zeroFlowDuration	Durée pendant laquelle le flux de courant tombe à un niveau zéro ou à un niveau inférieur à la capacité de détection du capteur	N
60	zeroSequence	Le courant homopolaire est la somme vectorielle des courants de phase	N
64	distortionPowerFactor	rapport entre le VAh de distorsion et le VAh apparent	N
81	frequencyExcursion	Mesurage de l'écart de la fréquence par rapport à la fréquence nominale	N
90	applicationContext	Information qui décrit le contexte logique dans lequel une demande, un mesurage ou une commande sont effectués.	I
91	apTitle	Nom d'application qui fait ou a fait une demande	I
92	assetNumber	Identifiant d'actif	I
93	bandwidth	Mesurage du flux de données	I
94	batteryVoltage	Tension de batterie	N
95	broadcastAddress	Adresse cible de message impliquant toutes les unités de points d'extrémité à portée d'un expéditeur particulier	I

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Code	Énumération	Commentaires	Statut normatif
96	deviceAddressType1	Adresse cible du point d'extrémité Type1	I
97	deviceAddressType2	Adresse cible du point d'extrémité Type2	I
98	deviceAddressType3	Adresse cible du point d'extrémité Type3	I
99	deviceAddressType4	Adresse cible du point d'extrémité Type4	I
100	deviceClass	Identifiant unique de la configuration du point d'extrémité	I
101	electronicSerialNumber	Numéro de série d'un dispositif	I
102	endDeviceID	Identifiant unique du endDevice – dispositif qui fournit des mesurages ou sous le contrôle du réseau	I
103	groupAddressType1	Adresse cible de groupe Type1	I
104	groupAddressType2	Adresse cible de groupe Type2	I
105	groupAddressType3	Adresse cible de groupe Type3	I
106	groupAddressType4	Adresse cible de groupe Type4	I
107	ipAddress	Adresse IP du point d'extrémité	I
108	macAddress	Adresse MAC du point d'extrémité	I
109	mfgAssignedConfigurationID	Configuration donnée à un dispositif au moment de sa fabrication	I
110	mfgAssignedPhysicalSerialNumber	Numéro de série attribué à un dispositif au moment de sa fabrication	I
111	mfgAssignedProductNumber	Numéro de produit attribué à un dispositif au moment de sa fabrication	I
112	mfgAssignedUniqueCommunicationAddress	Adresse de communication attribuée à un dispositif au moment de sa fabrication	I
113	multiCastAddress	Adresse cible de message impliquant un grand groupe d'unités de points d'extrémité à portée d'un expéditeur particulier	I
114	oneWayAddress	Adresse de communication d'un point d'extrémité du réseau utilisé dans une communication unidirectionnelle	I
115	signalStrength	Mesurage de l'intensité du signal RF	I
116	twoWayAddress	Adresse de communication utilisée pour une communication bidirectionnelle	I
117	signaltoNoiseRatio	Mesurage de l'intensité du signal reçu (RF) divisée par le plancher de bruit (RF)	I
118	alarm	Mesurage lié à une alarme	I
119	batteryCarryover	Estimation de la capacité de transit de la batterie	I
120	dataOverflowAlarm	Indication ou mesurage d'une perte de données	I
121	demandLimit	Réglage du seuil qui détermine le point de déclenchement qui, s'il est dépassé, déclenche une action de limitation de la demande ou une alarme	N
122	demandReset	Comptage du nombre de fois où la demande a été réinitialisée (à distance, localement et/ou automatiquement.)	N

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Code	Énumération	Commentaires	Statut normatif
123	diagnostic	Mesurage lié au diagnostic des équipements	I
124	emergencyLimit	Réglage qui indique une limite d'urgence	I
125	encoderTamper	Indication de falsification à l'aide d'un codeur de compteur	I
126	ieee1366MomentaryInterruption	Comptage des interruptions momentanées IEEE-1366	N
127	ieee1366MomentaryInterruptionEvent	Comptage des événements d'interruption momentanée IEEE-1366	N
128	ieee1366SustainedInterruption	Durée d'interruption prolongée IEEE-1366	N
129	interruptionBehaviour	Mesurage lié aux interruptions de courant (Note: souvent un comptage ou une durée d'interruption.)	I
130	inversionTamper	Mesurage lié à une falsification d'inversion (Note: généralement un comptage des inversions)	I
131	loadInterrupt	Mesurage lié à l'interruption de charge (Note: généralement un comptage des interruptions de charge ou un mesurage de la durée)	I
132	loadShed	Mesurage lié au délestage de charge (Note: généralement un comptage des délestages de charge ou la durée des délestages de charge)	I
133	maintenance	Mesurage lié à la maintenance en cours des équipements	I
134	physicalTamper	Mesurage lié à une falsification physique (NOTE: généralement un comptage des falsifications)	I
135	powerLossTamper	Indication de falsification lors d'une coupure de courant	I
136	powerOutage	Mesurage lié aux pannes d'alimentation en énergie (NOTE: généralement un état)	I
137	powerQuality	Mesurage lié à la qualité de l'énergie	I
138	powerRestoration	Mesurage lié au rétablissement du courant (NOTE: généralement un état)	I
139	programmed	Mesurage lié à la programmation d'un dispositif (NOTE: généralement le mesurage d'un état)	I
140	pushbutton	Mesurage lié à un bouton-poussoir (NOTE: généralement un état ou un compte)	N
141	relayActivation	Mesurage lié aux activations de relais	N
142	relayCycle	Mesurage lié au cycle du relais (NOTE 1: une ouverture et une fermeture ensemble constituent un cycle, NOTE 2: Généralement exprimé en tant que comptage)	N
143	removalTamper	Indication d'altération des équipements qui confirme que ces derniers ont été déplacés ou ouverts.	I
144	reprogrammingTamper	Indication d'altération des équipements qui confirme que ces derniers ont été reprogrammés.	I

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Code	Énumération	Commentaires	Statut normatif
145	reverseRotationTamper	Indication d'altération démontrée par le flux d'énergie inverse	I
146	switchArmed	Mesurage de l'état des bras de commutateur	I
147	switchDisabled	Mesurage de l'état d'activation du commutateur	I
148	tamper	Indication de l'altération des équipements	I
149	watchdogTimeout	Réinitialisation déclenchée par un circuit matériel "chien de garde".	I
150	billLastPeriod	Facture du client pour la période de facturation précédente exprimée en devise.	N
151	billToDate	Facture du client, telle qu'elle est connue à ce jour dans la période de facturation actuelle. Exprimée en devise.	N
152	billCarryover	Facture du client, partie d'une obligation antérieure reportée d'une période de facturation précédente. Exprimée en devise.	N
153	connectionFee	Frais mensuels pour le raccordement au réseau de distribution.	I
154	audibleVolume	Son	I
155	volumetricFlow	Débit du fluide	I
156	relativeHumidity	L'usage le plus courant est l'expression des conditions climatiques ou météorologiques	N
157	skyCover	Degré de nébulosité. Utilisé pour exprimer les conditions climatiques ou météorologiques.	N
158	voltage	Non spécifiée	I
159	dcVoltage		I
160	acVoltagePeak	$Vp=\sqrt{2} \times Vrms$	I
161	acVoltagePeakToPeak	$Vpp=2 \times Vp$	I
162	pressure	Force sur la surface	I
163	density		I
164	energyDensity		I
165	dateOfLastDemandReset		I
166	arithmeticApparentEnergy	Somme arithmétique des grandeurs VAh par élément, la grandeur VAh apparente de chaque élément étant calculée à chaque intervalle momentané comme suit: $sqrt(V^2h_x)(I^2h_x)$ où x= chaque élément A, B, C, et V^2h_x et I^2h sont les valeurs fondamentales et harmoniques.	I
167	arithmeticApparentPower	Taux de l'énergie apparente arithmétique	I
168	arithmeticApparentDemand		I
169	phasorApparentEnergy	$Sqrt((Wh_x)^2+(VArh_x)^2)$ où x= chaque élément A,B,C et VArh est mesuré avec les valeurs Var IEEE	I

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Code	Énumération	Commentaires	Statut normatif
170	phasorApparentPower	Taux de l'énergie apparente du phaseur	I
171	phasorApparentDemand		I
172	distortionApparentEnergy	VAh_x de distorsion = Sqrt($(V^2h_x)(I^2h_x)$ – $(Wh_x)^2$ – $(VArh_x)^2$), où x= chaque élément A, B, ou C et $V2h_x$, $I2h_x$, Wh_x, et $varh_x$ sont les valeurs fondamentales et harmoniques	I
173	distortionApparentPower	Taux de l'énergie apparente de distorsion	I
174	distortionApparentDemand	Distorsion de l'énergie apparente passée par une fonction de demande	I
175	totalHarmonicDistortionDemand	THD traitée comme une demande	I
176	tddDemand	Distorsion de la demande totale traitée comme une demande	I
177	totalDemandDistortion	(Valeur efficace du contenu harmonique du courant) / (courant maximal de l'installation)	I
178	distortionPowerFactorDemand	distortionPF traitée comme une valeur de demande	I
179	fuzzyEnergy	Fuzzyvarh = sqrt($(varh)^2$ + (Vah de distorsion)^2), où varh est une valeur fondamentale et harmonique	I
180	fuzzyPower	Taux d'énergie floue	I
181	fuzzyDemand	Énergie floue en tant que demande	I
183	batteryChargeMoved	Charge utilisée ou ajoutée	I
184	batteryChargeStored	Charge présente	I
188	quadrant	Un des quatre quadrants par rapport à l'axe de référence	I
189	processorReset	Type de réinitialisation	I
190	xAxis	Mesurage le long de l'axe des x par rapport à l'axe de référence	I
191	yAxis	Mesurage le long de l'axe des y	I
192	zAxis	Mesurage le long de l'axe z	I
193	XYPlane	Mesurage dans le plan XY	I
194	YZPlane	Mesurage dans le plan YZ	I
195	XZPlane	Mesurage dans le plan XZ	I

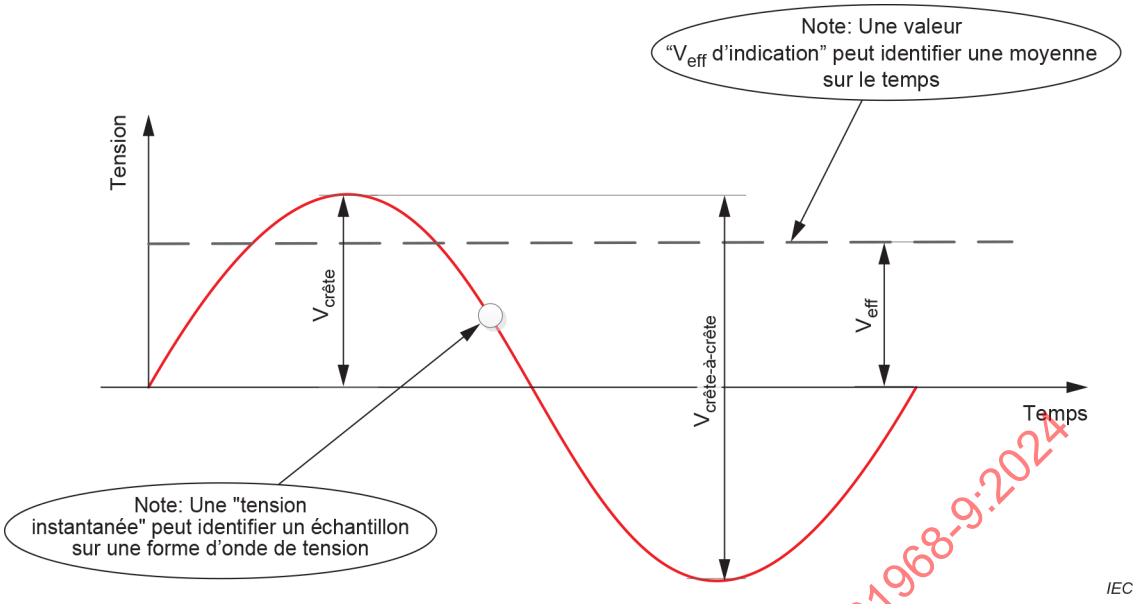
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NOTE La présente édition de l'IEC 61968-9 fait une distinction supplémentaire concernant le cadre de référence relatif à la tension. L'énumération initiale pour "voltage" (tension) est désormais utilisée de manière explicite pour identifier $Volts_{RMS}$. Ceci est justifié par le fait que le type le plus courant de mesure réalisé entre les systèmes est une valeur en $Volts_{RMS}$. Cependant, il ne s'agit pas du seul moyen de mesure de la tension. De nouvelles énumérations ont été créées afin de pouvoir également identifier les Volts-peak (Volts-crête), les Volts-peak-to-peak (Volts-crête à crête), les Volts DC (Volts CC) et les formes d'onde de tension non spécifiées. La Figure C.3 définit un certain nombre de mesurages de la tension. En combinaison avec l'attribut de cumul, il est possible de représenter une valeur de "indicating $Volts_{RMS}$" ($Volts_{eff}$ d'indication) qui est mesurée sur de nombreux cycles, une valeur de "instantaneous $Volts_{RMS}$" ($Volts_{eff}$ instantanée) qui est mesurée sur un seul cycle, ou une valeur de "instantaneous voltage" (tension instantanée) qui représente un échantillon ponctuel unique sur la forme d'onde prélevé à un instant donné.

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Figure C.3 – Mesurages de tension

C.2.9 Attribute #8, interharmonicNumerator

Voir C.2.10.

C.2.10 Attribute #9, interharmonicDenominator

Les interharmoniques sont représentés sous forme de nombre rationnel avec un numérateur et un dénominateur. Les harmoniques sont représentés à l'aide du même mécanisme et identifiés par un dénominateur de "1".

Ils sont représentés au moyen de la formule suivante:

$$\text{Interharmonic} = \frac{\text{InterharmonicNumerator}}{\text{InterharmonicDenominator}}$$

et

$$\text{Harmonic} = \text{InterharmonicNumerator}$$

où le InterharmonicDenominator est égal à '1'.

L'énumération des harmoniques ou interharmoniques est définie par un élément composé:

<interharmonic>::= <interharmonicNumerator> <interharmonicDenominator>

Le numérateur et les dénominateurs interharmoniques normatifs sont définis dans le Tableau C.11. Les valeurs supplémentaires peuvent être créées librement à l'aide de cette approche et sont considérées comme des valeurs "informatives" plutôt que "normatives".

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Tableau C.11 – Énumérations des harmoniques et interharmoniques

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Numérateur interharmonique	Dénominateur interharmonique	Énumération	Commentaires	Statut normatif
0	0	none	Non applicable	N
1	2	interharmonic1/2	Interharmonique de ½	N
1	1	fundamental	fondamental	N
2	1	harmonic2	deuxième harmonique	N
3	1	harmonic3	troisième harmonique	N
4	1	harmonic4	quatrième harmonique	N
5	1	harmonic5	cinquième harmonique	N
6	1	harmonic6	sixième harmonique	N
7	1	harmonic7	septième harmonique	N
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C.2.11 Attribute #10, argumentNumerator

Voir C.2.12.

C.2.12 Attribute #11, argumentDenominator

Les éléments d'argument sont utilisés pour introduire des nombres dans la description de l'unité de mesure où ils sont nécessaires. La définition prend en charge un nombre rationnel avec un numérateur et un dénominateur. Cependant, la plupart des arguments utilisés dans la pratique sont des entiers. Les entiers ont tous "1" comme dénominateur.

$$\text{argument} = \frac{\text{numerator}}{\text{denominator}}$$

L'énumération des arguments est définie par un élément composé:

<argument> ::= <numerator> <denominator>

Le numérateur et les dénominateurs normatifs sont définis dans le Tableau C.12. Les valeurs supplémentaires peuvent être créées librement à l'aide de cette approche. À des fins d'essai, les valeurs non présentées dans le tableau sont considérées comme des valeurs "informatives" plutôt que "normatives".

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Tableau C.12 – Énumérations des arguments

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Numérateur	Dénominateur	Énumération	Commentaires	Statut normatif
0	0	none	Non applicable	N
1	2	n½	Moitié	I
0	1	n0	"Zéro" (pour les systèmes qui utilisent des plans de numérotation fondés sur zéro)	N
1	1	n1	"Un" lorsqu'un argument tel que CEMI(n=1) est nécessaire à la mesure	N
2	1	n2	"Deux" lorsqu'un argument tel que CEMI(n=2) est nécessaire à la mesure	N
3	1	n3	"Trois" lorsqu'un argument tel que CEMI(n=3) est nécessaire à la mesure	N
4	1	n4	"Quatre" lorsqu'un argument tel que CEMI(n=4) est nécessaire à la mesure	N
5	1	n5	"Cinq" lorsqu'un argument est nécessaire à la mesure	N
6	1	n6	Six	N
7	1	n7	Sept	N
8	1	n8	Huit	N
9	1	n9	Neuf	N
10	1	n10	Dix	N
15	1	n15	Quinze	N
30	1	n30	Trente	N
45	1	n45	Quarante-cinq	N
60	1	n60	Soixante	N
120	1	n120	2 × 60 = 120	N
155	1	n155	Cent cinquante-cinq	N
240	1	n240	4 × 60 = 240	N
305	1	n305	Trois cent cinq	N
360	1	n360	6 × 60 = 360	N
480	1	n480	8 × 60 = 480	N
720	1	n720	12 × 60 = 720	N
720	60	n720/60	12 × 60/1 × 60	N
720	120	n720/120	12 × 60/2 × 60	N
720	180	n720/180	12 × 60/3 × 60	N
720	240	n720/240	12 × 60/4 × 60	N
720	360	n720/360	12 × 60/6 × 60	N

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C.2.13 Attribute #12, tou

L'élément Temps d'utilisation (TOU) est utilisé pour décrire toute attribution de la valeur à une case TOU spécifique. Les énumérations TOU sont définies dans le Tableau C.13.

Tableau C.13 – Énumérations de temps d'utilisation

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
1	touA	Utilisation dans la première case TOU définie	N
2	touB	Utilisation dans la deuxième case TOU définie	N
3	touC	Utilisation dans la troisième case TOU définie	N
4	touD	Utilisation dans la quatrième case TOU définie	N
5	touE	Utilisation dans la cinquième case TOU définie	N
6	touF	Utilisation dans la sixième case TOU définie	N
7	touG	Etc.	I
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C.2.14 Attribute #13, cpp

L'élément Tarification pour période critique (CPP) est utilisé pour décrire toute attribution de la valeur à une case CPP spécifique. Bien que l'élément CPP soit généralement considéré comme une forme spécialisée de l'élément TOU, il est séparé des énumérations TOU afin de faciliter la modélisation. Les énumérations CPP sont définies dans le Tableau C.14.

Tableau C.14 – Énumérations des tarifications pour période critique

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
1	cppA	Consommation associée à la tarification pour période critique A	N
2	cppB	Consommation associée à la tarification pour période critique B	N
3	cppC	Consommation associée à la tarification pour période critique C	N
4	cppD	Consommation associée à la tarification pour période critique D	N
5	cppE	Consommation associée à la tarification pour période critique E	N
6	cppF	Consommation associée à la tarification pour période critique F	N
7	cppG	Etc.	I
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C.2.15 Attribute #14, consumptionTier

La tarification de niveau de consommation fait référence à la méthode de facturation par laquelle un certain "block" d'énergie est acheté (ou vendu) à un prix donné, puis le bloc d'énergie suivant est acheté à un autre prix, etc., sur toute une période définie. Au début de la période définie, la consommation est à l'origine égale à zéro et toute utilisation est mesurée en fonction du ConsumptionTier1 (premier niveau de consommation). Si ce bloc d'énergie est consommé avant la fin de la période, la consommation d'énergie est alors recombinée en fonction du ConsumptionTier2 (deuxième niveau de consommation). Si ce bloc d'énergie est consommé avant la fin de la période, la consommation d'énergie est alors recombinée en fonction du ConsumptionTier3 (troisième niveau de consommation), et ainsi de suite. À la fin de la période définie, l'accumulateur de consommation est réinitialisé et l'utilisation au sein du ConsumptionTier1 redémarre.

Ceci s'oppose au "forfait" usuel pour la puissance, pour laquelle tous les achats sont effectués à un prix fixé. Lorsque la tarification forfaitaire est utilisée, il convient de préciser un consumptionTier "non applicable".

Les énumérations des niveaux de consommation sont définies dans le Tableau C.15.

Tableau C.15 – Énumérations des niveaux de consommation

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Code	Énumération	Commentaires	Statut normatif
0	none	Non applicable	N
1	consumptionTier1	Utilisation dans la première case de consommation définie	N
2	consumptionTier2	Utilisation dans la deuxième case de consommation définie	N
3	consumptionTier3	Utilisation dans la troisième case de consommation définie	N
4	consumptionTier4	Utilisation dans la quatrième case de consommation définie	N
5	consumptionTier5	Utilisation dans la cinquième case de consommation définie	N
6	consumptionTier6	Utilisation dans la sixième case de consommation définie	N
7	consumptionTier7	Des niveaux de consommation supplémentaires peuvent être créés le cas échéant.	I
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La tarification TOU ou CPP peut être utilisée conjointement à la tarification des niveaux de consommation. Les exemples fournis dans le Tableau C.16 peuvent être utiles:

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Tableau C.16 – Exemples de combinaison des énumérations de TOU et de niveaux de consommation

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Code Tou	Code de niveau de consommation	Commentaires
1	0	Période A de TOU avec tarification forfaitaire
1	1	Période A de TOU avec niveau de consommation 1
1	2	Période A de TOU avec niveau de consommation 2
1	3	Période A de TOU avec niveau de consommation 3
2	1	Période B de TOU avec niveau de consommation 1
2	2	Période B de TOU avec niveau de consommation 2
2	3	Période B de TOU avec niveau de consommation 3
3	1	Période C de TOU avec niveau de consommation 1
3	2	Période C de TOU avec niveau de consommation 2
3	3	Période C de TOU avec niveau de consommation 3

C.2.16 Attribute #15, phases

Les énumérations de phases de comptage sont décrites dans le Tableau C.17.

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Tableau C.17 – Énumérations de phases

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		Position	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Code	**Énumération**	**Commentaires**	**En réseau**	**Ouvert**	**Branche haute**	**Delta**	**Wye**	**S_1**	**S_2**	**A_1**	**B_1**	**C_1**	**N_1**	**A_2**	**B_2**	**C_2**	**N_2**	**Statut normatif**
0	none	Non applicable à une phase quelconque	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	N
16	phaseN	Neutre	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	N
17	phaseNtoGnd	Neutre à la terre	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	N
32	phaseC	Phase C	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	N
33	phaseCtoN	Phase C à neutre	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	N
40	phaseCtoAv	Courant ou tension de phase C par rapport à la tension de phase A	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	N
41	phaseCAtoN	CA à neutre	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	N
64	phaseB	Phase B	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	N
65	phaseBtoN	Phase B à neutre	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	N
66	phaseBtoC	Phase B à C	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	N
72	phaseBtoAv	Courant ou tension de phase B par rapport à la tension de phase A	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	N
97	phaseBCtoN	BC à neutre	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	N
128	phaseA	Phase A	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	N
129	phaseAtoN	Phase A à neutre	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	N
132	phaseAtoB	Phase A à B	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	N
136	phaseAtoAv	Courant de phase A par rapport à la tension de phase A	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	N
193	phaseABtoN	AB à neutre	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	N
224	phasesABC	Impliquant toutes les phases	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	N

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		Position	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	
Code	**Énumération**	**Commentaires**	**En réseau**	**Ouvert**	**Branche haute**	**Delta**	**Wye**	**S_1**	**S_2**	**A_1**	**B_1**	**C_1**	**N_1**	**A_2**	**B_2**	**C_2**	**N_2**	**Statut normatif**
225	phaseABCtoN	ABC à neutre	0	0	0	0	0	0	0	1	1	1	0	0	0	0	1	N
256	s2	Phase S2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	N
257	s2N	Phase S2 à neutre	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	N
512	s1	Phase S1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	N
513	s1N	Phase S1 à neutre	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	N
768	s12	Phase S1 à S2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	N
769	s12N	Phase S1, S2 à neutre	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	N
1248	threeWireWye	Montage en étoile à 3 fils	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	N
1249	fourWireWye	Montage en étoile à 4 fils	0	0	0	0	1	0	0	1	1	1	0	0	0	0	1	N
2272	threeWireDelta	Montage en triangle à 3 fils	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	N
2273	fourWireDelta	Montage en triangle à 4 fils	0	0	0	1	0	0	0	1	1	1	0	0	0	0	1	N
6369	fourWireHLDelta	Triangle à branche haute à 4 fils	0	0	1	1	0	0	0	1	1	1	0	0	0	0	1	N
10465	fourWireOpenDelta	Triangle ouvert à 4 fils	0	1	0	1	0	0	0	1	1	1	0	0	0	0	1	N
17153	networked	Compteur en réseau	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	N

NOTE 1 Les valeurs des codes ont été calculées par:

$$\text{Code} = \text{Networked} \times 2^{14} + \text{Open} \times 2^{13} + \text{HighLeg} \times 2^{12} + \text{Delta} \times 2^{11} + \text{Wye} \times 2^{10} + S_1 \times 2^9 + S_2 \times 2^8 + A_1 \times 2^7 + B_1 \times 2^6 + C_1 \times 2^5 + N_1 \times 2^4 + A_2 \times 2^3 + B_2 \times 2^2 + C_1 \times 2^1 + N_2$$

NOTE 2 Les vecteurs directionnels (tels que V_{AB} vs. V_{BA}) sont créés dans le code de phase par invocation de la phase impliquée (de gauche à droite dans la matrice) dans l'ordre dans lequel ils doivent être décrits dans l'énumération (de gauche à droite à la lecture).

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Lorsque le courant est mesuré, il est souvent simplement indiqué un conducteur monophasé tel que:

- A;
- B;
- C;
- N.

La "phase" dite du neutre à la terre peut être utilisée pour décrire le courant qui circule du fil neutre à la terre. Dans ce cas, sélectionner N_1 et N_2. Quand seul le neutre est sélectionné, choisir N_1. Dans tous les autres cas, lorsqu'il est fait référence au neutre, sélectionner N_2. Le principal objectif est la lisibilité. Il convient que lesdites règles donnent la lisibilité nécessaire.

Lorsque la tension est mesurée, elle peut contenir une simple description du conducteur de phase ou, si elle est mesurée par rapport à quelque chose d'autre, une indication de mesure comme "phase à neutre" (c'est-à-dire entre phase et neutre) ou "phase à phase" (c'est-à-dire entre phases). Les mesurages de tension communs comprennent:

- A;
- B;
- C;
- AN;
- BN;
- CN;
- AB;
- BC;
- CA;
- ABC.

Lorsque des angles de phase sont mesurés, le résultat est habituellement rapporté à une référence fixe telle que la phase de tension A. Le mot "angle" a déjà été décrit dans un champ précédent. Ce champ peut donc contenir une désignation d'angle telle que:

- $A_{courant}A_{volts}$;
- $B_{courant}A_{volts}$;
- $C_{courant}A_{volts}$.

Où il est admis que la première phase énumérée décrit la phase de courant ou de tension en cours de mesure et que la seconde phase (la lettre "A") décrit par rapport à quoi elle est mesurée (phase de tension A). Sachant que le fait que le mesurage soit un angle peut être déterminé à partir du contexte (fourni par l'unité de mesure) et que le point de référence est toujours la seconde phase, il n'est pas nécessaire de fournir d'autres indications dans le libellé littéral de la phase. Cela permet d'utiliser souvent le même code (tel que "Phase-CA") comme un descripteur de tension entre phases, un descripteur d'angle de phase de tension, ainsi qu'un descripteur d'angle de phase de courant.

Les tensions résidentielles ou autres tensions biphasées secondaires peuvent être identifiées par "S1" ou "S2". Ces étiquettes peuvent être utilisées lorsque les noms "ABC" de la ou des phases qui alimentent le service sont inconnus ou non importants.

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Les différents câblages du réseau polyphasé peuvent être identifiés en tant que:

- Wye
- Delta
- Triangle à branche haute
- Triangle ouvert
- En réseau

L'utilisation de 3 ou 4 fils peut être déterminée en comptant simplement le nombre de phases (y compris neutre) impliquées dans le service.

C.2.17 Attribute #16, multiplier

Le codage du ReadingType propose un champ pour décrire un multiplicateur ("multiplier") de puissance de dix en fonction de la valeur des données. Ce dispositif n'est pas tout à fait identique au préfixe SI habituel, bien que le résultat soit le même dans de nombreux cas. L'utilisateur doit déterminer quel symbole affichable approprié est fondé sur les dimensions de l'unité de mesure. Les énumérations de multiplicateurs sont décrites dans le Tableau C.18 concernant les unités de mesure à une seule dimension (par exemple, "V" et non "V^2"). La valeur d'index représente la puissance de dix.

Tableau C.18 – Énumérations de puissances de dix

Code	Symbole affichable pour les unités de mesure à une seule dimension	Commentaires	Statut normatif
-24	y	yocto = $\times 10^{-24}$	N
-21	z	septo = $\times 10^{-21}$	N
-18	a	atto = $\times 10^{-18}$	N
-15	f	femto = $\times 10^{-15}$	N
-12	p	pico = $\times 10^{-12}$	N
-9	n	nano = $\times 10^{-9}$	N
-6	µ	micro = $\times 10^{-6}$	N
-3	m	milli = $\times 10^{-3}$	N
-2	c	centi = $\times 10^{-2}$	N
-1	d	deci = $\times 10^{-1}$	N
0		Non applicable ou "×1"	N
1	da	deca = $\times 10^{1}$	N
2	h	hecto = $\times 10^{2}$	N
3	k	kilo = $\times 10^{3}$	N
6	M	Mega = $\times 10^{6}$	N
9	G	Giga = $\times 10^{9}$	N
12	T	Tera = $\times 10^{12}$	N
15	P	Peta = $\times 10^{15}$	N
18	E	Exa = $\times 10^{18}$	N
21	Z	Zetta = $\times 10^{21}$	N
24	Y	Yotta = $\times 10^{24}$	N

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Il convient de rappeler que ce multiplicateur de puissance de dix ne fonctionne pas de la même manière que le préfixe SI. Le préfixe SI est considéré comme partie intégrante de l'unité de mesure. Un multiplicateur de puissance de dix ne fait pas partie intégrante de l'unité de mesure. Lorsqu'un préfixe SI est utilisé, il est admis que "10^{-3}" est représenté par "milli" et qu'un mm^3 est identique à $(mm)^3$, ce qui est la même chose que $(0\ 001)^3$ ou $10^{-9}\ m^3$. Ce n'est pas le même résultat que $0\ 001 \times m^3$ (ce que donne un multiplicateur de puissance de dix.).

Les règles d'utilisation des préfixes SI peuvent être consultées dans l'IEC 60050-112:2010, 02-03.

Quand l'unité de mesure décrite est un rapport rendu sous la forme d'une grandeur sans dimension (comme une concentration), il arrive parfois d'afficher un symbole autre que le symbole avec préfixe de mesure étalon. Cependant, la convention moderne consiste à utiliser les symboles à préfixe SI devant le rapport sans dimension décrit. Par exemple, il convient de décrire une concentration ppm par volume ("ppmv") plutôt avec l'expression "µL/L". Quelques scalaires historiques sans dimension sont fournis dans le Tableau C 19 pour référence.

Tableau C.19 – Énumérations de multiplicateurs de concentration historiques

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Code	Symbole affichable	Commentaires	Statut normatif
0	PU	par unité = $\times 1 = 10^0$	I
-2	%	pourcentage = $\times 0{,}01 = \times 10^{-2}$	I
-3	‰	pour mille = $\times 0\ 001 = \times 10^{-3}$	I
-6	ppm	parties par million, $\times 0{,}000\ 001 = \times 10^{-6}$	I
-9	ppb	parties par milliard, $\times\ 0\ 000\ 0{,}000\ 001 = \times 10^{-9}$	I
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C.2.18 Attribute #17, unit

Le Tableau C.20, le Tableau C.21, le Tableau C.22, le Tableau C.23, le Tableau C.24, le Tableau C.25, le Tableau C.26 et le Tableau C.27 décrivent les énumérations d'unités ("unit") de mesure. Elles sont organisées en fonction de leurs relations avec les unités de mesure SI. Les unités SI sont les unités de mesure préférentielles, mais en tant que norme internationale, il est admis que d'autres unités de mesure doivent également être prises en charge dans certaines régions. Les définitions des unités de mesure courantes telles que la "tension", le "courant" et d'autres grandeurs peuvent être trouvées gratuitement en ligne sur le site Web Electropedia de l'IEC.

Dans ces tableaux, la colonne "code" est une valeur unique. Le "statut normatif" indique si le "code" est normatif ou informatif. La colonne "grandeur" indique la catégorie de mesure. Le "nom d'unité" donne le nom officiel de l'unité, ainsi que des commentaires potentiels concernant son utilisation ou sa relation vis-à-vis des autres unités. La colonne "symbole" indique dans la majorité des cas le symbole affichable officiel de l'unité. Dans les cas de conflit provoqués par la combinaison de différents systèmes de mesure, la préférence est donnée à l'unité de mesure SI. (Tel est le cas de rad (rd) et de rod (rd)). La colonne "énumération" crée une chaîne unique qui peut être utilisée par les modélisateurs CIM afin de saisir une valeur de chaîne pour l'unité. L'énumération a été créée selon les règles suivantes:

- une transformation inférieure dite "camel-case" de la colonne de symbole est tentée. Tous les espaces sont supprimés du symbole pour créer l'énumération;
- le symbole défini est limité aux caractères alphanumériques;
- les symboles "-", "(" et ")" sont supprimés;
- le symbole "/" est remplacé par la chaîne "Par";
- le symbole "°" est remplacé par la chaîne "Deg";
- d'autres symboles spéciaux tels que “¤”, “'”, “µ” et “ℏ” sont remplacés par d'autres chaînes textuelles alphas;
- les chiffres ne sont pas admis en tant que premier caractère de l'énumération;
- le texte à indice supérieur ou inférieur est utilisé comme texte normal dans l'énumération (si les conflits sont évitables);
- si deux symboles différents donnent la même énumération (à cause des règles de capitalisation), alors l'un d'eux est modifié (en donnant la préférence aux unités SI de base). Des exceptions ont été créées pour les symboles "A", "B", "G", "H", "ℏ", "M", "m_e", "S" et "T".

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Tableau C.20 – Unités de mesure SI de base

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
2	Longueur	mètre	m	m	N
3	Masse	gramme	g	g	N
5	Courant	ampère	A	a	N
6	Température	Kelvin	K	degK	I
7	Quantité de substance	mole	mol	mol	I
8	Intensité lumineuse	candela	cd	cd	I
27	Durée	seconde	s	s	N
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Tableau C.21 – Unités de mesure SI dérivées à noms spéciaux

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole affichable	Énumération	Statut normatif
10	Angle plan	Radian (m/m)	rad	rad	N
11	Angle solide	Stéradian (m^2/m^2)	sr	sr	I
21	Dose absorbée	Gray (J/kg)	Gy	gy	I
22	Radioactivité	Becquerel (1/s)	Bq	bq	I
23	Température	Degrés Celsius	°C	degC	N
24	Équivalent de dose	Sievert (J/kg)	Sv	sv	I
25	Capacitance électrique	Farad (C/V)	F	f	N
26	Charge électrique	Coulomb (A seconde)	C	c	I
28	Inductance électrique	Henry (Wb/A)	H	h	N
29	Potentiel électrique	Volt (W/A)	V	v	N
30	Résistance électrique	Ohm (V/A)	Ω	ohm	N
31	Joule d'énergie	(N·m = C·V = W·s)	J	j	N
32	Force newton	(kg m/s^2)	N	n	N
33	Fréquence	Cycles par seconde ou (1/s)	Hz	hz	N
34	Puissance lumineuse	(lm/m^2)	lx	lx	I
35	Flux lumineux	lumen (cd sr)	lm	lm	I
36	Flux magnétique	Weber (V s)	Wb	wb	I
37	Induction magnétique	Tesla (Wb/m^2)	T	t	I
38	Puissance réelle	Watt. Par définition, un Watt est égal à une Joule par seconde. La puissance électrique peut être constituée de composants réels et réactifs. La partie réelle de la puissance électrique (I^2R) ou $VI\cos\theta$, est exprimée en Watts. (Voir également la puissance apparente et la puissance réactive).	W	w	N

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole affichable	Énumération	Statut normatif
39	Pression	Pascal (N/m^2) NOTE Le mesurage de la pression absolue ou relative est implicite avec cette entrée. Voir ci-après pour des formes plus explicites.	Pa	pa	N
53	Conductance électrique	Siemens (A / V = 1 / Ω)	S	siemens	N
155	Pression	Pascal, pression absolue	PaA	paA	N
140	Pression	Pascal, pression manométrique	PaG	paG	N
158	Activité catalytique	katal = mol / s	kat	kat	I
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition NOTE L'orthographe britannique "litre" et l'orthographe américaine "liter" sont équivalentes.					

Tableau C.22 – Unités de mesure SI dérivées sans nom spécial

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole affichable	Énumération	Statut normatif
4	Vitesse de rotation	tours par seconde NOTE Comparer aux cycles par seconde, Hz	t/s	revPerS	I
41	Surface	Mètre carré	m^2	m2	N
42	Volume	Mètre cube	m^3	m3	N
43	Vitesse	mètre par seconde (m/s)	m/s	mPerS	N
44	Accélération	mètre par seconde carrée	m/s^2	mPerS2	I
45	Débit volumétrique	mètres cubes par seconde	m^3/s	m3PerS	N
46	Efficacité énergétique	mètre / mètre cube	m/m^3	mPerM3	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole affichable	Énumération	Statut normatif
47	Moment de masse	kilogramme mètre (kg·m) (premier moment de masse) NOTE 1 Les utilisateurs doivent fournir le préfixe "k" pour obtenir "kg m".	g m	gM	I
48	Densité	gramme/mètre cube NOTE 2 Les utilisateurs doivent fournir le préfixe multiplicateur "k" pour former kg/m^3	g/m^3	gPerM3	I
49	Viscosité	mètre carré / seconde	m^2/s	m2PerS	I
50	Conductivité thermique	Watt/mètre Kelvin	W/(m K)	wPerMK	I
51	Capacité calorimétrique	Joule/Kelvin	J/K	jPerK	I
54	Vitesse angulaire	radians par seconde	rad/s	radPerS	I
61	Puissance apparente	Voltampère (voir également puissance réelle et puissance réactive).	VA	vA	N
63	Puissance réactive	Voltampère réactive. Le composant "réactif" ou "imaginaire" de la puissance électrique (VISinθ). (Voir également la puissance réelle et la puissance apparente). NOTE 3 Différents modèles de compteur utilisent différentes méthodes pour obtenir leurs résultats. Certains compteurs peuvent calculer la puissance réactive comme une valeur arithmétique, alors que d'autres la calculent de manière vectorielle. Il convient que le consommateur de données détermine la méthode d'utilisation et le caractère approprié du mesurage pour l'objet prévu.	VAr	vAr	N
66	Volt secondes	Volt secondes (Ws/A)	Vs	vS	N
67	Volts carrés	Volt carré (W^2/A^2)	V^2	v2	N
68	A secondes	A secondes	As	aS	N
69	A au carré	Ampère carré	A^2	a2	N
70	Durée A au carré	Ampère carré seconde	A^2s	a2S	I
71	Énergie apparente	Volt Ampère Heures	VAh	vAH	N
72	Énergie réelle	Watts heure	Wh	wH	N
73	Énergie réactive	Volt Ampère Heures réactif	VArh	vArH	N
74	Flux magnétique	Volt par Hertz	V/Hz	vPerHz	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole affichable	Énumération	Statut normatif
75	Taux de variation de la fréquence	Hertz par seconde	Hz/s	hzPerS	I
78	Moment de masse	kg m^2 (Deuxième moment de masse, communément appelé le moment d'inertie) NOTE 4 Les utilisateurs doivent fournir le préfixe "k" pour obtenir "kg m^2".	gm^2	gM2	I
81	Taux de rampe	Watt par seconde	W/s	wPerS	I
82	Débit volumétrique	litre par seconde	L/s	lPerS	I
100	Quantité de puissance	Q	Q	q	I
101	Quantité d'énergie	Qh	Qh	qh	I
102	résistivité	Ohm mètre, ρ (rho)	Ωm	ohmM	I
103	A/m	intensité du champ magnétique, Ampère par mètre	A/m	aPerM	I
104	volt-heure-carrée	Volt-heures-carrées	V^2h	v2H	I
105	ampère-heure carré	Ampère-heure carré	A^2h	a2H	I
106	Ampère-heure	Ampère-heure	Ah	ah	I
107	Wh/m^3	énergie par volume	Wh/m^3	wHPerM3	I
108	Horodatage	heure et date au format ISO 8601	timeStamp	timeStamp	N
115	Kh-Wh	constante de mesure d'énergie active	Wh/rev	wHPerRev	N
116	Kh-VArh	constante de mesure d'énergie réactive	VArh/rev	vArHPerRev	N
117	Kh-Vah	constante de mesure d'énergie apparente	VAh/rev	vAHPerRev	N
125	Débit volumétrique	mètre cube par heure	m^3/h	m3PerH	N
126	Débit volumétrique	mètre cube compensé par heure	$m^3{}_{(compensé)}/h$	m3CompensatedPerH	N
127	Débit volumétrique	mètre cube non compensé par heure	$m^3{}_{(non\ compensé)}/h$	m3UncompensatedPerH	N
137	Débit volumétrique	litre par heure	L/h	lPerH	N
139	Débit volumétrique	litre (non compensé) par heure	$L_{(non\ compensé)}/h$	lUncompensatedPerH	N
138	Débit volumétrique	litre (compensé) par heure	$L_{(compensé)}/h$	lCompensatedPerH	N
161	Quantité de puissance	Q mesurée à 45°	Q_{45}	q45	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole affichable	Énumération	Statut normatif
162	Quantité de puissance	Q mesurée à 60°	Q_{60}	q60	I
163	Quantité d'énergie	Qh mesurée à 45°	$Q_{45}h$	q45H	I
164	Quantité d'énergie	Qh mesurée à 60°	$Q_{60}h$	q60H	I
165	Énergie massique	Joule / kg	J/kg	jPerKg	I
166	Volume	mètre cube, avec la valeur non compensée correspondant aux effets climatiques.	m^3 (non compensé)	m3Uncompensated	N
167	Volume	mètre cube, avec la valeur compensée correspondant aux effets climatiques.	m^3 (compensé)	m3Compensated	N
173	Numéro d'onde	mètre réciproque, $\sigma, \tilde{\nu}$ (1/m)	M^{-1}	m1	I
174	Volume massique	mètre cube par kilogramme, v	m^3/kg	m3PerKg	I
175	Viscosité dynamique	Pascal seconde	Pa s	paS	I
176	Moment de force	Newton mètre	N m	nM	I
177	Tension superficielle	Newton par mètre	N/m	nPerM	I
178	Accélération angulaire	radian par seconde carrée	rad/s^2	radPerS2	I
179	Densité de flux thermique, éclairement énergétique	Watt par mètre carré	W/m^2	wPerM2	I
180	Capacité calorifique spécifique, entropie spécifique	Joule par kilogramme kelvin	J/(kg K)	jPerKgK	I
181	Densité d'énergie	Joule par mètre cube	J/m^3	jPerM3	I
182	intensité du champ électrique	Volt par mètre	V/m	vPerM	I
183	densité de la charge électrique	Coulomb par mètre cube	C/m^3	cPerM3	I
184	densité de la charge superficielle	Coulomb par mètre carré	C/m^2	cPerM2	I
185	permittivité	Farad par mètre	F/m	fPerM	I
186	perméabilité	Henry par mètre	H/m	hPerM	I
187	énergie molaire	Joule par mole	J/mol	jPerMol	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole affichable	Énumération	Statut normatif
188	entropie molaire, capacité thermique molaire	Joule par mole kelvin	J/(mol K)	jPerMolK	I
189	exposition (rayons x)	Coulomb par kilogramme	C/kg	cPerKg	I
190	débit de dose absorbée	Gray par seconde	Gy/s	gyPerS	I
191	intensité radiante	Watt par stéradian	W/sr	wPerSr	I
192	luminance	Watt par mètre carré stéradian	W/(m^2 sr)	wPerM2Sr	I
193	concentration d'activité catalytique	katal par mètre cube	kat/m^3	katPerM3	I
280	Volt-heure	Volt-heures	Vh	vH	N
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition					

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Tableau C.23 – Unités de mesure non SI acceptées à utiliser avec le système d'unités international

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
159	Durée	minute = 60 s	min	min	I
160	Durée	heure = 60 min = 3 600 s	h	hr	I
195	Durée	jour = 24 h = 86 400 s	d	d	I
9	Angle plan	degré	°	deg	N
196	Angle plan	minute	'	angleMin	I
197	Angle plan	seconde	"	angleSec	I
198	Surface	hectare	ha	ha	I
134	Volume	litre = dm^3 = m^3/1 000	L	l	N
199	masse	"tonne" ou "tonne métrique" (1 000 kg = 1 Mg)	t	tonne	I

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NOTE L'orthographe britannique "litre" et l'orthographe américaine "liter" sont équivalentes.

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Tableau C.24 – Unités de mesure sans dimension et de concentration

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
0	N/A	aucun (non applicable)		none	N
65	Facteur de puissance	sans dimension $\cos\theta = \frac{P}{\lvert S\rvert}$ NOTE 1 Cette définition du facteur de puissance ne s'applique qu'aux systèmes équilibrés. Voir l'autre définition au code 153. NOTE 2 Tenir compte des différentes conventions de signe appliquées entre l'IEC et l'EEI. Le consommateur des données est réputé comprendre le type de compteur utilisé et la convention de signe appliquée par l'entreprise de distribution.	cosθ	cosTheta	N
79	Rapport logarithmique	Bel NOTE 3 Les utilisateurs doivent combiner cette unité au préfixe de multiplicateur "d" pour former décibels (dB).	B	bel	I
109	État	statut, où: "1" = "vrai", "sous tension", "on", "élevé", "configuré"; "0" = "faux", "hors tension", "off", "faible", "supprimé" NOTE 4 Une valeur booléenne est préférentielle, mais d'autres valeurs peuvent être prises en charge.	status	status	N
111	Quantité de substance	Valeur de compteur	nombre	nombre	N
113	Rapport logarithmique de l'intensité de signal	Bel-mW, normalisé en 1 mW. Note: Pour former "dBm", combiner "Bm" au multiplicateur "d".	Bm	bm	N
114	Valeur d'application	Valeur codée	code	code	N
118	EndDeviceEvent	Valeur à interpréter comme EndDeviceEventCode	meCode	meCode	N
143	Concentration	Rapport du volume d'un soluté divisé par le volume de la solution. NOTE 5 Les utilisateurs peuvent avoir besoin d'utiliser un préfixe tel que "µ" pour exprimer une grandeur telle que "µL/L"	L/L	lPerL	N

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
144	Concentration	Rapport de la masse d'un soluté divisé par la masse de la solution. NOTE 6 Les utilisateurs peuvent avoir besoin d'utiliser un préfixe tel que "µ" pour exprimer une grandeur telle que "µg/g"	g/g	gPerG	N
145	Concentration	La quantité de concentration de la substance, (c), la quantité de solvant en moles divisée par le volume de la solution en m³.	mol/m³	molPerM3	I
146	Concentration	Fraction molaire (χ), rapport de la quantité molaire d'un soluté divisée par la quantité molaire de la solution.	mol/mol	molPerMol	I
147	Concentration	Molalité, la quantité de soluté en moles et la quantité de solvant en kilogrammes.	mol/kg	molPerKg	I
148	Longueur	Rapport de longueur	m/m	mPerM	I
149	Durée	Rapport de temps NOTE 7 Les utilisateurs peuvent avoir besoin de fournir un préfixe tel que "µ" pour afficher des taux tels que "µs/s"	s/s	sPerS	N
150	Fréquence	Dérivée de fréquence NOTE 8 Les utilisateurs peuvent avoir besoin de fournir un préfixe tel que "m" pour afficher des taux tels que "mHz/Hz"	Hz/Hz	hzPerHz	N
151	Tension	Rapport de tensions NOTE 9 Les utilisateurs peuvent avoir besoin de fournir un préfixe tel que "m" pour afficher des taux tels que "mV/V"	V/V	vPerV	N
152	Courant	Rapport d'ampérages NOTE 10 Les utilisateurs peuvent avoir besoin de fournir un préfixe tel que "m" pour afficher des taux tels que "mA/A"	A/A	aPerA	I
153	Facteur de puissance	FP, rapport de la puissance active à la puissance apparente. NOTE 11 La convention de signe utilisée pour le facteur de puissance diffère entre les compteurs IEC et les compteurs EEI (ANSI). Les consommateurs des données sont réputés comprendre le type de compteur utilisé et conviennent de la convention de signe appliquée dans une entreprise de distribution donnée.	W/VA	wPerVA	I
154	Nombre de rotations	Tours	rev	rev	I
168	Intensité du signal	Rapport de puissance NOTE 12 Les utilisateurs peuvent avoir besoin de fournir un préfixe tel que "m" pour afficher des taux tels que "mW/W"	W/W	wPerW	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
170	Index de réfraction	n	*n*	refractiveIndexN	I
171	Perméabilité relative	μ_r	μ_r	relativePermeabilityMur	I
172	Rapport logarithmique	Neper	Np	np	I
281	Humidité	Humidité relative exprimée comme le rapport de la pression partielle de la vapeur d'eau dans le mélange air-eau à la pression de vapeur saturée de l'eau à la température spécifiée.	φ	realtiveHumidity	N
282	Nébulosité	Rapport entre la partie du ciel couverte et l'ensemble de la voûte céleste.	skyCover	skyCover	N
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Tableau C.25 – Unités non SI dont les valeurs dans les unités SI doivent être obtenues expérimentalement

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
200	énergie	électronvolt (1 eV = 1,602 176 × 10^{-19} J)	eV	eV	I
201	masse	dalton (1 Da = 1,660 538 × 10^{-27} kg)	Da	da	I
202	masse	unité unifiée de masse atomique (1 u = 1 Da)	u	u	I
203	longueur	unité astronomique (1ua = 1,495 978 × 10^{11} m)	ua	ua	I
204	vitesse	unité naturelle de vitesse (vitesse de la lumière dans le vide) = 299 792 458 m/s	c_0	c0	I
205	action	unité naturelle d'action (constante réduite de Planck) = 1,054 571 × 10^{-34} J s	ħ	nuH	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
206	masse	unité naturelle de masse (masse de l'électron) = 9,109 382 × 10^{-31} kg	m_e	nuMe	I
207	durée	unité naturelle de temps	$\hbar/(m_e c_0^2)$	nuHPerNuMeC02	I
208	charge	unités atomiques de charge (charge élémentaire) = 1,602 176 × 10^{-19} C	e	auE	I
209	masse	unités atomiques de masse (masse de l'électron) = 9,109 382 × 10^{-31} kg	m_e	auMe	I
210	action	unité atomique d'action (constante réduite de Planck) = 1,054 571 × 10^{-34} J s	$\hbar$	auH	I
211	longueur	unité atomique de longueur, bohr (rayon de Bohr) = 0,529 177 × 10^{-10} m	a_0	auA0	I
212	énergie	unité atomique d'énergie, hartree = 4 359 744	E_h	auEh	I
213	durée	unité atomique de temps	$\hbar/E_h$	auHPerAuEh	I
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Tableau C.26 – Autres unités de mesure non SI

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
76	Nombre de caractères	caractères	char	char	N
77	Débit de données	caractères par seconde	char/s	charPerSec	I
80	Unité monétaire	Argent en général NOTE Les unités monétaires spécifiques sont identifiées par la classe de devise	¤	argent	I
119	Volume	pied cube	ft^3	ft3	N
120	Volume	pied cube compensé correspondant aux effets climatiques	ft^3 (compensé)	ft3Compensated	N
121	Volume	pied cube non compensé correspondant aux effets climatiques	ft^3 (non compensé)	ft3Uncompensated	N
122	Débit volumétrique	pied cube par heure	ft^3/h	ft3PerH	N
123	Débit volumétrique	pied cube compensé par heure	ft^3 (compensé)/h	ft3CompensatedPerH	N
124	Débit volumétrique	pied cube non compensé par heure	ft^3 (non compensé)/h	ft3UncompensatedPerH	N
128	Volume	Gallon US (1 gal = 231 in^3 = 128 fl oz.)	US gal	uSGal	N
129	Débit volumétrique	Gallon US par heure	US gal/h	uSGalPerH	N
130	Volume	Gallon impérial	imp gal	impGal	N
131	Débit volumétrique	Gallon impérial par heure	imp gal/h	impGalPerH	N
132	Énergie	Unité thermique britannique	BTU	btu	N
133	Puissance	BTU par heure	BTU/h	btuPerH	N
141	Pression	Livre par pouce carré, absolu	psiA	psiA	I
142	Pression	Livre par pouce carré, manométrique	psiG	psiG	I
156	Volume	Litre, avec la valeur non compensée correspondant aux effets climatiques	$L_{(non\ compensé)}$	lUncompensated	N
157	Volume	Litre, avec la valeur compensée correspondant aux effets climatiques	$L_{(compensé)}$	lCompensated	N
169	Énergie	Thermique	therm	therm	N
214	Pression	bar (1 bar = 100 kPa)	bar	bar	I
215	Pression	millimètre de mercure (1 mmHg ≈ 133,3 Pa)	mmHg	mmHg	I
216	Longueur	ångström (1Å = 10^{-10} m)	Å	angstrom	I
217	Longueur	mile nautique (1 M = 1852 m)	M	nmi	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
218	Surface	barn (1 b = 100 fm^2 = 10^{-28} m^2)	b	barn	I
219	Vitesse	nœud (1 kn = 1852/3600) m/s	kn	kn	I
220	Activité	curie (1 Ci = 3,7 × 10^{10} Bq)	Ci	ci	I
221	exposition	roentgen (1 R = 2,58 × 10^{-4} C/kg)	R	r	I
222	dose absorbée	rad (1 rd = 1 cGy)	rd	doseRad	I
223	équivalent de dose	rem (1 rem = 10^{-2} Sv)	rem	rem	I
224	longueur	pouce	in	in	I
225	longueur	pied (1 ft = 12 in)	ft	ft	I
226	longueur	rod (1 rod = 16,5 ft)	rod	rod	I
227	longueur	furlong (1 fur = 660 ft)	fur	fur	I
228	longueur	mile (1 mille terrestre = 8 fur = 80 chaînes = 320 rods = 5280 pieds)	mi	mi	I
229	surface	pied carré (1 ft^2 = 144 in^2)	ft^2	ft2	I
230	surface	yard carré (1 yd^2 = 9 ft^2)	yd^2	yd2	I
231	surface	rod carré (1 rod^2 = 272,25 ft^2)	rod^2	rod2	I
232	surface	acre (1 acre = 160 rd^2 = 43 560 ft^2)	acre	acre	I
233	surface	mille carré (1 mi^2 = 640 acres)	mi^2	mi2	I
234	surface	section de terrain (1 mi^2 = 1 section de terrain)	section de terrain	sectionOfLand	I
235	surface	canton (1 canton = 6 milles carrés)	canton	canton	I
237	Volume	yard cube (1 yd^3 = 27 ft^3)	yd^3	yd3	I
238	longueur	chaînon (1 li = 0,66 ft)	li	li	I
239	longueur	chaîne (1 ch = 100 chaînons = 4 rods = 66 ft)	ch	ch	I
240	Volume	Pinte liquide US (1 pt = 28,875 in^3 = 128 fl dr)	US liq pt	uSLiqPt	I
241	Volume	Quart liquide US (1 qt = 2 pt)	US liq qt	uSLiqQt	I
242	Volume	Drachme liquide des systèmes de mesure de pharmacie	fl dr ap	flDrAp	I
243	Volume	Once liquide des systèmes de mesure de pharmacie (1 fl oz ap = 8 fl dr ap)	fl oz ap	flOzAp	I
244	Volume	Pinte sèche US (1 pt = 67,2 in^3)	US dry pt	usDryPt	I
245	Volume	Quart sec US (1 qt = 2 in3)	US dry qt	usDryQt	I
246	Volume	US peck (1 pk = 8 qt)	US pk	usPk	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
247	Volume	Hectolitre US (1 bu = 4 pk)	US bu	usBu	I
248	Masse	grain (1 grain = 1/7000 avdp lb) NOTE Le "grain" est identique dans les unités de masse des systèmes avoirdupois, troy et de pharmacie.	gr	gr	I
249	Masse	Drachme avoirdupois (1 Avdp dr = 27-11/32 gr) NOTE L'abréviation "dr" peut être utilisée s'il n'y a aucune possibilité que la drachme avoirdupois ne soit confondue avec la drachme des systèmes troy ou de pharmacie.	avdp dr	avdpDr	I
250	Masse	Once avoirdupois (1 Avdp oz = 16 Avdp dr) NOTE L'abréviation "oz" peut être utilisée s'il n'y a aucune possibilité que l'once avoirdupois ne soit confondue avec l'once des systèmes troy ou de pharmacie.	avdp oz	avdpOz	I
251	Masse	Livre Avoirdupois (1 lb = 16 oz) NOTE Bien que le terme "livre" soit couramment utilisé dans de nombreux pays simplement en tant que "livre (lb)", le terme historique "avoirdupois" est ajouté pour apporter du contexte et le distinguer dans cette définition des systèmes de mesure troy et de pharmacie qui utilisent les mêmes noms. L'abréviation "lb" peut être utilisée à la place de "avdp lb" si aucune confusion n'est possible avec la livre nommée dans lesdits autres systèmes.	avdp lb	avdpLb	I
252	Masse	Quintal avoirdupois (1 cwt = 100 lbs)	short cwt	shortCwt	I
253	Masse	Tonne avoirdupois (1 tonne courte = 2 000 lbs)	short ton	shortTon	I
254	Masse	Quintal brut ou long avoirdupois (1 long cwt = 112 lbs)	long cwt	longCwt	I
255	Masse	Tonne brute ou longue avoirdupois (1 long ton = 20 long cwt)	long ton	longTon	I
256	Masse	Pennyweight troy (1 dwt = 24 grains)	dwt	dwt	I
257	Masse	Once troy (1 oz t = 20 dwt)	oz t	ozT	I
258	Masse	Livre troy (1 lb t = 12 oz t)	lb t	lbT	I
259	Masse	Scrupule des systèmes de mesure de pharmacie (1 s ap = 20 grains)	s ap	sAp	I
260	Masse	Drachme des systèmes de mesure de pharmacie (1 dr ap = 3 s ap)	dr ap	drAp	I
261	Masse	Once des systèmes de mesure de pharmacie (1 oz ap = 8 dr ap)	oz ap	ozAp	I

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
262	Masse	Livre des systèmes de mesure de pharmacie (1 lp ap = 12 oz ap)	lb ap	lbAp	I
263	Consommation de carburant	mille par gallon impérial	mpg (Imp)	mpgImp	I
264	Consommation de carburant	mille par gallon US	mpg (US)	mpgUS	I
265	Consommation de carburant	équivalent du mille par gallon US	MPGe (US)	mPGeUS	I
266	Consommation de carburant	litre par 100 km	l/(100 km)	lPer100km	I
267	Consommation de carburant	kilowattheure par mille (Note: les utilisateurs doivent fournir le préfixe "k" pour créer "kWh/mi")	Wh/mi	wHPerMi	I
268	Consommation de carburant	kilowattheure par 100 mille (Note: les utilisateurs doivent fournir le préfixe "k" pour créer "kWh/(100 mi))	Wh/(100 mi)	wHPer100Mi	I
279	Température	degrés Fahrenheit	°F	degF	I
284	Volume	Pouces cubes	in^3	in3	I

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Tableau C.27 – Unités non SI associées au système d'unités CGS et CGS gaussien

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Code	Grandeur	Nom d'unité (et commentaires)	Symbole	Énumération	Statut normatif
269	Énergie	erg (1 erg = 10^{-7} J)	erg	erg	I
270	Force	dyne (1 dyn = 10^{-5} N)	dyn	dyn	I
271	Viscosité dynamique	poise (1 P = 0,1 Pa s)	P	p	I
272	Viscosité cinématique	stokes (1 St = 1 cm^2/s)	St	st	I
273	Luminance	stilb (1 sb = 10^4 cd/m^2)	sb	sb	I
274	Éclairement énergétique	phot (1 ph = 10^4 lx)	ph	ph	I
275	Accélération	gal (1 Gal = 10^{-2} m s^{-2}) NOTE Le présent "Gal" est une abréviation de "Galileo" et non de "gallon''.	Gal	gal	I
276	Flux magnétique	Maxwell (1 Mx = 10^{-8} Wb)	Mx	mx	I
277	Induction magnétique	Gauss (1 G = 10^{-4} T)	G	gauss	I
278	Champ magnétique	Œrsted (1 Oe = ($10^3/4\pi$) A/m)	Oe	oe	I

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C.2.19 Attribute #18, currency

Les codes de devise ("currency") sont définis dans l'ISO 4217. Certains codes ont été répétés dans le Tableau C.28 pour référence. Les codes de devise supplémentaires peuvent être extraits librement de l'ISO 4217.

Tableau C.28 – Unités de mesure des devises (issues de l'ISO 4217)

Code	Symbole affichable	Nom d'unité	Statut normatif
0		None	N
36	AUD	Dollar australien	I
124	CAD	Dollar canadien	I
156	CNY	Yuan renminbi chinois	I
208	DKK	Couronne danoise	I
356	INR	Roupie indienne	I
392	JPY	Yen japonais	I
578	NOK	Couronne norvégienne	I
643	RUB	Rouble russe	I
710	ZAR	Rand d'Afrique du Sud	I
752	SEK	Couronne suédoise	I
756	CHF	Franc suisse	I
826	GBP	Livre britannique	I
840	USD	Dollar US	I
978	EUR	Euro	I
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C.3 Utilisation d'attributs d'éléments de données pour définir le nom de ReadingType – Formule de construction avec des exemples de codes ReadingType

Le "ReadingType" peut être généré automatiquement en remplissant judicieusement chacun des attributs et en les présentant dans un ordre côte à côte. Il est recommandé que les attributs soient le plus explicites possible pour identifier un élément de donnée, mais sans devenir si explicites qu'ils spécifient outre mesure l'élément de données.

Un nom de ReadingType peut être généré en présentant la forme numérique de chaque attribut côte à côte séparée par des points.

<ReadingType.Name.name>::= <macroPeriod> “.” <aggregate> “.”<measuringPeriod>”,” <accumulation> “.” <flowDirection> "." <commodity> "." <measurementKind> “.” <interharmonicNumerator> "." <interharmonicDenominator> "." <argumentNumerator> “.” <argumentDenominator> “.” <tou> "." <cpp> "." <consumptionTier> “.” <phases> “.” <multiplier> “.” <unit> “.” <currency>

Ces champs peuvent être convertis en un nom prononçable régionalisé (localisé) en utilisant la forme textuelle régionale (locale) pour chacun des attributs non égal à zéro et en les présentant dans l'ordre, côte à côte, séparés par des espaces et autres symboles selon le cas. Pour la plupart des applications, cette disposition apporte généralement plus d'informations qu'il est nécessaire d'indiquer (verbalement) concernant les données. Supprimer les adjectifs descriptifs qui sont mutuellement compris par le contexte de communication est une pratique acceptée dans le langage courant. Le Tableau C.29 donne des exemples de ces conversions en anglais. Il peut être noté que dans la formule EBNF ci-après, les symboles tels que "(" et ")" sont intégrés pour améliorer la lisibilité. A des fins identiques, les espaces autour de l'unité de mesure sont également omis.

<Name.description>::= [<macroPeriod> " "] [<aggregate> " "] [<measuringPeriod> " "] [<accumulation> " "] [<flowDirection> " "] [<commodity> " "] [<measurementKind> " "] [<interharmonicNumerator> " "] [<interharmonicDenominator> " "] [<argumentNumerator> " "] [<argumentDenominator> " "] [<tou> " "] [<cpp> " "] [<consumptionTier> " "] [<phases> " "] "(" [<multiplier>] [<unit>] [<currency>] ")"

Alors qu'une bonne interface élimine toute ambiguïté et n'édite pas de données "anonymes", une bonne interface n'aboutit pas non plus à l'autre extrême pour spécifier outre mesure les données qu'elle édite. Le concept est similaire à la pratique qui consiste à éditer un nombre approprié de chiffres de résolution pour une valeur numérique. Un système peut connaître (par exemple) la phase sur laquelle une tension a été mesurée et la fournir comme attribut du mesurage. Un autre système peut ne pas connaître la phase avec une bonne autorité et éditer simplement la tension mesurée au niveau d'un compteur. Les ReadingTypeID utilisés dans une réponse peuvent (par conséquent) différer légèrement des ReadingTypeID utilisés dans une demande. Il convient que les codes ReadingType utilisés par un éditeur de données soient appropriés pour les données fournies.

Les exemples donnés dans le Tableau C.29 ne constituent nullement une liste exhaustive de ce qui peut être construit avec les valeurs d'énumération répertoriées ci-dessus. Après avoir parcouru les exemples (ci-dessous) et les listes d'énumérations (ci-dessus) sans avoir trouvé l'énumération nécessaire, des énumérations personnalisées peuvent être réalisées. Certains des champs (comme le "numérateur") sont naturellement un champ entier. Si l'énumération nécessaire n'est qu'un entier, il convient alors que l'utilisateur fournisse l'entier exigé. Néanmoins, si le champ est une énumération de type liste, il convient d'être prudent. Au lieu d'utiliser simplement le prochain nombre disponible sur la liste, il convient de créer des énumérations personnalisées par l'utilisateur, numérotées 9 000 ou plus.

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Tableau C.29 – Exemples de ReadingType

Code de ReadingType ID	Description	Statut normatif
8.0.0.0.0.1.152.0.0.0.0.0.0.0.0.0.0.840	billingPeriod electricitySecondaryMetered billCarryover (USD)	N
8.0.0.0.0.1.150.0.0.0.0.0.0.0.0.0.0.840	billingPeriod electricitySecondaryMetered billLastPeriod (USD)	N
8.8.0.3.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum cumulative forward electricitySecondaryMetered demand (kW)	N
8.8.53.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum fixedBlock15Min indicating forward electricitySecondaryMetered demand (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.0.0.0.3.63.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand (kVAr)	N
8.8.0.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.1.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touA (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.2.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touB (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.3.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touC (kW)	N
8.8.0.6.1.1.8.0.0.0.0.0.4.0.0.0.3.38.0	billingPeriod maximum indicating forward electricitySecondaryMetered demand touD (kW)	N
8.8.0.6.19.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum indicating reverse electricitySecondaryMetered demand (kW)	N
8.8.71.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	billingPeriod maximum rollingBlock15MinIntvl5MinSubIntvl indicating forward electricitySecondaryMetered demand (kW)	N
8.8.101.6.1.1.8.0.0.720.1.0.0.0.0.3.38.0	billingPeriod maximum specifiedFixedBlock indicating forward electricitySecondaryMetered demand n720 (kW)	N
8.8.102.6.1.1.8.0.0.720.240.0.0.0.0.3.38.0	billingPeriod maximum specifiedRollingBlock indicating forward electricitySecondaryMetered demand n720/240 (kW)	N
8.0.0.9.1.1.12.0.0.0.0.1.0.0.0.3.72.0	billingPeriod summation forward electricitySecondaryMetered energy touA (kWh)	N
8.0.0.9.1.1.12.0.0.0.0.2.0.0.0.3.72.0	billingPeriod summation forward electricitySecondaryMetered energy touB (kWh)	N
8.0.0.9.1.1.12.0.0.0.0.3.0.0.0.3.72.0	billingPeriod summation forward electricitySecondaryMetered energy touC (kWh)	N
0.0.0.1.0.1.122.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered demandReset (count)	N
0.0.0.1.0.1.11.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered energization (count)	N
0.0.0.1.0.1.131.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered loadInterrupt (count)	N
0.0.0.1.0.1.141.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered relayActivation (count)	N
0.0.0.1.0.1.142.0.0.0.0.0.0.0.0.0.111.0	bulkQuantity electricitySecondaryMetered relayCycle (count)	N
0.0.0.1.1.1.12.0.0.0.0.0.0.0.0.3.73.0	bulkQuantity forward electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.1.1.12.0.0.0.0.0.0.0.0.3.72.0	bulkQuantity forward electricitySecondaryMetered energy (kWh)	N
0.0.0.1.1.7.58.0.0.0.0.0.0.0.0.2.120.0	bulkQuantity forward naturalGas volume (hft³(compensated))	N

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Code de ReadingType ID	Description	Statut normatif
0.0.0.1.1.7.58.0.0.0.0.0.0.0.0.2.121.0	bulkQuantity forward naturalGas volume (hft³(uncompensated))	N
0.0.0.1.1.7.58.0.0.0.0.0.0.0.0.3.120.0	bulkQuantity forward naturalGas volume (kft³(compensated))	N
0.0.0.1.1.7.58.0.0.0.0.0.0.0.0.3.121.0	bulkQuantity forward naturalGas volume (kft³(uncompensated))	N
0.0.0.1.4.1.12.0.0.0.0.0.0.0.0.3.73.0	bulkQuantity net electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.4.1.12.0.0.0.0.0.0.0.0.3.72.0	bulkQuantity net electricitySecondaryMetered energy (kWh)	N
0.0.0.1.19.1.12.0.0.0.0.0.0.0.0.3.73.0	bulkQuantity reverse electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.19.1.12.0.0.0.0.0.0.0.0.3.72.0	bulkQuantity reverse electricitySecondaryMetered energy (kWh)	N
0.0.0.1.20.1.12.0.0.0.0.0.0.0.0.3.73.0	bulkQuantity total electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.20.1.12.0.0.0.0.0.0.0.0.3.73.0	bulkQuantity total electricitySecondaryMetered energy (kVArh)	N
0.0.0.1.20.1.12.0.0.0.0.0.0.0.0.3.72.0	bulkQuantity total electricitySecondaryMetered energy (kWh)	N
0.0.0.0.0.3.97.0.0.0.1.0.0.0.0.0.114.0	communication deviceAddressType2 n0 (code)	N
0.0.0.0.0.3.123.0.0.0.0.0.0.0.0.0.114.0	communication diagnostic (code)	N
0.0.0.0.0.3.104.0.0.0.1.0.0.0.0.0.114.0	communication groupAddressType2 n0 (code)	N
0.0.0.0.0.3.133.0.0.0.0.0.0.0.0.0.114.0	communication maintenance (code)	N
0.0.0.0.0.3.114.0.0.0.1.0.0.0.0.0.114.0	communication oneWayAddress n0 (code)	N
0.0.0.0.0.3.114.0.0.1.1.0.0.0.0.0.114.0	communication oneWayAddress n1 (code)	N
11.0.0.1.4.1.12.0.0.0.0.0.0.0.0.3.72.0	daily bulkQuantity net electricitySecondaryMetered energy (kWh)	N
11.0.0.4.0.1.126.0.0.0.0.0.0.0.0.0.111.0	daily deltaData electricitySecondaryMetered ieee1366MomentaryInterruption (count)	N
11.0.0.4.0.1.127.0.0.0.0.0.0.0.0.0.111.0	daily deltaData electricitySecondaryMetered ieee1366MomentaryInterruptionEvent (count)	N
11.0.0.4.0.1.128.0.0.0.0.0.0.0.0.0.111.0	daily deltaData electricitySecondaryMetered ieee1366SustainedInterruption (count)	N
11.0.0.4.0.1.128.0.0.0.0.0.0.0.0.0.27.0	daily deltaData electricitySecondaryMetered ieee1366SustainedInterruption (s)	N
11.8.0.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	daily maximum indicating forward electricitySecondaryMetered demand (kW)	N
11.0.0.9.4.1.12.0.0.0.0.1.0.0.0.3.72.0	daily summation net electricitySecondaryMetered energy touA (kWh)	N
0.0.0.4.1.1.12.0.0.0.0.0.0.0.0.3.73.0	deltaData forward electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.1.1.12.0.0.0.0.0.0.0.0.3.72.0	deltaData forward electricitySecondaryMetered energy (kWh)	N
0.0.0.4.4.1.12.0.0.0.0.0.0.0.0.3.73.0	deltaData net electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.4.1.12.0.0.0.0.0.0.0.0.3.72.0	deltaData net electricitySecondaryMetered energy (kWh)	N

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Code de ReadingType ID	Description	Statut normatif
0.0.0.4.19.1.12.0.0.0.0.0.0.0.0.3.73.0	deltaData reverse electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.19.1.12.0.0.0.0.0.0.0.0.3.72.0	deltaData reverse electricitySecondaryMetered energy (kWh)	N
0.0.0.4.20.1.12.0.0.0.0.0.0.0.0.3.73.0	deltaData total electricitySecondaryMetered energy (kVArh)	N
0.0.0.4.20.1.12.0.0.0.0.0.0.0.0.3.72.0	deltaData total electricitySecondaryMetered energy (kWh)	N
0.0.0.0.0.1.5.0.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered currentAngle (count)	N
0.0.0.0.0.1.6.0.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered currentImbalance (count)	N
0.0.0.0.0.1.11.0.0.0.0.0.0.0.0.0.109.0	electricitySecondaryMetered energization (status)	N
0.0.0.0.0.1.13.0.0.0.0.0.0.0.0.0.109.0	electricitySecondaryMetered energizationLoadSide (status)	N
0.0.0.0.0.1.43.0.0.0.0.0.0.0.0.0.109.0	electricitySecondaryMetered switchPosition (status)	N
0.0.0.0.0.1.57.0.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered voltageImbalance (count)	N
0.0.0.0.0.1.59.0.0.0.0.0.0.0.0.0.111.0	electricitySecondaryMetered zeroFlowDuration (count)	N
0.4.0.0.0.1.55.0.0.0.0.0.0.0.0.0.111.0	excess electricitySecondaryMetered voltageAngle (count)	N
0.0.2.4.1.1.12.0.0.0.0.0.0.0.0.3.72.0	fifteenMinute deltaData forward electricitySecondaryMetered energy (kWh)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.0.0.5.0	indicating electricitySecondaryMetered current (A)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.128.0.5.0	indicating electricitySecondaryMetered current phaseA (A)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.64.0.5.0	indicating electricitySecondaryMetered current phaseB (A)	N
0.0.0.6.0.1.4.0.0.0.0.0.0.0.32.0.5.0	indicating electricitySecondaryMetered current phaseC (A)	N
0.0.0.6.0.1.5.0.0.0.0.0.0.0.136.0.9.0	indicating electricitySecondaryMetered currentAngle phaseAtoAv (deg)	N
0.0.0.6.0.1.5.0.0.0.0.0.0.0.72.0.9.0	indicating electricitySecondaryMetered currentAngle phaseBtoAv (deg)	N
0.0.0.6.0.1.5.0.0.0.0.0.0.0.40.0.9.0	indicating electricitySecondaryMetered currentAngle phaseCtoAv (deg)	N
0.0.0.6.0.1.15.0.0.0.0.0.0.0.0.0.33.0	indicating electricitySecondaryMetered frequency (Hz)	N
0.0.0.6.0.1.38.0.0.0.0.0.0.0.0.0.65.0	indicating electricitySecondaryMetered powerFactor (cosθ)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.0.0.29.0	indicating electricitySecondaryMetered voltage (V)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.128.0.29.0	indicating electricitySecondaryMetered voltage phaseA (V)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.64.0.29.0	indicating electricitySecondaryMetered voltage phaseB (V)	N
0.0.0.6.0.1.54.0.0.0.0.0.0.0.32.0.29.0	indicating electricitySecondaryMetered voltage phaseC (V)	N
0.0.0.6.0.1.55.0.0.0.0.0.0.0.72.0.9.0	indicating electricitySecondaryMetered voltageAngle phaseBtoAv (deg)	N

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Code de ReadingType ID	Description	Statut normatif
0.0.0.6.0.1.55.0.0.0.0.0.0.0.40.0.9.0	indicating electricitySecondaryMetered voltageAngle phaseCtoAv (deg)	N
0.0.0.6.19.1.8.0.0.0.0.0.0.0.0.3.38.0	indicating reverse electricitySecondaryMetered demand (kW)	N
0.0.0.12.1.1.37.0.0.0.0.0.0.0.0.3.63.0	instantaneous forward electricitySecondaryMetered power (kVAr)	N
0.0.0.12.1.1.37.0.0.0.0.0.0.0.0.3.38.0	instantaneous forward electricitySecondaryMetered power (kW)	N
0.0.0.12.20.1.37.0.0.0.0.0.0.0.0.3.38.0	instantaneous total electricitySecondaryMetered power (kW)	N
0.0.0.13.0.1.140.0.0.0.0.0.0.0.0.0.108.0	latchingQuantity electricitySecondaryMetered pushbutton (timeStamp)	N
0.8.0.6.1.1.8.0.0.0.0.0.0.0.0.3.38.0	maximum indicating forward electricitySecondaryMetered demand (kW)	N
0.9.0.6.0.1.38.0.0.0.0.0.0.0.0.0.65.0	minimum indicating electricitySecondaryMetered powerFactor (cosθ)	N
0.0.0.0.19.1.4.0.0.0.0.0.0.0.0.0.111.0	reverse electricitySecondaryMetered current (count)	N
22.0.0.1.1.1.12.0.0.0.0.0.0.0.0.3.73.0	seasonal bulkQuantity forward electricitySecondaryMetered energy (kVArh)	N
22.8.0.6.1.1.8.0.0.0.0.1.0.0.0.3.38.0	seasonal maximum indicating forward electricitySecondaryMetered demand touA (kW)	N
22.8.0.6.1.1.8.0.0.0.0.2.0.0.0.3.38.0	seasonal maximum indicating forward electricitySecondaryMetered demand touB (kW)	N
22.8.0.6.1.1.8.0.0.0.0.3.0.0.0.3.38.0	seasonal maximum indicating forward electricitySecondaryMetered demand touC (kW)	N
22.0.0.9.1.1.12.0.0.0.0.1.0.0.0.3.72.0	seasonal summation forward electricitySecondaryMetered energy touA (kWh)	N
22.0.0.9.1.1.12.0.0.0.0.2.0.0.0.3.72.0	seasonal summation forward electricitySecondaryMetered energy touB (kWh)	N
22.0.0.9.1.1.12.0.0.0.0.3.0.0.0.3.72.0	seasonal summation forward electricitySecondaryMetered energy touC (kWh)	N
0.0.7.4.1.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData forward electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.1.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData forward electricitySecondaryMetered energy (kWh)	N
0.0.7.4.4.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData net electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.4.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData net electricitySecondaryMetered energy (kWh)	N
0.0.7.4.19.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData reverse electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.19.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData reverse electricitySecondaryMetered energy (kWh)	N
0.0.7.4.20.1.12.0.0.0.0.0.0.0.0.3.73.0	sixtyMinute deltaData total electricitySecondaryMetered energy (kVArh)	N
0.0.7.4.20.1.12.0.0.0.0.0.0.0.0.3.72.0	sixtyMinute deltaData total electricitySecondaryMetered energy (kWh)	N
0.0.100.4.1.1.12.0.0.30.1.0.0.0.0.3.72.0	specifiedInterval deltaData forward electricitySecondaryMetered energy n30 (kWh)	N
32.0.0.4.0.1.12.0.0.0.0.0.0.0.0.3.72.0	specifiedPeriod deltaData electricitySecondaryMetered energy (kWh)	N
32.0.0.0.0.1.151.0.0.0.0.0.0.0.0.0.840	specifiedPeriod electricitySecondaryMetered billToDate (USD)	N

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Code de ReadingType ID	Description	Statut normatif
0.0.0.9.20.1.12.0.0.0.0.1.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touA (kWh)	N
0.0.0.9.20.1.12.0.0.0.0.2.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touB (kWh)	N
0.0.0.9.20.1.12.0.0.0.0.3.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touC (kWh)	N
0.0.0.9.20.1.12.0.0.0.0.4.0.0.0.3.72.0	summation total electricitySecondaryMetered energy touD (kWh)	N
N = Normatif I = Informatif D = Déconseillé depuis la dernière édition		

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Annexe D
(normative)

Énumérations de codes de qualité

D.1 Généralités

Les codes de qualité peuvent être retournés avec une Reading.value pour indiquer que les données ont quelque chose de remarquable. La présente Annexe D décrit un profil d'énumérations proposé pour les codes de qualité à utiliser dans ce contexte.

La présence d'un code de qualité est facultative. Un élément manquant implique que le producteur de données n'affirme pas que les données soient adéquates. L'approche de certains systèmes (de type MS, par exemple) peut être fondée sur le principe "pas de nouvelles, bonnes nouvelles", ce qui signifie que des codes de qualité ne sont ajoutés que si des problèmes sont détectés. Cela permet de conserver un volume minimal de données. D'autres systèmes (tels qu'un MDM) ajoutent de la valeur aux données en les validant. À ce stade, des codes de qualité peuvent être ajoutés aux données pour déclarer explicitement que les données sont "valides" ou qu'elles ont réussi les essais formels de "validation".

Les valeurs de code de qualité définies par la présente Annexe D sont acheminées dans un message en utilisant un élément ReadingQuality.quality.

D.2 Identification du système proposant un commentaire sur les données

Il est concevable que tout équipement qui touche aux données soit susceptible d'introduire une erreur ou de présenter des remarques relatives à la véracité des données. Par exemple, un compteur peut enregistrer des données d'intervalles et proposer ces données au système de collecte de données, mais, ce faisant, indiquer également qu'il s'est produit quelque chose de remarquable (comme une panne d'alimentation en énergie ou un réajustement d'horloge par exemple) au cours de certains des intervalles. Un système de collecte de données de compteur peut obtenir des relevés sur le terrain, mais réaliser un contrôle de bon sens sur les valeurs pour découvrir que certaines de celles-ci ne sont pas raisonnables. Un système de gestion de données de compteur, armé de la connaissance de l'historique du compte et des profils d'utilisation, peut examiner minutieusement les données pour découvrir que certaines valeurs sont suspectes ou suggérer éventuellement qu'une altération a pu avoir lieu. Tous ces systèmes ont besoin d'une occasion de commenter les données sans (nécessairement) les modifier. Lorsqu'un système modifie effectivement les données, cela aussi peut être noté dans les codes de qualité.

D.3 Construction

Le profil nord-américain définit le code ReadingQuality.quality à générer à partir d'un champ en trois parties:

ReadingQuality.quality::= <System Identifier> "." <Categorization> "." <Index>

Cela crée un nom à 3 champs. Les mappages de CIM ReadingQualityType sont définis par l'IEC 61968-11 comme suit:

System Identifier = ReadingQualityType.systemId

Categorization = ReadingQualityType.category

Index = ReadingQualityType.subCategory

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D.4 Identifiant du système de code de qualité

Le premier des trois champs fournit une identification du système qui a déclaré le problème des données. Cela est décrit dans le Tableau D.1. D'autres systèmes, en dehors d'un sous-système IEC 61968-9, peuvent également identifier des problèmes de données.

Tableau D.1 – Identifiant système

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Code d'identifiant système	Description	Statut normatif
0	Non applicable	N
1	Dispositif terminal	N
2	Réseau (de collecte de données) de système de comptage	N
3	Système de gestion de données de compteur	N
4	Autre système (non énuméré)	N
5	Spécifié de façon externe (voir données d'accompagnement)	I
I = Informative N = Normative D = Déconseillée		

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D.5 Catégorisation des codes de qualité

Le deuxième champ du code de qualité identifie une catégorie pour le problème. Ces champs sont décrits individuellement dans le Tableau D.2.

Tableau D.2 – Exemples de catégories de codes de qualité

Reproduit avec l'autorisation de l'UCAIug.

Catégorie	Description	Commentaire	Statut normatif
0	Valide	Validité des données	N
1	Relatifs au diagnostic	L'équipement qui produit ou gère les données a identifié un problème de diagnostic qui peut avoir un effet sur cette valeur.	N
2	Problèmes relatifs à la qualité de l'énergie au niveau du point de collecte des données	L'équipement qui produit les données a identifié des problèmes relatifs à la qualité de l'énergie qui peuvent avoir un effet sur la véracité des données.	N
3	Relatif à la protection des Recettes / contre la falsification	Système qui identifie que les données sont douteuses pour des raisons relatives à la falsification ou à la protection des recettes.	N
4	Relatifs à la collecte de données	Une condition ou un événement significatif (qui n'est pas associé à une falsification, à la qualité de l'alimentation électrique ou aux diagnostics) s'est produit et peut affecter la véracité des données.	N

Catégorie	Description	Commentaire	Statut normatif
5	Ayant échoué aux essais de bon sens	À première vue, les données semblent incorrectes.	N
6	Ayant échoué aux essais de validation	Les données font échouer une ou plusieurs règles de validation.	N
7	Édité	Remplacé ou approuvé par un individu.	N
8	Estimé	Remplacé par une valeur calculée par une machine à partir d'une analyse de données d'historique utilisant le même type de mesure.	N
9	~~Battant~~	Cette catégorie semble être couverte par d'autres catégories dans la présente norme.	D
10	Douteux	La véracité des données est douteuse pour une raison autre que celles décrites par les catégories 1 à 6.	N
11	Dérivé	La valeur a été calculée (à l'aide d'opérations logiques ou mathématiques) à partir d'un ou de plusieurs relevés du compteur ou de l'appareil auquel la valeur est attribuée et/ou à partir des relevés de compteur(s) ou d'appareil(s) autres que le compteur ou l'appareil auquel la valeur est attribuée.	N
12	Prévu	Valeur prévue.	N
I = Informative N = Normative D = Déconseillée			

D.6 Index de codes de qualité

Chaque catégorie fournit le contexte qui permet de comprendre un index particulier.

Le Tableau D.3 s'appuie sur la "catégorie 0" définie dans le Tableau D.2.

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Tableau D.3 – Codes relatifs à la validité

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Catégorie	Index	Description	Définition	Statut normatif
0	0	Data Valid	Aucun problème de qualité des données n'a été détecté; toutefois, les données n'ont pas été traitées par un processus VEE (Validation, Édition et Estimation) formel.	N
0	1	Validated	Le relevé a passé avec succès la partie validation d'un processus VEE (Validation, Édition et Estimation) formel et n'a pas été édité ou estimé ultérieurement.	N
I = Informative N = Normative D = Déconseillée				

Le Tableau D.4 s'appuie sur la "catégorie 1" définie dans le Tableau D.2.

Tableau D.4 – Codes relatifs aux diagnostics

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Catégorie	Index	Description	Commentaires	Statut normatif
1	0	DiagnosticsFlag	Un ou plusieurs diagnostics ont été générés à partir du matériel d'origine.	N
1	1	BatteryLow		N
1	3	SensorFailure		N
1	4	WatchdogFlag	Une expiration du délai du temporisateur chien de garde ou autre défaillance de la fonction chien de garde s'est produite dans le matériel d'origine.	N
1	5	ParityError	Une erreur de parité a été générée depuis le matériel d'origine.	N
1	6	CRCError	Une erreur de contrôle de redondance cyclique a été générée depuis le matériel d'origine.	N
1	7	RAMChecksumError	Une erreur de somme de contrôle a été détectée dans la mémoire RAM du matériel.	N
1	8	ROMChecksumError	Une erreur de somme de contrôle a été détectée dans la mémoire ROM du matériel.	N
1	9	ClockError	Une défaillance ou anomalie a été détectée avec l'horloge dans le matériel.	N
I = Informative N = Normative D = Déconseillée NOTE les codes relatifs aux diagnostics peuvent produire des EndDeviceEvents correspondants à générer.				

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Le Tableau D.5 s'appuie sur la "catégorie 2" définie dans le Tableau D.2.

Tableau D.5 – Codes relatifs à la qualité de l'énergie

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Catégorie	Index	Description	Commentaires	Statut normatif
2	0	PowerQualityFlag	Rechercher le(s) MeterEvent connexe(s)	N
2	1	ExcessiveOutageCount	Valeur dépassée pour le seuil du compte de pannes d'alimentation en énergie	N
2	2	PqCounter	Valeur dépassée pour le seuil du compte de qualité d'énergie	N
2	3	ServiceDisconnectSwitching	Opération de déconnexion du service pendant l'intervalle de collecte des données	N
2	32	PowerFail	Une panne d'alimentation s'est produite pendant ou au début de cet intervalle. ANSI C12.19. Si l'alimentation est arrêtée pendant tout l'intervalle, il convient de définir la valeur de données présentée sur zéro.	N
I = Informative N = Normative D = Déconseillée				

Le Tableau D.6 s'appuie sur la "catégorie 3" définie dans le Tableau D.2.

Tableau D.6 – Codes relatifs à la protection des recettes / contre la falsification

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Catégorie	Index	Description	Commentaires	Statut normatif
3	0	RevenueProtection	Générique	N
3	1	CoverOpened	Le compteur indique qu'un couvercle étanche a été ouvert.	N
3	2	LogicalDisconnect	La valeur provient d'un compteur dont il convient qu'il n'ait (théoriquement) aucun débit ou un débit très minime.	N
3	3	RevenueProtectionSuspect		N
3	4	ReverseRotation	Un flux inverse du produit mesuré a été détecté. Cela peut indiquer une falsification sur les sites qui n'ont pas été identifiés comme étant capables de génération côté client.	N
3	5	StaticDataFlag	Le compteur affiche une utilisation historique très faible (le cas échéant).	N
I = Informative N = Normative D = Déconseillée				

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Le Tableau D.7 s'appuie sur la "catégorie 4" définie dans le Tableau D.2.

Tableau D.7 – Codes relatifs à la collecte de données

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Catégorie	Index	Description	Commentaires	Statut normatif
4	0	AlarmFlag	Alarme générique	N
4	1	OverflowConditionDetected	Un état de débordement numérique pour une valeur de relevé ou compteur d'impulsion a été détecté.	N
4	2	PartialInterval	Intervalle partiel (court) en raison d'une modification d'horloge, d'une panne d'alimentation en énergie ou d'un événement similaire.	N
4	3	LongInterval	Long intervalle enregistré en raison d'une modification d'horloge ou d'un événement similaire.	N
4	4	SkippedInterval	Intervalle sauté par le compteur en raison d'une modification d'horloge ou d'un événement similaire.	N
4	5	TestData	Valeur de donnée obtenue alors que l'appareil était en mode d'essai.	N
4	6	ConfigurationChanged	Configuration modifiée qui peut affecter la valeur de relevé ou son interprétation.	N
4	7	NotRecording	Arrêt de l'enregistrement de profil de charge	N
4	8	ResetOccurred	Réinitialisation qui peut affecter la valeur de relevé ou son interprétation.	N
4	9	ClockChanged	Une modification de l'heure de l'horloge est intervenue.	N
4	10	LoadControlOccurred	Valeur de donnée obtenue au moment de la présence d'une régulation de la charge.	N
4	16	DstInEffect	Heure d'été/hiver d'économie d'énergie en vigueur au cours ou au début de cet intervalle	N
4	64	ClockSetForward	Horloge réglée dans le sens de l'avance au cours ou au début de cet intervalle. L'intervalle peut être court.	N
4	128	ClockSetBackward	Horloge réglée dans le sens du retard au cours ou au début de cet intervalle. L'intervalle peut être long.	N
4	129	FailedProbeAttempt	Une défaillance ayant empêché la lecture par relevé manuel s'est produite.	N
4	130	CustomerRead	La valeur de relevé a été fournie par un client.	N
4	131	ManualRead	La valeur de relevé provient d'un agent de l'entreprise de distribution ayant réalisé un relevé manuel.	N

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Catégorie	Index	Description	Commentaires	Statut normatif
4	259	DstChangeOccurred	Des données ont été compromises par un changement d'heure d'été/hiver d'économie d'énergie. Des horodatages et/ou des valeurs de données peuvent être incorrect(e)s. NOTE En comparaison avec l'approche ANSI C12.19 dans laquelle l'indicateur DST est réglé pour tout l'été, cet indicateur n'est réglé pour les données altérées que si le changement d'heure d'été/hiver se produit au printemps et en automne.	N
I = Informative N = Normative D = Déconseillée				

Le Tableau D.8 s'appuie sur la "catégorie 5" définie dans le Tableau D.2.

Tableau D.8 – Codes relatifs à Ayant échoué aux essais de bon sens

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Catégorie	Index	Description	Commentaires	Statut normatif
5	256	DataOutsideExpectedRange	Les données présentées ont été identifiées comme non valides par le système émetteur.	N
5	257	ErrorCode	Les données ont été identifiées comme non valides par le système émetteur et ont été remplacées par une valeur codée spéciale pour indiquer une erreur.	N
5	258	Suspect	Il convient que les données soient examinées méticuleusement et considérées comme suspectes	N
5	259	KnownMissingRead	NOTE 1 Il convient que l'élément "value" soit vide lorsque le code de qualité indique qu'il est (bien entendu) manquant. NOTE 2 Si une raison est connue, elle peut être fournie par l'élément MeterReadings.Reason.	N
I = Informative N = Normative D = Déconseillée				

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Le Tableau D.9 s'appuie sur la "catégorie 6" définie dans le Tableau D.2.

Tableau D.9 – Codes relatifs à Ayant échoué aux essais de validation

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Catégorie	Index	Énumération	Commentaires	Statut normatif
6	0	Failed validation – Generic	Échec de relevé à un ou plusieurs contrôles de validation non spécifiés. Il s'agit d'un code générique qui peut être utilisé si un code plus spécifique n'est pas disponible dans ce tableau.	N
6	1	Failed validation – ZeroUsageOn ActiveMeter	Échec de validation du relevé dû à l'usage de zéro sur un compteur actif.	N
6	2	Failed validation – UsageOn InactiveMeter	Échec de validation du relevé dû au non-usage de zéro sur un compteur inactif.	N
6	3	Failed validation – UsageAbove Maximum	Échec de validation du relevé car il s'agit d'une valeur d'usage supérieure au maximum absolu admis.	N
6	4	Failed validation – UsageBelow Minimum	Échec de validation du relevé car il s'agit d'une valeur d'usage inférieure au minimum absolu exigé.	N
6	5	Failed validation – UsageAbove MaximumPct	Échec de validation du relevé car il s'agit d'une valeur d'usage supérieure au pourcentage maximal admis.	N
6	6	Failed validation – UsageBelow MinimumPct	Échec de validation du relevé car il s'agit d'une valeur d'usage inférieure au pourcentage minimal exigé.	N
6	9	Failed Validation – TOU SumCheck Failure	Échec de validation du relevé car la somme des valeurs d'intervalle n'est pas comparable à la différence correspondante dans les relevés de registre.	N
6	y	Failed Validation Rule Y	Échec de relevé à un ou plusieurs contrôles de validation définis. "y" doit être remplacé par un entier positif qui indique la règle de validation ayant échoué. Il est recommandé que les valeurs pour y commencent à 1001 pour permettre de constituer dans la durée la liste des énumérations normatives dans la norme IEC jusqu'à 1 000. Il n'existe aucune limite quant à l'importance de la valeur du nombre qui peut être utilisé pour "y"; cependant, les parties qui participent à l'échange de ce code doivent avoir une compréhension commune de la signification de chaque règle de validation #.	I

I = Informative

N = Normative

D = Déconseillée

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Les déploiements individuels s'abonnent à des ensembles particuliers de règles de validation formelle. Bien qu'il n'y existe pas de norme internationale sur les règles de validation, la présente norme fournit un emplacement réservé auquel la première règle peut être définie en tant que "règle n° 1" pour un déploiement donné, la deuxième règle en tant que "règle n° 2", et ainsi de suite, selon les besoins, jusqu'à ce que toutes les règles soient numérotées. Chaque système, s'exécutant alors en tant qu'entreprise de distribution donnée sous un ensemble donné de règles, est soumis au même ensemble de règles qui ont été officiellement répertoriées et numérotées.

Le Tableau D.10 s'appuie sur la "catégorie 7" définie dans le Tableau D.2.

Tableau D.10 – Codes relatifs à l'édition

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Catégorie	Index	Description	Commentaires	Statut normatif
7	0	Manually Edited – Generic	La valeur de relevé a été éditée par une personne qui utilise une méthode d'estimation manuelle non spécifiée. Il s'agit d'un code générique qui peut être utilisé si un code plus spécifique n'est pas disponible dans ce tableau.	N
7	1	Manually Added	Une valeur de relevé a été ajoutée par une personne.	N
7	3	Manually Rejected	Une valeur a été proposée par le système ou n'a pas satisfait à un niveau donné de contrôle de la qualité. La valeur a été examinée et rejetée par un être humain	N
7	Y	Manually Edited – Method Y	La valeur de relevé a été éditée par une personne qui utilise une méthode d'estimation manuelle définie. "y" doit être remplacé par un entier positif qui indique la méthode d'estimation manuelle qui a été utilisée. Il est recommandé que les valeurs pour y commencent à 1001 pour permettre de constituer dans la durée la liste des énumérations normatives dans la norme IEC jusqu'à 1 000. Il n'existe aucune limite quant à l'importance de la valeur du nombre qui peut être utilisé pour "y"; cependant, les parties qui participent à l'échange de ce code doivent avoir une compréhension commune de la signification de chaque méthode d'édition manuelle #y.	I
I = Informative N = Normative D = Déconseillée				

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Le concept d'"edited" signifie qu'un être humain a participé à la création de la valeur. Il peut faire l'objet d'une saisie clavier dans le système. Il peut être suggéré par le système à l'aide de l'une des nombreuses approches, mais finalement approuvé par un être humain. Les valeurs qui sont générées par l'ordinateur et ne sont jamais approuvées par un être humain relèvent de la catégorie "estimé''. Les valeurs qui proviennent d'un compteur, identifiées comme suspectes, mais néanmoins acceptées par un être humain pour une utilisation relèvent de la catégorie "douteux".

Les différents systèmes peuvent identifier différentes façons d'aider l'utilisateur à créer une nouvelle valeur. Le schéma de numérotation permet de répertorier les différentes façons et de les identifier formellement pour un déploiement donné.

Le Tableau D.11 s'appuie sur la "catégorie 8" définie dans le Tableau D.2.

Tableau D.11 – Codes relatifs à l'estimation

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Catégorie	Index	Énumération	Commentaires	Statut normatif
8	0	Estimated – Generic	La valeur de relevé a été estimée par une machine avec un algorithme de calcul qui utilise une méthode d'estimation non spécifiée. Il s'agit d'un code générique qui peut être utilisé si un code plus spécifique n'est pas disponible dans ce tableau.	N
8	Y	Machine Estimated – Method Y	La valeur de relevé a été estimée par une machine avec un algorithme de calcul qui utilise une méthode d'estimation définie. "y" doit être remplacé par un entier positif qui indique la méthode d'estimation qui a été utilisée. Il est recommandé que les valeurs pour y commencent à 1 001 pour permettre de constituer dans la durée la liste des énumérations normatives dans la norme IEC jusqu'à 1 000. Il n'existe aucune limite quant à l'importance de la valeur du nombre qui peut être utilisé pour "y"; cependant, les parties qui participent à l'échange de ce code doivent avoir une compréhension commune de la signification de chaque méthode d'estimation #y.	I
I = Informative N = Normative D = Déconseillée				

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Les estimations peuvent être générées de nombreuses manières. Par exemple, une estimation peut être fondée sur une combinaison d'utilisation historique, d'analyse de tendance et de conditions météorologiques. Une autre approche consiste à créer une valeur pour un compteur en s'appuyant sur un mesurage d'informations équivalentes d'un autre compteur. (Par exemple, il peut exister plusieurs sources de mesure de la tension d'alimentation disponibles. En cas d'échec de la source préférentielle, une autre source peut être utilisée avec un résultat équivalent.) Certaines techniques utilisées peuvent avoir un caractère propriétaire. D'autres techniques d'estimation peuvent être couramment utilisées et peuvent être exigées d'un point de vue légal par certains régulateurs dans certains lieux. Le schéma de numérotation "approche n°1", "approche n°2", et ainsi de suite est un emplacement réservé dans lequel les approches utilisées peuvent être officiellement répertoriées pour un déploiement donné et identifiées en tant que technique spécifique.

Le Tableau D.12 s'appuie sur la "catégorie 10" définie dans le Tableau D.2.

Tableau D.12 – Codes relatifs à Douteux

Reproduit avec l'autorisation de l'UCAIug.

Catégorie	Index	Description	Commentaires	Statut normatif
10	0	Indeterminate	La qualité est inconnue ou ne peut pas être déterminée. NOTE 1 Similaire au cas dans lequel aucun code qualité n'est fourni, mais dans lequel d'autres codes peuvent être présents, ce qui jette le doute sur la véracité des données, ou une situation, qui peut être apparue, empêche toute sorte d'analyse sur les données ou sur le matériel qui a fourni les données. NOTE 2 Lorsqu'elle est utilisée en réponse à une demande Power (Energization) Status ou Switch Position, une qualité "Indeterminate" (indéterminé) signifie que l'état d'alimentation en énergie ou la position du commutateur est inconnu(e) ou ne peut pas être déterminé(e). Lorsqu'il est utilisé en réponse à une demande pour d'autres types de relevés, "indeterminate" signifie que la qualité de la valeur fournie est explicitement inconnue.	N
10	1	Manually accepted	Indique que la valeur n'a pas un certain niveau de contrôle de la qualité, mais que la panne a été modifiée par un utilisateur humain.	N
I = Informative N = Normative D = Déconseillée				

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Le Tableau D.13 s'appuie sur la "catégorie 11" définie dans le Tableau D.2.

Tableau D.13 – Codes relatifs à Dérivé

Reproduit avec l'autorisation de l'UCAIug.

Catégorie	Index	Énumération	Commentaires	Statut normatif
11	0	Derived – Deterministic	"Derived "(Dérivé) indique que la valeur a été calculée (à l'aide d'opérations logiques ou mathématiques) à partir d'un ou de plusieurs relevés du compteur ou de l'appareil auquel la valeur est attribuée et/ou à partir des relevés de compteur(s) ou d'appareil(s) autres que le compteur ou l'appareil auquel la valeur est attribuée. "Deterministic"(Déterministe) (à la différence de "Derived" – voir article suivant) est utilisé lorsqu'un degré significatif d'incertitude n'existe pas dans la valeur résultante. Par exemple, la qualité de "x.11.0" ou "Derived – Deterministic" peut être utilisée quand une valeur d'un compteur virtuel est calculée en tant que somme des valeurs de deux compteurs ou plus.	N
11	1	Derived – Inferred	"Derived "(Dérivé) indique que la valeur a été calculée (à l'aide d'opérations logiques ou mathématiques) à partir d'un ou de plusieurs relevés du compteur ou de l'appareil auquel la valeur est attribuée et/ou à partir des relevés de compteur(s) ou d'appareil(s) autres que le compteur ou l'appareil auquel la valeur est attribuée. "Infered "(Déduit) (à la différence de "Deterministic" – voir article précédent) est utilisé lorsqu'un degré significatif d'incertitude peut exister dans la valeur résultante. Lorsqu'il est utilisé en réponse à Power (Energization) Status Checks, "x.11.1" ou "Dérivé – Déduit" est synonyme de "Déduit". Par exemple, un UsagePoint peut être déterminé pour une valeur "De-energized" et une Qualité de relevé "Derived- Infered" s'il est déduit comme étant hors tension, car un ou plusieurs autres UsagePoint sont confirmés comme étant "hors tension" sur le même transformateur de distribution. Dans ce cas, il y a très peu de risques que la déduction soit incorrecte.	N
I = Informative N = Normative D = Déconseillée				

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Le Tableau D.14 s'appuie sur la "catégorie 12" définie dans le Tableau D.2.

Tableau D.14 – Codes relatifs à la projection

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Catégorie	Index	Énumération	Commentaires	Statut normatif
12	0	Projected – Generic	La valeur de relevé a été projetée (prévision) avec un algorithme de calcul qui utilise une méthode de projection (prévision) non spécifiée. Il s'agit d'un code générique qui peut être utilisé si un code plus spécifique n'est pas disponible dans ce tableau.	N
12	Y	Projected – Method Y	La valeur de relevé a été projetée (prévision) avec un algorithme de calcul qui utilise une méthode de projection (prévision) définie. "y" doit être remplacé par un entier positif qui indique la méthode de projection (prévision) qui a été utilisée. Il est recommandé que les valeurs pour y commencent à 1 001 pour permettre de constituer dans la durée la liste des énumérations normatives dans la norme IEC jusqu'à 1 000. Il n'existe aucune limite quant à l'importance de la valeur du nombre qui peut être utilisé pour "y"; cependant, les parties qui participent à l'échange de ce code doivent avoir une compréhension commune de la signification de chaque méthode de projection #y.	I
I = Informative N = Normative D = Déconseillée				

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De la même façon que "estimated" crée une valeur générée par l'ordinateur à partir d'une vue historique des données d'un événement qui s'est produit dans le passé, "projected" crée une valeur générée par l'ordinateur, prévue dans l'avenir. Le schéma de numérotation "approche n°1", "approche n°2", et ainsi de suite, est un emplacement réservé dans lequel les approches utilisées peuvent être officiellement répertoriées pour un déploiement donné et identifiées en tant que technique spécifique.

D.7 Exemples de codes de qualité

Certains des codes décrits dans le Tableau D.15 sont utilisés dans des systèmes depuis la publication de l'IEC 61968-2009.

Tableau D.15 – Exemples de codes de qualité

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Code de qualité	Origine (du Tableau D.1)		Catégorie (du Tableau D.2)		Index (des Tableaux D.3 à D.15)		Statut normatif
Non fourni	Non fourni		Non fourni		AssumedValid	aucun	N
1.0.0	Dispositif terminal	1	0	Validité	DataValid	0	N
1.1.4	Dispositif terminal	1	1	Diagnostic	WatchdogFlag	4	N
1.4.1	Dispositif terminal	1	4	Collecte de données	OverflowConditionDetected	1	N
1.4.16	Dispositif terminal	1	4	Collecte de données	DstInEffect	16	N
1.4.2	Dispositif terminal	1	4	Collecte de données	Partial (short) Interval	2	N
1.4.3	Dispositif terminal	1	4	Collecte de données	LongInterval	3	N
1.4.4	Dispositif terminal	1	4	Collecte de données	SkippedInterval	4	N
1.4.5	Dispositif terminal	1	4	Collecte de données	TestData	5	N
1.5.257	Dispositif terminal	1	5	Raisonnabilité	ErrorCode	257	N
2.0.0	Réseau MS	2	0	Validité	DataValid	0	N
2.3.4	Réseau MS	2	3	Falsification	ReverseRotation	4	N
2.3.5	Réseau MS	2	3	Falsification	StaticDataFlag	5	N
2.4.259	Réseau MS	2	4	Collecte de données	DstChangeOccurred	259	N
2.5.256	Réseau MS	2	5	Raisonnabilité	DataOutsideExpectedRange	256	N
2.5.257	Réseau MS	2	5	Raisonnabilité	ErrorCode	257	N
3.0.0	MDM	3	0	Validité	DataValid	0	N
3.10.0	MDM	3	10	Douteux	Indeterminate	0	N
3.10.1	MDM	3	7	Édité	Manually accepted	1	N
3.11.0	MDM	3	11	Dérivé	Dérivé – générique	0	N
3.11.1	MDM	3	11	Dérivé	Dérivé – Déduit	1	N
3.3.3	MDM	3	3	Falsification	RevenueProtectionSuspect	3	N
3.3.5	MDM	3	3	Falsification	StaticDataFlag	5	N
3.5.259	MDM	3	5	Raisonnabilité	Lecture manquante connue	259	N
3.6.0	MDM	3	6	Validation	Échec de validation – Générique	0	N
3.7.0	MDM	3	7	Édité	Edité manuellement – Générique	0	N

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Annexe E
(normative)

Énumérations EndDeviceEventType

E.1 Généralités

Les systèmes de comptage non seulement collectent des relevés des compteurs, mais consignent aussi des événements. La présente Annexe E décrit les codes recommandés à utiliser pour l'identification correcte des événements IEC 61968.

Les codes d'EndDeviceEventTypes sont classés d'une manière qui divise le code énuméré en quatre parties:

EndDeviceEventType:=
<EndDeviceType>.<EndDeviceDomain>.<EndDeviceSubdomain>.<EndDeviceEventOrAction>

où

<EndDeviceType>	= valeur numérique de l'énumération EndDeviceType (voir la section EndDeviceType)
<EndDeviceDomain>	= valeur numérique de l'énumération EndDeviceDomain (voir la section EndDeviceDomain)
<EndDeviceSubdomain>	= valeur numérique de l'énumération EndDeviSubdDomain (voir la section EndDeviceSubdomain)
<EndDeviceEventOrAction>	= valeur numérique de l'énumération EndDeviceEventorAction (voir la section EndDeviceEventOrAction)

E.2 Conditions d'alarme

E.2.1 Généralités

Alors que l'EndDeviceEventType définit l'événement qui s'est produit, il est également nécessaire d'indiquer la gravité d'un événement (Alarm, Advisory, Normal, etc.). Il convient de définir ces valeurs dans le champ EndDeviceEvent.severity. Cela permet à chaque système qui met en œuvre des événements CIM de classifier la gravité de ses événements en fonction de ses intentions, sans devoir effectuer un classement selon une définition rigide figurant dans l'IEC 61968-9.

E.2.2 Suppression de conditions d'alarme et communication des modifications d'état/de condition

Dans certains cas, la modification d'état d'un paramètre particulier doit être communiquée à un système externe. Dans le petit nombre de cas découverts, un EndDeviceEventorAction concis a simplement été ajouté pour la décrire. Les événements indiqués dans le Tableau E.1 prennent en charge cette méthode de communication.

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Tableau E.1 – Exemple de pairages entre les évènements de compteur et les mnémoniques d'énumération EndDeviceEvent

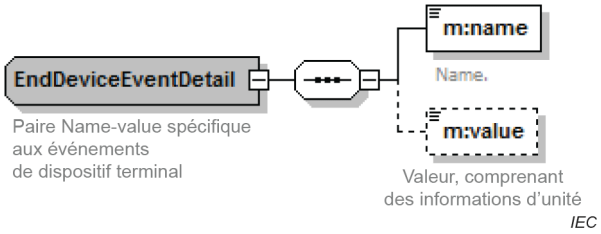
Description de l'événement ou de la commande	EndDeviceEvent Catégorie (utilisant des mnémoniques d'énumération)
Diagnostic 8 Condition Fort courant neutre effacée	*.Power.NeutralCurrent. MaxLimitReachedCleared
Energie réactive avance effacée Attention 040000 Condition Energie réactive avance effacée	*.Power.PowerFactor.OutofRangeCleared
Forte distorsion éliminée Diagnostic 5 Forte distorsion éliminée	*.Power.PowerQuality.HighDistortionCleared
Déséquilibre de tension éliminé Diagnostic 2 Déséquilibre de tension éliminé	*.Power.Voltage.ImbalanceCleared
Alerte phase effacée, condition d'alerte d'angle de phase éliminée	*.Power.PhaseAngle.OutofRangeCleared
Phase croisée éliminée Diagnostic 1 Polarité de condition, Phase croisée, Flux de l'énergie Rv effacé	*.Power.Phase.CrossPhaseCleared
Phase inactive effacée Diagnostic 3 Condition de phase inactive effacée	*.Power.Phase.InactiveCleared
Bosse de tension commencée (Phase A)	*.Power.PhaseAVoltage.SwellStarted
Bosse de tension commencée (Phase B)	*.Power.PhaseBVoltage.SwellStarted
Bosse de tension commencée (Phase C)	*.Power.PhaseCVoltage.SwellStarted
Bosse de tension éliminée Attention 004000 Condition de surcharge de la demande effacée	*.Power. Voltage.SwellStopped
Bosse de tension arrêtée (Phase A) Diagnostic 7 Condition de surtension, Phase A éliminée	*.Power.PhaseAVoltage.SwellStopped
Bosse de tension arrêtée (Phase B)	*.Power.PhaseBVoltage.SwellStopped
Bosse de tension arrêtée (Phase C)	*.Power.PhaseCVoltage.SwellStopped
Baisse soudaine de tension commencée (Phase A)	*.Power.PhaseAVoltage.SagStarted
Baisse soudaine de tension commencée (Phase B)	*.Power.PhaseBVoltage.SagStarted
Baisse soudaine de tension commencée (Phase C)	*.Power.PhaseCVoltage.SagStarted
Baisse soudaine de tension éliminée Attention 000400 Condition de sous-tension éliminée	*.Power.Voltage.SagStopped
Baisse soudaine de tension arrêtée (Phase A); Diagnostic 6 Condition de sous-tension, Phase A éliminée	*.Power.PhaseAVoltage.SagStopped
Baisse soudaine de tension arrêtée (Phase B)	*.Power.PhaseBVoltage.SagStopped
Baisse soudaine de tension arrêtée (Phase C)	*.Power.PhaseCVoltage.SagStopped

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E.3 Données d'événement

Certains événements exigent ou contiennent plus d'informations détaillées qu'une description et une catégorie. Par exemple, la spécification de numéros particuliers de canal, d'alarme, de relais, de port, de formule, de version, etc. Il convient de régler ces numéros sur l'élément identifié par la paire nom/valeur EndDeviceEvent.EndDeviceEventDetails.

Il convient toutefois de ne pas trop utiliser cette construction ou de l'utiliser à mauvais escient. Cette construction a pour but unique de capturer des données auxiliaires relatives à l'événement. Il convient de ne pas l'utiliser à la place de l'envoi d'un ensemble complet d'informations EndDeviceEvent, par exemple (voir la Figure E.1).

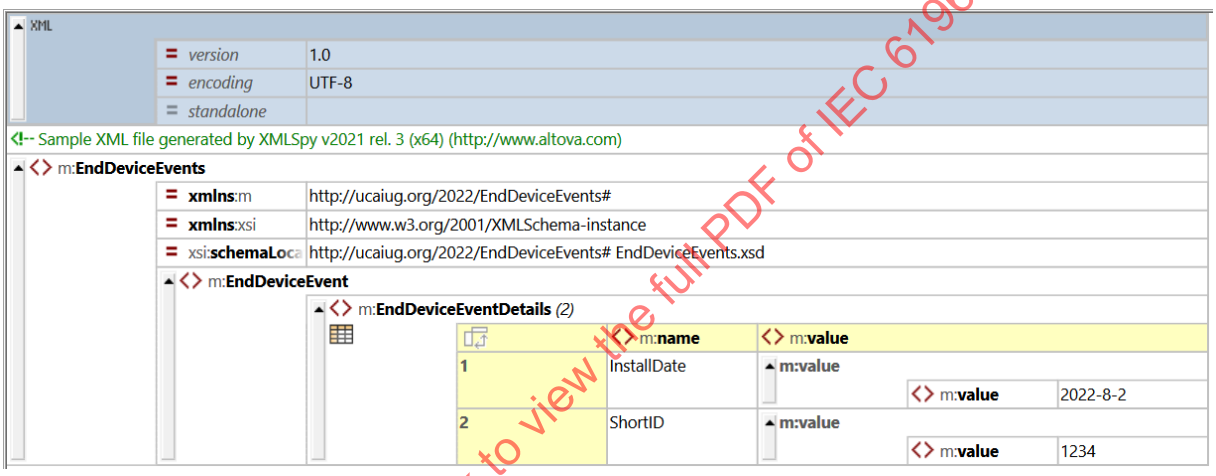


La Figure E.1 est reproduite avec l'autorisation de l'UCAIug.

Figure E.1 – Données d'événement

Voici quelques exemples de son utilisation:

Un événement d'appariement PAN terminé ([PAN Pairing Completed]) peut également fournir les données indiquées à la Figure E.2.

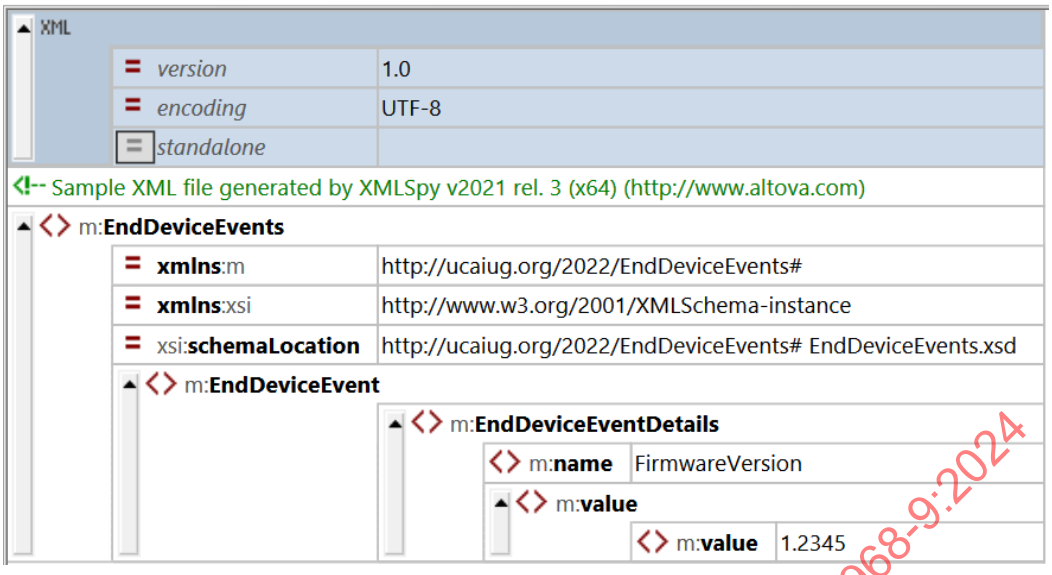


La Figure E.2 est reproduite avec l'autorisation de l'UCAIug.

Figure E.2 – Exemple 1 de plusieurs EndDeviceEventDetails

Un événement de téléchargement de microprogramme ([Firmware Downloaded]) peut également fournir les données indiquées à la Figure E.2.

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La Figure E.3 est reproduite avec l'autorisation de l'UCAIug.

Figure E.3 – Exemple 2 de EndDeviceEventDetails

Un événement d'exception de tension ([Voltage Exception]) peut également fournir les données décrites à la Figure E.4.



La Figure E.4 est reproduite avec l'autorisation de l'UCAIug.

Figure E.4 – Exemple 3 de EndDeviceEvent

E.4 Identifiant en 4 parties: EndDeviceEventType

Les Articles E.5 à E.8 décrivent chaque partie de l'énumération EndDeviceEventType:

- <EndDeviceType>;
- <EndDeviceDomain>;
- <EndDeviceSubdomain>;
- <EndDeviceEventorAction>.

E.5 EndDeviceType

Au niveau le plus élevé, il est utile d'identifier le type d'appareil à partir duquel l'événement a été créé. Il convient que chacun de ces éléments représente un appareil physique, bien que la valeur zéro (0) puisse être utilisée dans des cas particuliers. Les codes EndDeviceType sont énumérés et décrits dans le Tableau E.2.

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Tableau E.2 – Codes EndDeviceType

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Énumération EndDeviceType		
Mnémonique	**Valeur**	**Description**
n/a	0	Non applicable. Utiliser ce type d'appareil lorsqu'un type d'appareil n'est pas connu.
Cabinet	30	Baie intelligente
Collector	10	Appareil qui agit comme un point central de communication entre HES et les appareils sur site.
ComDevice	26	Appareil de communication
DAPDevice	1	Appareil de point d'agrégation de données
DERDevice	2	Appareil de réponse à la demande
DSPDevice	6	Appareil de traitement de signaux numériques
ElectricMeter	3	Appareil situé sur les lieux de mesure de l'utilisation d'électricité.
ElectricVehicle	58	(ou véhicule électrique rechargeable), véhicule qui peut être branché sur le réseau électrique.
EnergyRouter	23	Un routeur d'énergie, analogue au routeur de données et de communications bien connu, détecte automatiquement la demande d'électricité et délivre l'électricité transformée sous la forme exigée (courant alternatif ou courant continu) à la tension et à la fréquence correctes sur un système d'alimentation électrique.
Feeder	13	Les lignes ("feeders") transportent du courant triphasé et tendent à suivre les chemins principaux près du poste.
GasMeter	4	Appareil situé sur les lieux de mesure de l'utilisation du gaz.
Gateway	5	Appareil de passerelle.
Generator	14	Il s'agit généralement d'un générateur électrique rotatif. Un élément doit faire tourner le générateur – il peut s'agir d'une roue à aubes dans un barrage hydroélectrique, d'un gros moteur diesel ou d'une turbine à gaz.
InPremisesDisplay(IPD/IHD)	15	L'affichage IPD/IHD (In-Premises/In-Home Display) permet aux clients de l'entreprise de distribution de suivre leur consommation d'énergie sous une forme de tableau ou de graphique en fonction des kWh utilisés.
LoadControlDevice	16	Appareil utilisé pour mettre en place des services "différables", communément appelés "heures creuses".
Luminaire	31	Lampe (fixation et ampoule) qui fournit de la lumière à la zone environnante.
NetworkRouter	11	Un routeur distribue des données informatiques numériques contenues dans un paquet de données sur un réseau.
PANDevice	12	Appareil réseau PAN ("premises area network") qui ne fait pas spécifiquement l'objet d'informations détaillées supplémentaires.
PANGateway	7	Une passerelle PAN relie un réseau de communication externe à des appareils de gestion de l'énergie dans les locaux.
PANMeter	17	Appareil réseau PAN ("premises area network") dont la fonction est d'effectuer des mesures (de consommation électrique, par exemple).
PrepaymentTerminal	18	Appareil qui permet au client d'effectuer un paiement anticipé avant de pouvoir utiliser l'énergie.
ProgCtlThermostat(PCT)	19	Appareil thermostat dont les paramètres peuvent être contrôlés par l'intermédiaire d'une API (c'est-à-dire sans intervention humaine).
RangeExtender	20	Appareil d'extension de portée hertzienne ou répéteur hertzien qui peut étendre la portée d'un réseau sans fil existant.

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Énumération EndDeviceType		
Mnémonique	**Valeur**	**Description**
Regulator	21	Un régulateur de tension est un régulateur électrique conçu pour maintenir automatiquement un niveau de tension constant.
Sensor	32	Appareil qui mesure un état physique et consigne une alarme ou un mesurage en conséquence
Substation	22	Un poste ("substation") électrique est une station secondaire d'un système electricity generation, transmission and distribution system where voltage is transformed from high to low or the reverse using transformers.
Transformer	8	Appareil qui convertit la tension (de l'ordre de milliers de volts) d'un générateur en un courant à très haute tension pour le transport longue distance sur le réseau de transport.
WasteWaterMeter	25	Appareil de mesure de l'utilisation des eaux usées.
WaterMeter	24	Appareil de mesure de l'utilisation de l'eau.

E.6 EndDeviceDomain

Le type d'appareil étant connu, il convient de classifier l'événement par un code EndDeviceDomain. Ce code fournit une indication sur le caractère de haut niveau de l'événement. Une attention particulière doit être accordée à EndDeviceDomain dans lequel un événement est classé. Au moyen d'une classification appropriée des événements par un petit ensemble de codes EndDeviceDomain, un système peut exécuter plus facilement les rapports sur la base des types d'événements qui se sont produits ou qui ont été reçus. Les codes EndDeviceDomain sont énumérés et décrits dans le Tableau E.3.

Tableau E.3 – Codes EndDeviceDomain

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Énumération EndDeviceDomain		
Mnémonique	**Valeur**	**Description**
n/a	0	Non applicable. Utilisé lorsqu'un domaine n'est pas nécessaire. Il convient de ne l'utiliser que rarement.
AssociatedDevice	39	Appareil (un relais, par exemple) qui peut être associé à un dispositif terminal.
Battery	2	Tous les événements ou les commandes relatifs à une batterie d'appareil.
Billing	20	Événements ou commandes relatifs au coût de l'énergie (y compris les prix, tarifs, TOU, etc.).
Brighten	75	Événements ou commandes relatifs à une fonction d'atténuation / éclairage
Cartridge	3	Événements ou commandes relatifs aux enregistreurs d'impulsions à l'état solide pour le comptage
Channel 1	50	Événements ou commandes relatifs au canal 1
Channel 2	51	Événements ou commandes relatifs au canal 2
Channel 3	52	Événements ou commandes relatifs au canal 3
Channel 4	53	Événements ou commandes relatifs au canal 4
Channel 5	54	Événements ou commandes relatifs au canal 5
Channel 6	55	Événements ou commandes relatifs au canal 6
Channel 7	56	Événements ou commandes relatifs au canal 7
Channel 8	57	Événements ou commandes relatifs au canal 8
Clock	36	Événements ou commandes relatifs à une horloge interne d'appareil.

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Énumération EndDeviceDomain		
Mnémonique	**Valeur**	**Description**
Communication	1	Événements ou commandes relatifs aux problèmes de pure communication. Envisager d'autres domaines avant d'utiliser celui-ci.
Conductor	74	Événements relatifs à un conducteur
Configuration	7	Événements ou commandes relatifs à la configuration de l'appareil.
Demand	8	Événements ou commandes relatifs à la demande (c'est-à-dire kW) et paramètres de la demande (par opposition à la consommation, c'est-à-dire kWh).
Dim	71	Commande de contrôle pour faire varier l'intensité lumineuse d'un luminaire et ignorer toute capacité de détection de mouvement.
DimWithMotionSense	72	Commande de contrôle pour faire varier l'intensité lumineuse d'un luminaire et réagir à tout mouvement à proximité.
Dimmer	70	Événements relatifs à une fonction de gradation
Firmware	11	Événements ou commandes relatifs au microprogramme de l'appareil.
GasSupply	4	Événements ou commandes relatifs à la fourniture de gaz naturel ou de propane.
Humidité	42	Événements ou commandes relatifs à l'humidité
Installation	6	Événements ou commandes relatifs à l'installation de l'appareil.
KYZPulseCounter	38	Fonction de comptage d'impulsions à l'intérieur d'un compteur ou d'un autre dispositif terminal.
LoadControl	15	Événements ou commandes liés à la restriction ou au contrôle automatique de la consommation d'énergie d'un client.
LoadProfile	16	Événements ou commandes relatifs à la consommation d'énergie (c'est-à-dire la "charge") au fil du temps sur un appareil.
Logs	17	Événements ou commandes relatifs aux journaux internes d'un appareil.
Memory	18	Événements ou commandes relatifs à la mémoire de l'appareil.
Metrology	21	Événements ou commandes relatifs à tout type de mesure réalisé par un appareil.
MobileSecurity	14	Événements ou commandes relatifs à la sécurité des appareils lorsque l'appareil est accessible par le biais d'un outil ou appareil mobile.
Modem	19	Événements ou commandes relatifs au modem d'un appareil.
Network	23	Événements ou commandes relatifs au statut d'un appareil sur le réseau. Également utilisé pour les événements réseau généraux, tels que la mise en service d'un réseau PAN.
Pairing	10	Événements ou commandes relatifs à la liaison d'appareils entre eux (par exemple, PANDevice avec Meter, ComDevice avec Meter, etc.).
Pole	73	Événements relatifs à un poteau électrique de distribution
Power	26	Événements ou commandes relatifs au statut d'alimentation d'un appareil.
Pression	29	Événements ou commandes relatifs aux seuils de pression d'un appareil.
RCDSwitch	31	Événements ou commandes relatifs aux activités de branchement / débranchement à distance de l'appareil.
Recoder	41	Appareil de codage
Security	12	Événements ou commandes relatifs à la sécurité des appareils (par exemple, SecurityKey, HMAC, Parity, Rotation, autre TamperDetection, etc.).
Subcomponent	9	Événements ou commandes relatifs au microprogramme sur un module contenu par un appareil.
Temperature	35	Événements ou commandes relatifs à l'appareil

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Énumération EndDeviceDomain		
Mnémonique	**Valeur**	**Description**
VideoDisplay	13	Événements ou commandes relatifs à l'affichage/écran CRT d'un appareil.
Voltage Fuse	60	Événements ou commandes relatifs au fusible de tension
Volume	40	Grandeur d'un espace tridimensionnel délimité; espace occupé par un liquide ou un gaz.
Watchdog	37	Fonction matérielle ou logicielle déclenchée à l'expiration d'un délai de temporisateur.
WaterSupply	5	Événements ou commandes relatifs à la fourniture en eau.

E.7 EndDeviceSubDomain

EndDeviceDomain peut être subdivisé en codes EndDeviceSubdomain. Les codes EndDeviceSubdomain sont énumérés et décrits dans le Tableau E.4.

Tableau E.4 – Codes EndDeviceSubdomain

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
n/a	0	Non applicable. Utilisé lorsqu'un sous-domaine n'est pas nécessaire. Il convient de ne l'utiliser que rarement
Access	1	Relatif à la sécurité physique (c'est-à-dire l'accessibilité) ou relatif à l'autorisation électronique de lecture/écriture sur un support numérique
Activation	283	Ouverture d'une fonction
AlarmTable	285	Tableau interne d'un appareil pour le suivi des alarmes
ADConverter	142	Relatif à la conversion analogique numérique
AllEvents	148	Relatif à un ensemble d'événements (généralement utilisé dans un scénario d'annulation de tous les événements de régulation de la charge)
ApparentPower	290	Amplitude de la puissance complexe mesurée en volts-ampères
Allocation	2	Relatif à la désignation ou à l'affectation; généralement relatif à la mémoire (RAM/ROM)
Association	74	Relatif à la liaison/appariement d'un appareil/objet à un autre appareil/objet
AUTDProcess	3	Relatif aux processus Always Up To Date (AUTD), watchdog ou keep-alive
AutoRegistration	5	Relatif au processus d'enregistrement automatique
AutoTime	7	Relatif au réglage automatique de l'heure
BTU	13	Relatif aux unités thermiques britanniques
Buffer	14	Relatif au stockage temporaire de données
Cable	15	Relatif à un câble physique
Calculation	16	Relatif à un calcul mathématique
Calibration	18	Relatif à un ensemble de graduations affichant des positions ou des valeurs

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
Certificate	21	Relatif à un document qui atteste de l'authenticité de quelque chose; généralement, un certificat de sécurité
Channel	350	Relatif à un canal de compteur
Charge	22	Relatif à la charge électrique, relatif aux frais de facturation
Checksum	284	Donnée de taille fixe calculée à partir d'un bloc arbitraire de données numériques dans le cadre de la détection d'erreurs accidentelles
Concentration	39	Relatif à la densité ou à la composition d'une chose
Constants	23	Relatif à des valeurs définies de manière statique
ControlPoint	26	Relatif aux paramètres de régulation de la charge
Cover	29	Relatif à quelque chose qui constitue un couvercle ou qui fournit une couverture
CRC	30	Relatif au contrôle de redondance cyclique
Credit	8	Relatif à la partie droite d'un compte; facturation
Current	6	Relatif à la puissance électrique mesurée en ampères
Data	31	Relatif aux informations factuelles
DataLog	33	Relatif à un enregistrement (c'est-à-dire un journal) d'informations factuelles
Date	34	Relatif au temps calendaire
Day	35	Relatif à la partie jour du temps calendaire
DaylightSavingsTime	56	Relatif à la pratique consistant à avancer l'horloge d'une heure au printemps
DayLimit	299	Limite établie pour une période quotidienne
Decryption	36	Relatif à la conversion de données cryptées en données lisibles
Display	143	Relatif à un écran CRT, à un écran LED ou à toute autre forme d'appareil vidéo
DLMS/COSEM Key	405	Relatif à une clé DLMS/COSEM
Door	128	Relatif à une barrière mobile utilisée pour couvrir une ouverture; par exemple, une porte d'accès à un compteur ou à un collecteur
Emergency Codes	361	Relatif aux codes d'urgence mondiaux dans les compteurs à prépaiement
Emergency Override	362	Relatif à la neutralisation d'urgence dans les compteurs à prépaiement.
EmergencySupplyCapacityLimit	138	Relatif aux limites de capacité de fourniture d'urgence
Encoder	40	Relatif à l'objet qui convertit les informations d'un format à un autre
EncoderRegister	41	Relatif au registre de l'encodeur (c'est-à-dire sur un compteur)
EPROM	42	Relatif à la mémoire en lecture seule programmable et effaçable
Event	43	Relatif à quelque chose qui s'est passé; il convient d'utiliser des sous-domaines plus spécifiques avant d'utiliser celui-ci
EventLog	44	Relatif à un enregistrement (c'est-à-dire un journal) de données d'événement

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
EWM	45	Relatif à un module sans fil externe
Feature	46	Relatif à une caractéristique non spécifique
FirmwareReset	47	Relatif à la restauration du microprogramme à son état d'origine
Flow	48	Relatif au mouvement d'une substance (électricité, gaz, eau, etc.)
FPV	49	Relatif à une forme de compressibilité élevée
Frames	50	Relatif à des blocs de taille fixe; comme en mémoire
Fréquence	4	Relatif au nombre de cycles par unité de temps
GCAnalyzer	51	Relatif à l'analyseur chromatographique en phase gazeuse qui est utilisé pour mesurer le mélange composant du gaz naturel fourni à un site
Groups	390	Relatif à des groupes ou des équipes.
HeadEndSystem	52	Relatif au système de comptage/AMI
Hardware	401	Relatif au matériel de comptage
HistoryLog	53	Relatif à un enregistrement (c'est-à-dire un journal) de données historiques
HMAC	54	Relatif au code d'authentification du message haché; méthode spécifique de calcul d'un MAC
Holiday	97	Relatif aux jours réservés ayant une signification spéciale
Identity	10	Relatif à un identifiant unique
Imax	400	Relatif à Imax ou au courant maximal
Initialisation	298	Fonction de démarrage
Input	55	Relatif aux données saisies dans le système
InstallDate	57	Relatif à la date de préparation de l'utilisation
IntelligentRegister	58	Relatif à un registre spécifique sur un appareil
Interval	59	Relatif aux données d'énergie d'intervalle; durée entre deux événements
IO	60	Relatif aux entrées/sorties générales
IPAddress	127	Relatif à une adresse IP (Internet Protocol Address)
LANAddress	61	Relatif à une identification unique d'un appareil sur un réseau d'appareils
LastRead	62	Relatif au relevé final d'un compteur
List	63	Relatif à une liste interne [contenue en mémoire ou dans le microprogramme]
ListPointers	64	Relatif à un ensemble spécifique de valeurs conservé par un compteur
Login	65	Relatif au processus d'accès à un appareil, un ordinateur ou un système
LowSpeedBus	145	Relatif à un circuit qui relie le processeur à d'autres appareils; transmission bas débit
MagneticSwitch	66	Relatif à tout type de commutateur magnétique
MaintMode	11	Relatif à un mode de fonctionnement spécifique dans lequel un appareil peut être défini ou réglé
Measurement	67	Relatif à l'ampleur d'une grandeur
MeasurementType	286	Code qui définit le type de données de mesure
Mesh	68	Généralement relatif au type de compteur réseau

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
MeterBus	147	Relatif à un circuit qui connecte un appareil ou un module à un compteur
MeteringMode	12	Relatif à un mode de fonctionnement spécifique dans lequel un appareil peut être défini ou réglé
Mobile	69	Relatif aux appareils qui ne sont pas confinés à un seul endroit
MOL%	70	Relatif au pourcentage de moles
NetworkId	71	Relatif à une identification unique d'un appareil sur un réseau d'appareils
NeutralCurrent	137	Relatif à la partie essentielle de l'unification électrofaible
NVRAM	72	Relatif à la mémoire vive non volatile
OptionBoard	146	Relatif à un type de module dans un compteur
Parameter	75	Relatif à une variable transmise à une fonction
ParentDevice	76	Relatif à un propriétaire d'appareil
Parity	77	Généralement relatif à un état pair/impair ou marche/arrêt; propriété de symétrie
Password	24	Relatif à un mot de passe utilisé pour l'authentification
Phase	25	Généralement relatif à un moyen de distribuer le courant alternatif; lorsque la phase spécifique n'est pas pertinente, il convient de l'utiliser en tant que EndDeviceSubdomain
PhaseAngle	130	Relatif à la composante angulaire des coordonnées polaires
PhaseAngleA	306	Relatif à la composante A angulaire des coordonnées
PhaseAngleB	308	Relatif à la composante B angulaire des coordonnées
PhaseAngleC	310	Relatif à la composante C angulaire des coordonnées
PhaseAngleAB	312	Relatif à la composante AB angulaire des coordonnées
PhaseAngleBC	314	Relatif à la composante BC angulaire des coordonnées
PhaseAngleCA	316	Relatif à la composante CA angulaire des coordonnées
PhaseA	126	Relatif à la phase A d'un circuit multiphase
PhaseAApparentPower	291	Puissance apparente de la phase A d'un circuit multiphase
PhaseAActivePower	324	Puissance active de la phaseA d'un circuit multiphase
PhaseABvoltage	301	Relatif à la tension de la phase AB
PhaseACurrent	287	Relatif au courant de la première phase d'une alimentation triphasée
PhaseAReactivePower	295	Puissance réactive de la phase A d'un circuit multiphase
PhaseAVoltage	131	Relatif à la tension de la première phase d'une alimentation triphasée
PhaseAVoltagePotential	126	Relatif au potentiel de tension de la première phase d'une alimentation triphasée
PhaseB	134	Relatif à la phase B d'un circuit multiphase

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
PhaseBApparentPower	292	Puissance apparente de la phase B un circuit multiphase
PhaseBActivePower	326	Puissance active de la phase B un circuit multiphase
PhaseBCurrent	288	Relatif au courant de la seconde phase d'une alimentation triphasée
PhaseBCVoltage	302	Relatif à la tension de la phase BC
PhaseBReactivePower	296	Puissance réactive de la phase B un circuit multiphase
PhaseBVoltage	132	Relatif à la tension de la seconde phase d'une alimentation triphasée
PhaseBVoltagePotential	134	Relatif au potentiel de tension de la seconde phase d'une alimentation triphasée
PhaseC	135	Relatif à la phase C d'un circuit multiphase
PhaseCApparentPower	293	Puissance apparente de la phase C un circuit multiphase
PhaseCActivePower	328	Puissance active de la phase C un circuit multiphase
PhaseCAVoltage	304	Relatif à la tension de la phase CA
PhaseCCurrent	289	Relatif au courant de la troisième phase d'une alimentation triphasée
PhaseCReactivePower	297	Puissance réactive de la phase C un circuit multiphase
PhaseCVoltage	133	Relatif à la tension de la troisième phase d'une alimentation triphasée
PhaseCVoltagePotential	135	Relatif au potentiel de tension de la troisième phase d'une alimentation triphasée
PhaseSequence	78	Relatif à l'ordre des phases d'une alimentation multiphase
PhaseVoltage	79	Dans une phase simple ou dans les situations dans lesquelles la phase spécifique n'est pas pertinente, est relatif à la tension dans la phase
PLC	402	Relatif au courant porteur en ligne
Position	365	Relatif à une position relative ou géographique
PowerFactor	27	Relatif au rapport de la puissance réelle qui circule vers la charge à la puissance apparente dans le circuit
PowerFactorPhaseA	318	Relatif au rapport de la puissance réelle qui circule vers la charge à la puissance apparente dans le circuit lié à la phase A.
PowerFactorPhaseB	320	Relatif au rapport de la puissance réelle qui circule vers la charge à la puissance apparente dans le circuit lié à la phase B.
PowerFactorPhaseC	322	Relatif au rapport de la puissance réelle qui circule vers la charge à la puissance apparente dans le circuit lié à la phase C.
PowerQuality	28	Relatif à l'ensemble des limites de propriétés électriques qui permet aux systèmes électriques de fonctionner de façon attendue sans perte significative de performances
PowerQualityRecording	80	Relatif à la capture et au stockage de données de qualité électrique
PrepayData	360	Relatif aux données qui impliquent des compteurs à prépaiement.

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
PrepaymentCredit	81	Relatif à la partie droite d'un compte; facturation pour les comptes de prépaiement
Pricing	9	Relatif à la facturation
Processor	82	Relatif à une unité centrale de traitement, généralement
Program	83	Relatif à un ensemble prédéfini d'instructions
Pulse	84	Relatif à un moyen par lequel l'énergie est mesurée
Queue	197	Relatif à une zone de stockage relativement temporaire utilisée pour conserver les demandes ou les tâches jusqu'à ce qu'elles puissent être traitées
Radio	136	Relatif à un appareil physique qui traite les signaux radio
RAM	85	Relatif à la mémoire vive
Rate	86	Relatif à la vitesse
ReadAccess	202	Relatif au niveau d'autorisation détenu: lecture, écriture, mise à jour, par exemple
Readings	87	Relatif à la collecte de données de consommation, de diagnostic et de statut auprès d'un compteur
ReactivePower	294	Puissance qui n'effectue pas le travail mesuré en VA réactifs (VAr)
Recoder	300	Appareil de codage
Recovery	88	Relatif à un processus de restauration à partir d'un état de rupture
Register	89	Relatif à un emplacement réservé à des informations
Registration	90	Relatif à un processus par lequel un appareil est reconnu ou ajouté
Relay	91	Relatif à un commutateur à fonctionnement électrique
RemoteAccess	211	Relatif à la sécurité physique (c'est-à-dire l'accessibilité) ou à l'autorisation électronique de lecture/écriture sur support numérique à partir d'un appareil mobile ou à partir d'un emplacement autre que celui auquel se trouve l'objet accédé
ROM	92	Relatif à la mémoire en lecture seule
Rotation	93	Relatif au déplacement d'un objet dans un mouvement circulaire
RTP	94	Relatif à la tarification en temps réel
Schedule	95	Relatif à un calendrier ou un planning d'événements futurs
Season	228	Relatif à la division d'une année marquée par des changements atmosphériques; généralement l'hiver, le printemps, l'été et l'automne
SecondaryCredit	96	Relatif à un montant de crédit autre que principal
SecuredRegister	98	Relatif à un registre spécifique sur un appareil
SecuredTable	99	Relatif à un tableau qui exige une autorisation pour être accessible
SecurityKey	32	Relatif à un élément d'information qui détermine la sortie opérationnelle d'un chiffrement cryptographique
SecurityKeyLength	119	Relatif à la longueur d'une clé de sécurité

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
SecurityKeyVersion	120	Relatif à la version d'une clé de sécurité
SelfDetermination	366	Fonctionnement fondé sur des paramètres autodéterminés, par exemple, automatique.
SelfRead	231	Relatif à un processus avec un appareil à lecture automatique
SelfTest	100	Relatif à un processus avec un appareil à exécution d'essai interne automatique
Sensor	144	Relatif à un appareil mécanique qui transmet un signal à un appareil de mesure
Session	129	Relatif à une session de communication, généralement
SetPoint	101	Relatif au seuil auquel une fonctionnalité est engagée; généralement relatif à la régulation de la charge
SigmaticMessage	102	Relatif aux messages stigmatiques
Signature	103	Relatif à la sécurité électronique et à la signature de messages
SignatureLength	104	Relatif à la longueur d'une signature de sécurité
SignatureTimestamp	105	Relatif à la durée de validité d'une signature de sécurité
SignatureUsage	106	Relatif à la façon dont une signature est utilisée
SpecificGravity	240	Relatif au rapport de la densité de la substance à la densité de l'eau
StandardTime	107	Relatif à l'heure standard, par opposition à l'heure d'été
StandbyMode	108	Relatif à un mode de fonctionnement spécifique dans lequel un appareil peut être défini ou réglé
Status	17	Relatif à l'état actuel d'un objet
Storage	109	Relatif au support sur lequel l'information est maintenue; également relatif à l'acte de stockage des informations
SupplyCapacityLimit	139	Relatif aux limites de capacité de fourniture
Table	110	Relatif à une structure qui contient des lignes et des colonnes
Tariff	140	Terme de facturation relatif au coût ou au montant facturé
Test	111	Relatif à une classification qui désigne une action hors production
TestMode	19	Relatif à un mode de fonctionnement spécifique dans lequel un appareil peut être défini ou réglé
TextMessage	112	Relatif à un message ou à un ensemble de caractères qui sont envoyés à un appareil
Threshold	261	Relatif à un niveau ou un point auquel il se produira quelque chose
Tier	113	Relatif à un niveau
Time	114	Relatif à l'heure du jour sous la forme heures:minutes:secondes:millisecondes
Timeout	125	Relatif à un seuil spécifique qui précise à quel moment rendre la main automatiquement en l'absence de réponse
TimeReset	115	Relatif à la réinitialisation de l'heure de la journée

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Énumération EndDeviceSubDomain		
Mnémonique	**Valeur**	**Description**
TimeSync	116	Relatif au processus de réglage de la valeur de l'heure du jour sur un appareil afin de la faire correspondre à celle d'une source de confiance pour l'heure du jour
TimeVariance	117	Relatif à la différence acceptable de l'heure du jour d'un appareil par rapport à une source de confiance pour l'heure du jour
TimeZone	118	Relatif aux régions horaires autour de la terre définies par les méridiens
TOU	121	Relatif au temps d'utilisation
Tranceiver	122	Relatif à un appareil qui possède à la fois un transmetteur et un récepteur
Usage	123	Relatif à la façon dont un objet est utilisé
Version	124	Relatif à une itération ou une traduction spécifique
Voltage	38	Relatif à la force électrique qui conduit un courant électrique entre deux points
Watchdog	370	Relatif à une procédure ou un processus de chien de garde.
Window	73	Relatif à une période pendant laquelle un appareil peut être associé/couplé à un compteur ou à un autre appareil
WriteAccess	282	Relatif au niveau d'autorisation détenu: lecture, écriture, mise à jour, par exemple

E.8 EndDeviceEventOrAction

La partie la plus spécifique de l'EndDeviceEventType est sa valeur EndDeviceEventOrAction. Cette partie de l'énumération EndDeviceEventType se présente généralement sous la forme d'un verbe qui définit l'action pour l'événement qui vient de se produire.

Les codes EndDeviceEventOrAction sont énumérés et décrits dans le Tableau E.5.

Tableau E.5 – Codes EndDeviceEventOrAction

Reproduit avec l'autorisation de l'UCAIug.

Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
n/a	0	Non applicable. Utilisé lorsqu'un EndDeviceEventOrAction n'est pas nécessaire. Il convient de ne l'utiliser que rarement.
Aborted	1	Événement qui se produit quand une intervention provoque l'arrêt de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain).
Accessed	2	En général, il s'agit d'un événement de sécurité qui survient lorsque l'accès physique ou l'accès aux données a été établi (qu'il soit autorisé ou non).
Acknowledged	3	Événement qui indique la réception de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain).
Activated	4	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est à présent actif alors qu'il était inactif.
Added	370	Événement qui indique qu'un appareil ou un service a été ajouté

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
AlmostFull	283	Événement qui indique qu'une ressource a quasiment atteint sa capacité maximale
ArmedForClosure	11	Événement qui indique qu'une commande ArmForClosure a été exécutée avec succès.
ArmedForOpen	12	Événement qui indique qu'une commande ArmForOpen a été exécutée avec succès.
ArmForClosure	5	Commande utilisée pour indiquer une demande d'armement d'un commutateur pour la fermeture.
ArmForClosureFailed	226	Événement qui indique qu'une demande ArmForClosure a échoué.
ArmForOpen	6	Commande utilisée pour indiquer une demande d'armement d'un commutateur pour l'ouverture.
ArmForOpenFailed	222	Événement qui indique qu'une demande ArmFor Open a échoué.
Attempted	7	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain), fondé sur la combinaison d'EndDeviceDomain et d'EndDeviceSubdomain, a été tenté.
Calculated	21	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain), fondé sur la combinaison d'EndDeviceDomain et d'EndDeviceSubdomain, a été calculé.
Cancel	8	Commande utilisée pour indiquer une demande de fin d'une commande précédemment émise.
CancelFailed	86	Événement qui indique qu'une annulation (Cancel) a échoué.
Cancelled	10	Événement qui indique qu'une commande ou un ensemble de commandes émis précédemment s'est terminé avec succès.
Change	13	Commande utilisée pour indiquer une demande de modifications.
Changed	24	Événement qui indique qu'une demande Change connexe a été effectuée avec succès.
ChangedOut	284	Événement qui indique qu'un actif a été remplacé
ChangeOutRequired	27	Commande utilisée pour demander le remplacement d'un appareil par un nouvel appareil du même type.
ChangePending	14	Événement qui indique qu'une mise à jour n'a pas encore été réalisée.
Charged	15	Événement qui peut indiquer un état relatif à la facturation ou actuellement soumis à une charge électrique.
Cleared	28	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain), sur l'appareil a été résolu ou vidé.
Close	299	Une commande pour l'élément décrit par EndDeviceDomain/EndDeviceSubdomain, NOTE Cette commande peut être utilisée pour fermer une fenêtre d'appariement. Il convient de ne pas l'utiliser pour fermer un commutateur. Il convient d'utiliser en lieu et place la commande "Connect".
Closed	16	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain), sur l'appareil qui a été ouvert ne l'est plus.
ColdStarted	31	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été démarré alors qu'il se trouvait à l'état arrêté (différent d'un WarmStart qui implique le démarrage de l'élément alors que celui-ci se trouve déjà à l'état démarré).

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
Confirmed	17	Événement qui indique la réception et l'acceptation de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain).
Connect	18	Commande de demande de mise en service d'un appareil. NOTE Cette commande ‘ferme’ effectivement un commutateur électrique ou ‘’ouvre’’ une vanne d’eau.
Connected	42	Événement qui indique la mise en service d'un appareil.
ConnectFailed	67	Événement qui indique qu'une demande Connect a échoué.
Corrupted	43	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est passé de l'état correct à l'état incorrect.
CorruptionCleared	281	Événement qui indique qu'une condition d'endommagement a été éliminée.
Create	82	Commande de demande de création de quelque chose.
Created	83	Événement qui indique qu'une demande Create a réussi.
CreateFailed	297	Événement qui indique qu'une demande Create a échoué.
CrossPhaseCleared	70	Événement qui indique que l'instabilité due à la modulation croisée de phases a été corrigée.
CrossPhaseDetected	45	Événement qui indique l'instabilité due à la modulation croisée de phases.
Deactivated	19	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) sur l'appareil qui se trouvait précédemment à l'état actif n'est plus actif.
Decreased	57	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) possède une valeur ou une amplitude inférieure.
Delayed	20	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est plus lent que prévu ou se terminera plus tard que prévu.
Disable	22	Commande de demande de rendre l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) inopérant (interdit).
Disabled	66	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été rendu inopérant (interdit) avec succès.
DisableFailed	220	Événement qui indique qu'une demande Disable a échoué.
Disallowed	161	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) n’était pas permis.
Disconnect	23	Commande qui demande qu'un appareil soit mis hors service; peut également signifier une demande de connexion serveur à l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain). NOTE Cette commande ‘ouvre’ effectivement un commutateur électrique ou ‘’ferme’’ une vanne d’eau.
Disconnected	68	Événement qui indique qu'un appareil a été mis hors service avec succès; peut également signifier que la connexion à l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été coupée ou a pris fin.
DisconnectFailed	84	Événement qui indique qu'une demande Disconnect a échoué.
Display	77	Commande de demande d'affichage de quelque chose (comme dans un TextMessage).
Displayed	78	Événement qui indique qu'une demande Display a été effectuée avec succès.

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
DisplayFailed	87	Événement qui indique qu'une demande Display a échoué.
Distorted	91	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve dans un état différent de l'état attendu.
Downloaded	25	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été transmis du réseau à l'appareil.
Enable	26	Commande de demande de rendre l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) opérant.
Enabled	76	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été rendu opérant avec succès.
EnableFailed	221	Événement qui indique qu'une demande Enable a échoué.
Error	79	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) ne s'est pas achevé avec succès.
ErrorCleared	279	Événement qui indique qu'une condition d'erreur a été éliminée.
Established	29	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été reconnu.
EventStarted	287	Événement qui indique qu'un événement (par exemple, événement de réponse à la demande) a commencé
EventStopped	288	Événement qui indique qu'un événement (par exemple, événement de réponse à la demande) a été stoppé
Exceeded	139	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a dépassé la valeur attendue.
Execute	30	Commande de demande d'exécution de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain).
Expired	64	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a atteint une fin, généralement déterminée par une date ou une heure.
Failed	85	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) n'a pas réussi.
Fault	375	Événement qui indique une panne
FaultCleared	366	Événement qui indique que la panne déclarée précédemment a été éliminée
FireAlarm	376	Événement qui indique la détection de fumée ou de flammes
FireAlarmCleared	371	Événement qui indique que la FireAlarm consignée précédemment a été éliminée.
Frozen	88	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve à l'état statique.
Full	32	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est complet.
Galloping	367	Événement qui indique qu'une vibration résonante a été détectée
GallopingCeased	368	Événement qui indique que la vibration consignée précédemment a cessé.
HighDistortion	69	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a présenté une modification non souhaitée de la forme d'onde d'un signal.
HighDistortionCleared	71	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est revenu à la normale après avoir été à l'état HighDistortion.

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
ImbalanceCleared	75	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est revenu à l'état d'équilibre après avoir été à l'état de déséquilibre.
Imbalanced	98	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) n'est pas équilibré.
Impact	372	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été frappé
ImpactCleared	377	Événement qui indique que l'Impact consigné précédemment ne l'est plus ou a été éliminé.
Inactive	100	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve à l'état inactif.
InactiveCleared	72	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est revenu à l'état actif après avoir été à l'état inactif.
Increased	102	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a crû.
Initialized	33	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été réglé sur des valeurs de départ.
InProgress	34	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se dirige actuellement vers un objectif ou une fin.
Installed	105	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été préparé pour utilisation.
Interruption (temporary)	350	Événement qui indique une interruption de service ou de communication momentanée.
Interruption (long)	351	Événement qui indique une interruption de service ou de communication de longue durée.
Invalid	35	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve dans un état défaillant.
LimitChanged	296	Événement qui indique que le point de définition d'une limite a été modifié
LimitReached	286	Événement qui indique qu'une limite supérieure ou inférieure a été franchie.
Loaded	36	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est à présent engagé.
LossDetected	47	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve dans un état de déficience. Généralement utilisé en relation avec la puissance, la tension ou le courant électrique.
MaxLimitChanged	295	Événement qui indique que le point de définition d'une limite maximale a été modifié
MaxLimitCleared	293	Événement qui indique qu'un événement MaxLimitReached a été éliminé
MaxLimitReached	93	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a atteint une valeur maximale acceptable.
MaxLimitReachedCleared	73	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est revenu à un état acceptable après s'être trouvé à l'état MaxLimitReached.
MinLimitChanged	294	Événement qui indique que le point de définition d'une limite minimale a été modifié

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
MinLimitCleared	292	Événement qui indique qu'un événement MinLimitReached a été éliminé
MinLimitReached	150	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a atteint une valeur minimale acceptable.
Mismatched	159	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) n'est pas compatible avec lui-même ou avec quelque chose dans son environnement.
Missing	285	Événement qui indique qu'une entité (par exemple, actif, mesurage, etc.) est manquante
Normal	37	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve dans un état (ou une norme) typique.
NotArmed	290	Événement qui indique qu'un appareil n'est plus dans un état armé
NotAuthorized	38	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a fait l'objet d'un accès sans autorisation.
NotFound	160	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est perdu ou manquant.
Open	298	Une commande pour l'élément décrit par EndDeviceDomain/EndDeviceSubdomain, NOTE Cette commande peut être utilisée pour ouvrir une fenêtre d'appariement. Il convient de ne pas l'utiliser pour ouvrir un commutateur. Il convient d'utiliser en lieu et place la commande "Disconnect".
Opened	39	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est accessible.
Opted-In	80	Événement qui indique qu'un consommateur a accepté de se joindre à un programme.
Opted-Out	81	Événement qui indique qu'un consommateur ne souhaite pas se joindre à un programme.
OutofRange	40	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve en dehors des valeurs acceptables.
OutofRangeCleared	74	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) est revenu à des valeurs acceptables.
Overflow	177	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a dépassé sa taille ou son volume.
PositionDropped	373	Événement qui indique une diminution de l'élévation
PositionDropCleared	374	Événement qui indique que la PositionDropped consignée précédemment a été éliminée.
Preempted	41	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été remplacé par un autre qui a priorité sur lui.
Processed	44	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a passé avec succès toutes les étapes d'une procédure prescrite.
Read	46	Il peut s'agir d'un événement (si le terme est considéré comme participe passé du verbe "Read", "lu" en français) ou d'une commande (si le terme est considéré comme le verbe "Read" à l'infinitif, "lire" en français).
Ready	48	Événement qui indique qu'une condition "prêt" a été atteinte sur un appareil.

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
ReadyForActivation	280	Événement qui indique qu'un appareil a été préparé
Re-established	49	Événement qui indique qu'une condition, généralement une connexion, a été établie après avoir été perdue.
Registered	50	Événement qui indique qu'un appareil ou qu'une condition d'un appareil a été enregistré.
Released	51	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été libéré.
Removed	212	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été mis hors service.
Replaced	52	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été remplacé par un nouvel élément, généralement parce qu'il était obsolète ou usé.
Reprogrammed	213	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a changé de directions ou de programme.
Reset	214	Commande pour demander qu'il convient de réinitialiser l'élément à un état zéro ou un état original (élément identifié par EndDeviceDomain.EndDeviceSubdomain).
ResetFailed	65	Événement qui indique qu'une demande Reset a échoué.
ResetOccurred	215	Événement qui indique qu'une demande Reset a été effectuée avec succès.
Restarted	53	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a redémarré généralement à partir d'un état déjà démarré.
Restored	216	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été replacé à son état antérieur.
Reversed	219	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été placé à l'opposé de son état normal. Généralement utilisé pour une rotation.
SagStarted	223	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été glissé dans un état différent de l'état attendu.
SagStopped	224	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a cessé de fléchir. Généralement utilisé avec l'événement SagStarted.
Same Phase Detected	365	Événement qui indique qu'une phrase similaire a été détectée en rapport à une demande.
Schedule	300	Commande pour demander que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) soit positionné pour une exécution à une date ultérieure.
Scheduled	225	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été réglé pour une exécution à une date ultérieure.
ScheduleFailed	301	Évènement pour indiquer que la commande pour demander que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) s'exécute à une date ultérieure a échoué.
Sealed	227	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve dans un boîtier étanche ou que son accès direct n'est pas possible.
Set to Credit	355	Commande pour demander qu'un compteur soit réglé sur le mode Credit
Set to Credit Failed	357	Événement qui indique que la demande de passer au mode Credit a échoué.

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
Set to Credit Successful	359	Événement qui indique que la demande de passer au mode Credit a abouti avec succès.
Set to Prepay	354	Commande pour demander qu'un compteur soit réglé sur le mode Prepayment.
Set to Prepay Failed	356	Événement qui indique que la demande de passer au mode Prepay a échoué.
Set to Prepay for Provisioning	361	Commande pour demander qu'un compteur soit provisionné pour les compteurs à prépaiement.
Set to Prepay Successful (Block)	360	Événement qui indique que la demande de régler un compteur sur le prépaiement (bloc) a abouti avec succès.
Set to Prepay Successful (TOU)	358	Événement qui indique que la demande de régler un compteur sur prépaiement (TOU) a abouti avec succès.
Start	54	Commande de demande de déclenchement ou de démarrage de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain).
Started	242	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a démarré.
StartFailed	217	Événement qui indique qu'une demande Start a échoué.
Stop	55	Commande de demande d'arrêt normal de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain).
StopFailed	218	Événement qui indique qu'une demande Stop a échoué.
Stopped	243	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) s'est arrêté. Lorsque cela est le résultat d'une commande Stop, il est pris pour hypothèse que les choses se sont arrêtées normalement (c'est-à-dire Sans erreurs).
Substituted	56	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été remplacé par un autre.
Succeeded	58	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) s'est accompli.
SwellStarted	248	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) s'est développé à partir de son état attendu.
SwellStopped	249	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a cessé de gonfler. Généralement utilisé avec l'événement SwellStarted.
SwitchPositionChanged	289	Événement qui indique qu'une position de commutateur a changé.
TamperCleared	291	Événement qui indique qu'une qu'une alarme de fraude a été éliminée
TamperDetected	257	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été modifié ou altéré secrètement. Ces événements sont généralement associés à la sécurité ou à la facturation.
Terminate	302	Commande pour demander qu'un élément (identifié par EndDeviceDomain/EndDeviceSubdomain) s'arrête immédiatement et brusquement.
Terminated	59	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) s'est terminé de façon subite.
TerminateFailed	303	Événement pour indiquer que la tentative d'arrêt de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a échoué.
Tilted	263	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été penché ou incliné.

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Énumération EndDeviceEventOrAction		
Mnémonique	**Valeur**	**Description**
TiltCleared	369	L'inclinaison identifiée précédemment s'est arrêtée
Under Voltage Cleared	353	Événement qui indique qu'une condition de sous-tension a été éliminée.
Under Voltage Detected	352	Événement qui indique qu'une condition de sous-tension a été détectée.
Uninitialized	61	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) possède toutes ses valeurs à leur état de départ.
Unlocked	62	Événement qui indique que le verrou, physique ou logiciel, de l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été libéré.
Unsealed	269	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) n'est pas scellé.
Unsecure	63	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve dans un état non protégé.
Unstable	270	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) se trouve dans un état irrégulier.
Uploaded	60	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été transmis de l'appareil au réseau.
WarmStarted	278	Événement qui indique que l'élément (identifié par EndDeviceDomain/EndDeviceSubdomain) a été démarré alors qu'il se trouvait dans l'état déjà démarré (différent d'un ColdStart qui implique qu'il a été démarré à partir de l'état arrêté).
WriteFailed	282	Événement qui indique qu'une opération d'écriture a échoué.

E.9 EndDeviceEventTypes normatifs

Les champs EndDeviceType, EndDeviceDomain, EndDeviceSubdomain et EndDeviceEventOrAction sont combinés et présentés sous la forme d'une chaîne unique. Les événements normatifs sont répertoriés dans les tableaux suivants: Tableau E.6, Tableau E.7, Tableau E.8, Tableau E.9, Tableau E.10, Tableau E.11, Tableau E.12, Tableau E.13, Tableau E.14, Tableau E.15, Tableau E.16, Tableau E.17, Tableau E.18, Tablaue E.19, Tableau E.20, Tableau E.21, Tableau E.22, Tableau E.23, Tableau E.24, Tableau E.25, Tableau E.26, Tableau E.27, Tableau E.28, Tableau E.29, Tableau E.30, Tableau E.31 et Tableau E.32, regroupés par EndDeviceDomain.

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Tableau E.6 – Événements de Battery (batterie)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Condition de batterie faible détectée Batterie faible détectée pour le module Batterie faible Batterie faible détectée pour le module	*.2,22.150	*	Battery	Charge	MinLimitReached
Batterie OK Batterie Rf OK	*.2,22.37	*	Battery	Charge	Normal
Batterie défaillante	*.2,0.85	*	Battery	n/a	Failed
Batterie installée	*.2,0.105	*	Battery	n/a	Installed
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.7 – Événements de Billing (facturation)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Ajusté le crédit restant	*.20.8.24	*	Billing	Credit	Changed
Soustrait du crédit restant	*.20.8.57	*	Billing	Credit	Decreased
Ajouté au crédit restant	*.20,8.102	*	Billing	Credit	Increased
Crédit d'urgence de prépaiement	*.20,81.102	*	Billing	PrepaymentCredit	Increased
Programme de tarification modifié	*.20,83.24	*	Billing	Program	Changed
Activation de RTP	*.20,94.4	*	Billing	RTP	Activated
Désactivation de RTP	*.20,94.19	*	Billing	RTP	Deactivated
Activation de programme spécial	*.20,95.4	*	Billing	Schedule	Activated
Crédit d'urgence secondaire	*.20,96.102	*	Billing	SecondaryCredit	Increased
Tarif quotidien modifié Tarif hebdomadaire modifié Modification de tarif	*.20,140.24	*	Billing	Tariff	Changed

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Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Réinitialisation de la facturation déprogrammée Réinitialisation de la facturation	20.140.214	*	Billing	Tariff	Reset
Étage modifié	*.20,113.24	*	Billing	Tier	Changed
Discordance de débuts de TOU Discordance de TOU Discordance d'années de TOU	20.121.159	*	Billing	TOU	Mismatched
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.8 – Événements de Cartridge (cartouche)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Erreur de cartouche	*.3,17.79	*	Cartridge	Status	Error
Cartouche gelée	*.3,17.88	*	Cartridge	Status	Frozen
Cartouche installée	*.3,17.105	*	Cartridge	Status	Installed
Aucune cartouche insérée	*.3,17.160	*	Cartridge	Status	NotFound
Cartouche retirée	*.3,17.212	*	Cartridge	Status	Removed
Cartouche remplacée Cartouche bouton-poussoir remplacée Cartouche de terminal mobile Mode de remplacement de cartouche, lecture impossible	*.3,17.52	*	Cartridge	Status	Replaced
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.9 – Événements de Clock (horloge)

Description de l'événement ou de la commande	EndDevice Event Type	End Device Type	End Device Domain	EndDevice SubDomain	EndDevice EventOrAction
Réglage automatique de l'heure effectué	*.36,7.58	*	Clock	AutoTime	Succeeded
Réglage de date modifié	*.36,34.24	*	Clock	Date	Changed
Date et heure d'exécution non valides Plage de dates et heures complète non valide	*.36,34.35	*	Clock	Date	Invalid
Erreur de changement de jour	*.36,35.79	*	Clock	Day	Error
Jour de longueur incorrecte	*.36,35.35	*	Clock	Day	Invalid
Passe de l'heure DST à la nouvelle heure	*.36,56.24	*	Clock	DaylightSavingsTime	Changed

Description de l'événement ou de la commande	EndDevice Event Type	End Device Type	End Device Domain	EndDevice SubDomain	EndDevice EventOrAction
Erreur de variation de l'heure standard ou de l'heure d'économie d'énergie	*.36,56.40	*	Clock	DaylightSavingsTime	OutofRange
Passage de l'heure DST à l'heure précédente	*.36,56.214	*	Clock	DaylightSavingsTime	Reset
Passer à l'heure d'économie d'énergie au printemps	*.36,56.242	*	Clock	DaylightSavingsTime	Started
Congé modifié Congés modifiés	*.36,97.24	*	Clock	Holiday	Changed
Date d'installation non valide	*.36,57.35	*	Clock	InstallDate	Invalid
Problème temporaire d'horloge	*.36,0.79	*	Clock	n/a	Error
Dysfonctionnement d'horloge Échec d'horloge électronique	*.36,0.85	*	Clock	n/a	Failed
Saison changée	*.36,228.24	*	Clock	Season	Changed
Passer à l'heure d'automne standard	36.107.242	*	Clock	StandardTime	Started
Valeur de réglage de l'heure mise à la nouvelle heure Temps de travail du registre réglé sur une nouvelle heure Valeur de réglage de l'heure changée (ancienne heure) Valeur de réglage de l'heure changée Collector Radio Set TimeKeeper Réglage de l'heure du compteur	*.36,114.24	*	Clock	Time	Changed
Variation du temps > 10 secondes	*.36,114.40	*	Clock	Time	OutofRange
Valeur de réglage de l'heure remise à l'heure précédente Heure de registre de travail mise à l'heure précédente Heure réinitialisée	36.114.214	*	Clock	Time	Reset
Incapable de réinitialiser l'heure	*.36,115.85	*	Clock	TimeReset	Failed
Erreur de synchronisation	*.36,116.79	*	Clock	TimeSync	Error
Échec de synchronisation:Échec de synchronisation d'horloge ou E/S de compteur (38)	*.36,116.85	*	Clock	TimeSync	Failed
Synchronisation de l'enregistreur	*.36,116.58	*	Clock	TimeSync	Succeeded
La variation du temps a dépassé les limites, même après que le module a essayé de la corriger. La variation du temps a dépassé les limites sans tentative de correction automatique.	36.117.139	*	Clock	TimeVariance	Exceeded
ID de fuseau horaire non valide	*.36,118.35	*	Clock	TimeZone	Invalid
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.10 – Événements de Communication

Description de l'événement ou de la commande	EndDevice Event Type	End Device Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Défaillance de chien de garde ou d'entretien détectée	*.1.3.85	*	Communication	AUTDProcess	Failed
Câble coupé	*.1,15.85	*	Communication	Cable	Failed
Défaillance de communication de registre de codeur	*.1,41.85	*	Communication	EncoderRegister	Failed
Comm HES RF établie	*.1,52.29	*	Communication	HeadEndSystem	Established
Comm Rf sans HES	*.1,52.85	*	Communication	HeadEndSystem	Failed
Défaillance de communication de registre intelligent	*.1,58.85	*	Communication	IntelligentRegister	Failed
Communications perdues entre les modules au sein d'un compteur	*.1,60.85	*	Communication	IO	Failed
Discordance de définition du tableau E/S	*.1,60.159	*	Communication	IO	Mismatched
Comm Rf sans maillage	*.1,68.85	*	Communication	Mesh	Failed
Échec d'appel téléphonique entrant Échec des communications	*.1,0.85	*	Communication	n/a	Failed
Communications rétablies	*.1,0.49	*	Communication	n/a	Re-established
Communication terminée normalement	*.1,0.59	*	Communication	n/a	Terminated
Alarme file d'attente	*.1,197.85	*	Communication	Queue	Failed
Retard de communication du collecteur	*.1,17.20	*	Communication	Status	Delayed
Réinitialisation de l'émetteur-récepteur Rf	1.122.214	*	Communication	Tranceiver	Reset
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.11– Événements de Configuration

Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Constantes modifiées Constante primaire modifiée Constante secondaire modifiée Constante de sortie modifiée	*.7,23.24	*	Configuration	Constants	Changed
ID du matériel du compteur modifié	*.7.10.24	*	Configuration	Identity	Changed
ID de passerelle non valide ID de transformateur non valide	*.7.10.35	*	Configuration	Identity	Invalid
Nœud manquant	*.7.10.160	*	Configuration	Identity	NotFound
Liste IP groupe radio collecteur	*.7.127.24	*	Configuration	IPAddress	Changed
Mode maintenance Mode atelier de compteur lancé	*.7.11.242	*	Configuration	MaintMode	Started
Mode atelier de compteur arrêté	*.7.11.243	*	Configuration	MaintMode	Stopped
Commencer les relevés du compteur d'enregistrement Commencer le mode veille	*.7.12.242	*	Configuration	MeteringMode	Started
Mode de comptage arrêté	*.7.12.243	*	Configuration	MeteringMode	Stopped
Demander la configuration client	*.7.0.13	*	Configuration	n/a	Change
Paramètres réseau groupe radio collecteur	*.7.0.24	*	Configuration	n/a	Changed
Erreur de configuration détectée	*.7.0.79	*	Configuration	n/a	Error
Configuration Initialized	*.7.0.33	*	Configuration	n/a	Initialized
Passerelle reprogrammée	*.7.0.213	*	Configuration	n/a	Reprogrammed
Définition de somme modifiée Type de somme modifié Synchro de valeurs de compteur Synchro de valeurs de somme Lien de sortie modifié Format d'énergie modifié Format électrique modifié	*.7.75.24	*	Configuration	Parameter	Changed
Modification de programme de compteur effectuée	*.7.83.24	*	Configuration	Program	Changed
Vitesse modifiée	*.7.86.24	*	Configuration	Rate	Changed
Point de consigne dépassé, canal n°	7.101.139	*	Configuration	SetPoint	Exceeded
Mode "standby" lancé	7.108.242	*	Configuration	StandbyMode	Started

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Support de stockage modifié	*.7.109.24	*	Configuration	Storage	Changed
Bouton d'essai enfoncé	*.7.19.76	*	Configuration	TestMode	Enabled
Mode d'essai lancé	*.7.19.242	*	Configuration	TestMode	Started
Mode d'essai arrêté	*.7.19.243	*	Configuration	TestMode	Stopped
Date et heure d'expiration de délai non valides	*.7.125.35	*	Configuration	Timeout	Invalid
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.12– Événements de Demand (demande)

Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Incapable de réinitialiser la demande	*.8.0.65	*	Demand	n/a	ResetFailed
Réinitialisation de demande détectée	*.8.0.215	*	Demand	n/a	ResetOccurred
Discordance des définitions de demande	*.8.0.159	*	Demand	n/a	Mismatched
Seuil de surcharge de la demande	8.261.139	*	Demand	Threshold	Exceeded
Mise en garde relative au seuil de demande	*.8.261.93	*	Demand	Threshold	MaxLimitReached
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.13 – Événements de Firmware (microprogramme)

Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Erreur de convertisseur analogique / numérique	*.11.142.79	*	Firmware	ADConverter	Error
Constantes non valides	*.11.23.35	*	Firmware	Constants	Invalid
Inconnu dans l'analyse Marqueur de diagnostic	*.11.31.79	*	Firmware	Data	Error
Code d'événement d'enregistrement non reconnu Message inintelligible reçu	*.11.31.35	*	Firmware	Data	Invalid
Écran d'erreur figé	*.11.143.88	*	Firmware	Display	Frozen
Alarme acquittée, alarme n°	*.11.43.3	*	Firmware	Event	Acknowledged
Alarme activée, alarme n° Alarme de zone	*.11.46.4	*	Firmware	Feature	Activated

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Alarme désarmée, alarme n° Installation à distance désarmée Synch à distance désarmée	*.11.46.66	*	Firmware	Feature	Disabled
Alarme permise, alarme n° Installation à distance activée Synch à distance armée Valeur d'alarme fixée, alarme n°	*.11.46.76	*	Firmware	Feature	Enabled
Défaillance de commande différée	*.11.46.85	*	Firmware	Feature	Failed
Commande illégale	*.11.46.35	*	Firmware	Feature	Invalid
Incapable de réinitialiser	*.11.47.85	*	Firmware	FirmwareReset	Failed
Discordance d'ID d'appareil interne	*.11.10.159	*	Firmware	Identity	Mismatched
Entrée instable, entrée n°	*.11.55.270	*	Firmware	Input	Unstable
Lire l'erreur de liste d'articles	*.11.63.79	*	Firmware	List	Error
Aucune liste de protocole, type introuvable Aucun élément de lecture dans la liste	*.11.63.160	*	Firmware	List	NotFound
Erreur de bus basse vitesse	*.11.145.79	*	Firmware	LowSpeedBus	Error
Alarme bus de compteur	*.11.147.79	*	Firmware	MeterBus	Error
Démarrage à froid	*.11.0.31	*	Firmware	n/a	ColdStarted
Image de microprogramme corrompue	*.11.0.43	*	Firmware	n/a	Corrupted
Configuration perdue	*.11.0.79	*	Firmware	n/a	Error
DCW charge radio du collecteur	*.11.0.85	*	Firmware	n/a	Failed
Reprogrammation de compteur Dispositif terminal programmé Configuration écrite/modifiée Reprogrammé Compteur reconfiguré L'appareil a été synchronisé	*.11.0.213	*	Firmware	n/a	Reprogrammed
Dernière réinitialisation par chien de garde Réinitialisation de l'équipement de comptage	*.11.0.214	*	Firmware	n/a	Reset
Redémarrage imprévu	*.11.0.53	*	Firmware	n/a	Restarted
Compteur non programmé	*.11.0.61	*	Firmware	n/a	Uninitialized
Démarrage à chaud	*.11.0.278	*	Firmware	n/a	WarmStarted

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Erreur de tableau d'options	*.11.146.79	*	Firmware	OptionBoard	Error
Erreur de paramètre Erreur de configuration	*.11.75.79	*	Firmware	Parameter	Error
Données de reprogrammation non valides Type d'appareil non valide, par exemple pas TOU	*.11.75.35	*	Firmware	Parameter	Invalid
Discordance de configuration diverse	*.11.75.159	*	Firmware	Parameter	Mismatched
Numéro de téléphone alternatif utilisé	*.11.75.56	*	Firmware	Parameter	Substituted
Échec du processeur de registre	*.11.82.85	*	Firmware	Processor	Failed
État illégal de processeur de commandes	*.11.82.35	*	Firmware	Processor	Invalid
Réinitialisation de processeur	*.11.82.214	*	Firmware	Processor	Reset
Mise en garde non programmée	*.11.83.79	*	Firmware	Program	Error
Dysfonctionnement de programme	*.11.83.85	*	Firmware	Program	Failed
Erreur d'autocontrôle Défaillance de diagnostic	*.11.100.79	*	Firmware	SelfTest	Error
Échec de l'auto-essai	*.11.100.85	*	Firmware	SelfTest	Failed
Dysfonctionnement de capteur	*.11.144.85	*	Firmware	Sensor	Failed
Commande "Alter option" (modifier option) exécutée	*.11.17.24	*	Firmware	Status	Changed
Mise à niveau du microprogramme en attente	*.11.17.14	*	Firmware	Status	ChangePending
Microprogramme téléchargé	*.11.17.25	*	Firmware	Status	Downloaded
Statut de téléchargement aval du microprogramme État du compteur vérifié	*.11.17.37	*	Firmware	Status	Normal
Microprogramme remplacé Modification de microprogramme terminée	*.11.17.52	*	Firmware	Status	Replaced
Réinitialisation d'appareil achevée	*.11.17.214	*	Firmware	Status	Reset
Fin du tableau d'événements de données atteinte	*.11.110.79	*	Firmware	Table	Error
Affichage des différences de tableau	11.110.159	*	Firmware	Table	Mismatched
Appel téléphonique entrant d'essai	*.11.111.58	*	Firmware	Test	Succeeded

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Différences d'affichage du mode essai	*.11.19.159	*	Firmware	TestMode	Mismatched
Limite basse non valide	*.11.261.35	*	Firmware	Threshold	Invalid
Facteur de correction de calcul > max.	*.11.261.40	*	Firmware	Threshold	OutofRange
Version non valide du logiciel de compteur	*.11.124.35	*	Firmware	Version	Invalid
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.14 – Événements GasSupply

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Perte totale de l'approvisionnement en gaz	*.4.0.85	*	GasSupply	n/a	Failed
Approvisionnement en gaz rétabli	*.4.0.216	*	GasSupply	n/a	Restored
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.15– Événements d'Installation

Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Statut d'enregistrement automatique	*.6.5.34	*	Installation	AutoRegistration	InProgress
Confirmation d'enregistrement automatique	*.6.5.58	*	Installation	AutoRegistration	Succeeded
Remplacement de compteur	*.6.0.27	*	Installation	n/a	ChangeOut
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.16 – Événements LoadControl

Description de l'événement ou de la commande	EndDevice Event Type	End Device Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Point de régulation modifié par l'état Point de régulation modifié par la commande Point de régulation modifié en raison du prépaiement Point de régulation modifié par programme	*.15.26.24	*	Loadcontrol	ControlPoint	Changed
Commande "Abort" exécutée	*.15.0.1	*	Loadcontrol	n/a	Aborted
Sélection utilisateur de la régulation de la charge	*.15.83.4	*	LoadControl	Program	Activated
Fermeture momentanée du relais de régulation de la charge, relais n° Relais de commande de sortie basculé, relais n°	*.15.91.24	*	Loadcontrol	Relay	Changed
Programme de commutation abandonné	*.15.95.1	*	Loadcontrol	Schedule	Aborted
Programme chargé	*.15.95.36	*	Loadcontrol	Schedule	Loaded
Restaurer la régulation de la charge	*.15.17.216	*	Loadcontrol	Status	Restored
Régulation de la charge lancée Relais de régulation de la charge fermé Fermeture permanente du relais de régulation de la charge, relais n° Modèle de régulation de la charge démarré	*.15.17.242	*	Loadcontrol	Status	Started
Relais de régulation de la charge ouvert Relais de régulation de la charge ouvert, relais n°	*.15.17.243	*	Loadcontrol	Status	Stopped
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.17 – Événements LoadProfile

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Pointeurs de liste réinitialisés	*.16.64.214	*	Loadprofile	ListPointers	Reset
Échec des relevés de surveillance de la charge	*.16.87.85	*	Loadprofile	Readings	Failed
Données de profil de charge corrompues	*.16.109.43	*	Loadprofile	Storage	Corrupted
Zone des données de profils de charges presque pleine	*.16.109.32	*	Loadprofile	Storage	Full
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.18 – Événements de Logs (journaux)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Journal de données téléchargé	*.17.33.60	*	Logs	DataLog	Transmitted
Dernier article lu du journal d'événements mis à jour	*.17.44.24	*	Logs	EventLog	Changed
Journal d'événements vidé	*.17.44.28	*	Logs	EventLog	Cleared
Erreur de journal d'événements	*.17.44.79	*	Logs	EventLog	Error
Journal d'événements plein	*.17.44.32	*	Logs	EventLog	Full
Journal d'événements téléchargé Appel d'événement	*.17.44.60	*	Logs	EventLog	Transmitted
Dernier article lu du journal d'historique mis à jour	*.17.53.24	*	Logs	HistoryLog	Changed
Journal d'historique effacé	*.17.53.28	*	Logs	HistoryLog	Cleared
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tablaue E.19 – Événements de Memory (mémoire)

Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Erreur d'allocation de la mémoire	*.18/02/1979	*	Memory	Allocation	Error
Erreur d'engorgement/dépassement de capacité de tampon	*.18.14.177	*	Memory	Buffer	Overflow
Mémoire EPROM lue	*.18.42.2	*	Memory	EPROM	Accessed
Mémoire EPROM écrite	*.18.42.24	*	Memory	EPROM	Changed
Défaillance d'EPROM	*.18.42.85	*	Memory	EPROM	Failed
Erreur de tramage	*.18.50.79	*	Memory	Frames	Error
Dépassement d'intervalle – pulsations > 65 535	*.18.59.177	*	Memory	Interval	Overflow
Détection de corruption de données	*.18.0.43	*	Memory	n/a	Corrupted
Discordance de mémoire de masse	*.18.0.159	*	Memory	n/a	Mismatched
Défaillance de NVRAM	*.18.72.85	*	Memory	NVRAM	Failed
Discordance des définitions de famille	*.18.75.159	*	Memory	Parameter	Mismatched
Erreur de surveillance de pulsations redondante	*.18.84.79	*	Memory	Pulse	Error
Erreur de RAM	*.18.85.79	*	Memory	RAM	Error
Défaillance de RAM	*.18.85.85	*	Memory	RAM	Failed
Mémoire RAM pleine	*.18.85.32	*	Memory	RAM	Full
Erreur de récupération de données	*.18.88.85	*	Memory	Recovery	Failed
Erreur de ROM	*.18.92.79	*	Memory	ROM	Error

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Défaillance de ROM	*.18.92.85	*	Memory	ROM	Failed
Disque presque plein	*.18.109.32	*	Memory	Storage	Full
Tableau de données plein	*.18.110.32	*	Memory	Table	Full
Dépassement de connecteur de tableau	18.110.177	*	Memory	Table	Overflow
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.20– Événements de Metrology (métrologie)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
BTU alarme BTU hors intervalle	*.21.13.40	*	Metrology	BTU	OutofRange
Erreur de calcul de volume corrigé	*.21.16.79	*	Metrology	Calculation	Error
Modification de l'étalonnage Valeur d'étalonnage établie, n°	*.21.18.24	*	Metrology	Calibration	Changed
Déviation excessive de l'étalonnage, n°	*.21.18.40	*	Metrology	Calibration	OutofRange
Calibrage arrivé à expiration	*.21.18.64	*	Metrology	Calibration	Expired
Alarme concentration	*.21.39.40	*	Metrology	Concentration	OutofRange
Journal d'événements vidé	*.21.44.28	*	Metrology	EventLog	Cleared
Défaillance potentielle de l'EWM	*.21.45.85	*	Metrology	EWM	Failed
FPV calculé de manière déraisonnable	*.21.49.40	*	Metrology	FPV	OutofRange
Défaillance d'analyseur de GC	*.21.51.85	*	Metrology	GCAnalyzer	Failed
Journal d'historique effacé	*.21.53.28	*	Metrology	HistoryLog	Cleared
Erreur de forme C, entrée n°	*.21.55.79	*	Metrology	Input	Error
Valeur non valide, canal n°	*.21.55.35	*	Metrology	Input	Invalid
Lecture d'intervalle réussie	*.21.59.58	*	Metrology	Interval	Succeeded
Dernier article lu mis à jour	*.21.62.24	*	Metrology	LastRead	Changed
Mettre à jour les pointeurs de liste	*.21.63.24	*	Metrology	List	Changed
Liste effacée	*.21.63.28	*	Metrology	List	Cleared
Réinitialiser les pointeurs de liste	*.21.63.214	*	Metrology	List	Reset
Erreur de mesure détectée	*.21.67.79	*	Metrology	Measurement	Error
Mesurage échoué	*.21.67.85	*	Metrology	Measurement	Failed

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Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
MOL % total hors plage	*.21.70.40	*	Metrology	MOL%	OutofRange
Erreur de mesure détectée	*.21.0.79	*	Metrology	n/a	Error
Retour du compteur dans les limites, canal n°	*.21.0.37	*	Metrology	n/a	Normal
Compteur reprogrammé Dispositif terminal programmé	*.21.0.213	*	Metrology	n/a	Reprogrammed
Défaillance de mémoire non volatile détectée	*.21.72.85	*	Metrology	NVRAM	Failed
Erreur d'impulsion de turbine	*.21.84.79	*	Metrology	Pulse	Error
Générateur d'impulsion	*.21.84.85	*	Metrology	Pulse	Failed
Surremplissage d'impulsions, canal n°	*.21.84.177	*	Metrology	Pulse	Overflow
Échec de relevés de compteur	*.21.87.85	*	Metrology	Readings	Failed
kWh reçus – alarme effacée	*.21.87.37	*	Metrology	Readings	Normal
Lecture attendue manquante	*.21.87.160	*	Metrology	Readings	NotFound
Appel téléphonique entrant programmé	*.21.87.225	*	Metrology	Readings	Scheduled
Erreur de registre	*.21.89.79	*	Metrology	Register	Error
kW précédent > capacité du registre	*.21.89.139	*	Metrology	Register	Exceeded
Registre plein	*.21.89.32	*	Metrology	Register	Full
Discordance des définitions de registre	*.21.89.159	*	Metrology	Register	Mismatched
Lecture du registre réussie	*.21.89.58	*	Metrology	Register	Succeeded
Auto-relevé de compteur	*.21.231.58	*	Metrology	SelfRead	Succeeded
Message sigmatique non valide	*.21.102.35	*	Metrology	SigmaticMessage	Invalid
Alarme relative à la masse volumique	*.21.240.40	*	Metrology	SpecificGravity	OutofRange
Erreur d'autocontrôle détectée	*.21.17.79	*	Metrology	Status	Error
Activation de tableau en attente	*.21.110.4	*	Metrology	Table	Activated
Tableau écrit	*.21.110.24	*	Metrology	Table	Changed
Tableau en attente d'effacement	*.21.110.28	*	Metrology	Table	Cleared
Seuil supérieur/supérieur du compteur, canal n° Seuil supérieur du compteur, canal n° Seuil supérieur de la vitesse delta, canal n°	21.261.139	*	Metrology	Threshold	Exceeded
Alarme communiquée relative à la limite	*.21.261.93	*	Metrology	Threshold	MaxLimitReached

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Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Seuil inférieur du compteur, canal n° Seuil de dépassement inférieur/inférieur, canal n° Alarme de limite inférieure	21.261.150	*	Metrology	Threshold	MinLimitReached
Seuil supérieur / inférieur du compteur	*.21.261.40	*	Metrology	Threshold	OutofRange
Limite haute quotidienne dépassée pour le gaz	21.123.139	*	Metrology	Usage	Exceeded
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.21 – Événements MobileSecurity

Description de l'événement ou de la commande	EndDevice Event Type	End Device Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Erreur de données aléatoires de jeton MAT ou erreur LAN cible	*.14.31.79	*	MobileSecurity	Data	Error
Bloc d'adresses LAN non valide pour le jeton MAT	*.14.61.35	*	MobileSecurity	LANAddress	Invalid
ID réseau non valide du jeton MAT	*.14.71.35	*	MobileSecurity	NetworkId	Invalid
Erreur de génération de message du jeton MAT	*.14.32.79	*	MobileSecurity	SecurityKey	Error
Jeton MAT expiré Jeton MAT expiré, délai keep-alive dépassé	*.14.32.64	*	MobileSecurity	SecurityKey	Expired
Options non valides du jeton MAT	*.14.32.35	*	MobileSecurity	SecurityKey	Invalid
Jeton MAT préempté	*.14.32.41	*	MobileSecurity	SecurityKey	Preempted
Jeton MAT traité	*.14.32.44	*	MobileSecurity	SecurityKey	Processed
Jeton MAT libéré	*.14.32.51	*	MobileSecurity	SecurityKey	Released
Longueur non valide du jeton MAT	*.14.119.35	*	MobileSecurity	SecurityKeyLength	Invalid
Version non valide du jeton MAT	*.14.120.35	*	MobileSecurity	SecurityKeyVersion	Invalid
Session précédente déjà établie	14.129.161	*	MobileSecurity	Session	Disallowed
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.22 – Événements de modem

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Panne d'alimentation en énergie, batterie modem faible	*.19.22.150	*	Modem	Charge	MinLimitReached
Défaillance de modem détectée	*.19.17.85	*	Modem	Status	Failed
Modem initialisé	*.19.17.33	*	Modem	Status	Initialized
Remplacement de modem	*.19.17.105	*	Modem	Status	Installed
Aucun modem	*.19.17.160	*	Modem	Status	NotFound
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.23 – Événements ModuleFirmware

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Microprogramme du module remplacé	*.9.17.52	*	ModuleFirmware	Status	Replaced
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.24 – Événements Network (réseau)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Défaillance d'association de réseau	*.23.74.85	*	Network	Association	Failed
Premier branchement du collecteur	*.23.52.42	*	Network	HeadEndSystem	Connected
Appareil parent non opérant	*.23.76.66	*	Network	ParentDevice	Disabled
Pannes radio	*.23.136.85	*	Network	Radio	Failed
Données d'enregistrement radio du collecteur	*.23.136.50	*	Network	Radio	Registered
Fermeture d'entrée facultative, générateur	*.23.17.42	*	Network	Status	Connected
Appareil non opérant Passerelle non opérante	*.23.17.66	*	Network	Status	Disabled
Ouverture d'entrée facultative, générateur Appareil déconnecté	*.23.17.68	*	Network	Status	Disconnected
Erreur de DAP Erreur de DSP	*.23.17.79	*	Network	Status	Error
Défaillance de nœud Défaillance de liaison de nœud	*.23.17.85	*	Network	Status	Failed

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Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Compteur installé Passerelle installée	*.23.17.105	*	Network	Status	Installed
Dispositif terminal scellé	*.23.17.227	*	Network	Status	Sealed
Dispositif terminal non scellé	*.23.17.269	*	Network	Status	Unsealed
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.25 – Événements PAN / HAN

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Fenêtre d'appariement PAN fermée	*.10.73.16	*	Pairing	Window	Closed
Fenêtre d'appariement PAN ouverte (Ready To Pair	*.10.73.39	*	Pairing	Window	Opened
Appariement PAN réussi	*.10.0.58	*	Pairing	n/a	Succeeded
Échec de l'appariement PAN	*.10.0.85	*	Pairing	n/a	Failed
Message texte PAN annulé	*.13.112.10	*	VideoDisplay	TextMessage	Canceled
Message texte PAN affiché	*.13.112.78	*	VideoDisplay	TextMessage	Displayed
Tarification PAN réussie	*.20/09/1958	*	Billing	Pricing	Succeeded
Échec de la tarification PAN	*.20/09/1985	*	Billing	Pricing	Failed
Échec de l'annulation de tous les événements de régulation de la charge PAN	*.15.148.86	*	LoadControl	AllEvents	CancelFailed
Annulation de tous les événements de régulation de la charge PAN	*.15.148.10	*	LoadControl	AllEvents	Canceled
Échec de l'annulation de l'événement de régulation de la charge PAN	*.15.43.86	*	LoadControl	Event	CancelFailed
Annulation de l'événement de régulation de la charge PAN	*.15.43.10	*	LoadControl	Event	Canceled
Événement de régulation de la charge PAN programmé	*.15.43.225	*	LoadControl	Event	Scheduled
Inclusion de l'événement de régulation de la charge PAN	*.15.43.80	*	LoadControl	Event	Opt-In

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Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Exclusion de l'événement de régulation de la charge PAN	*.15.43.81	*	LoadControl	Event	Opt-Out
Appareil PAN supprimé Appareil de régulation de la charge PAN supprimé Passerelle PAN supprimée	*.0.0.212	*	n/a	n/a	Removed
Réseau PAN rendu opérant	*.23.0.76	*	Network	n/a	Enabled
Réseau PAN rendu inopérant	*.23.0.66	*	Network	n/a	Disabled
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.26 – Événements de Power (puissance)

Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Limite basse du courant dépassée	*.26.6.150	*	Power	Current	MinLimitReached
Fréquence de ligne instable	*.26.4.270	*	Power	Fréquence	Unstable
Fort courant neutre	*.26.137.93	*	Power	NeutralCurrent	MaxLimitReached
Fort courant neutre éliminé	*.26.137.73	*	Power	NeutralCurrent	MaxLimitReachedCleared
Condition de phase croisée	*.26.25.45	*	Power	Phase	CrossPhaseDetected
Condition de phase croisée effacée	*.26.25.70	*	Power	Phase	CrossPhaseCleared
Perte de phase, Désexcitation de phase	*.26.25.85	*	Power	Phase	Failed
Condition de phase inactive (tension présente, courant absent)	*.26.25.100	*	Power	Phase	Inactive
Condition de phase inactive effacée	*.26.25.72	*	Power	Phase	InactiveCleared
Alerte phase effacée	*.26.25.37	*	Power	Phase	Normal
Seuil de phase	*.26.25.40	*	Power	Phase	OutofRange
Rétablissement de phase	*.26.25.216	*	Power	Phase	Restored
Seuil au-dessus/ au-dessous de la limite de l'angle de phase	*.26.130.40	*	Power	PhaseAngle	OutofRange
Seuil au-dessus/ au-dessous de la limite de l'angle de phase effacé	*.26.130.74	*	Power	PhaseAngle	OutofRangeCleared
Limite de l'angle de phase dépassée	26.130.139	*	Power	PhaseAngle	Exceeded
Baisse soudaine de tension commencée (PhaseA)	26.131.223	*	Power	PhaseAVoltage	SagStarted

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Baisse soudaine de tension arrêtée (PhaseA)	26.131.224	*	Power	PhaseAVoltage	SagStopped
Bosse de tension commencée (PhaseA)	26.131.248	*	Power	PhaseAVoltage	SwellStarted
Bosse de tension arrêtée (PhaseA)	26.131.249	*	Power	PhaseAVoltage	SwellStopped
Phase A inactive	26.126.100	*	Power	PhaseA	Inactive
Baisse soudaine de tension commencée (PhaseB)	26.132.223	*	Power	PhaseBVoltage	SagStarted
Baisse soudaine de tension arrêtée (PhaseB)	26.132.224	*	Power	PhaseBVoltage	SagStopped
Bosse de tension commencée (PhaseB)	26.132.248	*	Power	PhaseBVoltage	SwellStarted
Bosse de tension arrêtée (PhaseB)	26.132.249	*	Power	PhaseBVoltage	SwellStopped
Phase B inactive	26.134.100	*	Power	PhaseB	Inactive
Baisse soudaine de tension commencée (PhaseC)	26.133.223	*	Power	PhaseCVoltage	SagStarted
Baisse soudaine de tension arrêtée (PhaseC)	26.133.224	*	Power	PhaseCVoltage	SagStopped
Bosse de tension commencée (PhaseC)	26.133.248	*	Power	PhaseCVoltage	SwellStarted
Bosse de tension arrêtée (PhaseC)	26.133.249	*	Power	PhaseCVoltage	SwellStopped
PhaseC inactive	26.135.100	*	Power	PhaseC	Inactive
Erreur de séquence de phase	*.26.78.79	*	Power	PhaseSequence	Error
Perte de transducteur de tension sur une phase Perte de tension par phase	*.26.79.47	*	Power	PhaseVoltage	LossDetected
Le facteur de puissance dépasse les limites	*.26.27.139	*	Power	PowerFactor	Exceeded
Énergie réactive avance effacée Condition d'énergie réactive en avance effacée	*.26.27.24	*	Power	PowerFactor	OutofRangeCleared
Mise en garde relative à l'énergie réactive en avance Condition d'énergie réactive en avance	*.26.27.40	*	Power	PowerFactor	OutofRange
Forte distorsion détectée	*.26.28.69	*	Power	PowerQuality	HighDistortion
Forte distorsion éliminée	*.26.28.71	*	Power	PowerQuality	HighDistortionCleared
Événement de qualité d'énergie générique	*.26.28.40	*	Power	PowerQuality	OutofRange
Enregistrement rendu non opérant	*.26.80.66	*	Power	PowerQuality Recording	Disabled
Enregistrement rendu opérant	*.26.80.76	*	Power	PowerQuality Recording	Enabled

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Vérifier l'alimentation électrique de la section Vérifier l'alimentation électrique du compteur Vérifier l'alimentation électrique du départ Vérifier l'alimentation électrique du transformateur	*.26.17.68	*	Power	Status	Disconnected
Panne d'alimentation en énergie du collecteur Rf Panne d'alimentation en énergie Mise hors tension Panne d'alimentation en énergie non détectée Dernière alarme de panne de souffle Interruption de service du transformateur	*.26.0.85	*	Power	n/a	Failed
Perte de puissance ou de tension de la phase A	*.26.126.85	*	Power	PhaseA	Failed
Perte de puissance ou de tension de la phase B	*.26.134.85	*	Power	PhaseB	Failed
Perte de puissance ou de tension de la phase C	*.26.135.85	*	Power	PhaseC	Failed
Rétablissement du compteur Mise sous tension / Alimentation restaurée Rétablissement du transformateur	*.26.0.216	*	Power	n/a	Restored
Restauration de la puissance ou de la tension de la phase A	26.126.216	*	Power	PhaseA	Restored
Restauration de la puissance ou de la tension de la phase B	26.134.216	*	Power	PhaseB	Restored
Restauration de la puissance ou de la tension de la phase C	26.135.216	*	Power	PhaseC	Restored
Exception de tension	*.26.38.139	*	Power	Voltage	Exceeded
Condition de déséquilibre de tension	*.26.38.98	*	Power	Voltage	Imbalanced
Condition de déséquilibre de tension effacée	*.26.38.75	*	Power	Voltage	ImbalanceCleared
Perte de transducteur de tension VT Faible potentiel de perte détecté	*.26.38.47	*	Power	Voltage	LossDetected
Haute tension	*.26.38.93	*	Power	Voltage	MaxLimitReached
Basse tension	*.26.38.150	*	Power	Voltage	MinLimitReached
Déséquilibre de tension éliminé	*.26.38.37	*	Power	Voltage	Normal
Bosse de tension éliminée	*.26.38.37	*	Power	Voltage	Normal
Baisse soudaine de tension	*.26.38.223	*	Power	Voltage	SagStarted
Baisse soudaine de tension éliminée	*.26.38.224	*	Power	Voltage	SagStopped

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Condition de surtension	*.26.38.248	*	Power	Voltage	SwellStarted
Bosse de tension éliminée	*.26.38.249	*	Power	Voltage	SwellStopped
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.27 – Événements de Pressure (pression)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
La pression captée est égale à P max	*.29.261.93	*	Pression	Threshold	MaxLimitReached
La pression captée est égale à P min	29.261.150	*	Pression	Threshold	MinLimitReached
La pression est hors plage.	*.29.261.40	*	Pression	Threshold	OutofRange
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.28 – Événements RCDSwitch

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Mise en marche du service Clôture d'entrée de statut, n° Compteur branché Branchement exécuté	*.31.0.42	*	RCDswitch	n/a	Connected
Échec de connexion	*.31.0.67	*	RCDSwitch	n/a	ConnectFailed
Arrêt du service Ouverture d'entrée de statut, n° Compteur débranché Fonctionnement du disjoncteur Débranchement exécuté	*.31.0.68	*	RCDswitch	n/a	Disconnected
Échec de connexion Échec de déconnexion	*.31.0.84	*	RCDswitch	n/a	DisconnectFailed
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.29 – Événements de Security (sécurité)

Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Tentative d'accès non autorisé	*.12.1.38	*	Security	Access	NotAuthorized
Unité accédée Unité accessible au lecteur Unité accessible à l'enregistreur	*.12.1.58	*	Security	Access	Succeeded
Alerte expiration de certificat Expiration de certificat	*.12.21.64	*	Security	Certificate	Expired
Retrait de couvercle détecté	*.12.29.212	*	Security	Cover	Removed
Erreur CRC	*.12.30.79	*	Security	CRC	Error
Erreur de déchiffrement de texte en clair	*.12.31.63	*	Security	Data	Unsecure
Erreur générale de déchiffrement	*.12.36.79	*	Security	Decryption	Error
Échec de déchiffrement	*.12.36.85	*	Security	Decryption	Failed
Evénement de capot du collecteur	*.12.128.2	*	Security	Door	Accessed
Porte fermée	*.12.141.16	*	Security	Enclosure	Closed
Porte ouverture	*.12.141.39	*	Security	Enclosure	Opened
Falsification de codeur	*.12.40.257	*	Security	Encoder	TamperDetected
Échec d'initialisation du chiffrement	*.12.298.85	*	Security	Initialisation	Failed
Écoulement inverse détecté	*.12.48.219	*	Security	Flow	Reversed
Erreur de déchiffrement, échec HMAC	*.12.54.85	*	Security	HMAC	Failed
Échec d'ouverture de session utilisateur Échec d'ouverture de session passerelle	*.12.65.85	*	Security	Login	Failed
Alarme commutateur magnétique	*.12.66.257	*	Security	MagneticSwitch	TamperDetected
Falsification physique Indication de fraude Tentative de fraude détectée	*.12.0.257	*	Security	n/a	TamperDetected
Inclinaison détectée	*.12.0.263	*	Security	n/a	Tilted
ID réseau non valide du jeton de configuration	*.12.71.35	*	Security	NetworkId	Invalid
Erreur de parité	*.12.77.79	*	Security	Parity	Error
Mot de passe modifié	*.12.24.24	*	Security	Password	Changed
Mot de passe non valide	*.12.24.35	*	Security	Password	Invalid
Unité accédée à distance	*.12.211.58	*	Security	RemoteAccess	Succeeded
Compteur inversé ou rotation inverse détectée Rotation inverse détectée	*.12.93.219	*	Security	Rotation	Reversed

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Description de l'événement ou de la commande	EndDevice Event Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Registre sécurisé lu Tableau sécurisé lu	*.12.98.2	*	Security	SecuredRegister	Accessed
Clé locale désactivée	*.12.32.66	*	Security	SecurityKey	Disabled
Clé locale activée	*.12.32.76	*	Security	SecurityKey	Enabled
Erreur de génération de message du jeton de configuration	*.12.32.79	*	Security	SecurityKey	Error
Clé de sécurité non valide	*.12.32.35	*	Security	SecurityKey	Invalid
Options non valides du jeton de configuration	*.12.32.35	*	Security	SecurityKey	Invalid
Clé précédente utilisée	*.12.32.41	*	Security	SecurityKey	Preempted
Jeton de configuration traité	*.12.32.44	*	Security	SecurityKey	Processed
Clé locale débloquée	*.12.32.62	*	Security	SecurityKey	Unlocked
Longueur non valide pour le jeton de configuration	*.12.119.35	*	Security	SecurityKeyLength	Invalid
Version non valide du jeton de configuration	*.12.120.35	*	Security	SecurityKeyVersion	Invalid
Erreur générale de signature	*.12.103.79	*	Security	Signature	Error
Erreur d'algorithme de signature Échec de vérification de signature Erreur d'algorithme de signature Échec de vérification de signature Erreur d'algorithme de signature Échec de vérification de signature	*.12.103.85	*	Security	Signature	Failed
Clé de signature non valide spécifiée Erreur de vérification de signature Clé de signature non valide spécifiée Erreur de vérification de signature Clé de signature non valide spécifiée Erreur de vérification de signature	*.12.103.35	*	Security	Signature	Invalid
Signature manquante	12.103.160	*	Security	Signature	NotFound
Longueur non valide	*.12.104.35	*	Security	SignatureLength	Invalid
Horodatage de signature non valide	*.12.105.35	*	Security	SignatureTimestamp	Invalid
Erreur d'utilisation de signature	*.12.106.79	*	Security	SignatureUsage	Error
Dispositif terminal accessible en écriture	*.12.282.58	*	Security	WriteAccess	Succeeded
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau E.30 – Événements de Temperature (température)

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
La température retourne dans la plage	*.35.0.37	*	Temperature	n/a	Normal
La température est hors plage	*.35.0.40	*	Temperature	n/a	OutofRange
La température captée est égale à T max	*.35.261.93	*	Temperature	Threshold	MaxLimitReached
La température captée est égale à T min	35.261.150	*	Temperature	Threshold	MinLimitReached
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.31 – Événements VideoDisplay

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Défaillance d'affichage	*.13.17.85	*	VideoDisplay	Status	Failed
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau E.32 – Événements WaterSupply

Description de l'événement ou de la commande	EndDeviceEvent Type	EndDevice Type	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Perte totale de l'approvisionnement en eau	*.5.0.47	*	WaterSupply	n/a	Failed
Approvisionnement en eau rétabli	*.5.0.270	*	WaterSupply	n/a	Restored
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Annexe F
(normative)

Énumérations EndDeviceControlType

F.1 Généralités

De nombreux systèmes de comptage ont la capacité d'émettre une commande à l'équipement de terrain qui entreprend une action. L'action peut consister à réinitialiser la demande, à ouvrir ou à fermer un commutateur ou en un certain nombre d'autres activités. La présente Annexe F décrit des exemples de codes qui peuvent être utilisés pour de telles applications.

Les énumérations EndDeviceControlType sont classées de la même manière que les énumérations EndDeviceEventType décrites à l'Annexe E. Le code est divisé en quatre parties:

EndDeviceControl.type:=
<EndDeviceType>.<EndDeviceDomain>.<EndDeviceSubdomain>.<EndDeviceEventOrAction>

où

<EndDeviceType>	valeur numérique de l'énumération EndDeviceType (voir la section EndDeviceType à l'Annexe E)
<EndDeviceDomain>	valeur numérique de l'énumération EndDeviceDomain (voir la section EndDeviceDomain à l'Annexe E)
<EndDeviceSubdomain>	valeur numérique de l'énumération EndDeviSubdomain (voir la section EndDeviceSubdomain à l'Annexe E)
<EndDeviceEventOrAction>	valeur numérique de l'énumération EndDeviceEventorAction (voir la section EndDeviceEventOrAction à l'Annexe E)

Ces types de commandes comprennent les types de commandes utilisés pour les commandes d'appareil PAN. Les commandes peuvent entraîner la génération d'un événement par le dispositif terminal, opération qui serait ensuite consignée par un message EndDeviceEvents.

F.2 Énumérations normatives EndDeviceControlType

Les champs EndDeviceType, EndDeviceDomain, EndDeviceSubdomain et EndDeviceEventOrAction sont combinés et présentés sous la forme d'une chaîne unique. Les événements normatifs sont répertoriés dans le Tableau F.1, le Tableau F.2, le Tableau F.3 et le Tableau F.4, regroupés par EndDeviceDomain.

Tableau F.1 – Commandes de demande ("demand")

Description de l'événement ou de la commande	EndDevice Control Type	Expected Events	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Réinitialiser la demande	*.8.0.214	*.8.0.215 *.8.0.65	Demand	n/a	Reset
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau F.2 – Commandes LoadControl

Description de l'événement ou de la commande	EndDevice Control Type	Expected Events	End Device Domain	EndDevice SubDomain	EndDevice EventOrAction
Lancer régulation de la charge, port 0	*.15.0.54	*.15.17.242 *.15.17.217	LoadControl	n/a	Start
Arrêter/terminer la régulation de la charge, port 1	*.15.0.55	*.15.17.216 *.15.17.218	LoadControl	n/a	Stop
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

Tableau F.3 – Commandes PAN/HAN

Description de l'événement ou de la commande	EndDevice Control Type	Expected Events	EndDevice Domain	EndDevice SubDomain	EndDevice EventOrAction
Fenêtre d'appariement PAN ouverte	*.10.73.298	*.10.73.39	Pairing	Window	Open
Fenêtre d'appariement PAN fermée	*.10.73.299	*.10.73.16	Pairing	Window	Close
Affichage message texte PAN	*.13.112.77	*.13.112.78	VideoDisplay	TextMessage	Display
Annulation du message texte PAN	*.13.112.8	*.13.112.10	VideoDisplay	TextMessage	Cancel
Créer un signal de prix PAN	*.20.9.82	*.20.9.58	Billing	Pricing	Create
Annulation de tous les événements de régulation de la charge PAN	*.15.148.8	*.15.148.10	LoadControl	AllEvents	Cancel
Annulation de l'événement de régulation de la charge PAN	*.15.43.8	*.15.43.10	LoadControl	Event	Cancel
Programmation de l'événement de régulation de la charge PAN	*.15.43.300	*.15.43.225	LoadControl	Event	Schedule
Activation du réseau PAN	*.23.0.26	*.23.0.76	Network	n/a	Enable
Désactivation du réseau PAN	*.23.0.22	*.23.0.66	Network	n/a	Disable
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Tableau F.4 – Commandes RCDSwitch

Description de l'événement ou de la commande	EndDevice Control Type	Expected Events	End Device Domain	EndDevice SubDomain	EndDevice EventOrAction
Désactiver la limite de capacité de fourniture d'urgence RCD	*.31.138.22	*.31.138.66 31.138.220	RCDSwitch	EmergencySupply CapacityLimit	Disable
Activer la limite de capacité de fourniture d'urgence RCD	*.31.138.26	*.31.138.76 31.138.221	RCDSwitch	EmergencySupply CapacityLimit	Enable
Armer le commutateur de branchement/débranchement à distance en vue de la fermeture	*.31.0.5	*.31.0.11 *.31.0.226	RCDSwitch	n/a	ArmForClosure
Armer le commutateur de branchement/débranchement à distance en vue de l'ouverture	*.31.0.6	*.31.0.12 *.31.0.222	RCDSwitch	n/a	ArmForOpen
Fermer le commutateur de branchement/débranchement à distance	*.31.0.18	*.31.0.42 *.31.0.67	RCDSwitch	n/a	Connect
Désactiver la formule n° 1 de limitation de demande pour le commutateur RCD Désactiver le commutateur RCD	*.31.0.22	*.31.0.66 *.31.0.220	RCDSwitch	n/a	Disable
Ouvrir le commutateur de branchement/débranchement à distance	*.31.0.23	*.31.0.68 *.31.0.84	RCDSwitch	n/a	Disconnect
Activer la formule n° 2 de limitation de demande pour le commutateur RCD Activer le commutateur RCD	*.31.0.26	*.31.0.76 *.31.0.221	RCDSwitch	n/a	Enable
Désactiver la limite de capacité de fourniture RCD	*.31.139.22	*.31.139.66 31.139.220	RCDSwitch	SupplyCapacity Limit	Disable
Activer la limite de capacité de fourniture RCD	*.31.139.26	*.31.139.76 31.139.221	RCDSwitch	SupplyCapacity Limit	Enable
Un astérisque (*) désigne n'importe quelle valeur EndDeviceType. Par hypothèse, la valeur utilisée dans le cadre de toute utilisation de production de ces événements est pertinente pour l'appareil qui envoie réellement cet événement.					

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Annexe G
(normative)

Schémas XML pour les charges utiles de message

G.1 Généralités

La présente Annexe G a pour objet de fournir des schémas XSD informatifs pour les charges utiles de message afin d'augmenter les descriptions données plus haut dans le présent document. Ces schémas XSD sont normatifs, mais peuvent être étendus selon les besoins à des fins de mises en œuvre spécifiques.

NOTE 1 Aucune exigence d'utilisation de l'IEC 61968-100:2022 ne s'applique pour les messages définis dans l'IEC 61869-9. Toutefois, si l'IEC 61968-100:2022 doit être appliquée pour les messages définis dans l'IEC 61869-9, il est nécessaire d'étendre ces profils afin de référencer la AbstractPayload comme cela est défini dans l'IEC 61968-100:2022. Se reporter à l'Annexe C de l'IEC 61968-100:2022 pour des exemples.

NOTE 2 Les schémas référencés ont été créés à partir de la version CIM iec61970cim17v40_iec61968cim13v13b_iec62325cim03v17b_cim100.1.1.1, with CIMTool Version 1.10.0. L'utilisateur de la norme qui souhaite utiliser exactement ces schémas ou les modifier à des fins de mise en œuvre spécifique trouvera ces produits, ainsi que les versions actuelles et historiques du CIM et du CIMTool à l'adresse https://cimug.ucaiug.org/Standards%20Artifacts/Forms/AllItems.aspx

Une bibliothèque de *CIM Meter Reading and Control Profile Messages* est disponible sous https://cimug.ucaiug.org. Le site Web[1] peut contenir d'autres artefacts utiles pour le développeur, y compris entre autres, des fichiers OWL et des représentations tabulaires desdits fichiers pour les profils.

G.2 ComModuleConfig

Le schéma ComModuleConfig est disponible en ligne à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/ComModuleConfig.xsd

G.3 EndDeviceConfig

Le schéma EndDeviceConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/EndDeviceConfig.xsd

G.4 EndDeviceControls

Le schéma EndDeviceControls est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/EndDeviceControls.xsd

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[1] Les liens seront hébergés tant que l'édition de 2023 (la troisième) de l'IEC 61869-9 restera en vigueur. Lorsque le présent document est remplacé ou supprimé, les liens peuvent devenir invalides.

G.5 EndDeviceEvents

Le schéma EndDeviceEvents est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/EndDeviceEvents.xsd

G.6 GetComModuleConfig

Le schéma GetComModuleConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetComModuleConfig.xsd

G.7 GetEndDeviceConfig

Le schéma GetEndDeviceConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetEndDeviceConfig.xsd

G.8 GetEndDeviceControls

Le schéma GetEndDeviceControls est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetEndDeviceControls.xsd

G.9 GetEndDeviceEvents

Le schéma GetEndDeviceEvents est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/EndDeviceEvents.xsd

G.10 GetEndDeviceGroups

Le schéma GetEndDeviceGroups est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetEndDeviceGroups.xsd

G.11 GetMeterConfig

Le schéma GetMeterConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetMeterConfig.xsd

G.12 GetMeterReadings

Le schéma GetMeterReadings est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetMeterReadings.xsd

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G.13 GetMeterReadSchedules

Le schéma GetMeterReadSchedule est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetMeterReadSchedules.xsd

G.14 GetUsagePointConfig

Le schéma GetUsagePointConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetUsagePointConfig.xsd

G.15 GetUsagePointGroups

Le schéma GetUsagePointGroups est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetUsagePointGroups.xsd

G.16 GetUsagePointLocationConfig

Le schéma GetUsagePointLocationsConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/GetUsagePointLocationConfig.xsd

G.17 MasterDataLinkageConfig

Le schéma MasterDataLinkageConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MasterDataLinkageConfig.xsd

G.18 MeterConfig

Le schéma MeterConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MeterConfig.xsd

G.19 MeterReadings

Le schéma MeterReadings est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MeterReadings.xsd

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G.20 MeterReadSchedules

Le schéma MeterReadSchedules est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/MeterReadSchedules.xsd

G.21 UsagePointConfig

Le schéma UsagePointConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/UsagePointConfig.xsd

G.22 UsagePointGroups

Le schéma UsagePointGroups est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/UsagePointGroups.xsd

G.23 UsagePointLocationConfig

Le schéma UsagePointLocationConfig est disponible à l'adresse

https://cimug.ucaiug.org/Standards%20Artifacts/UCA%20TF%2014/Part%209/3rd-Edition%20(CDV2)/XSDs/UsagePointLocationConfig.xsd

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Annexe H
(normative)

Requête de données au moyen des profils Get

H.1 Généralités

La présente Annexe H a pour objet de décrire l'utilisation des messages Get pour récupérer des données. Les messages Get utilisent un profil Get afin de fournir les paramètres utilisés pour spécifier la demande. Ces paramètres servent de filtres de l'ensemble de données retourné dans le message REPLY. Il s'agit effectivement d'un modèle de ''requête''. Si besoin est, ces filtres peuvent être définis comme des profils contextuels d'une manière similaire à ceux utilisés pour définir les charges utiles. Les structures en question sont alors réalisées sous la forme de schémas XML.

Se reporter à l'IEC 61968-100:2022 pour une utilisation correcte des profils Get dans un contexte plus large de traitement de messages. L'Annexe D de l'IEC 61968-100:2022 comporte des exemples d'échanges de messages avec des profils Get.

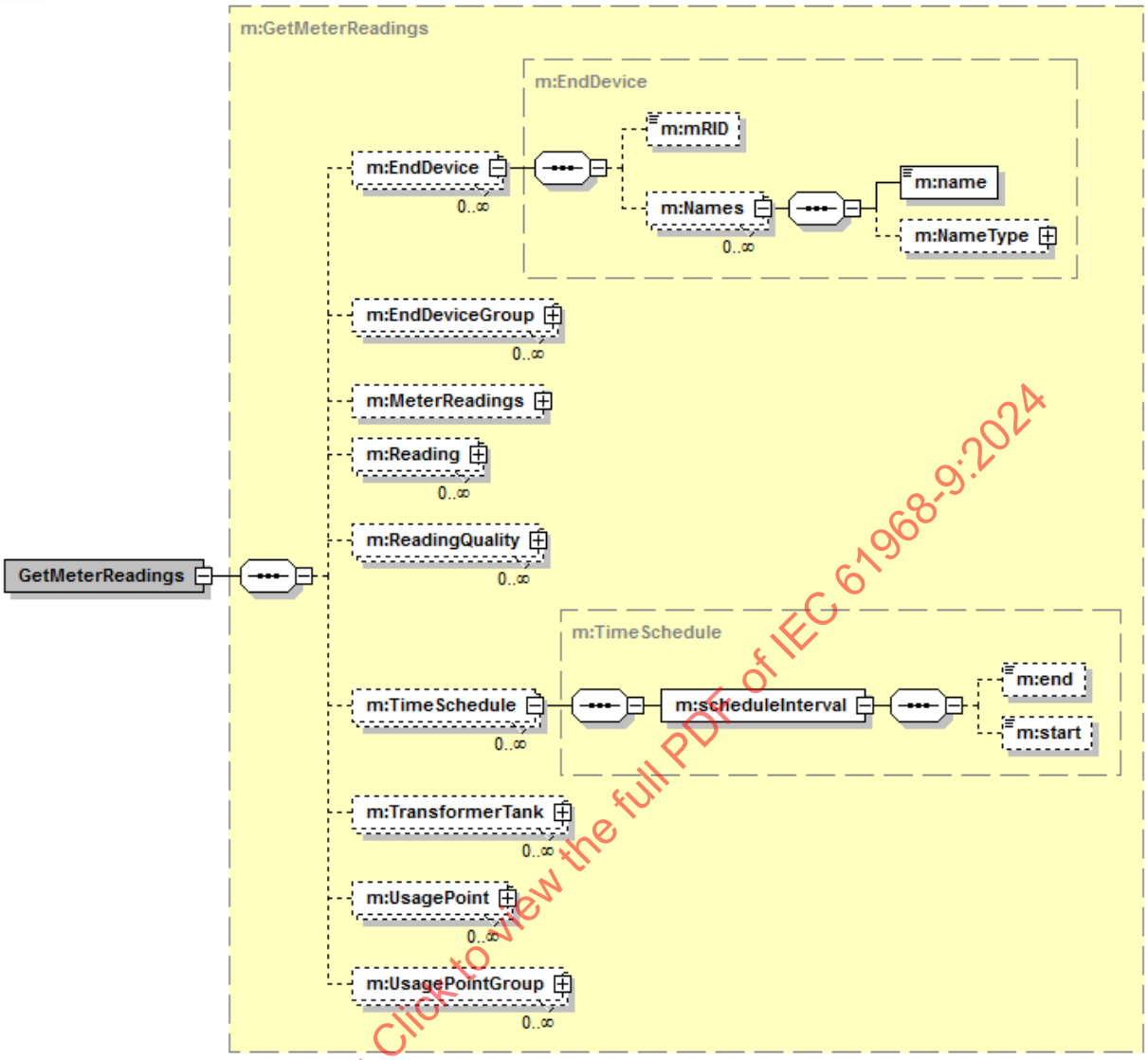
Les Articles H.2 et H.3 représentent la structure de deux profils Get énumérés dans le Tableau 2. Les Articles D.7 et D.4 de l'Annexe D de l'IEC 61968-100:2022 comportent des exemples d'utilisation de ces deux profils.

Les utilisateurs de la présente norme peuvent définir des profils Get supplémentaires afin de satisfaire à leurs exigences d'échange de données.

H.2 GetMeterReadings

La structure représentée à la Figure H.1 est un profil contextuel qui peut être utilisé pour qualifier des demandes "Get MeterReadings'. Elle fournit un exemple représentatif de la façon dont les mRID, les noms et l'heure peuvent être spécifiés dans un profil "Get" pour qualifier une requête.

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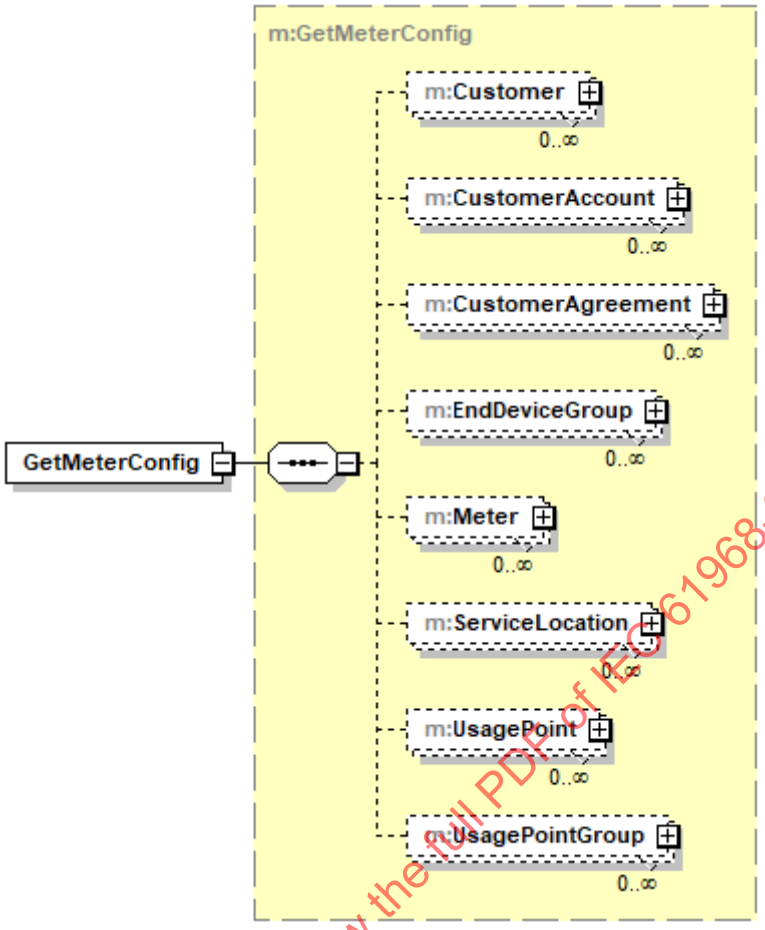
Reproduit avec l'autorisation de l'UCAIug.

Figure H.1 – GetMeterReadings

H.3 GetEndDeviceConfig

La structure représentée à la Figure H.2 est un profil contextuel qui peut être utilisé pour qualifier des demandes "GET MeterConfig''.

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Figure H.2 – GetMeterConfig

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Annexe I
(informative)

Traitement des transactions de gestion de données de référence

La présente Annexe I a pour objet de décrire la façon dont le traitement des transactions est effectué afin de répondre aux besoins de gestion de données de référence définis par l'IEC 61968-9. L'introduction du verbe "update" dans l'IEC 61968-100:2022 permet de résoudre les problèmes créés par la suppression d'un ou plusieurs attributs ou instances d'un objet CIM associé dans un ensemble d'opérations. Toutefois, dans le présent document, une attention particulière doit toujours être accordée à la réalisation de deux actions ou plus relatives aux actions Gestion de données de référence qui doivent être manipulées dans une séquence spécifique et/ou avec une intégrité transactionnelle globale (c'est-à-dire que toutes les actions doivent réussir ou elles doivent toutes être annulées).

Un message défini dans l'IEC 61968-9 qui utilise la construction OperationSet possède toujours un verbe Header avec "execute" ou "executed" et un nom "OperationSet". Un OperationSet contient une ou plusieurs Operations, et chaque nom Operation possède un operationId qui complète le CorrelationID du message global pour permettre de corréler avec plus de précision le contenu d'un ou de plusieurs messages de réponse avec les Operations individuelles d'un OperationSet. Les Operations individuelles d'un OperationSet possèdent des verbes et des noms de niveau OperationSet. Les verbes admissibles sont create, created, change, changed, delete, deleted, update et updated.

Chaque OperationSet peut comprendre un booléen EnforceMsgSequence ou un booléen EnforceTransactionalIntegrity, voire les deux. Le booléen EnforceMsgSequence doit être défini sur "true" lorsque les Operations de l'OperationSet doivent être exécutées dans l'ordre croissant de leur operationID. Le booléen EnforceTransactionalIntegrity doit être défini sur "true"" si toutes les Operations de l'OperationSet doivent réussir. Dans ce cas, si toutes les Operations de ce type ne réussissent pas, toutes doivent être interrompues ou annulées. Si l'une ou l'autre valeur booléenne, voire les deux sont omises, elles sont réputées fausses ("false").

Pour plus d'informations sur l'exécution des transactions Gestion de données de référence pour une description complète du nouveau message XSD et des modèles d'échange normatif, se reporter à l'IEC 61968-100:2022.

Il convient également de noter que, même si le présent document fournit les moyens d'acheminer des transactions Gestion de données de référence avec des structures de données fondées sur des schémas XML, il est aussi possible, d'un point de vue technique, d'utiliser l'IEC 61970-552 pour des transactions fondées sur RDF. Cette capacité peut ou peut ne pas être disponible dans les éditions futures de l'IEC 61968-9 et de l'IEC 61968-100.

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Annexe J
(informative)

Cas d'utilisation de la gestion de données de référence

J.1 Généralités

La présente Annexe J a pour objet de fournir une description de cas d'utilisation informatifs relatifs à la gestion de données de référence.

L'IEC 61698-100 contient des verbes et des constructions utiles pour la gestion de données de référence, et les exemples présentés ci-dessous utilisent cette norme. Il est toutefois possible d'utiliser d'autres pratiques communes en TI telles que les verbes communs Create, Read, Update, et Delete (CRUD), ainsi que d'autres méthodes de gestion de données.

Le Tableau J.1 identifie les cas d'utilisation exemplaires de Gestion de données de référence / Synchronisation des données et fournit des recommandations sur la méthode de construction et de remplissage du message de demande ou de stéréotype d'événement pour chaque cas d'utilisation.

La gestion des données de référence entre plusieurs systèmes peut impliquer souvent l'emploi de profils de plusieurs parties de l'IEC 61968. Par exemple, les fonctions de gestion du client (IEC 61968-8) incluent la facturation des clients à l'aide des données de relevé et de commande de compteur (Meter Reading and Control Data) (IEC 61968-9). De ce fait, il peut s'avérer nécessaire que les fonctions et les systèmes métier définis dans l'IEC 61968-8 utilisent des profils de l'IEC 61968-9 et inversement. L'Annexe J représente l'utilisation de profils de plusieurs parties de l'IEC 61968 afin de fournir un ensemble exhaustif de scénarii de gestion de données de référence qui peuvent s'appliquer aux fonctions et systèmes métier de l'IEC 61968-9. Pour les profils présentés à l'Annexe J et qui relèvent d'autres parties de l'IEC 61968, la partie dont relèvent ces profils a été identifiée à des fins pratiques.

Bien que l'intention soit de ne pas créer de dépendance dans cette partie par rapport à d'autres parties, la manipulation des données de référence exige la formation de relations entre les ensembles de données, et l'IEC 61968-100 permet de le réaliser plus facilement. Les exemples de la présente annexe utilisent par conséquent l'IEC 61968-100.

Les cas d'utilisation proposés ici ne visent pas à fournir les informations détaillées de configuration complètes sur ces objets; il s'agit simplement de représenter les techniques impliquées dans la création, la modification et la suppression de ces objets, ainsi que les techniques de gestion des relations entre ces objets à l'aide du profil MasterDataLinkageConfig.

Dans le Tableau J.1, les entrées de la colonne "Ligne de relation" font référence aux lignes de relation de la Figure 49.

Se reporter également à l'IEC 61968-100:2022 pour plus d'informations relatives à la gestion de données maître / synchronisation des données.

NOTE L'introduction des verbes "update" et "updated" dans l'IEC 61968-100:2022 a fondamentalement modifié la manière dont les attributs individuels et les instances d'éléments peuvent être ajoutés, supprimés ou retirés d'un élément configuré. L'utilisation des verbes "change" et "changed" (dans l'IEC 61968-100:2022) exige désormais de spécifier une charge utile de remplacement exhaustive. Dans le tableau ci-dessous, les cas d'utilisation qui utilisaient précédemment les verbes "change/changed" ont été modifiés pour utiliser les verbes "update/updated". Lorsque les verbes "update" et "updated'' sont employés, l'enveloppe du message IEC 61968-100:2022 contient une UpdateAction dont les valeurs énumérées sont "add", "remove" ou "modify" pour indiquer si les attributs et/ou les éléments spécifiés dans la charge utile doivent être ajoutés, supprimés ou modifiés dans l'élément de configuration.

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Tableau J.1 – Exemples de cas d'utilisation de gestion de données de référence / synchronisation des données

Numéro de cas d'utilisation	DS-1	DS-2	DS-3	DS-4
Description du cas d'utilisation	Créer un compteur et / ou recevoir un compteur dans l'inventaire	Ajouter ou mettre à jour un ou plusieurs attributs simples pour un compteur dans l'inventaire	Supprimer un ou plusieurs attributs simples pour un compteur dans l'inventaire	Ajouter une instance supplémentaire d'une classe, telle que Register, à un compteur dans l'inventaire
Verbe d'en-tête	create/created	update/updated	update/updated	update/updated
Nom d'en-tête	MeterConfig	MeterConfig	MeterConfig	MeterConfig
Appliquer Seq	n/a	n/a	n/a	n/a
Appliquer Trans	n/a	n/a	n/a	n/a
Verbe Op Set	n/a	n/a	n/a	n/a
Nom Op Set	n/a	n/a	n/a	n/a
UpdateAction	n/a	add/modify	remove	add
Description de la charge utile	1) ID du Meter 2) Autant d'informations détaillées que disponibles / souhaitées sur le Meter 3) Dates d'entrée en vigueur et motif, le cas échéant	1)ID du Meter 2) Attributs et/ou instances d'éléments actuellement ajoutés ou modifiés 3) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du Meter 2) Attributs actuellement supprimés 3) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du Meter 2) ID et informations détaillées du Register ajouté 3) Dates d'entrée en vigueur et motif, le cas échéant
Ligne de relation	n/a	n/a	n/a	n/a
Commentaires	L'ID du Meter peut être un mRID et/ou un ou plusieurs Names.name. Présent de l'indicatif des verbes utilisés pour les modèles requête/réponse; passé utilisé pour les notifications publiées (pas de réponse).	Les attributs simples n'ont qu'une seule occurrence à un emplacement quelconque donné dans le schéma.		

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Numéro de cas d'utilisation	DS-5	DS-6	DS-7	DS-8
Description du cas d'utilisation	Supprimer une instance d'une classe, telle que Register, à un compteur dans l'inventaire	Configurer un compteur sans registres définis précédemment pour collecter les relevés d'enregistrement des kWh d'avance et des intervalles de 15 minutes	Reconfigurer un compteur pour que le Channel 2 du Register 1 collecte les relevés d'enregistrement des kWh d'avance toutes les 5 minutes au lieu des relevés d'intervalle d'enregistrement des kWh d'avance toutes les 15 minutes	Supprimer un compteur de l'inventaire
Verbe d'en-tête	update/updated	update/updated	update/updated	delete/deleted
Nom d'en-tête	MeterConfig	MeterConfig	MeterConfig	MeterConfig
Appliquer Seq	n/a	n/a	n/a	n/a
Appliquer Trans	n/a	n/a	n/a	n/a
Verbe Op Set	n/a	n/a	n/a	n/a
Nom Op Set	n/a	n/a	n/a	n/a
UpdateAction	remove	n/a	n/a	n/a
Description de la charge utile	1) ID du Meter 2) ID du Register supprimé 3) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du Meter 2) ID du Register 1 3) Autant d'informations détaillées du Register 1 que disponibles / souhaitées 4) ID du Channel 1 du Register 1 5) Autant d'informations détaillées du Channel 1 du Register 1 que disponibles / souhaitées, y compris ReadingType pour BulkQuantity de kWh 6) ID du Channel 2 du Register 1 7) Autant d'informations détaillées du Channel 2 du Register 1 que disponibles / souhaitées, y compris ReadingType pour les intervalles de 15 minutes de collecte des kWh d'avance DeltaData 8) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du Meter 2) ID du Register 1 3) ID du Channel 2 du Register 1 4) Autant d'informations détaillées du Channel 2 du Register 1 que disponibles / souhaités, y compris ReadingType pour les intervalles de 5 minutes de collecte des kWh d'avance DeltaData 5) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du Meter 2) Dates d'entrée en vigueur et motif, le cas échéant
Ligne de relation	n/a	n/a	n/a	n/a
Commentaires				De nombreux systèmes peuvent choisir de ne pas supprimer les compteurs, mais de les marquer comme retirés et/ou hors service.

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Numéro de cas d'utilisation	DS-9	DS-10	DS-11	DS-12
Description du cas d'utilisation	Recevoir un com module dans l'inventaire	Créer une catégorie de service	Créer un fournisseur de services	Créer un emplacement de service
Verbe d'en-tête	create/created	create/created	create/created	create/created
Nom d'en-tête	ComModuleConfig	ServiceCategoryConfig (IEC 61968-8)	SupplierConfig (IEC 61968-8)	ServiceLocationConfig (IEC 61968-8)
Appliquer Seq	n/a	n/a	n/a	n/a
Appliquer Trans	n/a	n/a	n/a	n/a
Verbe Op Set	n/a	n/a	n/a	n/a
Nom Op Set	n/a	n/a	n/a	n/a
UpdateAction	n/a	n/a	n/a	n/a
Description de la charge utile	1) ID du ComModule 2) Autant d'informations détaillées que disponibles / souhaitées sur le ComModule 3) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du ServiceCategory 2) Autant d'informations détaillées que disponibles / souhaitées sur le ServiceCategory 3) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du ServiceSupplier 2) Autant d'informations détaillées que disponibles / souhaitées sur le ServiceSupplier 3) Dates d'entrée en vigueur et motif, le cas échéant	1) ID du ServiceLocation 2) Autant d'informations détaillées que disponibles / souhaitées sur le ServiceLocation 3) Dates d'entrée en vigueur et motif, le cas échéant
Ligne de relation	n/a	n/a	n/a	n/a
Commentaires	Suivre les exemples des cas d'utilisation DS-2 à DS-8 pour les modifications ou la suppression d'un ComModule déjà présent dans l'inventaire.	Suivre les exemples des cas d'utilisation DS-2 à DS-8 pour les modifications ou la suppression d'un ServiceCategory.	Sur les marchés dérégulés, l'entreprise de distribution et le détaillant peuvent être des ServiceSuppliers distincts (avec des ServiceSupplier.kind différents). Suivre les exemples des cas d'utilisation DS-2 à DS-8 pour les modifications ou la suppression d'un ServiceSupplier.	Suivre les exemples des cas d'utilisation DS-2 à DS-8 pour les modifications ou la suppression d'un ServiceLocation.

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